RCR STD-28

PERSONAL HANDY PHONE SYSTEM

ARIB STANDARD

VERSION 5.3

(1/2)

RCR STD-28

Version 1.0	December	20th	1993
Version 1.1	March	3rd	1995
Version 2.0	December	26th	1995
Version 2.1	May	29th	1996
Version 2.2	June	25th	1996
Version 3.0	November	27th	1997
Version 3.1	March	17th	1998
Version 3.2	February	2nd	1999
Version 3.3	March	2nd	2000
Version 4.0	March	28th	2002
Version 4.1	May	25th	2004
Version 5.0	September	29th	2005
Version 5.1	November	30th	2005
Version 5.2	May	29th	2006
Version 5.3	September	25th	2008

Association of Radio Industries and Businesses (ARIB)

General Notes to the English translation of ARIB Standards and Technical Reports

3. The ARIB Standards and ARIB Technical Reports are usually written in Japanese and approved by the ARIB Standard Assembly. This document is a translation into English of the approved document for the purpose of convenience of users. If there are any discrepancies in the content, expressions, etc., between the Japanese original and this translated document, the Japanese original shall prevail.

4. The establishment, revision and abolishment of ARIB Standards and Technical Reports are approved at the ARIB Standard Assembly, which meets several times a year. Approved ARIB Standards and Technical Reports, in their original language, are made publicly available in hard copy, CDs or through web posting, generally in about one month after the date of approval. The original document of this translation may have been further revised and therefore users are encouraged to check the latest version at an appropriate page under the following URL:

http://www.arib.or.jp/english/index.html

5. The original "Personal Handy Phone System ARIB Standard Version 5.3 (RCR STD-28)" is written in Japanese and has been approved by the 71st Standard Assembly Meeting (September 25, 2008).

6. The note about IPR (Industrial Property Rights) in the INTRODUCTION of Fascicle 1 of the Standard applies to the use of Essential IPR for the ARIB Standard in Japan. If the ARIB Standard is adopted outside Japan, Essential IPR will be treated in accordance with policies stated by each IPR owner. The IPR owners are, however, expected to apply the rules of the preface of the "Guidelines for Treatment of Industrial Property Rights in connection with the ARIB Standard" (September 5, 1995, approved by the 1st Standard Assembly Meeting). In the preface of the Guidelines, it is stated that it is "desirable that the Essential IPR which relates to any or all parts of the contents of the ARIB Standard should be used free of charge by anyone and that it would not block the use of such Essential IPR in any other country where such an ARIB Standard is adopted".

PERSONAL HANDY PHONE SYSTEM ARIB STANDARD

INTRODUCTION

Association of Radio Industries and Businesses (ARIB) has been investigating and summarizing the basic technical requirements for establishing standards for developing a digital mobile telephone system. These will appear in the form of standards and specifications governing the use of radio facilities and equipment for systems that transmit over radio waves. The standards and specifications are being developed based on the participation of and discussions with the various radio equipment manufacturers, operators and users.

The standards and specifications contained herein will serve as guidelines for developing standards for private use based on the publicly established technical standards in Japan. Their purpose is to enable effective use of radio frequencies by avoiding interference among users, conflicts among the standards of individual operators, and so forth, so that all parties involved, including radio equipment manufacturers, users and others will be able to ensure the quality and compatibility of radio facilities and equipment.

This standard is being established principally for “Personal Handy Phone System Radio Interfacing”. In order to ensure fairness, impartiality and openness among all parties involved during the drafting process, the relevant radio equipment manufacturers, telecommunications operators and the users were invited both domestically and overseas to participate openly in the activities of the Standard Assembly so as to develop this standard with the total agreement of all parties involved.

The scope of application of this standard covers the minimum requirements for communication. Those are intended to serve as fundamental specifications for telecommunication equipment operators in developing their individual specifications that fall within the scope of this standard.

We hope that this standard will aid all parties involved, including radio equipment manufacturers, telecommunication operators, the users and others in the development of the radio telecommunication system.

Note 1:
Although this ARIB Standard contains no specific reference to any Essential Industrial Property Right relating thereto, the holders of such Essential Industrial Property Rights state to the effect that the rights listed in Attachment 1 which are the Industrial Property Rights relating to this standard are held by the parties also listed therein and that to the users of this standard such holders shall not assert any rights and shall unconditionally grant a license to practice such Industrial Property Rights contained therein. However, this does not apply to anyone who uses this ARIB Standard and also owns and lays claim to any other Essential Industrial Property Right of which the scope is included in any or all parts of contents of the provisions of this ARIB Standard.

Note 2:
Although this ARIB Standard contains no specific reference to any Essential Industrial Property Right

relating thereto, the holders of such Essential Industrial Property Rights state to the effect that the rights listed in Attachment 2 which are the Industrial Property Rights relating to this standard are held by the parties also listed therein and that to the users of this standard such holders shall grant, under the reasonable terms and conditions, a non-exclusive and non-discriminatory license to practice the Industrial Property Rights contained therein. However, this does not apply to anyone who uses this ARIB Standard and also owns and lays claim to any other Essential Industrial Property Right of which the scope is included in any or all parts of contents of the provisions of this ARIB Standard.

Attachment 1 List of Essential Industry Property Rights for RCR STD-28

Patent Applicant	Title of invention	Application No. and Publication No.	Remarks
Sony Corporation	(1) Digital cordless telephone equipment	Publication No. 92-213933	
Telefonaktiebolaget L M Ericsson	(1) Equipment for transmission of telephone calls to a portable, wireless telephone set	Application No. 94-14361 (utility model)	Application in U.S., Germany, Great Britain, France, Sweden, Australia, Austria, Netherlands, Swiss, Denmark, Norway, Finland and Brazil
	(2) Installation with portable, wireless telephone sets	Publication No. 87-502841 PCT/SE86/00210	Application in U.S., Germany, Great Britain, France, Italy, Sweden, Australia, Netherlands, Swiss, Denmark, Norway and Finland
Toshiba Corporation	(1) Private communication method	Publication No. 86-54750	
NEC Corporation	(1) Radio communication equipment	Public notice (note 1) No. 90-052464	Application in U.S., Canada, Germany, Great Britain, Sweden and Australia
Nippon Telegraph and Telephone Corporation (NTT)	(1) Radio channel assignment method	Publication No. 92-111544	
	(2) Communication channel designation method	Publication No. 92-373327	
	(3) Control channel standby method	Publication No. 92-373323	
	(4) Mobile communication radio control channel structure method	Publication No. 91-104428	Application in U.S., Germany, Great Britain and Sweden
	(5) Mobile communication method	Publication No. 90-7633	
Motorola	(1) Cellular radio telephone system and method with dropped call protection	Application No. 1-19398	
Fujitsu Limited	(1) Radio communication method	Publication No. 88-294150	Application in U.S., Germany, Great Britain, France and Italy
Mitsubishi Electric Corporation	(1) Frame synchronization control equipment	Publication No. 93-48513	

(Note1) Publication after examination.

Attachment 2 List of Essential Industry Property Rights for RCR STD-28 Ver.4.1

Patent Holder	Name of Patent	Registration No./Application No.	Remarks
Motorola CORPORATION[*41]	A comprehensive confirmation form has been submitted with regard to RCR STD-28 Ver.4.1		

[*41]:These patents are applied to the revised part of RCR STD-28 Ver.4.1.

About description methods in this document

- In Chapters 1 through 7, regulations/standards and their corresponding measurement methods are described.

- In Chapter 8, basic terminology is explained to aid understanding of this document.

- In the appendices, descriptions of the regulations/standards of Chapters 1-7 are described to aid understanding. The described items of the appendices have the same effect as the regulations/standards.

- The attachments describe regulations/standards that can be disclosed according to disclosure procedure regulations.

- To clarify the classifications of private/public in the standard, the following markings are attached to the right side of each chapter and section.

  Also, the marking of "Private mandatory" and/or "Public mandatory" are attached occasionally to the right of subheading in each section.

  (Private mandatory) Private system mandatory standardization object item (forced standard)
  (Private standard) Private system standardization object item
  (Private reference) Private system object reference item
  (Public mandatory) Public system mandatory standardization object item (forced standard)
  (Public standard) Public system standardization object item
  (Public reference) Public system object reference item
  (Reference) Private/public reference item
  (Overseas standard) Standardized items for overseas private/FWA
  (Domestic mandatory) PHS-FWA system mandatory standardization object item (forced standard)
  (Domestic standard) PHS-FWA system standardization object item
  (Domestic reference) PHS-FWA system object reference item

- ARIB was formerly called as RCR

- The descriptions about version numbers of RCR STD-28 in this document, related standards and other related technical reports are defined as below.
  Basically, there are 2 patterns in the description on version numbers.
  1. Regarding the description on the protocol version, in most of cases, a version number shall be expressed just itself as indicated in (1), but including all of its revision numbers if the revision numbers exit (See (1)).
  2. However, in some cases, a version number might be expressed as "version number + its revision number" style as indicated in (2).
     (1) Version x → Version x.0 and Version x.n (n: If described only "Version x", Version x include all revision number of Version x. n=1, 2, …)
     (2) Version x Rev. - y → Version x.y

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Annexes

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Chapter 1　General

Chapter 1 General

1.1 Overview (Private standard/Public standard)

The standard is provided to specify the radio interface of communication systems that perform digital-cordless telephone and PHS communication (hereinafter referred to as "personal handy phone systems") as specified in radio equipment rules item 8.2 of article 49 and item 8.3 of article 49.

1.2 Application scope (Private standard/Public standard)

Personal handy phone systems are constructed from the personal stations, cell stations and relay stations (radio stations which relay communication between cell station and personal stations) shown in Figure 1.1.

The standard specifies the radio interface as shown in Figure 1.1, for the personal handy phone systems.

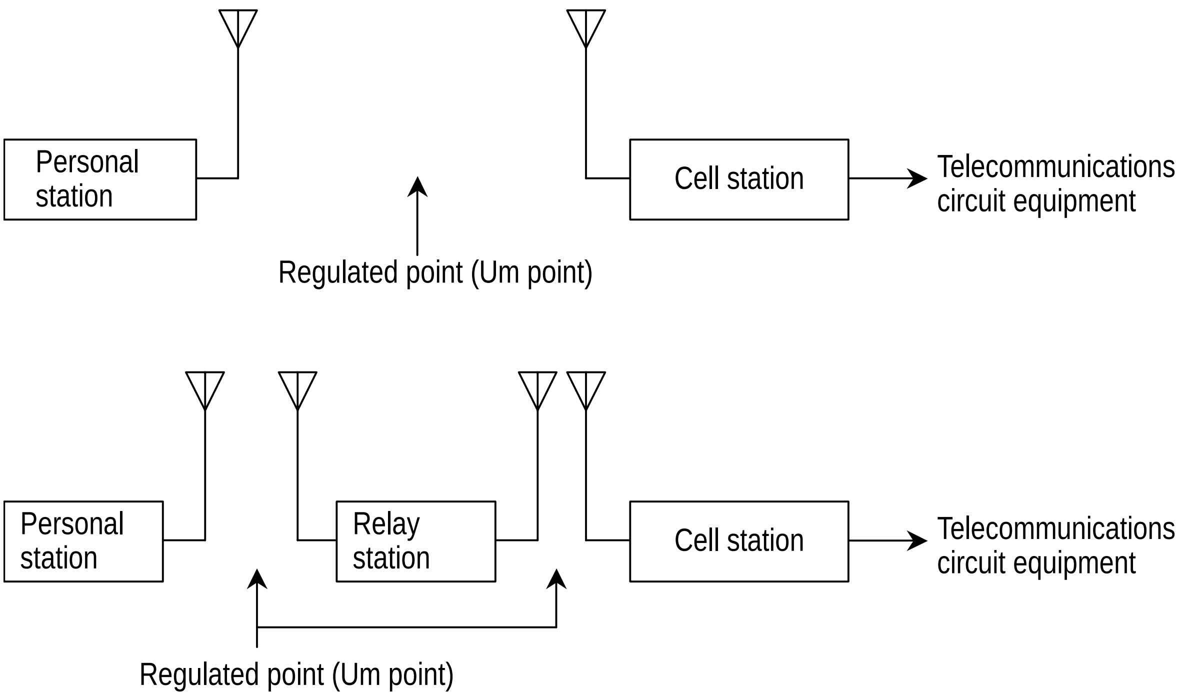

Figure 1.1 Structure of personal handy phone system

1.3 Basic rules of standardization (Private standard/Public standard)

Considering interconnection, the minimum required standards for basic connection and basic services are specified as mandatory, and the minimum required standards based on the need for selectable protocols and so forth are specified as optional.

In addition, care is taken that the standard does not restrict future expandability of the system in order to provide users freedom of choice.

Figure 1.2 shows the relationship between standards and options.

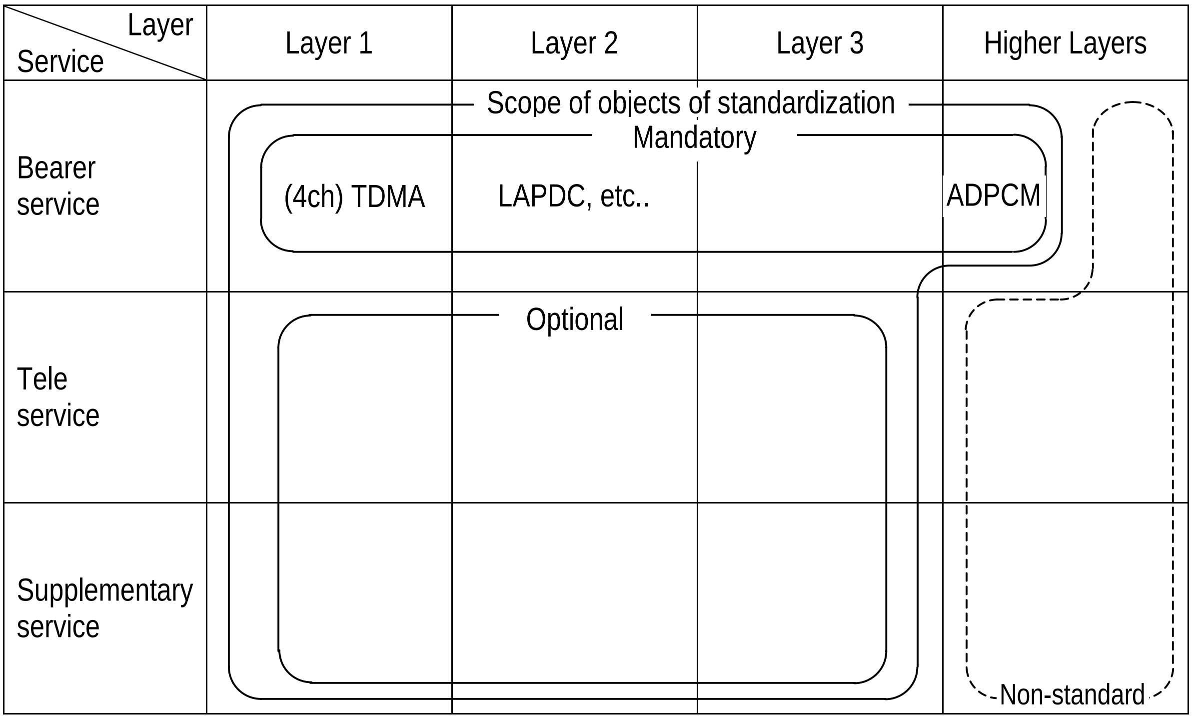

Figure 1.2 Scope of standardization

Also, options are classified as follows. Furthermore, functional options will be divided into CS options and PS options in the future.

(1) CS option: Relevant function is optional for CS and mandatory for PS.

(2) PS option: Relevant item is mandatory for CS and optional for PS.

(3) Functional option: The relevant item is optional for both CS and PS.

1.4 Document conformity (Private standard/Public standard)

In the standard, "execute" refers to radio law execution rules, "equipment" refers to radio equipment rules, "notification" refers to Ministry of Internal Affairs and Communications notifications, "formal authorization" refers to radio equipment formal authorization rules, "technological conformity" refers to technological standards conformity for certain radio equipment.

Also, the relationship between radio equipment established by legal ordinance and the radio interface provisions specified by this standard is shown in Table 1.1.

Table 1.1 Distinction between cell station and personal station, and applicable Um point interface provisions.

Cell station / Personal station	Digital cordless telephone Base station	PHS Cell station	radio station which relay communication between cell station and personal stations
Digital cordless telephone personal station	Private system standard		Private system standard
PHS personal station (on-land)		Public system standard	Public system standard
radio station which relay communication between cell station and personal stations		Public system standard	

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Chapter 2 System Overview

Chapter 2 System Overview

2.1 System structure (Private standard/Public standard)

The personal handy phone system is made up of personal stations, cell stations and radio stations which relay communications between cell stations and personal stations (hereinafter, referred as relay stations).

2.1.1 Personal station (PS) (Private standard/Public standard)

The personal station, as a subscriber communication terminal, is used to make land mobile radio communications to either personal stations or cell stations.

A personal station consists of radio equipment made up of antenna, transmitter, and receiver; voice encoding equipment; control equipment; and a sending/receiving handset. Also, a terminal can be connected to the personal station if needed.

2.1.2 Cell station (CS) (Private standard/Public standard)

The cell station carries out mobile radio communication with personal stations on land.

A cell station consists of radio equipment made up of antenna, transmitter, and receiver; voice coding equipment; and control equipment.

2.1.3 Relay station (RS) (Public standard)

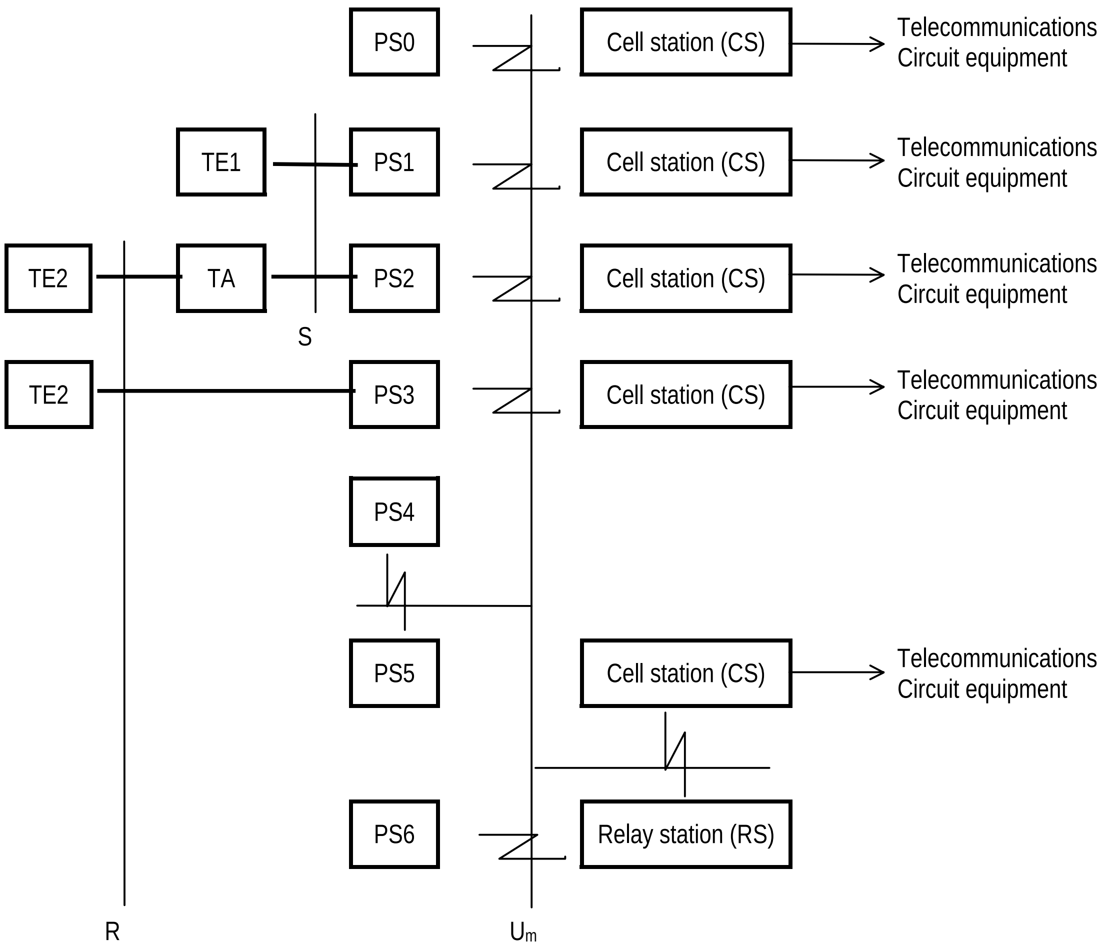
The relay station relays mobile radio communication between cell station and personal stations on land.

A cell station or personal station opposing part of relay station consists of radio equipment made up of antenna, transmitter, and receiver; voice coding equipment; and control equipment.

The relay station, which shall be registered (in accordance with Paragraph 1.2, Execute-article16) , is defined as the registered relay station.

2.2 Interface definition (Private standard/Public standard)

There are 3 interface points for the personal handy phone system (Um, R, S points), as shown in Figure 2.1.



(1) Um point : Interface point between personal station and cell station, interface point between relay station and cell station or personal station, or, interface point between personal station and personal station.

(2) R point : Interface point between I interface non-conforming terminal and mobile terminal equipment or terminal adapter.

(3) S point : Interface point between I interface conforming terminal or terminal adapter and mobile terminal equipment.

PS0, PS4, PS5, PS6	: Personal station, including integrated man/machine interface of terminals, etc.
PS1, PS2	: Personal station with I interface.
PS3	: Personal station without I interface.
TE1	: Terminal equipment with I interface.
TE2	: Terminal equipment without I interface.
TA	: Interface conversion equipment between non-I-interface and I-interface.

Figure 2.1 Interface points

2.3 System basic functions (Private standard/Public standard)

The personal handy phone system is a digital cordless telephone system that offers integrated telecommunications services such as voice and data and so forth via a universal radio interface (Um point). Its basic functions satisfy the items below.

(1) Digitalization of the system

Aims for assurance quality equal to or better than the existing analog cordless telephone system, improvement of encryption, and effective use of frequencies.

(2) Interconnectability

Basic connection of the personal station with cell stations at various locations such as the office, home, outdoors, etc. is possible.

It can also be used as a personal station by implementing the required processes if the condition arises that a personal station which was previously used for home or office is to be used by connecting to a public cell station.

(3) Connection with communications network

Connection is possible with the existing analog telephone network, and with ISDN, which is a digital network.

(4) Use of the abundant ISDN services

In addition to the services that have been used by cordless telephone systems until now, the more abundant services that can be offered by ISDN can be used.

2.3.1 System conditions (Private standard/Public standard)

The system conditions of the personal handy phone system are as follows.

2.3.1.1 Basic functions (Private standard/Public standard)

The personal handy phone system has the following functions.

(1) It can be connected to the public telephone network offered by type I telecommunications operators.

(2) It has a common radio interface, and interconnection by this is possible.

(3) The personal station, cell station and relay station have a slot-unit interference detection function, and can automatically allocate a less interfered channel.

(4) If interference is received during communication, the personal station, cell station and relay station can avoid interference in slot units.
Interference avoidance is by channel switching, automatic reconnection, temporary stoppage of transmission, etc.

(5) It has an identification code that identifies the cell station (system identification code (private) or operator identification code (public)), and an identification code that separately identifies the personal station (PS identification code). In the connection operation, these codes are sent mutually, which prevents erroneous connection and erroneous charging.

2.3.2 Services that can be used by this system (Private standard/Public standard)

2.3.2.1 Service features (Private standard/Public standard)

Service attributes of the personal handy phone system, at present, are as shown in Table 2.1.

Table 2.1 Service attributes

Service attribute	Service item
Information transfer capability	Speech, 3.1kHz audio, unrestricted digital
Transfer mode	Circuit mode
Information transfer rate	32k bit/s, 64k bit/s (Only for unrestricted digital)
Communications format	Point-to-point

2.3.2.2 Service types (Private standard/Public standard)

(1) Bearer service

The bearer service assumed and used via communications channels, at present, is as shown in Table 2.2.

(2) Teleservice

Teleservice used via communication channels is not specified at present.

(3) Supplementary services (circuit mode)

Supplementary services proper to PHS used as circuit mode services are presently as shown in Table 2.2.

Table 2.2 Service types

Type	Item	Overview
Bearer service	32k bit/s speech (note 5)(note 6)	Provides bearer capability suited for voice communication with terminal; 32k bit/s ADPCM CODEC or 16k bit/s ADPCM CODEC is inserted. (note 8)
	32k bit/s 3.1kHz audio (note 5) (note 6)	Provides bearer capability suited for 3.1kHz bandwidths communication with terminal; 32k bit/s ADPCM CODEC or 16k bit/s ADPCM CODEC is inserted. (note8)
	32k bit/s unrestricted digital (note 2) (note 5) (note9)	Provides bearer capability suited for digital data communication with terminal; information is transmitted transparently.
	64k bit/s unrestricted digital (note 3) (note 5) (note 7) (note 10)	Using max 2 channels on Um point, provides bearer capability suited for digital data communication with terminal; information is transmitted transparently.
Supplementary services	DTMF signal transmission	Service which generates DTMF signals on CS side from message from PS.
	Hooking signal transmission (note 1)(note 2)	Service which generates hooking signals on CS side from message from PS.
	Pause signal Transmission (note 1)(note 3)	Service which generates pause signals on CS side from message from PS.
	Hold within the CS-PS loop (note 1)(note 3)	Service which holds call on CS side from message from PS.
	Call transfer within the CS-PS loop (note 1)(note 3)	Service which provides call transfer on CS side from message from PS.
	Call waiting within the CS-PS loop (note 1)(note 3)	Service which provides call waiting on CS side from message from PS.
	Conference call within the CS-PS loop (note 1)(note 3)	Service which provides three-party service on CS side from message from PS.
	Hold within the CS-multiple PS (note 1)(note 3)	Service which provides hold within the CS-multiple PS additional service on CS side from message from PS.
	Call type notification within the CS-PS loop (note 1)(note 3)	Service which provides calling party number, called party number and so on from message from PS and/or CS.
	PS remote control function (note 1)(note 3)	Service which provides remote control function from message from PS and/or CS.
	PHS User-to-User Signaling (PHS-UUS) supplementary service (note 3)(note 4)	Service which allows PS to send/receive a limited amount of information to/from another PS over the communication channel in association with a call to the other PS.

(Note1) Private only
(Note2) Standard protocol can be used RT-MM protocol version from RCR STD-28 (version 2)
(Note3) Standard protocol can be used RT-MM protocol version from RCR STD-28 (version 3)
(Note4) Public only
(Note5) When π/4 shift QPSK half rate (16k bit/s) (Public only)communication is used, standard protocol can be used RT/MM protocol version newer than RCR STD-28(version 4.1).
(Note6) When BPSK full rate (16kbit/s)(Public only) communication is used, standard protocol can be used RT/MM protocol version newer than RCR STD-28(version 5.0).
(Note7) When 8PSK(48kbit/s) or 16QAM(64kbit/s) communication is used, standard protocol can be used RT/MM protocol version newer than RCR STD-28(version 5.0).
(Note8) 16kbit/s ADPCM CODEC is used for π/4 shift QPSK half rate (16kbit/s) or BPSK full rate (16kbit/s) communication for Public use.

(Note9) π /4 shift QPSK full rate (32kbit/s) is used for 32kbit/s unrestricted digital, but π /4 shift QPSK half rate (16kbit/s) is allowed to be used for Public.
(Note10) For 64kbit/s unrestricted digital information service, see clause 2.6.

2.4 Access method (Private standard/Public standard)

2.4.1 Transmission method (Private standard/Public standard)

The radio access method for the personal handy phone system is the four-channel multiplex multi-carrier TDMA-TDD shown in Table 2.3. CODEC is full rate CODEC (32k bit/s ADPCM) and half rate CODEC (16k bit/s ADPCM) (Public only), but in the future quarter rate (8k bit/s) CODEC applications can be imagined.

Table 2.3 Transmission method parameters

Radio access method	TDMA-TDD
Number of TDMA multiplexed circuits	4 (when full rate CODEC is used)
Carrier frequency spacing	300 kHz
Modulation method	π /4 shift QPSK, BPSK(note1), QPSK, 8PSK(note2), 12QAM, 16QAM, 24QAM, 24QAM, 32QAM, 64QAM (roll-off rate = 0.5, 0.38)
Transmission rate	192~5120k bit/s

(Note 1) π /2 shift BPSK(BPSK which has been shifted by π /2 each symbol period)is included.
(Note 2) D8PSK(Differentially encoded 8PSK) is included.

2.4.2 Function channel structure (Private standard/Public standard)

Function channel structure of the personal handy phone system is shown in Figure 2.2.

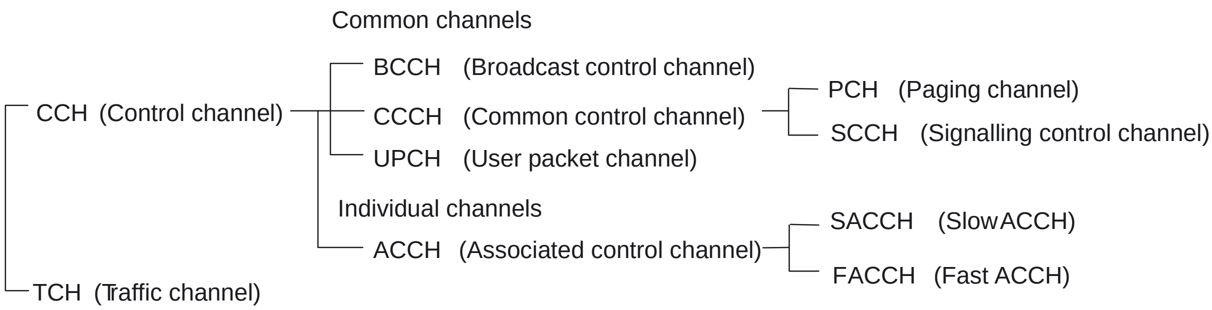


Figure 2.2 Function channel structure

(1) BCCH (Broadcast control channel)

This is a one-way downlink channel for broadcasting control information from the cell station to the personal station. It transmits information related to channel structure, system information, etc.

(2) CCCH (Common control channel)

This channel carries out control information transmission necessary for call connection.

(a) PCH (Paging Channel)

This is a one-way downlink point-point channel that simultaneously transmits the identical information to individual cells or a wide area of multiple cells (the paging area) from a cell station to the personal station.

(b) SCCH (Signaling Control Channel)

This is a bidirectional point-point channel that transmits information needed for call connection between the cell station and the personal station, and it transmits independent information to each cell.

The uplink channels apply random access.

(3) UPCH (User Packet Channel)

This is a bidirectional point-multipoint channel. It performs transmission of control signal information and user packet data.

(4) ACCH (Associated Control Channel)

This is a bidirectional channel that is associated with TCH (Traffic channel). It carries out transmission of control information and user packet data needed for call connection. The ACCH which is ordinarily associated with TCH is defined as SACCH, and the channel that temporarily steals TCH and carries out high speed data transmission is defined as FACCH.

(5) TCH (Traffic channel)

This transmits user information. It is a point-point bidirectional channel.

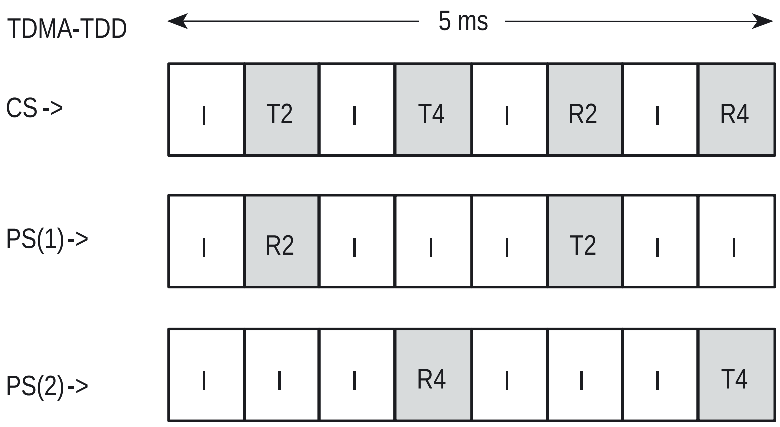
2.4.3 Radio line control (Private standard/Public standard)

(1) Control procedures

Control procedures are defined as those which perform connection in receiving and sending to a personal station, register personal station location, switch channels during communication, identify services, and so forth. It is necessary for these procedures to be performed reliably through the use of common and individually assigned slots.

(2) Slot structure

Figure 2.3 shows the slot arrangement in light of appropriate sending/receiving slot separation in TDD transmission.



T : transmission R : reception, I :→ Ri : Corresponding transmission/reception

Figure 2.3 Slot arrangement (corresponding to 32k bit/s)

2.4.4 Carrier structure (Private standard/Public standard)

The structure of the radio carrier in the personal handy phone system is as shown in Table 2.4.

Table 2.4 Carrier structure

Control carriers	(a) Private	2 frequencies 1,898.45MHz 1,900.25MHz	
	(b) Public	More than 1 frequencies	Is made use of communications carriers for public system.
Communications carriers	(a) Common usage for Private, Direct communication between PSs, and Public	10 frequencies	Decreases the number of control carriers for public. (note) In direct communication between personal stations in a specific group, is made use of 3 carriers from 10 carriers for direct communication between personal stations.
	(b) Common usage for Private and Public	30 frequencies	Decreases the number of control carriers for public system. (note)
	(c) Public	75 frequencies	Decreases the number of control carriers for public system. (note)

(Note) From among the communications carriers for public system, the control carriers for public system is designated, so the number of communication carriers for public system will decrease by exactly the number of designated carriers (refer to Figure 4.2.3).

(1) Control carrier

A carrier in which only common usage slots can be assigned and which can perform steady intermittent transmission in CS is called a control carrier.

(2) Communications carrier

A carrier in which individual assigned slots can be assigned so that the user can perform communication is called a communications carrier. Furthermore, it is possible to allocate common usage slots for a communications carrier as well, but in order to avoid interference with individual assigned slots, steady use by intermittent transmission and so forth is not possible.

(3) Carrier for direct communication between personal stations

A carrier for performing direct communication between PSs (personal stations) without going through a CS is called a carrier for direct communication between personal stations. In a carrier for direct communication between personal stations, connection control and conversation can be carried out on the same slot.

2.5 Protocol basic rules (Private standard/Public standard)

2.5.1 Protocol model (Private standard/Public standard)

In general, a communication protocol is made up of the call connection phase and the communications phase.

In the personal handy phone system protocol structure, it is divided into 3 protocol stages as shown below: A phase which establishes the radio interface handshake (link channel establishment phase), a phase which connects the call between the cell station (CS) that established the handshake and personal station (PS) (service channel establishment phase), and a phase which performs communication and data transmission (communications phase).

(a) It has expandability in each type of service on control channels that are inferior in transmission quality and capacity compared to the fixed communications network.

(b) Together with aiming for unification of the protocol, it reduces as much as possible the amount of PS loaded software.

(c) It easily supports local protocols for individual services.

In the link channel establishment phase, the special radio control channel structure is applied, and the service channel establishment phase and the communications phase use the hierarchical structure of layers 1 through 3 conforming to the OSI model. The basic signal structure is shown in Figure 2.4. Here, the communications phase is defined as the term after the point when the services shown in section 2.3.2 are provided from the CS side to PS. Here, services include inband information.

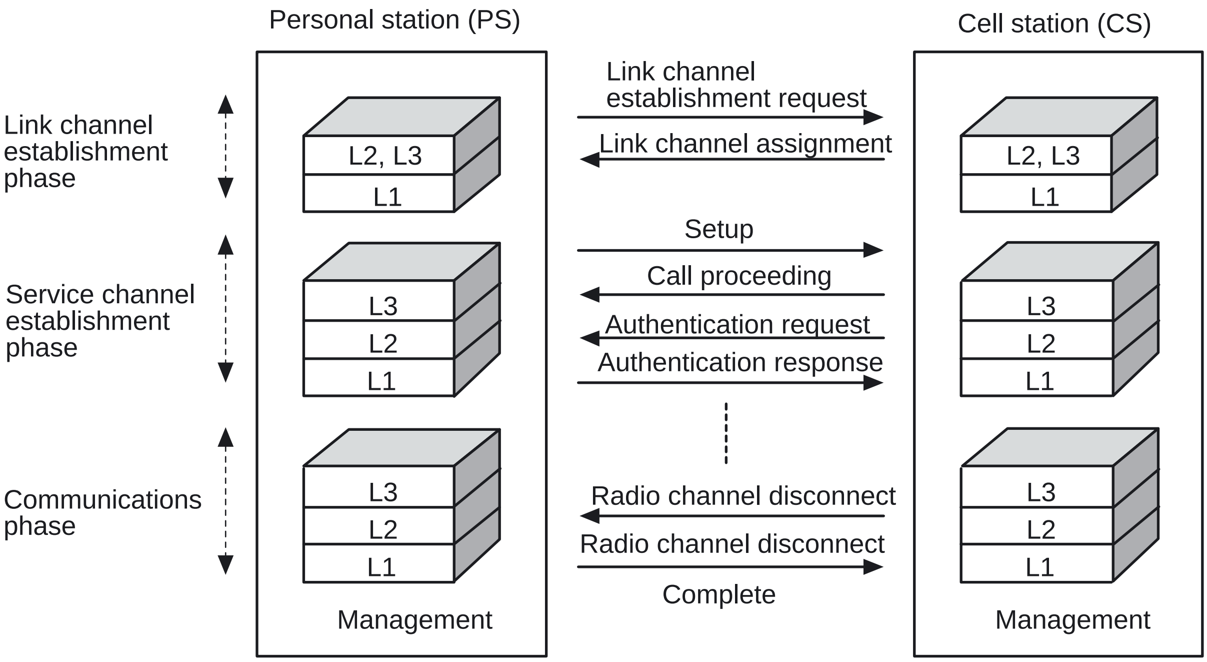


Figure 2.4 Basic structure of signals

(1) Call connection phase

The call connection phase consists of the link channel establishment phase for establishing the link with the radio interface and the service channel establishment phase for establishing the radio link for telephone service such as voice transmission and non-telephone service such as ISDN.

(a) Link channel establishment phase

The link channel establishment phase is defined as the stage of using control channel functions to select a channel (hereafter referred to as link channel) with the quality and capacity required for each service's call connection, and to select the protocol type required in the next phase of call connection.

(b) Service channel establishment phase

The service channel establishment phase is defined as the stage of using link channel functions obtained in the link channel establishment phase to select a channel (hereafter referred to as service channel) with the capacity required for providing service and to select the protocol type required in the communications phase.

(2) Communications phase

In the communications phase, as shown in Figure 2.5, it is possible to employ the optimum channel and the optimum protocol for each service.

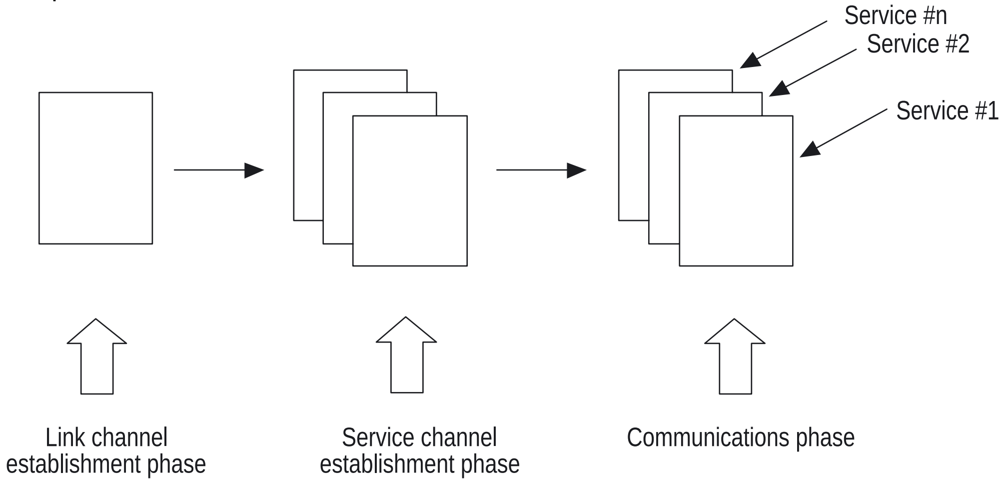


Figure 2.5 Service type and protocol phases

2.5.2 Hierarchical structure (Private standard/Public standard)

(1) Link channel establishment phase

In the link channel establishment phase, layer 2 and layer 3 have a mixed structure as shown in Figure 2.6.

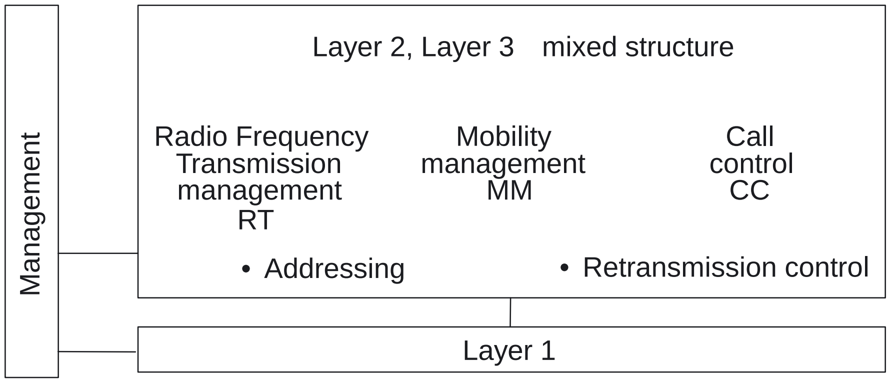


Figure 2.6 Hierarchical structure of link channel establishment phase

(2) Service channel establishment phase

As shown in Figure 2.7, layer 3 functions have a hierarchical structure that conforms to the OSI model that can be divided into RT (radio frequency transmission management), MM (mobility management) and CC (call control).

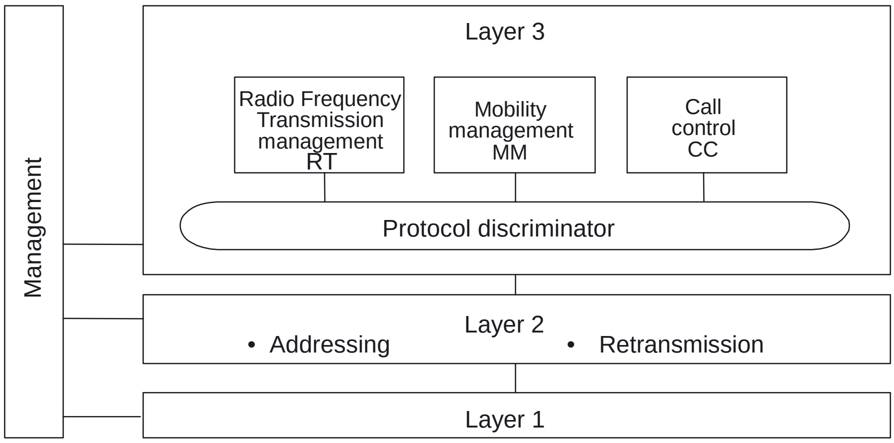


Figure 2.7 Hierarchical structure of service channel establishment phase

(3) Communications phase

The hierarchical structure of communication used via one radio channel (32k bit/s speech, 32k bit/s 3.1kHz audio, 32k bit/s unrestricted digital and 64kbit/s unrestricted digital) shown in Figure 2.8, the hierarchical structure of communication used via two radio channel (64k bit/s unrestricted digital) shown in Figure 2.9.
As shown in Figure 2.8 and Figure 2.9, layer 3 functions have a hierarchical structure that conforms to the OSI model that can be divided into RT, MM, and CC. However, in the case of 64k bit/s unrestricted digital information communication, the second TCH has only layer 1 function and RT function of layer 3.

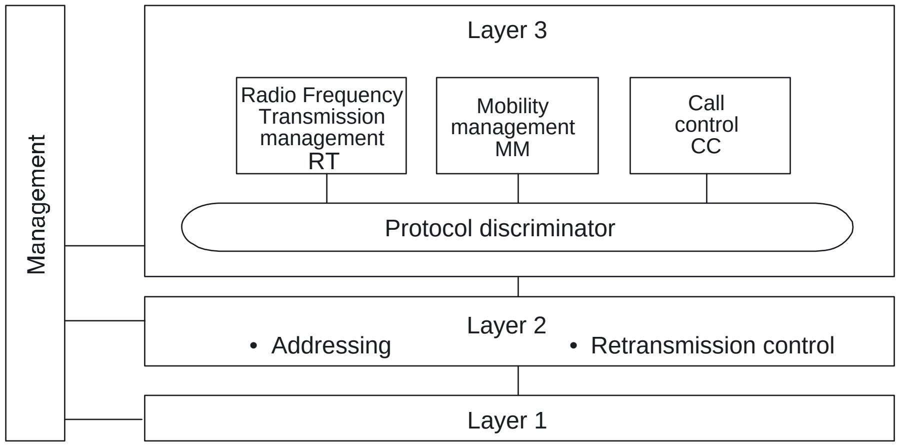


Figure 2.8 Hierarchical structure (communication using 1 radio channel)

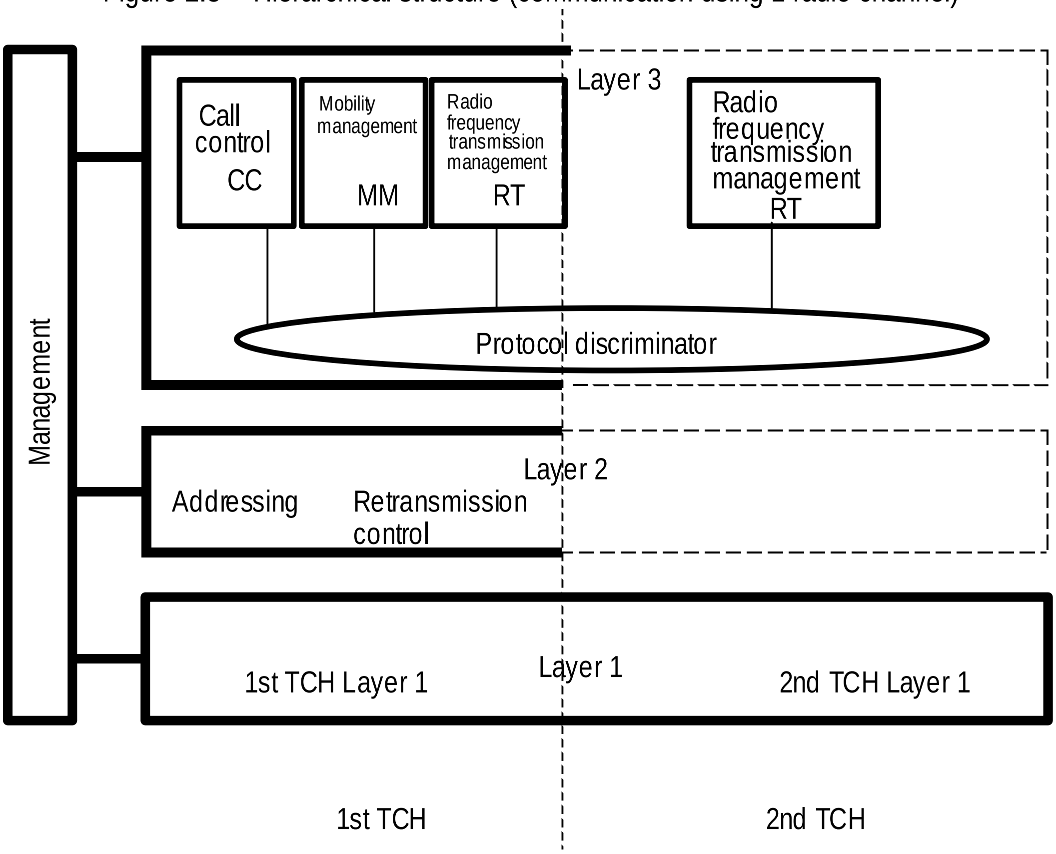


Figure 2.9 Hierarchical structure (communication using 2 radio channels)

2.5.3 Transmission rate support (Private standard/Public standard)

For the transmission rate, 32k bit/s and 16k bit/s (Public only) are standard, and 8k bit/s protocols are standardized as reserved.

And under unrestricted digital, 32k bit/s and 64k bit/s, and additional 16k bit/s (Public only) and 48kbit/s are standardized.

2.5.4 Other related rules (Private standard/Public standard)

(1) The control protocol and messages in a private system conform to the public system.

(2) State transition diagrams and SDL diagrams show the standard state and flow. A state or flow different from that described can be accepted if the function is the same.

2.6 64k bit/s Unrestricted Digital Information service (Private standard/Public standard)

In the 64k bit/s Unrestricted Digital Information service, the following three methods are standardized.

2.6.1 2slots fixed type 64k bit/s Unrestricted Digital Information service

64k bit/s Unrestricted Digital Information service is provided while always using two slots on radio.

2.6.2 Slot changeable type 64k bit/s Unrestricted Digital Information service

Using 2 slot on radio is allowed slot switching during communications as necessary and 64k bit/s Unrestricted Digital Information service is provided.
Also, π /4 shift QPSK half rate (16kbit/s) communication (Public only) is allowed as necessary.

2.6.3 Variable Modulation Method Type 64kbit/s Unrestricted Digital Information service

Change of modulation methods(π /4 shift QPSK, 8PSK, 16QAM) during communication is allowed as necessary to provide 64kbit/s unrestricted digital information service.
Also, variable slot type 64kbit/s unrestricted digital is allowed as necessary.

2.7 Encryption method (Private standard/Public standard)

(1) The protocol for carrying out encryption control is standardized.

(2) The standard user scrambling method is standardized.

2.8 VOX control (Private reference)

(1) The protocol for carrying out VOX control is standardized as an option.

(2) VOX control is standardized as an option.

(3) Background noise generation methods are not standardized, but the indication bits for background noise generation methods in the above described protocol are specified as layer 3 standards.

(4) In the no-sound interval, VOX control that performs transmission at least once in 4 frames is standardized as an option.

2.9 PS numbers (Private standard/Public standard)

(1) Subscriber numbers: Numbers for identifying personal stations in connections with telecommunications network. In public system, PS numbers always express subscriber numbers.

(2) The other numbers: Numbers for identifying personal stations within a certain system (contains extension numbers). In private system, numbering plan is allowed to be independent in each system.

2.10 Direct communication between personal stations (Private standard)

As an auxiliary means of communication in locations where communication cannot be performed via a cell station, the personal stations of this system can perform direct communication between personal stations without going through a cell station (below called "direct communication between personal stations").

And, direct communication between personal stations that can communicate in a specific group according to necessary(below called “direct communication between personal stations in a specific group”)can perform within limited carriers.

(below called standard of “direct communication between personal stations” apply to “direct communications between personal stations in a specific group”, but standard of “direct communication between personal stations in a specific group” doesn’t apply to “direct communication between personal stations”.)

Chapter 3 Technical requirements for radio facilities

Chapter 3 Technical Requirements for Radio Facilities

3.1 Overview (Private standard/Public standard)

This chapter has regulations regarding the technical requirements for radio facilities for the radio transmission section in the personal handy phone system.

3.2 General conditions (Private mandatory/Public mandatory)

3.2.1 Radio frequency band (Execute-article 6, Equipment-article 7 and item 8.2 of article 49) (Private mandatory/Public mandatory)

The radio frequency band used is the 1,900 MHz band (Private system: 1,893.5 MHz-1,906.1 MHz and Public system: 1,884.5MHz-1,919.6 MHz).

3.2.2 Carrier frequency spacing (Execute-article 6, Equipment-article 7 and item 8.2 of article 49) (Private mandatory/Public mandatory)

The carrier frequency spacing is 300 kHz.

The carrier frequency is 1,884.65MHz or 1884.65MHz plus some integer multiple of 300 kHz.

3.2.3 Antenna power control (Private reference/Public reference)

It has a minimum function that can control the antenna power as needed.

3.2.4 Communications system (Equipment-item 8.2 of article 49 and item 8.3 of article 49) (Private mandatory/Public mandatory)

It is a multiplex system that uses the multicarrier TDMA-TDD method.

3.2.5 Number of multiplexed circuits (Notification/ '98 year, number 612) (Private mandatory/Public mandatory)

The number of multiplexed circuits for TDMA is 4 (when using full rate codec).

Also, with the exception of during channel switching, the maximum number of channels that can be simultaneously by a personal station is four. Further, in the case of direct communication between personal stations, the maximum number of simultaneous usable channels is four.

3.2.6 Modulation method (Equipment-item 8.2 of article 49 and item 8.3 of article 49) (Private mandatory/Public mandatory)

The modulation method is $\pi/4$ shift QPSK modulation (quaternary phase modulation which has been shifted by $\pi/4$ each symbol period).
BPSK, QPSK, 8PSK, 12QAM, 16QAM, 24QAM, 32QAM, 64QAM and 256QAM are usable for public and private. Adaptive modulation method which changes modulation method according to data communications speed or radio condition is usable.

In case that occupied bandwidth is 288kHz or less, transmission side filtering is Square Root of Raised Cosine with Roll off factor (α) of 0.5. In case that occupied bandwidth exceeds 288kHz, transmission side filtering is Square Root of Raised Cosine with Roll off factor (α) of 0.5/0.38.

3.2.7 Transmission rate (Equipment-item 8.2 of article 49 and item 8.3 of article 49)
(Private mandatory/Public mandatory)

Each signal transmission rate is as follows.

In case that occupied bandwidth is 288kHz or less

π/4 shift QPSK	384kbps
BPSK	192kbps
QPSK	384kbps
8PSK	576kbps
12QAM	672kbps
16QAM	768kbps
24QAM	864kbps
32QAM	960kbps
64QAM	1152kbps
256QAM	1536kbps

In case that occupied bandwidth exceeds 288kHz and Roll off factor (α) is 0.5

π/4 shift QPSK	1152kbps
BPSK	576kbps
QPSK	1152kbps
8PSK	1728kbps
12QAM	2016kbps
16QAM	2304kbps
24QAM	2592kbps
32QAM	2880kbps
64QAM	3456kbps
256QAM	4608kbps

In case that occupied bandwidth exceeds 288kHz and Roll off factor (α) is 0.38

π/4 shift QPSK	1280kbps
BPSK	640kbps
QPSK	1280kbps
8PSK	1920kbps
12QAM	2240kbps
16QAM	2560kbps
24QAM	2880kbps
32QAM	3200kbps
64QAM	3840kbps
256QAM	5120kbps

3.2.8 Voice coding rate (Notification/ '98 year, number 612) (Private mandatory/Public mandatory)

The voice coding rate is 32k bit/s-ADPCM (when applying full rate CODEC) and 16k bit/s ADPCM (when applying half rate CODEC) (Public only).

3.2.9 Frame length (Notification/ '98 year, number 612) (Private mandatory/Public mandatory)

The frame length is 5 msec (structure of 4 transmission slots + 4 reception slots).

3.2.10 Processing delay (Private standard/Public standard)

The delay generated by voice coding and time division multiplexing, etc., is of a scope that will not damage the natural quality of conversation.

3.2.11 VOX control (Private reference)

VOX control is an option.

3.2.12 Radio station identification number (Private standard/Public standard)

Assignment of identification numbers for radio stations and transmission procedures and so forth are determined with adequate consideration of free selection of networks by users, roaming, ensuring security of communications, monitoring radio stations, etc.

3.2.12.1 Selective calling systems (Equipment-item 2 of article 9)
(Private mandatory/Public standard)

The calling identification memory device and the calling identification discrimination device for base station (meaning the radio station which is mainly used fixedly) of digital cordless telephones shall be of a type conforming the established technical requirements.

3.2.12.2 Calling identification memory device requirements (Notification/'98 year, number 517)
(Private mandatory/Public standard)

a) The stored calling identification code must not be easily erasable.

b) Transmission must not be possible if the calling identification code has not been stored.

c) The calling identification memory device must not be easily retrievable.

3.2.12.3 Calling identification discrimination system requirements (Notification/'98 year, number 517)
(Private mandatory/Public standard)

The calling identification code (meaning the code for the purpose of identifying person(s) with whom the radio communication service is performed, excluding the identification signal under Article 8 paragraph (1) item iii) of the Radio Law) must be detectable from the radio waves received.

3.2.13 Security measures (Private standard/Public standard)

For preventing improper use, assignment of numbers of personal station equipment characteristics, application of authentication procedures, application of security functions for communications information, etc. can be designated.

3.2.14 Counter-electromagnetic interference measures (Private standard/Public standard)

Measures are taken to prevent electromagnetic interference by the radio station equipment with other office or household electronic equipment.

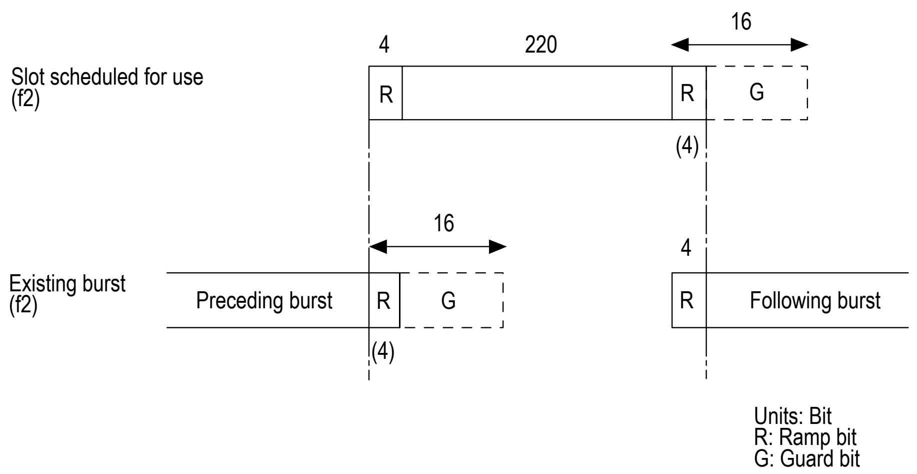
3.2.15 Physical slot transmission condition (Private standard/Public standard)

(1) Control carrier (Notification/'98 year, number 612) (Private mandatory)

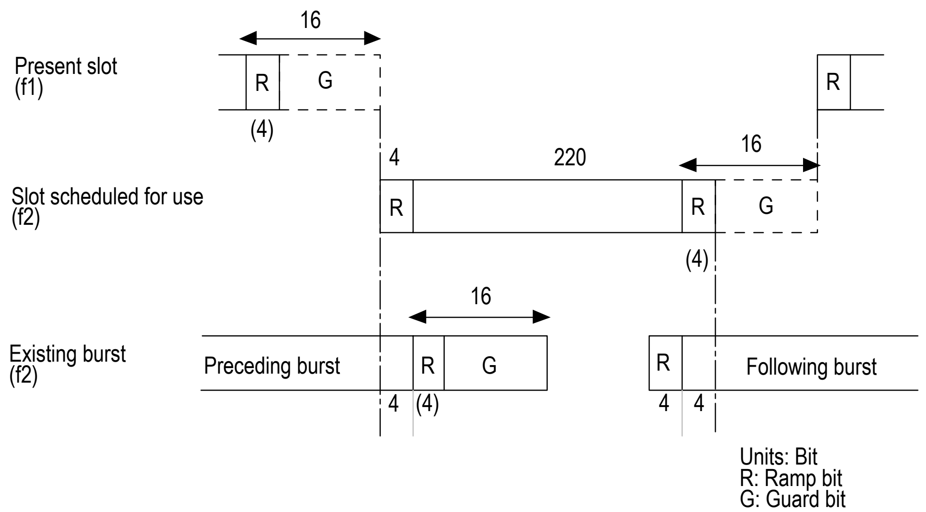
In control carriers for personal use (home, office, other non-public uses. Same below.), the number of slots transmitting in one second per carrier should be 8 or less.

(2) Communications carrier

In the communications carrier, the appropriate corresponding slots are transmitted and used only after sensing the carrier within 2 seconds before transmission and confirming that the appropriate slot timing (called period of 1 slot length) which can be used is idle across 4 or more continuous frames (when full rate), or 2 or more continuous significant frames (when half rate) (public only). In the case where the preceding burst and/or continuing burst exceed the prescribed interference level, and they are present within or including the timing shown in Figures 3.1 (a) and (b) in case that occupied bandwidth is 288kHz or less and π /4 shift QPSK, and they overlap the slot scheduled for use, or the existing burst overlaps with the same timing as the slot scheduled for use, it is judged that there is a carrier.
Each timing in case other band signal and modulation method should be same as shown in Figures 3.1 in case that occupied bandwidth is 288kHz or less and π /4 shift QPSK.
In case that occupied bandwidth exceeds 288kHz, career sense should be carried out about continuous 3 frequencies.



In case that occupied bandwidth is 288kHz or less and π /4 shift QPSK
(a) Carrier sensing method on PS side



In case that occupied bandwidth is 288kHz or less and π /4 shift QPSK
(b) Carrier sensing method on CS side

Figure 3.1 Carrier sensing method

In this case, when the relevant channel's (called the relevant slot on the relevant carrier) interference level is above level 1, it is decided that the relevant channel is not available. However, only when the interference level of all channels used by the relevant radio station exceed level 1 (when there is a channel designation from the opposite station, called the relevant specified channel), it is decided that channels at interference level 2 or less can be used. Therefore, only in this case, it can be judged that channels whose interference level is level 2 or less are available (free). However, slots already used by the relevant radio station are not objects of available slot determination.

Carrier sensing determination levels are as shown in Table 3.1.

Table 3.1 Carrier sensing levels

Level 1	26 dB μ V
Level 2	44 dB μ V

(3) Carrier for direct communication between personal stations

In the carrier for direct communication between personal stations, the relevant corresponding slot is transmitted and used only after performing carrier sensing by the origination-side personal station, and confirming that the relevant reception slot timing can be used (free) over 4 or more continuous frames. Also, determination of available slots is performed by the same method as for communications carriers, or equivalent methods, for the period shown in Figure 3.1 (a), taking into consideration asynchronous interference.

In this case, when the interference level of the relevant channel exceeds level 2, it is judged that the relevant slot is not available.

The carrier sensing judgment levels are as shown in Table 3.1.

(4) Example of carrier sensing position on PS side

The measurement points are within the following range in case that occupied bandwidth is 288kHz or less and π /4 shift QPSK. Judgment uses the average value of any length of time, or the instantaneous value of any point. Furthermore, in the modulated signal, since the deviation of instantaneous power is large with respect to average power, use caution in judgment.

[1] Preceding part (T0) $T2 - 220/(384 \times 10^3) \leq T0 \leq T1$

[2] Middle part (T2) $T1 + 8/(384 \times 10^3) \leq T2 \leq T3 - 8/(384 \times 10^3)$

[3] Following part (T4) $T3 \leq T4 \leq T2 + 220/(384 \times 10^3)$

However, $T2 - T0 \leq 220/(384 \times 10^3)$, $T4 - T2 \leq 220/(384 \times 10^3)$

Judgment: If [1] [2] [3] are all below the specified level for at least 4 continuous frames (when full rate) or 2 or more continuous significant frames (when half rate) (Public only), that slot is judged as "free".

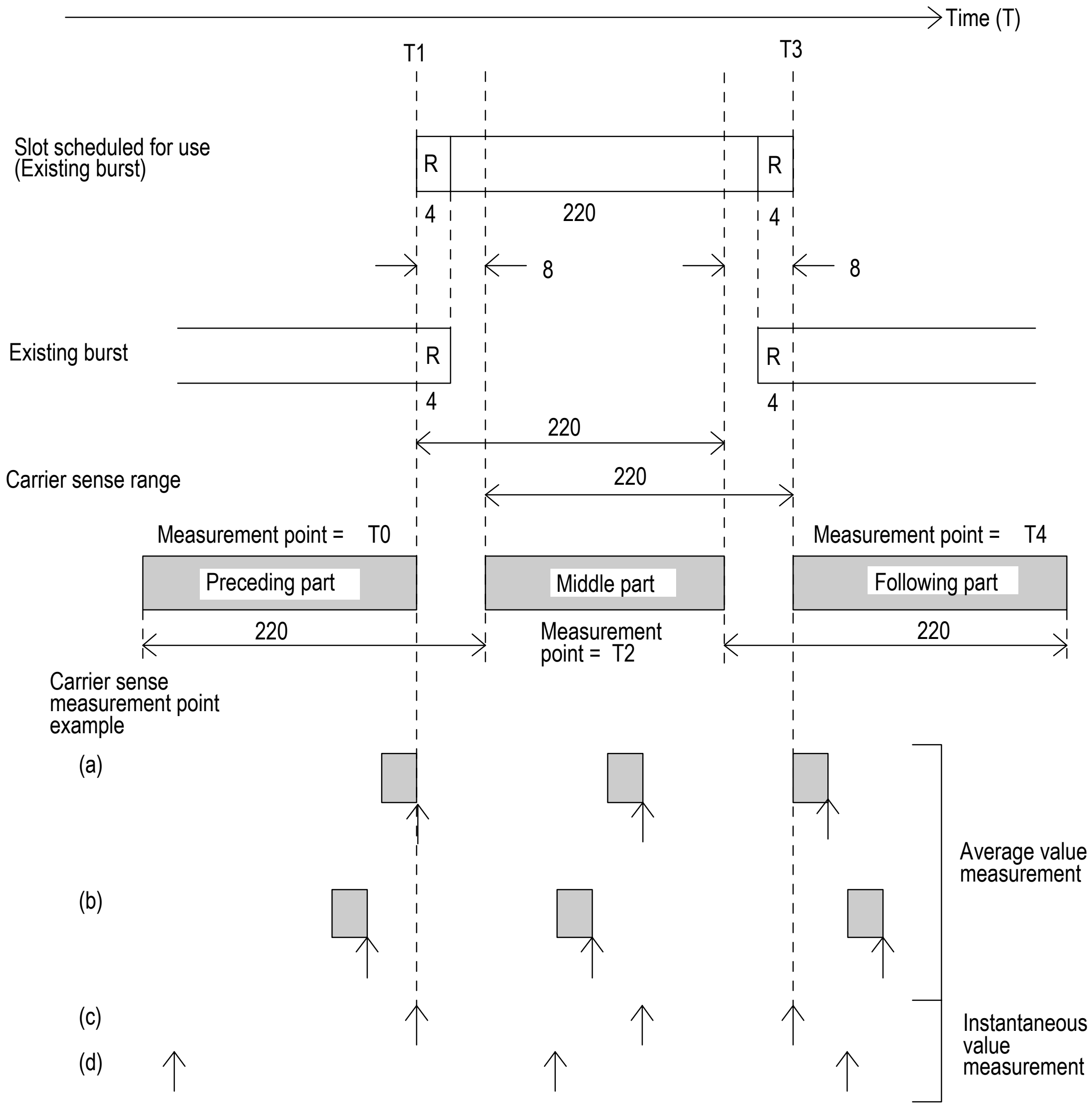


Figure 3.2-1 Example of carrier sensing position on PS side

Each timing in case other band signal and modulation method should be same as shown in Figure 3.2-1 in case that occupied bandwidth is 288kHz or less and π /4 shift QPSK.

(5) Example of carrier sensing position on CS side

The measurement points are within the following range in case that occupied bandwidth is 288kHz or less and π /4 shift QPSK. Judgment uses the average value of any length of time, or the instantaneous value of any point. Furthermore, in the modulated signal, since the deviation of instantaneous power is large with respect to average power, use caution in judgment.

[1] Preceding part (T0) $T2 - 220/(384 \times 10^3) \le T0 \le T1 + 4/(384 \times 10^3)$

[2] Middle part (T2) $T1 + 8/(384 \times 10^3) \le T2 \le T3 - 8/(384 \times 10^3)$

[3] Following part (T4) $T3 - 4/(384 \times 10^3) \le T4 \le T2 + 220/(384 \times 10^3)$

However, $T2 - T0 \le 220/(384 \times 10^3)$, $T4 - T2 \le 220/(384 \times 10^3)$

Judgment: If [1] [2] [3] are all below the specified level for at least 4 continuous frames (when full rate), or 2 or more continuous significant frames (when half rate) (Public only), that slot is judged as "free".

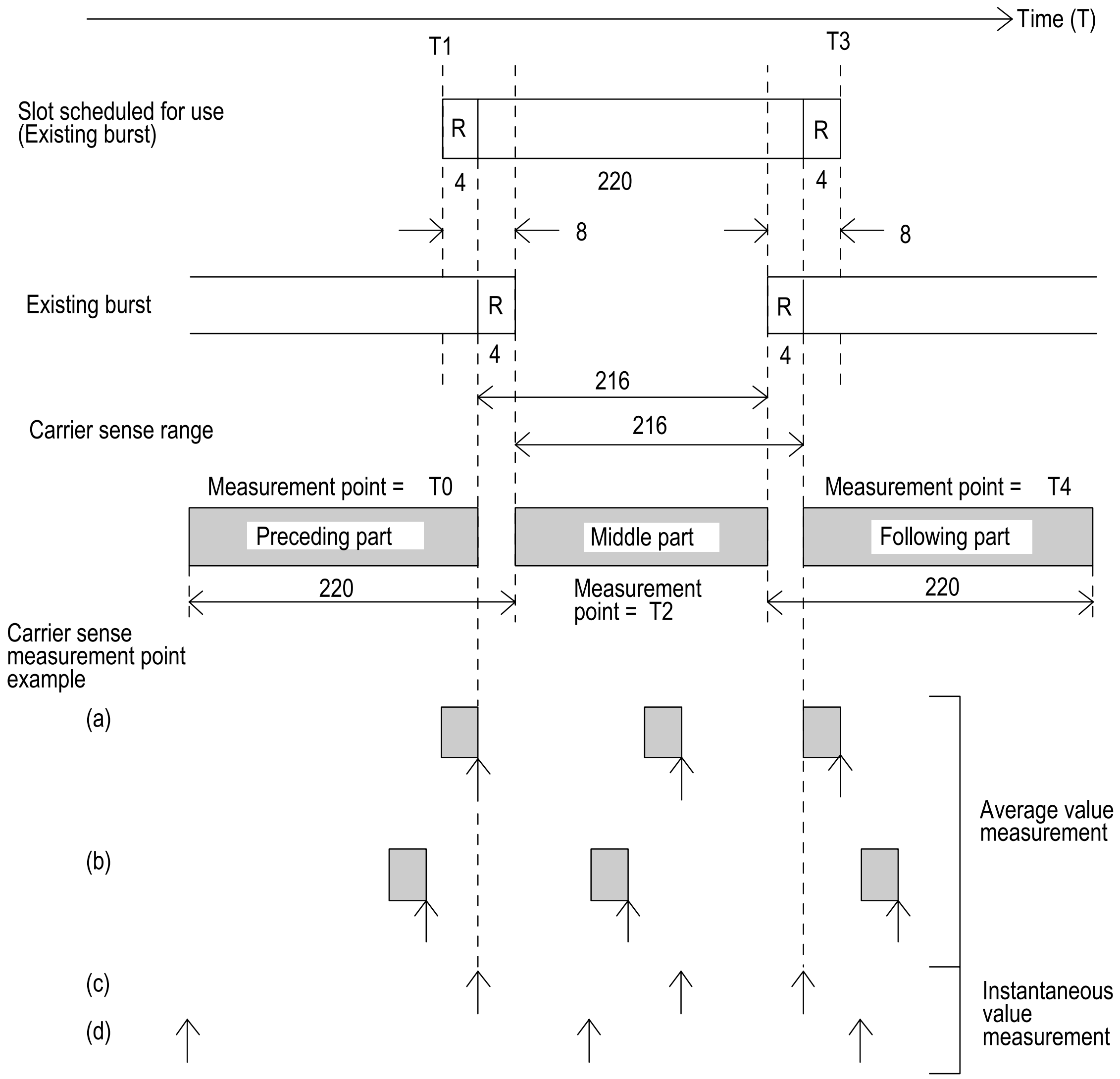


Figure 3.2-2 Example of carrier sensing position on CS side

Each timing in case other band signal and modulation method should be same as shown in Figure 3.2-2 in case that occupied bandwidth is 288kHz or less and π /4 shift QPSK.

3.2.16 Interference avoidance and transmission disable (Private standard/Public standard)

Cell stations and personal stations perform line monitoring (error detection). If interference is incurred, interference avoidance is performed according to its degree in the following order.

[1] Channel switching to another slot on same carrier
[2] Channel switching to slot on another carrier
[3] Channel switching to another cell station
[4] Automatic reconnection
[5] Temporary stop of transmission
[6] Release of radio line

In case that cell stations and personal stations has an adaptive modulation method, it is possible that interference is reduced by changing modulation method and communication is continued.

3.2.16.1 Interference avoidance (Private standard/Public standard)

The cell station and personal station perform continuous line monitoring after service channel establishment. The number of slots which have slot errors (unique word non-detection or CRC error) among valid slots (slots for which transmission is scheduled by peer station in response to transmission of own station) are monitored (called FER measurement) for 1.2 seconds (when full rate: 240 slots equivalent, when half rate: 120 slots equivalent (Public only)), and if that number is above the channel switching FER threshold value reported from the cell station (when half rate, half of the channel switching FER threshold value reported from the cell station (rounding off under a decimal point) (Public only)) , interference avoidance is performed by any of items [1] – [4] of 3.2.16 interference avoidance and transmission disable, according to the regulations of 4.4.3.5 Radio frequency transmission management (RT).

3.2.16.2 Transmission disable (Private standard/Public standard)

(1) Communications carrier

The personal station and cell station carry out continuous line supervision. Slot errors in valid slots are observed, and if slot errors occur continuously, it results in slot error state.

Regardless of whether it does, does not or can not perform interference avoidance by the above item, if continuous slot error state continues for at least 4 seconds, the personal station temporarily stops transmission until the state is recovered, regardless of reception level.

And similarly, cell station and personal station promptly sends the calling termination signal and stops transmitting upon completion of communication.

Also if the continuous slot error state continues for at least 60 seconds, the personal station and cell station release the radio line regardless of reception level.

(2) Carrier for direct communication between personal stations

If transmission continues for 30 minutes, the personal station unconditionally stops transmission. Also, transmission is not to be restarted for 1/90 or more periods of the communication time (minimum 2 seconds) after transmission is stopped.

3.2.17 Reception window (Private standard/Public standard)

The reception window is set while taking into consideration the maximum value of radio wave propagation delay time and transmission timing and transmission jitter regulations.

3.2.18 Transmission timing and transmission jitter (Private standard/Public standard)

(1) CS transmission timing

At the antenna terminal, standard transmission timing of control physical slot is taken as (5 x n) ms (n is LCCH interval value) after the last transmitted control physical slot. Also, at the antenna terminal standard transmission timing of control physical slot is taken as (5 x l) ms (l is 1 when full rate, 2 when half rate, or 4 when quarter rate) after the last transmitted communication physical slot. CS transmission timing in this case is within ±5 ppm of the interval accuracy with respect to standard timing.

As for the relationship of transmission timing between the last control or communication physical slot that contains a message that specifies the communication physical slot to PS (abbreviated as designation physical slot) and the applicable communication physical slot, at the antenna terminal, standard transmission timing of the applicable communication physical slot is taken as (5 x k_1 + 0.625 x {absolute slot number of communication physical slot - absolute slot number of designation physical slot}) ms (k_1 is a natural number) after the timing of the designation physical slot. CS transmission timing in this case is within ±1 symbol of the timing where interval accuracy of ±5 ppm is added to standard timing.

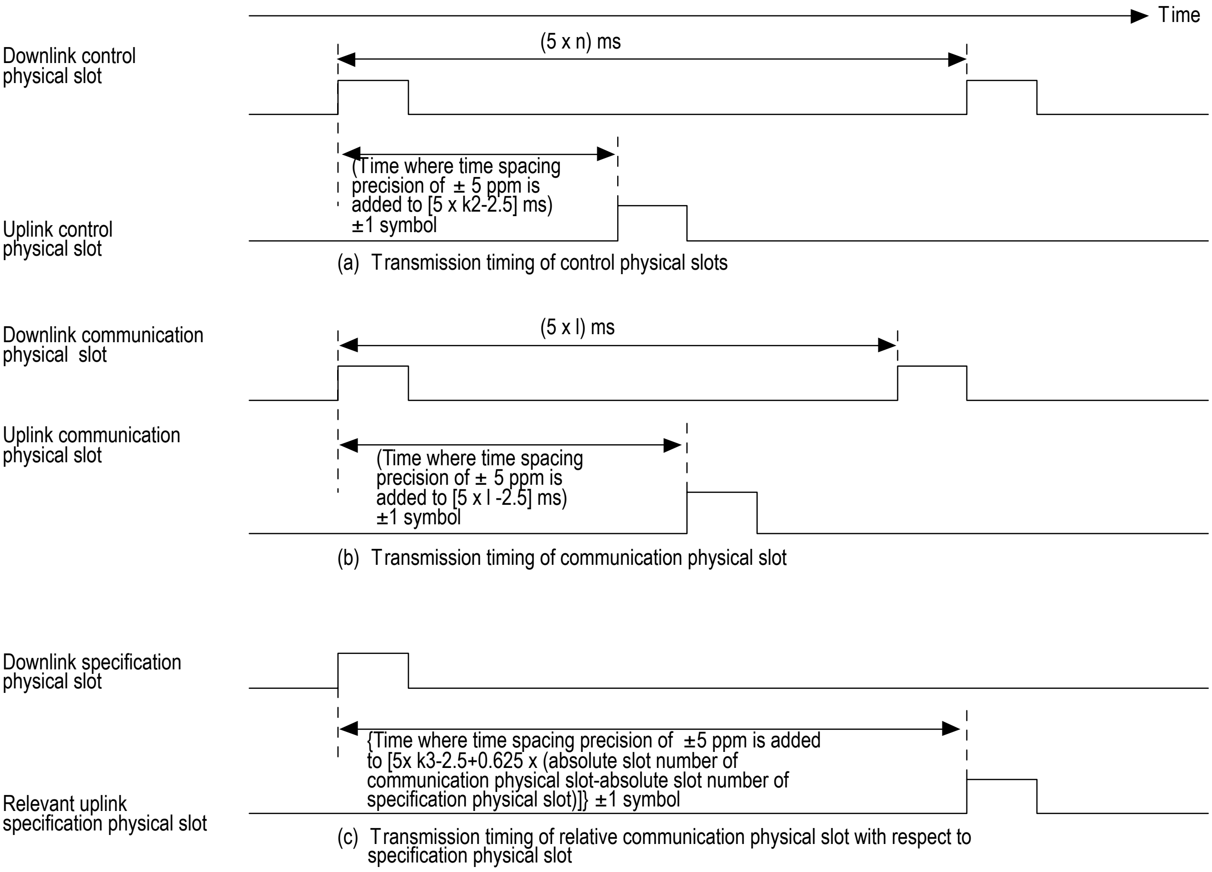
(2) PS transmission timing

At the antenna terminal, standard transmission timing of the control physical slot is taken as (5 x k_2 - 2.5) ms (k_2 is a natural number less than or equal to LCCH interval value) after the timing of the received control physical slot.

Also, at the antenna terminal, standard transmission timing of the communication physical slot is taken as (5 x l - 2.5) ms (l is same as that in (1) above) after the timing of the received communication physical slot. However, as for the relationship with the timing of the received designation physical slot (same meaning as that in (1) above), at the antenna terminal, standard transmission timing of the relative communication physical slot is (5 x k_3 - 2.5 + 0.625 x {absolute slot number of communication physical slot - absolute slot number of designation physical slot}) ms (k_3 is a natural number) after the timing of received designation physical slot.

PS transmission timing, in the synchronized state, is within ±1 symbol of the timing where interval accuracy of ±5 ppm is added to standard timing.

See Figure 3.3.



(Note) Figure (a), (b) and (c) show timing at the PS antenna terminal when wave propagation delay is not included.

Figure 3.3 PS transmission timing

(3) CS transmission jitter

When roll off factor of base band band-pass filter is 0.5

π /4 shift QPSK	1/8 symbol or less
BPSK	1/8 symbol or less
QPSK	1/8 symbol or less
8PSK	1/16 symbol or less
12QAM	1/16 symbol or less
16QAM	1/16 symbol or less
24QAM	1/32 symbol or less
32QAM	1/32 symbol or less
64QAM	1/32 symbol or less
256QAM	1/32 symbol or less

When roll off factor of base band band-pass filter is 0.38

π /4 shift QPSK	1/8 symbol or less
BPSK	1/8 symbol or less
QPSK	1/8 symbol or less
8PSK	1/32 symbol or less
12QAM	1/32 symbol or less
16QAM	1/32 symbol or less

24QAM	1/32 symbol or less
32QAM	1/32 symbol or less

(4) PS transmission jitter

When PS is detecting UW from CS PS transmission jitter are as follows.

When roll off factor of base band band-pass filter is 0.5

π/4 shift QPSK	1/8 symbol or less
BPSK	1/8 symbol or less
QPSK	1/8 symbol or less
8PSK	1/16 symbol or less
12QAM	1/16 symbol or less
16QAM	1/16 symbol or less
24QAM	1/32 symbol or less
32QAM	1/32 symbol or less
64QAM	1/32 symbol or less
256QAM	1/32 symbol or less

When roll off factor of base band band-pass filter is 0.38

π/4 shift QPSK	1/8 symbol or less
BPSK	1/8 symbol or less
QPSK	1/8 symbol or less
8PSK	1/32 symbol or less
12QAM	1/32 symbol or less
16QAM	1/32 symbol or less
24QAM	1/32 symbol or less
32QAM	1/32 symbol or less

Note that value after extracting affected portion by CS transmission jitter shall be applicable, if CS has transmission jitter.

(Note) Transmission jitter specifies deviation between frames, and the maximum value of deviation between adjacent frames shall satisfy the above standards of (3) and (4).

3.2.19 Communication quality (Private standard/Public standard)

(1) Communication quality when CS is connected to digital network (communication quality of PS)

See Table 3.2.1 and Figure 3.4.

Specified values of Table 3.2.1 shall apply when only the mutual conversion between ADPCM <—> μ -law PCM according to ITU-T recommendation G.726 for voice coding is performed.

Table 3.2.1 Communication quality standards

Item	Standard
Sending loudness rating (SLR)	5 ~ 11 dB
Reception loudness rating (RLR)	-1 ~ 5 dB
Sidetone masking rating (STMR)	10 ~ 15 dB

(Note 1) The loudness rating constant conforms to ITU-T recommendations.
P. 76 Determination of loudness ratings: Fundamental principles
P. 79 Calculation of loudness ratings

(Note 2) The sidetone masking rating is equivalent to "Talker Sidetone" on P. 66 of ITU-T recommendation.

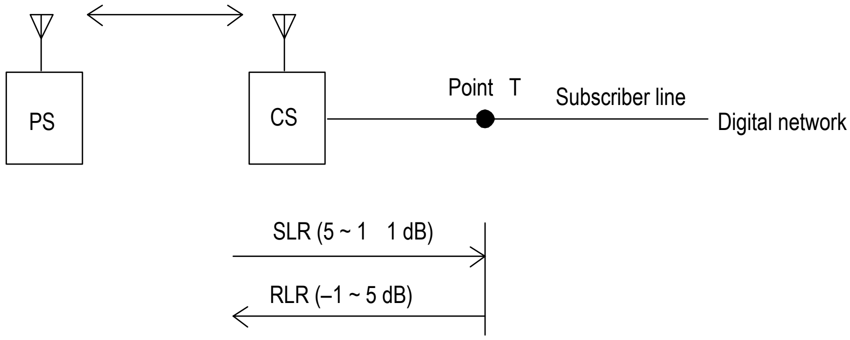


Figure 3.4 Measurement point regulations

(2) Communication quality when CS is connected to analog network

See Table 3.2.2 and Figure 3.5.

Specified values of in Table 3.2.2 shall apply when PS satisfies communication quality standards of (1).

Table 3.2.2 Communication quality standards

Item	Standard	Measurement conditions (pseudo-line)
Sending loudness rating (SLR)	12 dB or less	0.4 mm ϕ -7 dB
Reception loudness rating (RLR)	-2 ~ -10 dB	0.4 mm ϕ -7 dB
Sidetone masking rating (STMR)	3 dB or more	0.4 mm ϕ -7 dB 0.5 mm ϕ -7 dB 0.65 mm ϕ -7 dB, 0 dB

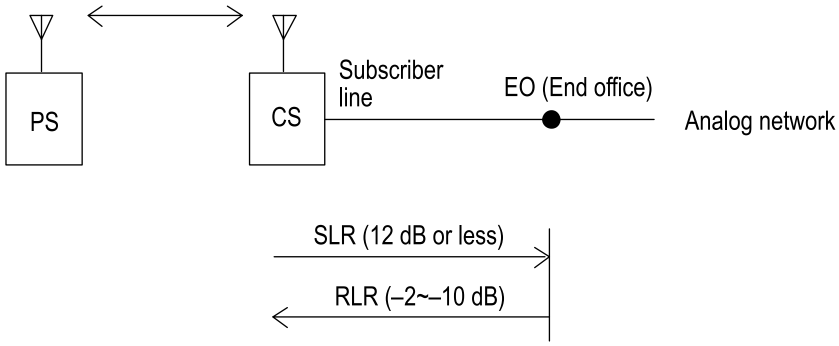


Figure 3.5 Measurement point regulations

3.2.20 Output power specified in the Terminal Equipment Regulations

(Private standard/Public standard)

(1) Output power of PS

If PS is used for non-speech communication, output power to the ADPCM coder input point of that PS is as shown in Table 3.3.1.

Table 3.3.1 Output power tolerance limits of PS

Item	Output power tolerance limits
Output power	Less than -8 dBm (Mean level), and not exceeding 0dBm (Maximum level).

(Note) "Mean level" refers to the average output power level (effective value) when the terminal equipment is in operational state. "Maximum level" refers to the highest possible signal power level (effective value) settable when adjusting the output level of the terminal equipment.

(2) Output power of CS (Output power when CS is connected to analog network) (Private standard)

If CS is used for non-speech communication, output power of the CS to network is as shown in Table 3.3.2, provided that PS satisfies values shown in Table 3.3.1.

Table 3.3.2 Output power tolerance limits of CS

Item	Output power tolerance limits
Output level up to 4kHz	Less than -8 dBm (Mean level), and not exceeding 0dBm (Maximum level).

(Note 1) "Mean level" refers to the average signal power level (effective value) when the terminal equipment is in operational state. "Maximum level" refers to the highest possible signal power level (effective value) settable when adjusting the output level of the terminal equipment.

(Note 2) Output power should be measured with the output connected to a balanced impedance of 600 ohm, and be expressed in an absolute value.

(Note 3) If CS has the signal source of non-speech communication, spurious output level is stipulated other than this stipulation. (Refer to article 14 of specifications for terminal equipment.)

(3) Output power of CS (Output power when CS is connected to digital network) (Private standard)

If CS is used for non-speech communication, the output power when digital signals are converted into analog signals is shown in Table 3.3.3, provided that PS satisfies values shown in Table 3.3.1.

Table 3.3.3 Output power tolerance limits of CS

Item	Output power tolerance limits
Output power	Less than -8 dBm (Mean level), and not exceeding 0dBm (Maximum level).

(Note) "Mean level" refers to the average signal power level (effective value) when the terminal equipment is in operational state. "Maximum level" refers to the highest possible signal power level (effective value) settable when adjusting the output level of the terminal equipment.

3.2.21 Time alignment control (Private reference/Public reference)

If needed, time alignment control which corrects signaling delay time up to ± 1 symbol should be used.

3.2.22 Unsymmetrical communication (Private reference/Public reference)

If needed, unsymmetrical communication of modulation method, frequency bandwidth and time slot within current frame configuration should be used.

3.2.23 Error-correcting coding (Private reference/Public reference)

If needed, error-correcting coding should be used.

3.2.24 Slot connection (Private reference/Public reference)

If needed, slot connecting communication within current frame configuration should be possible.

3.3 Conditions for modulation method (Private standard/Public standard)

3.3.1 Modulation method (Private standard/Public standard)

π/4 shift QPSK, BPSK(in case of π/2 shift BPSK), QPSK, 8PSK(in case of D8PSK), 12QAM, 16QAM, 24QAM, 32QAM, 64QAM and 256QAM are prescribed as follows.

3.3.1.1 Modulation method

(Private standard/Public standard)

The modulation procedures for stipulating modulation methods are shown in Figure 3.6.1 – 3.6.10

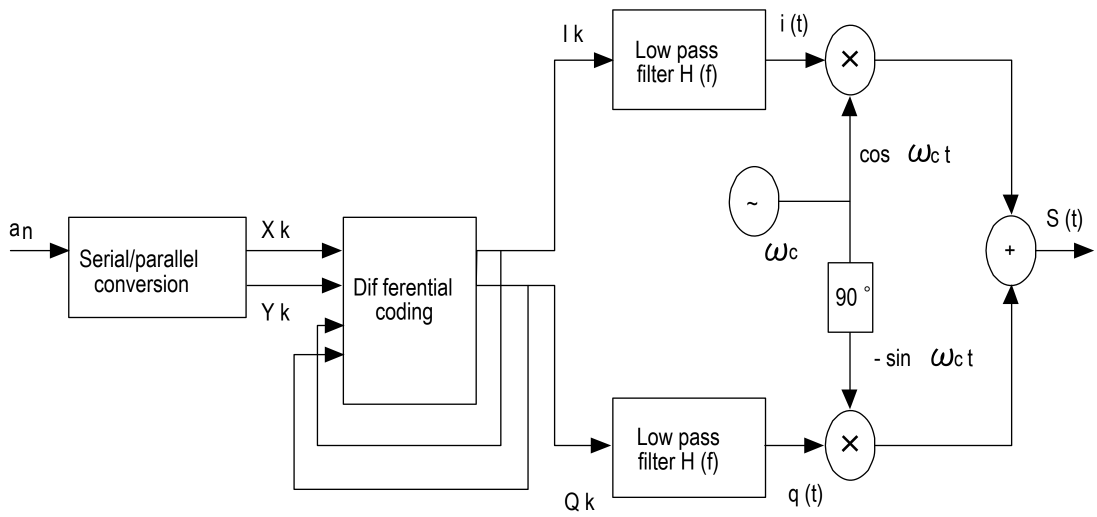


Figure 3.6.1 π /4 shift QPSK modulation circuit

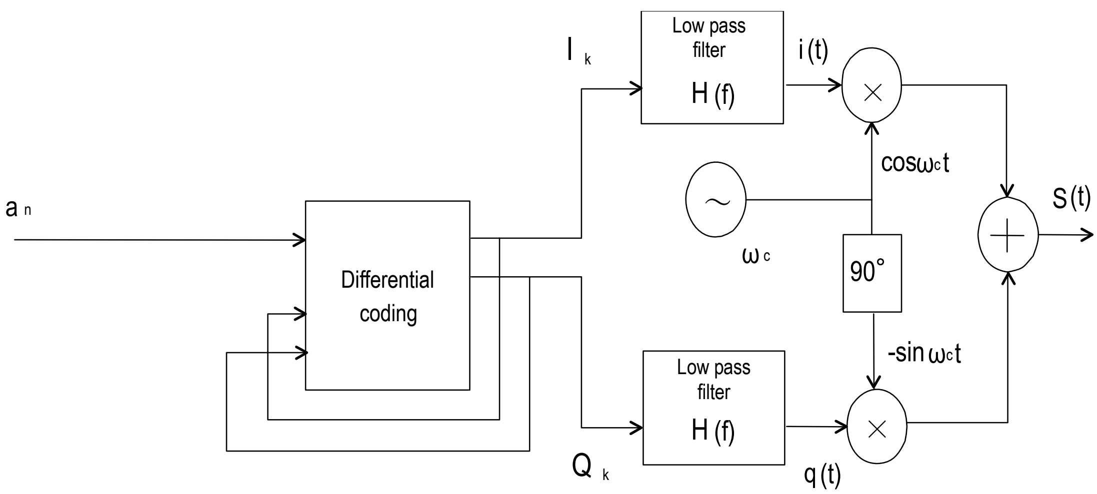


Figure 3.6.2 BPSK modulation circuit (in case of π /2 shift BPSK)

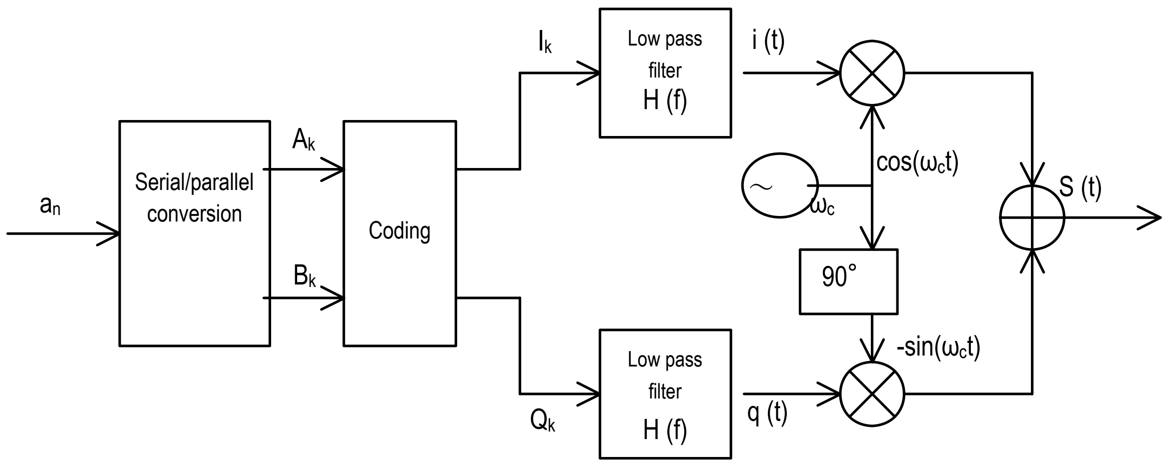


Figure 3.6.3 QPSK modulation circuit

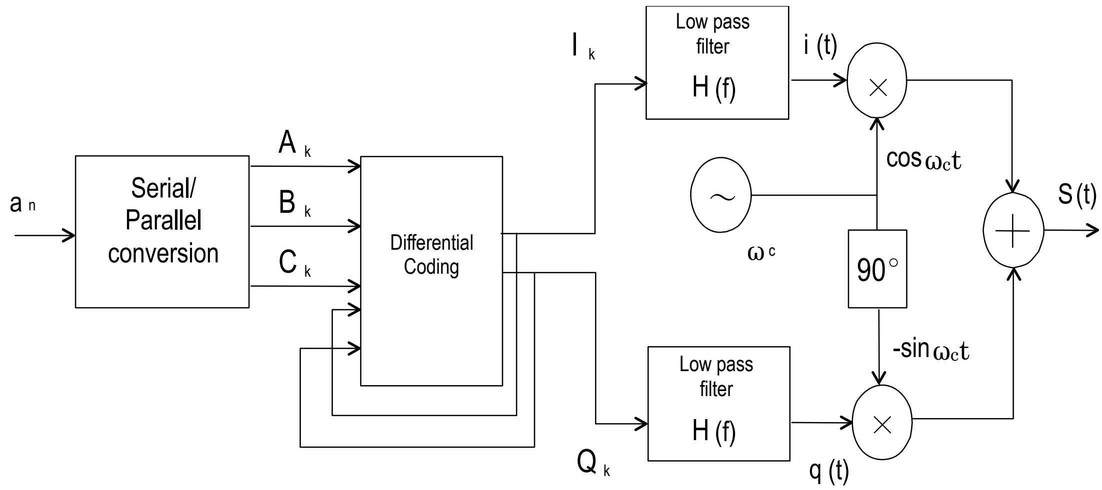


Figure 3.6.4 8PSK modulation circuit (in case of D8PSK)

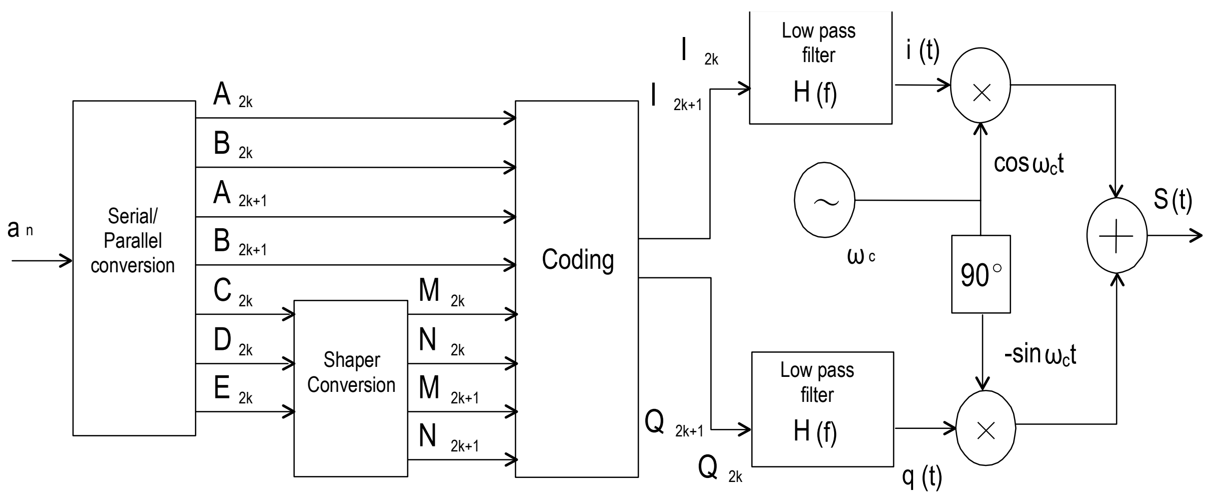


Figure 3.6.5 12QAM modulation circuit

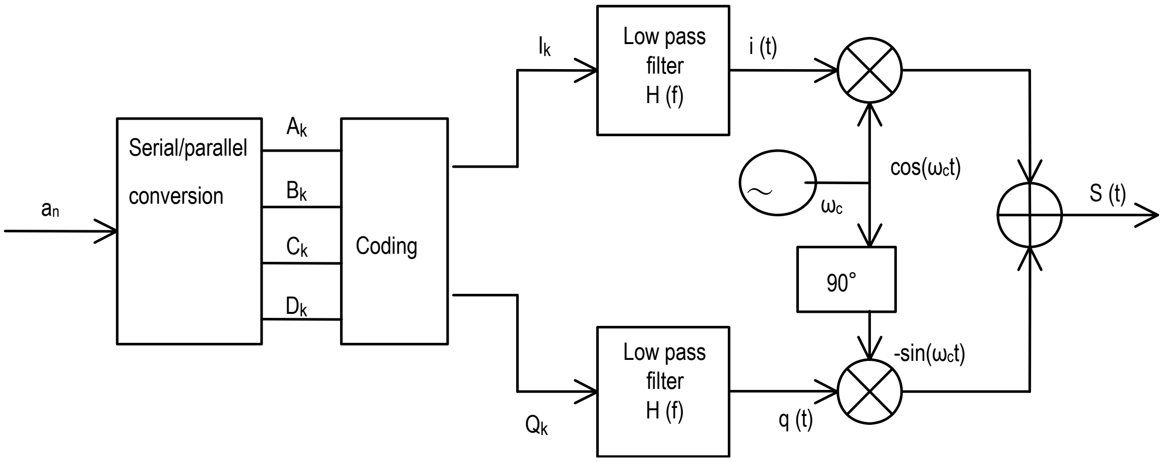


Figure 3.6.6 16QAM modulation circuit

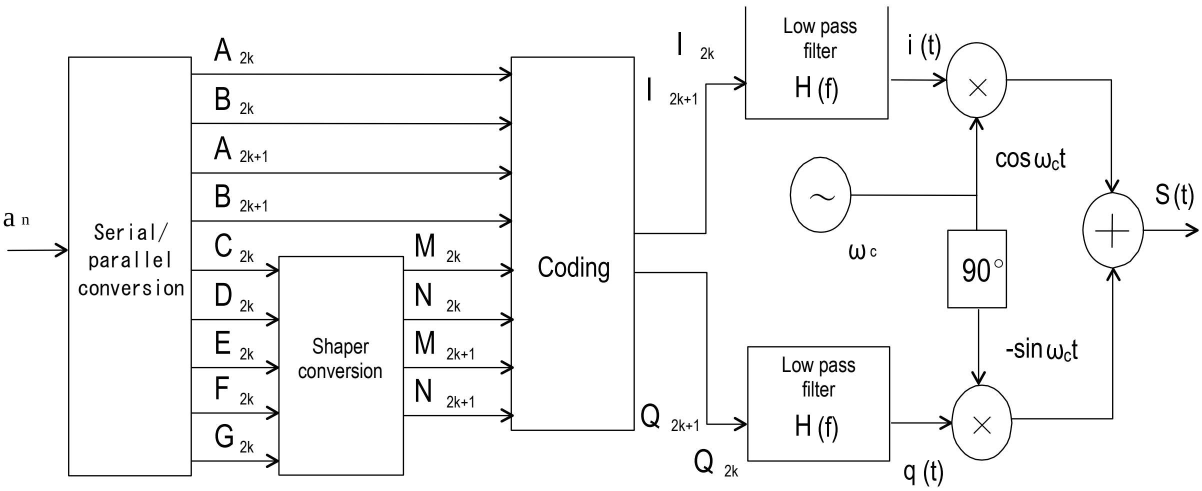


Figure 3.6.7 24QAM modulation circuit

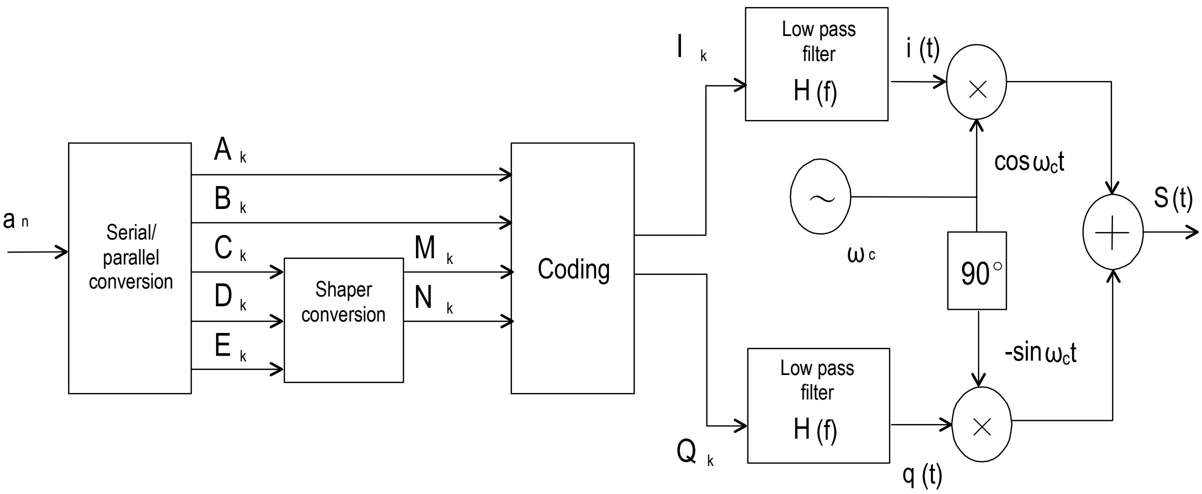


Figure 3.6.8 32QAM modulation circuit

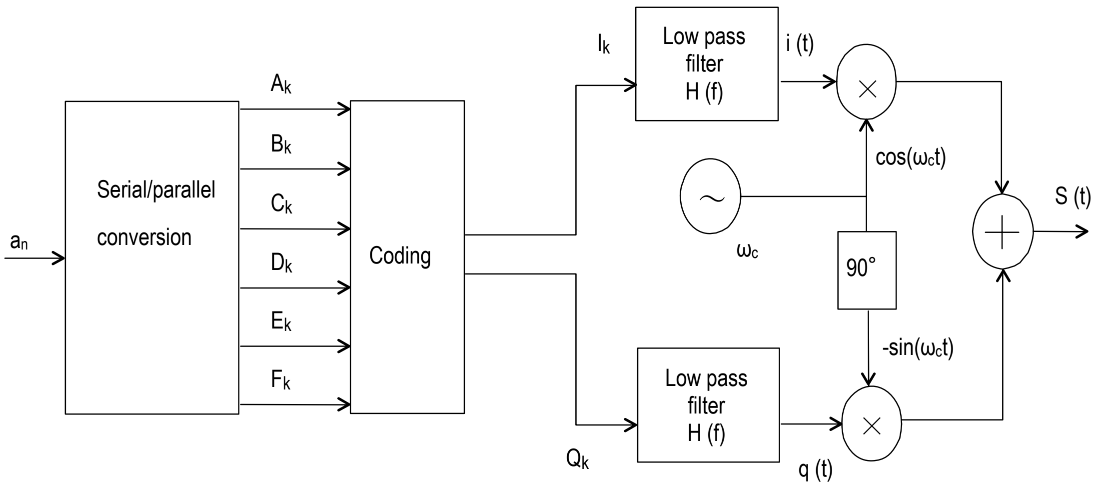


Figure 3.6.9 64QAM modulation circuit

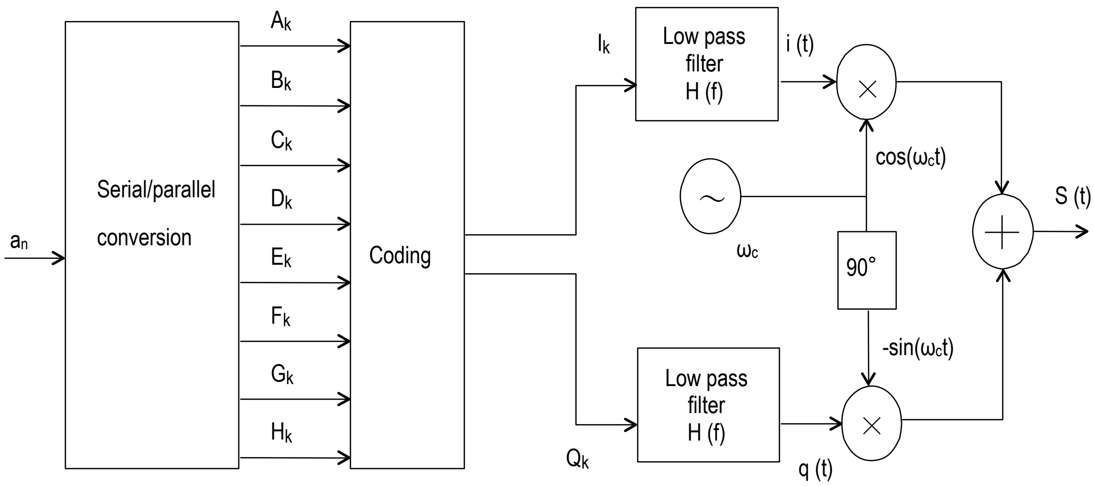


Figure 3.6.10 256QAM modulation circuit

3.3.1.2 Coding (Private standard/Public standard)

(a) π /4 shift QPSK

(1) The serial signal input is converted to (X_k, Y_k) symbols by the serial/parallel converter and then changed to corresponding signals (I_k, Q_k) by the differential encoder. Conversion from serial signal input to (X_k, Y_k) (binary/quaternary conversion) is performed as noted below, and conversion from (X_k, Y_k) to (I_k, Q_k) is performed according to equation 3.3-1.1 and Table 3.4.1.

Binary data time series	• • • a_{n-1}, a_n, a_{n+1} • • •
↓	↓ ↓
Symbol time series	(a_n, a_{n+1})
	↓ ↓
	X_k Y_k

$$I_k = I_{k-1} \cos[\Delta\phi(X_k, Y_k)] - Q_{k-1} \sin[\Delta\phi(X_k, Y_k)]$$
$$Q_k = I_{k-1} \sin[\Delta\phi(X_k, Y_k)] + Q_{k-1} \cos[\Delta\phi(X_k, Y_k)] \qquad \text{Equation (3.3-1.1)}$$

Table 3.4.1 $\pi/4$ shift QPSK Differential coding regulations

X_k	Y_k	$\Delta\phi$
1	1	$-3\pi/4$
0	1	$3\pi/4$
0	0	$\pi/4$
1	0	$-\pi/4$

(2) The signal space diagram is shown in Figure 3.7.1.

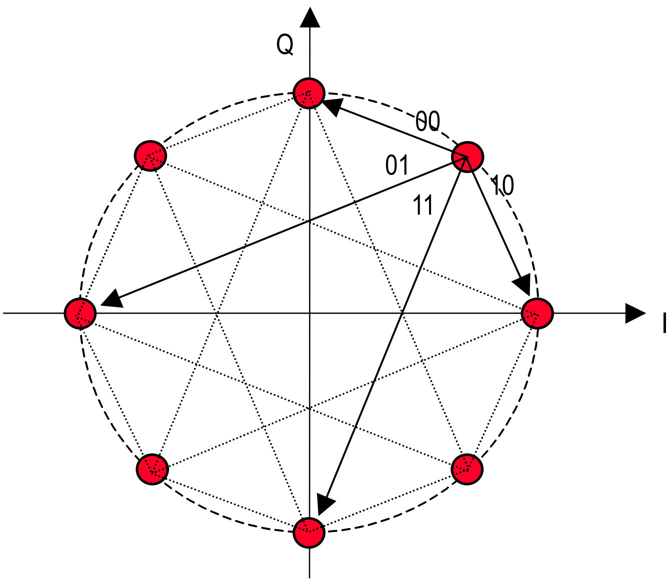


Figure 3.7.1 $\pi/4$ shift QPSK signal space diagram

(b) BPSK (in case of $\pi/2$ shift BPSK)

(1) The serial signal input (a_n) is converted to corresponding signals (I_k,Q_k) by the differential encoder. Conversion from serial signal input to corresponding signals (I_k,Q_k) is performed according to equation 3.3-1.2 and Table 3.4.2.

Binary data time series ⋯, a_{n-1}, a_n, a_{n+1}, a_{n+2}, ⋯
↓ ↓
Symbol time series a_n

$$I_k = I_{k-1} \cos[\Delta\phi(a_n)] - Q_{k-1} \sin[\Delta\phi(a_n)]$$
$$Q_k = I_{k-1} \sin[\Delta\phi(a_n)] + Q_{k-1} \cos[\Delta\phi(a_n)] \qquad \text{Equation (3.3-1.2)}$$

Table 3.4.2 BPSK coding regulations($\pi/2$ shift BPSK Differential coding regulations)

a_n	$\Delta\varnothing$
1	$-\pi/2$
0	$\pi/2$

(2) The signal space diagram is shown in Figure 3.7.2

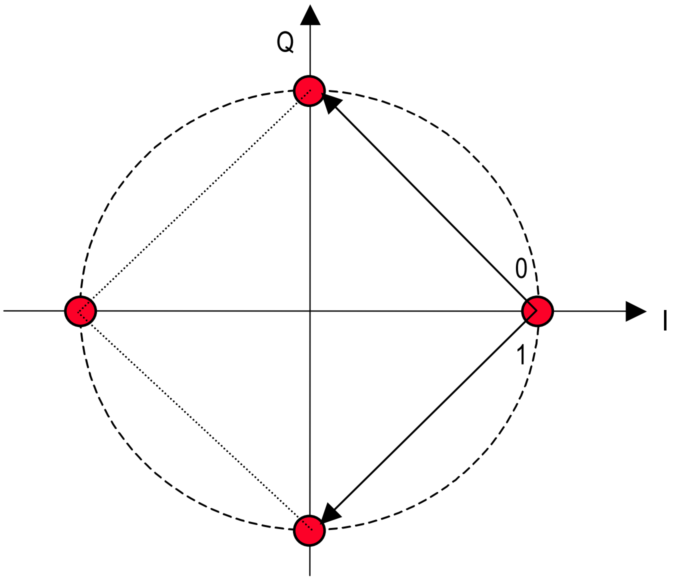


Figure 3.7.2 BPSK signal space diagram (in case of $\pi/2$ shift BPSK)

(c) QPSK

(1) The serial signal input is converted to (A_k, B_k) symbols by the serial/parallel converter and then changed to corresponding signals (I_k, Q_k) by the encoder. Conversion from serial signal input to (A_k, B_k) (binary/quaternary conversion) is performed as noted below, and conversion from (A_k, B_k) to (I_k, Q_k) is performed according to Table 3.4.3.

Binary data time series ⋯, a_{n-1}, a_n, a_{n+1}, a_{n+2}, ⋯

↓ ↓ ↓

Symbol time series (a_n, a_{n+1})

↓ ↓

A_k, B_k

Table 3.4.3 QPSK coding regulations

A_k	B_k	I_k	Q_k
1	1	1	0
0	1	0	1
0	0	-1	0
1	0	0	-1

(2) The signal space diagram is shown in Figure 3.7.3

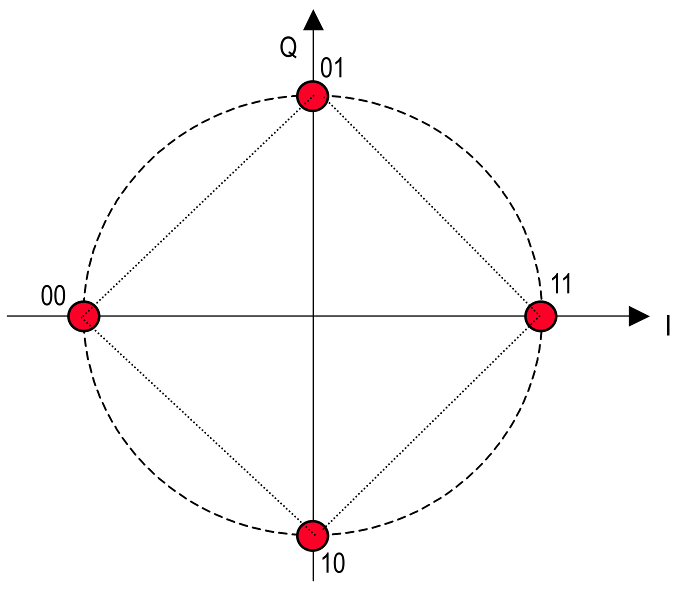


Figure 3.7.3 QPSK signal space diagram

(d) 8PSK (in case of D8PSK)

(1) The serial signal input is converted to (A_k, B_k, C_k) symbols by the serial/parallel converter and then changed to corresponding signals (I_k, Q_k) by the differential encoder. Conversion from serial signal input to (A_k, B_k, C_k) (binary/8ary conversion) is performed as noted below, and conversion from (A_k, B_k, C_k) to (I_k, Q_k) is performed according to equation 3.3-1.3 and Table 3.4.4.

$$\begin{array}{lc}
\text{Binary data time series} & \cdots, a_{n-1}, a_n, a_{n+1}, a_{n+2}, a_{n+3}, \cdots \\
\downarrow & \downarrow \quad \downarrow \quad \downarrow \\
\text{Symbol time series} & (a_n, a_{n+1}, a_{n+2}) \\
 & \downarrow \quad \downarrow \quad \downarrow \\
 & A_k,\ B_k,\ C_k
\end{array}$$

$$I_k = I_{k-1} \cos[\Delta Ø (A_k, B_k, C_k)] - Q_{k-1} \sin[\Delta Ø (A_k, B_k, C_k)]$$
$$Q_k = I_{k-1} \sin[\Delta Ø (A_k, B_k, C_k)] + Q_{k-1} \cos[\Delta Ø (A_k, B_k, C_k)] \qquad \text{Equation (3.3-1.3)}$$

Table 3.4.4 8PSK coding regulations (D8PSK Differential coding regulations)

A_k		B_k	$\Delta Ø$
1	1	1	0
1	1	0	$\pi/4$
0	1	0	$\pi/2$
0	1	1	$3\pi/4$
0	0	1	π
0	0	0	$-3\pi/4$
1	0	0	$-\pi/2$
1	0	1	$-\pi/4$

(2) The signal space diagram is shown in Figure 3.7.4

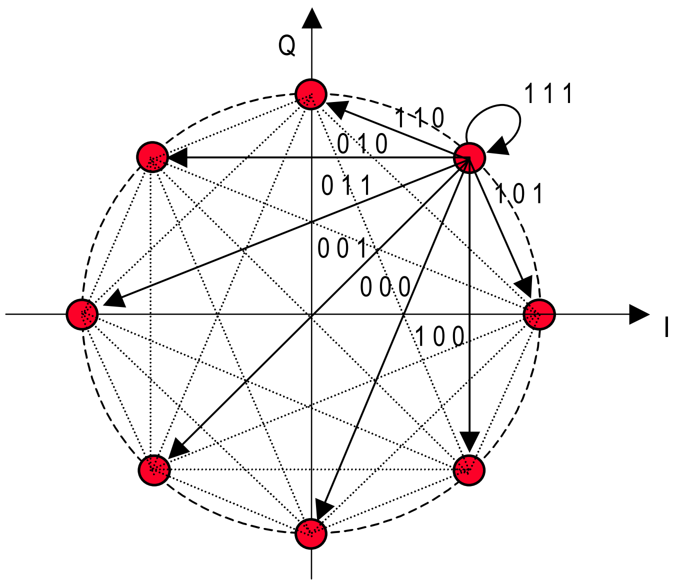


Figure 3.7.4 8PSK signal space diagram (in case of D8PSK)

(e) 12QAM

(1) The serial signal input is converted to (A_{2k}, B_{2k}, A_{2k+1}, B_{2k+1}, C_{2k}, D_{2k}, E_{2k}) symbols by the serial/parallel converter and (C_{2k}, D_{2k}, E_{2k}) is converted to (M_{2k}, N_{2k}, M_{2k+1}, N_{2k+1}) by the shaper and then (A_{2k}, B_{2k}, M_{2k}, N_{2k}) and (A_{2k+1}, B_{2k+1}, M_{2k+1}, N_{2k+1}) are changed to corresponding signals (I_{2k}, Q_{2k}) and (I_{2k+1}, Q_{2k+1}) by the encoder. Conversion from serial signal input to (A_{2k}, B_{2k}, A_{2k+1}, B_{2k+1}, C_{2k}, D_{2k}, E_{2k}) is performed as noted below, conversion from (C_{2k}, D_{2k}, E_{2k}) to (M_{2k}, N_{2k}, M_{2k+1}, N_{2k+1}) is performed according to Table 3.4.5, and conversion from (A_{2k}, B_{2k}, M_{2k}, N_{2k}) and (A_{2k+1}, B_{2k+1}, M_{2k+1}, N_{2k+1}) to (I_{2k}, Q_{2k}) and (I_{2k+1}, Q_{2k+1}) is performed according to Table 3.4.6.

Binary data time series $\cdots$, a_{n-1}, a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, a_{n+5}, a_{n+6}, a_{n+7} $\cdots$

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

Symbol time series (a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, a_{n+5}, a_{n+6})

↓ ↓ ↓ ↓ ↓ ↓ ↓

A_{2k} B_{2k} A_{2k+1} B_{2k+1} C_{2k} D_{2k} E_{2k}

Table 3.4.5 12QAM shaper conversion regulations

C_{2k}	D_{2k}	E_{2k}	M_{2k}	N_{2k}	M_{2k+1}	N_{2k+1}
0	0	0	0	0	0	0
0	0	1	0	0	0	1
0	1	0	0	0	1	0
0	1	1	0	1	0	1
1	0	0	0	1	0	0
1	0	1	0	1	1	0
1	1	0	1	0	0	1
1	1	1	1	0	0	0

Table 3.4.6 12QAM coding regulations

A_i	M_i	I_i
B_i	N_i	Q_i
1	1	−3
0	0	−1
1	0	1
0	1	3

where i=2k,2k+1

(2) The signal space diagram is shown in Figure 3.7.5

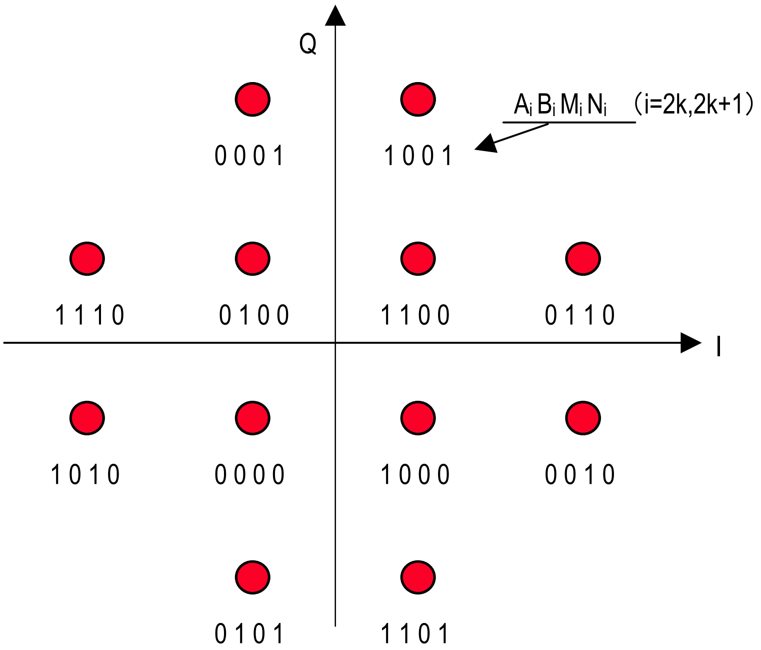


Figure 3.7.5 12QAM signal space diagram

(f) 16QAM

(1) The serial signal input is converted to (A_k, B_k, C_k, D_k) symbols by the serial/parallel converter and then changed to corresponding signals (I_k, Q_k) by the encoder. Conversion from serial signal input to (A_k, B_k, C_k, D_k) (binary/16ary conversion) is performed as noted below, and conversion from (A_k, B_k, C_k, D_k) to (I_k, Q_k) is performed according to Table 3.4.7

Binary data time series ⋯, a_{n-1}, a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, ⋯
↓ ↓ ↓ ↓ ↓
Symbol time series (a_n, a_{n+1}, a_{n+2}, a_{n+3})
↓ ↓ ↓ ↓
A_k, B_k, C_k, D_k

Table 3.4.7 16QAM coding regulations

A_k	C_k	I_k
B_k	D_k	Q_k
0	0	−1
0	1	−3
1	0	1
1	1	3

(2) The signal space diagram is shown in Figure 3.7.6

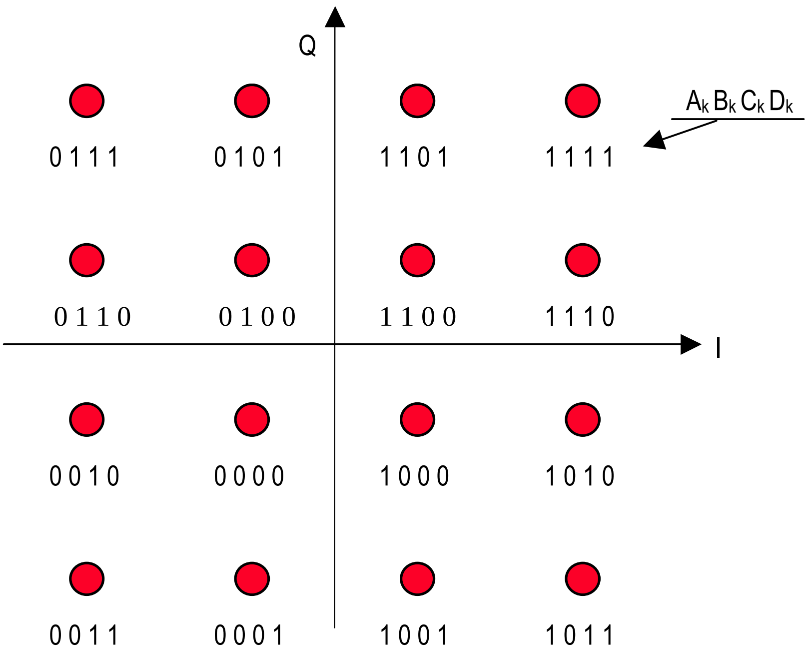


Figure 3.7.6 16QAM signal space diagram

(g) 24QAM

(1) The serial signal input is converted to (A_{2k}, B_{2k}, A_{2k+1}, B_{2k+1}, C_{2k}, D_{2k}, E_{2k}, F_{2k}, G_{2k}) symbols by the serial/parallel converter and (C_{2k}, D_{2k}, E_{2k}, F_{2k}, G_{2k}) is converted to (M_{2k}, N_{2k}, M_{2k+1}, N_{2k+1}) by the shaper and then (A_{2k}, B_{2k}, M_{2k}, N_{2k}) and (A_{2k+1}, B_{2k+1}, M_{2k+1}, N_{2k+1}) are changed to corresponding signals (I_{2k}, Q_{2k}) and (I_{2k+1}, Q_{2k+1}) by the encoder. Conversion from serial signal input to (A_{2k}, B_{2k}, A_{2k+1}, B_{2k+1}, C_{2k}, D_{2k}, E_{2k}, F_{2k}, G_{2k}) is performed as noted below, conversion from (C_{2k}, D_{2k}, E_{2k}, F_{2k}, G_{2k}) to (M_{2k}, N_{2k}, M_{2k+1}, N_{2k+1}) is performed according to Table 3.4.8, and conversion from (A_{2k}, B_{2k}, M_{2k}, N_{2k}) and (A_{2k+1}, B_{2k+1}, M_{2k+1}, N_{2k+1}) to (I_{2k}, Q_{2k}) and (I_{2k+1}, Q_{2k+1}) is performed according to Table 3.4.9.

Binary data time series ⋯, a_{n-1}, a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, a_{n+5}, a_{n+6}, a_{n+7}, a_{n+8}, a_{n+9} ⋯

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

Symbol time series (a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, a_{n+5}, a_{n+6}, a_{n+7}, a_{n+8})

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

A_{2k} B_{2k} A_{2k+1} B_{2k+1} C_{2k} D_{2k} E_{2k} F_{2k} G_{2k}

Table 3.4.8 24QAM shaper conversion regulations

C_{2k}	D_{2k}	E_{2k}	F_{2k}	G_{2k}	M_{2k}	N_{2k}	M_{2k+1}	N_{2k+1}
0	X_2	X_3	X_4	X_5	X_2	X_3	X_4	X_5
1	0	0	X_4	X_5	2	0	X_4	X_5
1	0	1	X_4	X_5	0	2	~X_4	X_5
1	1	0	X_4	X_5	~X_4	X_5	2	0
1	1	1	X_4	X_5	X_4	X_5	0	2

The symbolic Xn shown in Table 3.4.8 represents data series (C_{2k}, D_{2k}, E_{2k}, F_{2k}, G_{2k}) converted by serial/parallel conversion. For example, when C_{2k} of data series input is "0", data series output (M_{2k}, N_{2k}, M_{2k+1}, N_{2k+1}) is (D_{2k}, E_{2k}, F_{2k}, G_{2k}). Also "~" means reversal of the bit.

Table 3.4.9 24QAM coding regulations

A_i	M_i	I_i
B_i	N_i	Q_i
0	2	−5
1	1	−3
0	0	−1
1	0	1
0	1	3
1	2	5

where i=2k,2k+1

(2) The signal space diagram is shown in Figure 3.7.7

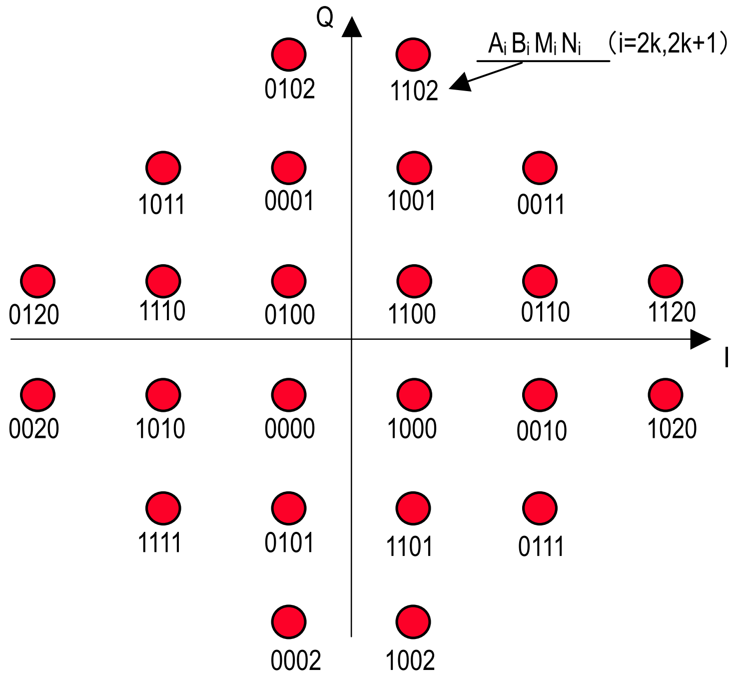


Figure 3.7.7 24QAM signal space diagram

(h) 32QAM

(1) The serial signal input is converted to (A_k, B_k, C_k, D_k, E_k) symbols by the serial/parallel converter and (C_k, D_k, E_k) is converted to (M_k, N_k) by the shaper and then (A_k, B_k, M_k, N_k) is changed to corresponding signals (I_k, Q_k) by the encoder. Conversion from serial signal input to (A_k, B_k, C_k, D_k, E_k) is performed as noted below, conversion from (C_k, D_k, E_k) to (M_k, N_k) is performed according to Table 3.4.10, and conversion from (A_k, B_k, M_k, N_k) to (I_k, Q_k) is performed according to Table 3.4.11.

Binary data time series ⋯, a_{n-1}, a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, ⋯

↓ ↓ ↓ ↓ ↓ ↓

Symbol time series (a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4})

↓ ↓ ↓ ↓ ↓

A_k B_k C_k D_k E_k

Table 3.4.10 32QAM shaper conversion regulations

C_k	D_k	E_k	M_k	N_k
0	0	0	0	0
0	0	1	0	1
0	1	0	0	2
0	1	1	1	0
1	0	0	1	1
1	0	1	1	2
1	1	0	2	0
1	1	1	2	1

Table 3.4.11 32QAM coding regulations

A_k / B_k	M_k / N_k	I_k / Q_k
0	2	−5
1	1	−3
0	0	−1
1	0	1
0	1	3
1	2	5

(2) The signal space diagram is shown in Figure 3.7.8

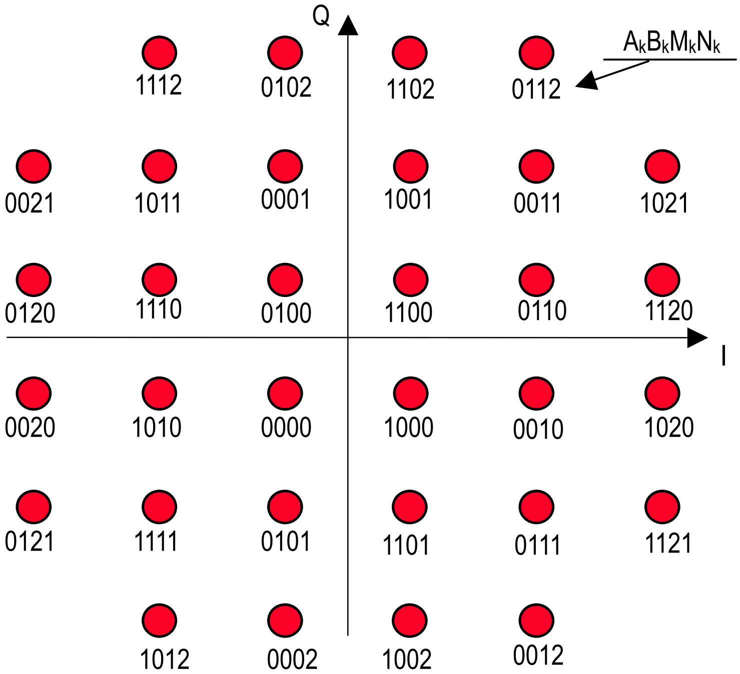


Figure 3.7.8 32QAM signal space diagram

(i) 64QAM

(1) The serial signal input is converted to (A_k, B_k, C_k, D_k, E_k, F_k) symbols by the serial/parallel converter and then changed to corresponding signals (I_k, Q_k) by the encoder. Conversion from serial signal input to (A_k, B_k, C_k, D_k, E_k, F_k) (binary/64ary conversion) is performed as noted below, and conversion from (A_k, B_k, C_k, D_k, E_k, F_k) to (I_k, Q_k) is performed according to Table 3.4.12

Binary data time series ⋯, a_{n-1}, a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, a_{n+5}, a_{n+6}, ⋯

↓ ↓ ↓ ↓ ↓ ↓ ↓

Symbol time series (a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, a_{n+5})

↓ ↓ ↓ ↓ ↓ ↓

A_k, B_k, C_k, D_k, E_k, F_k

Table 3.4.12 64QAM coding regulations

A_k	C_k	E_k	I_k
B_k	D_k	F_k	Q_k
0	0	1	−1
0	0	0	−3
0	1	0	−5
0	1	1	−7
1	0	1	1
1	0	0	3
1	1	0	5
1	1	1	7

(2) The signal space diagram is shown in Figure 3.7.9

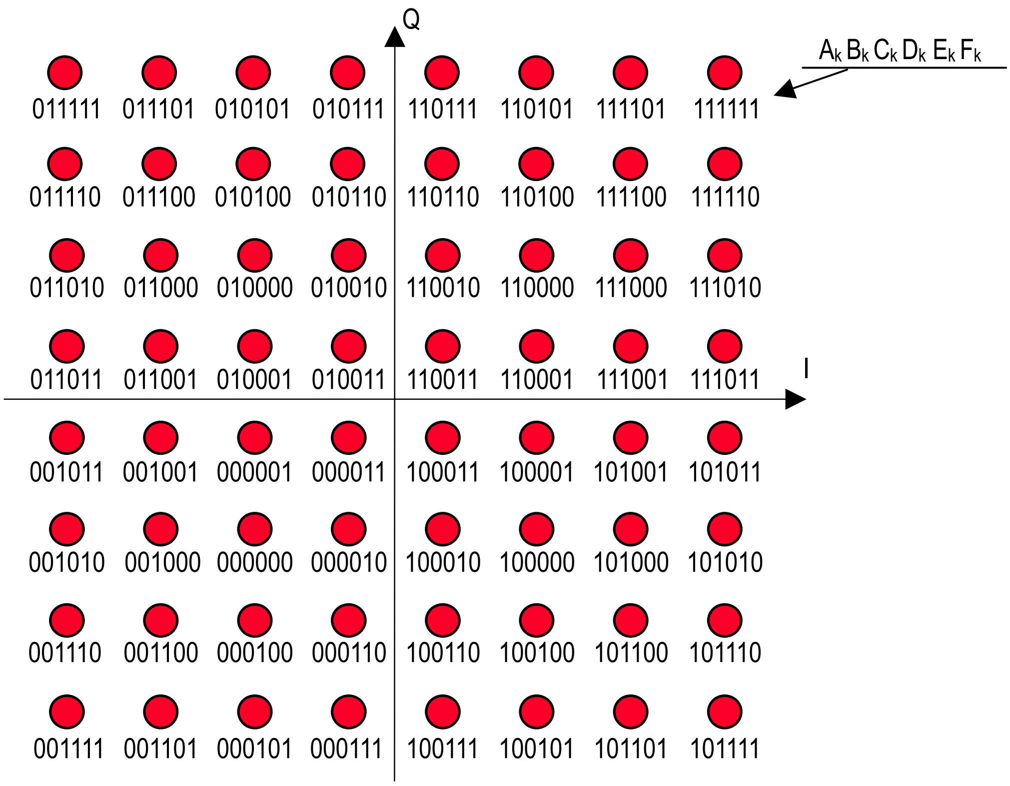


Figure 3.7.9 64QAM signal space diagram

(j) 256QAM

(1) The serial signal input is converted to (A_k, B_k, C_k, D_k, E_k, F_k, G_k, H_k) symbols by the serial/parallel converter and then changed to corresponding signals (I_k, Q_k) by the encoder. Conversion from serial signal input to (A_k, B_k, C_k, D_k, E_k, F_k, G_k, H_k) (binary/256ary conversion) is performed as noted below, and conversion from (A_k, B_k, C_k, D_k, E_k, F_k, G_k, H_k) to (I_k, Q_k) is performed according to Table 3.4.13

Binary data time series ⋯, a_{n-1}, a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, a_{n+5}, a_{n+6}, a_{n+7}, a_{n+8} ⋯

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

Symbol time series (a_n, a_{n+1}, a_{n+2}, a_{n+3}, a_{n+4}, a_{n+5}, a_{n+6}, a_{n+7})

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

A_k, B_k, C_k, D_k, E_k, F_k, G_k, H_k

Table 3.4.13 256QAM coding regulations

A_k / B_k	C_k / D_k	E_k / F_k	G_k / H_k	I_k / Q_k
0	0	1	1	−1
0	0	1	0	−3
0	0	0	0	−5
0	0	0	1	−7
0	1	0	1	−9
0	1	0	0	−11
0	1	1	0	−13
0	1	1	1	−15
1	0	1	1	1
1	0	1	0	3
1	0	0	0	5
1	0	0	1	7
1	1	0	1	9
1	1	0	0	11
1	1	1	0	13
1	1	1	1	15

(2) The signal space diagram is shown in Figure 3.7.10

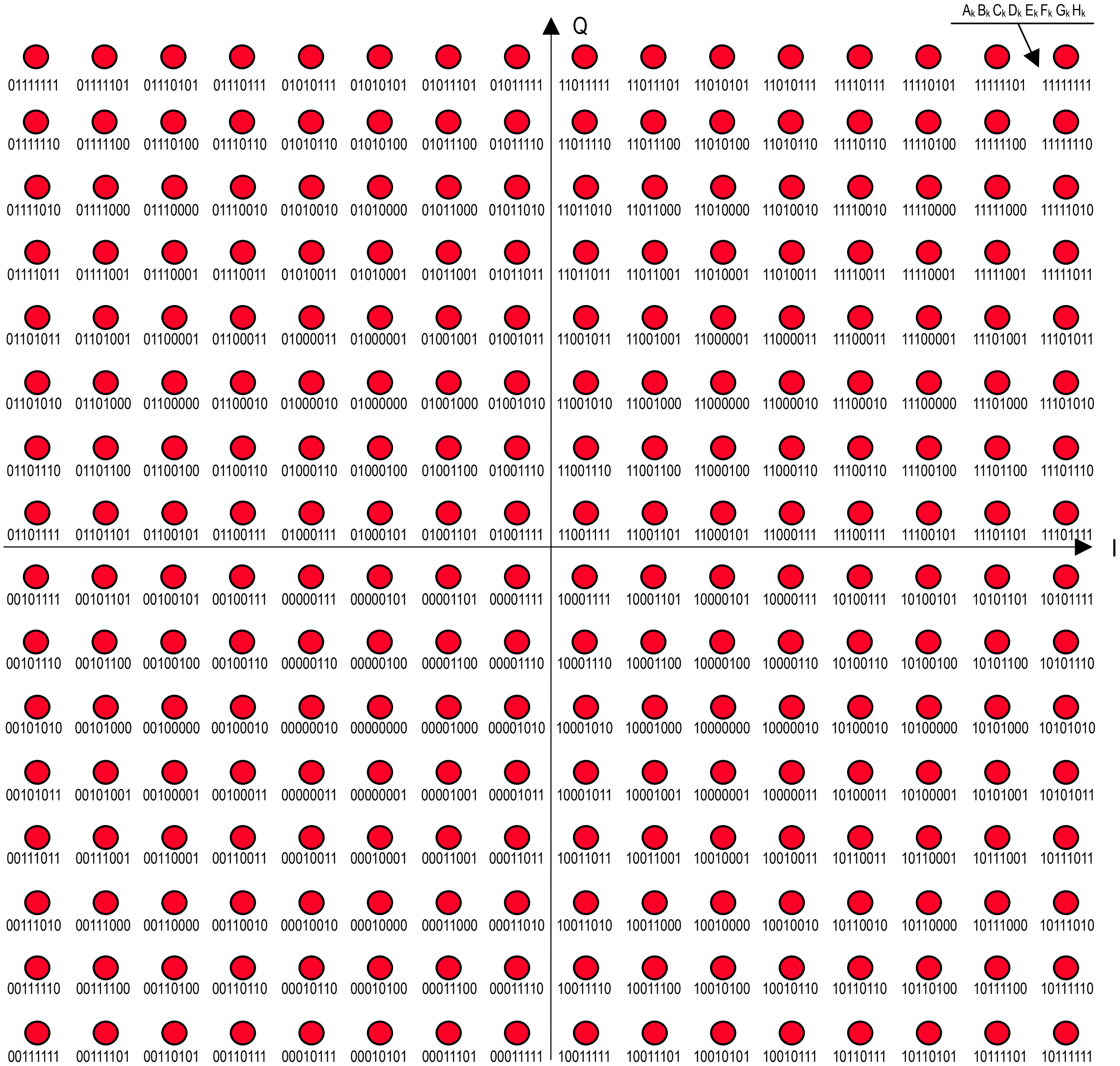


Figure 3.710 256QAM signal space diagram

3.3.1.3 Spectrum shaping of baseband signal (Private standard/Public standard)

(1) For the baseband bandwidth limits, root Nyquist characteristics H(f) shown in equation 3.3-2 are used.

$$|H(f)| = \begin{cases} 1 & 0 \le |f| < (1-\alpha)/2T \\ \cos\left[(T/4\alpha)\left(2\pi|f| - \pi(1-\alpha)/T\right)\right] & (1-\alpha)/2T \le |f| < (1+\alpha)/2T \\ 0 & (1+\alpha)/2T \le |f| \end{cases}$$

Where, Equation (3.3-2)

$T = (1/192) \times 10^{-3}$ sec (When occupied bandwidth is 288kHz or less and Roll off factor (α) is 0.5)
$T = (1/576) \times 10^{-3}$ sec (When occupied bandwidth exceeds 288kHz and Roll off factor (α) is 0.5)
$T = (1/640) \times 10^{-3}$ sec (When occupied bandwidth exceeds 288kHz and Roll off factor (α) is 0.38)

(2) Roll off factor (Equipment-item 8.2 of article 49 and item 8.3 of article 49)
(Private mandatory/Public mandatory)

When occupied bandwidth is 288kHz or less, Roll off factor (α) = 0.5.
When occupied bandwidth exceeds 288kHz, Roll off factor (α) = 0.5 or 0.38.

(3) The phase characteristic of H(f) is linear.

3.3.1.4 Orthogonal modulation (Private standard/Public standard)

S(t) shown in Figure 3.6.1 through 3.6.8 is represented by the following equation.

$$\begin{aligned} S(t) &= \mathrm{Re}\left[\{ i(t) + j \cdot q(t) \} \exp(j\omega_c t)\right] \\ &= i(t)\cos\omega_c t - q(t)\sin\omega_c t \end{aligned} \qquad \text{Equation (3.3-3)}$$

$$\text{Where, } i(t) = F^{-1}\left[H(f) \cdot F\{ I_k(t) \} \right]$$
$$q(t) = F^{-1}\left[H(f) \cdot F\{ Q_k(t) \} \right] \qquad \text{Equation (3.3-4)}$$

$F[x]$, $F^{-1}[X]$ is shown by the Fourier transform/inverse Fourier transform of x, X.

$I_k(t)$, $Q_k(t)$ are the continuous impulse functions possessing energy that is proportional to the square power of the amplitude of orthogonal signals I_k, and Q_k respectively.

3.3.1.5 Transient characteristics of burst edges (Private standard/Public standard)

In spite of modulation method, the burst rise (and fall) ramp time is
occupied bandwidth is 288kHz or less : 2 symbols
occupied bandwidth exceeds 288kHz : 4 symbols

3.3.1.6 Transmission signal spectrum (Private standard/Public standard)

According to section 3.4.2.3.

3.3.2 Transmission rate (Equipment-item 8.2 of article 49 and item 8.3 of article 49)
(Private mandatory/Public mandatory)

It is 192~3200 kbit/s.

3.4 Conditions relating to transmitter and receiver (Private standard/Public standard)

3.4.1 Frequency bands and carrier numbers (Private mandatory/Public mandatory)

Table 3.5 shows the relationship between the frequency bands and the carrier numbers.

Table 3.5 Relationship between frequency bands and carrier numbers

Carrier Numbers	Frequency bands (MHz)	Usefulness	Carrier Numbers	Frequency bands (MHz)	Usefulness
221	1884.650		13	1898.750	Common usage for
222	950		14	1899.050	communication
223	1885.250		15	350	carrier on Private
224	550		16	650	and Public (note1)
225	850		17	950	
226	1886.150		18	1900.250	Control carrier on
227	450				Private
228	750		19	550	
229	1887.050		20	850	
230	350		21	1901.150	
231	650		22	450	
232	950		23	750	
233	1888.250		24	1902.050	
234	550	Communication	25	350	
235	850	carrier for Public	26	650	
236	1889.150	(note 1)	27	950	Common usage for
237	450		28	1903.250	communication
238	750		29	550	carrier on Private
239	1890.050		30	850	and Public (note1)
240	350		31	1904.150	
241	650		32	450	
242	950		33	750	
243	1891.250		34	1905.050	
244	550		35	350	
245	850		36	650	
246	1892.150		37	950	
247	450		38	1906.250	
248	750		39	550	
249	1893.050		40	850	
250	350		41	1907.150	
251	650	Common usage for	42	450	
252	950	communication	43	750	
253	1894.250	carrier onPrivate and	44	1908.050	
254	550	Public (note1)	45	350	
255	850		46	650	
1	1895.150		47	950	
2	450	Common usage for	48	1909.250	Communication
3	750	communication	49	550	carrier for Public
4	1896.050	carrier on Private,	50	850	(note 1)
5	350	Direct	51	1910.150	
6	650	communications	52	450	
7	950	between PSs (note2)	53	750	
8	1897.250	and Public (note1)	54	1911.050	
9	550		55	350	
10	850		56	650	
11	1898.150	Common usage for	57	950	
		communication carrier on	58	1912.250	
		Private and Public (note1)	59	550	
12	450	Control carrier on Private	60	850	

61 62 63 64 65 66 67 68 69 70 71	1913.150 450 750 1914.050 350 650 950 1915.250 550 850 1916.150	Communication carrier for Public (note 1)	72 73 74 75 76 77 78 79 80 81 82	1916.450 750 1917.050 350 650 950 1918.250 550 850 1919.150 450	Communication carrier for Public (note 1)

(Note 1) Includes more than one control carrier for public system, as the case may be.
(Note 2) Includes 3 carriers (4, 7, 9) for direct communication between personal stations in a specific group.

3.4.2 Transmission characteristics (Private standard/Public standard)

3.4.2.1 Transmission power (Execute-article 6 and Equipment-item 8.3 of article 49)
(Private mandatory/Public mandatory)

(1) Definition

a. If there is an antenna measurement terminal: It is antenna supplied power.
b. If there isn't an antenna measurement terminal: It is antenna emission power measured at the test site or at the RFCD (Radio-Frequency Coupling Device) calibrated at the test site.
c. Regardless of modulation method, transmission power is average supplied power of one channel.

(2) Standards

Maximum transmission power: For public cell stations, maximum transmission power is 500 mW or less. For other cell stations, personal stations and relay stations, maximum transmission power is 10 mW or less. However, in cases where public cell stations use frequency band 1893.65MHz - 1905.95MHz, maximum transmission power is 20mW or less, and in cases of using frequency band 1906.25MHz – 1908.05MHz and 1915.85MHz - 1918.25MHz, maximum transmission power is 2W or less.(In case that it is used as communication carrier, maximum transmission power is 500mW or less.) Also, in case that it is relay stations, using 1884.65MHz - 1893.35MHz or 1906.25MHz – 1919.45MHz and using for personal stations, maximum transmission power is 20mW or less. (For the registered relay station, maximum transmission power is 10mW or less.)

Output accuracy: Within + 20%, -50%

However, in foreign countries, namely the countries except Japan, the followings shall be applied on condition that it is in conformity with national legislations of each of the countries.

Maximum transmission power: For public cell stations, maximum transmission power is 2W or less. For other cell stations, personal stations and relay stations, maximum transmission power is 10mW or less. However, in cases where relay stations are for personal stations, the maximum transmission power is 20mW or less.
On the other hand, when using shared frequencies for private and public systems, the maximum transmission power of public cell stations is 20mW or less, and that of relay station is 10mW or less even if it is for personal stations.

Output accuracy: within +20%, -50%

(3) Supplemental remarks (Private standard/Public standard)

Peak power for the average power 10mW, 20mW, 500mW or less shall be:

a. 80mW, 160mW, 4W or less respectively in case of full rate communication.
b. 160mW, 320mW, 8W or less respectively in case of half rate communication.

3.4.2.2 Transmission of calling identification code
(Notification/'94 year, number 424 and '98 year, number 517)
(Private mandatory/Public mandatory)

When the calling identification code is transmitted, the signal transmitted from the transmitter must be as follows:

(1) For personal stations, the signal is 28 bits, and for digital cordless telephone base stations, the signal comprises 29 bits. (Refer to section 4.2.10.)
(Private mandatory/Public mandatory)

(2) The signal has the established slot configuration, and transmits using channel coding and scrambling methods. (Refer to section 4.2.9, section 4.2.10, and section 4.2.11.)
(Private mandatory/Public standard)

3.4.2.3 Adjacent channel power (Equipment-item 8.2 of article 49 and item 8.3 of article 49)
(Private mandatory/Public mandatory)

(1) Definition

Adjacent channel power is average power in a burst radiated within a band of ± 96 kHz centering on a frequency separated by Δ f kHz from the carrier wave frequency, in cases where it is modulated by a standard encoding test signal of the same coding speed as the modulated signal.

(2) Standards

In case that occupied bandwidth is 288kHz or less
a. 600 kHz detuned: 800 nW or less
b. 900 kHz detuned: 250 nW or less

In case that occupied bandwidth exceeds 288kHz
a. 900 kHz detuned: 800 nW or less
b. 1200 kHz detuned: 250 nW or less

3.4.2.4 Transient response characteristics of burst transmission (Private standard/Public standard)

(1) Definition

When burst waves modulated by the digital signal at the radio station are ON/OFF, the burst transmission transient response characteristics is the time which is from the starting point of the transient response accompanying the turning off of the burst waves (refer Figure 3.8) until 80 nW is reached,
or
from 80 nW until the point at the end of the transient response accompanying turning on of the burst waves (refer Figure 3.8).

(2) Standards

a. Time characteristics: The time characteristics standards are 13.0 μ s or less. Also, the instantaneous Power is

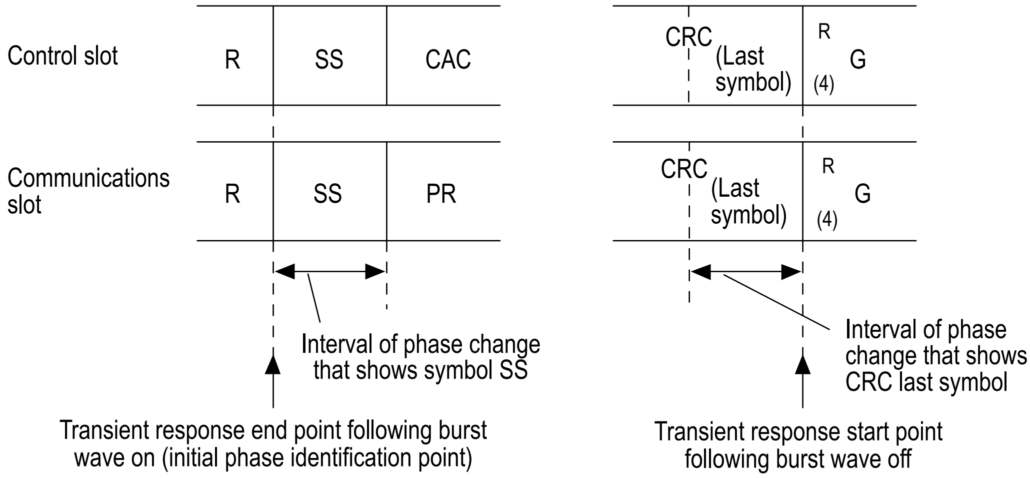
π /4 shift QPSK	: [Average power within burst + 4dB] or less
BPSK	: [Average power within burst + 6dB] or less
QPSK	: [Average power within burst + 5dB] or less
8PSK	: [Average power within burst + 5dB] or less

12QAM : [Average power within burst + 7dB] or less
16QAM : [Average power within burst + 8dB] or less
24QAM : [Average power within burst + 8dB] or less
32QAM : [Average power within burst + 8dB] or less
64QAM : [Average power within burst + 9dB] or less
256QAM : [Average power within burst + 9dB] or less

b. The power when off satisfies section 3.4.2.5.

(3) Relationship between slot structure and burst wave on/off control

Figure 3.8 shows the relationship between the slot structure and burst wave on/off control when the occupied bandwidth is 288kHz or less and in case of π/4 shift QPSK. The relationship between the slot structure and burst wave on/off control in other band signals and modulation methods is the absolute time which is equal to the timing when the occupied bandwidth is 288kHz or less and in case of π/4 shift QPSK as shown in Figure 3.8.



[When the occupied bandwidth is 288kHz or less and in case of π/4 shift QPSK]
Figure 3.8 Relationship between slot structure and burst wave on/off control

3.4.2.5 Carrier off time leakage power (Equipment-item 8.2 of article 49 and item 8.3 of article 49)
(Private mandatory/Public mandatory)

(1) Definition

Carrier off time leakage power is power radiated in the relevant transmission frequency band within the no-signal time.

(2) Standards

It is 80 nW or less.

(3) The measurement is performed during communication, and the measurement period is the non-transmission slot.

3.4.2.6 Tolerance limits of the intensity of spurious emission or unwanted emission

(Private mandatory/Public mandatory)

(1) Definition (Execute - Item 1 of Article 2)

“Spurious emission” is emission(s) on a frequency or frequencies which are outside the required bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, subharmonic emissions, parasitic emissions, and intermodulation products, but exclude out-of-band emissions. (No.63 of Item 1)

“Out-of-band emission” is the radio emission of frequency adjacent to the required frequency band which is generated in the course of modulation for information transmission. (No.63-2 of Item 1)

“Unwanted emission” refers to the spurious emission and out-of-band emission. (No.63-3 of Item 1)

“Spurious domain” is the frequency bandwidth in which the spurious emission outside the out-of-band domain is dominant. (No.63-4 of Item 1)

“Out-of-band domain" is the frequency bandwidth in which the out-of-band emission outside the required frequency band is dominant. (No.63-5 of Item 1)

(2) Standards

Tolerance limits to be applied after December 1, 2005 (Equipment Regulation Appendix No.3 -20, 21)

Tolerance limits of the intensity of spurious emission in out-of-band domain and unwanted emission in spurious domain for digital cordless telephone are shown below.

Table 3.6.1 Tolerance limits of the intensity of spurious emission or unwanted emission (Digital cordless telephone)

Frequency band	Tolerance limits of the intensity of spurious emission in out-of-band domain	Tolerance limits of the intensity of unwanted emission in spurious domain
More than 1,893.5MHz up to 1,919.6MHz	250nW or less	250nW or less
1,893.5MHz or less and more than 1,919.6MHz	2.5μW or less	2.5μW or less

(Note 1) Tolerance limits of the intensity of spurious or unwanted emissions are the average power value in the duration of spurious or unwanted emissions for each frequency supplied to the power line.

(Note 2) Frequency at the boundary of out-of-band domain and spurious domain is the carrier of ±996kHz.

Tolerance limits of the intensity of unwanted emission in spurious domain for systems except digital cordless telephone are shown below.

Table 3.6.2 Tolerance limits of the intensity of unwanted emission (except digital cordless telephone)

Frequency band	Tolerance limits of the intensity of unwanted emission in spurious domain
(1) From 1,884.5MHz up to 1,919.6MHz	Average power of the bandwidth of any 1MHz is 794nW or less
(2) Less than 1,884.5MHz and more than 1,919.6MHz (except those frequencies shown in (3))(Note 1)	Average power of the bandwidth of any 1MHz is 794nW or less
(3) From 1,920MHz up to 1,980MHz and from 2,110MHz up to 2,170MHz (Note 1)	Average power of bandwidth of any 1MHz is 251nW or less

(Note 1) Limited to the frequency band where detuning frequency is 2.25MHz or more.
(Note 2) Tolerance limits of the intensity of unwanted emissions are the average power value in the duration of unwanted emissions for each frequency supplied to the power line.
(Note 3) Frequency at the boundary of out-of-band domain and spurious domain is the carrier of ±996kHz in case of transmission equipment with the occupied bandwidth 288kHz or less, or ±1,296kHz in case of transmission equipment with the occupied bandwidth exceeding 288kHz.

However, the following transitional measure shall be noted. (Based on supplementary provision of the Radio Equipment Rules (Ministerial ordinance No.119 dated August 9, 2005))

a. Tolerance limits based on the Radio Equipment Rules before November 30 2005.

(2) Standards

Digital cordless telephone

a. Within band (1,893.5 MHz 1,919.6 MHz): 250nW or less.
b. Out of band (except above): 2.5μW or less.

Except above

a. Within band: 794nW/MHz or less.
b. Out of band (Detuning frequency exceeds 2.25MHz): 794nW/MHz or less.
c. Out of band (Detuning frequency exceeds 2.25MHz and 1920MHz-1980MHz and 2110MHz-2179MHz): 251nW/MHz or less.

(RCR STD-28 v.5.0)

b.The registered relay station

Tolerance limits of the intensity of unwanted emission in spurious domain for the registered relay station are shown below.

Table 3.6.3 Tolerance limits of the intensity of unwanted emission (The registered relay station)

Frequency band	Tolerance limits of the intensity of unwanted emission in spurious domain
(1)From 1,884.5MHz up to 1,919.6MHz	Average power of the bandwidth of any 1MHz is 794nW or less
(2)Less than 1,884.5MHz and more than 1,919.6MHz (except those frequencies shown in (3) and (4)) (Note 1)	Average power of the bandwidth of any 1MHz is 794nW or less
(3)From 815MHz up to 845MHz, from 860MHz up to 890MHz , from 898MHz up to 901MHz, from 915MHz up to 925MHz, from 1,427.9MHz up to 1,452.9MHz, from 1,475.9MHz up to 1,500.9MHz, from 1,749.9MHz up to 1,784.9MHz, from 1,844.9MHz up to 1,879.9MHz and from 2,010MHz up to 2,025MHz (Note 1)	Average power of the bandwidth of any 1MHz is 251nW or less
(4)From 1,920MHz up to 1,980MHz and from 2,110MHz up to 2,170MHz (Note 1)	Average power of the bandwidth of any 1MHz is 79.4nW or less

(Note 1) Limited to the frequency band where detuning frequency is 2.25MHz or more.
(Note 2) Tolerance limits of the intensity of unwanted emissions are the average power value in the duration of unwanted emissions for each frequency supplied to the power line.
(Note 3) Frequency at the boundary of out-of-band domain and spurious domain is the carrier of ±996kHz in case of transmission equipment with the occupied bandwidth 288kHz or less, or ±1,296kHz in case of transmission equipment with the occupied bandwidth exceeding 288kHz.

(3) Measurement is performed during communication, and the measurement period is transmission slots and non-transmission slots (except within the band).

3.4.2.7 Allowed value for occupied bandwidth (Equipment - attached table/number 2)
(Private mandatory/Public mandatory)

(1) Definition

The occupied bandwidth is the frequency range that contains 99 % of the Transmission Power, with 0.5 % of the Transmission Power above this range, and 0.5 % below this range.

(2) Standards

In case that 1893.5MHz – 1919.6MHz is used, the allowed value is 288 kHz or less and in case that 1884.5MHz – 1893.5MHz, the allowed value is used, 884kHz or less.

3.4.2.8 Frequency stability (Equipment - attached table/number 1)
(Private mandatory/Public mandatory)

(1) Definition

The frequency stability is the largest deviation that can be accepted from the assigned frequency of the frequency of the occupied bandwidth due to emissions.

(2) Standards

Absolute accuracy: ± 3 x 10^{-6} or less.

3.4.2.9 Modulation accuracy (Private standard/Public standard)

(1) Definition

It is the actual value of the error of the signal point vector (the square root of the result of dividing the sum of the squares of the errors of the signal point vectors by the number of phase identification points within the slot) (refer to 7.1.7).

(2) Standards

In case that Roll off factor of base band band-pass filter is 0.5

π /4 shift QPSK	12.5% or less
BPSK	12.5% or less
QPSK	12.5% or less
8PSK	8% or less
12QAM	8% or less
16QAM	8% or less
24QAM	6% or less
32QAM	5% or less
64QAM	5% or less
256QAM	2.5% or less

In case that Roll off factor of base band band-pass filter is 0.38

π /4 shift QPSK	8% or less
BPSK	8% or less
QPSK	8% or less
8PSK	8% or less
12QAM	8% or less
16QAM	8% or less
24QAM	6% or less
32QAM	5% or less

Note: In case multiple modulation methods are prepared for the slot structure, specifications of all modulation methods prepared must be satisfied.

3.4.2.10 Transmission rate accuracy (Private standard/Public standard)

The absolute accuracy of the personal station and cell station is ± 5 X 10^{-6} or less.

3.4.2.11 Cabinet radiation (Private standard/Public standard)

Device which is using only modulation method π /4 shift QPSK and carrier frequency spacing 300kHz is 2.5 μ W or less. Except that, except 1920MHz – 1980MHz and 2110MHz – 2170MHz is 794 nW/MHz or less, within 1920MHz – 1980MHz and 2110MHz – 2170MHz is 251nW/MHz.

3.4.3 Reception characteristics (Private standard/Public standard)

3.4.3.1 Frequency deviation of local oscillator (Private standard/Public standard)

(1) Definition

The frequency deviation is the maximum deviation width of the oscillation frequency of the station oscillator.

(2) Standards

Not specified.

3.4.3.2 Sensitivity (PS: Private standard/Public standard)
(CS: Private standard/Public mandatory)

(1) Definition

Sensitivity is the reception input level where the bit error rate (BER) becomes 1 X 10^{-2} when transmitting 2556 bits or more of a signal modulated by a 511-bit-period binary pseudo-noise series signal on TCH.

(2) Standards

In case that occupied bandwidth is 288kHz or less

π/4 shift QPSK	16.0dB μ V or less
BPSK	12.5dB μ V or less
QPSK	15.5dB μ V or less
8PSK	20.0dB μ V or less
12QAM	21.5dB μ V or less
16QAM	22.0dB μ V or less
24QAM	24.5dB μ V or less
32QAM	26.5dB μ V or less
64QAM	30.0dB μ V or less
256QAM	37.5dB μ V or less

In case that occupied bandwidth exceeds 288kHz

π/4 shift QPSK	21.2dB μ V or less
BPSK	17.7dB μ V or less
QPSK	20.7dB μ V or less
8PSK	25.2dB μ V or less
12QAM	26.7dB μ V or less
16QAM	27.2dB μ V or less
24QAM	29.7dB μ V or less
32QAM	31.7dB μ V or less
64QAM	35.2 dBμV or less
256QAM	42.7 dBμV or less

* Above specified value of each bandwidth signal and each modulation method is each “specified sensitivity”.

3.4.3.3 Bit error rate performance (Private standard/Public standard)

(1) Definition

The bit error rate performance are the bit error rate (BER) for the designated reception input level when transmitting a signal modulated by a 511-bit-period binary pseudo-noise series signal on TCH.

(2) Standards

Not specified.

3.4.3.4 Adjacent channel selectivity (Private standard/Public standard)

(1) Definition

Adjacent channel selectivity is the ratio of (specified sensitivity + 3 dB) and the unwanted wave level at which the TCH bit error rate (BER) becomes 1×10^{-2} due to unwanted signals added to the wanted signal of specified sensitivity + 3 dB (detuned by Δ f kHz) modulated by a digital signal (binary pseudo-noise series with code length 32,767 bits). Signal of occupied frequency band under 288kHz is used as unwanted wave.

(2) Standards

a. When occupied frequency bandwidth is 288kHz or less
   - see below at detuning frequency 600kHz.

π/4 shift QPSK	50.0dB or more
BPSK	50.0dB or more
QPSK	50.0dB or more
8PSK	46.0dB or more
12QAM	44.5dB or more
16QAM	44.0dB or more
24QAM	41.5dB or more
32QAM	39.5dB or more
64QAM	36.0dB or more
256QAM	28.5dB or more

b. When occupied frequency bandwidth exceeds 288kHz
   - More than 50dB at detuning frequency 900kHz.

3.4.3.5 Intermodulation performance (Private standard/Public standard)

(1) Definition

Intermodulation characteristics are the ratio of (specified sensitivity + 3 dB) and the unwanted signal level at which the TCH bit error rate (BER) becomes 1×10^{-2} due to 2 unwanted signals added to the wanted signal of specified sensitivity + 3 dB and detuned by 600 kHz and 1.2 MHz when occupied frequency bandwidth is 288kHz or less, or 900 kHz and 1.8 MHz when occupied frequency bandwidth exceeds 288kHz.

(2) Standards

π/4 shift QPSK	47.0dB or more
BPSK	47.0dB or more
QPSK	47.0dB or more

8PSK	43.0dB or more
12QAM	41.5dB or more
16QAM	41.0dB or more
24QAM	38.5dB or more
32QAM	36.5dB or more
64QAM	33.0dB or more
256QAM	25.5dB or more

3.4.3.6 Spurious response immunity (Private standard/Public standard)

(1) Definition

Spurious response immunity is the ratio of (specified sensitivity + 3 dB) and the unwanted signal level at which the TCH bit error rate (BER) becomes 1 x 10^{-2} due to unmodulated unwanted signals added to the wanted signal of specified sensitivity + 3 dB.

(2) Standards

π/4 shift QPSK	47.0dB or more
BPSK	47.0dB or more
QPSK	47.0dB or more
8PSK	43.0dB or more
12QAM	41.5dB or more
16QAM	41.0dB or more
24QAM	38.5dB or more
32QAM	36.5dB or more
64QAM	33.0dB or more
256QAM	25.5dB or more

3.4.3.7 Conducted spurious component (Equipment-Article 24)
(Private mandatory/Public mandatory)

(1) Definition

It is the intensity of radio waves generated from the antenna terminal under reception conditions.

(2) Standards

It is 4 nW or less.

(3) Measurement is performed during standby, and the measurement period is the entire interval.

3.4.3.8 Cabinet radiation (Private standard/Public standard)

Below 1 GHz it is 4 nW or less; and above 1 GHz it is 20 nW or less.

3.4.3.9 Receive signal strength indicator accuracy (Private standard/Public standard)

(1) Personal station

The reception level detection values (RF level predicted values) for RF input level of 16 dB μ V ~ 60 dB μ V (dynamic range = 44 dB) have monotonically increasing characteristics, and absolute accuracy is ±6 dB.

The reception level detection range (RF input level 10 dB μ V ~ 80 dB μ V) and the permitted range of RF level predicted values for that are shown in Figure 3.9.

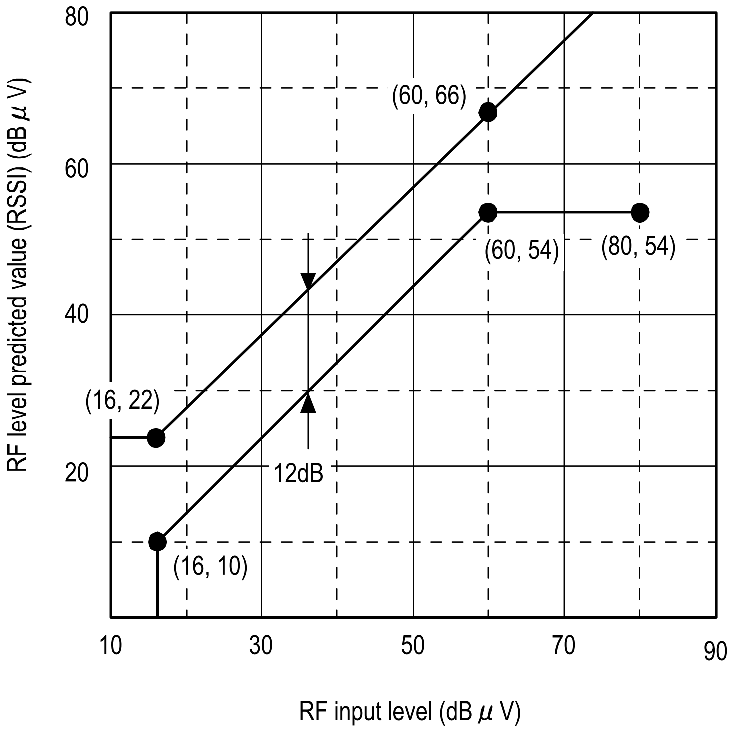


Figure 3.9 Receive signal strength indicator accuracy

(2) Cell station

Not specified.

3.4.3.10 Bit error rate floor performance (Public standard)

Applied to public radio stations.

(1) Definition

It is the input level which results in a bit error rate (BER) of 1 x 10^{-5} when a signal modulated by a 511-bit period binary pseudo-noise series signal is transmitted by TCH.

(2) Standard

In case that occupied bandwidth is 288kHz or less

π/4 shift QPSK	25.0dBμV or less
BPSK	21.5dBμV or less
QPSK	24.5dBμV or less
8PSK	29.0dBμV or less
12QAM	30.5dBμV or less
16QAM	31.0dBμV or less
24QAM	33.5dBμV or less
32QAM	35.5dBμV or less
64QAM	39.0dBμV or less
256QAM	46.5dBμV or less

In case that occupied bandwidth exceeds 288kHz

π/4 shift QPSK	30.2dBμV or less
BPSK	26.7dBμV or less
QPSK	29.7dBμV or less
8PSK	34.2dBμV or less
12QAM	35.7dBμV or less
16QAM	36.2dBμV or less
24QAM	38.7dBμV or less
32QAM	40.7dBμV or less

3.4.4 Antennas (Equipment-item 8.2 of article 49 and item 8.3 of article 49)

(Private mandatory/Public mandatory)

(1) Cell station

Antenna for private system is cabinet-built-in-type with gain of 4 dBi or less. However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 4 dBi, the portion by which it is lower may be compensated by the gain of the antenna.

When 1893.65MHz – 1905.95MHz, 1908.35MHz – 1915.55MHz as well as 1918.55MHz – 1919.45MHz, antenna for public system has a gain of 10 dBi or less (except 1898.45 MHz and 1900.25 MHz). However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 10 dBi, the portion by which it is lower may be compensated by the gain of the antenna.

When 1906.25MHz – 1908.05MHz as well as 1915.85MHz – 1918.25MHz, antenna for public system has a gain of 15 dBi or less (but should be 10dBi or less when used as traffic channel). However, in cases where the EIRP is less than the value when the specified antenna power is applied to an antenna of absolute gain 15 dBi, the portion by which it is lower may be compensated by the gain of the antenna.

When adaptive array antenna (The antenna which increase the antenna gain in the direction of the other party of communication, and decrease the antenna gain in the direction of the other radio stations which use same channel) is applied to public system and 1893.65MHz – 1919.45MHz, antenna gain is 16 dBi or less (except 1898.45 MHz and 1900.25 MHz). However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 16 dBi, the portion by which it is lower may be compensated by the gain of the antenna.

When 1884.65MHz – 1893.35MHz, antenna for public system has a gain of 21 dBi or less. However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 21 dBi, the portion by which it is lower may be compensated by the gain of the antenna.

However, in foreign countries, namely the countries except Japan, the specifications for the cell station antennas shall be kept flexible with the system design and not provided in this standard, on condition that they are in conformity with national legislations of each of the countries.

(2) Personal station

Gain is 4 dBi or less. However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 4 dBi, the portion by which it is lower may be compensated by the gain of the antenna.

(3) Relay station

Antenna gain for private system is 4 dBi or less. However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 4 dBi, the portion by which it is lower may be compensated by the antenna gain.

Antenna gain for public system is 4 dBi or less when 1893.65MHz - 1905.95MHz. (except 1898.45MHz and 1900.25MHz) However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 4 dBi, the portion by which it is lower may be compensated by the antenna gain.

When public system for cell station, when 1884.65MHz - 1893.35MHz and 1906.25MHz - 1919.45MHz, antenna gain is 4 dBi or less. However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 4 dBi, the portion by which it is lower may be compensated by the antenna gain.

However, when public system for personal station, when 1906.25MHz - 1919.45MHz, antenna gain is 10 dBi or less. However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 10 dBi, the portion by which it is lower may be compensated by the gain of the antenna. When 1884.65MHz - 1893.35MHz, antenna gain is 21 dBi or less. However, in cases where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 21 dBi, the portion by which it is lower may be compensated by the gain of the antenna.

Antenna gain for the registered relay station is 4dBi or less. However, in case where the effective radiated power is less than the value when the specified antenna power is applied to an antenna of absolute gain 4dBi, the portion by which it is lower may be compensated by the antenna gain.

Chapter 4 Communication Control Methods

Chapter 4 Communication Control Methods

4.1 Overview (Private standard/Public standard)

In this chapter the radio interface of the personal handy phone system is specified. First, layer 1 standards are shown, and then, the interface for each protocol phase is specified according to the protocol model shown in Chapter 2.

Furthermore, refer to Chapter 6 for the communication control method pertaining to direct communication between personal stations.

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4.2 Layer 1 standards

4.2 Layer 1 standards (Private standard/Public standard)

The regulations of this section are standard common to private systems and public systems except for items which are marked as reference.

4.2.1 Overview (Private standard/Public standard)

In this section, layer 1 (physical layer) of the radio interface of the personal handy phone system is specified. The layer 1 structural conditions such as channel types, physical slot usage methods, logical control channels structural methods, communication physical slot designation methods as well as signal (slot) structure and so forth are clarified.

4.2.2 Definition of functions (Private standard/Public standard)

In this standard, the items below are defined as layer 1 functions of the radio interface (Um point).

(1) Synchronization

There is superframe synchronization that detects logical control channel superframes, and bit synchronization and frame synchronization (TDMA frame synchronization) needed for signal reception. The synchronization bursts for starting synchronization on the communications carrier and for resynchronizing when the reception signal was degraded are specified.

(2) Identification codes

Coding that identifies nodes (personal station and cell station) terminating at the Um point. The identification code showing the calling station or calling station and called station must be included in the layer 1 control signal (control physical slot) and synchronization burst.

(3) Error detection

Function that detects the occurrence of bit errors in received signals. It is also used in layer 2 signal reception processing.

(4) Common access channel transmission/reception

Layer 1 function necessary for transmission and reception of control signals from control carriers and communications carriers. Specifies physical slots required in each function channel and the structure of logical control channel needed to transmit and receive control signals on control carriers.

(5) User information transmission/reception

Function necessary for end to end transmission/reception of user information control signals and user information such as voice, user data signal, etc.

(6) Scramble

Function for dealing with interference among communication physical slots between different cell stations and for maintaining DC balance in code series transmitted at the Um point.

(7) Encryption

Function with the purpose of encryption of user information, etc., during transmission.

(8) VOX

Depending on presence or absence of voice signals of the personal station during transmission, function for carrying out low power consumption operation. Not specified in a public system, and specified as an optional function in a private system.

(9) Other

Guard bit, start symbol, and Ramp (time) that are decided from the electrical physical conditions for transmission/reception of physical slots are specified.

4.2.3 Service characteristics (Private standard/Public standard)

Layer 1 (physical layer) provides service to layer 2 (data link layer) and management entity and uses services offered from layer 2 and management entity. Layer 1 offers the following functions to layer 2 and management.

(1) Transmission function

Synchronization, common access channel transmission/reception and user information transmission/ reception functions.

(2) Channel ON/OFF

Provides signal transmission function and procedure for starting/stopping control channel and communication channel according to requests from personal station and cell station.

(3) Maintaining the radio link

Function and procedures for maintaining the radio link are offered.

(4) Maintenance

Signal transmission functions, procedures and necessary layer 1 functions are offered for realization of maintenance functions.

(5) Status

Layer 1 status is indicated to management entity.

(6) Error detection

Has a function that carries out error detection for each slot.

4.2.4 Channel types (Private standard/Public standard)

4.2.4.1 Function channel types and method of use (Private standard/Public standard)

The correspondence between channels used in the protocol phase and the function channels are shown in Figure 4.2.1.

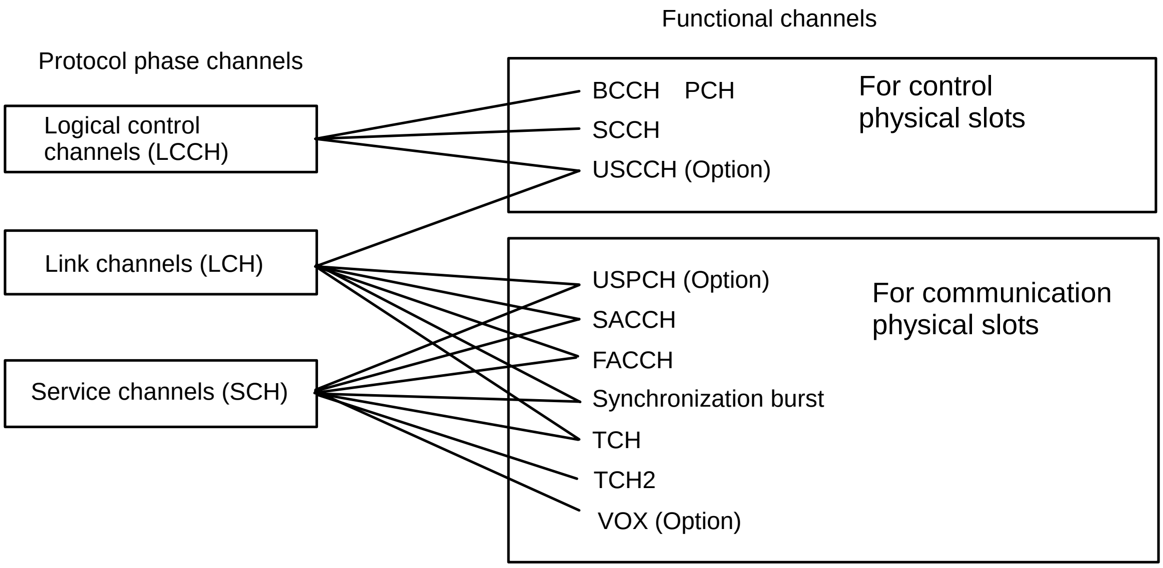


Figure 4.2.1 Correspondence between protocol phase channels and function channels

(a) Logical control channel LCCH

This is a general term for channels used in the link channel establishment phase by the cell station (CS) and the personal station (PS).

(b) Link channel LCH

This is a general term for channels used in the service channel establishment phase by the CS and PS.

(c) Service Channel SCH

This is a general term for channels used in the communications phase by CS and PS.

(d) Slot

This is the accumulation of bit sequence corresponding to the physical channel that was multiplexed on the time axis in the TDMA format. In the second generation cordless telephone system, 1 slot length is 0.625 ms.

(e) Control physical slot

Slot which all users use in common. The function channels needed to control setup and so forth of communication physical slots are set up on the control physical slot. This slot can be intermittently transmitted only when on a control carrier.

(f) Communication physical slot

Slot which each user uses exclusively for communication. The control channel needed to establish and control individual calls or traffic channel is set up on the communication physical slot.

Function channels are as follows:

(1) BCCH (Broadcast Control Channel)

This is a downlink one-way channel to broadcast control information from the CS to PS. It transmits information related to channel structure, and system information, etc.

(2) CCCH (Common Control Channel)

This channel carries out the transmission of control information needed for call connection.

(a) PCH (Paging Channel)

This is a downlink one-way point-multipoint channel that simultaneously transmits identical information to individual cells or a wide area of multiple cells (the paging area) from the CS to PS.

(b) SCCH (Signalling Control Channel)

This is a bidirectional point-point channel that transmits information needed for call connection between the CS and PS, and it transmits independent information to each cell.

The uplink channel (PS —> CS) is random access.

(3) UPCH (User Packet Channel)

This is a two-way point-multipoint channel. It transmits control signal information and user packet data.

(a) USCCH

The UPCH that can be set up on the control physical slot is defined as USCCH (User specific control channel). If it satisfies the specified items, the usage method is arbitrary.

The uplink channel is random access.

(b) USPCH

The UPCH that can be set up on the communication physical slot is defined as the USPCH (User specific packet channel). If it satisfies the specified items, the use method is arbitrary.

(4) ACCH (Associated Control Channel)

This is a two way channel that is auxiliary to TCH (Traffic channel). It carries out the transmission of control information and user packet data necessary for call connection. The channel which is ordinarily auxiliary to TCH is defined as SACCH, and the channel that temporarily steals TCH and carries out high speed data transmission is defined as FACCH. Further, FACCH set up on the link channel includes a function of assigning the physical slot needed for set up of the service channel.

(5) TCH (Traffic channel)

It transmits user information. It is a point-point two way channel.

(6) Synchronization burst

Used for ensuring frequency and time synchronization when connecting calls and switching channels.

(7) VOX

Optional channel that shows VOX control start and background noise information

(8) TCH2

It is used to change the modulation method.

4.2.4.2 Function channel and protocol phase as well as physical slot correspondence (Private standard/Public standard)

The correspondence between the function channels and protocol phase as well as physical slots is shown in Figure 4.2.2.

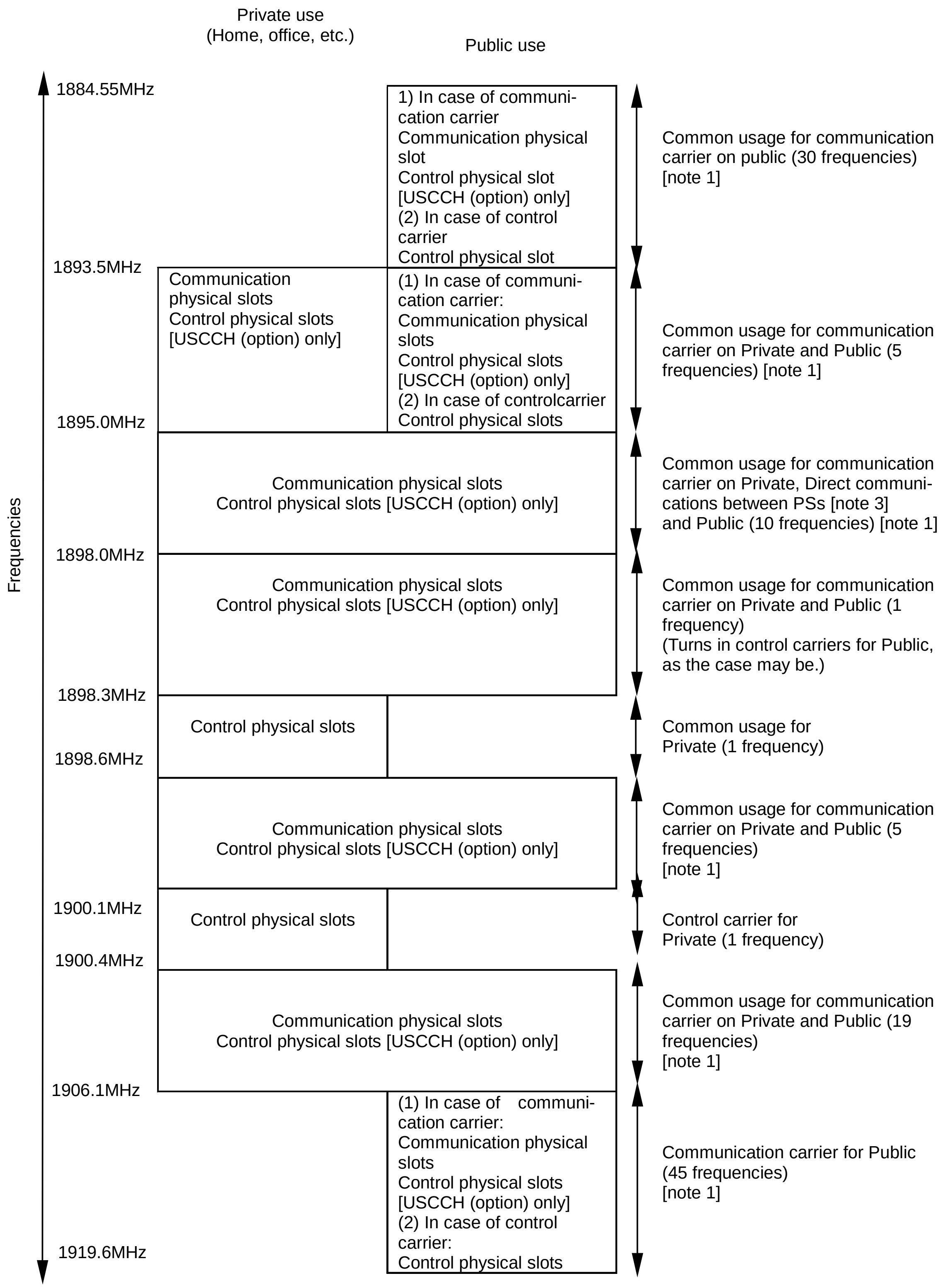
Protocol phase / Physical slot		Link channel establishment phase (logic control channel LCCH)	Service channel estabilishment phase (link channel LCH)	Communications phase (service channel SCH)
Physical slot for control	Uplink	SCCH USCCH (Option)	USCCH (Option)	
	Down-link	BCCH PCH SCCH USCCH (Option)	USCCH (Option)	
Physical slot for communications			TCH FACCH SACCH USPCH (Option) Synchronization burst	TCH TCH2 FACCH SACCH USPCH (Option) Synchronization burst VOX (option)

Figure 4.2.2 Protocol phase, physical slot and function channel correspondence

4.2.5 Physical slot usage method (Private standard/Public standard)

4.2.5.1 Mapping of physical slots on frequency axis (Private mandatory/Public mandatory)

The correspondence relationship of each physical slot with the control carrier exclusively used for control and communications carriers other than that is shown in Figure 4.2.3.



[Note 1] Includes more than one control carrier for public system, as the case may be.
[Note 2] It is desirable not to use carriers adjacent to control carriers for private system and public system.
[Note 3] Includes 3 carriers (4, 7, 9) for direct communication between personal stations in a specific group.

Figure 4.2.3 Mapping of physical slots on frequency axis

4.2.5.2 Physical slot transmission condition (Private standard/Public standard)

(1) Control carriers

In control carriers, carrier sensing, etc., for confirming that channels are open at the beginning of transmission is not necessary. Control physical slots from CS are intermittently transmitted. Control physical slot transmission conditions of CS and PS are as follows.

Further, the radio channel information broadcasting message informs from CS to PS the position of the control physical slot for which transmission is possible for each PS and the structure of the logical control channel transmitted by CS.

(a) CS transmission (Private mandatory)

8 slots or less per second are transmitted on one control carrier wave in a private system.

(b) PS transmission

1) Rules

Transmit according to slotted ALOHA synchronized to downlink signal from CS. Therefore, continuous signal transmission that does not follow the slotted ALOHA algorithm is not allowed. Furthermore, in the case where PS does not agree with the identification code provided by the system identification code (private) or operator identification code (public) in the CS calling station identification code contained in the downlink signal from CS, transmission of the control carrier to the relevant CS is not performed.

2) Constraint 1 (Private mandatory/Public mandatory)

If the system identification code (for private system) or operator identification code (for public system) in the calling station identification code included in the signal from the CS does not match the given identification code, the PS must not transmit the control carrier to that CS.

3) Constraint 2

Even though the system identification code or the operator identification code matches the given identification code, the PS must not transmit the control carrier to that CS, if the country code included in the 2nd system information broadcasting message from the CS does not match the given country code.

However, in case of recalling-type handover, PS can transmit the control carrier to that CS regardless of information of the 2nd system information broadcasting message.

(2) Communications carriers

(a) Rules

On communication carriers, each time a transmission starts it is necessary to confirm in advance, according to specific carrier sensing conditions, that the relevant slot can be used. Therefore CS detects and memorizes free slots on the communication carrier, and when a request for a link channel is received from PS, it is necessary to designate the appropriate free and confirmed physical channel (slot and frequency) and to transmit the link channel assignment.

And under 64kbit/s unrestricted digital, when a request for additional TCH is received from PS, it is necessary to designate the appropriate free and confirmed physical channel (slot and frequency) and to transmit the additional TCH assignment.

(b) Constraints (Private mandatory/Public mandatory)

If the system identification code (for private system) or operator identification code (for public system) in the calling station identification code included in the signal from the CS does not match the given identification code, switching from the control carrier to the communication carrier must not be done.

(3) Transmission Frequency (Private mandatory/Public mandatory)

The frequency of the signal transmitted from PS must be selected automatically according to the reception of the signal of the CS link channel assignment and additional TCH assignment under 64kbit/s unrestricted digital.

4.2.6 Mapping of logical control channels on the TDMA frame (Private standard/Public standard)

Rules of the logical control channel structure are shown in Figure 4.2.4.

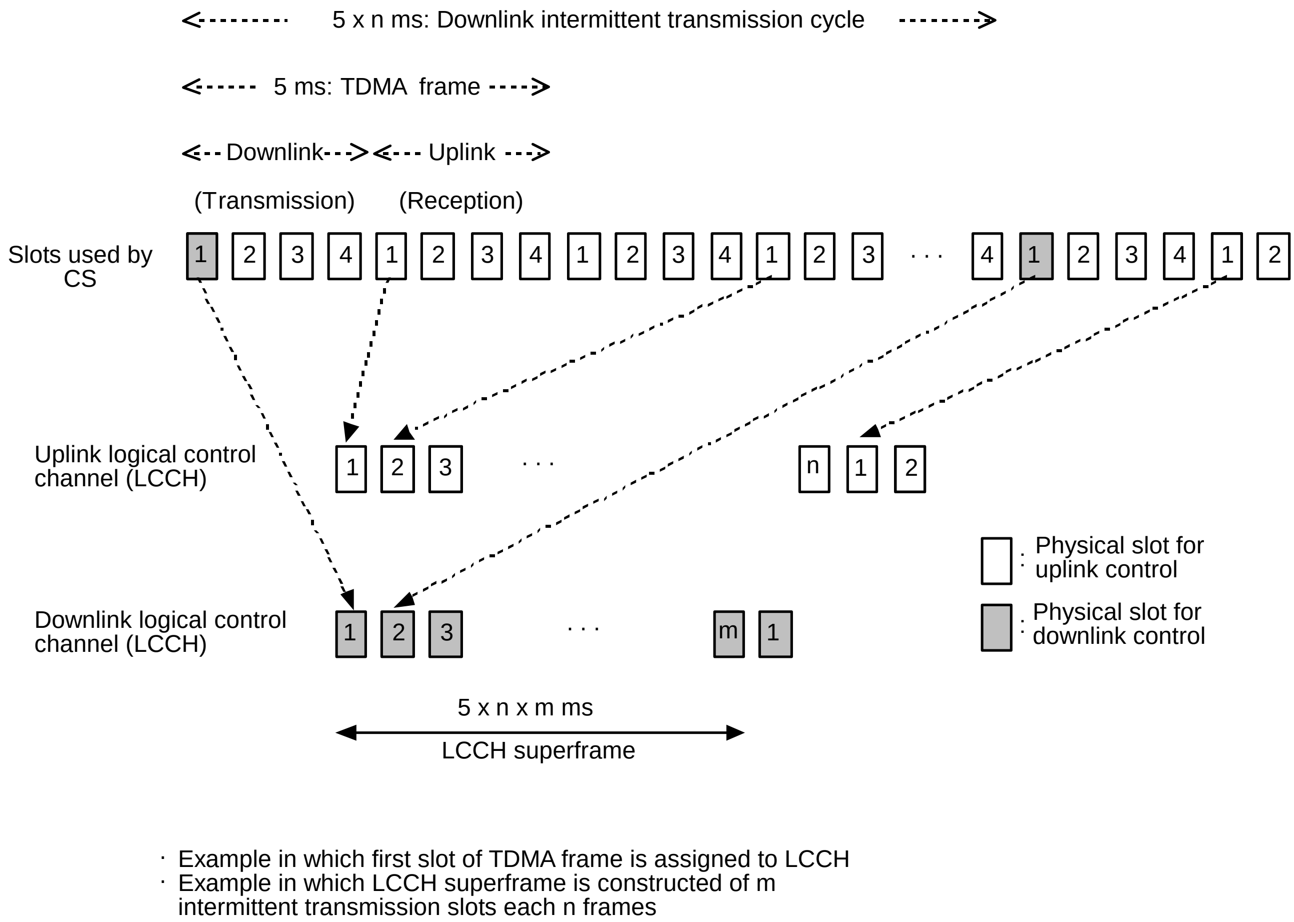


Figure 4.2.4 Slots and logical control channels used by CS

The logical control channel (LCCH) has the superframe structure shown in section 4.2.7, and all transmission/reception timing of physical slots for controlling intermittent transmission and SCCH uplink slot designation and so forth is generated based on the superframe.

4.2.7 Structure of logical control channel (Private standard/Public standard)

4.2.7.1 Definition of superframe (Private standard/Public standard)

The minimum cycle of the downlink logical control channel that specifies the slot position of all LCCH elements is specified as the LCCH superframe. As downlink LCCH elements, there are BCCH used by the appropriate system, all PCH (P1-Pk: Number of groups = k) corresponding to the paging group, as well as the SCCH with fixed insertion and USCCH (option).

BCCH (A) must be transmitted by the lead slot of the LCCH superframe, and the lead position of the superframe is reported via BCCH (A) transmission. Also, BCCH (B) is defined as an option that is transmitted by something other than the superframe lead.

4.2.7.2 Downlink logical control channel superframe structure (Private standard/Public standard)

The superframe structure of the downlink logical control channel (LCCH) is informed to each PS as profile data by a radio channel information broadcasting message and global definition information pattern on BCCH. (Refer to section 4.3.4.2.)

Depending on how the profile data that defines the structure is selected, the LCCH superframe can transmit the identical paging group (pi: i = 1 to k) multiple times, but the number of continuous transmissions (provided by n_{BS}) for one paging call and the number of same paging groups n_{SG} included in the LCCH superframe are independent. Continuous transmission in response to one paging call can be concluded within the LCCH superframe, or it can be spread over several superframes.

If necessary, it is possible to temporarily steal LCCH elements except for BCCH(A), and send the other LCCH elements.

(Refer to section 4.3.4.4 and 4.4.3.6.3.4.9 for the paging group designation method.)

Otherwise, the frame basic units must follow the rules below.

(a) Within 1 frame basic unit, regularly intermittently transmitted BCCH or SCCH or USCCH appears first, and PCH is established as the function channel that follows it.

(b) Within 1 frame basic unit, if n_{PCH} is greater than or equal to 2, the respective PCHs are continuously established.

Further, during system operation, if profile data is modified, it is necessary to control so that all PSs can receive those modified contents.

Specific profile data are shown below.

(1) LCCH interval value (n)

Shows the cycle in which CS intermittently transmits an LCCH slot; is the value expressed by the number of TDMA frames (n) within the intermittent transmission cycle.

(2) Frame basic unit length (n_{SUB})

This is the length of the LCCH superframe constituent elements that are made up of BCCH, SCCH (downlink) or USCCH (downlink) and PCH. This LCCH superframe constituent element is called the frame basic unit.

(3) Number of same paging groups (n_{SG})

This is the number of times that the same paging group is repeatedly transmitted in 1 superframe.

(4) PCH number (n_{PCH})

This is the number of PCH signal elements in a frame basic unit.

(5) Paging grouping factor (n_{GROUP})

This is the number of frame basic units required for one transmission of each PCH belonging to all paging groups in 1 superframe.

Furthermore, the multiples (n_{GROUP}) of the number of PCHs (n_{PCH}) is specified as the group division number of PCH information.

However, when the PCH paging groups are mutually related when 2 LCCH are used (refer to section 4.2.7.4), number of group divisions = n_{GROUP} x n_{PCH} x 2.

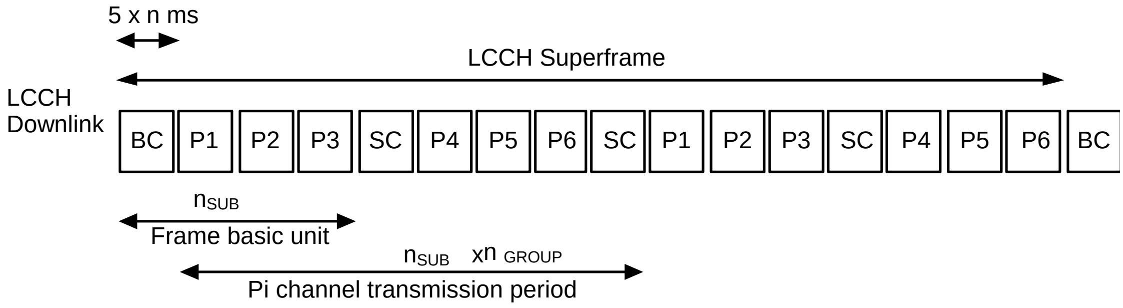
(6) Battery saving cycle maximum value (n_{BS})

The number of times (n_{BS}) CS continuously transmits the identical reception signal to a certain paging group. The maximum battery saving cycles of PS that are permitted by the system depending on n_{BS} are specified.

(Maximum battery saving cycle = 5 ms x n x n_{GROUP} x n_{SUB} x n_{BS})

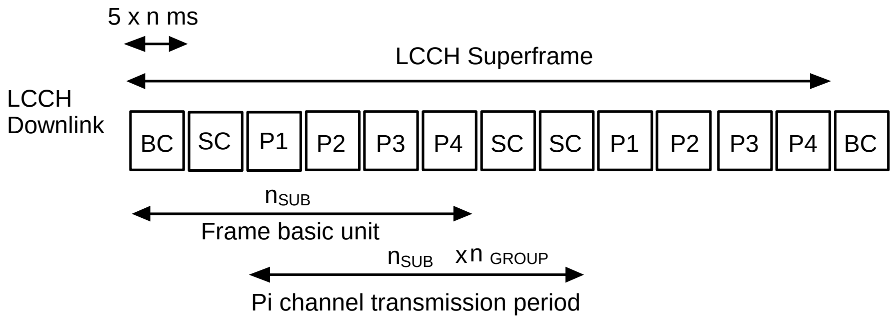
The relationships among profile data are shown below. Also, basic examples of the superframe construction and explanatory examples of battery saving cycles are shown in Figure 4.2.5 -4.2.7.

$n_{SUB} \geqq n_{PCH}$ +1:	In the first frame basic unit, because BCCH (A) is always assigned, n_{PCH} + 1 is the lower limit of frame basic unit length.
N = n_{SG} x n_{GROUP} (Units are frame basic units)	The number of frame basic units N within an LCCH superframe is given by the product of the number of the same paging groups n_{SG} and the paging grouping factor n_{GROUP}.
$n_{FRM} \leqq (\geqq)\ n_{GROUP}$ x n_{BS}:	If the number of same paging groups n_{SG} in the LCCH superframe is the same as the battery saving cycle maximum value n_{BS}, there is an equal sign; in other cases, there is a not-equal sign. Left side: Number of frame basic units in LCCH superframe Right side: Maximum battery saving cycle (The unit is the frame basic unit.)



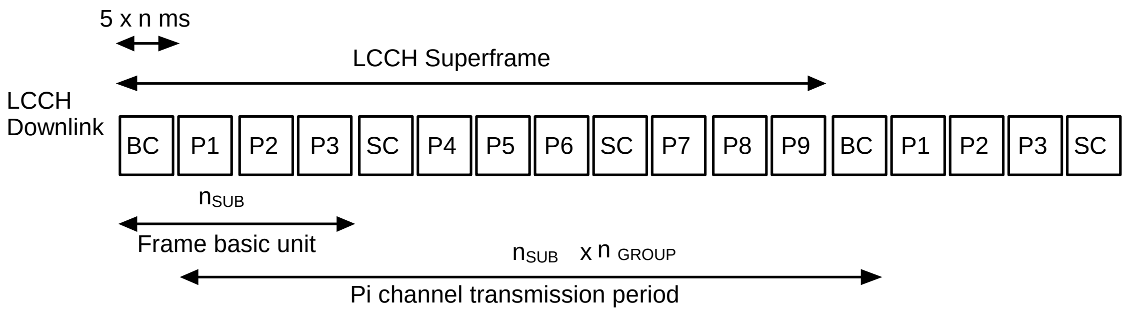
• The diagram above shows an example in which $n_{SG} = 2$, $n_{SUB} = 4$, $n_{PCH} = 3$, $n_{GROUP} = 2$.

(a) Superframe structure example 1



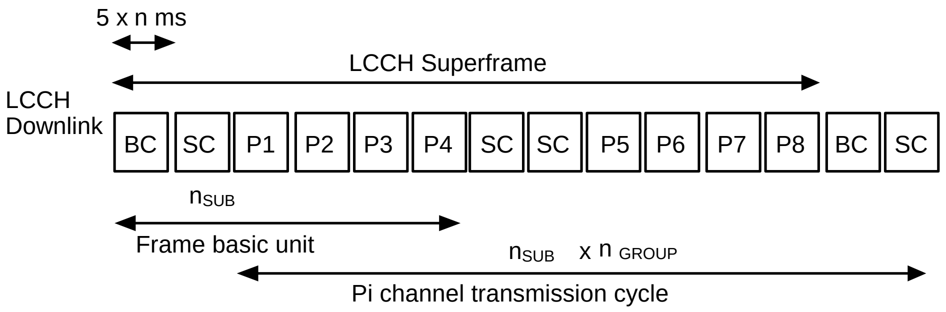
• The diagram above shows an example in which $n_{SG} = 2$, $n_{SUB} = 6$, $n_{PCH} = 4$, $n_{GROUP} = 1$.

(b) Superframe structure example 2



• The diagram above shows an example in which $n_{SG} = 1$, $n_{SUB} = 4$, $n_{PCH} = 3$, $n_{GROUP} = 3$.

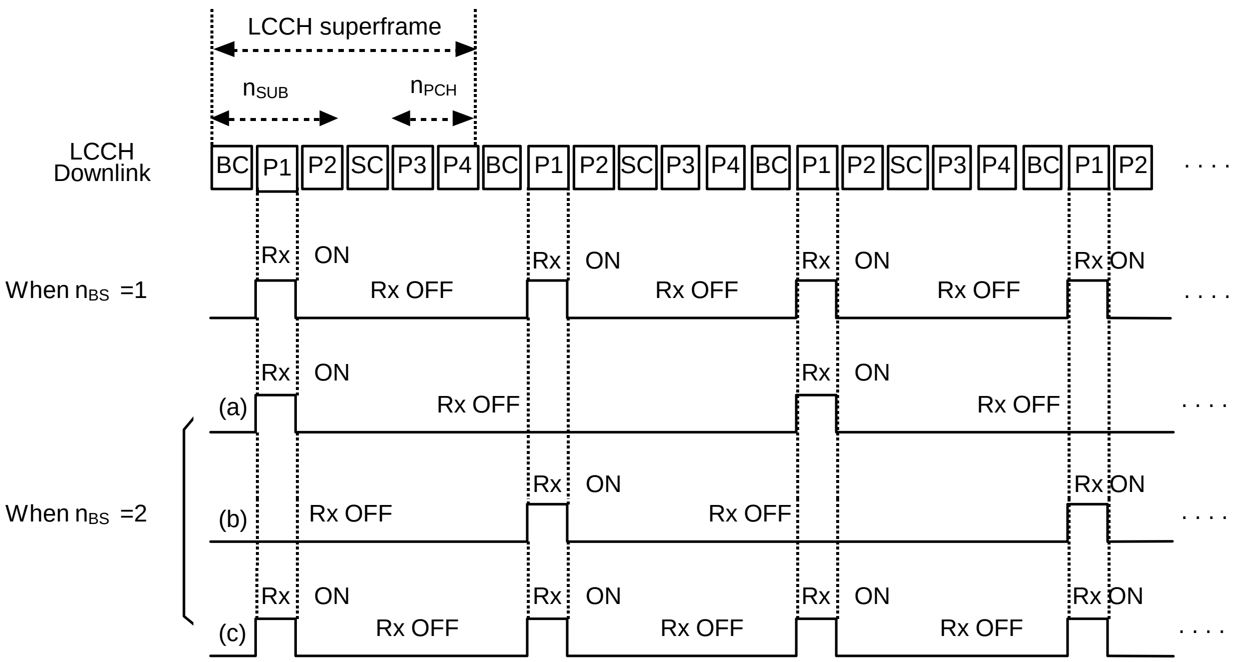
(c) Superframe structure example 3



• In the above diagram, the example is shown with n_{SG} = 1 , n_{SUB}=6, n_{PCH}=4, n_{GROUP}=2.

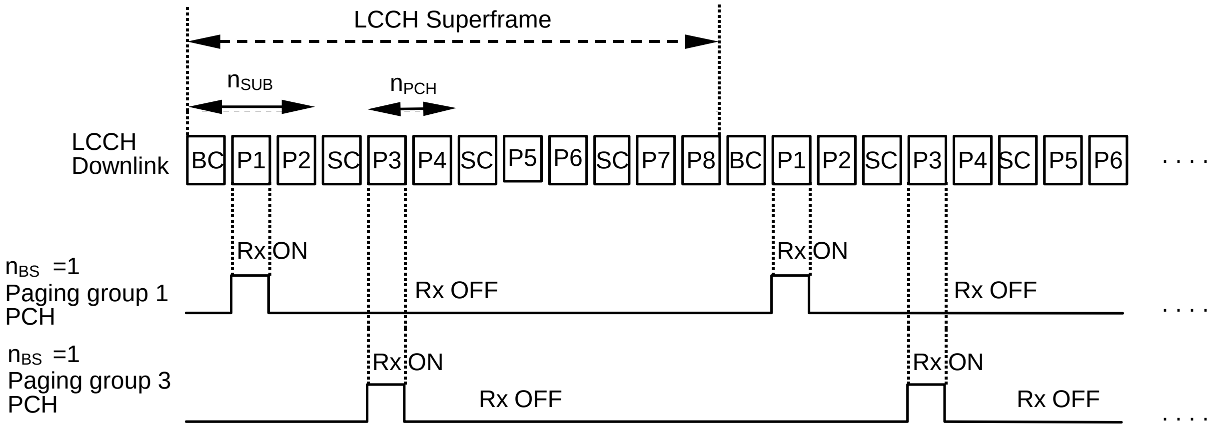
(d) Superframe structure example 4

Figure 4.2.5 Superframe structure example



• In the diagram above, the example is shown with n_{SG} = 1, n_{SUB}=3, n_{PCH}=2, n_{GROUP}=2.

Figure 4.2.6 Paging group P1 battery saving method



• In the diagram above, the example is shown with n_{SG} = 1, n_{SUB}=3, n_{PCH}=2, n_{GROUP}=4.

Figure 4.2.7 Paging group P1/P3 battery saving method

4.2.7.3 Uplink logical control channel structure (Private standard/Public standard)

Figure 4.2.8 shows an example of standard structure for the uplink logical control channel (LCCH). The LCCH uplink performs random access with slotted ALOHA, and it is sent from each PS only when needed. As a standard, 5 classes can be designated for the control physical slot positions that can be transmitted from PS, and these are informed from CS to PS according to the radio channel information broadcasting message on BCCH. (Refer to section 4.3.4.2.1.)

Specifically, the uplink LCCH position (slot position) is specified as follows according to the number of LCCHs used by one CS. However, if two LCCHs are used, in a private system, this indicates the case where 2 control carriers are used; in a public system, this indicates the case where two LCCHs are constructed on one control carrier. (Refer to section 4.2.7.5.)

[For 1 control carrier wave]

(1) It is on the carrier currently being used and it is the uplink slot 2.5 ms after the downlink LCCH that is currently being used. (Refer to Figure 4.2.8 (a))

(2) It is on the carrier currently being used and it is the uplink slot every 5 ms corresponding to the TDMA slot 2.5 ms after the downlink LCCH that is currently being used.
(Refer to Figure 4.2.8 (b))

[For 2 control carrier waves]

(1) It is on the carrier currently being used and it is the uplink slot 2.5 ms after the downlink LCCH that is currently being used. (Refer to Figure 4.2.8 (c))

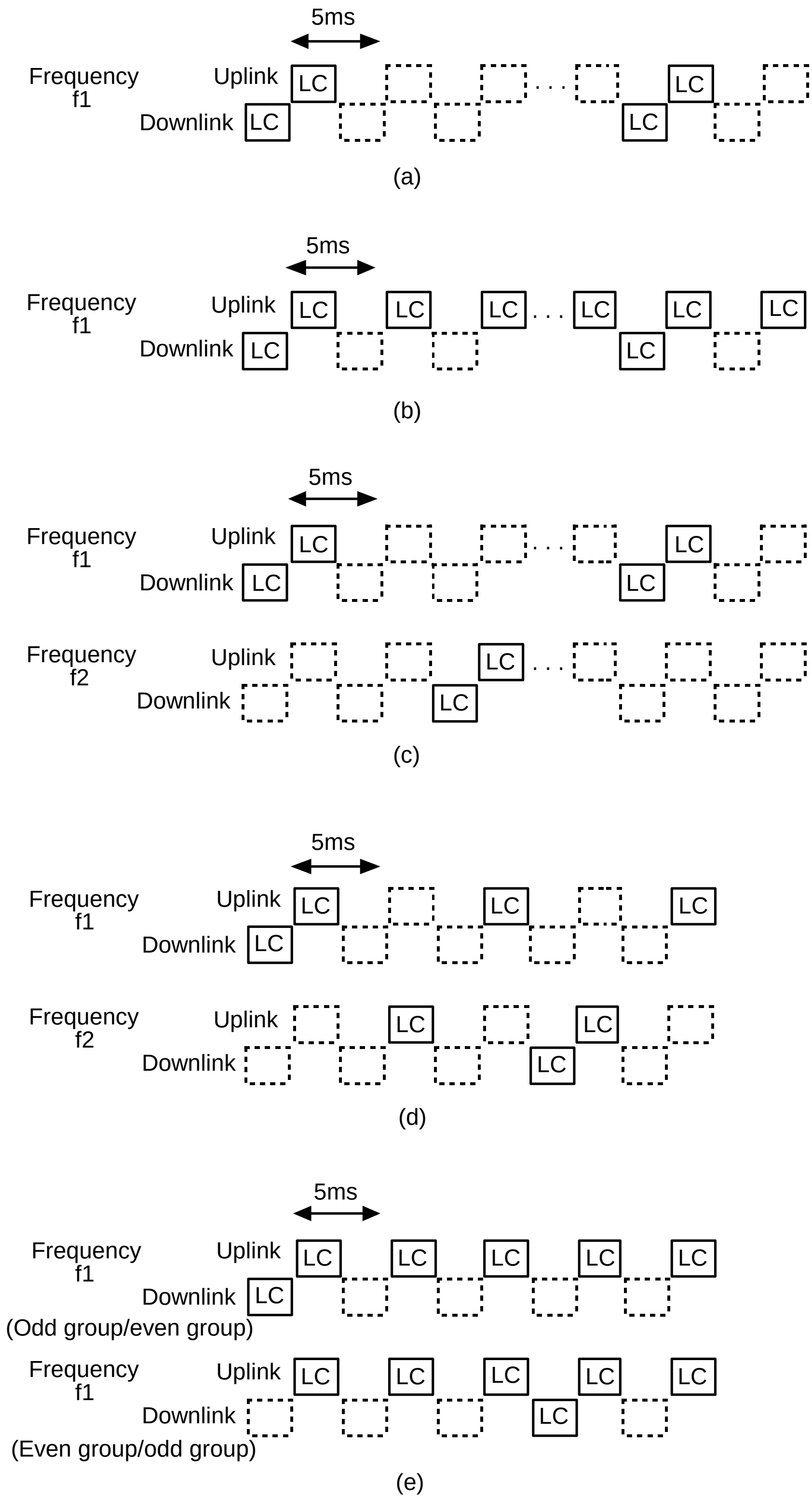
(2) It is on the carrier currently being used; the TDMA frame 2.5 ms after the downlink LCCH currently being used is defined as the first TDMA frame, and by counting from the relevant first TDMA frame, the odd-numbered TDMA frames allocate the relevant carriers, and the even-numbered TDMA frames allocate the other carriers. The specified uplink LCCH is the uplink slot each 2 TDMA frames (10 ms) corresponding to the aforementioned assignment on the TDMA frames in the respective carriers. However, in this case, the LCCH interval value (n) must be even. (Refer to Figure 4.2.8 (d))

(3) It is on the carrier currently being used; and is the uplink slot every 5 ms corresponding to the TDMA slot 2.5 ms after the downlink LCCH presently being used. (Refer to Figure. 4.2.8 (e))

However, the uplink LCCH position (slot position) is as follows.

Handover: Uplink timing of LCCH superframe which transmitted first link channel establishment request message.

Otherwise: Uplink timing of LCCH superframe that agrees with own paging group.
LCCH signals must not be transmitted at different timing of LCCH superframe when retry sequence is activated in the above both cases. This mode is used only in a public system.

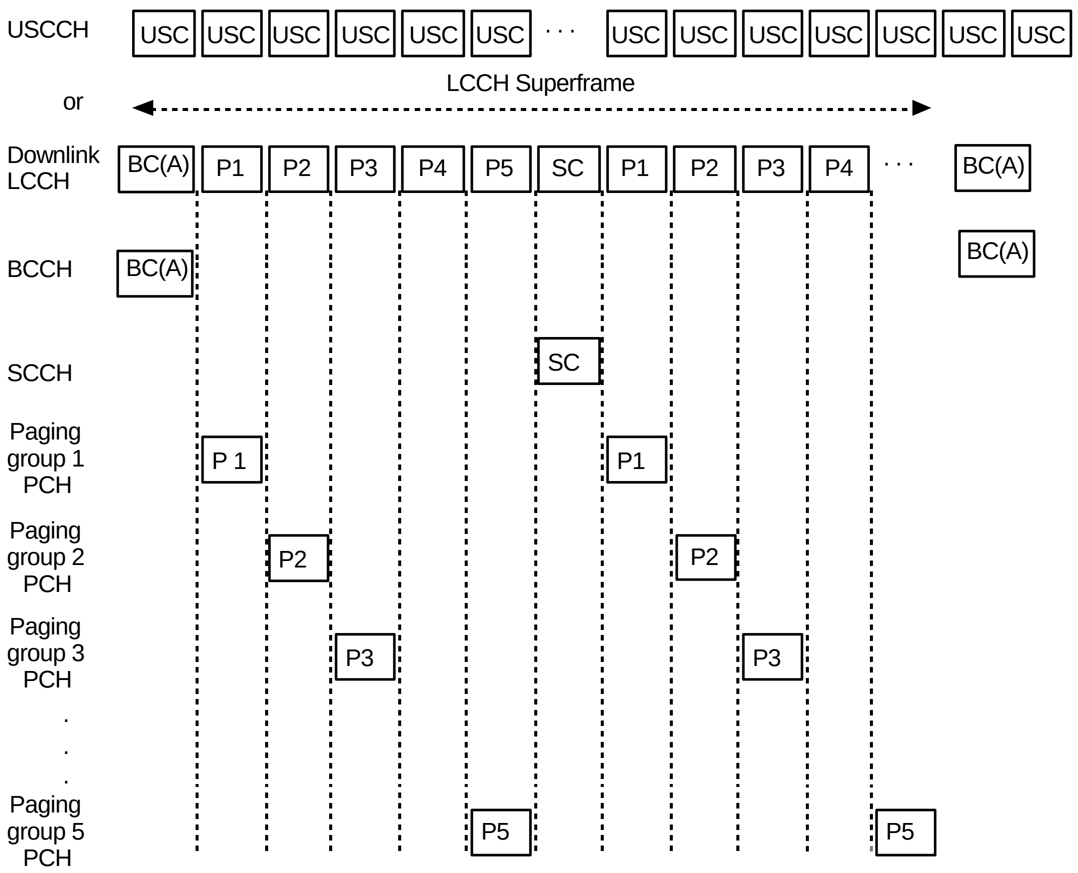


• In (a) – (d), SCCH or USCCH (option) can be transmitted as the uplink LCCH.
• In (e), only SCCH can be transmitted as uplink LCCH.

Figure 4.2.8 Structure example of uplink logical control channel (LCCH)

4.2.7.4 Downlink logical control channel structure (Private standard/Public standard)

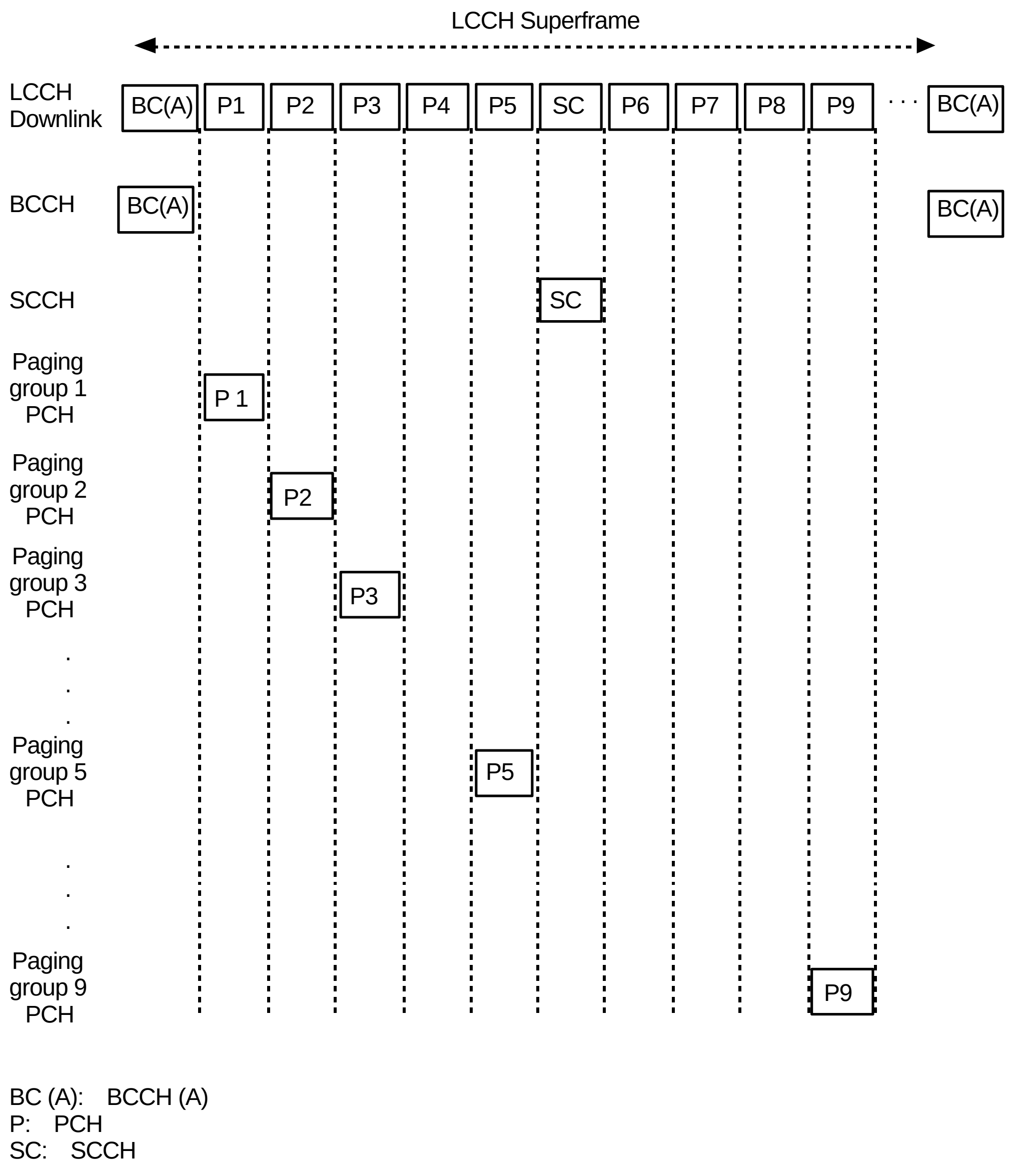
A standard structural example of the downlink logic control channel (LCCH) is shown in Figure 4.2.9.



BC (A): BCCH (A)
P: PCH
SC: SCCH
USC: USCCH

- If required, the LCCH element except BCCH (A) can be temporarily stolen, and another LCCH element can be transmitted.

(a) Structural example 1 of downlink logical control channel (LCCH)



(b) Structural example 2 of downlink logical control channel (LCCH)

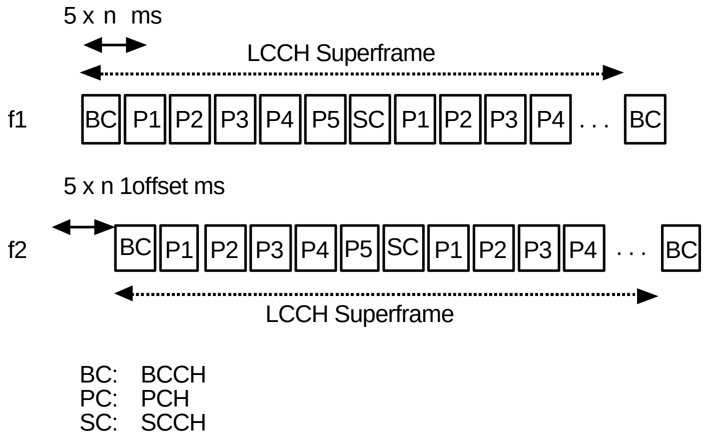
Figure 4.2.9 Structural examples of downlink logical control channel (LCCH)

4.2.7.5 Logical control channel multiplexing (Private standard/Public standard)

CS can multiplex logical control channels within the scope of the physical slot transmission condition. In this case, PS can receive at least 1 logical control channel transmission from CS. Shown here is a standard structural example of a downlink logical control channel using two carriers. However, the same method of use is possible on 1 carrier (f1 = f2) for a public system.

(1) When PCH paging groups are independent

The PCH paging groups of the control carriers f1 and f2 are mutually independent, but each downlink LCCH superframe structure is identical. For $n_{1offset}$, refer to section 4.3.4.2.1.



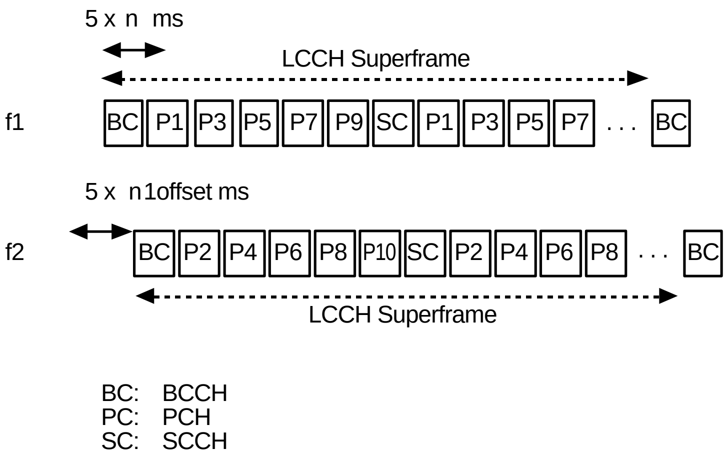
• Here, an example is shown for the case where two LCCH are the same absolute slot.

Figure 4.2.10 Example of independent LCCH using two carriers

(2) When PCH paging groups are inter-related

Control carrier f1's PCH transmits odd-numbered groups, and f2 transmits even-numbered groups.

However, in a private system, the frequency of smaller carrier number shall be f1 and the frequency of larger carrier number shall be f2.



• Here, an example is shown for the case where two LCCH are the same absolute slot.

Figure 4.2.11 Example of LCCH structure with paging groups straddling two carriers

4.2.7.6 PS logical control channel usage (Private standard/Public standard)

This section shows the required regulations when PS receives a logical control channel.

(1) Global definition information reception operation

A radio channel information broadcasting message must be sent from CS, and this message must contain LCCH downlink superframe profile data and LCCH uplink access timing.

Furthermore, the 2nd system information broadcasting message must be sent from CS, and this message must contain a country code and a system type. In case of private systems, this message also contains a paging area type.

This broadcast information is global definition information defined in common between CSs within the paging area, and in addition, a global definition information pattern is added as index data of the relevant definition information. This global definition information pattern is transmitted to PS by a radio channel information broadcasting message, paging message and local information broadcasting message. However, if a local information broadcasting reception indication is indicated in the paging message and local information broadcasting message, the global definition information pattern is not sent.

As a rule, before LCCH steady reception, PS must receive a radio channel information broadcasting message and a 2nd system information broadcasting message. However, if PS stores a valid global definition information pattern, the contents of a global definition information is not necessarily received because the LCCH uplink access timing, downlink superframe profile data, a country code, and system type for public and private system, and paging area type for private system which are necessary for starting LCCH reception from a new CS are already known.

The conditions under which the global definition information pattern is valid are as follows.

[1] By receiving the radio channel information broadcasting message and the 2nd system information broadcasting message, the global definition information pattern is valid from the point where the global definition information and global definition information pattern are stored.

[2] As long as the PS remains in the same paging area and there are no changes in the global definition information pattern, the global definition information pattern stored by the PS is valid.

[3] When the PS power is turned on and when the conversation is ended, if the relevant paging area global definition information pattern transmitted by CS is the same as that stored by PS, it is valid.

(2) Local information broadcasting message reception operation

An LCCH downlink signal to which a local information broadcasting reception indication has been added is transmitted from the CS by which the local information broadcasting message is transmitted. The PS that receives this local information broadcasting reception indication must perform BCCH reception, and must receive local definition information. However, the PS which has received the local definition information according to the relevant reception indication has no duty to receive the relevant broadcasting message as long as there are no changes in the local definition information contents. By the status number (mi: i = 1 to 3), PS can autonomously judge whether or not reception of new local definition information is required.

When SCCH is transmitted from PS to CS, if a system information broadcasting message is transmitted from CS that contains access restriction pertaining to LCCH transmission, PS must perform the transmission process according to the relevant broadcast information. If a system information broadcasting message was transmitted, it must performs the SCCH transmission process according to section 4.3.4.2.2.
Furthermore, if reception of a 2nd system information broadcasting message/3rd system information broadcasting message (public only) or option information broadcasting message (private only) is indicated by the local information broadcasting reception indication, the broadcasting reception operation specified in this section is performed. However, the reception process of the broadcasting contents of the option information broadcasting message is not specified.

(3) Regulations on status number (mi)

A status number (mi) which shows the change history of the restriction information is added to the local information broadcasting message. The conditions under which no responsibility for local information broadcasting message reception arises even if the local information broadcasting reception indication is received at the PS are limited to the case where this status number (mi) is valid. Here, handling of the status number mi is specified as follows.

[1] Due to reception of the local information broadcasting message, the relevant status number (mi) is valid from the point where the status number (mi) is stored together with the broadcasting contents.

[2] After the status number (mi) is valid in item (1) above, reception of the local information broadcasting reception indication continues, and as long as there are no changes in the status number (mi), the relevant status number (mi) is valid.

[3] If PCH or BCCH cannot be received and PS cannot perform the validity confirmation of status number (mi) shown in item (2) above for more than 60 seconds continuously, the status number (mi) must become invalid.

[4] Validity of the status number mi is guaranteed independently in each CS of different CS-IDs. Therefore, a stored status number mi is valid only when the logical control channel from the same CS is received.

[5] If it is informed to PS that there was no transmission of the local information broadcasting message by the broadcasting status indication in the radio channel information broadcasting message, the relevant status number (mi) is invalid.

[6] If the status number (mi) is not valid in PS, it must receive a new local information broadcasting message corresponding to the relevant status number (mi), and the reception process shown in (1) must be performed. At this time, the operation must be performed according to local information broadcasting message contents corresponding to the stored status number (mi), until PS acquires the new local definition information.

(4) Exceptions pertaining to local definition information reception responsibility

Local definition information in the radio channel information broadcasting message is not managed by the status number (mi). Therefore, reception must be aligned with the acquisition of global definition information when the following (5) LCCH reception begins.

(5) LCCH reception start operation

The following is specified for the LCCH reception start operation after communication is ended and when zone shifting during standby is performed, after the PS power is turned on.

[1] It checks whether or not the global definition information pattern is valid.

If it is confirmed that it is invalid, the radio channel information broadcasting message is received.

[2] If the local information broadcasting message is received in the state where it is not confirmed whether or not the global definition information pattern is valid, it follows those contents.

[3] If a valid local information broadcasting reception indication is received in the state where it is not confirmed whether or not the global definition information pattern is valid, it follows that reception indication.

[4] The fact that the local information broadcasting message was transmitted is indicated in the radio channel information broadcasting message. If PS received a radio channel information broadcasting message, after confirming the global definition information, it executes the reception process of the required local information broadcasting message.

Note that in the case where PCH paging groups are mutually related, CS in 2LCCH mode of a public system indicates LCCH structure by odd-even identification designation bit and odd-even identification bit in a global definition information pattern. In this case LCCH which includes the own paging group PCH shall be selected and received.

(6) PS operation during handover

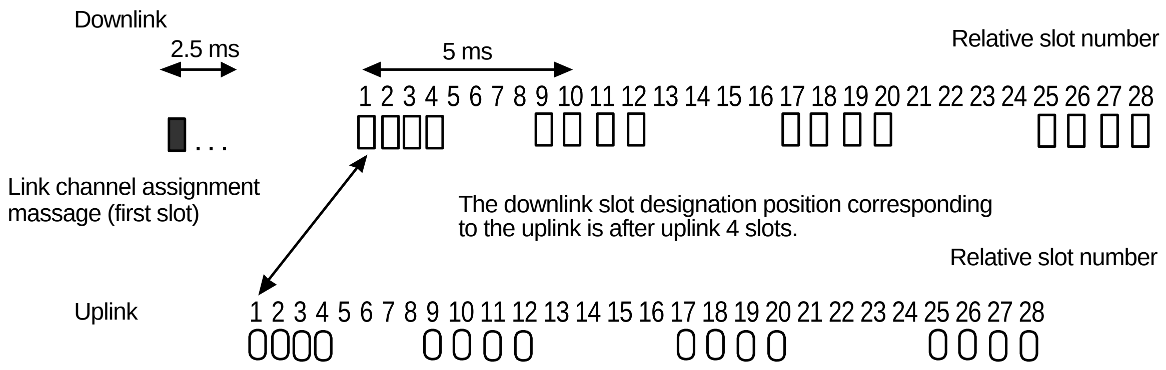
If PS activates re-calling type handover, it does not need to follow the local information broadcasting reception indication. Therefore, if the LCCH profile data of the handover destination CS and the uplink LCCH access timing are known, LCCH reception is performed without receiving broadcasting contents from the handover destination CS, and a link channel establishment request message is transmitted.

(7) Exceptions from (5), (6) above

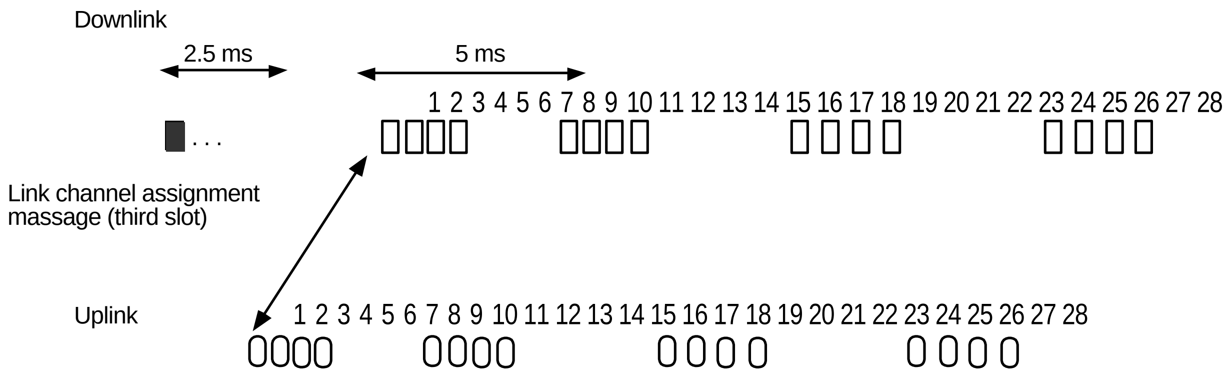
Valid when PS receives a zone information indication message from a CS during communication and this ends the call. As long as it follows these contents, after the call is ended, PS can shift to the standby operation to the relevant CS regardless of the regulations of (5), (6) above.

4.2.8 Communication physical slot designation method (Private standard/Public standard)

Designation of communication physical slots is performed by a signal (link channel assignment message) on SCCH sent from the CS. The slot designation position is indicated by the relative value (relative slot number) of the first slot 2.5 ms after the signal (link channel assignment message) that designated the slot. Also, physical slot transmission condition after slot designation follow the conditions in section 4.2.5.2. A slot designation example is shown in Figure 4.2.12.



(When the link channel assignment message is on the first slot)



(When the link channel assignment message is on the third slot)

Figure 4.2.12 Examples of relative slot number

The method of designating the relative slot numbers for various transmission rates (when the link channel assignment signal is on the first slot), is shown in Figure 4.2.13.

(1) 32 kbit/s channel designation method

- Designated by the transmission rate and numbers 1-8.

(2) 16 kbit/s channel designation method

- Designated by the transmission rate and numbers 1-16.

(3) 8 kbit/s channel designation method

- Designated by the transmission rate and numbers 1-32.

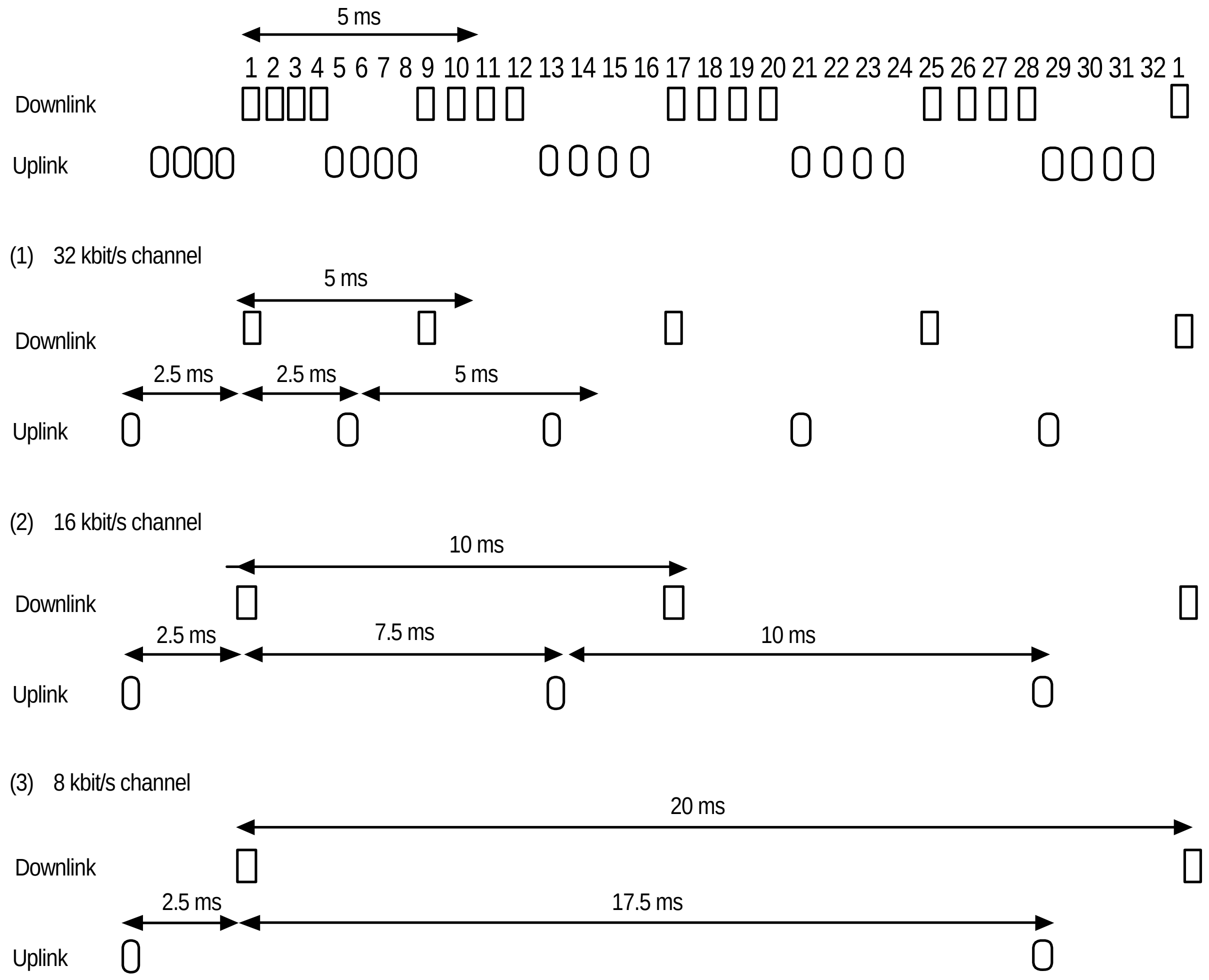


Figure 4.2.13 Relationship between transmission rate and relative slot number
(when relative slot number is "1")

4.2.9 Slot structure (Private standard/Public standard)

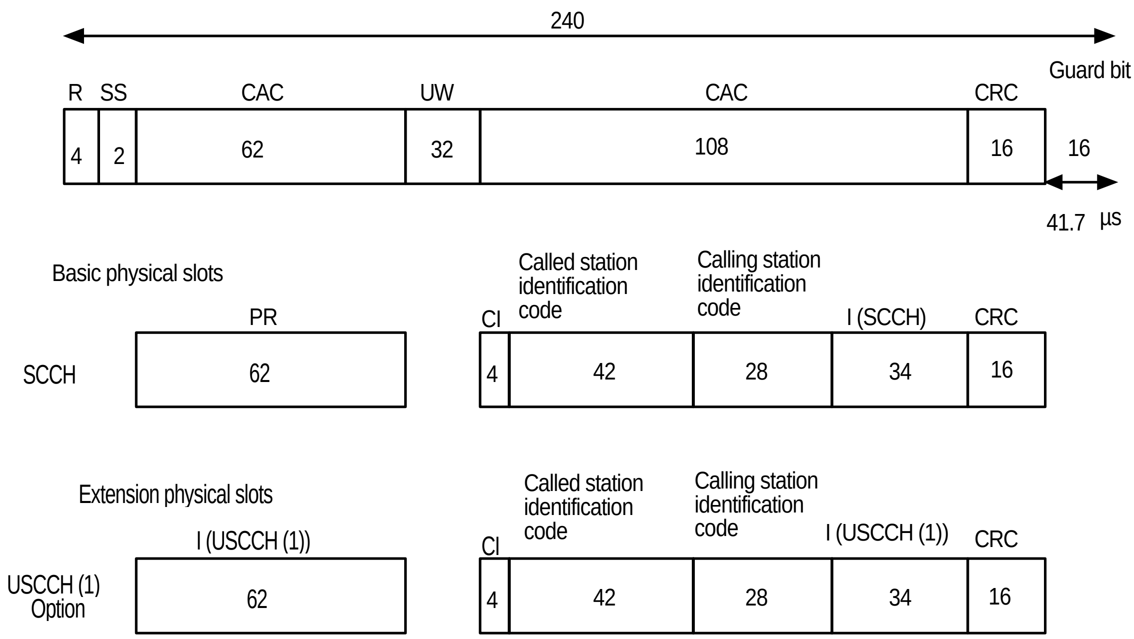
Slot structure follows the general rules below, and the structures of the control physical slots and the communication physical slots are shown in Figure 4.2.14.1 - 4.2.17.2.

(1) In order to distinguish between control physical slots and communication physical slots, unique words (UW) have different patterns.

(2) With control physical slots, the bit synchronization needed for signal reception is carried out independently for each slot; with communication physical slots, as a general rule, it is carried out according to the synchronization burst previously transmitted in signal sending/receiving. Therefore in the function channel for communication physical slots the preamble bits are compressed in order to establish bit synchronization. However, in order to have extension functions on the communication physical slot, a signal that has the same preamble as the control physical slot is defined as an option.

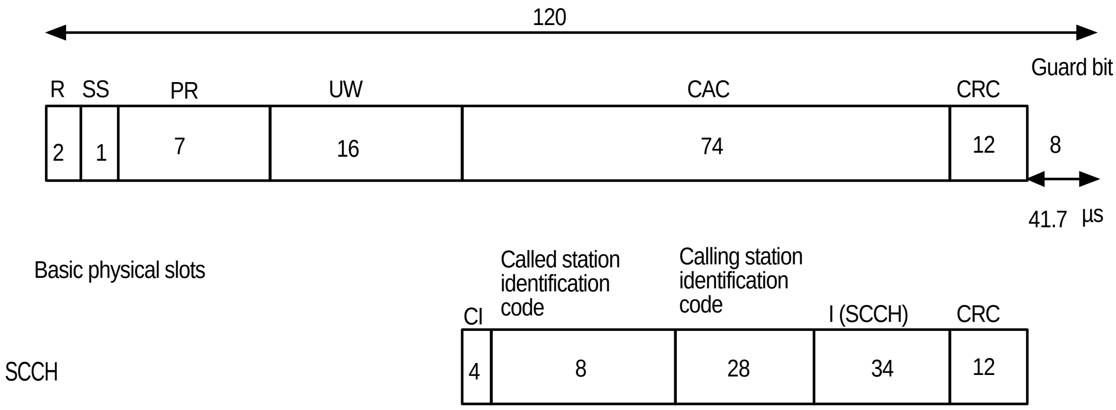
(3) The structure of the control physical slot does not depend on the method of accessing the control channel.

(4) Regarding the USCCH as well as USPCH, in the standard, only the slot structure is specified; the methods of using them are optional, as shown in section 4.2.4.1.



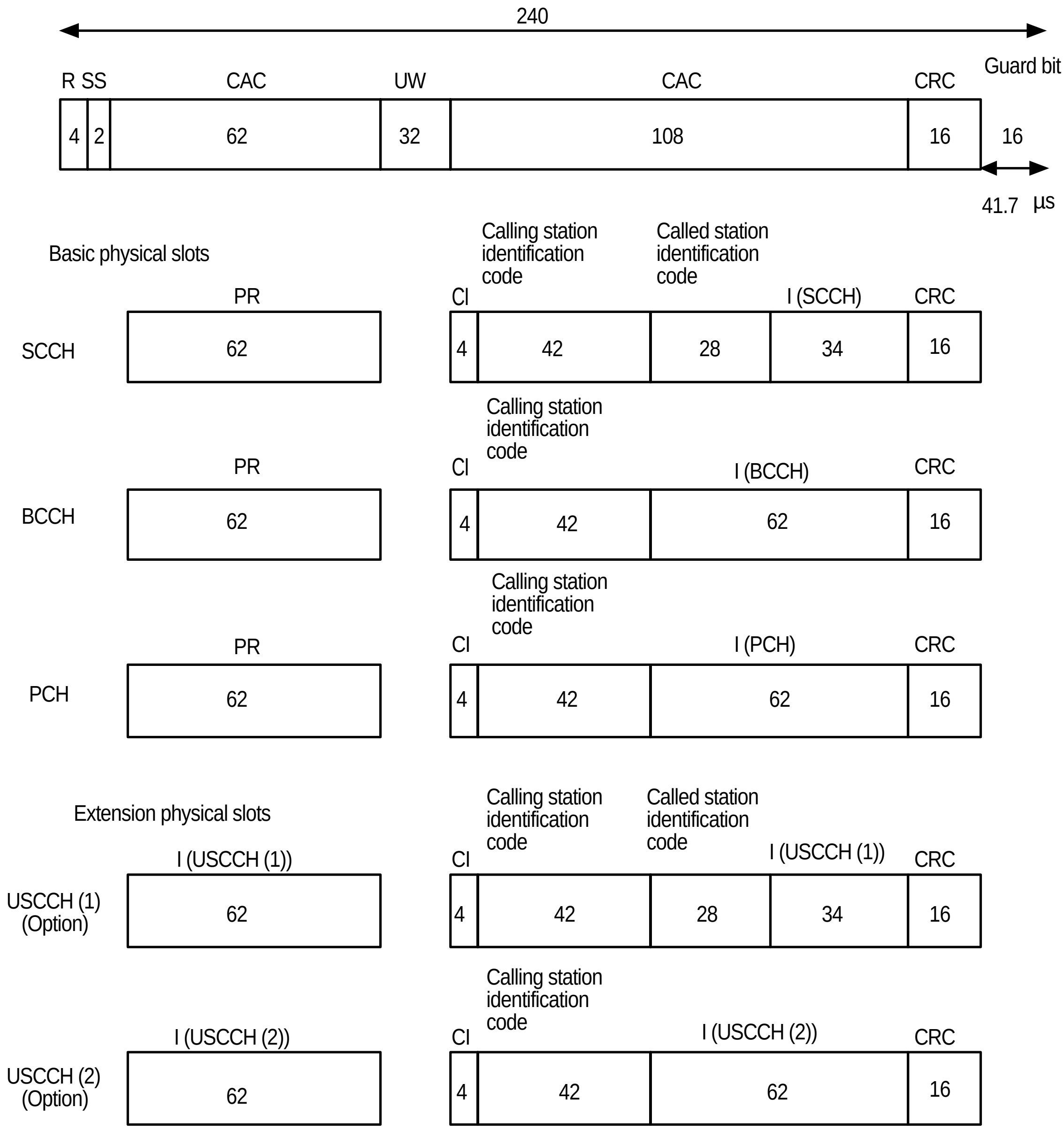
R: Ramp (time)
UW: Unique word
CAC: Common access channel
PR: Preamble
CI: Channel identifier
SS: Start symbol
Calling station identification coding : Includes local station identification code.
Called station identification code : Includes identification code of peer station that performs connection.

Figure 4.2.14.1 Control physical slot structure of π /4 shift QPSK (uplink)
(Numbers in the figure without units represent bits)



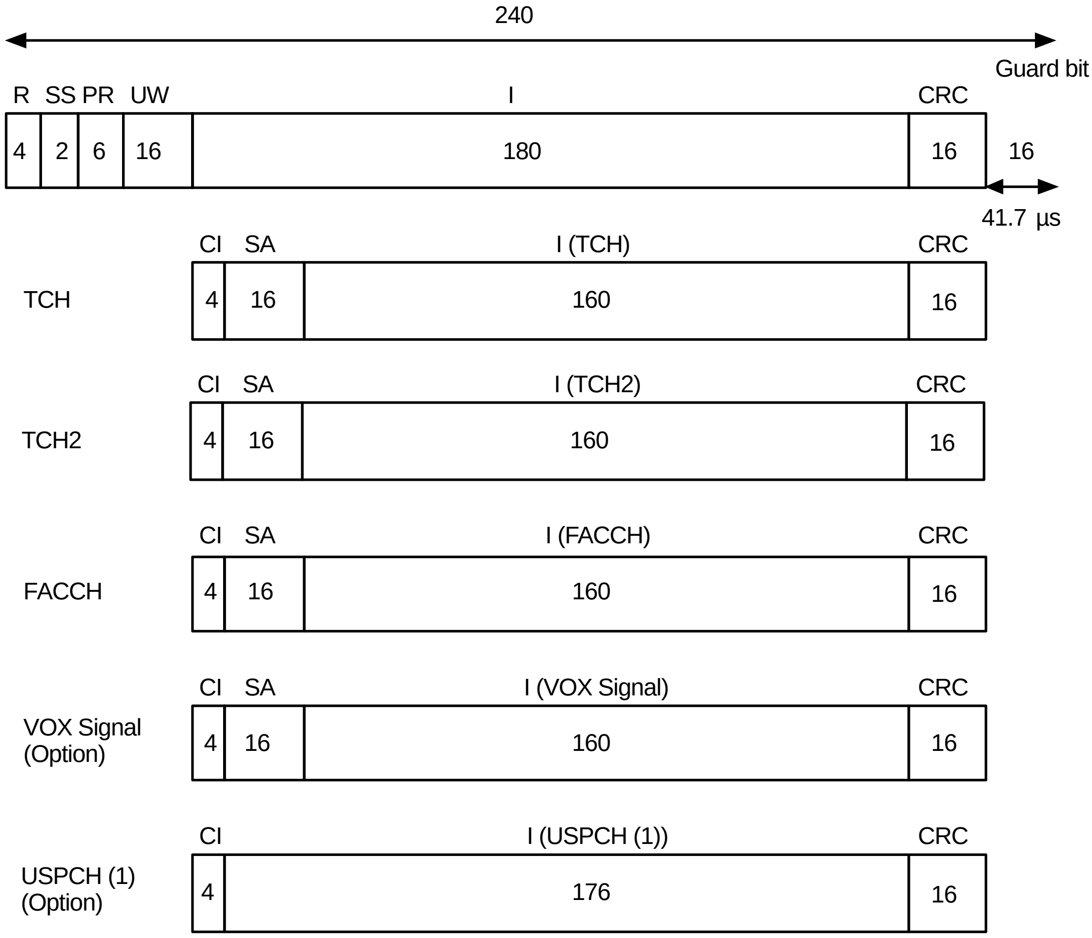
R: Ramp (time) PR: Preamble
UW: Unique word CI: Channel identifier
CAC: Common access channel SS: Start symbol
Calling station identification coding : Includes local station identification code.
Called station identification code : Includes identification code of peer station that performs connection.

Figure 4.2.14.1 Control physical slot structure of π /2 shift BPSK (uplink)
(Numbers in the figure without units represent bits)



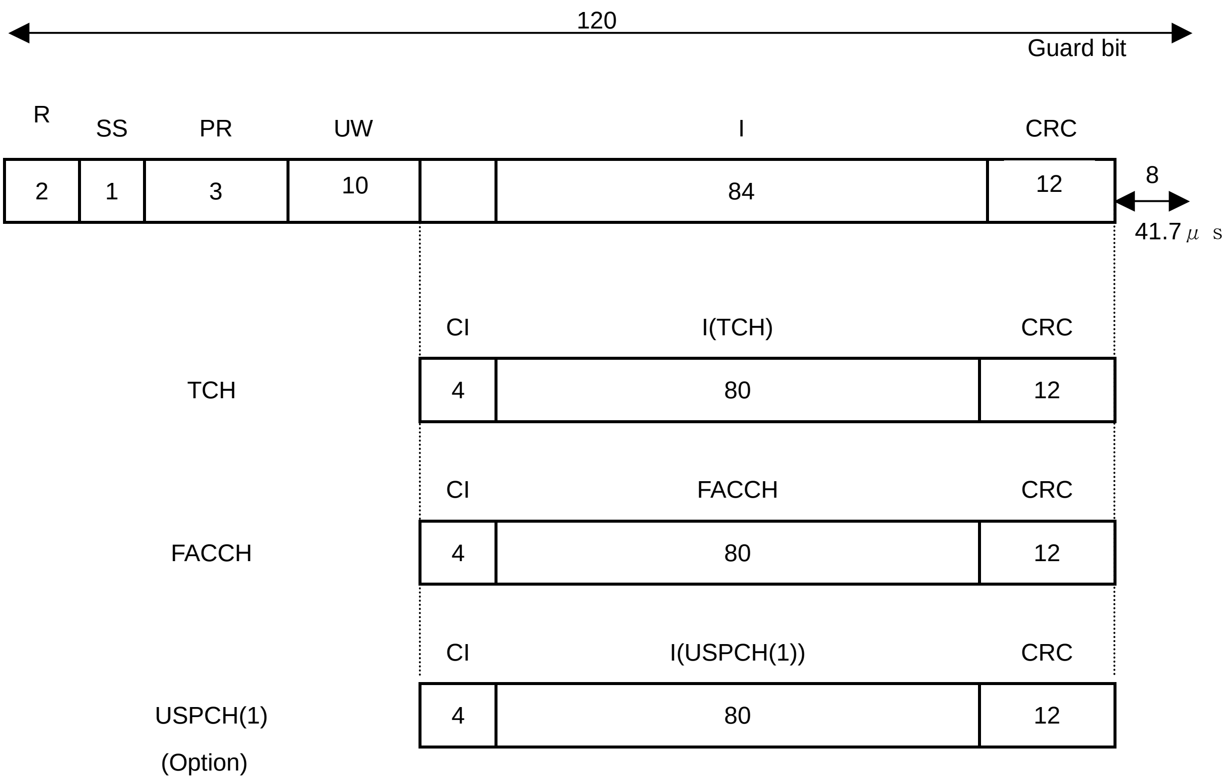
R: Ramp (time)
PR: Preamble
UW: Unique word
CI: Channel identifier
CAC: Common access channel
SS: Start symbol
Calling station identification code: Includes local station identification code.
Called station identification code: Includes identification code of peer station that performs connection.

Figure 4.2.15 Control physical slot structure (downlink)
(Numbers in the figure without units represent bits)



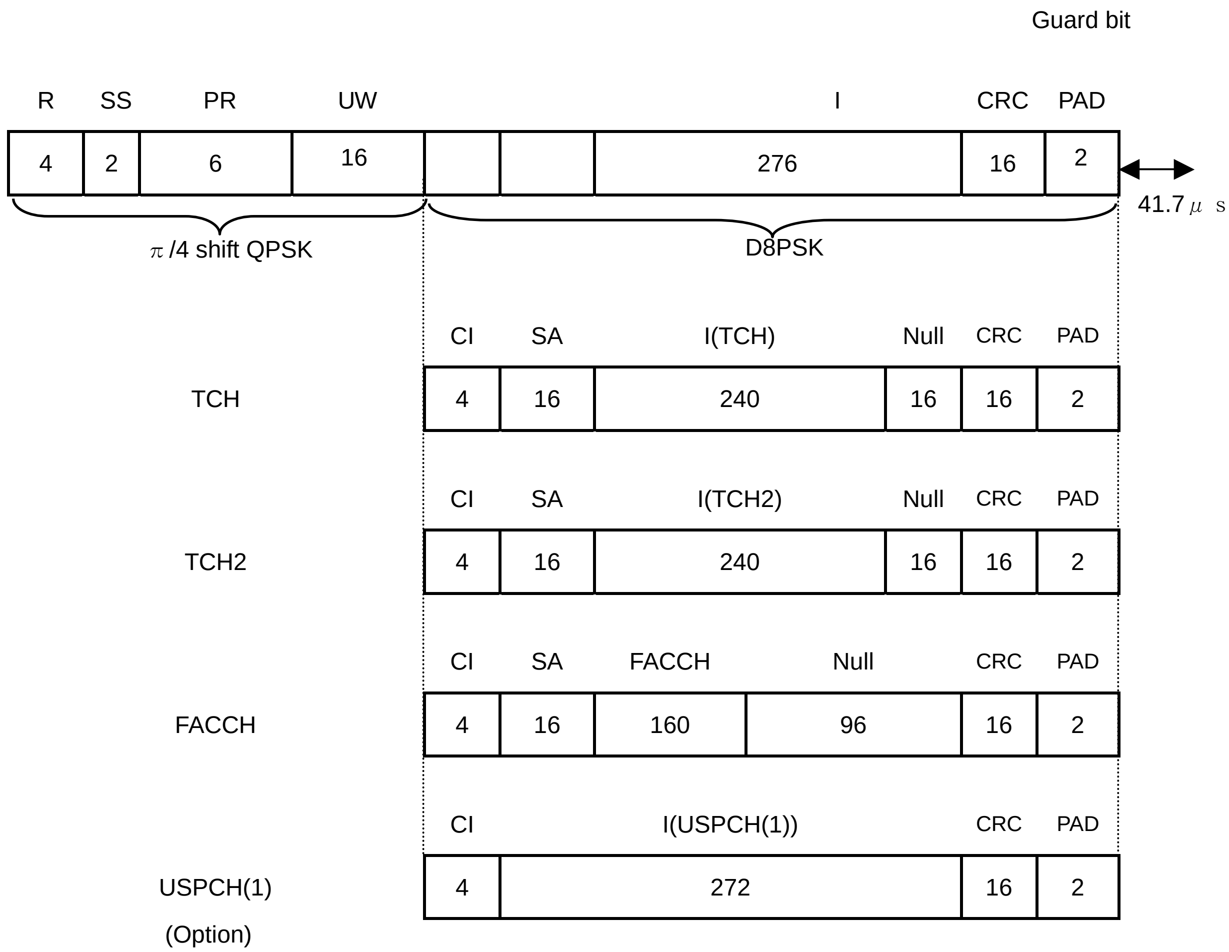
R: Ramp (time)
UW: Unique word
SA: SACCH
PR: Preamble
CI: Channel identifier
SS: Start symbol

Figure 4.2.16.1 Communication physical slot structure of π /4 shift QPSK (uplink/downlink)
(Numbers in the figure without units represent bits)



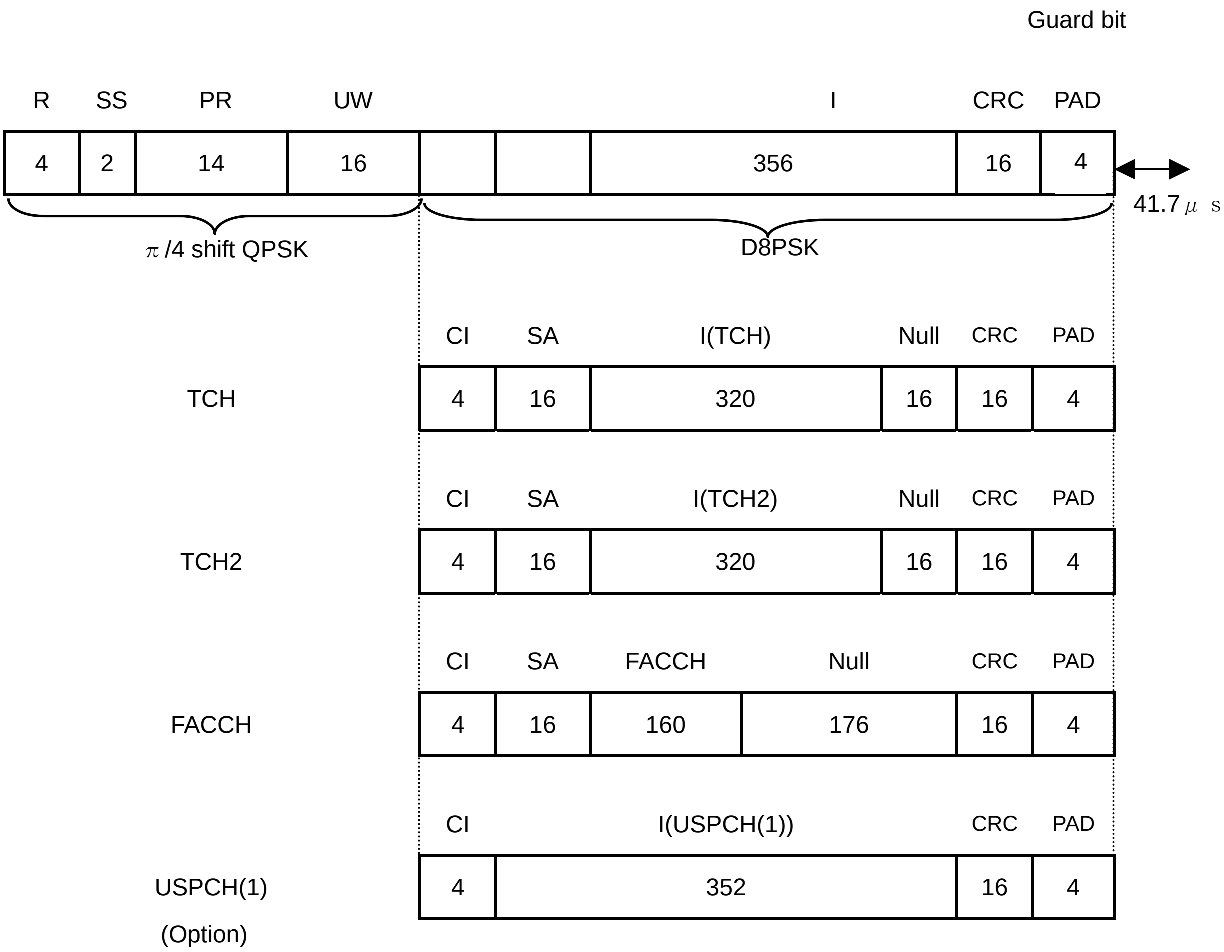
R: Ramp (time)
UW: Unique word
SS: Start symbol
PR: Preamble
CI: Channel identifier

Figure 4.2.16.2 Communication physical slot structure of π /2 shift BPSK (uplink/downlink)
(Numbers in the figure without units represent bits)



R: Ramp (time)
UW: Unique word
SA: SACCH
PAD: Padding
PR: Preamble
CI: Channel identifier
SS: Start symbol

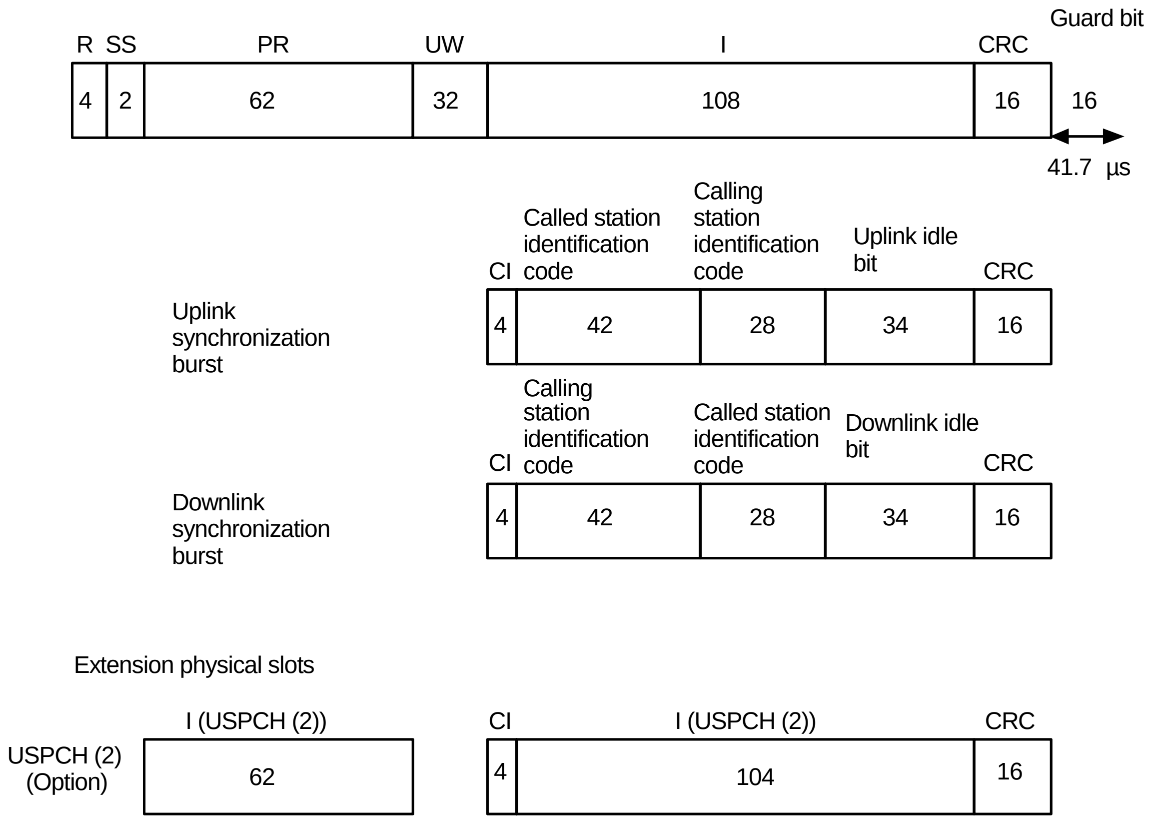
Figure 4.2.16.3 Communication physical slot structure of D8PSK (uplink/downlink)
(Numbers in the figure without units represent bits)



R: Ramp (time)
UW: Unique word
SA: SACCH
PAD: Padding
PR: Preamble
CI: Channel identifier
SS: Start symbol

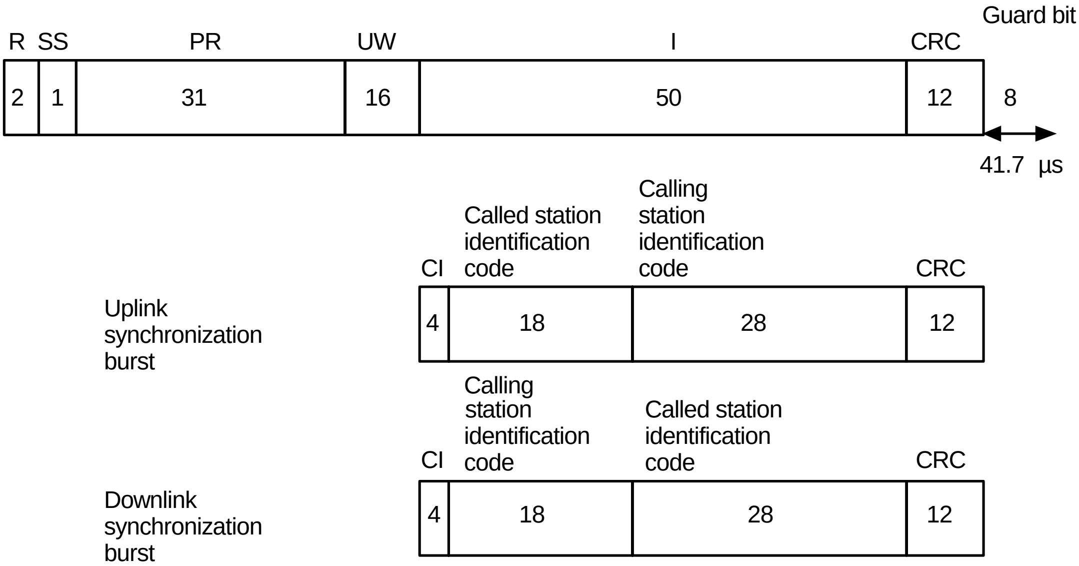
Note : When the encoding method is 16QAM, absolute phase 0 degrees at the time of the phase change end of UW last symbol.

Figure 4.2.16.4 Communication physical slot structure of 16QAM (uplink/downlink)
(Numbers in the figure without units represent bits)



R: Ramp time
PR: Preamble
UW: Unique word
CI: Channel identifier
SS: Start symbol
Calling station identification code: Includes own identification code.
Called station identification code: Includes identification code of peer station that performs connection.

Figure 4.2.17.1 Communication physical slot (synchronization burst and USPCH(2)) structure of π/4 shift QPSK (uplink/downlink)
(Numbers in the figure without units represent bits)



R: Ramp time
PR: Preamble
UW: Unique word
CI: Channel identifier
SS: Start symbol
Calling station identification code: Includes own identification code.
Called station identification code: Includes identification code of peer station that Performs connection.

Figure 4.2.17.2 Communication physical slot (synchronization burst and USPCH(2)) structure of π /2 shift BPSK (uplink/downlink)
(Numbers in the figure without units represent bits)

The synchronization signals (preamble, unique word) as well as transient response ramp bit, guard bit needed in each slot are shown below.

(1) Guard bit, Ramp time （π /4 shift QPSK）

(a) Uplink Guard bits = 16 bits
Ramp bits = 4 bits

(b) Downlink Guard bits = 16 bits
Ramp bits = 4 bits

Guard bit and ramp time in the other modulation methods is the absolute time equal to the time in case of π /4 shift QPSK.

(2) Preamble pattern (Private mandatory/Public standard)

Control physical slot (π /4 shift QPSK)	SS: 10 SS + PR: 1001 repetitions
Control physical slot (π /2 shift BPSK)	SS: 10 SS + PR: 1010 repetitions
Communication physical slot (π /4 shift QPSK)	SS: 10 SS + PR: 1001 repetitions
Communication physical slot (π /2 shift BPSK)	SS: 10 SS + PR: 1010 repetitions
Communication physical slot (D8PSK)	SS: 10 SS +PR: 1001 repetitions
Communication physical slot (16QAM)	SS: 10 SS +PR: 1001 repetitions
Synchronization burst (π /4 shift QPSK)	SS: 10 SS +PR: 1001 repetitions
Synchronization burst (π /2 shift BPSK)	SS: 1 SS+PR: 1010 repetitions

(3) Unique word pattern (Private mandatory/Public standard)

(a) Control physical slot, synchronization burst, USPCH (2) [Option]

π /4 shift QPSK

Uplink 0110 1011 1000 1001 1001 1010 1111 0000 32-bit pattern
Downlink 0101 0000 1110 1111 0010 1001 1001 0011 32-bit pattern

π /2 shift BPSK Control physical slot

Uplink 1001 0100 1000 0011 16-bit pattern

π /2 shift BPSK Synchronization burst

Uplink 0000 1010 1011 0000 16-bit pattern
Downlink 1110 1000 0100 1110 16-bit pattern

(b)Communication physical slot (except synchronization burst, USPCH (2) [Option])

π /4 shift QPSK, D8PSK, 16QAM

Uplink 1110 0001 0100 1001 16-bit pattern
Downlink 0011 1101 0100 1100 16-bit pattern

π /2 shift BPSK

Uplink 0001 0101 10 10-bit pattern
Downlink 1001 1010 01 10-bit pattern

4.2.10 Channel coding (Private standard/Public standard)

4.2.10.1 Channel coding rules (Private standard/Public standard)

The signals transmitted by the radio channels are transmitted after all the encoding for error detection is carried out. On the reception side, error detection is performed, and it is judged whether there are any errors in that slot.

The general facts related to channel coding regulations are as follows.

(1) All data (control signals, voice, bearer) is transmitted after encoding according to cyclic redundancy check (CRC) on the transmission side.

(2) When receiving unique words, the allowable number of erroneous bits detected is as follows:

Unique word length 16 bits: Permitted error 1 bit or less equivalent

Unique word length 32 bits: Permitted error 1 bit or less equivalent

Unique word length 10 bits: Permitted error 1 bit or less equivalent

(3) The error detection CRC code is as follows: (Private mandatory/Public standard)

(a) π /4 shift QPSK, D8PSK, 16QAM

ITU-T 16 bit CRC

Generator polynomial: $1 + X^{5} + X^{12} + X^{16}$

(b) π /2 shift BPSK

12 bit CRC

Generator polynomial: $1 + X + X^{2} + X^{3} + X^{11} + X^{12}$

A standard CRC coding method is shown in Figure 4.2.18.2. The initial values of the shift register S15-S0 are all set to 1. While the coder in Figure 4.2.18.2 is reading from D108 to D1, T1 reaches the bottom and T2 is closed. Then, while outputting 16-bit detection bits, T1 reaches the top and T2 is opened.

When the information bit length is 196 bits, 292 bits and 372 bits, D108 is read D180, D276 and D356 respectively.

Also, 12bit CRC coding method is shown in Figure 4.2.18.4. The initial values of the shift register S11-S0 are all set to 1. When the coder in Figure 4.2.18.4 is reading from D50 to D1, T1 reaches the bottom and T2 is closed.

When the information bit length is 86 bits and 96 bits, D50 is read D74 and D84 respectively.

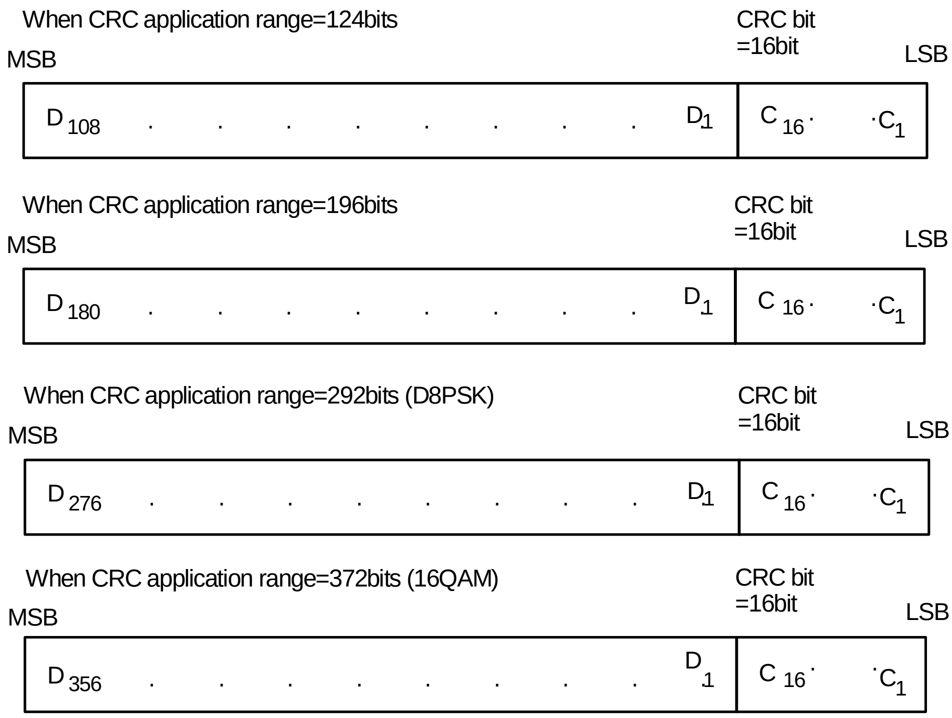


Figure 4.2.18.1 Data series that carries out CRC coding

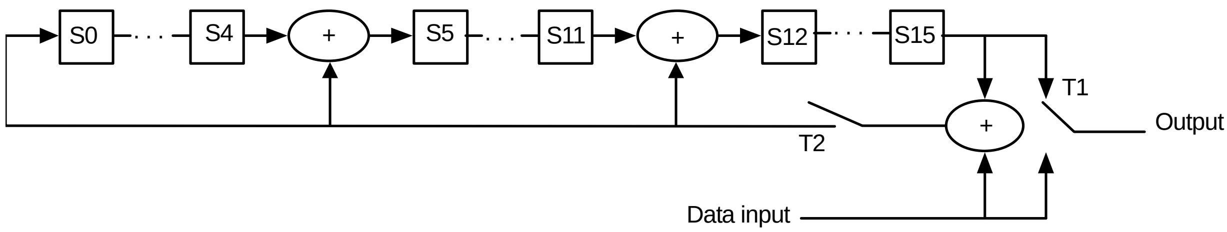


Figure 4.2.18.2 CRC encoder (ITU-T 16bit CRC)

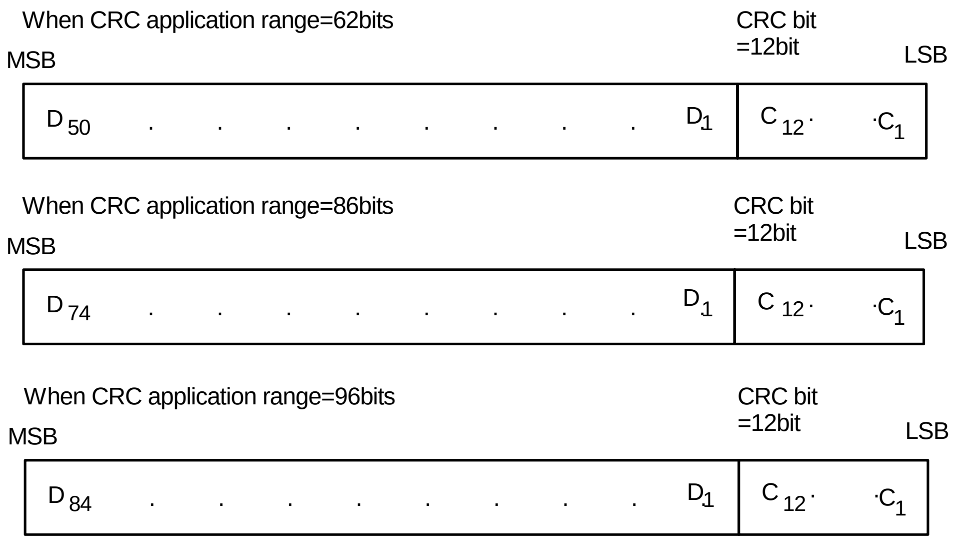


Figure 4.2.18.3 Data series that carries out CRC coding

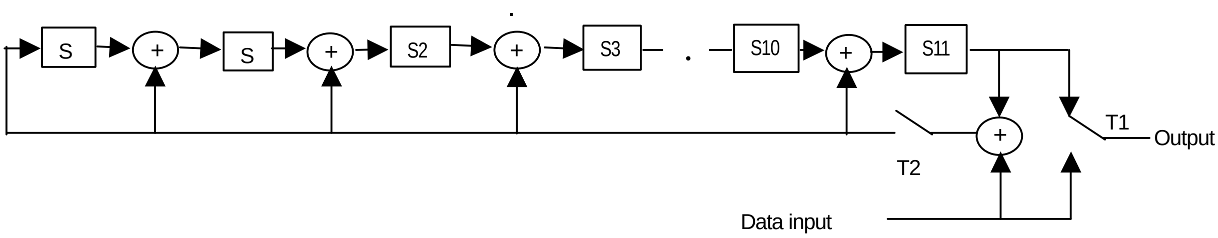


Figure 4.2.18.4 CRC encoder (12bit CRC)

4.2.10.2 Calling station identification code and called station identification code
(Private standard/Public standard)

4.2.10.2.1 Structure of calling station identification code and called station identification code
(Private standard/Public standard)

For radio supervision, the PS identification code (28 bits), system identification code (29 bits), and operator identification code (9 bits) are unique codes for the PS, system, and operator respectively. The structures and usage methods of the calling station identification code and called station identification code which contain them are as shown below.

(1) Calling station identification code: Shows the "identification code" of the transmitting station of the relevant function channel.

If the transmitting station is CS: (CS-ID)
(Private system): System identification code + additional ID
(Public system): Operator identification code + Public system additional ID (paging area number + additional ID) (π /4 shift QPSK)
Operator identification code + part of Public system additional ID (π /2 shift BPSK) (See Figure 4.2.20.2.1 – 4.2.20.2.3)
If the transmitting station is PS: PS identification code (PS-ID)

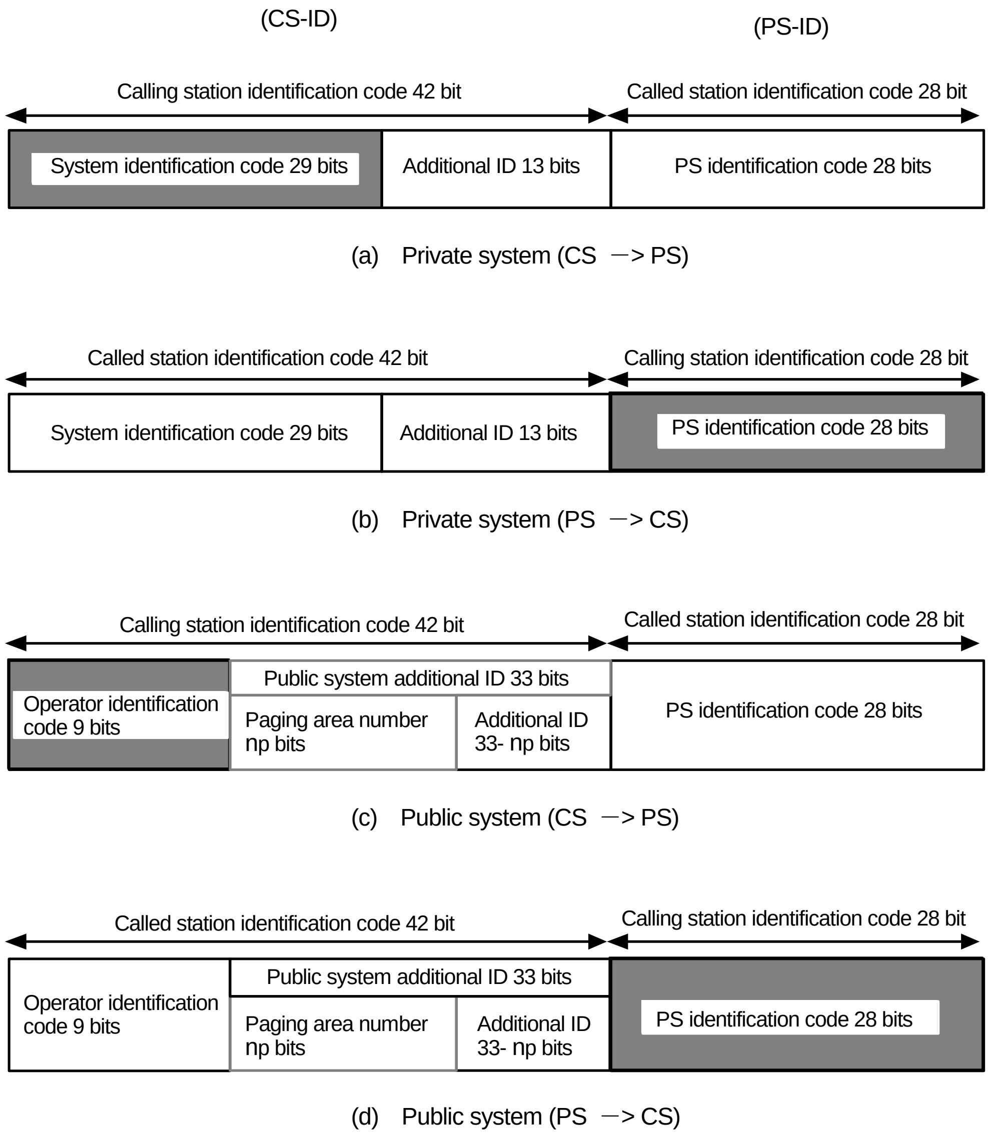
When an additional ID (13 bits) of private system is used for paging area number, additional ID consists of paging area number (n_p bit) and additional ID (13-n_p bit).

(2) Called station identification code: Shows the calling station identification code of the opposing station.

On BCCH, PCH and USCCH (2) which assume that the opposing station calling station identification code is unclear or undetermined, the called station identification code does not exist in the format, and is defined only in SCCH, USCCH (1) and the synchronization burst. Furthermore, the first bit in the system identification code and operator identification code is a bit for identifying public/private. (Public: 1; Private: 0)

(3) Identification code format (Private mandatory/Public standard)

The PS identification code and CS system identification code for private systems and CS operator identification code for public systems must be formatted according to the format shown in Figure 4.2.19.



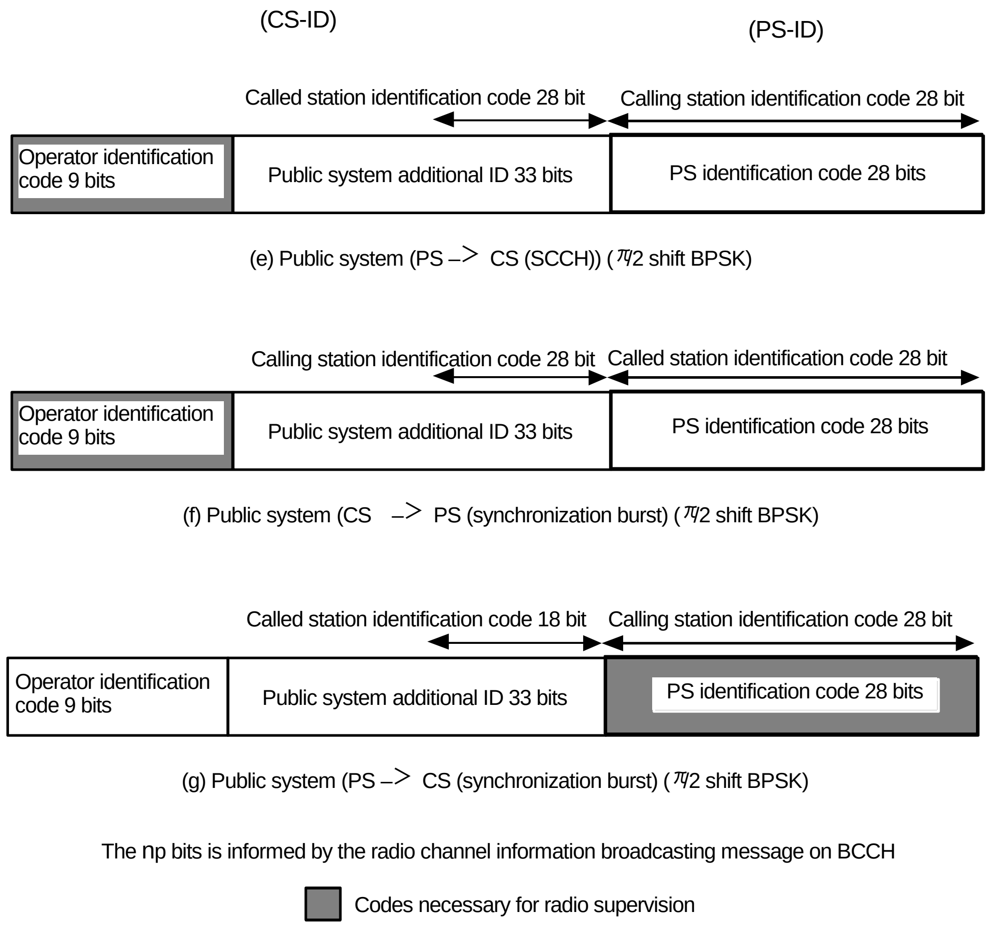


Figure 4.2.19 Structure of calling station identification code and called station identification code

4.2.10.2.2 Bit transmission order of calling station identification code and called station identification code

(Private standard/Public standard)

The bit transmission order of calling station identification code and called station identification code is shown below.

(1) Private system CS-ID

- System identification code = 1
- Additional ID = 1

(a) The system identification code is expressed as a binary number, and is transmitted from its MSB. (Private mandatory)

(b) Then, the additional ID is also transmitted from its MSB. (Private standard)

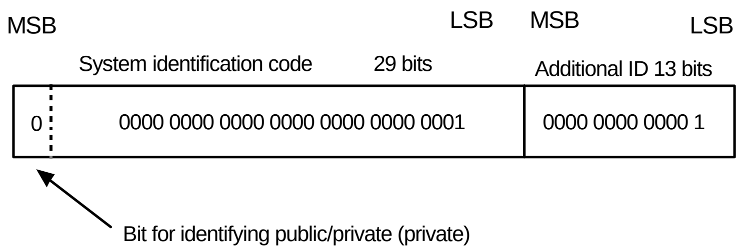


Figure 4.2.20.1 CS-ID bit transmission order in private system

(2) Public system CS-ID

(a) In case the modulation method is π /4 shift QPSK

- Operator identification code = 257 (decimal)
- n_p = 16 (decimal)
- Paging area number = 1 (decimal)
- Additional ID = 1 (decimal)

(a) The operator identification code is expressed as a binary number, and is transmitted from its MSB. (Public mandatory)

(b) Then, the paging area number and additional ID are transmitted in that order from their MSB. (Public standard)

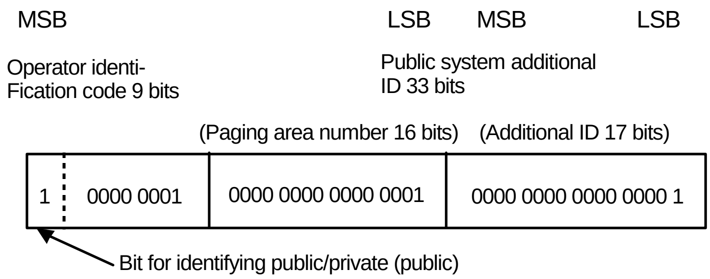


Figure 4.2.20.2.1 CS-ID bit transmission order in public system

(b) In case the modulation method is π /2 shift BPSK

In π /2 shift BPSK Control physical slot, the lower 8 bits of the CS-ID (42 bits) are transmitted from MSB side.

Also, in synchronization burst, the lower 18 bits of the CS-ID (42 bits) are transmitted from MSB side.

- Operator identification code = 259 (decimal)
- n_p = 16 (decimal)
- Paging area number = 1 (decimal)
- Additional ID = 3 (decimal)

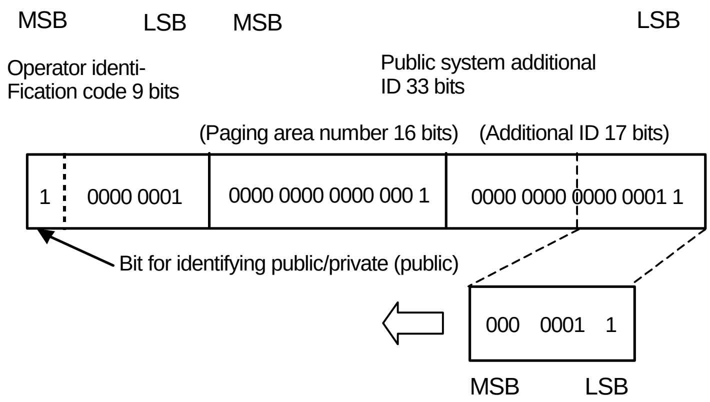


Figure 4.2.20.2.2 CS-ID bit transmission order in public system
(π /2 shift BPSK control physical slot)

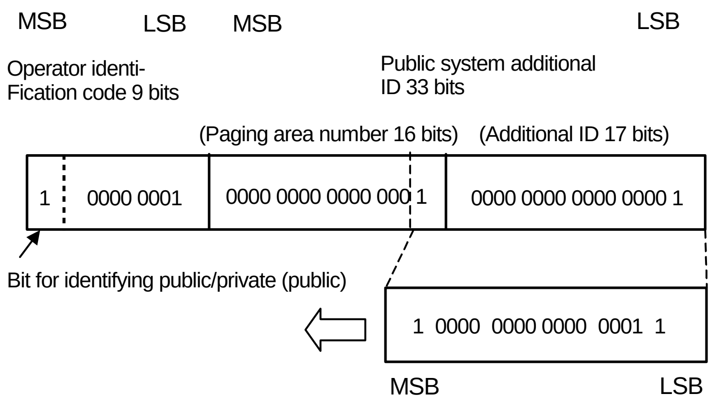


Figure 4.2.20.2.3 CS-ID bit transmission order in public system
(π /2 shift BPSK synchronization burst)

(3)PS-ID (Private mandatory/Public standard)

• PS identification code = 1

The PS identification code is expressed as a binary number, and is transmitted from its MSB.

MSB LSB

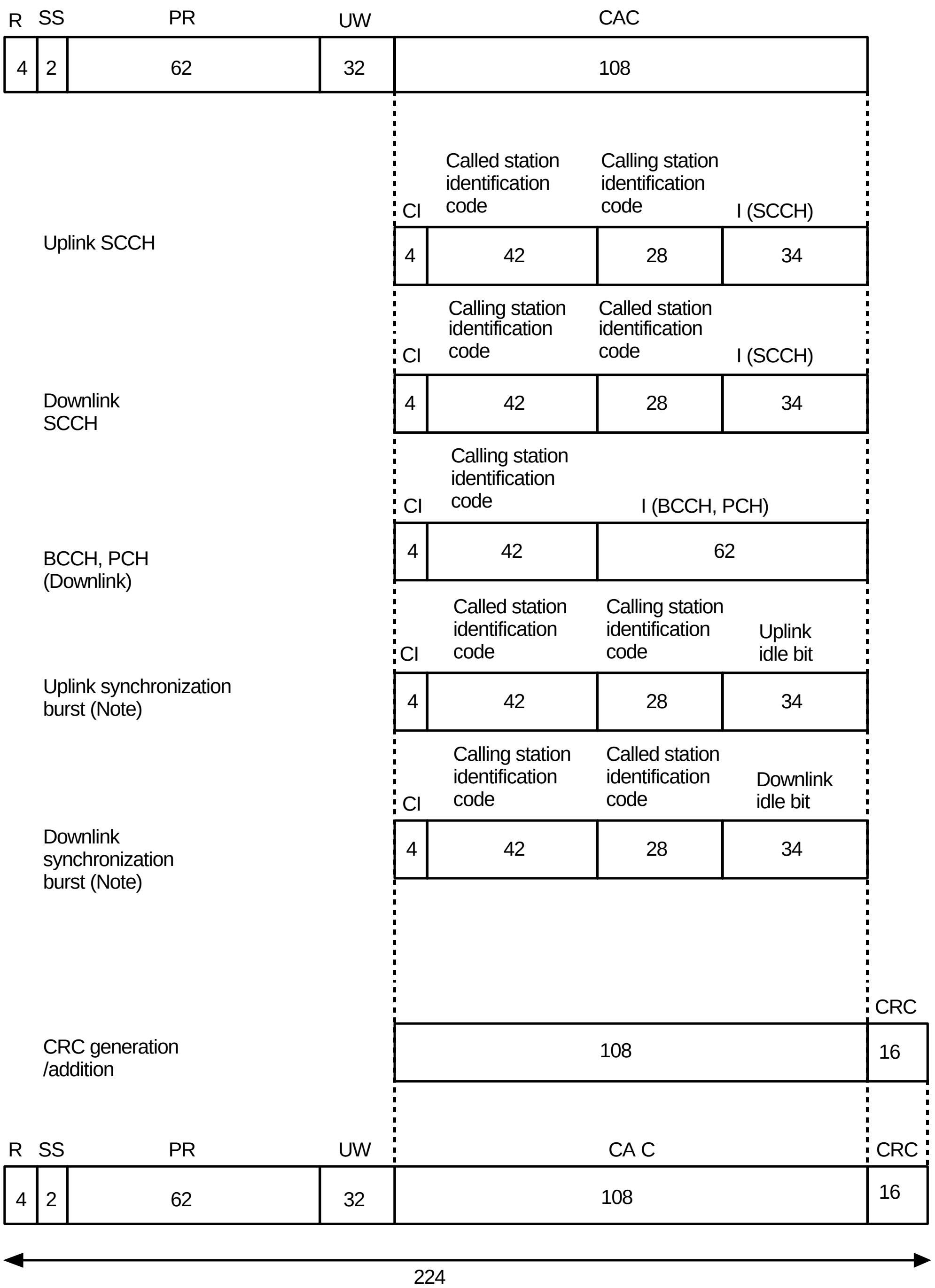
PS identification code28 bits

0000 0000 0000 0000 0000 0000 0001

Figure 4.2.20.3 PS-ID bit transmission order

4.2.10.3 Channel coding format (Private standard/Public standard)

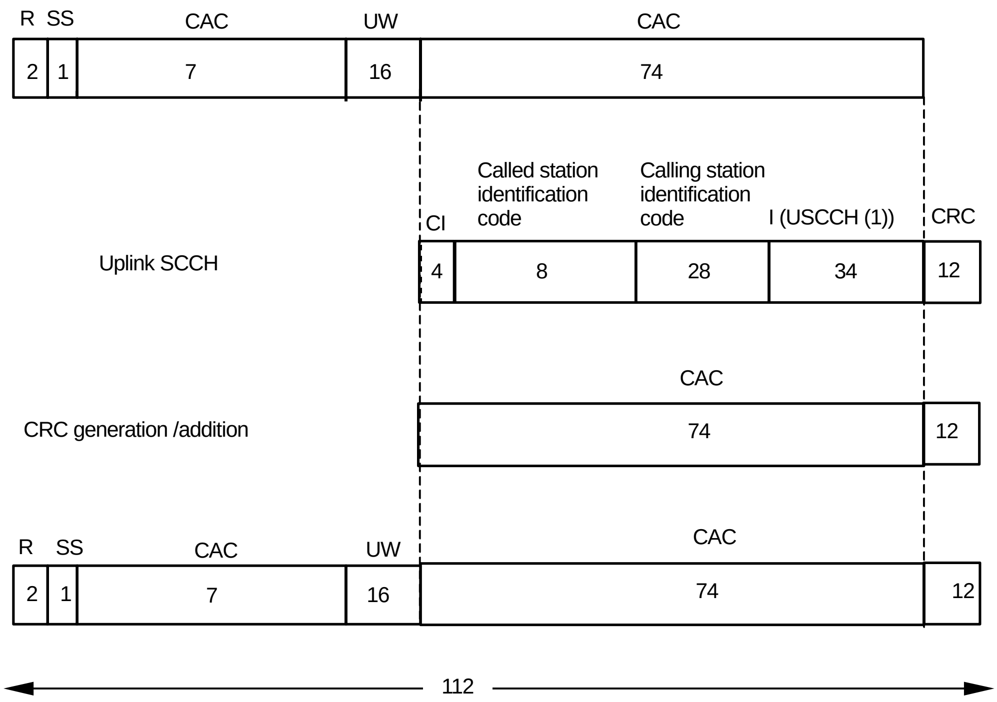
In Figure 4.2.21.1-4.2.23.4 below, each physical slot channel coding format is shown.



R: Ramp (time) PR: Preamble
UW: Unique word CI: Channel identifier
CAC: Common access channel SS: Start symbol

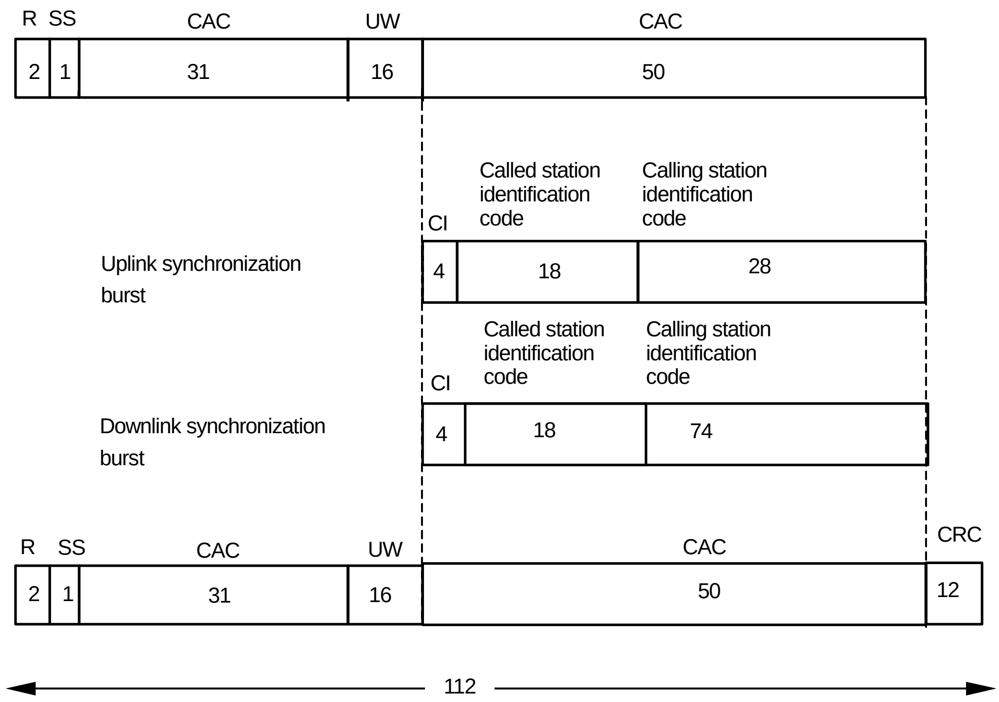
(Note) Signal on communication physical slot

Figure 4.2.21.1 Control physical slot signals and communication physical slot synchronization burst channel coding format for $\pi/4$ shift QPSK



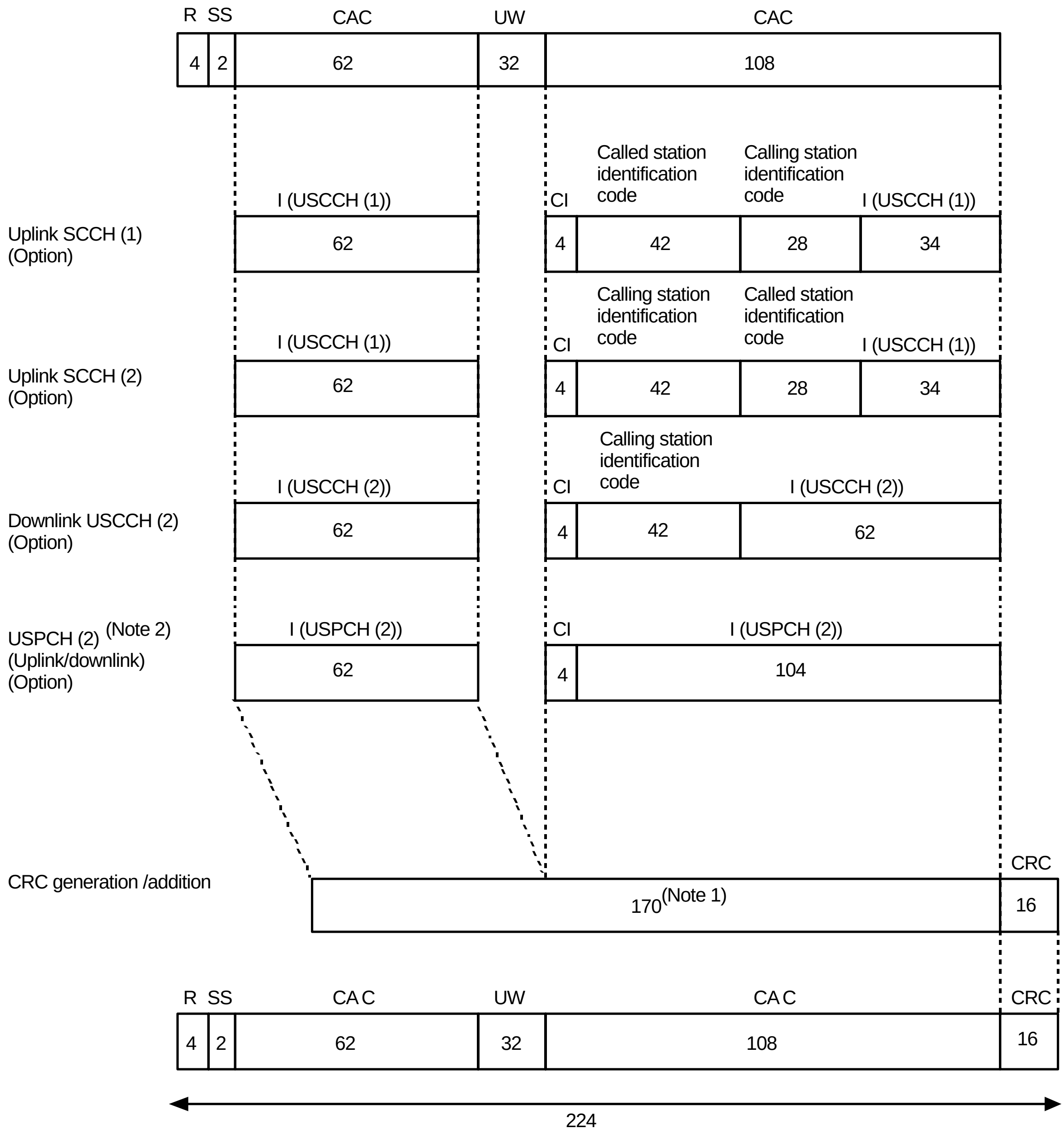
R: Ramp (time)
UW: Unique word
CAC: Common access channel
PR: Preamble
CI: Channel identifier
SS: Start symbol

Figure 4.2.21.2 Control physical slot signals channel coding format for π /2 shift BPSK



R: Ramp (time)
UW: Unique word
CAC: Common access channel
PR: Preamble
CI: Channel identifier
SS: Start symbol

Figure 4.2.21.3 Synchronization burst channel coding format for π /2 shift BPSK

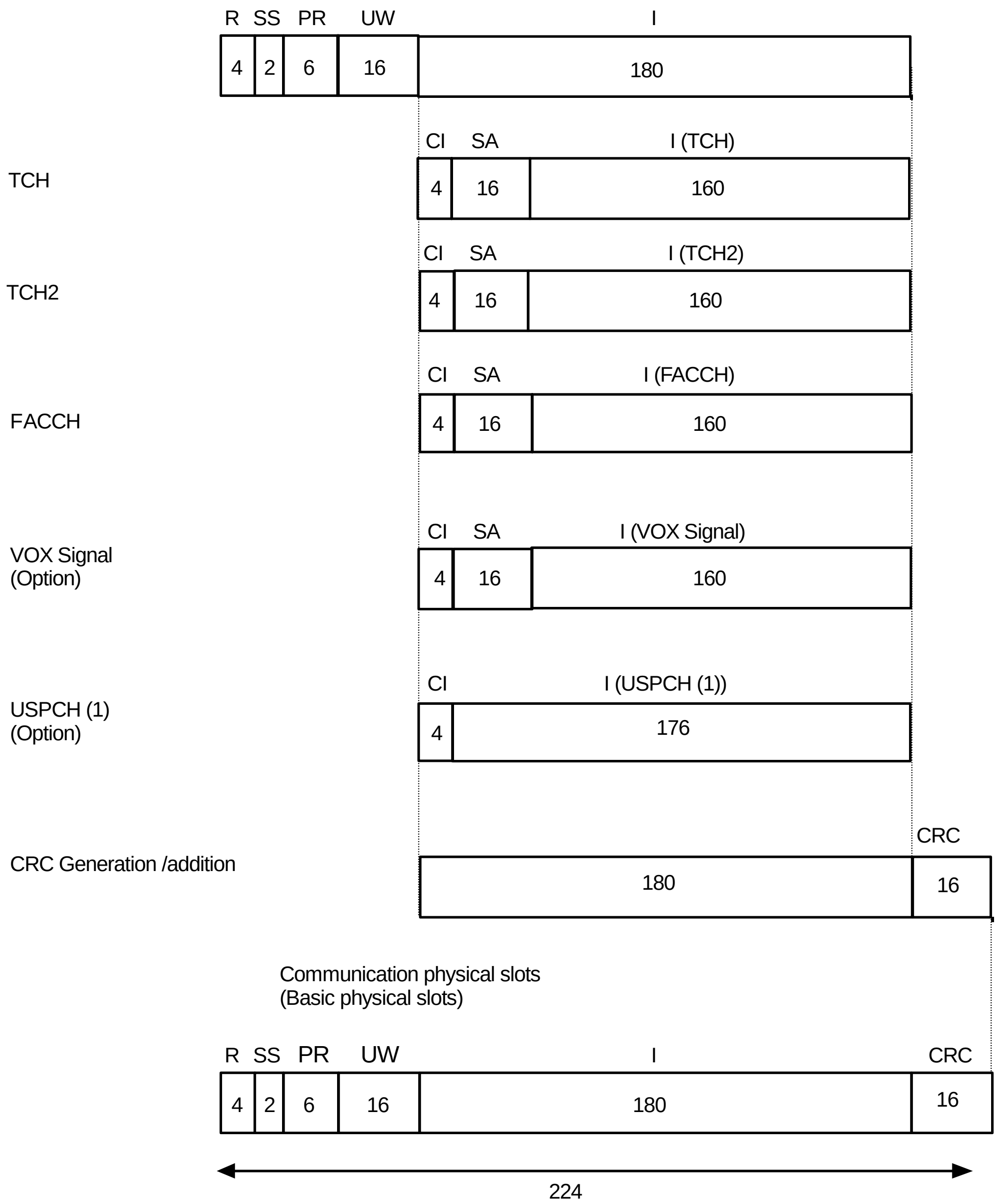


It is possible to set up data parts in the PR part as optional signals.

R: Ramp (time) PR: Preamble
UW: Unique word CI: Channel identifier
SS: Start symbol

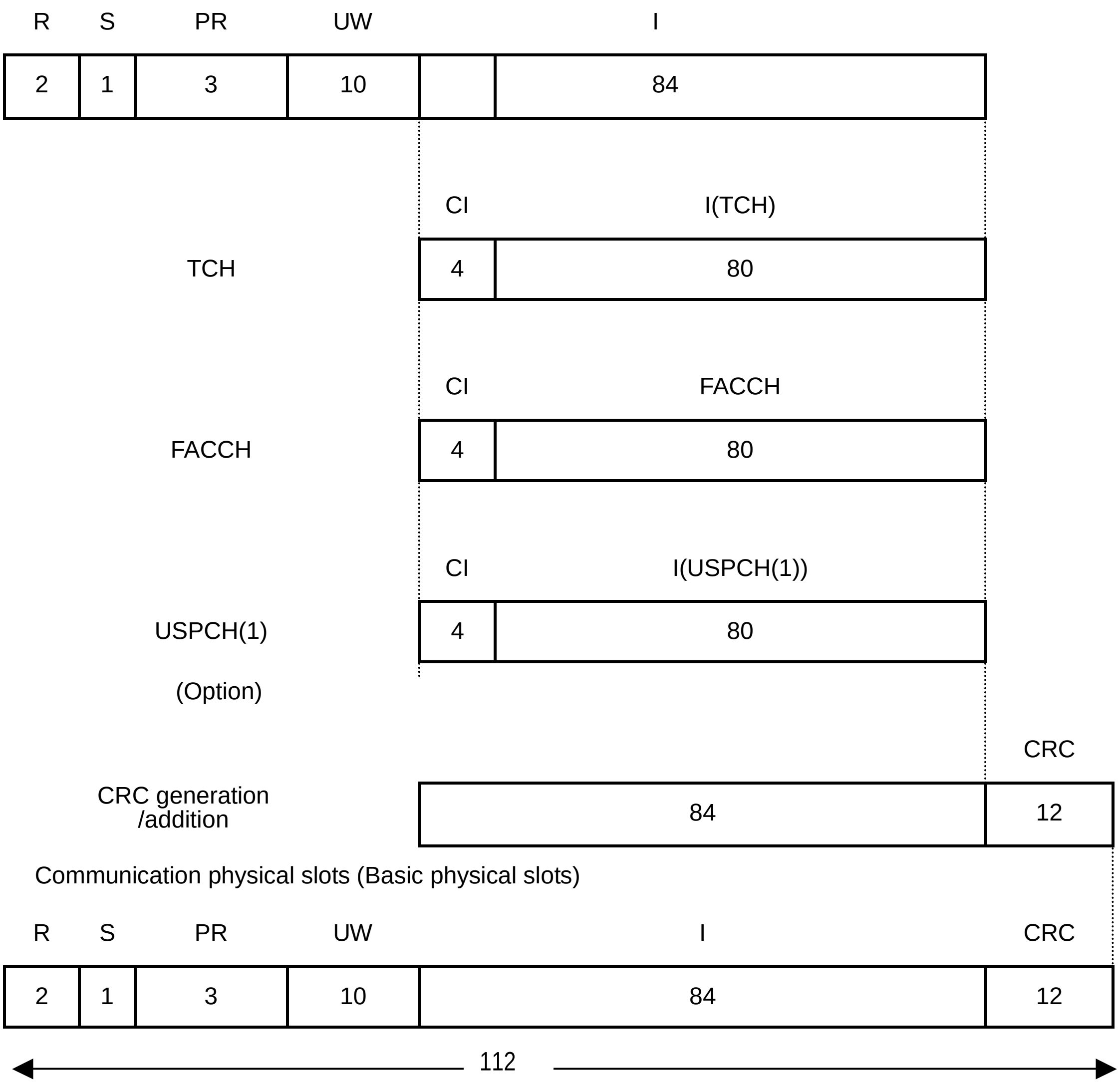
(Note1) The scope of CRC execution is optional.
(Note2) Signals on communication physical slot

Figure 4.2.22 USCCH(1), USCCH(2) and USPCH(2) channel coding format (optional)



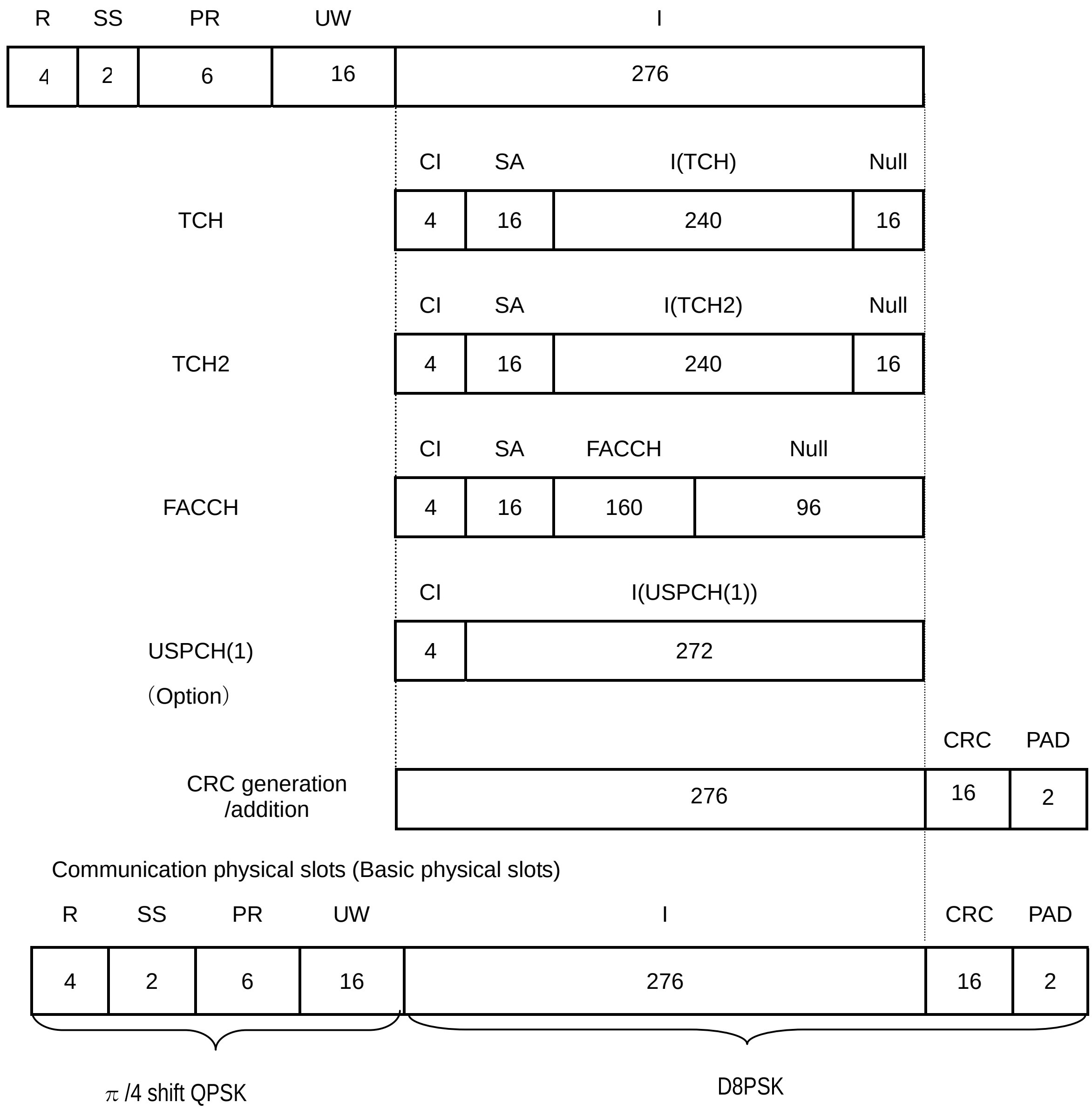
R: Ramp (time)
UW: Unique word
SS: Start symbol
PR: Preamble
CI: Channel identifier

Figure 4.2.23.1 Communication physical slot signal (uplink/downlink) channel coding format for $\pi/4$ shift QPSK (TCH, TCH2, FACCH, VOX signals, USPCH(1))



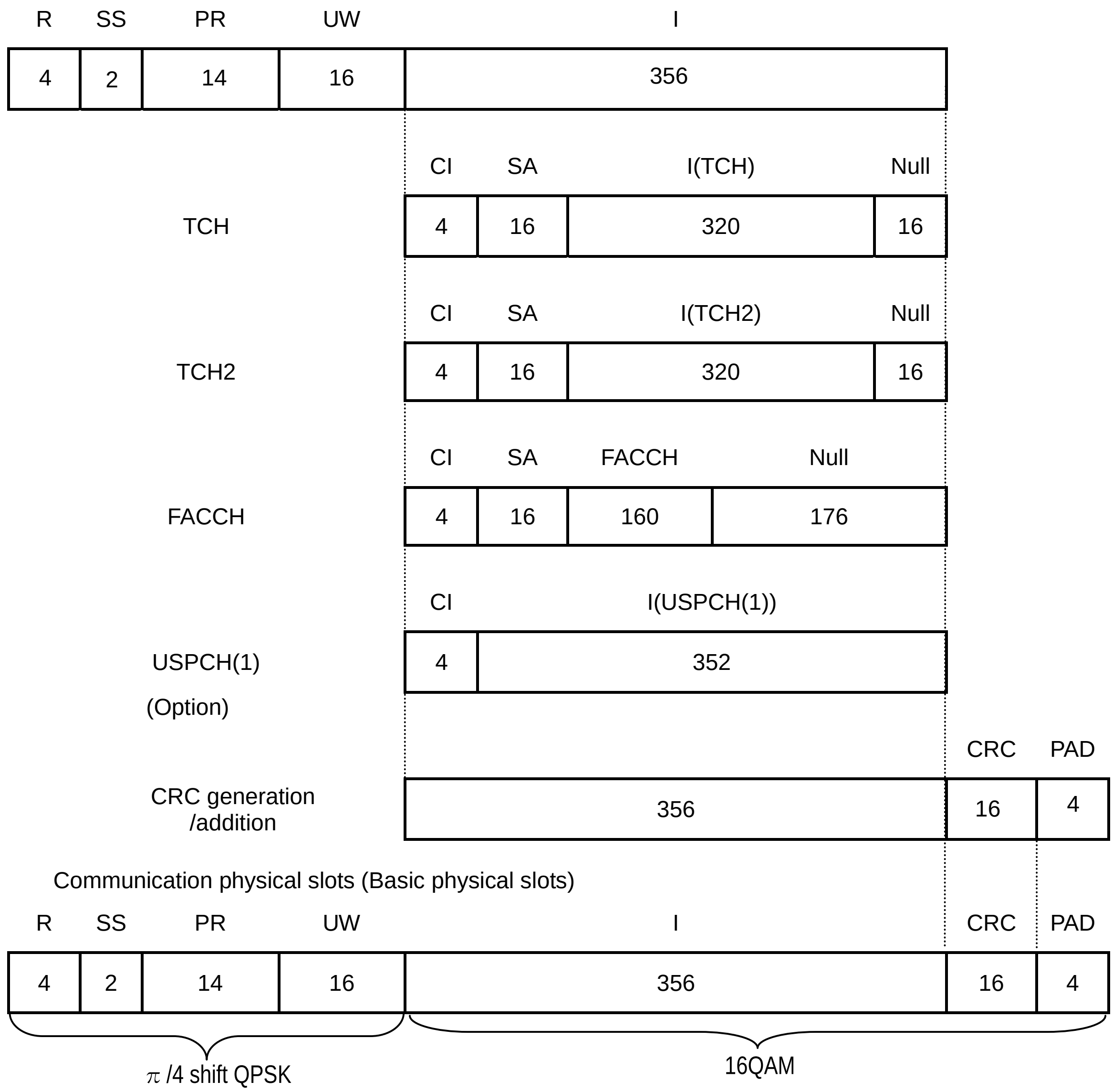
R: Ramp (time) PR: Preamble
UW: Unique word CI: Channel identifier
SS: Start symbol

Figure 4.2.23.2 Communication physical slot signal (uplink/downlink) channel coding format for π /2 shift BPSK (TCH, FACCH, VOX signals, USPCH(1))



R: Ramp (time)
UW: Unique word
SS: Start symbol
PR: Preamble
CI: Channel identifier
PAD: Padding

Figure 4.2.23.3 Communication physical slot signal (uplink/downlink) channel coding format for D8PSK (TCH, TCH2, FACCH, USPCH(1))



R: Ramp (time) PR: Preamble
UW: Unique word CI: Channel identifier
SS: Start symbol PAD: Padding

Figure 4.2.23.4 Communication physical slot signal (uplink/downlink) channel coding format for 16QAM (TCH, TCH2, FACCH, USPCH(1))

4.2.10.4 CI bit coding rules (Private standard/Public standard)

Below, channel classification (CI) coding rules are shown in Tables 4.2.1 - 4.2.4.

(1) Control physical slot uplink

Table 4.2.1 Control physical slot uplink CI coding

Bit	4	3	2	1
Reserved	0	0	0	0
	0	0	0	1
	0	0	1	0
	0	0	1	1
	0	1	0	0
Option	0	1	0	1
	0	1	1	0
	0	1	1	1
	1	0	0	0
Reserved	1	0	0	1
SCCH	1	0	1	0
Reserved	1	0	1	1
	1	1	0	0
	1	1	0	1
USCCH (1)	1	1	1	0
Reserved	1	1	1	1

(Note) Bit transmission order is in the order of bit 4, bit 3, bit 2, bit 1.

(2) Control physical slot downlink

Table 4.2.2 Control physical slot downlink CI coding

Bit	4	3	2	1
Reserved	0	0	0	0
	0	0	0	1
	0	0	1	0
BCCH (B)	0	0	1	1
BCCH (A)	0	1	0	0
Option	0	1	0	1
	0	1	1	0
	0	1	1	1
	1	0	0	0
Reserved	1	0	0	1
SCCH	1	0	1	0
PCH	1	0	1	1
Reserved	1	1	0	0
	1	1	0	1
USCCH (1)	1	1	1	0
USCCH (2)	1	1	1	1

(Note) BCCH (A) shows the BCCH transmitted by the LCCH superframe header.
BCCH (B) shows the BCCH (option) transmitted by other than the LCCH superframe header.

(3) Communication physical slot uplink

Table 4.2.3 Communication physical slot uplink CI coding

Bit	4	3	2	1
TCH	0	0	0	0
FACCH	0	0	0	1
USPCH (2)	0	0	1	0
USPCH (1)	0	0	1	1
Reserved	0	1	0	0
Option	0	1	0	1
	0	1	1	0
	0	1	1	1
	1	0	0	0
Synchronization burst	1	0	0	1
Reserved	1	0	1	0
	1	0	1	1
TCH2	1	1	0	0
Reserved	1	1	0	1
	1	1	1	0
VOX signal	1	1	1	1

(4) Communication physical slot downlink

Table 4.2.4 Communication physical slot downlink CI coding

Bit	4	3	2	1
TCH	0	0	0	0
FACCH	0	0	0	1
USPCH (2)	0	0	1	0
USPCH (1)	0	0	1	1
Reserved	0	1	0	0
Option	0	1	0	1
	0	1	1	0
	0	1	1	1
	1	0	0	0
Synchronization burst	1	0	0	1
Reserved	1	0	1	0
	1	0	1	1
TCH2	1	1	0	0
Reserved	1	1	0	1
	1	1	1	0
VOX signal	1	1	1	1

4.2.10.5 Layer 1 bit transmission order (Private standard/Public standard)

The bit transmission order of each physical slot is shown below.

4.2.10.5.1 Control physical slot uplink (PS－> CS) (Private standard/Public standard)

4.2.10.5.1.1 Basic physical slot (Private standard/Public standard)

(1) SCCH

Slot structure

R	SS	PR	UW	CI	Called station identification code	Calling station identification code	I (SCCH)	CRC
4	2	62	32	4	42	28	34	16

Bit arrangement

R	SS	PR
Any	10	01100110011001100110011001100110011001100110011001100110011001
4	2	62

Continued on level below

From level above

UW	CI	Called station identification code	Calling station identification code	I (SCCH)	CRC
01101011100010011001101011110000	1010				
32	4	42	28	34	16

Figure 4.2.24.1-1 Structure of control physical slot (SCCH) (π /4 shift QPSK)((uplink)

Slot structure

R	SS	PR	UW	CI	Called station identifycation code	Calling station identifycation code	I(SCCH)	CRC
2	1	7	16	4	8	28	34	12

Bit arrangement

R	SS	PR	UW	CI	Called station identifycation code	Calling station identifycation code	I(SCCH)	CRC
Any	1	0101010	1001010010000011	1010				
2	1	7	16	4	8	28	34	12

Figure 4.2.24.1-2 Structure of control physical slot (SCCH) (π /2 shift BPSK)(uplink)

4.2.10.5.1.2 Extension physical slot (Private standard)

(1) USCCH(1)

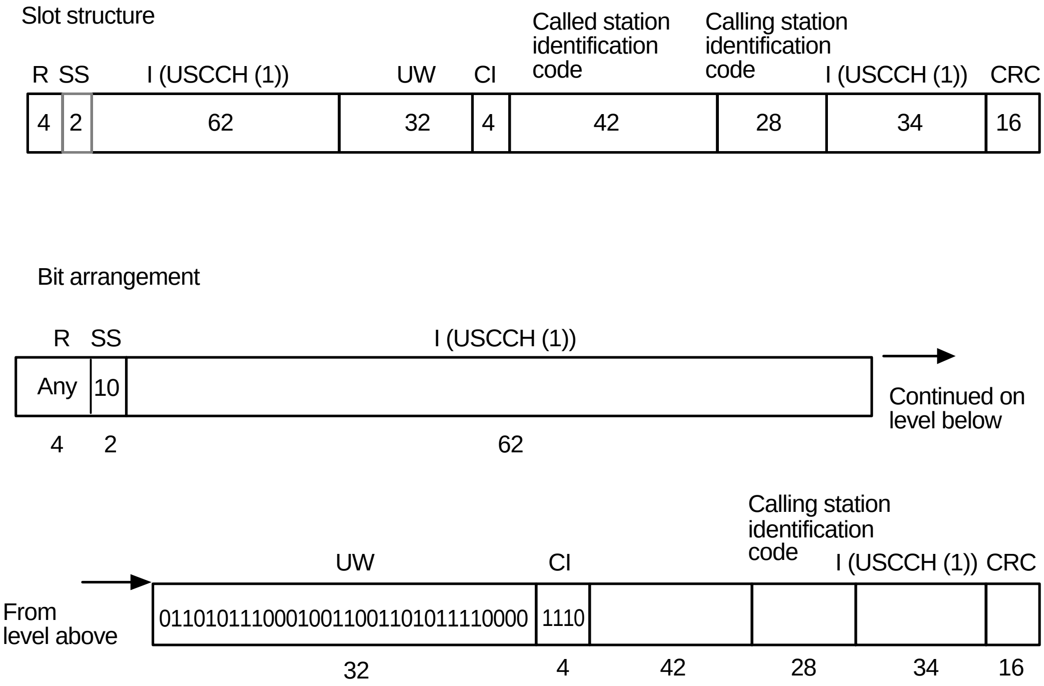


Figure 4.2.24.2 Structure of control physical slot (USCCH(1)) (uplink)

4.2.10.5.2 Control physical slot downlink (CS —> PS) (Private standard/Public standard)

4.2.10.5.2.1 Basic physical slot (Private standard/Public standard)

(1) SCCH

Slot structure

R	SS	PR	UW	CI	Calling station identification code	Called station identification code	I (SCCH)	CRC
4	2	62	32	4	42	28	34	16

Bit arrangement

R	SS	PR
Any	10	01100110011001100110011001100110011001100110011001100110011001
4	2	62

Continued on level below

From level above

UW	CI	Calling station identification code	Called station identification code	I (SCCH)	CRC
01010000111011110010100110010011	1010				
32	4	42	28	34	16

Figure 4.2.24.3 Structure of control physical slot (SCCH) (downlink)

(2) BCCH(A)

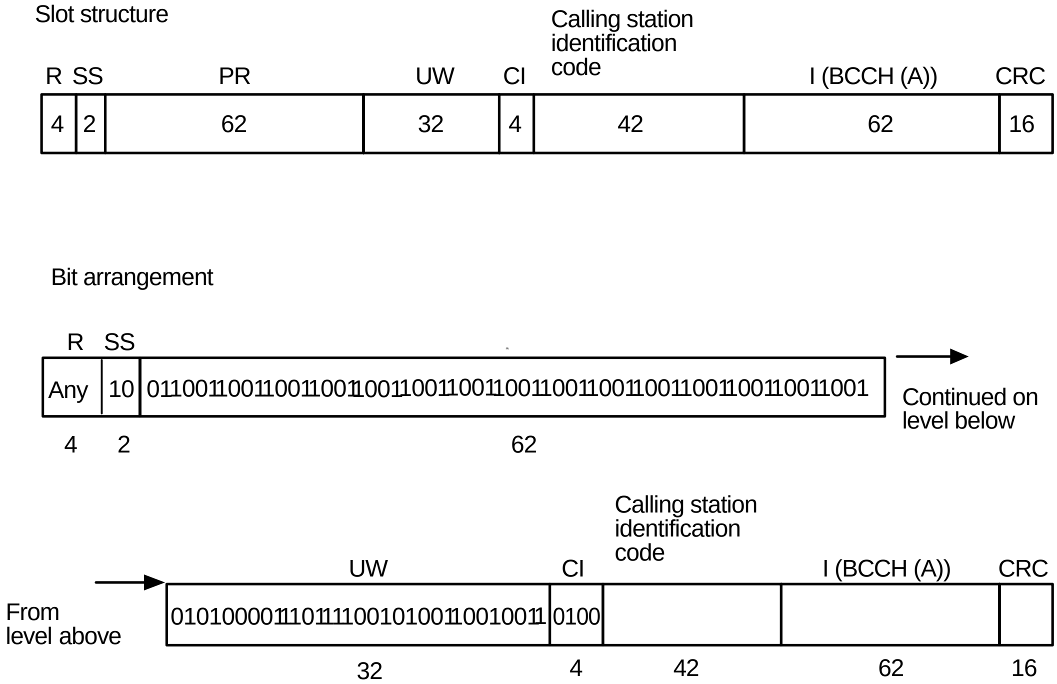


Figure 4.2.24.4 Structure of control physical slot (BCCH) (downlink)

(3) PCH

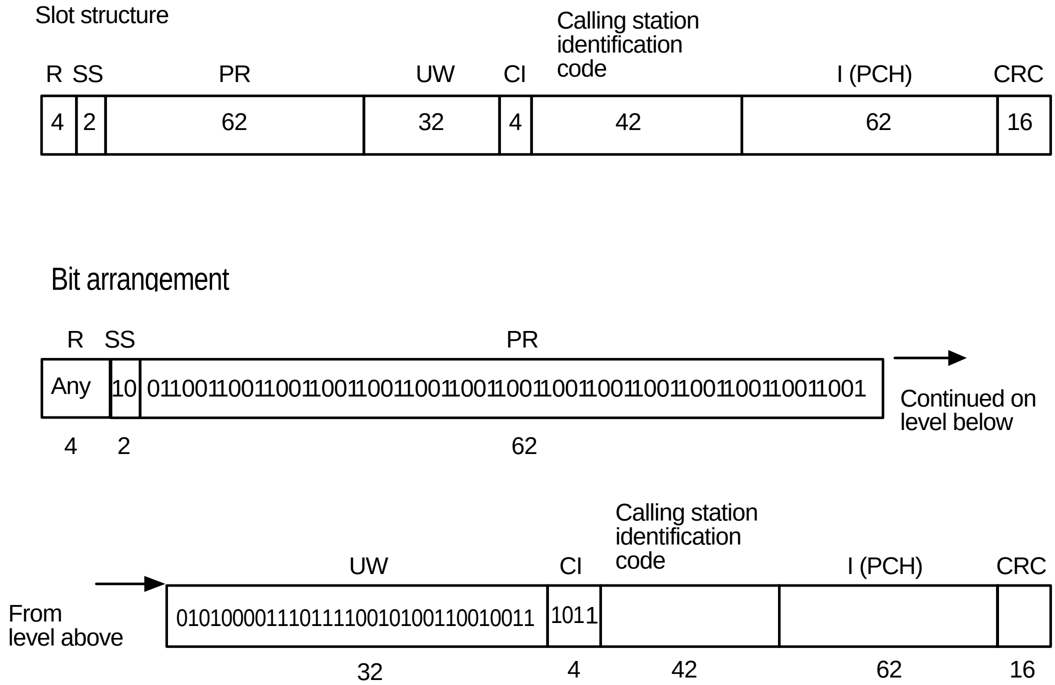


Figure 4.2.24.5 Structure of control physical slot (PCH) (downlink)

4.2.10.5.2.2 Extension physical slot (Private standard)

(1) USCCH(1)

Slot structure

R	SS	I (USCCH (1))	UW	CI	Calling station identification code	Called station identification code	I (USCCH (1))	CRC
4	2	62	32	4	42	28	34	16

Bit arrangement

R	SS	I (USCCH (1))
Any	10	
4	2	62

→ Continued on level below

From level above →

UW	CI	Called station identification code	Calling station identification code	I (USCCH (1))	CRC
01010000111011110010100110010011	1110				
32	4	42	28	34	16

Figure 4.2.24.6 Structure of control physical slot (USCCH(1)) (downlink)

4.2.10.5.3 Communication physical slot uplink (PSm－> CS) (Private standard/Public standard)

4.2.10.5.3.1 Basic physical slot (Private standard/Public standard)

(1) TCH

Slot structure

R	SS	PR	UW	CI	SA	I (TCH)	CRC
4	2	6	16	4	16	160	16

Bit arrangement

R	SS	PR	UW	CI	SA	I (TCH)	CRC
Any	10	011001	1110000101001001	0000			
4	2	6	16	4	16	160	16

Figure 4.2.24.7-1 Structure of communication physical slot (TCH) (π /4 shift QPSK) (uplink)

Slot structure

R	SS	PR	UW	CI	I(TCH)	CRC
2	1	3	10	4	80	12

Bit arrangement

R	SS	PR	UW	CI	I(TCH)	CRC
Any	1	010	0001010110	0000		
2	1	3	10	4	80	12

Figure 4.2.24.7-2 Structure of communication physical slot (TCH) (π /2 shift BPSK) (uplink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH)	Null	CRC	PAD
4	2	6	16	4	16	240	16	16	2

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH)	
Any	10	011001	1110000101001001	0000			Continued on level below
4	2	6	16	4	16	240	

	Null	CRC	PAD
From level above	0000000000000000		00
	16	16	2

Figure 4.2.24.7-3 Structure of communication physical slot (TCH) (D8PSK) (uplink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH)	Null	CRC	PAD
4	2	14	16	4	16	320	16	16	4

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH)	
Any	10	01100110011001	1110000101001001	0000			Continued on level below
4	2	14	16	4	16	320	

	Null	CRC	PAD
From level above	0000000000000000		0000
	16	16	4

Figure 4.2.24.7-4 Structure of communication physical slot (TCH) (16QAM) (uplink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH2)	CRC
4	2	6	16	4	16	160	16

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH2)	CRC
Any	10	011001	1110000101001001	1100			
4	2	6	16	4	16	160	16

Figure 4.2.24.7-5 Structure of communication physical slot (TCH2) (π /4 shift QPSK) (uplink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH2)	Null	CRC	PAD
4	2	6	16	4	16	240	16	16	2

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH2)
Any	10	011001	1110000101001001	1100		
4	2	6	16	4	16	240

Continued on level below

From level above

Null	CRC	PAD
0000000000000000		00
16	16	2

Figure 4.2.24.7-6 Structure of communication physical slot (TCH2) (D8PSK) (uplink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH2)	Null	CRC	PAD
4	2	14	16	4	16	320	16	16	4

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH2)
Any	10	01100110011001	1110000101001001	1100		
4	2	14	16	4	16	320

Continued on level below

From level above

Null	CRC	PAD
0000000000000000		0000
16	16	4

Figure 4.2.24.7-7 Structure of communication physical slot (TCH2) (16QAM) (uplink)

(2) FACCH

Slot structure

R	SS	PR	UW	CI	SA	I (FACCH)	CRC
4	2	6	16	4	16	160	16

Bit arrangement

R	SS	PR	UW	CI	SA	I (FACCH)	CRC
Any	10	011001	1110000101001001	0001			
4	2	6	16	4	16	160	16

Figure 4.2.24.8-1 Structure of communication physical slot (FACCH) (π /4 shift QPSK) (uplink)

Slot structure

R	SS	PR	UW	CI	I(FACCH)	CRC
2	1	3	10	4	80	12

Bit arrangement

R	SS	PR	UW	CI	I(FACCH)	CRC
Any	1	010	0001010110	0001		
2	1	3	10	4	80	12

Figure 4.2.24.8-2 Structure of communication physical slot (FACCH) (π /2 shift BPSK) (uplink)

Slot structure

R	SS	PR	UW	CI	SA	I(FACCH)	Null	CRC	PAD
4	2	6	16	4	16	160	96	16	2

Bit arrangement

R	SS	PR	UW	CI	SA	I(FACCH)
Any	10	011001	1110000101001001	0001		
4	2	6	16	4	16	160

Continued on level below

From level above

Null	CRC	PAD
		00
96	16	2

Figure 4.2.24.8-3 Structure of communication physical slot (FACCH) (D8PSK) (uplink)

Slot structure

R	SS	PR	UW	CI	SA	I(FACCH)	Null	CRC	PAD
4	2	14	16	4	16	160	176	16	4

Bit arrangement

R	SS	PR	UW	CI	SA	I(FACCH)
Any	10	01100110011001	1110000101001001	0001		
4	2	14	16	4	16	160

Continued on level below

From level above

Null	CRC	PAD
		0000
176	16	4

Figure 4.2.24.8-4 Structure of communication physical slot (FACCH) (16QAM) (uplink)

(3) Uplink synchronization burst

Slot structure

R	SS	PR	UW	CI	Called station identification code	Calling station identification code	Modifier	CRC
4	2	62	32	4	42	28	34	16

Bit arrangement

R	SS	PR
Any	10	01100110011001100110011001100110011001100110011001100110011001
4	2	

Continued on level below

From level above

UW	CI	Called station identification code	Calling station identification code
01101011100010011001101011110000	1001		
32	4	42	28

Continued on level below

From level above

Modifier	CRC
0000000000000000000000000000000000	
34	16

Figure 4.2.24.9-1 Structure of communication physical slot (uplink synchronization burst) (π /4 shift QPSK) (uplink)

Bit arrangement

R	SS	PR
Any	10	01100110011001100110011001100110011001100110011001100110011001
4	2	62

Continued on level below

From level above

UW	CI	Called station identification code	Calling station identification code
01101011100010011001101011110000	1001		
32	4	42	28

Continued on level below

From level above

Modifier	CRC
0000000000000000000000000000000001	
34	16

Figure 4.2.23.9-2 Structure of communication physical slot (uplink 2nd synchronization burst) (π /4 shift QPSK) (uplink)

Slot structure

R	SS	PR	UW	CI	Called station identification code	Calling station identification code	CRC
2	1	31	16	4	18	28	12

Bit arrangement

R	SS	PR	UW	CI
Any	1	0101010101010101010101010101010	0000101010110000	1001
2	1	31	16	4

Continued on level below

From Level above

Called station identification code	Calling station identification code	CRC
18	28	12

Figure 4.2.24.9-3 Structure of communication physical slot (uplink synchronization burst) (π /2 shift BPSK) (uplink)

4.2.10.5.3.2 Extension physical slot (Private standard)

(1) USPCH(1)

Slot structure

R	SS	PR	UW	CI	I (USPCH(1))	CRC
4	2	6	16	4	176	16

Bit arrangement

R	SS	PR	UW	CI	I (USPCH(1))	CRC
Any	10	011001	1110000101001001	0011		
4	2	6	16	4	176	16

Figure 4.2.24.10-1 Structure of communication physical slot (USPCH(1)) (π /4 shift QPSK) (uplink)

Slot structure

R	SS	PR	UW	CI	I(USPCH(1))	CRC
2	1	3	10	4	80	12

Bit arrangement

R	SS	PR	UW	CI	I(USPCH(1))	CRC
Any	1	010	0001010110	0011		
2	1	3	10	4	80	12

Figure 4.2.24.10-2 Structure of communication physical slot (USPCH(1)) (π /2 shift BPSK) (uplink)

Slot structure

R	SS	PR	UW	CI	I(USPCH(1))	CRC	PAD
4	2	6	16	4	272	16	2

Bit arrangement

R	SS	PR	UW	CI	I(USPCH(1))	CRC	PAD
Any	10	011001	1110000101001001	0011			
4	2	6	16	4	272	16	2

Figure 4.2.24.10-3 Structure of communication physical slot (USPCH(1)) (D8PSK) (uplink)

Slot structure

R	SS	PR	UW	CI	I(USPCH(1))	CRC	PAD
4	2	14	16	4	352	16	4

Bit arrangement

R	SS	PR	UW	CI	I(USPCH(1))	CRC	PAD
Any	10	01100110011001	1110000101001001	0011			
4	2	14	16	4	352	16	4

Figure 4.2.24.10-4 Structure of communication physical slot (USPCH(1)) (16QAM) (uplink)

4.2.10.5.4 Communication physical slot downlink (CS－> PS) (Private standard/Public standard)

4.2.10.5.4.1 Basic physical slot (Private standard/Public standard)

(1) TCH

Slot structure

R	SS	PR	UW	CI	SA	I (TCH)	CRC
4	2	6	16	4	16	160	16

Bit arrangement

R	SS	PR	UW	CI	SA	I (TCH)	CRC
Any	10	011001	0011110101001100	0000			
4	2	6	16	4	16	160	16

Figure 4.2.24.11-1 Structure of communication physical slot (TCH) (π /4 shift QPSK) (downlink)

Slot structure

R	SS	PR	UW	CI	I(TCH)	CRC
2	1	3	10	4	80	12

Bit arrangement

R	SS	PR	UW	CI	I(TCH)	CRC
Any	1	010	1001101001	0000		
2	1	3	10	4	80	12

Figure 4.2.24.11-2 Structure of communication physical slot (TCH) (π /2 shift BPSK) (downlink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH)	Null	CRC	PAD
4	2	6	16	4	16	240	16	16	2

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH)	
Any	10	011001	0011110101001100	0000			Continued on level below
4	2	6	16	4	16	240	

	Null	CRC	PAD
From level above	0000000000000000		00
	16	16	2

Figure 4.2.24.11-3 Structure of communication physical slot (TCH) (D8PSK) (downlink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH)	Null	CRC	PAD
4	2	14	16	4	16	320	16	16	4

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH)	
Any	10	01100110011001	0011110101001100	0000			Continued on level below
4	2	14	16	4	16	320	

	Null	CRC	PAD
From level above	0000000000000000		0000
	16	16	4

Figure 4.2.24.11-4 Structure of communication physical slot (TCH) (16QAM) (downlink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH2)	CRC
4	2	6	16	4	16	160	16

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH2)	CRC
Any	10	011001	0011110101001100	1100			
4	2	6	16	4	16	160	16

Figure 4.2.24.11-5 Structure of communication physical slot (TCH2) (π /4 shift QPSK) (downlink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH2)	Null	CRC	PAD
4	2	6	16	4	16	240	16	16	2

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH2)
Any	10	011001	0011110101001100	1100		
4	2	6	16	4	16	240

Continued on level below

From level above

Null	CRC	PAD
0000000000000000		00
16	16	2

Figure 4.2.24.11-6 Structure of communication physical slot (TCH2) (D8PSK) (downlink)

Slot structure

R	SS	PR	UW	CI	SA	I(TCH2)	Null	CRC	PAD
4	2	14	16	4	16	320	16	16	4

Bit arrangement

R	SS	PR	UW	CI	SA	I(TCH2)
Any	10	01100110011001	0011110101001100	1100		
4	2	14	16	4	16	320

Continued on level below

From level above

Null	CRC	PAD
0000000000000000		0000
16	16	4

Figure 4.2.24.11-7 Structure of communication physical slot (TCH2) (16QAM) (downlink)

(2) FACCH

Slot structure

R	SS	PR	UW	CI	SA	I (FACCH)	CRC
4	2	6	16	4	16	160	16

Bit arrangement

R	SS	PR	UW	CI	SA	I (FACCH)	CRC
Any	10	011001	0011110101001100	0001			
4	2	6	16	4	16	160	

Figure 4.2.24.12-1 Structure of communication physical slot (FACCH) (π /4 shift QPSK) (downlink)

Slot structure

R	SS	PR	UW	CI	I(FACCH)	CRC
2	1	3	10	4	80	12

Bit arrangement

R	SS	PR	UW	CI	I(FACCH)	CRC
Any	1	010	1001101001	0001		
2	1	3	10	4	80	12

Figure 4.2.24.12-2 Structure of communication physical slot (FACCH) (π /2 shift BPSK) (downlink)

Slot structure

R	SS	PR	UW	CI	SA	I(FACCH)	Null	CRC	PAD
4	2	6	16	4	16	160	96	16	2

Bit arrangement

R	SS	PR	UW	CI	SA	I(FACCH)
Any	10	011001	0011110101001100	0001		
4	2	6	16	4	16	160

Continued on level below

From level above

Null	CRC	PAD
		00
96	16	2

Figure 4.2.24.12-3 Structure of communication physical slot (FACCH) (D8PSK) (downlink)

Slot structure

R	SS	PR	UW	CI	SA	I(FACCH)	Null	CRC	PAD
4	2	14	16	4	16	160	176	16	4

Bit arrangement

R	SS	PR	UW	CI	SA	I(FACCH)	
Any	10	01100110011001	0011110101001100	0001			Continued on level below
4	2	14	16	4	16	160	

	Null	CRC	PAD
From level above			0000
	176	16	4

Figure 4.2.24.12-4 Structure of communication physical slot (FACCH) (16QAM) (downlink)

(3) Downlink synchronization burst

Slot structure

R	SS	PR	UW	CI	Calling station identification code	Called station identification code	Modifier	CRC
4	2	62	32	4	42	28	34	16

Bit arrangement

R	SS	PR	
Any	10	01100110011001100110011001100110011001100110011001100110011001	Continued on level below
4	2	62	

	UW	CI	Calling station identification code	Called station identification code	
From level above	010100001110111110010100110010011	1001			Continued on code below
	32	4	42	28	

	Modifier	CRC
From level above	00000000000000000000000000000	
	34	16

Figure 4.2.23.13-1 Structure of communication physical slot
(downlink synchronization burst) (π /4 shift QPSK) (downlink)

Bit arrangement

R	SS	PR	
Any	10	01100110011001100110011001100110011001100110011001100110011001	Continued on level below
4	2	62	

	UW	CI	Calling station identification code	Called station identification code	
From level above	010100001110111110010100110010011	1001			Continued on level below
	32	4	42	28	

	Modifier	CRC
From level above	0000000000000000000000000000000001	
	34	16

Figure 4.2.24.13-2 Structure of communication physical slot (uplink 2nd synchronization burst) (π /4 shift QPSK) (downlink)

Slot structure

R	SS	PR	UW	CI	Called station identification code	Calling station identification code	CRC
2	1	31	16	4	18	28	12

Bit arrangement

R	SS	PR	UW	CI	
Any	1	0101010101010101010101010101010	1110100001001110	1001	Continued on level below
2	1	31	16	4	

	Called station identification code	Calling station identification code	CRC
From Level above			
	18	28	12

Figure 4.2.24.13-3 Structure of communication physical slot (uplink synchronization burst) (π /2 shift BPSK) (downlink)

4.2.10.5.4.2 Extension physical slot

(1) USPCH(1)

Slot structure

R	SS	PR	UW	CI	I (USPCH(1))	CRC
4	2	6	16	4	176	16

Bit arrangement

R	SS	PR	UW	CI	I (USPCH(1))	CRC
Any	10	011001	0011110101001100	0011		
4	2	6	16	4	176	16

Figure 4.2.24.14-1 Structure of communication physical slot (USPCH(1))
(π /4 shift QPSK) (downlink)

Slot structure

R	SS	PR	UW	CI	I(USPCH(1))	CRC
2	1	3	10	4	80	12

Bit arrangement

R	SS	PR	UW	CI	I(USPCH(1))	CRC
Any	1	010	1001101001	0011		
2	1	3	10	4	80	12

Figure 4.2.24.14-2 Structure of communication physical slot (USPCH(1))
(π /2 shift BPSK) (downlink)

Slot structure

R	SS	PR	UW	CI	I(USPCH(1))	CRC	PAD
4	2	6	16	4	272	16	2

Bit arrangement

R	SS	PR	UW	CI	I(USPCH(1))	CRC	PAD
Any	10	011001	0011110101001100	0011			
4	2	6	16	4	272	16	2

Figure 4.2.24.14-3 Structure of communication physical slot (USPCH(1))
(D8PSK) (downlink)

Slot structure

R	SS	PR	UW	CI	I(USPCH(1))	CRC	PAD
4	2	14	16	4	352	16	4

Bit arrangement

R	SS	PR	UW	CI	I(USPCH(1))	CRC	PAD
Any	10	01100110011001	0011110101001100	0011			
4	2	14	16	4	352	16	4

Figure 4.2.24.14-4 Structure of communication physical slot (USPCH(1)) (16QAM) (downlink)

4.2.11 Scramble method (Private standard/Public standard)

In the standard, the scramble standards are set. Scramble is applied to both control physical slots and communication physical slots.

4.2.11.1 Scramble pattern (Private standard/Public standard)

(1) Fundamental principle

The scramble pattern is identical for CS transmission and PS transmission.

(2)For control physical slots (Private mandatory/Public standard)

The scramble pattern initial register value for control physical slots is '1111111111'.

(3) For communication physical slots

The scramble pattern initial register value for communication physical slots uses a pattern that adds the header 1 bit (fixed at "1") to the lower order 9 bits that identify the CS (CS-ID). Further, the scramble pattern of the communication physical slot changes with each CS.

(Note) In private systems, since it is assumed that an additional ID is not used, the scramble pattern register initial values agree between adjacent CSs, and appreciable leakage may occur. As a means of avoiding the occurrence of appreciable leakage, there is a method in which the lower 9 bits of the system identification code are copied, and set in the additional ID.

4.2.11.2 Scramble method (Private standard/Public standard)

(1) Execution procedure for scramble

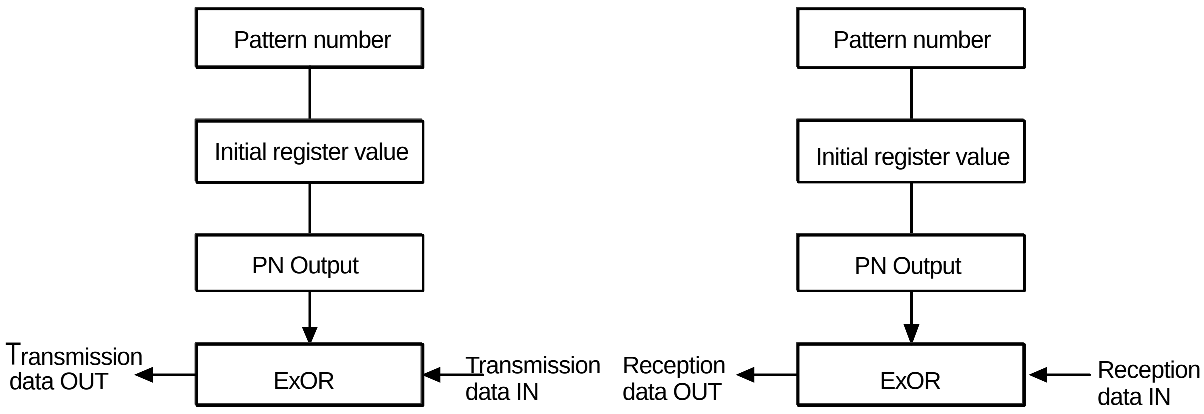
The execution procedure for scramble is shown in Figure 4.2.24.

(2) Scramble processing (Private mandatory/Public standard)

The PN pattern used is PN (10,3). Also, the scramble processing is the reset type that sets the initial register value for each frame.

(3) Example of a shift register structure

An example of a shift register structure which generates the appropriate PN pattern is shown in Figure 4.2.25.



(a) Scrambling method (b) Descrambling method

Figure 4.2.25.1 Scrambling method

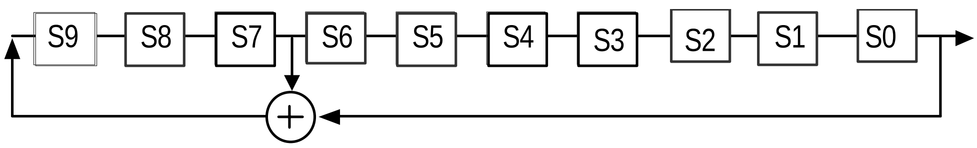


Figure 4.2.25.2 PN pattern generation circuit structure

4.2.11.3 Scramble application area (Private standard/Public standard)

The scramble application area for physical slots is shown in Figure 4.2.26. In the diagram, the shaded area is the bit area for which scramble is necessary.

(1) Control physical slots (basic physical slots, extension physical slots)

(a) π /4 shift QPSK

	R	SS	CAC	UW	CI	
Uplink	4	2	62	32	4	120

	R	SS	CAC	UW	CI	
Downlink	4	2	62	32	4	120

(b) π /2 shift BPSK

	R	SS	PR	UW	CI	
Uplink	2	1	7	16	4	82

(2) USPCH (2) (option), synchronization burst

(a) π /4 shift QPSK

	R	SS	CAC	UW	CI	
Uplink	4	2	62	32	4	120

	R	SS	CAC	UW	CI	
Downlink	4	2	62	32	4	120

(b) π /2 shift BPSK

	R	SS	PR	UW	CI	
Uplink	2	1	31	16	4	58

	R	SS	PR	UW	CI	
Downlink	2	1	31	16	4	58

(3) Communication physical slots (excluding synchronization burst, USPCH (2))

(a) π /4 shift QPSK

	R	SS	PR	UW	CI	SA	
Uplink	4	2	6	16	4	16	176

	R	SS	PR	UW	CI	SA	
Downlink	4	2	6	16	4	16	176

(b) π /2 shift BPSK

	R	SS	PR	UW	CI	
Uplink	2	1	3	10	4	92

	R	SS	PR	UW	CI	
Downlink	2	1	3	10	4	92

(c) D8PSK

	R	SS	PR	UW	CI	
Uplink	4	2	6	16	4	290

	R	SS	PR	UW	CI	
Downlink	4	2	6	16	4	290

(d) 16QAM

	R	SS	PR	UW	CI	
Uplink	4	2	14	16	4	372

	R	SS	PR	UW	CI	
Downlink	4	2	14	16	4	372

(4) USPCH (1) (option)

(a) π /4 shift QPSK

	R	SS	PR	UW	CI		
Uplink	4	2	6	16	4	16	176

	R	SS	PR	UW	CI		
Downlink	4	2	6	16	4	16	176

(b) π /2 shift BPSK

	R	SS	PR	UW	CI	
Uplink	2	1	3	10	4	92

	R	SS	PR	UW	CI	
Downlink	2	1	3	10	4	92

(c) D8PSK

	R	SS	PR	UW	CI	
Uplink	4	2	6	16	4	290

	R	SS	PR	UW	CI	
Downlink	4	2	6	16	4	290

(d) 16QAM

	R	SS	PR	UW	CI	
Uplink	4	2	14	16	4	372

	R	SS	PR	UW	CI	
Downlink	4	2	14	16	4	372

Figure 4.2.26 Scrambling application area

4.2.11.4 Correspondence between ID structure and scramble pattern register

(1) Control physical slot scramble pattern register initial value (Private standard/Public standard)

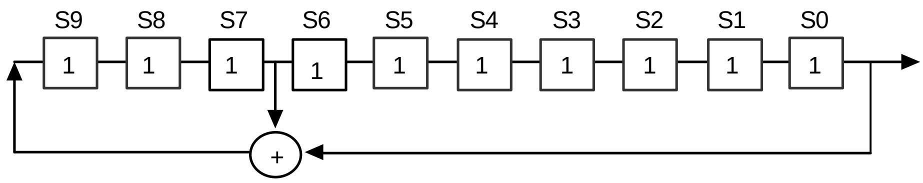
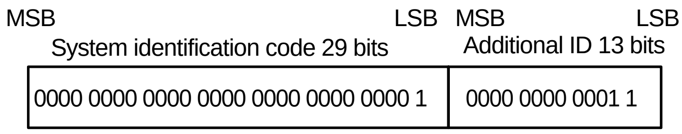


Figure 4.2.26.1 Register initial value in control physical slot

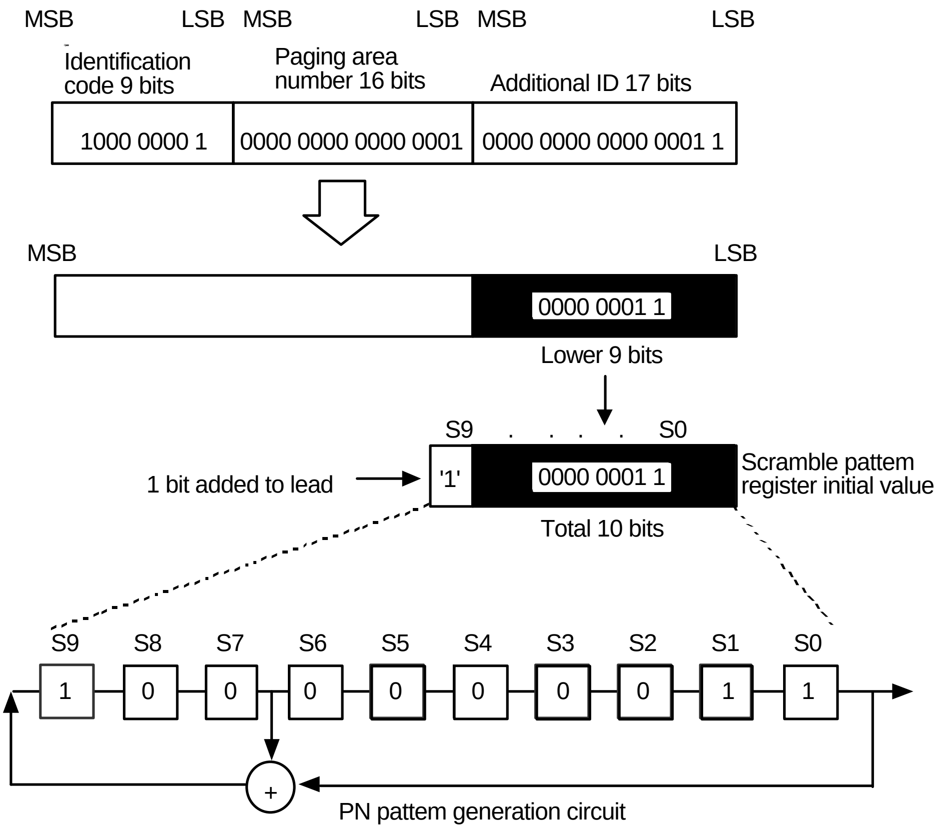
(2) Communication physical slot scramble pattern register initial value (Private standard/Public standard)

(a) Private system (example where system identification code = 1, additional ID = 3)



(b) Public system (example where operator identification code = 257 (decimal), n_p = 16 (decimal),

Paging area number = 1 (decimal), additional ID = 3 (decimal))



(Note) The header value of PN output is S0 of the scramble pattern register initial value.

Figure 4.2.26.2 Register initial value in communication physical slot

4.2.12 User scrambling mechanism (Private standard/Public standard)

The standard determines a user scrambling mechanism procedure, which takes scrambling of TCH information based on the key data (hereafter referred to as encryption key, for example PS key input).

4.2.12.1 Encryption key (Private standard/Public standard)

Encryption key is 4-character hexadecimal number used for the initial value of shift register for scramble process. In case of "0000", scramble does not take effect.

4.2.12.2 Transmission of encryption key (Private standard/Public standard)

The encryption key is transmitted from PS to CS by encryption key set message in the service channel establishment phase.

4.2.12.3 Scramble process (Private standard/Public standard)

The initial value of shift register for scramble processing is set from memory or generated by user setting in PS, and set from encryption key reported from PS in CS. The following 16-stage PN pattern is used for scrambling.

PN (16, 12, 3, 1)

An example of the scramble process is shown in Figure 4.2.27. The scramble process is the reset-type that sets the register initial values every frame.

An example of structure of the shift register structure that generates the PN pattern for user scrambling, is shown in Figure 4.2.28.

4.2.12.4 User scrambling control procedure (Private standard/Public standard)

The user scrambling function is applied to the first TCH and the following TCH of the communications phase after the point when the service channel establishment phase encryption key set message is sent from PS to CS.

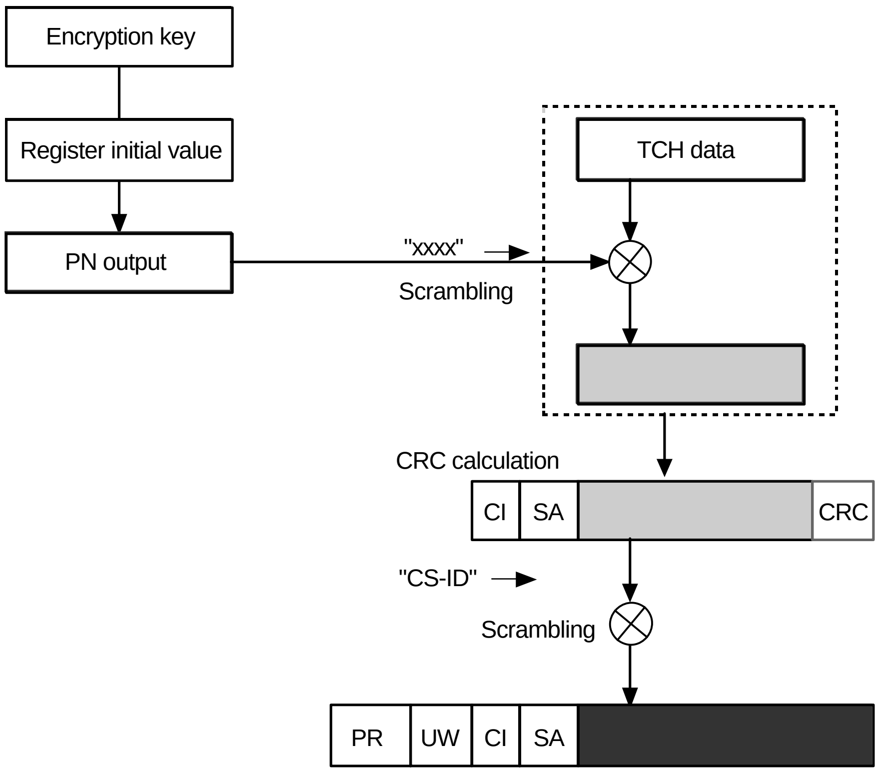


Figure 4.2.27 User scrambling process example

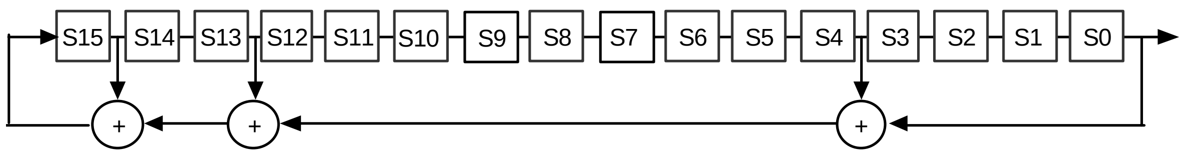


Figure 4.2.28 PN pattern generation circuit structure

4.2.13 VOX control (optional) (Private reference)

The VOX control function is an option. Accordingly, VOX control is carried out between CS and PS only when it is decided that VOX control will be performed according to the RT function request procedure. Also, even after deciding to carry out VOX control by the function request procedure, VOX control prohibit/permit can be carried out by a VOX control message in the communication phase.

VOX control rules are as follows:

(1) VOX can be performed in uplink and/or downlink directions.

(2) Use CI for VOX. (Refer to section 4.2.10.4)

(3) When communication begins, PS determines the presence or absence of VOX control with CS. At that time it determines the information format of background noise.
(4) In the intervals below, PS halts VOX control and transmits TCH regardless of the presence or absence of sound.

[1] The interval from after communication starts until the first frame with sound is detected.

[2] During channel switching (from Carrier Number reception until detection of the first frame with sound by the new communication channel [if switched back, the old communication channel])

[3] From receiving VOX function blocked from CS until receiving VOX function block released, or until communication ends.

4.2.13.1 VOX function setting (Private reference)

(1) Setting in service channel establishment phase

PS transmits to CS the possibility/impossibility of VOX function and the background noise generation method in the VOX function information of the Function request message (RT). After that, CS transmits to PS the possibility/impossibility of VOX function and the background noise generation method in the VOX function information of the Function request response message (RT). PS carries out VOX control according to the Function request response message.

(2) VOX setting during communication

In order to carry out setting of the VOX control function during a call, the following functions are used.

VOX control prohibit/permit are carried out according to the VOX control message. If block is received when the VOX control is active, control is stopped. Also, if release block is received when VOX control is blocked, control is again started.

A PS in VOX control possible state can arbitrarily execute channel ON/OFF.

4.2.13.2 VOX implementation example (Private reference)

Below, an implementation example of VOX is shown. Figure 4.2.29 shows the relationship between the radio interface burst and the presence or absence of voice. VOX starts when the first VOX burst is sent/received. VOX ends when a burst other than for VOX is sent/received.

[Downlink VOX]

During VOX, VOX bursts with the determined background noise information attached are transmitted constantly.

[Uplink VOX]

During VOX, uplink VOX bursts with background noise information attached is sent once every four frames.

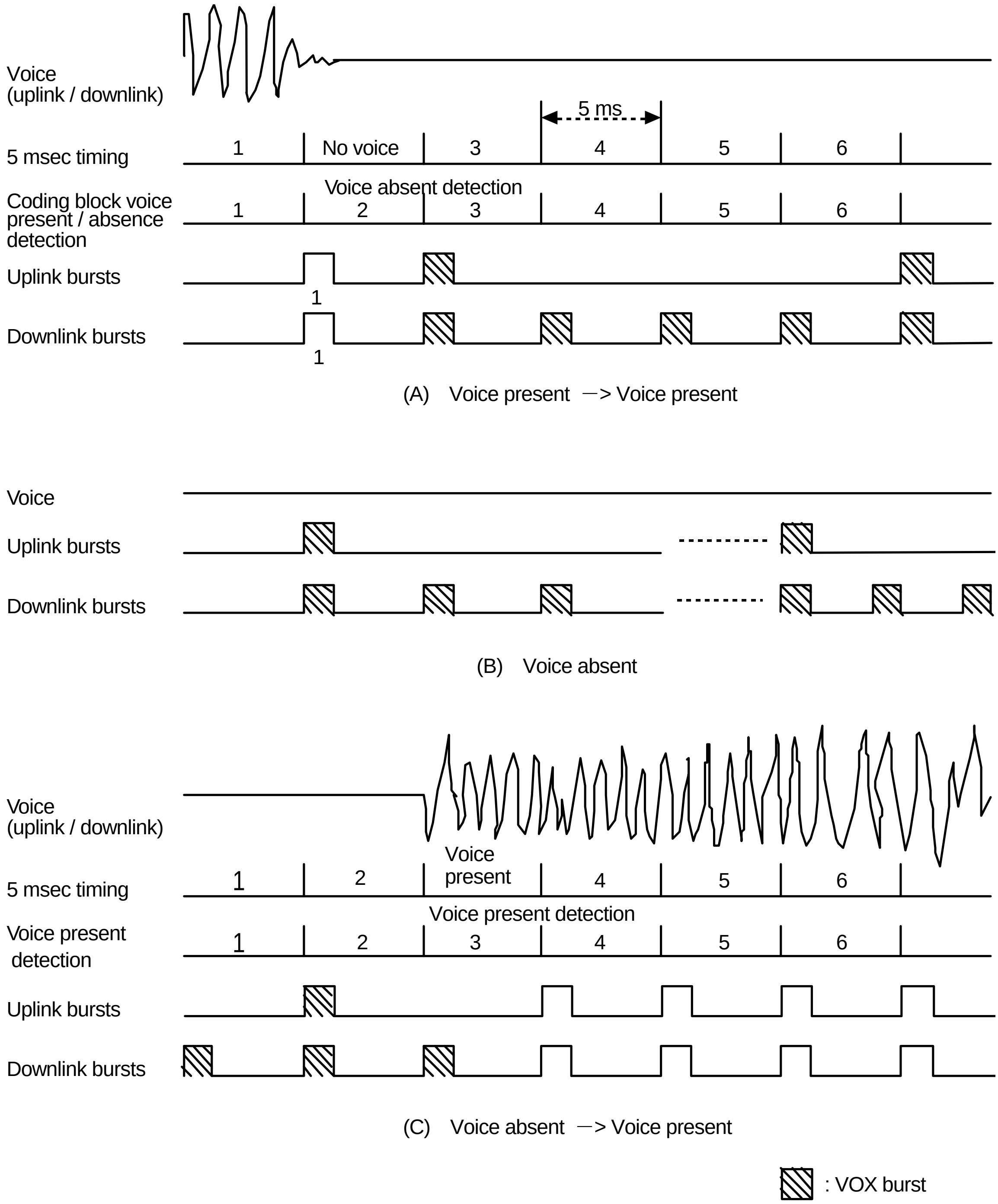


Figure 4.2.29 VOX control example

4.2.14 Specific examples of bit arrangement (Private standard/Public standard)

4.2.14.1 Example in basic physical slot uplink (SCCH) (Private standard/Public standard)

(1) CRC

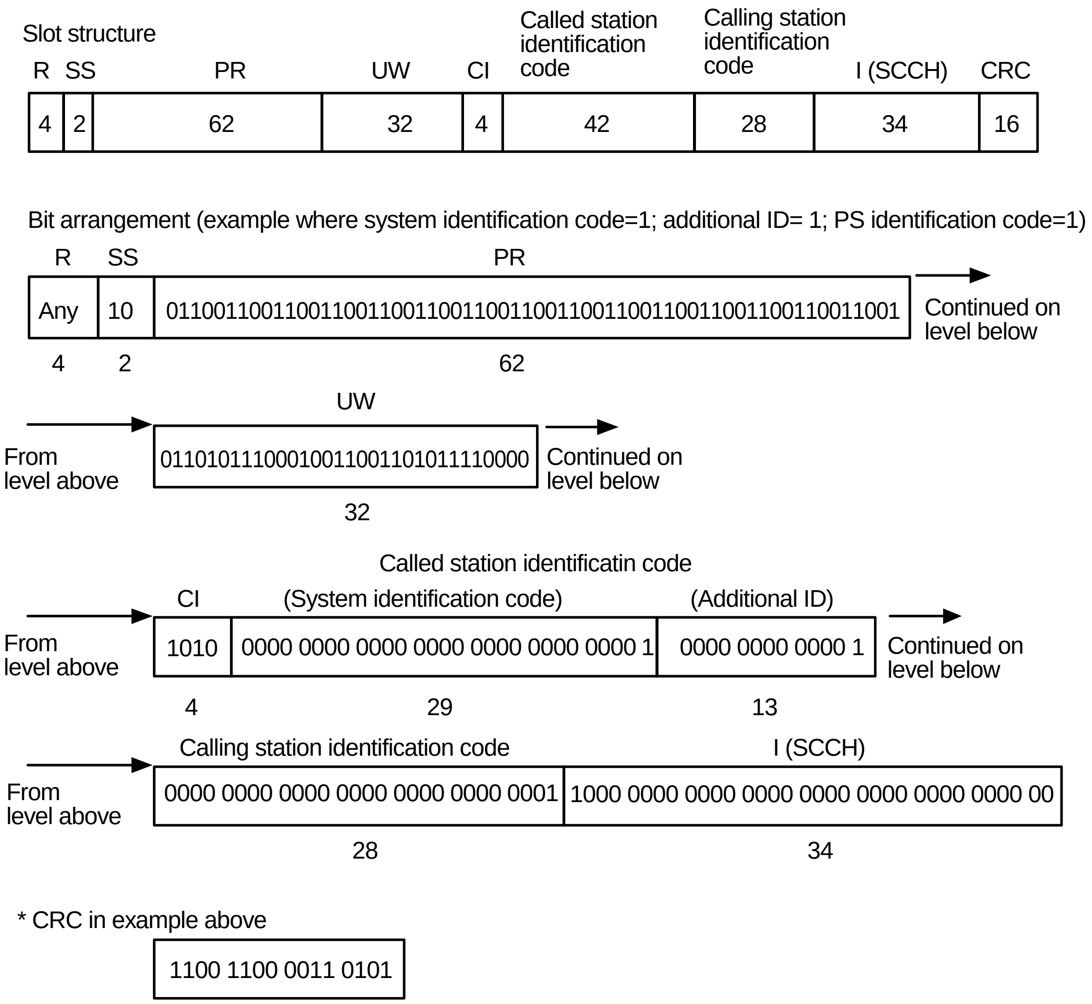


Figure 4.2.30 Example of CRC in control physical slot uplink (SCCH)

(2) Scramble

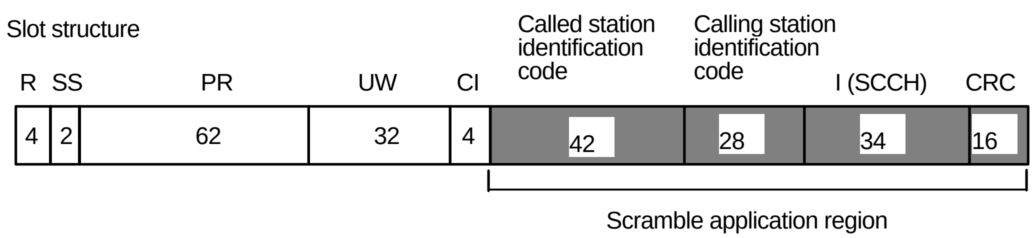


Figure 4.2.31 Scramble application region in uplink SCCH

(a) Bit arrangement and scramble pattern

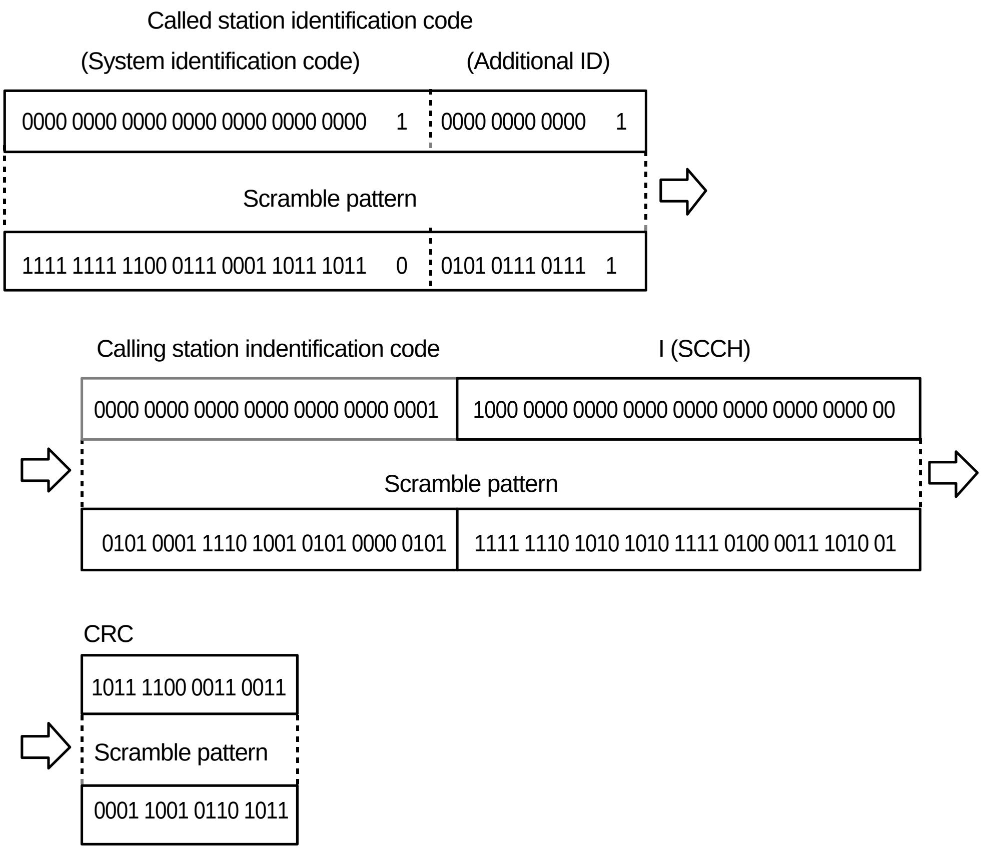


Figure 4.2.32 Comparison of bit arrangement and scramble pattern in uplink SCCH

(b) Bit arrangement after scramble

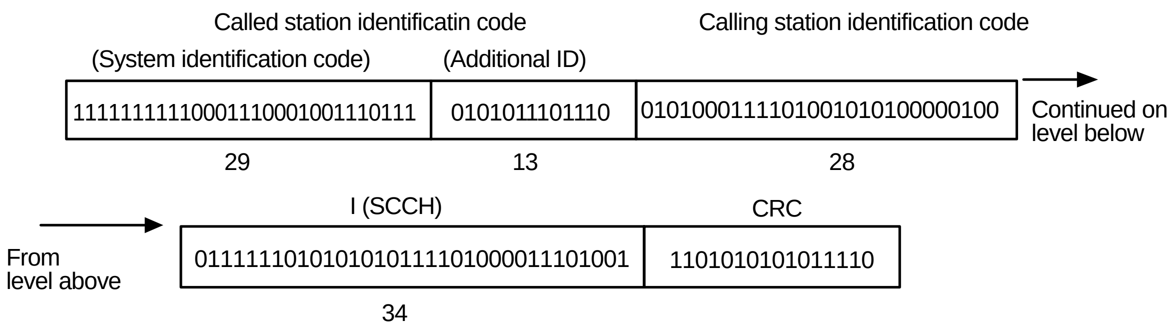


Figure 4.2.33 Example of scramble in control physical slot uplink (SCCH)

4.2.14.2 Example in basic physical slot (TCH) (Private standard/Public standard)

(1) Bit arrangement in I (TCH)) (π /4 shift QPSK)

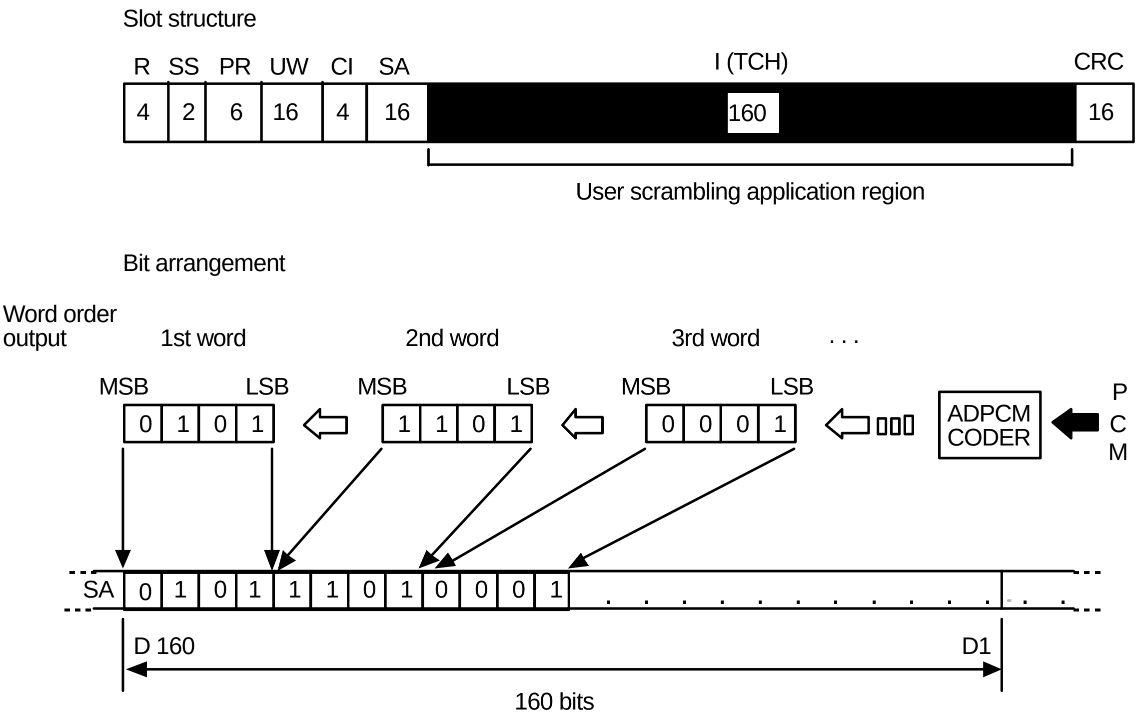


Figure 4.2.34.1.1 Example of bit arrangement in TCH (π /4 shift QPSK)

(2) Bit arrangement in I (TCH)) (π /2 shift BPSK)

Slot structure

R	SS	PR	UW	CI	I(TCH)	CRC
2	1	3	10	4	80	12

User scrambling application region

Bit arrangement

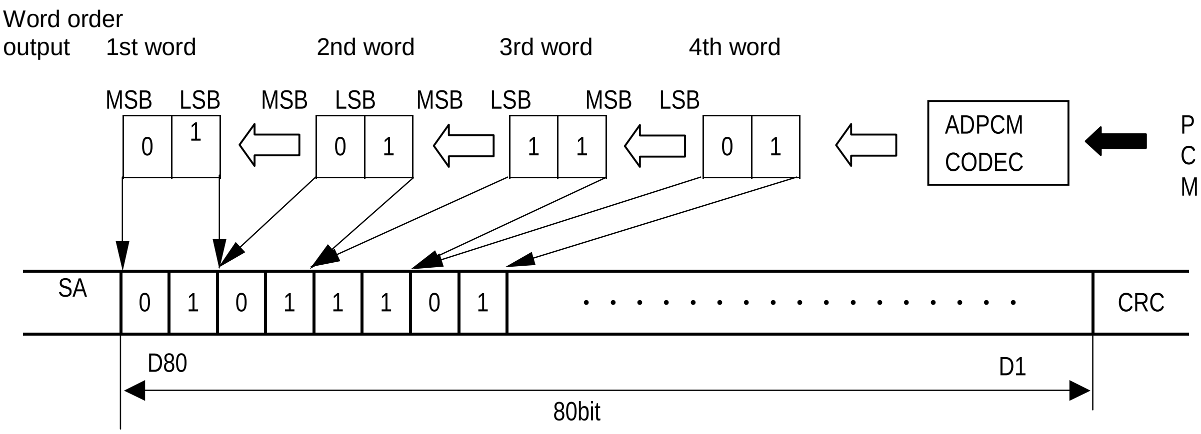


Figure 4.2.34.2 Example of bit arrangement in I (TCH) (π /2 shift BPSK)

(3) Bit arrangement in I (TCH)) (D8PSK)

Slot structure

R	SS	PR	UW	CI	SA	I	Null	CRC	PAD
4	2	6	16	4	16	240	16	16	2

User scrambling application region

Bit arrangement

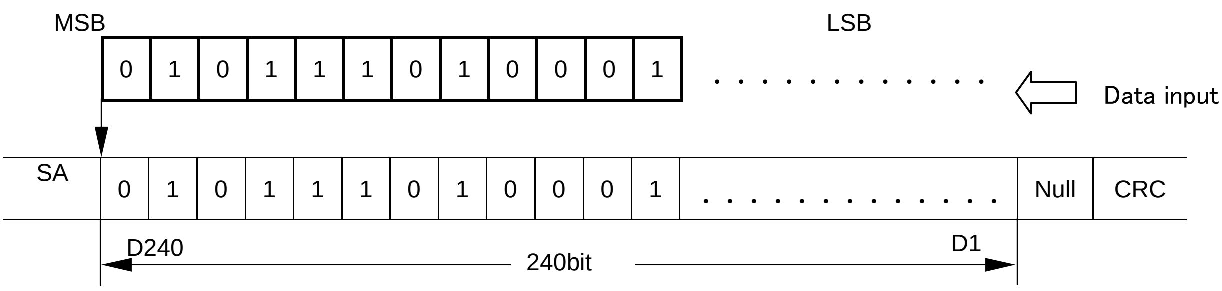


Figure 4.2.34.3 Example of bit arrangement in I (TCH) (D8PSK)

(4) Bit arrangement in I (TCH)) (16QAM)

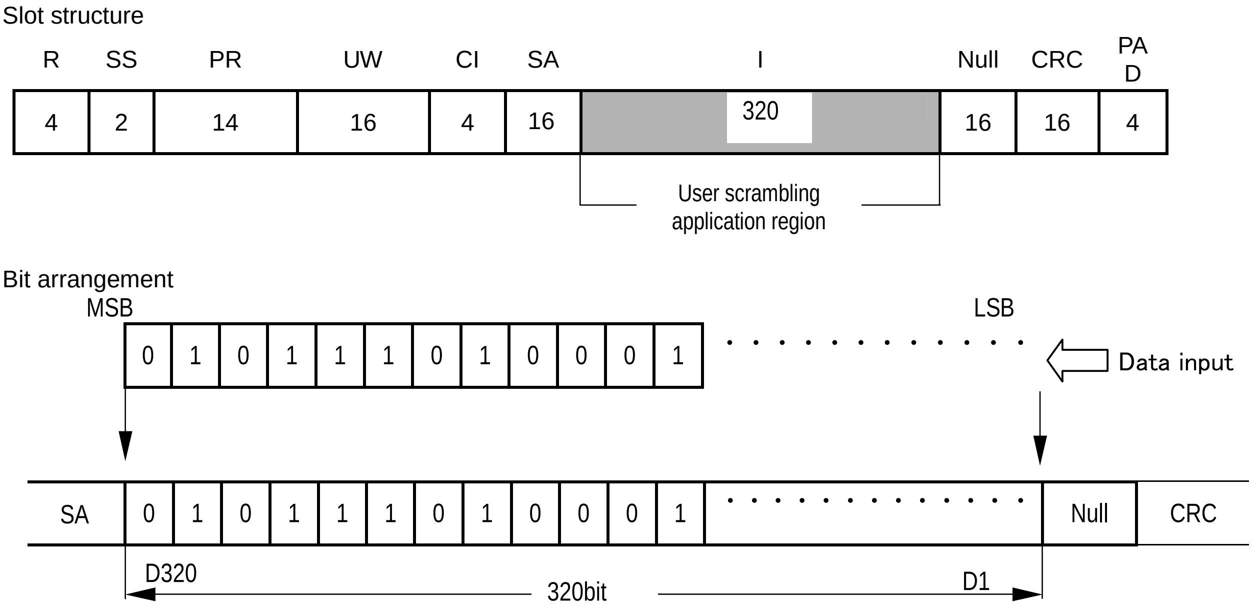
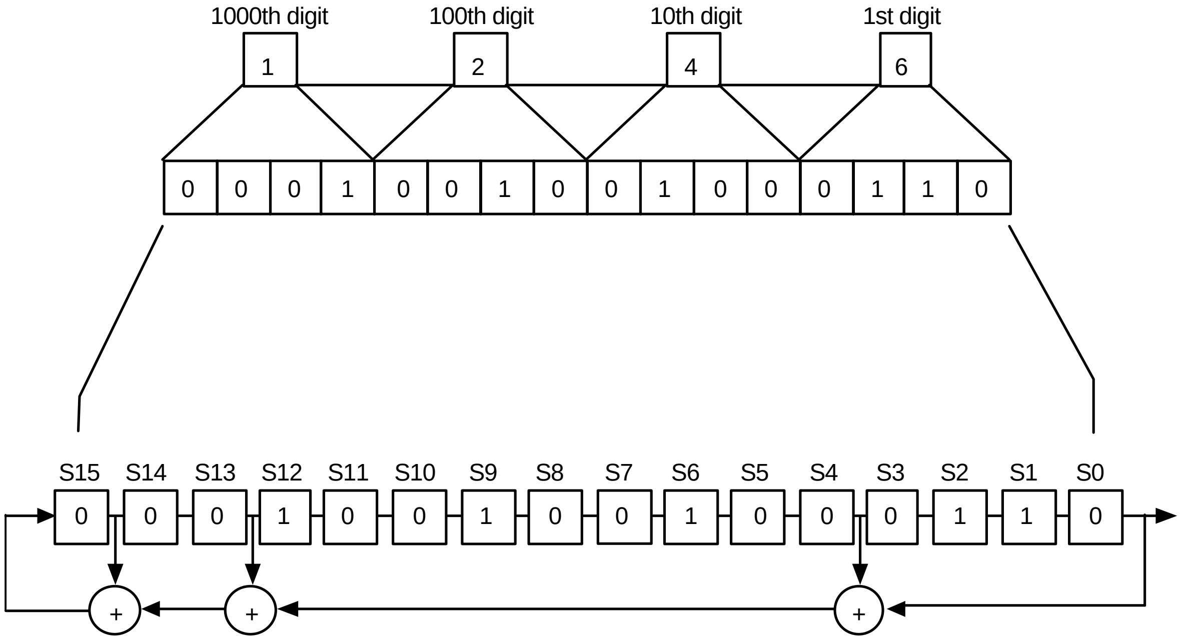


Figure 4.2.34.4 Example of bit arrangement in I (TCH) (16QAM)

(2) Specific example of user scrambling process

(a) Initialization of registers

Input of encryption key from PS key



(Note) The PN output lead value is S0 of the scramble pattern register initial value.

Figure 4.2.35 Example of scramble pattern register initialization

(b) Example of user scrambling pattern (Register initialization uses the above values.)

0110 0010 0100 1000 0111 0000 1001 0110 1100 0001 0110 0100 0110 1100 1101 0000 1101 0010 1110 1100

0101 1011 1000 1111 1110 1011 1111 0101 0101 0100 0011 1010 0110 1100 0001 0100 0011 0010 0001 1000

Figure 4.2.36 Example of user scrambling pattern in I (TCH)

(c) Specific example of user scrambling of I (TCH)

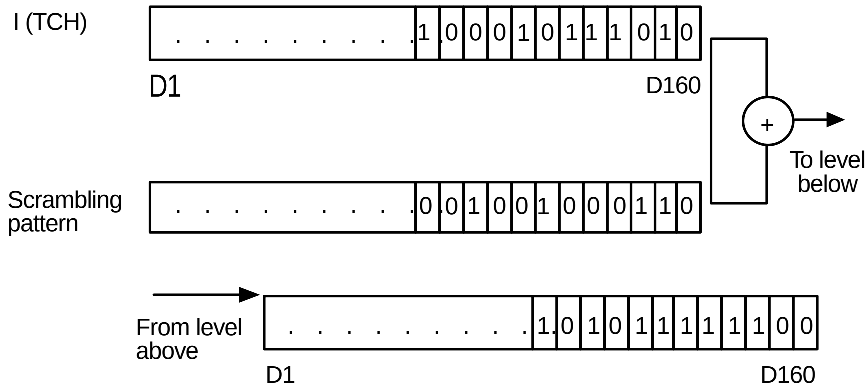


Figure 4.2.37 Specific example of user scrambling in I (TCH)

4.2.15 TCH activation procedure and detailed regulations (Private standard/Public standard)

The sequence of establishing the link channel is shown in Appendix B. Detailed regulations of the control operations are shown below.

(1) PS synchronization burst transmission timing

When PS starts to transmit the uplink synchronization burst to the CS, the same transmission timing as an ordinary physical slot has to be satisfied. That is, the permitted timing accuracy when the first uplink synchronization burst is transmitted is equal to the standard timing accuracy specified value based on the downlink signal of the logical control channel last received by PS, plus the error due to the fact that it operates by the autonomous clock during the process that includes frequency switching/unwanted signal measurement until the uplink synchronization burst is actually transmitted (process time is less than TR101C - 1).
In case of TCH reassignment in the same CS and 2nd TCH additional process on 64kbit/s unrestricted digital, the permitted timing accuracy when the first uplink synchronization burst is transmitted is equal to the standard timing accuracy specified value based on the downlink signal of RT message of the traffic channel includes TCH reassign or additional TCH assign last received by PS, plus the error due to the fact that it operates by the autonomous clock during the process that includes frequency switching/unwanted signal measurement until the uplink synchronization burst is actually transmitted (process time is less than TR101C - 1).

(2) Synchronization burst reception process

When the following items are satisfied by synchronization burst reception in both PS and CS, the process is performed which establishes layer 1 synchronization as if synchronization burst reception was performed normally.

1) The unique word is to be detected in error state of 1 bit or less.

2) No errors are to be detected by CRC decoding check.

3) The calling/called station identification code contained in the synchronization burst are to agree with the transmitting/receiving CS and PS code.

4) The modifier contained in the synchronization burst is to agree with bit pattern of the channel.

Furthermore, after the PS transmits the initial uplink synchronization burst, once the downlink synchronization burst is received from CS, the uplink signal transmitted thereafter must be transmitted by the transmission timing that uses the relevant downlink synchronization burst as a standard.

(3) TCH idle burst reception process

After both PS and CS complete reception of the synchronization bursts, they enter to TCH activation in progress state (steady state) due to reception of the TCH idle burst. The PS must continue to transmit the TCH idle burst until it enters steady state. When the TCH idle burst for entering to steady state is received, the unique word must be received with 1 or less bit errors.

(4) Regulations on TCH re-establishment procedure

When out of zone or when TCH switching activation takes place due to interference, the downlink synchronization burst is transmitted during the prescribed time on the channel on which communication was taking place up until then. As a result, PS can perform TCH re-activation on the channel on which communication was taking place as required. In this case, when the following items are satisfied by synchronization burst reception, the process that performs re-establishment of layer 1 synchronization is performed as if synchronization burst reception was performed normally.

1) The unique word is to be detected in error state of 1 bit or less.

2) No errors are to be detected by CRC decoding check.

3) The calling/called station identification code contained in the synchronization burst are to agree with the transmitting/receiving CS and PS codes.

4) The modifier contained in the synchronization burst is to agree with bit pattern of the channel.

4.2.16 Malfunction detection for personal station (Private standard/Public standard)

(1) Malfunction detection timer

The personal station shall equip a malfunction detection timer which is independent on other functions. This timer operates normally when the personal station is power on. If the personal station is controlled by software, a reset command should be inserted into the control software so that the timer does not end while the sequence is being executed. The same operation shall be performed by also the personal station hardware design. The maximum timer value shall be 60 seconds.

(2) Fault transmission

To minimize the possibility of the fault transmission caused by malfunction of the parts in the personal station, the personal station must have the detection function and prevention function for fault transmission.

4.2.17 Constraints during automatic response detection (Private standard/Public standard)

When the function for PS to automatically verify the response from the other terminal during transmission is provided, when the response from the other terminal cannot be verified, PS must send a channel cut signal and stop transmitting within one minute after sending a signal designating the other terminal.

4.2.18 Constraints when automatically retransmitting (Private standard/Public standard)

For PSs that have an auto retransmission function (a function that automatically calls another party repeatedly when there is no answer), the number of auto retransmissions must be two or less. A transmission occurring three minutes or more after the initial transmission, however, is considered to be a different transmission. This provision does not apply in the case of fire, theft, or other emergency.

4.3 Link channel establishment phase

4.3 Link channel establishment phase (Private standard/Public standard)

4.3.1 Overview (Private standard/Public standard)

In this section, the signal formats and the regulations on protocol needed for the link channel establishment phase are specified. Further, the standard formats using BCCH, PCH as well as SCCH specified in the former section are mandatory, and anything else is not especially specified and is an option.

4.3.2 General regulations (Private standard/Public standard)

4.3.2.1 Protocol regulations (Private standard/Public standard)

These are as follows.

(1) The message is completed for each single physical slot.

(2) Because this phase does not use layer structure, layer 2 with transmission acknowledgment and error recovery function does not exist. Accordingly, the header element that corresponds to layer 2 functions is not included.

(3) The total number of link channel establishment request retries, link channel establishment re-request and link channel establishment re-request retries is a maximum of 3 in the same outgoing call (including recalling-type handover), incoming call or location registration operation.

4.3.2.2 Format rules (Private standard/Public standard)

(1) Octet transmission order

The transmission order of the octet within the message format is in order from octet 1, octet 2, octet 3... .

(2) Bit transmission order

The transmission order of bits within the octet is in order from bit 1, bit 2, bit 3... .

4.3.2.2.1 Rules about unused elements (Private standard/Public standard)

The rules pertaining to unused elements of the message contents and information element explanations in the messages are as follows.

Reserved : This is the area saved for extension. Usage against this standard is not permitted.
Unless otherwise specified, the transmission side transmits "0" .
When an old-version equipment receives a bit other than "0" in a reserved area of the old version, it must ignore the bit and act as if the bit is "0".

Option : This is the area where the method of use is optional.

- : This means that the same bit value shown below in the table is inserted.

x : Don't care

4.3.2.2.2 Standard protocol regulations (Private standard/Public standard)

Regulations are shown for selecting a standard protocol in the link channel establishment phase.

(1) There are three types of CIs: BCCH(A), PCH, SCCH. BCCH (B) is functional option. Other types are ignored by the reception side.

(2) Bit 7 of message type is 0 only. Bit 7 = 1 (but public is SCCH only) is functional option. Other types are ignored by the reception side.

(3) LCH type and LCH protocol type are standard only.

Furthermore, Table 4.3.1-1 and Table 4.3.1-2 show option classifications of the link channel establishment phase.

Method of processing unrecognized options is shown in Table 4.3.1-3.

Table 4.3.1-1 Option classifications of link channel establishment phase (private systems)

CI	Message type	LCH protocol type	Information element
BCCH	Radio channel information broadcasting (bit 7 = 0)	—	With options in paging grouping factor, paging area number length, number of same paging groups, battery saving cycle maximum value, n offset, number of PCH, frame basic unit length and control carrier structure. Bit 5, 6 of octet 8 are optional.
BCCH	System information broadcasting (bit 7 = 0)	Standard/ Reserved/ Optional	With options in LCH type, LCH protocol type, extension LCH protocol type, CC protocol type, octet 4-5, octet 4-5 usage designation, Broadcasting reception indication.
BCCH	2nd system information broadcasting (bit 7 = 0)	—	With options in broadcasting reception indication.
BCCH	Option information broadcasting (bit 7 = 0)	—	Octets 2~6 and bits 1~3 for octet 7 are optional, with options in broadcasting reception indication.
BCCH	Option (bit 7 = 1)	Optional	All areas optional.
PCH	Paging	—	Options in calling service classification, Broadcasting reception indication.
SCCH	Idle (bit 7 = 0)	—	No options.
SCCH	Link channel establishment request (bit 7 = 0)	Standard/ Reserved/ Optional	Options in LCH type, LCH protocol type, extension LCH protocol type, CC protocol type. Octet 5 is optional.
SCCH	Link channel assignment (bit 7 = 0)	—	Options in LCH type, extension LCH protocol type, CC protocol type.
SCCH	Link channel assignment rejection (bit 7 = 0)	—	Octets 4, 5 are optional. Options in rejection reason.
SCCH	Link channel establishment re-request (bit 7 = 0)	Standard/ Reserved/ Optional	Options in LCH type, LCH protocol type, extension LCH protocol type, CC protocol type, and causes. Octet 5 is optional.
SCCH	Option (bit 7 = 1)	Optional	All areas optional.
USCCH	Undetermined	Undetermined	Undetermined
Option	Undetermined	Undetermined	Undetermined

Table 4.3.1-2 Option classifications of link channel establishment phase (public systems)

CI	Message type	LCH protocol type	Information element
BCCH	Radio channel information broadcasting (bit 7 = 0)	—	No options.
BCCH	System information broadcasting (bit 7 = 0)	Standard/ Reserved	No options.
BCCH	2nd/3rd system information broadcasting (bit 7 = 0)	—	No options.
PCH	Paging	—	No options.
SCCH	Idle (bit 7 = 0)	—	No options.
SCCH	Link channel establishment request (bit 7 = 0)	Standard/ Reserved	Octet 5 is optional.
SCCH	Link channel assignment (bit 7 = 0)	—	No options.
SCCH	Link channel assignment rejection (bit 7 = 0)	—	Octets 4, 5 are optional. Options in rejection reason.
SCCH	Link channel establishment re-request (bit 7 = 0)	Standard/ Reserved	Octet 5 is optional. Options in rejection reason.
SCCH	Option (bit 7 = 1)	Optional	All areas optional.
USCCH	Undetermined	Undetermined	Undetermined
Option	Undetermined	Undetermined	Undetermined

Table 4.3.1-3 Method of processing unrecognized options (private use)

Information element	Message	Process Upon reception of unrecognized option
LCH protocol Type	Link channel establishment request Link channel establishment re-request	Construed as standard (using service channels) or disconnection
	System information broadcasting	Construed as standard (use of either link channel only or use of service channel is possible) or nonselection of LCCH
Extension LCH protocol Type	Link channel establishment request Link channel establishment re-request	Construed as absence of requests for RT and /or MM functions, or disconnection
	Link channel assignment	Construed as absence of instructions for reception of notification information, absence of requests for RT and/or MM functions, or disconnection
	System information broadcasting	Construed as RT or MM functions being omissible or non-selection of LCCH
CC protocol type	Link channel establishment request Link channel establishment re-request Link channel assignment	Construed as divided transmission of dial signals, or disconnection
	System information broadcasting	Construed as divided transmission of dial signals being possible or non-selection of LCCH
reject reason	Link channel assignment reject	Contents construed as grounds for optional rejection
cause	Link channel establishment re-request	Contents construed as grounds for optional rejection
-	Paging	Paging service type=Construed as absence of paging service
Option	Link channel establishment request Link channel establishment re-request Link channel assignment reject Option information broadcasting Radio channel information broadcasting	These information elements are to be ignored
-	Option	This message is to be ignored, and status to remain unchanged
LCH type	Link channel establishment request Link channel establishment re-request Link channel assignment System information broadcasting	This message is to be ignored, and status to remain unchanged
Paging grouping factor	Radio channel information broadcasting	This message is to be ignored, and status to remain unchanged
Paging area number length	Radio channel information broadcasting	When a fixed paging area method is included in a paging area type, this message is to be ignored, and status to remain unchanged In the case of a paging area method limited to a PS-designated type, these information elements are to be ignored
Number of same paging groups	Radio channel information broadcasting	This message is to be ignored, and status to remain unchanged
Battery saving cycle maximum value	Radio channel information broadcasting	This message is to be ignored, and status to remain unchanged
n offset	Radio channel information broadcasting	When a control carrier structure is optional, this bit range is optional These information elements are to be ignored

Information element	Message	Process Upon reception of unrecognized option
Number of PCHs	Radio channel information broadcasting	This message is to be ignored, and status to remain unchanged
Flame basic unit length	Radio channel information broadcasting	This message is to be ignored, and status to remain unchanged
Control carrier structure	Radio channel information broadcasting	This message is to be ignored, and status to remain unchanged
Paging area number (Octets 4,5)	System information broadcasting	When a Paging area number length is optional, this bit range is optional These information elements are to be ignored
Octet 4,5 usage designation	System information broadcasting	When a Paging area number length is optional, this bit range is optional These information elements are to be ignored
Broadcasting reception indication	System information broadcasting 2nd system information broadcasting Option information broadcasting Paging	Option of these information elements are to be ignored

4.3.2.2.3 System information default regulations (Private standard/Public standard)

Defaults for the contents of system information broadcasting are specified, and in systems operating by default values, system information broadcasting can be omitted. Table 4.3.2-1 and Table 4.3.2-2 show defaults to be used in system information broadcasting.

Table 4.3.2-1 CS individual system information default values (private system)

Function	Default	Notes
CC protocol type	Overlap sending is possible	
Extension LCH protocol type	RT function request omittable	
Extension LCH protocol type	MM function request omittable	
CS information	General CS	
CS information	Non-originating-exclusive CS	
CS information	Non-specified-user-service CS	
CS information	Non-SD-write CS	
CS information	Relevant CS available	
Restriction information	No restriction	

Table 4.3.2-2 System information default values (public system)

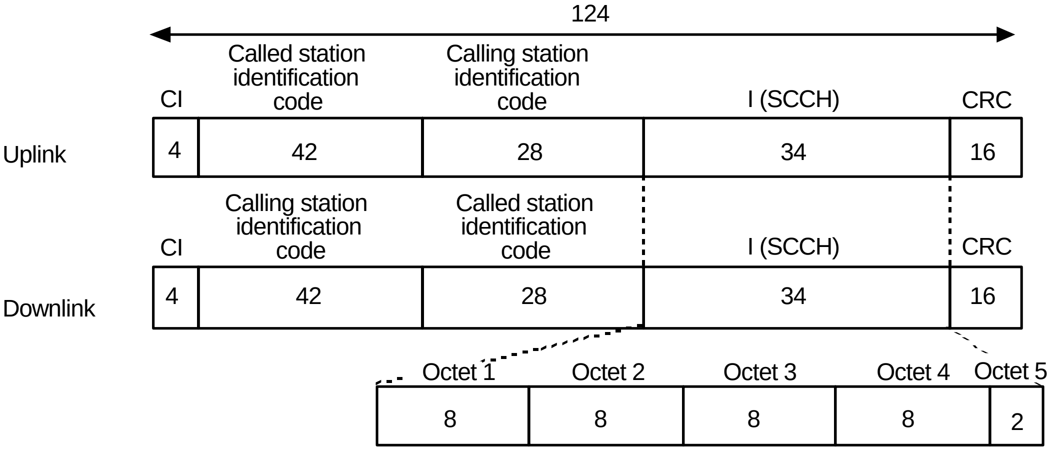
Function	Default	Notes
Extension LCH protocol type	RT function request omittable	
Extension LCH protocol type	MM function request omittable	
CS information	Relevant CS available	
CS information	Non-SD-write CS	
Restriction information	No restriction	
RT-MM protocol version	Version 1 (RCR STD-28 (version 1))	

4.3.2.3 Message format (Private standard/Public standard)

The message formats for SCCH, BCCH, PCH are shown in Figure 4.3.1 through 4.3.3.

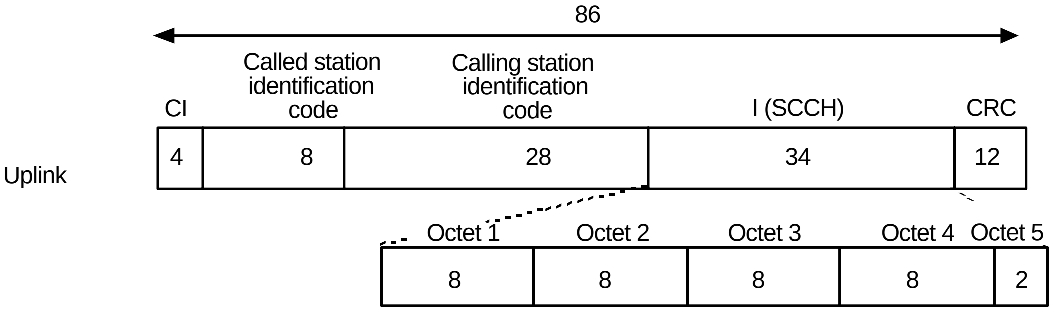
(1) SCCH

In case of π /4 shift QPSK



Octet \ Bit	8	7	6	5	4	3	2	1
1		Message type						
2								
3								
4								
5								

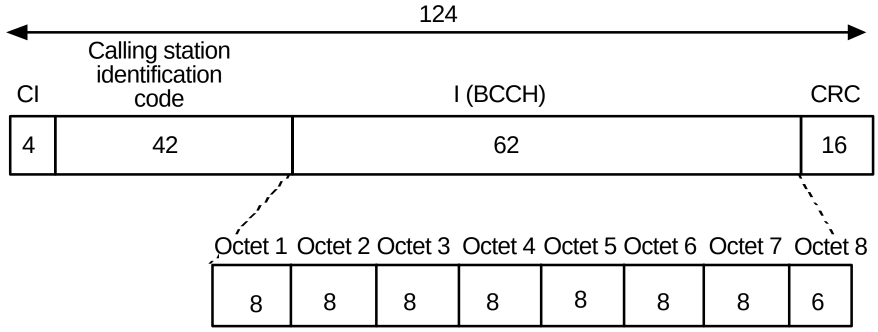
In case of π /2 shift BPSK



Octet \ Bit	8	7	6	5	4	3	2	1
1		Message type						
2								
3								
4								
5								

Figure 4.3.1 SCCH message format

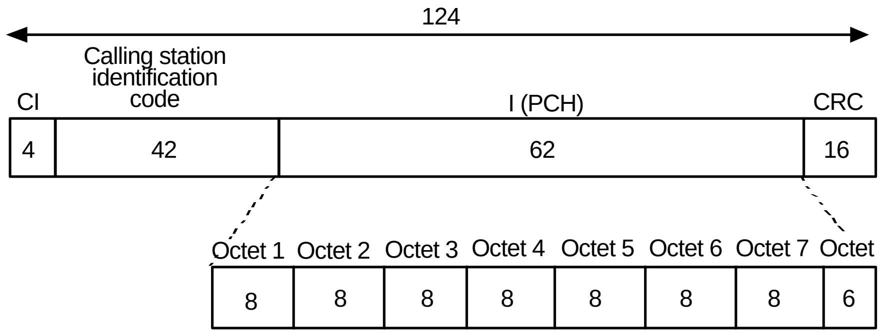
(2) BCCH



Octet \ Bit	8	7	6	5	4	3	2	1
1		Message type						
2								
3								
4								
5								
6								
7								
8								

Figure 4.3.2 BCCH message format

(3) PCH



Octet \ Bit	8	7	6	5	4	3	2	1
1								
2								
3								
4								
5								
6								
7								
8								

(Note) In PCH, only single messages are defined. For this reason, the area that displays message type is omitted.

Figure 4.3.3 PCH message format

4.3.2.4 Definition information (Private standard/Public standard)

4.3.2.4.1 Types of definition information (Private standard/Public standard)

Definition information is classified into the following 2 types.

(1) Global definition information:

- Information common within paging area;
- Information can vary depending on time band in each paging area.

(2) Local definition information:

- Information of each radio zone (CS);
- Information can vary depending on time band in each zone.

4.3.2.4.2 Definition information and transmission methods (Private standard/Public standard)

Definition information can be classified into 2 types depending on the general transmission method: Broadcasting information transmitted by BCCH, and notification information transmitted by RT message.

The definition information and transmission methods are shown in Table 4.3.3. Details of the transmission methods are explained in section 4.3.2.5.

Table 4.3.3 Definition information and transmission methods

No.	Definition information	Global Local	Transmission method		Private system	Public system
Broadcasting information						
1	Radio channel structure	G	BCCH (CH)	Zone information notification message (communica-tions phase)	Mandatory	Mandatory
2	Control carrier structure information	L	BCCH (CH)	Same as above	Mandatory	Mandatory
3	System operation information	L	BCCH (SYS)	Same as above	Mandatory (omittable)	Mandatory (omittable)
4	Traffic restriction information	L	BCCH (SYS)	Same as above	Mandatory (omittable)	Mandatory (omittable)
5	Country code. System type	G	BCCH (SYS2)	Same as above	Mandatory	Mandatory
6	Paging area type	G	BCCH (SYS2)	Same as above	Mandatory	Reserved
7	2nd system operating information	L	BCCH (SYS2)	Same as above	Mandatory	Mandatory
8	3rd system operating information	L	BCCH (SYS3)	Same as above		Reserved
9	Option information	L	BCCH (OP)	Same as above	Functional option	
Notification information						
10	Area information (zone holding level information, etc.)	G	RT message (SC Hestablish-ment phase)	Zone information indication message (communica-tions phase)	Functional option	Mandatory (omittable)

(Note) BCCH (CH): Radio channel information broadcasting message;
That pertaining to radio channel structure and control carrier structure of BCCH, PCH, SCCH, etc.

BCCH (SYS): System information broadcasting message;
System operation information (including that pertaining to traffic restriction information).

BCCH (SYS2): 2nd system operating information broadcasting message;
Country code. System type;
Paging area type;
2nd system operation information.

BCCH (SYS3): 3rd system operating information broadcasting message (exclusive use by public systems).
3rd system operating information.

BCCH (OP): Option information broadcasting message (exclusive use by private systems);
That pertaining to option information.

Furthermore, the following terms are defined.

(1) System information broadcasting message: Shows the system information broadcasting message (message type 0001010); does not mean 2nd, 3rd system information broadcasting messages.

(2) Local information broadcasting messages: Show system information broadcasting message, 2nd system information broadcasting message, 3rd system information broadcasting message (public), option information broadcasting message (private).

(3) Local definition information: Shows information included in local definition information elements shown in Table 4.3.3.

(4) Local information broadcasting reception indication: Shows reception indication of local information broadcasting messages.

4.3.2.4.3 Relationship between global definition information and local definition information (Private standard/Public standard)

If global definition information is changed, all global definition information (including notification information) and local definition information is updated.

4.3.2.5 Definition information transmission method (Private standard/Public standard)

4.3.2.5.1 Classification of definition information (Private standard/Public standard)

Definition information is classified into the following 2 types depending on the transmission method.

(1) Broadcasting information (information that should be received by PSs before LCH establishment);

- Information regarding radio channel structure (G) ;
- Information regarding control carrier structure (L) ;
- System operating information (L) ;
- Traffic restriction information (L) ;
- Country code, System type (G) ;
- Paging area type (G) ;
- 2nd system operating information (L) ;
- 3rd system operating information (public) (L) ;
- Option information (private) (L) .

(2) Notification information (information that can be transmitted after LCH establishment)

- Area information (G).

(Note) G = Global definition information;
L = Local definition information.

4.3.2.5.2 Information transmission method (Private standard/Public standard)

4.3.2.5.2.1 Broadcasting information transmission method (Private standard/Public standard)

Broadcasting information must be received by PSs through BCCH before LCH establishment.

For a PS that does not have a zone selection level, that is an initial PS, the zone selection level default value (10 dBμV) is defined, and zone selection is tentatively performed at that level.

Furthermore, if it is determined that there is a zone information indication function by the RT function request/response sequence for a public system, a CS can send the broadcasting information by a zone information indication message during communication.

4.3.2.5.2.2 Notification information transmission method (Private standard/Public standard)

After LCH establishment, notification information is sent on an RT message due to a request from the PS. Specifically, PS reports its own (area information) notification status number to the CS via a link channel establishment (re-)request message, and CS judges whether or not notification information must be received from the notification status number, and if it is required, it sends a notification information reception indication to the PS by the link channel assignment message.

In the service channel establishment phase, a PS that has received a notification information reception indication requests notification information by a definition information request message.

4.3.2.5.2.3 Handling of notification status number of notification information

(Private standard/Public standard)

(1) Private system (CS option)

Regulation is the same as the one for a public system.

(2) Public system

Specified as follows.

[1] By PS receiving the notification information in a definition information response message, the notification status number is valid from the point when the notification status number is stored together with the notification information and paging area number.

[2] The notification status number stored by PS is only valid so long as the PS stays in the same paging area and the global definition information pattern dose not change.

[3] If PS shifts paging areas, the notification status number possessed by PS becomes invalid. Therefore, when PS shifts paging areas, if a link channel establishment (re-)request is transmitted, it must declare that it does not possess notification information.

[4] If global definition information pattern was changed, notification status number possessed by PS becomes invalid. Therefore, if PS first transmits a link channel establishment (re-)request message after the global definition information pattern is changed, it must declare that it does not possess notification information.

[5] If the relevant global information definition pattern transmitted by the CS is the same as that of stored in PS at the time when the PS is turned on or communication is completed, the notification status number is valid.

4.3.2.6 RT-MM version management (Private standard/Public standard)

4.3.2.6.1 Version management rules (Private standard/Public standard)

(1) Protocols pertaining to RT-MM messages and information elements are managed by versions.

(2) Additions and changes to RT-MM messages and information elements are performed only when the version is upgraded. Otherwise, no additions or changes may be performed.

(3) This standard specifies the protocols of version 5.

(4) Messages and information elements used in CC shall comply with the version of RCR STD-28 indicated by the RT-MM protocol version.

4.3.2.6.2 Version determination method (Private standard/Public standard)

(1) PS reports its own RT-MM version to CS by a link channel establishment (re-)request message.

(2) If CS supports to the version reported from PS, it transmits a link channel assignment message (If PS receives a link channel assignment message from CS, it judges that the relevant version is permitted).

If CS does not support to the version reported from PS, it transmits a link channel assignment reject message (cause: RT-MM protocol version disagreement) to PS.

(3) If CS broadcasts a 2nd system information broadcasting message in a public system, or if CS broadcasts a 2nd system information broadcasting message and the 2nd system information broadcasting usage method of the radio channel information broadcasting is specified in the "the 2nd system information broadcasting usage method is according to the method indicated in RCR STD-28 version 2 or after" in a private system, the RT-MM protocol version indicated by the 2nd system information broadcasting message specified by RCR STD-28 version 2 or after is the version which the CS supports.

(4) If CS does not broadcast either a system information broadcasting message or a 2nd system information broadcasting message according to the method specified by RCR STD-28 (version 2 or after), PS can take this as meaning that the RT-MM protocol version held by the relevant CS is version 1.

4.3.2.7 Function request method (Private standard/Public standard)

4.3.2.7.1 Usage of the extension LCH protocol type at the link channel establishment phase (Private standard/Public standard)

(1) If the function request is mandatory at the service channel establishment phase, CS notifies the function request mandatory by the extension LCH protocol type of system information broadcasting message. In this case, excepting the handover, PS must set the function request present to the extension LCH protocol type of the link channel establishment (re-)request message.

(2) If the function request is omittable at the service channel establishment phase, CS notifies the function request omittable by the extension LCH protocol type of system information broadcasting message. In this case, PS usually sets the function request absent to the extension LCH protocol type of the link channel establishment (re-)request message, and omits the function request. However, if the function request is needed by the PS's condition, the PS can transmit the extension LCH protocol type of the link channel establishment (re-)request message with setting the function request present. And, if CS omits the system information broadcasting message, the same rule is applied.

(3) At the above-mentioned occasion (2), excepting the case when PS sets the function request absent to the extension LCH protocol type of the link channel establishment (re-)request message, CS can set either the function request present or the function request absent to the extension LCH protocol type of link channel assignment message.

4.3.2.7.2 Conditions for execution of function request sequence (Private standard/Public standard)

Table 4.3.4 shows the conditions of the function request sequence becoming mandatory or omittable at service channel establishment phase, which conditions are classified according to the extension LCH protocol types.

Table 4.3.4 Conditions for execution of functional request sequence

CS → PS System information broadcasting message	Function request mandatory				Function request omittable (note 2)		
PS → CS Link channel establishment (re-) request message	Function request present		Function request absent (note 1)		Function request present		Function request absent
CS → PS Link channel assignment message	Function request present	Function request absent	Function request present	Function request absent	Function request present	Function request absent	Function request absent
Operation of CS, PS at SCH establish phase	Execution of function request	Non-execution of function request	Execution of function request	Non-execution of function request	Execution of function request	Non-execution of function request	Non-execution of function request

(Note 1) Only on the handover, PS can notify the function request absent.
(Note 2) Including the case of omitting the system information broadcasting message.

4.3.3 Message type list (Private standard/Public standard)

A list of messages defined in the link channel establishment phase is shown in Table 4.3.5. Also, the format of message type information elements is shown in Figure 4.3.4 and the coding is shown in Tables 4.3.6-4.3.7.

Table 4.3.5 Messages for link channel establishment phase

Messages for channel setup	Reference
Idle Link channel establishment request Link channel assignment Link channel assignment reject Link channel establishment re-request	4.3.4.1.1 4.3.4.1.2 4.3.4.1.3 4.3.4.1.4 4.3.4.1.5
Messages for broadcasting	**Reference**
Radio channel information broadcasting System information broadcasting 2nd system information broadcasting 3rd system information broadcasting Option information broadcasting	4.3.4.2.1 4.3.4.2.2 4.3.4.2.3 4.3.4.2.4 4.3.4.2.5
Message for paging	**Reference**
Paging	4.3.4.3

Octet \ Bit	8	7	6	5	4	3	2	1
1	Reserved	Message type						

Figure 4.3.4 Format of message type

Table 4.3.6 Uplink (PS —> CS) message type coding

Bit 7	6	5	4	3	2	1	
0	0	0	0	-	-	-	Channel setup message
				0	0	1	Link channel establishment request
				0	1	0	Link channel establishment re-request
1	-	-	-	-	-	-	Option message (note 1)
	x	x	x	x	x	x	Option
		Other					Reserved
							x: Don’t care

Table 4.3.7 Downlink (CS —> PS) message type coding

Bit 7	6	5	4	3	2	1	
0	0	0	0	-	-	-	Channel setup message
				0	0	0	Idle
				0	0	1	Link channel assignment
				0	1	0	Link channel assignment reject
0	0	0	1	-	-	-	Broadcasting message
				0	0	1	Radio channel information broadcasting
				0	1	0	System information broadcasting
				0	1	1	2nd system information broadcasting
				1	1	1	3rd system information broadcasting (note 2)/ Option information broadcasting (note 3)
1	-	-	-	-	-	-	Option massage (note 1)
	x	x	x	x	x	x	Option
		Other					Reserved
							x: Don’t care

When there is a reception indication of 3rd system information broadcasting or option information broadcasting, PS performs status number control and broadcasting message reception according to the reception indication, but it is not necessary to check the content of the broadcasting information.

(Note 1) Private system and public system (functional option)
Only for SCCH in public system
(Note 2) Public system (reserved)
(Note 3) Private system (functional option)

4.3.4 Message format (Private standard/Public standard)

4.3.4.1 Channel setup messages (Private standard/Public standard)

4.3.4.1.1 Idle (Private standard/Public standard)

In downlink SCCH timing, only when there is no significant signal to be transmitted, this message can be transmitted. In the relevant message, the called station identification code and information elements are all "0". The message format is shown in Table 4.3.8.

Table 4.3.8 Idle message

Message type : Idle
Direction : CS CS —> PS (downlink)
Function channel : SCCH

Octet \ Bit	8	7	6	5	4	3	2	1
1	Re-served	0 Message type	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5							0	0

4.3.4.1.2 Link channel establishment request (Private standard/Public standard)

The PS carries out link set up request to CS using this message. The link set up request is only possible from PS to CS. PS designates the link channel (LCH) type needed for communication and the call connection protocol type and transmits the link channel establishment request to CS. The message format is shown in Table 4.3.9 and the explanation of each information element is shown in Table 4.3.10.

Table 4.3.9 Link channel establishment request message

Message type : Link channel establishment request
Direction : PS —> CS (uplink)
Function channel : SCCH

Octet \ Bit	8	7	6	5	4	3	2	1
1	Re-served	0 Message type	0	0	0	0	0	1
2	LCH type			LCH protocol type		Extension LCH protocol type		
3	CC protocol type		System type			RT-MM protocol version		
4	Reserved			Notification of usable band		Area information notification status number		
5							Option	

Table 4.3.10 Information elements in link channel establishment request message

LCH type (octet 2)

Bit 8	7	6	
0	0	0	Standard (π /4 shift QPSK 32 kbit/s)
0	0	1	Reserved
0	1	0	Reserved
0	1	1	Reserved (pirvate)/Standard (π /4 shift QPSK 32 kbit/s or 16 kbit/s) (public)
1	0	0	Reserved (private)/ Standard (π /4 shift QPSK 32 kbit/s or 16 kbit/s or π /2 shift BPSK 16 kbit/s) (public)
1	0	1	Reserved
1	1	0	Option (private)/reserved (public)
1	1	1	Option (private)/reserved (public)

LCH protocol type (octet 2)

Bit 5	4	
0	0	Standard (service channel used) (note 1)
0	1	Standard (service channel not used) (note 2)
1	0	Reserved
1	1	Option (private)/reserved (public)

(Note 1) Used when a procedure with the communication phase is requested, such as in the case of activation of the call origination and reception sequence.

(Note 2) Used when a procedure without the communication phase is requested, such as in the case of activation of the location registration sequence.

Extension LCH protocol type (octet 2)

If reserved (1 0) or (1 1) was set in the LCH protocol type (octet 2), all areas of this element become reserved. If optional (1 1), all areas are optional.

If the LCH protocol type is standard (0 0) or standard (0 1), it becomes as follows.

Bit 2	
0	RT function request absent
1	RT function request present

Bit 1	
0	MM function request absent
1	MM function request present

All other areas are reserved.

RT/MM function request absent: Notifies that RT/MM function request is not transmitted in service channel establishment phase.

RT/MM function request present: Notifies that RT/MM function request is transmitted in service channel establishment phase.

CC protocol type (octet 3)

When standard (0 1), reserved (1 0) or reserved (1 1) is set in the LCH protocol type (octet 2), this element is all reserved. If option (1 1) is set, all areas are optional.

If the LCH protocol type is standard (0 0), it is as follows.

Bit 8	
0	Dial signal en-bloc transmission
1	Dial signal overlap transmission (reserved in public system)

All other areas are reserved.

Dial signal en-bloc transmission : Requests that the dial signal is en-bloc transmitted by SETUP.
Dial signal overlap transmission : Requests that the dial signal is overlap transmitted by INFOrmation.

System type (octet 3)

Shows the system type required by a PS.

Bit 6	5	4	
0	0	0	Public system (including private system based on RCR STD-28 (version 1)
0	0	1	Private system based on RCR STD-28 (version 2) or RCR STD-28 (version 3)
0	1	0	System type 3 (reserved)
	.		.
	.		.
	.		.
1	1	1	System type 8 (reserved)

RT-MM protocol version (octet 3)

Shows the RT-MM protocol version held by PS.

Bit 3	2	1	
0	0	0	Version 1 (RCR STD-28 (version 1))
0	0	1	Version 2 (RCR STD-28 (version 2))
0	1	0	Version 3 (RCR STD-28 (version 3))
0	1	1	Version 4 (RCR STD-28 (version 4))
1	0	0	Version 5 (RCR STD-28 (version 5))
1	0	1	Version 6 (reserved)
	.		.
	.		.
1	1	1	Version 8 (reserved)

Notification of usable band (octet 4)

This element notifies usable frequency band for the PS.

Bit 5	Bit 4	
0	0	Frequency band which is specified by RCR STD-28 version 1/version 2 /version 3.
0	1	In case of public system, corresponds to the frequency band specified by RCR STD-28 version 3 Rev.-1 or newer version. In case of private sysytem, corresponds to the frequency band specified by RCR STD-28 version 3.2 or newer version.
1	0	In case of public system, corresponds to the frequency band specified by RCR STD-28 version 4 or newer version. For the case of private system, reserved
1	1	reserved

(Note) CS is expected to have the usable band which is informed from the PS.

<u>Area information notification status number (octet 4)</u>

This element indicates that PS does not hold the area information, or it indicates the notification status number of the area information which the PS holds.

Bit 3	Bit 2	Bit 1	
0	0	0	Does not hold area information
0	0	1	Status number 1
	.		.
	.		.
	.		.
1	1	1	Status number 7

4.3.4.1.3 Link channel assignment (Private standard/Public standard)

After there is a link channel establishment request from PS, CS uses this message to perform channel assignment in response to PS. Further, before this message is transmitted, CS needs to confirm that it is possible to provide the LCH protocol type and LCH type that are requested by PS. The message format is shown in Table 4.3.11 and the explanation of each information element is shown in Table 4.3.12.

Table 4.3.11 Link channel assignment message

Message type : Link channel assignment
Direction : CS —> PS (downlink)
Function channel : SCCH

<table>
<tr><th>Octet \ Bit</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th></tr>
<tr><td>1</td><td>Re-served</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td></td><td></td><td colspan="7">Message type</td></tr>
<tr><td>2</td><td colspan="3">LCH type</td><td colspan="2">Reserved</td><td colspan="3">Extension LCH protocol type</td></tr>
<tr><td>3</td><td colspan="2">CC protocol type</td><td>Re-served</td><td colspan="5">Relative slot number</td></tr>
<tr><td>4</td><td colspan="8">Carrierber number n_f (note)</td></tr>
<tr><td>5</td><td colspan="6"></td><td colspan="2">Absolute slot number</td></tr>
</table>

(Note) Frequency band which is available for the PS, should be specified.

Table 4.3.12 Information elements in link channel assignment message

<u>LCH type (octet 2)</u>

Bit 8	7	6	
0	0	0	Standard (π /4 shift QPSK 32 kbit/s)
0	0	1	Reserved (pirvate)/Standard (π /4 shift QPSK 16 kbit/s) (public)
0	1	0	Reserved
0	1	1	Reserved (private)/ Standard (π /2 shift BPSK 16 kbit/s) (public)
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Option (private)/Reserved (public)
1	1	1	Option (private)/Reserved (public)

<u>Extension LCH protocol type (octet 2)</u>

If reserved (1 0) or reserved (1 1) is set in the LCH protocol type (octet 2) of the link channel establishment (re-) request message, all areas are reserved. If set to option (1 1), all areas are optional.

If the LCH protocol type is standard (0 0) or standard (0 1), it is as follows.

Bit 3	
0	Notification information reception indication absent
1	Notification information reception indication present

Bit 2	
0	RT function request absent
1	RT function request present

Bit 1	
0	MM function request absent
1	MM function request present

Notification information reception indication absent: PS cannot request notification information from CS by definition information request message in service channel establishment phase.

Notification information reception indication present: PS must request notification information from CS by definition information request message in service channel establishment phase.

RT/MM function request absent: RT/MM function request may not be transmitted in service channel establishment phase.

RT/MM function request present: RT/MM function request must be transmitted in service channel establishment phase.

CC protocol type (octet 3)

This element is all reserved when standard (0 1) or reserved (1 0) or reserved (1 1) is set in the LCH protocol type (octet 2) of the link channel establishment (re-) request message. If option (1 1) is set, all areas are optional.

When the LCH protocol type is standard (0 0), it is as follows.

Bit 8	
0	Dial signal en-bloc transmission
1	Dial signal overlap transmission (reserved in public system)

Otherwise, all regions are reserved.

Dial signal en-bloc transmission : Dial signal must be en-bloc transmitted by SETUP.

Dial signal overlap transmission : Dial signal can be overlap transmitted by INFOrmation.

Relative slot number (octet 3)

Bit

5	4	3	2	1	
0	0	0	0	0	Relative slot number = 1
0	0	0	0	1	Relative slot number = 2
		.			.
		.			.
1	1	1	1	1	Relative slot number = 32

(Note) For the relative slot number designation method, refer to section 4.2.8.

Carrier number n_f (octet 4)

Bit

8	7	6	5	4	3	2	1	(carrier number)
0	0	0	0	0	0	0	0	Reserved
0	0	0	0	0	0	0	1	First carrier (1,895.15 MHz)
0	0	0	0	0	0	1	0	Second carrier (1,895.45 MHz)
			.					.
			.					.
0	1	0	1	0	0	1	0	Eighty second carrier (1,919.45 MHz)
0	1	0	1	0	0	1	1	Reserved
			.					.
			.					.
1	1	0	1	1	1	0	0	Reserved
1	1	0	1	1	1	0	1	Two hundreds twenty first carrier (1,884.65MHz)
1	1	0	1	1	1	1	0	Two hundreds twenty second carrier (1,884.95MHz)
			.					.
1	1	1	1	1	1	1	1	Two hundreds fifty fifth carrier (1,894.85 MHz)

<u>Absolute slot number (octet 5)</u>

Bit
2 1

0 0 Shows that the relevant link channel assignment message was transmitted on the 1st TDMA slot.
0 1 Shows that the relevant link channel assignment message was transmitted on the 2nd TDMA slot.
1 0 Shows that the relevant link channel assignment message was transmitted on the 3rd TDMA slot.
1 1 Shows that the relevant link channel assignment message was transmitted on the 4th TDMA slot.

(Note) If LCH type (octet 2) of the link channel establishment (re-) request message is standard (0 0 0), the TDMA slot number of the communications carrier is obtained by the following equation.

TDMA slot number of communications carrier = {(absolute slot number + relative slot number-2) MOD 4} + 1

4.3.4.1.4 Link channel assignment reject (Private standard/Public standard)

CS uses this message to inform that channel setup is not possible in response to a link channel (re-)request from PS. CS can indicate the reject reason in this message, such as that there is no free radio channel, LCH protocol type or LCH type request cannot be satisfied, etc. The message format is shown in table 4.3.13, and the explanation of information elements is shown in table 4.3.14.

Table 4.3.13 Link channel assignment reject message

Message type : Link channel assignment reject
Direction : CS —> PS (downlink)
Function channel : SCCH

Octet \ Bit	8	7	6	5	4	3	2	1
1	Re-served	0	0	0	0	0	1	0
		Message type						
2	Reject reason							
3	Reserved							
4	Option							
5							Option	

Table 4.3.14 information elements of link channel assignment reject message

Reject reason (octet 2)

Bit

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Reserved
0	0	0	0	0	0	0	1	All CS slots in use
0	0	0	0	0	0	1	0	No CS free channel
0	0	0	0	0	0	1	1	No free outgoing line on wired side
0	0	0	0	0	1	0	0	LCH type disagreement
0	0	0	0	0	1	0	1	LCH protocol disagreement
0	0	0	0	0	1	1	0	Extension LCH protocol disagreement
0	0	0	0	0	1	1	1	CC protocol disagreement
0	0	0	0	1	0	0	1	Traffic restriction
0	0	0	0	1	0	1	0	Relevant CS use impossible (zone selection impossible)
0	0	0	0	1	0	1	1	RT-MM protocol version disagreement
0	0	0	0	1	1	0	0	Reserved
			.					
			.					
0	1	1	1	1	1	1	1	Reserved
				Other				Option

All CS slots in use: Shows that in response to link channel establishment (re-)request transmitted by PS, CS has no resources (slots) that should be assigned.

No CS free channel: Shows that in response to link channel establishment (re-)request transmitted by PS, CS does not have radio channel resources (traffic channels) that should be assigned.

No free outgoing line on wired side: Shows that in response to link channel establishment (re-)request transmitted by PS, CS does not have resources on wired side(outgoing lines) that should be assigned.

LCH type disagreement: Shows that CS does not have LCH type that can be used in common with the PS that transmitted the link channel establishment (re-)request.

LCH protocol disagreement: Shows that CS does not have the LCH protocol (including system type) that can be used in common with the PS that transmitted the link establishment (re-)request.

Extension LCH protocol disagreement: Shows that CS does not have the extension LCH protocol that can be used in common with the PS that transmitted the link establishment (re-)request.

CC protocol disagreement: Shows that CS does not have the CC protocol that can be used in common with the PS that transmitted the link establishment (re-)request.

Traffic restriction:	Shows that because CS is under traffic restriction, the link channel cannot be assigned.
Relevant CS use impossible (zone selection impossible):	Shows that relevant CS cannot be used.
RT-MM protocol version disagreement:	Shows that CS does not have the RT-MM protocol version that can be used in common with the PS that transmitted the link channel establishment (re-)request.

4.3.4.1.5 Link channel establishment re-request (Private standard/Public standard)

After a link channel assignment message is received from CS, PS can use this message to halt the link channel establishment sequence and re-request CS for link channel establishment. The message format is shown in Table 4.3.15 and the explanation of information elements in Table 4.3.16.

Table 4.3.15 Link channel establishment re-request message

Message type : Link channel establishment re-request
Direction : PS —> CS (uplink)
Function channel : SCCH

<table>
<tr><td>Octet \ Bit</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Re-served</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td colspan="7">Message type</td></tr>
<tr><td>2</td><td colspan="3">LCH type</td><td colspan="2">LCH protocol type</td><td colspan="3">Extension LCH protocol type</td></tr>
<tr><td>3</td><td colspan="2">CC protocol type</td><td colspan="3">System type</td><td colspan="3">RT-MM protocol version</td></tr>
<tr><td>4</td><td colspan="5">Cause</td><td colspan="3">Area information notification status number</td></tr>
<tr><td>5</td><td colspan="6"></td><td colspan="2">Option</td></tr>
</table>

Table 4.3.16 Information elements in link channel establishment re-request message

LCH type (octet 2)

Bit 8	7	6	
0	0	0	Standard (π /4 shift QPSK 32 kbit/s)
0	0	1	Reserved
0	1	0	Reserved
0	1	1	Reserved (pirvate)/Standard (π /4 shift QPSK 32 kbit/s or 16 kbit/s) (public)
1	0	0	Reserved (private)/ Standard (π /4 shift QPSK 32 kbit/s or 16 kbit/s or π /2 shift BPSK 16 kbit/s) (public)
1	0	1	Reserved
1	1	0	Option (private)/reserved (public)
1	1	1	Option (private)/reserved (public)

LCH protocol type (octet 2)

Bit 5	4	
0	0	Standard (service channel used)
0	1	Standard (service channel not used)
1	0	Reserved
1	1	Option (private)/reserved (public)

Extension LCH protocol type (octet 2)

If reserved (1 0) or reserved (1 1) is set in the LCH protocol type (octet 2), all areas of this element become reserved. If option (1 1) is set, all areas are optional.

If the LCH protocol type is standard (0 0) or standard (0 1), it is as follows.

Bit 2	
0	RT function request absent
1	RT function request present

Bit 1	
0	MM function request absent
1	MM function request present

All other areas are reserved.

RT/MM function request absent: Notifies that RT/MM function request is not transmitted in service channel establishment phase.

RT/MM function request present: Notifies that RT/MM function request is transmitted in service channel establishment phase.

CC protocol type (octet 3)

This element is all reserved when standard (0 1) or reserved (1 0) or reserved (1 1) is set in the LCH protocol type (octet 2). When option (1 1) is set, all areas are optional.

When the LCH protocol type is standard (0 0), it is as follows.

Bit 8	
0	Dial signal en-bloc transmission
1	Dial signal overlap transmission (reserved in public system)

Otherwise, all regions are reserved.

Dial signal en-bloc transmission: Requests that dial signal be en-bloc transmitted by SETUP.

Dial signal overlap transmission: Requests that dial signal be overlap transmitted by INFOrmation.

System type (octet 3)

Shows system type required by PS.

Bit 6	5	4	
0	0	0	Public system (including private system based on RCR STD-28 (version 1)
0	0	1	Private system based on RCR STD-28 (version 2) or RCR STD-28 (version 3)
0	1	0	System type 3 (Reserved)
	.		
	.		
	.		
1	1	1	System type 8 (Reserved)

RT-MM protocol version (octet 3)

Shows RT-MM protocol version held by PS.

Bit 3	2	1	
0	0	0	Version 1 (RCR STD-28 (version 1))
0	0	1	Version 2 (RCR STD-28 (version 2))
0	1	0	Version 3 (RCR STD-28 (version 3))
0	1	1	Version 4 (RCR STD-28 (version 4))
1	0	0	Version 5 (RCR STD-28 (version 5))
1	0	1	Version 6 (reserved)
	.		.
	.		.
1	1	1	Version 8 (reserved)

Cause (octet 4)

Bit 8	7	6	5	4	
0	0	0	0	0	Reserved
0	0	0	0	1	Reserved
0	0	0	1	0	Reserved
0	0	0	1	1	Reserved
0	0	1	0	0	Reserved
0	0	1	0	1	Reserved
0	0	1	1	0	Assigned channel use not possible (shows that assigned channel cannot be used due to interference etc.)
0	0	1	1	1	Assigned channel non-corresponding PS (shows that it is not the radio station that corresponds to the assigned channel.)
0	1	0	0	0	Assigned carrier non-corresponding PS (shows that it is not the radio station that corresponds to the assigned carrier.)
0	1	0	0	1	Reserved
		.			.
		.			.
1	1	1	1	1	Reserved
		Other			Option

Area information notification status number (octet 4)

This element indicates that PS does not hold the area information, or it indicates the notification status number of the area information which the PS holds.

Bit			
3	2	1	
0	0	0	Does not have area information
0	0	1	Status number 1
	.		.
	.		.
1	1	1	Status number 7

4.3.4.2 Broadcasting messages (Private standard/Public standard)

4.3.4.2.1 Radio channel information broadcasting message (Private standard/Public standard)

CS must broadcast the radio channel structure to PS using this message. The message format is shown in Table 4.3.17, and the information element explanations are shown in Table 4.3.18.

Furthermore, refer to section 4.2.7 for the relationship between the information elements of this message and the superframe structure.

Table 4.3.17 Radio channel information broadcasting message

Message type : Radio channel information broadcasting
Direction : CS —> PS (downlink)
Function channel : BCCH

Octet \ Bit	8	7	6	5	4	3	2	1
1	Re-served	0	0	0	1	0	0	1
		Message type						
2	LCCH interval value n*							
3	Paging grouping factor n_{GROUP}*					Paging area number length n_p*		
4	Re-served	2nd system information broadcasting usage method*/reserved (note 3)	Number of same paging groups n_{SG}*			Battery saving cycle maximum value n_{BS}*		
5	n_{offset}		Number of PCHs n_{PCH}*			Frame basic unit length n_{SUB}*		
6	n_{offset}							
7	Absolute slot number		Broadcasting status indication			Uplink LCCH timing*	Control carrier structure	
8			Option /Odd-even ID bit (note 2)	Option /Odd-even ID desig-nation bit (note 2)	Global definition information pattern *			

(Note 1) Among the information elements of this message, those marked with a * are global definition information elements, and others are local definition information elements.
(Note 2) This information element is optional only in a private system.
(Note 3) This information element is only for private systems. It is reserved for public systems.

Table 4.3.18 Information elements in radio channel information broadcasting message

LCCH interval value n (octet 2)
Shows the downlink LCCH slot intermittent cycle.

Bit

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Reserved
0	0	0	0	0	0	0	1	n = 1
0	0	0	0	0	0	1	0	n = 2
0	0	0	0	0	0	1	1	n = 3
			.					.
			.					.
0	0	0	1	0	1	0	0	n = 20 (public standard)
			.					.
			.					.
1	1	1	1	1	1	1	1	n = 255

(Note) n _ 25 in private system.

Paging grouping factor n_{GROUP} (octet 3)

Shows the value corresponding to the number of group divisions of PCH information.

Bit

8	7	6	5	
0	0	0	0	LCCH superframe is not constructed (option)
0	0	0	1	$n_{GROUP} = 1$
0	0	1	0	$n_{GROUP} = 2$
	.			.
	.			.
1	1	1	1	$n_{GROUP} = 15$

(Note 1) For public standards, refer to Table 4.3.19.
(Note 2) If LCCH is multiplexed, the values of n_{PCH} and n_{GROUP} are set such that the paging group number does not exceed 127.

Paging area number length n_p (octet 3)

In a private system, it shows the bit length of the paging area number information element in the system information broadcasting message or the bit length of paging area number within the additional ID when the fixed paging area method with the additional ID is used. In a public system, it shows the bit length of the paging area number included in the CS-ID.

(Refer to section 4.2.10.2 and section 4.3.4.2.2)

Bit

4	3	2	1	(Private)	(Public)
0	0	0	0	Option	Reserved
0	0	0	1	Option	n_p = 4
0	0	1	0	Option	n_p = 6
0	0	1	1	n_p = 8	n_p = 8
0	1	0	0	n_p = 10	n_p = 10
0	1	0	1	n_p = 12	n_p = 12
0	1	1	0	n_p = 14	n_p = 14
0	1	1	1	n_p = 16	n_p = 16
1	0	0	0	n_p = 0(note 1)	n_p = 17
1	0	0	1	n_p = 1	n_p = 18
1	0	1	0	n_p = 5	n_p = 19
1	0	1	1	n_p = 9	n_p = 20
1	1	0	0	n_p = 13(note 2)	n_p = 21
1	1	0	1	Reserved	n_p = 22
1	1	1	0	Reserved	n_p = 23
1	1	1	1	Reserved	n_p = 24

(Note 1) "n_p = 0" indicates that the triggers of location registration procedure are only the followings; PS initializing by Power ON, area condition recovering from out of zone, system mode switching from a public system or another private system to the current private system. While PSs move within the same system after the last location registration, re-registration is not needed.

(Note 2) Indicate the followings when CSs notify that the system uses the fixed paging area method with the additional ID: All bits of the additional ID are assigned to discriminate the boundary of paging area; PSs must perform re-registration to every new CSs.

(Note 3) If handover between paging areas is executed, n_p must be the same even in a different paging area.

(Note 4) In private system, if the option is selected for paging area number length n_p, the global definition information elements are handled as the local definition information elements.

2nd system information broadcasting usage method (octet 4)

This information element is used only in private systems, and is reserved in public systems.

Bit

7	
0	2nd system information broadcasting usage method is in according to the method indicated by RCR STD-28 (version 1)
1	2nd system information broadcasting usage method is according to the method indicated by RCR STD-28 (version 2) to follow thereafter.

Number of same paging groups n_{SG} (octet 4)

Shows the number of PCH slots belonging to the same paging group in the LCCH superframe.

Bit

6	5	4	
0	0	0	LCCH superframe is not constructed (option)
0	0	1	n_{SG} = 1 (public standard)
	.		.
	.		.
1	1	1	n_{SG} = 7

Battery saving cycle maximum value n_{BS} (octet 4)

Shows the number of times CS continuously sends the same paging signal to the paging group.

Bit

3	2	1	
0	0	0	LCCH superframe is not constructed (option)
0	0	1	n_{BS} = 1 (public standard)
.			.
.			.
1	1	1	n_{BS} = 7

n_{offset} (octets 5, 6)

When the control carrier structure is (0 1) and (1 0) in a private system, or (1 0) in a public system, this information element shows that the other control slots are transmitted in any of absolute slot numbers 1, 2, 3, 4 of the TDMA frame after 5 x $n_{1offset}$ ms.

In a private system, when the control carrier structure is (0 0) and (1 1), all areas are optional.
In a public system, when the control carrier structure is not (1 0), all areas are reserved.

Bit (octet 5)

8	7	
0	0	Shows that the absolute slot number is the 1st slot position.
0	1	Shows that the absolute slot number is the 2nd slot position.
1	0	Shows that the absolute slot number is the 3rd slot position.
1	1	Shows that the absolute slot number is the 4th slot position.

Bit (octet 6)

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	$n_{1offset}$ = 0
0	0	0	0	0	0	0	1	$n_{1offset}$ = 1
0	0	0	0	0	0	1	0	$n_{1offset}$ = 2
0	0	0	0	0	0	1	1	$n_{1offset}$ = 3
	.							.
	.							.
1	1	1	1	1	1	1	1	$n_{1offset}$ = 255

(Note) The time from the local control slot to the other control slot is given by the following equation.

Δt = 5 x $n_{1offset}$ ms + 0.625 x (absolute slot number of other control slot - absolute slot number of local control slot) ms

Number of PCHs n_{PCH} (octet 5)

Shows the number of PCHs in the frame basic unit.

Bit

6	5	4	
0	0	0	No PCHs (option)
0	0	1	1 PCH slot in frame basic unit (n_{PCH} = 1)
	.		.
	.		.
1	1	1	7 PCH slots in frame basic unit (n_{PCH} = 7)

(Note 1) For public standards, refer to Table 4.3.19.
(Note 2) If LCCH is multiplexed, the values of n_{PCH} and n_{GROUP} are set such that the paging group number does not exceed 127.

Frame basic unit length n_{SUB} (octet 5)

Shows the length of the LCCH superframe structural element (frame basic unit).

Bit

3	2	1	
0	0	0	Option
0	0	1	n_{SUB} = 1
	.		.
	.		.
1	1	1	n_{SUB} = 7

(Note) For public standards, refer to Table 4.3.19.

Absolute slot number (octet 7)

Bit

8	7	
0	0	Shows that the relevant message was transmitted on the 1st TDMA slot.
0	1	Shows that the relevant message was transmitted on the 2nd TDMA slot.
1	0	Shows that the relevant message was transmitted on the 3rd TDMA slot.
1	1	Shows that the relevant message was transmitted on the 4th TDMA slot.

Broadcasting status indication (octet 7)

Shows the presence or absence of information broadcasting messages other than radio channel information broadcasting message sent on the relevant LCCH.

Bit			
6	5	4	
x	x	1/0	System information broadcasting present/absent
x	1/0	x	2nd system information broadcasting present/absent
1/0	x	x	Option information broadcasting (private) or 3rd system information broadcasting (public) present/absent
			x: Don't care

Uplink LCCH timing (octet 7)

Shows the uplink LCCH timing which can be used by the relevant CS.

Bit	
3	
0	CS, being on the presently-used carrier, can receive the uplink LCCH only in the uplink slot 2.5 ms after the presently-used downlink LCCH.
1	CS, being on the presently-used carrier, can also receive the uplink LCCH shown below in addition to the uplink slot 2.5 ms after the presently-used downlink LCCH.

(a) Private system
Uplink LCCH timing has the following meanings in combination with the control carrier structure (octet 7, bits 2, 1).

Bit			
3	2	1	
-	0	0	Shows that only 1 frequency is used as the carrier that constitutes LCCH.
0	0	0	CS, being on the presently-used carrier, can receive the uplink LCCH only in the uplink slot 2.5 ms after the presently-used downlink LCCH.
1	0	0	CS, being on the presently-used carrier, can receive the uplink LCCH in the uplink slot every 5 ms corresponding to the TDMA slot where the presently-used downlink LCCH is located.
-	0	1	Shows that 2 frequencies are used, and each LCCH is independent.
0	0	1	CS, being on the presently-used carrier, can receive the uplink LCCH only in the uplink slot 2.5 ms after the presently-used downlink LCCH.
1	0	1	Being on the presently-used carrier, the TDMA frame 2.5 ms after the presently-used downlink LCCH is defined as the 1st TDMA frame. Counting from this 1st TDMA frame, the uplink slots every 2 TDMA frames (10 ms) corresponding to the odd-numbered TDMA frames are used (even-numbered TDMA frames are used for other carriers). However, in this case, the LCCH interval value (n) must be an even number.
-	1	0	Shows that 2 frequencies are used, and the PCH paging groups are inter-related.
0	1	0	CS, being on the presently-used carrier, can receive the uplink LCCH only in the uplink slot 2.5 ms after the presently-used downlink LCCH.
1	1	0	Being on the presently-used carrier, the TDMA frame 2.5 ms after the presently-used downlink LCCH is defined as the 1st TDMA frame. Counting from this 1st TDMA frame, the uplink slots every 2 TDMA frames (10 ms) corresponding to the odd-numbered TDMA frames are used(even-numbered TDMA frames are used for other carriers).However, in this case, the LCCH interval value (n) must be an even number.
x	1	1	Option
			x: Don't care

(b) Public system

Uplink LCCH timing has the following meanings in combination with the control carrier structure (octet 7, bits 2, 1).

Bit 3	2	1	
-	0	0	Shows that only 1 LCCH is used.
0	0	0	CS, being on the presently-used carrier, can receive the uplink LCCH only in the uplink slot 2.5 ms after the presently-used downlink LCCH.
1	0	0	CS, being on the presently-used carrier, can receive the uplink LCCH in the uplink slot every 5 ms corresponding to the TDMA slot where the presently-used downlink LCCH is located.
-	0	1	Shows that 2 LCCHs are used, and each LCCH is independent.
0	0	1	CS, being on the presently-used carrier, can receive the uplink LCCH only in the uplink slot 2.5 ms after the presently-used downlink LCCH.
1	0	1	Being on the presently-used carrier, the TDMA frame 2.5 ms after the presently-used downlink LCCH is defined as the 1st TDMA frame. Counting from this 1st TDMA frame, the uplink slots every 2 TDMA frames (10ms) corresponding to the odd-numbered TDMA frames are used (even-numbered TDMA frames are used for other carriers). However, in this case, the LCCH interval value (n) must be an even number.
-	1	0	Shows that 2 LCCHs are used, and the PCH paging groups are inter-related.
0	1	0	CS, being on the presently-used carrier, can receive the uplink LCCH in the uplink slot 2.5 ms after the presently-used downlink LCCH. However, [1] During handover, CS can receive the first link channel establishment request message in the uplink slot 2.5 ms after any downlink LCCH. [2] Otherwise, CS can receive uplink LCCH only in the uplink slot 2.5 ms after a downlink LCCH in which the relevant PS paging group and the paging group specified by the odd-even identification bit agree. In either case, during retry request processing, CS can only receive with the same LCCH uplink timing.
1	1	0	CS, being on the presently-used carrier, can receive the uplink LCCH in the uplink slot every 5 ms corresponding to the TDMA slot where the presently-used downlink LCCH is located. However, [1] During handover, CS can receive the first link channel establishment request message in the uplink slot every 5 ms corresponding to the TDMA slot where any downlink LCCH is located. [2] Otherwise, CS can receive LCCH in the uplink slot every 5 ms corresponding to the TDMA slot where the downlink LCCH is located, in which the relevant PS paging group and the paging group specified by the odd-even identification bit agree. In either case, during retry request processing, CS can only receive with the same LCCH uplink timing.
Other			Reserved

(Note) If handover between paging areas is executed, the uplink LCCH timing must be the same even in a different paging area.

Control carrier structure (octet 7)

Shows the presence or absence of a mutual relationship between paging group and number of LCCHs used by the relevant CS.

Bit 2	1	
0	0	Shows that only 1 LCCH is used.
0	1	Shows that 2 LCCHs are used, and each individual LCCH is independent. (In private system, 2 frequencies are used; reserved in public system)
1	0	Shows that 2 LCCHs are used, and PCH paging groups are mutually related. (In private system, 2 frequencies are used; in public system, 1 frequency is used)
1	1	Option (private) /Reserved (public)

Refer to section 4.2.7.3 for control carrier structure.

Odd-even identification bit (octet 8)

(a) This information element has the following meanings if (1 0) (shows that there is a mutual relationship between PCH paging groups) is set in the control carrier structure (octet 7) information element contained in the radio channel information broadcasting message, and if "1" is set in the odd-even identification designation bit.

Bit 6	
0	Shows LCCH which transmits even-numbered paging groups.
1	Shows LCCH which transmits odd-numbered paging groups.

(b) In cases other than the above, it has the following meanings.

Bit 6	
0	Reserved
1	Reserved

Odd-even identification designation bit (octet 8)

Bit 5	
0	Control carrier structure is not (1 0)
1	Control carrier structure is (1 0)

Global definition information pattern (octet 8)

Informs the global definition information pattern in the relevant bit area to PS.

Bit 4	3	2	1		
0	0	0	0	Global definition information pattern	(0)
0	0	1	0	Global definition information pattern	(1)
	.			.	
	.			.	
	.			.	
1	1	1	0	Global definition information pattern	(7)
	Other			Reserved	

[The LCCH structure parameters in public system]

Table 4.3.19 Obtainable values of n_{SUB}, n_{GROUP}, n_{PCH} in public system

n_{SUB}	n_{GROUP}	n_{PCH}						
		1	2	3	4	5	6	7
2	6	O	X	X	X	X	X	X
3	4	O	O	X	X	X	X	X
4	3	O	O	O	X	X	X	X
6	2	O	O	O	O	O	X	X

O: Valid value for n_{PCH}
X: Invalid value for n_{PCH}

From the basis shown below, the values of frame basic unit length (n_{SUB}), paging grouping factor (n_{GROUP}) and number of PCHs (n_{PCH}) can be any of those shown in Table 4.3.19.

(1) The LCCH superframe cycle is 1.2 seconds.

(2) The LCCH interval value (n) is n = 20.

(3) The battery saving cycle maximum value (n_{BS}) is n_{BS} = 1.

(4) The number of same paging groups (n_{SG}) is n_{SG} = 1.

(5) The frame basic unit length (n_{SUB}) and paging grouping factor (n_{GROUP}) are natural values such that n_{SUB} x n_{GROUP} = 12.

(6) The number of PCHs (n_{PCH}) is a natural number such that $n_{SUB} > n_{PCH}$.

(7) n_{PCH} and n_{SUB} are each natural numbers equal to 7 or less, and n_{GROUP} is a natural number equal to 15 or less.

[The LCCH structure parameters in private system]

The range of the LCCH structure parameters in private system are as follows.

(1) The battery saving time on PS maximum value is equal to 2.5 seconds or less.
$5\text{ms} \times n \times n_{SUB} \times n_{GROUP} \times n_{BS} \leqq 2{,}500\text{ms}$

(2) The LCCH interval value (n) is $25 \leqq n \leqq 60$.

(3) $n_{GROUP} \times n_{PCH} \times 2 \leqq 8$: In case where the PCH paging group are mutually related in the 2 LCCH structure.
$n_{GROUP} \times n_{PCH} \leqq 8$: In case where the PCH paging group are not mutually related in either the 1 LCCH or the 2 LCCH structure.

(4) n_{SUB} is natural number equal to 6 or less, and n_{GROUP} and n_{BS} are each natural number equal to 4 or less.

(5) The number of PCHs (n_{PCH}) is a natural number such that $n_{SUB} > n_{PCH}$.

4.3.4.2.2 System information broadcasting message (Private standard/Public standard)

Using this message, CS can broadcast restriction information such as congestion control to PS. The message format is shown in Table 4.3.20 and the explanation of elements is shown in Table 4.3.21.

Table 4.3.20 System information broadcasting message

Message type : System information broadcasting
Direction : CS —> PS (downlink)
Function channel : BCCH

<table>
<tr><th>Bit / Octet</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th></tr>
<tr><td>1</td><td>Re-
served</td><td colspan="7">0 0 0 1 0 1 0
Message type</td></tr>
<tr><td>2</td><td colspan="3">(0 0 0)
LCH type</td><td colspan="2">(0 0)
LCH protocol type</td><td colspan="3">(0 1 1)
Extension LCH protocol type</td></tr>
<tr><td>3</td><td colspan="2">(0 0)
CC protocol type</td><td colspan="6">(0 0 0 0 0 0)
CS information</td></tr>
<tr><td>4</td><td colspan="8">(0 0 0 0 0 0 0 1)
Paging area number/RT-MM protocol version (note 2)</td></tr>
<tr><td>5</td><td colspan="8">(0 0 0 0 0 0 0 0)
Paging area number/Restriction group designation
(note 2) (note 3)</td></tr>
<tr><td>6</td><td colspan="4">(0 0 0 0)
Radio channel usage restriction information</td><td colspan="4">(0 0 0 0)
Access cycle interval</td></tr>
<tr><td>7</td><td colspan="2">(Undecided)
Absolute slot number</td><td colspan="3">(Undecided)
Broadcasting message status number m1</td><td>(0)
Re-
served</td><td colspan="2">(0 0)
Octet 4, 5 usage designation</td></tr>
<tr><td>8</td><td colspan="2"></td><td colspan="6">(Undecided)
Broadcasting reception indication</td></tr>
</table>

(Note 1) This is a local definition information element. In parentheses are the default values for public system.
(Note 2) The usage method of this information element is specified by "octet 4, 5 usage designation" (octet 7).
(Note 3) When this message is transmitted by a private system, this information element (octet 5) may be used for both paging area number and restriction group designation. Also, when this message is transmitted by a public system, this information element (octet 5) is all used as a restriction control group designation.

Table 4.3.21 Information elements of system information broadcasting message

LCH type (octet 2)

Bit 8	7	6	
0	0	0	Standard (π /4 shift QPSK 32 kbit/s)
0	0	1	Reserved
0	1	0	Reserved
0	1	1	Reserved
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Option (private)/Reserved (public)
1	1	1	Option (private)/Reserved (public)

LCH protocol type (octet 2)

Bit 5	4	
0	0	Standard (either link channel only or service channel can be used.)
0	1	Reserved
1	0	Reserved
1	1	Option (private)/Reserved (public)

Extension LCH protocol type (octet 2)

If reserved (0 1), reserved (1 0) or reserved (1 1) is set in LCH protocol type (octet 2), all areas of this element are reserved. If option (1 1) is set, all areas are optional.

If the LCH protocol type is standard (0 0), it is as follows.

Bit 2	
0	RT function request mandatory
1	RT function request omittable

Bit 1	
0	MM function request mandatory
1	MM function request omittable

Otherwise, all areas are reserved.

RT/MM function request mandatory:	Shows that RT/MM function request must be performed in service channel establishment phase.
RT/MM function request omittable :	Shows that RT/MM function request can be omitted in service channel establishment phase.

CC protocol type (octet 3)

This element is all reserved when reserved (0 1) , reserved (1 0) or reserved (1 1) is set in the LCH protocol type (octet 2). If option (1 1) is set, all areas are optional.

When the LCH protocol type is standard (0 0), it is as follows.

Bit
8
0 Dial signal en-bloc transmission mandatory
1 Dial signal overlap transmission possible (reserved in public system)

Otherwise, all regions are reserved.

Dial signal en-bloc transmission mandatory:	Shows that dial signal must be en-bloc transmitted by SETUP.
Dial signal overlap transmission possible:	Shows that dial signal can be either en-bloc transmitted by SETUP, or overlap transmitted by INFOrmation.

CS information (octet 3)

This reports the CS type. Its contents are CS service attributes (general CS, non-origination-exclusive station, etc.).

Bit
5
0 Relevant CS available (zone selection possible)
1 Relevant CS not available (zone selection impossible)

Bit
4
0 Non-SD-write CS
1 SD-write CS (reserved in public system)

Bit
3
0 Non-specified-user-service CS
1 Specified-user-service CS (reserved in public system)

Bit
2
0 Non-originating-exclusive CS (reception standby zone selection possible)
1 Originating-exclusive CS (reception standby zone selection impossible) (reserved in public system)

Bit
1
0 General CS
1 Priority CS (reserved in public system)

Other bits are all reserved.

- Relevant CS not available : PS selects relevant zone, and cannot wait for relevant CS for call originating, receiving and location registration.
- SD-write CS : CS that performs SD write.
- Specified-user-service CS : CS that takes priority in call connection to PS that has specified-user attribute.
- Originating-exclusive CS : CS that does not perform paging.
- Priority CS : CS that takes priority in call connection to PS that has priority attribute.

Method of use of octet 4 and octet 5

The method of use of octet 4 and octet 5 of the system information broadcasting message in a private system is specified by the paging area number length n_p reported by the radio channel information broadcasting message and the octet 4, 5 usage designation reported by the system information broadcasting message.

(1) When n_p = option

"Octet 4, 5 usage designation (octet 7)": All areas optional.

Octet 4, 5: All areas optional.

(2) When $n_p = 0$

"Octet 4, 5 usage designation (octet 7)" is (00). "$n_p = 0$" indicates that the triggers of location registration procedure are only the followings; PS initializing by Power ON, area condition recovering from out of zone, system mode switching from a public system or another private system to the current private system. While PSs move within the same system after the last location registration, re-registration is not needed.

Octet 4: RT-MM protocol version
Octet 5: Restriction group designation

(3) When $8 > n_p > 0$

"Octet 4, 5 usage designation (octet 7)" must be (01) or (10).

- When "Octet 4, 5 usage designation (octet 7)" is (01)

Octet 4: Bit ($9-n_p$) through bit 8 is paging area number, and other is reserved.
Octet 5: Restriction group designation

- When "Octet 4, 5 usage designation (octet 7)" is (10)

Octet 4: RT-MM protocol version
Octet 5: Bit ($9-n_p$) through bit 8 is the paging area number, and other is reserved

(4) When n_p = 8

"Octet 4, 5 usage designation (octet 7)" must be (0 1) or (1 0).

• When "Octet 4, 5 usage designation (octet 7)" is (0 1)

Octet 4: Paging area number
Octet 5: Restriction group designation

• When "Octet 4, 5 usage designation (octet 7)" is (1 0)

Octet 4: RT-MM protocol version
Octet 5: Paging area number

(5) When 16 > n_p > 8

"Octet 4, 5 usage designation (octet 7)" must be (0 1).

Octet 4: Paging area number

Octet 5: Bit 1 through bit (16 - n_p) is the restriction group designation. Other is the paging area number.

(6) When n_p = 16

"Octet 4, 5 usage designation (octet 7)" must be (0 1).

Octet 4, 5: Paging area number

(7) When n_p = reserved

"Octet 4, 5 usage designation (octet 7)" : All areas are reserved.

Octets 4, 5: All areas reserved

(Example) When n_p = 12

Octet \ Bit	8	7	6	5	4	3	2	1
4	Paging area number 2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}
5	Paging area number 2^{3}	2^{2}	2^{1}	2^{0}	Restriction group designation (note)			

(Note) (Relevant PS's restriction group) = (PS number) MOD (number of restriction groups) + 1.

When n_p = 5, "Octet 4, 5 usage designation (octet 7)" is (01)

Octet \ Bit	8	7	6	5	4	3	2	1
4	Paging area number 2^4	2^3	2^2	2^1	2^0	Reserved 0	0	0
5	Restriction group designation (note)							

(Note) (Relevant PS's restriction group) = (PS number) MOD (number of restriction groups)+1.

When n_p = 5, "Octet 4, 5 usage designation (octet 7)" is (10)

Octet \ Bit	8	7	6	5	4	3	2	1
4	RT-MM protocol version							
5	Paging area number 2^4	2^3	2^2	2^1	2^0	Reserved 0	0	0

Paging area number (octet 4, 5)

When paging area type in the 2nd system information broadcasting is "Fixed paging area method by system information broadcasting present", this information shows paging area number in a private system.

RT-MM protocol version (octet 4)

Shows the RT-MM protocol version supported by CS.

However in public system this information element shows whether CS supports version 1 or not.

Bit

8	7	6	5	4	3	2	1	(carrier number)
x	x	x	x	x	x	x	1/0	Version 1 (RCR STD-28 (version 1)) present/absent
x	x	x	x	x	x	1/0	x	Version 2 (RCR STD-28 (version2)) present/absent (reserved for public system)
x	x	x	x	x	1/0	x	x	Version 3 (RCR STD-28 (version3)) present/absent (reserved for public system)
x	x	x	x	1/0	x	x	x	Version 4 (RCR STD-28 (version 4)) present/absent (reserved for public system)

x	x	x	1/0	x	x	x	x	Version 5 (RCR STD-28 (version 5)) present/absent (reserved for public system)
x	x	1/0	x	x	x	x	x	Version 6 present/absent (reserved)
			Other					Reserved
								x: Don't care

(Note) If multiple protocol versions are held, the relevant multiple bits are "1".

Restriction group designation (octet 5)

Specifies the restriction implementing general PS group. General PSs are divided into a maximum of 8 groups, and existence of restriction is specified for each group. Refer to Appendix C for restriction control.

[Relevant PS restriction group] = [PS number (note 1)] MOD [number of restriction groups] + 1

Bit

8	7	6	5	4	3	2	1	(note 2)
x	x	x	x	x	x	x	1/0	Group 1 restriction present/absent
x	x	x	x	x	x	1/0	x	Group 2 restriction present/absent
			.					.
			.					.
1/0	x	x	x	x	x	x	x	Group 8 restriction present/absent
								x: Don't care

(Note 1) The PS's number for determining the PS restriction group is calculated as follows.

[1] When PS number type is "BCD"

The lower 4 digits up to the filler are treated as decimal "1000", "100", "10", "1". If the numbers up to the filler are less than 4 digits, everything from the "1000" position is treated as "0".

[2] When PS number type is "hexadecimal"

Lower 16 bits are treated as numerical values.

(Note 2) Only bits assigned as restriction group designation are valid.

Radio channel usage restriction information (octet 6)

Reports the radio channel restriction information.

(1) Priority PS restriction information

Bit

8	
0	Priority PS location registration possible
1	Priority PS location registration impossible

Bit	
7	
0	Priority PS outgoing call possible
1	Priority PS outgoing call impossible

(2) General PS restriction information

Bit	
6	
0	General PS location registration restriction absent
1	General PS location registration restriction present
5	
0	General PS outgoing call restriction absent
1	General PS outgoing call restriction present

Access cycle interval (octet 6)

Specifies the cycle which a general PS can access SCCH. It is valid when general PS restriction information bit 5 or 6 is "1".

Bit

4	3	2	1	Restriction cancellation valid cycle
0	0	0	0	No restriction
0	0	0	1	LCCH superframe cycle x 4
0	0	1	0	LCCH superframe cycle x 8
	.			.
	.			.
1	1	1	1	LCCH superframe cycle x 60

Absolute slot number (octet 7)

Bit

8	7	
0	0	Shows that relevant message was transmitted on the 1st TDMA slot.
0	1	Shows that relevant message was transmitted on the 2nd TDMA slot.
1	0	Shows that relevant message was transmitted on the 3rd TDMA slot.
1	1	Shows that relevant message was transmitted on the 4th TDMA slot.

Broadcasting message status number m1 (octet 7)

Shows the status number of the present system information broadcasting message. This element can be used arbitrarily, but when the status changes, the new status is set.

Bit

6	5	4
0	0	0
	.	
	.	
1	1	1

Octet 4, 5 usage designation (octet 7)

Specifies the usage method of octet 4 and octet 5 of the system information broadcasting message.

If n_p is optional, all areas of this information element are optional.
If n_p is reserved, all areas of this information element are optional.

Bit 2	1		
0	0	Octet 4:	RT-MM protocol version (public standard) (note 2)
		Octet 5:	Restriction group designation
0	1	Octet 4:	Paging area number (note 3)
		Octet 5:	Paging area number, restriction group designation
1	0	Octet 4:	RT-MM protocol version (note 4)
		Octet 5:	Paging area number
1	1	Option (private)/Reserved (public)	

(Note 1) If the RT-MM protocol version is specified in octet 4, bits 5–8 of octet 4 are reserved.
(Note 2) In a public system, (0 0) is used as standard, and other than (0 0) is all reserved.
(Note 3) If (0 1) is used, the RT-MM protocol version is managed by another method.
(Note 4) If (1 0) is used, all groups become the object of restriction groups, and the paging area number $0 < n_p \leqq 8$ is used.

Broadcasting reception indication (octet 8)

Performs broadcasting signal reception indication to PS. The relevant bit area is used according to the broadcasting signal information element class (global definition information, local definition information).

Bit 6	5	4	3	2	1	
-	-	-	-	-	0	Global definition information pattern indication
-	-	0	0	0	0	Global definition information pattern (0)
-	-	0	0	1	0	Global definition information pattern (1)
		.				.
		.				.
-	-	1	1	1	0	Global definition information pattern (7)
-	-	-	-	-	1	Local information broadcasting reception indication
-	-	-	0	0	1	System information broadcasting reception indication
-	-	-	0	1	1	2nd system information broadcasting reception indication
-	-	-	1	0	1	Option information broadcasting reception indication/Reserved (3rd system information broadcasting reception indication) (note)
-	-	-	1	1	1	Reserved

(Note) Optional in a private system; reserved in a public system.

In private system, when broadcasting reception indication bit 1 is global definition information pattern indication "0", bits 5, 6 are optional.

In public system, when broadcasting reception indication bit 1 is global definition information pattern indication "0", bits 5, 6 have the following meanings.

Odd-even identification bit

(a) When (1 0) (shows that PCH paging groups are mutually related) is set in "control carrier structure (octet 7)" contained in the radio channel information broadcasting message, and the odd-even identification designation bit is set to "1", this information element has the following meanings.

Bit 6	
0	Shows LCCH that transmits even-numbered paging groups
1	Shows LCCH that transmits odd-numbered paging groups

(b) In cases other than the above, this information element has the following meanings.

Bit 6	
0	Reserved
1	Reserved

Odd-even identification designation bit

Bit 5	
0	Control carrier structure is not (1 0)
1	Control carrier structure is (1 0)

When bit 1 of the broadcasting reception indication is local information broadcasting reception indication "1", bits 4–6 have the following meanings.

Bit 6	5	4	
0	0	0	
	.		Status number mi of broadcasting message specified by bits 1–3 is shown in Modulo 8.
	.		
	.		
1	1	1	

4.3.4.2.3 2nd system information broadcasting message (Private standard/Public standard)

Using this message, CS can broadcast information such as country code and system type to PS. The message format is shown in Table 4.3.22, and an explanation of the information elements is given in Table 4.3.23.

Table 4.3.22 2nd system information broadcasting message

Message type : 2nd system information broadcasting
Direction : CS —> PS (downlink)
Function channel : BCCH

<table>
<tr><th>Octet \ Bit</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Re-
served</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td colspan="7">Message type</td></tr>
<tr><td>2</td><td colspan="8" rowspan="2">Country code*</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td><td colspan="8">System type*</td></tr>
<tr><td>5</td><td colspan="8">RT-MM protocol version</td></tr>
<tr><td>6</td><td colspan="5">Reserved</td><td>Reserved/
modulation
method
(note 3)</td><td colspan="2">Available slot number of simultaneous using</td></tr>
<tr><td>7</td><td colspan="2">Absolute slot number</td><td colspan="3">Broadcasting message status number m_2</td><td colspan="3">Paging area type*/Reserved
(note 2)</td></tr>
<tr><td>8</td><td colspan="2"></td><td colspan="6">Broadcasting reception indication</td></tr>
</table>

(Note 1) In the information elements of this message, the information elements marked by * are the global definition information element, and the other elements are the local definition information element.

(Note 2) This information element is used for a private system, reserved in a public system.

(Note 3) This information element is used for a public system, reserved for a private system.

Table 4.3.23 Information elements in 2nd system information broadcasting message

Country code (octets 2-3)

Country code is used to indicate the country which assigns the CS identification code.

System type (octet 4)

Shows system type held by CS.

Bit 8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1/0	Public system (include private system based on RCR STD-28 (version 1) present/absent
x	x	x	x	x	x	1/0	x	Private system based on RCR STD-28 (version 2) or RCR STD-28 (version 3) present/absent
x	x	x	x	x	1/0	x	x	System type 3 present/absent (reserved)

x	x	x	x	1/0	x	x	x	System type 4 present/absent (reserved)
		Other						Reserved
								x: Don't care

(Note) If CS holds multiple system types, the relevant multiple bits are "1".

RT-MM protocol version (octet 5)

Shows RT-MM protocol version held by CS.

Bit

8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1/0	Version 1 (RCR STD-28 (version 1)) present/absent
x	x	x	x	x	x	1/0	x	Version 2 (RCR STD-28 (version 2)) present/absent
x	x	x	x	x	1/0	x	x	Version 3 (RCR STD-28 (version 3)) present/ absent
x	x	x	x	1/0	x	x	x	Version 4 (RCR STD-28 (version 4)) present/ absent
x	x	x	1/0	x	x	x	x	Version 5 (RCR STD-28 (version 5)) present/absent
x	x	1/0	x	x	x	x	x	Version 6 present/absent (reserved)
		Other						Reserved
								x: Don't care

(Note) If CS holds multiple protocol versions, the relevant multiple bits are "1".

Modulation method (octet 6)

It shows if CS supports the modulation method (π /2 shift BPSK) or not.

Bit

3	
0	The station does not support π /2 shift BPSK
1	The station supports π /2 shift BPSK

Available slot number of simultaneous using (octet 6)

It shows available slot number of simultaneous using which one CS can same call.

Bit

2	1	
0	0	1 slot
0	1	2 slots
Other		Reserved

Absolute slot number (octet 7)

Bit

8	7	
0	0	Shows relevant message was transmitted on the 1st TDMA slot.
0	1	Shows relevant message was transmitted on the 2nd TDMA slot.
1	0	Shows relevant message was transmitted on the 3rd TDMA slot.
1	1	Shows relevant message was transmitted on the 4th TDMA slot.

Broadcasting message status number m_2 (octet 7)

Shows status number of current 2nd system information broadcasting message. This element can be used arbitrarily, but if the status changes, the new status is set.

Bit

6	5	4
0	0	0
	.	
	.	
1	1	1

Paging area type (octet 7)

In private system, Uses to notify the paging area method held by CS to PS.

Bit

3	2	1	
x	x	1/0	Fixed paging area method by the system information broadcasting (BCCH (SYS)) present/absent
x	1/0	x	Paging area method with PS indication present/absent
1/0	x	x	Fixed paging area method by additional ID present/absent

(Note 1) In public system, this information element is reserved.

(Note 2) CS must hold at least one type of paging area methods. If CS holds multiple paging area types, the relevant multiple bits are "1".

Broadcasting reception indication (octet 8)

Performs broadcasting signal reception indication to PS. The relevant bit area is used according to the broadcasting signal information element class (global definition information, local definition information).

Bit

6	5	4	3	2	1	
-	-	-	-	-	0	Global definition information pattern indication
-	-	0	0	0	0	Global definition information pattern (0)
-	-	0	0	1	0	Global definition information pattern (1)
		.				.
		.				.
		.				.
-	-	1	1	1	0	Global definition information pattern (7)
-	-	-	-	-	1	Local information broadcasting reception indication
-	-	-	0	0	1	System information broadcasting reception indication
-	-	-	0	1	1	2nd system information reception indication
-	-	-	1	0	1	Option information broadcasting reception indication/Reserved (3rd system information broadcasting reception indication) (note)
-	-	-	1	1	1	Reserved

(Note) Optional in a private system; reserved in a public system.

In private system, when broadcasting reception indication bit 1 is global definition information pattern indication "0", bits 5, 6 are optional.

In public system, when broadcasting reception indication bit 1 is global definition information pattern indication "0", bits 5, 6 have the following meanings.

Odd-even identification bit

(a) When (1 0) (shows that PCH paging groups are mutually related) is set in "control carrier structure (octet 7)" contained in the radio channel information broadcasting message, and the odd-even identification designation bit is set to "1", this information element has the following meanings.

Bit 6	
0	Shows LCCH that transmits even-numbered paging groups
1	Shows LCCH that transmits odd-numbered paging groups

(b) In cases other than the above, this information element has the following meanings.

Bit 6	
0	Reserved
1	Reserved

Odd-even identification designation bit

Bit 5	
0	Control carrier structure is not (1 0)
1	Control carrier structure is (1 0)

When bit 1 of the broadcasting reception indication is local information broadcasting reception indication "1", bits 4–6 have the following meanings.

Bit 6	5	4	
0	0	0	
	.		Status number mi of broadcasting message specified by bits 1–3 is shown in Modulo 8.
	.		
	.		
1	1	1	

4.3.4.2.4 3rd system information broadcasting message (Public standard)

CS can broadcast 3rd system information for a public system to PS using this message. The message format is shown in Table 4.3.24 and the explanation of elements is shown in Table 4.3.25.

Table 4.3.24 3rd system information broadcasting message

Message type : 3rd system information broadcasting
Direction : CS —> PS (downlink)
Function channel : BCCH

<table>
<tr><th>Octet \ Bit</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Re-served</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td colspan="7">Message type</td></tr>
<tr><td>2</td><td colspan="8" rowspan="5">Reserved</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td colspan="2">Absolute slot number</td><td colspan="3">Broadcasting message status number m3</td><td colspan="3">Reserved</td></tr>
<tr><td>8</td><td colspan="2"></td><td colspan="6">Broadcasting reception indication</td></tr>
</table>

Table 4.3.25 Information elements in 3rd system information broadcasting message

Absolute slot number (octet 7)

Bit 8	Bit 7	
0	0	Shows relevant message was transmitted on the 1st TDMA slot.
0	1	Shows relevant message was transmitted on the 2nd TDMA slot.
1	0	Shows relevant message was transmitted on the 3rd TDMA slot.
1	1	Shows relevant message was transmitted on the 4th TDMA slot.

Broadcasting message status number m3 (octet 7)

Shows status number of current 3rd system information broadcasting message. This element can be used arbitrarily, but when the status changes, the new status is set.

Bit 6	Bit 5	Bit 4
0	0	0
	.	
	.	
1	1	1

Broadcasting reception indication (octet 8)

Performs broadcasting signal reception indication to PS. The relevant bit area is used according to the broadcasting signal information element class (global definition information, local definition information).

Bit 6	5	4	3	2	1	
-	-	-	-	-	0	Global definition information pattern indication
-	-	0	0	0	0	Global definition information pattern (0)
-	-	0	0	1	0	Global definition information pattern (1)
		.				.
		.				.
		.				.
-	-	1	1	1	0	Global definition information pattern (7)
-	-	-	-	-	1	Local information broadcasting reception indication
-	-	-	0	0	1	System information broadcasting reception indication
-	-	-	0	1	1	Reserved (2nd system information broadcasting reception indication)
-	-	-	1	0	1	Reserved (3rd system information broadcasting reception indication)
-	-	-	1	1	1	Reserved

When broadcasting reception indication bit 1 is global definition information pattern indication "0", bits 5, 6 have the following meanings.

Odd-even identification bit

(a) When (1 0) (shows that PCH paging groups are mutually related) is set in "control carrier structure (octet 7)" contained in the radio channel information broadcasting message, and the odd-even identification designation bit is set to "1", this information element has the following meanings.

bit 6	
0	Shows LCCH that transmits even-numbered paging groups
1	Shows LCCH that transmits odd-numbered paging groups

(b) In cases other than the above, this information element has the following meanings.

Bit 6	
0	Reserved
1	Reserved

Odd-even identification designation bit

Bit 5	
0	Control carrier structure is not (1 0)
1	Control carrier structure is (1 0)

When bit 1 of the broadcasting reception indication is local information broadcasting reception indication "1", bits 4–6 have the following meanings.

Bit 6	5	4	
0	0	0	
	.		Status number mi of broadcasting message specified by bits 1–3 is shown in Modulo 8.
	.		
	.		
1	1	1	

4.3.4.2.5 Option information broadcasting message (Private standard)

CS can broadcast private system option information to PS using this message. The message format is shown in Table 4.3.26 and the explanation of information elements is shown in Table 4.3.27.

Table 4.3.26 Option information broadcasting message

Message type : Option information broadcasting
Direction : CS —> PS (downlink)
Function channel : BCCH

Octet \ Bit	8	7	6	5	4	3	2	1
1	Re-served	0	0	0	1	1	1	1
		Message type						
2	Option							
3								
4								
5								
6								
7	Absolute slot number		Broadcasting message status number m3			Option		
8			Broadcasting reception indication					

Table 4.3.27 Information elements in option information broadcasting message

Absolute slot number (octet 7)

Bit 8	7	
0	0	Shows relevant message was transmitted on the 1st TDMA slot.
0	1	Shows relevant message was transmitted on the 2nd TDMA slot.
1	0	Shows relevant message was transmitted on the 3rd TDMA slot.
1	1	Shows relevant message was transmitted on the 4th TDMA slot.

Broadcasting message status number m3 (octet 7)

Shows status number of current option information broadcasting message. This element can be used arbitrarily, but when the status changes, the new status is set.

Bit		
6	5	4
0	0	0
	.	
	.	
1	1	1

Broadcasting reception indication (octet 8)

Performs broadcasting signal reception indication to PS. The relevant bit area is used according to the broadcasting signal information element class (global definition information, local definition information).

Bit						
6	5	4	3	2	1	
-	-	-	-	-	0	Global definition information pattern indication
-	-	0	0	0	0	Global definition information pattern (0)
-	-	0	0	1	0	Global definition information pattern (1)
		.				.
		.				.
		.				.
-	-	1	1	1	0	Global definition information pattern (7)
-	-	-	-	-	1	Local definition information broadcasting reception indication
-	-	-	0	0	1	System information broadcasting reception indication
-	-	-	0	1	1	2nd system information reception indication
-	-	-	1	0	1	Option information broadcasting reception indication
-	-	-	1	1	1	Reserved

When bit 1 of the broadcasting reception indication is global definition information broadcasting reception indication "0", bits 5–6 are optional.

When bit 1 of the broadcasting reception indication is local definition information broadcasting reception indication "1", bits 4-6 have the following meanings.

Bit			
6	5	4	
0	0	0	
	.		Status number mi of the broadcasting message indicated by bits 1-3 is shown In modulo 8.
	.		
	.		
1	1	1	

4.3.4.3 Paging message (Private standard/Public standard)

Using this message, CS reports that PS received a call. When PS responds to the paging from CS, it is necessary to activate the link channel establishment request. The message format is shown in Table 4.3.28, and the explanation of information elements is shown in Table 4.3.29.

Table 4.3.28 Paging message

Message type : Paging
Direction : CS- > PS (downlink)
Function channel : PCH

Octet \ Bit	8	7	6	5	4	3	2	1
1	Re-served	Paging service type			PS number (1st digit)			
2	PS number (2nd digit)				PS number (3rd digit)			
3	PS number (4th digit)				PS number (5th digit)			
4	PS number (6th digit)				PS number (7th digit)			
5	PS number (8th digit)				PS number (9th digit)			
6	PS number (10th digit)				PS number (11th digit)			
7	PS number (12th digit)				PS number (13th digit) / Extension paging service type			
8			Broadcasting reception indication					

Table 4.3.29 Information elements in paging message

<u>Paging service type (octet 1)</u>

Bit 7	6	5	
0	0	0	No paging
0	0	1	Shows paging service by PS number of BCD 13 digits or less.
0	1	0	Shows paging service by PS number of 7 digits hexadecimal (reserved in public system).
0	1	1	Shows paging service by PS number of 13 digits hexadecimal (note)
1	0	0	Shows paging service by BCD 13 digits or less domestic PS number.
1	0	1	Shows the paging service by the extension paging service (reserved in public system).
1	1	x	Option (private)/Reserved (public) x: Don't care

(Note) As for the public system, the PS number that it is expressed with number from 0 to 9 of the N individuals is considered the integer of N digits decimal system where number of digit K is the place of 10^{n-k} ($1 \leq k \leq n$), and the thing that is was changed into 13 digits hexadecimal is shown.

(Example)

PS number bofore conversion	: 050-12-34567
Decimal system	: 501,234,567
13 digits hexadecimal	: 000001DE03B87

Extension paging service type (octet 7)

If the paging service type is the paging service (1 0 1) based on the extension paging service type, it has the following meanings.

Bit 4	3	2	1	
0	0	0	0	Ringing cessation (note 1)
0	0	0	1	Shows paging service (zone paging) to all PS receiving this message. (note 1)
0	0	1	0	Shows paging service by PS number of BCD 12 digits or less. (note 2)
0	1	0	0	Shows paging service by supplementary service within the CS-PS loop.(note 3)
		Other		Reserved

(Note 1) Used to inform and cancel the zone paging in private system.

(Note 2) Paging service by PS number of BCD 12 digits or less is used in clarifying the PS number is a number based on the original numbering plan as defined in each private system.

(Note 3) Used for supplementary service within the CS-PS loop in a private system. (refer to 4.3.4.3.1)

When the extension paging service is the ringing cessation (0 0 0 0) or paging service to all PS receiving this message (0 0 0 1), the paging message format is as follows.

Octet	Bit 8	7	6	5	4	3	2	1
1	Re-served	1	0	1				
2	Reserved							
3								
4								
5								
6								
7					Extension paging area service type			

When the extension paging services is the paging service by PS number of BCD 12 digits or less (0 0 1 0), the paging message format is as follows.

Octet	Bit 8	7	6	5	4	3	2	1
1	Re-served	1	0	1	PS number (1st digit)			
2	PS number (2nd digit)				PS number (3rd digit)			
3	PS number (4th digit)				PS number (5th digit)			
4	PS number (6th digit)				PS number (7th digit)			
5	PS number (8th digit)				PS number (9th digit)			
6	PS number (10th digit)				PS number (11th digit)			
7	PS number (12th digit)				Extension paging area service type			

<u>PS number (octets 1-7)</u>

For PS numbers, the 2 types of number digits shown below can be used.

- In the case of BCD, PS number is put in such that the first number, that is, the number dialed first, is transmitted first.
- In the case of BCD, the number of digits of PS number, if smaller than the maximum number of digits for each paging service type, adds filler following PS number up to the maximum number of digits.
- Number digits are determined as BCD or hexadecimal as shown below.
- When used in a public system, if paging service type is (0 0 1), the types of number/numbering plan identifier of the PS number are considered undetermined/undetermined.
- When used in a public system, if paging service type is (0 1 1), the type of number of the PS number is considered as international number, and number plan identifier is considered as ISDN/telephony numbering plan.
- When used in a public system, if paging service type is (1 0 0), the type of number of the PS number is considered as domestic number, and number plan identifier is considered as ISDN／telephony numbering plan.

BCD number digits (octets 1-7)

Number \ Bit	4	3	2	1	Number \ Bit	4	3	2	1
	8	7	6	5		8	7	6	5
0	1	0	1	0	6	0	1	1	0
1	0	0	0	1	7	0	1	1	1
2	0	0	1	0	8	1	0	0	0
3	0	0	1	1	9	1	0	0	1
4	0	1	0	0	Filler	0	0	0	0
5	0	1	0	1	Option	Others			

Hexadecimal number digits (octets 1-7)

When 7 digits hexadecimal

Octet	Bit 8 7 6 5	4 3 2 1
1		MSB
2		
3		
4		LSB
5		
6	Don't care	
7		

When 13 digits hexadecimal

Octet	Bit 8 7 6 5	4 3 2 1
1		MSB
2		
3		
4		
5		
6		
7		LSB

Broadcasting reception indication (octet 8)

Performs broadcasting signal reception indication to PS. The relevant bit area is used according to the broadcasting signal information element class (global definition information, local definition information).

Bit 6	5	4	3	2	1	
-	-	-	-	-	0	Global definition information pattern indication
-	-	0	0	0	0	Global definition information pattern (0)
-	-	0	0	1	0	Global definition information pattern (1)
		.				.
		.				.
		.				.
-	-	1	1	1	0	Global definition information pattern (7)
-	-	-	-	-	1	Local information broadcasting reception indication
-	-	-	0	0	1	System information broadcasting reception indication
-	-	-	0	1	1	2nd system information reception indication
-	-	-	1	0	1	Option information broadcasting reception indication/Reserved (3rd system information broadcasting reception indication) (note)
-	-	-	1	1	1	Reserved

(Note) Optional in a private system; reserved in a public system.

In private system, when broadcasting reception indication bit 1 is global definition information pattern indication "0", bits 5, 6 are optional.

In public system, when broadcasting reception indication bit 1 is global definition information pattern indication "0", bits 5, 6 have the following meanings.

Odd-even identification bit

(a) When (1 0) (shows that PCH paging groups are mutually related) is set in "control carrier structure (octet 7)" contained in the radio channel information broadcasting message, and the odd-even identification designation bit is set to "1", this information element has the following meanings.

Bit 6	
0	Shows LCCH that transmits even-numbered paging groups
1	Shows LCCH that transmits odd-numbered paging groups

(b) In cases other than the above, this information element has the following meanings.

Bit 6	
0	Reserved
1	Reserved

Odd-even identification designation bit

Bit 5	
0	Control carrier structure is not (1 0)
1	Control carrier structure is (1 0)

When bit 1 of the broadcasting reception indication is local information broadcasting reception indication "1", bits 4~6 have the following meanings.

Bit 6	5	4	
0	0	0	
	.		Status number mi of broadcasting message specified by bits 1～3 is shown in Modulo 8.
	.		
	.		
1	1	1	

4.3.4.3.1. Zone paging for supplementary service in private system (Private standard)

When the extension paging service type is the supplementary service within the CS-PS loop(0 1 0 0), the paging message format is as follows.

<table>
<tr><th>Octet</th><th>Bit
8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th></tr>
<tr><td>1</td><td>Re-ser ved</td><td colspan="3">Paging service type
1 0 1</td><td colspan="4">Reserved</td></tr>
<tr><td>2</td><td colspan="8">Reserved</td></tr>
<tr><td>3</td><td colspan="3">Reserved</td><td colspan="2">System notification 1</td><td colspan="3">Notification of line type 1</td></tr>
<tr><td>4</td><td colspan="3">Reserved</td><td colspan="2">System notification 2</td><td colspan="3">Notification of line type 2</td></tr>
<tr><td>5</td><td colspan="3">Reserved</td><td colspan="2">System notification 3</td><td colspan="3">Notification of line type 3</td></tr>
<tr><td>6</td><td colspan="2">Reserved</td><td colspan="2">State notification
outside line busy / extension line busy</td><td colspan="4">Reserved</td></tr>
<tr><td>7</td><td>Re-ser ved</td><td>Discrimi-nator of informa-tion of caller ID</td><td colspan="2">Caller ID of supplementary service within the CS-PS loop
(0 0)</td><td colspan="4">Extension paging service type
0 1 0 0</td></tr>
</table>

Paging service type (octet 1)

Bit 7	6	5	
0	0	0	No paging
0	0	1	Shows paging service by PS number of BCD 13 digits or less.
0	1	0	Shows paging service by PS number of 7 digits hexadecimal.
0	1	1	Shows paging service by PS number of 13 digits hexadecimal.
1	0	0	Shows paging service by BCD 13 digits or less domestic PS number.
1	0	1	Shows paging service by extension paging service.
1	1	x	Option
	Others		Reserved

x : Don’t care

Extension paging service type (octet 7)

Bit

4	3	2	1	
0	0	0	0	Ringing cessation
0	0	0	1	Shows paging service (zone paging) to all the PS receiving this message.
0	0	1	0	Shows paging service by PS number of BCD 12 digits or less.
0	1	0	0	Shows paging service by supplementary service within the CS-PS loop.
	Others			Reserved

Discriminator of information of caller ID (octet 7)

Bit

7	
0	Caller ID absent.
1	Caller ID present.

System notification 1 (zone paging, hold within the system) (octet 3)

Shows the status of the notification of line type 1 which informs the line condition to PS.

Bit

5	4	
0	0	No line type broadcasting.
0	1	Broadcasting of line busy.
1	0	Zone paging.
1	1	Hold within the CS-multiple PS.

Caller ID of supplementary service within the CS-PS loop (octet 7)

Bit

6	5	
0	0	Not available (Shows original paging type)
0	1	Reserved (Caller ID 1)
1	0	Reserved (Caller ID 2)
1	1	Reserved (Caller ID 3)

Notification of line type 1 (Extension line, Door phone, Outside line) (octet 3)

Notifies the line condition to PS. Depends on the information of system notification 1.

Bit

3	2	1	
0	0	0	Undetermined
0	0	1	Outside line 1.
0	1	0	Outside line 2.
0	1	1	Door phone A.
1	0	0	Door phone B.
1	0	1	Extension line 1.
1	1	0	Extension line 2.
1	1	1	Option

System notification 2 (zone paging, hold within the system) (octet 4)

Shows the status of the notification of line type 2 which informs the line condition to PS.

Bit

5	4	
0	0	No line type broadcasting.
0	1	Broadcasting of line busy.
1	0	Zone paging.
1	1	Hold within the CS-multiple PS.

Notification of line type 2 (Extension line, Door phone, Outside line) (octet 4)

Notifies the line condition to PS. Depends on the information of system notification 2.

Bit

3	2	1	
0	0	0	Undetermined
0	0	1	Outside line 1.
0	1	0	Outside line 2.
0	1	1	Door phone A.
1	0	0	Door phone B.
1	0	1	Extension line 1.
1	1	0	Extension line 2.
1	1	1	Option

System notification 3 (zone paging, hold within the system) (octet 5)

Shows the status of the notification of line type 3 which informs PS the line condition.

Bit

5	4	
0	0	No line type broadcasting.
0	1	Broadcasting of line busy.
1	0	Zone paging.
1	1	Hold within the system.

Notification of line type 3 (Extension line, Door phone, Outside line) (octet 5)

Notifies the line condition to PS. Depends on the information of system notification 3.

Bit 3	2	1	
0	0	0	Undetermined
0	0	1	Outside line 1.
0	1	0	Outside line 2.
0	1	1	Door phone A.
1	0	0	Door phone B.
1	0	1	Extension line 1.
1	1	0	Extension line 2.
1	1	1	Option

State notification (outside line busy / extension line busy) (octet 6)

Bit 6	5	
x	1/0	Extension line busy / not busy
1/0	x	Outside line busy / not busy
		x : Don’t care

When the extension information distinction shows caller ID present, the paging message format is as follows.

Octet	Bit 8	7	6	5	4	3	2	1
1	Re-served	Paging service type 1	0	1	Calling number (1st digit)			
2	Calling number (2nd digit)				Calling number (3rd digit)			
3	Calling number (4th digit)				Calling number (5th digit)			
4	Calling number (6th digit)				Calling number (7th digit)			
5	Calling number (8th digit)				Calling number (9th digit)			
6	Calling number (10th digit)				Calling number (11th digit)			
7	Re-served	Discrimi-nator of informa-tion of caller ID (1)	Caller ID of supplementary service within the CS-PS loop		Extension paging service type 0	1	0	0

Paging service type (octet 1)

Bit 7	6	5	
0	0	0	No paging
0	0	1	Shows paging service by PS number of BCD 13 digits or less.
0	1	0	Shows paging service by PS number of 7 digits hexadecimal.
0	1	1	Shows paging service by PS number of 13 digits hexadecimal.
1	0	0	Shows paging service by BCD 13 digits or less domestic PS number.
1	0	1	Shows paging service by extension paging service.
1	1	x	Option
	Others		Reserved
			x : Dont care

Extension paging service type (octet 7)

Bit 4	3	2	1	
0	0	0	0	Ringing cessation
0	0	0	1	Shows paging service (zone paging) to all the PS receiving this message.
0	0	1	0	Shows paging service by PS number of BCD 12 digits or less.
0	1	0	0	Shows paging service by supplement service within the CS-PS loop.
	Others			Reserved

Discriminator of information of caller ID (octet 7)

Bit 7	
1	(Fixed.) Notification of caller ID and original paging type present.

Caller ID of supplementary service within the CS-PS loop (octet 7)

Bit 6	5	
0	0	Not available (Shows original paging type)
0	1	Reserved (Caller ID 1)
1	0	Reserved (Caller ID 2)
1	1	Reserved (Caller ID 3)

(Note) The contents of the caller ID(1-3) in this service corresponds to the number(1-3) in the system notification and of the notification of line type in the original paging type.

Calling party number (PS number from outside line)

BCD number digits (octets 1-6)

Number \ Bit	4 / 8	3 / 7	2 / 6	1 / 5	Number \ Bit	4 / 8	3 / 7	2 / 6	1 / 5
0	1	0	1	0	6	0	1	1	0
1	0	0	0	1	7	0	1	1	1
2	0	0	1	0	8	1	0	0	0
3	0	0	1	1	9	1	0	0	1
4	0	1	0	0	Filler	0	0	0	0
5	0	1	0	1	Option	Others			

(Example) If the outside line 1 is held within the system and the outside line 2 is in the zone paging state (calling party number is 03-3456-7890) in the supplementary service within the CS-PS loop, the following PCH is sent from CS.

PCH (1) Paging in supplementary service within the CS-PS loop

Octet	Bit 8	7	6	5	4	3	2	1
1	0	1	0	1	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	1	1	0	0	1
4	0	0	0	1	0	0	1	0
5	0	0	0	0	0	0	0	0
6	0	0	1	0	0	0	0	0
7	0	1	0	0	0	1	0	0

PCH (2) Notification of caller ID

Octet	Bit 8	7	6	5	4	3	2	1
1	0	1	0	1	1	0	1	0
2	0	0	1	1	0	0	1	1
3	0	1	0	0	0	1	0	1
4	0	1	1	0	0	1	1	1
5	1	0	0	0	1	0	0	1
6	1	0	1	0	0	0	0	0
7	0	1	1	0	0	1	0	0

4.3.4.4 Detailed regulations of PCH paging group (Private standard/Public standard)

In a private system, if the paging group is designated based on the residue of PS number devided by paging group number, the following rules apply, and if CS designates the paging group the section 4.4.3.6.3.4.9 applies.

4.3.4.4.1 Paging group calculation rules (Private standard/Public standard)

The PCH paging group calculation rules are as follows.

[1] When 2 LCCH are used, and PCH paging groups are mutually related
Paging group = (PS number) MOD (n_{PCH} x n_{GROUP} x 2) + 1

[2] Cases other than the above
Paging group = (PS number) MOD (n_{PCH} x n_{GROUP} x 1) + 1

4.3.4.4.2 PS side process (Private standard/Public standard)

PS performs the remainder calculation based on the PS number and the contents of the radio channel information broadcasting message broadcasted by CS (n_{PCH}, n_{GROUP}, control carrier structure), and determine its own paging group.

4.3.4.4.3 PCH paging group calculation examples (Private standard/Public standard)

(1) Calculation methods

[1] When paging service type is "BCD"
The lower 4 digits up to the filler are treated as decimal "1000", "100", "10", "1". If the numbers up to the filler are less than 4 digits, everything from the "1000" position is treated as "0".

[2] When paging service type is "hexadecimal"
Lower 16 bits are treated as numerical values.

(2) Calculation examples

(Example 1) Paging service type : 1 (BCD 13 digits or less)
PS number : 03-3456-7890
n_{GROUP} : 4
n_{PCH} : 2
X (note) : 1

(Note) When 2 LCCH are used and PCH paging groups are mutually related: X = 2; Otherwise X = 1

<u>PS number</u>

0	0	0	1	1	0	1	0
0	0	1	1	0	0	1	1
0	1	0	0	0	1	0	1
0	1	1	0	0	1	1	1
1	0	0	0	1	0	0	1
1	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0

Paging group number = 7890 MOD (4 x 2 x 1) + 1 = 2 + 1 = <u>3</u>

(Example 2) Paging service type : 1 (BCD 13 digits or less)
PS number : 317
n_{GROUP} : 4
n_{PCH} : 2
X (note) : 1

(Note) When 2 LCCH are used and PCH paging groups are mutually related: X = 2; Otherwise X = 1

PS number

0	0	0	1	0	0	1	1
0	0	0	1	0	1	1	1
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Paging group number = 317 MOD (4 x 2 x 1) + 1 = 5 + 1 = 6

(Example 3) Paging service type : 2 (hexadecimal 7 digits)
PS number : $(123001A)_{HEX}$
n_{GROUP} : 4
n_{PCH} : 2
X (note) : 1

(Note) When 2 LCCH are used and PCH paging groups are mutually related: X = 2; Otherwise X = 1

PS number

0	0	1	0	0	0	0	1
0	0	1	0	0	0	1	1
0	0	0	0	0	0	0	0
0	0	0	1	1	0	1	0
Don't care							
Don't care							
Don't care							

Paging group number = $(001A)_{HEX}$ MOD (4 x 2 x 1) + 1= 26 MOD 8 + 1 = 2 + 1 = 3

(Example 4) Paging service type : 3 (hexadecimal 13 digits)
PS number : $(000123456789A)_{HEX}$
n_{GROUP} : 4
n_{PCH} : 2
X (note) : 1

(Note) When 2 LCCH are used and PCH paging groups are mutually related: X = 2; Otherwise X = 1

PS number

0	0	1	1	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	1	0
0	0	1	1	0	1	0	0
0	1	0	1	0	1	1	0
0	1	1	1	1	0	0	0
1	0	0	1	1	0	1	0

Paging group number = $(789A)_{HEX}$ MOD (4 x 2 x 1) + 1= 30874 MOD 8 + 1 = 2 + 1 = <u>3</u>

(Example 5) Paging service type : 5 (extension paging service type)
Extension paging service type : 2 (BCD 12 digits or less)
PS number : 03-3456-7890
n_{GROUP} : 4
n_{PCH} : 2
X (note) : 1

(Note) When 2LCCH is used and the PCH paging groups are mutually related: X=2;Otherwise X=1

PS number

0	1	0	1	1	0	1	0
0	0	1	1	0	0	1	1
0	1	0	0	0	1	0	1
0	1	1	0	0	1	1	1
1	0	0	0	1	0	0	1
1	0	1	0	0	0	0	0
0	0	0	0	0	0	1	0

Paging group number = 7890 MOD (4 x 2 x 1) + 1= 2 + 1 = <u>3</u>

4.3.4.5 Coding example of country code (Private standard/Public standard)

Shows the coding example of the Japanese country code which is used at the 2nd system information broadcasting message (octets 2-3) and the broadcasting information information element (octets 16-17) within the zone information indication message.

Country code

bit

8	7	6	5	4	3	2	1
0	0	0	0	0	1	0	0
0	1	0	0	1	0	1	0

(Intentionally blanked)

4.4 Service channel establishment phase and communications phase

4.4 Service channel establishment phase and communications phase (Private standard/Public standard)

4.4.1 Overview (Private standard/Public standard)

In this section, layer 2 designations and layer 3 designations used in the service channel establishment phase and communications phase are specified.

4.4.2 Layer 2 standards (Private standard/Public standard)

4.4.2.1 Overview (Private standard/Public standard)

In this standard the frame structure, procedure elements, and field system and procedure for appropriate operation of the link access procedure LAPDC (Link Access Procedure for Digital Cordless) on associated control channels (SACCH and FACCH) of the personal handy phone system are specified.

4.4.2.1.1 Range of application of the standard (Private standard/Public standard)

This standard applies to associated control channels (SACCH and FACCH) in the service channel establishment phase and communications phase of the second generation cordless telephone format.

4.4.2.1.2 LAPDC overview (Private standard/Public standard)

(1) In order to ensure reliability of the radio transfer route, the transfer procedure uses an HDLC subset. The basic procedure class of the subset uses the BAC (Balanced operation ABM Class), and as an additional function of the procedure class, the deletion function of the I response is used.

(2) For high-speed control during communication, UI commands are defined so that information can be transmitted without link establishment procedure.

(3) The address part is constructed from the SAPI and command/response field bit (C/R).

(4) Frame synchronization is carried out at layer 1, and the flag sequence of layer 2 is not used. Thus "0" insertion into continuous "1" 's of transmission data and "0" deletion in receiving side are not performed.

(5) Because error detection is carried out by CRC at layer 1, layer 2 does not have an FCS (Frame Check Sequence) addition/checking function.

4.4.2.1.3 Format rules (Private standard/Public standard)

(1) Format regulation

The basic format regulation used in this standard is shown in Figure 4.4.1. The bits of one octet are lined up horizontally and are given the numbers from 1 to 8. Multiple octets are lined up vertically and are given the numbers from 1 to n.

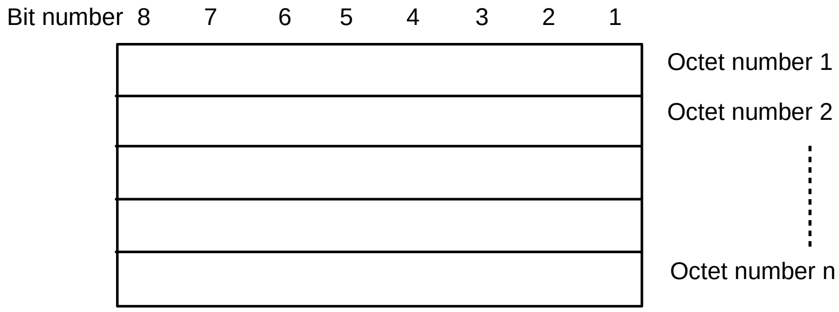


Figure 4.4.1 Format regulation

(2) Message transmission order

Octets are transmitted from octet 1 in order of the smaller number, and bits within the octet are transmitted from bit 1 in order of the smaller number.

(3) Field mapping regulation

If the field is included in 1 octet, the minimum bit number within the field becomes the least significant bit value.

As a rule, if the field across to 2 octets or more, the bit value becomes lower as the octet number increases, and the minimum bit number within the field has the least significant bit value.

However, there are cases where exceptional regulations (regulations following the bit order on the physical slot) are used.

Furthermore, in this section, parts which define signals according to the format described above are shown in "white" and parts other than defined signals (parts expressed as simple bit lines) are shown in "gray." In this way, signal definition is shown independently in each layer. (Example: Figure 4.4.2)

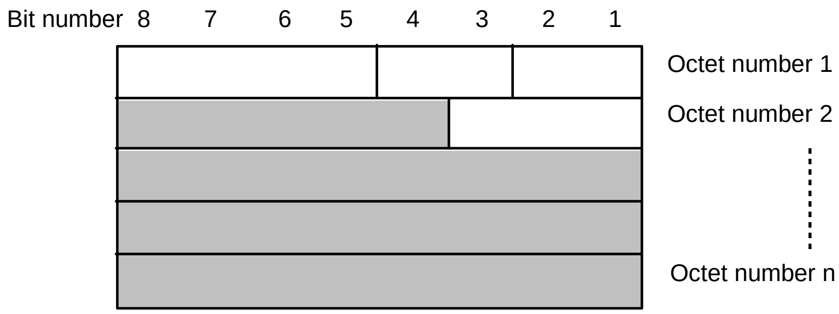


Figure 4.4.2 Format expression example

4.4.2.2 Layer 2 frame structure (Private standard/Public standard)

4.4.2.2.1 Relationship between physical slot and frame (Private standard/Public standard)

Layer 2's flag sequence is omitted because synchronization is established according to a physical slot unique word and because the slot length is fixed. Also, since error detection is performed by layer 1 CRC, FCS is not used in layer 2.

The layer 2 frames of SACCH and FACCH are mutually independent, and may exist on the same physical slot.

(1) Relationship of SACCH radio channel slot and layer 2 frame

Figure 4.4.3 shows the relationship between physical slot and SACCH's layer 2 frame. SACCH's layer 2 frame constitutes one frame in 2 physical slots. The first bit of each physical slot is the slot order bit and shows the structure of the slot. (Refer to 4.2.9 Slot structure for D8PSK and 16AQAM.)

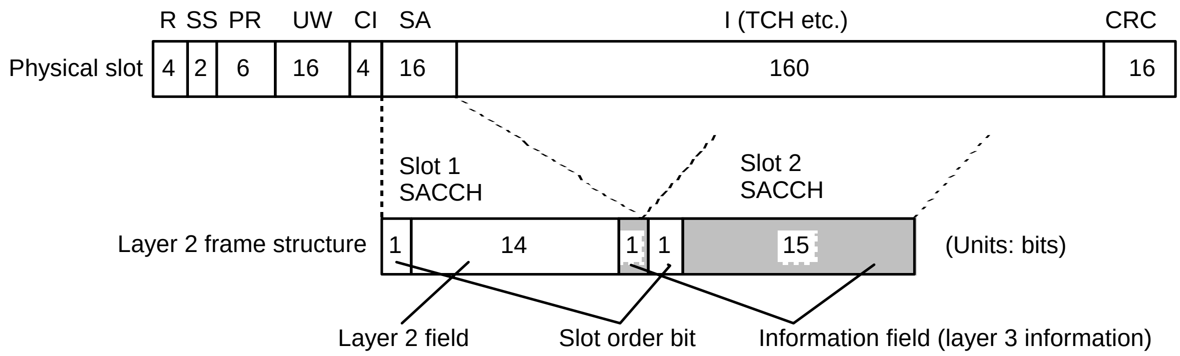


Figure 4.4.3 Relationship of physical slot and SACCH's layer 2 frame

(2) FACCH's layer 2 frame structure

Figure 4.4.4 shows the relationship between physical slots and FACCH's layer 2 frame. FACCH's layer 2 frame constitutes 1 frame in 1 physical slot. (Refer to 4.2.9 Slot structure for $\pi/2$ shift BPSK, D8PSK and 16AQAM.)

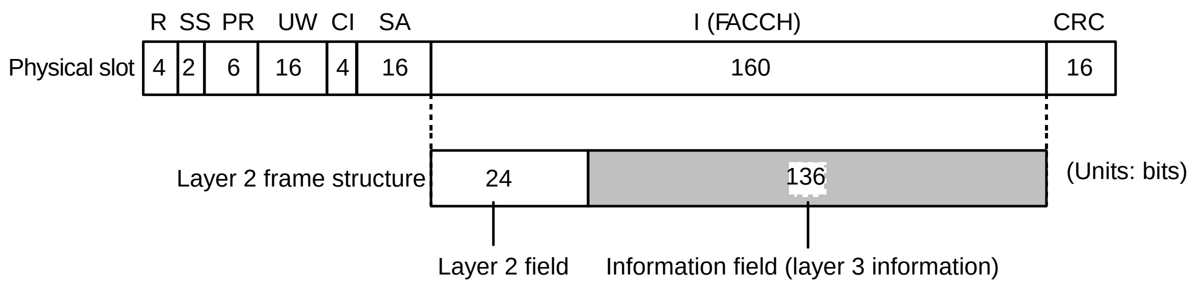


Figure 4.4.4 Relationship of physical slots and FACCH's layer 2 frame

4.4.2.2.2 Elements of SACCH (Private standard/Public standard)

(1) Layer 2 frame structure

Figure 4.4.5 shows the relationship between SACCH's layer 2 frame and the physical slots as well as layer 3 information. Information is divided into frame units and transmitted, and error control (retransmission control) is carried out in frame units. Further, frame units are integral multiples of octets.

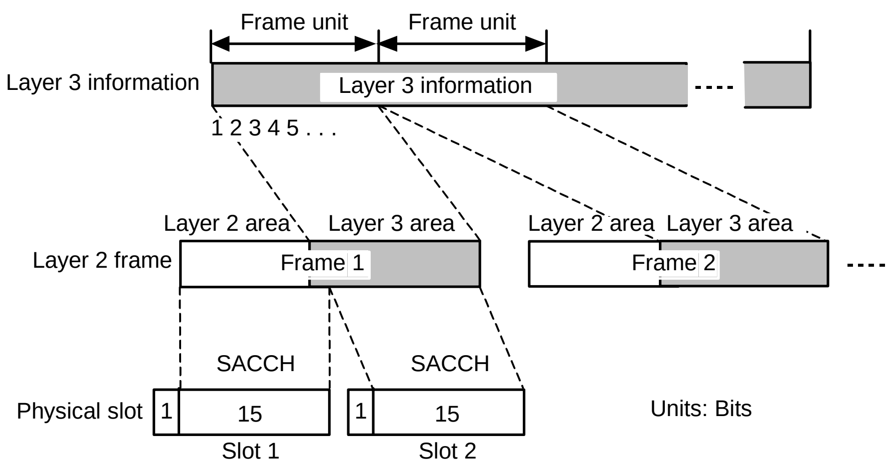


Figure 4.4.5 Relationship between layer 2 frame and physical slots as well as layer 3 information

(2) Signal structure for each physical slot

Figure 4.4.6 shows the signal structure for SACCH physical slots.

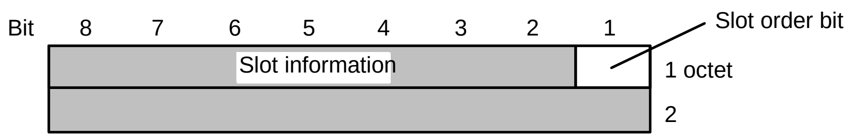


Figure 4.4.6 Physical slot signal structure

- Slot order bit

Figure 4.4.7 shows how to use slot order bits. Significant physical slots must be used as 1 group of 2 slots. A slot order bit of "0" indicates the first slot in the layer 2 frame, and it continues to be "0" until a "1" indicates the last slot in the layer 2 frame. Also, if the slot is open, "1" is continuous.

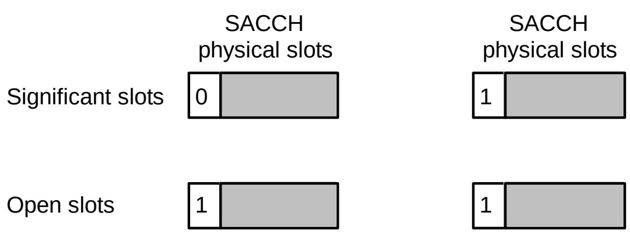


Figure 4.4.7 Method of using slot order bits

(3) Layer 2 frame signal structure

Figure 4.4.8 shows SACCH's layer 2 frame signal structure.

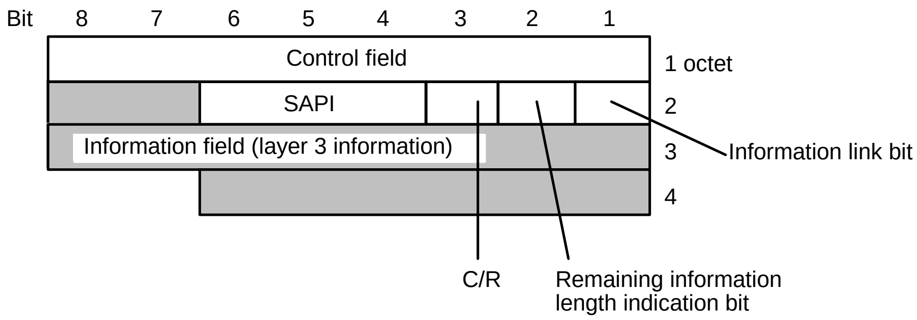


Figure 4.4.8 Signal structure of layer 2 frame

- Information link bit

Table 4.4.1 shows the bit assignment for information link bits.If the information field (layer 3 information) is divided into multiple frames and transmitted, it shows whether it is the last frame or not, and when it is the leading frame or a middle frame, it is used to link continuing frame information.

Table 4.4.1 Bit assignment for information link bits

Bit 1	
0	Leading frame or middle frame
1	End frame or undivided frame

- Remaining information length indication bit

Table 4.4.2 shows the remaining information length indication bit assignments. It shows the octet number of layer 3 information length within a frame that is not divided or the last frame.

Table 4.4.2 Assignment of remaining information length indication bits

Bit 2	
0	Layer 3 information length is 1 octet
1	Layer 3 information length is 2 octets

(4) Control bit elements

Refer to section 4.4.2.4.

(5) Elements of command/response field bit (C/R)

The C/R bit shows whether the frame is a command or response. When a command is transmitted from the PS side, the C/R bit is "0", and when a response is transmitted it is "1". Also, when a command is transmitted from the CS side, the C/R bit is "1", and when a response is transmitted it is "0". C/R bit assignments are shown in Table 4.4.3.

Table 4.4.3 Command/response assignments

Bit 3

C/R bit	Direction	C/R
1	CS → PS	Command
0	PS → CS (PS) (note)	
0	CS → PS	Response
1	PS → CS (PS) (note)	

(Note) (PS) is used in direct communication between personal stations.

(6) SAPI elements

SAPI shows the method classification in layer 3. Table 4.4.4-1 shows SAPI bit assignments.

Table 4.4.4-1 SAPI bit assignments

Bit 6	5	4	
0	0	0	Reserved
0	0	1	Connection control
0	1	0	Reserved
Other			Reserved

4.4.2.2.3 Elements of FACCH (Private standard/Public standard)

(1) Layer 2 frame structure

Figure 4.4.9 shows the relationship between FACCH's layer 2 frame and physical slots as well as layer 3 information. Information is divided into frame units and transmitted, and error control (retransmission control) is carried out by frame units. Further, frame units are integral multiples of octets.

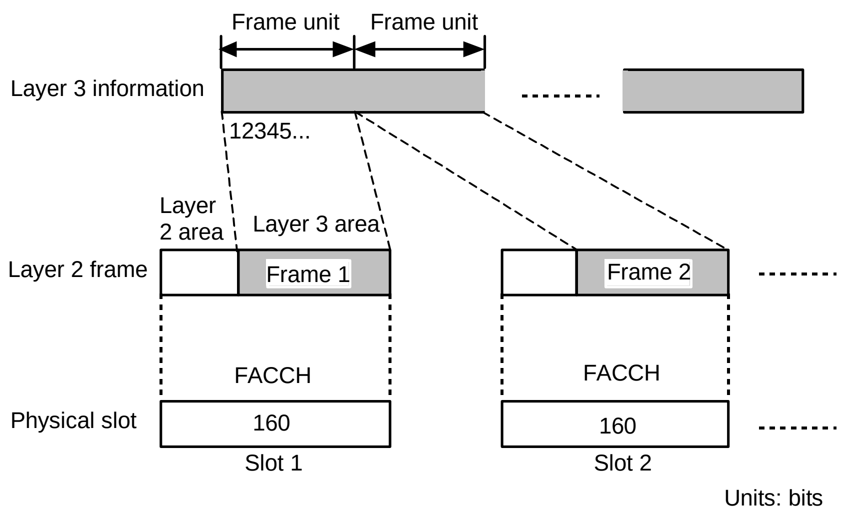


Figure 4.4.9 Relationship of layer 2 frame and physical slots as well as layer 3 information

(2) Layer 2 frame signal structure

Figure 4.4.10 shows the signal structure of FACCH's layer 2 frame.

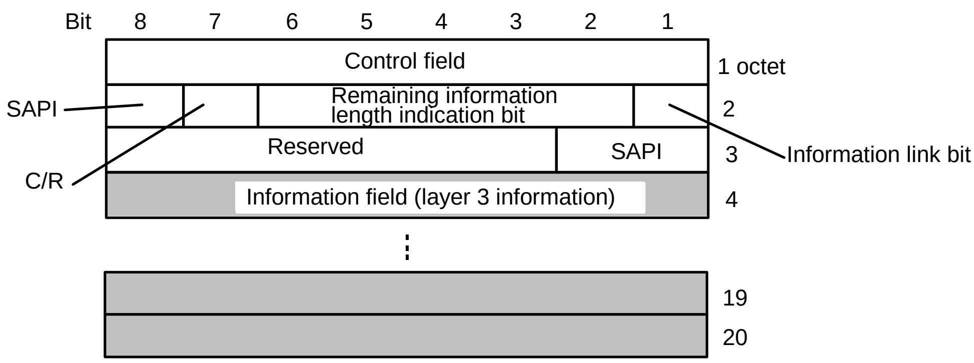


Figure 4.4.10 Signal structure of layer 2 frame

- Information link bit

Table 4.4.5 shows the bit assignments for information link bits. If the information field (layer 3 information) is divided into multiple frames and transmitted, it shows whether or not the frame is the last frame, and when it is the leading frame or a middle frame, it is used to link continuing frame information.

Table 4.4.5 Bit assignment for information link bits

Bit 1	
0	Leading frame or middle frame
1	End frame or undivided frame

- Remaining information length indication bit

Table 4.4.6 shows the bit assignments for the remaining information length indication bits. If the information field (layer 3 information) is the last frame or a frame that is not divided, it indicates the octet number of the layer 3 information length within the frame.

Table 4.4.6 Remaining information length indication bit assignments

Bit 6	5	4	3	2	
0	0	0	0	0	No layer 3 information
0	0	0	0	1	Layer 3 information length is 1 octet
0	0	0	1	0	Layer 3 information length is 2 octets
		. . .			. . .
1	0	0	0	0	Layer 3 information length is 16 octets
1	0	0	0	1	Layer 3 information length is 17 octets
		other			Reserved

(3) Elements of control field

Refer to section 4.4.2.4.

(4) Elements of command/response field bit (C/R)

Refer to section 4.4.2.2.2 item (5).

(5) Elements of SAPI

SAPI shows the type of layer 3 method. SAPI bit assignments are shown in Table 4.4.4-2.

Table 4.4.4-2 SAPI bit assignments

	3rd octet		2nd octet	
Bit	2	1	8	
	0	0	0	Reserved
	0	0	1	Connection control
	0	1	0	Reserved
	Other			Reserved

4.4.2.3 Address field (Private standard/Public standard)

The address field format, as shown in Figure 4.4.11, is constructed from the 1-bit command/response field bit (C/R) and the 3-bit service access point identifier (SAPI).

In LAPDC application, FACCH and SACCH perform point-point communication in the service channel establishment phase, which is a 1-to-1 data link, and therefore there is no terminal identifier in the address field part.

(Bit length)	(3)	(1)
	SAPI	C / R

C / R: Command/response field bit (refer to Table 4.4.3)
SAPI: Service access point identifier (refer to Table 4.4.4)

Figure 4.4.11 Address field format

4.4.2.4 Control field (Private standard/Public standard)

The control field identifies command or response frame classifications. And, if necessary, the control field has a sequence number.

The control field format specifies 3 types, information transfer format (I format), supervisory format (S format), and unnumbered format (U format). The control field format is shown in Table 4.4.7. Further, the modulo of the sequence number is 8.

Also, the bit structure of the control part is shown in Table 4.4.8.

Table 4.4.7 Control field format

Format	Control field							
	8	7	6	5	4	3	2	1
I format	N (R)			P	N (S)			0
S format	N (R)			P/F	S1	S2	0	1
U format	M1	M2	M3	P/F	M4	M5	1	1

P/F : P bit when it is transmitted as a command, and F bit when it is transmitted as a response
N (S) : Send sequence number
N (R) : Receive sequence number
Sn : Supervisory function identification bit (n = 1, 2)
Mn : Modifier function identification bit (n = 1–5)

4.4.2.4.1 Information transfer (I) format (Private standard/Public standard)

The I format is used for carrying out layer 3 entity mutual information transfer. The functions of N(S), N(R), and P are each independent. Each I frame has a P bit set at "0" or "1" as well as one sequence number N(S). The method of using N(S) as well as P is specified in section 4.4.2.5.

Also, N(R) is added in order to use it for transfer acknowledgment, but because transfer acknowledgment is carried out by the supervisory (S) frame, processing related to N(R) is not carried out in I frame reception.

4.4.2.4.2 Supervisory (S) format (Private standard/Public standard)

S format is used for carrying out supervisory control functions, that is, I frame acknowledgment and I frame retransmission requests.

N(R) and P/F functions are independent. Each supervisory frame has a P/F bit set at "0" or "1" and one sequence number N(R) that shows the acknowledgment state of the I frame received by the data link layer entity.

4.4.2.4.3 Unnumbered (U) format (Private standard/Public standard)

U format is used for providing supplementary link control functions. This format does not have sequence numbers, and has a P bit set at "1", or an F bit set at "0" or "1". However, the UI command is always set at "0".

Table 4.4.8 Control field bit structure

Format	Command abbreviation	Response abbreviation	Name	Control part bit structure							
				8	7	6	5	4	3	2	1
I format	I		Information	N (R)			P	N (S)			0
S format	RR	RR	Receive ready	N (R)			P/F	0	0	0	1
	RNR	RNR	Receive not ready	N (R)			P/F	0	1	0	1
U format	SABM		Set Asynchronous Balanced Mode	0	0	1	P	1	1	1	1
	DISC		Disconnect	0	1	0	P	0	0	1	1
	UI		Unnumbered Information	0	0	0	P	0	0	1	1
		UA	Unnumbered Acknowledg-ment	0	1	1	F	0	0	1	1
		DM	Disconnected mode	0	0	0	F	1	1	1	1
		FRMR	Frame Reject	1	0	0	F	0	1	1	1

4.4.2.5 Control operation elements (Private standard/Public standard)

4.4.2.5.1 Communication mode (Private standard/Public standard)

In communication mode, CS and PS are mutually equal regarding link control, and it uses the set asynchronous balanced mode (ABM) in which each can communicate without peer permission.

4.4.2.5.2 Poll (P)/Final (F) bit (Private standard/Public standard)

All frames have poll/final (P/F) bits. P/F bits provide the next function to both the command frame and the response frame.

The P/F bit is called the P bit for the command frame and the F bit for the response frame. The P bit set at 1 is used by the data link layer entity to poll the response frame from its peer's data link layer entity. The F bit set at 1 is used by the data link layer entity to indicate the response frame transmitted as the result of a poll command.

Until a P = 1 command and F = 1 response are transmitted and received, and an F = 1 response is sent in response to a P=1 command, a new P = 1 command cannot be transmitted unless there is a T1 time out. This regulation is valid across all the data link control operation procedures of section 4.4.2.8.4 except where specially noted. For example, this means that if a DL-release-request primitive is received in establish waiting state of multiframe acknowledged operation mode, the DISC command cannot be transmitted until a valid F = 1 response is received or T1 reaches time out.

4.4.2.5.3 Variables and sequence numbers (Private standard/Public standard)

(1) Modulo

Continuous numbers from 0 up to n-1 are attached to each I frame (here, n is the modulo of the sequence number). The modulo is 8, and the sequence number circulates through the whole range from 0 to 7.

(2) Send state variable V (S)

The data link layer entity has a send state variable V(S) for when the I frame is used. V(S) shows the sequence number of the I frame that should be transmitted next. This V(S) can take values from 0 to n-1. The value of this V(S) increases by 1 for each continuous transfer of each information frame. However, V(S) must not exceed the value of adding the maximum number of outstanding I frames N3 (see section 4.4.2.8.2) to V(A). The value for the number of outstanding I frames O (see section 4.2.8.3) is in the range $0 \leqq O \leqq 7$.

(3) Acknowledge state variable V (A)

The data link layer entity has an acknowledge state variable V(A) corresponding to when the I frame command and the S frame command/ response are used. V(A) shows the frame that can be acknowledged next by its peer. (V(A)-1 is equal to N(S) of the I frame acknowledged last.) This V(A) can take a value from 0 to n-1. The value of V(A) is updated by the correct N(R) value acknowledged by the S frame transmitted from its peer. The correct N(R) value is a value in the range of $V(A) \leqq N(R) \leqq V(S)$.

(4) Send sequence number N (S)

Only the I frame has the Send sequence number N(S) of the transmitted frame. The value of N(S) previous to transfer of I frames of continuous numbers is set so that it is equal to V(S) of the relevant I frame transmitted immediately before.

(5) Receive state variable V(R)

The data link layer entity has a receive state variable V(R) when using I frame command and S frame command/response. V(R) shows the sequence number of the I frame series that should be received next. This V(R) can take values from 0 up to n-1. The value of V(R) is incremented by 1 when error-free continuous N(S) I frames are received and that N(S) is equal to V(R).

(6) Receive sequence number N(R)

All I frames and S frames have Receive sequence numbers for the I frames that should be received next. Previous to I or S frame transfer, the value of N(R) is set so that it becomes equal to the newest V (R). N(R) indicates that the data link layer entity that sent that N(R) correctly received all I frames that have numbers up to N(R)-1. However, there is no receiving processing of N(R) attached to an I frame.

4.4.2.5.4 Timers (Private standard/Public standard)

(1) Response acknowledgment timer T1

This is a response waiting timer that starts when the P = 1 command is sent, and stops when the F=1 response is received. By reaching time out, it transmits the appropriate command, and it is used when controlling retransmission.

(2) Response transfer timer T2

This is a timer for delaying S frame response to a correctly received P = 0 I frame. It starts when a P = 0 I frame is received, and it sends an F = 0 S response frame when it times out. When the timer is operating, it does not stop if a P = 0 I frame is received; it stops when a P = 1 command frame is received.

(3) Peer station busy supervisory timer T3

This is a timer for supervising peer stations busy. It starts when an RNR frame is received, and when it times out, it transmits an S command frame and queries peer's state. If an RNR frame is received while the timer is operating, the timer restarts; if an RR frame is received, the timer stops.

(4) Link supervisory timer T4

This is a timer that supervises the normality of the data link when frame transmission and reception do not exceed a fixed time in multiframe acknowledged operation mode. It operates exclusive of T1; it starts with F = 1 response reception, it stops with P = 1 command transmission, and it restarts with F = 0 response reception. It acknowledges the link (S frame transmission and reception) at time out.

4.4.2.6 Command and response (Private standard/Public standard)

4.4.2.6.1 Information transfer (I) command (Private standard/Public standard)

The information transfer (I) command function inserts the information obtained from layer 3 into the frame's information field, and transmits it with assigning numbers.

4.4.2.6.2 Set asynchronous balanced mode (SABM) command (Private standard/Public standard)

The SABM unnumbered command is used for setting designated PS and CS to the modulo 8 acknowledged multiframe operations mode.

The data link layer entity that received the SABM transmits a UA response at the first opportunity, and reports reception of the SABM command. If an SABM command is received, V(S) and V(R) of the data link entity are set at 0. When the SABM command is sent, all exceptional conditions are cleared. At the point that the SABM command is processed, I frames that have already been sent and have not had acknowledged response are abandoned without acknowledged response. In this way, I frames can be lost, but their recovery is carried out by a higher layer or management entity.

4.4.2.6.3 Disconnect (DISC) command (Private standard/Public standard)

The DISC unnumbered command is used to end acknowledged multiframe operations mode.

4.4.2.6.4 Receive ready (RR) command/response (Private standard/Public standard)

The data link layer entity uses the RR monitor frame for the following purposes.

(1) To show that the data link layer entity can receive an I frame.

(2) Among the I frames that are completely received, to acknowledge response for I frames up to N(R)-1 I frames.

(3) Beforehand, it reports cancellation of the busy state shown by RNR frame transfer.

In addition to applications showing the state of the data link layer entity, the data link layer entity uses the RR command with P bit = 1 for querying the state of its peer data link entity.

4.4.2.6.5 Receive not ready (RNR) command/response (Private standard/Public standard)

The RNR monitor frame is used to show that the data link layer entity is in reception busy state. Reception busy state is the state where the succeeding I frame cannot be temporarily received.

4.4.2.6.6 Unnumbered acknowledgment (UA) response (Private standard/Public standard)

The UA unnumbered response SABM command or DISC command receives the unnumbered command, and is used for acknowledging reception. The received SABM command or DISC command is processed after the UA response is transmitted.

4.4.2.6.7 Disconnected mode (DM) response (Private standard/Public standard)

The DM unnumbered response is used for reporting to its peer that the data link layer entity cannot execute the acknowledged multiframe operation mode. The DM response does not have an information part.

4.4.2.6.8 Frame reject (FRMR) response (Private standard/Public standard)

The FRMR unnumbered response is received by the data link layer entity as a report of the error state where recovery is not possible even by retransmission of the identical frame. When a frame is received that is not an invalid frame, the error state is named when at least one of the following error conditions applies.

Furthermore, FRMR transfer is fixed at F = 1.

(1) When a command/response is received that has a control field that is not defined or not implemented

(2) When an unnumbered frame or supervisory frame that has an incorrect length is received

(3) When a frame is received for which the N(R) is not valid

(4) When an information frame is received that exceeds the maximum length

An undefined control frame is one that has coding not shown in Table 4.4.8.
An N (R) value that is invalid is an N(R) that takes a value outside of the range V (A)≦N (R)≦V (S).
The reason for the FRMR response can be inserted in the information field as a function option. This information field format is shown in Table 4.4.9.

4.4.2.6.9 Unnumbered information (UI) command (Private standard/Public standard)

The UI unnumbered command is used for high-speed transfer of the layer 3 signal without transmission acknowledged by Layer 2. For example, since an FACCH link is not established in the communications phase, it is possible to use the UI command and transmit control signals even in unestablish state.

Table 4.4.9 Structure of FRMR information fields

Information field bit structure						
24 - 21	20 - 17	16 - 14	13	12 - 10	9	8 - 1
Reserved	z y x w	N (R)	C/R	N (S)	0	RFCF

RFCF: Bit structure of control field of reception frame in which frame rejection state was generated
N (S): Present value of Send sequence number
N (R): Present value of receive sequence number
C/R: "1" if reception frame is command, and "0" if reception frame is response
w: "1" if the control field of the reception frame is undefined or impossible to execute
x: "1" if the reception frame includes unapproved information fields
y: "1" if information fields exceeding capacity of buffer that can be used are received
z: "1" if N (R) of the reception frame is invalid N(R)

4.4.2.7 Elements for communication between layers (Private standard/Public standard)

4.4.2.7.1 Overview (Private standard/Public standard)

In this standard, communication between layers and communication between data link layer entities and management entities are carried out through primitives.

In general, a primitive is something that abstractly represents the logical exchanges of information and control between a data link layer and an adjacent layer. It is not something that provides a specific entity or interface.

Primitives consist of commands related to service elements to lower layers and of responses from them. The basic form of a primitive is as follows.

XX--general name-type: Parameter

Here XX shows the interface through which the primitive flows. In this standard, XX is as follows.

DL: Communication between layer 3 and data link layer entities
MDL: Communication between management and data link layer entities
PH: Communication between data link layer and layer 1 entities
MPH: Communication between management and layer 1 entities

4.4.2.7.1.1 General name (Private standard/Public standard)

The general name specifies the operation that should be executed. The primitives defined in this standard are shown in Table 4.4.10. A primitive has parameters, but not all have parameters.

The general names for primitives defined in this standard are as shown below.

(1) DL-establish

The DL-establish primitive is used to request procedures for establishing multiframe acknowledged operation mode, for indication of the results, or for acknowledgment.

(2) DL-release

The DL-release primitive is used for requesting procedures for completion of the set multiframe acknowledged operation mode, acknowledging the results, or indicating completion of previously defined multiframe operations or indication that establishing was not successful.

(3) DL-data

The layer 3 entity uses the DL-data primitive for the data link layer's acknowledged information transfer service. It is used for requesting transfer of layer 3 information and indicating its receipt.

(4) DL-unit data

The layer 3 entity uses the DL-unit-data primitive for the data link layer's non-acknowledged information transfer service. It is used for requesting transfer of layer 3 information and indicating its receipt.

(5) MDL-error

The MDL-error primitive is used to indicate to a management entity that there was an error related to a previous management function request, or an error was detected in the result of communication with data link layer peer entity.

(6) MDL-unit data

The MDL-unit data primitive is used by the management entity to request message transfer using the non-acknowledged information transfer service of the data link layer; it is also used to indicate its receipt.

(7) PH-data

The PH-data primitive requests the layer 1 entity to transmit message units including frames used in communication between data link layers, and is used for indicating that layer 1 received it.

(8) PH-activate

The PH-activate primitive is used to indicate to the data link layer entity that layer 1 was activated.

(9) PH-deactivate

The PH-deactivate primitive is used to indicate to the data link layer entity that layer 1 was stopped.

(10) MPH-activate

The MPH-activate primitive is used by the management entity to indicate to the data link layer entity that layer 1 activation was requested, or that layer 1 was activated.

(11) MPH-deactivate

The MPH-deactivate primitive is used to request a stop of layer 1 or to indicate that layer 1 was stopped. Request primitives are used by the network management entity.

4.4.2.7.1.2 Primitive type (Private standard/Public standard)

The primitive type defined in this standard are the 4 types below. Further, the relationship between the data link layer entity (layer 2 entity) and primitives is shown in Figure 4.4.12.

(1) Request

The request primitive types is used when requesting service from lower layers by higher layers or layer management entities.

(2) Indication

The indication primitive types is used by layers offering services for reporting to higher layers or management entities.

(3) Response

The response primitive types is used by a higher layer or the management entity as a result of the indication primitive.

(4) Confirm

The confirm primitive types is used to report to the request source that the layer entity that received a service request has completed processing.

Table 4.4.10 Primitive List

Entity	General name	Type				Parameter (Message unit)	Message unit contents
		Request	Indication	Response	Confirm		
Layer 3 | Layer 2	DL-establish	○	○		○		
	DL-release	○	○		○		
	DL-data	○	○			○	Layer 3 message
	DL-unit data	○	○			○	Layer 3 message
Manage-ment | Layer 2	MDL-error		○			○	Layer 2 error message
	MDL-unit data	○	○			○	Management message
Layer 2 | Layer 1	PH-data	○	○			○	Layer 2 frame
	PH-activate		○				
	PH-deactivate		○				
Manage-ment | Layer 1	MPH-activate	○	○				
	MPH-deactivate	○	○				

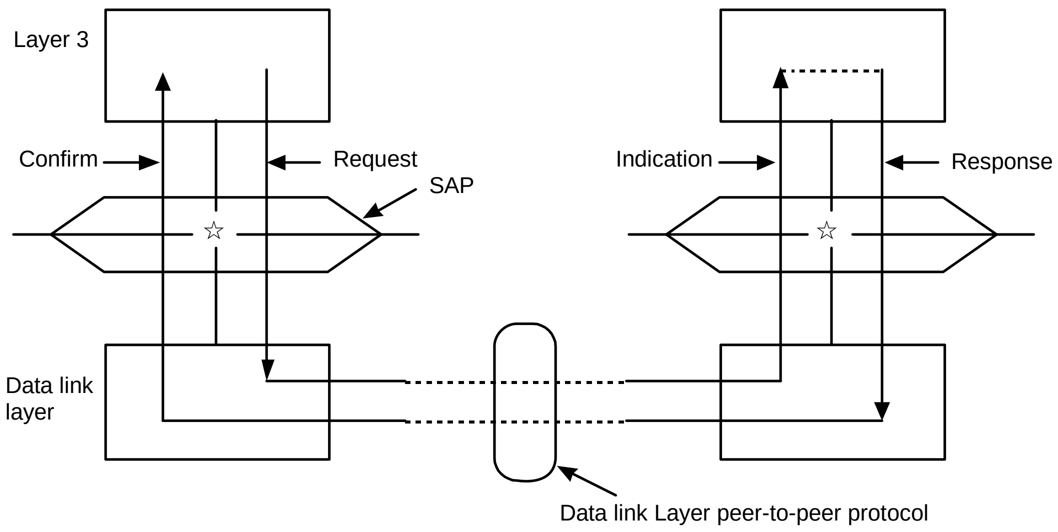


Figure 4.4.12 Relationship between layer 2 and data link primitive types

4.4.2.7.1.3 Parameter definition (Private standard/Public standard)

The message unit includes inter-layer supplementary information related to the operation and results in a response to a request. In the case of data primitives, the message unit includes the requested inter-layer message. For example, the message unit for the DL-data primitive includes layer 3 information. The message unit of the PH-data primitive includes the data link layer frames.

4.4.2.7.2 Primitive procedures (Private standard/Public standard)

4.4.2.7.2.1 Overview (Private standard/Public standard)

Primitive procedures specify mutual operations for activating and offering services between adjacent layers. The service primitive expresses procedure elements.

In this standard, layer 3 entity and data link entity mutual operations are specified.

4.4.2.7.2.2 Layer 3 entity and data link layer entity mutual operations (Private standard/Public standard)

The state of the data link connection end point is determined by the detailed state of the data link layer entity. The states of data link end point are shown below.

(1) Link connection release state

(2) Link establish waiting state

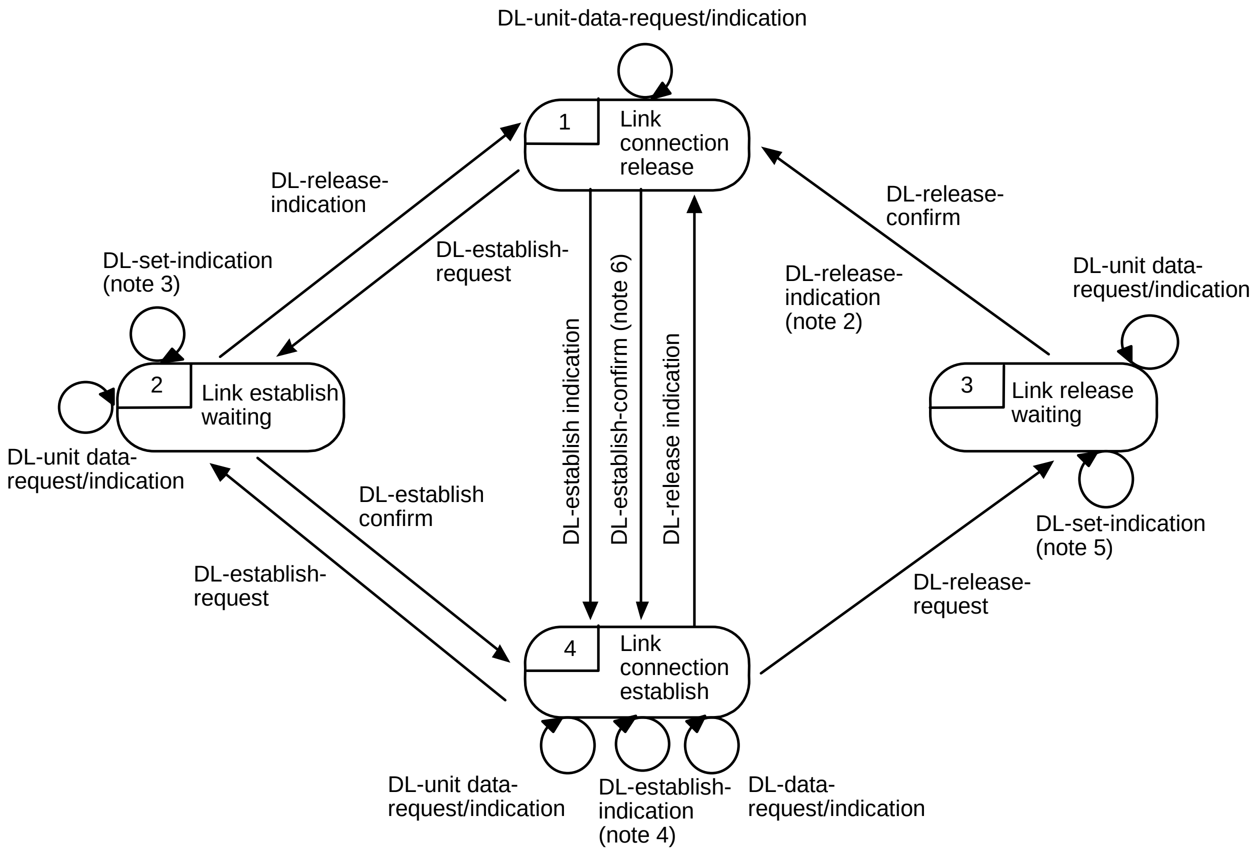
(3) Link release waiting state

(4) Link connection establish state

Primitives offer procedures that conceptually specify methods of activating the user services of the data link layer entity.

In this section, restrictions pertaining to sequences generated by primitives are specified. Sequences are related to the state at one point-point data link connection end point.
An overview of the primitive sequences at one point-point data link connection end point is shown in Figure 4.4.13. Link connection release state and link connection establish state are stable states, and link establish waiting state and link release waiting state are transient states.

This model shows layer 2 operations that can be seen from layer 3. In this model, it is assumed that primitives transmitted or received between layers are processed by a FIFO queue. Collisions may occur between "request" and "indication" primitives in operations that seem to contradict actual layer 2 protocols. That is, these collisions may occur in actual examples. In such a case, the guidelines of this figure are to be followed.



(Note 1) When the data link layer entity transmits a DL-establish-indication (this is used in re-establish activated by the data link layer entity or peer system), DL-release-confirm or DL-release-indication primitive, all data units corresponding to the DL-data-request primitive are aborted.
(Note 2) This primitive occurs when DL-release-request and DL-release-indication primitives collide.
(Note 3) This primitive occurs when DL-establish-request and DL-establish-indication primitives collide.
(Note 4) This primitive occurs when layer 3 is notified of link re-establish.
(Note 5) This primitive occurs when DL-release-request and DL-establish-indication collide.
(Note 6) This primitive occurs when DL-establish-request and DL-release-indication collide.
Since this DL-release-indication is not related to DL-establish-request, the data link layer entity sets the link, and sends DL-establish-confirm.

Figure 4.4.13 State transition figure for primitive sequences in point-point data link connection end point seen from layer 3 (excluding exceptional condition) (note 1)

4.4.2.8 Data link control operations (Private standard/Public standard)

4.4.2.8.1 Procedure classes and operation modes (Private standard/Public standard)

The procedure classes use balanced procedure classes in which CS and PS are equal with regard to link control, and the operation modes use asynchronous modes by which communication is possible without peer permission.

4.4.2.8.2 System constants (Private standard/Public standard)

The system constants required for data link control are shown in Table 4.4.11.

Table 4.4.11 System constant list

System constants	Abbreviat-ed name	Definition of value	value
Max. number of bits in I frame information part	N1	Maximum number of bits in I frame information part	FACCH = 136 bits SACCH = 16 bits
Number of time outs until moving to system recovery	N2	Number of consecutive time outs until it moves to system recovery	10 times
Maximum number of outstanding I frames	N3	Maximum number of I frames that can be transmitted without acknowledging peer reception	7 frames
Response acknowledge timer	T1	Timer value for acknowledging if peer received 1 or multiple frames	0.2 seconds
Response transmission timer	T2	Timer value for delaying response transmission to I frames received normally	1 second
Peer station reception busy supervisory timer	T3	Timer value for supervisory (S) frame transmission of peer station busy state	1 second
Link supervisory timer	T4	Timer for supervising link normality when I frames and S frames are not sent or received and T1 is not activated	10 seconds (Note)

(Note) The value is not specified in case of π /2 shift BPSK communication.

4.4.2.8.3 Counters (Private standard/Public standard)

The counters needed for data link control are shown in Table 4.4.12.

Table 4.4.12 Counter list

Counter type	Abbreviated name	Definition of value
Send state variable	V (S)	Shows transmitter send sequence number of I frame that should be transmitted next.
Receive state variable	V (R)	Shows transmitter send sequence number of I frame that should be received next.
Number of outstanding I frames	O	Shows number of I frames previously transmitted that have not been acknowledged as received by peer. Also, N3 can be set, and I frame transmission can be specified.
Number of timer T1 consecutive time outs	K	Shows number of times when T1 timer has timed out consecutively.
Send state variable when transmitting P bit	J	Shows value of S when P bit =1 frame was transmitted.
Acknowledge state variable	V (A)	Shows transmitter send sequence number of I frame that should be acknowledged next by peer.

4.4.2.8.4 Data link control operation procedures (Private standard/Public standard)

In this section, control operation procedures used by the data link layer are specified. Appropriate procedure elements (frame types) are shown below.

(1) Unacknowledged information transfer (section 4.4.2.8.4.1)

(a) UI command

(2) Acknowledged multiframe information transfer (sections 4.4.2.8.4.2 – 9)

(a) SABM command

(b) UA response

(c) DM response

(d) DISC command

(e) RR command/response

(f) RNR command/response

(g) I command

(h) FRMR response

4.4.2.8.4.1 Unacknowledged information transfer procedure (Private standard/Public standard)

(1) Overview

The procedures used in information transfer by the unacknowledged operation mode are specified below.

The data link error recovery procedures are not specified for the unacknowledged type. Furthermore, this frame can be used regardless of mode state even in multiframe acknowledged operation mode, but since the processing procedure does not change, descriptions of the processes related to transmission and reception of the UI frame have been omitted from the regulations of the processing procedure in multiframe acknowledged operation mode.

(2) Unacknowledged information (UI frame) transmission

The unacknowledged information is delivered to the data link layer entity via both DL-unit data-request primitive and MDL-unit data-request primitive. Layer 3 or the management message unit is transmitted by the UI command frame. This frame is unnumbered and does not have a sequence number, and the P bit is usually "0", and it does not perform retransmission control and state transition by transfer.

(3) Unacknowledged information (UI frame) reception

By receiving a UI frame that has SAPI provided on the destination-side, the contents of the information field included in this frame are passed from the data link layer entity to the layer 3 entity or the management entity via the DL-unit data-indication primitive or the MDL-unit data-indication primitive. However, UI frame reception does not carry out state changes or retransmission in the data link layer entity.

Also, UI command frames that have other SAPI are aborted.

4.4.2.8.4.2 Multiframe acknowledged operation mode establishing procedures
(Private standard/Public standard)

(1) Overview

These procedures are used to set the multiframe acknowledged operation mode at CS and a specific PS. The layer 3 entity uses the DL-establish-request primitive to request multiframe acknowledged operation mode information transfer from the data link layer. Re-establishing is performed by data link layer entity procedures specified in Section 4.4.2.8.4.3. All frames other than U frame formats that are received during establishing procedures are ignored.

(2) SABM frame transmission

When it receives a DL-establish-request primitive, the data link layer entity transmits the P = 1 SABM command and clears existing exceptional conditions, clears the number of consecutive timer T1 time outs (below referred to as K), starts the response acknowledge timer (below: T1) and enters multiframe acknowledged operation mode establish waiting state. In establish waiting state, it carries out the following operations according to the frame received.

(a) When the F = 1 UA response is received, T1 is stopped, T4 is activated and the various counters are initialized, and after DL-establish-confirm primitive is issued, it enters the multiframe acknowledged operation mode establishing state.

(b) When an F = 1 DM response is received, T1 is stopped, and the DL-release-indication primitive is issued, and it enters the multiframe acknowledged operation mode not-establish state.

(c) When the FRMR response is received, T1 is re-activated, and the MDL -error-indication primitive is issued, and it transmits SABM and performs new link establishing.

(d) When SABM is received, an F = 1 UA response is transmitted, but SABM response acknowledge waiting state continues.

(e) When the DISC command is received, T1 is stopped, and an F = 1 DM response is transmitted, and the DL-release-indication primitive is issued, and it enters the multiframe acknowledged operation mode not-establish state.

(f) If commands and responses other than those above are received, they are ignored.

(g) When T1 times out, if K < N2, K is incremented by 1, and the P = 1 SABM is retransmitted, and T1 is started. If K = N2, the data link layer entity issues the MDL-error-indication primitive and DL-release-indication primitive, and enters unestablish state.

(h) When a DL-release-request primitive is received, it holds the release request, and after process (a), due to the held release request, it transmits a P = 1 DISC , reactivates T1, and enters multiframe acknowledged operation mode release waiting state.

(i) When a DL-establish-request primitive is received, it stores the history of receiving this primitive, and establish waiting state of multiframe acknowledged operation mode continues. After that, if an F = 1 UA is received, it issues a DL-establish-confirm primitive to layer 3, and enters establish state of multiframe acknowledged operation mode.

(3) SABM frame reception

In multiframe acknowledged operation mode unestablish state, a data link layer entity that received an SABM command carries out the processing below when it can shift to the multiframe acknowledged operation mode state.

(a) It transmits an F = 1 UA response and initializes the various counters.

(b) It activates T4 and issues the DL-establish-indication primitive, and enters multiframe acknowledged operation mode establishing state.

If link establishing is not possible, it transmits an F = 1 DM response, and does not shift state.

4.4.2.8.4.3 Multiframe acknowledged operation mode re-establish (Private standard/Public standard)

(1) Re-establish conditions

Multiframe acknowledged operation mode re-establish is carried out under the conditions below in establishing state and exception condition of multiframe acknowledged operating mode.

(a) When SABM is received

(b) When the DL-establish-request primitive is received

(c) When the data link layer entity issues the MDL-error-indication primitive to the management entity with K (the number of consecutive time outs for timer T1) equal to N2

(d) When FRMR response is received

(2) Re-establishing procedures

For multiframe acknowledged operations mode re-establishing conditions, the data link layer entity carries out processing following the regulations below.

In multiframe acknowledged operation mode establishing state, the following processes are performed.

(a) When SABM is received, it stops all timers, initializes the various counters, issues the DL-establish-indication primitive, activates F = 1 UA transmission and T4, and enters multiframe acknowledged operation mode establishing state.

(b) If a DL-establish-request primitive is received, it stops timers that are in operation other than T1, transmits SABM, activates T1, and enters establish waiting state of multiframe acknowledged operation mode.

(c) When FRMR is received, it issues the MDL-error-indication primitive, transmits SABM, activates T1, and enters establish waiting state of multiframe acknowledged operations mode.

According to these conditions, if an F = 1 UA is received in link establish waiting state, it activates T4, and if link re-establish was performed by a request from the layer 3 entity, it issues the DL-establish- confirm primitive, and if the data link layer entity performs re-establish independently, it issues the DL-establish-indication primitive. Also, all outstanding I frames are aborted by link re-establish.

Also, in exception condition, the following processes are performed.

(a) When SABM is received, the T1 timer is stopped, each of the various counters is initialized, a DL-establish-indication primitive is issued, F = 1 UA transmission and T4 are activated, and it enters multiframe acknowledged operation mode establishing state.

(b) If a DL-establish-indication primitive is received, SABM transmission and T1 are activated, and it enters establish waiting state of multiframe acknowledged operation mode.

(c) When FRMR is received, all timers are stopped, an MDL-error-indication primitive is issued, SABM transmission and T1 are activated, and it enters establish waiting state of multiframe acknowledged operation mode.

4.4.2.8.4.4 Multiframe acknowledged operation mode release

(Private standard/Public standard)

(1) Overview

These procedures are used for releasing the data link between a CS and a specific PS.
If release of the data link is requested by the layer 3 entity, the DL-release-request primitive is issued to the data link layer entity. Also, all outstanding queued I frames and the DL-data-request primitive are aborted.

If release is done by a primitive from the layer 1 entity, the data link layer entity aborts all I frames, and if the DL-release-request primitive is outstanding, the DL-release-confirm primitive is issued, and in other situations the DL-release-indication primitive is issued. Also, all frames received during release procedures other than U frames are ignored.

(2) Release procedures

The data link layer entity in the establish state of multiframe acknowledged operation mode which received the DISC command stops all timers, transmits an F = 1 UA response, issues the DL-release-indication primitive, and enters link not-establish state.

The data link layer that has received a link release request from the layer 3 entity stops timers that are operating except for T1, transmits a P = 1 DISC command, activates T1, resets K, and enters release waiting state of multiframe acknowledged operation mode. In release waiting state, the following processes are performed by the received frame or by the primitive.

(a) When an F = 1 UA response and an F = 1 DM response are received, it stops T1, issues the DL-release-confirm primitive, and enters unestablish state of multiframe acknowledged operation mode.

(b) If an FRMR is received, it stops T1, issues an MDL-error-indication primitive, transmits a P = 1 DISC, activates T1, and does not shift state.

(c) If T1 times out, when K < N2, a P = 1 DISC is transmitted and T1 is activated, and it enters release waiting state of multiframe acknowledged operation mode. Also, when K = N2, an MDL-error-indication primitive and DL-release-confirm primitive are issued, and it enters unestablish state of multiframe acknowledged operation mode.

(d) If SABM is received, it transmits an F = 1 DM response and does not shift state.

(e) If DISC is received, it transmits an F = 1 UA response, and does not shift state.

(f) If a command or response other than the above is received, it is ignored.

Also, regarding the link not-establish state, the following processing is carried out.

(a) When the DISC command is received, an F = 1 DM response is transmitted, and it does not shift state.

(b) When the SABM command is received, processing is done following the procedures in section 4.4.2.8.4.2 multiframe acknowledged operation mode establishing procedures.

(c) If a P = 1 frame other than this is received, it transmits an F = 1 DM response, and does not shift state.

(d) Frames other than these are all aborted.

Also, in exceptional condition, the following processes are performed.

(a) If a DISC command is received, T1 timer is stopped, a DL-release-indication primitive is issued, an F = 1 UA response is transmitted, and it enters unestablish state of multiframe acknowledged operation mode.

(b) If an F = 1 DM response is received, timer T1 is stopped, a DL-release-indication primitive is transmitted, and it enters unestablish state of multiframe acknowledged operation mode.

(c) If a DL-release-request primitive is received, a P = 1 DISC command is transmitted, T1 is activated, and it enters release waiting state of multiframe acknowledged operation mode.

4.4.2.8.4.5 Collision between unnumbered command and response

(Private standard/Public standard)

(1) Collision of same transmission and reception commands

If the transmitted U command (SABM or DISC) and received U command are the same, the data link layer entity transmits an F = 1 UA response at the earliest opportunity. However, state shifting is not performed following U command transmission, and it is carried out after reception of a UA response. The data link layer entity reports using the primitive appropriate to the corresponding layer 3 entity.

(2) Collision of different transmission command and reception command

If the transmitted U command (SABM or DISC) and the received U command are different, the data link layer entity transmits an F = 1 DM response at the earliest opportunity. A data link layer entity that receives the DISC command after sending SABM, when it receives an F = 1 DM response, issues the DL-release-indication primitive, stops T1 , and enters unestablish state. A data link layer entity that receives SABM after sending the DISC command issues a DL-release-confirm primitive when it receives an F = 1 DM response, and enters unestablish state.

(3) DM response reception

Regardless of state in multiframe acknowledged operation mode, if an F = 1 DM response is received, link release is performed.

4.4.2.8.4.6 Acknowledged information transfer (Private standard/Public standard)

(1) I frame transmission

Information delivered from the layer 3 entity by the DL-data-request primitive is transmitted by I frame. V(S) and V(R) values are assigned to the control field parameters N(S) and N(R), respectively. The P value is set by the DL-data-request primitive. However, the data link layer entity can also set it independently. The V(S) value is incremented by 1 when I frame transmission is completed. Also, T1 is activated when a P = 1 I frame is transmitted. Also, if T1 did time out, processing is done following the T1 time out processing procedures in item (4) of section 4.4.2.8.4.7.

If the number of outstanding I frames (below: O) equals the maximum number of outstanding I frames (below: N3), the data link layer entity cannot transmit any new I frames. However, retransmission can be done according to the I frame retransmission procedure in section 4.4.2.8.4.8.

(2) I frame reception

Regardless of the timer recovery state, when the data link layer entity receives valid I frames that have transmission sequence numbers (below: N(S)) equal to the V(R) and local station reception is not busy, the following processing is carried out.

(a) Passes information field to the top layer using the DL-data-indication primitive

(b) Increments V(R) value by 1.

(c) Performs the following processing according to P bit value. Also, if the data link layer entity goes into local station busy state, all received I frames are processed according to the procedures for creating and releasing reception-busy state of section 4.4.2.8.4.8.

When P = 1

- When it's not in local station reception busy state due to reception of I frames, the data link layer entity transmits an F = 1 RR response.

- When it enters local station reception busy state, the data link layer entity transmits an F = 1 RNR response.

When P = 0

According to the regulations of item 2 in section 4.4.2.8.4.7, after the response transmission timer (below: T2) times out, the following processing is performed.

- When it's not in local station reception busy state, the data link layer entity transmits an F = 0 RR response.

- When it's in local station reception busy state, the data link layer entity transmits an F = 0 RNR response and processing is done according to local station reception busy state procedures.

4.4.2.8.4.7 Transmission and reception of acknowledgment (Private standard/Public standard)

(1) Transmission of acknowledgment

When the data link layer entity transmits I frames or S frames, usually it is set so that the transmitter receive sequence number (below: N(R)) value and the V(R) value are equal. Also, if a P = 1 I command is received, an F = 1 S response is transmitted immediately, and the transmission timing of the RR and RNR responses to the P = 0 I command is decided by the T2 value.

(2) T2 timer processing

T2 specifies the transmission timing of the RR response or RNR response in response acknowledgment for normally received P = 0 I frames from its peer station. T2 starts when the N(S) of the I frames normally received from its peer station equals V(R) and T2 is not started.

If T2 times out, an F = 0 RR response is sent as the response for I frames received up until then if the local station isn't busy, and if the local station is busy, an F = 0 RNR response is sent.

The T2 timer stops when an F = 1 or P = 1 S frame is transmitted.

(3) Reception of acknowledgment

Regardless of local station reception busy state or timer recovery state, if valid S frames are received, the data link layer entity regards as acknowledged all completely transmitted I frames that have N(S) values up to the received N(R)-1 value, and the V(A) value is set at N(R) according to the N(R) included in the frames. If the data link layer entity receives an F = 1 S frame that has a valid N(R) value, timer T1 is stopped. At this time, if N(S) (the value expressed by J) at the time of P = 1 I frame transmission and the value of N(R) are not equal, the value of V(A) is set to N(R), and if the reception response is RR, the I frame is retransmitted immediately, and if it is RNR, the I frame is retransmitted by the retransmission procedure of section 4.4.2.8.4.7(5), after waiting for recovery of reception busy of its peer station.

If a P = 1 S frame is received, the value of N(R) is set to V(A), and if not in local reception busy state, an F = 1 RR response is sent, and if in local station reception busy state, an F = 1 RNR response is sent.

If an F = 0 S frame is received, retransmission control is not activated even if outstanding I frames are present.

(4) T1 time out processing

In establish state of multiframe acknowledged mode, if T1 times out, depending on the state, the following processing is performed.

(a) If it's not already in timer recovery state, it enters timer recovery state and sets K = 1.

(b) If it's already in timer recovery state, K is incremented by 1. The data link layer entity performs the following processing according to the values of N2 and K.

[1] If K > N2: If it's not in local station reception busy state, it sends a P = 1 RR command, and if it's in local station reception busy state, it sends a P = 1 RNR command and starts T1.

[2] If K = N2: It performs the operation mode re-establish process according to re-establish procedures in section 4.4.2.8.4.3.

The timer recovery state is released by reception of a valid S response set at F = 1 by the data link layer entity. If the value of N(R) of the received S frame is V (A) ≦ N (R) ≦ V (S), V (S) is set at the value of the received N(R).

(5) Retransmission control

In multiframe acknowledged operation mode, I frame retransmission control is performed by the P/F bit check pointing function. The P/F bit check pointing function detects I frame sequence number errors using the value of N(R) of this frame, since the P = 1 command and F = 1 response are transmitted and received in response to each other.

It operates as follows, with the local station as the I frame origination-side, and its peer station as the destination-side.

When transmission and reception are performed without sequence number errors, a P = 0 I frame in which the values of V(S) and V(R) are set to N(S) and N(R) is transmitted by the local station, and 1 is added to V(S). Its peer station that receives this I frame checks whether N(S) is equal to V(R), and if they are equal, it adds 1 to V(R), and takes in the information field. Then, a P = 1 I frame is similarly transmitted from the local station. If a P = 1 I frame is sent, 1 is added to V(S), then the value of V(S) is set to J. When this is received by its peer station, it checks whether N(S) is equal to V(R), and if they are equal, it adds 1 to V(R), takes in the information field, and transmits an F = 1 RR frame in which the value of V(R) is set to N(R). The F = 1 RR frame is received by the local station, and it sets the value of N(R) to V(A). If the value of N(R) is equal to the value of J, it can be confirmed that everything up to the P = 1 I frame was transferred.

If a sequence number error occurs due to a missing P = 0 I frame, it operates in the same way as the case where the initial I frame is missing as stated in the example above. Because the initial I frame reception process is not carried out at its peer station, if a 2nd P = 1 I frame is received, because N(S) > V(R), the information field is aborted, V(R) is not incremented, and the value of V(R) is set to N(R), and an F = 1 RR frame is transmitted. The F = 1 RR frame is received at the local station, and it sets the value of N(R) to V(A). Also, because N(R) < J, it recognizes that an I frame was missing in the sequence, and it sets the value of V(A) to V(S), and retransmits everything from the V(S) I frame. Also, if due to a missing response, because N(R) and J are not equal, it is seen as the I frame not being missing, and V(S) is not changed and retransmission control is not performed.

If there is a missing P = 1 I frame or F = 1 RR frame, it operates in the same way as the case where the 2nd I frame or its response is missing in the example above. For example, although T1 timer operation is not described, when a P = 1 I frame is transmitted at the local station, T1 is activated, but since there is no F = 1 response, T1 times out. When T1 times out, a P = 1 RR command is transmitted in order to query the reception state of its peer station. Its peer station that has received this RR command transmits an F = 1 RR response by N(R) set to the value of V(R). At the local station, V(A) is set by N(R) of the received RR response, and because N(R) < J in the case where a P = 1 I frame is missing, the value of V(A) is set to V(S), and everything is retransmitted from V(S). Also, in the case where a response is missing, because N(R) is equal to J, it recognizes that no I frames were missing, and V(S) is not changed, and retransmission control is not performed.

4.4.2.8.4.8 Generation and cancel of reception busy state (Private standard/Public standard)

(1) Generation and cancel of local station reception busy state

If local station reception busy state is generated, and temporary stop in transmission of I frames to its peer station is requested, it is reported to its peer station by transmitting one of the following RNR frames.

(a) F = 0 RNR response.

(b) If busy state occurs after receiving a P = 1 command frame, F = 1 RNR response.

(c) If busy state occurs when T1 times out, P = 1 RNR command.

Even if the state is local station reception busy, it is possible to transmit I frames and other frames.

Also, when I frames or S frames are received in local station reception busy state, one of the following processes is performed, according to the value of the P/F bit.

(a) If a P = 1 I frame is received, the information field is aborted and an F = 1 RNR response is sent.

(b) If a P = 0 I frame is received, the T2 timer is started, and the information field is aborted.

(c) If a P = 1 (0) S frame is received, it is processed including updating V (A), and an F = 1 (0) RNR response frame is sent.

However, P = 1 (0), F = 1 (0) means that when a P = 1 frame is received, an F = 1 frame is sent, and when a P = 0 frame is received, an F = 0 frame is sent.

(d) If an F bit = 1/0 S frame is received, it is processed including updating of V(A).

If the release of local station reception busy state is reported to its peer data link layer entity, the data link layer entity sends a P = 1/0 RR command with the V(R) value set at N(R) to its peer station. Release of local station reception busy state can also be reported by transmitting a SABM command or a UA response corresponding to a SABM command.

(2) Generation and cancel of peer reception busy state

In establish state of multiframe acknowledged operation mode, if the data link layer entity receives a valid RNR command or response, its peer station reception busy state is recognized and its peer station reception busy supervisory timer T3 is started, and the S frame reception process is performed according to the regulations of section 4.4.2.8.4.7.

If the data link layer entity recognizes that its peer station is in reception busy state, it does not transmit any I frames.

T3 stops when an RR frame is received reporting the release of its peer station's reception busy state, and is restarted when an RNR frame is received. If T3 does time out, in order to query the reception busy state of its peer station, if the local station is not busy it sends a P = 1 RR command, and if the local station is busy it sends a P = 1 RNR command and starts T1. T1 is stopped by receiving an F = 1 response.

If T1 times out, processing is carried out according to the procedures in T1 time out processing of item (4) of section 4.4.2.8.4.7.

If a P = 1/0 S command or F = 1/0 S response is received while recognizing the peer station reception busy, the following processes are performed.

(a) For an RR command or RR response, its peer station reception busy state is released.

(b) For an RNR command or RNR response, its peer station reception busy state is maintained.

If an SABM command is received, the data link layer entity releases its peer station reception busy state.

4.4.2.8.4.9 Report and recovery of error state (Private standard/Public standard)

Error state is generated as the result of the physical Layer error or the procedure errors in the data link layer entity. The valid error recovery procedures in recovering after error state detection by the data link layer are specified in this section.

(1) N(S) sequence error

N(S) sequence error state is generated on the destination-side if the valid I frames received have N(S) values not equal to the destination-side V(R). The information fields of all I frames that have N(S) values not equal to V(R) are aborted.

Until I frames with correct N(S) values are received, the destination-side does not update V(R) for reception of the I frame with the sequence error or any the following I frames, and S response transmission is implemented based on the process when an I frame is received.

(2) N(R) sequence error

N(R) sequence error state is generated at the origination-side when S frames are received that have N(R) values that cannot be recovered by retransmission. N(R) values that cannot be recovered by retransmission are V (A) > N (R) and N (R) > V (S).

The data link layer entity reports this error state to the management entity by start of T1 timer, transmission of FRMR, and MDL-error-indication primitive, and it enters exception condition.

(3) Timer recovery state

If the data link layer entity cannot receive one I frame or the last I frame in a series of I frames due to transfer error, it cannot detect out-of-sequence state. Therefore, the data link layer entity which sent the unacknowledged I frames follows the procedures for T1 time out processing in item 4 of section 4.4.2.8.4.7 in order to determine which I frames are to be retransmitted according to timer T1's time out.

(4) Invalid frame state

When invalid frames are received, they are aborted without reporting to the origination-side, and no operations related to those frames are carried out. Invalid frames are the following frames.

(a) Frames in which the information field is not constructed of integral multiples of octets

(b) Frames including SAPI not supported on the destination-side

(c) Frames that are not expected in the procedures (P = 1 frame reception after P = 1 reception)

(5) Frame reject

The state in which errors cannot be recovered by retransmission of the same frame is called frame reject, and frame reject is generated by any of the following conditions.

(a) When command/response is received that has information fields that cannot be executed or are not defined

(b) When S frames or U frames with incorrect length are received

(c) When frames with invalid N(R) are received

(d) When frames are received with information fields that exceed the maximum length

Undefined control fields are those not in the control bit structures of Table 4.4.8 of section 4.4.2.4.

When frame reject is generated in establish state of multiframe acknowledged operation mode, the data link layer entity issues the MDL-error-indication primitive and transmits the FRMR response to its peer data link layer entity, and T1 is started, and it enters exception condition.

The following processes are performed when they occur in exception condition.

(a) When DL-establish-request is received, it is processed according to the re-establish procedure of multiframe acknowledged operation mode of section 4.4.2.8.4.3.

(b) When DL-release-request is received, it is processed according to the release procedure of multiframe acknowledged operation mode of section 4.4.2.8.4.4.

(c) When SABM is received, it is processed according to the re-establish procedure of multiframe acknowledged operation mode of section 4.4.2.8.4.3.

(d) When DISC is received, it is processed according to the release procedure of multiframe acknowledged operation mode of section 4.4.2.8.4.4.

(e) When an F = 1 DM is received, timer T1 is stopped and a DL-release-indication primitive is issued, and it enters unestablish state of multiframe acknowledged operation mode.

(f) When other frames besides P = 1 are received, FRMR transmission and T1 activation are performed, and state is not shifted.

(g) When FRMR is received, all timers are stopped, and MDL-error-indication primitive is issued, SAMB is transmitted, and T1 timer is activated, and it enters establish waiting state of multiframe acknowledged operation mode.

(h) When other frames are received, they are ignored.

(i) When T1 times out, if K < N2, K is incremented by 1, FRMR in F = 1 is retransmitted, and T1 is activated. If K = N2, it is processed according to the re-establish procedure of multiframe acknowledged operation mode of section 4.4.2.8.4.3.

When frame reject is generated during shifting procedure, releasing procedure, releasing multiframe acknowledged operation mode or when the data link is not established, the data link layer entity aborts that frame.

Furthermore, in order to perform a recovery operation based on the reason set in the FRMR information field, the destination-side must distinguish between invalid frames and frames that have information fields that exceed the maximum set value.

(6) Reception of FRMR response

When the data link layer entity receives FRMR response during data link operations, it issues the MDL-error-indication primitive, and performs processes according to various regulations in response to the various states of multiframe acknowledged operation mode.

(7) Unpolled response frame reception

When a unpolled response frame is received, it is processed as in Table 4.4.13.

Table 4.4.13 Handling when unpolled response frame is received.

Operating state / Received frame	When link is established	When link is released	When in multiframe operation mode	
			Set mode	Timer recovery state
UA response F = 1	Data link establish	Data link release		
DM response F = 1	Data link release	Data link release	Data link release	Data link release
Supervisory response F = 1			Supervisory frame reception process	Supervisory frame reception process
Supervisory response F = 0			Supervisory frame reception process	Supervisory frame reception process

4.4.2.8.4.10 Data link supervisory function procedures (Private standard/Public standard)

(1) Overview

These procedures operate based on RR or RNR responses as well as the link supervisory timer (below: T4). Also, as described below, they operate in establish state of the multiframe acknowledged operation mode.

If there are no frames that are transmitted or received on the data link connection, normality of the data link connection cannot be verified by the control procedures shown up to the previous section. For this reason, T4 is defined, and even in the above mentioned cases, it provides procedures that verify normality of data link connection. T4 expresses the maximum allowable time that frame exchange is not carried out. When T4 reaches time out, the normality of the data link connection is verified by transmission/reception of S frames.

Further, PS and CS are to independently perform supervision of the data link according to this procedure.

(2) T4 activation

T4 is activated under any of the following conditions.

(a) when shifting to the multiframe acknowledged operation mode

(b) when an F = 1 S response is received in the multiframe acknowledged operation mode

(c) Reactivated when an F = 0 S response is received in the multiframe acknowledged operation mode

(Note) These 3 conditions show that T4 is reactivated only when T1 is stopped and not reactivated.

(3) T4 stop

T4 is stopped under any of the following conditions.

(a) When a P = 1 command is transmitted in the multiframe acknowledged operation mode

(b) When it has shifted to another state from the multiframe acknowledged operation mode

(4) T4 time out processing

When T1 has not timed out and is not activated, if T4 times out, the data link layer entity carries out the following operations.

(a) If not in local reception busy state, a P = 1 RR command is transmitted, and if in local reception busy state a P = 1 RNR command is transmitted.

(b) It activates T1.

(c) If a valid F = 1 S response is received, T1 is stopped and T4 is reactivated.

(d) If T1 times out, processing follows procedures for T1 time out processing in item 4 of section 4.4.2.8.4.7.

Layer 3 standards

Radio frequency transmission management (RT)

4.4.3 Layer 3 standards (Private standard/Public standard)

4.4.3.1 Overview (Private standard/Public standard)

This standard specifies procedures for establishing up, maintaining, switching, releasing network connection, PS location registration and authentication at the radio interface of personal handy phone systems. These procedures apply to messages exchanged through link channels in the service channel establishment phase and service channels in the communications phase. Their aim is to provide the environment, procedures and messages needed for radio control, mobile control and call control in link channels and service channels.

4.4.3.1.1 Range of standard (Private standard/Public standard)

The procedures specified by this standard are for control of the line switching connections.

Options and defaults are determined as follows by the standard.

(1) Handling of RT function requests

The RT function request sequence has a default of "omit". Also, if the RT function request sequence is omitted, the defaults are as shown in Table 4.4.3.1.1 and Table 4.4.3.1.2. Also, the value specified in extension LCH protocol type has a default of "RT function request omittable". If something other than the relevant default is selected by the PS side, an RT function request is performed.

If the RT function request sequence is used, PS reports its own requested function to CS by the RT function request message. CS judges whether or not that function is allowed, or whether a function other than that requested is used, and it reports the used function to PS by the RT function request response message. PS and CS obey the functions of the RT function request response message.

(2) Handling of additional TCH adoption capability under 64k unrestricted digital.

Information element of the additional TCH adoption capability under 64k unrestricted digital has a default of "omit". Also, if the Information element of the additional TCH adoption capability is omitted, the defaults are as shown in Table 4.4.3.1.3. In case of select except a default by PS side, must be included Information element of the additional TCH adoption capability in the additional TCH request or the additional TCH re-request message.

If the negotiation of additional channel request function is used, PS reports its has function to CS by the additional channel assignment function in the additional channel request or the additional channel re-request message. CS judges whether or not that function is allowed, or whether a function other than that requested is used, and it reports to PS by the Information element of the additional TCH adoption capability of additional channel assign message or additional channel assign reject message.

Table 4.4.3.1.1 Defaults of RT function request contents (private) (note)

Function request	Default	Notes
Encryption	No active encryption control; user scrambling; key set for each call; no passcode	
TCH switching	PS/CS common: Switching function within carrier within CS, among carriers present. No TCH switching function to other CS. No CS-ID designation switching function to other CS. Recalling-type connection function to other CS within paging area present. Recalling-type connection function to other CS between paging areas present	

(Note) "Condition report function", "PS-ID Notification control information", "Transmission Power Control", "VOX Function Information", "Zone information indication function" and "Modulation method" are not specified because of private reference. Therefore, they are treated as no function.

Table 4.4.3.1.2 Defaults of RT function request contents (public) (note)

Function request	Default	Notes
Encryption	No active encryption control; user scrambling; key set for each call; no passcode	
TCH switching	PS/CS common: Switching function within carrier within CS, among carriers present. No TCH switching function to other CS. No CS-ID designation switching function to other CS. Recalling-type connection function to other CS with in paging area present.	
	CS: Recalling-type connection function to other CS between paging areas absent	
	PS: Recalling-type connection function to other CS between paging areas present	
Transmission Power Control information	Transmission Power Control Function absent, Independent Transmission Power Control Function absent	
Zone information indication function	Zone information indication function absent	
Modulation method	Modulation method switching function absent (Modulation method support $\pi/4$ shift QPSK only.	

(Note) "Condition report function", "PS-ID Notification control information", and "VOX Function Information" are not specified. Therefore, they are treated as no function.

Table 4.4.3.1.3 Defaults of additional TCH assignment function under 64k unrestricted digital (public/private) (note)

Function request	Default	Notes
Additional TCH assignment function type	PS/CS common: Same carrier,adjacent slot , additional TCH assignment function present. Optional carrier, one slot separation, additional TCH assignment function present. Optional carrier, not same slot, additional TCH assignment function present. Slot changeable type information function absent	
Additional TCH function type	PS/CS common: Switching function within carrier within CS using additional TCH, among carriers present. Recalling-type connection function to other CS using additional TCH present.	

(Note) Recalling-type connection function to other CS between paging areas, follows contents of RT function requests.

(3) Handling of MM function request

The MM function request sequence is an omittable mandatory function, and its default is "omittable". Also, the defaults for each MM function are shown in Table 4.4.3.1.3 and Table 4.4.3.1.4. Also, the value specified in extension LCH protocol type has a default of "MM function request omittable". If something other than the relevant default is selected by the PS side, an MM function request is performed.

If the MM function request sequence is used, PS reports its own requested function to CS by the MM function request message. CS judges whether or not that function is allowed, or whether a function other than that requested is used, and it reports the used function to PS by the MM function request response message. PS and CS obey the functions of the MM function request response message.

Table 4.4.3.1.4 Defaults of MM function request contents (private)

Function request	Default	Notes
Authentication type	Standard authentication sequence for private systems present (note)	
Active authentication	Active authentication procedure absent	
Paging area	Only fixed paging area by Additional ID	

(Note) The authentication algorithm in private systems is entrusted to each system.

Table 4.4.3.1.5 Defaults of MM function request contents (public) (note)

Function request	Default	Notes
Authentication type	Standard authentication function present	
Active authentication	Active authentication procedure absent	

(Note) Since the "paging area" is not specified, it is treated as a fixed paging area.

4.4.3.1.2 Application to interface structure (Private standard/Public standard)

Layer 3 procedures use layer 2 functions and services, and they request layer 2 services and receive information from layer 2 and so forth using primitives defined in the layer 2 standards. These primitives are used to show communication between protocol layers but they do not specify implementation.

4.4.3.2 Definition of layer 3 functions (Private standard/Public standard)

4.4.3.2.1 Radio frequency transmission management (RT) (Private standard/Public standard)

The radio frequency transmission management entity RT has functions related to management of radio resources, and these functions include radio zone selection, radio line set up, maintenance, switching, and disconnection functions.

4.4.3.2.2 Mobility management (MM) (Private standard/Public standard)

The mobility management entity MM has functions related to mobile support of PS. These functions include location registration and authentication functions.

4.4.3.2.3 Call control (CC) (Private standard/Public standard)

The call control entity CC has functions related to circuit call connection control, and these functions include call set up, maintenance and release functions.

4.4.3.3 Overview of signal methods (Private standard/Public standard)

4.4.3.3.1 Layer 3 functions and signal structure (Private standard/Public standard)

RT, MM, CC have independent structures, and the messages are sent/received using layer functions for each function.

4.4.3.3.2 Signal format (Private standard/Public standard)

The layer 3 signal format structure is "protocol discriminator + message type + individual information elements" for RT and MM, and "protocol discriminator + call reference + message type + individual information elements" for CC. Each message length is specified in octet units.

4.4.3.3.3 Protocol rules (Private standard/Public standard)

The total number of TCH Switching Request retries, TCH switching re-requests and TCH Switching Re-Request retries is a total of 3 in the same TCH switching operation.

4.4.3.4 Layer 2 primitives (Private standard/Public standard)

Primitives related to signal transmission requests, transmission completion, reception report, link set up, release, etc. are used. Also, primitives related to set up of layer 2 SAPI and the SAPI reception report are specified. (For details, refer to section 4.4.2.)

4.4.3.5 Radio frequency transmission management (RT) (Private standard/Public standard)

In this section, radio management control signals required in the standard are specified.

4.4.3.5.1 Radio frequency transmission management (RT) state definitions (Private standard/Public standard)

4.4.3.5.1.1 RT state in PS (Private standard/Public standard)

This section specifies the basic RT state on the PS side. The code within parentheses ( ) shows each status. However, the RT state shifts across the link channel establishment phase shown in section 4.3 and the phases after that.

[1] Standby (P0)

PS standby state.

[2] Incoming call (P1)

State that PS has received a call from CS.

[3] Outgoing call link channel request (P3)

State that PS transmitted link channel establishment request for outgoing call (including location registration) to CS.

[4] Incoming call link channel request (P4)

State that PS transmitted link channel establishment request for response to incoming call to CS.

[5] Outgoing call link channel assignment (P6)

State that PS designated radio channel (link channel assignment) for call (including location registration) originating from CS.

[6] Incoming call link channel assignment (P7)

State that PS designated radio channel (link channel assignment) for incoming call from CS.

[7] TCH activation (P8)

State that PS set up traffic channel (TCH).

[8] TCH switching request (P9)

State that PS transmitted TCH Switching Request to CS during communication and has not yet received any response.

[9] TCH Switching Indication (P10)

State that PS received TCH Switching Indication during communication from CS.

[10] Downlink synchronization burst waiting (P11)

[11] Outgoing call link channel re-request (P12)

State that link channel establishment re-request was transmitted by PS to CS for call origination (including location registration).

[12] Incoming call link channel re-request (P13)

State that PS transmitted link channel establishment re-request for response to call (including location registration) to CS.

[13] TCH Switching Re-Request (P14)

[14] Recalling (recalling-type handover) link channel request (P15)

State where PS transmitted link channel establishment request for recalling connection (recalling-type handover) to CS.

[15] Recalling (recalling-type handover) link channel assignment (P16)

State in which PS specified radio channel (link channel assignment) for recalling connection (recalling-type handover) from CS.

[16] Recalling (recalling-type handover) link channel re-request (P17)

State in which PS transmitted link channel establishment re-request for recalling connection (recalling-type handover) to CS.

[17] Null (P18)

State of 2ndTCH that the activation of TCH is not required.

[18] TCH activation waiting (P19)

State of 2ndTCH that PS is designated 2ndTCH originating from CS.

[19] Recalling type handover (P20)

State of 2ndTCH that PS has not received designation for 2ndTCH, while recalling connection (recalling type handover) process being activated.

[20] TCH activation waiting 2 (P21)

State of 2ndTCH that PS has assigned 2ndTCH, while recalling connection (recalling type handover) process being activated.

[21] Modulation reassign (P22)

State of modulation reassign after receiving Modulation Reassign indication.

4.4.3.5.1.2 RT state in CS (Private standard/Public standard)

This section specifies the basic RT state at the CS side. The code within parentheses ( ) shows each status. However, the RT state shifts across the link channel establishment phase shown in section 4.3 and phases after that.

[1] Standby (C0)

Standby state of CS

[2] Link channel request acceptance (C2)

State that CS received link channel establishment request from PS.

[3] Link channel assignment (C5)

State that CS transmitted link channel assignment to PS.

[4] TCH activation (C8)

State that CS set up traffic channel (TCH).

[5] TCH Switching Request (C9)

State that CS received TCH Switching Request from PS

[6] TCH Switching Indication (C10)

State that CS transmitted TCH Switching Indication during communication to PS.

[7] Radio channel disconnection (C11)

State that CS requested disconnection of radio channel to PS.

[8] Uplink synchronization burst waiting 1 (C12)

[9] Uplink synchronization burst waiting 2 (C13)

[10] Modulation reassign (C14)

State of modulation reassign.

4.4.3.5.2 Definition and contents of message functions (Private standard/Public standard)

Table 4.4.3.5.1 shows messages for radio frequency transmission management (RT). However, it does not include messages specified in the link channel establishment phase of section 4.3. The details of each message are specified below.

The description method is as follows.

(1) Brief explanation of method of use, message type, significance, direction and function channel

Significances are local and global, but the significances for RT signals are only local signals regardless of the network.

a. Local significance: Related only to accessing either the origination-side or destination-side.

b. Global significance: Related to origination-side/destination-side access.

(2) Information elements of messages

For each information element, the table shows the following items.

a. Item number in this standard that specifies the information element

b. Direction that the information element can be transmitted:

From PS to CS (uplink), from CS to PS (downlink) or both directions.

c. Classification of information elements

Mandatory (M) : These are information elements specified in the standard, and they must be included in the message

Optional (O) : These are information elements specified in the standard, and they are information elements that may be included in the message depending on the service.

d. Information length: Shows the maximum information length of information elements in octet units.

Also, if the information length section is marked with a "*", it means that the maximum octet length of the information element is not specified, and that it depends on the CS side or service.

(3) Usage regulations of messages/information elements in private and public systems

The messages and information elements used in private systems and public systems follow the message type diagrams (Figure 4.4.3.5.3-1, 2) and information element coding tables (Tables 4.4.3.5.29-1, 2) specified for each system.

Table 4.4.3.5.1 Messages for radio frequency transmission management

Messages pertaining to activation of communication	Reference
Definition information request	4.4.3.5.2.1
Definition information response	4.4.3.5.2.2
Encryption key set	4.4.3.5.2.7
Function request	4.4.3.5.2.8
Function request response	4.4.3.5.2.9
Paging response	4.4.3.5.2.10
Zone information indication	4.4.3.5.2.2.21
Messages pertaining to communication/channel release	**Reference**
PS Release	4.4.3.5.2.11
Radio-channel Disconnect	4.4.3.5.2.12
Radio-channel Disconnect Complete	4.4.3.5.2.13
Messages pertaining to channel establishing	**Reference**
Condition inquiry	4.4.3.5.2.3
Condition report	4.4.3.5.2.4
Encryption control	4.4.3.5.2.5
Encryption control acknowledge	4.4.3.5.2.6
TCH Switching Indication	4.4.3.5.2.14
TCH Switching Request Reject	4.4.3.5.2.15
TCH Switching Request	4.4.3.5.2.16
TCH Switching Re-Request	4.4.3.5.2.17
Transmission Power Control	4.4.3.5.2.18
VOX control	4.4.3.5.2.19
PS-ID Notification	4.4.3.5.2.20
Additional channel Assign	4.4.3.5.2.22
Additional channel Assign Reject	4.4.3.5.2.23
Additional channel Request	4.4.3.5.2.24
Additional channel Request Indicate	4.4.3.5.2.25
Additional channel Request Indicate Reject	4.4.3.5.2.26
Additional channel Re-request	4.4.3.5.2.27
Modulation Reassign	4.4.3.5.2.28
Modulation Reassign Reject	4.4.3.5.2.29
Modulation Reassign Request	4.4.3.5.2.30

4.4.3.5.2.1 Definition information request (Private standard/Public standard)

This message is transmitted to CS from PS for requesting notification of definition information (refer to Table 4.4.3.5.2).

Table 4.4.3.5.2 Definition information request message contents

Message type : Definition information request
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	uplink	M	1	
Message type	4.4.3.5.3.3	uplink	M	1	
Definition information request	4.4.3.5.3.4.3	uplink	M	1	

4.4.3.5.2.2 Definition information response (Private standard/Public standard)

This message is transmitted from CS to PS to report definition information (refer to Table 4.4.3.5.3).

Table 4.4.3.5.3 Definition information response message contents

Message type : Definition information response
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	downlink	M	1	
Message type	4.4.3.5.3.3	downlink	M	1	
Area information	4.4.3.5.3.4.1	downlink	O	8	(note)

(Note) The information elements requested by the definition information request must be in the response.

4.4.3.5.2.3 Condition inquiry (Private reference)

This message is transmitted from CS to PS for querying about the reception level of the local zone and peripheral zones (refer to Table 4.4.3.5.4).

Table 4.4.3.5.4 Condition inquiry message contents

Message type : Condition inquiry
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	downlink	M	1	
Message type	4.4.3.5.3.3	downlink	M	1	
Report condition	4.4.3.5.3.4.15	downlink	M	4	

4.4.3.5.2.4 Condition report (Private reference)

This message is transmitted from PS to CS or from CS to PS to autonomously report a condition and from PS to CS to respond to a condition inquiry (refer to Table 4.4.3.5.5).

Table 4.4.3.5.5 Condition report message contents

Message type : Condition report
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	both	M	1	
Message type	4.4.3.5.3.3	both	M	1	
Reception level	4.4.3.5.3.4.14	both	O	2	
Zone condition report	4.4.3.5.3.4.23	uplink	O	9~ *	

4.4.3.5.2.5 Encryption control (Private reference)

This message is transmitted from CS to PS or from PS to CS to indicate operation or stopping of the encryption function.

This message is used in encryption control in the communications phase (refer to Table 4.4.3.5.6).

Table 4.4.3.5.6 Encryption control message contents

Message type : Encryption control
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	both	M	1	
Message type	4.4.3.5.3.3	both	M	1	
Encryption control information	4.4.3.5.3.4.9	both	M	1	
Encryption key set	4.4.3.5.3.4.10	both	O	3~ *	(note)

(Note) This information element is included in this message when encryption key notification is required.

4.4.3.5.2.6 Encryption control acknowledge (Private reference)

This message is transmitted from PS to CS or from CS to PS as an acknowledgment of encryption control.

Encryption control in the communications phase (start/stop of the encryption process) is activated by transmission of this message (refer to Table 4.4.3.5.7).

Table 4.4.3.5.7 Encryption control acknowledge message contents

Message type : Encryption control acknowledge
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	both	M	1	
Message type	4.4.3.5.3.3	both	M	1	
Encryption control information	4.4.3.5.3.4.9	both	M	1	
Encryption key set	4.4.3.5.3.4.10	both	O	3~*	(note)

(Note)This information element is included in this message when encryption key notification is required.

4.4.3.5.2.7 Encryption key set (Private standard/Public standard)

This message is used to report the encryption key, and is transmitted from PS to CS as necessary. This message is used in the service channel establishment phase.

If the encryption key was set by this message, the encryption function is effective starting from the first TCH data of the communications phase

In case of 64kbit/s communication, Encryption key is common to TCH & 2ndTCH, which means that Encryption key set on TCH is also used on 2ndTCH. (refer to Table 4.4.3.5.8).

Table 4.4.3.5.8 Encryption key set message contents

Message type : Encryption key set
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	uplink	M	1	
Message type	4.4.3.5.3.3	uplink	M	1	
Encryption	4.4.3.5.3.4.8	uplink	O	3	(note)
Encryption key set	4.4.3.5.3.4.10	uplink	M	3~*	

(Note) If this information element is not included, it is seen as meaning that default encryption is specified.

4.4.3.5.2.8 Function request (Private standard/Public standard)

This message is transmitted from PS to CS in order for PS to perform an RT function request to CS (refer to Table 4.4.3.5.9).

Table 4.4.3.5.9 Function request message contents

Message type : Function request
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	uplink	M	1	
Message type	4.4.3.5.3.3	uplink	M	1	
Condition report function	4.4.3.5.3.4.6	uplink	O	2	(note 1)
Encryption	4.4.3.5.3.4.8	uplink	O	3	(note 1)
PS-ID Notification control information	4.4.3.5.3.4.13	uplink	O	1	(note 1)
TCH switching	4.4.3.5.3.4.18	uplink	O	2	(note 1) (note 2)
Transmission Power Control	4.4.3.5.3.4.19	uplink	O	2	(note 1)
VOX Function Information	4.4.3.5.3.4.22	uplink	O	2	(note 1)
Zone information indication function	4.4.3.5.3.4.24	uplink	O	1	(note 1)
Modulation	4.4.3.5.3.4.30	uplink	O	3 - *	(Note 1) (Note 3)

(Note 1) When this information element is not contained in a function request, it shows that PS has the default function shown in Table 4.4.3.1.1 (private) or Table 4.4.3.1.2 (public).

(Note 2) This information element alone is used only to declare the function that PS itself possesses.

(Note 3) This information element is used only to declare the modulation that PS itself supports. Also, the PS that can reassign the modulation is to set this information element regardless of the communication method.

4.4.3.5.2.9 Function request response (Private standard/Public standard)

This message is transmitted from CS to PS in order for CS to notify PS of standards and to respond to an RT function request from PS (refer to Table 4.4.3.5.10).

Table 4.4.3.5.10 Function request response message contents

Message type : Function request response
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classifica-tion	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	downlink	M	1	
Message type	4.4.3.5.3.3	downlink	M	1	
Condition report function	4.4.3.5.3.4.6	downlink	O	2	(note 1)
Encryption	4.4.3.5.3.4.8	downlink	O	3	(note 1)
PS-ID Notification control information	4.4.3.5.3.4.13	downlink	O	1	(note 1)
TCH switching	4.4.3.5.3.4.18	downlink	O	2	(note 1) (note 2)
Transmission Power Control	4.4.3.5.3.4.19	downlink	O	2	(note 1)
VOX Function Information	4.4.3.5.3.4 22	downlink	O	2	(note 1)
Zone information indication function	4.4.3.5.3.4.24	downlink	O	1	(note 1)
Independence Transmission Power Control information	4.4.3.5.3.4.29	downlink	O	5~*	
Modulation	4.4.3.5.3.4.30	downlink	O	2 - *	(Note 1) (Note 4)

(Note 1) When there is a function request corresponding to these respective information elements in the function request from PS, the relevant information elements must be contained in this message.

(Note 2) This information element alone is used only to declare the function that CS itself possesses.

(Note 3) This information is valid only in the relevant CS.

(Note 4) This information element is used indicate the modulation that can be reassigned during communication.
In case the CS that does not support the Modulation Reassign received a function request message including modulation information element, it sets modulation information element with modulation content length 0 (i.e. modulation information element with information element identifier and content length 2 octet only) to this message and transmit it.

4.4.3.5.2.10 Paging response (Private standard/Public standard)

This message is transmitted from PS to CS in order for PS to respond to a paging call from CS (refer to Table 4.4.3.5.11).

Table 4.4.3.5.11 Paging response message contents

Message type : Paging response
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	uplink	M	1	
Message type	4.4.3.5.3.3	uplink	M	1	
PS number	4.4.3.5.3.4.11	uplink	M	8	
Paging response type	4.4.3.5.3.4.25	uplink	O	3 ~ 4	(note)

(Note) This information element is used for zone paging response in private system.

4.4.3.5.2.11 PS Release (Private reference)

This message is transmitted from CS to PS in order to unilaterally release the radio channel (refer to Table 4.4.3.5.12).

Table 4.4.3.5.12 PS Release message contents

Message type : PS Release (personal station release)
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	downlink	M	1	
Message type	4.4.3.5.3.3	downlink	M	1	
Cause	4.4.3.5.3.4.5	downlink	M	2	
CS-ID	4.4.3.5.3.4.7	downlink	M	7	
PS-ID	4.4.3.5.3.4.12	downlink	M	5	

4.4.3.5.2.12 Radio-channel Disconnect (Private standard/Public standard)

This message is transmitted from CS to PS to release the radio channel (refer to Table 4.4.3.5.13).

Table 4.4.3.5.13 Radio-channel Disconnect message contents

Message type : Radio-channel Disconnect
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	downlink	M	1	
Message type	4.4.3.5.3.3	downlink	M	1	
Cause	4.4.3.5.3.4.5	downlink	M	2	(Note)
CS-ID	4.4.3.5.3.4.7	downlink	M	7	(Note)
PS-ID	4.4.3.5.3.4.12	downlink	M	5	

(Note) Can be omitted in case of π /2 shift BPSK.

4.4.3.5.2.13 Radio-channel Disconnect Complete (Private standard/Public standard)

This message is transmitted from PS to CS to indicate the fact that the radio channel was released and as a response to 4.4.3.5.2.12 Radio-channel Disconnect. After PS transmits this message, it enters standby state (refer to Table 4.4.3.5.14)

Table 4.4.3.5.14 Radio-channel Disconnect Complete message contents

Message type : Radio-channel Disconnect Complete
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	uplink	M	1	
Message type	4.4.3.5.3.3	uplink	M	1	
CS-ID	4.4.3.5.3.4.7	uplink	M	7	(Note)
PS-ID	4.4.3.5.3.4.12	uplink	M	5	

(Note) Can be omitted in case of π /2 shift BPSK.

4.4.3.5.2.14 TCH Switching Indication (Private standard/Public standard)

This message is transmitted from CS to PS to indicate TCH switching. After PS receives this message, it immediately starts the operation of switching to the specified channel.

This message is used for channel switching during communication (refer to Table 4.4.3.5.15).

Table 4.4.3.5.15 TCH Switching Indication message contents

Message type : TCH Switching Indication
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	downlink	M	1	
Message type	4.4.3.5.3.3	downlink	M	1	
Carrier number	4.4.3.5.3.4.4	downlink	O	2	(note 1) (note 4)
CS-ID	4.4.3.5.3.4.7	downlink	O	7	(note 1) (note 3)
SCH type	4.4.3.5.3.4.16	downlink	O	3	(note 2)
Slot Number	4.4.3.5.3.4.17	downlink	O	2	

(Note 1) If all of these information elements are contained in the TCH Switching Indication from CS to PS, the TCH switching process is indicated to PS.
(Note 2) If standard (π /4 shift QPSK 32 kbit/s) was specified as the SCH type in π /4 shift QPSK communication, it does not have to be contained in this message. Also, if (π /2 shift BPSK 16kbit/s) is specified in π /2 shift BPSK communication, it does not have to be contained in this message.
(Note 3) If this information element is included, PS selects the specified CS.
(Note 4) Appropriate frequency band for the PS should be chosen.

4.4.3.5.2.15 TCH Switching Request Reject (Private standard/Public standard)

This message is transmitted from CS to PS when the TCH Switching Request to CS from PS is rejected (refer to Table 4.4.3.5.16).

Table 4.4.3.5.16 TCH Switching Request Reject message contents

Message type : TCH Switching Request Reject
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	downlink	M	1	
Message type	4.4.3.5.3.3	downlink	M	1	
Cause	4.4.3.5.3.4.5	downlink	M	2	

4.4.3.5.2.16 TCH Switching Request (Private standard/Public standard)

This message is transmitted from PS to CS to perform a TCH Switching Request from PS to CS (refer to Table 4.4.3.5.17).

Table 4.4.3.5.17 TCH Switching Request message contents

Message type : TCH Switching Request
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	uplink	M	1	
Message type	4.4.3.5.3.3	uplink	M	1	
Carrier number	4.4.3.5.3.4.4	uplink	O	2	(note 1)
Cause	4.4.3.5.3.4.5	uplink	O	2	(note 2)
CS-ID	4.4.3.5.3.4.7	uplink	O	7	(note 3)
SCH type	4.4.3.5.3.4.16	uplink	O	3	(note 4)
Slot Number	4.4.3.5.3.4.17	uplink	O	2	(note 1)

(Note 1) Contained in this message if the free candidate channels are reported from PS.

(Note 2) If reception interference is detected from the PS side, the cause is "reception quality degraded", and if level degradation is detected, the cause is "reception level degraded". If this information element is not included, it should be regarded as meaning that cause is "reception quality degraded".

(Note 3) Included when CS-ID of switching destination is reported from PS. Many of these information elements may be contained in this message. If multiple information elements are included, PS transmits them in order from the CS-ID of the highest degree of request.

(Note 4) If standard (π /4 shift QPSK 32 kbit/s) is requested as the SCH type in π /4 shift QPSK communication, it does not have to be contained in this message. Also, if (π /2 shift BPSK 16kbit/s) is specified in π /2 shift BPSK communication, it does not have to be contained in this message.

4.4.3.5.2.17 TCH Switching Re-Request (Private standard/Public standard)

This message is transmitted from PS to CS to re-request TCH switching from PS to CS. This message is used for channel switching during communication. (Refer to Table 4.4.3.5.18.)

Table 4.4.3.5.18 TCH Switching Re-Request message contents

Message type : TCH Switching Re-Request
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	uplink	M	1	
Message type	4.4.3.5.3.3	uplink	M	1	
Carrier number	4.4.3.5.3.4.4	uplink	O	2	(note 1)
Cause	4.4.3.5.3.4.5	uplink	M	2	(note 2)
CS-ID	4.4.3.5.3.4.7	uplink	O	7	(note 3)
SCH type	4.4.3.5.3.4.16	uplink	O	3	(note 4)
Slot Number	4.4.3.5.3.4.17	uplink	O	2	(note 1)

(Note 1) Contained in this message if the free candidate channels are reported from PS.
(Note 2) If reception interference is detected from the PS side, the cause is "reception quality degraded", and if level degradation is detected, the cause is "reception level degraded".
(Note 3) Included when CS-ID of switching destination is reported from PS. Many of these information elements may be contained in this message. If multiple information elements are included, PS transmits them in order from the CS-ID of the highest degree of request.
(Note 4) If standard (π/4 shift QPSK 32 kbit/s) is requested as the SCH type in π/4 shift QPSK communication, it does not have to be contained in this message. Also, if (π/2 shift BPSK 16kbit/s) is specified in π/2 shift BPSK communication, it does not have to be contained in this message.

4.4.3.5.2.18 Transmission Power Control (Private reference)

This message is transmitted in order to specify operation or prohibition of the Transmission Power Control function (refer to Table 4.4.3.5.19).

Table 4.4.3.5.19 Transmission Power Control message contents

Message type : Transmission Power Control
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	both	M	1	
Message type	4.4.3.5.3.3	both	M	1	
Transmission Power Control Request	4.4.3.5.3.4.20	both	M	2	

4.4.3.5.2.19 VOX control (Private reference)

This message is transmitted to indicate operation or prohibition of the VOX function (refer to Table 4.4.3.5.20)

Table 4.4.3.5.20 VOX control message contents

Message type : VOX control
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	both	M	1	
Message type	4.4.3.5.3.3	both	M	1	
VOX Control	4.4.3.5.3.4.21	both	M	1	

4.4.3.5.2.20 PS-ID notification (Private reference)

This message is transmitted from CS to PS, or from PS to CS, to report the respective PS identification code (PS-ID) during communication. Refer to section 4.2.10.2 for details of the PS identification code (refer to Table 4.4.3.5.21).

Table 4.4.3.5.21 PS-ID notification message contents

Message type : PS-ID notification
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	both	M	1	
Message type	4.4.3.5.3.3	both	M	1	
CS-ID	4.4.3.5.3.4.7	both	O	7	
PS-ID	4.4.3.5.3.4.12	both	M	5	

4.4.3.5.2.21 Zone information indication (Private reference/Public standard)

This message is transmitted from CS to PS to report zone information. (Refer to Table 4.4.3.5.22.)

Table 4.4.3.5.22 Zone information indication message contents

Message type : Zone information indication
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	downlink	M	1	
Message type	4.4.3.5.3.3	downlink	M	1	
Area information	4.4.3.5.3.4.1	downlink	O	8	
Broadcasting information	4.4.3.5.3.4.2	downlink	M	15~27	

4.4.3.5.2.22 Additional channel Assign (Private standard/Public standard)

This message is transmitted from CS to PS to assign additional channel(s). After PS receives this message, PS immediately starts the operation of adding the specified channel （refer to Table 4.4.3.5.23).

Table 4.4.3.5.23 Additional channel Assign message contents

Message type :Additional channel Assign
Significance :Local
Direction :Downlink
Function channel :SACCH/FACCH

Information Element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	Downlink	M	1	
Message type	4.4.3.5.3.3	Downlink	M	1	
Additional TCH Adoption Capability	4.4.3.5.3.4.26	Downlink	O	4	(note 1)
Additional TCH Information	4.4.3.5.3.4.28	Downlink	M	5~*	

(Note 1) Included to declare the TCH adding function that CS possesses. Omitted when CS possesses capabilities provided as default.
(Note 2) Appropriate frequency band for the PS should be chosen.

4.4.3.5.2.23 Additional channel Assign Reject (Private standard/Public standard)

This message is transmitted from CS to PS, to refuse TCH addition requested by PS (refer to Table 4.4.3.5.24).

Table 4.4.3.5.24 Additional channel Assign Reject message contents

Message type :Additional channel Assign Reject
Significance :Local
Direction :Downlink
Function channel :SACCH/FACCH

Information Element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	Downlink	M	1	
Message type	4.4.3.5.3.3	Downlink	M	1	
Cause	4.4.3.5.3.4.5	Downlink	M	2	
Additional TCH Identification	4.4.3.5.3.4.27	Downlink	O	3~*	(note 1)

(note 1) Included to indicate the number of additional TCHs that CS can assign and its identification. Omitted when the number of additional channels to assign is 1.

4.4.3.5.2.24 Additional channel Request (Private standard/Public standard)

This message is transmitted from PS to CS to request additional channel(s). It is used when communication over 32kbit/s is required （refer to Table 4.4.3.5.25).

Table 4.4.3.5.25 Additional channel Request message contents

Message type :Additional channel Request
Significance :Local
Direction :Uplink
Function channel :SACCH/FACCH

Information Element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	Uplink	M	1	
Message type	4.4.3.5.3.3	Uplink	M	1	
Additional TCH Adoption Capability	4.4.3.5.3.4.26	Uplink	O	4	(note 1)
Additional TCH Identification	4.4.3.5.3.4.27	Uplink	O	3~*	(note 2)

(note 1) Included when PS requests some restriction on TCH to be added depending on its capability.
May be omitted when PS possesses default capability.
CS can transmit Additional channel Reject message, when this information element puts restrictions on assignable TCH.

(note 2) Included to indicate the number of additional channels and their identification, which PS requests. Omitted when the number of additional channels to request is 1.

4.4.3.5.2.25 Additional channel Request Indicate (Private standard/Public standard)

This message is transmitted from CS to PS to let PS request additional channel(s). It is used when communication over 32kbit/s is required （refer to Table 4.4.3.5.26).

Table 4.4.3.5.26 Additional channel Request Indicate message contents

Message type :Additional channel Request Indicate
Significance :Local
Direction :Downlink
Function channel :SACCH/FACCH

Information Element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	Downlink	M	1	
Message type	4.4.3.5.3.3	Downlink	M	1	
Additional TCH Identification	4.4.3.5.3.4.27	Downlink	O	3~*	(note 1)

(note 1) Included to indicate the number of additional channels for communication and their identification , when CS pages PS. Omitted when the number of additional channels to assign is 1.

4.4.3.5.2.26 Additional channel Request Indicate Reject (Private standard/Public standard)

This message is transmitted to reject Additional channel Request Indicate message, when PS cannot accept the request from CS（refer to Table 4.4.3.5.27).

Table 4.4.3.5.27 Additional channel Request Indicate Reject message contents

Message type :Additional channel Request Indicate Reject
Significance :Local
Direction :Uplink
Function channel :SACCH/FACCH

Information Element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	Uplink	M	1	
Message type	4.4.3.5.3.3	Uplink	M	1	
Cause	4.4.3.5.3.4.5	Uplink	M	2	
Additional TCH Identification	4.4.3.5.3.4.27	Uplink	O	3~*	(note 1)

(note 1) Included to indicate the number of additional channels and their identification, which PS can correspond against the number of additional channels that CS requested with Additional channel Request Indicate message. Omitted when the number of additional channels is 1.

4.4.3.5.2.27 Additional channel Re-request (Private standard/Public standard)

This message is transmitted from PS to CS to re-request additional channel(s). It is used when communication over 32kbit/s is required （refer to Table 4.4.3.5.28).

Table 4.4.3.5.28 Additional channel Re-request message contents

Message type :Additional channel Re-request
Significance :Local
Direction :Uplink
Function channel :SACCH/FACCH

Information Element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	Uplink	M	1	
Message type	4.4.3.5.3.3	Uplink	M	1	
Cause	4.4.3.5.3.4.5	Uplink	M	2	
Additional TCH Adoption Capability	4.4.3.5.3.4.26	Uplink	O	4	(note 1)
Additional TCH Identification	4.4.3.5.3.4.27	Uplink	O	3~*	(note 2)

(note 1) Included when PS requests some restrictions on TCH to be added depending on its capability. May be omitted when PS possesses default capability.
CS can transmit Additional channel Reject message, when this information element puts restrictions on assignable TCH.

(note 2) Included to indicate the number of additional channels and their identification, which PS requests. Omitted when the number of additional channels to request is 1.

4.4.3.5.2.28 Modulation Reassign Indication (Private reference/Public standard)

This message is transmitted from CS to PS to indicate the modulation reassign. PS starts operation to reassign the designated modulation as soon as it received the message. (refer to 4.4.3.5.29)

Table 4.4.3.5.29 Modulation Reassign Indication message contents

Message type : Modulation Reassign
Significance :Local
Direction : Downlink
Function channel : SACCH/FACCH

Information Element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	Downlink	M	1	
Message type	4.4.3.5.3.3	Downlink	M	1	
Modulation	4.4.3.5.3.4.30	Downlink	M	3	(Note)

(Note) Only one modulation can be set in a Modulation Reassign message.

4.4.3.5.2.29 Modulation Reassign Reject (Private reference/Public standard)

This message is transmitted from CS to PS to reject the modulation reassign request from PS to CS. (refer to 4.4.3.5.30)

Table 4.4.3.5.30 Modulation Reassign Reject message contents

Message type : Modulation Reassign Reject
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information Element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	Downlink	M	1	
Message type	4.4.3.5.3.3	Downlink	M	1	
Cause	4.4.3.5.3.4.5	Downlink	M	2	

4.4.3.5.2.30 Modulation Reassign Request (Private reference/Public standard)

This message is transmitted from PS to CS when PS requests modulation reassign to CS. It is used for modulation reassign when communication is in progress. (refer to 4.4.3.5.31)

Table 4.4.3.5.31 Modulation Reassign Request message contents

Message type : Modulation Reassign Request
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information Element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.5.3.2	Uplink	M	1	
Message type	4.4.3.5.3.3	Uplink	M	1	
Modulation	4.4.3.5.3.4.30	Uplink	M	3~*	(Note)

(Note) More than one modulation can be set to modulation information element. The modulation to be set shall be in the order of precedence.

4.4.3.5.3 Message format and information element coding (Private standard/Public standard)

In this section, message contents are specified. The bits within each octet are transmitted in order from the minimum number from bit 1. In the same way, octets are transmitted in order from the minimum number from octet 1.

4.4.3.5.3.1 Overview (Private standard/Public standard)

Each message is made up of the following parts:

(1) Protocol discriminator

(2) Message type

(3) Other information elements

(1) and (2) are common to all messages, and must be included in all messages. (3) is specified depending on the message type. This structure is shown in Figure 4.4.3.5.1 as an example.

Bit 8	7	6	5	4	3	2	1	
Protocol discriminator								octet 1
0	Message type							octet 2
Other information elements								...

Figure 4.4.3.5.1 Message format structure

If the field is extended and exceeds 1 octet, as the octet number becomes larger, the rank of the value shown by the bit becomes smaller. The least significant bit of the field becomes the minimum number bit of the octet with the largest field number.

4.4.3.5.3.2 Protocol discriminator (Private standard/Public standard)

The protocol discriminator is used for identifying the message for radio interface radio management from among the messages specified by the standard. Also, it distinguishes messages specified by the standard and OSI network layer protocol units that are coded based on other standards. Figure 4.4.3.5.2 shows the protocol discriminator.

Octet \ Bit	8	7	6	5	4	3	2	1
1	Protocol discriminator							

Bit

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Reserved (cannot be used as
				.				. protocol discriminator for the
				.				. .message)
0	0	0	0	0	1	1	1	Reserved
0	0	0	1	0	0	0	0	Reserved
				.				. (reserved for other network
				.				. layers or layer 3 protocols)
0	0	1	1	1	1	1	1	Reserved
0	1	0	0	0	0	0	0	Domestic use
				.				.
				.				.
0	1	0	0	0	0	1	0	Domestic use
0	1	0	0	0	0	1	1	RCR STD-28 radio interface radio frequency transmission management message
0	1	0	0	0	1	0	0	RCR STD-28 radio interface mobility management message
0	1	0	0	0	1	0	1	RCR STD-28 radio interface call control message
0	1	0	0	0	1	1	0	Domestic use
				.				.
				.				.
0	1	0	0	1	1	1	1	Domestic use
0	1	0	1	0	0	0	0	Reserved
				.				. (reserved for other network
				.				. layers or layer 3 protocols)
1	1	1	1	1	1	1	0	Reserved
				Other				Reserved

Figure 4.4.3.5.2 Protocol discriminator

4.4.3.5.3.3 Message type (Private standard/Public standard)

Message type is an information element used for identifying the functions of the transferred message, and it is as shown in Figure 4.4.3.5.3-1 and Figure 4.4.3.5.3-2. This information element is 1 octet.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Message type						

Message type (octet 1):

Bit 8	7	6	5	4	3	2	1	
0	0	0	-	-	-	-	-	Messages related to communication set-up
			0	0	0	0	1	Broadcasting information request
			0	0	0	1	0	Broadcasting information response
			0	0	0	1	1	Encryption key set
			0	0	1	0	0	Function request
			0	0	1	0	1	Function request response
			0	0	1	1	0	Paging response
			0	0	1	1	1	Zone information indication
0	0	1	-	-	-	-	-	Messages related to release of channel/communication
			0	0	0	0	1	PS Release
			0	0	0	1	0	Radio-channel Disconnect
			0	0	0	1	1	Radio-channel Disconnect Complete
0	1	0	-	-	-	-	-	Messages related to channel set up
			0	0	0	0	1	Condition inquiry
			0	0	0	1	0	Condition report
			0	0	0	1	1	Encryption control
			0	0	1	0	0	Encryption control acknowledge
			0	0	1	0	1	Transmission Power Control
			0	0	1	1	0	TCH Switching Indication
			0	0	1	1	1	TCH Switching Request Reject
			0	1	0	0	0	TCH Switching Request
			0	1	0	0	1	VOX control
			0	1	0	1	0	PS-ID notification
			0	1	0	1	1	TCH Switching re-request
			0	1	1	0	0	Additional channel Assign
			0	1	1	0	1	Additional channel Assign Reject
			0	1	1	1	0	Additional channel Request
			0	1	1	1	1	Additional channel Request Indicate
			1	0	0	0	0	Additional channel Request Indicate Reject
			1	0	0	0	1	Additional channel Re-request
			1	0	0	1	0	Modulation Reassign
			1	0	0	1	1	Modulation Reassign Reject
			1	0	1	0	0	Modulation Reassign Request
0	1	1	-	-	-	-	-	Option messages
			x	x	x	x	x	Option
				Other				Reserved

x: Don't care

Figure 4.4.3.5.3-1 Message types (private)

	Bit 8	7	6	5	4	3	2	1
Octet 1	0	Message type						

Message type (octet 1):

Bit 8	7	6	5	4	3	2	1	
0	0	0	-	-	-	-	-	Messages related to communication set-up
			0	0	0	0	1	Definition information request
			0	0	0	1	0	Definition information response
			0	0	0	1	1	Encryption key set
			0	0	1	0	0	Function request
			0	0	1	0	1	Function request response
			0	0	1	1	0	Paging response
			0	0	1	1	1	Zone information indication
0	0	1	-	-	-	-	-	Messages related to release of channel/communication
			0	0	0	1	0	Radio-channel Disconnect
			0	0	0	1	1	Radio-channel Disconnect Complete
0	1	0	-	-	-	-	-	Messages related to channel set up
			0	0	1	1	0	TCH Switching Indication
			0	0	1	1	1	TCH Switching Request Reject
			0	1	0	0	0	TCH Switching Request
			0	1	0	1	1	TCH Switching Re-Request
			0	1	1	0	0	Additional channel Assign
			0	1	1	0	1	Additional channel Assign Reject
			0	1	1	1	0	Additional channel Request
			0	1	1	1	1	Additional channel Request Indicate
			1	0	0	0	0	Additional channel Request Indicate Reject
			1	0	0	0	1	Additional channel Re-request
			1	0	0	1	0	Modulation Reassign
			1	0	0	1	1	Modulation Reassign Reject
			1	0	1	0	0	Modulation Reassign Request
0	1	1	-	-	-	-	-	Option messages
			x	x	x	x	x	Option
				Other				Reserved

x: Don't care

Figure 4.4.3.5.3-2 Message types (public)

4.4.3.5.3.4 Coding regulations and information elements (Private standard/Public standard)

Coding of other information elements follows the coding regulations below. These regulations make it possible for each piece of equipment that processes messages to find information elements that are necessary and to ignore those that are not necessary.

As coding regulations, 2 types of information elements are specified.

a. Single octet information elements (Figure 4.4.3.5.4 (a) and (b))

b. Multiple octet information elements (Figure 4.4.3.5.4 (c) and (d))

	Bit 8	7	6	5	4	3	2	1
Octet 1	1	Information element identifier			Information contents			

(a) Single octet information element coding (type 1)

	Bit 8	7	6	5	4	3	2	1
Octet 1	1	Information element identifier						

(b) Single octet information element coding (type 2)

	Bit 8	7	6	5	4	3	2	1
Octet 1	0	Information element identifier						
2	Information element content length							
3	Information contents							
:	:							

(c) Multiple octet information element coding (type 1)

	Bit 8	7	6	5	4	3	2	1
Octet 1	0	Information element identifier						
2	Information contents							
:	:							

(d) Multiple octet information element coding (type 2)

Figure 4.4.3.5.4 Information element format

The information element identifier bit coding for the information elements shown in this section is shown in Table 4.4.3.5.32-1 and Table 4.4.3.5.32-2.

Table 4.4.3.5.32-1 Information element coding (private)

Bit 8	7	6	5	4	3	2	1	
1	-	-	-	-	-	-	-	Single octet information elements
	0	0	0	-	-	-	-	Definition information request
	0	0	1	-	-	-	-	Encryption control information
	0	1	1	-	-	-	-	VOX Control
	1	0	0	-	-	-	-	Zone information indication function
	1	0	1	-	-	-	-	PS-ID notification control information

Bit 8	7	6	5	4	3	2	1	
0	-	-	-	-	-	-	-	Multiple octet information elements
	0	0	0	0	0	0	1	Area information
	0	0	0	0	1	0	0	Broadcasting information
	0	0	0	0	1	0	1	Carrier number
	0	0	0	0	1	1	0	Cause
	0	0	0	0	1	1	1	Condition report function
	0	0	0	1	0	0	0	CS-ID
	0	0	0	1	0	0	1	Encryption
	0	0	0	1	1	0	1	Encryption key set
	0	0	0	1	1	1	0	PS-ID
	0	0	0	1	1	1	1	PS number
	0	0	1	0	0	0	0	Reception level
	0	0	1	0	0	1	0	Report Condition
	0	0	1	0	0	1	1	SCH type
	0	0	1	0	1	0	0	Slot Number
	0	0	1	0	1	0	1	TCH switching
	0	0	1	0	1	1	0	Transmission Power Control
	0	0	1	0	1	1	1	Transmission Power Control Request
	0	0	1	1	0	0	0	VOX Function Information
	0	0	1	1	0	0	1	Zone condition report
	0	0	1	1	0	1	0	Paging Response Type
	0	0	1	1	0	1	1	Additional TCH Adoption Capability
	0	0	1	1	1	0	0	Additional TCH Identification
	0	0	1	1	1	0	1	Additional TCH Information
	0	0	1	1	1	1	1	Modulation
	1	x	x	x	x	x	x	Option
				Other				Reserved

x: Don't care

Table 4.4.3.5.32-2 Information element coding (public)

Bit 8	7	6	5	4	3	2	1	
1	-	-	-	-	-	-	-	Single octet information elements
	0	0	0	-	-	-	-	Definition information request
	1	0	0	-	-	-	-	Zone information indication function

Bit 8	7	6	5	4	3	2	1	
0	-	-	-	-	-	-	-	Multiple octet information elements
	0	0	0	0	0	0	1	Area informaiton
	0	0	0	0	1	0	0	Broadcasting information
	0	0	0	0	1	0	1	Carrier number
	0	0	0	0	1	1	0	Cause
	0	0	0	1	0	0	0	CS-ID
	0	0	0	1	0	0	1	Encryption
	0	0	0	1	1	0	1	Encryption key set
	0	0	0	1	1	1	0	PS-ID
	0	0	0	1	1	1	1	PS number
	0	0	1	0	0	1	1	SCH type
	0	0	1	0	1	0	0	Slot Number
	0	0	1	0	1	0	1	TCH switching
	0	0	1	0	1	1	0	Transmission Power Control
	0	0	1	1	0	1	1	Additional TCH Adoption Capability
	0	0	1	1	1	0	0	Additional TCH Identification
	0	0	1	1	1	0	1	Additional TCH Information
	0	0	1	1	1	1	0	Independence Transmission Power Control Information
	0	0	1	1	1	1	1	Modulation
	1	x	x	x	x	x	x	Option
				Other				Reserved

x: Don't care

The descriptions of the information elements shown in this section and below are in alphabetical order as a rule. However, for each information element within one message, the specific order within each codeset is used.

The value of the information element identifier codes for multiple octet information elements follows the order shown by each information element within the message, and they are assigned in order from the smaller value. By doing this, it is possible for the destination-side equipment to decide whether or not a specific information element is there without looking at the whole message. (note 2)

There are two types of multiple octet information elements. The second octet of type 1 shows the total octet length of the content part (octet 3 and thereafter) of those information elements. The number of octets in the information element contents is binary coded and the least significant becomes bit 1. The total octet length of the content part (octet 2 and thereafter) of the information elements in type 2 is fixed at something specified previously for each information element identifier by the standard.

The type 1 multiple octet information element option is allowed even if the existing content length is 0. At this time, the destination-side needs to process this as if this information element does not exist.

Single octet information elements can be set at an optional place in the message.

Single octet information elements are of 2 types. A type 1 information element is shown by the information element identifier at bits 7, 6, 5. When bits 7,6, 5 are "0 1 0", a type 2 single octet information element is guaranteed.

The parts of this standard that mention the information elements include reserved bits in some cases, and those bits are set at "0". However, in order to obtain compatibility for future implementation, even if the reserved bit is set at "1", that message must not be simply rejected.

(Note 1) Type 1 multiple octet information elements: Among the information elements made up of multiple octets, those of variable length (including information element length).
(Note 2) If the destination-side equipment must be able to judge the presence or absence of a certain information element and abandon it, the information element length of the standard type 2 multiple octet information element must be known completely.

4.4.3.5.3.4.1 Area information (Private standard/Public standard)

This information element is used to broadcast information pertaining to area from CS to PS. This information element is 8 octets, as shown in Figure 4.4.3.5.6.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Area information 0	0	0	0	0	0	1 Information element identifier
2	Standby zone selection level							
3	Standby zone hold level							
4	Recalling-type handover process level							
5	Recalling-type handover destination zone selection level							
6	TCH switching-type handover process level							
7	Channel switching FER threshold value							
8	Reserved		BPSK area information			Area information report status number		

Standby zone selection level (octet 2)

Specifies the threshold value level (control channel) at which PS selects CS (refer to Appendix Z for method of use).

Bit

8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
			.					.
			.					.
0	1	0	0	0	0	0	0	30 dBμV
			.					.
			.					.
0	0	1	0	1	1	0	0	10 dBμV

(Note 1) 1 dB units
(Note 2) If PS does not have the standby zone selection level, it can perform zone selection at 10 dBμV.

Standby zone hold level (octet 3)

Specifies the threshold value level (control channel) at which PS again selects CS (refer to Appendix Z for method of use).

Bit

8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
			.					.
			.					.
0	1	0	0	0	0	0	0	30 dBμV
			.					.
			.					.
0	0	1	0	1	1	0	0	10 dBμV

(Note 1) 1 dB units
(Note 2) If PS does not have the standby zone selection level, it can perform zone selection at 10 dBμV.

Recalling-type handover process level (octet 4)

Specifies the threshold level (communication channel) at which PS performs recalling-type handover. (Refer to section 4.4.3.5.4 for method of use.)

Bit

8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
			.					.
			.					.
0	1	0	0	0	0	0	0	30 dBμV
			.					.
			.					.
0	0	1	0	1	1	0	0	10 dBμV

(Note 1) 1 dB units
(Note 2) If PS does not have the recalling-type handover process level, it can perform the recalling-type handover process at 10 dBμV.
(However, when PS enters the communications phase, in order to acquire the Area information held by CS, the condition does not exist where it does not have the recalling-type handover process level in the communications phase.)

Recalling-type handover destination zone selection level (octet 5)

Specifies the threshold level (control channel) at which PS selects the recalling-type handover destination CS. (Refer to section 4.4.3.5.4 for the method of use.)

Bit

8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
			.					.
			.					.
0	1	0	0	0	0	0	0	30 dBμV
			.					.
			.					.
0	0	1	0	1	1	0	0	10 dBμV

(Note 1) 1 dB units
(Note 2) If PS does not have the recalling-type handover destination zone selection level, it can perform zone selection at 10 dBμV.

TCH switching-type handover process level (octet 6)

Specifies the threshold level (communication channel) at which PS performs TCH switching-type handover.

Bit

8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
			.					.
			.					.
0	1	0	0	0	0	0	0	30 dBμV
			.					.
			.					.
0	0	1	0	1	1	0	0	10 dBμV

(Note 1) 1 dB units
(Note 2) This octet is valid only when with TCH switching-type connection function to CS within paging area or to other paging area is specified in the TCH switching information element of the RT function request response message.

Channel switching FER threshold value (octet 7)

Specifies, when full rate in number of slot errors n in 240 slots, the FER (frame error rate) threshold value (communication channel) at which PS performs channel switching because of reception quality degradation. When half rate (Public only), the value which is half of the number of slot errors n is applied. (if he value calculated into half is not an integral number, round off under decimal point) (Refer to section 4.4.3.5.4 for method of use.)

Bit

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Number of slot errors n = 0
0	0	0	0	0	0	0	1	Number of slot errors n = 1
			.					.
			.					.
1	1	1	1	0	0	0	0	Number of slot errors n = 240
		Other						Reserved

(Note) If PS does not have the channel switching FER threshold value, channel switching can be performed at 240 slots.
(However, when PS enters the communications phase, in order to acquire the Area information held by CS, it does not depend on the fact that it does not have the channel switching FER threshold value in the communications phase.)

Area information report status number (octet 8)

Shows the status number of Area information reported by this information element.

Bit			
3	2	1	
0	0	0	Reserved
0	0	1	Status number 1
	.		.
	.		.
1	1	1	Status number 7

BPSK area information (octet 8)

To be used in case of π /2 shift BPSK communication.

Bit			
6	5	4	
0	0	0	0 dBμV
	~		
1	1	1	7 dBμV

(Note 1) Octets 2 - 6 level minus this value is used to forπ/2 shift BPSK.
(Note 2) This information is granted only when BPSK area information request is present in the Definition Information Request information element.

Figure 4.4.3.5.6 Area information

4.4.3.5.3.4.2 Broadcasting information (Private reference/Public standard)

Broadcasting information is an information element used to broadcast information pertaining to PS from CS, and is as shown in Figure 4.4.3.5.7. This information element can report all radio channel information, system information, 2nd system information, 3rd system information (public) and option information (private).

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Broadcasting information 0	0	0	0	1	0	0 Information element identifier
2	Broadcasting information content length							
3	LCCH interval value n *							
4	Paging grouping factor n_{GROUP} *				Paging area number length n_p *			
5	Reserv -ed	2nd system information broadcasting usage method*/reserved (note 7)	Numbering of same paging groups n_{SG}*			Battery saving cycle maximum value n_{BS}*		
6	Option/Reserved (note 1)		Number of PCHs n_{PCH}*			Frame basic unit length n_{SUB}*		
7	Option/Reserved (note 1)							
8	Reserved		Broadcasting status indication			Uplink LCCH timing*	Control carrier structure	
9	Reserved		Option/ Re- served (note 1)	Option/ Odd-even ID designation bit (note 5)	Global definition information pattern*			
10	LCH type			LCH protocol type		Extension LCH protocol type		
11	CC protocol type		CS information					
12	Paging area number/RT-MM protocol version (note 2)							
13	Paging area number/Restriction group designation (note 2) (note 6)							
14	Radio channel usage restriction information				Access cycle interval			
15	Reserved		Broadcasting message status number m1			Re-ser ved	Octet 12, 13 usage designation	
16, 17	Country code*							
18	System type*							
19	RT-MM protocol version							
20	Reserved					Reserved /Modula- tion (note 8)	Available slot number of simultaneous using	
21	Reserved		Broadcasting message status number m2			Paging area type*/ Reserved (note 7)		
22–26	Option/Reserved (note 3)							
27	Reserved		Broadcasting message status number m3			Reserved		

(Note 1) This information element is optional in private system, reserved in public systems.
(Note 2) The method of use of this information element (octets 12, 13) is according to the "octets 12, 13 usage designation" of octet 15.
(Note 3) This information element (octets 22~26) is the information area for 3rd system information (public) or option information broadcasting message (private). It is optional in a private system, and reserved in a public system.
(Note 4) In the information elements of this message, information elements marked with a "*" are global definition information elements, and others are local definition information elements.
(Note 5) This information element is optional only in the case of a private system.
(Note 6) If this message is transmitted in a private system, this information element (octet 13) may be used as both a paging area number and restriction group designation. Also, if this message is transmitted by a public system, this information element (octet 13) is all used as a restriction group designation.
(Note 7) This information element is used in private system, reserved in public systems.
(Note 8) This information element is used in public system, reserved in private systems.

Coding regulations about each information element in octet 3 ~ 27 are the same specification as coding regulations about information elements in the each broadcasting message specified in "4.3.4.2 Broadcasting messages".
However, "Octets 4, 5 usage designation" in 4.3.4.2 broadcasting messages is applied to "Octets 12, 13 usage designation".

Figure 4.4.3.5.7 Broadcasting information

4.4.3.5.3.4.3 Definition information request (Private standard/Public standard)

The Definition information request is used to request broadcasting information, and it is as shown in Figure 4.4.3.5.8. This information element is a single octet information element (type 1).

Octet \ Bit	8	7	6	5	4	3	2	1
1	1	Definition information request 0	0	0 Information element identifier	Definition information type			

Definition information type (octet 1)

Bit 4	3	2	1	
x	x	x	1/0	Area information request present/absent
x	x	1/0	x	BPSK area information request present/absent
	Other			Reserved
				x: Don't care

Figure 4.4.3.5.8 Definition information request

4.4.3.5.3.4.4 Carrier number (Private standard/Public standard)

The Carrier number is a number that shows the frequency of the communications radio channel, and it is shown in Figure 4.4.3.5.9. This information element is 2 octets.

Octet \ Bit	8	7	6	5	4	3	2	1
1	0	0	0	0	0	1	0	1
		Carrier number / Information element identifier						
2	Carrier number							

Carrier number (octet 2)

Bit 8	7	6	5	4	3	2	1	(Carrier number)
0	0	0	0	0	0	0	1	First carrier (1,895.15 MHz)
0	0	0	0	0	0	1	0	Second carrier (1,895.45 MHz)
				. . .				. . .
0	1	0	1	0	0	1	0	Eighty second carrier (1,919.45 MHz)
0	1	0	1	0	0	1	1	Reserved
				. .				. .
1	1	0	1	1	1	0	0	Reserved
1	1	0	1	1	1	0	1	Two hundreds twenty first carrier (1,884.65MHz)
1	1	0	1	1	1	1	0	Two hundreds twenty second carrier (1,884.95 MHz)
				. .				. .
1	1	1	1	1	1	1	1	Two hundreds fifty fifth carrier (1,894.85 MHz)
			Other					Reserved

Figure 4.4.3.5.9 Carrier number

4.4.3.5.3.4.5 Cause (Private standard/Public standard)

The cause is used to indicate the message creation reasons and location, and it is shown in Figure 4.4.3.5.10. This information element is 2 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Cause 0	0	0	0	1	1	0 Information element identifier
2	Location	Cause value						

Location (octet 2)

Bit
8
0 PS
1 CS or network

Cause value (octet 2)

Bit 7	6	5	4	3	2	1	
0	0	0	-	-	-	-	Normal class
			0	0	0	0	Normal disconnect
			1	1	1	1	Other normal events
0	1	0	-	-	-	-	Resource use impossible class
			0	0	0	1	No vacant channel (includes no slot available)
			0	0	1	0	No available channel
			0	0	1	1	No out going circuit available
			0	1	0	0	No additional channel (TCH) (Slot changeable information possible)
			0	1	0	1	No available modulation
			0	1	1	0	Modulation reassign impossible
			0	1	1	1	Modulation reassign not supported
			1	0	0	1	Reception level degradation (including specified channel use impossible)
			1	0	1	0	Reception quality degradation (including specified channel use impossible)
			1	1	0	0	Equipment abnormal
			1	1	0	1	rate up
			1	1	1	0	rate down
			1	1	1	1	Other resource use impossible class (includes no channel adding function)
1	0	0	-	-	-	-	Service or option not implemented class
			1	1	1	1	Service or option not implemented, unspecified (includes no channel adding function at CS side)
1	0	1	-	-	-	-	Invalid message (e.g. parameter out of range) class
			0	0	0	1	Assigned carrier non-corresponding (PS side)
			1	0	0	0	No channel adding function (PS side)
1	1	0	-	-	-	-	Procedure error class
			0	0	0	1	Message failure
			0	1	1	0	Timer expiration
			1	1	1	1	Other procedure error classes
1	1	1	x	x	x	x	Option
			Other				Reserved

x: Don't care

Figure 4.4.3.5.10 Cause

4.4.3.5.3.4.6 Condition report function (Private reference)

The condition report function is used for designating the condition report function, and it is as shown in Figure 4.4.3.5.11. This information element is 2 octets.

<table>
<tr><td>Octet</td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td colspan="7">Condition report function
0 0 0 0 1 1 1
Information element identifier</td></tr>
<tr><td>2</td><td colspan="7">Reserved</td><td>Function infor-mation</td></tr>
</table>

Function information (octet 2)

Bit
1
0 No condition report/no condition inquiry
1 With condition report/with condition inquiry

Figure 4.4.3.5.11 Condition report function

4.4.3.5.3.4.7 CS-ID (CS identification) (Private standard/Public standard)

The CS-ID is as shown in Figure 4.4.3.5.12, and it is information element used to identify the CS. These information elements are 7 octets.

The CS ID structure is as below. (Refer to section 4.2.10.2)

Private: System identification code (29) + additional ID (13)
Public: Operator identification code (9) + paging area number (n_p) + additional ID (33-n_p)
Numbers in parentheses are the number of bits.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	CS-ID 0	0	0	1	0	0	0 Information element identifier
2	(MSB) CS-ID							
3	CS-ID							
4	CS-ID							
5	CS-ID							
6	CS-ID							
7	Reserved						CS-ID (LSB)	

CS-ID (octets 2-7)

42-bit binary CS-ID. (Refer to section 4.2.10.2.)

Figure 4.4.3.5.12 CS-ID

4.4.3.5.3.4.8 Encryption (Private standard/Public standard)

Encryption is an information element for specifying the encryption function during communication, and it is shown in Figure 4.4.3.5.13. This information element is 3 octets.

<table>
<tr><td></td><td>Bit</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Octet</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">0</td><td colspan="7">Encryption</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td colspan="7">Information element identifier</td></tr>
<tr><td>2</td><td colspan="4">Encryption</td><td colspan="2">Encryption key type</td><td>Encryption control during communi-cation</td><td>Re-served</td></tr>
<tr><td>3</td><td colspan="4">Encryption key ciphering type</td><td colspan="4">Reserved</td></tr>
</table>

Encryption (octet 2)

Bit 8	7	6	5	
0	0	0	0	No encryption function
x	x	x	1/0	User scrambling present/absent
x	x	1/0	x	Reserved
x	1/0	x	x	Reserved
1/0	x	x	x	Option
				x : Don't care

Encryption key type (octet 2)

Bit 4	3	
0	0	Key set for each call
0	1	Prior encryption key (present)
1	0	Prior encryption key (updated)
1	1	Reserved

Encryption control during communication (octet 2)

Bit 2	
0	Encryption control during communication
1	No encryption control during communication

(Note) This information element is valid only in the function request and function request response messages.

Encryption key ciphering type (octet 3)

Bit 8	7	6	5	
0	0	0	0	No ciphering
x	x	x	1/0	Reserved (with/without standard ciphering)
x	x	1/0	x	Reserved
x	1/0	x	x	Reserved
1/0	x	x	x	Option

x: Don't care

Figure 4.4.3.5.13 Encryption

4.4.3.5.3.4.9 Encryption control information (Private reference)

Encryption control information is for operation/stop of the encryption function during communication, and it is shown in Figure 4.4.3.5.14. This information element is a single octet information element (type 1).

Octet	Bit 8	7	6	5	4	3	2	1
1	1	Encryption control information 0	0	1 Information element identifier	Reserved			Encryption control

Encryption control (octet 1)

Bit 1	
0	Encryption function is stopped
1	Encryption function is operated

Figure 4.4.3.5.14 Encryption control information

4.4.3.5.3.4.10 Encryption key set (Private standard/Public standard)

The encryption key set is an information element used for reporting the key for performing encryption, and it is shown in Figure 4.4.3.5.15. Using the encryption key set, an encryption key of any length can be transmitted.

In case of 64kbit/s communication, Encryption key is common to TCH & 2ndTCH, which means that Encryption key set on TCH is also used on 2ndTCH.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Encryption key set 0	0	0	1	1	0	1 Information element identifier
2	Encryption key set content length							
3 ~ *	Encryption key							

Encryption key (octets 3~*)

- Shows the encryption key.
- User scrambling method is shown in Appendix Y.

Figure 4.4.3.5.15 Encryption key set

4.4.3.5.3.4.11 PS number (Private standard/Public standard)

The PS number is a number used by CS to identify the PS in the paging response, and it is as shown in Figure 4.4.3.5.16. This information element is 8 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	PS number 0	0	0	1	1	1	1 Information element identifier
2	Re-served	Paging service type			PS number (first number)			
3	PS number (second number)				PS number (third number)			
4	PS number (fourth number)				PS number (fifth number)			
5	PS number (sixth number)				PS number (seventh number)			
6	PS number (eighth number)				PS number (ninth number)			
7	PS number (tenth number)				PS number (eleventh number)			
8	PS number (twelfth number)				PS number (thirteenth number)/ Extension paging service type			

Paging service type (octet 2)

Bit 7	6	5	
0	0	0	Reserved
0	0	1	Shows paging service by BCD 13-digit or less PS number.
0	1	0	Shows paging service by hexadecimal 7-digit PS number (however, reserved in public system).
0	1	1	Shows paging service by hexadecimal 13-digit PS number.
1	0	0	Shows paging service by BCD 13 digits or less domestic PS number.
1	0	1	Shows paging service by extension paging service type (however, reserved in public system).
1	1	x	Option (private)/Reserved (public) x: Don't care

Extension paging service type (octet 8)

If the paging servece type is paging service by extension paging service (101), it means as follows.

Bit 4	3	2	1	
0	0	1	0	Shows paging service by PS number of BCD 12 digits of less. (note 1)
0	1	0	0	Shows paging service by supplementary service within the CS-PS loop. (note 2)
	Other			Reserved

(Note 1) Paging service by PS number of BCD 12 digits or less is used for showing that the PS number is based on the original numbering plan defined in each private system.
(Note 2) Used for supplementary service within the CS-PS loop in a private system.

If extension paging service type is paging service by PS number of BCD 12 digits or less (0010), the format of PS number information element is as follows:

Octet	Bit 8	7	6	5	4	3	2	1
1	0	0	0	0	1	1	1	1
		PS number / Information element identifier						
2	Re-served	1	0	1	PS number (1st digit)			
3	PS number (2nd digit)				PS number (3rd digit)			
4	PS number (4th digit)				PS number (5th digit)			
5	PS number (6th digit)				PS number (7th digit)			
6	PS number (8th digit)				PS number (9th digit)			
7	PS number (10th digit)				PS number (11th digit)			
8	PS number (12th digit)				Extension paging service type			

PS number (octets 2-8)

For PS numbers, for each paging service type, it is possible to use two types of number indication method.

- In the case of BCD, the first number, that is the number first dialed, is packed in the PS number in order from the lowest octet.
- In the case of BCD, the number of digits of PS number, if smaller than the maximum number of digits for each paging service type, adds filler following PS number up to the maximum number of digits.
- As the number digits, BCD and hexadecimal are determined as shown below.
- When used in a public system, if paging service type is (001), the types of number/numbering plan identifier of the PS number are considered undetermined/undetermined.
- When used in a public system, if paging service type is (011), the type of number of the PS number is considered as international number, and number plan identifier is considered as ISDN/telephony numbering plan.
- When used in a public system, if paging service type is (100), the type of number of the PS number is considered as domestic number, and number plan identifier is considered as ISDN/telephony numbering plan.

BCD number digits (octets 2–8)

Octet \ Bit	4	3	2	1	Octet \ Bit	4	3	2	1
	8	7	6	5		8	7	6	5
0	1	0	1	0	6	0	1	1	0
1	0	0	0	1	7	0	1	1	1
2	0	0	1	0	8	1	0	0	0
3	0	0	1	1	9	1	0	0	1
4	0	1	0	0	Filler	0	0	0	0
5	0	1	0	1	Option	Others			

Hexadecimal number digits (octets 2–8)

When 7 digits hexadecimal

Octet	Bit 8 7 6 5	4 3 2 1
2		MSB
3		
4		
5		LSB
6		
7	(Don't	care)
8		

When 13 digits hexadecimal

Octet	Bit 8 7 6 5	4 3 2 1
2		MSB
3		
4		
5		
6		
7		
8		LSB

Figure 4.4.3.5.16 PS number

4.4.3.5.3.4.12 PS-ID (Private standard/Public standard)

PS-ID is used for verifying the ID of PS between CS and PS during communication, and it is as shown in Figure 4.4.3.5.17. This information element is 5 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	PS-ID 0	0	0	1	1	1	0 Information element identifier
2	(MSB) PS-ID							
3	PS-ID							
4	PS-ID							
5	Reserved				PS-ID (LSB)			

Figure 4.4.3.5.17 PS-ID

4.4.3.5.3.4.13 PS-ID notification control information (Private reference)

PS-ID notification control information is an information element used to specify the PS-ID notification function during communication, and it is as shown in Figure 4.4.3.5.18. This information element is a single octet information element (type 1).

Octet	Bit 8	7	6	5	4	3	2	1
1	1	PS-ID notification control information 1	0	1 Information element identifier	Reserved			PS-ID ex-change

PS-ID exchange (octet 1)

Bit 1	
0	PS-ID exchange during communication absent
1	PS-ID exchange during communication present

Figure 4.4.3.5.18 PS-ID notification control information

4.4.3.5.3.4.14 Reception level (Private reference)

The reception level shows the reception level of communication measured at CS or PS, and it is as in Figure 4.4.3.5.19. This information element is 2 octets.

	Bit 8	7	6	5	4	3	2	1
Octet 1	0	Reception level 0	0	1	0	0	0	0 Information element identifier
2	Reception level							

Reception level value (octet 2)

Bit 8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
			.					.
			.					.
0	1	0	0	0	0	0	0	30 dBμV
			.					.
			.					.
0	0	1	0	1	1	0	0	10 dBμV

(Note) 1 dB units

Figure 4.4.3.5.19 Reception level

4.4.3.5.3.4.15 Report Condition (Private reference)

The Report Condition is information for specifying the conditions for reporting to CS the peripheral zone Reception level detected by PS, and it is shown in Figure 4.4.3.5.20. This information element is 4 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Report Condition 0	0	1	0	0	1	0 Information element identifier
2	Autonomous report start/stop threshold value							
3	Autonomous report interval							
4	Periodic report interval							

Autonomous report start/stop threshold value (octet 2)

Specifies the reception level threshold value at which the condition report from PS is autonomously started/stopped. When the reception level is below the relevant threshold level, the autonomous report is performed with the specified autonomous report interval.

Bit 8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
				.				.
				.				.
0	1	0	0	0	0	0	0	30 dBμV
				.				.
				.				.
0	0	1	0	1	1	0	0	10 dBμV

(Note) 1 dB units

Autonomous report interval (octet 3)

When the autonomous condition report from PS is a required condition, the interval at which the relevant report is repeated (0 - 255 x 100 ms) is specified in binary.

Bit

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Shows autonomous report stop condition.
0	0	0	0	0	0	0	1	1 x 100 ms
			.				.	
			.				.	
1	1	1	1	1	1	1	0	254 x 100 ms
1	1	1	1	1	1	1	1	255 x 100 ms

(Note) 100 ms units

Periodic report interval (octet 4)

The periodic report interval of the peripheral zone reception level (0 - 255 sec) is specified in binary.

Bit

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Shows stop condition of periodic report.
0	0	0	0	0	0	0	1	1 sec
				.				.
				.				.
1	1	1	1	1	1	1	0	254 sec
1	1	1	1	1	1	1	1	255 sec

(Note) 1 sec units

Figure 4.4.3.5.20 Report Condition

4.4.3.5.3.4.16 SCH type (Private standard/Public standard)

SCH type is an information element that identifies the SCH type when TCH switching is carried out, and it is as shown in Figure 4.4.3.5.21. This information element is 3 octets.

Octet \ Bit	8	7	6	5	4	3	2	1
1	0	SCH type 0	0	1	0	0	1	1 Information element identifier
2	Reserved					SCH type		
3	Extension SCH type/reserved/option							

SCH type (octet 2)

Bit 3	2	1	
0	0	0	Standard (π /4 shift QPSK 32 kbit/s)
0	0	1	Reserved (private)/Standard (π /4 shift QPSK 16 kbit/s) (public)
0	1	0	Reserved
0	1	1	Reserved (private)/Standard (π /4 shift QPSK 32 kbit/s or 16 kbit/s) (public) (note)
1	0	0	Reserved
1	0	1	Reserved (for extension classification)
1	1	0	Option (private)/Reserved (public)
1	1	1	Option (private)/Reserved (public)

(Note) Valid only in TCH switching (re-)request message

Extension SCH type (octet 3)

Extension SCH type shows SCH type added by option, and when SCH type (octet 2) is standard (0 0 0), all areas are reserved and the destination-side is "Don't care."

Also, when the option (1 1 0) or (1 1 1) is set in the SCH type (octet 2), all areas are options, and other than that all areas are reserved.

Figure 4.4.3.5.21 SCH type

4.4.3.5.3.4.17 Slot Number (Private standard/Public standard)

The relative Slot Number is a number shown by a relative value in which the old absolute Slot Number that was communicated is shown first. It is as shown in Figure 4.4.3.5.22. This information element is 2 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Slot Number 0	0	1	0	1	0	0 Information element identifier
2	Re-served	Absolute slot number		Relative Slot Number				

Absolute Slot Number (octet 2)

Bit 7	6	
0	0	Shows that relevant message was transmitted by TDMA slot 1.
0	1	Shows that relevant message was transmitted by TDMA slot 2.
1	0	Shows that relevant message was transmitted by TDMA slot 3.
1	1	Shows that relevant message was transmitted by TDMA slot 4.

Relative Slot Number (octet 2)

Bit 5	4	3	2	1	
0	0	0	0	0	Relative Slot Number = 1
0	0	0	0	1	Relative Slot Number = 2
		.			.
		.			.
		.			.
1	1	1	1	1	Relative Slot Number = 32

Figure 4.4.3.5.22 Slot Number

4.4.3.5.3.4.18 TCH switching (Private standard/Public standard)

TCH switching is an information element used for designating the possible channel switching control function during communications by PS, and it is shown in Figure 4.4.3.5.23. This information element is 2 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	TCH switching 0	0	1	0	1	0	1 Information element identifier
2	TCH switching function type							

The contents of the information element are as follows.

<u>TCH switching function type (octet 2)</u>

Bit 8	7	6	5	4	3	2	1	
0	x	x	x	x	x	x	1/0	Switching control function for communications physical slots within carrier within CS present/absent {PS standard (mandatory): CS option (note 6) in private. Standard (mandatory) in public.}
0	x	x	x	x	x	1/0	x	Switching control function for communications physical slots between carriers within CS present/absent {PS standard (mandatory): CS option (note 6) in private. Standard (mandatory) in public.}
0	x	x	x	x	1/0	x	x	Recalling-type connection function to other CS within paging area present/absent (note 1, 2) {PS standard (mandatory) : CS option in private. Standard (mandatory) in public.}
0	x	x	x	1/0	x	x	x	TCH switching-type connection function to other CS within paging area present/absent (note 1, 2) {Functional option}
0	x	x	1/0	x	x	x	x	Recalling-type connection function to other CS among paging areas present/absent (note 1, 2, 4) {PS standard (mandatory) : CS option}
0	x	1/0	x	x	x	x	x	TCH switching-type connection function to other CS among paging areas present/absent (note 1, 2, 4) {Functional option}
0	1/0	x	x	x	x	x	x	CS-ID designation switching function to other CS present/absent (note 3, 5) {Functional option}
1	x	x	x	x	x	x	x	Option

x: Don't care

(Note 1) Connection to other CS also includes connection to own CS.

(Note 2) [1] CS functions

Switching function within paging area: Shows function performed among CSs within paging area.

Switching function among paging areas: Shows function which performs switching among CSs among paging areas.

[2] PS functions

Switching function within paging area: Shows function which performs switching by transmitting recalling request or TCH Switching Request only to CS within paging area.

Switching function among paging areas: Shows function which performs switching by transmitting recalling request or TCH Switching Request without discrimination of within/among paging areas.

(Note 3) Connection to other CS does not include connection to own CS.

(Note 4) If the handover function among paging areas is selected commonly between PS and CS, PS can operate as if the paging area numbers are the same even in different paging areas, with regard to paging area number length (n_p), uplink LCCH timing value and TCH switching function.

(Note 5) Limited to the case of recalling-type handover.
Designation of this function present is valid only when the recalling-type handover function is present (when bit 3 or bit 5 of octet 2 is "1").

(Note 6) It shall be required to be equipped with both or one of the following functions; switching control function for communications physical slots within carrier within CS or/and switching control function for communications physical slots between carriers within CS.

Figure 4.4.3.5.23 TCH switching

4.4.3.5.3.4.19 Transmission Power Control (Private reference/public Standard)

Transmission Power Control is an information element used to specify the Transmission Power Control function by function request, and it is as shown in Figure 4.4.3.5.24. This information element is 2 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Transmission Power Control 0	0	1	0	1	1	0 Information element identifier
2	Reserved						Independent Transmission Power function	Trans-mis-sion power func-tion

Independent Transmission power function (octet 2)

Bit
2
0 Independent Transmission Power Control function absent
1 Independent Transmission Power Control function present

Figure 4.4.3.5.24 Transmission Power Control

4.4.3.5.3.4.20 Transmission Power Control Request (Private reference)

Transmission Power Control Request is an information element for controlling a relative increase or decrease in transmission power with respect to the present transmission power, and it is as shown in Figure 4.4.3.5.25. This information element is 2 octets.

Octet \ Bit	8	7	6	5	4	3	2	1
1	0	Transmission Power Control Request 0	0	1	0	1	1	1 Information element identifier
2	Transmission power							

Transmission power (octet 2)

Bit
8
0 Shows control of reduction in transmission power.
1 Shows control of increase in transmission power.

Bit

7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0 dB
0	0	0	0	0	0	1	1 dB
			.				.
			.				.
0	1	0	0	0	0	0	32 dB

"0000001" through "0100000" are codes for 1 dB through 32 dB in 1 dB intervals.

(Note) When it cannot be controlled to the specified value, it is controlled to the nearest possible value.

Figure 4.4.3.5.25 Transmission Power Control Request

4.4.3.5.3.4.21 VOX Control (Private reference)

VOX Control is an information element used to prohibit and permit the VOX function during communication, and it is shown in Figure 4.4.3.5.26. This information element is a single octet information element (type 1).

Octet	Bit 8	7	6	5	4	3	2	1
1	1	VOX Control 0	 1	 1 Information element identifier	Reserved			VOX con-trol status

VOX control status (octet 1)

Bit
1
0 VOX function is blocked.
1 VOX function block is released.

Figure 4.4.3.5.26 VOX Control

4.4.3.5.3.4.22 VOX Function Information (Private reference)

VOX Function Information is an information element for designating the VOX function, and it is as shown in Figure 4.4.3.5.27. This information element is 2 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	VOX Function Information 0	0	1	1	0	0	0 Information element identifier
2	Background noise generation method						VOX function	

VOX function (octet 2)

Bit 2	1	
0	0	VOX function absent
0	1	Uplink VOX function present
1	0	Downlink VOX function present
1	1	Both directions VOX function present

Background noise generation method (octet 2)

Bit 8	7	6	5	4	3	
0	0	0	0	0	0	Background noise information absent
1	x	x	x	x	x	Option
		Other				Reserved
						x : Don't care

Figure 4.4.3.5.27 VOX Function Information

4.4.3.5.3.4.23 Zone condition report (Private reference)

Zone condition report is used for performing condition report from PS to CS, and is as shown in Figure 4.4.3.5.4.28. This information element transmits CS-ID and its reception level from CS. Octets 3 through 9 make up one piece of zone condition information, and multiple pieces of zone condition information can be contained in an information element.

<table>
<tr><td></td><td colspan="8">Bit</td></tr>
<tr><td>Octet</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td colspan="7">Zone Condition report
0 0 1 1 1 0 1
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Zone condition report content length</td></tr>
<tr><td>3</td><td colspan="8">(MSB) CS-ID</td></tr>
<tr><td>4</td><td colspan="8">CS-ID</td></tr>
<tr><td>5</td><td colspan="8">CS-ID</td></tr>
<tr><td>6</td><td colspan="8">CS-ID</td></tr>
<tr><td>7</td><td colspan="8">CS-ID</td></tr>
<tr><td>8</td><td colspan="6">Reserved</td><td colspan="2">CS-ID
(LSB)</td></tr>
<tr><td>9</td><td colspan="8">Reception level value</td></tr>
<tr><td>.
.</td><td colspan="8">.
.</td></tr>
</table>

CS-ID (octets (3-8) + 7n) (n≧0)

42-bit binary CS-ID. (Refer to section 4.2.10.2)

Reception level value (octet 9 + 7n) (n≧0)

Bit 8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
			.					.
			.					.
0	1	0	0	0	0	0	0	30 dBμV
			.					.
			.					.
0	0	1	0	1	1	0	0	10 dBμV

(Note) 1 dB units

Figure 4.4.5.3.28 Zone condition report

4.4.3.5.3.4.24 Zone information indication function (Private reference/Public standard)

The zone information indication function is used to receive broadcasting information during communication, and is as shown in Figure 4.4.3.5.29. This information element is a single octet information element (type 1).

Octet	Bit 8	7	6	5	4	3	2	1
1	1	Zone information indication function 1	0	0 Information element identifier	Reserved			Zone infor-mation indica-tion

Zone information indication (octet 1)

Bit
1
0 Zone information indication function absent
1 Zone information indication function present

Figure 4.4.3.5.29 Zone information indication function

4.4.3.5.3.4.25 Paging response type (Private standard)

Paging response type is used for responding to a paging call with extension paging service type showing a zone paging call, and it is as shown in Figure 4.4.3.5.30. This information element is multiple octet information element (type 1).

<table>
<tr><td>Octet</td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td colspan="7">Paging response type
0 0 1 1 0 1 0
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Paging response type content length</td></tr>
<tr><td>3</td><td>0/1
Exten
-sion</td><td colspan="3">Paging service type
1 0 1</td><td colspan="4">Extension paging
service type</td></tr>
<tr><td>3a</td><td>1
Exten
-sion</td><td colspan="3">Reserved</td><td>Notifi-
cation
from
the
syste
m</td><td colspan="3">Paging response
content</td></tr>
</table>

Extension of this information element is used in supplementary service within the CS-PS loop for the private system. Extension method is as follows.

- 0/1 Extension : The 8th bit is used for extension bit, and octet(N) is extended to the following octets(Na, Nb, ……).
- The 8th bit "0" shows next octet follows this octet.
- The 8th bit "1" shows this octet is the last of the octet group.
- When another octet follows, the 8th bit in the format description is described as "0/1 Extension".
- When the last octet in extended area, 8th bit in the format description is described as "1 Extension".

Paging service type (octet 3)

Bit 7	6	5	
0	0	0	Reserved
	.		.
	.		.
	.		.
1	0	0	Reserved
1	0	1	Shows paging service by extension paging service type
1	1	x	Option
			x : Don't care

Extension paging service type (octet 3)

If paging service type shows paging service (101) by extension paging service type, it means as follows.

Bit

4	3	2	1	
0	0	0	0	Reserved
0	0	0	1	shows responding to zone paging call that shows " shows paging service to all PS receiving this paging message " in the PCH.
0	1	0	0	shows responding to zone paging call that shows " shows paging service (supplementary service within the CS-PS loop) to all PS receiving this paging message " in the PCH.
Other				Reserved

Notification from the system (zone paging, hold within the CS-multiple PS) (octet 3a)

This is the bit of the octet for supplementary service within the CS-PS loop. Responding to zone paging or to hold within the CS-multiple PS, it has the following meaning.

Bit

4	
0	Zone paging
1	Hold within the CS-multiple PS

Paging response content (octet 3a)

This information is a part of the octet for supplementary service within the CS-PS loop. Responding to zone paging or to hold within the CS-multiple PS, it has the following meaning.

Bit

3	2	1	
0	0	0	Undetermined
0	0	1	Outside line 1
0	1	0	Outside line 2
0	1	1	Door phone A
1	0	0	Door phone B
1	0	1	Extension line 1
1	1	0	Extension line 2
1	1	1	Option

Figure 4.4.3.5.30 Paging response type

4.4.3.5.3.4.26 Additional TCH Adoption Capability (Private standard/Public standard)

Additional TCH Adoption Capability information element is used when PS transmits Additional channel Request or Additional channel Re-request message to indicate the information of correspondable channel, and when CS transmits Additional channel Assign message to declare the function that CS possesses, as shown in Figure 4.4.3.5.31. This information element is 4 octet long.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Additional TCH Adoption Capability 0 0 1 1 0 1 1 Information element identifier						
2 3	Additional TCH assignment function type							
4	Additional TCH function type							

Additional TCH assignment function type (octet 2)

Bit 8	7	6	5	4	3	2	1	
0	x	x	x	x	x	x	1/0	Channel adding function for communications physical slot within the neighboring slot within the same carrier present/absent {Standard (mandatory)}
0	x	x	x	x	x	1/0	x	Channel adding function for communications physical slot within the slot next to the neighbor within the arbitrary carrier present/absent {Standard (mandatory)}
0	x	x	x	x	1/0	x	x	Channel adding function for communications physical slot within the different slot within the arbitrary carrier present/absent {Standard (mandatory)}
0	x	x	x	1/0	x	x	x	Channel adding function for communications physical slot within the arbitrary slot within the arbitrary carrier present/absent {Functional option}
Other								Reserved

1:present, 0:absent, x: Don't care

Additional TCH assignment function type (octet 3)

Bit 8	7	6	5	4	3	2	1	
0	x	x	x	x	x	x	1/0	Slot changeable information function present/absent
Other								Reserved

1:present, 0:absent, x: Don't care

Additional TCH function type (octet 4)

Bit 8	7	6	5	4	3	2	1	
0	x	x	x	x	x	x	1/0	TCH switching function when additional channels are occupied present/absent {Standard (mandatory)}
0	x	x	x	x	x	1/0	x	Recalling type connection function to other CS when additional channels are occupied present/absent {Standard (mandatory)}
Other								Reserved

1:present, 0:absent, x: Don’t care

Figure 4.4.3.5.31 Additional TCH Adoption Capability

4.4.3.5.3.4.27 Additional TCH Identification (Private standard/Public standard)

Additional TCH Identification information element is used to indicate the identification information of additional TCH(s), and it is as shown in Figure 4.4.3.5.32. This information element is a variable length information element whose length is minimum 3 octets, and Additional TCH discrimination can be repeatedly indicated.

Octet	bit 8	7	6	5	4	3	2	1
1	0	Additional TCH Identification 0 0 1 1 1 0 0 Information element identifier						
2	Additional TCH Identification content length							
3	Reserved						Additional TCH discrimination	
4 :	: :							

Additional TCH discrimination (octet 3~)

2 1	
0 0	reserved
0 1	The Second Traffic Channel
Other	reserved

Figure 4.4.3.5.32 Additional TCH Identification

4.4.3.5.3.4.28 Additional TCH Information (Private standard/Public standard)

Additional TCH Information is used to indicate the information of additional TCH(s), and it is as shown in Figure 4.4.3.5.33. This information element is a variable length information element whose length is minimum 5 octets, and octet 3 through octet 11 can be repeatedly indicated to assign multiple channels.

<table>
<tr><td></td><td colspan="8">Bit</td></tr>
<tr><td>Octet</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td colspan="7">Additional TCH Information
0 0 1 1 1 0 1
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Additional TCH Information content legth</td></tr>
<tr><td>3</td><td>CS-ID Indication</td><td colspan="5">Reserved</td><td colspan="2">Additional TCH discrimination</td></tr>
<tr><td>4</td><td colspan="8">Carrier number</td></tr>
<tr><td>5</td><td>reserved</td><td colspan="2">Absolute Slot Number</td><td colspan="5">Relative Slot Number</td></tr>
<tr><td>6</td><td colspan="8">(MSB) CS-ID</td></tr>
<tr><td>7</td><td colspan="8">CS-ID</td></tr>
<tr><td>8</td><td colspan="8">CS-ID</td></tr>
<tr><td>9</td><td colspan="8">CS-ID</td></tr>
<tr><td>10</td><td colspan="8">CS-ID</td></tr>
<tr><td>11</td><td colspan="6">Reserved</td><td colspan="2">CS-ID (LSB)</td></tr>
</table>

CS-ID Indication (octet 3)

Bit 8	
0	Omit CS-ID Indication (octet 6 - 11)
1	Show CS-ID Indication

Additional TCH discrimination (octet 3)

2 1	
0 0	reserved
0 1	The Second Traffic Channel
Other	reserved

Carrier number (octet 4)

Bit 8	7	6	5	4	3	2	1	(Carrier number)
0	0	0	0	0	0	0	1	First carrier (1895.15MHz)
0	0	0	0	0	0	1	0	Second carrier (1895.45MHz)
:								:
0	1	0	1	0	0	1	0	Eighty second carrier(1919.45MHz)
0	1	0	1	0	0	1	1	Reserved
:								:
1	1	0	1	1	1	0	0	Reserved
1	1	0	1	1	1	0	1	Two hundreds twenty first carrier (1,884.65MHz)
1	1	0	1	1	1	1	0	Two hundreds twenty second carrier (1,884.95 MHz)
:								:
1	1	1	1	1	1	1	1	Two hundred fifty fifth carrier (1894.85MHz)
Other								Reserved

Absolute Slot Number (octet 5)

Bit 7	6	
0	0	Shows that relevant message is transmitted by TDMA slot 1
0	1	Shows that relevant message is transmitted by TDMA slot 2
1	0	Shows that relevant message is transmitted by TDMA slot 3
1	1	Shows that relevant message is transmitted by TDMA slot 4

Relative Slot Number (octet 5)

Bit 5	4	3	2	1	
0	0	0	0	0	Relative Slot Number = 1
0	0	0	0	1	Relative Slot Number = 2
:					:
1	1	1	1	1	Relative Slot Number = 32

(note) refer to section 4.4.3.5.3.4.17 Slot Number for the definition of relative slot number.

CS-ID(octet 6 --11)

42 bit binary CS-ID (refer to section 4.2.10.2).

Figure 4.4.3.5.33 Additional TCH information

4.4.3.5.3.4.29 Independent TX Power Control Information (Private Standard)(Public standard)

Independent Tx Power Control Information is used for reporting Independent Tx Power Control Information from CS to PS, and it is as shown in Figure 4.4.3.5.34. This information element is transmitted by necessity when ITXPT is present.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Independent Tx Power Control Information 0	0	1	1	1	1	0 Information element identifier
2	ITXPC information content length							
3	Reserved	ITXPC activate level						
4	Reserved	ITXPC process level						
5	Reserved	ITXPC width						

ITXPC activate level (Octet 3)

Bit 7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0dB
0	0	0	0	0	0	1	1dB
			.				.
			.				.
			.				.
1	0	0	0	0	0	0	64dB

"0000001" through "1000000" are codes for 1dB through 64dB in 1dB intervals.

ITXPC process level (Octet 4)

Bit 7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0dB
0	0	0	0	0	0	1	1dB
			.				.
			.				.
			.				.
1	0	0	0	0	0	0	64dB

"0000001" through "1000000" are codes for 1dB through 64dB in 1dB intervals.

ITXPC width(Octet 5)

Bit 7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0dB
0	0	0	0	0	0	1	1dB
			.				.
			.				.
			.				.
1	0	0	0	0	0	0	64dB

"0000001" through "1000000" are codes for 1dB through 64dB in 1dB intervals.

Figure 4.4.3.5.34

4.4.3.5.3.4.30 Modulation (Private standard/Public standard)

As shown in Figure 4.4.3.5.35, modulation is the information element which is used to specify the reassignable modulation when reassigning the modulation. This information element has variable length and may contain more than one modulation.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Modulation 0	0	1	1	1	1	1 Information element identifier
2	Modulation content length							
3	Reserved			Modulation				
≀	≀							

Modulation (Octet 3 -)

Bit 5	4	3	2	1	
0	0	0	0	0	π/4 Shift QPSK
0	0	0	0	1	D8PSK
0	0	0	1	0	16QAM
0	0	0	1	1	Reserved
					:
0	1	1	1	1	Reserved
Others					Option

(Note) Basic modulation (π/4 Shift QPSK) is omitted in function request message and function request response message.

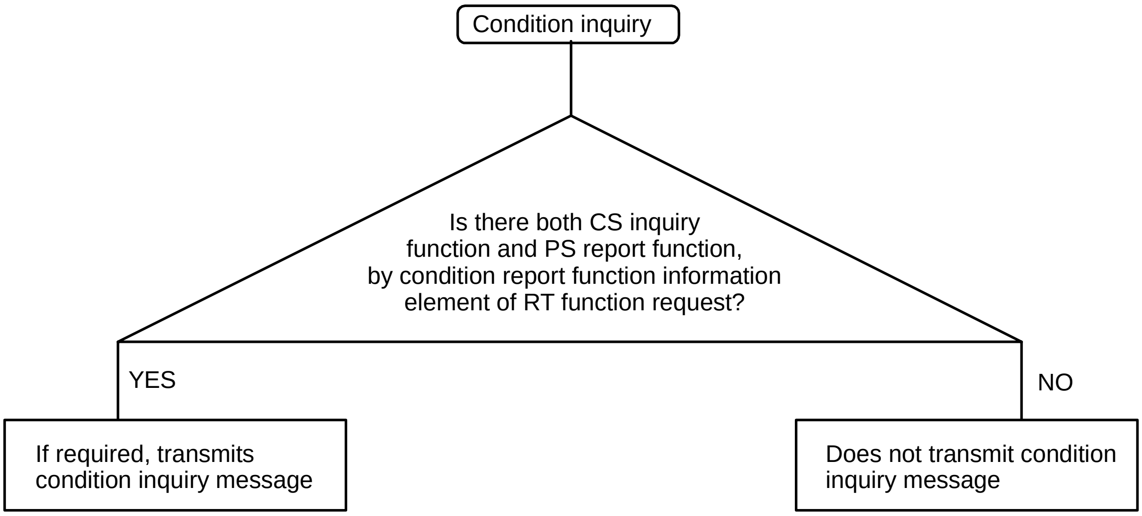
Figure 4.4.3.5.35 Modulation

4.4.3.5.4 RT supplementary regulations (Private standard/Public standard)

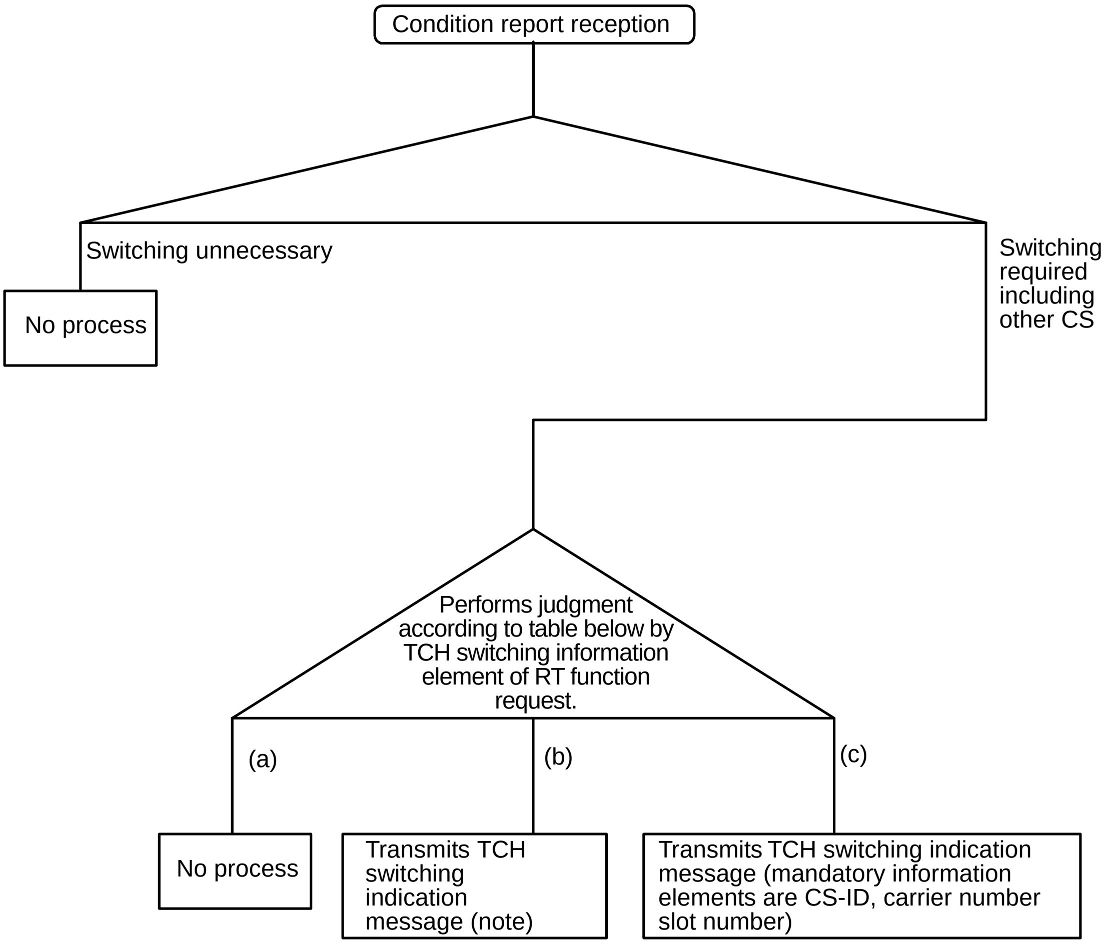
The cell station and personal station processes for performing channel switching during communication are as follows.

(1) Cell station operation

[1] Condition inquiry (Private reference)



[2] Process when condition report message is received (Private reference)

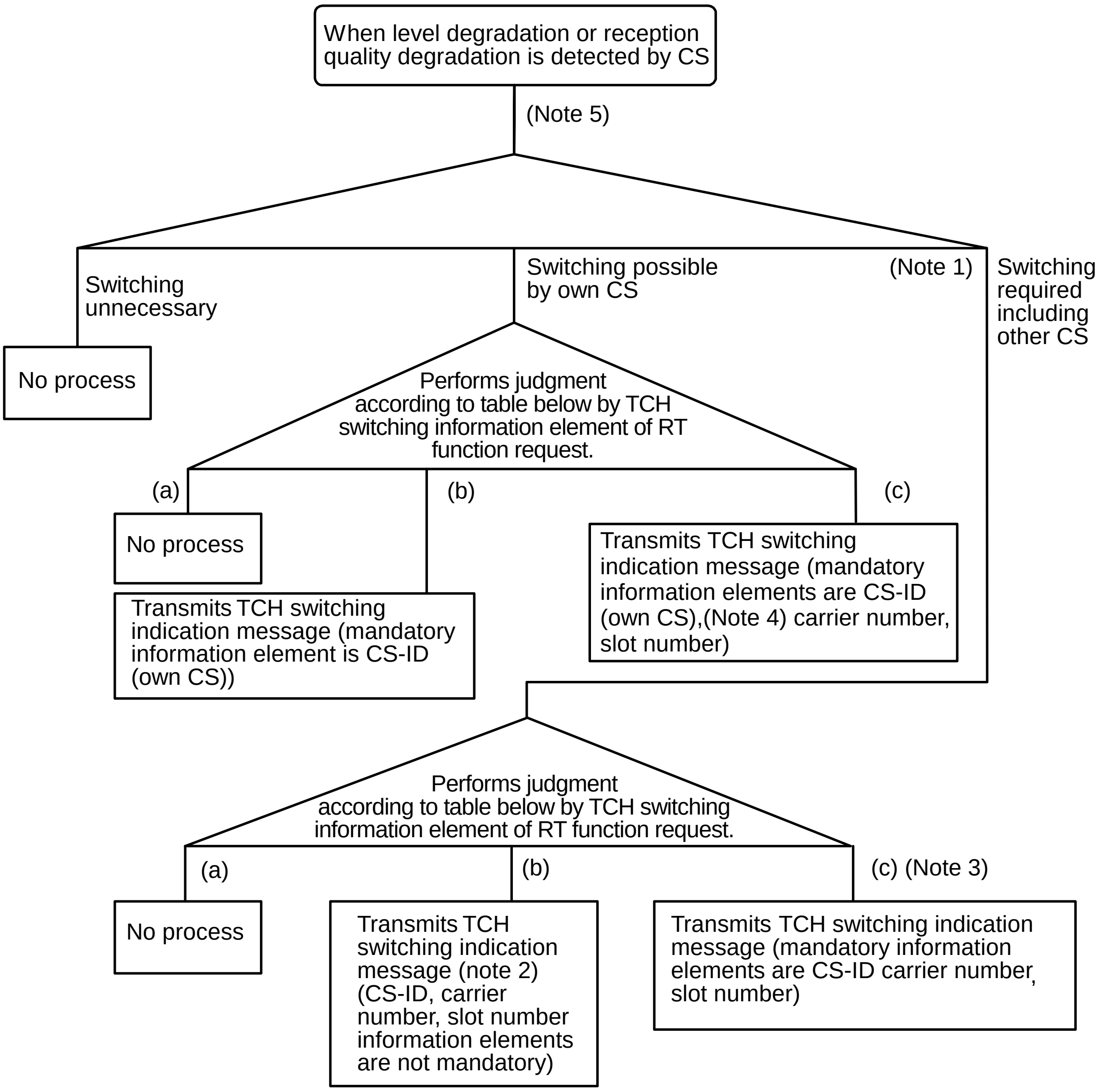


		Do both CS and PS have re-calling connection function?	
		No	Yes
Do both CS and PS have TCH switching control functions?	No	(a)	(b)
	Yes	(c)	(b) or (c) *

* By judgment of CS

(Note) If a CS-ID is not included in the TCH Switching Indication message, the PS side autonomously selects the recalling destination from peripheral CSs including busy CSs (old channel). However, the recalling destination CS is the CS which satisfies the recalling-type handover destination zone selection level threshold value.
Also, for the recalling process to another CS within or among paging areas, it is arranged by the PS and busy CS (old channel) by an RT function request.

[3] Process when level degradation or reception quality degradation is detected by CS
(Private standard/Public standard)



		Do both CS and PS have re-calling connection function?	
		No	Yes
Do both CS and PS have TCH switching control functions? (own CS/ other CS)	No	(a)	(b)
	Yes	(c)	(b) or (c) *

* By judgment of CS

(Note 1) When level degradation is detected or there are no free channels in other slots of the own CS, this sequence may be activated.

(Note 2) If a CS-ID is not included in the TCH Switching Indication message, the PS side autonomously selects the re-calling destination from peripheral CSs including busy CSs (old channel).
However, the recalling destination CS is the CS which satisfies the recalling-type handover destination zone selection level threshold value.
Also, for the recalling process to another CS within or among paging areas, it is arranged by the PS and busy CS (old channel) by an RT function request.

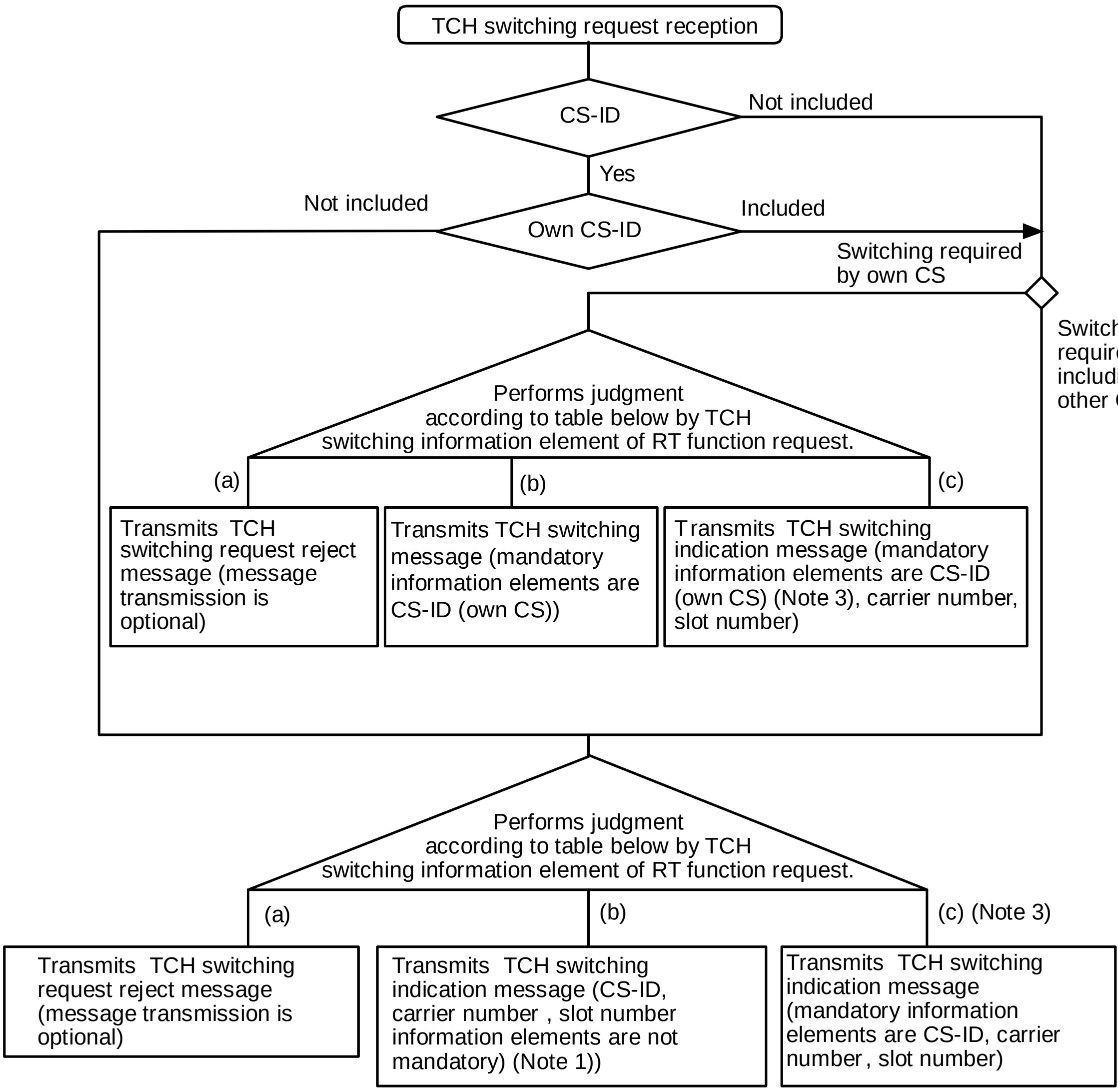
(Note 3) CS-ID designation switching to another CS is a function option.

(Note 4) The process can be omitted in case of π /2 shift BPSK communication.

(Note 5) When adaptive modulation that reassigns modulation is supported, this interference avoidance can be omitted if effect of the interference can be reduced and the communication can be maintained by reassigning the modulation.

[4] Process when TCH Switching Request message is received

(Private standard/Public standard)



		Do both CS and PS have re-calling connection function?	
		No	Yes
Do both CS and PS have TCH switching control functions? (own CS/other CS)	No	(a)	(b)
	Yes	(c)	(b) or (c) *

* By judgment of CS

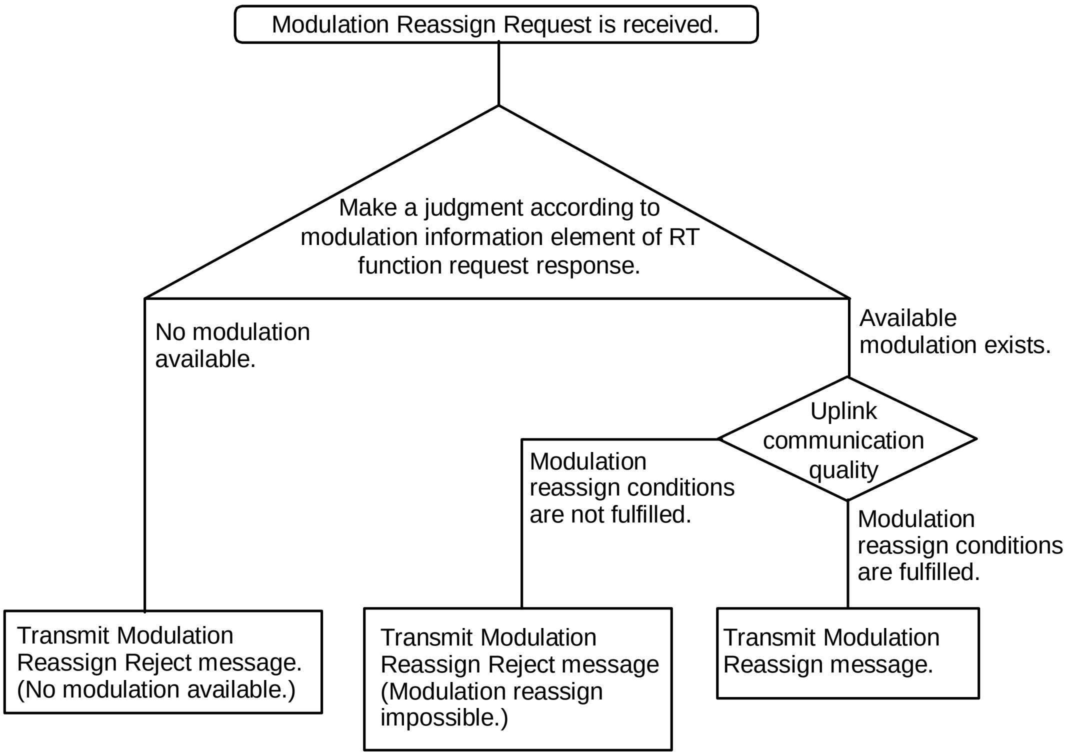
(Note 1) If a CS-ID is not included in the TCH Switching Indication message, the PS side autonomously selects re-calling from peripheral CSs including busy CSs (old channel). However, the recalling destination CS is the CS which satisfies the recalling-type handover destination zone selection level threshold value.
Also, for the recalling process to another CS within or among paging areas, it is arranged by the PS and busy CS (old channel) by an RT function request.

(Note 2) CS-ID designation switching to another CS is a functional option.

(Note 3) The process can be omitted in case of π /2 shift BPSK communication.

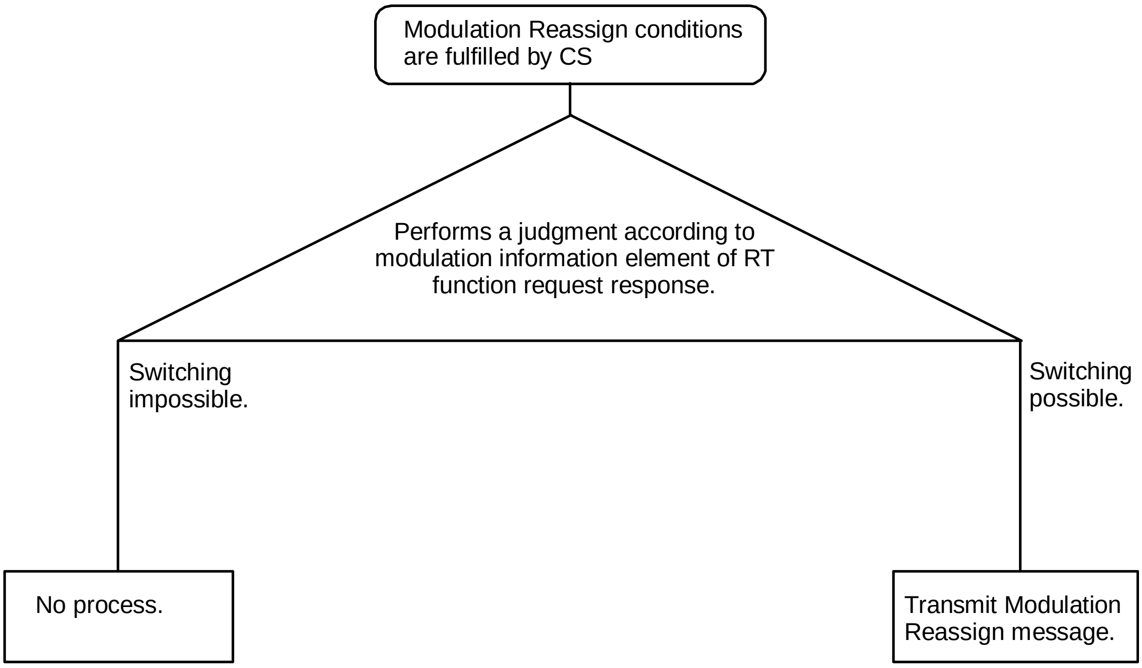
[5] Process when Modulation Reassign Request message is received

(Private reference/Public standard)



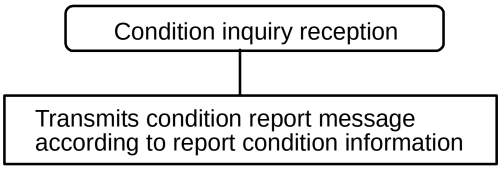
[6] Process when Modulation Reassign conditions are fulfilled by CS

(Private reference/Public standard)

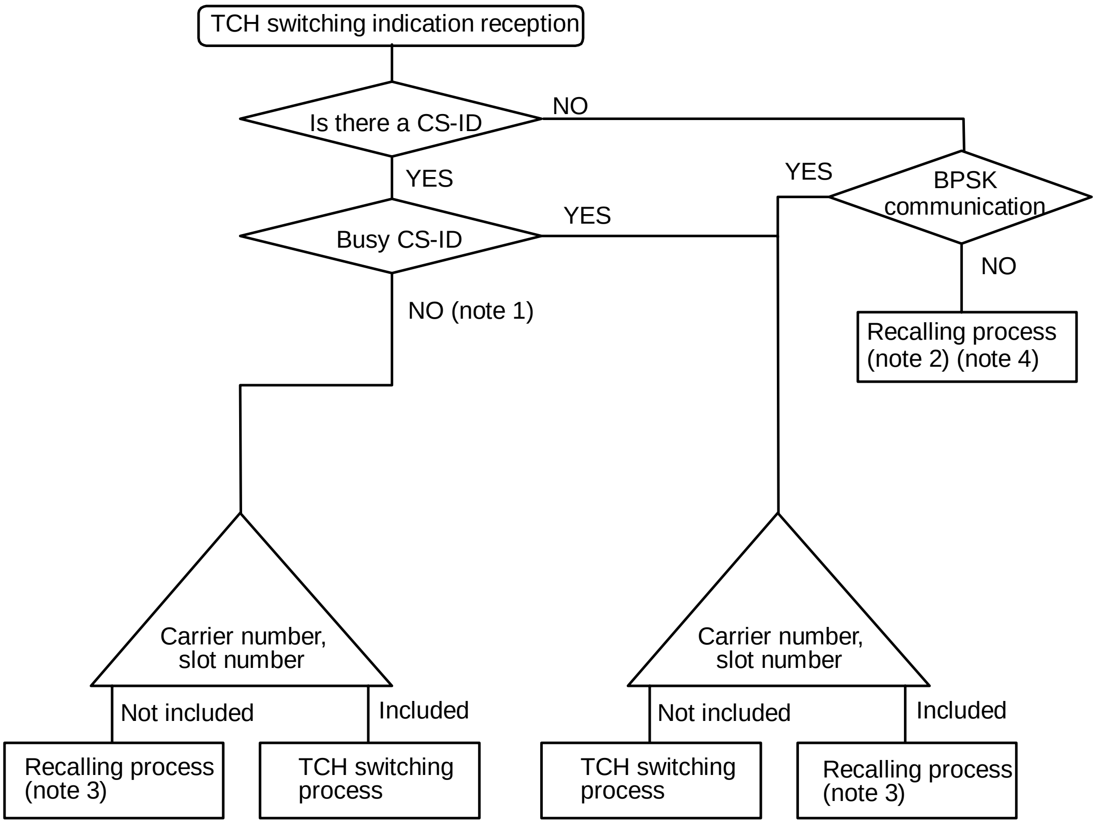


(2) Operation of personal station

[1] Process when condition inquiry message is received (Private reference)



[2] Process when TCH Switching Indication message is received
(Private standard/Public standard)



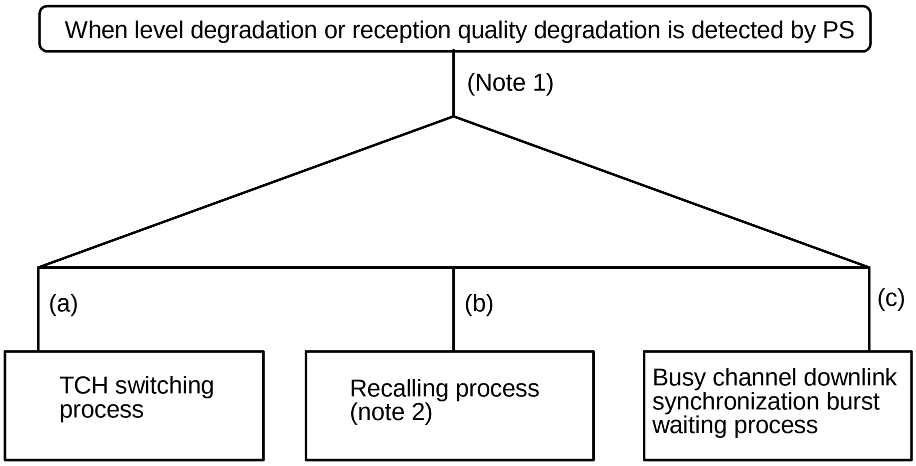
(Note 1) The CS-ID designation switching process in the case of another CS-ID is a functional option (public).

(Note 2) If a CS-ID is not included in the TCH Switching Indication message, the PS side automatically selects the recalling destination from peripheral CSs including busy CSs (old channel). However, the recalling destination CS is the CS which satisfies the recalling-type handover destination zone selection level threshold value.

(Note 3) The PS side automatically selects the CS specified as the recalling destination. However, the recalling destination CS is the CS which satisfies the recalling-type handover destination zone selection level threshold value.

(Note 4) For the recalling process to another CS within or among paging areas, it is arranged by the PS and busy CS (old channel) by an RT function request.

[3] Process when level degradation or reception quality degradation is detected by PS
(Private standard/Public standard)

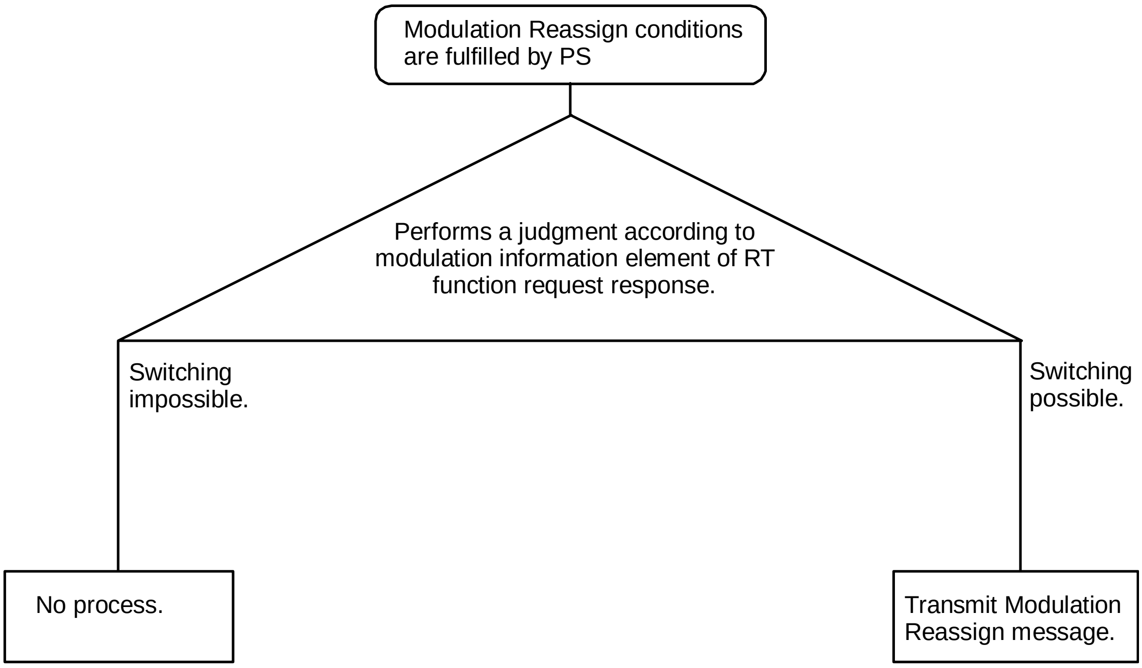


(Note 1) Selection of (a)–(c) is by PS judgment. However, it follows the indication of area information reported by CS. Also, when transmission stop conditions arise, (c) must be selected. When adaptive modulation that reassigns modulation is supported, this interference avoidance can be omitted if effect of the interference can be reduced and the communication can be maintained by reassigning the modulation.

(Note 2) The PS side automatically selects the recalling destination from peripheral CSs including busy CSs (old channel).
However, the recalling destination CS is the CS which satisfies the recalling-type handover destination zone selection level threshold value.
Also, for the recalling process to another CS within or among paging areas, it is arranged by the PS and busy CS (old channel) by an RT function request.

[4] Process when Modulation Reassign conditions are fulfilled by PS

(Private reference/Public standard)



(Intentionally blanked)

Mobility management (MM)

4.4.3.6 Mobility management (MM) (Private standard/Public standard)

In this section, the mobility management control signals required in this standard are specified.

4.4.3.6.1 Mobility management (MM) state definitions (Private standard/Public standard)

4.4.3.6.1.1 MM state in PS (Private standard/Public standard)

This section specifies the basic MM state for the PS side of the radio interface. The code within parentheses ( ) shows each state.

[1] Null (P0)

The PS's MM function is null.

[2] Location registration (P1)

State that PS requested location registration to CS.

[3] Authentication (P2)

State that PS requested authentication from CS ("Authentication Request") and has not yet responded to CS.

[4] Location registration retry waiting (P3)

State that PS received location registration reject (retry possible) from CS.

4.4.3.6.1.2 MM state in CS (Private standard/Public standard)

This section specifies basic MM state for the CS side of the radio interface. The code within parentheses ( ) are codes that show the various state.

[1] Null (C0)

The CS's MM function is null.

[2] Location registration (C1)

State that CS requested location registration from PS ("location registration request").

[3] Authentication (C2)

State that CS requested authentication to PS.

4.4.3.6.2 Message function definitions and contents (Private standard/Public standard)

The mobility management (MM) messages are shown in Table 4.4.3.6.1. The details of each message are specified below. The method of description is as follows.

(1) A brief explanation of method of use, message type, significance, direction and function channel.

Significances are local and global, but the significances of the MM signal are only local signals that are not related to the network.

a. Local significance: Related only to access in one direction on either the origination-side or destination-side.

b. Global significance: Related to origination-side/ destination-side access.

(2) Message information elements

For each information element, the table shows the following:

a. Item number of this standard that specifies the information element.

b. Direction the information element can be transmitted:

From PS to CS (uplink), from CS to PS (downlink) or both directions.

c. Information element classification:

Mandatory (M): This is an information element specified by the standard and it must be included in the message.

Optional (O): This is an information element specified by the standard and it may be included in the message depending on the service.

d. Information length: Shows the maximum information length of the information element in octet units.

Also, a "*" in the information length section indicates that the maximum octet length of the information element is not specified, and it can depend on the CS side or service.

(3) Usage regulation of messages/information elements in private and public systems

The messages/information elements used in private and public systems follow the message type (Figure 4.4.3.6.3-1, 2) and information element coding (Table 4.4.3.6.10-1, 2) specified for each system.

Table 4.4.3.6.1 Messages for mobility management

Message	Reference
Authentication Request	4.4.3.6.2.1
Authentication Response	4.4.3.6.2.2
Function request	4.4.3.6.2.3
Function request response	4.4.3.6.2.4
Location Registration Acknowledge	4.4.3.6.2.5
Location registration area report	4.4.3.6.2.6
Location Registration Reject	4.4.3.6.2.7
Location Registration Request	4.4.3.6.2.8

4.4.3.6.2.1 Authentication Request (Private standard/Public standard)

This message is for confirming the legitimacy of PS, and it is transmitted from CS to PS. (Refer to Table 4.4.3.6.2)

Table 4.4.3.6.2 Authentication Request message contents

Message type : Authentication Request
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classifica-tion	Information length	Remarks
Protocol discriminator	4.4.3.6.3.2	downlink	M	1	
Message type	4.4.3.6.3.3	downlink	M	1	
Authentication classification	4.4.3.6.3.4.4	downlink	M	2	
Authentication Random Pattern	4.4.3.6.3.4.5	downlink	M	2 ~ *	

4.4.3.6.2.2 Authentication Response (Private standard/Public standard)

This message is for reporting the response to the Authentication Request, and it is transmitted from PS to CS. (Refer to Table 4.4.3.6.3)

Table 4.4.3.6.3 Authentication Response message contents

Message type : Authentication Response
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.6.3.2	uplink	M	1	
Message type	4.4.3.6.3.3	uplink	M	1	
Authentication Ciphering Pattern	4.4.3.6.3.4.3	uplink	M	2 ~ *	

4.4.3.6.2.3 Function request (Private standard/Public standard)

This message is transmitted from PS to CS when PS requests MM functions from CS. (Refer to Table 4.4.3.6.4)

Table 4.4.3.6.4 Function request message contents

Message type : Function request
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.6.3.2	uplink	M	1	
Message type	4.4.3.6.3.3	uplink	M	1	
Authentication classification	4.4.3.6.3.4.4	uplink	O	2	(note)
Active Authentication	4.4.3.6.3.4.2	uplink	O	1	(note)
Paging area	4.4.3.6.3.4.8	uplink	O	2	(note)

(Note) If this information element is not included in the function request, PS has the default functions shown in Table 4.4.3.1.3 (private) or Table 4.4.3.1.4 (public).

4.4.3.6.2.4 Function request response (Private standard/Public standard)

This message is transmitted from CS to PS for responding to the MM function request from PS. (Refer to Table 4.4.3.6.5)

Table 4.4.3.6.5 Function request response message contents

Message type : Function request response
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.6.3.2	downlink	M	1	
Message type	4.4.3.6.3.3	downlink	M	1	
Authentication classification	4.4.3.6.3.4.4	downlink	O	2	(note 1)
Active Authentication	4.4.3.6.3.4.2	downlink	O	1	(note 1)
Paging area	4.4.3.6.3.4.8	downlink	O	2	(note 1)

(Note 1) If there is a function request corresponding to the respective information element in the function request from PS, the relevant information element must be contained in this message.
(Note 2) This information is valid only in the relevant CS.

4.4.3.6.2.5 Location Registration Acknowledge (Private standard/Public standard)

This message is transmitted from CS to PS to report that the location registration request was accepted. (Refer to Table 4.4.3.6.6)

Table 4.4.3.6.6 Location Registration Acknowledge message contents

Message type : Location Registration Acknowledge
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.6.3.2	downlink	M	1	
Message type	4.4.3.6.3.3	downlink	M	1	
Location registration area report	4.4.3.6.3.4.7	downlink	O	9 ~ 51	
Paging group	4.4.3.6.3.4.9	downlink	O	2	(note)

(Note) If this information element is not included, it should regard as a paging group by paging group division remainder of the PS number.

4.4.3.6.2.6 Location registration area report (Private standard)

This message transmits from PS to CS the specified CS-ID and reception level from CS in order for PS to specify the paging zone. (Refer to Table 4.4.3.6.7)

Table 4.4.3.6.7 Location Registration Area Report message contents

Message type : Location registration area report
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.6.3.2	uplink	M	1	
Message type	4.4.3.6.3.3	uplink	M	1	
Location registration area report	4.4.3.6.3.4.7	uplink	M	9 ~ 51	
Reception level	4.4.3.6.3.4.11	uplink	M	2	Own zone reception level

(Note) If PS sends this message, MM function request must be required.

4.4.3.6.2.7 Location Registration reject (Private standard/Public standard)

This message is transmitted from CS to PS in the event of Location Registration Reject. (Refer to Table 4.4.3.6.8)

Table 4.4.3.6.8 Location Registration Reject message contents

Message type : Location Registration Reject
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.6.3.2	downlink	M	1	
Message type	4.4.3.6.3.3	downlink	M	1	
Cause	4.4.3.6.3.4.6	downlink	M	2	

4.4.3.6.2.8 Location Registration Request (Private standard/Public standard)

This message is for PS requesting a new location registration, and it is transmitted from PS to CS. (Refer to Table 4.4.3.6.9)

Table 4.4.3.6.9 Location Registration Request message contents

Message type : Location Registration Request
Significance : Local
Direction : Uplink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.6.3.2	uplink	M	1	
Message type	4.4.3.6.3.3	uplink	M	1	
PS number	4.4.3.6.3.4.10	uplink	M	8	(note)

(Note) This information element may be contained multiple times.

4.4.3.6.3 Message format and information element coding (Private standard/Public standard)

This section specifies the message contents. The bits of each octet are transmitted from the bit of the lowest number, starting from bit 1. In the same way, the octets are transmitted from the lowest-numbered octet, starting with octet 1.

4.4.3.6.3.1 Overview (Private standard/Public standard)

Each message is constructed of the following parts.

(1) Protocol discriminator

(2) Message type

(3) Other information elements

(1) and (2) are common to all messages and must be included. (3) is specified depending on the message type. This structure is shown in Figure 4.4.3.6.1 as an example.

<table>
<tr><td></td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>octet</td><td colspan="8"></td></tr>
<tr><td></td><td colspan="8">Protocol discriminator</td></tr>
<tr><td></td><td>0</td><td colspan="7">Message type</td></tr>
<tr><td></td><td colspan="8">Other information elements</td></tr>
</table>

Figure 4.4.3.6.1 Message format structure

If the field expands exceeding 1 octet, as the octet number becomes larger, the rank of the value shown by the bit becomes smaller. The least significant bit in the field becomes the minimum number bit of the octet with the largest number in that field.

4.4.3.6.3.2 Protocol discriminator (Private standard/Public standard)

The protocol discriminator is used to distinguish messages for radio interface mobility management from within the messages specified by the standard. Also, they distinguish between OSI network layer protocol units that are coded based on other standards and messages specified by the standard. Figure 4.4.3.6.2. shows the protocol discriminator.

Octet	Bit 8	7	6	5	4	3	2	1
1	Protocol discriminator							

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Reserved
				.				. (cannot be used as
				.				. protocol discriminator for
the				.				. message)
0	0	0	0	0	1	1	1	Reserved
0	0	0	1	0	0	0	0	Reserved
				.				. (reserved for other network
				.				. layers or layer 3 protocols)
0	0	1	1	1	1	1	1	Reserved
0	1	0	0	0	0	0	0	Domestic use
				.				.
				.				.
0	1	0	0	0	0	1	0	Domestic use
0	1	0	0	0	0	1	1	RCR STD-28 radio interface radio frequency transmission management message
0	1	0	0	0	1	0	0	RCR STD-28 radio interface mobility management message
0	1	0	0	0	1	0	1	RCR STD-28 radio interface call control message
0	1	0	0	0	1	1	0	Domestic use
				.				.
				.				.
0	1	0	0	1	1	1	1	Domestic use
0	1	0	1	0	0	0	0	Reserved
				.				. (reserved for other network
				.				. layers or layer 3 protocols)
1	1	1	1	1	1	1	0	Reserved
			Other					Reserved

Figure 4.4.3.6.2 Protocol discriminator

4.4.3.6.3.3 Message type (Private standard/Public standard)

Message type is an information element used for identifying the function of the transferred message, and it is as shown in Figure 4.4.3.6.3-1 and Figure 4.4.3.6.3-2. This information element is 1 octet.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Message type						

Message type (octet 1)

Bit 8	7	6	5	4	3	2	1	
0	0	0	-	-	-	-	-	Messages related to authentication
			0	0	0	0	1	Authentication Request
			0	0	0	1	0	Authentication Response
0	0	1	-	-	-	-	-	Messages related to location registration
			0	0	0	0	1	Location Registration Request
			0	0	0	1	0	Location Registration Acknowledge
			0	0	0	1	1	Location Registration Reject
			0	0	1	0	0	Location Registration Area Report (Note)
0	1	0	-	-	-	-	-	Messages related to functions
			0	0	0	0	1	Function request
			0	0	0	1	0	Function request response
0	1	1	-	-	-	-	-	Option messages
			x	x	x	x	x	Option
		Other						Reserved
								x: Don't care

(Note) Functional option

Figure 4.4.3.6.3-1 Message types (private)

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Message type						

Message type (octet 1)

Bit 8	7	6	5	4	3	2	1	
0	0	0	-	-	-	-	-	Messages related to authentication
			0	0	0	0	1	Authentication Request
			0	0	0	1	0	Authentication Response
			1	0	0	0	0	Reserved
			.					. (for SD write-in)
			.					.
			1	1	1	1	1	Reserved
0	0	1	-	-	-	-	-	Messages related to location registration
			0	0	0	0	1	Location Registration Request
			0	0	0	1	0	Location Registration Acknowledge
			0	0	0	1	1	Location registration reject
0	1	0	-	-	-	-	-	Messages related to functions
			0	0	0	0	1	Function request
			0	0	0	1	0	Function request response
0	1	1	-	-	-	-	-	Option messages
			x	x	x	x	x	Option
		Other						Reserved

x: Don't care

Figure 4.4.3.6.3-2 Message types (public)

4.4.3.6.3.4 Other information elements (Private standard/Public standard)

4.4.3.6.3.4.1 Coding regulations (Private standard/Public standard)

Coding of other information elements follows the coding regulations below. These regulations are designed so that each piece of equipment that processes messages can find the information elements it needs and ignore those that aren't needed.

There are 2 varieties of information elements specified for coding regulations.

a. Single octet information elements (Figure 4.4.3.6.4 (a) and (b))

b. Multiple octet information elements (Figure 4.4.3.6.4 (c) and (d))

	Bit 8	7	6	5	4	3	2	1
Octet 1	1	Information element identifier			Information contents			

(a) Single octet information element coding (type 1)

	Bit 8	7	6	5	4	3	2	1
Octet 1	1	Information element identifier						

(b) Single octet information element coding (type 2)

	Bit 8	7	6	5	4	3	2	1
Octet 1	0	Information element identifier						
2	Information element contents length							
3	Information element contents							
:	:							

(c) Multiple octet information element coding (type 1)

	Bit 8	7	6	5	4	3	2	1
Octet 1	0	Information element identifier						
2	Information contents							
:	:							

(d) Multiple octet information element coding (type 2)

Figure 4.4.3.6.4 Information element formats

Table 4.4.3.6.10-1 and Table 4.4.3.6.10-2 show the information element identifier coding for information elements shown in this section.

Table 4.4.3.6.10-1 Information element coding (private)

(codeset 0)

Bit 8	7	6	5	4	3	2	1	
1	-	-	-	-	-	-	-	Single octet information element
	0	0	0	-	-	-	-	Active Authentication (note 1)

Bit 8	7	6	5	4	3	2	1	
0	-	-	-	-	-	-	-	Multiple octet information element
	0	0	0	0	1	0	1	Authentication Ciphering Pattern
	0	0	0	0	1	1	0	Authentication Type
	0	0	0	0	1	1	1	Authentication Random Pattern
	0	0	0	1	0	0	0	Cause
	0	0	0	1	0	0	1	Location registration area report (note 1)
	0	0	0	1	0	1	0	Paging area (note 1)
	0	0	0	1	0	1	1	Paging Group (note 2)
	0	0	0	1	1	0	0	PS number
	0	0	0	1	1	0	1	Reception level (note 1)
	1	x	x	x	x	x	x	Option
			Other					Reserved

x: Don't care

(Note 1) Functional option
(Note 2) CS option

Table 4.4.3.6.10-2 Information element coding (public)

(codeset 0)

Bit 8	7	6	5	4	3	2	1	
1	-	-	-	-	-	-	-	Single octet information element
	0	0	0	-	-	-	-	Active Authentication (note)

Bit 8	7	6	5	4	3	2	1	
0	-	-	-	-	-	-	-	Multiple octet information element
	0	0	0	0	1	0	1	Authentication Ciphering Pattern
	0	0	0	0	1	1	0	Authentication Type
	0	0	0	0	1	1	1	Authentication Random Pattern
	0	0	0	1	0	0	0	Cause
	0	0	0	1	1	0	0	PS number
	0	1	1	0	0	0	0	Reserved
				:				: (for SD write-in)
	0	1	1	1	1	1	1	Reserved
	1	x	x	x	x	x	x	Option
			Other					Reserved

x: Don't care

(Note) Functional option

Descriptions of the information elements shown in this section and below are in alphabetical order as a rule. However, for each information element within one message, the specific order within each codeset is used.

The value of the information element identifier codes for multiple number octet information elements follows the order shown by each information element within the message, and they are assigned in order from the smaller value. By doing this, it is possible for the destination-side equipment to decide whether or not a specific information element is there without looking at the whole message. (note 2)

There are two types of multiple number octet information elements. The second octet of type 1 shows the total octet length of the content part (octet 3 and thereafter) of those information elements. The number of octets in the information element contents is binary coded and the least significant becomes bit 1. The total octet length of the content part (octet 2 and thereafter) of the information elements in type 2 is fixed at something specified previously for each information element identifier in the standard.

The type 1 multiple octet information element option is allowed even if the existing content length is 0. At this time, the destination-side needs to process this as if this information element does not exist.

Single octet information elements can be set at an optional place in the message.

Single octet information elements are of 2 types. A type 1 information element is shown by the information element identifier at bits 7, 6, 5. When bits 7,6, 5 are "0 1 0", a type 2 single octet information element is guaranteed.

The parts of this standard that mention the information elements include reserved bits in some cases, and those bits are set at "0". However, in order to obtain compatibility for future implementation, even if the reserved bit is set at "1", that message must not be simply rejected.

(Note 1) Type 1 multiple octet information elements: Among the information elements made up of multiple octets, those of variable length (including information element length).

(Note 2) If the destination-side equipment must be able to judge the presence or absence of a certain information element and abandon it, the information element length of the standard type 2 multiple octet information element must be known completely.

4.4.3.6.3.4.2 Active Authentication (Private standard/Public standard)

Active Authentication is an information element used to identify whether or not authentication is performed during communication, and is as shown in Figure 4.4.3.6.5. This information element is a single octet information element (type 1).

Octet	Bit 8	7	6	5	4	3	2	1
1	1	Active Authentication 0	0	0 Information element identifier	Reserved			Authentication control

Authentication control (octet 1)

Bit
1
0 Active Authentication absent
1 Active Authentication present

(Note) "Active Authentication" is authentication which is performed when the PS receives network additional services and so forth (separate from ordinary call origination, receiving, or location registration) after entering the communications phase.

Figure 4.4.3.6.5 Active Authentication

4.4.3.6.3.4.3 Authentication Ciphering Pattern (Private standard/Public standard)

The authentication ciphering pattern is the element which be found from the Authentication Random Pattern at PS to inform the calculation result to CS, and it is shown in Figure 4.4.3.6.6. This information element is of variable length.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Authentication Ciphering Pattern 0	0	0	0	1	0	1 Information element identifier
2	Authentication calculation result content length							
3 ~ *	Authentication Ciphering Pattern							

Authentication Ciphering Pattern content length (octet 2) : Shows number of octets in Authentication Ciphering Pattern.

Authentication Ciphering Pattern (octets 3 ~ *) : Shows calculation result bit string which be found from the Authentication Random Pattern.

Figure 4.4.3.6.6 Authentication Ciphering Pattern

4.4.3.6.3.4.4 Authentication Type

Authentication Type is an information element that shows to the cell station the authentication method that the personal station has, and it is shown in Figure 4.4.3.6.7. This information element has 2 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Authentication Type 0	0	0	0	1	1	0 Information element identifier
2	Authentication Type							

Authentication Type (octet 2)

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	No Authentication Type
x	x	x	x	x	x	x	1/0	Standard authentication function present/absent (however, reserved in private system).
x	x	x	x	x	x	1/0	x	Reserved (authentication function present/absent)
x	x	x	x	x	1/0	x	x	Reserved (authentication function present/absent)
x	x	x	1/0	x	x	x	x	Standard authentication sequence for private systems present/absent
x	x	1/0	x	x	x	x	x	Reserved (authentication sequence present/absent)
				Other				Option

x: Don't care

(Note 1) Bits 1 ~ 3 indicate whether or not there is an independent authentication function available.
(Note 2) Bits 5 and 6 indicate whether or not there is an independent authentication sequence available.

Figure 4.4.3.6.7 Authentication Type

4.4.3.6.3.4.5 Authentication Random Pattern (Private standard/Public standard)

The Authentication Random Pattern is a random pattern for performing authentication at PS, and it is shown in Figure 4.4.3.6.8.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Authentication Random Pattern 0	0	0	0	1	1	1 Information element identifier
2	Authentication Random Pattern content length							
3 ~ *	Authentication Random Pattern							

Authentication Random Pattern content length (octet 2) : Shows the number of octets in the Authentication Random Pattern.
Authentication Random Pattern (octets 3 ~ *) : Shows random bit string.

Figure 4.4.3.6.8 Authentication Random Pattern

4.4.3.6.3.4.6 Cause (Private standard/Public standard)

The cause is an information element used to show the message generation reasons and locations, and it is shown in Figure 4.4.3.6.9. This information element is 2 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	0	0	0	1	0	0	0
		Cause / Information element identifier						
2	Location	Cause						

Location (octet 2)

Bit 8	
0	PS
1	CS

Cause (octet 2)

Bit 7	6	5	4	3	2	1	
0	0	0	-	-	-	-	Location registration
			0	0	0	0	Location registration retry possible
			0	0	0	1	Location registration retry impossible
1	1	0	-	-	-	-	Subscriber Data write
			0	0	0	0	Reserved
			.				. (for Subscriber Data write-in)
			.				.
			1	1	1	1	Reserved
1	1	1	x	x	x	x	Option
		Other					Reserved

x: Don't care

Location registration retry possible : Location registration re-request is possible, because location registration has not succeeded for reason such as resource use impossible.

Location registration retry impossible: Location registration re-request is impossible in paging area on that system, because location registration has not succeeded for reason such as authentication disagreement.

Figure 4.4.3.6.9 Cause

4.4.3.6.3.4.7 Location registration area report (Private standard)

The location registration Area Report is an information element used in order for PS to register the paging area, and is as shown in Figure 4.4.3.6.10. This message transmits CS-ID of a CS other than one during communication, and its reception level from CS. Octets 3 through 9 make up one piece of location registration area information, and multiple pieces of location registration area information are treated as a location registration Area Report. It can contain a maximum of 7 CS-IDs.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Location registration area report 0	0	0	1	0	0	1 Information element identifier
2	Location registration area report content length							
3	(MSB) CS-ID							
4	CS-ID							
5	CS-ID							
6	CS-ID							
7	CS-ID							
8	Reserved						CS-ID (LSB)	
9	Reception level value							
. .	. .							

Location registration area report content length (octet 2)

Shows the number of octets of the information length.

CS-ID (octets (3 ~ 8) + 7n) (n = 0 ~ 6)

42-bit binary CS-ID. (Refer to section 4.2.10.2)

Reception level value (octet 9 + 7n) (n = 0 ~ 6)

Bit 8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
			. .					. .
0	1	0	0	0	0	0	0	30 dBμV
			. .					. .
0	0	1	0	1	1	0	0	10 dBμV

(Note) 1 dB units

Figure 4.4.3.6.10 Location registration area report

4.4.3.6.3.4.8 Paging Area (Private standard)

The paging area is an information element used to register the PS paging area, and is as shown in Figure 4.4.3.6.11. This information element is 2 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Paging area 0	0	0	1	0	1	0 Information element identifier
2	Paging area							

Paging area (octet 2)

Bit 8	7	6	5	4	3	2	1	
0	x	x	x	x	x	x	1/0	Fixed paging area by System Information Broadcasting (BCCH (SYS)) present/absent
0	x	x	x	x	x	1/0	x	PS specified paging area present/absent
0	x	x	x	x	1/0	x	x	Fixed paging area by Additional ID present/absent
1	x	x	x	x	x	x	x	Option
		Other						Reserved

x: Don't care

Figure 4.4.3.6.11 Paging area

4.4.3.6.3.4.9 Paging group (Private standard)

The paging group is an information element for designating the paging group from CS to PS, and is as shown in Figure 4.4.3.6.12. This information element is 2 octets.

(1) When 2 LCCH are used, and the PCH paging groups are mutually related

Paging group number = (PS number) MOD (n_{PCH} x n_{GROUP} x 2) +1

(2) In cases other than the above

Paging group number = (PS number) MOD (n_{PCH} x n_{GROUP}) + 1

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Paging group 0	0	0	1	0	1	1 Information element identifier
2	Desig- nation method	Paging group number						

Designation method (octet 2)

Bit 8		
0	Paging group by remainder of number of paging group divisions of PS number (default) Paging group number = (PS number) MOD (n_{GROUP} x n_{PCH} x X) + 1 If PCH paging groups are mutually related when 2 LCCH frequencies are used Otherwise	 : X = 2 : X = 1
1	Paging group by CS	

(Note) BCD is used as the type of PS number, and if other than 0 ~ 9 are used in the number, the designation method is "1".

Paging group number (octet 2)

Bit 7	6	5	4	3	2	1	
0	0	0	0	0	0	0	No paging group
0	0	0	0	0	0	1	Paging group number = 1
0	0	0	0	0	1	0	Paging group number = 2
			.				.
			.				.
1	1	1	1	1	1	1	Paging group = 127

(Note 1) If LCCH is multiplexed, the values of n_{PCH} and n_{GROUP} are set so that the number of paging groups does not exceed 127.

(Note 2) If bit 8 of octet 2 is "0", bits 1 ~ 7 are optional.

Figure 4.4.3.6.12 Paging Group

4.4.3.6.3.4.9.1 Example of calculation of Paging Group by paging group number division remainder (Private standard)

(1) Calculation method

[1] When PS number type is BCD

Lower 4 digits before filler are treated as the position of decimal "1000", "100", "10", "1". If there are less than 4 digits before the filler, it is treated as "0" in order from the position of "1000".

[2] When PS number type is hexadecimal

Lower 16 bits are treated as numerical values.

(2) Calculation examples

[Example 1] Paging service type : 1 (less than 13 digits BCD)
PS number : 03-3456-7890
n_{GROUP} : 4
n_{PCH} : 2
X : 1

PS number

0	0	0	1	1	0	1	0
0	0	1	1	0	0	1	1
0	1	0	0	0	1	0	1
0	1	1	0	0	1	1	1
1	0	0	0	1	0	0	1
1	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0

Paging group number = 7890 MOD (4 x 2 x 1) + 1 = 2 + 1 = 3

[Example 2] Paging service type : 1 (Less than 13 digits BCD)
PS number : 317
n_{GROUP} : 4
n_{PCH} : 2
X : 1

PS number

0	0	0	1	0	0	1	1
0	0	0	1	0	1	1	1
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Paging group number = 317 MOD (4 x 2 x 1) + 1 = 5 + 1 = 6

[Example 3] Paging service type : 2 (7 digits hexadecimal)
PS number : $(123001A)_{HEX}$
n_{GROUP} : 4
n_{PCH} : 2
X : 1

PS number

0	0	1	0	0	0	0	1
0	0	1	0	0	0	1	1
0	0	0	0	0	0	0	0
0	0	0	1	1	0	1	0
Don't care							
Don't care							
Don't care							

Paging group number = $(001A)_{HEX}$ MOD (4 x 2 x 1) + 1 = 26 MOD 8 + 1 = 2 + 1 = 3

[Example 4] Paging service type : 3 (13 digits hexadecimal)
PS number : $(000123456789A)_{HEX}$
n_{GROUP} : 4
n_{PCH} : 2
X : 1

PS number

0	0	1	1	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	1	0
0	0	1	1	0	1	0	0
0	0	0	1	0	1	1	0
0	1	1	1	1	0	0	0
1	0	0	1	1	0	1	0

Paging group number = $(789A)_{HEX}$ MOD (4 x 2 x 1) + 1 = 30874 MOD 8 + 1 = 2 + 1 = <u>3</u>

[Example 5] Paging service type : 5 (Extension Paging Service Type)
Extend Service Type : 2 (Less than 12 digits BCD)
PS number : 03-3456-7890
n_{GROUP} : 4
n_{PCH} : 2
X : 1

PS number

0	1	0	1	1	0	1	0
0	0	1	1	0	0	1	1
0	1	0	0	0	1	0	1
0	1	1	0	0	1	1	1
1	0	0	0	1	0	0	1
1	0	1	0	0	0	0	0
0	0	0	0	0	0	1	0

Paging group number = 7890 MOD (4 x 2 x 1) + 1 = 2 + 1 = <u>3</u>

4.4.3.6.3.4.10 PS number (Private standard/Public standard)

The PS number is a number to identify the location registration requesting PS, and it is shown in Figure 4.4.3.6.13. This information element is 8 octets. This information element may be repeated multiple times with 1 message.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	PS number 0	0	0	1	1	0	0 Information element identifier
2	Re-served	Paging service type			PS number (first number)			
3	PS number (second number)				PS number (third number)			
4	PS number (fourth number)				PS number (fifth number)			
5	PS number (sixth number)				PS number (seventh number)			
6	PS number (eighth number)				PS number (ninth number)			
7	PS number (tenth number)				PS number (eleventh number)			
8	PS number (twelfth number)				PS number (thirteenth number)/ Extension Paging Service Type			

Paging service type (octet 2)

Bit 7	6	5	
0	0	0	Reserved
0	0	1	Shows paging service by BCD 13-digit or less PS number
0	1	0	Shows paging service by hexadecimal 7-digit PS number (however, reserved in public system).
0	1	1	Shows paging service by hexadecimal 13-digit PS number.
1	0	0	Shows paging service by BCD 13 digits or less domestic PS number.
1	0	1	Shows paging service by Extension Paging Service Type (however, reserved in public system).
1	1	x	Option (private)/Reserved (public) x: Don't care

Extension Paging Service Type (octets 8)

If the Paging Service Type is the Paging Service which is specified by Extension Paging Service (101), it means as follows.

Bit 4	3	2	1	
0	0	1	0	Paging by PS number with 12 BCD digits or less (note 1)
0	1	0	0	Shows paging service by supplementary service within the CS-PS loop. (note 2)
	Other			Reserved

(Note 1) Paging service dependent on the PS number following the 12th digit of BCD is used to clearly indicate that the PS number is based on the unique numbering plan defined on a per private system basis.

(Note 2) Used for supplementary service within the CS-PS loop in a private system.

<table>
<tr><td></td><td colspan="8">Bit</td></tr>
<tr><td>Octet</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">0</td><td colspan="7">PS number</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td colspan="7">Information element identifier</td></tr>
<tr><td>2</td><td>Re-served</td><td>1</td><td>0</td><td>1</td><td colspan="4">PS number (first number)</td></tr>
<tr><td>3</td><td colspan="4">PS number (second number)</td><td colspan="4">PS number (third number)</td></tr>
<tr><td>4</td><td colspan="4">PS number (fourth number)</td><td colspan="4">PS number (fifth number)</td></tr>
<tr><td>5</td><td colspan="4">PS number (sixth number)</td><td colspan="4">PS number (seventh number)</td></tr>
<tr><td>6</td><td colspan="4">PS number (eighth number)</td><td colspan="4">PS number (ninth number)</td></tr>
<tr><td>7</td><td colspan="4">PS number (tenth number)</td><td colspan="4">PS number (eleventh number)</td></tr>
<tr><td>8</td><td colspan="4">PS number (twelfth number)</td><td colspan="4">Extension paging service type</td></tr>
</table>

<u>PS number (octets 2 ~ 8)</u>

For PS numbers, for each paging service type, it is possible to use two types of number indication method.

- In the case of BCD, the first number, that is the number first dialed, is packed in the PS number in order from the lowest octet.

- In the case of BCD, the number of digits of PS number, if smaller than the maximum number of digits for each paging service type, adds filler following PS number up to the maximum number of digits.

- As the number digits, BCD and hexadecimal are determined as shown below.

- When used in a public system, if paging service type is (001), the types of number/numbering plan identifier of the PS number are considered undetermined/undetermined.

- When used in a public system, if paging service type is (011), the type of number of the PS number is considered as international number, and number plan identifier is considered as ISDN/telephony numbering plan.

- When used in a public system, if paging service type is (100), the type of number of the PS number is considered as domestic number, and number plan identifier is considered as ISDN/telephony numbering plan.

BCD number digits (octets 2 ~ 8)

Number \ Bit	8	7	6	5	Number \ Bit	8	7	6	5
	4	3	2	1		4	3	2	1
0	1	0	1	0	6	0	1	1	0
1	0	0	0	1	7	0	1	1	1
2	0	0	1	0	8	1	0	0	0
3	0	0	1	1	9	1	0	0	1
4	0	1	0	0	Filler	0	0	0	0
5	0	1	0	1	Option	Other			

Hexadecimal number digits (octets 2 ~8)

When 7 digits hexadecimal

Octet	Bit 8 7 6 5	4 3 2 1
2		MSB
3		
4		
5		LSB
6		
7	(Don't	care)
8		

When 13 digits hexadecimal

Octet	Bit 8 7 6 5	4 3 2 1
2		MSB
3		
4		
5		
6		
7		
8		LSB

Figure 4.4.3.6.13 PS number

4.4.3.6.3.4.11 Reception level (Private standard)

The reception level shows the reception level of communication measured at PS, and is as shown in Figure 4.4.3.6.14. This information element is 2 octets.

Octet	Bit 8	7	6	5	4	3	2	1
1		Reception level						
	0	0	0	0	1	1	0	1
		Information element identifier						
2	Reception level value							

Reception level value (octet 2)

Bit 8	7	6	5	4	3	2	1	
0	1	1	1	0	0	1	0	80 dBμV
			.					.
			.					.
0	1	0	0	0	0	0	0	30 dBμV
			.					.
			.					.
0	0	1	0	1	1	0	0	10 dBμV

(Note) 1 dB units

Figure 4.4.3.6.14 Reception level

Call control (CC)

4.4.3.7 Call control (CC) (Private standard/Public standard)

This section specifies call control signals needed in the standard.

4.4.3.7.1 Call control (CC) state definitions (Private standard/Public standard)

4.4.3.7.1.1 CC state at PS (Private standard/Public standard)

Call state on the PS side is specified. Symbols within parentheses ( ) describe the various states.

[1] Null (P0)

State that call does not exist.

[2] Call initiated (P1)

State at origination-side. State that "SETUP" was transmitted from PS to CS.

[3] Overlap sending (P2) (private only)

State at origination-side. State that PS received acknowledgment ("SETUP ACKnowledge") in response to call request signifying permission for information transmission in overlap sending.

[4] Outgoing call proceeding (P3)

State at origination-side. State that PS received acknowledgment ("CALL PROCeeding") that CS received all necessary information for setup.

[5] Call delivered (P4)

State at origination-side. State that PS received "ALERTing" from CS. In this state, the PS can authorize the alerting at the destination-side if network supports the function of reporting the "ALERTing" to the CS.

[6] Call present (P6)

State at destination-side. PS received "SETUP" from CS, but has not yet transmitted any response.

[7] Call received (P7)

State at destination-side. PS transmitted "ALERTing" to CS, but there is no response yet.

[8] Connect request (P8)

State at destination-side. State that PS transmitted "CONNect" to CS, and is waiting for "CONNect ACKnowledge".

[9] Incoming call proceeding (P9)

State at destination-side. State that PS transmitted acknowledgment response ("CALL PROCeeding") that all information necessary for setup was received.

[10] Active (P10)

State that acknowledgment ("CONNect ACKnowledge") of connect was received from CS at the destination-side.

State that "CONNect " was received from CS at the origination-side. If the network supports the function that reports "CONNect " by CS, PS can acknowledge the connect request of the destination-side in this state. In this state, the PS can acknowledge the connect request of the destination-side if the network supports the function that reports "CONNect " by PS.

[11] Disconnect request (P11)

State that PS transmitted "DISConnect" to CS and is waiting for acknowledgment from CS.

[12] Disconnect indication (P12)

State that PS received "DISConnect" from CS.

[13] Release request (P19)

State that PS transmitted "RELease" to CS and is waiting for acknowledgment from CS.

4.4.3.7.1.2 CC state at CS (Private standard/Public standard)

Call state at the CS side is specified. Within parentheses ( ), symbols describe the various states.

[1] Null (C0)

State that call does not exist.

[2] Call initiated (C1)

State at origination-side. State that CS received "SETUP" and there is not yet any response.

[3] Overlap sending (C2)

State at origination-side. State of sending acknowledgment response ("SETUP ACKnowledge") to setup request; able to receive information (if there is any) via overlap sending.

[4] Outgoing call proceeding (C3)

State at origination-side. State that CS acknowledged (transmitted "CALL PROCeeding") to PS that all necessary information for setup was received.

[5] Call delivered (C4)

State at origination-side. State that CS reported "ALERTing" to PS that outgoing call of destination-side was started. However, if "ALERTing" report is not supported from network side to CS, after CS outgoing call proceeding (C3), it enters this state by any timing (after dial sending complete, etc.).

[6] Call present (C6)

State at destination-side. State that CS transmitted "SETUP" to PS but has not yet received any response.

[7] Call received (C7)

State at destination-side. State that CS received "ALERTing" from PS, but has not yet received "CONNect".

[8] Connect request (C8)

State at destination-side. State that CS received "CONNect" from PS, but has not yet transmitted "CONNect ACKnowledgment".

[9] Incoming call proceeding (C9)

State at destination-side. State that CS received "CALL PROCeeding" from PS.

[10] Active (C10)

State on destination-side. State that acknowledge (connect acknowledge) was transmitted by CS in response to "CONNect".

State on origination-side in which response of destination-side was reported by "CONNect" transmission to PS by CS. However, in cases where "CONNect" notification from the network to CS is not supported on the origination-side, CS enters to this state with any timing after call delivered (C4).

[11] Disconnect request (C11)

State that CS received "DISConnect" from PS.

[12] Disconnect indication (C12)

State in which CS reports to PS the disconnection of the end-to-end connection of the network (if it exists). If disconnection of the end-to-end connection is not reported to CS by the network by "DISConnect", CS does not have to transmit this disconnect to PS.

[13] Release request (C19)

State that CS transmitted "DISConnect" to PS, and is waiting for acknowledgment from PS.

4.4.3.7.1.3 Functional operation state at PS (Private standard/Public standard)

[1] Null (P0)

State that functional operation does not exist.

[2] Recalling (P1)

State in which setup (facility: Recalling-type channel switching or Recalling-type channel switching for private system) was transmitted by PS to CS.

4.4.3.7.1.4 Functional operation state at CS (Private standard/Public standard)

[1] Null (C0)

State that functional operation does not exist.

[2] Recalling (C1)

State in which setup (facility: Recalling-type channel switching or Recalling-type channel switching for private system) was received by CS.

4.4.3.7.2 Message function definitions and contents (Private standard/Public standard)

This item specifies the call control (CC) messages, focusing on the function definition and information contents of each message. The following items are included in each regulation.

(1) A brief explanation of the method of use, message type, significance, direction, and function channel.

Significances can be local or global, but if the top network of CS is an analog network and the interval cannot be defined globally, all messages are used locally between CS and PS.

a. Local significance: Related to access of only either the origination-side or destination-side.

b. Global significance: Related to origination-side/destination-side access.

The function channel is the channel on which the message can be transferred.

(2) Message information elements

The tables describe the following for each of the information elements.

a. Item number of the standard that specifies the information element

b. Direction in which information element is transmitted:
Ex: From PS to CS (uplink); From CS to PS (downlink)

c. Information element type

Mandatory (M): Information element specified by the standard, and must be included in the message.

Optional (O) : Information element specified by the standard, and may be included in message depending on service.

d. Information length: Maximum information length of information element is shown in octet units.

Also, a "*" in the information length section indicates that the maximum octet length of the information element is not specified, and it can depend on the CS side or service.

4.4.3.7.2.1 CC message overview (Private standard/Public standard)

The CC message overview is shown in Table 4.4.3.7.1.

Table 4.4.3.7.1 CC message overview

Call establishment messages	Reference
ALERTing CALL PROCeeding CONNect CONNect ACKnowledge PROGress SETUP SETUP ACKnowledge (note 1)	4.4.3.7.2.1.1 4.4.3.7.2.1.2 4.4.3.7.2.1.3 4.4.3.7.2.1.4 4.4.3.7.2.1.8 4.4.3.7.2.1.11 4.4.3.7.2.1.12
Call Information phase message	Reference
USER INFOrmation (note 1)	4.4.3.7.2.1.16
Call clearing messages	Reference
DISConnect RELease RELease COMPlete	4.4.3.7.2.1.5 4.4.3.7.2.1.9 4.4.3.7.2.1.10
Other messages	Reference
FACility INFOrmation (note 2) NOTIFY STATus STATus ENQuiry (note 2)	4.4.3.7.2.1.6 4.4.2.7.2.1.7 4.4.3.7.2.1.15 4.4.3.7.2.1.13 4.4.3.7.2.1.14

(Note 1) Private only. Functional option in the private system.
(Note 2) Functional option in both the public and the private system.

4.4.3.7.2.1.1 ALERTing (Private standard/Public standard)

This message is sent from the destination PS to CS to indicate the fact that the destination PS is in the process of calling. On the origination side, the CS sends this to report to the PS that call is initiated on the destination side. (Refer to Table 4.4.3.7.2)

Table 4.4.3.7.2 ALERTing message contents

Message type : ALERTing
Significance : Global
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Classifi-cation	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2~3	
Message type	4.4.3.7.3.4	both	M	1	
Facility	4.4.3.7.3.5.11	both	O	2 ~ *	(note 1)
Progress indicator	4.4.3.7.3.5.13	both	O	2 ~ 4	(note 2)
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 4)
Signal	4.4.3.7.3.5.15	downlink	O	2 ~ 3	(note 3)

(Note 1) Used in functional operation.
(Note 2) Included when in-band information /pattern is offered.
(Note 3) Included when information, that shows the tone is offered.
(Note 4) In the private system, included the information which CS provides to display on PS.
The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.2 CALL PROCeeding (Private standard/Public standard)

This message is to describe that the requested setup is started. It is transferred from the destination PS to CS or from CS to the origination PS, and it shows that setup information cannot be received beyond this point. (Refer to Table 4.4.3.7.3.)

Table 4.4.3.7.3 CALL PROCeeding message contents

Message type : CALL PROCeeding
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Progress indicator	4.4.3.7.3.5.13	both	O	2 ~ 4	(note 1)
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 2)

(Note 1) Included when in-band information/pattern is offered
(Note 2) In the private system, included the information which CS provides to display on PS. The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.3 CONNect (Private standard/Public standard)

This message is sent from the destination PS to CS, or from the CS to the origination PS, to report the fact that the destination PS received a call. (Refer to Table 4.4.3.7.4)

Table 4.4.3.7.4 CONNect message contents

Message type : CONNect
Significance : Global
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Bearer capability	4.4.3.7.3.5.4	both	O	4 ~ 11	(note 5)
Facility	4.4.3.7.3.5.11	both	O	2 ~ *	(note 1)
Progress indicator	4.4.3.7.3.5.13	both	O	2 ~ 4	(note 2)
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 6)
Signal	4.4.3.7.3.5.15	downlink	O	2 ~ 3	(note 3)
Low layer Compatibility	4.4.3.7.3.5.20	both	O	2 ~ 18	(note 4)

(Note 1) Used in functional operation.
(Note 2) Included when in-band information is offered.
(Note 3) Included when information that shows the tone is offered.
(Note 4) Included in the PS-to-CS direction when the answering user wants to return low layer compatibility information to the calling user. Included in the CS-to-PS direction if the user awarded the call included a low layer compatibility information element in the CONNECT message. Optionally included for low layer compatibility negotiation.
(Note 5) The Bearer capability information element is included when the procedures shown in Appendix X for bearer capability selection apply.
(Note 6) In the private system, included the information which CS provides to display on PS. The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.4 CONNect ACKnowledge (Private standard/Public standard)

This message is transmitted from CS to the destination PS to report that the call was provided. Also, for symmetry of protocol procedures, it may be transmitted from the origination PS to CS. (Refer to Table 4.4.3.7.5.)

Table 4.4.3.7.5 CONNect ACKnowledge message contents

Message type : CONNect ACKnowledge
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 2)
Signal	4.4.3.7.3.5.15	downlink	O	2 ~ 3	(note 1)

(Note 1) Included when information that shows the tone is offered.
(Note 2) In the private system, included the information which CS provides to display on PS.
The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.5 DISConnect (Private standard/Public standard)

This message is transmitted from PS to request call clearing from CS, or from CS in order to describe that the call was disconnected. (Refer to Table 4.4.3.7.6)

Table 4.4.3.7.6 DISConnect message contents

Message type : DISConnect
Significance : Global
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Cause	4.4.3.7.4.5.10	both	M	4 ~ 5	
Facility	4.4.3.7.3.5.11	both	O	2 ~ *	(note 1)
Progress indicator	4.4.3.7.3.5.13	downlink	O	2 ~ 4	(note 2)
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 6)
Signal	4.4.3.7.3.5.15	downlink	O	2 ~3	(note 3)
Locking shift	4.4.3.7.3.5.3	downlink	O	1	Codeset 5 (note 4)
Advice of charge	4.4.3.7.3.5.16	downlink	O	2 ~ *	(note 5)

(Note 1) Used in functional operation.
(Note 2) Included when in-band tone is provided from CS to PS.
(Note 3) Included when information that shows the tone is provided.
(Note 4) Mandatory when codeset is shifted.
(Note 5) Included when the call charge is reported.
(Note 6) In the private system, included the information which CS provides to display on PS. The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.6 FACility (Private standard/Public standard)

This message is sent in order to request or check supplementary services. (Refer to Table 4.4.3.7.7)

Invoked supplementary services and the related parameters are specified in the facility information element.

Table 4.4.3.7.7 FACility message contents

Message type : FACility
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Facility	4.4.3.7.3.5.11	both	M	2 ~ *	
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note)

(note) In the private system, included the information which CS provides to display on PS.
The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.7 INFOrmation (Private standard/Public standard)

This message is transferred when it is desired to transmit information from PS or CS. (Refer to Table 4.4.3.7.8)

Table 4.4.3.7.8 INFOrmation message contents

Message type : INFOrmation
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Sending complete	4.4.3.7.3.5.14	uplink	O	1	(note 1)
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 7)
Keypad facility	4.4.3.7.3.5.12	uplink	O	2 ~ 34	(note 2)
Signal	4.4.3.7.3.5.15	downlink	O	2 ~ 3	(note 3)
Called party number	4.4.3.7.3.5.6	uplink	O	2 ~ *	(note 4)
Locking shift	4.4.3.7.3.5.3	uplink	O	1	Codest 5 (note 5)
Communication type	4.4.3.7.3.5.23	uplink	O	2 ~ 3	(note 6)

(Note 1) Included when PS indicates the end of overlap sending to CS.
(Note 2) Included when PS sends dial information and forth to CS in overlap sending (P2) state and thereafter. In addition, included when PS sends hooking signal to CS.
(Note 3) Included when information that shows tone is provided.
(Note 4) Included when PS sends called party number information to CS. Information length depends on the network.
(Note 5) Mandatory if codeset is shifted.
(Note 6) Included when PS reports CS of communication type in private system.
(Note 7) In the private system, included the information which CS provides to display on PS. The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.8 PROGress (Private standard/Public standard)

This message is sent from CS or PS to indicate the progress of a call in cases where interconnection or in-band information/pattern is provided. (Refer to Table 4.4.3.7.9)

Table 4.4.3.7.9 PROGress message contents

Message type : PROGress
Significance : Global
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Cause	4.4.3.7.3.5.10	both	O	2 ~ 5	(note 1)
Progress indicator	4.4.3.7.3.5.13	both	M	4	
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 2)

(Note 1) Included when information pertaining to provision of in-band information /pattern is offered by PS or CS.
(Note 2) In the private system, included the information which CS provides to display on PS.
The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.9 RELease (Private standard/Public standard)

This message is transmitted in one direction from either PS or CS, and it shows that the equipment that transmitted this message has already disconnected the traffic channel, and it is transmitted to release the traffic channel and call reference.

At the destination-side equipment, the traffic channel and call reference are released after transmission of the RELease COMPlete message. (Refer to Table 4.4.3.7.10)

Table 4.4.3.7.10 RELease message contents

Message type : RELease
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Cause	4.4.3.7.3.5.10	both	O	2 ~ 5	(note 1)
Facility	4.4.3.7.3.5.11	both	O	2 ~ *	(note 2)
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 6)
Signal	4.4.3.7.3.5.15	downlink	O	2 ~ 3	(note 3)
Locking shift	4.4.3.7.3.5.3	downlink	O	1	Codeset 5 (note 4)
Advice of charge	4.4.3.7.3.5.16	downlink	O	2 ~ *	(note 5)

(Note 1) Mandatory in the case of the first message that activates clearing procedures. Also included when a "RELease" message is sent as a result of error processing conditions.
(Note 2) Used in functional operation.
(Note 3) Included when information that shows tone is provided.
(Note 4) Mandatory if codeset is shifted.
(Note 5) Included when the call charge is reported.
(Note 6) In the private system, included the information which CS provides to display on PS. The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.10 RELease COMPlete (Private standard/Public standard)

This message is transmitted in one direction from PS or CS. It shows that the equipment that transmitted this message has already released the traffic channel and call reference. (Refer to Table 4.4.3.7.11)

Table 4.4.3.7.11 RELease COMPlete message contents

Message type : RELease COMPlete
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Cause	4.4.3.7.3.5.10	both	O	2 ~ 5	(note 1)
Facility	4.4.3.7.3.5.11	both	O	2 ~ *	(note 2)
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 6)
Signal	4.4.3.7.3.5.15	downlink	O	2 ~ 3	(note 3)
Locking shift	4.4.3.7.3.5.3	downlink	O	1	Codeset 5 (note 4)
Advice of charge	4.4.3.7.3.5.16	downlink	O	2 ~ *	(note 5)

(Note 1) Mandatory in the case of the first message that activates clearing procedures. Also included when a "RELease COMPlete " message is sent as a result of error processing conditions.
(Note 2) Used in functional operation.
(Note 3) Included when information that shows tone is provided.
(Note 4) Mandatory if codeset is shifted.
(Note 5) Included when the call charge is reported.
(Note 6) In the private system, included the information which CS provides to display on PS. The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.11 SETUP (Private standard/Public standard)

This message is transferred in order to start call setup from the origination PS to CS or from CS to the destination PS. (Refer to Table 4.4.3.7.12)

Table 4.4.3.7.12 SETUP message contents

Message type : SETUP
Significance : Global
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Sending complete	4.4.3.7.3.5.14	uplink	O	1	(note 1)
Repeat indicator	4.4.3.7.3.5.21	both	O	1	(note 16)
Bearer capability	4.4.3.7.3.5.4	both	M	4 ~ 11	(note 17)
Facility	4.4.3.7.3.5.11	both	O	2 ~ *	(note 2)
Progress indicator	4.4.3.7.3.5.13	both	O	2 ~ 4	(note 3)
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 18)
Keypad facility	4.4.3.7.3.5.12	uplink	O	2 ~ 34	(note 4)
Signal	4.4.3.7.3.5.15	downlink	O	2 ~ 3	(note 5)
Calling party number	4.4.3.7.3.5.8	both	O	2 ~ *	(note 6)
Calling party subaddress	4.4.3.7.3.5.9	both	O	2 ~ 23	(note 7)
Called party number	4.4.3.7.3.5.6	both	O	2 ~ *	(note 8)
Called party subaddress	4.4.3.7.3.5.7	both	O	2 ~ 23	(note 9)
Redirecting number	4.4.3.7.3.5.27	downlink	O	2 ~ 25	(note 19)
Repeat indicator	4.4.3.7.3.5.21	both	O	1	(note 12)
Low layer compatibility	4.4.3.7.3.5.20	both	O	2 ~ 18	(note 13)
High layer compatibility	4.4.3.7.3.5.19	both	O	2 ~ 5	(note 14)
Locking shift	4.4.3.7.3.5.3	uplink	O	1	Codeset 5 (note 10)
PS identity	4.4.3.7.3.5.18	uplink	O	2 ~ 9	(note 11)
Manual call origination indicator	4.4.3.7.3.5.22	uplink	O	2 ~ 3	(note 15)

(Note 1) Included in this message when indicating that all the necessary information for call setup is included in the "SETUP " message.
(Note 2) Used in functional operation.
(Note 3) Included in case of connection that provides in-band information/pattern.
(Note 4) For the transfer of called party number information from PS to CS, the called party number information element or keypad facility information element is included. Also, the keypad

facility information element is included when PS wants to forward other set up information to CS.

(Note 5) Included when information that shows the tone is provided.

(Note 6) Included to perform origination PS identification. Information length depends on the network.

(Note 7) Included in direction from PS to CS when the origination-side wants to indicate the calling party subaddress. If the origination-side includes the calling party subaddress information element in the "SETUP" message, it is included in the information from CS to PS.

(Note 8) For transfer of called party number information from PS to CS, the called party number information element or the keypad facility information element can be included in this message. In the case of recalling-type handover, since the keypad facility information element is not included, the called party number information element is mandatory. The same thing is used for the called party number information element as the calling party number information element.

(Note 9) Included in direction from PS to CS when the origination-side wants to indicate the called party subaddress. If the origination-side includes the called party subaddress information element in the "SETUP" message, it is included in the information from CS to PS on the destination-side.

(Note 10) Mandatory if codeset is shifted.

(Note 11) Included when PS makes a call or recalling-type channel switching only in the private system.

(Note 12) Included when 2, 3 or 4 Low layer compatibility information elements are included for low layer compatibility negotiation.

(Note 13) Included in the PS-to-CS direction when the calling user wants to pass low layer compatibility information to the called user. Included in the CS-to-PS direction if the calling user included a low layer compatibility information element in the STEUP message. If low layer compatibility negotiation procedure used, 2, 3 or 4 elements by prioritized list may be included.

(Note 14) Included in the PS-to-CS direction when the calling user wants to pass high layer compatibility information to the called user. Included in the CS-to-PS direction if the calling user included a high layer compatibility information element in the SETUP message.

(Note 15) Included when PS informs CS of manual calling in the private system.

(Note 16) The Repeat indicator information element is included immediately before the first Bearer capability information element when the bearer capability negotiation procedure is used. (Refer to Appendix AJ)

(Note 17) May be repeated if the bearer capability negotiation procedure is used (Refer to Appendix AJ). For bearer capability negotiation, two Bearer capability information elements may be included in descending order of priority, i.e., highest priority first. Although support of multiple Bearer capability information elements may not be supported on all networks, on networks that do support it, and through suitable subscription arrangements, two Bearer capability information elements may be included (Refer to Appendix X). When they are not presented by a Repeat indicator information element, they are included in ascending order of priority.

(Note 18) In the private system, included the information which CS provides to display on PS.
The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

(Note 19) When Redirecting number is forwarded from CS to PS, it is included.

4.4.3.7.2.1.12 SETUP ACKnowledge (Private standard)

This message is sent from CS to the origination PS to describe that call setup is initiated and to request further information. (Refer to Table 4.4.3.7.13)

Table 4.4.3.7.13 SETUP ACKnowledge message contents

Message type : SETUP ACKnowledge
Significance : Local
Direction : Downlink
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	downlink	M	1	
Call reference	4.4.3.7.3.3	downlink	M	2 ~ 3	
Message type	4.4.3.7.3.4	downlink	M	1	
Progress indicator	4.4.3.7.3.5.13	downlink	O	2 ~ 4	(note 1)
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note 3)
Signal	4.4.3.7.3.5.15	downlink	O	2 ~ 3	(note 2)

(Note 1) Included in the case of a connection that provides in-band information/pattern information.
(Note 2) Included when information that shows tone is provided.
(Note 3) In the private system, included the information which CS provides to display on PS. The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.13 STATus (Private standard/Public standard)

This message is transferred from either PS or CS at any time within the call for reporting error status or as a response to STATus ENQuiry message. (Refer to Table 4.4.3.7.14)

Table 4.4.3.7.14 STATus message contents

Message type : STATus
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Cause	4.4.3.7.3.5.10	both	M	4 ~ 5	
Call state	4.4.3.7.3.5.5	both	M	3	
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note)

(Note) In the private system, included the information which CS provides to display on PS.
The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.14 STATus ENQuiry (Private standard/Public standard)

This message is transmitted at any time for requesting a status message from layer 3 to PS or CS. If this message is received, transmission of the "STATus" message is mandatory as a response. (Refer to Table 4.4.3.7.15)

Table 4.4.3.7.15 STATus ENQuiry message contents

Message type : STATus ENQuiry
Significance : Local
Direction : Both directions
Function channel : SACCH/FACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note)

(Note) In the private system, included the information which CS provides to display on PS.
The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.15 NOTIFY (Private standard/Public standard)

This message is sent from CS to PS to indicate the information pertaining to a call, such as user suspended. (Refer to Table 4.4.3.7.16)

Table 4.4.3.7.16 NOTIFY message contents

Message type : NOTIFY
Significance : Global
Direction : Downlink
Function channel : SACCH

Information element	Reference	Direction	Type	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	downlink	M	1	
Call reference	4.4.3.7.3.3	downlink	M	2 ~ 3	
Message type	4.4.3.7.3.4	downlink	M	1	
Notification indicator	4.4.3.7.3.5.17	downlink	M	3	
Display	4.4.3.7.3.5.24	downlink	O	2 ~ 82	(note)

(Note) In the private system, included the information which CS provides to display on PS. The minimum length is 2 octets; the maximum length is CS-side dependent and is either 34 or 82 octets.

4.4.3.7.2.1.16 USER INFOrmation (Private standard)

This message is sent from PS to CS to transfer the information to the remote user. This message is also sent from CS to PS to deliver the information from the other user. (Refer to Table 4.4.3.7.17)

Table 4.4.3.7.17 USER INFOrmation message contents

Message type : USER INFOrmation
Significance : Global
Direction : Both directions
Function channel : SACCH

Information element	Reference	Direction	Classification	Information length	Remarks
Protocol discriminator	4.4.3.7.3.2	both	M	1	
Call reference	4.4.3.7.3.3	both	M	2 ~ 3	
Message type	4.4.3.7.3.4	both	M	1	
More data	4.4.3.7.3.5.25	both	O	1	(note)
User-user	4.4.3.7.3.5.26	both	M	2 ~ 255	

(Note) Included by the sending user to indicate that another "USER INFOrmation" message pertaining to the same message block will follow.

4.4.3.7.3 Message format and information element coding (Private standard/Public standard)

This section specifies message contents. The bits in each octet are transmitted in order of lowest number from bit 1. In the same way, octets are transmitted in order of lowest number from octet 1.

4.4.3.7.3.1 Overview (Private standard/Public standard)

Each message is constructed of the following parts.

(1) Protocol discriminator

(2) Call reference

(3) Message type

(4) Other information elements

(1), (2), and (3) are common to all messages and must be included in all messages.

On the other hand, (4) is specified depending on the message type. This structure is shown in Figure 4.4.3.7.1 as an example.

Except where separately specified, specific information elements can exist only once in a provided message.

If a field expands exceeds 1 octet, as the octet number gets larger, the rank of the value shown by the bit becomes smaller. Accordingly, the least significant bit in the field becomes the minimum number bit in that field's largest number octet.

Octet	Bit 8	7	6	5	4	3	2	1
1	Protocol discriminator							
2 .	Call reference							
n .	0	Message type						
. .	Other information elements							

Figure 4.4.3.7.1 Message organization example

Among messages, there is those that have more information than it can be processed or more information than it is required by a certain equipment such as PS or CS. All equipment must be able to ignore excess information that is not required in equipment processing among the information contained in the message. For example, if the "calling party number" displayed by the "SETUP" message is not required for the equipment, the equipment ignores it.

4.4.3.7.3.2 Protocol discriminator (Private standard/Public standard)

The protocol discriminator is used to distinguish messages for radio interface call control from among messages specified by the standard. Also, it distinguishes between OSI network layer protocol units that are coded based on other standards and messages specified by the standard. Figure 4.4.3.7.2 shows the protocol discriminator.

	Bit 8	7	6	5	4	3	2	1
Octet 1	Protocol discriminator							

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Reserved
				.				. (cannot be used as protocol
				.				. discriminator for the message)
0	0	0	0	0	1	1	1	Reserved
0	0	0	1	0	0	0	0	Reserved
				.				. (reserved for other network
				.				. layers or layer 3 protocols)
0	0	1	1	1	1	1	1	Reserved
0	1	0	0	0	0	0	0	Domestic use
				.				.
				.				.
0	1	0	0	0	0	1	0	Domestic use
0	1	0	0	0	0	1	1	RCR STD-28 radio interface radio frequency transmission management message
0	1	0	0	0	1	0	0	RCR STD-28 radio interface mobility management message
0	1	0	0	0	1	0	1	RCR STD-28 radio interface call control message
0	1	0	0	0	1	1	0	Domestic use
				.				.
				.				.
0	1	0	0	1	1	1	1	Domestic use
0	1	0	1	0	0	0	0	Reserved
				.				. (reserved for other network
				.				. layers or layer 3 protocols)
1	1	1	1	1	1	1	0	Reserved
Other								Reserved

Figure 4.4.3.7.2 Protocol discriminator

4.4.3.7.3.3 Call reference (Private standard/Public standard)

The call reference is used to identify calls on the same radio interface. The call reference has no meaning end-to-end via the network.

The call reference information element contains a call reference length, call reference value and call reference flag.

The call reference value is assigned by the origination-side of the radio interface with respect to the call. These call references are unique to the origination-side within the ACCH layer 2 logical link connection. The call reference value is assigned when the call starts, and continues while the call exists. If the same value is assigned to respective calls which originated on the two sides of the link, two of the same call reference values may be used on the same ACCH layer 2 logical link connection. Even when two of the same call reference values are used on the same ACCH layer 2 logical link connection, the calls can be identified by the call reference flag.

The call reference flag takes on values of "0" or "1", and is used to identify on which side of the ACCH layer 2 logical link the call reference was produced. The call reference flag is always set to "0" on the call origination-side, and the call reference flag is always set to "1" on the call destination-side.

Figure 4.4.3.7.3 shows the call reference coding.

Octet	Bit 8	7	6	5	4	3	2	1
1	Reserved				Call reference length			
2	0/1 (note 1)	Call reference value						
3								

(Note 1) Call reference flag
(Note 2) In RCR STD-28 (version 1, version 2 and version 3), call reference length is limited to 1 octet.

<u>Call reference length (octet 1)</u>

Call reference length shows the information length of the call reference value in octet units.

Bit 4	3	2	1	
0	0	0	1	Call reference value is 1 octet.
0	0	1	0	Reserved (call reference value is 2 octets)
	Other			Reserved

Call reference flag (octet 2)

Bit 8	
0	Sent from call origin side
1	Sent to call origin side

Figure 4.4.3.7.3 Call reference coding

4.4.3.7.3.4 Message type (Private standard/Public standard)

Message type is used to identify the function of transferred messages.

Message type comes third in each message. Message type is coded as shown in Figure 4.4.3.7.4.

Bit 8 is an extension bit, and is left for future use.

	Bit 8	7	6	5	4	3	2	1
Octet 1	0	Message type						

Bit 8	7	6	5	4	3	2	1	
0	0	0	-	-	-	-	-	Call establishment messages
			0	0	0	0	1	ALERTing
			0	0	0	1	0	CALL PROCeeding
			0	0	0	1	1	PROGress
			0	0	1	0	1	SETUP
			0	0	1	1	1	CONNect
			0	1	1	0	1	SETUP ACKnowledge(note 1)
			0	1	1	1	1	CONNect ACKnowledge
0	0	1	-	-	-	-	-	Call information phase message
			0	0	0	0	0	USER INFOrmation (note 1)
0	1	0	-	-	-	-	-	Call clearing messages
			0	0	1	0	1	DISConnect
			0	1	1	0	1	RELease
			1	1	0	1	0	RELease COMPlete
0	1	1	-	-	-	-	-	Other messages
			0	0	0	1	0	FACility
			0	0	1	0	0	Option
					.			.
					.			.
			0	1	1	0	0	Option
			0	1	1	1	0	NOTIFY
			1	0	1	0	1	STATus ENQuiry (note 2)
			1	1	0	1	1	INFOrmation (note 2)
			1	1	1	0	1	STATus
				Other				Reserved

(Note 1) Private only. Functional option in private system.
(Note 2) Functional option in both public and private system.

Figure 4.4.3.7.4 Message type

4.4.3.7.3.5 Other information elements (Private standard/Public standard)

4.4.3.7.3.5.1 Coding regulations (Private standard/Public standard)

The coding of other information elements follows the coding regulations below. These regulations make it possible for all equipment that performs message processing to find the necessary information elements.

There are 2 varieties of information elements specified as coding regulations.

a. single octet information elements (Figure 4.4.3.7.5 (a) and (b))

b. multiple octet information elements (Figure 4.4.3.7.5 (c))

(1) The following regulations are applied to multiple octet information elements coding. However, the regulations are applied to coding of octet 3 and below.

a. The first number of the octet number shows one octet or octet group.

b. Each octet group is a self contained entity. The internal structure of an octet group may be defined in c. and below.

c. Octet groups are extended by the extension mechanism below.

- Bit 8 is used as the extension bit, and octet (N) is extended to the next octet (Na, Nb...).
- When bit 8 is "0", it shows that the octet is continuing to the next octet.
- When bit 8 is "1", it shows that this octet is the last of the octet group.
- If another octet continues, the bit 8 position in the format description says "0/1 extension".
- If it is the last octet in the extension area, the bit 8 position in the format description says "1 extension".

d. In addition to the extension method in c., extension to the next octet is possible by describing bits 7-1 within the octet.

e. The extension mechanism in c. and d. can be used at the same time.

	Bit 8	7	6	5	4	3	2	1
Octet 1	1	Information element identifier			Information element contents			

(a) Single octet information element coding (type 1)

	Bit 8	7	6	5	4	3	2	1
Octet 1	1	Information element identifier						

(b) Single octet information element coding (type 2)

	Bit 8	7	6	5	4	3	2	1
Octet 1	0	Information element identifier						
2	Information element content length							
3	Information element contents							
:	:							

(c) Multiple octet information element coding

Figure 4.4.3.7.5 Information element format

(2) The coding for information element identification bits for the information elements shown in this section is displayed in Table 4.4.3.7.18.

Table 4.4.3.7.18 Information element coding

[Codeset 0] (note 1)

Bit

8	7	6	5	4	3	2	1	
1	-	-	-	-	-	-	-	Single octet information element
	0	0	1	-	-	-	-	Locking shift
	0	1	0	0	0	0	0	More data (note 4)
	0	1	0	0	0	0	1	Sending complete (note 4)
	1	0	1	-	-	-	-	Repeat indicator

8	7	6	5	4	3	2	1	
0	-	-	-	-	-	-	-	Multiple octet information element
	0	0	0	0	1	0	0	Bearer capability
	0	0	0	1	0	0	0	Cause
	0	0	1	0	1	0	0	Call state
	0	0	1	1	1	0	0	Facility
	0	0	1	1	1	1	0	Progress indicator
	0	1	0	0	1	1	1	Notification indicator
	0	1	0	1	0	0	0	Display (note 4)
	0	1	0	1	1	0	0	Keypad facility (note 4)
	0	1	1	0	1	0	0	Signal (note 3)
	1	1	0	1	1	0	0	Calling party number
	1	1	0	1	1	0	1	Calling party subaddress (note 3)
	1	1	1	0	0	0	0	Called party number
	1	1	1	0	0	0	1	Called party subaddress (note 3)
	1	1	1	0	1	0	0	Redirecting number (note 3)
	1	1	1	1	1	0	0	Low layer compatibility
	1	1	1	1	1	0	1	High layer compatibility
	1	1	1	1	1	1	0	User-user (note 3)
			Other					Reserved (note 2)

[Codeset 5]

Bit

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	1	Advice of charge (note 3)
0	1	0	0	0	0	0	1	PS identity (note 4)
0	1	0	0	0	0	1	0	Manual call origination indicator (note 4)
0	1	0	0	0	0	1	1	Communication type (note 4)
		Other						Reserved (note 2)

(Note 1) Refer to section 4.4.3.7.3.5.2 for codeset.

(Note 2) If bits 5–8 are "0000" among reserved values, this is an information element that must be understood on the destination-side. It is reserved for a standard information element. (Refer to Appendix X.)

(Note 3) This is a functional option in both public and private system.

(Note 4) Private only. Functional option in private system.

(3) Descriptions of the information elements shown in this section and below are in alphabetical order (except the shift procedure and information elements defined after version 1) as a rule. However, for each information element within one message, a certain number order of the regulations within each codeset is used. The code value of the information element identifiers for the multiple octet information elements follows the number order shown by each information element within the message, and they are assigned in number order from the smaller values. By doing this, the destination-side equipment can make judgments whether or not a specific information element is present without looking at the whole message.

(4) The single octet information elements can be set at any place within the message. There are 2 types of single octet information elements. A type 1 information element shows the information element identifier at bits 7, 6, 5. When bits 7, 6, 5 are "0 1 0", they assure a type 2 single octet information element.

(5) The part that lists information elements in this standard in some cases includes reserved bits, and those bits are set at "0". However, in order to obtain compatibility for future implementation, even if the option bit is set at "1", that message must not be simply rejected. There are 2 types of multiple octet information elements. The second octet of the type 1 information element shows the total octet length of the contents part (octet 3 and below) of that information element. The number of information element octets is binary-coded and the least significant bit becomes bit 1.

(6) The optional type 1 multiple octet information element permits cases where the existing content length is 0. At these times, the destination-side must treat this as if this information element does not exist.

4.4.3.7.3.5.2 Information element identifier codeset extension and locking shift procedure (Private standard/Public standard)

When the format described in section 4.4.3.7.3.5.1 is used, the number of information element identifiers that can be coded is a maximum of 256. To extend the number of information element identifier codes, a group number is assigned to a grouping of 256 codes that can be expressed by 1 octet, and independent information element coding is possible for each group number (this group of codes is called a codeset). There are 8 types of codeset 0 - 7.

In each codeset, the coding regulations of section 4.4.3.7.3.5.1 are applied.

In each codeset, for the information element identifier codes that can be set, there are 128 multiple octet information elements and a minimum of 8 single octet information elements (when single octet information element type 1 is used), but in order to easily shift from one codeset to another codeset, one single octet information element (one where the code of bits "7 6 5" is "0 0 1") is reserved. Also, a single octet information element where the code of bits "7 6 5" is "0 0 0" is reserved. Therefore, a minimum of 134 codes can be assigned to an information element in each codeset.

The codeset used at any given time is called the "used codeset".

For a silent used codeset, codeset 0 is used. A change in the used codeset is called a codeset shift, and for the shift procedure, the locking shift procedure is used.

Locking shift is when the codeset is shifted according to the following regulations.

(1) A locking shift is only valid within a message that contains a locking shift information element.

(2) The used codeset is 0 when all message content analysis is started.

(3) A change of used codeset is performed by the locking shift information element. That is, in the state where the codeset in the message is the used codeset, when a locking shift information element appears, it enters the used codeset in the codeset specified by the locking shift information element.

(4) Once a codeset is specified, it continues until another locking shift information element that specifies use of another codeset appears.

(5) Codeset shifting is used only for shifting from the original codeset to a codeset of a higher numerical value.

4.4.3.7.3.5.3 Locking shift (Private standard/Public standard)

The locking shift information element is used to assign a new code set. It is specified a single octet information element and is coded as shown in Figure 4.4.3.7.6. The locking shift information element must be common in all codesets.

	Bit 8	7	6	5	4	3	2	1
Octet 1	1	0	0	1	0	Codeset identifier		

<u>Codeset identifier (octet 1)</u>

Bit 3	2	1	
0	0	0	Codeset 0: Cannot be used
0	0	1	Reserved
	.		.
	.		.
1	0	0	Reserved
1	0	1	Codeset 5: Use information element for domestic
1	1	0	Codeset 6: Information element specific to the local network
1	1	1	Codeset 7: User-specific information element

Figure 4.4.3.7.6 Locking shift

4.4.3.7.3.5.4 Bearer capability (Private standard/Public standard)

Bearer capability is used to indicate the request for Bearer capability provided by the network. The Bearer capability information element is coded as shown in Figure 4.4.3.7.7.

<table>
<tr><th>Octet</th><th>Bit
8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">0</td><td colspan="7">Bearer capability</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td colspan="7">Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Bearer capability content length</td></tr>
<tr><td>3</td><td>1
Extension</td><td colspan="2">Coding standard</td><td colspan="5">Information transfer capability</td></tr>
<tr><td>4</td><td>0/1
Extension</td><td colspan="2">Transfer mode</td><td colspan="5">Information transfer rate</td></tr>
<tr><td>5</td><td>0/1
Extension</td><td colspan="2">0 1
Layer 1</td><td colspan="5">User information layer 1 protocol</td></tr>
<tr><td>5a</td><td>0/1
Extension</td><td>Synch./
async.</td><td>Negotia-
tion</td><td colspan="5">User rate</td></tr>
<tr><td>5b</td><td>0/1
Extension</td><td colspan="2">Intermediate rate</td><td>NIC on Tx</td><td>NIC on Rx</td><td>Flow control on Tx</td><td>Flow control on Rx</td><td>0
Spare</td></tr>
<tr><td>5c</td><td>0/1
Extension</td><td colspan="2">Number of stop bits</td><td colspan="2">Number of data bits</td><td colspan="3">Parity information</td></tr>
<tr><td>5d</td><td>1
Extension</td><td>Duplex mode</td><td colspan="6">Modem type</td></tr>
<tr><td>6</td><td>1
Extension</td><td colspan="2">1 0
Layer 2</td><td colspan="5">User information layer 2 protocol</td></tr>
<tr><td>7</td><td>1
Extension</td><td colspan="2">1 1
Layer 3</td><td colspan="5">User information layer 3 protocol</td></tr>
</table>

Coding standard (octet 3)

Bit 7	6	
0	0	RCR standard
1	0	Reserved
1	1	Specific to the local network standard
Other		Reserved

Information transfer capability (octet 3)

Bit 5	4	3	2	1	
0	0	0	0	0	Speech
0	1	0	0	0	Unrestricted digital information
0	1	0	0	1	Reserved (Restricted digital information)
1	0	0	0	0	3.1kHz audio
Other					Reserved

Transfer mode (octet 4)

Bit 7	6	
0	0	Circuit mode
Other		Reserved

Information transfer rate (octet 4)

Bit 5	4	3	2	1	
0	0	1	1	1	Reserved (Circuit mode 8 kbit/s)
0	1	0	1	0	Reserved (Circuit mode 16 kbit/s)
0	1	1	0	0	Circuit mode 32 kbit/s
1	0	0	0	0	Circuit mode 64 kbit/s
Other					Reserved

(Note) If reserved information transfer rate code is pointed, the call should be rejected. In that case, the cause of "Incompatible destination" should be indicated if PS is termination side and the cause of "Bearer service not implemented" should be indicated if PS is origination side.

User information layer 1 protocol (octet 5)

Bit 5	4	3	2	1	
0	0	0	0	0	Reserved
0	0	0	0	1	Standardized rate adaption JT-V 110/X 30. This implies the presence of octet 5a and optionally octets 5b, 5c and 5d as defined below.
0	0	1	0	0	Recommendation G.726 32 kbit/s ADPCM
0	0	1	1	1	Non-ITU-T standardized rate adaption. This implies the presence of octet 5a and, optionally, octets 5b, 5c and 5d. The use of this code point indicates that the user rate specified in octet 5a is defined by the user. Additionally, octet 5b, 5c and 5d, if present, are defined consistent with the user specified rate adaption.
Other					Reserved

(Note) If the information transfer capability is "Unrestricted digital information" (or "Restricted digital information"), and if the user information layer 1 protocol is not to be identified to the network, octet 5 shall be omitted.

Synchronous/asynchronous (octet 5a)

Bit 7	
0	Synchronous
1	Asynchronous

(Note) Octet 5b-5d may be omitted in case of synchronous users.

Negotiation (octet 5a)

Bit 6	
0	In-band negotiation not possible
1	In-band negotiation possible

(Note) See Recommendations V.110 and X.30 or Modem type

User rate (octet 5a)

Bit 5	4	3	2	1	
0	0	0	0	0	Rate is indicated by E-bits specified in Recommendation I.461 or may negotiate at in-band negotiation.
0	0	0	0	1	Reserved
0	0	0	1	0	Reserved
0	0	0	1	1	2.4 kbit/s Recommendations X.1 and V.6
0	0	1	0	0	Reserved
0	0	1	0	1	4.8 kbit/s Recommendations X.1 and V.6
0	0	1	1	0	7.2 kbit/s Recommendation V.6
0	0	1	1	1	8 kbit/s Recommendation I.460
0	1	0	0	0	9.6 kbit/s Recommendations X.1 and V.6
0	1	0	0	1	14.4 kbit/s Recommendation X.1
0	1	0	1	0	16 kbit/s Recommendation I.460
0	1	0	1	1	19.2 kbit/s Recommendation V.6
0	1	1	0	0	32 kbit/s Recommendation I.460
0	1	1	1	0	48 kbit/s Recommendations X.1 and V.6
0	1	1	1	1	56 kbit/s Recommendation V.6
Other					Reserved

Intermediate rate (octet 5b)

Bit 7	6	
0	0	Not used
0	1	Reserved (8 kbit/s)
1	0	Reserved (16 kbit/s)
1	1	Reserved (32 kbit/s)

Network independent clock (NIC) on transmission (Tx) (octet 5b)

Bit 5	
0	Not required to send data with network independent clock
1	Required to send data with network independent clock

Network independent clock (NIC) on reception (Rx) (octet 5b)

Bit 4	
0	Cannot accept data with network independent clock
1	Can accept data with network independent clock

Flow control on transmission (Tx) (octet 5b)

Bit 3	
0	Not required to send data with flow control mechanism
1	Required to send data with flow control mechanism

Flow control on reception (Rx) (octet 5b)

Bit 2	
0	Cannot accept data with flow control mechanism
1	Can accept data with flow control mechanism

Number of stop bits (octet 5c)

Bit 7	6	
0	0	Not used
0	1	1 bit
1	0	1.5 bits
1	1	2 bits

Number of data bits excluding parity bits if present (octet 5c)

Bit 5	4	
0	0	Not used
0	1	5 bits
1	0	7 bits
1	1	8 bits

Parity information (octet 5c)

Bit 3	2	1	
0	0	0	Odd
0	1	0	Even
0	1	1	None
1	0	0	Forced to 0
1	0	1	Forced to 1
Other			Reserved

Duplex mode (octet 5d)

Bit 7	
0	Half duplex
1	Full duplex

Modem type (octet 5d)

Bit 6	5	4	3	2	1	
0	0	0	0	0	0	National use
			∫			
0	0	0	1	0	1	National use
0	1	0	0	0	1	Recommendation V.21
0	1	0	0	1	0	Recommendation V.22
0	1	0	0	1	1	Recommendation V.22 bis
0	1	0	1	0	0	Recommendation V.23
0	1	0	1	0	1	Recommendation V.26
0	1	0	1	1	0	Recommendation V.26 bis
0	1	0	1	1	1	Recommendation V.26 ter
0	1	1	0	0	0	Recommendation V.27
0	1	1	0	1	0	Recommendation V.27 ter
0	1	1	0	1	1	Recommendation V.29
0	1	1	1	0	0	Recommendation V.32
1	0	0	0	0	0	National use
			∫			
1	0	1	1	1	1	National use
1	1	0	0	0	0	User specific
			∫			
1	1	1	1	1	1	User specific
Other						Reserved

User information layer 2 protocol (octet 6)

Bit 5	4	3	2	1	
0	0	0	1	0	RCR STD-28
Other					Reserved

(Note) If the user information layer 2 protocol is to be identified to the network, then octet 6 shall be present; otherwise octet 6 shall be omitted.

<u>User information layer 3 protocol (octet 7)</u>

Bit					
5	4	3	2	1	
0	0	0	1	0	RCR STD-28
Other					Reserved

(Note) If the user information layer 3 protocol is to be identified to the network, then octet 7 shall be present; otherwise octet 7 shall be omitted.

Figure 4.4.3.7.7 Bearer capability

4.4.3.7.3.5.5 Call state (Private standard/Public standard)

This information element is used to describe the call state of the current call. This information element is coded as shown in Figure 4.4.3.7.8.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	0	0	1	0	1	0	0
		Call state / Information element identifier						
2	Call state content length							
3	Coding standard		Call state value (coded in binary)					

Coding standard (octet 3)

Bit 8	7	
0	0	RCR standard
1	0	Reserved
1	1	Specific to the local network standard
Other		Reserved

Call state value (octet 3)

Bit 6	5	4	3	2	1	PS state	CS state
0	0	0	0	0	0	P0 Null	C0 Null
0	0	0	0	0	1	P1 Call initiated	C1 Call initiated
0	0	0	0	1	0	P2 Overlap sending	C2 Overlap sending
0	0	0	0	1	1	P3 Outgoing call proceeding	C3 Outgoing call proceeding
0	0	0	1	0	0	P4 Call delivered	C4 Call delivered
0	0	0	1	1	0	P6 Call present	C6 Call present
0	0	0	1	1	1	P7 Call received	C7 Call received
0	0	1	0	0	0	P8 Connect request	C8 Connect request
0	0	1	0	0	1	P9 Incoming call proceeding	C9 Incoming call proceeding
0	0	1	0	1	0	P10 Active	C10 Active
0	0	1	0	1	1	P11 Disconnect request	C11 Disconnect request
0	0	1	1	0	0	P12 Disconnect indication	C12 Disconnect indication
0	1	0	0	1	1	P19 Release request	C19 Release request
Other						Reserved	

Figure 4.4.3.7.8 Call state

4.4.3.7.3.5.6 Called party number (Private standard/Public standard)

The called party number is used to indicate the communication destination of the call. The maximum length of this information element depends on the network. The called party number information element is coded as shown in Figure 4.4.3.7.9.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	1	1	1	0	0	0	0
		Called party number Information element identifier						
2	Called party number content length							
3	1 Exten-sion	Type of number			Numbering plan identifier			
4 ~ *	0	Number digit (IA5 character) (note)						

(Note) The number digit is expressed in the same order as the order input from octet 4. That is, the digit dialed first is input to the first octet 4.

Type of number (octet 3)

Bit 7	6	5	
0	0	0	Undetermined
0	0	1	International number
0	1	0	Domestic number
0	1	1	Specific to the local network number
1	0	0	Reserved for extension
1	1	1	Reserved for extension
Other			Reserved

Numbering plan identifier (octet 3)

Bit				
4	3	2	1	
0	0	0	0	Undetermined
0	0	0	1	ISDN/telephone numbering plan
1	0	0	0	Domestic numbering plan
1	0	0	1	Private network numbering plan
1	1	1	1	Reserved for extension
Other				Reserved

Figure 4.4.3.7.9 Called party number

4.4.3.7.3.5.7 Called party subaddress (Private standard/Public standard)

The called party subaddress information element is used to identify the subaddress of the destination-side. The maximum length of this information element is 23 octets.

The subaddress information element is coded as shown in Figure 4.4.3.7.10.

<table>
<tr><td></td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>Octet
1</td><td>0</td><td colspan="7">Called party subaddress
1 1 1 0 0 0 1
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Called party subaddress content length</td></tr>
<tr><td>3</td><td>1
Exten-
sion</td><td colspan="3">Subaddress
type</td><td>Odd/
even
indicato
r</td><td colspan="3">Reserved</td></tr>
<tr><td>4~23</td><td colspan="8">Subaddress information</td></tr>
</table>

<u>Subaddress type (octet 3)</u>

Bit 7	6	5	
0	0	0	NSAP (Recommendation X.213/ISO 8348 AD2)
0	1	0	User-specific subaddress
Other			Reserved

<u>Odd/even indicator (octet 3)</u>

Bit 4	
0	Number of address signals is even
1	Number of address signals is odd

(Note) The Odd/even indicator is used when the subaddress type is the user-specific subaddress and the code is BCD.

<u>Subaddress information (octets 4 and below)</u>

The NSAP address (subaddress type 0 0 0) follows the format shown by octet 4 which includes an AFI (authority and format identifier) code. Encoding follows "binary coding specifications" defined by X.213/ISO 8348 AD2. (Refer to ITU-T recommendation I.344.)

For the user-specific subaddress, the field is a maximum of 20 octets, and it is encoded according to user specifications.

Figure 4.4.3.7.10 Called party subaddress

4.4.3.7.3.5.8 Calling Party Number (Private standard/Public standard)

The calling party number is used to identify the call transmission origin. The maximum length of this information element depends on the CS or network. The calling party number information element is coded as shown in Figure 4.4.3.7.11.

<table>
<tr><td>Octet</td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td colspan="7">Calling party number
1 1 0 1 1 0 0
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Calling party number content length</td></tr>
<tr><td>3</td><td>0/1
Exten
-sion</td><td colspan="3">Type of number</td><td colspan="4">Numbering plan identifier</td></tr>
<tr><td>3a</td><td>1
Exten
-sion</td><td colspan="2">Presentation indicator</td><td colspan="3">Reserved</td><td colspan="2">Network screening indicator</td></tr>
<tr><td>4 ~ *</td><td>0</td><td colspan="7">Number digit
(IA5 character)</td></tr>
</table>

The type of number and numbering plan identifier are coded in the same way as the called party number information element.

Presentation indicator (octet 3a)

Bit 7	6	
0	0	Presentation allowed
0	1	Presentation restricted
1	0	No number can be presented due to interconnection conditions.
1	1	Reserved

(Note) At the origination-side interface, the presentation indicator is used to indicate the decision of the origination-side's calling party number to the destination-side. This can also be requested by a dedicated base. If octet 3a is omitted, or if there is no support for call reference indication impossible, the value is seen as "00: Presentation allowed."

<u>Network screening indicator (octet 3a)</u>

Bit		
2	1	
0	0	PS insert, no network verification
0	1	With PS insert, network verification, success
1	0	PS insert, network verification failure
1	1	Network insert

(Note) When reporting the network screening indicator/calling party number to the user, it is information for showing whether the origination-side reported its own calling party number or if the network inserted it without the user reporting it. If octet 3a is omitted, it is seen as "00: PS insert, no network verification".

Figure 4.4.3.7.11 Calling party number

4.4.3.7.3.5.9 Calling party subaddress (Private standard/Public standard)

The calling party subaddress information element is used to identify the subaddress of the origination-side. The maximum length of this information element is 23 octets.

The calling party subaddress information element is coded as shown in Figure 4.4.3.7.12.

<table>
<tr><td>Octet</td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td colspan="7">Calling party subaddress
1 1 0 1 1 0 1
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Calling party subaddress content length</td></tr>
<tr><td>3</td><td>1
Exten-
sion</td><td colspan="3">Subaddress type</td><td>Odd/
even
indicato
r</td><td colspan="3">Reserved</td></tr>
<tr><td>4 ~ 23</td><td colspan="8">Subaddress information</td></tr>
</table>

Subaddress type (octet 3)

Bit 7	6	5	
0	0	0	NSAP (Recommendation X.213/ISO 8348 AD2)
0	1	0	User-specific subaddress
Other			Reserved

Odd/even indicator (octet 3)

Bit 4	
0	Number of address signals is even
1	Number of address signals is odd

(Note) In the Odd/even indicator, the subaddress type is the user-specific subaddress, and is used only when the code is BCD.

Subaddress information (octets 4 and below)

The NSAP address (subaddress type 0 0 0) follows the format shown by octet 4 which includes an AFI (Authority and Format Identifier) code. Encoding follows "binary coding specifications" defined by ITU-T Recommendation X.213/ISO 8348 AD2. (Refer to ITU-T Recommendation I.344.)

For the user-specific subaddress, the field is a maximum of 20 octets, and it is encoded according to user specifications.

Figure 4.4.3.7.12 Calling party subaddress

4.4.3.7.3.5.10 Cause (Private standard/Public standard)

The cause is used to describe the message generation reason and location. The cause information element is coded as shown in Figure 4.4.3.7.13.

Octet	Bit 8	7	6	5	4	3	2	1
		Cause						
1	0	0	0	0	1	0	0	0
		Information element identifier						
2	Cause content length							
3	0/1 Extension	Coding standard		Reserved	Location			
3a	1 Extension	Specification type						
4	1 Extension	Cause value						

<u>Coding standard (octet 3)</u>

Bit 7	6	
0	0	RCR standard
1	0	Reserved
1	1	Specific to the local network standard
Other		Reserved

<u>Location (octet 3)</u>

Bit 4	3	2	1	
0	0	0	0	User
0	0	0	1	Local user-accommodating private network (own side)
0	0	1	0	Local user-accommodating public network (own side)
0	0	1	1	Transit network
0	1	0	0	Remote user-accommodating public network (destination-side)
0	1	0	1	Remote user-accommodating private network (destination-side)
0	1	1	1	International network
1	0	1	0	Network of interworking destination
	Other			Reserved

Specification type (octet 3a)

Bit 7	6	5	4	3	2	1	
0	0	0	0	1	0	1	Personal handy phone system standards
0	0	0	1	0	0	0	Option
		Other					Reserved

(Note) If octet 3a is omitted, the specification type of the personal handy phone system standards is set.

Cause value (octet 4)

The cause value is divided into 2 parts: The class (bits 7 ~ 5) and reason type value (bits 4 ~ 1).

The class shows the general properties of the reason.

Bit 7	6	5	4	3	2	1	
0	0	0	-	-	-	-	Normal class
			0	0	0	1	Unallocated (unassigned) number
			0	0	1	0	No route to specified transit network
			0	0	1	1	No route to destination
			0	1	1	0	Channel unacceptable
			0	1	1	1	Call awarded and being delivered in an established channel
0	0	1	-	-	-	-	Normal class
			0	0	0	0	Normal call clearing
			0	0	0	1	User busy
			0	0	1	0	No user responding
			0	0	1	1	No answer from user (user alerted)
			0	1	0	0	Subscriber absent
			0	1	0	1	Call rejected
			0	1	1	0	Number changed
			1	0	1	0	Non-selected user clearing
			1	0	1	1	Destination out of order
			1	1	0	0	Invalid number format (address incomplete)
			1	1	0	1	Facility rejected
			1	1	1	0	Response to STATUS ENQUIRY
			1	1	1	1	Normal unspecified
0	1	0	-	-	-	-	Resource unavailable class
			0	0	1	0	No circuit/channel available
			0	1	1	0	Network out of order
			1	0	0	1	Temporary failure
			1	0	1	0	Switching equipment congestion
			1	0	1	1	Access information discarded
			1	1	0	0	Requested circuit/channel not available
			1	1	1	1	Resource unavailable, unspecified

Bit 7	6	5	4	3	2	1	
0	1	1	-	-	-	-	Service or option unavailable class
			0	0	0	1	Quality of Service not available
			0	0	1	0	Requested facility not subscribed
			1	0	0	1	Bearer capability not authorized
			1	0	1	0	Bearer capability not presently available
			1	1	1	1	Service or option not available, unspecified
1	0	0	-	-	-	-	Service or option not implemented class
			0	0	0	1	Bearer capability not implemented
			0	0	1	0	Channel type not implemented
			0	1	0	1	Requested facility not implemented
			0	1	1	0	Only restricted digital information bearer capability is available
			1	1	1	1	Service or option not implemented, unspecified
1	0	1	-	-	-	-	Invalid message (e.g. parameter out of range) class
			0	0	0	1	Invalid call reference value
			0	0	1	0	Identified channel does not exist
			0	0	1	1	A suspended call exists, but this call identity does not
			0	1	0	0	Call identity in use
			0	1	0	1	No call suspended
			0	1	1	0	Call having the requested call identity has been cleared
			1	0	0	0	Incompatible destination
			1	0	1	1	Invalid transit network selection
			1	1	1	1	Invalid message, unspecified
1	1	0	-	-	-	-	Protocol error (e.g. unknown message) class
			0	0	0	0	Mandatory information element is missing
			0	0	0	1	Message type non-exist or not implemented
			0	0	1	0	Message not compatible with call state or message type non-exist or not implemented
			0	0	1	1	Information element/parameter non-exist or not implemented
			0	1	0	0	Invalid information element contents
			0	1	0	1	Message not compatible with call state
			0	1	1	0	Recovery on timer expiry
			1	1	1	1	Protocol error, unspecified
1	1	1	-	-	-	-	Interworking class
			1	1	1	1	Interworking, Unspecified
			Other				Reserved

Figure 4.4.3.7.13 Cause

4.4.3.7.3.5.11 Facility (Private standard/Public standard)

The facility information element is coded as shown in Figure 4.4.3.7.14.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Facility 0	0	1	1	1	0	0 Information element identifier
2	Facility content length (note)							
3	1 Extension	0 Spare	0	Protocol profile				
4 ~*	Protocol data units (PDUs)							

(Note) The facility content length is coded to indicate the number of octets (excluding the facility information element identifier and facility content length) contained in the facility information element.

Protocol profile (octet 3)

Bit 5	4	3	2	1	
1	0	0	0	1	Remote operation protocol
1	0	0	1	0	Reserved (CMIP protocol)
1	0	0	1	1	Reserved (ACSE protocol)
		Other			Reserved (note)

(Note) Other values are all reserved; their method of use is outside the scope of this standard.

Protocol data units (octet 4~)

If the protocol profile is remote operation, components are included in the protocol data unit. (For the definition of components, refer to TTC standard JT-Q932).

(1) Invoke (Private standard/Public standard)

[1] Recalling-type channel switching (Private reference/Public standard)

This protocol unit is used only as a facility information element of the setup message of the PS recalling connection sequence.

Also, if the result to this invoke is normal, the return result is set and returned from CS in the facility information element of the connect message; if the return result is abnormal, a return error or reject is set and returned from CS in the facility information element of the disconnect message (note) or release complete message (note).

(Note) The clearing procedure in this case is according to Appendix X (CC switched call control procedure) section 4 Call clearing.

Octet \ Bit	8	7	6	5	4	3	2	1	
4	1	0	1	0	0	0	0	1	
	Component type tag								
5	Component length (note 1)								
6	0	0	0	0	0	0	1	0	
	Invoke identifier tag								
7	Invoke identifier length (note 2)								
8	Invoke identifier								
12	0	0	0	0	0	1	1	0	(note 7)
	Operation value tag								
13	Operation value length (note 3)								
14a	0	0	0	0	0	0	1	0	(note 9)
14b	1	0	0	0	0	0	1	1	
14c	0	0	1	1	1	0	0	0	
14d	1	0	0	0	1	1	0	0	
14e	1	0	0	1	1	0	1	0	
14f	0	1	0	1	1	1	0	0	
14g	0	1	0	0	0	0	0	1	
14h	0	0	0	0	0	0	0	1	
14i	0	0	0	0	0	0	1	0	
15.1	0	0	1	1	0	0	0	1	
	Class		For-mat	SET					
15.2	0	Length (note 4)							
15.3.1	1	0	0	0	0	0	1	0	
	Class		For-mat	Handover type (2)					
	0	0	0	0	0	0	0	1	
		Length							
	0	0	0	0	0	0	0	1	
	Recalling-type channel switching								
15.3.2	1	0	0	0	0	0	1	1	
	Class		For-mat	Calculation result (3)					
	0	Length (note 8)							
	Calculation result (note 5)								
15.3.3	0	1	0	0	0	0	0	0	
	Class		For-mat						
	0	Length (note 10)							
	0	1	1	0	1	1	0	0	
		JT-Q931 calling party number information element							
	0	Calling party number content length (note 10)							
	1				0	0	0	1	
	Exten-sion	Type of number (note 6)			ISDN/telephone numbering plan (note 6)				
	0	Number digit IA5 character (0–9, #, *)							

(Note 1) The component length is coded to indicate the number of octets contained in the component (excluding component type tag and component length octets).
(Note 2) The invoke identifier is coded to indicate the number of octets of the invoke identifier.
(Note 3) The operation value length is coded to indicate the number of octets of the object identifier specified by RCR.
(Note 4) Length indicates the number of octets from the first following octet to the final octet (excluding the own octet).
(Note 5) Using the previous calculation result as the random pattern, the length is 0 ~ * by the result of recalculation.
(Note 6) The type of the number is the domestic number (010) when the country which gave the PS number, and the identification code of the CS is same, otherwise, international number (001). The numbering plan identifier is the ISDN/telephony numbering plan.
(Note 7) Octets 9-11 (link identifier) are not sent.
(Note 8) Length is coded to indicate the number of octets of the calculation result.
(Note 9) Octets 14a ~ 14i are the object identifiers (handover) specified by RCR.
(Note 10) Length and calling party number content length indicate the number of octets from the first following octet to the final octet of JT-Q931 calling party number information element (excluding the own octet).

[2] Recalling-type channel switching for private system (Private standard)

This protocol unit is used only as a facility information element of the setup message of the PS recalling connection only in private system.

After receiving this invoke, CS may execute MM Authentication Request/Response sequence instead of checking the Calculation result in this invoke.

Also, if the result to this invoke is normal, the return result is set and returned from CS in the FACility information element of the connect message; if the result is abnormal, a return error or reject is set and returned from CS in the facility information element of the DISConnect message (note) or release complete message (note).

(Note) The clearing procedure in this case is according to Appendix X (CC circuit switched call control procedure) section 4 Call clearing.

Octet	Bit 8	7	6	5	4	3	2	1
4	1	0	1	0	0	0	0	1
	Component type tag							
5	Component length (note 1)							
6	0	0	0	0	0	0	1	0
	Invoke identifier tag							
7	Invoke identifier length (note 2)							
8	Invoke identifier							
12	0	0	0	0	0	1	1	0
	Operation value tag							
13	Operation value length (note 3)							
14a	0	0	0	0	0	0	1	0
14b	1	0	0	0	0	0	1	1
14c	0	0	1	1	1	0	0	0
14d	1	0	0	0	1	1	0	0
14e	1	0	0	1	1	0	1	0
14f	0	1	0	1	1	1	0	0
14g	0	1	0	0	0	0	0	1
14h	0	0	0	0	0	0	0	1
14i	0	0	0	0	0	0	1	1
15.1	0	0	1	1	0	0	0	1
	Class		For-mat	SET				
15.2	0	Length (note 4)						
15.3.1	1	0	0	0	0	0	1	0
	Class		For-mat	Handover type (2)				
	0	0	0	0	0	0	0	1
		Length						
	0	0	0	0	0	0	0	1
	Recalling-type channel switching							
15.3.2	0	1	0	0	0	0	0	0
	Class		For-mat	Calculation result (3)				
	0	Length (note 11)						
	Calculation result (note 12)							
15.3.3	0	1	0	0	0	0	0	0
	Class		For-mat					
	0	Length (note 9)						
	0	1	1	0	1	1	0	0
		JT-Q931 calling party number information element						
	0	Calling party number content length (note 9)						
	1 Exten-sion	Type of number (note 5)			Numbering plan identifier (note 5)			
	Number digit IA5 character (0-9, #, *)							
15.3.4	1	0	0	0	0	1	0	0
	Class		For-mat	PS identity (4)				
	0	Length (note 10)						
	Reserved	Paging service type			PS number (1st digit)			
	PS number (2nd digit)				PS number (3rd digit)			
	PS number (4th digit)				PS number (5th digit)			
	PS number (6th digit)				PS number (7th digit)			
	PS number (8th digit)				PS number (9th digit)			
	PS number (10th digit)				PS number (11th digit)			
	PS number (12th digit)				PS number (13th digit) / Extended paging service type			

(Note 2) The invoke identifier is coded to indicate the number of octets of the invoke identifier.

(Note 3) The operation value length is coded to indicate the number of octets of the object identifier specified by RCR.

(Note 4) Length indicates the number of octets from the first following octet to the final octet (excluding the own octet).

(Note 5) Type of number and Numbering plan identifier are coded to the available value ina a private network.

(Note 6) As for codeing of Paging service type, Extended paging service type and PS number, see 4.4.3.7.3.5.18 PS number section.

(Note 7) Octets 9-11 (link identifier) are not sent.

(Note 8) Octets 14a-14i are the object identifiers (private handover) specified by RCR.

(Note 9) Length and Calling party number content length indicate the number of octets from the first following octet to the final octet of JT-Q931 calling party number information element (excluding the own octet).

(Note 10) Length indicates the number of octets from the first following octet to the final octet of PS number (excluding the own octet).

(Note 11) Length is coded to indicate the number of octets of the calculation result.

(Note 12) Using the previous calculation result as the random pattern, the length is 0 ~ * by the result of recalculation.

[3] DTMF signal (Private standard/Public standard)

This protocol data unit is used as the facility information element of the facility message. Also, if the result to this invoke is abnormal, reject is set in the facility information element of the facility message, and it is returned from CS.

Octet	Bit 8	7	6	5	4	3	2	1	
4	1	0	1	0	0	0	0	1	
	Component type tag								
5	Component length (note 1)								
6	0	0	0	0	0	0	1	0	
	Invoke identifier tag								
7	Invoke identifier length (note 2)								
8	Invoke identifier								
12	0	0	0	0	0	1	1	0	(note 6)
	Operation value tag								
13	Operation value length (note 3)								
14a	0	0	0	0	0	0	1	0	(note 7)
14b	1	0	0	0	0	0	1	1	
14c	0	0	1	1	1	0	0	0	
14d	1	0	0	0	1	1	0	0	
14e	1	0	0	1	1	0	1	0	
14f	0	1	0	1	1	1	0	0	
14g	0	1	0	0	0	0	0	1	
14h	0	0	0	0	0	0	0	1	
14i	0	0	0	0	0	0	0	1	
15.1	0	0	1	1	0	0	0	1	
	Class		For-mat	SET OF					
15.2	Length (note 4)								
15.3.1	1	0	0	0	0	0	0	1	
	Class		For-mat	DTMF signal (1)					
	Length (note 8)								
	IA5 character (0 ~ 9, #, *) (DTMF signal) (note 5)								

(Note 1) The component length is coded to indicate the number of octets contained in the component (excluding component type tag and component length octets).
(Note 2) The invoke identifier is coded to indicate the number of octets of the invoke identifier.
(Note 3) The operation value length is coded to indicate the number of octets of the object identifier specified by RCR.
(Note 4) Length indicates the number of octets from the first following octet to the final octet (excluding the own octet).
(Note 5) Multiple ones possible. Limited to 0 ~ 9, #, * only.

(Note 6) Octets 9-11 are not sent.
(Note 7) Octets 14a–14i are the object identifiers (DTMF signal) specified by RCR.
(Note 8) Length indicates the number of octets from the first following octet to the final octet of IA5 characters (excluding the own octet).

(2) Return result (Private standard/Public standard)

Octet \ Bit	8	7	6	5	4	3	2	1
4	1	0	1	0	0	0	1	0
	Component type tag							
5	Component length (note 1)							
6	0	0	0	0	0	0	1	0
	Invoke identifier tag							
7	Invoke identifier length							
8	Invoke identifier (note 2)							

(Note 1) The component length is coded to indicate the number of octets contained in the component (excluding component type tag and component length octets).
(Note 2) The invoke identifier of the corresponding invoke is sent.
(Note 3) This component is for stating acceptance of handover, and it has no arguments.

(3) Return error (Private standard/Public standard)

[1] Return error specified by ITU-T recommendation Q.950

Octet \ Bit	8	7	6	5	4	3	2	1
4	1	0	1	0	0	0	1	1
	Component type tag							
5	Component length (note 1)							
6	0	0	0	0	0	0	1	0
	Invoke identifier tag							
7	Invoke identifier length							
8	Invoke identifier (note 2)							
9	0	0	0	0	0	0	1	0
	Error value tag							
10	0	0	0	0	0	0	0	1
		Error value length						
11	Q.950 error							

(Note 1) The component length is coded to indicate the number of octets contained in the component (excluding component type tag and component length octets).
(Note 2) The invoke identifier of the corresponding invoke is sent.

Q.950 error values

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	User non-contracted
0	0	0	0	0	0	1	1	Provision impossible
0	0	0	0	0	1	0	1	Information contents insufficient
0	0	0	0	0	1	1	1	Service provision impossible state
0	0	0	0	1	0	0	0	Service provision impossible by basic service
0	0	0	0	1	0	1	0	Supplementary service with unauthorized mutual action
0	0	0	0	1	0	1	1	Temporary resource use impossible
0	0	1	0	1	0	1	1	Procedure error

[2] Return error specified by RCR

Octet	Bit 8	7	6	5	4	3	2	1	
4	1	0	1	0	0	0	1	1	
	Component type tag								
5	Component length (note 1)								
6	0	0	0	0	0	0	1	0	
	Invoke identifier tag								
7	Invoke identifier length (note 2)								
8	Invoke identifier								
9	0	0	0	0	0	1	1	0	
	Error value tag								
10	0	Error value length (note 3)							
11a	0	0	0	0	0	0	1	0	(note 4)
11b	1	0	0	0	0	0	1	1	
11c	0	0	1	1	1	0	0	0	
11d	1	0	0	0	1	1	0	0	
11e	1	0	0	1	1	0	1	0	
11f	0	1	0	1	1	1	0	0	
11g	0	1	0	0	0	0	0	1	
11h	0	0	0	0	0	0	1	0	
11i	Reserved (return error value specified by RCR)								

(Note 1) The component length is coded to indicate the number of octets contained in the component (excluding component type tag and component length octets).
(Note 2) The invoke identifier of the corresponding invoke is sent.
(Note 3) The error value length is coded to indicate the number of octets of the object identifier specified by RCR.
(Note 4) Octets 11a–11i are the object identifiers (return error) specified by RCR.

(4) Reject (Private standard/Public standard)

Octet	Bit 8	7	6	5	4	3	2	1
4	1	0	1	0	0	1	0	0
	Component type tag							
5	Component length (note 1)							
6	0	0	0	0	0	0	1	0
	Invoke identifier tag							
7	Invoke identifier length							
8	Invoke identifier (note 2)							
9	Problem tag							
10	Problem length (note 3)							
11	Problem							

(Note 1) The component length is coded to indicate the number of octets contained in the component (excluding component type tag and component length octets).
(Note 2) The invoke identifier of the corresponding invoke is sent.
(Note 3) The problem length is coded to indicate the number of octets of the problem.

[1] Problem tag (octet 9)

Bit 8	7	6	5	4	3	2	1	
1	0	0	0	0	0	0	0	General problem
1	0	0	0	0	0	0	1	Invoke problem
1	0	0	0	0	0	1	0	Return result problem
1	0	0	0	0	0	1	1	Return error problem

[2] Problem (octet 11)

- General problem

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Unrecognized component
0	0	0	0	0	0	0	1	Mistyped component
0	0	0	0	0	0	1	0	Component of wrong structure

- Invoke problem

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Duplicate Invoke ID
0	0	0	0	0	0	0	1	Unrecognized operation
0	0	0	0	0	0	1	0	Mistyped argument
0	0	0	0	0	0	1	1	Resource limitation
0	0	0	0	0	1	0	0	Initiating release
0	0	0	0	0	1	0	1	Unrecognized link identifier
0	0	0	0	0	1	1	0	Unexpected link response
0	0	0	0	0	1	1	1	Unexpected linked operation

- Return result problem

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Unrecognized invocation ID
0	0	0	0	0	0	0	1	Result response was unexpected
0	0	0	0	0	0	1	0	Mistype result

- Return error problem

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Unrecognized invocation ID
0	0	0	0	0	0	0	1	Return error was unexpected
0	0	0	0	0	0	1	0	Unrecognized error
0	0	0	0	0	0	1	1	Unexpected error
0	0	0	0	0	1	0	0	Mistyped parameter

Figure 4.4.3.7.14 Facility information elements

4.4.3.7.3.5.12 Keypad facility (Private standard)

The keypad facility is used to carry IA5 characters set by the terminal keypad. In addition, the keypad facility is used to carry the hooking signal information and pause signal information from PS to CS. The keypad facility information elements are coded as shown in Figure 4.4.3.7.15.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Keypad faciliy 0	1	0	1	1	0	0 Information element identifier
2	Keypad facility content length							
3 ~ 34	0	Keypad facility information (IA5 characters) (note) . .						

(Note) IA5 character ESC (1B) + H(48) is defined as the hooking signal information. To use the hooking signal information is functional option.
IA5 character ESC (1B) + P(50) is defined as the pause signal information. To use the pause signal information is functional option.

Figure 4.4.3.7.15 Keypad facility information element

4.4.3.7.3.5.13 Progress indicator (Private standard/Public standard)

The progress indicator is used to report events generated while a call exists. The progress indicator information element is coded as shown in Figure 4.4.3.7.16. This information element may be repeated twice in one message.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Progress indicator 0	0	1	1	1	1	0 Information element identifier
2	Progress indicator content length							
3	1 Exten -sion	Coding standard		Re- served	Location			
4	1 Exten -sion	Progress description						

Coding standard (octet 3)

Bit 7	Bit 6	
0	0	RCR standard
1	0	Reserved
1	1	Specific to the local network standard
Other		Reserved

Location (octet 3)

Bit 4	3	2	1	
0	0	0	0	User
0	0	0	1	Local user-accommodating private network (own side)
0	0	1	0	Local user-accommodating public network (own side)
0	1	0	0	Remote user-accommodating public network (destination-side)
0	1	0	1	Remote user-accommodating private network (destination-side)
1	0	1	0	Interworking destination network
Other				Reserved

Progress description (octet 4)

Bit 7	6	5	4	3	2	1	
0	0	0	0	0	0	1	Call is not end-to-end ISDN. Progress information may be available.
0	0	0	0	0	1	0	Destination address is non-ISDN.
0	0	0	0	0	1	1	Originating address is non-ISDN.
0	0	0	0	1	0	0	Call has returned to the ISDN.
0	0	0	0	1	0	1	Interworking has occurred and has resulted in a telecommunication service change.
0	0	0	1	0	0	0	In-band information, or appropriate pattern is now available
	Other						Reserved

Figure 4.4.3.7.16 Progress indicator

4.4.3.7.3.5.14 Sending complete (Private standard)

The sending complete information element is used to describe to CS that PS completed the overlap call sending procedures. The sending complete information element is shown in Figure 4.4.3.7.17.

Octet	Bit 8	7	6	5	4	3	2	1
1	1	Sending complete 0	1	0	0	0	0	1 Information element identifier

Figure 4.4.3.7.17 Sending complete

4.4.3.7.3.5.15 Signal (Private standard/Public standard)

Signal is used for transmitting information so that tone outgoing call signals are generated by CS in connect request to PS. Signal information elements are coded as shown in Figure 4.4.3.7.18.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Signal 0	1	1	0	1	0	0 Information element identifier
2	Signal content length							
3	Signal content value							

Signal content value (octet 3)

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Dial tone on
0	0	0	0	0	0	0	1	Ring back tone on
0	0	0	0	0	0	1	0	Interrupt tone on
0	0	0	0	0	0	1	1	Network congestion tone on
0	0	0	0	0	1	0	0	Busy tone on
0	0	0	0	0	1	0	1	Confirm tone on
0	0	0	0	0	1	1	0	Answer tone on
0	0	0	0	0	1	1	1	Call waiting tone on
0	0	0	0	1	0	0	0	Off hook warning tone on
0	0	1	1	1	1	1	1	Tone off
0	1	0	0	0	0	0	0	Alerting on pattern 0 (note)
0	1	0	0	0	0	0	1	Alerting on pattern 1 (note)
0	1	0	0	0	0	1	0	Alerting on pattern 2 (note)
0	1	0	0	0	0	1	1	Alerting on pattern 3 (note)
0	1	0	0	0	1	0	0	Alerting on pattern 4 (note)
0	1	0	0	0	1	0	1	Alerting on pattern 5 (note)
0	1	0	0	0	1	1	0	Alerting on pattern 6 (note)
0	1	0	0	0	1	1	1	Alerting on pattern 7 (note)
0	1	0	0	1	1	1	1	Alerting off
		Other						Reserved

(Note) Alerting on patterns are to indicate the alerting patterns. Usage of these are not specified yet.

Figure 4.4.3.7.18 Signal

4.4.3.7.3.5.16 Advice of charge (Private standard/Public standard)

The advice of charge is included in the CC message related to disconnect recovery transmitted from CS, and it is carried as a domestic codeset that uses locking shift procedures.

This information element is coded as shown in Figure 4.4.3.7.19.

Octet \ Bit	8	7	6	5	4	3	2	1
1	0	Advice of charge 0	0	0	0	0	0	1 Information element identifier
2	Advice of charge content length							
3	1 Exten-sion	Reserved			Charge type			
4 ~ *	0	Charge indicate (IA5 characters)						

Charge type (octet 3)

Bit 4	3	2	1	
0	0	1	0	Total charge
1	x	x	x	Option
Other				Reserved

Figure 4.4.3.7.19 Advice of charge

4.4.3.7.3.5.17 Notification indicator (Private standard/Public standard)

The notification indicator element is used to notify the information related to a call.
This information element is coded as shown in Figure 4.4.3.7.20.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Notification indicator 0	1	0	0	1	1	1 Information element identifier
2	Notification indicator content length							
3	1 Exten -sion	Notification description						

Notification description (octet 3)

Bit 7	6	5	4	3	2	1	
0	0	0	0	0	0	0	User suspended
0	0	0	0	0	0	1	User resumed
			Other				Reserved

Figure 4.4.3.7.20 Notification indicator

4.4.3.7.3.5.18 PS identity (Private standard)

PS identity is used by CS to identify each PS for call control. The PS identity information element is coded as shown in Figure 4.4.3.7.21.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	PS identity 1	0	0	0	0	0	1 Information element identifier
2	PS identity content length							
3	Re-served	Paging service type			PS number (1st digit)			
4	PS number (2nd digit)				PS number (3rd digit)			
5	PS number (4th digit)				PS number (5th digit)			
6	PS number (6th digit)				PS number (7th digit)			
7	PS number (8th digit)				PS number (9th digit)			
8	PS number (10th digit)				PS number (11th digit)			
9	PS number (12th digit)				PS number (13th digit) / Extended paging service type			

Paging service type (Octet 3)

Bit 7	6	5	
0	0	0	Reserved
0	0	1	Shows paging service by PS number of BCD 13 digits or less.
0	1	0	Shows paging service by hexadecimal 7digit PS number.
0	1	1	Shows paging service by hexadecimal 13 digit PS number.
1	0	0	Shows paging service by BCD 13 digits or less domestic PS number.
1	0	1	Shows paging service by Extension Paging Service Type.
1	1	X	Option X : Don't care

Extended paging service type (Octet 9)

Bit 4	3	2	1	
0	0	1	0	Paging service by PS number of BCD 12 digits or less. (note 1)
0	1	0	0	Shows paging service by supplementary service within the CS-PS loop. (note 2)
	Other			Reserved

(Note 1) Paging service by PS number of BCD 12 digits or less is used to explicitly indicate that PS number is based on a numbering plan defined in each private system.
(Note 2) Used for supplementary service within the CS-PS loop in a private system.

In case of Paging service by PS number of BCD 12 digits or less (0010), PS identity information element is coded as follows.

<table>
<tr><td>Octet</td><td>Bit 8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td></td><td></td><td colspan="7">PS identity
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">PS identity content length</td></tr>
<tr><td>3</td><td>Re-served</td><td>1</td><td>0</td><td>1</td><td colspan="4">PS number (1st digit)</td></tr>
<tr><td>4</td><td colspan="4">PS number (2nd digit)</td><td colspan="4">PS number (3rd digit)</td></tr>
<tr><td>5</td><td colspan="4">PS number (4th digit)</td><td colspan="4">PS number (5th digit)</td></tr>
<tr><td>6</td><td colspan="4">PS number (6th digit)</td><td colspan="4">PS number (7th digit)</td></tr>
<tr><td>7</td><td colspan="4">PS number (8th digit)</td><td colspan="4">PS number (9th digit)</td></tr>
<tr><td>8</td><td colspan="4">PS number (10th digit)</td><td colspan="4">PS number (11th digit)</td></tr>
<tr><td>9</td><td colspan="4">PS number (12th digit)</td><td colspan="4">Extended paging service type</td></tr>
</table>

PS number (Octets 3-9)

The two types of number digit shown below can be used for PS number.

- In the case of BCD, the first number, that is the number first dialed, is packed in the PS number in order from the lowest octet.

- In the case of BCD, the number of digits of PS number, if smaller than the maximum number of digits for each paging service type, adds filler following PS number up to the maximum number of digits.

- As for digit cording, BCD and hexadecimal are defined as shown below.

BCD number digits (octets 3-9)

Number \ Bit	8 / 4	7 / 3	6 / 2	5 / 1	Number \ Bit	8 / 4	7 / 3	6 / 2	5 / 1
0	1	0	1	0	6	0	1	1	0
1	0	0	0	1	7	0	1	1	1
2	0	0	1	0	8	1	0	0	0
3	0	0	1	1	9	1	0	0	1
4	0	1	0	0	Filler	0	0	0	0
5	0	1	0	1	Option	Others			

Hexadecimal number digits (octets 3-9)

For 7 digits hexadecimal

Octet	Bit 8 7 6 5	4 3 2 1
1		MSB
2		
3		
4		LSB
5		
6	Don't	care
7		

For 13 digits hexadecimal

Octet	Bit 8 7 6 5	4 3 2 1
1		MSB
2		
3		
4		
5		
6		
7		LSB

Figure 4.4.3.7.21 PS number

4.4.3.7.3.5.19 High layer compatibility (Private standard/Public standard)

The purpose of the High layer compatibility information element is to provide a means which should be used by the remote user for compatibility checking.
The High layer compatibility information element is coded as shown in Figure 4.4.3.7.22.
The maximum length of this information is five octets.

(Note) The High layer compatibility information element is transported transparently between a call network node addressed by the call originating entity. However, if explicitly requested by the user (at subscription time), a network which provides some capabilities to realize teleservices may interpret this information to provide a particular service.

<table>
<tr><td>Octet</td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td></td></tr>
<tr><td>1</td><td>0</td><td colspan="7">High layer compatibility
1 1 1 1 1 0 1
information element identifier</td><td></td></tr>
<tr><td>2</td><td colspan="8">Length of high layer compatibility contents</td><td></td></tr>
<tr><td>3</td><td>1
Exten
-sion</td><td colspan="2">Coding standard</td><td colspan="3">Interpretation</td><td colspan="2">Presentation method of Protocol profile</td><td></td></tr>
<tr><td>4</td><td>0/1
Exten
-sion</td><td colspan="7">High layer characteristics identification</td><td></td></tr>
<tr><td>4a</td><td>1
Exten
-sion</td><td colspan="7">Extended High layer characteristics identification</td><td>(Note 1)</td></tr>
<tr><td>4a</td><td>1
Exten
-sion</td><td colspan="7">Extended Video telephone characteristics identification</td><td>(Note 2)</td></tr>
</table>

(Note 1) This octet may be present when octet 4 indicates Maintenance or Management.
(Note 2) This octet may be present when octet 4 indicates Audiovisual.

Coding standard (octet 3)

Bit 7	6		
0	0	RCR standardized coding, as described below	
0	1	ISO/IEC standard	(note 1)
1	0	National standard	(note 1, note2)
1	1	Standard defined for the network (either public or private) present at the network side of the interface	(note 1)
Other		Reserved	

(Note 1) These other coding standard should be used only when the desired high layer compatibility cannot be represented by the RCR standardized coding.

(Note 2) High layer characteristic identification is provided for as National standard according to coding same as the RCR standard as for Interpretation and Protocol profile at the time of National standard coding. In this case, the extended high layer characteristic identification is not used.

Interpretation (octet 3)

Bit 5	4	3	
1	0	0	First (primary or only) high layer characteristics identification (in octet 4) is used in the call
Other		Reserved	

(Note) "Interpretation" indicates how the "High layer characteristics identification" (in octet 4) should be interpreted.

Presentation method of protocol profile (octet 3)

Bit 2	1	
0	1	High layer protocol profile (without specification of attributes)
Other		Reserved

High layer characteristics identification (octet 4)

Bit 7	6	5	4	3	2	1	
0	0	0	0	0	0	1	Telephony
0	0	0	0	1	0	0	Facsimile Group 2/3 (Recommendation F. 182)
0	1	0	0	0	0	1	Facsimile Group 4 class 1 (Recommendation F. 184)
0	1	0	0	1	0	0	Facsimile service Group 4, Class 2 and class 3 (Recommendation F. 184)
0	1	0	1	0	0	0	(Note 7)
0	1	1	0	0	0	1	(Note 7)
0	1	1	0	0	1	0	Syntax based Videotex (Recommendation F. 300 and Recommendation T.102)
0	1	1	0	0	1	1	International Videotex interworking via gateways or interworking units (Recommendation F. 300 and Recommendation T. 101)
0	1	1	0	1	0	1	Telex service (Recommendation F. 60)
0	1	1	1	0	0	0	Message Handling Systems (MHS) (JT-X. 400 - series Recommendation)
1	0	0	0	0	0	1	OSI application (note 2) (X. 200 - series Recommendation)
1	0	0	0	0	1	0	FTAM application (ISO 8571)
1	0	1	1	1	1	0	Reserved for maintenance (Recommendation Q. 94 x) (note 4)
1	0	1	1	1	1	1	Reserved for management (note 4)
1	1	0	0	0	0	0	Video telephone (JT-F720,JT-F721andJT-F731 profile la)(note 5)
1	1	0	0	0	0	1	Video conference (Recommendation F.702 and F.731 profile lb)(note 5)
1	1	0	0	0	1	0	Audio graphic conference (Recommendation F.702 and F.731 (profile 2a2 is at least contained, and 2a1, 2a3, 2b1, 2b2, and 2bc are contained as an option.))(note 5, note 6)
1	1	0	0	0	1	1	Reserved for Audio visual services (F.700-series Recommendation)
			⁀				
1	1	0	0	1	1	1	
1	1	0	1	0	0	0	Multimedia services (Recommendation F.700 series)
1	1	0	1	0	0	1	Reserved for Audio visual services (F.700-series Recommendation)
			⁀				
1	1	0	1	1	1	1	
1	1	1	1	1	1	1	Reserved
Other							Reserved

(Note 1) The coding above applies in the case of "Coding standard" = "RCR standard" and "Presentation method of protocol profile" = "High layer protocol profile".
(Note 2) Further compatibility checking will be executed by the OSI high layer protocol.
(Note 3) Code points are added only to those service for which Recommendations are available.
(Note 4) When this coding is included, octet 4 may be followed by octet 4a.
(Note 5) When this coding is used, octet 4 may be followed by octet 4a.

(Note 6) It should have the communication function which becomes an indispensable common nucleus which becomes the guarantee of a minimum communication ability, when confirmed that it is multimedia service by this code value.
(Note 7) This code value had been allocated in deleted F.200-series Recommendation before.
(Note 8) Support of the services pointed by the coding above depends on each PHS operator's implementation.

Extended High layer characteristics identification (octet 4a)

Bit 7	6	5	4	3	2	1	
0	0	0	0	0	0	1	Telephony
0	0	0	0	1	0	0	Facsimile Group 2/3 (Recommendation F. 182)
0	1	0	0	0	0	1	Facsimile Group 4 Class 1 (Recommendation F. 184)
0	1	0	0	1	0	0	Facsimile service Group 4, Class 2 and Class 3 (Recommendation F. 184)
0	1	0	1	0	0	0	(Note 4)
0	1	1	0	0	0	1	(Note 4)
0	1	1	0	0	1	0	Syntax based Videotex (Recommendation F. 300 and Recommendation T.102)
0	1	1	0	0	1	1	International Videotex interworking via gateways or interworking units (Recommendation F. 300 and Recommendation T. 101)
0	1	1	0	1	0	1	Telex service (Recommendation F. 60)
0	1	1	1	0	0	0	Message Handling Systems (MHS) (X. 400 - series Recommendations)
1	0	0	0	0	0	1	OSI application (note 2) (X. 200 - series Recommendation)
1	0	0	0	0	1	0	FTAM application (ISO 8571)
1	0	1	1	1	1	0	Not available for assignment
1	0	1	1	1	1	1	Not available for assignment
1	1	0	0	0	0	0	Video telephone (JT-F720,JT-F721andJT-F731 profile la)
1	1	0	0	0	0	1	Video conference (Recommendation F.702 and F.731 profile lb)
1	1	0	0	0	1	0	Audio graphic conference (Recommendation F.702 and F.731 (profile 2a2 is at least contained, and 2a1, 2a3, 2b1, 2b2, and 2bc are contained as an option.))
1	1	0	0	0	1	1	Reserved for Audio visual services (Recommendation F.700 series)
			～				
1	1	0	0	1	1	1	
1	1	0	1	0	0	0	Multimedia services (Recommendation F.700 series)
1	1	0	1	0	0	1	Reserved for Audio visual services (Recommendation F.700 series)
			～				
1	1	0	1	1	1	1	
1	1	1	1	1	1	1	Reserved
Other							Reserved

Extended Audio visual characteristics identification (octet 4a)

Bit 7 6 5 4 3 2 1	
0 0 0 0 0 0 1	Ability setting of initial channel of JT-H221
0 0 0 0 0 1 0	Ability setting of The Second channel of JT-H221
0 1 0 0 0 0 1	Ability setting of initial channel which relates to call of 3.1kHz audio or voice
Other	Reserved

(Note 1) The coding above applies in the case of "Coding standard" = "National standard" and "Presentation method of protocol profile" = "High layer protocol profile".
(Note 2) Further compatibility checking will be executed by the OSI high layer protocol.
(Note 3) Code points are added only to those service for which Recommendations are available.
(Note 4) This code value had been allocated in deleted F.200-series Recommendation before.
(Note 5) Support of the services pointed by the coding above depends on each PHS operator's implementation.

High layer characteristics identification (Japanese National standard) (octet 4)

Bit 7 6 5 4 3 2 1	
0 0 0 0 0 0 1	Still Images transfer equipment (TTC JJ-41.10)
Other	Reserved

(Note 1) The coding above applies in case of "Coding standard" = "National standard" and applied in Japanese domestic only.
(Note 2) Support of the services pointed by the coding above depends on each PHS operator's implementation.

Figure 4.4.3.7.22 High layer compatibility

4.4.3.7.3.5.20 Low layer compatibility (Private standard/Public standard)

The purpose of the Low layer compatibility information element is to provide a means which should be used for compatibility checking by an addressed entity (e.g. a remote user or an interworking unit or a high layer function network node addressed by the calling user).
The Low layer compatibility information element is transferred transparently between the call originating entity (e.g. the calling user) and the addressed entity unless the rate adaption is not executed by interworking unit between the networks whose information transfer rate is different form other's.
If low layer compatibility negotiation is allowed by the network, the Low layer compatibility information element is also passed transparently form the addressed entity to the originating entity unless the rate adaption is not executed by interworking unit between the networks whose information transfer rate is different form other's.
The Low layer compatibility information element is coded as shown in Figure 4.4.3.7.23.
Support of the services pointed by the coding below depends on each PHS operator's implementation.

<table>
<tr><td>Octet</td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td colspan="7">Low layer compatibility
1 1 1 1 1 0 0
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Length of the low layer compatibility contents</td></tr>
<tr><td>3</td><td>0/1
Extension</td><td colspan="2">Coding standard</td><td colspan="5">Information transfer capability</td></tr>
<tr><td>3a</td><td>1
Extension</td><td>Negotiation indication</td><td colspan="6">0 0 0 0 0 0
Spare</td></tr>
<tr><td>4</td><td>0/1
Extension</td><td colspan="2">Transfer mode</td><td colspan="5">Information transfer rate</td></tr>
<tr><td>4.1
(note 1)</td><td>1
Extension</td><td colspan="7">Rate multiplier</td></tr>
<tr><td>5</td><td>0/1
Extension</td><td colspan="2">0 1
Layer 1
identification</td><td colspan="5">User information layer 1 protocol</td></tr>
<tr><td>5a
(note 2)</td><td>0/1
Extension</td><td>Synch./
async.</td><td>In-band
Negotiation</td><td colspan="5">User rate</td></tr>
<tr><td>5b
(note 3)</td><td>0/1
Extension</td><td colspan="2">Intermediate rate</td><td>NIC on
Tx</td><td>NIC on
Rx</td><td>Flow control on
Tx</td><td>Flow control on
Rx</td><td>0
Spare</td></tr>
<tr><td>5b
(note 4)</td><td>0/1
Extension</td><td>Header/
No
header</td><td>Multi-
frame
support</td><td>Operation
Mode</td><td>LLI
negotiation</td><td>Assignor/
assignee</td><td>In-band/
out-band
negotiation</td><td>0
Spare</td></tr>
<tr><td>5c
(note 2)</td><td>0/1
Extension</td><td colspan="2">Number of stop bits</td><td colspan="2">Number of data bits</td><td colspan="3">Parity information</td></tr>
<tr><td>5d
(note 2)</td><td>1
Extension</td><td>Duplex
mode</td><td colspan="6">Modem type</td></tr>
<tr><td>6</td><td>0/1
Extension</td><td colspan="2">1 0
Layer 2
identification</td><td colspan="5">User information layer 2 protocol</td></tr>
<tr><td>6a
(note 5)</td><td>0/1
Extension</td><td colspan="2">Operation Mode</td><td colspan="3">0 0 0
Spare</td><td colspan="2">JT-Q933</td></tr>
<tr><td>6a</td><td>1</td><td colspan="7"></td></tr>
</table>

<table>
<tr><td>(note 6)</td><td>Extension</td><td colspan="7">User specified layer 2 protocol</td></tr>
<tr><td>6b
(note 5)</td><td>1
Extension</td><td colspan="7">Window size (k)</td></tr>
<tr><td>7</td><td>0/1
Extension</td><td colspan="2">1 1
Layer 3
identification</td><td colspan="5">User information Layer 3 protocol</td></tr>
<tr><td>7a
(note 7)</td><td>0/1
Extension</td><td colspan="2">Operation mode</td><td colspan="5">0 0 0 0 0
Spare</td></tr>
<tr><td>7a
(note 8)</td><td>1
Extension</td><td colspan="7">User specified layer 3 protocol information</td></tr>
<tr><td>7b
(note 7)</td><td>0/1
Extension</td><td colspan="3">0 0 0
Spare</td><td colspan="4">Default packet size</td></tr>
<tr><td>7c
(note 7)</td><td>1
Extension</td><td colspan="7">Packet window size</td></tr>
<tr><td>7a
(note 9)</td><td>0
Extension</td><td colspan="3">0 0 0
Spare</td><td colspan="4">Addition layer 3 protocol information
Most significant bit</td></tr>
<tr><td>7b
(note 9)</td><td>1
Extension</td><td colspan="3">0 0 0
Spare</td><td colspan="4">Addition layer 3 protocol information
Least significant bit</td></tr>
</table>

(Note 1) This octet required if octet 4 indicates multirate (64 kbit/s base rate). Otherwise, it shall not present.

(Note 2) This octet may be present only if the User information layer 1 protocol in octet 5 indicates either of the Standardized rate adaption JT-V110/X30 or JT-V120 and the information transfer capability in octet 3 indicates unrestricted digital information.

(Note 3) This octet is significant only if the User information layer 1 protocol in octet 5 indicates Standardized rate adaption JT-V110/X30.

(Note 4) This octet is significant only if the User information layer 1 protocol in octet 5 indicates Standardized rate adaption JT-V120.

(Note 5) This octet may be present only if the User information layer 2 protocol in octet 6 indicates certain acknowledged HDLC elements of procedure.

(Note 6) This octet may be present only if the User information layer 2 protocol in octet 6 indicates user specified layer 2 protocol.

(Note 7) This octet may be present only if the User information layer 3 protocol in octet 7 indicates a layer 3 protocol based on Recommendation JT-X25, ISO/IEC 8208 or Recommendation X.223/ISO 8878.

(Note 8) This octet may be present only if the User information layer 3 protocol in octet 7 indicates user specified layer 3 protocol.

(Note 9) When ISO/IECTR9577 is displayed by octet 7, this octet is included.

Coding standard (octet 3)

Bit 7	Bit 6	
0	0	RCR standard
0	1	ISO/IEC standard (note)
1	0	National standard (note)
1	1	Standard defined for the network (either public or private) present on the network side of the interface (note)
Other		Reserved

(Note) These other coding standards should be used only when the desired low layer compatibility cannot be represented by RCR standard coding.

Information transfer capability (octet 3)

Bit 5	4	3	2	1	
0	0	0	0	0	Speech
0	1	0	0	0	Unrestricted digital information
0	1	0	0	1	Reserved (Restricted digital information)
1	0	0	0	0	3.1 kHz audio
1	0	0	0	1	Unristricted digital information with tone/announcements (note)
1	1	0	0	0	Video
Other					Reserved

(Note) Unrestricted digital information with tones/announcements (UDI-TA) is the information transfer attribute value that had previously been named "7 kHz audio".

Negotiation indicator (octet 3a)

Bit 7	
0	Out-band negotiation not possible
1	Out-band negotiation possible

(Note 1) See Appendix AF for description of low layer compatibility negotiation.
(Note 2) When octet 3a is omitted, "out-band negotiation not possible" shall be assumed.

Transfer mode (octet 4)

Bit 7	Bit 6	
0	0	Circuit mode
1	0	Reserved (Packet-mode)
Other		Reserved

Information transfer rate (octet 4)

Bit 5	4	3	2	1	Circuit mode	Packet-mode
0	0	0	0	0	-	Reserved (This code is used for packet-mode)
0	0	1	1	1	Reserved (8 kbit/s)	-
0	1	0	1	0	Reserved (16 kbit/s)	-
0	1	1	0	0	32 kbit/s	-
1	0	0	0	0	64 kbit/s	-
1	0	0	0	1	Reserved (2 X 64 kbit/s)	-
1	0	0	1	1	Reserved (384 kbit/s)	-
1	0	1	0	1	Reserved (1536 kbit/s)	-
1	0	1	1	1	Reserved (1920 kbit/s)	-
1	1	0	0	0	Reserved (Multi rate (64 kbit/s base rate))	-
Other					Reserved	-

(Note 1) When the information transfer rate 2 x 64 kbit/s is used the coding of octet 3 and 4 refer to both 64 kbit/s channels.

(Note 2) Additional attributes are defined as below;

Low layer compatibility		Additional attributes			
Transfer mode	Information transfer capability	Structure	Configuration	Establishment	Symmetry
Circuit	Speech	8kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Unrestricted data	8kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Restricted data	8kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	3.1 kHz audio	8kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Unrestricted data with tone/announcements	8kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Video	8kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Packet	Unrestricted data	Service data unit integrity	Point-to-point	Demand	Bi-directional symmetric

Rate multiplier (octet 4.1)

Coded as a binary representation of the multiplier to the base rate. The multiplier can take any value from 2 up to the maximum number of B-channel available on the interface.

User information Layer 1 protocol (octet 5)

Bit 5	4	3	2	1	
0	0	0	0	1	Standardized rate adaption JT-V 110/X 30. This implies the presence of octet 5a and optionally octets 5b, 5c and 5d as defined below.
0	0	0	1	0	TTC Standard JT-G711 μ-law (note 2)
0	0	0	1	1	ITU-T Recommendation G.711 A-law (note 2)
0	0	1	0	0	ITU-T Recommendation G.726 32 kbit/s ADPCM
0	0	1	0	1	TTC Standard JT-H221 and JT-H242
0	0	1	1	0	TTC Standard JT-H223 and JT-H245
0	0	1	1	1	Non-TTC standardized rate adaption. This implies the presence of octet 5a and, optionally, octets 5b, 5c and 5d. The use of this code point indicates that the user rate specified in octet 5a is defined by the user. Additionally, octet 5b, 5c and 5d, if present, are defined consistent with the user specified rate adaption.
0	1	0	0	0	Standardized rate adaption JT-V120. This implies the presence of octet 5a and 5b defined below, and optionally octets 5c and 5d.
0	1	0	0	1	Standardized rate adaption JT-X31. HDLC flag stuffing.
Other					Reserved

(Note 1) If the information transfer capability is "Unrestricted digital information" (or "Restricted digital information"), and if the user information layer 1 protocol is not to be identified to the network, octet 5 shall be existed.

(Note 2) RCR STD-28 does not permit the transmission of G.711 encoded voice data at Um point.

Synchronous/asynchronous (octet 5a)

Bit 7	
0	Synchronous data
1	Asynchronous data

(Note) Octet 5b-5d may be omitted in case of synchronous users rates.

In-band negotiation (octet 5a)

Bit 6	
0	In-band negotiation not possible
1	In-band negotiation possible

(Note) See Recommendations JT-V 110 and JT-X 30 or modem type Recommendations.

User rate (octet 5a)

Bit 5	4	3	2	1	
0	0	0	0	0	Rate is indicated by E-bits specified in Recommendation I.461 or may be negotiated in-band negotiation.
0	0	0	0	1	0.6 kbit/s Recommendations X. 1
0	0	0	1	0	1.2 kbit/s
0	0	0	1	1	2.4 kbit/s Recommendations X. 1
0	0	1	0	0	3.6 kbit/s
0	0	1	0	1	4.8 kbit/s Recommendations X. 1
0	0	1	1	0	7.2 kbit/s
0	0	1	1	1	8 kbit/s Standard JT-I. 460
0	1	0	0	0	9.6 kbit/s Recommendations X. 1
0	1	0	0	1	14.4 kbit/s
0	1	0	1	0	16 kbit/s Standard JT-I. 460
0	1	0	1	1	19.2 kbit/s
0	1	1	0	0	32 kbit/s Standard JT-I. 460
0	1	1	0	1	38.4 kbit/s Standard JT-V. 110
0	1	1	1	0	48 kbit/s Recommendations X. 1
0	1	1	1	1	56 kbit/s
1	0	0	0	0	64 kbit/s Recommendation X. 1
1	0	0	1	0	57.6 kbit/s Recommendation V. 14 extended
1	0	0	1	1	28.8 kbit/s Standard JT-V. 110
1	0	0	1	0	24 kbit/s Standard JT-V. 110
1	0	1	0	1	0.1345 kbit/s Recommendation X.1
1	0	1	1	0	0.100 kbit/s Recommendation X.1
1	0	1	1	1	0.075/1.2 kbit/s Recommendations X. 1 (Note)
1	1	0	0	0	1.2/0.075 kbit/s Recommendations X. 1 (Note)
1	1	0	0	1	0.050 kbit/s Recommendations X. 1
1	1	0	1	0	0.075 kbit/s Recommendations X. 1
1	1	0	1	1	0.110 kbit/s Recommendations X. 1
1	1	1	0	0	0.150 kbit/s Recommendations X. 1
1	1	1	0	1	0.200 kbit/s Recommendations X. 1
1	1	1	1	0	0.300 kbit/s Recommendations X. 1
1	1	1	1	1	12 kbit/s
Other					Reserved

(Note) The first rate is the transmit rate in the forward direction of the call. The second rate is transmit rate in the backward direction of the call.

Octet 5b for JT-V 110 and JT-X 30 rate adaptation

Intermediate rate (octet 5b)

Bit		
7	6	
0	0	Not used
0	1	8 kbit/s
1	0	16 kbit/s
1	1	32 kbit/s

Network independent clock (NIC) on transmission (Tx) (octet 5b) (Note 1)

Bit	
5	
0	Not required to send data with network independent clock
1	Required to send data with network independent clock

(Note 1) Refers to transmission in the forward direction of the call.
(Note 2) See JT-V 110 and JT-X 30.

Network independent clock (NIC) on reception (Rx) (octet 5b) (Note 1)

Bit	
4	
0	Cannot accept data with network independent clock
1	Can accept data with network independent clock

(Note 1) Refers to transmission in the backward direction of the call.
(Note 2) See JT-V 110 and JT-X 30.

Flow control on transmission (Tx) (octet 5b) (Note 1)

Bit	
3	
0	Not required to send data with flow control mechanism
1	Required to send data with flow control mechanism

(Note 1) Refers to transmission in the forward direction of the call.
(Note 2) See JT-V 110 and JT-X 30.

Flow control on receive (Rx) (octet 5b) (Note 1)

Bit
2
0 Cannot accept data with flow control mechanism
1 Can accept data with flow control mechanism

(Note 1) Refers to transmission in the backward direction of the call.
(Note 2) See JT-V 110 and JT-X 30.

Octet 5b for JT-V120 rate adaption

Rate adaption header/no header (octet 5b)

Bit
7
0 Rate adaption header not included
1 Rate adaption header included

Multiple frame establishment support in data link (octet 5b)

Bit
6
0 Multiple frame establishment not supported. Only UI frames allowed
1 Multiple frame establishment supported

Operation Mode (octet 5b)

Bit
5
0 Bit transparent mode of operation
1 Protocol sensitive mode of operation

Logical link identifier negotiation (octet 5b)

Bit
4
0 Default, LLI = 256
1 Full protocol negotiation (note)

(Note) A connection over which protocol negotiation will be executed in indicated in bit 2 of octet 5b.

Assignee/assignor (octet 5b)

Bit
3
0 Message originator is "default assignee"
1 Message originator is "assignor only"

In-band/out-band negotiation (octet 5b)

Bit 2	
0	Negotiation is done with USER INFOrmation messages on a temporary signalling connection (note)
1	Negotiation is done in-band using logical link zero

(Note) Private only. In public system, "USER INFOrmation" message is not standardized.

Number of stop bits (octet 5c)

Bit 7	6	
0	0	Not used
0	1	1 bit
1	0	1.5 bits
1	1	2 bits

Number of data bits excluding parity bits if present (octet 5c)

Bit 5	4	
0	0	Not used
0	1	5 bits
1	0	7 bits
1	1	8 bits

Parity information (octet 5c)

Bit 3	2	1	
0	0	0	Odd
0	1	0	Even
0	1	1	None
1	0	0	Forced to 0
1	0	1	Forced to 1
Other			Reserved

Duplex mode (octet 5d)

Bit 7	
0	Half duplex
1	Full duplex

Modem type (octet 5d)

Bit 6	5	4	3	2	1	
0	0	0	0	0	0	National use
			～			
0	0	0	1	0	1	National use
0	1	0	0	0	1	Recommendation V. 21
0	1	0	0	1	0	Recommendation V. 22
0	1	0	0	1	1	Recommendation V. 22 bis
0	1	0	1	0	0	Recommendation V. 23
0	1	0	1	0	1	Recommendation V. 26
0	1	0	1	1	0	Recommendation V. 26 bis
0	1	0	1	1	1	Recommendation V. 26 ter
0	1	1	0	0	0	Recommendation V. 27
0	1	1	0	0	1	Recommendation V. 27 bis
0	1	1	0	1	0	Recommendation V. 27 ter
0	1	1	0	1	1	Recommendation V. 29
0	1	1	1	0	0	Recommendation V. 32
0	1	1	1	1	0	Recommendation V. 34
1	0	0	0	0	0	National use
			～			
1	0	1	1	1	1	National use
1	1	0	0	0	0	User specified
			～			
1	1	1	1	1	1	User specified
Other						Reserved

User information layer 2 protocol (octet 6)

Bit 5	4	3	2	1	
0	0	0	0	1	Basic mode ISO 1745
0	0	0	1	0	RCR STD-28 (note 4)
0	0	1	1	0	TTC Standard JT-X. 25, link layer (note 1,4)
0	0	1	1	1	Recommendation X. 25 multilink (note 4)
0	1	0	0	0	Extended LAPB ; for half duplex operation (T. 71)
0	1	0	0	1	HDLC ARM (ISO 4335) (note 4)
0	1	0	1	0	HDLC NRM (ISO 4335) (note 4)
0	1	0	1	1	HDLC ABM (ISO 4335) (note 4)
0	1	1	0	0	LAN logical link control (ISO 8802/2)
0	1	1	0	1	TTC Standard JT-X. 75 Single Link Procedure (SLP) (Note 4)
0	1	1	1	0	TTC Standard JT-Q. 922 (note 4)
0	1	1	1	1	Core aspects of TTC Standard JT-Q. 922
1	0	0	0	0	User specified (note 2)
1	0	0	0	1	ISO 7776 DTE-DTE operation (note 3, 4)
Other					Reserved

(Note 1) This Recommendation is compatible with ISO 1777 DTE-DTE operation.

(Note 2) When this coding is included, octet 6a will include user coding for the user specified laver 2 protocol.
(Note 3) This standard is compatible with TTC Standard JT-X. 75 modified by the application rules defined in TTC Standard JT-T. 90.
(Note 4) When this coding included, octet 6a and 6b with ITU-T encoding may be included.

Octet 6a for ITU-T coding

Operation Mode (octet 6a)

Bit 7	6	
0	1	Normal operation mode
1	0	Extended mode of operation
Other		Reserved

JT-Q933 use (octet 6a)

Bit 2	1	
0	0	For use when the coding defined in TTC standard JT-Q933 is not used
Other		Reserved

Octet 6a for User protocol

User specified layer 2 protocol information (octet 6a)

The use and coding of octet 6a is according to user defined requirements.

Window size (k) (octet 6b)

Bit 7~1 binary coding of k parameter value in the range from 1 to 127.

User information layer 3 protocol (octet 7)

Bit 5	4	3	2	1	
0	0	0	1	0	RCR STD-28
0	0	1	1	0	TTC Standard JT-X.25, packet layer (note 2)
0	0	1	1	1	ISO/IEC 8208 (X.25 packet level protocol for data terminal equipment) (note 2)
0	1	0	0	0	Recommendation X.223/ISO 8878 (use of ISO/IEC 8208 and TTC Standard JT-X.25 to provide OSI-CONS) (note 2)
0	1	0	0	1	ISO/IEC 8743 (OSI connectionless mode protocol)
0	1	0	1	0	Recommendation T.70 minimum network layer
0	1	0	1	1	ISO/IEC TR9577 (Protocol identification in the network layer)
1	0	0	0	0	User specified (note 1)
Other					Reserved

(Note 1) When this coding included, octet 7a will included user coding for the specified layer 3 protocol.
(Note 2) When this coding included, octets 7a, 7b and 7c with ITU-T encoding may be included.

Octet 7a for ITU-T coding

Operation Mode (octet 7a)

Bit 7	Bit 6	
0	1	Normal packet sequence numbering
1	0	Extended packet sequence numbering
Other		Reserved

Octet 7a for User protocol

User specified layer 3 protocol information (octet 7a)

The use and coding of octet 7a is according to user defined requirements.

Coding for ISO/IECTR9577 of octet 7a and 7b (Note)
Bit 8(extended) is set in 0 in octet 7a and 1 in octet 7b.
Bit 7-5 of both octets is the spares (It sets it in 0).

7a Bit 4	3	2	1	7b Bit 4	3	2	1	
1	1	0	0	1	1	0	0	Internet protocol (RFC791) (Appendix C of ISO/IECTR9577)
1	1	0	0	1	1	1	1	point to point protocol (RFC1548)
		Other						Reserved

(Note) There is a possibility to be included (octet7a and 7b) to identify User information layer 3 protocols to the address entity if the User information layer 3 protocols show "Network layer identification". Any network protocol identification defined in ISOIECTR9577 can be included. Octet 7c is not included.

Default packet size (octet 7b)

Bit 4	3	2	1	
0	1	0	0	Default packet size 16 octets
0	1	0	1	Default packet size 32 octets
0	1	1	0	Default packet size 64 octets
0	1	1	1	Default packet size 128 octets
1	0	0	0	Default packet size 256 octets
1	0	0	1	Default packet size 512 octets
1	0	1	0	Default packet size 1024 octets
1	0	1	1	Default packet size 2048 octets
1	1	0	0	Default packet size 4096 octets
Other				Reserved

Packet window size (octet 7c)

Bit 7-1 binary coding of packet window size value in the range from 1 to 127.

Figure 4.4.3.7.23 Low layer Compatibility

4.4.3.7.3.5.21 Repeat indicator (Private standard/Public standard)

The purpose of the Repeat indicator information element is to indicate how repeated information elements shall be interpreted, when included in a message. The Repeat indicator information element is included before the first occurrence of the information element which will be repeated in a message. The Repeat indicator information element is coded as shown in Figure 4.4.3.7.24.

(Note) Use of the Repeat indicator information element in conjunction with an information element that occurs only once in a message shall not of itself constitute an error.

Octet	Bit 8	7	6	5	4	3	2	1
1	1	Repeat indicator 1	0	1 Information element indicator	Repeat indication			

Repeat indication (octet 1)

Bit 4	3	2	1	
0	0	1	0	Prioritized list for selecting one possibility
Other				Reserved

Figure 4.4.3.7.24 Repeat indicator

4.4.3.7.3.5.22 Manual call origination indicator (Private standard)

Manual call origination indicator is used to report CS of manual call. It is carried as a domestic codeset that uses locking shift procedures.

This information element is coded as shown in Figure 4.4.3.7.25.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	Manual call origination indicator 1	0	0	0	0	1	0 Information element identifier
2	Manual call origination indicator content length							
3	1 Extension	Manual call content						

Manual call content (octet 3)

Bit 7	6	5	4	3	2	1	
0	0	0	0	0	0	1	A user can detect a dial tone on the PS side. (note)
Other							Reserved

(Note) If CS is connected with analog network, the CS can send address signal before 3 seconds passed since DC loop closed.

Figure 4.4.3.7.25 Manual call origination indicator

4.4.3.7.3.5.23 Communication type (Private standard)

Communication type is used when PS notifies CS whether the communication that follows this information element is speech or non-speech communication. It is carried as a domestic codeset that uses locking shift procedures.

This information element is coded as shown in Figure 4.4.3.7.26.

<table>
<tr><td>Octet</td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td colspan="7">Communication type
1 0 0 0 0 1 1
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Communication type content length</td></tr>
<tr><td>3</td><td>1
Exten
-sion</td><td colspan="7">Communication type</td></tr>
</table>

<u>Communication type (octet 3)</u>

Bit

7	6	5	4	3	2	1	
0	0	0	0	0	0	0	Speech
0	0	0	0	0	0	1	Non-speech
Other							Reserved

(Note) If this communication type is not reported from PS, CS shall regard communication type as speech.

Figure 4.4.3.7.26 Communication type

4.4.3.7.3.5.24 Display (Private standard)

The purpose of the Display information element is to supply display information that may be displayed by the user. The information contained in this element is coded in IA5 characters.

The maximum length of the Display information element depends on network. If a user receives a Display information element with a length exceeding the maximum length which the user can handle, the information element should be truncated by the user.

The Display information element is coded as shown in Figure 4.4.3.7.27.

octet	Bit 8	7	6	5	4	3	2	1
1	0	Display 0	1	0	1	0	0	0 Information element identifier
2	Length of display contents							
3〜	0	Display information (IA5 characters)						

Figure 4.4.3.7.27 Display information element

4.4.3.7.3.5.25 More data (Private standard)

The More data information element is sent by the user to the network in a "USER INFOrmation" message, and delivered by the network to the destination user in the corresponding "USER INFOrmation" message. The presence of the More data information element indicates to the destination user that another "USER INFOrmation" message will follow, containing information belonging to the same block.

The use of More data information element is not supervised by the network.

The More data information element is coded as shown in Figure 4.4.3.7.28.

Octet	Bit 8	7	6	5	4	3	2	1
1	1	More data 0	1	0	0	0	0	0 Information element identifier

Figure 4.4.3.7.28 More data information element

4.4.3.7.3.5.26 User-user (Private standard/Public standard)

The purpose of the User-user information element is to convey information between PHS users or information between PHS users and ISDN users. This information is not interpreted by the network, but rather is carried transparently and delivered to the remote user.

The User-user information element is coded as shown in Figure 4.4.3.7.29. There are no restrictions on content of the user information field.

In “USER INFOrmation” messages sent in association with a circuit-mode connection, the User-user information element has a network dependent maximum size of 35 or 131 octets. The maximum length of “USER INFOrmation” messages that is sent in a temporary or permanent user-user signalling connection, is 260 octets.

(note) The User-user information element is transported transparently between a call originating entity, e.g. a calling user and the addressed entity, e.g. a remote user or a high layer function network node addressed by the call originating entity.

Octet	Bit 8	7	6	5	4	3	2	1
1	0	1	1	1	1	1	1	0
		User-user Information element identifier						
2	Length of user-user contents							
3	Protocol discriminator							
4～	User information							

Protocol discriminator (octet 3)

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	User-specific protocol (Note 1)
0	0	0	0	0	0	0	1	OSI high layer protocols
0	0	0	0	0	0	1	0	Recommendations X.244 (Note2)
0	0	0	0	0	0	1	1	Reserved for the system management convergence function.
0	0	0	0	0	1	0	0	IA5 characters (Note 4)
0	0	0	0	0	1	0	1	Recommendations X.208/209 Coding user information (Note 5)
0	0	0	0	0	1	1	1	Standard JT-V.120 Rate adaption
0	0	0	0	1	0	0	0	RCR STD-28 call control messages
0	0	0	1	0	0	0	0	Standard JT-X25 is included, reserved for other networks or the layer 3 protocol. (Note 3)
				⁞				
0	0	1	1	1	1	1	1	
0	1	0	0	0	0	0	0	National use
0	1	0	0	0	0	0	1	National use Recommendations X.208/209 (ASN ; Abstraction sentence structure notation 1) (Note 5)
0	1	0	0	0	0	1	0	National use Common channel interface between PBXs

0	1	0	0	0	0	1	1	National use Common format of specific application identifications
0	1	0	0	0	0	1	1	National use
				⟆				
0	1	0	0	1	1	1	1	
0	1	0	1	0	0	1	1	Standard JT-X25 is included, reserved for other networks or the layer 3 protocol. (Note 3)
				⟆				
1	1	1	1	1	1	1	0	
Other								Reserve

(Note 1) The user information is structured according to user needs..
(Note 2) The user information is structured according to Recommendation X.244 which specifies the structure of X.25 call user data.
(Note 3) These values are reserved to discriminate these protocol discriminators from the first octet of a Recommendation X.25 packet including general format identifier.
(Note 4) The user information consists of IA5 characters.
(Note 5) The number of X.208 and X.209 components contained in a User-user information element as well as their semantics and use are user-application dependent and may be subject to other Recommendations.

Figure 4.4.3.7.29 User-user information element

4.4.3.7.3.5.27 Redirecting number (Private standard/Public standard)

Redirecting number is used to specify the forwarding origins of redirection of calls. The maximum length of this information element is 25 octets. Redirecting number information element is encoded as shown in Figure 4.4.3.7.30. In this information element, in that case, the first Redirecting number information element is information on last redirection of calls repeatedly in 1 message 2 times might.

<table>
<tr><td>Octet</td><td>Bit
8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td colspan="7">Redirecting number
1 1 1 0 1 0 0
Information element identifier</td></tr>
<tr><td>2</td><td colspan="8">Length of redirecting number information element contents</td></tr>
<tr><td>3</td><td>0/1
ext.</td><td colspan="3">Type of number</td><td colspan="4">Numbering plan identification</td></tr>
<tr><td>3a</td><td>0/1
ext.</td><td colspan="2">Presentation indicator</td><td colspan="2">Reserved</td><td colspan="3">Network screening indicator</td></tr>
<tr><td>3b</td><td>1
ext.</td><td colspan="3">Reserved</td><td colspan="4">Reason for diversion</td></tr>
<tr><td>4~*</td><td>0</td><td colspan="7">Number digits
(IA5 characters) (Note)</td></tr>
</table>

(Note) The number digit is expressed in the same order as the order input from octet 4. That is, the digit dialed first is input to the first octet 4.

Encode it excluding the forwarding reason as well as the Calling party number information element.

Reason for diversion (octet 3b)

Bit 4	3	2	1	
0	0	0	0	Undetermined
0	0	0	1	Call forwarding busy or called DTE busy (circuit-mode and packet-mode)
0	0	1	0	Call forwarding no reply (circuit-mode only)
0	0	1	1	Call forwarding out of zone or power off
1	0	1	0	call deflection or call forwarding by the called DTE (circuit-mode and packet-mode)
1	1	1	1	Call forwarding unconditional or systematic call redirection (circuit-mode and packet-mode)
Other				Reserved

Figure 4.4.3.7.30 Redirecting number

4.4.3.7.4 Supplementary services (Private standard/Public standard)

4.4.3.7.4.1 Supplementary service types (Private standard/Public standard)

The supplementary services provided in the personal handy phone system are shown in Table 4.4.3.7.19.

Table 4.4.3.7.19 Supplementary service types

Supplementary service	Reference
DTMF signal transmission	4.4.3.7.4.1.1
Hooking signal transmission (note 1)	4.4.3.7.4.1.2
Supplementary service within the CS - PS loop (note 1)	4.4.3.7.4.1.3
Pause signal transmission (note 1)	4.4.3.7.4.1.4
PHS User-to-User Signalling (PHS-UUS) supplementary service (note 2)	4.4.3.7.4.1.5

(Note 1) Only in private system
(Note 2) Only in public system

4.4.3.7.4.1.1 DTMF signal transmission (Private standard/Public standard)

(1) Definition

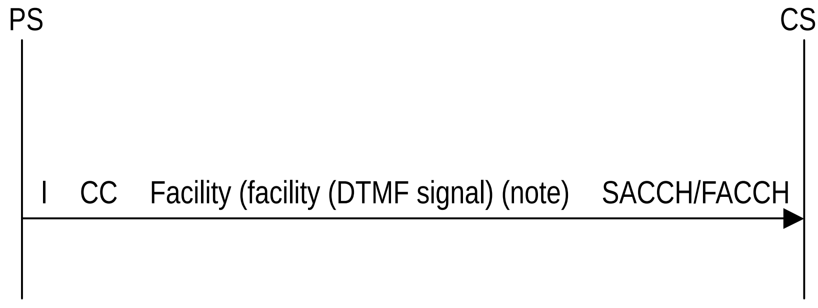
DTMF signal transmission is a function by which DTMF signals are transmitted from PS.
DTMF signal information are transmitted to the CS side as a call control (CC) message, and DTMF signals are generated on the CS side.

(2) Sequence

The DTMF signal transmission sequence is shown in Figure 4.4.3.7.30.

(3) Other

The conditions in the SDL diagrams must be satisfied for both CS and PS when the DTMF signal transmission function is supported.



(Note) Facility information element is mandatory.

Figure 4.4.3.7.30 DTMF signal transmission sequence

4.4.3.7.4.1.2 Hooking signal transmission (Private standard)

(1) Definition

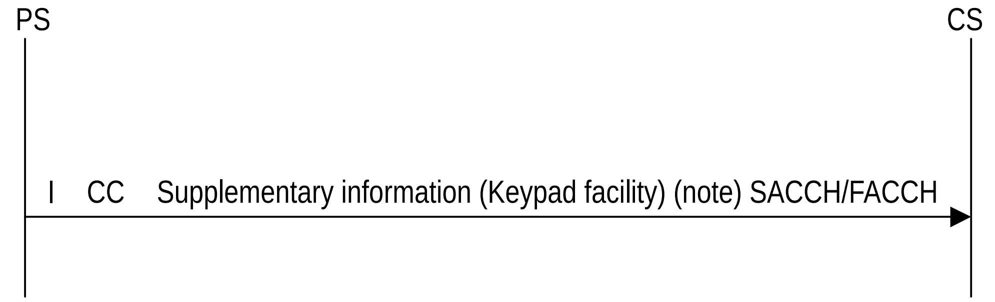
Hooking signal transmission is a function for transmitting the hooking signal information from PS. Hooking signal information are transmitted to the CS side as included in a call control (CC) message, and the hooking signal is generated in the CS side.

(2) Sequence

The hooking signal transmission sequence is shown in Figure 4.4.3.7.31.

(3) Other

To use the hooking signal information is a functional option.



(Note) IA5 character ESC (1B) + H (48) is defined as the hooking signal information.

Figure 4.4.3.7.31 Hooking signal transmission sequence

4.4.3.7.4.1.3 Supplementary services within the CS - PS loop (Private standard)

(1) Definition

The various supplementary services within the CS - PS loop are started up by messages from PS and CS.
For details, refer to the Appendix AL materials.

(2) Sequence

For details on each supplementary services within the CS - PS loop, refer to the Appendix AL materials.

(3) Other

The supplementary service within the CS - PS loop are described. The following items are included:

- Hold within the CS - PS loop
- Call transfer within the CS - PS loop
- Call waiting within the CS - PS loop
- Conference call within the CS - PS loop
- Hold within the CS - multiple PS
- Call type notification within the CS - PS loop
- PS remote control function

4.4.3.7.4.1.4 Pause signal transmission (Private standard)

(1) Definition

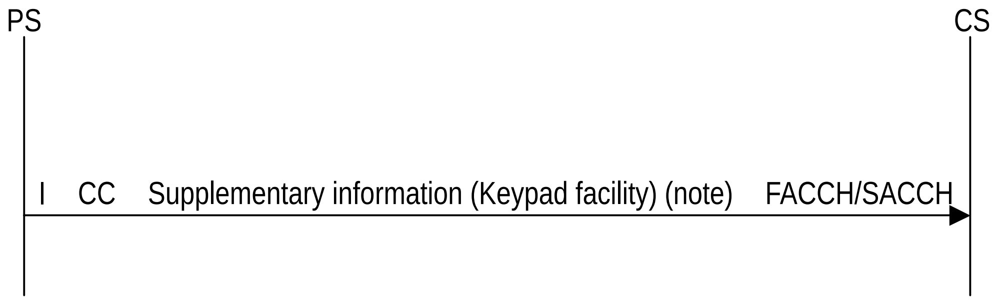
Pause signal transmission is a function for transmitting the pause signal information from PS.
Pause signal information are transmitted to the CS side as included in a call control (CC) message, and the pause signal is generated in the CS side.

(2) Sequence

The pause signal transmission sequence is shown in Fig. 4.4.3.7.32.

(3) Other

To use the pause signal information is a functional option.



(Note) IA5 character ESC (1B) + P (50) is defined as the pause signal information.

Figure 4.4.3.7.32 Pause signal transmission sequence

4.4.3.7.4.1.5 PHS User-to-User Signaling (PHS-UUS) supplementary service (Public standard)

(1) Definition

The PHS User-to-User Signaling (PHS-UUS) supplementary service allows PS to send/receive a limited amount of information to/from another PS over the communication channnel in association with a call to the other PS.

(2) Sequence

A peculiar sequence to PHS User-to-User Signaling (PHS-UUS) supplementary service is unnecessary.

(3) Other

For details, refer to the Appendix AM materials.

4.4.3.7.5 State transition tables (Private standard/Public standard)

The state transition tables of the functional operations executed by the facility message and facility information element are shown below.

4.4.3.7.5.1 State transition table description method (Private standard/Public standard)

The functional operation state transition table description method is shown in Figure 4.4.3.7.33.

Functional operation state	Call state (a/b)	(Transmittable signals)	(4) Received signal	
			b: CONN	b: DISC
1 Recalling state	2 Null/ Call acceptance	b: SET UP (1 - 1)	b: CONN ACK (omittable) (0 - 2)	b: REL → (b: REL COMP) (0 - 0)

(2) Functional operation state (3) Call state (a/b)

(1) Present state (5) (Re-)action and next state number

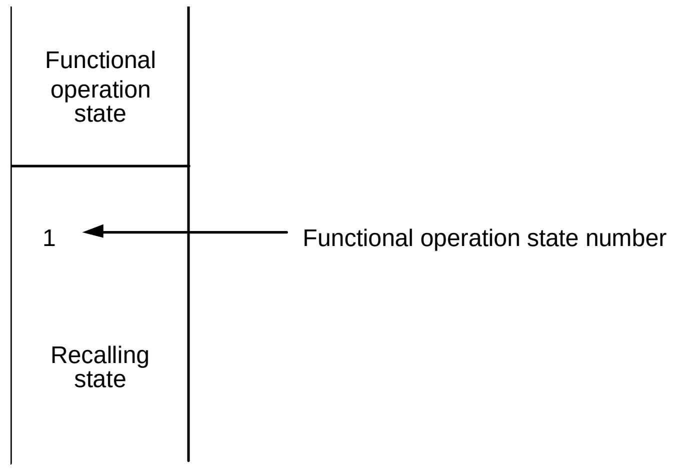
Figure 4.4.3.7.33 State transition table description method

(1) Present state

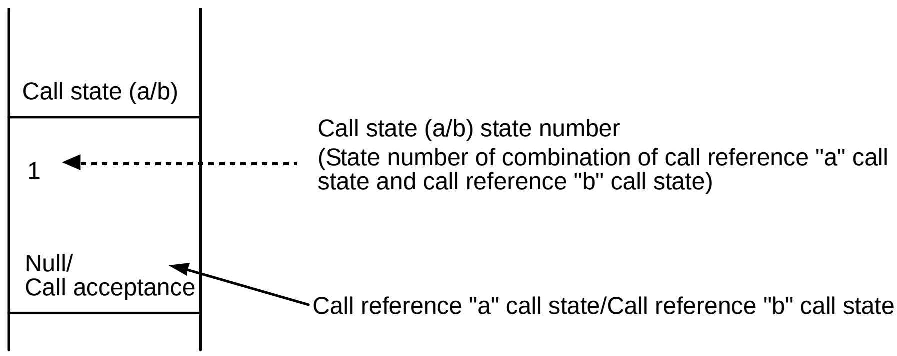
The present state is a combination of functional operation and call state.

(2) Functional operation state

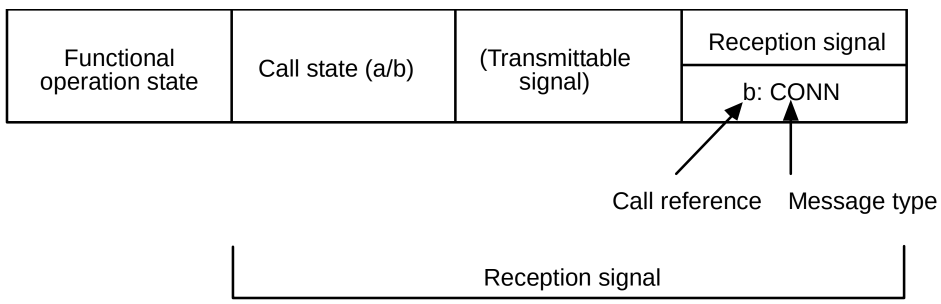
Describes the functional operation state.



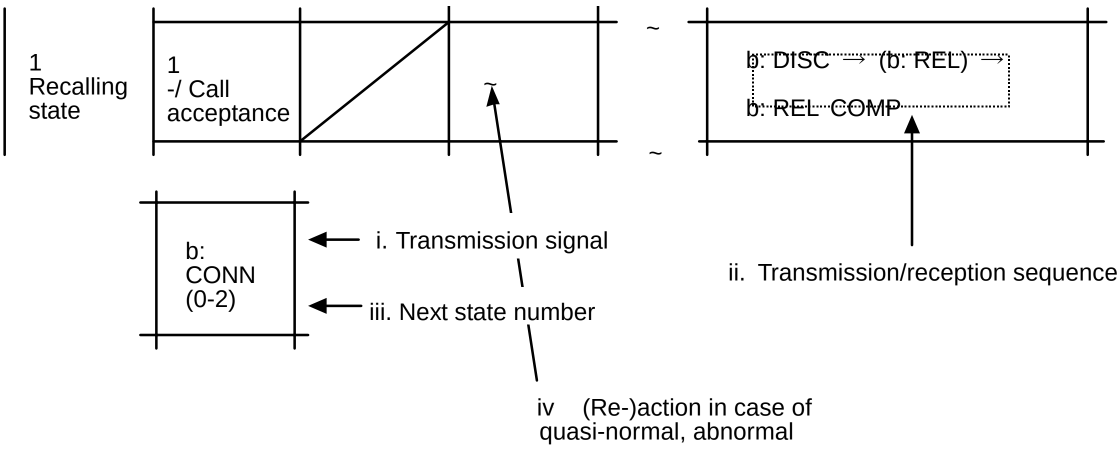
(3) Call state (a/b)



(4) Reception signal



(5) (Re-)action and next state number



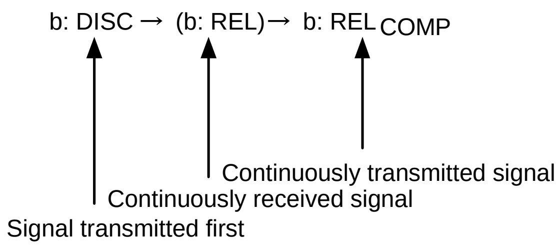
The series of transmittable signals shows the transmittable signals and next state number in each state. The series of reception signals shows the (re-)action (transmission signal) to each reception signal and the next state number in each state.

i. Transmission signal

b: CONN

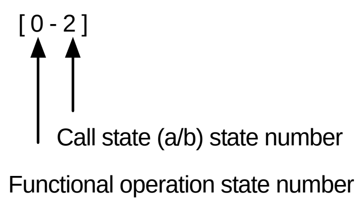
Call reference Message type

ii. Transmission/reception sequence



The right pointed arrow indicates continuity. Parentheses describe that it is a received signal.

iii. Next state number



iv. Reaction in case of quasi-normal, abnormal

~ : According to RCR standard error procedure, or quasi-normal procedure.

4.4.3.7.5.2 Functional operation state (Private standard/Public standard)

(1) Recalling-type channel switching

The PS-side state transition table is shown in Table 4.4.3.7.20, and the CS-side state transition table is shown in Table 4.4.3.7.21.

(2) Recalling-type channel switching for private system (Private standard)

The PS-side state transition table is shown in Table 4.4.3.7.20, and the CS-side state transition table is shown in Table 4.4.3.7.21.

Table 4.4.3.7.20 Recalling-type channel switching state (PS side)
/ Recalling-type channel switching for private system state (PS side)

a: Call reference of old channel
b: Call reference of new channel

Functional operation state	Call state (a/b)	(Transmittable signal)	Reception signal b: CALL PROC	Reception signal b: CONN	Reception signal b: DISC	Reception signal b: REL COMP
0 Null	0 Null/Null		~	~	~	~
	1 Active/Null	b: SETUP [1 - 1]				
	2 Null/Active		~	~	~	~
1 Recalling state (note)	1 Null/Call initiated		[1 - 2]	~	~	[0 - 0]
	2 Null/Outgoing call proceeding		~	b: CONN ACK (omittable) [0 - 2]	b: REL → (b: REL COMP) [0 - 0]	~

(Note) If the CC call state enters null in a quasi-normal process, the functional operation state also enters null.

Table 4.4.3.7.21 Recalling-type channel switching state (CS side of new channel) (note 1) /Recalling-type channel switching for private system state (CS side of new channel)(note 1)

a: Call reference of old channel
b: Call reference of new channel

Functional operation state	Call state (a/b)	(Transmittable signal)	Reception signal b: SETUP	Reception signal b: CONN ACK
0 Null	0 –/Null		[0 - 1]	~
	1 –/Call initiated	b: CALL PROC [1 - 1]		
		b: REL COMP [0 - 0]		
	2 –/Active		~	[0 - 2]
1 Recalling state (note 2)	1 –/Outgoing call proceeding	b: DISC → (b: REL) → b: REL COMP [0 - 0]		
		b: CONN [0 - 2]		

(Note 1) The CS side of the old channel is not described because there are no processes related to facility.
(Note 2) If the CC call state enters null in a quasi-normal process, the functional operation state also enters null.

Control Sequences

4.4.3.8 Control sequences (Private standard/Public standard)

This section shows the standard control sequences required in the standard.

In the description pertaining to the layer 3 control procedure, the control order is [1], [2], [3] ..., and the terms "user" and "network" are used.

User: Pertains to PS0, PS1, PS2, PS3, TA, TE1, TE2 shown in section 2.2; which equipment the user appearing in the text pertains to depends on implementation of each piece of equipment.

Network: Pertains to the cell station (CS) and communication networks connected to the cell station; what the network appearing in the text pertains to depends on the implementation of the cell station and on the services provided by the communication network.

4.4.3.8.1 Outgoing call (Private standard/Public standard)

4.4.3.8.1.1 En-bloc sending (Private standard/Public standard)

The control sequence of en-bloc sending is shown in Figure 4.4.3.8.1.

The control order is as follows.

[1] Call request (CC)

Call establishment is initiated by the user transmitting a setup message (CC) to the network. However, if outgoing call is restricted by restriction information in the system information broadcasting message (BCCH), it operates according to the restriction information.

[2] Call proceeding (CC)

When the network receives the setup message (CC) and confirms that call acceptance is suitable, the network sends a call proceeding message (CC) to the user to indicate that the call is being processed, and it enters "outgoing call proceeding" state.

When the user receives the call proceeding message (CC), it enters "outgoing call proceeding" state.

[3] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives it reports notification information by a definition information response message (RT).

[4] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[5] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

[6] MM function request (MM)

A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[7] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing. If the authentication result is OK, call connection continues.

[8] Call confirmation indication (CC)

If the network receives an indication of the fact that destination user alerting was initiated, the network transmits an alerting message (CC) to the user.

[9] Call connected (CC)

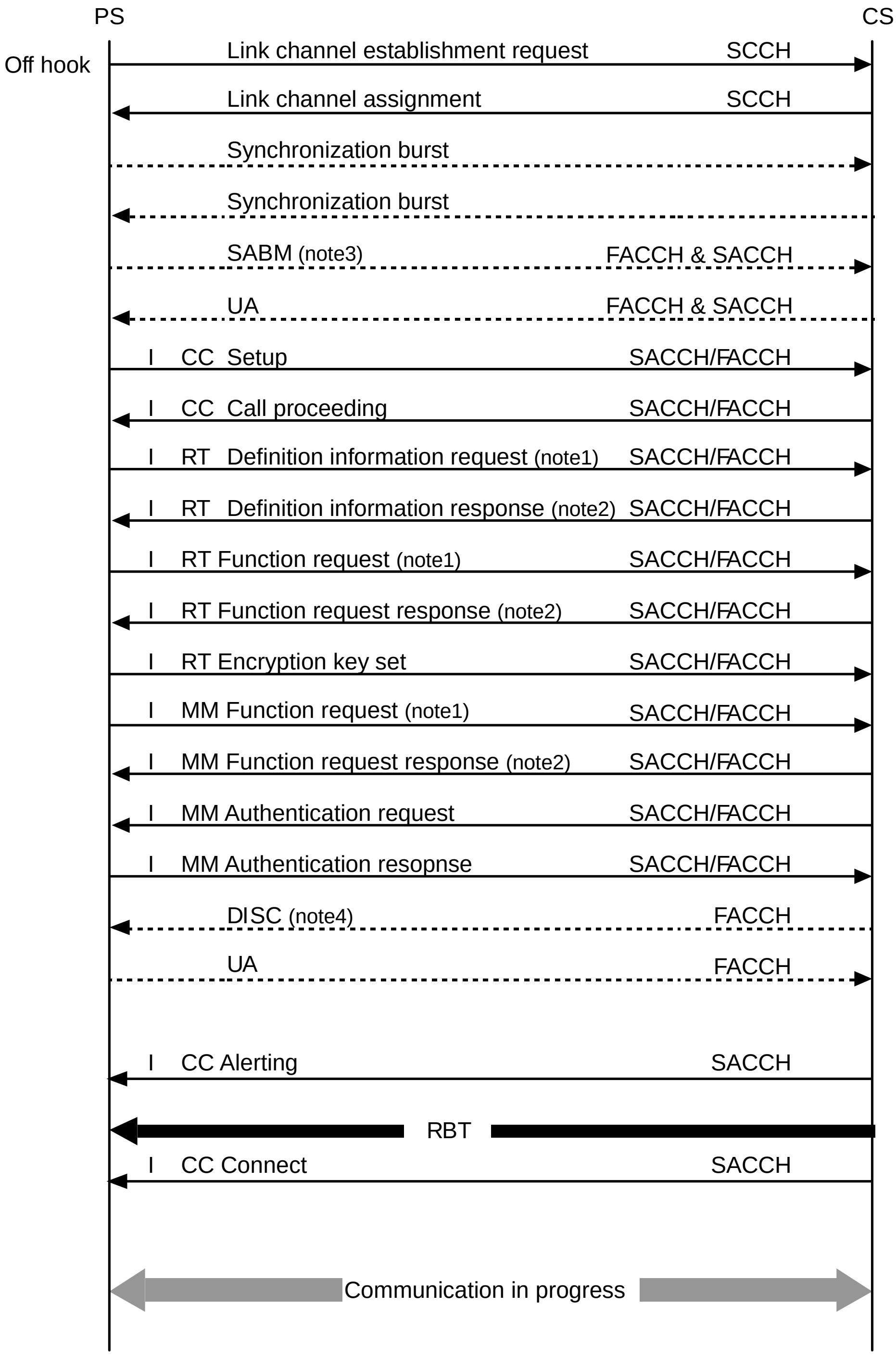
If the network receives an indication of the fact that the call was accepted by the destination user, it transmits a connect message (CC) to the user.

[10] Call reject (RT, MM, CC)

If it is indicated by the network or destination user that the call cannot be accepted, the call release procedure is initiated according to the regulations of call clearing.

(Note) Interworking report at origination-side interface

During call establishment, if CS originated a call to a non-ISDN network or if it received a message containing a progress indicator from ISDN, the progress indicator information element is returned to the origination user by a call control message (call proceeding, alerting, connect) or a progress message.



(Note 1) This control signal can be omitted as necessary.

(Note 2) This control signal is for the previous control signal with the (note 1) attached. It is transmitted only when the relevant control signal is received.

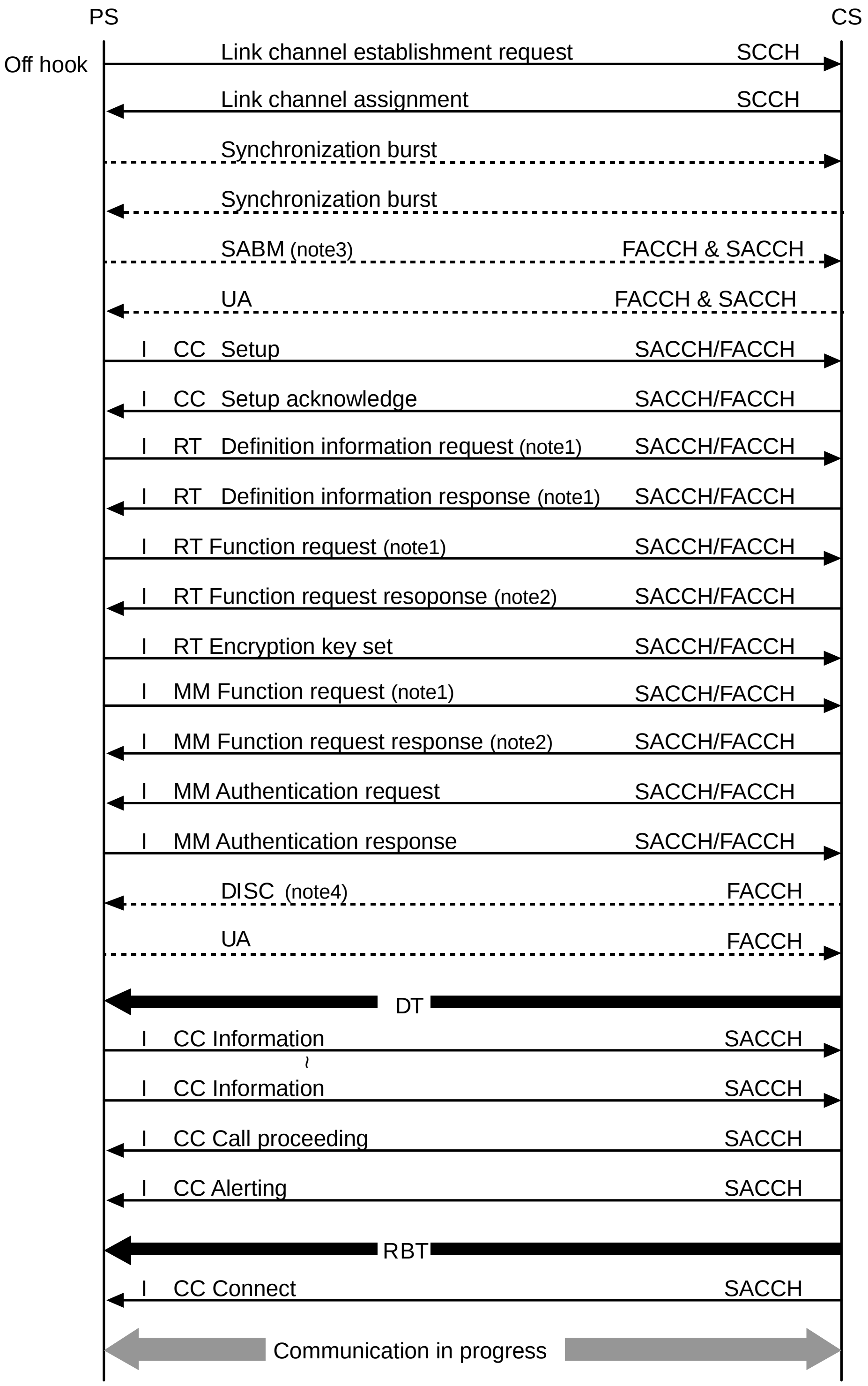
(Note 3) The layer 3 sequence of the service channel establishment phase is activated after the FACCH or SACCH layer 2 multiframe acknowledged operation mode is established.

(Note 4) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.

Figure 4.4.3.8.1 Control sequence (en-bloc sending)

4.4.3.8.1.2 Overlap sending (Private standard)

The control sequence of overlap sending is shown in Figure 4.4.3.8.2.



(Note 1) This control signal can be omitted as necessary.

(Note 2) This control signal is for the previous control signal with the (note 1) attached. It is transmitted only when the relevant control signal is received.

(Note 3) The layer 3 sequence of the service channel establishment phase is activated after the FACCH or SACCH layer 2 multiframe acknowledged operation mode is established.

(Note 4) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.

(Note 5) Overlap sending is a functional option.

Figure 4.4.3.8.2 Control sequence (overlap sending)

4.4.3.8.2 Incoming call (Private standard/Public standard)

The control sequence of incoming call is shown in Figure 4.4.3.8.3.

The control order is as follows.

[1] Incoming call request

The network indicates incoming call by transmitting a paging message (PCH) to the user.

The user receives the paging message (PCH), and establishes LCH.

[2] Incoming call response (RT)

After LCH establishment, the user transmits a paging response message (RT) to the network.

[3] Call present(CC)

The network which has received the paging response message (RT) transmits a setup message (CC).

[4] Response to setup (CC)

The user which has received the setup message (CC) responds by a call proceeding message (CC).

[5] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives this, reports notification information by a definition information response message (RT).

[6] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[7] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

[8] MM function request (MM)

A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[9] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing. If the authentication result is OK, call connection continues.

[10] Call received (CC)

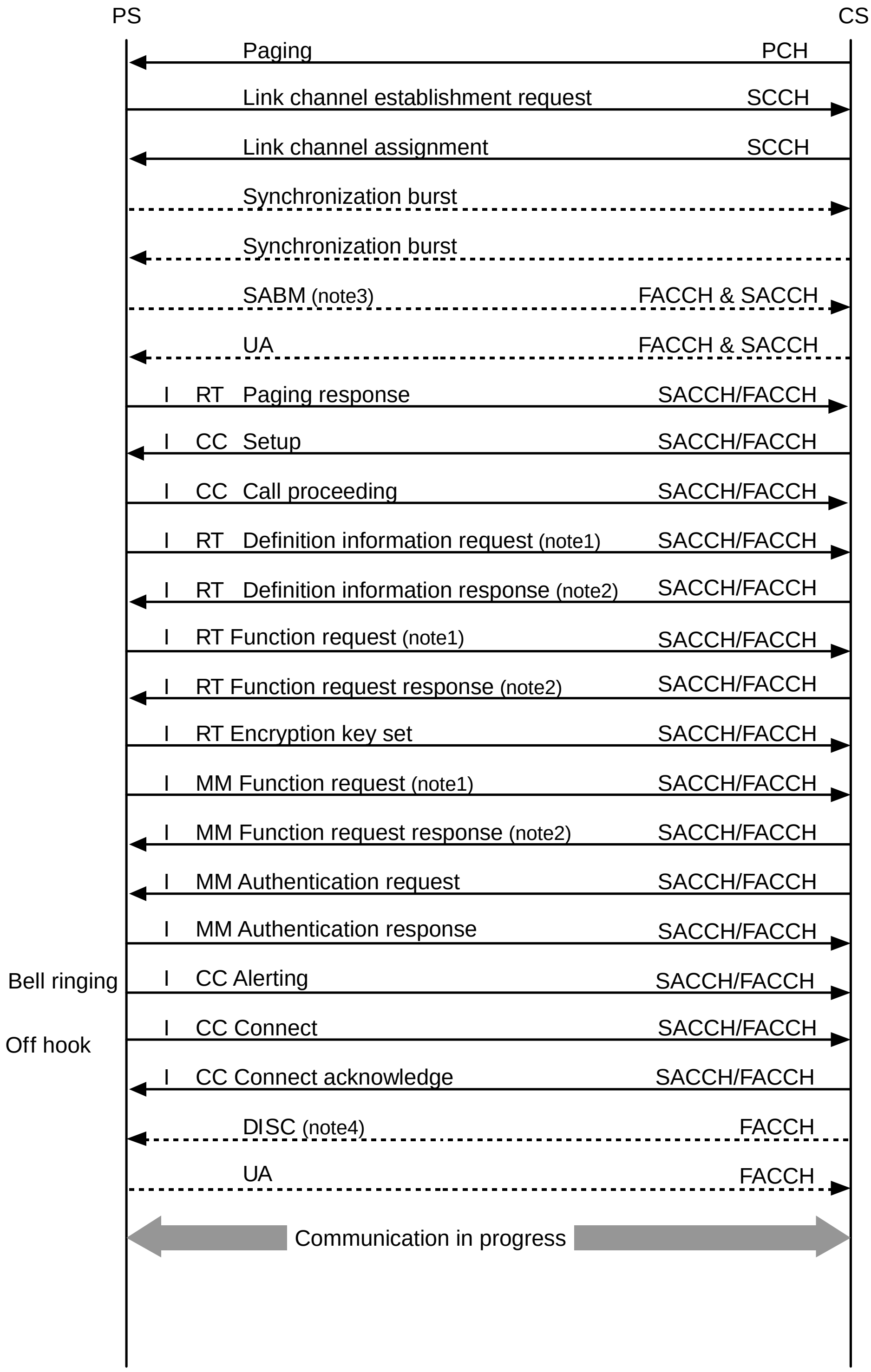
The user that sent the authentication response message (MM) transmits an alerting message (CC) or connect message (CC). (By judgment of user)

[11] Call accept (CC)

If the user goes off hook after an alerting message (CC) is transmitted, the user reports acceptance of the incoming call by transmitting a connect message (CC) to the network.

[12] Active indication (RT, MM, CC)

A network which has received a connect message (CC) transmits a connect acknowledge message (CC) to the user. The user receives a connect acknowledge message (CC) which indicates that the circuit switched connection was completed, and it enters "active" state.



(Note 1) This control signal can be omitted as necessary.
(Note 2) This control signal is for the previous control signal with the (note 1) attached. It is transmitted only when the relevant control signal is received.
(Note 3) The layer 3 sequence of the service channel establishment phase is activated after the FACCH or SACCH layer 2 multiframe acknowledged operation mode is established.
(Note 4) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.

Figure 4.4.3.8.3 Control sequence (incoming call)

4.4.3.8.3 Disconnect (Private standard/Public standard)

The control sequence of disconnect is shown in Figures 4.4.3.8.4 and 5.

(1) PS side disconnect

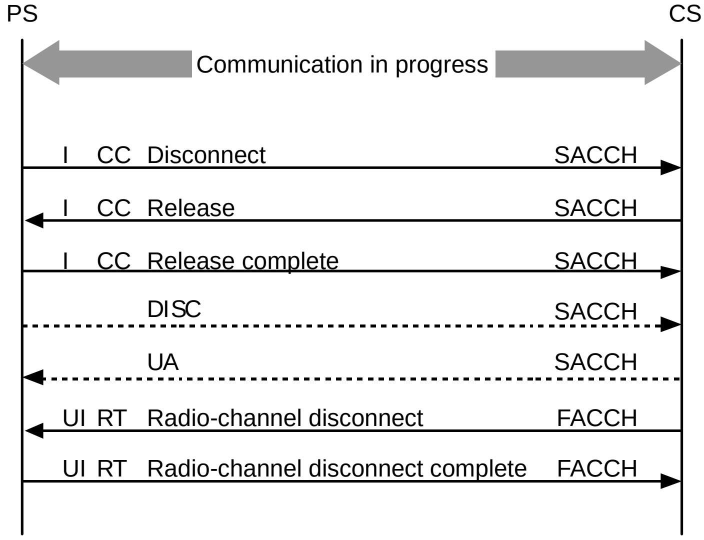


Figure 4.4.3.8.4 Control sequence (PS side disconnect)

(2) CS side disconnect

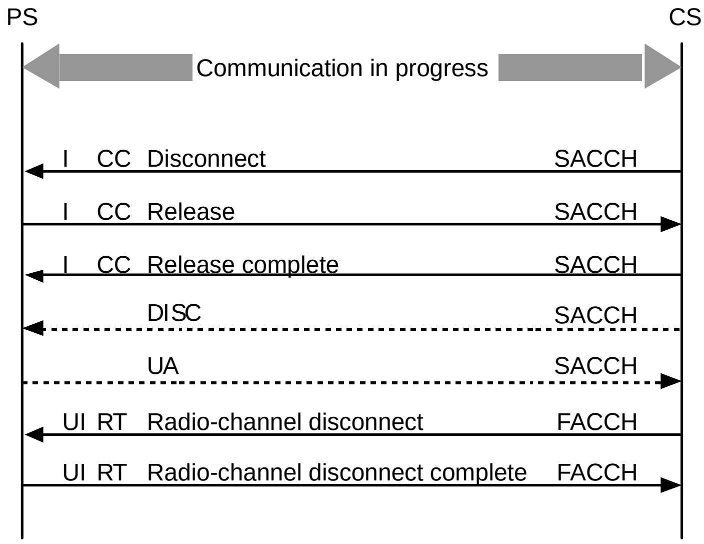


Figure 4.4.3.8.5 Control sequence (CS side disconnect)

4.4.3.8.4 Location registration (Private standard/Public standard)

The control sequence of location registration is shown in Figure 4.4.3.8.6.

The control order is as follows.

[1] Location registration request (MM)

Location registration is initiated by the user transmitting a location registration request message (MM) to the network. However, if location registration is restricted by restriction information in the system information broadcasting message (BCCH), it operates according to the restriction information.

[2] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives it reports the notification information by a definition information response message (RT).

[3] RT function request (RT)

A user that has indicated that it performs an RT function request, requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[4] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

[5] MM function request (MM)

A user that has indicated that it performs an MM function request, requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[6] Location registration area report (MM)

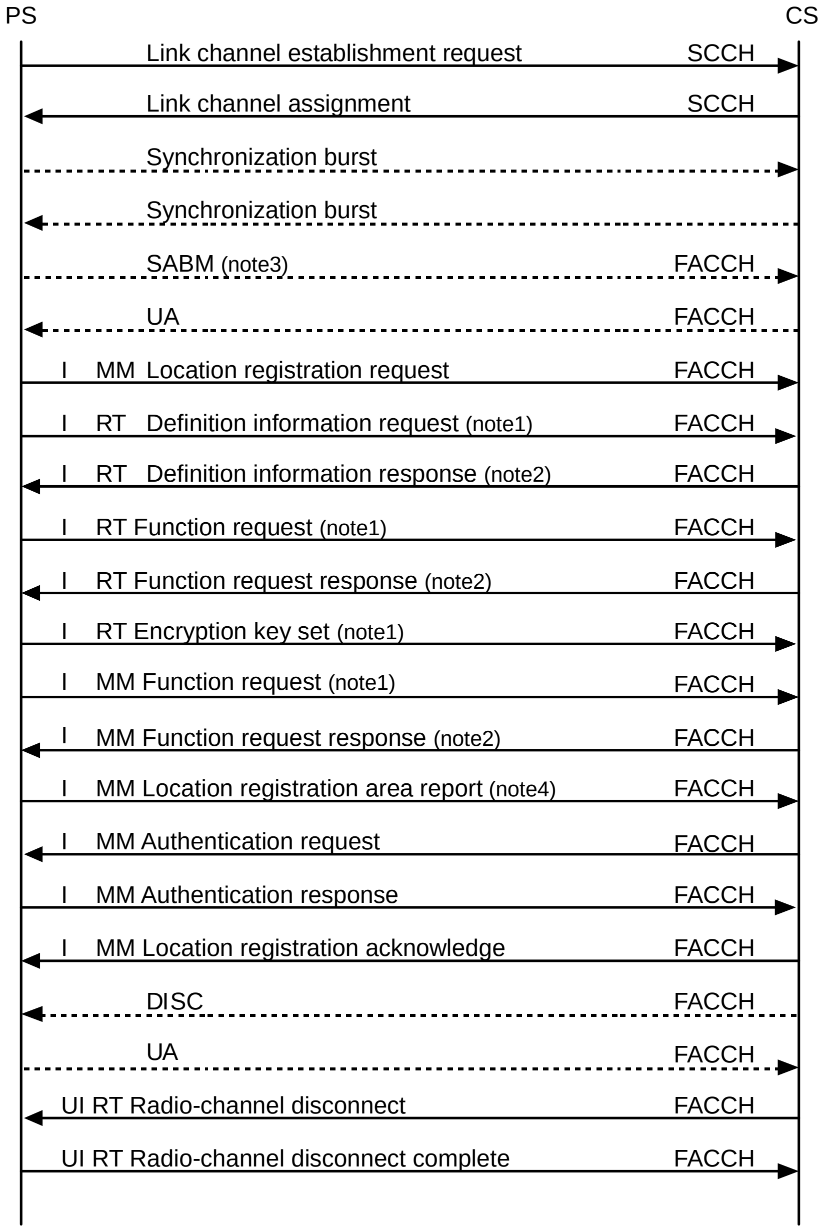
If the user registers the location by the paging area method with PS indication in a private system, the user reports the CS-ID that the user wants to indicate and the reception level from the indicated CS, to the network by a location registration area report message (MM).

[7] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is NG, the network returns a location registration reject message (MM) and rejects location registration procedures. If the authentication result is OK, the network continues location registration procedures.

[8] Location registration acknowledge (MM)

If the network receives an indication that location registration ended normally, it transmits a location registration acknowledge message (MM) to the user. If the network receives an indication that location registration could not be accepted, it transmits a location registration reject message (MM) to the user.



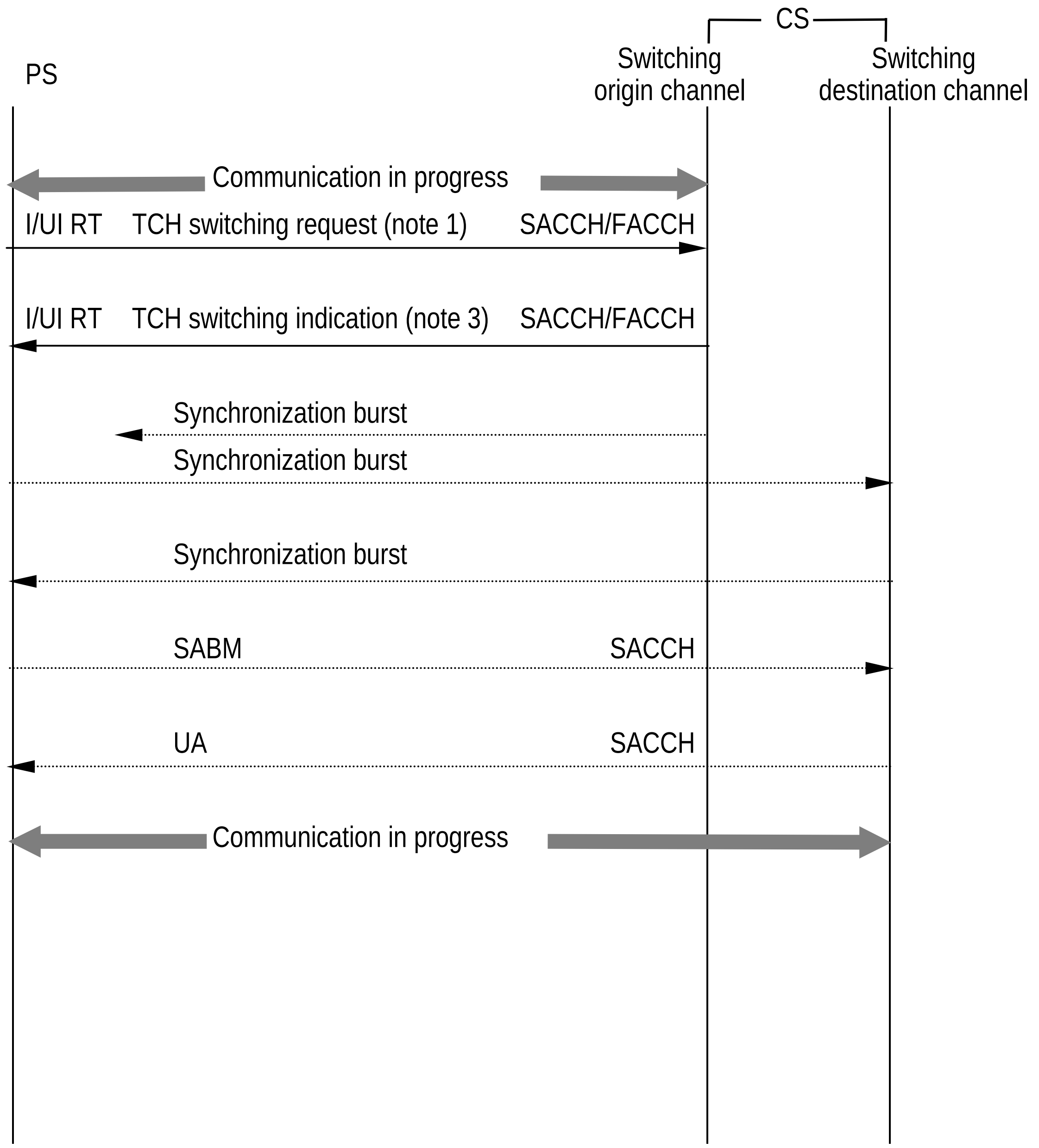
(Note 1) This control signal can be omitted as necessary.
(Note 2) This control signal is for the previous control signal with the (note 1) attached. It is transmitted only when the relevant control signal is received.
(Note 3) The layer 3 sequence of the service channel establishment phase is activated after the FACCH layer 2 multiframe acknowledged operation mode is established.
(Note 4) This control signal is transmitted only when the PS registers the location by the paging area method with PS indication in a private system.

Figure 4.4.3.8.6 Control sequence (location registration)

4.4.3.8.5 Channel switching during communication (Private standard/Public standard)

4.4.3.8.5.1 Channel switching during communication (switching on same CS)
(Private standard/Public standard)

The control sequence is shown in Figure 4.4.3.8.7



(Note 1) Unnecessary in case of CS activation.
(Note 2) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 3) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.7 Control sequence (channel switching during communication (switching on same CS))

4.4.3.8.5.2 Channel switching during communication (switching to other CS : PS recalling-type)
(Private standard/Public standard)

The control sequence is shown in Figure 4.4.3.8.8.

The control order is as follows.

[1] Recalling-type handover request (CC)

Handover is initiated by the user transmitting a setup message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) to the network.

[2] Recalling-type handover proceeding (CC)

When the network receives the setup message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) and confirms that call acceptance is suitable, the network sends " outgoing call proceeding (CC) : Recalling (functional operation) " state.
When the user receives the call proceeding message (CC), it enters " outgoing call proceeding (CC) : Recalling (functional operation) " state.

The network that receives the setup message (CC) judges whether or not the authentication reciphering pattern obtained using the authentication key in the home memory of the user agrees with authentication ciphering pattern reported from the user by facility information element. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing. If the authentication result is OK, handover continues.

Only in a private system, the network can do the authentication with the authentication request message (MM) and the authentication response message (MM) by the judgment of the network, without the reference of the authentication ciphering pattern in the setup message (facility : Private recalling-type channel switching) (CC).

[3] RT functional request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[4] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

[5] MM function request (MM)

A user that has indicate that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

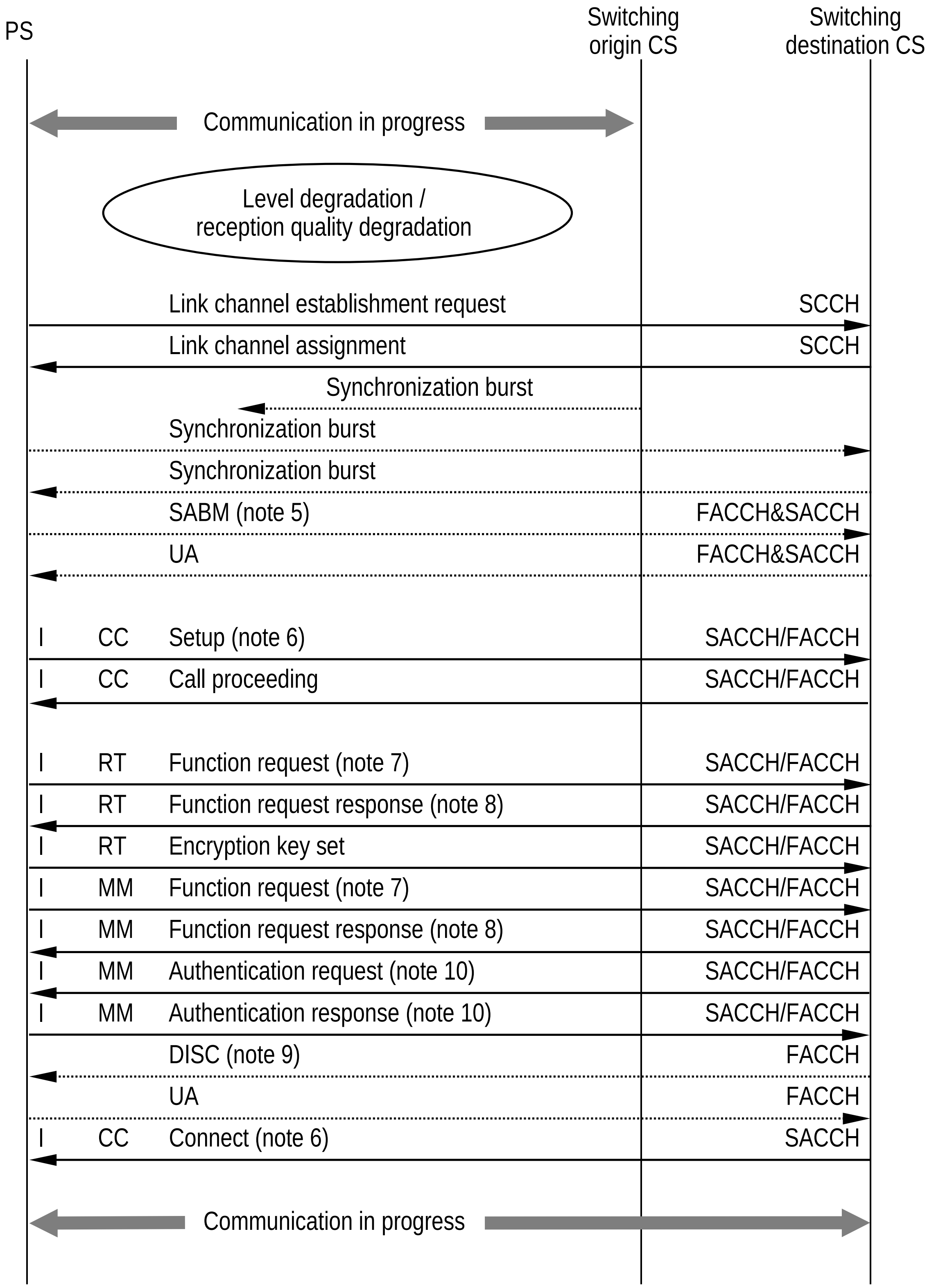
[6] Authentication (MM)

In a private system, if the network does not do the authentication by the authentication ciphering pattern in the setup message (facility : Private recalling-type channel switching) (CC) by the judgment of the network, the authentication procedure is as follows. In the case, the user follows the request the network.

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is NG, the network returns a location registration reject message (MM) and rejects location registration procedures. If the authentication result is OK, the network continues handover procedures.

[7] Call connected (CC)

If the network receives an indication of the that recalling-type handover was accepted, it transmits a connect message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) to the user. The user who received the connect message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) terminates handover normally, and enters “ active “ state.


PS
Switching origin CS
Switching destination CS
Communication in progress
Level degradation / reception quality degradation
Link channel establishment request
SCCH
Link channel assignment
SCCH
Synchronization burst
Synchronization burst
Synchronization burst
SABM (note 5)
FACCH&SACCH
UA
FACCH&SACCH
I CC Setup (note 6)
SACCH/FACCH
I CC Call proceeding
SACCH/FACCH
I RT Function request (note 7)
SACCH/FACCH
I RT Function request response (note 8)
SACCH/FACCH
I RT Encryption key set
SACCH/FACCH
I MM Function request (note 7)
SACCH/FACCH
I MM Function request response (note 8)
SACCH/FACCH
I MM Authentication request (note 10)
SACCH/FACCH
I MM Authentication response (note 10)
SACCH/FACCH
DISC (note 9)
FACCH
UA
FACCH
I CC Connect (note 6)
SACCH
Communication in progress

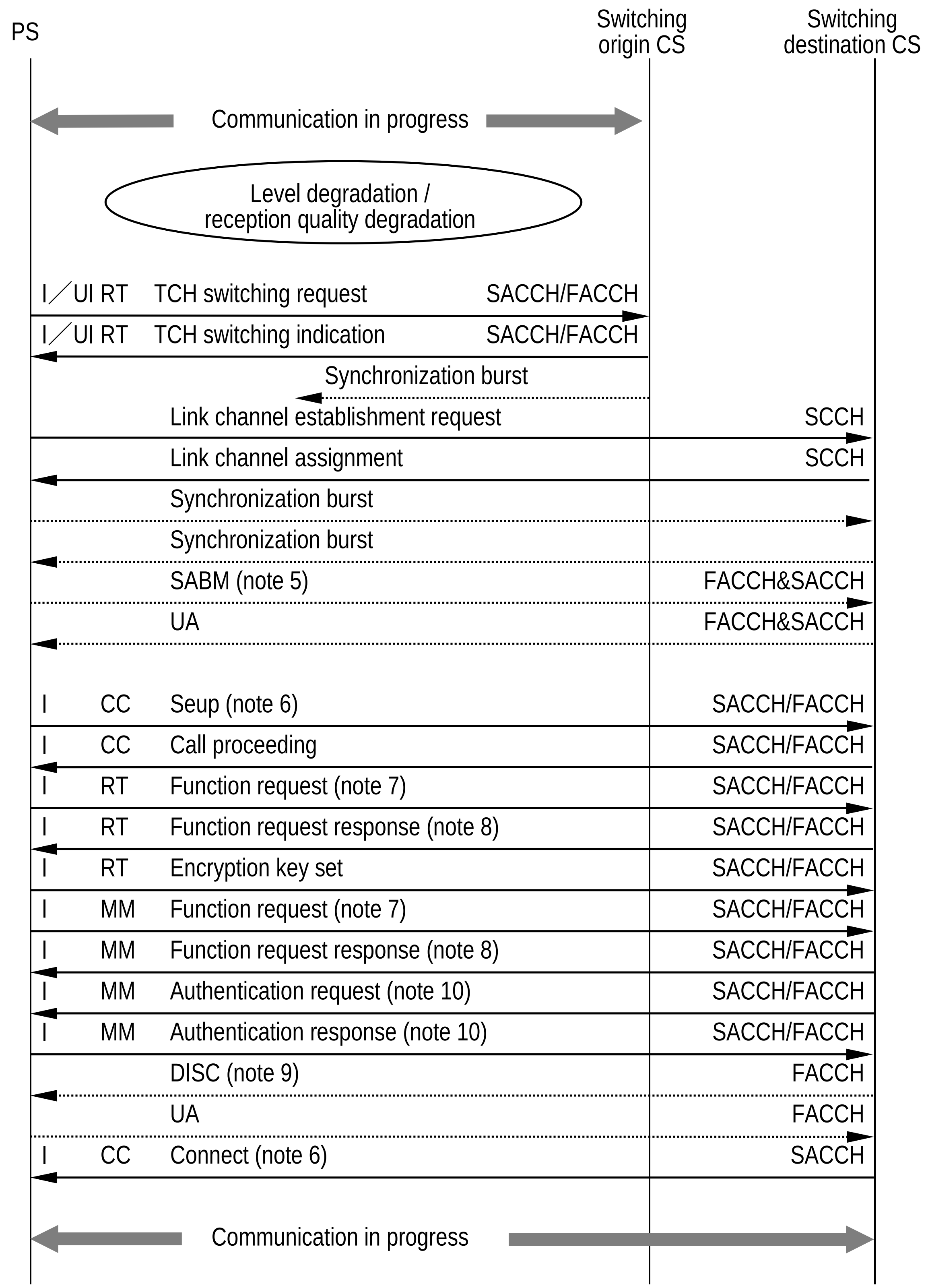
(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT functions requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitting only in a private system.

Figure 4.4.3.8.8 Control sequence (channel switching during communication (switching to other CS : PS recalling-type))

4.4.3.8.5.3 Channel switching during communication (switching to other CS : Recalling-type with PS request) (Private standard/ Public standard)

The control sequence is shown in Figure 4.4.3.8.9.

The control order is the same as that explained in section 4.4.3.8.5.2.



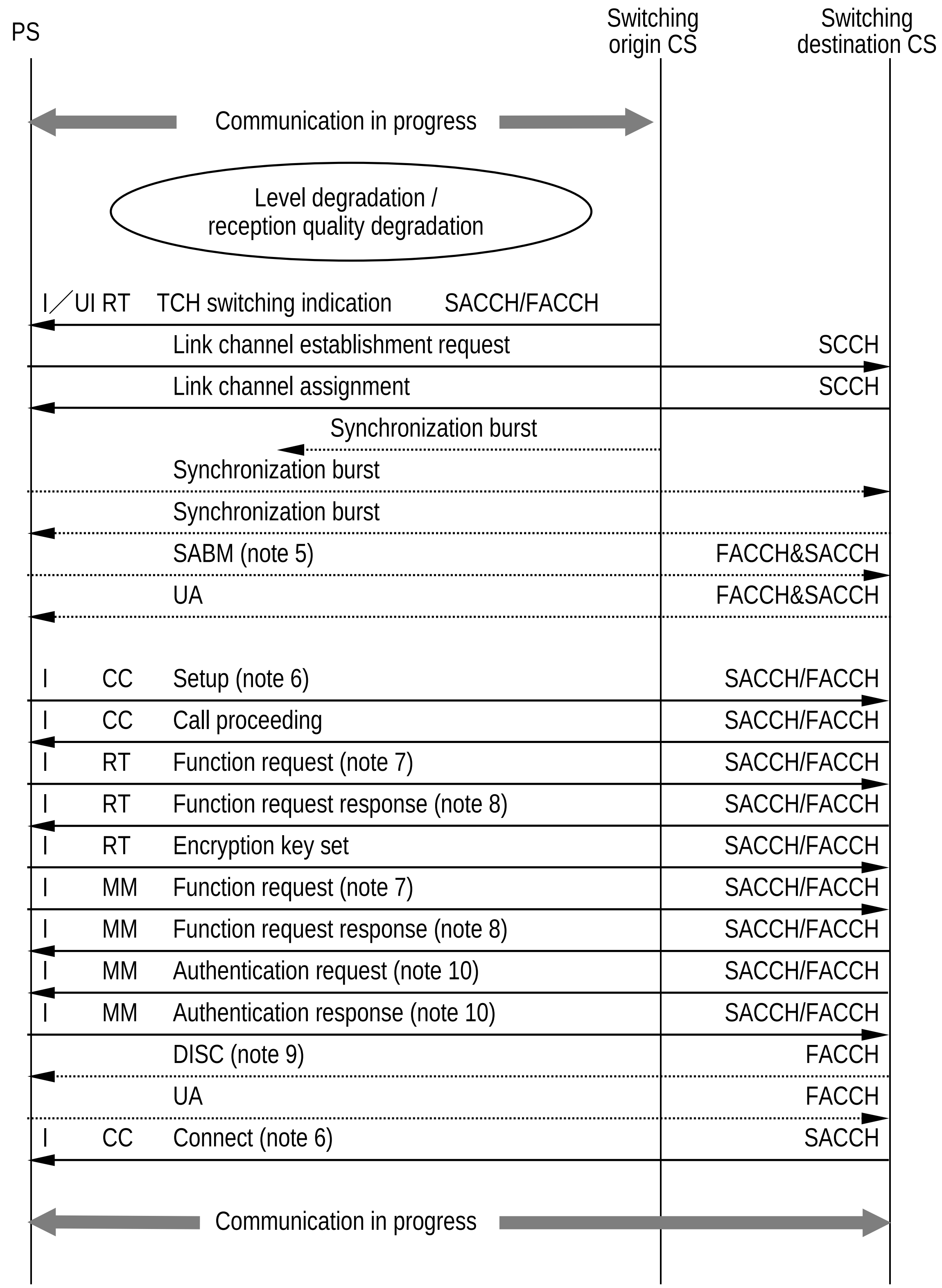
(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT functions requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitting only in a private system.

Figure 4.4.3.8.9 Control sequence (channel switching during communication (switching to other CS : Recalling-type with CS request))

4.4.3.8.5.4 Channel switching during communication (switching to other CS : Recalling-type with CS indication) (Private standard/Public standard)

The control sequence is shown in Figure 4.4.3.8.10.

The control order is the same as in section 4.4.3.8.5.2.

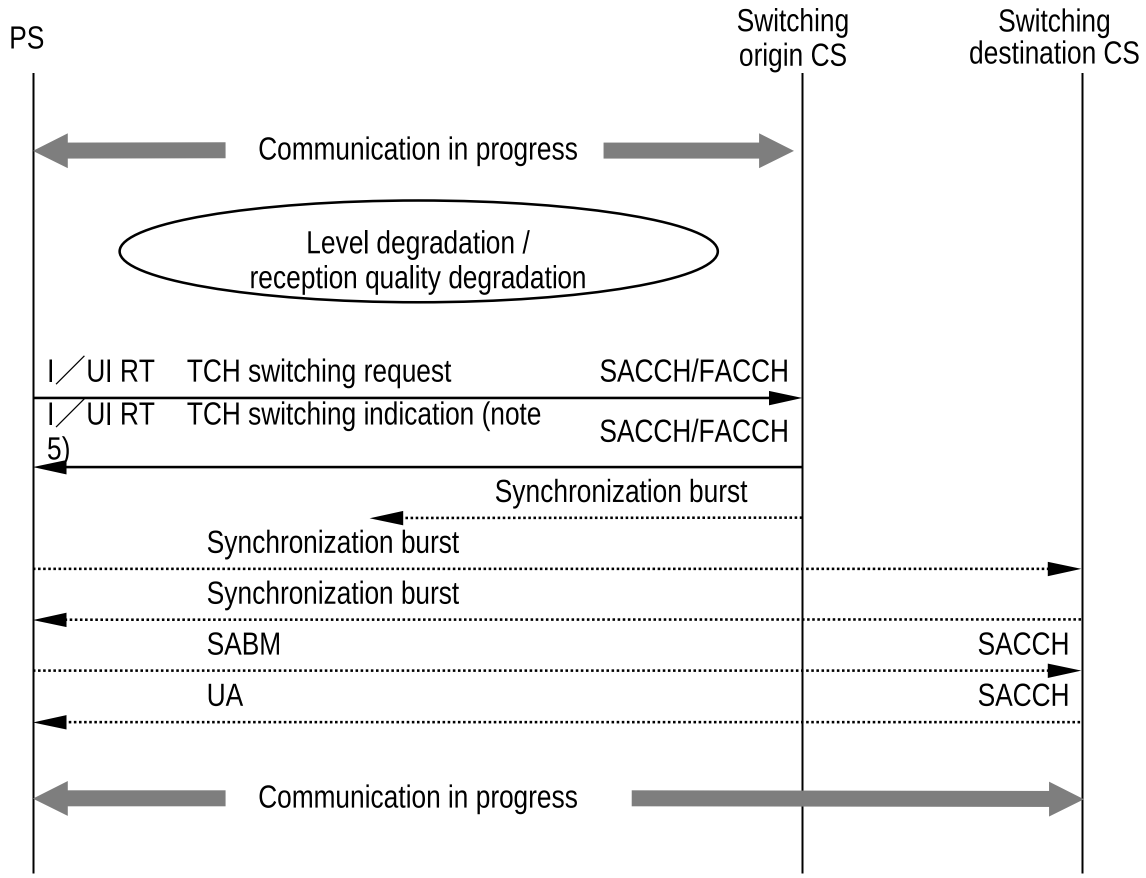


(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT functions requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitting only in a private system.

Figure 4.4.3.8.10 Control sequence (channel switching during communication (switching to other CS : Recalling-type with CS indication))

4.4.3.8.5.5 Channel switching during communication (switching to other CS : TCH switching-type with PS request) (Private standard/Public standard)

The control sequence is shown in Figure 4.4.3.8.11

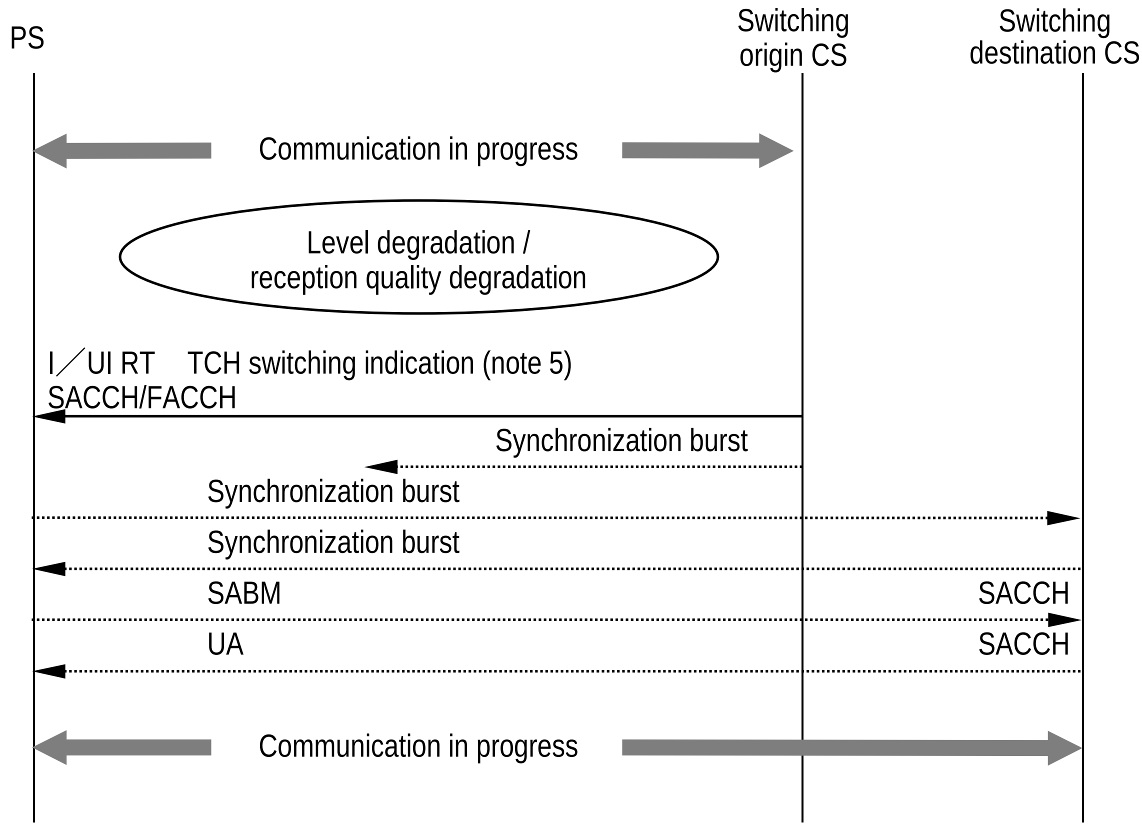


(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same. (In this case, refer to Figure 4.4.3.8.7)
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT functions requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible.
(Note 4) In a public system, this switching is a functional option.
(Note 5) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.11 Control sequence (channel switching to other CS : TCH switching-type with PS request))

4.4.3.8.5.6 Channel switching during communication (switching to other CS : TCH switching-type with CS indication) (Private standard/Public standard)

The control sequence is shown in Figure 4.4.3.8.12.

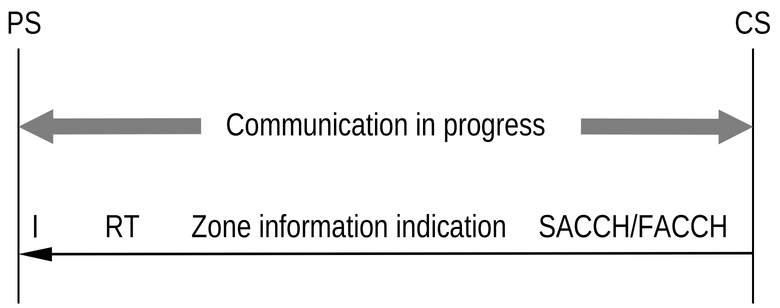


(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same. (In this case, refer to Figure 4.4.3.8.7)
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT functions requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible.
(Note 4) In a public system, this switching is a functional option.
(Note 5) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.12 Control sequence (channel switching during communication (switching to other CS : TCH switching-type with CS indication))

4.4.3.8.6 Zone information indication (Private standard/Public standard)

The control sequence is shown in Figure 4.4.3.8.13



(Note) If " with zone information indication function " is specified by the RT function request, the zone information indication is reported from CS in the communication phase.

Figure 4.4.3.8.13 Control sequence (zone information indication)

4.4.3.8.7 Zone paging (Private standard)

The control sequence of zone paging is shown in Figure 4.4.3.8.14.

The control order is as follows.

[1] Incoming call request

The network indicates incoming call by transmitting a paging message (PCH) to the user.
The user receives the paging (PCH), and rings without establishing LCH.

[2] Incoming call response (RT)

If the user goes off hook, after LCH establishment, the user transmits a paging response message (RT) to the network.

[3] Call present (CC)

The network which has received the paging response message (RT) transmits a setup message (CC).

[4] Response to setup (CC)

The user which has received the setup message (CC) responds by a call proceeding message (CC).

[5] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives this, reports notification information request (RT).

[6] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[7] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

[8] MM function request (MM)

A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[9] Authentication (MM)

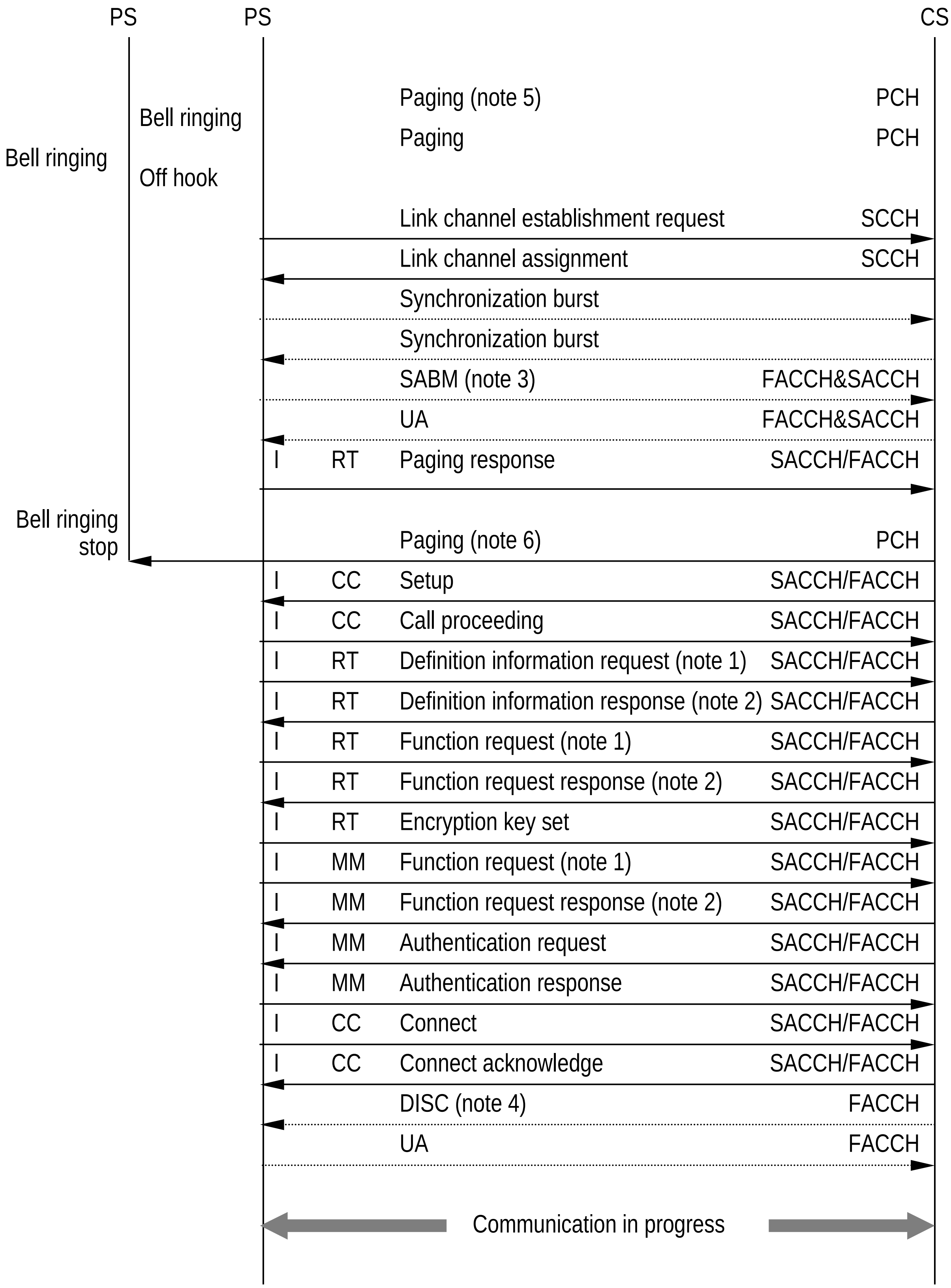
When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agree with that reported from the user. If the authentication result is NG, the call release procedure is initiated according to the regulation of call clearing. If the authentication result is OK, call connection continues. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing.

[10] Call accept (CC)

The user that sent the authentication response message (MM) reports acceptance of the incoming call by transmitting a connect message (CC) to the network.

[11] Active indication (RT, MM, CC)

A network which has received a connect message (CC) transmits a connect acknowledge message (CC) to the user. The user receives a connect acknowledge message (CC) which indicates that the circuit switched connection was completed, and it enters “active” state.


PS
PS
CS
Bell ringing
Bell ringing
Off hook
Paging (note 5) PCH
Paging PCH
Link channel establishment request SCCH
Link channel assignment SCCH
Synchronization burst
Synchronization burst
SABM (note 3) FACCH&SACCH
UA FACCH&SACCH
I RT Paging response SACCH/FACCH
Bell ringing stop
Paging (note 6) PCH
I CC Setup SACCH/FACCH
I CC Call proceeding SACCH/FACCH
I RT Definition information request (note 1) SACCH/FACCH
I RT Definition information response (note 2) SACCH/FACCH
I RT Function request (note 1) SACCH/FACCH
I RT Function request response (note 2) SACCH/FACCH
I RT Encryption key set SACCH/FACCH
I MM Function request (note 1) SACCH/FACCH
I MM Function request response (note 2) SACCH/FACCH
I MM Authentication request SACCH/FACCH
I MM Authentication response SACCH/FACCH
I CC Connect SACCH/FACCH
I CC Connect acknowledge SACCH/FACCH
DISC (note 4) FACCH
UA FACCH
Communication in progress

(Note 1) This control signal can be omitted as necessary.
(Note 2) This control signal is for the previous control signal with the (Note 1) attached. It is transmitted only when the relevant control signal received.
(Note 3) The layer3 sequence of the service channel establishment phase is activated after the FACCH or SACCH layer2 multiframe acknowledged operation mode established.
(Note 4) Before layer2 DISC transmission on FACCH, layer2 multiframe acknowledged operation mode should be established on SACCH.
(Note 5) In the case of PS's standby state, if the paging service type of the paging message indicates extension paging service type (101) and the extension paging service type indicates paging service to all PS (0001), PS rings without sending link channel establishment request message all at once. And PS stops ringing when PS is without synchronization.
(Note 6) If CS receives paging response message from PS or detects the stop of calling from the network, CS sets up extension paging service type of paging message, to " cessation of ringing ". The ringing PS that is not answered stops ringing when the PS receives the paging message, if extension paging service type in that message is " cessation of ringing".

Figure 4.4.3.8.14 Control sequence (zone paging)

4.4.3.8.8 64kbit/s Unrestricted Digital Information (64kbit/s UDI) (Private standard/ Public standard)

4.4.3.8.8.1 64kbit/s UDI Outgoing call (Private standard/ Public standard)

4.4.3.8.8.1.1 2 slots fixed type 64kbit/sUDI Outgoing call (En-bloc sending)
(Private standard/ Public standard)

The Control Sequence of en-bloc sending in 2 slots fixed type 64kbit/s Unrestricted Digital Information is shown in Figure 4.4.3.8.15.

The control order is as follows

[1] TCH Added (RT)

For 64kbit/s UDI, the user require the network to assign 2nd TCH by additional channel request message (RT) on the first assigned TCH (1st TCH). The responding network indicates the 2nd TCH channel to the user by the additional channel assign message (RT).
Until the 2nd TCH establishes the synchronization, the 1st TCH sustains the former situation without following proceeding. After the establishment, the 2nd TCH keeps the idle TCH condition.

[2] Call request (CC)

Call establishment is initiated by the user transmitting a setup message (CC) to the network.

[3] Outgoing call proceeding (CC)

When the network receives the setup message (CC) and confirms that call acceptance is suitable, the network sends a call proceeding message (CC) to the user to indicate that the call is being processed, and it enters “outgoing call proceeding “ state.

When the user receives the call proceeding message (CC) , it enters “ outgoing call proceeding “ state.

[4] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives it reports notification information by a definition information response message (RT).

[5] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request response message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[6] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

This encryption key is common to the both of 1st TCH and 2nd TCH.

[7] MM function request (MM)

A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[8] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is OK, call connection continues. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing.

[9] Call confirmation indication (CC)

If the network receives an indication of the fact that destination user alerting was initiated, the network transmits an alerting message (CC) to the user.

[10] Call connected (CC)

If the network receives an indication of the fact that the call was accepted by the destination user, it transmits a connect message (CC) to the user.

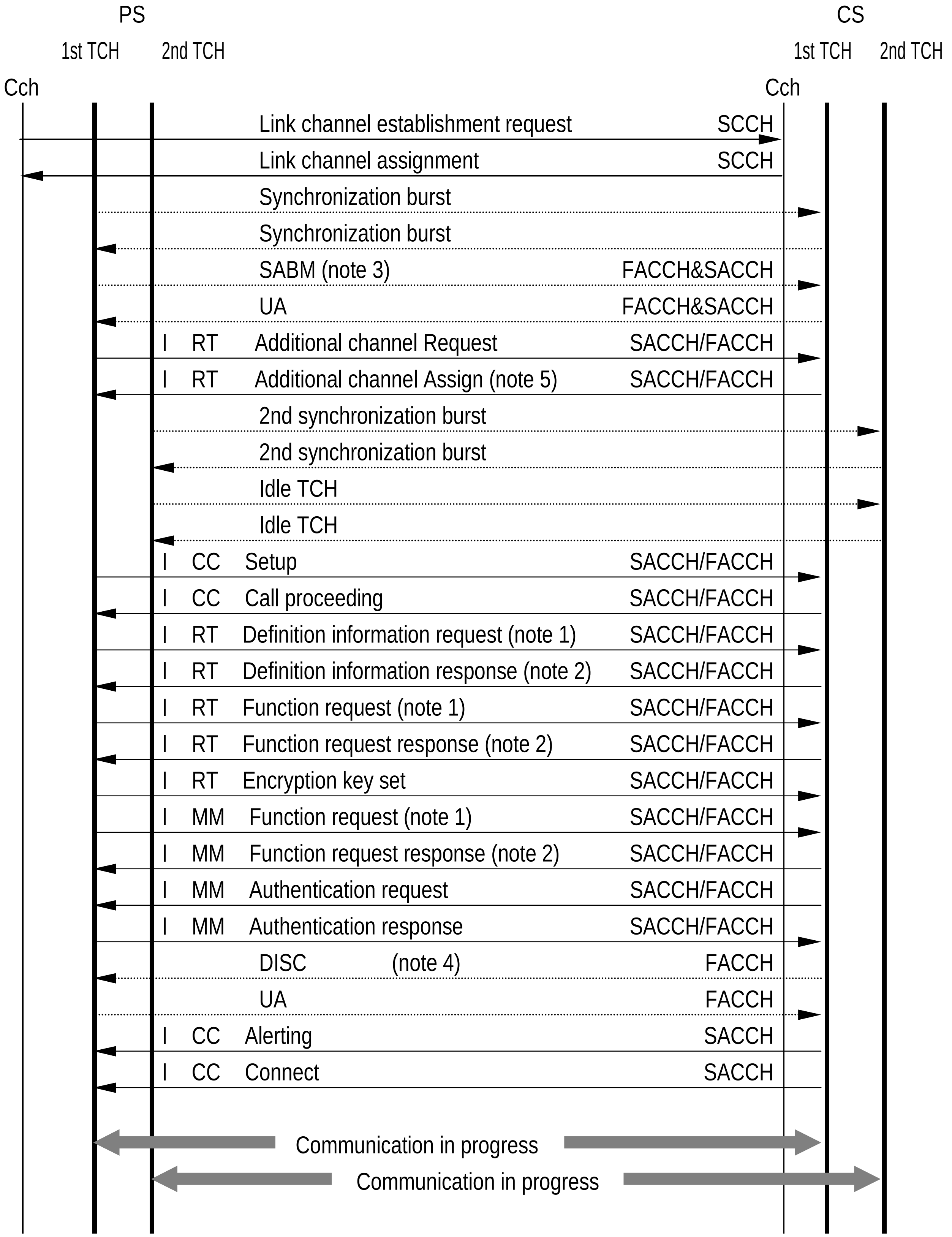
After the network sends the Call connected message (CC) or the user receives it, the 1st TCH and the 2nd TCH shift to active state.

[11] Call reject (RT, MM, CC)

If it is indicated by the network or destination user that the call cannot be accepted, the call release procedure is initiated according to the regulations of call clearing.

(Note) Interworking report at origination-side interface

During call establishment, if CS originated a call to a non-ISDN network or if it received a message containing a progress indicator from ISDN, the progress indicator information element is returned to the origination user by call control message (call proceeding, alerting, connect) or a progress message.

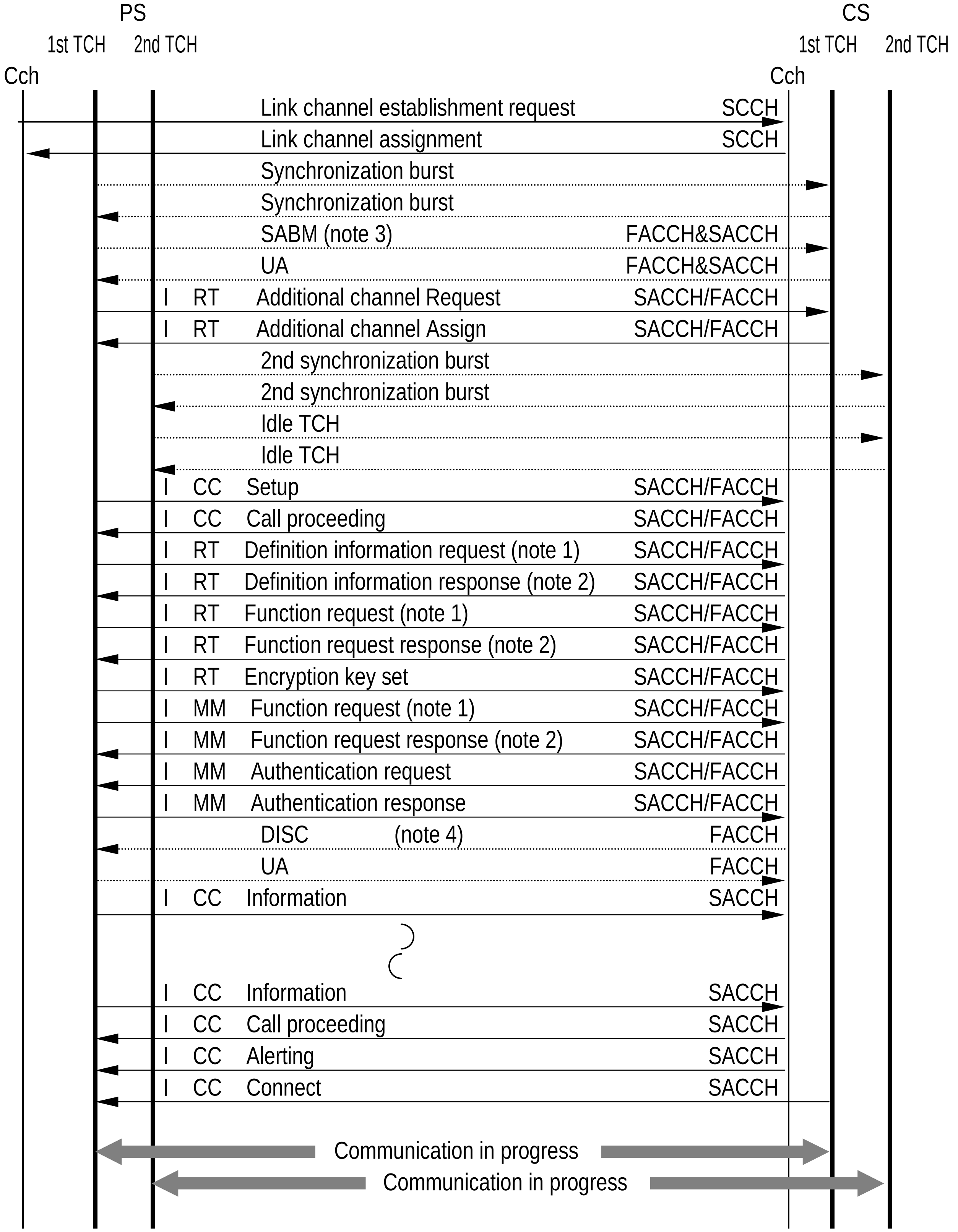

PS
CS
1st TCH
2nd TCH
1st TCH
2nd TCH
Cch
Cch
Link channel establishment request SCCH
Link channel assignment SCCH
Synchronization burst
Synchronization burst
SABM (note 3) FACCH&SACCH
UA FACCH&SACCH
I RT Additional channel Request SACCH/FACCH
I RT Additional channel Assign (note 5) SACCH/FACCH
2nd synchronization burst
2nd synchronization burst
Idle TCH
Idle TCH
I CC Setup SACCH/FACCH
I CC Call proceeding SACCH/FACCH
I RT Definition information request (note 1) SACCH/FACCH
I RT Definition information response (note 2) SACCH/FACCH
I RT Function request (note 1) SACCH/FACCH
I RT Function request response (note 2) SACCH/FACCH
I RT Encryption key set SACCH/FACCH
I MM Function request (note 1) SACCH/FACCH
I MM Function request response (note 2) SACCH/FACCH
I MM Authentication request SACCH/FACCH
I MM Authentication response SACCH/FACCH
DISC (note 4) FACCH
UA FACCH
I CC Alerting SACCH
I CC Connect SACCH
Communication in progress
Communication in progress

(Note 1) This control signal can be omitted as necessary.
(Note 2) This control signal is for the previous control signal with the (Note 1) attached. It is transmitted only when the relevant control signal is received.
(Note 3) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 4) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 5) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.15 Control sequence (2 slots fixed type 64kbit/s UDI Outgoing call (En-bloc sending))

4.4.3.8.8.1.2 2 slots fixed type 64kbit/s UDI Outgoing call (Overlap sending) (Private standard)

The control sequence of overlap sending in 2 slots fixed type 64k bit/s Unrestricted Digital Information service is shown in Figure 4.4.3.8.16.



(Note 1) This control signal can be omitted as necessary.
(Note 2) This control signal is for the previous control signal with the (Note 1) attached. It is transmitted only when the relevant control signal is received.
(Note 3) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 4) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 5) Overlap sending is a functional option.
(Note 6) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.16 Control sequence (2 slots fixed type 64kbit/s UDI Outgoing call (Overlap sending))

4.4.3.8.8.1.3 Slot changeable type 64kbit/sUDI Outgoing call (En-bloc sending)
(Private standard/ Public standard)

The Control Sequence of en-bloc sending in Slot changeable type 64kbit/s Unrestricted Digital Information is shown in Figure 4.4.3.8.17.

The control order is as follows

[1] TCH Added (RT)

For 64kbit/s UDI, the user require the network to assign 2nd TCH by additional channel request message (RT) on the first assigned TCH (1st TCH). The responding network indicates the 2nd TCH channel to the user by the additional channel assign message (RT).

While processing synchronous establishment of 2nd TCH, the 1st TCH sustains the former situation without following proceeding. However even if 2nd TCH is not necessarily establishment, it is possible to shift to the processing of following. After the establishment, the 2nd TCH keeps the idle TCH condition.

[2] Call request (CC)

Call establishment is initiated by the user transmitting a setup message (CC) to the network.

[3] Outgoing call proceeding (CC)

When the network receives the setup message (CC) and confirms that call acceptance is suitable, the network sends a call proceeding message (CC) to the user to indicate that the call is being processed, and it enters “outgoing call proceeding “ state.

When the user receives the call proceeding message (CC) , it enters “ outgoing call proceeding “ state.

[4] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives it reports notification information by a definition information response message (RT).

[5] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request response message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[6] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

This encryption key is common to the both of 1st TCH and 2nd TCH.

[7] MM function request (MM)

A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[8] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is OK, call connection continues. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing.

[9] Call confirmation indication (CC)

If the network receives an indication of the fact that destination user alerting was initiated, the network transmits an alerting message (CC) to the user.

[10] Call connected (CC)

If the network receives an indication of the fact that the call was accepted by the destination user, it transmits a connect message (CC) to the user.

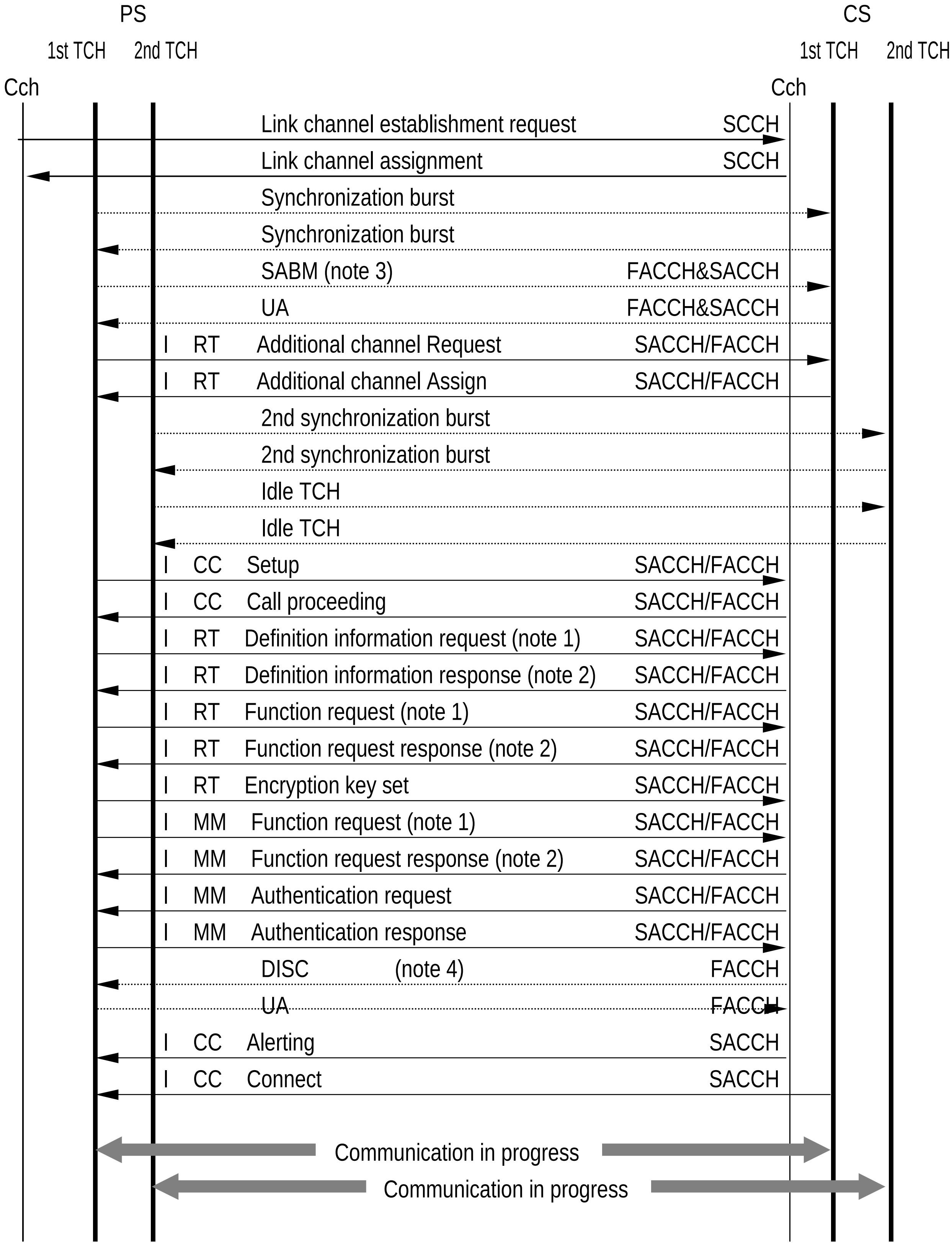
After the network sends the Call connected message (CC) or the user receives it, the 1st TCH and the 2nd TCH shift to active state.

[11] Call reject (RT, MM, CC)

If it is indicated by the network or destination user that the call cannot be accepted, the call release procedure is initiated according to the regulations of call clearing.

(Note) Interworking report at origination-side interface

> During call establishment, if CS originated a call to a non-ISDN network or if it received a message containing a progress indicator from ISDN, the progress indicator information element is returned to the origination user by call control message (call proceeding, alerting, connect) or a progress message.



(Note 1) This control signal can be omitted as necessary.

(Note 2) This control signal is for the previous control signal with the (Note 1) attached. It is transmitted only when the relevant control signal is received.

(Note 3) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.

(Note 4) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.

(Note 5) Appropriate frequency band for the PS should be chosen.

(Note 6) This control signal can be omitted as necessary in Slot changeable type 64k bit/s Unrestricted Information.

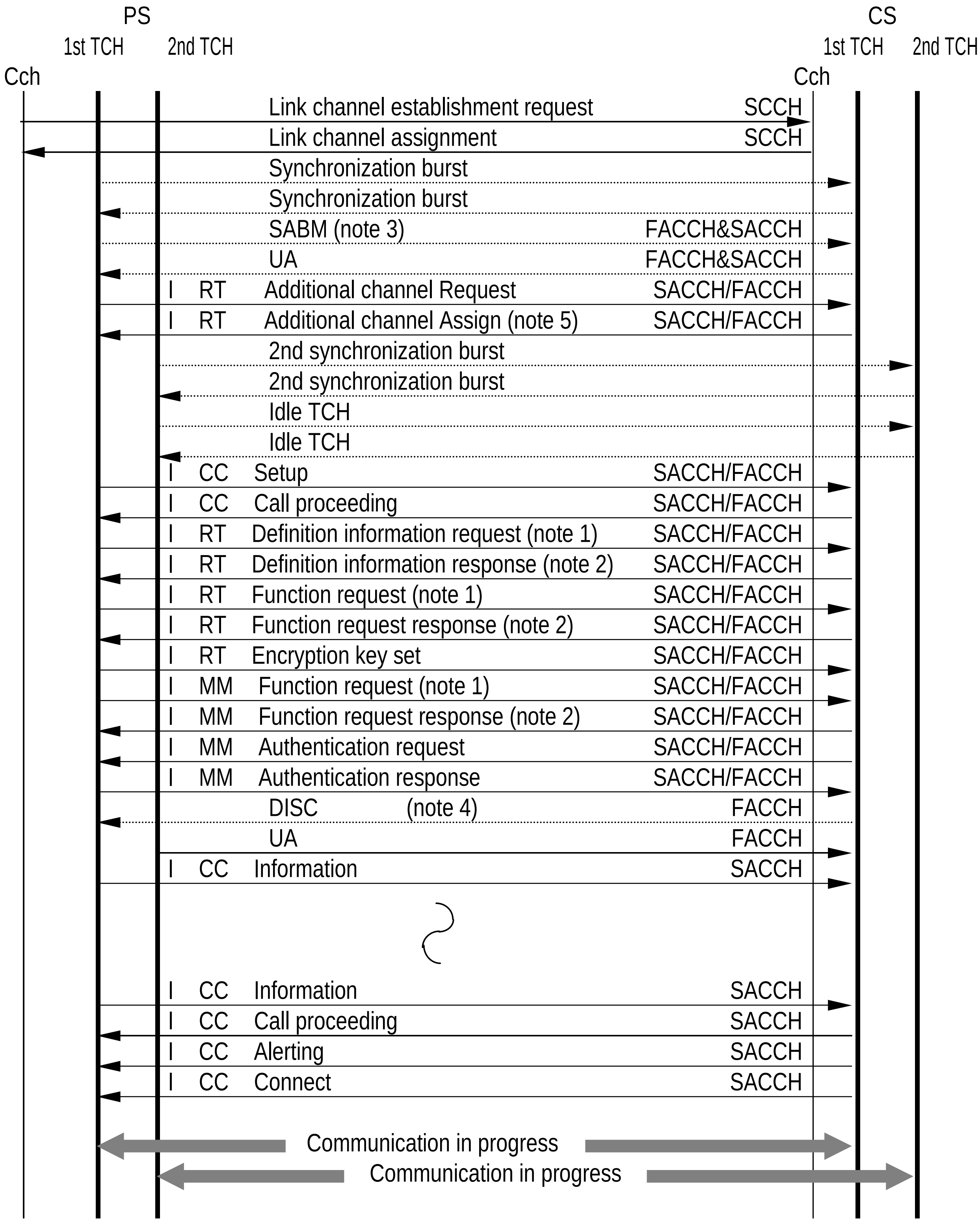
(Note 7) This control signal is for the previous control signal with the (Note 6) attached. It is transmitted only when the relevant control signal is received.

(Note 8) When additional channel processing is omitted, this control signal is in Slot changeable type 64k bit/s Unrestricted Information.

Figure 4.4.3.8.17 Control sequence (Slot changeable type 64kbit/s UDI Outgoing call (En-bloc sending))

4.4.3.8.8.1.4 Slot changeable type 64kbit/s UDI Outgoing call (Overlap sending)
(Private standard)

The control sequence of overlap sending in Slot changeable type 64k bit/s Unrestricted Digital Information service is shown in Figure 4.4.3.8.18.



(Note 1) This control signal can be omitted as necessary.
(Note 2) This control signal is for the previous control signal with the (Note 1) attached. It is transmitted only when the relevant control signal is received.
(Note 3) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 4) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 5) Overlap sending is a functional option.
(Note 6) Appropriate frequency band for the PS should be chosen.
(Note 7) This control signal can be omitted as necessary in Slot changeable type 64k bit/s Unrestricted Information.
(Note 8) This control signal is for the previous control signal with the (Note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) When additional channel processing is omitted, this control signal is in Slot changeable type 64k bit/s Unrestricted Information.

Figure 4.4.3.8.18 Control sequence (Slot changeable type 64kbit/s UDI Outgoing call (Overlap sending))

4.4.3.8.8.2 64kbit/s UDI Incoming call (Private standard/ Public standard)

4.4.3.8.8.2.1 2 slots fixed type 64k bit/s UDI Incoming call (Private standard/ Public standard)

The control sequence of incoming call is shown in Figure 4.4.3.8.19.

The control order is as follows.

[1] Incoming call request

The network indicates incoming call by transmitting a paging message (PCH) to the user.

The user receives the paging message (PCH), and establishes LCH.

[2] Incoming call response (RT)

After LCH establishment, the user transmits a paging response message (RT) to the network.

[3] TCH Addition (RT)

For 64kbit/s UDI, the network promotes to user to request to assign the 2nd TCH by the additional channel request indicate message (RT) on the first assigned TCH (1st TCH). The user requires the network to assign the 2nd TCH by the additional channel assign message (RT).

Until the 2nd TCH establishes the synchronization, the 1st TCH sustains the former situation without following proceeding. After the establishment, the 2nd TCH keeps the idle TCH condition.

[4] Call present (CC)

After receiving the paging response message (RT) and establishing the 2nd TCH, the network transmits a setup message (CC).

[5] Response to setup (CC)

The user which has received the setup message (CC) responds by a call proceeding message (CC).

[6] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives it reports notification information by a definition information response message (RT).

[7] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request response message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[8] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

This encryption key is common both of the 1st TCH and the 2nd TCH.

[9] MM function request (MM)

A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[10] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is OK, call connection continues. If the authentication result is NG, the call release procedure is initiated according to the regurations of call clearing.

[11] Call received (CC)

The user that sent the authentication response message (MM) transmits an alerting message (CC) or connect message (CC). (By judgment of user)

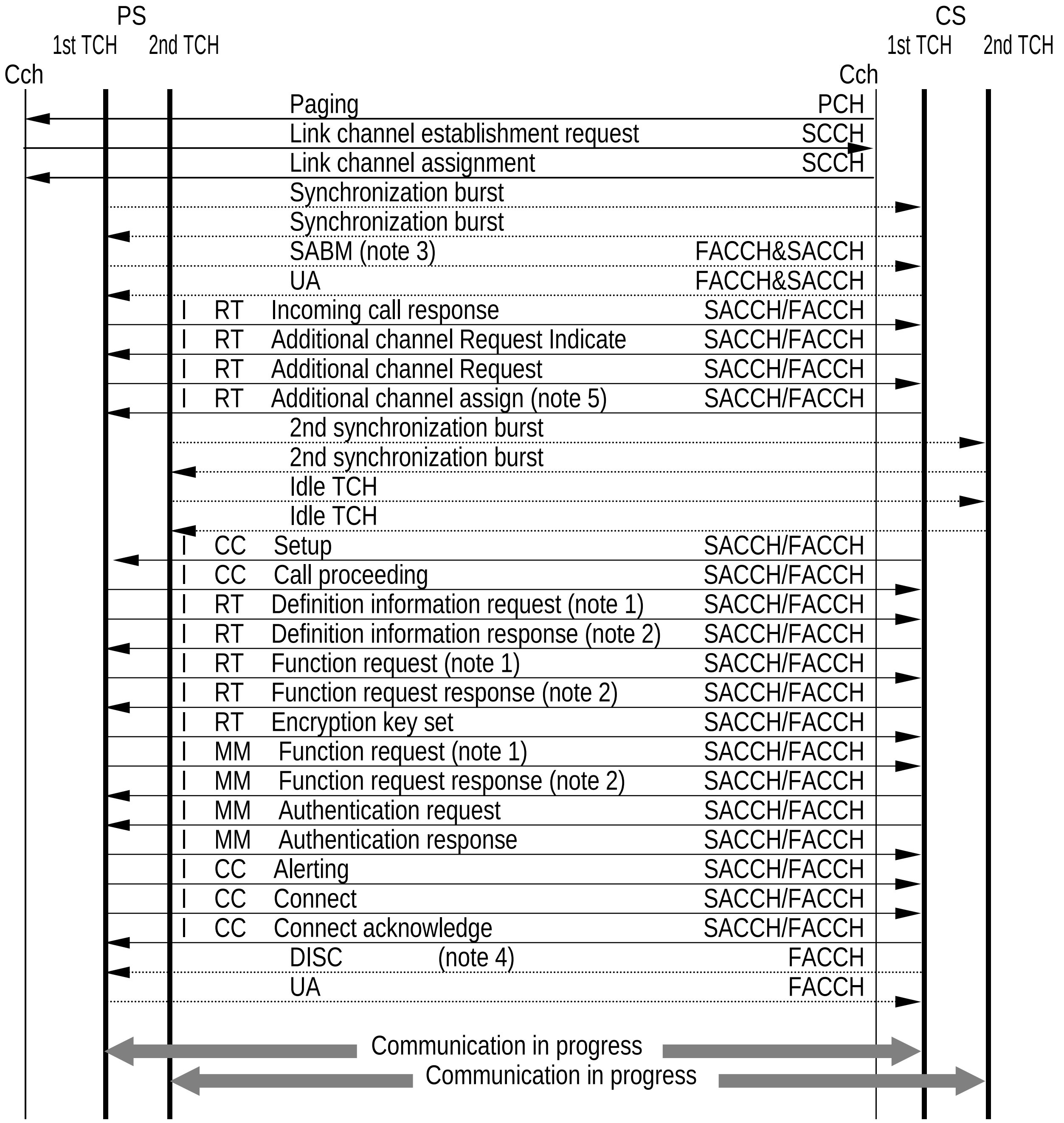
[12] Call accept (CC)

If the user goes off hook after an alerting message (CC) is transmitted, the user reports acceptance of the incoming call by transmitting a connect message (CC) to the network.

[13] Active indication (RT, MM, CC)

A network which has received a connect message (CC) transmits a connect acknowledge message (CC) to the user.

After the user receives a connect acknowledge message (CC) which indicates that the circuit switched connection was completed, and both the 1st TCH and the 2nd TCH shift to “active” state.



(Note 1) This control signal can be omitted as necessary.

(Note 2) This control signal is for the previous control signal with the (Note 1) attached. It is transmitted only when the relevant control signal is received.

(Note 3) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.

(Note 4) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.

(Note 5) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.19 Control sequence (2 slots fixed type 64kbit/s UDI Incoming call)

4.4.3.8.8.2.2 Slot changeable type 64k bit/s UDI Incoming call (Private standard/ Public standard)

The control sequence of incoming call is shown in Figure 4.4.3.8.20.

The control order is as follows.

[1] Incoming call request

The network indicates incoming call by transmitting a paging message (PCH) to the user.

The user receives the paging message (PCH), and establishes LCH.

[2] Incoming call response (RT)

After LCH establishment, the user transmits a paging response message (RT) to the network.

[3] TCH Addition (RT)

For 64kbit/s UDI, the network promotes to user to request to assign the 2nd TCH by the additional channel request indicate message (RT) on the first assigned TCH (1st TCH). The user requires the network to assign the 2nd TCH by the additional channel assign message (RT).

While processing synchronous establishment of 2nd TCH, the 1st TCH sustains the former situation without following proceeding. However even if 2nd TCH is not necessarily establishment, it is possible to shift to the processing of following. After the establishment, the 2nd TCH keeps the idle TCH condition.

[4] Call present (CC)

After receiving the paging response message (RT) and establishing the 2nd TCH or omitting synchrous establishment processing procedure of 2nd TCH, the network transmits a setup message (CC).

[5] Response to setup (CC)

The user which has received the setup message (CC) responds by a call proceeding message (CC).

[6] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives it reports notification information by a definition information response message (RT).

[7] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request response message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[8] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

This encryption key is common both of the 1st TCH and the 2nd TCH.

[9] MM function request (MM)

A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[10] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is OK, call connection continues. If the authentication result is NG, the call release procedure is initiated according to the regurations of call clearing.

[11] Call received (CC)

The user that sent the authentication response message (MM) transmits an alerting message (CC) or connect message (CC). (By judgment of user)

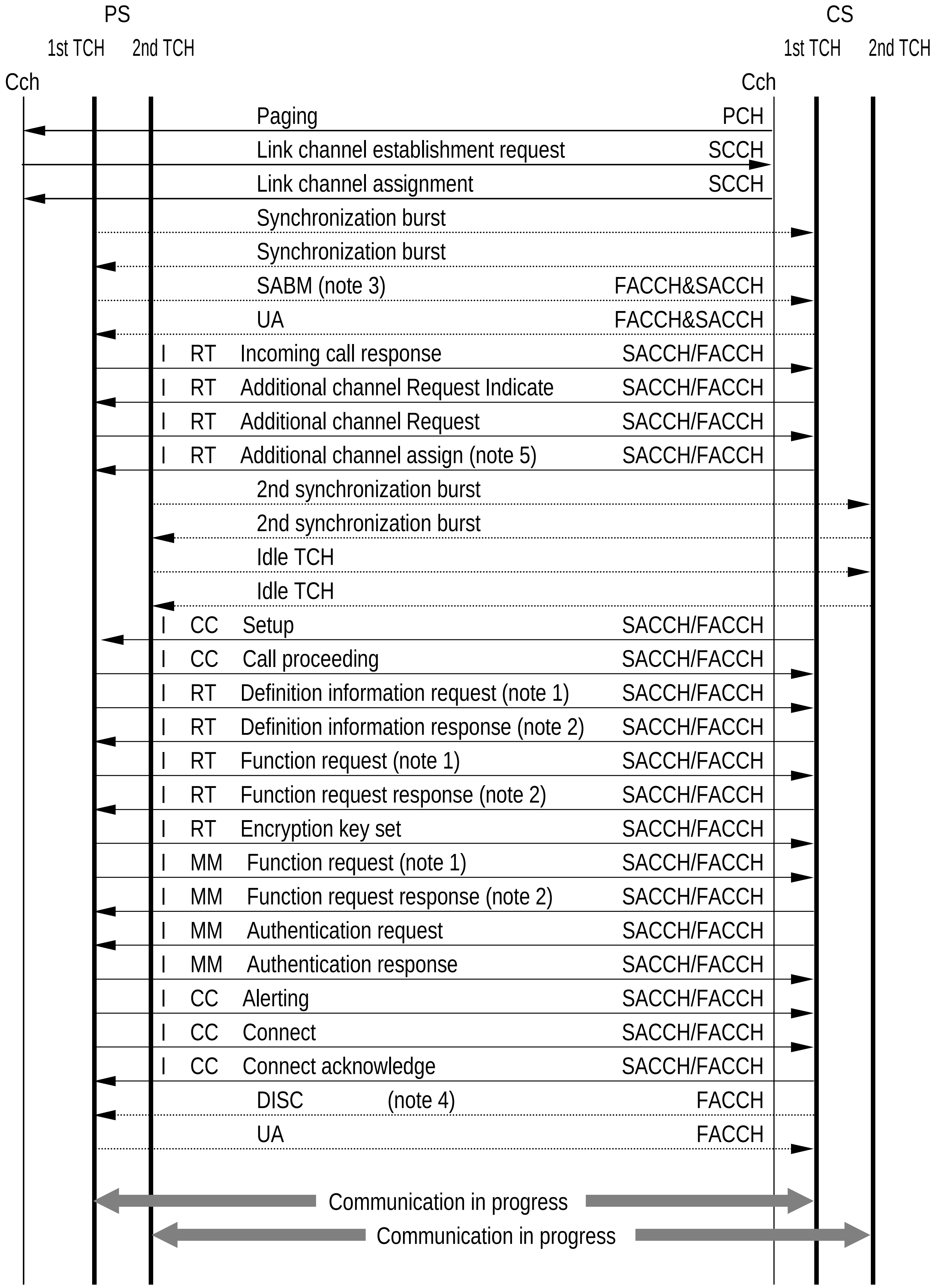
[12] Call accept (CC)

If the user goes off hook after an alerting message (CC) is transmitted, the user reports acceptance of the incoming call by transmitting a connect message (CC) to the network.

[13] Active indication (RT, MM, CC)

A network which has received a connect message (CC) transmits a connect acknowledge message (CC) to the user.

After the user receives a connect acknowledge message (CC) which indicates that the circuit switched connection was completed, and both the 1st TCH and the 2nd TCH shift to “active” state.


PS
1st TCH
2nd TCH
Cch
CS
1st TCH
2nd TCH
Cch
Paging
PCH
Link channel establishment request
SCCH
Link channel assignment
SCCH
Synchronization burst
Synchronization burst
SABM (note 3)
FACCH&SACCH
UA
FACCH&SACCH
I RT Incoming call response
SACCH/FACCH
I RT Additional channel Request Indicate
SACCH/FACCH
I RT Additional channel Request
SACCH/FACCH
I RT Additional channel assign (note 5)
SACCH/FACCH
2nd synchronization burst
2nd synchronization burst
Idle TCH
Idle TCH
I CC Setup
SACCH/FACCH
I CC Call proceeding
SACCH/FACCH
I RT Definition information request (note 1)
SACCH/FACCH
I RT Definition information response (note 2)
SACCH/FACCH
I RT Function request (note 1)
SACCH/FACCH
I RT Function request response (note 2)
SACCH/FACCH
I RT Encryption key set
SACCH/FACCH
I MM Function request (note 1)
SACCH/FACCH
I MM Function request response (note 2)
SACCH/FACCH
I MM Authentication request
SACCH/FACCH
I MM Authentication response
SACCH/FACCH
I CC Alerting
SACCH/FACCH
I CC Connect
SACCH/FACCH
I CC Connect acknowledge
SACCH/FACCH
DISC (note 4)
FACCH
UA
FACCH
Communication in progress
Communication in progress

(Note 1) This control signal can be omitted as necessary.
(Note 2) This control signal is for the previous control signal with the (Note 1) attached. It is transmitted only when the relevant control signal is received.
(Note 3) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 4) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 5) Appropriate frequency band for the PS should be chosen.
(Note 6) This control signal can be omitted as necessary in Slot changeable type 64k bit/s Unrestricted Information.
(Note 7) This control signal is for the previous control signal with the (Note 6) attached. It is transmitted only when the relevant control signal is received.
(Note 8) When additional channel processing is omitted, this control signal is in Slot changeable type 64k bit/s Unrestricted Information.

Figure 4.4.3.8.20 Control sequence (Slot changeable type 64kbit/s UDI Incoming call)

4.4.3.8.8.3 64kbit/s UDI Disconnect (Private standard/ Public standard)

The control sequence of disconnect is shown in Figures 4.4.3.8.21 and 22.

(1) PS side disconnect

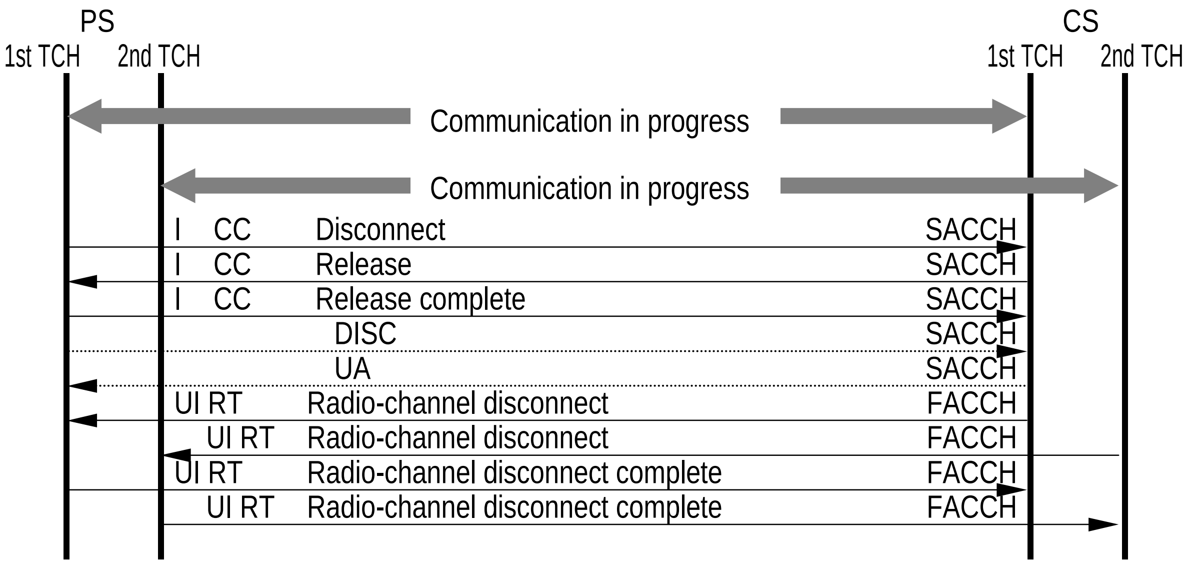


Figure 4.4.3.8.21 Control sequence (64kbit/s UDI PS side disconnect)

(2) CS side disconnect

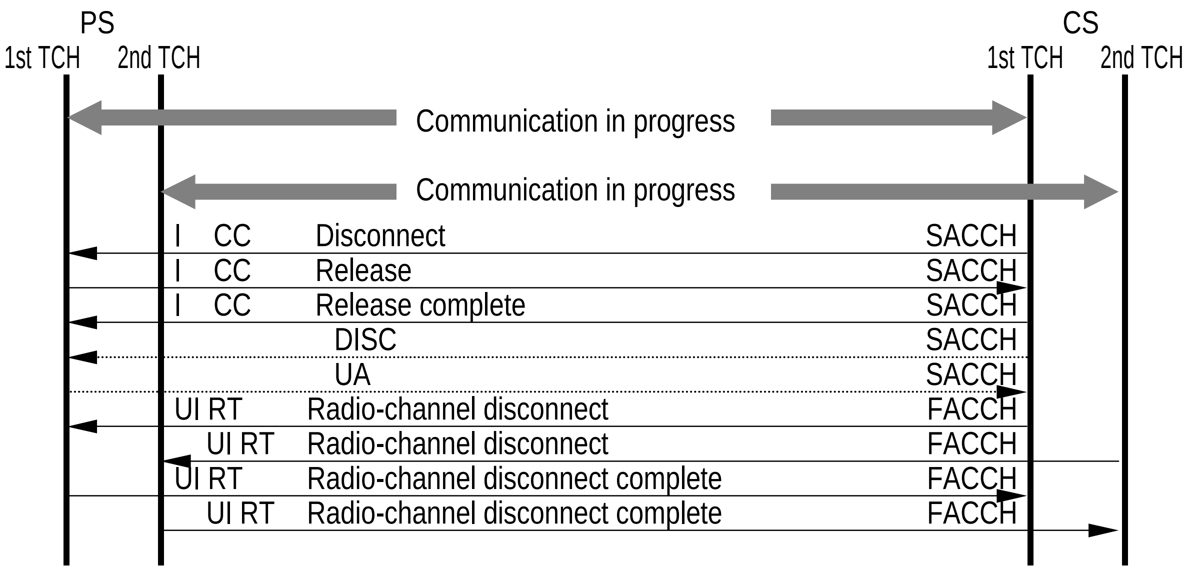


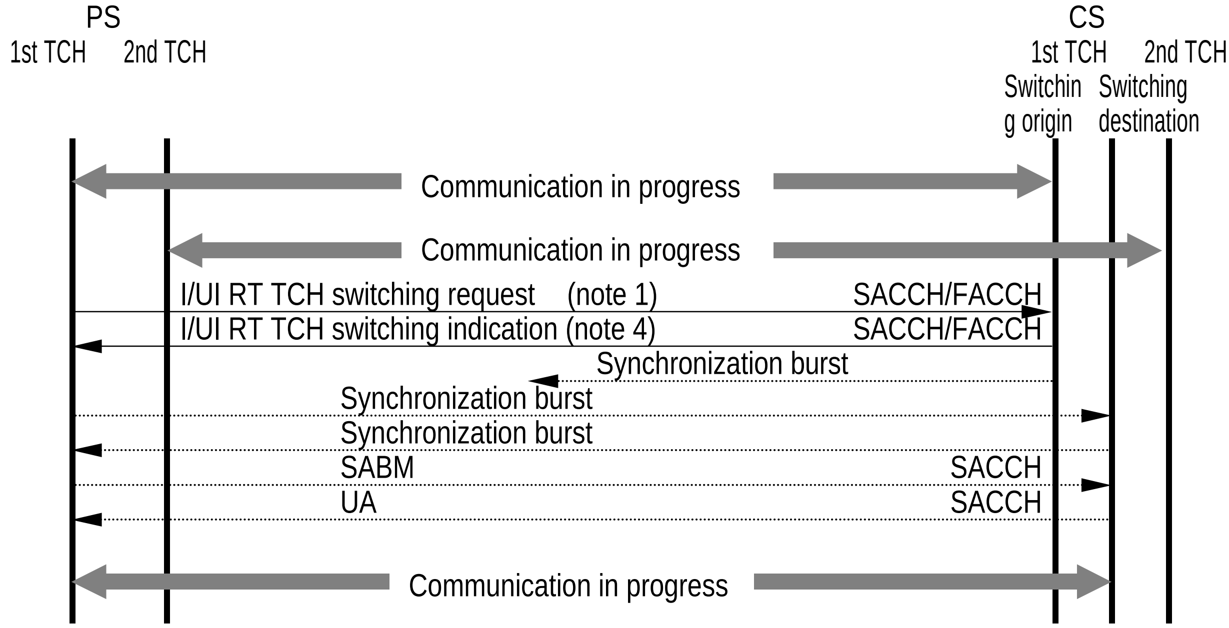
Figure 4.4.3.8.22 Control sequence (64kbit/s UDI CS side disconnect)

4.4.3.8.8.4 64kbit/s UDI Channel switching during communication (Private standard/ Public standard)

4.4.3.8.8.4.1 64kbit/s UDI Channel switching during communication (switching on same CS)
(Private standard/ Public standard)

The control sequence is shown in Figure 4.4.3.8.23 and 24.

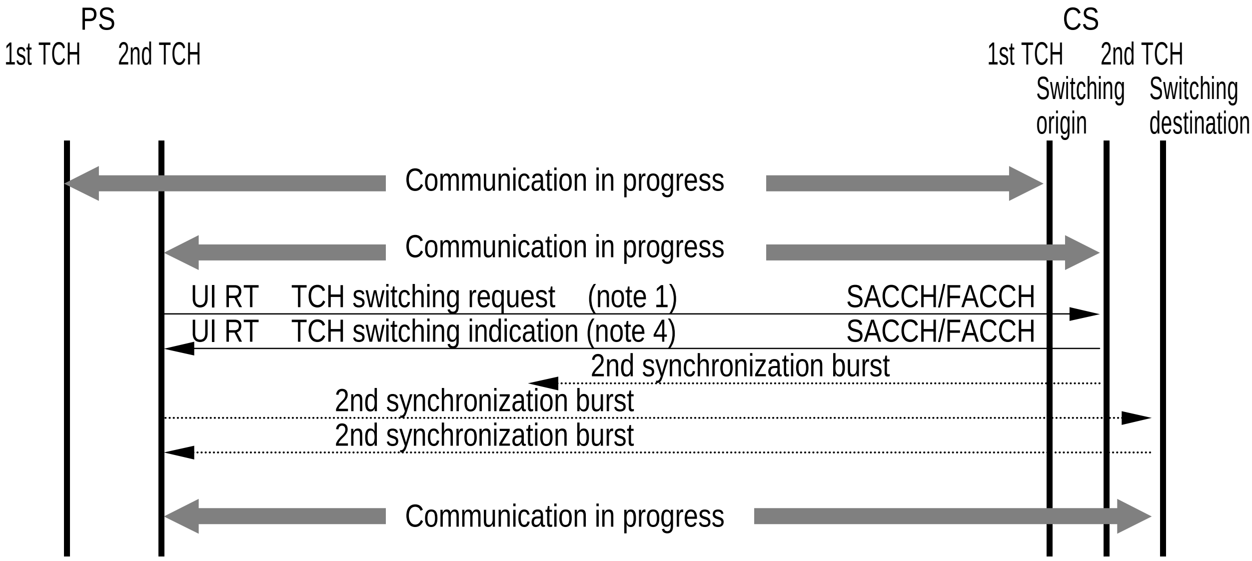
(1) 1st TCH



(Note 1) Unnecessary in case of CS activation.
(Note 2) The 1st TCH and the 2nd TCH do channel switching during communication on same CS independently, with no influence on the other TCH.
(Note 3) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 4) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.23 Control sequence (64kbit/s UDI Channel switching during communication (switching on same CS, 1st TCH))

(2) 2nd TCH



(Note 1) Unnecessary in case of CS activation.
(Note 2) The 1st TCH and the 2nd TCH do channel switching during communication on same CS independently, with no influence on the other TCH.
(Note 3) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 4) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.24 Control sequence (64kbit/s UDI Channel switching during communication (switching on same CS, 2nd TCH))

4.4.3.8.8.4.2 2 slots fixed type 64kbit/s UDI Channel switching during communication (switching to other CS : PS recalling-type) (Private standard/ Public standard)

The control sequence is shown in Figure 4.4.3.8.25.

The control order is as follows.

[1] TCH Addtion (RT)

For 64kbit/s UDI, the user requires the network to assign the 2nd TCH by the additional channel request message (RT) on the first assigned TCH (1st TCH). The responding network indicates the 2nd TCH channel to the user by the additional channel assign message (RT).

Until the 2nd TCH establishes the synchronization, the 1st TCH sustains the former situation without following proceeding. After the establishment, the 2nd TCH keeps the idle TCH condition.

[2] Recalling-type handover request (CC)

Handover is initiated by the user transmitting a setup message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) to the network.

[3] Recalling-type handover proceeding (CC)

When the network receives the setup message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) and confirms that call acceptance is suitable, the network sends a call proceeding message (CC) to the user to indicate that the call is being processed, and it enters " outgoing call proceeding (CC) : Recalling (function operation) " state.

When the user receives the call proceeding message (CC), it enters " outgoing call proceeding (CC) : Recalling (functional operation) " state.

The network that received the setup message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) judges whether or not the authentication reciphering pattern obtained using the authentication key in the home memory of the user agrees with authentication ciphering pattern reported from the user by facility information element. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing. If the authentication result is OK, handover continues.

Only in a private system, the network can do the authentication with the authentication request message (MM) and the authentication response message (MM) by the judgment of the network, without the reference of the authentication ciphering pattern in the setup message (facility : Private recalling-type channel switching) (CC).

[4] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[5] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

This encryption key is common both of the 1st TCH and the 2nd TCH.

[6] MM function request (MM)

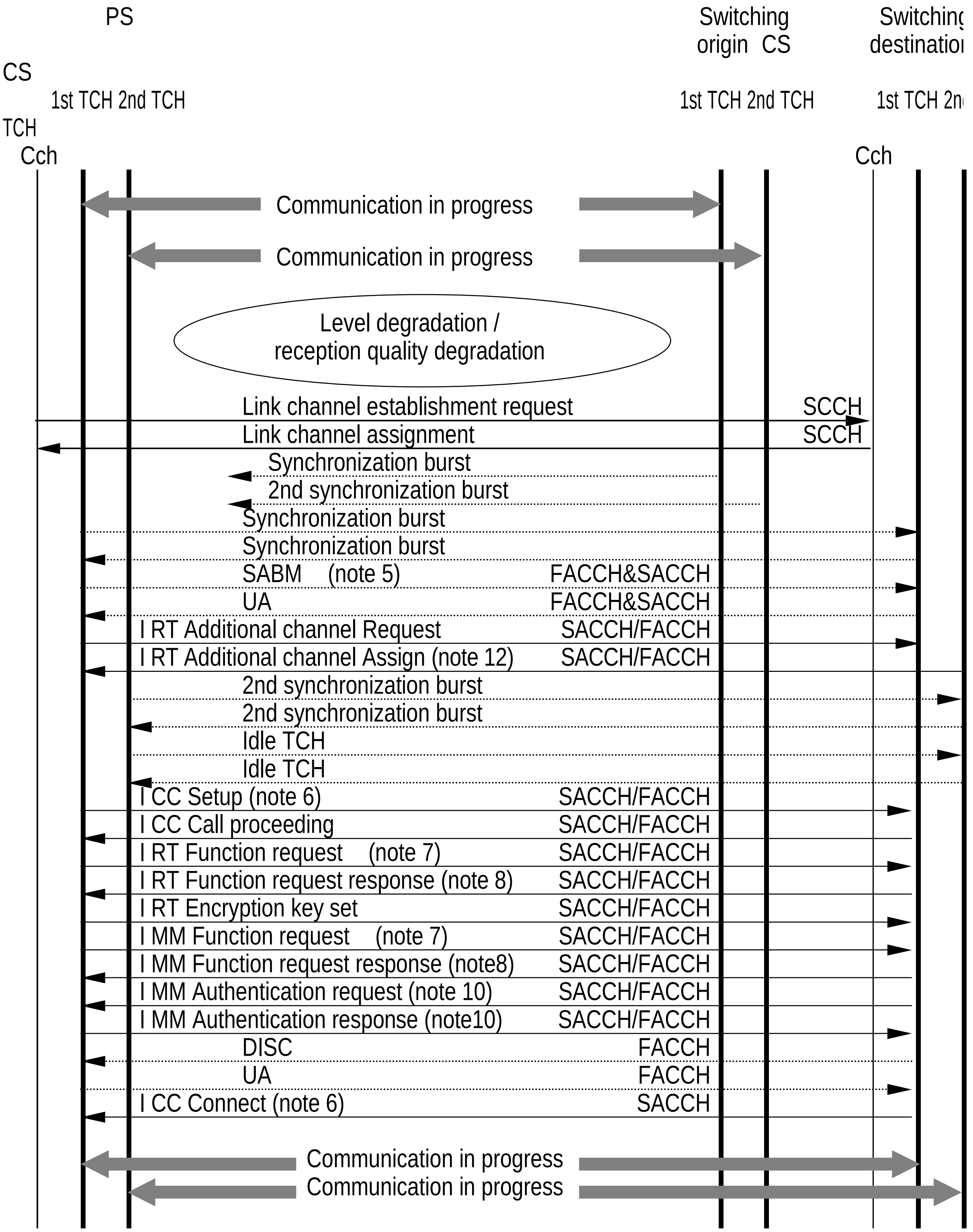
A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[7] Authentication (MM)

In a private system, if the network does not do the authentication by the authentication ciphering pattern in the setup message (facility : Private recalling-type channel switching) (CC) by the judgment of the network, the authentication procedure is as follows. In the case, the user follows the request of the network. When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agree with that reported from the user. If the authentication result is NG, the call release procedure is initiated according to the regulation of call clearing. If the authentication result is OK, the network continues handover procedures.

[8] Call connected (CC)

If the network receives an indication of the fact that recalling-type handover was accepted, it transmits a connect message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) to the user. The user who received the connect message (facility: Recalling-type channel switching or Private recalling-type channel switching) (CC) terminates handover normally, and both the 1st and 2nd TCH to “active” state.



(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.

(Note 2) There are cases where the switching origin CS and switching destination CS are the same.

(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, PS can start the recalling operation due to compatibility with the switching origin CS.

(Note 4) In a Public system, switching among paging areas is a CS option.

(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.

(Note 6) Facility information element is mandatory.

(Note 7) This control signal can be omitted as necessary.

(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.

(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.

(Note 10) This control signal can be transmitted only in a private system.

(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.

(Note 12) Appropriate frequency band for the PS should be chosen.

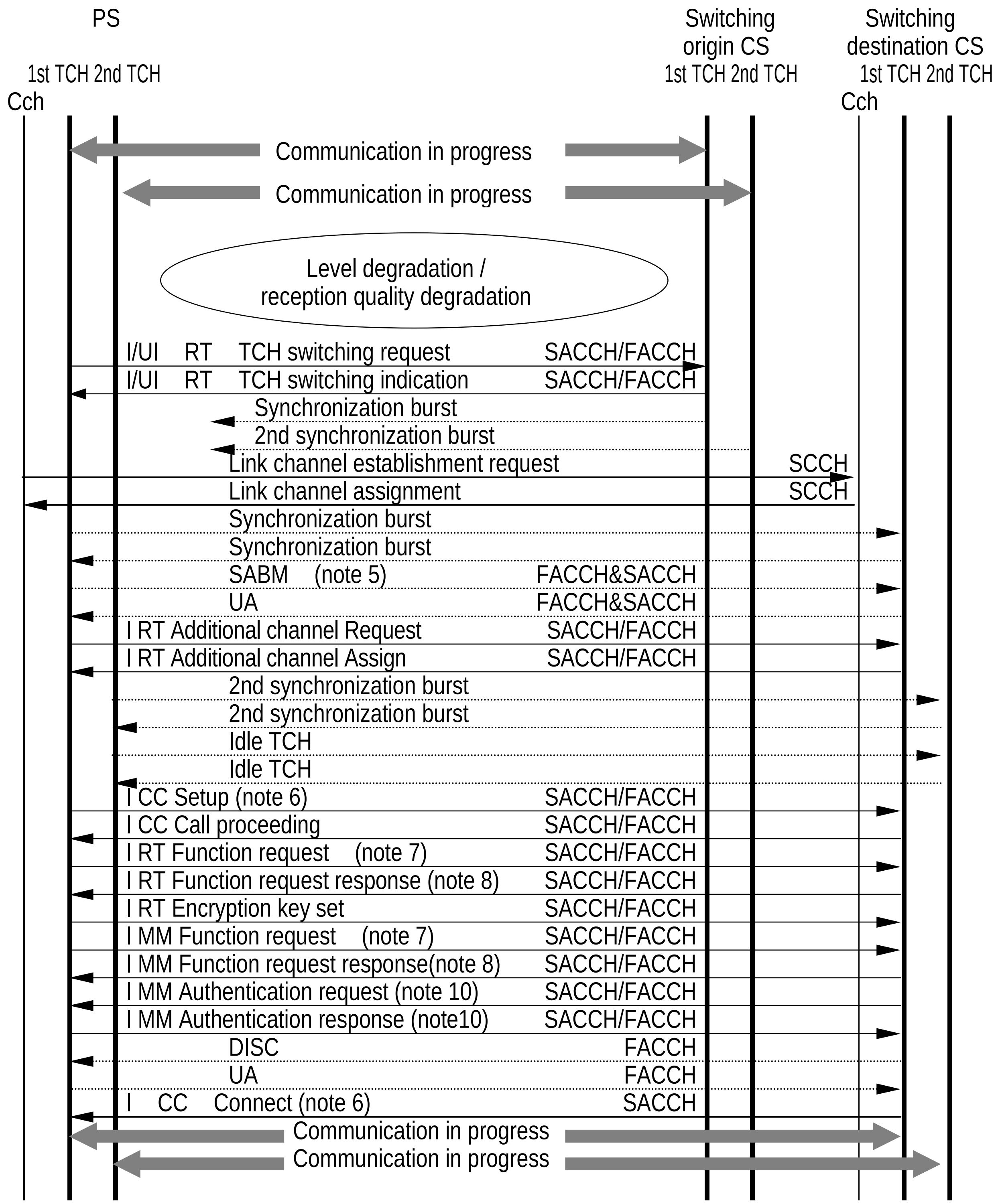
Figure 4.4.3.8.25 Control sequence (2 slots fixed type 64kbit/s UDI Channel switching during communication (switching to other CS : PS recalling-type)

4.4.3.8.8.4.3 2 slots fixed type 64kbit/s UDI Channel switching during communication (switching to other CS : Recalling-type with PS request) (Private standard/ Public standard)

The control sequence is shown in Figure 4.4.3.8.26 and 27.

The control order is the same as that explained in section 4.4.3.8.8.4.2.

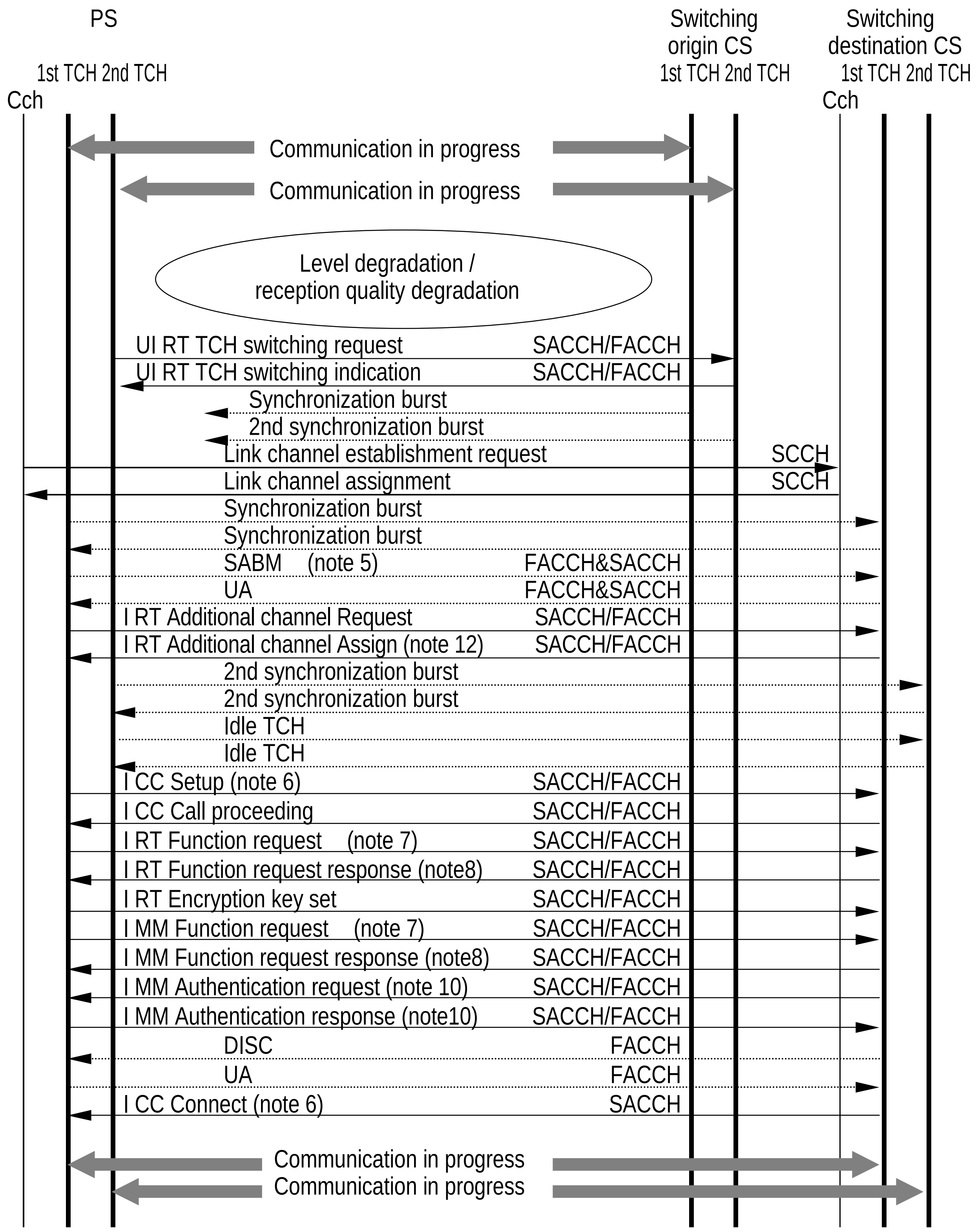
(1) 1st TCH



(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message, PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a Public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitted only in a private system.
(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.
(Note 12) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.26 Control sequence (2 slots fixed type 64kbit/s UDI Channel switching during communication (Switching to other CS：Recalling-type with PS request from 1st TCH side))

(2) 2nd TCH


PS
Switching origin CS
Switching destination CS
1st TCH 2nd TCH
1st TCH 2nd TCH
1st TCH 2nd TCH
Cch
Cch
Communication in progress
Communication in progress
Level degradation /
reception quality degradation
UI RT TCH switching request SACCH/FACCH
UI RT TCH switching indication SACCH/FACCH
Synchronization burst
2nd synchronization burst
Link channel establishment request SCCH
Link channel assignment SCCH
Synchronization burst
Synchronization burst
SABM (note 5) FACCH&SACCH
UA FACCH&SACCH
I RT Additional channel Request SACCH/FACCH
I RT Additional channel Assign (note 12) SACCH/FACCH
2nd synchronization burst
2nd synchronization burst
Idle TCH
Idle TCH
I CC Setup (note 6) SACCH/FACCH
I CC Call proceeding SACCH/FACCH
I RT Function request (note 7) SACCH/FACCH
I RT Function request response (note8) SACCH/FACCH
I RT Encryption key set SACCH/FACCH
I MM Function request (note 7) SACCH/FACCH
I MM Function request response (note8) SACCH/FACCH
I MM Authentication request (note 10) SACCH/FACCH
I MM Authentication response (note10) SACCH/FACCH
DISC FACCH
UA FACCH
I CC Connect (note 6) SACCH
Communication in progress
Communication in progress

(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message, PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a Public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitted only in a private system.
(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.
(Note 12) Appropriate frequency band for the PS should be chosen.

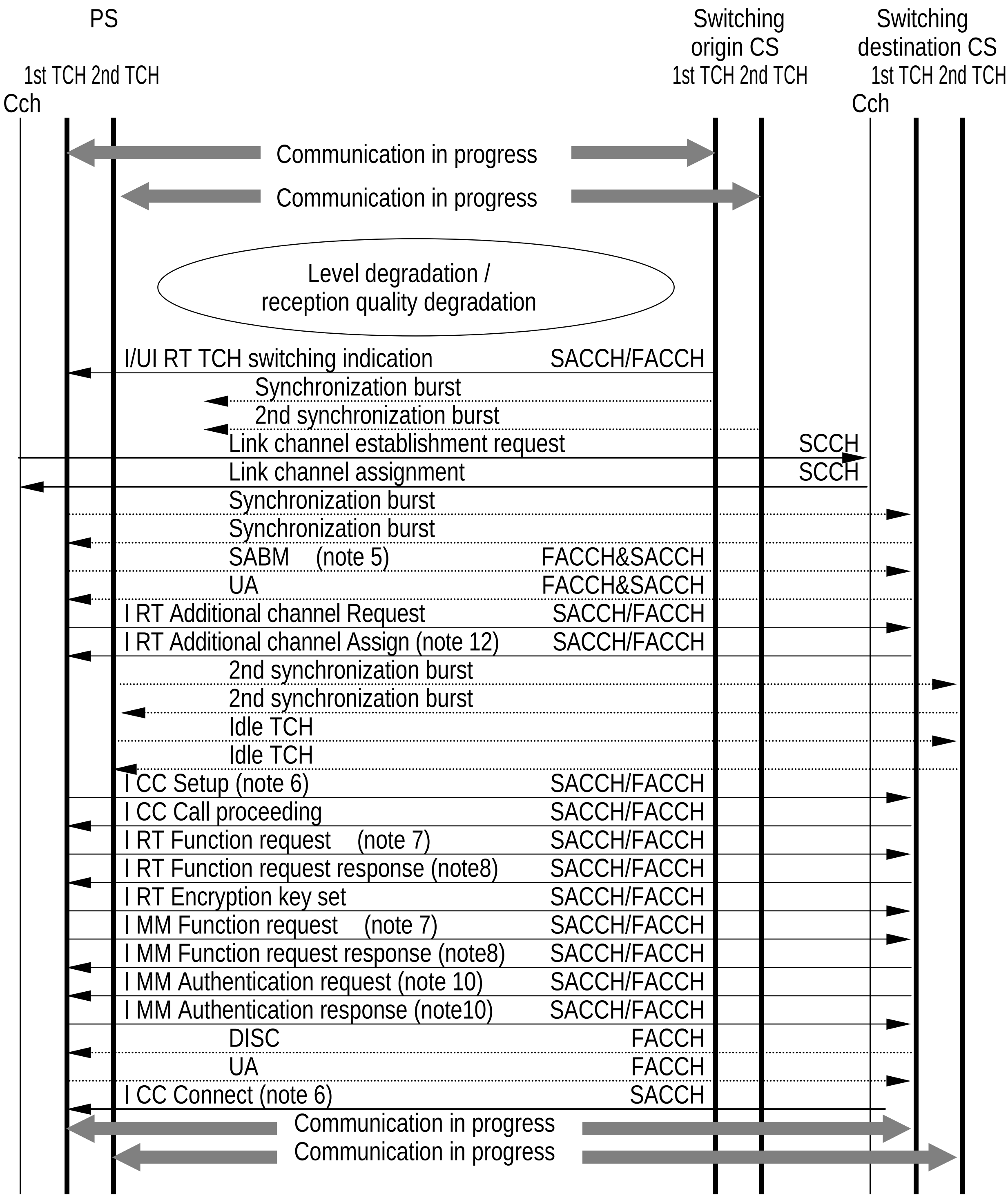
Figure 4.4.3.8.27 Control sequence (2 slots fixed type 64kbit/s UDI Channel switching during communication (Switching to other CS：Recalling-type with PS request from 2nd TCH side))

4.4.3.8.8.4.4 2 slots fixed type 64kbit/s UDI Channel switching during communication (switching to other CS : Recalling-type with CS indication) (Private standard/ Public standard)

The control sequence is shown in Figure 4.4.3.8.28 and 29.

The control order is the same as that explained in section 4.4.3.8.8.4.2.

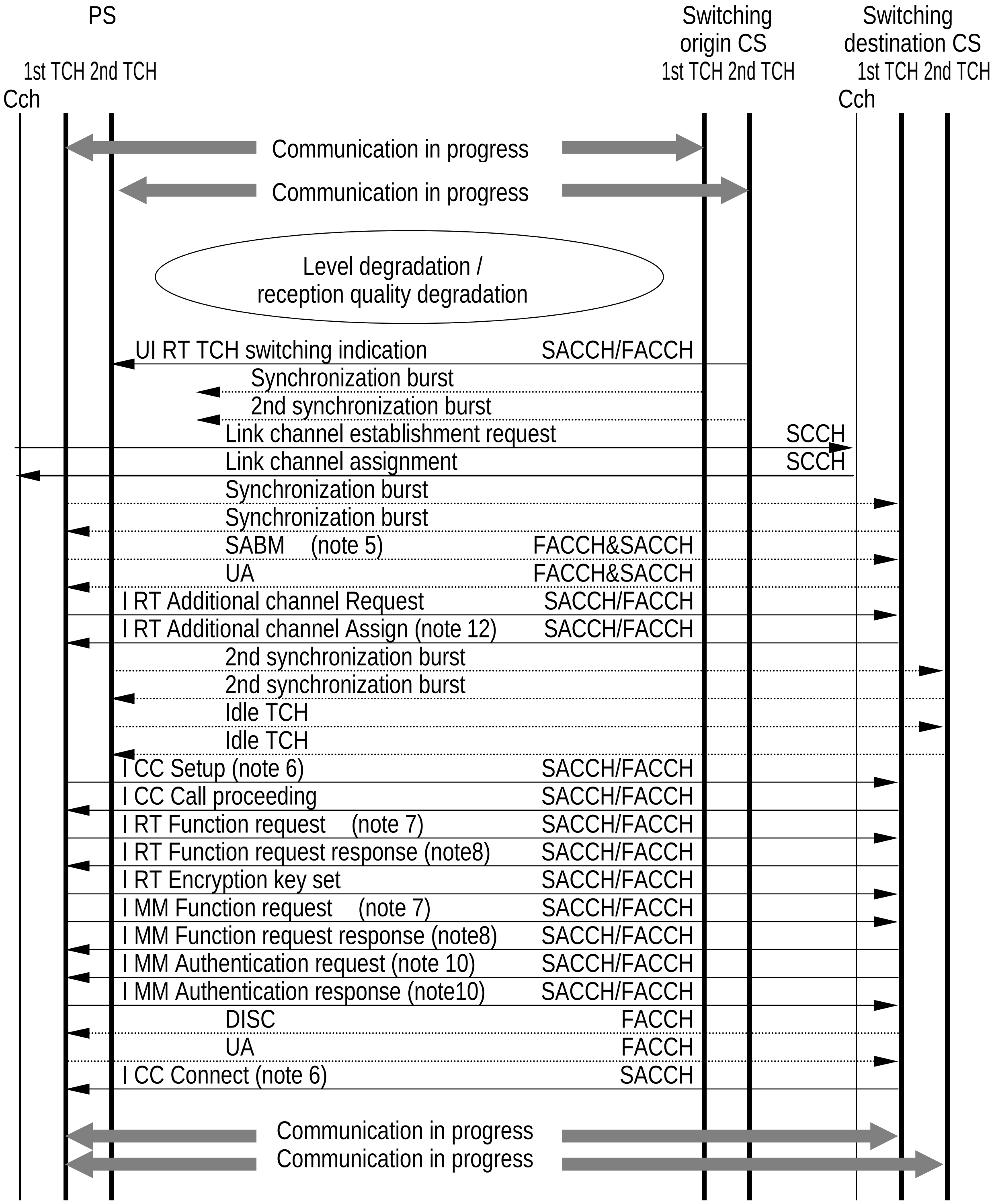
(1) 1st TCH



(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message, PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a Public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitted only in a private system.
(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.
(Note 12) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.28 Control sequence (2 slots fixed type 64k bit/s UDI Channel switching during communication
(Switching to other CS：Recalling-type with CS indication from 1st TCH side))

(2) 2nd TCH


PS
Switching origin CS
Switching destination CS
1st TCH 2nd TCH
1st TCH 2nd TCH
1st TCH 2nd TCH
Cch
Cch
Communication in progress
Communication in progress
Level degradation / reception quality degradation
UI RT TCH switching indication SACCH/FACCH
Synchronization burst
2nd synchronization burst
Link channel establishment request SCCH
Link channel assignment SCCH
Synchronization burst
Synchronization burst
SABM (note 5) FACCH&SACCH
UA FACCH&SACCH
I RT Additional channel Request SACCH/FACCH
I RT Additional channel Assign (note 12) SACCH/FACCH
2nd synchronization burst
2nd synchronization burst
Idle TCH
Idle TCH
I CC Setup (note 6) SACCH/FACCH
I CC Call proceeding SACCH/FACCH
I RT Function request (note 7) SACCH/FACCH
I RT Function request response (note8) SACCH/FACCH
I RT Encryption key set SACCH/FACCH
I MM Function request (note 7) SACCH/FACCH
I MM Function request response (note8) SACCH/FACCH
I MM Authentication request (note 10) SACCH/FACCH
I MM Authentication response (note10) SACCH/FACCH
DISC FACCH
UA FACCH
I CC Connect (note 6) SACCH
Communication in progress
Communication in progress

(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message, PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a Public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitted only in a private system.
(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.
(Note 12) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.29 Control sequence (2 slots fixed type 64k bit/s UDI Channel switching during communication (Switching to other CS：Recalling-type with CS indication from 2nd TCH side))

4.4.3.8.8.4.5 Slot changeable type 64kbit/s UDI Channel switching during communication (switching to other CS : PS recalling-type) (Private standard/ Public standard)

The control sequence is shown in Figure 4.4.3.8.30.

The control order is as follows.

[1] TCH Addtion (RT)

For 64kbit/s UDI, the user requires the network to assign the 2nd TCH by the additional channel request message (RT) on the first assigned TCH (1st TCH). The responding network indicates the 2nd TCH channel to the user by the additional channel assign message (RT).

While processing synchronous establishment of 2nd TCH, the 1st TCH sustains the former situation without following proceeding. However even if 2nd TCH is not necessarily establishment, it is possible to shift to the processing of following. After the establishment, the 2nd TCH keeps the idle TCH condition.

[2] Recalling-type handover request (CC)

Handover is initiated by the user transmitting a setup message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) to the network.

[3] Recalling-type handover proceeding (CC)

When the network receives the setup message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) and confirms that call acceptance is suitable, the network sends a call proceeding message (CC) to the user to indicate that the call is being processed, and it enters “ outgoing call proceeding (CC) : Recalling (function operation) “ state.

When the user receives the call proceeding message (CC), it enters “ outgoing call proceeding (CC) : Recalling (functional operation) “ state.

The network that received the setup message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) judges whether or not the authentication reciphering pattern obtained using the authentication key in the home memory of the user agrees with authentication ciphering pattern reported from the user by facility information element. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing. If the authentication result is OK, handover continues.

Only in a private system, the network can do the authentication with the authentication request message (MM) and the authentication response message (MM) by the judgment of the network, without the reference of the authentication ciphering pattern in the setup message (facility : Private recalling-type channel switching) (CC).

[4] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[5] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

This encryption key is common both of the 1st TCH and the 2nd TCH.

[6] MM function request (MM)

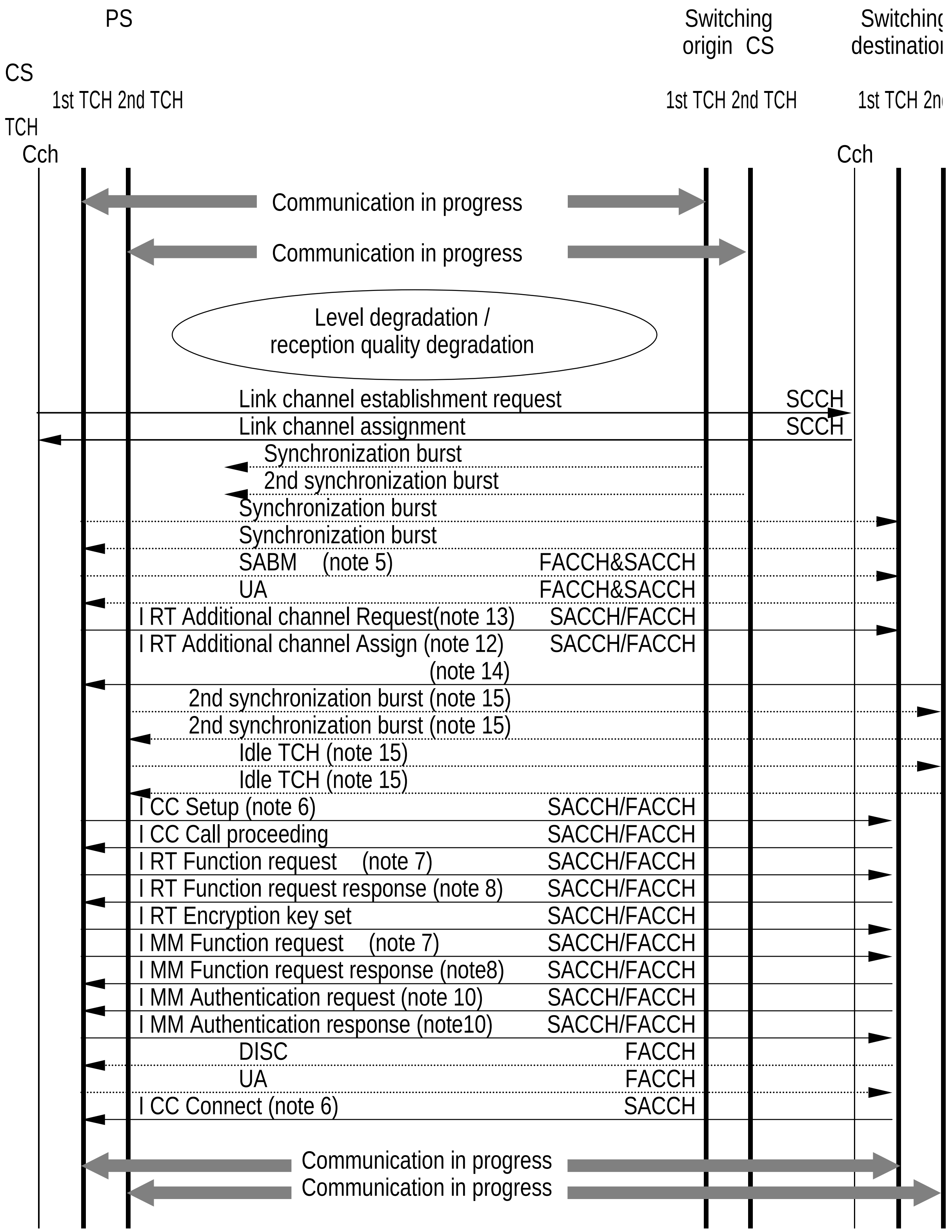
A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[7] Authentication (MM)

In a private system, if the network does not do the authentication by the authentication ciphering pattern in the setup message (facility : Private recalling-type channel switching) (CC) by the judgment of the network, the authentication procedure is as follows. In the case, the user follows the request of the network. When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agree with that reported from the user. If the authentication result is NG, the call release procedure is initiated according to the regulation of call clearing. If the authentication result is OK, the network continues handover procedures.

[8] Call connected (CC)

If the network receives an indication of the fact that recalling-type handover was accepted, it transmits a connect message (facility : Recalling-type channel switching or Private recalling-type channel switching) (CC) to the user. The user who received the connect message (facility: Recalling-type channel switching or Private recalling-type channel switching) (CC) terminates handover normally, and both the 1st and 2nd TCH to “active” state.



(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible

recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, PS can start the recalling operation due to compatibility with the switching origin CS.

(Note 4) In a Public system, switching among paging areas is a CS option.

(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.

(Note 6) Facility information element is mandatory.

(Note 7) This control signal can be omitted as necessary.

(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.

(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.

(Note 10) This control signal can be transmitted only in a private system.

(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.

(Note 12) Appropriate frequency band for the PS should be chosen.

(Note 13) This control signal can be omitted as necessary in Slot changeable type 64k bit/s Unrestricted Information.

(Note 14) This control signal is for the previous control signal with the (Note 13) attached. It is transmitted only when the relevant control signal is received.

(Note 15) When additional channel processing is omitted, this control signal is in Slot changeable.

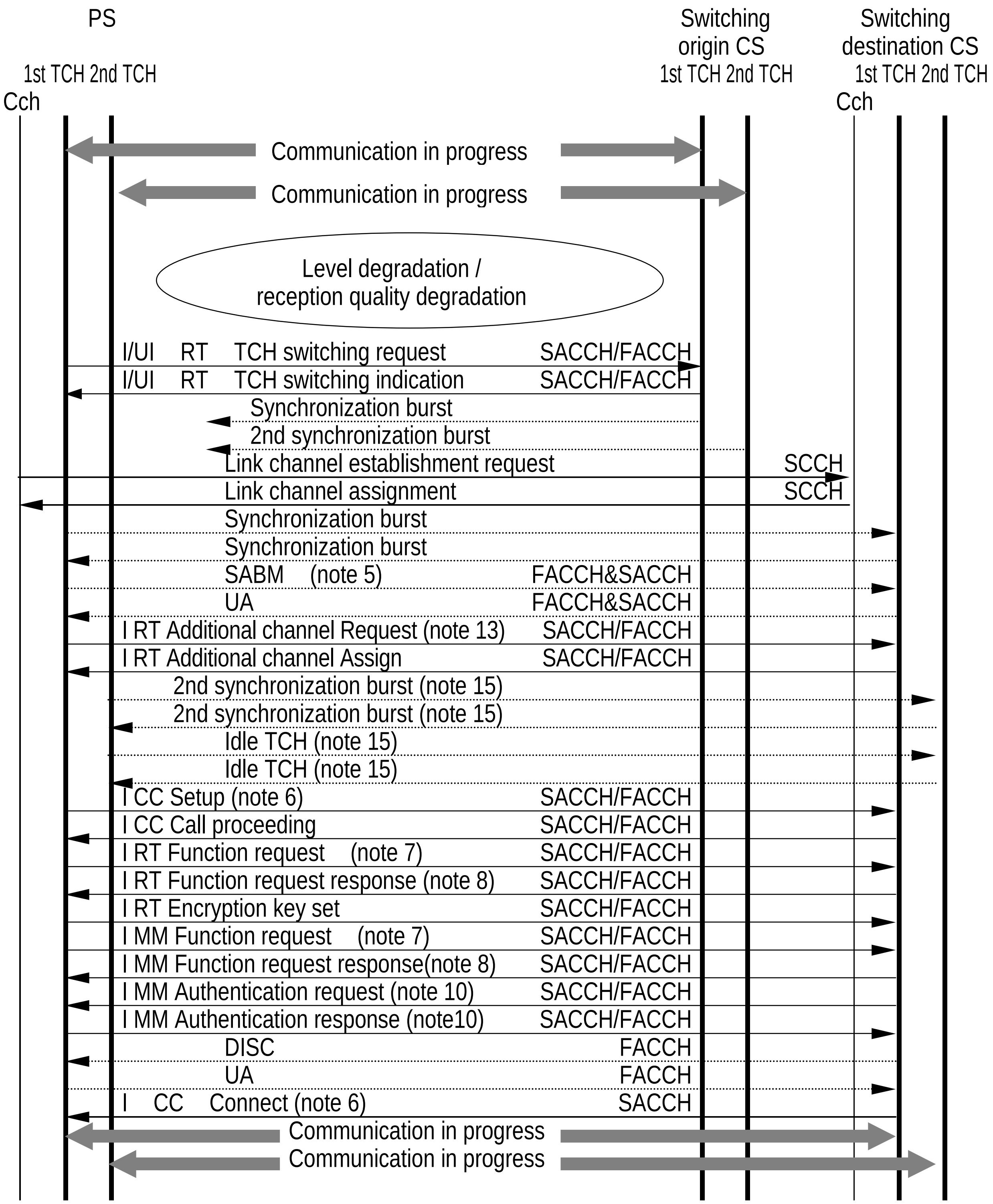
Figure 4.4.3.8.30 Control sequence (Slot changeable type 64kbit/s UDI Channel switching during communication (switching to other CS : PS recalling-type)

4.4.3.8.8.4.6 Slot changeable type 64kbit/s UDI Channel switching during communication (switching to other CS : Recalling-type with PS request) (Private standard/ Public standard)

The control sequence is shown in Figure 4.4.3.8.31 and 32.

The control order is the same as that explained in section 4.4.3.8.8.4.5.

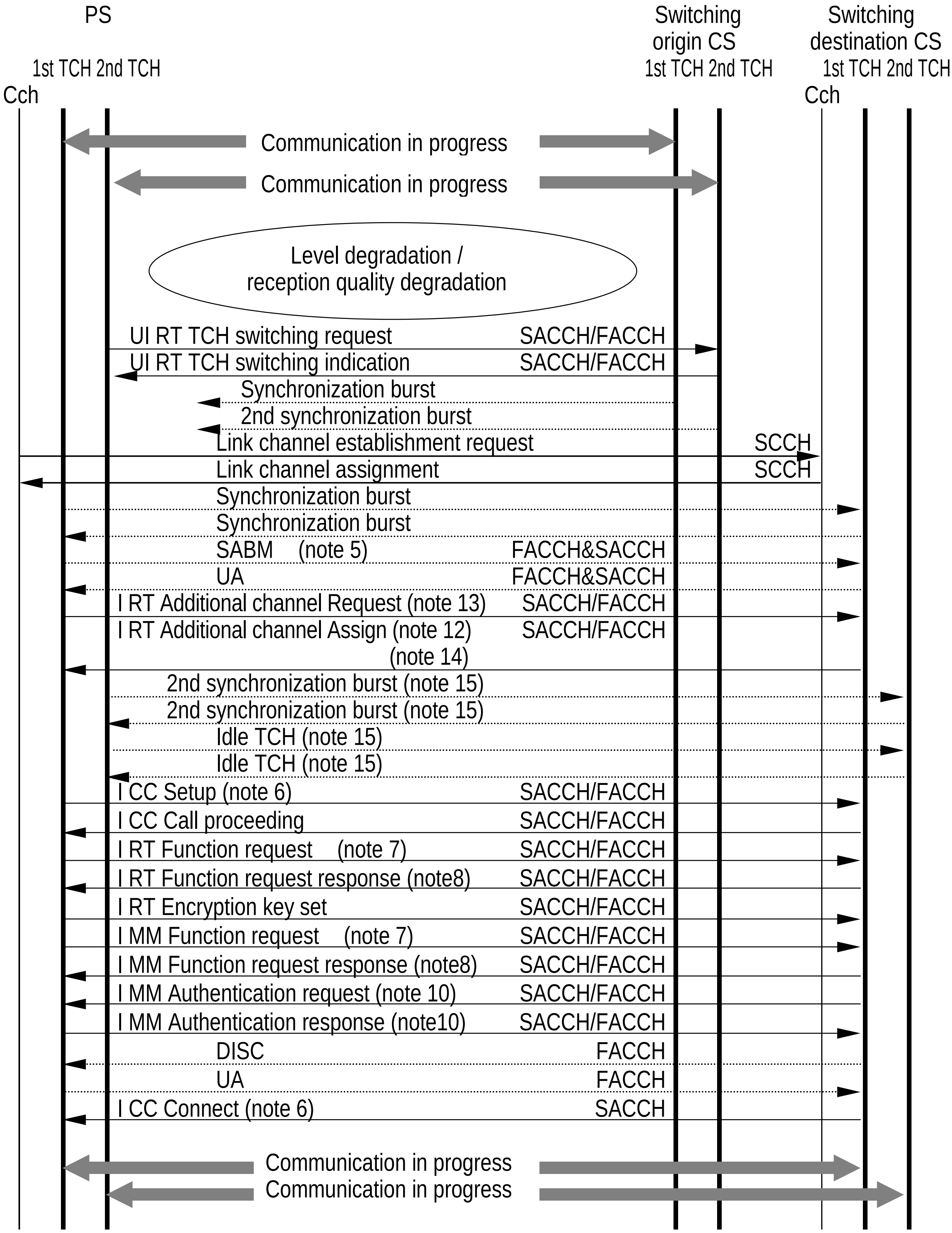
(1) 1st TCH



(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message, PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a Public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitted only in a private system.
(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.
(Note 12) Appropriate frequency band for the PS should be chosen.
(Note 13) This control signal can be omitted as necessary in Slot changeable type 64k bit/s Unrestricted Information.
(Note 14) This control signal is for the previous control signal with the (Note 13) attached. It is transmitted only when the relevant control signal is received.
(Note 15) When additional channel processing is omitted, this control signal is in Slot changeable.

Figure 4.4.3.8.31 Control sequence (Slot changeable type 64kbit/s UDI Channel switching during communication (Switching to other CS：Recalling-type with PS request from 1st TCH side))

(2) 2nd TCH


PS
Switching origin CS
Switching destination CS
1st TCH 2nd TCH
1st TCH 2nd TCH
1st TCH 2nd TCH
Cch
Cch
Communication in progress
Communication in progress
Level degradation / reception quality degradation
UI RT TCH switching request SACCH/FACCH
UI RT TCH switching indication SACCH/FACCH
Synchronization burst
2nd synchronization burst
Link channel establishment request SCCH
Link channel assignment SCCH
Synchronization burst
Synchronization burst
SABM (note 5) FACCH&SACCH
UA FACCH&SACCH
I RT Additional channel Request (note 13) SACCH/FACCH
I RT Additional channel Assign (note 12) (note 14) SACCH/FACCH
2nd synchronization burst (note 15)
2nd synchronization burst (note 15)
Idle TCH (note 15)
Idle TCH (note 15)
I CC Setup (note 6) SACCH/FACCH
I CC Call proceeding SACCH/FACCH
I RT Function request (note 7) SACCH/FACCH
I RT Function request response (note8) SACCH/FACCH
I RT Encryption key set SACCH/FACCH
I MM Function request (note 7) SACCH/FACCH
I MM Function request response (note8) SACCH/FACCH
I MM Authentication request (note 10) SACCH/FACCH
I MM Authentication response (note10) SACCH/FACCH
DISC FACCH
UA FACCH
I CC Connect (note 6) SACCH
Communication in progress
Communication in progress

(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message, PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a Public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitted only in a private system.
(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.
(Note 12) Appropriate frequency band for the PS should be chosen.
(Note 13) This control signal can be omitted as necessary in Slot changeable type 64k bit/s Unrestricted Information.
(Note 14) This control signal is for the previous control signal with the (Note 13) attached. It is transmitted only when the relevant control signal is received.
(Note 15) When additional channel processing is omitted, this control signal is in Slot changeable.

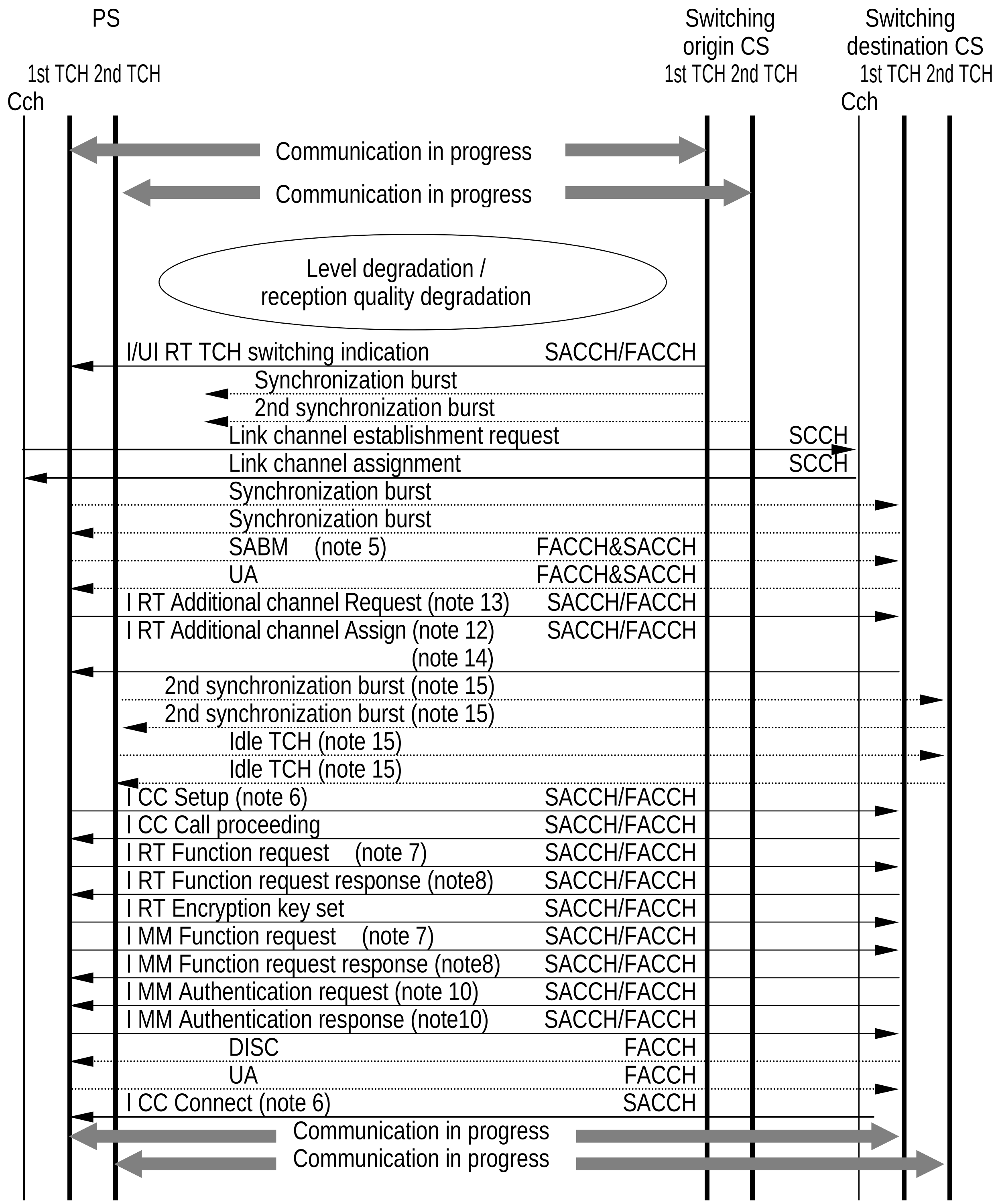
Figure 4.4.3.8.32 Control sequence (Slot changeable type 64kbit/s UDI Channel switching during communication (Switching to other CS：Recalling-type with PS request from 2nd TCH side))

4.4.3.8.8.4.7 Slot changeable type 64kbit/s UDI Channel switching during communication (switching to other CS : Recalling-type with CS indication) (Private standard/ Public standard)

The control sequence is shown in Figure 4.4.3.8.33 and 34.

The control order is the same as that explained in section 4.4.3.8.8.4.5.

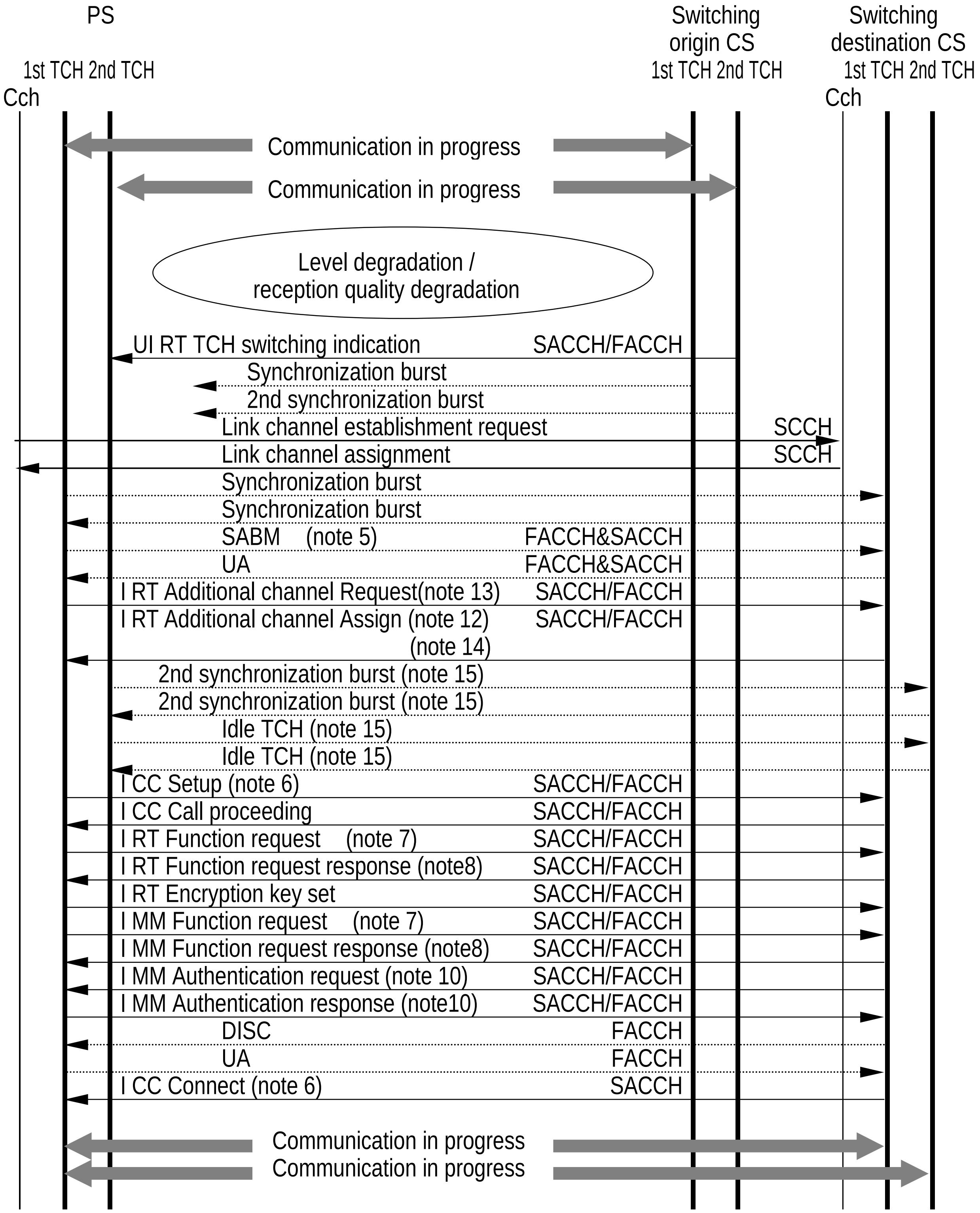
(1) 1st TCH



(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message, PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a Public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitted only in a private system.
(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.
(Note 12) Appropriate frequency band for the PS should be chosen.
(Note 13) This control signal can be omitted as necessary in Slot changeable type 64k bit/s Unrestricted Information.
(Note 14) This control signal is for the previous control signal with the (Note 13) attached. It is transmitted only when the relevant control signal is received.
(Note 15) When additional channel processing is omitted, this control signal is in Slot changeable.

Figure 4.4.3.8.33 Control sequence (Slot changeable type 64k bit/s UDI Channel switching during communication (Switching to other CS：Recalling-type with CS indication from 1st TCH side))

(2) 2nd TCH


PS
Switching origin CS
Switching destination CS
1st TCH 2nd TCH
Cch
1st TCH 2nd TCH
1st TCH 2nd TCH
Cch
Communication in progress
Communication in progress
Level degradation / reception quality degradation
UI RT TCH switching indication
SACCH/FACCH
Synchronization burst
2nd synchronization burst
Link channel establishment request
SCCH
Link channel assignment
SCCH
Synchronization burst
Synchronization burst
SABM (note 5)
FACCH&SACCH
UA
FACCH&SACCH
I RT Additional channel Request(note 13)
SACCH/FACCH
I RT Additional channel Assign (note 12) (note 14)
SACCH/FACCH
2nd synchronization burst (note 15)
2nd synchronization burst (note 15)
Idle TCH (note 15)
Idle TCH (note 15)
I CC Setup (note 6)
SACCH/FACCH
I CC Call proceeding
SACCH/FACCH
I RT Function request (note 7)
SACCH/FACCH
I RT Function request response (note8)
SACCH/FACCH
I RT Encryption key set
SACCH/FACCH
I MM Function request (note 7)
SACCH/FACCH
I MM Function request response (note8)
SACCH/FACCH
I MM Authentication request (note 10)
SACCH/FACCH
I MM Authentication response (note10)
SACCH/FACCH
DISC
FACCH
UA
FACCH
I CC Connect (note 6)
SACCH
Communication in progress
Communication in progress

(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT function requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message, PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) In a Public system, switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) Before layer 2 DISC transmission on FACCH, the layer 2 multiframe acknowledged operation mode should be established on SACCH.
(Note 10) This control signal can be transmitted only in a private system.
(Note 11) On channel switching to other CS during communication (recalling type), the both of 1st TCH and 2nd TCH switch to other CS.
(Note 12) Appropriate frequency band for the PS should be chosen.
(Note 13) This control signal can be omitted as necessary in Slot changeable type 64k bit/s Unrestricted Information.
(Note 14) This control signal is for the previous control signal with the (Note 13) attached. It is transmitted only when the relevant control signal is received.
(Note 15) When additional channel processing is omitted, this control signal is in Slot changeable.

Figure 4.4.3.8.34 Control sequence (Slot changeable type 64k bit/s UDI Channel switching during communication (Switching to other CS：Recalling-type with CS indication from 2nd TCH side))

4.4.3.8.8.5 Additional 2nd TCH during communication (Slot changeable type 64k bit/s UDI)
(Private standard/Public standard)

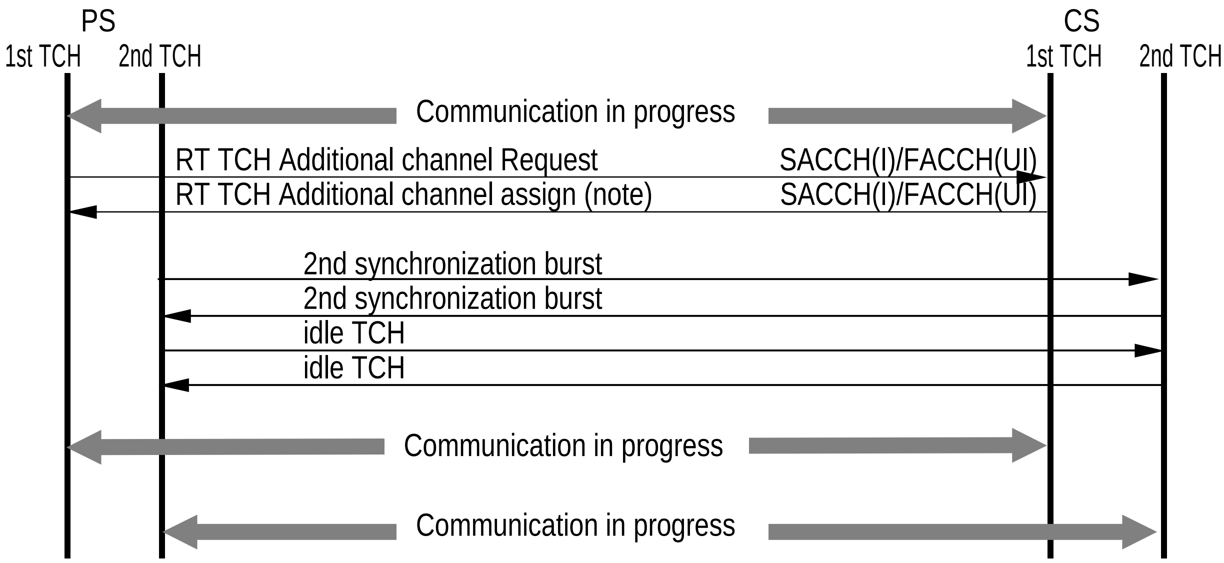
4.4.3.8.8.5.1 Additional 2nd TCH during communication (With PS request)
(Private standard/Public standard)

The control sequence is shown in Figure 4.4.3.8.35.

The control order is as follows.

(1) TCH Added (RT)

For 64k bit/s UDI, the user require the network to assign 2nd TCH by additional channel request message (RT) on the first assigned TCH (1st TCH). The responding network indicates the 2nd TCH channel to the user by the additional channel assign message (RT).
While processing synchronous establishment of 2nd TCH, the 1st TCH sustains the former situation without following proceeding. However even if 2nd TCH is not necessarily establishment, it is possible to shift to the processing of following. After the establishment, the 2nd TCH keeps the idle TCH condition.



(Note) Appropriate frequency band the PS should be chosen.

Figure 4.4.3.8.35 Control sequence (Additional 2nd TCH during communication (With PS request))

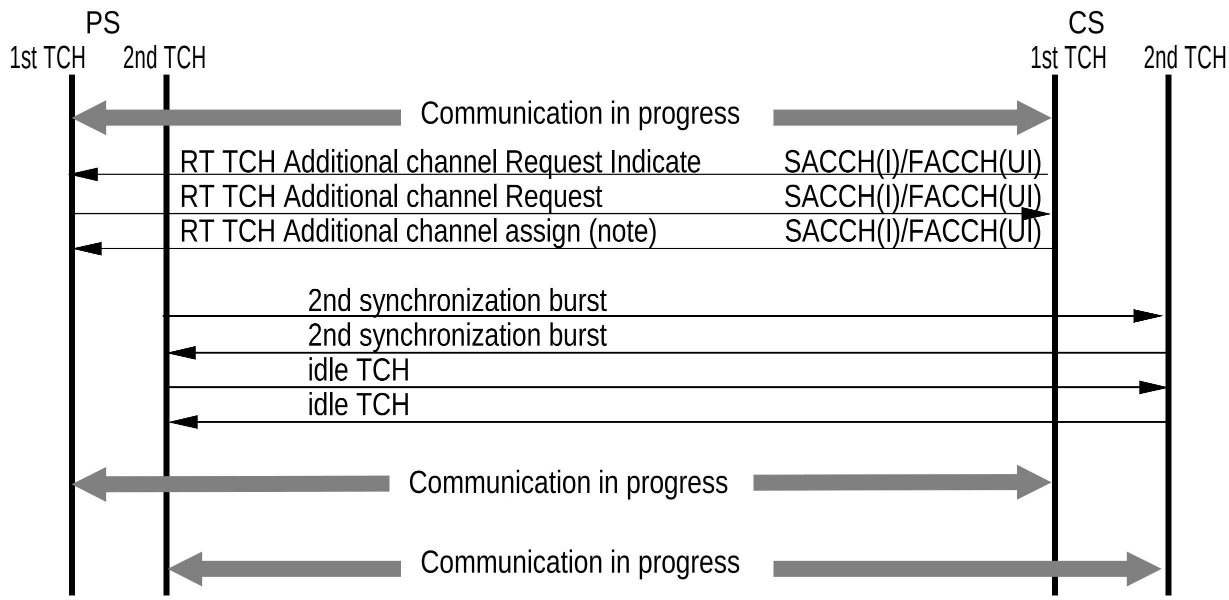
4.4.3.8.8.5.2 Additional 2nd TCH during communication (With CS indication)
(Private standard/Public standard)

The control sequence is shown in Figure 4.4.3.8.36.

The control order is as follows.

(1) TCH Added (RT)

For 64k bit/s UDI, the user require the network to assign 2nd TCH by additional channel request message (RT) on the first assigned TCH (1st TCH). The responding network indicates the 2nd TCH channel to the user by the additional channel assign message (RT).
While processing synchronous establishment of 2nd TCH, the 1st TCH sustains the former situation without following proceeding. However even if 2nd TCH is not necessarily establishment, it is possible to shift to the processing of following. After the establishment, the 2nd TCH keeps the idle TCH condition.



(Note) Appropriate frequency band the PS should be chosen.

Figure 4.4.3.8.36 Control sequence (Additional 2nd TCH during communication (With CS indication))

4.4.3.8.8.6 2nd TCH disconnection processing procedure (Slot changeable type)
(Private standard/Public standard)

The control sequence when 2nd TCH is disconnected, is shown in Figure 4.4.3.8.37 and 38.

(1) PS side disconnect

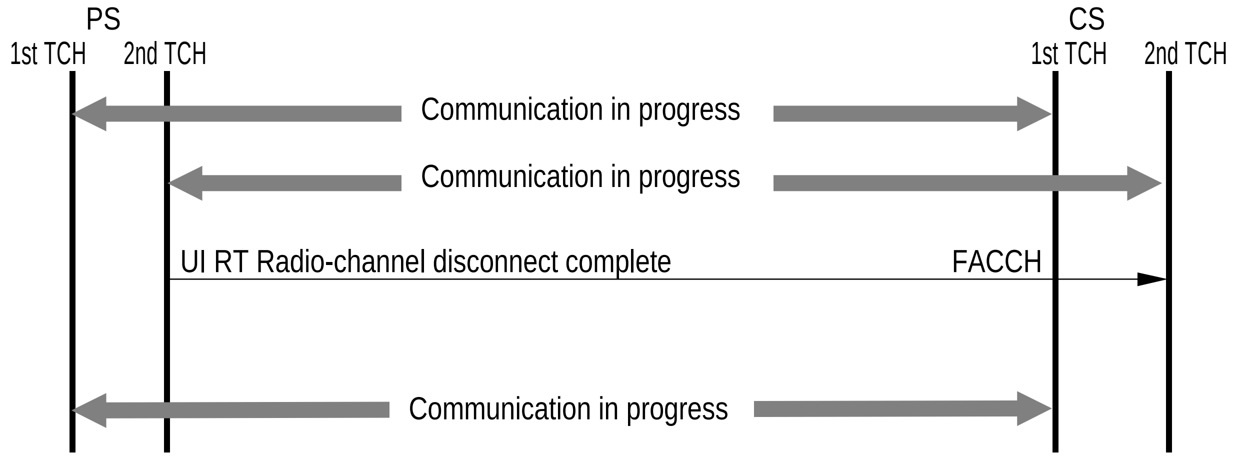


Figure 4.4.3.8.37 Control sequence (PS side 2nd TCH disconnect)

(2) CS side disconnect

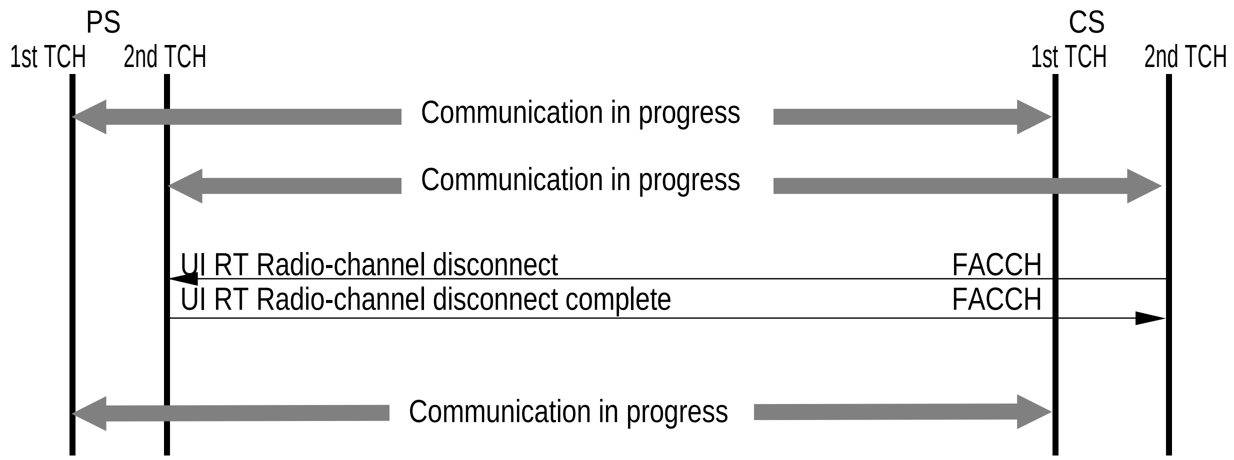
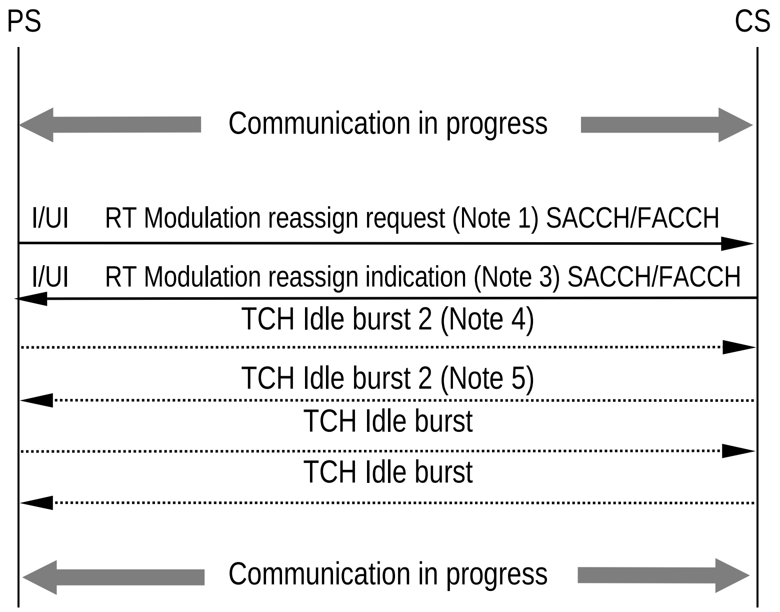


Figure 4.4.3.8.38 Control sequence (CS side 2nd TCH disconnect)

4.4.3.8.8.7 Modulation reassign during communication

The control sequence of modulation reassign during communication is shown in Figure 4.4.3.8.39.



(Note 1) Unnecessary in case of CS activation

(Note 2) Modulation reasign during communication is performed only during communication, and is not performed during the service channel establishment phase.

(Note 3) Appropriate modulation types for the PS should be chosen.

(Note 4) PS changes its receiving modulation type at TCH idle burst2 transmission timing.
CS changes receiving/transmitting modulation types after receiving TCH idle burst2 from PS.

(Note 5) PS changes its transmitting modulation type after receiving TCH idle burst2 from CS.

Figure 4.4.3.8.39 Control sequence (Modulation reassign during communication)

4.4.3.8.9 π /2 shift BPSK communication (Public standard)

4.4.3.8.9.1 Outgoing call (π /2 shift BPSK)

The control sequence of outgoing call (π /2 shift BPSK) is shown in Figure 4.4.3.8.9.1.

The control order is as follows.

[1] Call request (CC)

Call establishment is initiated by the user transmitting a setup message (CC) to the network. However, if outgoing call is restricted by restriction information in the system information broadcasting message (BCCH), it operates according to the restriction information.

[2] Call proceeding (CC)

When the network receives the setup message (CC) and confirms that call acceptance is suitable, the network sends a call proceeding message (CC) to the user to indicate that the call is being processed, and it enters "outgoing call proceeding" state.

When the user receives the call proceeding message (CC), it enters "outgoing call proceeding" state.

[3] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives it reports notification information by a definition information response message (RT).

[4] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[5] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

[6] MM function request (MM)

A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[7] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing. If the authentication result is OK, call connection continues.

[8] Call confirmation indication (CC)

If the network receives an indication of the fact that destination user alerting was initiated, the network transmits an alerting message (CC) to the user.

[9] Call connected (CC)

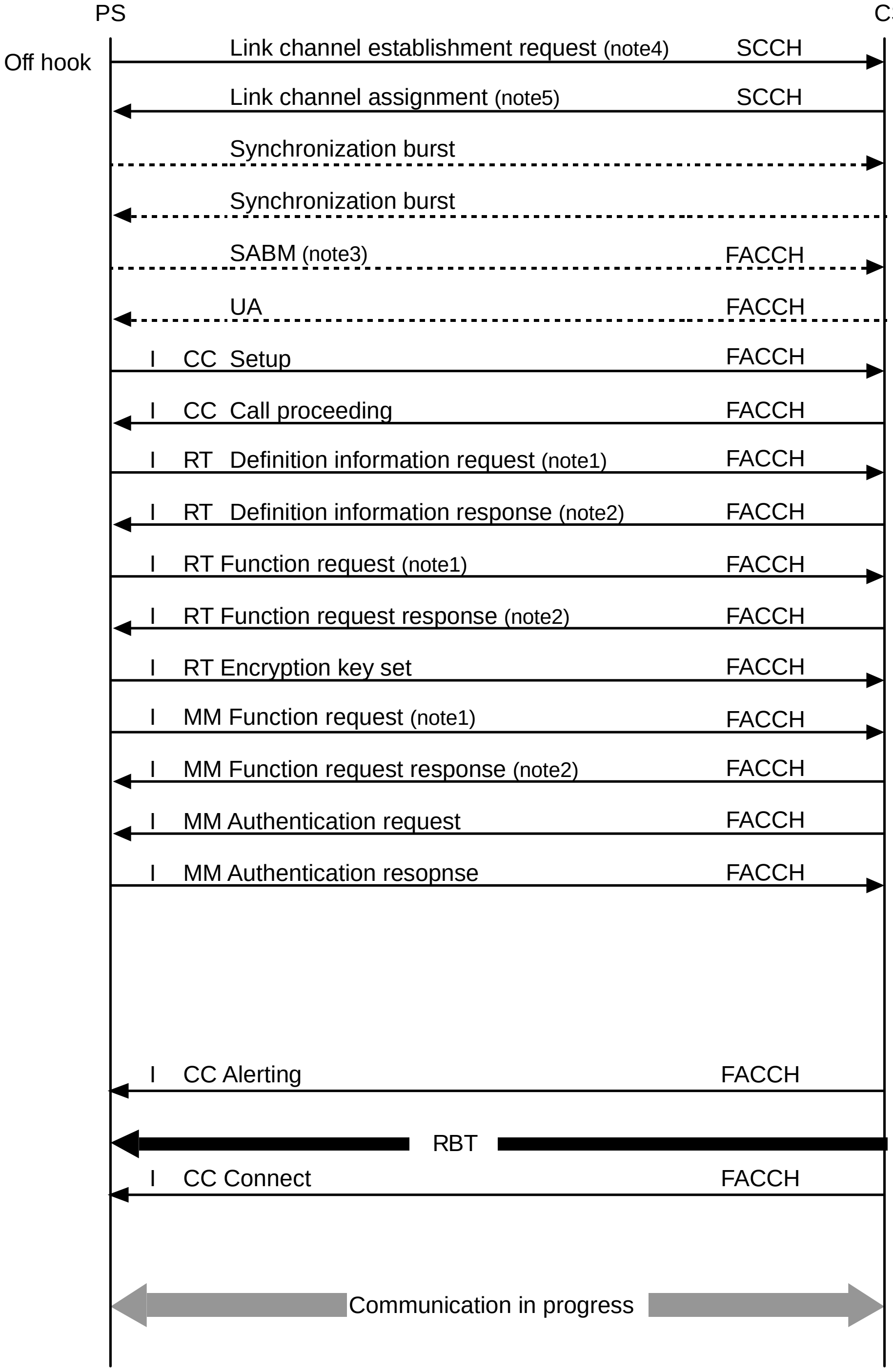
If the network receives an indication of the fact that the call was accepted by the destination user, it transmits a connect message (CC) to the user.

[10] Call reject (RT, MM, CC)

If it is indicated by the network or destination user that the call cannot be accepted, the call release procedure is initiated according to the regulations of call clearing.

(Note) Interworking report at origination-side interface

During call establishment, if CS originated a call to a non-ISDN network or if it received a message containing a progress indicator from ISDN, the progress indicator information element is returned to the origination user by call control message (call proceeding, alerting, connect) or a progress message.



(Note 1) This control signal can be omitted as necessary.

(Note 2) This control signal is for the previous control signal with the (note 1) attached. It is transmitted only when the relevant control signal is received.

(Note 3) The layer 3 sequence of the service channel establishment phase is activated after the FACCH layer 2 multiframe acknowledged operation mode is established.

(Note 4) LCH type information element is standard (π /4 shift QPSK 32Kbit/s or 16kbit/s or π /2 shift BPSK 16kbit/s) in this control signal.
There are a few cases in which modulation type of this control signal is defined as π /2 shift BPSK.

(Note 5) π /2 shift BPSK is used only at the situation that LCH type of this control signal is defined as standard(π /2 shift BPSK 16kbit/s) after synchronization burst.
This control signal modulation type is π /4 shift QPSK

Figure 4.4.3.8.9.1 Control sequence (Outgoing call (π /2 shift BPSK))

4.4.3.8.9.2 Incoming call (π /2 shift BPSK) (Public standard)

The control sequence of incoming call (π /2 shift BPSK) is shown in Figure 4.4.3.8.9.2.

The control order is as follows.

[1] Incoming call request

The network indicates incoming call by transmitting a paging message (PCH) to the user.

The user receives the paging message (PCH), and establishes LCH.

[2] Incoming call response (RT)

After LCH establishment, the user transmits a paging response message (RT) to the network.

[3] Call present(CC)

The network which has received the paging response message (RT) transmits a setup message (CC).

[4] Response to setup (CC)

The user which has received the setup message (CC) responds by a call proceeding message (CC).

[5] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives this, reports notification information by a definition information response message (RT).

[6] RT function request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[7] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

[8] MM function request (MM)

A user that has indicated that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[9] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing. If the authentication result is OK, call connection continues.

[10] Call received (CC)

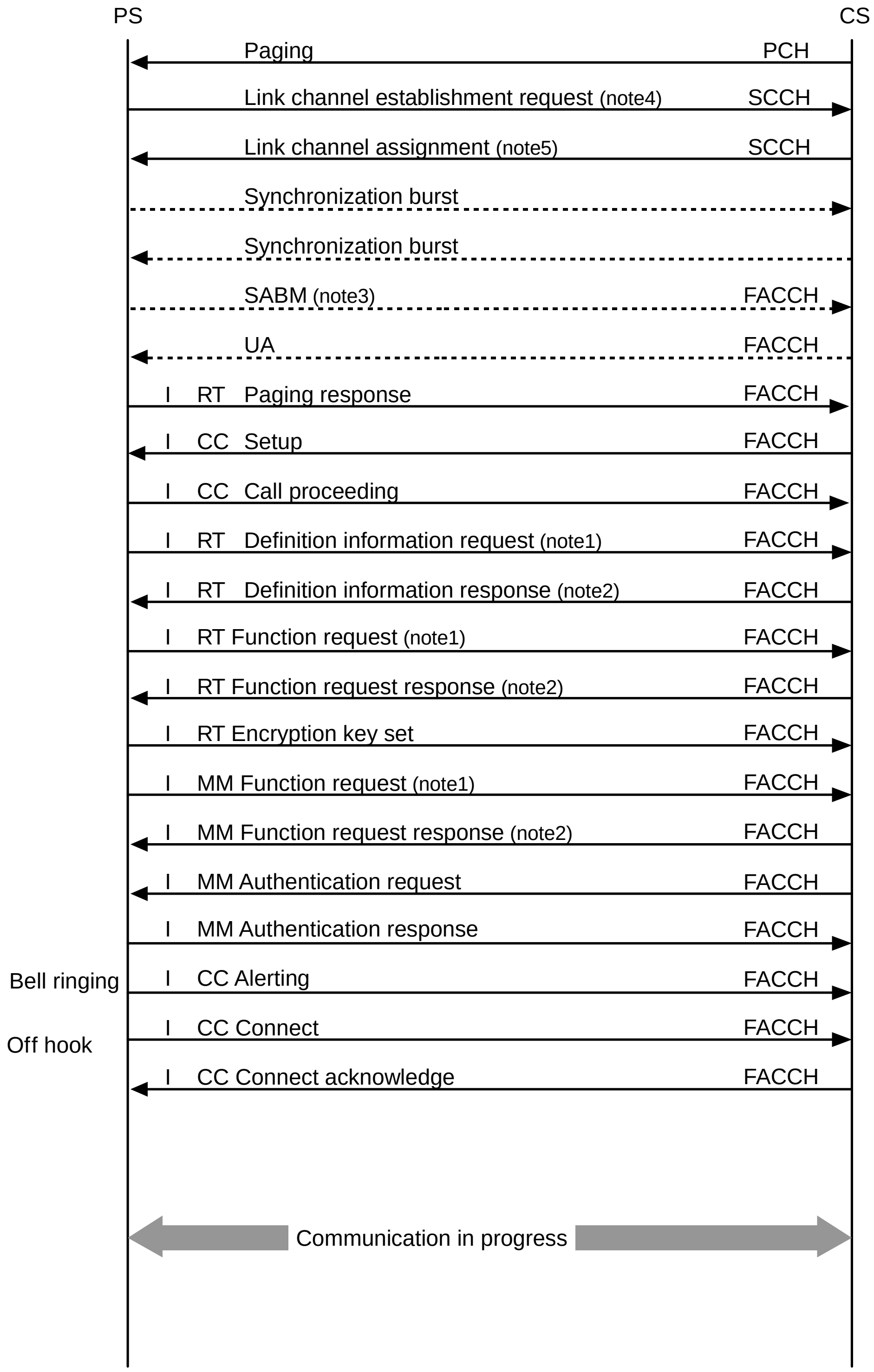
The user that sent the authentication response message (MM) transmits an alerting message (CC) or connect message (CC). (By judgment of user)

[11] Call accept (CC)

If the user goes off hook after an alerting message (CC) is transmitted, the user reports acceptance of the incoming call by transmitting a connect message (CC) to the network.

[12] Active indication (RT, MM, CC)

A network which has received a connect message (CC) transmits a connect acknowledge message (CC) to the user. The user receives a connect acknowledge message (CC) which indicates that the circuit switched connection was completed, and it enters "active" state.



(Note 1) This control signal can be omitted as necessary.

(Note 2) This control signal is for the previous control signal with the (note 1) attached. It is transmitted only when the relevant control signal is received.

(Note 3) The layer 3 sequence of the service channel establishment phase is activated after the FACCH layer 2 multiframe acknowledged operation mode is established.

(Note 4) LCH type information element is standard (π /4 shift QPSK 32Kbit/s or 16kbit/s or π /2 shift BPSK 16kbit/s) in this control signal.

There are a few cases in which modulation type of this control signal is defined as π /2 shift BPSK.

(Note 5) π /2 shift BPSK is used only at the situation that LCH type of this control signal is defined as standard(π /2 shift BPSK 16kbit/s) after synchronization burst.
This control signal modulation type is π /4 shift QPSK.

Figure 4.4.3.8.9.2 Control sequence (Incoming call (π /2 shift BPSK))

4.4.3.8.9.3 Disconnect (π /2 shift BPSK) (Public standard)

The control sequence of disconnect (π /2 shift BPSK) is shown in Figure 4.4.3.8.9.3 and 4.

(1) PS side disconnect (π /2 shift BPSK)

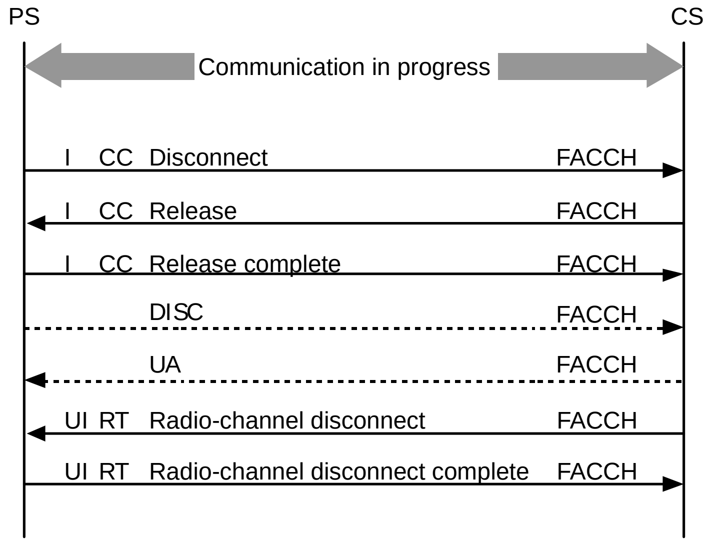


Figure 4.4.3.8.9.3 Control sequence (PS side disconnect (π /2 shift BPSK))

(2) CS side disconnect (π /2 shift BPSK)

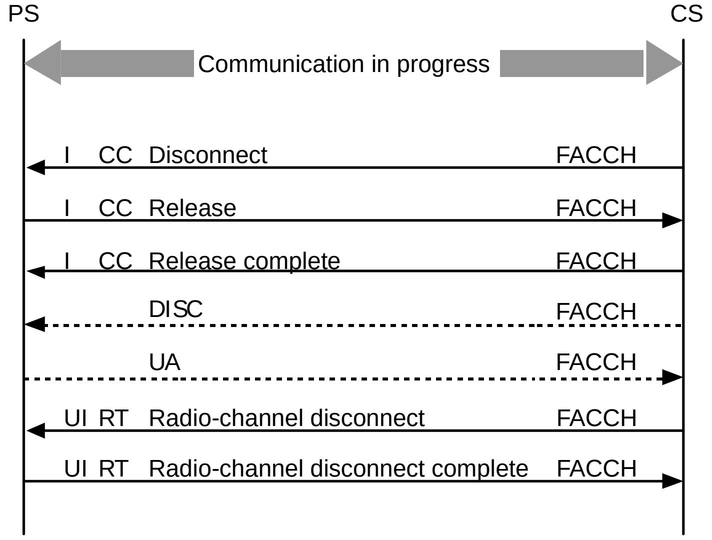


Figure 4.4.3.8.9.4 Control sequence (CS side disconnect (π /2 shift BPSK))

4.4.3.8.9.4 Location registration (π /2 shift BPSK) (Public standard)

The control sequence of registration (π /2 shift BPSK) is shown in Figure 4.4.3.8.9.5.

The control order is as follows.

[1] Location registration request (MM)

Location registration is initiated by the user transmitting a location registration request message (MM) to the network. However, if location registration is restricted by restriction information in the system information broadcasting message (BCCH), it operates according to the restriction information.

[2] Notification information request (RT)

If the user receives a notification information reception indication, the user requests notification information by a definition information request message (RT). The network which receives it reports the notification information by a definition information response message (RT).

[3] RT function request (RT)

A user that has indicated that it performs an RT function request, requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[4] Encryption key set (RT)

The user transfers the encryption key to the network by an encryption key set message (RT).

[5] MM function request (MM)

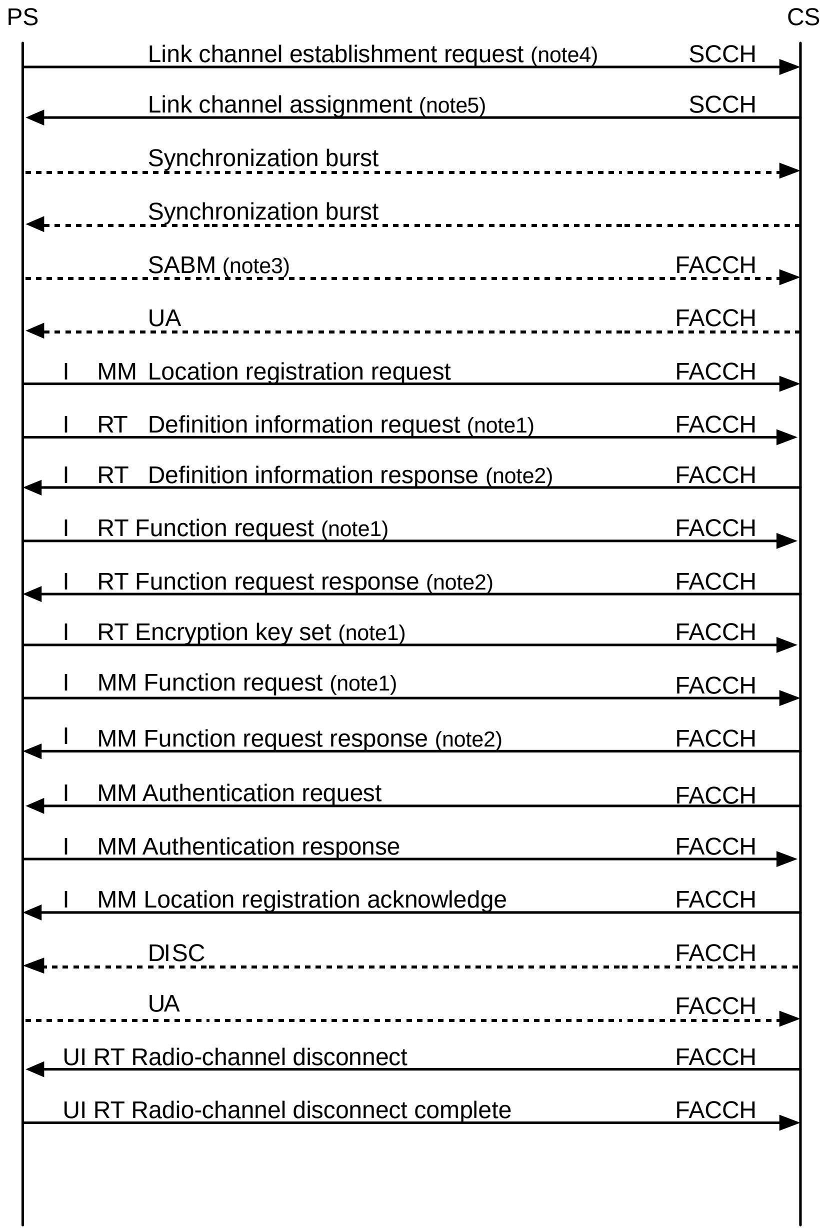
A user that has indicated that it performs an MM function request, requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[6] Authentication (MM)

When the necessary function request declared by the user ends, the network generates an authentication random pattern, and reports the random pattern by transmitting an authentication request message (MM) to the user. The user which received the authentication request message (MM) ciphers the random pattern using the authentication key that he has himself, and it reports the authentication ciphering pattern to the network using an authentication response message (MM). The network that received the authentication response message (MM) judges whether or not the authentication ciphering pattern obtained using the authentication random pattern and the authentication key in the home memory of the user agrees with that reported from the user. If the authentication result is NG, the network returns a location registration reject message (MM) and rejects location registration procedures. If the authentication result is OK, the network continues location registration procedures.

[7] Location registration acknowledge (MM)

If the network receives an indication that location registration ended normally, it transmits a location registration acknowledge message (MM) to the user. If the network receives an indication that location registration could not be accepted, it transmits a location registration reject message (MM) to the user.



(Note 1) This control signal can be omitted as necessary.

(Note 2) This control signal is for the previous control signal with the (note 1) attached. It is transmitted only when the relevant control signal is received.

(Note 3) The layer 3 sequence of the service channel establishment phase is activated after the FACCH layer 2 multiframe acknowledged operation mode is established.

(Note 4) LCH type information element is standard (π /4 shift QPSK 32Kbit/s or 16kbit/s or π /2 shift BPSK 16kbit/s) in this control signal.
There are a few cases in which modulation type of this control signal is defined as π /2 shift BPSK.

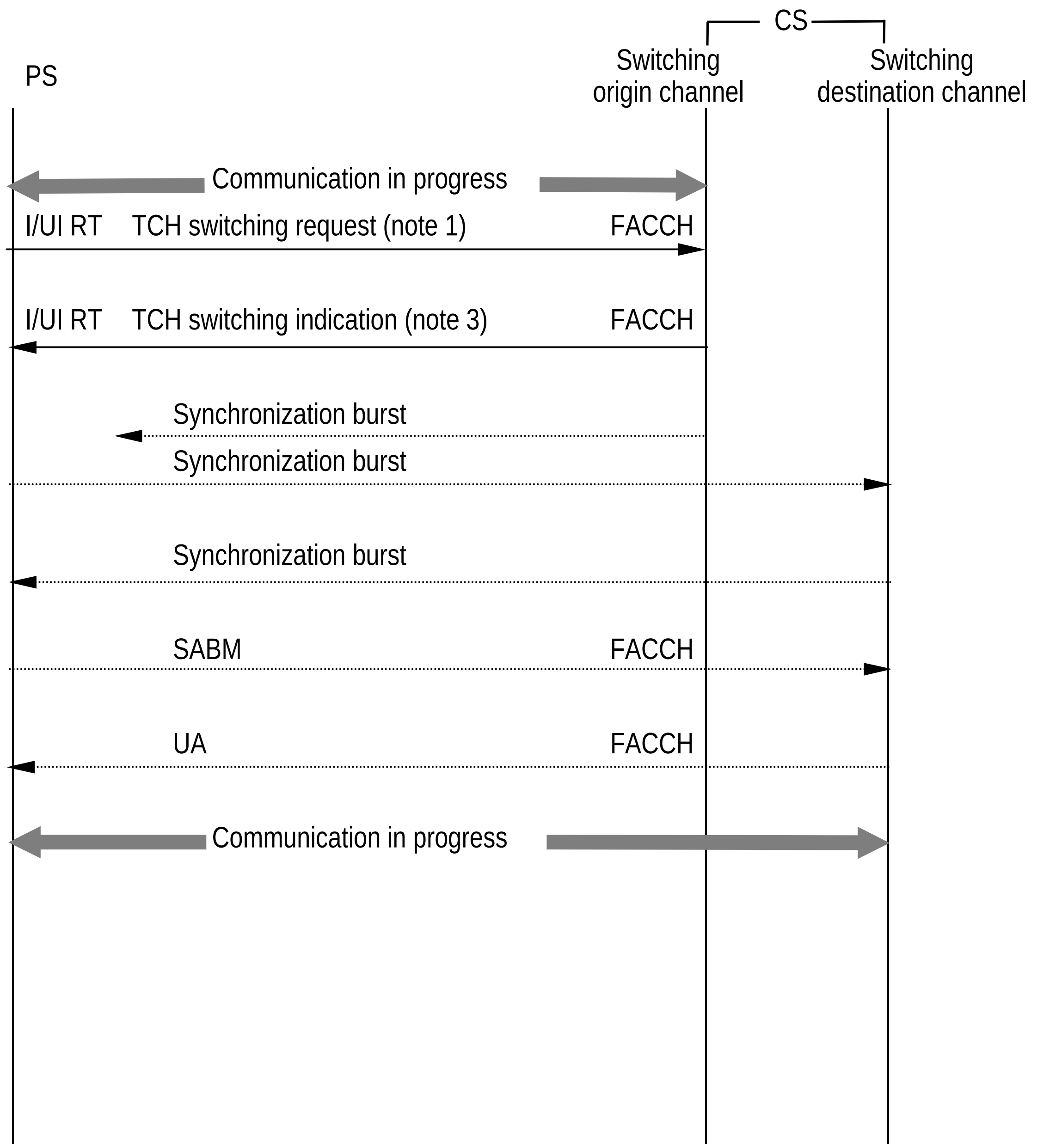
(Note 5) π /2 shift BPSK is used only at the situation that LCH type of this control signal is defined as standard(π /2 shift BPSK 16kbit/s) after synchronization burst.
This control signal modulation type is π /4 shift QPSK.

Figure 4.4.3.8.9.5 Control sequence (location registration(π /2 shift BPSK))

4.4.3.8.9.5 Channel switching during communication (π /2 shift BPSK) (Public standard)

4.4.3.8.9.5.1 Channel switching during communication (switching on same CS; π /2 shift BPSK) (Public standard)

The control sequence is shown in Figure 4.4.3.8.9.6.



(Note 1) Unnecessary in case of CS activation.
(Note 2) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 3) Appropriate frequency band for the PS should be chosen.

Figure 4.4.3.8.9.6 Control sequence (channel switching during communication (switching to same CS; π /2 shift BPSK))

4.4.3.8.9.5.2 Channel switching during communication (switching to other CS:PS recalling type; π/2 shift BPSK) (Public standard)

The control sequence is shown in Figure 4.4.3.8.9.7.

The control order is as follows.

[1] Recalling-type handover request (CC)

Handover is initiated by the user transmitting a setup message (facility : Recalling-type channel switching) (CC) to the network.

[2] Recalling-type handover proceeding (CC)

When the network receives the setup message (facility : Recalling-type channel switching) (CC) and confirms that call acceptance is suitable, the network sends call proceeding message(CC) and enters“ outgoing call proceeding (CC) : Recalling (functional operation) “ state.
When the user receives the call proceeding message (CC), it enters “ outgoing call proceeding (CC) : Recalling (functional operation) “ state.

The network that receives the setup message (facility : Recalling-type channel switching) (CC) judges whether or not the authentication reciphering pattern obtained using the authentication key in the home memory of the user agrees with authentication ciphering pattern reported from the user by facility information element. If the authentication result is NG, the call release procedure is initiated according to the regulations of call clearing. If the authentication result is OK, handover continues.

[3] RT functional request (RT)

A user that has indicated that it performs an RT function request requests the RT function of the network by a function request message (RT). The accepted RT function is reported to the user by a function request response message (RT).

[4] Encryption key set (RT)

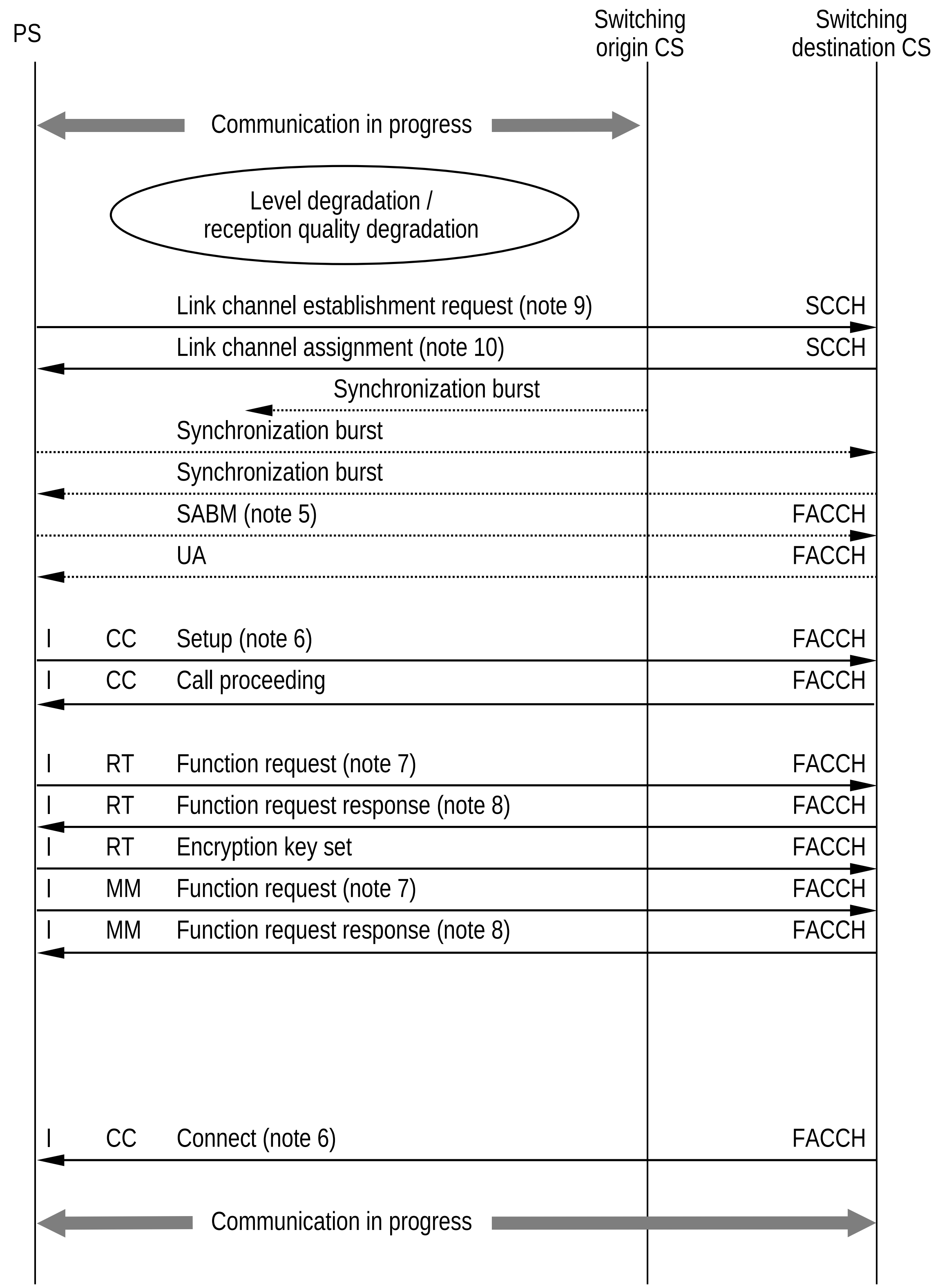
The user transfers the encryption key to the network by an encryption key set message (RT).

[5] MM function request (MM)

A user that has indicate that it performs an MM function request requests an MM function of the network by a function request message (MM). The accepted MM function is reported to the user by a function request response message (MM).

[6] Call connected (CC)

If the network receives an indication of the that recalling-type handover was accepted, it transmits a connect message (facility : Recalling-type channel switching) (CC) to the user. The user who received the connect message (facility : Recalling-type channel switching) (CC) terminates handover normally, and enters “ active “ state.


PS
Switching origin CS
Switching destination CS
Communication in progress
Level degradation / reception quality degradation
Link channel establishment request (note 9)
SCCH
Link channel assignment (note 10)
SCCH
Synchronization burst
Synchronization burst
Synchronization burst
SABM (note 5)
FACCH
UA
FACCH
I CC Setup (note 6)
FACCH
I CC Call proceeding
FACCH
I RT Function request (note 7)
FACCH
I RT Function request response (note 8)
FACCH
I RT Encryption key set
FACCH
I MM Function request (note 7)
FACCH
I MM Function request response (note 8)
FACCH
I CC Connect (note 6)
FACCH
Communication in progress

(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.

(Note 2) There are cases where the switching origin CS and switching destination CS are the same.

(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT functions requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, PS can start the recalling operation due to compatibility with the switching origin CS.

(Note 4) In a public system, switching among paging areas is a CS option.

(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.

(Note 6) Facility information element is mandatory.

(Note 7) This control signal can be omitted as necessary.

(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.

(Note 9) LCH type information element is standard (π /4 shift QPSK 32Kbit/s or16kbit/s or π /2 shift BPSK 16kbit/s) in this control signal.
There are a few cases in which modulation type of this control signal is defined as π /2 shift BPSK.

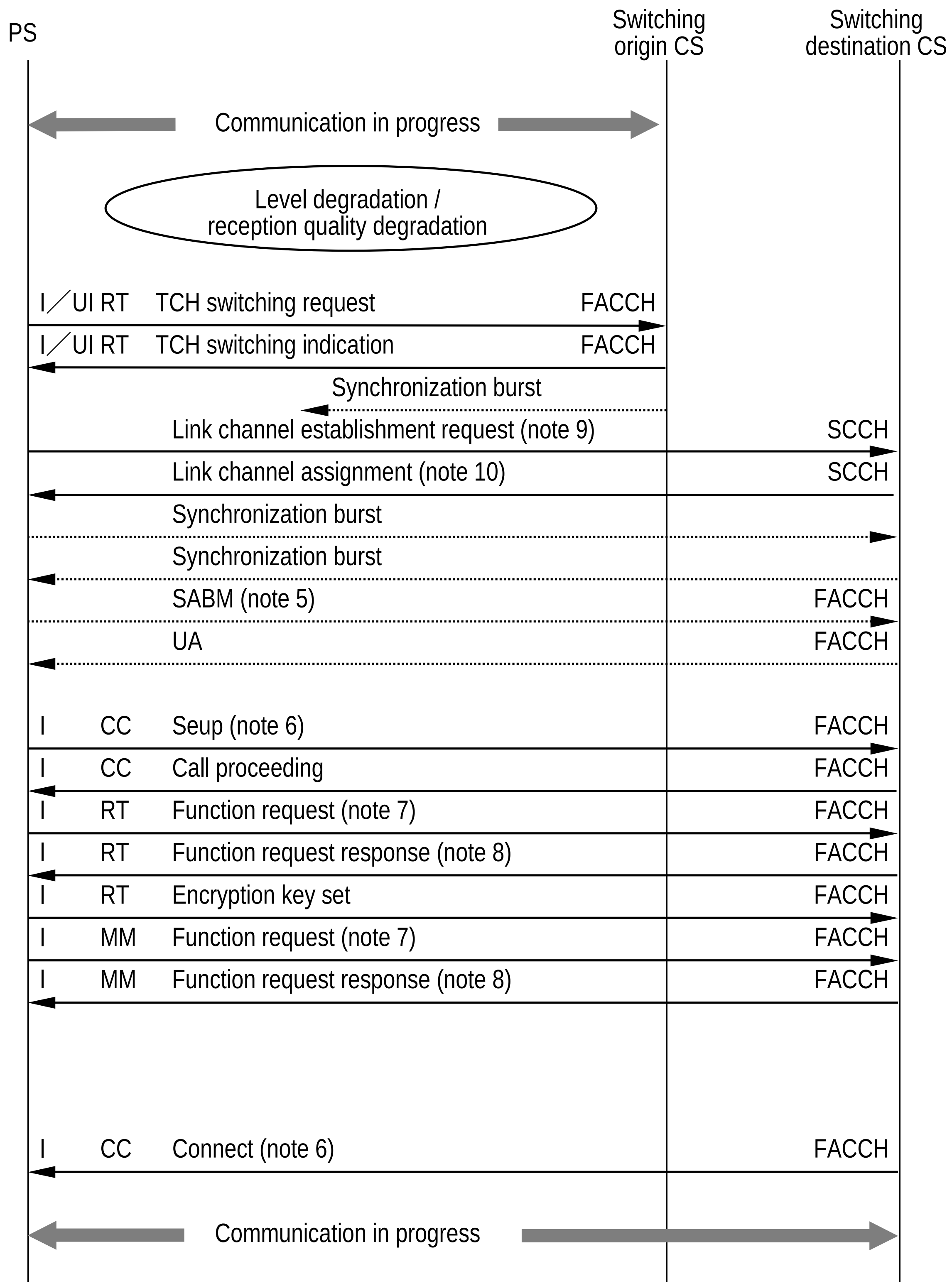
(Note 10) π /2 shift BPSK is used only at the situation that LCH type of this control signal is defined as standard(π /2 shift BPSK 16kbit/s) after synchronization burst in communication with switching destination CS.
This control signal modulation type is π /4 shift QPSK.

Figure 4.4.3.8.9.7 Control sequence (channel switching during communication (switching to other CS:PS recalling type; π /2 shift BPSK))

4.4.3.8.9.5.3 Channel switching during communication (switching to other CS: Recalling type with PS request; π /2 shift BPSK) (Public standard)

The control sequence is shown in Figure 4.4.3.8.9.8.

The control order is the same as that explanation in section 4.4.3.8.9.5.2.



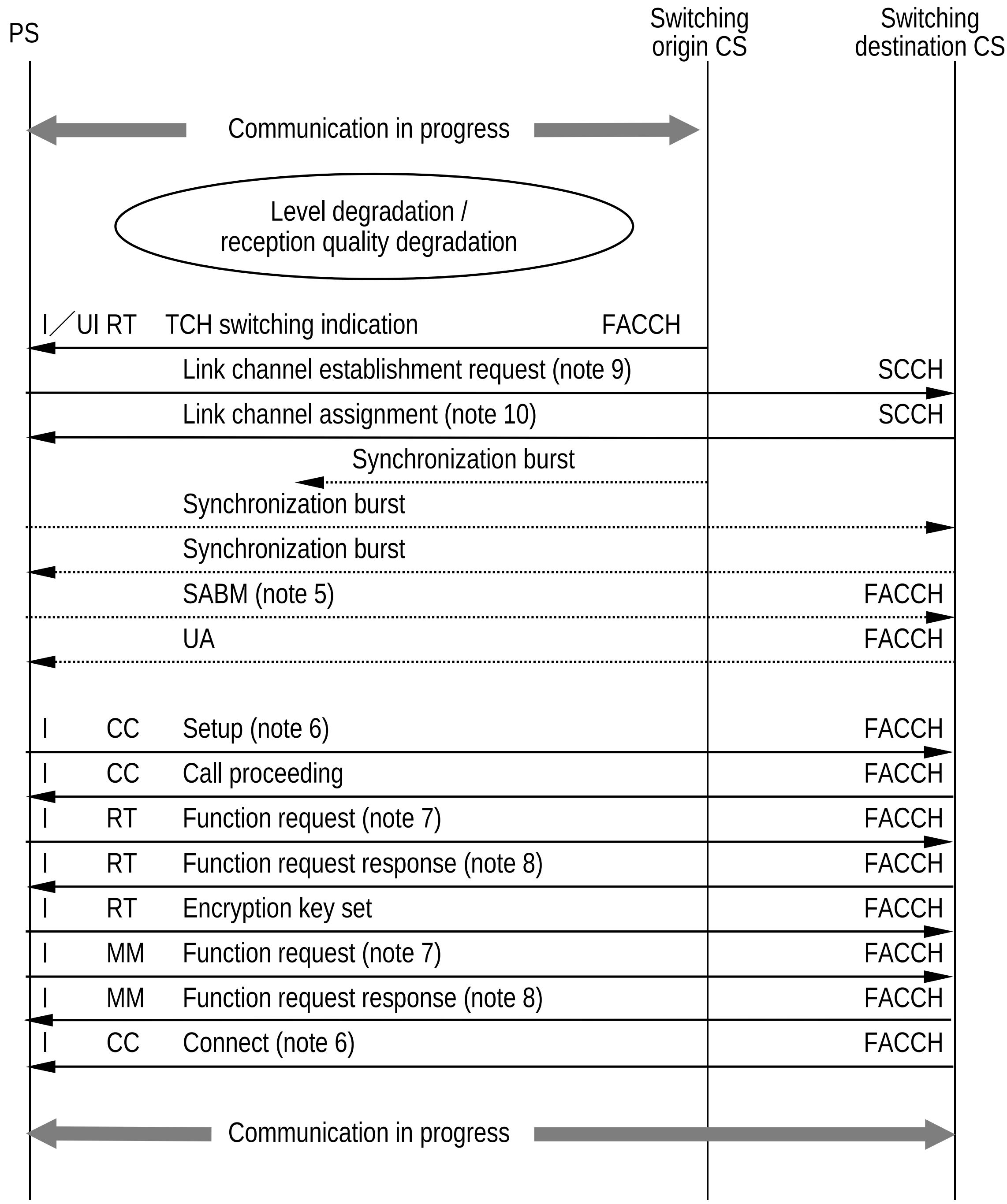
(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.
(Note 2) There are cases where the switching origin CS and switching destination CS are the same.
(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT functions requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message PS can start the recalling operation due to compatibility with the switching origin CS.
(Note 4) Switching among paging areas is a CS option.
(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.
(Note 6) Facility information element is mandatory.
(Note 7) This control signal can be omitted as necessary.
(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.
(Note 9) LCH type information element is standard (π /4 shift QPSK 32Kbit/s or 16kbit/s or π /2 shift BPSK 16kbit/s) in this control signal.
There are a few cases in which modulation type of this control signal is defined as π /2 shift BPSK.
(Note 10) π /2 shift BPSK is used only at the situation that LCH type of this control signal is defined as standard(π /2 shift BPSK 16kbit/s) after synchronization burst.
This control signal modulation type is π /4 shift QPSK.

Figure 4.4.3.8.9.8 Control sequence (channel switching during communication (switching to other CS:Recalling type with PS request; π /2 shift BPSK))

4.4.3.8.9.5.4 Channel switching during communication (switching to other CS: Recalling-type with CS indication; π /2 shift BPSK) (Public standard)

The control sequence is shown in Figure 4.4.3.8.9.9.

The control order is the same as that explanation in section 4.4.3.8.9.5.2.



(Note 1) Channel switching during communication is performed only during communication, and is not performed during the service channel establishment phase.

(Note 2) There are cases where the switching origin CS and switching destination CS are the same.

(Note 3) In cases where the switching origin/switching destination CS and PS have compatible recalling-type connection functions to other CSs within/among paging areas by their respective RT functions requests in response to the relationship of paging area between the switching origin CS and switching destination CS, the switching operation shown in the figure is possible. However, if there is no CS identification contained in the TCH switching indication message PS can start the recalling operation due to compatibility with the switching origin CS.

(Note 4) Switching among paging areas is a CS option.

(Note 5) The layer 3 sequence of the service channel establishment phase is activated after layer 2 multiframe acknowledged operation mode of SACCH or FACCH is established.

(Note 6) Facility information element is mandatory.

(Note 7) This control signal can be omitted as necessary.

(Note 8) This control signal is for the previous control signal with the (note 7) attached. It is transmitted only when the relevant control signal is received.

(Note 9) LCH type information element is standard (π /4 shift QPSK 32Kbit/s or 16kbit/s or π /2 shift BPSK 16kbit/s) in this control signal.
There are a few cases in which modulation type of this control signal is defined as π /2 shift BPSK.

(Note 10) π /2 shift BPSK is used only at the situation that LCH type of this control signal is defined as standard(π /2 shift BPSK 16kbit/s) after synchronization burst.
This control signal modulation type is π /4 shift QPSK.

Figure 4.4.3.8.9.9 Control sequence (channel switching during communication (switching to other CS : Recalling-type with CS indication))

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Chapter 5 Voice Coding Method

Chapter 5 Voice Coding Method

5.1 Overview (Private standard/Public standard)

This chapter specifies the voice coding method for the personal handy phone system.

5.2 Voice coding method (Private standard/Public standard)

The full rate voice coding method in the personal handy phone system is 32 kbit/s ADPCM as per ITU-T recommendation G.726.

Half rate voice coding method is 16 kbit/s AD PCM as per ITU-T recommendation G.726 (Public Only). Quarter-rate voice coding methods are not specified at present.

5.3 Voice decoding process during VOX (Private reference)

Voice decoding processing during VOX is an option. Background noise generation methods are not standardized.

5.4 Other voice decoding processes (Reference)

The required voice decoding processing is not standardized under the conditions shown below.

(1) When FACCH is received

(2) When transmission error occurs

(3) When a synchronization burst is received

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Chapter 6 Direct communication between personal stations

Chapter 6 Direct communication between personal stations

6.1 Overview (Private standard)

This chapter specifies the signal structures and communications protocols required for direct communication between personal stations without going through a CS (communication between PSs). In communication between PSs, connection is performed without a layered structure.

6.2 Layer 1 regulations (Private standard)

6.2.1 Multichannel access method (Private standard)

Communication between PSs in which the origination-side detects a free slot in the communications carrier and makes the call without setting up a dedicated control carrier, and the destination-side scans all channels. In the case of direct communication between PSs in a specific group, the destination-side scans decided 3 carriers. And in the case two channels are used, combinations and a use order of carriers and slots are shown in Table 6.2.1.

Table 6.2.1 Usage of carriers and slots in the case of two-slots communication

Communication status	Mandatory functions	Use order of functions
The second alerting or the second synchronization in the case of channel switching on 64kbit/s communication	(1) The same carrier and two sequential slots (2) The same carrier or different two carriers, and a slot and every other slot	(1) should be used in preference. (2) is used by necessity.

Note: The first TCH of the origination-side should be the first slot.

6.2.2 Carrier sensing (Private mandatory)

The origination-side PS performs carrier sensing in the communications carrier, and only after confirming that the relevant reception slot interval (called 1 slot interval) is available over at least 4 continuous frames, it transmits and uses the relevant corresponding slot.

Judgment of available slots is performed while taking asynchronous interference into consideration, and level 2 is used as the decision level.

Furthermore, carrier sensing is unnecessary in the destination-side PS.

The frequency of the radio wave transmitted by the receiving PS must be selected automatically by the reception of the transmitted signal of the transmitting PS.

6.2.3 Transmission disable conditions (Private mandatory)

Transmission disable conditions are according to section 3.2.16.

Furthermore, the transmission time is counted from when communication begins including connection.

6.2.4 Functional channels (Private standard)

The Functional channels used in communication between PSs are SCCH for the control physical slot, and TCH or FACCH for the communication physical slot.

6.2.5 Channel coding (Private standard)

6.2.5.1 Channel coding rules (Private standard)

The rules of channel coding are according to section 4.2.10.1.

6.2.5.2 Slot structure (Private standard)

The slot structure of each physical slot is shown in Figures 6.2.1 (a) – (c).

SCCH	R	SS	PR	UW	CI	Called station identification code	Calling station identification code	I (SCCH)	CRC	G	
	4	2	62	32	4	42	28	34	V	16	bit

240

(a) Structure of control physical slot (SCCH)

TCH	R	SS	PR	UW	CI	SA	I (TCH)	CRC	G	
	4	2	6	16	4	16	160	16	16	bit

240

(b) Structure of communications physical slot (TCH)

FACCH	R	SS	PR	UW	CI	SA	I (FACCH)	CRC	G	
	4	2	6	16	4	16	160	16	16	bit

240

(c) Structure of communications physical slot (FACCH)

R: Ramp time
UW: Unique word
SA: SACCH
PR: Preamble
CI: Channel identifier
SS: Start symbol
G: Guard bit

(Note 1) The signal structure of each SACCH physical slot is according to section 4.4.2.2.2. SACCH always transmits idle slots.
(Note 2) The signal structure of each FACCH physical slot is according to section 4.4.2.2.3.

Figure 6.2.1 Physical slot structure

The synchronization signals (preamble, unique word) required in each slot, the ramp bits and guard bits are as shown below.

(1) Guard bits, Ramp time

Guard bits = 16 bits
Ramp bits = 4 bits

(2) Preamble pattern (Private mandatory)

Both control physical slots and communication physical slots
SS: 10
SS + PR: 1001 repetitions

(3) Unique word pattern

(a) Control physical slots (Private mandatory)

Both directions common: 32 bits pattern 0101 0000 1110 1111 0010 1001 1001 0011

(b) Communication physical slots

Both directions common: 16 bits pattern 0011 1101 0100 1100

6.2.5.3 Structure of calling station identification code/called station identification code(Private standard)

The structure and methods of use of the calling station identification code and called station identification code in communication between PSs are shown below.

(1) Calling station identification code: Origination-side PS identification code (PS-ID)

(2) Called station identification code: System identification code or Group identification code for direct communication between personal stations + destination-side PS station number

The PS station number is the PS logical number valid only in communication between PSs mode, and is the part that is open to the user. The lead bit of the PS station number which consists of 13bits starts from the 30th bit (*) of the called station identification code.

Communication between PSs is valid only between PSs that share either the same system identification code or the same group identification code for direct communication between personal stations.

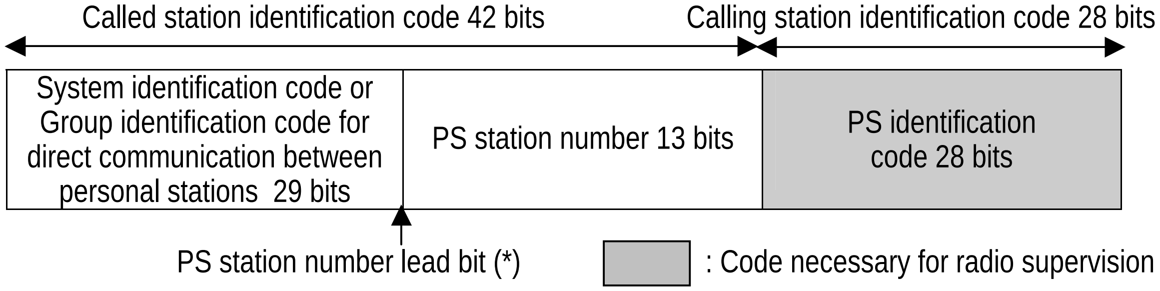


Figure 6.2.2 Structure of calling station identification code, called station identification code

6.2.5.4 CI bit coding (Private standard)

The channel identifier (CI) coding used in communication between PSs are shown in Table 6.2.1.

Table 6.2.2 CI coding

Bit	4	3	2	1
SCCH	1	0	1	0
TCH	0	0	0	0
FACCH	0	0	0	1

6.2.5.5 Scramble (Private standard)

Scramble is mandatory in communication between PSs as well, and it is applied as follows to the control physical slots and communication physical slots.

(1) For control physical slots (Private mandatory)

The scramble pattern register initial value of the control physical slots is "1 1 1 1 1 1 1 1 1 1".
Also, the scramble method is according to section 4.2.11.2, and the scramble application area is according to section 4.2.11.3.

(2) For communication physical slots

The scramble pattern register initial value of the communication physical slots is a pattern in which a lead bit (fixed at "1") is added to the lower 9 bits of either the system identification code or the group identification code for direct communication between personal stations (29 bits). Also, the scramble method is according to section 4.2.11.2, and the scramble application area is according to section 4.2.11.3.

6.2.5.6 User scrambling (Private standard)

In communication between PSs, since unique standard scrambling (section 6.2.5.5) is used for each system, User scrambling also uses this.

6.2.5.7 Voice coding method (Private standard)

The voice coding method in communication between PSs is 32 kbit/s ADPCM (at the full rate voice coding). Further, speech and unrestricted digital information are discriminated with the information type and protocol version of communication between PSs which are included in message format for communication between PSs.

6.3 Control procedures (Private standard)

6.3.1 Connection procedures (Private standard)

6.3.1.1 Message format for communication between personal stations (Private standard)

In communication between PSs, connection is performed using SCCH. Table 6.3.1 shows the SCCH message format, and Table 6.3.2 shows an explanation of each information element. SCCH is transmitted with 5 ms interval.

Furthermore, the format rules are according to section 4.3.2.2

Table 6.3.1 Message format for communication between personal stations

Function channel: SCCH
Direction : PS <—> PS (both directions)

Octet \ Bit	8	7	6	5	4	3	2	1
1	Message type							
2	LCH type			LCH protocol type		(note1)	(note2)	
3	(MSB) Origination-side PS station number							
4	Option			Origination-side PS station number (LSB)				
5							Option	

note1: Information type
note2: Protocol version of communication between PSs

Table 6.3.2 Information elements in message for direct communication between personal stations

Message type (octet 1)

Bit 8	7	6	5	4	3	2	1	
1	0	0	0	0	-	-	-	Messages of communication between PSs
					0	0	0	Alerting
					0	0	1	Connect
					0	1	0	Synchronization
					0	1	1	1st Alerting (note)
					1	0	0	1st Synchronization(note)
					1	0	1	2nd Alerting (note)
					1	1	0	2nd Synchronization(note)
				other				Reserved

LCH type (octet 2)

Bit 8	7	6	
0	0	0	Standard (32 kbit/s)
0	0	1	Reserved (16 kbit/s)
0	1	0	Reserved (8 kbit/s)
0	1	1	Reserved
1	0	0	Option
1	0	1	Option
1	1	0	Option
1	1	1	Option

LCH protocol type (octet 2)

Bit		
5	4	
0	0	Standard
0	1	Reserved
1	0	Option
1	1	Option

Information type (octet 2)

Bit	
3	
0	Speech
1	Unrestricted digital information

Protocol version of communication between PSs (octet 2)

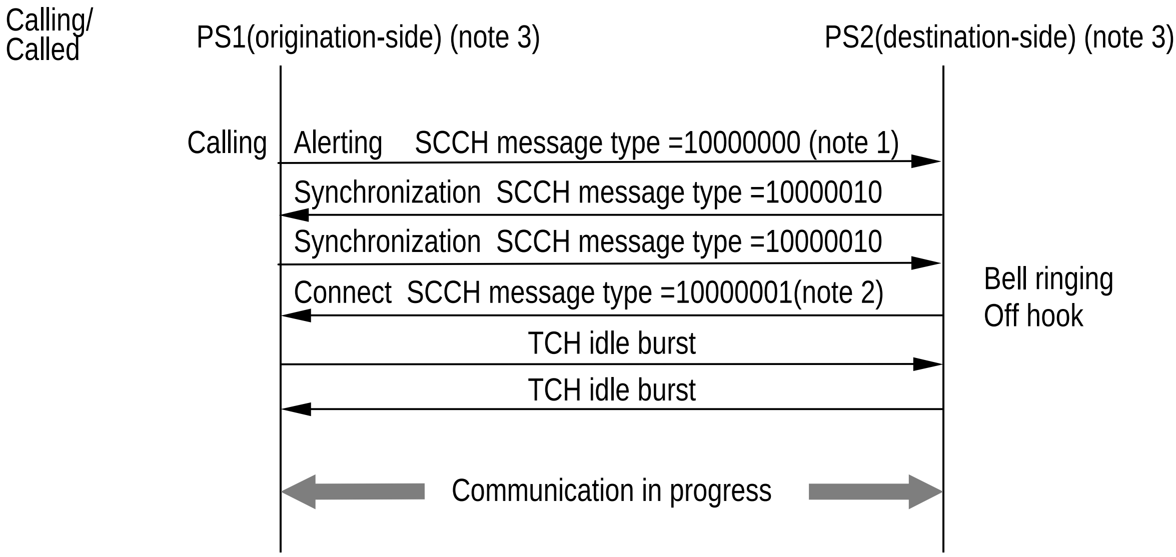
Bit		
2	1	
0	0	Version 0 (RCR STD-28 (version 1) or RCR STD-28(version 2) Communication between PSs)
0	1	Version 1 (RCR STD-28 (version 3) or RCR STD-28 (version 3 Rev.-1) Communication between PSs)
1	0	Version 1 (RCR STD-28 (version 3.2) Communication between PSs)
Other		Reserved

Origination-side PS station number (octets 3–4)

This is the logical number of the origination-side PS (13 bits).

6.3.1.2 Control sequence (Private standard)

6.3.1.2.1 Calling/Called of the 32k communication (Private standard)



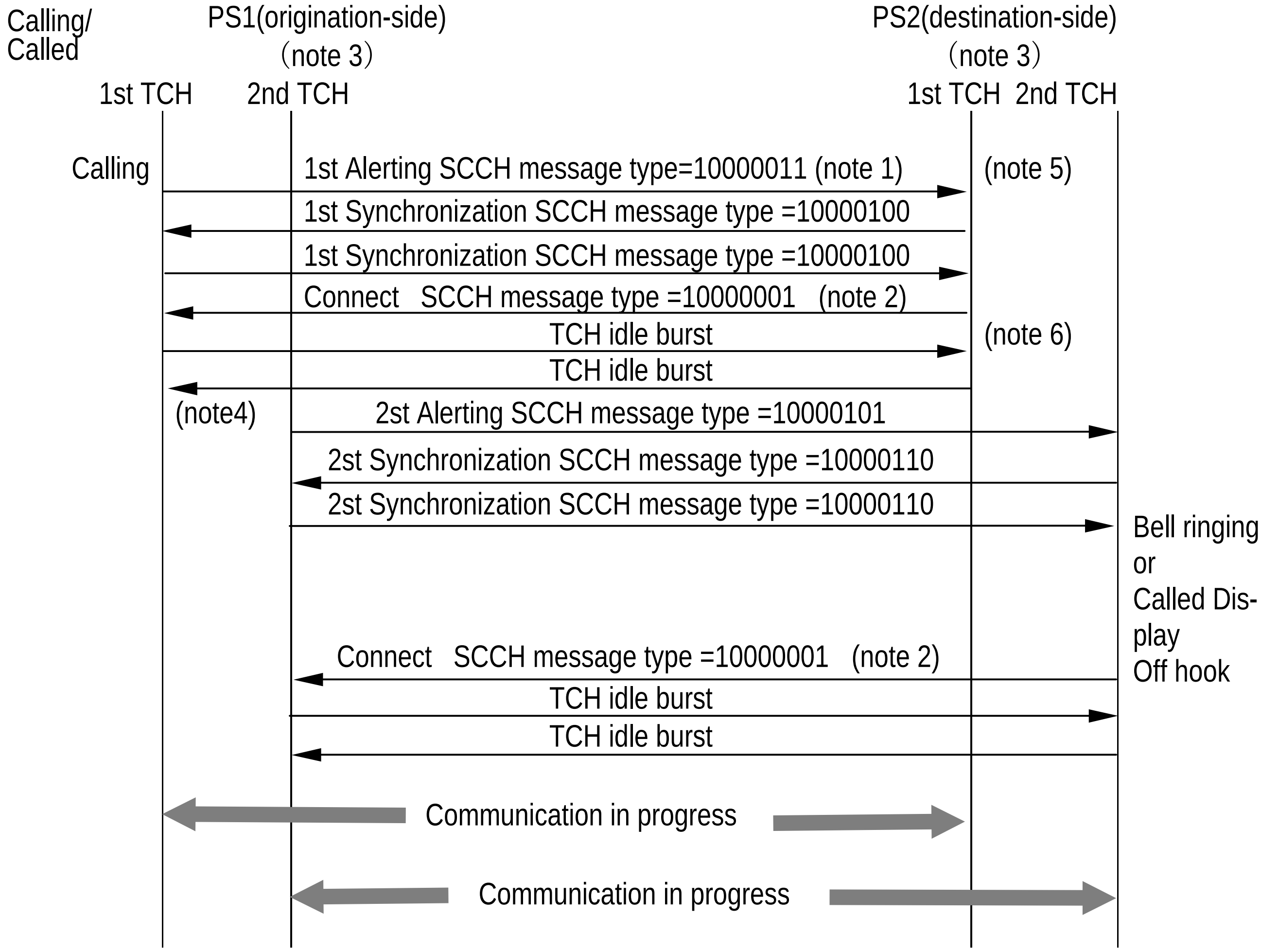
(Note 1) "Alerting" has a transmission time of 10 seconds, taking battery saving of the destination-side into consideration. "Alerting" is continuously transmitted.

(Note 2) PS2 can also return "connect" directly without "synchronization" when in automatic connect mode.

(Note 3) Transmission time count is performed from when "alerting" is transmitted on the origination-side, and from when "synchronization" is transmitted on the destination-side (when "connect" is transmitted if "synchronization" is omitted).

Figure 6.3.1 Control sequence (Calling/Called of the 32k communication)

6.3.1.2.2 Calling/Called of the 64k communication (Private standard)



(note 1) "1st Alerting" makes transmitting time 10 seconds, and "2nd Alerting" makes transmitting time after the “1st TCH”C establishment 10 seconds. "1st Alerting"and"2nd Alerting" is continuously transmitted.
(note 2) PS2 can also return "1st Connect" and "2nd Connect" directly without "Synchronization" when in automatic connect mode.
(note 3) Transmission time count is performed from when "1st Alerting" is transmitted on the origination-side, and from when "1st Synchronization" is transmitted on the destination-side (when "Connect" is transmitted if "1st Synchronization" is omitted).
(note 4) The transmission of "2nd Alerting" is decided that it may be done at the same time with the transmission of "1st Alerting".
(note 5) "2nd Alerting" received before receiving "1st Alerting" is ignored with PS2.
(note 6) Timer T106P is started with PS2 after the idle burst reception of “1st TCH”. Dis-connect does call of “1st TCH” when "2nd Alerting" isn't received by time T106P expiration.

Figure 6.3.2 Control sequence (Calling/Called of the 64k communication)

6.3.2 Disconnect (Private standard)

6.3.2.1 Message format (Private standard)

Disconnect is performed using a UI command by FACCH. The messages used are RT "Radio-channel disconnect" and "Radio-channel Disconnect Complete". "Radio-channel disconnect" and "Radio-channel Disconnect Complete" are continuously transmitted three time.

Table 6.3.3 and Table 6.3.4 show the contents of the two messages.

Table 6.3.3 Radio-channel Disconnect message contents

Message type : Radio-channel Disconnect
Significance : Local
Direction : Both directions
Function channel : FACCH

Information element	Reference	Direction	Type	Information length	Notes
Protocol dis-criminator	4.4.3.5.3.2	both	M	1	
Message type	4.4.3.5.3.3	both	M	1	
Cause	4.4.3.5.3.4.5	both	M	2	
Local station PS-ID	4.4.3.5.3.4.12	both	M	5	
Peer station PS-ID	4.4.3.5.3.4.12	both	M	5	

Table 6.3.4 Radio-channel Disconnect Complete message contents

Message type : Radio-channel Disconnect Complete
Significance : Local
Direction : Both directions
Function channel : FACCH

Information element	Reference	Direction	Type	Information length	Notes
Protocol dis-criminator	4.4.3.5.3.2	both	M	1	
Message type	4.4.3.5.3.3	both	M	1	
Local station PS-ID	4.4.3.5.3.4.12	both	M	5	
Peer station PS-ID	4.4.3.5.3.4.12	both	M	5	

6.3.2.2 Control sequence (Private standard)

6.3.2.2.1 Disconnect of the 32k communication (Private standard)

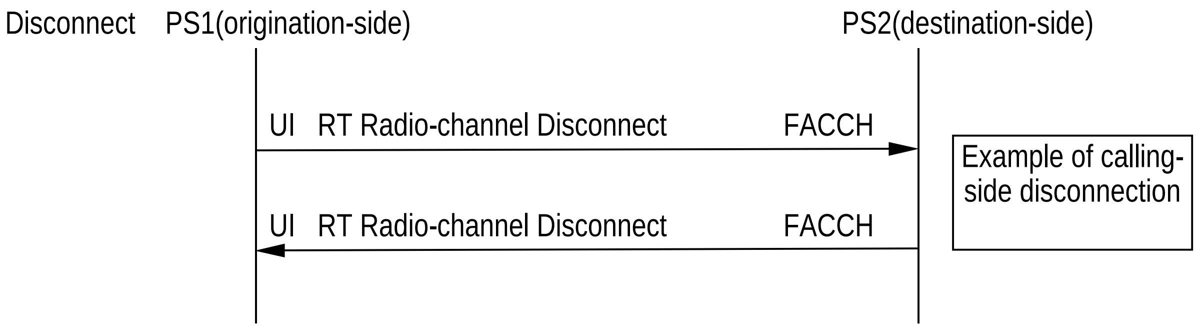
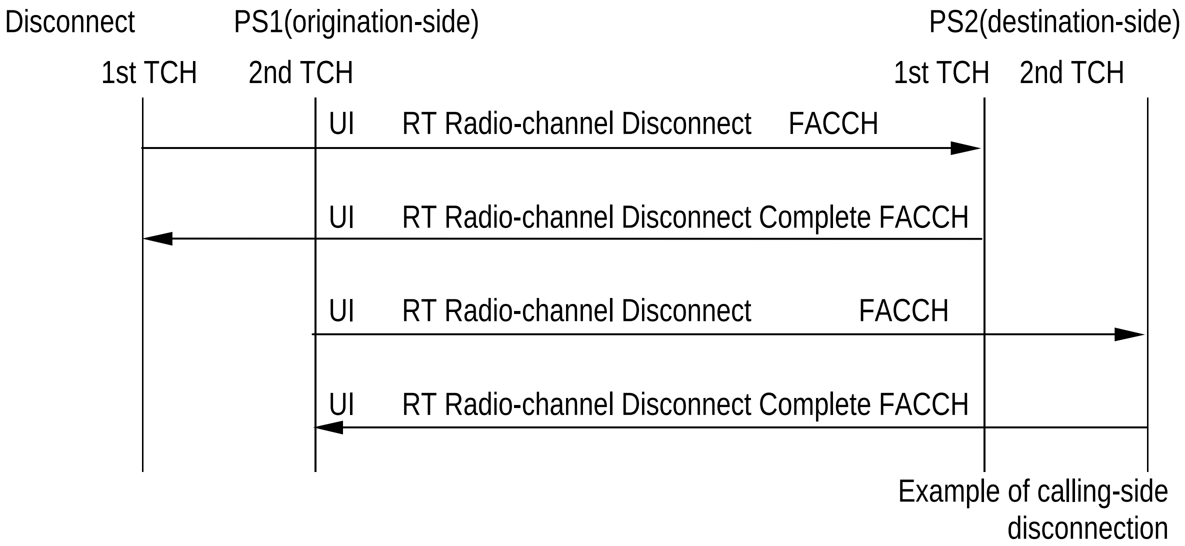


Figure 6.3.2 Control sequence (disconnect of the 32k communication)

6.3.2.2.2 Disconnect of the 64k communication (Private standard)



(note 1) Disconnect one “TCH” now when either “1st TCH” or “2nd TCH” is disconnect.

Figure 6.3.4 Control sequence (disconnect of the 64k communication)

6.3.3 Channel switching during communication (Private standard)

6.3.3.1 Message format (Private standard)

Channel switching is performed using a UI command by FACCH. The message used is RT "TCH Switching Request". "TCH Switching Request" are continuously transmitted three time.

Message contents are shown in Table 6.3.5.

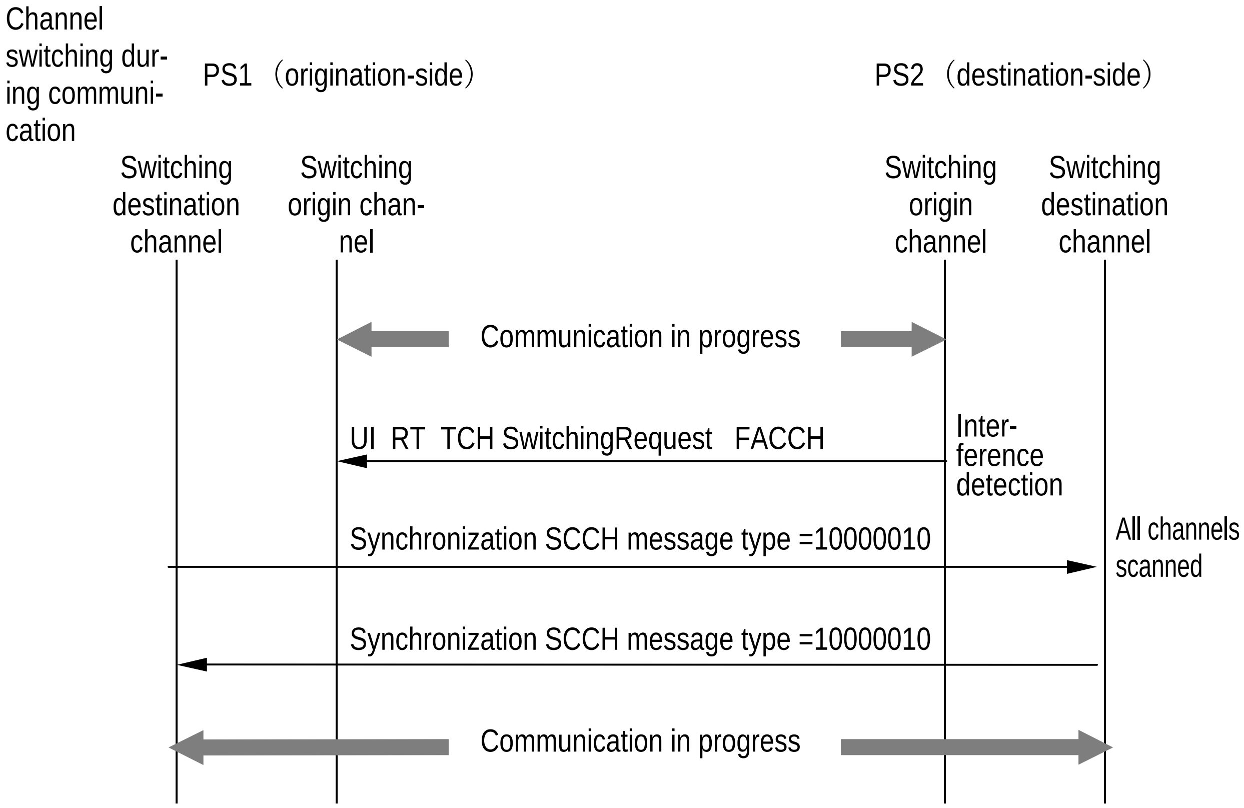
Table 6.3.5 TCH Switching Request message contents

Message type : TCH Switching Request
Significance : Local
Direction : Both directions
Function channel : FACCH

Information element	Reference	Direction	Type	Information length	Notes
Protocol dis-criminator	4.4.3.5.3.2	both	M	1	
Message type	4.4.3.5.3.3	both	M	1	
Local station PS-ID	4.4.3.5.3.4.12	both	M	5	
Peer station PS-ID	4.4.3.5.3.4.12	both	M	5	

6.3.3.2 Control sequence (Private standard)

6.3.3.2.1 Channel switching during of the 32k communication (Private standard)

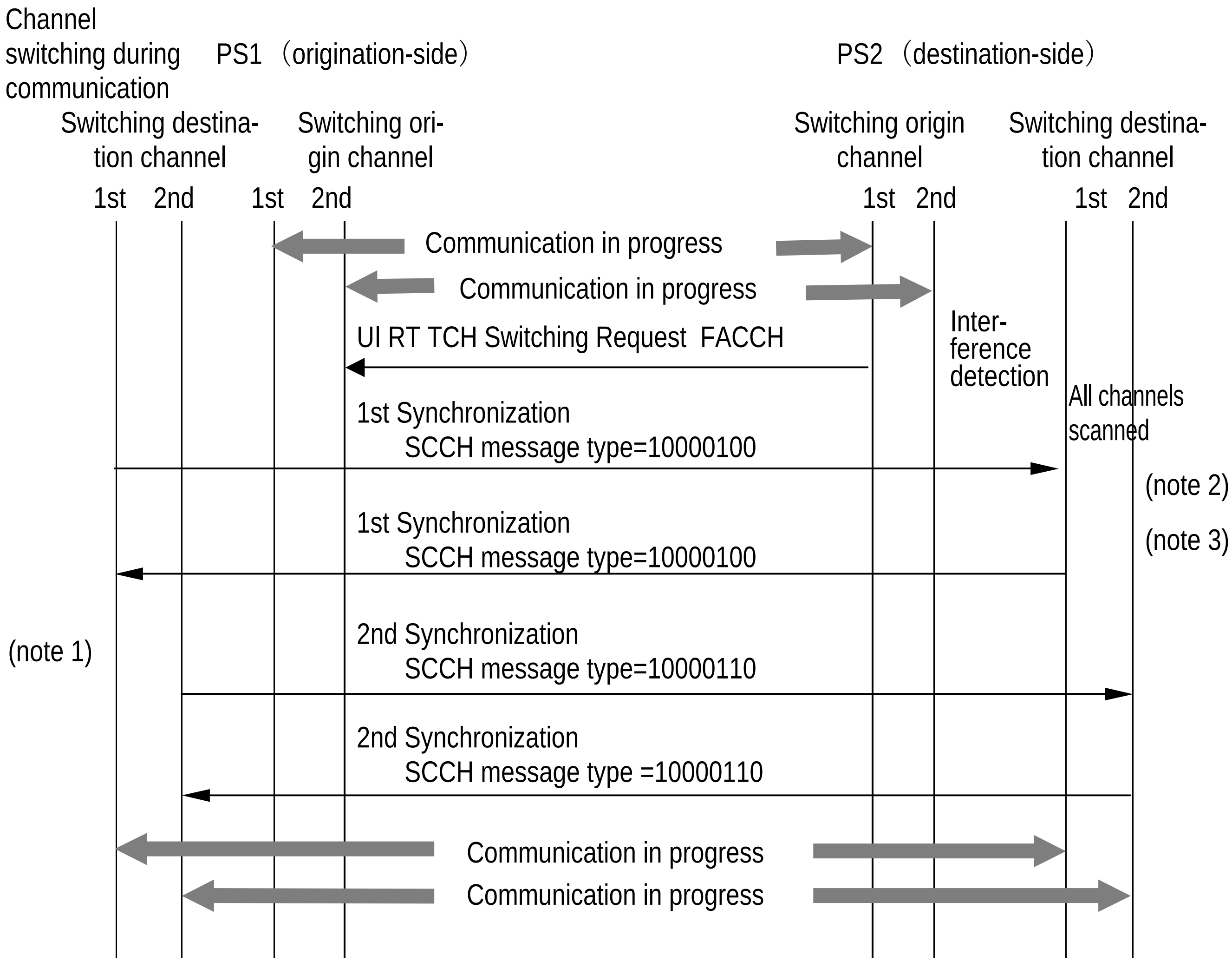


The TCH Switching Request is transmitted from the PS which detects interference. Also, the "Synchronization" signal is transmitted from the origination-side.

Figure 6.3.5 Control sequence (channel switching during of the 32k communication)

The TCH Switching Request is transmitted from the PS which detects interference. Also, the "Synchronization" signal is transmitted from the origination-side.

6.3.3.2.2 Channel switching during of the 64k communication (Private standard)



The TCH Switching Request is transmitted from the PS which detects interference. Also, the "Synchronization" signal is transmitted from the origination-side.

(note 1) The transmission of "2nd Synchronization" is decided that it may be done at the same time with the transmission of "1st Synchronization".
(note 2) "2nd Synchronization" received before receiving "1st Synchronization" is ignored with PS2.
(note 3) Disconnect does call of "1st TCH" with PS2 when Time T106P is started and "2nd Synchronization" isn't received by the expiration of time when "1st Synchronization" transmission starts.

Figure 6.3.5 Control sequence (channel switching during of the 64k communication)

The TCH Switching Request is transmitted from the PS which detects interference. Also, the "Synchronization" signal is transmitted from the origination-side.

6.3.4 Communication between PSs timers (Private standard)

6.3.4.1 Calling side timers (Private standard)

Table 6.3.6 Calling side timers

Timer No. (Value)	Operation type	Start conditions	Stop conditions	Expiration (Retry)	Expiration (Retry out)	Mandatory / Option Timer	Mandatory / Option Timer value
T001P (10s)	Outgoing call	"Alerting" transmission	"Synchronization" or "Connect" reception	-	Standby	Mandatory	Mandatory
T002P (200ms)	Outgoing call	"TCH idle burst" transmission	"TCH idle burst" reception	-	Standby	Mandatory	Mandatory
T003P (1s)	Disconnect	"Radio-channel Disconnect" transmission	"Radio-channel Disconnect Complete" reception	-	Standby	Mandatory	Mandatory
T004P (10s)	Channel switching during communication	"Synchronization" transmission	"Synchronization" reception	"Radio-channel Disconnect" transmission	Standby	Mandatory	Mandatory
T005P (180s)	transmission time	"Alerting" transmission	when call released	"Radio-channel Disconnect" transmission	Standby	Mandatory	Mandatory

(Note) "1st or 2nd Alerting" and "1st or 2nd Synchronization" are made "Alerting" and Synchronization".

6.3.4.2 Called side timers (Private standard)

Table 6.3.7 Called side timers

Timer No. (Value)	Operation type	Start conditions	Stop conditions	Expiration (Retry)	Expiration (Retry out)	Mandatory / Option	
						Timer	Timer value
T101P (100s)	Paging	"Synchronization" transmission	"Synchronization" reception	-	Standby	Mandatory	Mandatory
T102P (200ms)	Paging	"Connect" transmission	"TCH idle burst" reception	-	Standby	Mandatory	Mandatory
T103P (1s)	Disconnect	"Radio-channel Disconnect" transmission	"Radio-channel Disconnect Complete" reception	-	Standby	Mandatory	Mandatory
T104P (10s)	Channel switching during communication	"TCH Switching Request" transmission or reception	"Synchronization" reception	"Radio-channel Disconnect" transmission	Standby	Mandatory	Mandatory
T105P (180s)	transmission time	"Synchronization" transmission (note 2)	when call released	"Radio-channel Disconnect" transmission	Standby	Mandatory	Mandatory
T106P (10s)	Paging	The "TCH idle burst" reception (note 3) of "1st Alerting" or "1st Synchronization" transmission (note4)	"1st Alerting " reception (note3) "1st Synchronization" reception (note4)	-	Standby	Mandatory	Mandatory

(Note 1) "1st or 2nd Alerting" and "1st or 2nd Synchronization" are made "Alerting" and Synchronization".
(Note 2) If "Synchronization" is omitted, timer start at "Connect" transmission.
(Note 3) The case that the number of the use channels is "Paging" of 2.
(Note 4) In the case of the channel switching that the number of the use channels is 2.

6.4 Forwarding of group identification code for direct communication between PSs. (Private standard)

6.4.1 Overview

In the direct communication between PSs in a specific group, the group identification code for direct communication between PSs is used for system identification code for direct communication between PSs.
This chapter specifies the radio interface about forwarding of group identification code for direct communication between PSs, for doing the direct communication between PSs in a specific group.

6.4.2 Application scope

This chapter specifies the radio interface about direct communication between PSs in conformity to RCR STD-28 version 3-2.

6.4.3 Basic functions of forwarding of group identification code for direct communication between PSs

PS (master) ,that forwards group identification code for direct communication between PSs, forwards a group identification code for direct communication between PSs to PS (slave) in the radio.

6.4.4 Available frequencies

In the direct communication between PSs in a specific group, it restrict to available frequencies for no interference of the other communications, because the registration of between PSs is simple.
In forwarding of group identification code for direct communication between PSs, available frequency is any one of three frequencies (carrier numbers : 4,7,9).

6.4.5 Forwarding of group identification code for direct communication between PSs

The group identification code for direct communication between PSs is the code adding 1bit (fix "1") to the first bit in the PS-ID of PS (master).
PS (forwarding side) informs the necessity information by SCCH message in one of appointed frequencies. PS (receiving side) receives one, confirms a protocol version of direct communication between PSs and a code number, memorizes a group identification code for direct communication between PSs, and complete forwarding.

6.4.6 Message

In forwarding of group identification code for direct communication between PSs, it use the following message.

Function channel: SCCH
Direction : PS <—> PS (both directions)

Octet \ Bit	8	7	6	5	4	3	2	1
1	Message type							
2	LCH type			LCH protocol type		(note1)	(note2)	
3	Code number 1 st digit				Code number 2 nd digit			
4	Code number 3 rd digit				Code number 4 th digit			
5							Option	

note 1: Information type
note 2: Protocol version of communication between PSs

Message type (octet 1)

Bit 8	7	6	5	4	3	2	1	
1	0	0	0	0	1	1	1	Forwarding
other								Reserved

LCH type (octet 2)

Bit 8	7	6	
0	0	0	Standard (32 kbit/s)
other			Reserved

LCH protocol type (octet 2)

Bit 5	4	
0	0	Standard
other		Reserved

Information type (octet 2)

Bit 3	
0	Speech
other	Reserved

Protocol version of communication between PSs (octet 2)

Bit 2	1	
1	0	Version 2 (RCR STD-28 (version 3.2) Communication between PSs)
other		Reserved

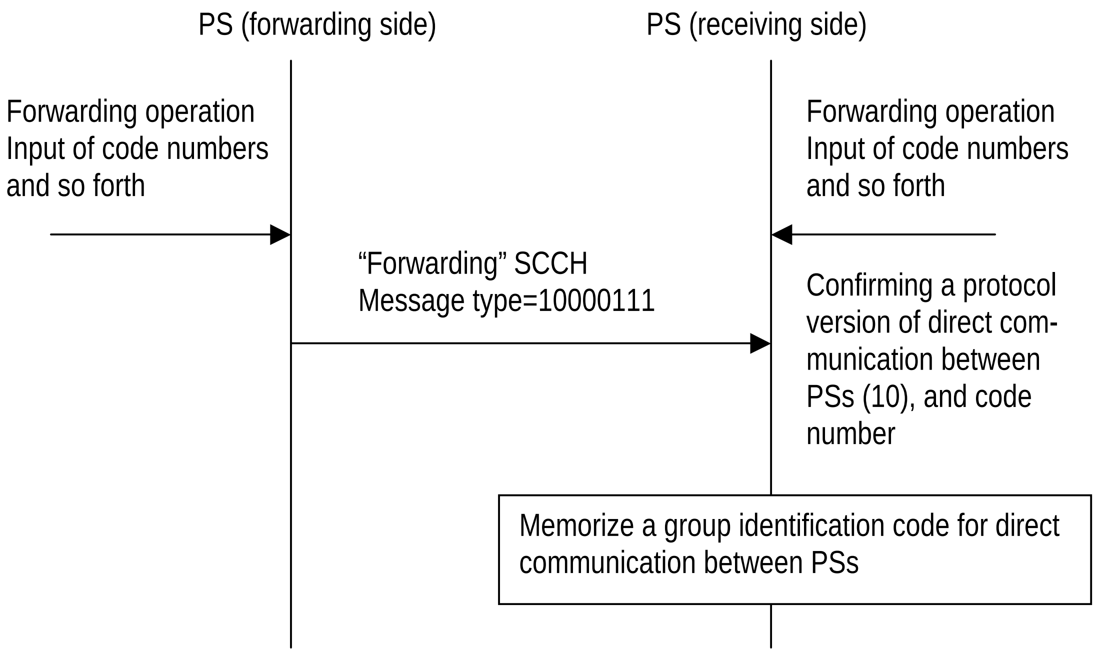
Code number (octets 3–4)

The code number, 4 figures, is used forwarding of group identification code for direct communication between PSs (16 bits).

Table 6.4.1 Code number digits

0	1010	5	0101
1	0001	6	0110
2	0010	7	0111
3	0011	8	1000
4	0100	9	1001

6.4.7 Control sequence



(note 1) In forwarding a group identification code for direct communication between PSs, PS (forwarding side) transmits SCCH message type ”Forwarding” by one of three frequencies. The transmission time is 5 seconds (maximum).

(note 2) In receiving a group identification code for direct communication between PSs, PS (receiving side) looks for SCCH message type “Forwarding” by scanning three frequencies.

(note 3) After receiving “Forwarding” , PS(receiving side) confirm a protocol version of direct communication between PSs is 10 (version2 : RCR STD-28 version 3-2 Direct communication between PSs) and 4 figures of code numbers, and memorize a group identification code for direct communication between PSs.

Figure 6.4.1 Control sequence (Forwarding)

Chapter 7 Measurement Methods

Chapter 7 Measurement Methods

Basically, measurement methods are in accordance with the statutes of interested countries. However, those test items that are not specified in the interested country shall be based on the provisions in this chapter.

In Japan, the test items specified in the Notification of Ministry of Internal Affairs and Communications (note 1) provided in the Proof Rules Attachment 1-1 (3) (items marked with asterisk in this chapter) shall follow the test methods indicated in the Notification.

Note 1) As of time point of revision of Version 5.0 (as of September 29, 2005), Tthis means Ministry of Internal Affairs and Communications' Notification No. 88 "Test Methods of Characteristics Tests" of January 26, 2004. However, from the time when the description of the Notification as well as the description of the Notification's Attachment No. 49 is revised, the content of the latest version must be followed.

7.1 Transmission system and 7.2 Reception system show measurement methods for the case where there are antenna measurement terminals and data input/output terminals, and 7.3 Measurement method when there is no measurement terminal shows methods for the case when there are neither. The antenna measurement terminal is created so that it operates with the same impedance when connected to the measurement equipment and when connected to the antenna.

One burst in this description of measurement methods is 1 slot 0.625 ms in the personal handy phone system.

(Note) Basically, it is desirable if the measurement methods are bundled, and the same methods are used. However, other methods are not ruled out as those are recognized to have the same or better accuracy , but in this case, it should be proven that the same or better results are obtained, and the appropriate foundations and used measurement methods for these proven results are to be clearly stated, and the said measurement methods of the measurement objects are to be described in the measurement data.

7.1 Transmission system (Private standard/Public standard)

The details of the measurement methods are described in sections 7.1.1 through 7.1.11.

For items that describe several measurement methods, any of the measurement methods may be used if they satisfy measurement accuracy.

The items common to each measurement method are as follows.

(1) The standard coded test signal used in modulation is a binary pseudo-noise series of code length 511 bits, and travels on information channel I (TCH) or all slot intervals.

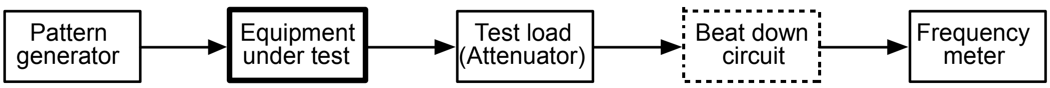
(2) The definition of inside a burst period is at least 98 symbols from the first symbol immediately after rising until the last symbol immediately before falling.

(3) The definition of outside a burst period is at least 720 symbols from the last symbol immediately before falling, excluding the last three symbols, to the first symbol immediately after the next slot rises, excluding the previous three symbols.

7.1.1* Frequency error (Private standard/Public standard)

7.1.1.1* Frequency error (frequency counter method) (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. Use a frequency counter as the frequency meter.

b. Using the counter's pulse measurement function, set the gate open time to a modulation interval of the standard coded test signal or at a value that measures as much as possible of the modulation interval or interval that should be the measurement object shown in item (3).

c. Use a frequency meter which, when necessary, adds indication digits according to an averaging function and calibrates the indication according to the previously known frequency in order to increase resolution of short bursts, or which inputs a beat down signal according to the previously known frequency, and ensures accuracy of one-tenth or less of the standards.

(3) Status of equipment under test

a. Set at test frequency and transmit. Modulate with the standard coded test signal.

b. In test mode measurement and so forth, in cases where special modulation is used for the traffic channel or all slot intervals and special code modulation is, it can be measured and the offset portion can be corrected. (Reference: If there is zero continuation, Offset is 24 kHz.) in case of π/4 shift QPSK modulation and 0Hz in case of 16QAM modulation.)

c. In test mode measurement, in cases where unmodulated carrier can be output, it can be measured unmodulated in cases of circuit methods where the center of the modulation spectrum is the carrier frequency.

d. In test mode setting, if continuous transmission is possible, measurement in that state is possible.

e. In case the modulation of the equipment under test is the one other than π/4 shift QPSK or π/2 shift BPSK, the test mode measurements specified in (b) and (c) instead of the standard coding test signals.

(4) Measurement procedures

Measure 100 individual bursts or more and find the average; that is the measured value.

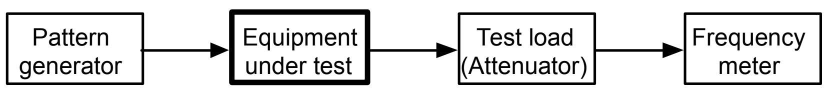
In the case of continuous transmission, measure with a gate time by which accuracy 1 order of magnitude can be obtained, better than the required accuracy.

(5) Other methods

Measurement of the reference oscillator output frequency can be substituted if the transmitter circuit construction is one in which the reference oscillator's frequency accuracy is the transmitter output frequency accuracy.

7.1.1.2* Frequency error (phase locus method) (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

Use the frequency meter described in "7.1.7 Modulation Accuracy".

(3) Status of equipment under test

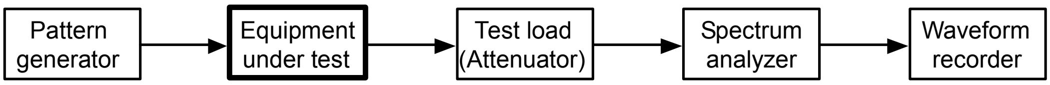
Set at test frequency and transmit.

(4) Measurement procedures

Measure output frequency of the equipment under test with the frequency meter.

7.1.2* Spurious emission (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. Detection of spurious emission

The spectrum analyzer and the wave form recorder at the time of spurious detection are to be set as follows:

	(within the band)		(out of the band)
	transmission carrier within ±6MHz except ±1MHz	within the band except transmission carrier ±6MHz	out of the band
Sweep frequency width	12MHz	35MHz	100MHz
Resolution bandwidth	30kHz	100kHz	1MHz
Video bandwidth	10kHz	1MHz	1MHz
Y axis scale	10db/div		
Input level	Value of the maximum dynamic range (e.g. from -5 to -10dBm)		
Sweep mode	Single sweep		
Sweep time	One bust per sample e.g. 5 sec or more for 1001 points.		
Detection mode	Positive peak		

Note 1: "Within the band" means the specified band (from 1,884.5MHz to 1,919.6MHz) and "without the band" means the band range other than the abovementioned band.
Note 2: The description "except transmission carrier ±1MHz" within the band should read as "except transmission carrier ±1.3MHz for those exceeding 288kHz of occupied bandwidth.
Note 3. When being "out of band," the frequency as low as possible up to the frequency that is more than triple the transmission carrier (e.g. 10MHz to 6GHz) are searched for every 100MHz sweep frequency width or by continuous sweep.

b. At the time of amplitude measurement

The spectrum analyzer and the wave form recorder at the time of amplitude measurement are to be set as follows.

Center frequency	Frequency of defined frequency range
Sweep frequency width	0 Hz
Resolution bandwidth	1MHz
Video bandwidth	About the same level as the resolution band width
Y axis scale	10 dB/div
Input level	Value of the maximum dynamic range (e.g. from -5 to -10dBm)
Sweep mode	Single sweep
Sweep trigger	The video trigger or free run, generally + voltage, but adjustment is necessary.
Sweep time	Within the band: 1ms, outside the band: 5ms
Detection mode	Sample

(3) Status of equipment under test

Set at test frequency and transmit.

(4) Measurement procedures

a. Detection of spurious emission

For the required band, sweep slowly and confirm spurious frequency. Frequency band to be detected is in a band are the frequency as low as possible up to the frequency that is more than triple the transmission carrier (e.g. 10MHz to 6GHz) in the band except transmission carrier ±1MHz and the out of the band except transmission carrier±2.25MHz.

b. Center frequency setting

The center frequency setting of the spectrum analyzer is aligned to the spurious frequency.

c. Measurement

Make a single sweep in the time domain and measure power per 1MHz. In case of spectrum analyzer without power measurement function, bandwidth 1MHz is measured by the same method as the one for adjacent channel leakage power. When the center frequency is within the band and within the transmission carrier±2.75MHz, the transmission carrier ±2.75MHz becomes the center frequency.

d. Data input

When the sweep is completed, the values of sample points inside and outside the burst period are entered into the array variable of the computer.

e. Antilogarithm conversion

The dBm value of the input data is converted to the antilogarithm of the power dimension.

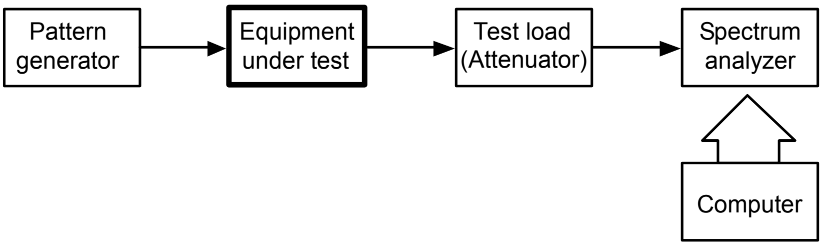
f. Power average

The converted antilogarithm data is averaged within the burst period (note) of the spurious emission, and the average power is found. The sample spacing is the reciprocal of the signal transmission rate or less.

(Note) Since the transmission carrier and spurious emission do not necessarily coincide in timing, the burst period of spurious emission is shown here.

7.1.3* Occupied bandwidth (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The spectrum analyzer is the digital storage type.

b. The spectrum analyzer settings are as follows.

Center frequency	Carrier frequency
Sweep frequency width	About 2 to 3.5 times the occupied bandwidth specification
Resolution bandwidth	About 3% or less of the occupied bandwidth specification
Video bandwidth	About the same as the resolution bandwidth
Y axis scale	10 dB/div
Input level	The carrier is 50 dB or more higher than the noise level of the spectrum analyzer.
Sampling points	400 points or more (example: 1001 points)
Sweep time	One or more bursts per sample; if there are 1001 points, 5 seconds or more
Detection mode	Positive peak
Sweep mode	Single sweep

c. The values measured by the spectrum analyzer are processed by an internal or external computer.

(3) Status of equipment under test

Set at test frequency and transmit.

(4) Measurement procedures

a. Measurement

The spectrum analyzer does a single sweep and measures the spectrum distribution.

b. Data input

When the sweep is completed, the values of all sample points are entered into the computer’s array variable.

c. Antilogarithm conversion

The dBm value for all data is converted to the antilogarithm (relative value may be used) of the power dimension.

d. Calculation of total power

The total power of the whole sample is found and recorded as "total power".

e. Calculating lower frequency limit

1) Power addition is carried out sequentially from the sample with the lowest frequency, and the critical sample point where this value becomes 0.5% of "total power" is found.

2) That critical point is converted to a frequency and recorded as "lower frequency limit".

f. Calculating upper frequency limit

1) Power addition is carried out sequentially from the sample with the highest frequency, and the critical sample point where this value is 0.5% of the "total power" is found.

2) That critical point is converted to a frequency and recorded as "upper frequency limit".

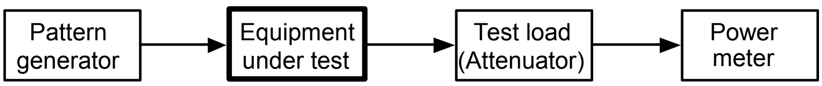
g. Calculating occupied bandwidth

The occupied bandwidth is found as "upper frequency limit" - "lower frequency limit".

7.1.4* Antenna power (Private standard/Public standard)

7.1.4.1* Antenna power (1) (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

Use a power meter which has a time constant adequately longer than the burst and which displays the true root mean square value power.

(3) Status of equipment under test

Set at test frequency and transmit.

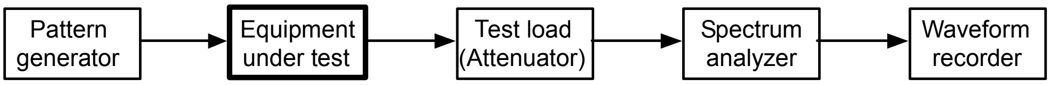
(4) Measurement procedures

The power is measured by the power meter.

When transmitting multiple slots, divide the displayed value by the number of transmission slots.

7.1.4.2* Antenna power (2) (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The spectrum analyzer and the waveform recorder are set as follows.

Center frequency	Carrier frequency
Sweep frequency width	0 Hz
Resolution bandwidth	Approximately 1 MHz
Video bandwidth	About the same as the resolution bandwidth or more
Y axis scale	Linear to voltage
Input level	Make the maximum value of the amplitude 70-90% of full scale.
Sweep mode	Single sweep
Sweep trigger	The video trigger. It is generally + voltage, but adjustment is necessary.
Sweep time	About 1 msec (for 1-slot transmission)

(3) Status of equipment under test

Set at test frequency and transmit.

(4) Measurement procedure

a. Measurement

The spectrum analyzer does a single sweep and measures the power distribution.

b. Data input

When the sweep is completed, the values of the sample points within the burst period are entered into the computer's array variable.

c. Antilogarithm conversion

The voltage value for the acquired data is converted to the antilogarithm of the power dimension.

d. Power averaging

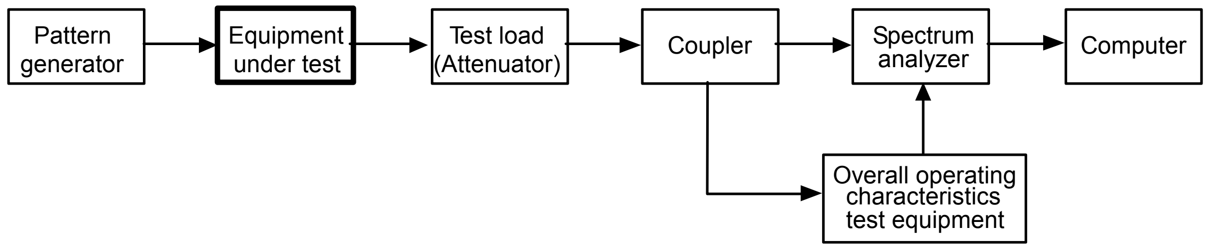
The antilogarithm converted data is averaged, and this is multiplied by (burst period : 0.583 ms *1) /(frame period : 5 ms).

The sample spacing is the reciprocal of the signal transmission rate or less.

*1: The time of 0.583 ms is set as the time for each 110 symbol + the preceding symbol and subsequent symbol. For different designs, however, another value can be used.

7.1.5* Carrier off time leakage power (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The spectrum analyzer is a digital storage type with a gate function.

b. The spectrum analyzer is set as follows.

Center frequency	Carrier frequency
Sweep frequency width	Specified bandwidth
Resolution bandwidth	About 300 kHz
Video bandwidth	About the same as the resolution band width or more
Y axis scale	10 dB/div
Sweep mode	Single sweep
Sweep trigger	The video trigger. It is generally + voltage, but adjustment is necessary.
Sweep time	One or more burst per sample, if there are 1001 points, 5 seconds or more.
Detection	Positive peak
Video gate	The gate timing is adjusted so that the output in the burst period does not appear.

c. The overall operating characteristics test equipment can output to the spectrum analyzer the gate signal corresponding to the burst period.

(3) Status of equipment under test

Set to test frequency and transmit.

(4) Measurement procedures

a. Detecting carrier off time leakage power

The spectrum analyzer gate function is used so that the output in the burst period does not appear; single sweep is done, and the indicated value is recorded for the carrier-off time leakage power.

b. Transmitter power measurement

The gate function is disabled and the spectrum analyzer does a single sweep and measures the indication of the carrier power.

c. Carrier-off time leakage power computation

The carrier-off time leakage power is computed from the difference between a. and b., based on the measured value of the antenna power.

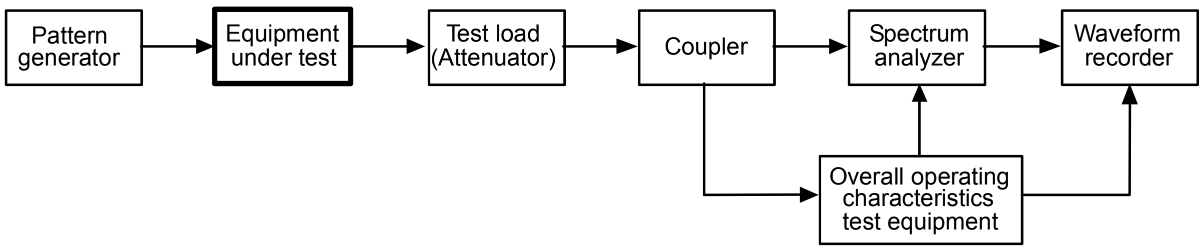
d. Average power within burst

If one feels that measurement accuracy up through c. is insufficient due the fact that carrier-off time leakage power is burst-shaped, etc., measure the average power within the burst (note) with the spectrum analyzer set in the same way as in Section 7.1.2., Spurious emission. However, the period to be measured is outside of the transmission burst period.

(Note) Indicates the period of the of leakage power burst.

7.1.6 Transient response characteristics of burst transmission (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The overall operating characteristics test equipment can output a trigger signal corresponding to the transmission burst timing.

b. Use a spectrum analyzer with a video output terminal. The vertical axes of the spectrum analyzer and waveform recorder are calibrated in advance by a power meter.

c. The spectrum analyzer is set as follows.

Center frequency	Carrier frequency
Sweep frequency width	0 Hz
Resolution bandwidth	About 1 MHz
Video bandwidth	About the same as or greater than the resolution bandwidth
Y axis scale	10 dB/div
Input level	Below permitted input power, and average noise level of spectrum analyzer is 10 dB below carrier-off time leakage power specification.

d. The video output signal is taken in by the waveform recorder.

Sweep trigger	External trigger (can be combined with delay sweep)
Sweep time	About 30 μs

(3) Status of equipment under test

Set at test frequency and transmit.

(4) Measurement procedures

The spectrum analyzer video output signal is measured by the waveform recorder.

7.1.7 Modulation accuracy (Private standard/Public standard)

(1) Definition of modulation accuracy

a. Definition

If ideal transmitter output passes through an ideal root roll-off reception filter and is sampled at ideal points with one symbol spacing, since interference between codes does not occur, modulation sequence values can be defined by the following equation.
In case of $\pi/4$ shift QPSK or $\pi/2$ shift BPSK or D8PSK,

$$S(K) = S(K-1) \cdot e^{j(\angle\Phi)} \qquad \text{Equation (7.1.7-1)}$$

Here, $\angle\Phi$ is in accordance with 3.3.1.2 Coding rule.

In case of 16QAM,

$$S(k) = a \cdot \{I(k) + j \cdot Q(k)\} \qquad \text{Equation (7.1.7-2)}$$

Here, I(k) and Q(k) are in accordance with 3.3.1.2 Coding rule. Also, a is $1/\sqrt{10}$.

Xk and Yk indicate two pieces of data that have been converted by serial-parallel conversion from a binary data series.

On the other hand, for actual transmitted signals, interference between codes occurs. The modulation accuracy is defined by measuring this error.

b. Modulation accuracy definition formula

When transmission is done with actual transmitters and passes through an ideal reception filter, if Z(k) is the signal obtained at instant k with 1-symbol spacing, we can show the following using S(k).

$$Z(K) = [C_0 + C_1 \cdot \{S(k) + E(k)\}] \cdot W^k \qquad \text{Equation (7.1.7-3)}$$

Here, $W = e^{dr+jda}$: Amplitude change of dr [neper/symbol] and frequency offset that corresponds to phase rotation of da [rad/symbol]
C_0: Fixed zero offset signifying imbalance in quaternary modulators
C_1: Complex constant signifying transmitter's optional phase and output power
E(k): Residual vector error of sample S (k)

The sum of the squares of the vector errors is the following equation.

$$\sum_{k=MIN}^{MAX} | E(k) |^2 = \sum_{k=MIN}^{MAX} | \{ [Z(k) \cdot W^{-k} - C_0] / C_1 \} - S(k) |^2 \qquad \text{Equation (7.1.7-3)}$$

C_0, C_1, W are selected in order to make this equation smallest, and are used to compute the vector error in relation to each symbol. The symbol timing position of the reception output is also selected to minimize the vector error.

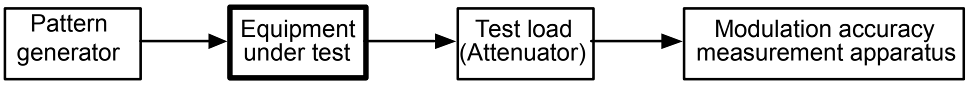
The channel (individual assignment) MAX and MIN can be given by:

MIN = 2 (vector immediately after ramp-up)
MAX = 112 (vector immediately before ramp-down)

The r.m.s. value for vector error is calculated as the square root of the result of dividing the sum of the second power of the vector error by the number of phase identification points in a slot.

The r.m.s. value of this vector error is defined as the modulation accuracy.

(2) Measurement system diagram



(3) Measurement equipment conditions, etc.

The modulation accuracy measurement equipment has a reception root roll-off filter function, and it can measure the r.m.s. difference between the transmitted signal and the ideal signal.

(4) Status of equipment under test

Set at test frequency and transmit.

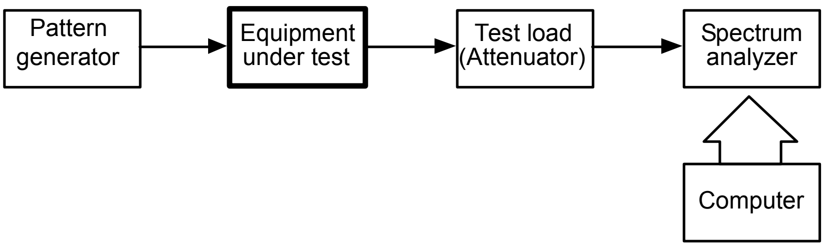
(5) Measurement procedures

a. Measure difference between actual transmission wave and ideal vector convergence point in signal space.

b. Add the square of the vector errors for each point obtained in a. above; divide it by the number of phase identification points within a slot; find the square root of this.

7.1.8* Adjacent channel leakage power (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. Spectrum analyzer settings (digital storage type)

Center frequency Refer to item (4) of this section

Sweep frequency width	Specified bandwidth, or value that slightly exceeds that
Resolution bandwidth	0.5–2.5% of specified bandwidth
Video bandwidth	About 3 times resolution bandwidth, or more
Y axis scale	10 dB/div
Number of samples	At least 400 points (For example, 1001 points. If there are few points, sweep frequency width is small)
Sweep time	One or more burst per sample, if there are 1001 points, 5 seconds or more.
Input level	Near maximum of linear range of internal mixer of spectrum analyzer (For example, -10 dBm ~ -30 dBm)
Screen display	MAX HOLD
Detection mode	Positive peak
Sweep mode	Single sweep

b. The measured values of the spectrum analyzer are processed by an external or internal computer.

(3) Status of equipment under test

Set at test frequency and transmit.

(4) Measurement procedures

a. Set the center frequency of the spectrum analyzer to the carrier frequency.

b. After sweeping is finished, enter all sample points into the array variable of the computer.

c. For all samples, convert the dBm value into the antilogarithm of the power dimension (relative value may be used).

d. Determine the power sum of all samples in specified bandwidth, and record total power (Pc).

e. Measurement of upper adjacent channel power (Pu)

Set the center frequency of the spectrum analyzer to the frequency set in a. + Δf kHz (specified detuned frequency), and repeat b to d.

The sum is referred to as Pu.

f. Measurement of lower adjacent channel power (Pl)

Set the center frequency of the spectrum analyzer to the frequency set in a. - Δf kHz (specified detuned frequency), and repeat b to d.

The sum is referred to as Pl.

g. Presentation of results

Upper adjacent channel power ratio is 10 log (Pc/Pu)

Lower adjacent channel power ratio is 10 log (Pc/Pl)

Subtract the above calculated value - 9 dB from the measured value of antenna power (dBm), and use this as the dBm measured value of each adjacent channel power. For measured values, these values can be converted to nW units.

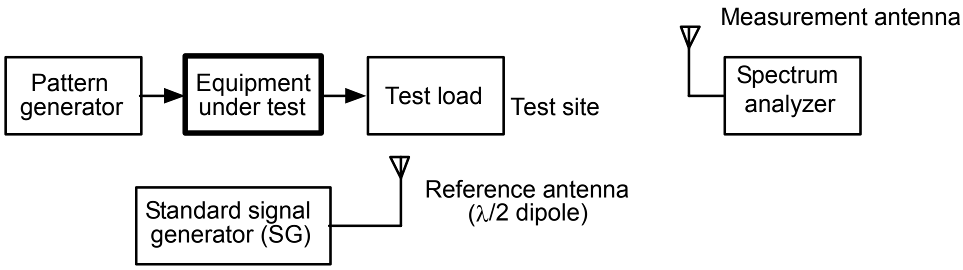
h. For specification in which Δf varies, repeat e. and f. while varying Δf.

(5) Future review

Since the above measurement method evaluates the noise spectrum by burst transmission transient response lower than real, if a suitable measurement method is proposed to IEC, its adoption will be studied and reviewed quickly.

7.1.9 Cabinet radiation (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The equipment under test terminates the antenna terminal with a test load.

b. Perform in a anechoic chamber with measurement distance 3 m or at an open area test site where ground-reflected waves are suppressed, and use a directional antenna for the measurement antenna. To suppress ground-reflected wave, install radio wave absorbers or a radio wave curtain on the ground at the measurement mid-point. The equipment under test should be set as high as possible.

c. If one side of the equipment under test exceeds 60 cm, the measurement distance must be at least 5 times that. If the measurement frequency is less than 100 MHz, perform at an open area test site with measurement distance of 30 m.

d. If using an RFCD: Radio-Frequency Coupling Device, calibrate coupling for each frequency measured, using the same model of the equipment, at the above mentioned test site.

e. The reference antenna for replacement is a λ/2 dipole, and the measuring frequency range is 25 MHz – 4 GHz.

f. In the case where the detected radiation is burst-shaped, add conditions and procedures that conform to "spurious emission."

(3) Status of equipment under test

Set to test frequency and transmit.

(4) Measurement procedures

a. Install the equipment under test on a turn table, and for the band of specified frequency, confirm the radiation of a spectrum.

b. Among those checked in a. above, the spectrum analyzer is tuned to one frequency component.

c. The measurement antenna is vertically or horizontally polarized as inferred from the structure of the equipment under test.

d. The turn table is rotated, and set to the maximum indication angle of radiation (average power within burst period).

e. The measurement antenna is again raised and lowered, and set to the maximum indication.

f. The equipment is rotated on the vertical plane that contains the measurement antenna, and it is set at the angle of the maximum indication.

g. By varying the measurement antenna polarization, it is confirmed that it conforms to c.. If different, d., e. or f. is repeated as needed at the polarity in the different directions, and the frequency, maximum indication, each angles and measurement antenna and polarity are recorded.

h. The procedures b.–g. above are carried out for all the spectrum frequencies found in a..

i. The equipment under test is replaced with the reference antenna

j. The reference antenna is tuned as needed to the frequency of the spectrum measured in g. above.

k. The reference antenna and the measurement antenna are both polarized in the way when measured in g. above.

l. The measurement antenna is raised and lowered, and the output level of the SG is adjusted so that the largest maximum indication of the spectrum analyzer matches the maximum value found in g above. The SG output level and the measurement antenna height at this time are both recorded.

m. Steps j. – m. are repeated for all frequency components measured up to step h. above.

n. Exchange the measurement antenna as necessary, and repeat until measurement of 25 MHz – 4 GHz is finished.

(5) Presentation of results

The cabinet radiation is reference antenna gain and SG/reference antenna cable loss correction added to the SG output level found in the measurements in (4).

7.1.10 Signal transmission rate (clock frequency error) (Private standard/Public standard)

(1) Measurement system diagram

(2) Measurement equipment conditions

The frequency resolution of the frequency meter should be smaller than one tenth of the transmission rate specification (clock frequency error).

If the clock is a burst output, a frequency counter is used that can measure the burst clock frequency.

(3) Status of equipment under test

Set at test frequency and transmit.

In the case of a personal station, perform in a state where the direct communication between personal stations are possible or transmission in test mode are possible.

(4) Measurement procedures

The clock frequency of the equipment under test is measured.

(5) Presentation of results

Calculate the error with respect to the nominal value of the measured value determined in (4).

(6) Other methods

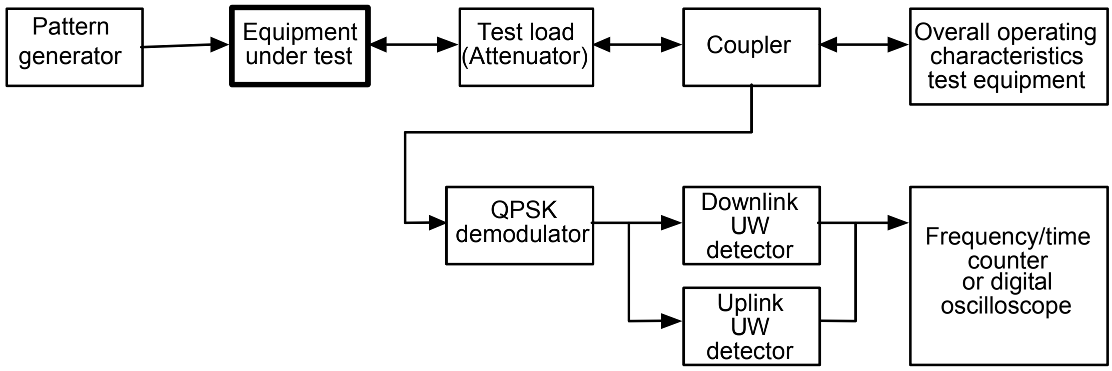
a. If a reference clock source of a frequency synthesizer that generates a transmission carrier is used as the transmission clock source, the error measured in section 7.1.1 can be used.

b. If the clock output from the equipment under test is other than 384 kHz and the clock source is shared the measured frequency error can be used.

7.1.11 Transmission timing (Private standard/Public standard)

7.1.11.1 Transmission timing (1) (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The overall operating characteristics equipment performs control sequences such as call origination with the equipment under test (cell station or personal station).

b. The QPSK demodulator can demodulate the specified burst signal.

c. The uplink and downlink UW (unique word) detectors each have a clock synchronization circuit and UW detection circuit, and by narrowly dividing the timing detection, the required detection accuracy is obtained. If necessary, UW detection output of uplink or downlink only is possible.

d. The digital oscilloscope can perform delay sweep, and its time axis resolution is sufficiently fine, and is calibrated by a high-stability oscillator.

(3) Status of equipment under test

Set to the test frequency, and transmit. It is in communication state with the overall operating characteristics test equipment.

(4) Measurement procedures

a. In the case of a cell station, only the downlink UW (unique word) detector is operated, and its detected output pulse spacing is measured.

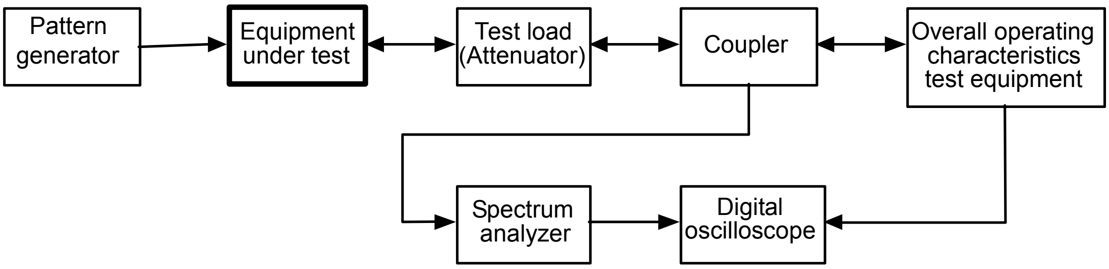
b. In the case of a personal station, the downlink UW detector and uplink UW detector are operated, and the detected output pulse spacing is measured.

c. It is measured multiple times, and the averaged value is taken as the transmission timing, and the jitter is the maximum deviation from this average.

d. The measured values in time units are converted to number of symbols.

7.1.11.2 Transmission timing (2) (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The overall operating characteristics equipment performs control sequences such as call origination with the equipment under test (cell station or personal station). The output signal of this equipment is lower than that of the equipment under test, and the signal of equipment under test can easily be distinguished it's self on the screen of a digital oscilloscope.

This equipment can also has trigger signal output that correspond to it's transmission timing.

b. The spectrum analyzer is to be equipped with a video output terminal, and is set as follows.

Center frequency	Carrier frequency
Sweep frequency width	0 Hz
Resolution band width	About 1 MHz
Video band width	Same as resolution band width or more
Y axis scale	10 dB/div
Input level	Maximum amplitude to be 70~90% of full scale

c. The digital oscilloscope can perform delayed sweep, and it's time axis is sufficiently fine, and accuracy is calibrated by a high-stability oscillator.

(3) Status of equipment under test

Set to the test frequency, and transmit. It is in communication state with the overall operating characteristics test equipment.

(4) Measurement procedures

Using the delayed sweep of the digital oscilloscope, measure the spacing of the same point of the envelope line having a specific pattern. Measure several times, and take the averaged value as transmission timing. The jitter is the maximum deviation from the average value.

The measured value of time units is converted to number of symbols.

7.2 Reception system (Private standard/Public standard)

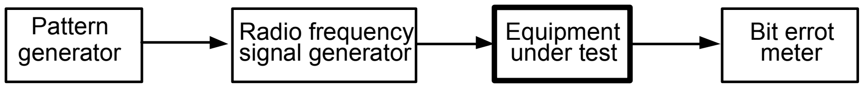
Sections 7.2.1 through 7.2.9 describe details of measurement methods.

Here, facts common to the measurement items that accompany error rate measurement (7.2.1-7.2.9) are described.

<Error rate measurement>

(1) Measurement system diagram

This diagram shows the basic system diagram for error rate measurement. Depending on the needs for each measurement, matching or combining network, power measurement equipments, etc. are added.



(2) Measurement equipment conditions, etc.

a. Radio-frequency signal generator

Frequency	Frequency of the specified frequency band
Frequency accuracy	Within ± 1 x 10^{-7}
Modulation accuracy	Within r.m.s. vector error 3% (recommended value)
Adjacent channel leakage power	± 600 kHz detuned at least 80 dB below carrier power (recommended value) ± 900 kHz detuned at least 80 dB below carrier power (recommended value)
Level calibration	In the state where a continuous carrier wave is modulated by repetition of a standard coded test signal, it is performed with a power meter. Output level of overall operating characteristics test equipment is the same.
Undesired signal timing	Transmitted at least across entire burst period of the desired signal.

b. Pattern generator

Clock frequency	384 kHz
Clock frequency accuracy	Within ± 1 x 10^{-6}
Generated pattern	The standard coded test signal that is transmitted by the information channel I (TCH) (binary pseudo-noise series of code length 511 bits conforming to ITU-T O.153) is generated continuously. Further, other patterns needed in communications to parts of the traffic channel other than the I (TCH) are generated.

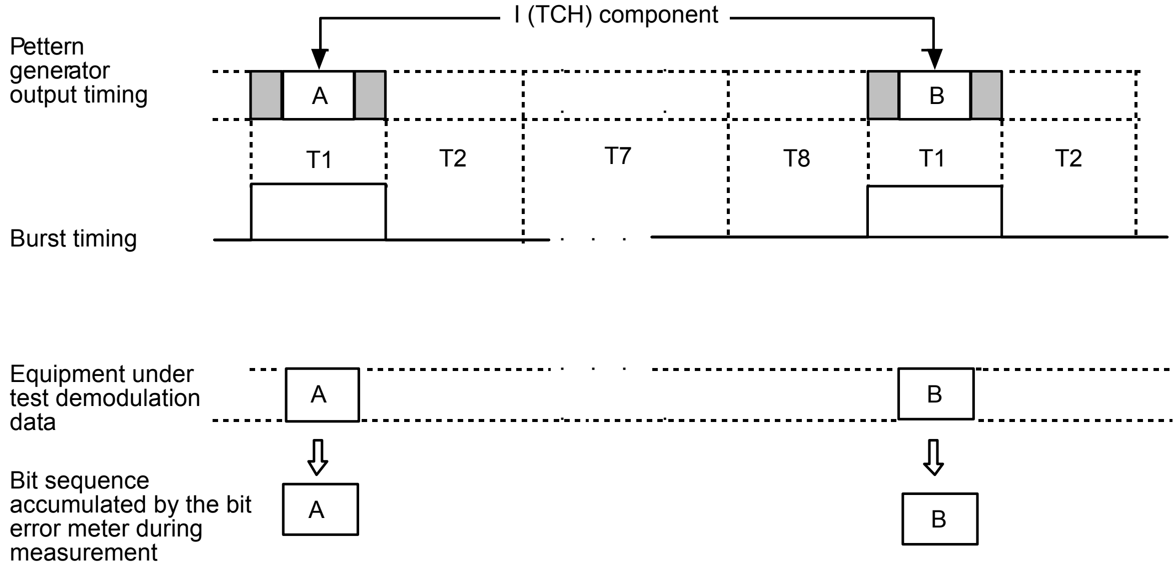
(3) Status of equipment under test and measurement equipment

a. The radio-frequency signal generator repeatedly sends the communication physical slot burst following the pattern input from the pattern generator.

b. The equipment under test is put into reception mode at the test communication frequency, and the information channel I (TCH) of the demodulated data is supplied to the bit error meter.

c. The bit error meter accumulates bit sequence from the information channel I (TCH) and measures the error rate for 2556 bits or more.

(Note) Examples of transmission/reception timing and demodulation data output timing are shown in Figure 7.2.1.



(1) The standard corded test signal is constructed by connecting the signals of partsA, B,... .

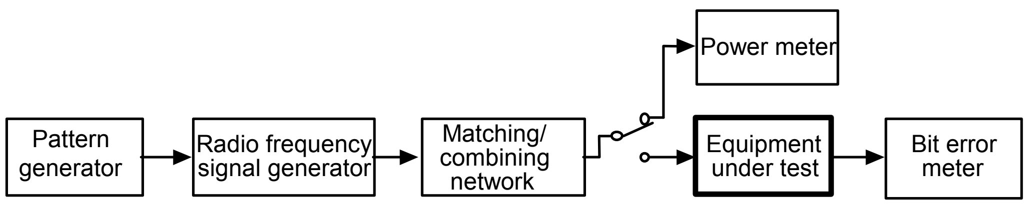
(2) T1, T2 ... T7, T8 show the times slots.

(3) The shaded part shows the other patterns necessary for communications.

Figure 7.2.1 Standard coded test signal transmission/reception methods in pattern generator and bit error meter (example)

7.2.1 Sensitivity (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. Radio frequency signal generator: Refer to <Error rate measurement> (2).

b. Pattern generator: Refer to <Error rate measurement> (2).

(3) Status of equipment under test

a. Set at test frequency and receive.

b. The demodulation data is the information channel I (TCH) (standard coded test signal component).

(4) Measurement procedures

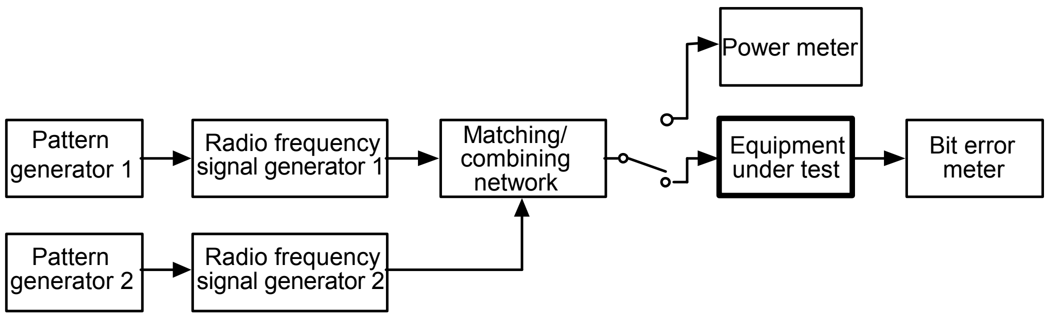
a. The radio frequency signal generator is to be tuned to the test frequency.
b. The radio frequency signal generator transmits bursts.

The signal level is set at the standard sensitivity level. And the switch is changed, signal is supplied to equipment under test.

c. The bit error meter accumulates bit sequence from the information channel I (TCH) and measures the error rate for 2556 bits or more.

7.2.2 Adjacent channel selectivity (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. Radio frequency signal generators 1 and 2: Refer to <Error rate measurement> (2).

b. Pattern generator 1: Refer to <Error rate measurement> (2).

c. Pattern generator 2

Clock frequency	384 kHz
Clock frequency accuracy	Within ± 1 x 10^{-6}
Generated pattern	Digital signals (binary pseudo-noise series of code length 32,767 bits conforming to ITU-T O.151) are continuously generated.

(3) Status of equipment under test

a. Set at test frequency and receive

b. Demodulation data is the information channel I (TCH) (the standard coded test signal component).

(4) Measurement procedures

a. The radio frequency signal generator 1 is to be tuned to the test frequency.

b. The radio frequency signal generator 2 is to be tuned to the frequency of the adjacent channel.

c. Radio frequency signal generator 1 does burst transmission. The signal level is set to the value at which the specified sensitivity level + 3 dB is obtained.

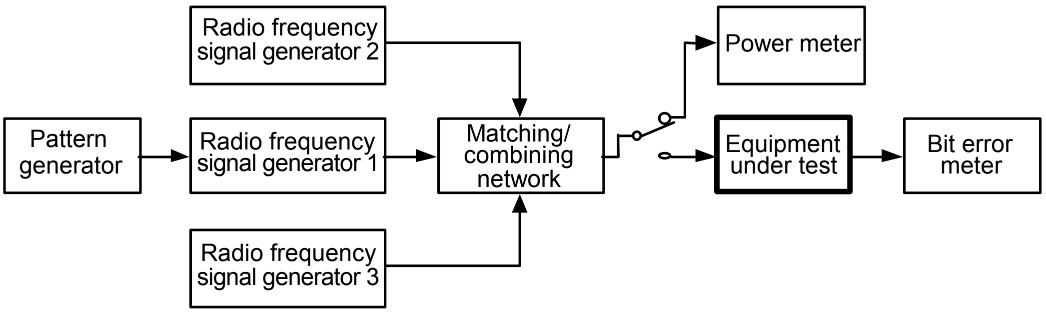
d. Radio frequency generator 2 does continuous or burst transmission. The signal level is set at the value which produces

[(specified sensitivity level + 3 dB) + (adjacent channel selectivity specified value) dB] dBμV

e. The bit error meter accumulates bit sequence from the information channel I (TCH) and measures the error rate for 2556 bits or more

7.2.3 Intermodulation characteristics (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. Radio frequency generators 1, 2 and 3: Refer to <Error rate measurement> (2).

b. Pattern generator Refer to <Error rate measurement> (2).

(3) Status of equipment under test

a. Set at test frequency and receive.

b. Demodulation data is to be the information channel I (TCH) (the standard coded test signal component).

(4) Measurement procedures

a. The radio frequency signal generator 1 is to be tuned to the test frequency.

b. The radio frequency signal generator 2 is to be tuned to test frequency + 600 kHz (or -600 kHz) and the radio frequency signal generator 3 is to be tuned to test frequency + 1200 kHz (or -1200 kHz).

c. Radio frequency signal generator 1 does burst transmission. The signal level is set at the value which produces the specified sensitivity level + 3 dB.

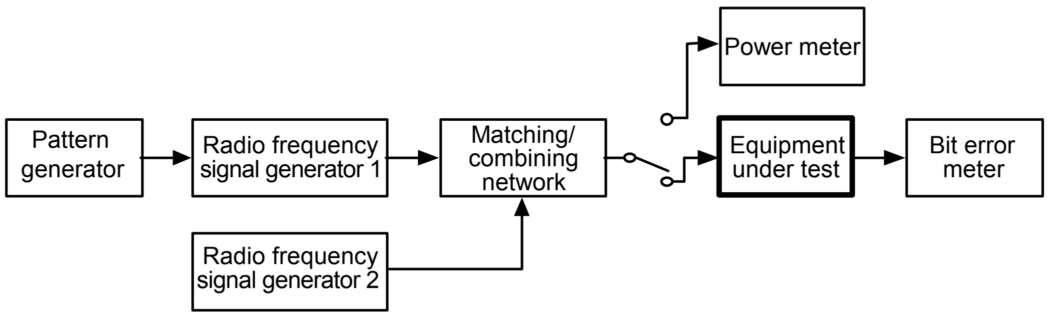
d. Radio frequency signal generators 2 and 3 do continuous or burst transmission, and are not modulated.

The signal levels of radio frequency generators 2 and 3 are set at the value which produces [(specified sensitivity level + 3 dB) + (intermodulation characteristics specified value) dB] dBμV. And the switch is changed, signal is supplied to equipment under test.

e. The bit error meter accumulates bit sequence from the information channel I (TCH) and measures the error rate for 2556 bits or more.

7.2.4 Spurious response immunity (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. Radio frequency signal generators 1 and 2: Refer to <Error rate measurement> (2).
b. Pattern generator Refer to <Error rate measurement> (2).

(3) Status of equipment under test

a. Set at test frequency and receive.

b. The demodulation data is to be the information channel I (TCH) (the standard coded test signal component).

(4) Measurement procedures

a. The radio frequency signal generator 1 is to be tuned to the test frequency.

b. The radio frequency signal generator 2 is to be tuned to the spurious frequency.

c. Radio frequency generator 1 does burst transmission. The signal level is set at the value which produces the specified sensitivity level + 3 dB.

d. Radio frequency signal generator 2 does continuous or burst transmission, and is not modulated.

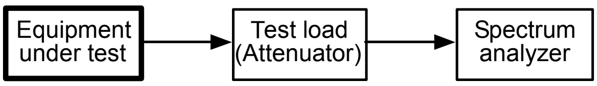
Also, the signal level is set at the value which produces

[(specified sensitivity level + 3 dB) + (spurious response immunity specified value) dB] dBμV.

e. The bit error meter accumulates bit sequence from the information channel I (TCH) and measures the error rate for 2556 bits or more.

7.2.5* Conducted spurious component (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

Setting of the spectrum analyzer

Center frequency	Frequency of the specified frequency range
Sweep frequency width	0 Hz
Resolution bandwidth	About 100 kHz
Y axis scale	10 dB/div
Input level	Amplitude maximum value is about 70-90% of full scale
Sweep mode	Single sweep
Sweep trigger	Video trigger. It is generally + voltage but adjustment is necessary.
Sweep time	About 20 msec

(3) Status of equipment under test

In standby receiving mode and able to receive test frequency.

(4) Measurement procedures

a. With the spectrum analyzer, confirm spurious components in the specified frequency band.

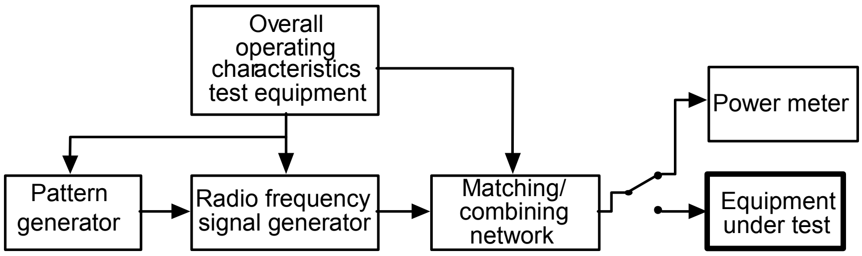
b. Set the spectrum analyzer's central frequency to the frequency checked in a. above, and measure the level of that spurious components.

7.2.6 Cabinet radiation (Private standard/Public standard)

Set the equipment under test to the test frequency, put in reception state, and use the same measurement methods as section 7.1.9.

7.2.7* Carrier sensing (slot transmission conditions) (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The pattern generator supplies a pattern of communication physical slots that includes the standard coded test signal in the information channel I (TCH).

b. The overall operating characteristics test equipment has a function that assign any communication physical slot to the equipment under test in access timing. Also, it provides a slot timing signal to the pattern generator and radio-frequency signal generator.

c. The radio-frequency signal generator supplies a signal modulated by the signal from the pattern generator to the overall operating characteristics test equipment-side transmission slot of the communication carrier assigned by the overall operating characteristics test equipment.

The overall operating characteristics test equipment and equipment under test are set up while considering the required C/I etc. so that call originating and terminating procedure can be performed.

d. The overall operating characteristics test equipment transmits carriers of the level specified in (3) in all communications carriers, except for one certain frequency.

(3) Measurement procedures

[1] PS measurement (including direct communication between personal stations)

(a) Using the overall operating characteristics test equipment, the carrier level of (2) d. is set to 45 dBμV, and progress a call processing sequence with PS under test using a signal of a higher level than this, and it confirms that the communications phase is established at the aforementioned certain frequency.

(b) Then, transmit a 45 dBμV signal of the timing specified in section 3.2.15 (2) at the aforementioned certain frequency synchronized to the overall operating characteristics test equipment by the radio-frequency signal generator. It confirms that the communications phase is not established even if the calling operation is performed from PS under test.

[2] CS measurement

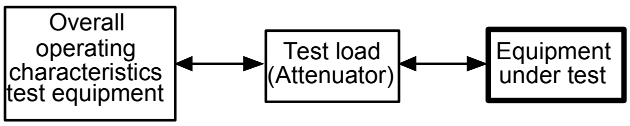
(a) Using the overall operating characteristics test equipment, the carrier wave level of (2) d is set to 27 dBμV, and progress a call processing sequence with CS under test using a signal of a higher level than this, and it confirms that the communications phase is established at the aforementioned certain frequency.

(b) Then, transmit a 45 dBμV signal of the timing specified in section 3.2.15 (2) at the aforementioned certain frequency synchronized to the overall operating characteristics test equipment by the radio-frequency signal generator, and confirm that the link channel cannot be established even if the call processing sequence is forced to progresses as in a..

7.2.8 Received signal strength indicator accuracy (Private standard/Public standard)

7.2.8.1 Method by area information and standby zone holding function (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The overall operating characteristics test equipment can progress the control sequence of outgoing call, incoming call and etc. with the equipment under test (personal station). The overall operating characteristics test equipment can report area information, and its standby zone selection level and standby zone holding level can be set from the outside. Also, it can report a paging area set from the outside, and it can also display the presence or absence of location registration from the equipment under test.

(3) Status of equipment under test

Set in standby state.

(4) Measurement procedures

a. Set the standby zone holding level of the overall operating characteristics test equipment to the appointed value, and set the standby zone selection level sufficiently higher than that value. Activate the equipment under test under sufficient high input level.

b. Confirm that the equipment under test has performed location registration. (Operate if manual operation is required.)

c. After setting the input level from the overall operating characteristics test equipment to the equipment under test at 7 dB (upper allowance + 1 dB) lower than the aforementioned appointed value, confirm the equipment under test displays the out-of -service-area or does not progress the control sequence even if the outgoing call procedure is performed.

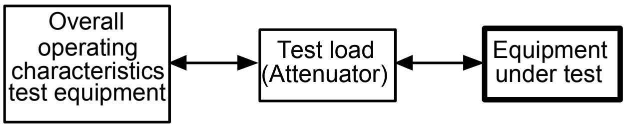
d. Change the paging area number of the overall operating characteristics test equipment, and after sufficiently increasing the input level to the equipment under test, confirm that the equipment under test performs location registration.

e. After setting the input level from the overall operating characteristics test equipment to the equipment under test at 7 dB (| lower allowance - 1 dB |) higher than the appointed value, confirm the equipment under test displays the in-service-area or does progress the control sequence and the communication phase is established with the outgoing call procedure.

f. If necessary, set the standby zone holding level to another value, and repeat steps a. – e..

7.2.8.2 Method by condition report function (Private reference)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The overall operating characteristics test equipment can progress the control sequence of outgoing call, incoming call and etc. with the equipment under test (personal station). The overall operating characteristics test equipment transmits the radio status enquiry signal, and it detects the received signal strength of the condition report signal from the equipment under test, and can display its contents.

(3) Status of equipment under test

Set in standby state.

(4) Measurement procedures

a. Progress the outgoing call or incoming call control sequence between the overall operating characteristics test equipment and the equipment under test, and establish the communications phase.

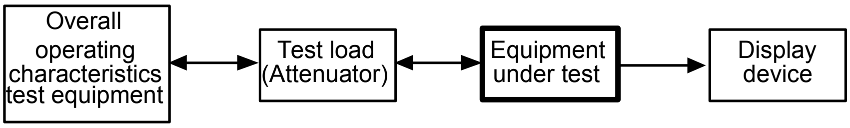
b. The input level from the overall operating characteristics test equipment to the equipment under test is set to the value required in measurement, and the radio status enquiry signal is transmitted, and it detects the received signal strength of the condition report signal from the equipment under test, and it displays these contents.

c. If necessary, the input level to the equipment under test is set to another value, and b. – c. are repeated.

d. Absolute accuracy is calculated from the measured value of b..

7.2.8.3 Method by which reception level value is displayed on display or provided display equipment (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. The overall operating characteristics test equipment can progress the control sequence of outgoing call, incoming call and etc. with the equipment under test (personal station) and so forth.

b. The display equipment is provided by the manufacturer, and it can display the received signal strength of the equipment under test. It is unnecessary if it can be displayed by the equipment under test.

(3) Status of equipment under test

Set in standby state.

(4) Measurement procedures

a. Progress the outgoing call or incoming call control sequence between the overall operating characteristics test equipment and the equipment under test, and establish the communications phase.

b. The input level from the overall operating characteristics test equipment to the equipment under test is set to the value required in measurement, and the display of the display equipment or the equipment under test is read out as the measured value.

c. If necessary, the input level to the equipment under test is set to another value, and b. – c. are repeated.

d. Accuracy is calculated from the measured value of b..

7.2.9 Bit error rate floor characteristics (Public standard)

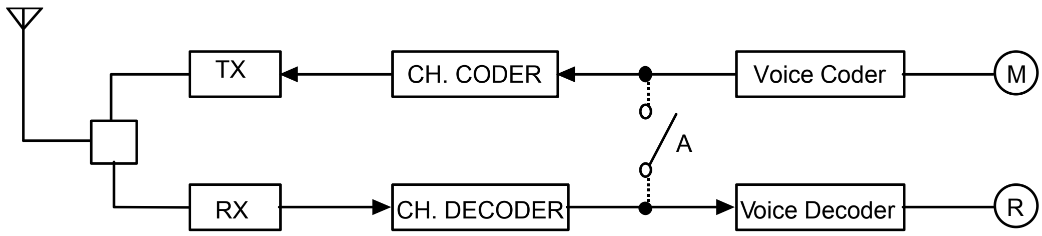
Measure with the similar procedure to 7.2.1 sensitivity.

However, the signal level is the bit error rate floor characteristics specified value, and the number of bits transmitted is at least 2.556 x 10^6.

7.3 Measurement methods in case of no measurement terminal (Private standard/Public standard)

In equipments where there is no antenna measurement terminal and no data input/output terminal, a loop-back path should be able to form between voice CODEC and channel CODEC as shown in the following diagram, and by keyboard operations or reception signal commands, it can be set. The loop-back should be performed for the information channel I (TCH).

(1) Measurement system diagram



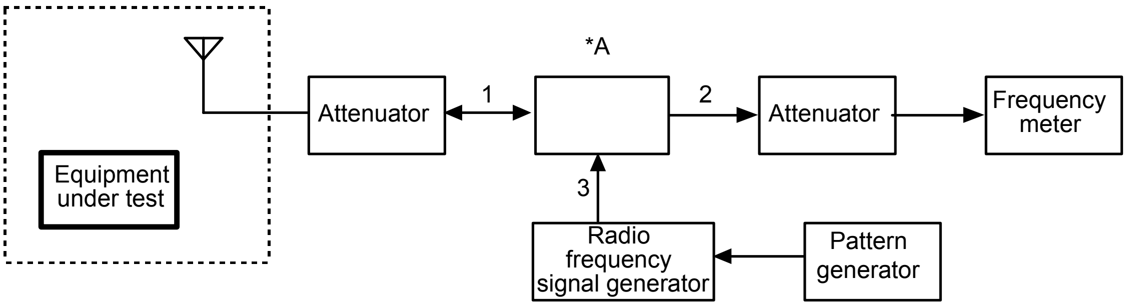
7.3.1 Transmission system (Private standard/Public standard)

7.3.1.1* Frequency error (Private standard/Public standard)

(1) In case of no transmission data input terminal

(a) Measurement system diagram

RFCD: Radio-Frequency Coupling Device



*A is a circulator or resistive coupler

(b) Measurement system conditions, etc.

a. The attenuators connected to each terminal of *A are set as required for circuit impedance stabilization.

b. The measurement system of terminal 2 of *A conforms to the case where there are measurement terminals. The system of terminal 3 conforms to the reception system measurement where there are measurement terminals.

c. Provides reception input of the degree where almost no errors occur in the reception output of the equipment under test. This level is such that leakage to the terminal 2 of *A can be ignored in frequency measurement.

d. In the case of a equipment under test that can supply an unmodulated carrier which is the center of the modulated spectrum, the frequency meter can be connected directly to the output of the RFCD.

(c) Status of equipment under test

Set to the loop-back test mode, and transmit at test frequency.

If the above unmodulated carrier can be supplied, transmit without modulation.

(d) Measurement procedures

a. Measure the output frequency of the equipment under test in the same way as when there are measurement terminals.

(2) In case of having data input terminals

The same as (1) is preferable, but the standard coded test signal is supplied from the transmission data input terminal, and the RFCD output or the coupled antenna output can be measured in the same way as when there is a measurement terminal.

(Note) Both of RFCD and antenna coupling method can be used where using of RFCD or the antenna coupling method are described except otherwise mentioned. However, if no coupling change during the measurement is required, this must be guaranteed. Similarly in the items below.

7.3.1.2* Spurious emission (Private standard/Public standard)

(1) Measurement of effective radiated power

Using the same test site as measurement of cabinet radiation, or an RFCD whose coupling co-efficient is calibrated for each frequency measured using the same model of device at this test site, other measurement conditions are the same as where there is an antenna measurement terminal. The method of providing a loop-back test mode reception signal is the same as 7.3.1.1 (1). In case of having the data input terminals, it is desirable to use the same manner mentioned above. However, the standard coded test signal can be supplied using urethane carbon impregnated high resistance lines which were confirmed not to affect the peripheral electric field.

(2) Presentation of results

Effective radiated power is calculated by dividing the prior measured value by the real value of relative gain of the antenna.

In this case, antenna relative gain is the ratio of the gain which results in the maximum within a 360° 3-dimensional angle of the equipment antenna at the transmission frequency, and the gain in the axial perpendicular direction of the half-wavelength no-loss dipole, and the stated value or the measured value is used for this relative gain.

7.3.1.3* Occupied bandwidth (Private standard/Public standard)

Similar to 7.3.1.1, the standard coded test signal is supplied by antenna coupling and loop-back test mode, and other measurement conditions are the same way as where there are measurement terminals.

The case where a transmission data input terminal is used also conforms to section 7.3.1.1.

7.3.1.4* Antenna power (Private standard/Public standard)

(1) Measurement of effective radiated power

Using the same test site as measurement of cabinet radiation, or an RFCD whose coupling co-efficient is calibrated for each frequency measured using the same model of device at this test site, other measurement conditions are the same as where there is an antenna measurement terminal. The method of providing a loop-back test mode reception signal is the same as 7.3.1.1 (1). In case of having the data input terminals, it is desirable to use the same manner mentioned above. However, the standard coded test signal can be supplied using urethane carbon impregnated high resistance lines which were confirmed not to affect the peripheral electric field.

(2) Presentation of results

Effective radiated power is calculated by dividing the prior measured value by the real value of relative gain of the antenna.

In this case, antenna relative gain is the ratio of the gain which results in the maximum within a 360° 3-dimensional angle of the equipment antenna at the transmission frequency, and the gain in the axial perpendicular direction of the half-wavelength no-loss dipole, and the stated value or the measured value is used for this relative gain.

7.3.1.5* Carrier off time leakage power (Private standard/Public standard)

Similar to 7.3.1.1, the standard coded test signal is supplied by antenna coupling and loop-back test mode, and other measurement conditions are the same way as where there are measurement terminals.

The case where a transmission data input terminal is used also conforms to section 7.3.1.1.

However, confirm that coupling co-efficient variation between measurement frequencies can be ignored.

7.3.1.6 Transient response characteristics of burst transmission (Private standard/Public standard)

Similar to 7.3.1.1, the standard coded test signal is supplied by antenna coupling and loop-back test mode, and other measurement conditions are the same way as where there are measurement terminals.

The case where a transmission data input terminal is used also conforms to section 7.3.1.1.

7.3.1.7 Modulation accuracy (Private standard/Public standard)

Similar to 7.3.1.1, the standard coded test signal is supplied by antenna coupling and loop-back test mode, and other measurement conditions are the same way as where there are measurement terminals.

The case where a transmission data input terminal is used also conforms to section 7.3.1.1.

7.3.1.8* Adjacent channel leakage power (Private standard/Public standard)

Similar to 7.3.1.1, the standard coded test signal is supplied by antenna coupling and loop-back test mode, and other measurement conditions are the same way as where there are measurement terminals.

The case where a transmission data input terminal is used also conforms to section 7.3.1.1.

However, confirm that coupling co-efficient variation between measurement frequencies can be ignored.

7.3.1.9 Cabinet radiation (Private standard/Public standard)

Since the antenna is always connected, it is included in the measurement of spurious emission.

7.3.1.10 Signal transmission rate (Private standard/Public standard)

Similar to 7.3.1.1, the standard coded test signal is supplied by antenna coupling and loop-back test mode, and other measurement conditions are the same way as where there are measurement terminals.

The case where a transmission data input terminal is used also conforms to section 7.3.1.1.

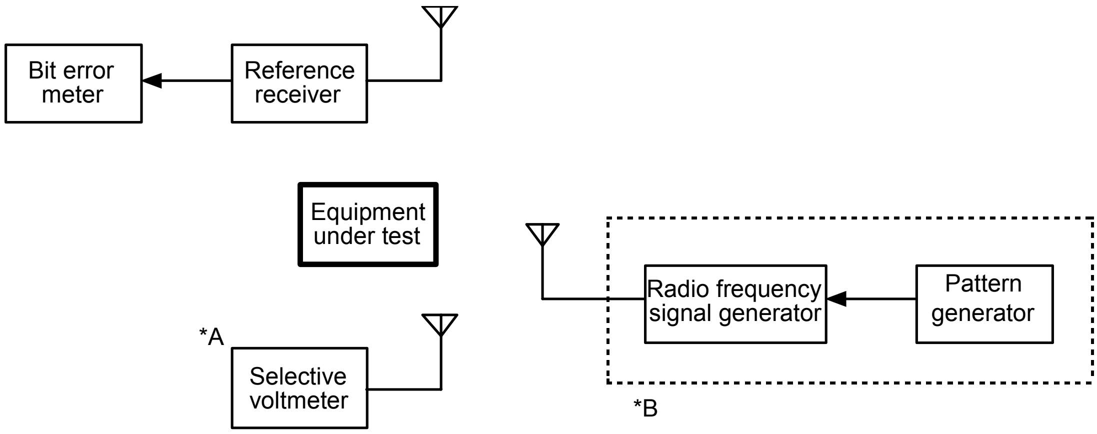
7.3.1.11 Transmission timing (Private standard/Public standard)

The equipment under test is installed inside the RFCD, and the RFCD terminal is treated in conformance with an antenna measurement terminal, and measurement should be performed by the same method as the case where there are measurement terminals.

7.3.2 Reception system (Private standard/Public standard)

7.3.2.1 Sensitivity (test site measurement) (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. Test site conditions are the same as cabinet radiation (section 7.1.9).

b. *A is substituted for the equipment under test, and the electric field strength of that position is measured. The antenna is a half-wavelength dipole antenna.

c. The *B system is one used for reception system measurement connected to an antenna terminal of the equipment under test where there are measurement terminals.

d. The reference receiver receives the waves of the equipment under test, and supplies to the bit error meter that demodulated data that conforms to the signal output to the reception data output terminal of the equipment under test in the case where there are mesurement terminals. The waves of the equipment under test can be received nearly error-free, and the reference receiver is to be about 3 m from the equipment under test and 4.2 m from the measurement antenna of *B in order not to affect other measurement systems.

(3) Status of equipment under test

Set to loop-back test mode, and transmit the test frequency. In case of having the data output terminals, it is desirable to use the same manner mentioned above. However, the measurement may be carried out with the output terminals being connected to the underground bit error meter by a cord which is hung down just under the equipment.

The equipment preassigned surface is to be aligned with the direction of the incoming radio waves.

(4) measurement procedures

a. Transmit from *B, and using *A , set the electric field strength of the installation location of the equipment under test to the following value E (dBμV/m).

$$E = \text{Sensitivity specified value (dB}\mu\text{V)} - 20\log \frac{300}{\pi f\ (\text{MHz})}\ (\text{dB}\bullet\text{m}) - \text{antenna relative gain (dBd)}$$

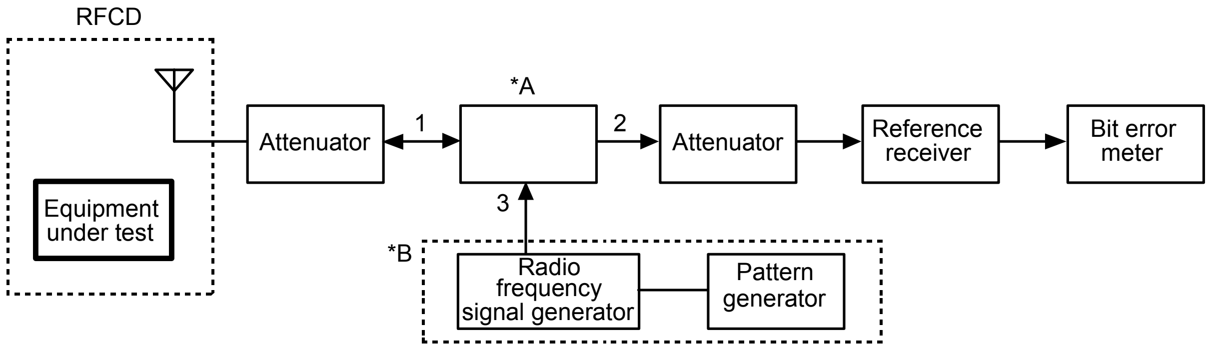
b. Move on *A, set the equipment under test at the location and activate it . The radio waves from the equipment are received by the reference receiver, and measure error rate using the bit error meter. Accumulate the bit sequence of the information channel I (TCH) from *B, and measure the error rate for 2556 bits or more.

7.3.2.2 Sensitivity (RFCD measurement) (Private standard/Public standard)

(1) When there is no data output terminal

[1] Measurement system diagram

The following measurement system shows the basic system diagram for error measurement.



*A is a circulator or resistive coupler

[2] Measurement system conditions, etc.

a. The attenuators connected to each terminal of *A are set as required for circuit impedance stabilization and for level adjustment of the two signal systems.

b. The measurement system *B conforms to the case where there are measurement terminals.

c. The reference receiver receives radio-frequency signals of the test frequency, and supplies to the bit error meter the demodulated data that conforms to the signal output to the reception data output terminal of the equipment under test in the case where there are measurement terminals.

d. The RFCD has coupling of about 20 dB, and has little effect on the operation of the equipment under test, and is calibrated at the measured frequency using the same equipment in the same test site as in measurement of cabinet radiation (7.1.9).

e. Input from the equipment under test to the reference receiver is to the degree that there are almost no errors. Output of the radio-frequency signal generator to the equipment under test to be the sensitivity measurement level, and is a level such that there is almost no effect on the aforementioned output to the reference receiver.

[3] Status of equipment under test

Set to loop-back test mode, and transmit at test frequency.

The equipment under test is aligned to the appointed way of holding and position.

[4] Measurement procedures

Conforms to procedure for the case where there are measurement terminals.

(2) Where there are reception data output terminals

It is desirable to do the same as (1), however, extending the reception output cord through the RFCD so as not to affect the degree of coupling, and it can be measured in the same way as where there are measurement terminals. In this case as well, the requirement for RFCD should be the same as in (1).

7.3.2.3 Adjacent channel selectivity (Private standard/Public standard)

In cases where there either are or are not the data output terminals, it should be performed based on the case where there are measurement terminals and section 7.3.2.2 (1) or (2), using an RFCD.

7.3.2.4 Intermodulation characteristics (Private standard/Public standard)

In cases where there either are or are not the data output terminal, it should be performed based on the case where there are measurement terminals and section 7.3.2.2 (1) or (2), using an RFCD.

7.3.2.5 Spurious response immunity (Private standard/Public standard)

(1) Test site measurement

[1] The test site has the same conditions as the sensitivity measurement. Electric field setting and loop-back measurement are also the same.

[2] The undesired signal system is the same as for the measurement terminal. The undesired signal strength is set such that the electric field strength ratio is the specified value of the spurious response immunity.

(2) RFCD measurement

[1] The RFCD has the same conditions as the sensitivity measurement, and calibrated with the same equipment for each measurement frequency.

[2] The undesired signal system is the same as for the measurement terminal. The undesired signal strength is set such that the electric field strength ratio is the specified value of spurious response immunity.

7.3.2.6* Conducted spurious components (Private standard/Public standard)

Since the antenna is always connected, measurement is impossible.

7.3.2.7 Cabinet radiation (Private standard/Public standard)

Since the antenna is always connected, this measurement includes the radiation of the conducted spurious components. The measurement method is based on transmission cabinet radiation (section 7.1.9).

7.3.2.8* Carrier sensing (slot transmission conditions) (Private standard/Public standard)

(1) Test site measurement

[1] The test site has the same conditions as the sensitivity measurement. Electric field setting is performed in the same way as the input voltage for which measurement is required, instead of sensitivity specification.

[2] The measurement system structure is a structure where the radio waves pass through the same structure as in the case where there are measurement terminals, and it is measured by the same method.

(2) RFCD measurement

[1] The RFCD has the same conditions as the sensitivity measurement.

[2] The equipment under test is installed inside the RFCD, and the RFCD terminal is treated in conformance with the antenna measurement terminal, and measurement is performed by the same method as the case where there are measurement terminals.

7.3.2.9 Received signal strength indicator accuracy (Private standard/Public standard)

(1) Test site measurement

[1] The test site has the same conditions as the sensitivity measurement. Electric field setting is performed in the same way as the input voltage for which measurement is required, instead of sensitivity specification.

[2] The measurement system structure is a structure where the radio waves pass through the same structure as in the case where there are measurement terminals, and it is measured by the same method.

If a display equipment is used, in order to minimize the effect of its connection on the measurement electric field, it is to be much smaller than the equipment under test, and connection lines other than to the equipment under test are to be unnecessary. Connection should be performed at a short distance, and is affixed where the effect on the equipment under test is small.

(2) RFCD measurement

[1] The RFCD has the same conditions as the sensitivity measurement.

[2] The equipment under test is installed inside the RFCD, and the RFCD terminal is treated in conformance with an antenna measurement terminal, and measurement is performed by the same method as the case where there are measurement terminals.

If a display equipment is used, in order to minimize the effect of its connection on the measurement electric field, it is to be much smaller than the equipment under test, and connection lines other than to the equipment under test are to be unnecessary. Connection is performed at a short distance, and is affixed where the effect on the equipment under test is small.

7.3.2.10 Bit error rate floor characteristics (test site measurement) (Public standard)

Measure with the similar procedure to 7.3.2.1 sensitivity (test site measurement).

However, the signal level is the value of the bit error rate floor characteristics specification, and the number of bits transmitted is at least 2.556 x 10^6.

7.3.2.11 Bit error rate floor characteristics (RFCD measurement) (Public standard)

Measure with the similar procedure to 7.3.2.2 sensitivity (RFCD measurement).

However, the signal level is the value of the bit error rate floor characteristics specification, and the number of bits transmitted is at least 2.556 x 10^6.

7.4 Miscellaneous (Private standard/Public standard)

7.4.1 Communication quality (Private standard/Public standard)

The basic rules of communication quality measurement are according to ITU-T recommendations P. 76.

(1) Communication quality measurement when CS is connected to digital network

[1] Measurement is performed in received field such that transmission errors do not occur in either PS or CS.

[2] "Reference codec" is measured by connecting to an analog wired interface in conformance with "codec approach" of P. 66 of ITU-T recommendations.

[3] Measurement system and measurement conditions of sending sensitivity, receiving sensitivity and side tone sensitivity conform to ITU-T recommendations P. 66, and the measurement method is according to P. 64 of the same recommendations.

[4] Calculation of the loudness rating and side tone masking is performed according to P. 79 of the same recommendations.

(2) Communication quality measurement when CS is connected to analog network

[1] Measurement is performed in received field such that transmission errors do not occur in either PS or CS.

[2] Measured by same measurement system and measurement conditions as analog telephone.

The measurement system and conditions conform to P. 64 of ITU-T recommendations, and calculation of loudness ratings is according to P. 79 of the same recommendations.

[3] The CS-side wired interface conditions (pseudo-line conditions) are according to the measurement conditions of 3.2.19 (2).

<u>ITU-T Recommendations related to communication quality measurement</u>

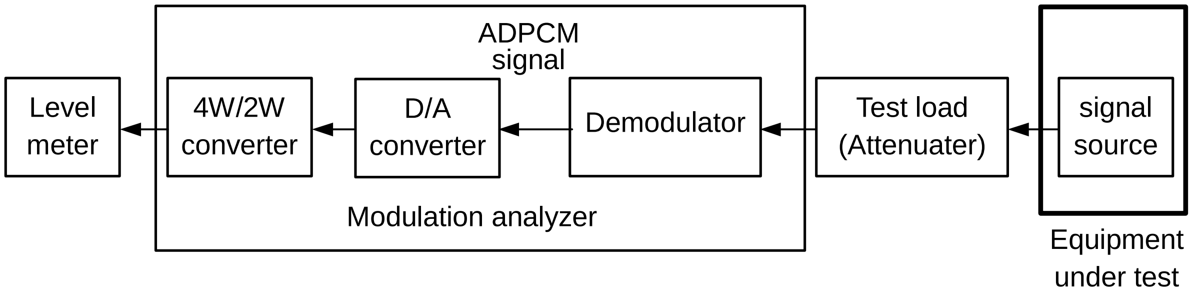
ITU-T recommendation P. 62	Measurement of subscriber's telephone equipment
ITU-T recommendation P. 64	Determination of sensitivity/frequency characteristics of local telephone systems to permit calculation of their loudness ratings
ITU-T recommendation P. 66	Methods for evaluating the transmission performance of digital telephone sets
ITU-T recommendation P. 76	Determination of Loudness ratings; fundamental rules
ITU-T recommendation P. 79	Calculation of Loudness ratings

7.4.2 Output power specified by Terminal Equipment Regulations (Private standard/Public standard)

7.4.2.1 Output power of PS (Private standard/Public standard)

7.4.2.1.1 In case signal source is located inside of equipment under test (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

Modulation-analyzer demodulates the transmit signal of equipment under test with demodulator, takes out ADPCM signal, and converts the demodulated signal to 2 wire analog signal by D/A-converter (include ADPCM decoder) and 4W/2W-converter. The converted 2W-signal is measured by level meter. Analog amplification/damping between D/A-converter input and 4W/2W converter output should not be performed, expect for 4W/2W conversion loss (3dB).

(3) Status of equipment under test

Set at test frequency and transmit. However set TCH data to internal signal source of equipment under test.

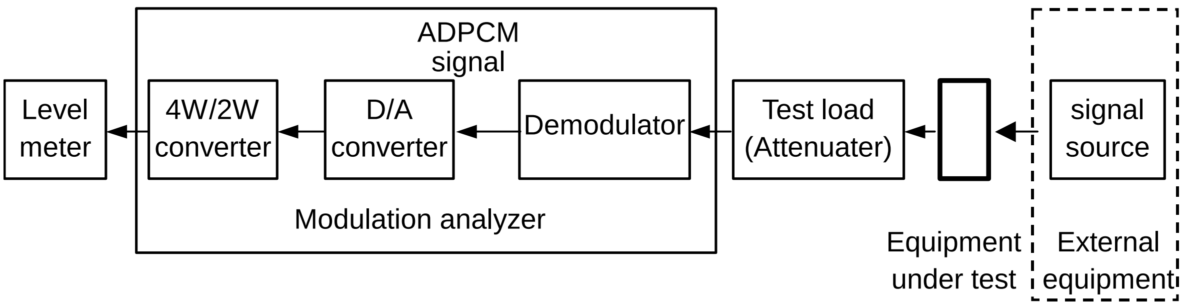
(4) Measurement procedures

a. Modulation-analyzer receives the transmission signal of equipment under test.

b. Level-meter measures demodulated analog signal.

7.4.2.1.2 In case external signal source other than speech can be connected to the equipment under test. (Private standard/Public standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

Modulation-analyzer demodulates the transmit signal of equipment under test with demodulator, takes out ADPCM signal, and converts the demodulated signal to 2 wire analog signal by D/A-converter (include ADPCM decoder) and 4W/2W-converter. The converted 2W-signal is measured by level meter. Analog amplification/damping between D/A-converter input and 4W/2W converter output should not be performed, expect for 4W/2W conversion loss (3dB).

(3) Status of equipment under test

Set at test frequency, and transmit. However set TCH data to signal fsource output of external equipment.

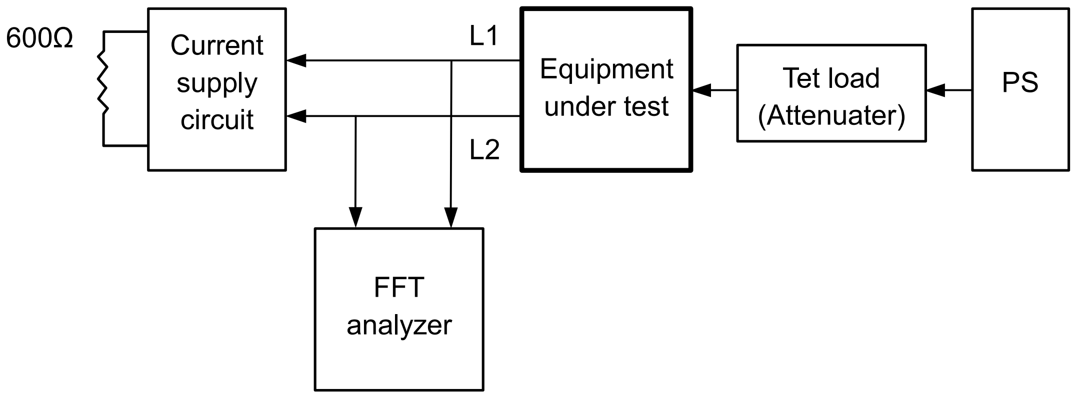
(4) Measurement procedures

a. Modulation-analyzer receives the transmission signal of equipment under test.

b. Level-meter measures demodulated analog signal.

7.4.2.2 Output power of CS (Private standard)

(1) Measurement system diagram



(2) Measurement equipment conditions, etc.

a. PS must satisty the specification of section 3.2.20 item (1).

b. -15dBm (average) signal is added at ADPCM coder input point of PS.

c. PS can be connected to equipment under test using control sequence specified RCR STD-28 (VERSION 2).

(3) Status of equipment under test

Equipment under test with connected PS demodulates TCH data and output the demodulated signal to L1. L2.

(4) Measurement procedures

Chapter 8 Terminology

Chapter 8 Terminology (Reference)

2nd TCH

This is a traffic channel which is used for 64k bit/s UDI communication, the channel does not contain neither LAPDC function in Layer 2 nor CC and MM entities in Layer 3 but has only RT entity in Layer 3.

2nd synchronization burst

This is the signal which is transmitted for the synchronization to establish communication physical slot and Channel switching of 2nd TCH. It includes 32bits unique word.

Abstract syntax notation 1 (ASN.1)

Terminology standardized by both ITU-T/ISO for describing abstract structures such as commands, protocols, etc.

Acknowledged operation

This is the information transfer operation that transfers layer 3 information by the frame acknowledged by the data link layer (layer 2). By retransmitting frames that are not acknowledged, error recovery can be carried out. If error recovery cannot be done by the data link layer, it is reported to the management entity. Flow sequences are also specified.

Associated Control Channel (ACCH)

This is the point-point bidirectional control channel that is associated with TCH. It transmits signalling information and user packet data.

Authentication

This is the function that acknowledges that the personal station carrying out communications is the correct personal station. It carries out call reception, call sending, location registration, etc.

Authentication ciphering pattern

This is the result obtained from the authentication random pattern by the calculation determined at the personal station.

Authentication random pattern

This is the random pattern transferred from the cell station side to the personal station in order to carry out authentication of the personal station.

Basic retransmission control

This is retransmission control carried out by the entire layer 2 frame which uses N(S), N(R) executed under HDLC procedures.

Bit transparency

This is transfer to the receiver of the bit sequence transferred from the sender without any modification.

Broadcast control channel (BCCH)

This is a one way channel for broadcasting control information from the cell station to the personal station. It transfers information related to channel structure, information related to the system and information related to restrictions.

CAC

This is an abbreviation of Common Access Channel. These are the common channels (BCCH, PCH, SCCH, UPCH). One function channel is shared by multiple users.

Call control (CC)

This is the layer 3 entity that performs call service control.

Call reference

This is a number that identifies the call at the same radio interface.

Called party number

This is the information field used to designate the call communications peer.

Calling party number

This is the information field used to identify the call origination source.

Cause

This is the information field that is used to show the reason for call connection or interruption.

Common control channel (CCCH)

This is PCH and SCCH. They are channels that perform control information transfer required in call connection.

Connection

The connection relationship between (N+1) entities is called the (N) connection. The (N) connection is provided by the (N) layer as a communications route mutually connecting (N) SAPs that are accessed by each (N+1) entity.

Connection end point

This is the terminal point of the connection in an (N) SAP.

Connection end point suffix (CES)

This is made up of the connection end point identifier and SAPI, and the connection end point identifier identifies the message unit transferred between the data link layer and layer 3.

Connection end point identifier

This is a concept used instead of data link connection identifier (DLCI) in the layer 3 entity and management entity.

CRC

This is the abbreviation for Cyclic Redundancy Check, and it is the method of detecting errors by the presence or absence of remainders after dividing the reception polynomial equation expressing the reception data by the generated polynomial equation.

CS

An abbreviation of Cell Station. It is the cell station.

Data link connection

This refers to establishing a response relationship between layer 3 entities using a data link protocol in the data link layer in order to achieve information exchange between two or more layer 3 entities.

Don't care

1 or 0. Relevant bit is ignored on destination-side.

Entity

This is the concept that models the function modules necessary for the relevant layer to perform communications.

Fast Associated Control Channel (FACCH)

This is an ACCH that temporarily steals TCH and performs high speed data transmission.

Frame

This is a signal interval made up of 8 TDMA-TDD slots.

Guard time

This is the no-signal time used between bursts so that the transmission bursts do not collide with each other in adjacent slot intervals.

IA5 character

Coding recommended by ITU-T for putting characters/numbers into a signal and sending.

LAPDC

This is an abbreviation for Link Access Procedure for Digital Cordless and it is the link access procedure (layer 2) on the control channel (CCH) for the communications phase and the service channel establishment phase, and it transfers information between layer 3 entities via the personal handy phone system’s radio interface.

Message type

This is the information element used to identify the function of the message that is being transmitted.

Mobility management (MM)

This is the layer 3 entity that performs the location registration and authentication function.

Object identifier

Something that identifies what information contents are acceptable using a means such as between communication equipment.

Option

The fact that something that is arbitrarily available as an option in the standard.

Preamble

This is a layer 1 signal pattern used to establish bit synchronization.

Primitive

This is information exchanged through service access points between adjacent upper layers and lower layers. There are the following types.

"Confirm" primitive

This primitive is used to acknowledge that the primitive operation has been completed by the layer that provided the requested service.

"Indication" primitive

This primitive is used by the layer that provides service to report some operation related to service to an adjacent upper layer.

"Request" primitive

This primitive is used when an upper layer requests service of an adjacent lower layer.

"Response" primitive

This primitive is used by the upper layer to acknowledge reception of the "indication" primitive from the lower layer.

Progress indicator

This is an information field used to report events that occur during a call.

PS

An abbreviation of Personal Station. Also called personal station or sub-device.

Radio frequency transmission management (RT)

This layer 3 entity controls radio channel set up, holding, switching, etc.

Ramp time

This is a required transient response time for burst signal transmission.

Relative slot number

This is the relative slot position of the radio channel.

Reserved

This is the region that is set aside for extension; use other than per regulations is not permitted.

Scramble

This is the randomization of the transmission code series by taking the exclusive logical sum of the M series (Maximum period sequence: Largest period series) and the code series that should be transmitted.
The scramble patterns are the same PN(10,3) for both PS transmission and CS transmission.

Security

This is a function that aims at normal operation of the system by preventing access from invalid personal stations, preventing crosstalk within the system, preventing eavesdropping, etc.

Service access point (SAP)

This is the access point for the (N) entity to receive (N-1) service provided from the lower rank (N-1) layer.

Service access point identifier (SAPI)

This is used to identify the service access point on the cell station side or personal station side of the Um point.

Signalling control channel (SCCH)

This is a bidirectional channel that transmits information required for call connection between a cell station and a personal station. Information is transmitted independently for each cell. Uplink channels are randomly accessed.

Slot

This is one signal interval of which 8 are provided in a 5 ms frame. They have a length of 0.625 ms, and there are two varieties: Individual assignment slots and common use slots.

Slow Associated Control Channel (SACCH)

This is the normal ACCH that usually accompanies TCH.

Subscriber Data (SD)

This is information registered (written) in the personal station to identify subscriber.

Symbol

This corresponds to the 2 bit (5.2 μs) radio interface transmission signal.

Synchronization burst

This is the signal transmitted for establishing synchronicity when switching channels and when setting up communication physical slots. It includes a 32-bit unique word.

Transparent

This is bit transparency.

User Packet Channel (UPCH)

This is a point-multipoint bidirectional channel that transmits control signal information and user packet data. On the control physical slot it's USCCH, and on the communication physical slot it's USPCH.

User Scramble

This is the function of scrambling communication contents in order to maintain security of communication contents when using radio circuits in which interception is possible.

VOX control

This is the function in which the communicating personal station turns transmission output ON/OFF according to the presence or absence of speech. This reduces personal station power consumption.

Acronym List

ABM	Asynchronous Balanced Mode
ACCH	Associated Control Channel
ACSE	Association Control Service Element
ADPCM	Adaptive Differential Pulse Code Modulation
AFI	Authority and Format Identifier
ARIB**	Association of Radio Industries and Businesses
ARM	Asynchronous Response Mode
ASN.1	Abstract Syntax Notation One
BAC	Balanced operation ABM Class (ABM: Asynchronous Balanced Mode)
BCCH	Broadcast Control Channel
BCD	Binary Coded Decimal
BER	Bit Error Rate
BPSK	Binary Phase Shift Keying
CAC	Common Access Channels
CC	Call Control
CCCH	Common Control Channel
CCH	Control Channel
CES	Connection Endpoint Suffix
CI	Channel identifier
CMIP	Common Management Information Protocol
CONS	Connection-Mode Network Service
CRC	Cyclic Redundancy Check
CS	Cell Station
CS-ID	CS Identification
DISC	Disconnect
DLCI	Data Link Connection Identifier
DM	Disconnected Mode
DT	Dial Tone
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency same as PB
FACCH	Fast Associated Control Channel
FCS	Frame Check Sequence
FER	Frame Error Rate
FFT	Fast Fourier Transform
FIFO	First In First Out
FRMR	Frame Reject
G	Guard (time)
HDLC	High level Data Link Control
I	Information
IA5	International Alphabet No. 5
IEC*	International Electrotechnical Commision
ISO*	International Organization for Standardization
ISDN	Integrated Services Digital Network
ITU-T*	International Telecommunication Union-Telecommunication Standardization Sector
LAN	Local Area Network
LAPB	Link Access Procedure Balanced
LAPDC	Link Access Procedure for Digital Cordless
LCCH	Logical Control Channel
LCH	Link Channel
LLI	Logical Link Identifier
LSB	Least Significant Bit
MM	Mobility Management
MoU	Memorandum of Understanding
MSB	Most Significant Bit
NIC	Network Independent Clock
NRM	Normal Response Mode
NSAP	Network Service Access Point
OSI	Open Systems Interconnection
PAD	Padding
PB	Push Button same as DTMF
PCH	Paging Channel
PDU	Protocol Data Unit
PN	Pseudo-Noise
PR	Preamble
PS	Personal Station
PS-ID	PS Identification
PSK	Phase Shift Keying
QAM	Quadrature Amplitude Modulation
QOS	Quality Of Service
QPSK	Quadrature Phase Shift Keying
R	Ramp (time)
RA	Rate Adaption
RBT	Ring Back Tone
RCR**	Research & Development Center for Radio Systems
RLR	Receive Loudness Rating
RNR	Receive Not Ready
RR	Receive Ready
RT	Radio frequency Transmission management
SAPI	Service Access Point Identifier
SABM	Set Asynchronous Balanced Mode
SACCH	Slow Associated Control Channel
SCCH	Signalling Control Channel
SCH	Service Channel
SD	Subscriber Data
SDL	Specification and Description Language
SLP	Single Link Procedure
SLR	Send Loudness Rating
SS	Start Symbol
STMR	Sidetone Masking Rating
TA	Terminal Adapter
TCH	Traffic Channel
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TTC**	Telecommunication Technology Committee

UA	Unnumbered Acknowledgment
UI	Unnumbered Information
UPCH	User Packet Channel
USCCH	User Specific Control Channel
USPCH	User Specific Packet Channel
UW	Unique Word
VOX	Voice Operated Transmission
WLL	Wireless Local Loop

(Note 1) Excludes unit display and codes.
(Note 2) * International standardigation organizations
** Japanese standardization organizations

PERSONAL HANDY PHONE SYSTEM

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(1/2)

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