**ENGLISH TRANSLATION**

# VIDEO CODING, AUDIO CODING, AND MULTIPLEXING SPECIFICATIONS FOR DIGITAL BROADCASTING

# ARIB STANDARD

## ARIB STD-B32 Version 3.11
## (Fascicle 3)

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|---|---|---|---|
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| Revised September 28, 2006 | Version 2.0 | | |
| Revised March 14, 2007 | Version 2.1 | | |
| Revised July 29, 2009 | Version 2.2 | | |
| Revised April 26, 2010 | Version 2.3 | | |
| Revised November 5, 2010 | Version 2.4 | | |
| Revised March 28, 2011 | Version 2.5 | | |
| Revised July 3, 2012 | Version 2.6 | | |
| Revised September 25, 2012 | Version 2.7 | | |
| Revised December 18, 2012 | Version 2.8 | | |
| Revised March 18, 2014 | Version 2.9 | | |
| Revised July 31, 2014 | Version 3.0 | | |
| Revised December 16, 2014 | Version 3.1 | | |
| Revised March 17, 2015 | Version 3.2 | | |
| Revised July 3, 2015 | Version 3.3 | | |
| Revised September 30, 2015 | Version 3.4 | | |
| Revised December 3, 2015 | Version 3.5 | | |
| Revised March 25, 2016 | Version 3.6 | | |

Association of Radio Industries and Businesses

# General Notes to the English Translation of ARIB Standards and Technical Reports

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- ARIB Standards and Technical Reports, in the original language, are made publicly available through web posting. 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.

# Foreword

The Association of Radio Industries and Businesses (ARIB) investigates and summarizes the basic technical requirements for various radio systems in the form of "ARIB Standards". These standards are developed with the participation of and through discussions amongst radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

ARIB Standards include "government technical regulations" (mandatory standard) that are set for the purpose of encouraging effective use of frequency and preventing interference with other spectrum users, and "private technical standards" (voluntary standards) that are defined in order to ensure compatibility and adequate quality of radio equipment and broadcasting equipment as well as to offer greater convenience to radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

This ARIB Standard is developed for "VIDEO CODING, AUDIO CODING, AND MULTIPLEXING SPECIFICATIONS FOR DIGITAL BROADCASTING". In order to ensure fairness and transparency in the defining stage, the standard was set by consensus at the ARIB Standard Assembly with the participation of both domestic and foreign interested parties from radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

ARIB sincerely hopes that this ARIB Standard will be widely used by radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

NOTE:
Although this ARIB Standard contains no specific reference to any Essential Industrial Property Rights relating thereto, the holders of such Essential Industrial Property Rights state to the effect that the rights listed in the Attachment 1 and 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, in the case of Attachment 1, such holders shall not assert any rights and shall unconditionally grant a license to practice such Industrial Property Rights contained therein, and in the case of Attachment 2, the holders shall grant, under 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 Rights of which is covered in whole or part in the contents of the provisions of this ARIB Standard.

Attachment 1 (Selection of Option 1)
(N/A)

Attachment 2 (Selection of Option 2)

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| Japan Broadcasting Corporation (NHK) | ﾃﾞｨｼﾞﾀﾙ情報伝送方式、ﾃﾞｨｼﾞﾀﾙ情報送信装置およびﾃﾞｨｼﾞﾀﾙ情報受信装置 | 特願平 05-65183<br>特開平 06-276169 | Japan |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver3.1.*15 | | |
| NEC Corporation | 画像信号の動き補償フレーム間予測符号化・復号化方法とその装置 | 特許 1890887 | Japan |
| | 画像の圧縮記録システム | 特許 2036887 | Japan,<br>United States,<br>United Kingdom,<br>Germany, France,<br>Netherlands,<br>Canada |
| | 適応変換符号化の方法及び装置 | 特許 2569842 | Japan,<br>United States,<br>United Kingdom,<br>Germany, France,<br>Netherlands |
| | 適応変換符号化の方法及び装置 | 特許 2778161 | Japan,<br>United States,<br>United Kingdom,<br>Germany, France,<br>Netherlands |
| | 適応変換符号化の方法及び装置 | 特許 2569849 | Japan,<br>United States,<br>United Kingdom,<br>Germany, France,<br>Netherlands |
| | 適応変換符号化復号化の方法及び装置 | 特許 2638208 | Japan,<br>United States,<br>United Kingdom,<br>Germany, France,<br>Netherlands |
| | 符号化方式及び復号方式 | 特許 2820096 | Japan, Korea,<br>Australia |
| | 改良 DCT の順変換計算装置および逆変換計算装置 | 特許 3185214 | Japan,<br>United States,<br>United Kingdom,<br>Germany, France,<br>Netherlands,<br>Canada |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| NEC Corporation | 適応変換符号化方式および適応変換復号方式 | 特許 3255022 | Japan, United States, United Kingdom, Germany, France, Netherlands, Italy, Sweden, Canada, Australia, Korea |
| | 変換符号化方法及び装置 | 特許 3444261 | Japan |
| | 適応変換符号化の方法及び装置 | 特許 2890522 | |
| | 適応変換符号化の方法及び装置 | 特許 2890523 | |
| NEC Corporation & Matsushita Electric Industrial Co., LTD. *1 (Joint application) | オーディオ復号装置と復号方法およびプログラム | 特許 3579047 | Japan, United States, United Kingdom, Germany, France, Netherlands, Italy, Sweden, Finland, Canada, Korea, Taiwan, China, Brazil, Hong Kong, India, Hungary, Czech, Spain |
| | オーディオ復号化装置およびオーディオ復号化方法 | 特許 3646938 | Japan, United States, United Kingdom, Germany, France, Netherlands, Italy, Sweden, Finland, Canada, Korea, Taiwan, China, Brazil, Hong Kong, India, Hungary, Czech, Spain |
| | オーディオ復号装置およびオーディオ復号方法 | 特許 3646939 | Japan, United States, United Kingdom, Germany, France, Netherlands, Italy, Sweden, Finland, Canada, Korea, Taiwan, China, Brazil, Hong Kong, India, Hungary, Czech, Spain |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| Matsushita Electric Industrial Co., LTD. | 画像信号のﾌﾚｰﾑ間内挿符号化方法とその装置 | 特許 1,949,701 | Japan, (MPEG Essential Patent) |
| | 動き補償予測方法とそれを用いた画像信号符号化方法 | 特許 2,699,703 | Japan, (MPEG Essential Patent) |
| | 画像信号符号化装置と画像信号復号化装置及び画像信号符号化方法と画像信号復号化方法 | 特許 2,695,244 | Japan, (MPEG Essential Patent) |
| | 画像符号化方法及び画像符号化装置 | 特許 2,684,941 | Japan, (MPEG Essential Patent) |
| Panasonic Corporation | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver3.0.*[14] | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver3.6.*[18] | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver3.7.*[19] | | |
| Sony Corporation | 音声信号圧縮方法及びメモリ書き込み方法 | 特許 1952835 | Japan |
| | オーディオ信号処理方法 | 特許 3200886 | Japan, United States, United Kingdom, Germany, France, Austria, Australia, Korea, Hong Kong |
| | オーディオ信号処理方法 | 特許 3141853 | Japan, United States, United Kingdom, Germany, France, Austria, Australia, Korea, Hong Kong |
| | 信号符号化又は復号化装置、及び信号符号化又は復号化方法、並びに記録媒体 | WO94/28633 | Japan, United States, United Kingdom, Germany, France, Netherlands, Austria, Italy, Spain, Canada, Australia, Korea, China |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| Sony Corporation | 信号符号化方法及び装置、信号復号化方法及び装置、並びに信号記録媒体 | 特開平 7-168593 | Japan, United States, United Kingdom, Germany, France, Korea, Taiwan, China, Malaysia, Indonesia, India, Thailand, Mexico, Turkey |
| | 符号化データ復号化方法及び符号化データ復号化装置 | 特許 2874745 | Japan, Hong Kong, Korea, United States, Germany, France, United Kingdom |
| | 映像信号符号化方法 | 特許 2877225 | Japan, Hong Kong, Korea, United States, Germany, France, United Kingdom |
| | 符号化データ編集方法及び符号化データ編集装置 | 特許 2969782 | Japan, Hong Kong, Korea, United States, Germany, France, United Kingdom |
| | 動画像データエンコード方法および装置、並びに動画像データデコード方法および装置 | 特許 2977104 | Japan, United States |
| | 動きベクトル伝送方法及びその装置並びに動きベクトル復号化方法及びその装置 | 特許 2712645 | Japan, Australia, Canada, Korea, United States, Germany, France, United Kingdom |
| | 画像情報符号化装置及び方法、並びに画像情報復号装置及び方法*8 | 特開 2005-039743 | Japan, Brazil, China, Germany, France, United Kingdom, Indonesia, India, Korea, Mexico, Russia, United States, Viet Nam |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| Sony Corporation | 信号処理装置および方法、並びにプログラム*8 | 特許第 3800427 | Japan, China, Germany, France, United Kingdom, Indonesia, India, Korea, Malaysia, Netherlands, Singapore, Thailand, Taiwan, United States |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.0.*6 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.1.*7 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver2.9.*13 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver3.0.*14 | | |
| Motorola Japan Ltd. | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.5.*1 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.6.*2 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.7.*3 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.8.*4 | | |
| Philips Japan Ltd. | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.5.*1 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.6.*2 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.7.*3 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.8.*4 | | |
| Mitsubishi Electric Corporation | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.1.*7 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver1.9.*5 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver2.2.*8 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver3.0.*21 | | |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| | 画像符号化装置、画像符号化方法、画像復号装置及び画像復号方法*14 | PCT/JP2014/ 003107 | WO |
| Nippon Telegraph and Telephone Corporation | ディジタル信号処理方法､その処理器、そのプログラム、及びそのプログラムを格納した記録媒体*9 | 特許 3871672 | Japan, United States, United Kingdom France, Germany, Italy, China |
| | 浮動小数点形式ディジタル信号可逆符号化方法、及び復号化方法と、その各装置、その各プログラム*9 | 特許 4049791 | Japan, United States, United Kingdom France, Germany, Italy, China |
| | 浮動小数点形式ディジタル信号可逆符号化方法、及び復号化方法と、その各装置、その各プログラム*9 | 特許 4049792 | Japan, United States, United Kingdom France, Germany, Italy, China |
| | 浮動小数点信号可逆符号化方法、復号化方法、及びそれらの装置、プログラム及びその記録媒体*9 | 特許 4049793 | Japan, United States, United Kingdom France, Germany, Italy, China |
| | 多チャネル符号化方法、復号化方法、これらの装置、プログラムおよびその記録媒体*9 | 特許 3886482 | Japan |
| | 多チャネル信号符号化方法、多チャネル信号復号化方法、それらの方法を用いた装置、プログラム、および記録媒体*9 | 特許 4348322 | Japan |
| | 情報符号化方法、復号化方法、共通乗数推定方法、これらの方法を利用した装置、プログラム及び記録媒体*9 | 特許 4324200 | Japan, United States, China |
| | 情報圧縮符号化装置､その復号化装置、これらの方法、及びこれらのプログラムとその記録媒体*9 | 特許 4328358 | Japan, United States, China |
| | 信号の符号化装置、復号化装置、方法、プログラム、記録媒体、及び信号のコーデック方法*9 | 特許 4359312 | Japan, United States, China |
| | 動画像の輝度変化補償方法、動画像符号化装置、動画像復号装置、動画像符号化もしくは復号プログラムを記録した記録媒体および動画像の符号化データを記録した記録媒体*14 | 特許第 2938412 | Japan |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| Nippon Telegraph and Telephone Corporation | 動画像符号化方法、動画像復号方法、画像符号化装置、画像復号装置、動画像符号化プログラム、動画像復号プログラムおよびそれらのプログラムの記録媒体*14 | 特許第 3866628 | Japan |
| Nippon Telegraph and Telephone Corporation & The University of Tokyo (Joint application) *9 | 多チャネル信号符号化方法、その復号化方法、これらの装置、プログラム及びその記録媒体 | 特許 4461144 (特願 2006-531829) | Japan, United States, China |
| | 長期予測符号化方法、長期予測復号化方法、これら装置、そのプログラム及び記録媒体 | 特許 4469374 (特願 2006-552928) | Japan, United States, China |
| Nippon Telegraph and Telephone Corporation & TODAI TLO, Ltd. (Joint application) *9 | 多チャネル信号符号化方法、その復号化方法、これらの装置、プログラム及びその記録媒体 | 特許 4374448 | Japan, United States, China |
| QUALCOMM Incorporated | Adaptive filter*10 | JP 3771275 | US 6,724,944; US 7,242,815; DE;EP;FI;FR;GB; HK;JP;NL |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver2.3.*9 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver2.4.*11 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver2.5.*12 | | |
| | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver3.0.*14 | | |
| | Parameter Selection in Data Compression and Decompression*16 | JP4819361 | US7,593,582; US7,388,993; US6,975,773; CN;EP;HK;IN; KR;MX;TH;TW |
| | Pixel-by-pixel weighting for intra-frame coding*16 | JP5372911 | US8,238,428; US20120300835; CN;IN;KR;TW |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| QUALCOMM Incorporated | Mode uniformity signaling for intra-coding*16 | JP5096561 | US8,488,672; CN; EP; IN; KR; TW |
| | Adaptive coding of video block prediction mode*16 | JP5254324 | US8,428,133; US8,520,732; JP; AT; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HU; IE; IN; IT; KR; NL; NO; PL; PT; RO; RU; SE; TW |
| | Filtering video data using a plurality of filters*16 | JP5650183 | US20100008430; JP; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW |
| | Non-zero rounding and prediction mode selection techniques in video encoding*16 | JP2012-533225 | US20110007802; JP; CN; EP; IN; TW |
| | Video coding using transforms bigger than 4x4 and 8x8*16 | JP5259828 | US8,483,285; AU; CA; CN; EP; ID; IN; KR; PH; RU; SG; TW; UA; VN; ZA |
| | Video coding with large macroblocks *16 | JP5384652 | US8,634,456; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TW; UA; VN; ZA |
| | Video coding with large macroblocks *16 | JP5547199 | US8,619,856; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TW; UA; VN; ZA |
| | Video coding with large macroblocks *16 | JP2012-504908 | US8,503,527; US20130308701; JP; CN; EP; HK; IN; KR; TW |
| | Chrominance high precision motion filtering for motion interpolation*16 | JP5646654 | US20110200108; CN; EP; HK; IN; KR; TW |
| | Block type signalling in video coding *16 | JP5642806 | US20110206123; BR; CN; EP; IN; KR; TW |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| QUALCOMM Incorporated | Mixed tap filters*16 | JP5607236 | US20110249737; JP; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Adapting frequency transforms for intra blocks coding based on size and intra mode or based on edge detection*16 | JP2013-531445 | US20120008683; JP; AT; BE; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HU; IE; IN; IT; KR; NL; NO; PL; PT; RO; SE |
| | Indicating intra-prediction mode selection for video coding*16 | JP2013-539940 | US20120082223; CN; EP; IN; KR |
| | Intra smoothing filter for video coding*16 | JP5587508 | US20120082224; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Entropy coding coefficients using a joint context model*16 | JP2013-543317 | US8,913,666; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Adaptive support for interpolating values of sub-pixels for video coding *16 | JP2014-502800 | US20120147967; JP; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Separately coding the position of a last significant coefficient of a video block in video coding*16 | JP2014-504077 | US20120140813; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Coding the position of a last significant coefficient within a video block based on a scanning order for the block in video coding*16 | JP2013-542151 | US20120140814; US20140341274; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| QUALCOMM Incorporated | Indicating intra-prediction mode selection for video coding using CABAC*16 | JP2014-506067 | US8,913,662; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Signaling quantization parameter changes for coded units in high effiency video coding (HEVC) *16 | JP2014-506752 | US20120189052; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Performing motion vector prediction for video coding*16 | JP2014-509480 | US20120195368; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Multi-metric filtering*16 | JP2014-511613 | US20120213291; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Quantized pulse code modulation in video coding*16 | JP2014-511649 | US20120224640; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Coding of transform coefficients for video coding*16 | JP2014-509158 | US20120230419; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Coding of transform coefficients for video coding*16 | JP2014-511657 | US20120230420; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Video coding techniques for coding dependent pictures after random access*16 | JP2014-513456 | US20120230433; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| QUALCOMM Incorporated | Hierarchy of motion prediction video blocks*16 | JP2014-511618 | US20120219064; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Coding of transform coefficients for video coding*16 | JP2014-511656 | US20120230418; US20140307777; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Bi-predictive merge mode based on uni-predictive neighbors in video coding*16 | JP2014-514814 | US20120243609; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Motion vector prediction in video coding*16 | JP2014-514861 | US20120269270; US20130272408; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Offset type and coefficients signaling method for sample adaptive offset*16 | JP2014-516217 | US20120287988; US20140241417; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Enhanced intra-prediction mode signaling for video coding using neighboring mode*16 | JP2014-517630 | US20120314766; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Memory efficient context modeling *16 | JP2014-522603 | US20120328003; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| QUALCOMM Incorporated | Coding of transform coefficients for video coding*16 | JP2014-511655 | US20120230417; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Unified merge mode and adaptive motion vector prediction mode candidates selection*16 | JP2014-517656 | US20120320969; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Derivation of the position in scan order of the last significant transform coefficient in video coding*16 | JP2014-521249 | US20130003834; BR; CA; CN; EP; IN; KR; RU |
| | Signaling syntax elements for transform coefficients for sub-sets of a leaf-level coding unit*16 | JP2014-521256 | US20130003821; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Video coding using adaptive motion vector resolution*16 | JP2014-523714 | US20130003849; US20140341297; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Unified merge mode and adaptive motion vector prediction mode candidates selection*16 | JP2014-516989 | US20120320968; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Signaling picture size in video coding*16 | JP2014-521281 | US20130016769; US20140341275; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
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| QUALCOMM Incorporated | Buffering prediction data in video coding*16 | JP2014-525198 | US20130022119; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Adaptive center band offset filter for video coding*16 | JP2014-533048 | US20130114674; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Motion vector determination for video coding*16 | JP2014-526840 | US20130070854; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Motion vector predictor candidate clipping removal for video coding*16 | JP2014-531873 | US20130083853; BR; CN; EP; IN; KR; TW |
| | Coding reference pictures for a reference picture set*16 | JP2014-530570 | US20130077687; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Video coding with subsets of a reference picture set*16 | JP2014-530571 | US20130077679; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Reference picture list construction for video coding*16 | JP2014-530567 | US20130077677; AE; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Reference picture list construction for video coding*16 | JP2014-530568 | US20130077678; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

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| QUALCOMM Incorporated | Reference picture list construction for video coding*16 | JP2014-526858 | US20130077685; AE; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Decoded picture buffer management *16 | JP2014-530569 | US20130077680; AR; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Performing transform dependent de-blocking filtering*16 | JP2014-531879 | US20130094572; CN; EP; IN; KR; TW |
| | Parallelization friendly merge candidates for video coding*16 | JP2014-517658 | US20130077691; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Intra PCM (IPCM) and lossless coding mode video deblocking*16 | JP2014-531169 | US20130101025; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Determining boundary strength values for deblocking filtering for video coding*16 | JP2014-534733 | US20130101024; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Loop filtering around slice boundaries or tile boundaries in video coding*16 | JP2014-533008 | US20130101016; CN; EP; IN; KR |
| | Coefficient scanning in video coding *16 | JP2014-525200 | US20130051475; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

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| QUALCOMM Incorporated | Random access with advanced decoded picture buffer (DPB) management in video coding*16 | JP2014-540043 | US20130107953; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Unified design for picture partitioning schemes*16 | JP2014-534737 | US20130107952; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Loop filtering control over tile boundaries*16 | JP2014-534738 | US20130107973; BR; CN; EP; IN; KR |
| | Video coding with network abstraction layer units that include multiple encoded picture partitions *16 | JP2014-540122 | US20130114735; BR; CN; EP; IN; KR; TW |
| | Intra-mode video coding*16 | JP2014-540129 | US20130114707; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Context state and probability initialization for context adaptive entropy coding*16 | JP2014-540089 | US20130114675; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Signaling quantization matrices for video coding*16 | JP2014-541203 | US20130114695; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Generating additional merge candidates*16 | JP2014-541199 | US20130114717; AE; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

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| QUALCOMM Incorporated | Padding of segments in coded slice NAL units*16 | JP2014-540073 | US20130114736; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Progressive coding of position of last significant coefficient*16 | JP2014-541158 | US20130114738; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Context reduction for context adaptive binary arithmetic coding *16 | JP2014-541069 | US20130114671; US20140355681; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Number of contexts reduction for context adaptive binary arithmetic coding*16 | JP2014-541070 | US20130114672; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Number of context reduction for context adaptive binary arithmetic coding*16 | JP2014-541071 | US20130114673; US20140355669; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Border pixel padding for intra prediction in video coding*16 | JP2014-520454 | US20120314767; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Largest coding unit (LCU) or partition-based syntax for adaptive loop filter and sample adaptive offset in video coding*16 | JP2014-543556 | US20130136167; BR; CN; EP; IN; KR; TW |
| | Performing motion vector prediction for video coding*16 | JP2014-549122 | US20130163668; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

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| QUALCOMM Incorporated | Signaling of deblocking filter parameters in video coding*16 | JP2014-553475 | US20130188733; US20140369404; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Determining contexts for coding transform coefficient data in video coding*16 | JP2014-552329 | US20130182772; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Determining contexts for coding transform coefficient data in video coding*16 | JP2014-552336 | US20130182773; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Determining contexts for coding transform coefficient data in video coding*16 | JP2014-552342 | US20130182758; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Coding parameter sets and NAL unit headers for video coding*16 | JP2014-552328 | US20130182755; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Throughput improvement for CABAC coefficient level coding*16 | JP2014-552197 | US20130182757; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Indication of use of wavefront parallel processing in video coding *16 | JP2014-553300 | US20130182774; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

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| QUALCOMM Incorporated | Sub-streams for wavefront parallel processing in video coding*16 | JP2014-553301 | US20130182775; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Context optimization for last significant coefficient position coding*16 | JP2014-541161 | US20130114676; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Restriction of prediction units in B slices to uni-directional inter prediction*16 | JP2014-556674 | US20130202037; AE; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Motion vector coding and bi-prediction in HEVC and its extensions*16 | US20130243093* | JP; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Deriving context for last position coding for video coding*16 | US20130251041* | JP; AE; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Chroma slice-level QP offset and deblocking*16 | US20130259141* | JP; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Coded block flag coding*16 | US20130266074* | JP; AE; AR; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; VN; ZA |
| | Low-delay video buffering in video coding*16 | US20130266075* | JP; AE; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Low-delay video buffering in video coding*16 | US20130266076* | JP; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

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| QUALCOMM Incorporated | Grouping bypass coded syntax elements in video coding*16 | WO2013154939* | US20130272380; JP; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Wavefront parallel processing for video coding*16 | WO2013154687* | US20130272370; JP; AE; AU; BR; CA; CN; EP; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Bypass bins for reference index coding in video coding*16 | WO2013154866* | US20130272377; JP; AE; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Transform coefficient coding*16 | WO2013158642* | US20130272423; JP; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |
| | Coding least signficant bits of picture order count values identifying long-term reference pictures*16 | JP2014-544936 | US20130142256; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Coding picture order count values identifying long-term reference frames*16 | JP2014-544938 | US20130142257; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Video coding with enhanced support for stream adaptation and splicing *16 | WO2013158415* | US20130279564; JP; AE; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Quantization parameter (QP) coding in video coding*16 | WO2013163526* | US20130287103; JP; AE; AR; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

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| QUALCOMM Incorporated | Parameter set updates in video coding*16 | WO2013163563* | US20130294499; JP; BR; CN; EP; IN; KR; TW |
| | Full random access from clean random access pictures in video coding*16 | WO2013163569* | US20130294500; JP; AR; CN; EP; IN; KR; TW |
| | Decoded picture buffer processing for random access point pictures in video sequences*16 | WO2013158461* | US20130279599; JP; CN; EP; IN; KR |
| | Marking reference pictures in video sequences having broken link pictures*16 | WO2013158462* | US20130279575; JP; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Signaling data for long term reference pictures for video coding *16 | WO2013184305* | US20130329787; JP; AE; AU; BR; CA; CN; IL; IN; MX; MY; PH; SG; TH |
| | Grouping of bypass-coded bins for SAO syntax elements*16 | WO2013188558* | US20130336382; AR; CN; TW |
| | High-level syntax extensions for high efficiency video coding*16 | US20130243081* | JP; AE; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; UA; VN; ZA |
| | Signaling long-term reference pictures for video coding*16 | WO2014004391* | US20140003538; AR; AU; CA; CN; EP; IL; IN; MY; SG; TW |
| | Streaming adaption based on clean random access (CRA) pictures*16 | WO2014004150* | US20140003536; AU; CA; EP; IL; IN; MX; MY; SG; TW |
| | Tiles and wavefront parallel processing*16 | WO2014005087* | US20140003531; JP; AR; CN; EP; IN; TW |
| | Random access and signaling of long-term reference pictures in video coding*16 | WO2014004201* | US20140003537; AR; AU; BR; CA; EP; IL; IN; MX; MY; SG; TW |
| | Coefficient groups and coefficient coding for coefficient scans*16 | WO2013158563* | US20130272378; JP; AE; AR; AU; BR; CA; CN; EP; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA |

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| QUALCOMM Incorporated | Video parameter set for HEVC and extensions*16 | WO2014008286* | US20140003491; AU; CA; EP; IN; MY; SG; TW |
| | Video parameter set for HEVC and extensions*16 | WO2014008287* | US20140003492; TW |
| | Video parameter set for HEVC and extensions*16 | WO2014008290* | US20140003493; EP; IN; TW |
| | SEI messages including fixed-length coded video parameter set ID (VPS_ID) *16 | WO2014011363* | US20140010277; IN; TW |
| | Coding random access pictures for video coding*16 | WO2014011567* | US20140016697; IN; TW |
| | Coding SEI NAL units for video coding*16 | WO2014011569* | US20140016707; AU; IN; SG; TW |
| | Coding timing information for video coding*16 | WO2014011570* | US20140016708; AU; IN; MY; SG; TW |
| | Video coding with improved random access point picture behaviors*16 | WO2014046850* | US20140079140; AR; TW |
| | Indication of interlaced video data for video coding*16 | WO2014047202* | US20140079116; AR; TW |
| | Indication of frame-packed stereoscopic 3D video data for video coding*16 | WO2014047204* | US20140078249; TW |
| | Indication and activation of parameter sets for video coding*16 | WO2014046812* | US20140086317; AR; TW |
| | Indication and activation of parameter sets for video coding*16 | WO2014046813* | US20140086337; AR; TW |
| | Hypothetical reference decoder parameters in video coding*16 | WO2014047183* | US20140086336; AR; TW |
| | Bitstream conformance test in video coding*16 | WO2014047178* | US20140086303; AR; TW |
| | Bitstream conformance test in video coding*16 | WO2014047175* | US20140086331; AR; TW |
| | Access unit independent coded picture buffer removal times in video coding*16 | WO2014047577* | US20140086332; AR; TW |
| | Coded picture buffer removal times signaled in picture and sub-picture timing supplemental enhancement information messages*16 | WO2014047580* | US20140086341; AR; TW |
| | Sequence level flag for sub-picture level coded picture buffer parameters*16 | WO2014047582* | US20140086342; AR; TW |
| | Expanded decoding unit definition *16 | WO2014047583* | US20140086340; AR; TW |
| | Buffering period and recovery point supplemental enhancement information messages*16 | WO2014047584* | US20140086343; AR; TW |

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| QUALCOMM Incorporated | Coded picture buffer arrival and nominal removal times in video coding*16 | WO2014047586* | US20140086344; AR; TW |
| | Long-term reference picture signaling in video coding*16 | PCT/US2013/060416* | US20140086324; AR; TW |
| | Error resilient decoding unit association*16 | WO2014051892* | US20140092993; TW |
| | Supplemental enhancement information message coding*16 | WO2014051893* | US20140092994; AR; TW |
| | Signaling of regions of interest and gradual decoding refresh in video coding*16 | WO2014051915* | US20140092963; |
| | Signaling layer identifiers for operation points in video coding*16 | WO2014052013* | US20140092955; AR; TW |
| | Improved signaling of layer identifiers for operation points of a video coder*16 | WO2014055536* | US20140092996; AR; TW |
| | Hypothetical reference decoder parameter syntax structure*16 | WO2014058598* | US20140098895; AR; TW |
| | Identification of operation points applicable to nested SEI message in video coding*16 | PCT/US2013/060925* | US20140098894; |
| | Sub-bitstream applicability to nested SEI messages in video coding*16 | PCT/US2013/060940* | US20140098896; AR; TW |
| | Low-delay buffering model in video coding*16 | WO2014099489* | US20140169448; TW |
| | Progressive refinement with temporal scalability support in video coding*16 | WO2014105485* | US20140185670; TW |
| | Conditional signaling of picture order count timing information for video timing in video coding*16 | WO2014107360* | US20140192901; AR; TW |
| | Signaling of clock tick derivation information for video timing in video coding*16 | WO2014107362* | US20140192902; AR; TW |
| | Signaling of clock tick derivation information for video timing in video coding*16 | WO2014107361* | US20140192903; AR; TW |
| | Video buffering operations for random access in video coding*16 | WO2014107250* | US20140192882; TW |
| QUALCOMM Incorporated | Non-nested SEI messages in video coding*16 | WO2014107396* | US20140192149; TW |
| | Gradual decoding refresh with temporal scalability support in video coding*16 | WO2014107721* | US20140192896; TW |
| | Coding of transform coefficients for video coding*16 | US20130058407 | |

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| | Determining quantization parameters for deblocking filtering for video coding*16 | US20130101031 | TW |
| JVC KENWOOD Holdings, Inc. | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver2.4.*11 | | |
| SHARP CORPORATION | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver3.0.*14 | | |
| Dolby Japan K. K. | Submitted comprehensive confirmation of patents for ARIB STD-B32 Ver3.5.*17 | | |
| Dolby International AB | Motion Vector Coding Method and Motion Vector Decoding Method※20 | US 8,401,080 | US |
| | Moving Picture Coding Method and Moving Picture Decoding Method※20 | US 8,396,116 | US |
| | Picture Coding Method, Picture Decoding Method, Picture Coding Apparatus, Picture Decoding Apparatus, and Program Thereof※20 | US 8,385,409 | US |
| | Image Sequence Compression Featuring Independently Coded Regions※20 | JP 4777583 | DE; EP; FR; JP; US |
| | Compressed Video Signal Including Independently Coded Regions※20 | US 6,507,618 | US |
| | Method of Coding and Decoding Images, Coding and Decoding Device and Computer Programs Corresponding thereto※20 | PCT/FR2012/050 380<br>JP 2013-557151 | BR; CN; EP; HK; IN; JP; KR; RU; US |
| | Method of Coding and Decoding Images, Coding and Decoding Device and Computer Programs Corresponding thereto※20 | PCT/FR2012/051 391<br>JP 2014-516422 | BR; CN; EP; HK; IN; JP; KR; RU; US |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
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| Dolby International AB | Method of Coding and Decoding Images, Coding and Decoding Device and Computer Programs Corresponding thereto※20 | PCT/FR2012/052 552<br>JP 2014-539392 | AL; AT; BE; BG; CH; CY; CZ; DE; DK; EE; EP; ES; FI; FR; GB; GR; HR; HU; IE; IS; IT; LI; LT; LU; LV; MC; MK; MT; NL; NO; PL; PT; RO; RS; SE; SI; SK; SM; TR; US; BR; HK; IN; JP; KR; CN; RU |
| | Method of Coding and Decoding Images, Coding and Decoding Device and Computer Programs Corresponding thereto※20 | PCT/FR2012/052 551<br>JP 2014-539391 | AL; AT; BE; BG; CH; CY; CZ; DE; DK; EE; EP; ES; FI; FR; GB; GR; HR; HU; IE; IS; IT; LI; LT; LU; LV; MC; MK; MT; NL; NO; PL; PT; RO; RS; SE; SI; SK; SM; TR; US; BR; HK; IN; JP; KR; CN; RU |
| | Methods and Systems for Parallel Video Encoding and Decoding※20 | PCT/JP2009/056 778<br>JP 5529937<br>JP 5075988<br>JP 5786061<br>JP 5075988<br>JP 2015-147980<br>JP 2015-147981 | CN; JP; RU; US; EP; JK; BR; IN |
| | Tracking a Reference Picture Based on an Designated Picture on an Electronic Device※20 | PCT/JP2012/077 021<br>JP 2014-516128 | US; CN; EP; JP |

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| Dolby International AB | Moving Picture Decoder※20 | JP 3664626<br>JP 3710464<br>JP 4462914<br>JP 4508627 | JP |
| | Method and System for Selectively Breaking Prediction in Video Coding ※20 | PCT/CA2011/001 412 | CN; EP; US |
| | Method and system for picture segmentation using columns※20 | PCT/CA2011/001 411 | CN; EP; US |
| | Method and System for Dynamic Selection of Transform Size in a Video Decoder Based on Signal Content※20 | US 7,894,530 | CN; US; TW |
| | Method and Apparatus for Controlling Loop Filtering or Post Filtering in Block Based Motion Compensationed Video Coding※20 | JP 3688248<br>JP 3714944<br>JP 4120989<br>JP 4565010<br>JP 4666411<br>JP 4666413<br>JP 4666414<br>JP 4666415<br>JP 4717136<br>JP 4717137<br>JP 4717138<br>JP 4723024<br>JP 4723025<br>JP 4723026<br>JP 4723027 | DE; EP; FR; GB; JP; US |

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| Dolby International AB | Adaptive filtering Based Upon Boundary Strength※20 | PCT/JP02/09306<br>JP 3688283<br>JP 3688288<br>JP 4372019<br>JP 4094019<br>JP 4372197<br>JP 4672065<br>JP 4672074<br>JP 4672077<br>JP 4672078<br>JP 4723022<br>JP 4723023<br>JP 5346908<br>JP 5222343<br>JP 5216070<br>JP 5216071 | AT; BE; CA; CN; DE; EP; ES; FR; GB; HK; IE; IT; JP; KR; NL; PT; SE; TR; US |
| | Encoding Device and Decoding Device※20 | JP 2001-348412<br>PCT/JP2002/011605<br>JP 3926726<br>JP 4308229<br>JP 5048697 | CN; DE; FR; GB; ID; JP; KR; NL; US |
| | Embedded Block Coding with Optimized Truncation※20 | US 6,778,709 | US |
| | Source Coding Enhancement Using Spectral-Band Replication※20 | PCT/IB1998/000893<br>JP 4220461<br>JP 3871347 | AT; BE; BR; CH; CN; DE; DK; ES; FI; FR; GB; HK; IE; IT; JP; LI; NL; PT; RU; SE; US |
| | Efficient Spectral Envelope Coding Using Variable Time/Frequency Resolution and Time/Frequency Switching※20 | PCT/SE2000/001887<br>JP 4035631<br>JP 4334526<br>JP 4628921 | AT; BE; BR; CH; CN; DE; DK; ES; FI; FR; GB; HK; IE; IT; JP; LI; NL; PT; RU; SE |
| | Efficient Spectral Envelope Coding Using Variable Time/Frequency Resolution and Time/Frequency Switching※20 | PCT/SE2000/000158 | US |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| Dolby International AB | Enhancing Perceptual Performance of SBR and Related HFR Coding Methods by Adaptive Noise-Floor Addition and Noise Limiting※20 | PCT/SE2000/000159<br>JP 4377302<br>JP 4511443<br>JP 4519783<br>JP 4519784<br>JP 4852122<br>JP 4852123<br>JP 3603026 | AT; BE; BR; CH; CN; DE; DK; ES; FI; FR; GB; GR; HK; IE; IT; JP; LI; LU; NL; PT; SE; US |
| | Spectral Translation/Folding in the Subband Domain※20 | PCT/SE2001/001171<br>JP 4289815<br>JP 5090390 | BR; CN; DE; FI; FR; GB; HK; JP; NL; RU; SE; US |
| | Enhancing Perceptual Performance of High Frequency Reconstruction Coding Methods by Adaptive Filtering※20 | PCT/SE2001/002510<br>JP 3954495 | AT; BE; CH; CN; DE; DK; ES; FI; FR; GB; HK; IE; IT; JP; KR; LI; NL; PT; SE; US |
| | Enhancing the Performance of Coding Systems that Use High Frequency Reconstruction Methods ※20 | PCT/SE2001/002533<br>JP 3983668<br>JP 4991397<br>JP 2011-269144<br>JP 2014-002174 | AT; BE; CH; CN; DE; DK; ES; FI; FR; GB; HK; IE; IT; JP; KR; LI; NL; PT; SE; TR; US |
| | Aliasing Reduction Using Complex-Exponential Modulated Filterbanks※20 | PCT/SE2002/000626<br>JP 3977744 | CN; DE; ES; FI; FR; GB; HK; IN; IT; JP; KR; NL; SE; TR |
| | Efficient and Scalable Parametric Stereo Coding for Low Bitrate Audio Coding Applications※20 | PCT/SE2002/001372<br>JP 4447317<br>JP 4474347<br>JP 4700467<br>JP 4786987<br>JP 4878384<br>JP 5133397<br>JP 5186444<br>JP 5186543<br>JP 5427270 | AT; BE; CH; CN; CZ; DE; DK; ES; FI; FR; GB; GR; HK; IE; IN; IT; JP; KR; LI; LU; NL; SE; TR; US |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| Dolby International AB | Methods for Improving High Frequency Reconstruction※20 | PCT/EP2002/013462<br>JP 3870193 | AT; BE; CH; CN; DE; DK; ES; FI; FR; GB; HK; IE; IN; IT; JP; KR; LI; NL; PT; SE; US |
| | Method for Reduction of Aliasing Introduced by Spectral Envelope Adjustment in Real-Valued Filterbanks※20 | PCT/EP2003/009485<br>JP 4328720<br>JP 5132627<br>JP 5326020<br>JP 5557467<br>JP 5577187 | AT; AU; BE; CA; CH; CN; DE; DK; ES; FI; FR; GB; HK; IN; IT; JP; KR; LI; MX; NL; NO; SE; SG; TR; UA; US; VN; ZA |
| | Method for Reduction of Aliasing Introduced by Spectral Envelope Adjustment in Real-Valued Filterbanks※20 | US 7,548,864<br>US 7,577,570<br>US 7,590,543<br>US 8,145,475<br>US 8,346,566<br>US 8,498,876<br>US 8,606,587 | US |
| | Advanced Processing Based on a Complex-Exponential-Modulated Filterbank and Adaptive Time Signalling Methods※20 | PCT/EP2004/004607<br>JP 4527716<br>JP 4602375 | AT; CH; CN; DE; DK; ES; FI; FR; GB; HK; IN; IT; JP; KR; LI; NL; PL; SE; TR; US |
| | Audio Data Decoding Device and Audio Data Coding/Decoding System※20 | JP 3765622<br>CN<br>ZL97114604.7 | CN |
| | Method for Reduced Bit-Depth Quantization※20 | PCT/JP02/08146<br>JP3678365<br>JP 3862725<br>JP 4030558<br>JP 4067558<br>JP 4745325<br>JP 4745425<br>JP 4745433<br>JP 4745434<br>JP 4745435<br>JP 4745436 | CA; US; AT; BE; BG; CH; CY; CZ; CN; DE; DK; EE; EP; ES; FI; FR; GB; GR; HK; IE; IT; JP; KR; LI; LU; MC; NL; PT; SE; SK; TR |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| | Methods and Systems for Image Intra-Prediction Mode Estimation, Communication, and Organization ※20 | PCT/JP03/06623<br>JP 3734492<br>JP 3734494<br>JP 4357427<br>JP 4357543<br>JP 4357590 | CN; DE; EP; ES; FR; GB; HK; IT; JP; KR; NL; TW; US |
| | Video Encoder※20 | PCT/JP2004/004374<br>JP 5025289<br>JP 5444047<br>JP 5536811 | AT; BE; CN; DE; EP; ES; FI; FR; GB; HK; IE; IT; JP; NL; PL; PT; SE; US |
| Dolby Laboratories Licensing Corporation | Device and Method of Improving the Perceptual Luminance Nonlinearity-Based Image Data Exchange Across Different Display Capabilities※20 | PCT/US2012/068212<br>JP 2016-032053 | AU; BR; CA; CN; DE; EP; ES; FR; GB; HK; IN; IT; JP; KR; MX; MY; NL; RU; SG; TH; US; VN |
| | Enhanced Temporal and Resolution Layering in Advanced Television※20 | PCT/US2001/11204 | CA; CG; US |
| | High Precision Encoding and Decoding of Video Images※20 | PCT/US2002/06078 | AT; BE; CH; CN; DE; DK; EP; ES; FI; FR; GB; HK; IT; LI; NL; SE; SG; TR; US |
| | Interpolation of Video Compression Frames※20 | PCT/US2002/22063<br>JP 4339680 | AU; CA; CN; JP; MX; SG; US |
| | Method and System for Improving Compressed Image Chroma Information※20 | PCT/US2002/22205<br>JP 5178389<br>JP 5506645<br>JP 5506901<br>JP 5506902<br>JP 5506903<br>JP 5506904<br>JP 5506905 | AU; BN; CA; CN; DE; EP; ES; FI; FR; GB; HK; IN; IT; JP; MX; NL; SE; SG; SK; TR; US |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| Dolby Laboratories Licensing Corporation | Interpolation of Video Compression Frames※20 | PCT/US2003/20397 | AU; CA; CN; EP; HK; IN; KR; MX; MY; SG; TW; US; MO; VE |
| | Quantization Control for Variable Bit Depth※20 | US 8,548,047 | US |
| | Compatible Stereoscopic Video Deliver※20 | PCT/US2009/050809 | CN; EP; US |
| | Methods and Devices for Sub-Sampling and Interleaving Multiple Images, EG Stereoscopic ※20 | PCT/US2010/022445<br>JP 5406942 | CN; EP; HK; JP; KR; US |
| | Directed Interpolation and Data Post-Processing※20 | PCT/US2010/031762<br>JP 5562408 | CN; EP; JP; US |
| | Methods and Systems for Reference Processing in Image and Video Codecs※20 | PCT/US2011/020168<br>JP 5680674 | CN; EP; JP; KR; US |
| | Image Processing Methods and Apparatus Using Localized Gamut Definitions※20 | PCT/US2011/050484 | CN; EP; KR; US |
| | Systems and Methods for Multi-Layered Frame-Compatible Video Delivery※20 | PCT/US2011/044757<br>JP 5749340<br>JP 2016-081931<br>JP 2016-081932 | CN; EP; HK; JP; US |
| | Inter-layer Reference Picture Processing for Coding Standard Scalability※20 | PCT/US2013/061352<br>JP 2015-534595 | AU; BR; ID; KR; MX; MY; PA; RU; SG; TH; UA; VN; CA; CN; EO; HK; IL; IN; JP; TW; US |
| | High Precision Up-sampling in Scalable Coding of High Bitdepth Video※20 | PCT/US2013/073006<br>JP 2015-549434 | TW; BR; HK; IN; KR; MY; RU; CN; EP; JP; US |

| Patent Applicant/ Holder | Name of Patent | Registration No./ Application No. | Remarks |
|---|---|---|---|
| Dolby Laboratories Licensing Corporation | Audio Data Decoding Device and Audio Data Coding/Decoding System※20 | JP 3765622<br>US 6,240,388 | US |
| | Method and Apparatus for Encoding and Decoding Multiple Audio Channels at Low Bit Rates Using Adaptive Selection of Encoding Method※20 | US 5,890,125<br>PCT/US1998/008647<br>JP 4223679 | JP; US |
| | Reconstruction of the Spectrum of an Audio Signal With Incomplete Spectrum Based on Frequency Translation※20 | PCT/US2003/008895<br>JP 4345890 | AU; BG; CA; CN; DE; EE; FR; GB; HK; ID; IE; IN; JP; KR; MY; SG; SI; SK; TR; US |
| | Processing Audio Signals with Adaptive Time or Frequency Resolution※20 | PCT/US2002/005999<br>JP 4763965 | JP; US |

*1 : Valid for the revised parts of ARIB STD-B32 Ver1.5
*2 : Valid for the revised parts of ARIB STD-B32 Ver1.6
*3 : Valid for the revised parts of ARIB STD-B32 Ver1.7
*4 : Valid for the revised parts of ARIB STD-B32 Ver1.8
*5 : Valid for the revised parts of ARIB STD-B32 Ver1.9
*6 : Valid for ARIB STD-B32 Ver1.0
*7 : Valid for the revised parts of ARIB STD-B32 Ver1.1
*8 : Valid for the revised parts of ARIB STD-B32 Ver2.2
*9 : Valid for the revised parts of ARIB STD-B32 Ver2.3 (received on April 16, 2010)
*10 : Valid for the revised parts of ARIB STD-B32 Ver2.3 (received on October 22, 2010)
*11 : Valid for the revised parts of ARIB STD-B32 Ver2.4 (received on October 28, 2010)
*12 : Valid for the revised parts of ARIB STD-B32 Ver2.5 (received on March 18, 2011)
*13 : Valid for the revised parts of ARIB STD-B32 Ver2.9 (received on March 11, 2014)
*14 : Valid for the revised parts of ARIB STD-B32 Ver3.0 (received on July 24, 2014)
*15 : Valid for the revised parts of ARIB STD-B32 Ver3.1 (received on December 9, 2014)
*16 : Valid for the revised parts of ARIB STD-B32 Ver3.0 (received on January 26, 2015)
*17 : Valid for the revised parts of ARIB STD-B32 Ver3.5 (received on November 26, 2015)
*18 : Valid for the revised parts of ARIB STD-B32 Ver3.6 (received on March 18, 2016)
*19 : Valid for the revised parts of ARIB STD-B32 Ver3.7 (received on June 29, 2016)
*20 : Valid for the revised parts of ARIB STD-B32 Ver3.5 (received on June 29, 2016)
*21 : Valid for the revised parts of ARIB STD-B32 Ver3.0 (received on April 26, 2018)

# TOTAL CONTENTS

# Part 3: Signal Multiplexing System

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# Part 3: Signal Multiplexing System

## Contents

# Chapter 1: General Terms

## 1.1 Objective

The purpose of this standard is to define the signal multiplexing system for digital broadcasting.

## 1.2 Scope

This standard applies to “Standard transmission system for digital broadcasting among standard television broadcasting and the like” (Ordinance No.87 of the Ministry of Internal Affairs and Communications, 2011) and “Standard transmission system for satellite general broadcasting (Ordinance No.94 of the Ministry of Internal Affairs and Communications, 2011), excluding multimedia broadcasting beased on selective band transmission system among multimedia broadcastings..

## 1.3 References

### 1.3.1 Normative documents

This standard contains excerpts from the matters provided for in the following documents:

(1) Ordinance No.87 of the Ministry of Internal Affairs and Communications, 2011 (Partial revision: December 10, 2013, July 3, 2014) “Standard transmission system for digital broadcasting among standard TV broadcasting and the like” (hereinafter referred to as “Ordinance”)

(2) Ordinance No.94 of the Ministry of Internal Affairs and Communications, 2011 (Partial revision: December 10, 2013, July 3, 2014) “Standard transmission system for satellite general broadcasting (hereinafter referred to as “Ordinance No.94”).

(3) Notification No.233 of the Ministry of Internal Affairs and Communications, 2014 “Defining configuration and transmission procedure of the conditional access related information , transmission procedure for PES packet, Section, TS packet, IP packet, ULE packet, MMTP packet, compressed IP packet and TLV packet,, configuration of transmission control signal and identifier, and configuration of emergency information identifier and emergency alarm broadcasting message” (hereinafter referred to as “Notification”)

(4) Rec. ITU-T H.222.0 (2012)|ISO/IEC 13818-1:2013: Information technology – Generic coding of moving pictures and assoiated audio information: Systems (Including Amendment 1 to 4)

(5) ISO/IEC 23008-1: 2014: Information technology - High efficiency coding and media delivery in heterogeneous environments - Part 1: MPEG media transport (MMT)

(6) IETF RFC 768: User Datagram Protocol, Aug. 1980

(7) IETF RFC 791: Internet Protocol, Sep. 1981

(8) IETF RFC 2460: Internet Protocol, Version 6 (IPv6) Specification, Dec. 1998

(9) IETF RFC 3095: RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed, Jul. 2001.

(10) IETF RFC 4326: Unidirectional Lightweight Encapsulation (ULE) for Transmission of IP Datagrams over an MPEG-2 Transport Stream (TS), Dec. 2005.

(11) IETF RFC 4815: RObust Header Compression (ROHC): Corrections and Clarifications to RFC 3095, Feb. 2007.

(12) IETF RFC 5905: Network Time Protocol Version 4: Protocol and Algorithms Specification, Jun. 2010.

## 1.4 Terminology

### 1.4.1 Definitions

(1) Digital terrestrial sound broadcasting:
Digital broadcasting among various types of ultra-short wave broadcasting carried out by terrestrial basic broadcast stations defined in Chapter 2, Ordinance.

(2) Digital terrestrial television broadcasting:
Digital broadcasting and high-definition television broadcasting among various types of standard television broadcasting carried out by terrestrial basic broadcast stations defined in Chapter 3, Ordinance.

(3) Multimedia broadcasting:
Television broadcasting and multimedia broadcasting carried out by terrestrial broadcast stations defined in Chapter 4, Ordinance.
- V-Low multimedia broadcasting based on connected segment system:
  Multimedia broadcasting defined in Section 1 of Chapter 4, Ordinance
- V-High multimedia broadcasting based on connected segment system:
  Television broadcasting and multimedia broadcasting defined in Section 2 of Chapter 4, Ordinance
- Multimedia broadcasting based on selective band transmission system:
  Television broadcasting and multimedia broadcasting defined in Section 3 of Chapter 4, Ordinance

(4) BS digital broadcasting:
Digital broadcasting among various types of standard television broadcasting, high-definition television broadcasting, ultra-short wave broadcasting and data broadcasting carried out by the wide band transmission system using satellite basic broadcast stations (including satellite basic broadcasting experimental test stations and development test stations for satellite basic broadcasting) that employ radio waves of frequencies higher than 11.7 GHz and equal to or lower than 12.2 GHz as defined in Section 2 of Chapter 5, Ordinance.

(5) Advanced BS digital broadcasting:
Digital broadcasting among various types of standard television broadcasting, high-definition television broadcasting, ultra high-definition television broadcasting, ultra-short wave broadcasting and data broadcasting carried out by the advanced wide band transmission system using satellite basic broadcast stations (including satellite basic broadcasting experimental test stations and development test stations for satellite basic broadcasting) that employ radio waves of frequencies higher than 11.7 GHz and equal to or lower than 12.2 GHz as defined in Section 3 of Chapter 5, Ordinance.

(6) Narrowband CS digital broadcasting:
Standard television broadcasting, high-definition television broadcasting, ultra-short wave broadcasting and data broadcasting carried out as a satellite general broadcasting by the narrowband transmission system using satellite broadcast stations that employ radio waves of frequencies higher than 12.2 GHz and equal to or lower than 12.75GHz as defined in Paragraph 1 of Article 3, Ordinance No.94.

(7) Wide band CS digital broadcasting:

Standard television broadcasting, high-definition television broadcasting, ultra-short wave broadcasting and data broadcasting carried out by the wide band transmission system using satellite basic broadcast stations that employ radio waves of frequencies higher than 12.2 GHz and equal to or lower than 12.75 GHz as defined in Section 3 of Chapter 6, Ordinance.

(8) Advanced narrowband CS digital broadcasting:
Standard television broadcasting, high-definition television broadcasting, ultra-short wave broadcasting and data broadcasting carried out as satellite general broadcasting by the advanced narrowband transmission system using satellite broadcast stations that employ radio waves of frequencies higher than 12.2 GHz and equal to or lower than 12.75 GHz as defined in Paragraph 1 of Article 3, Ordinance No.94.

(9) Advanced wide band CS digital broadcasting:
Standard television broadcasting, high-definition television broadcasting, ultra-short wave broadcasting and data broadcasting carried out by the advanced wide band transmission system using satellite basic broadcast stations that employ radio waves of frequencies higher than 12.2 GHz and equal to or lower than 12.75 GHz as defined in Section 5 of Chapter 6, Ordinance.

### 1.4.2 Abbreviations

| | |
|---|---|
| ACI: | Account Control Information |
| AL-FEC: | Application-Layer Forward Error correction |
| AMT: | Address Map Table |
| BCD: | Binary Coded Decimal |
| CA: | Conditional Access |
| CAT: | Conditional Access Table |
| CRC: | Cyclic Redundancy Check |
| DSM-CC: | Digital Storage Media Command and Control |
| ECM: | Entitlement Control Message |
| EMM: | Entitlement Management Message |
| ES: | Elementary Stream |
| FEC: | Forward Error Correction |
| HCfB: | Header Compression for Broadcasting |
| HEVC: | High Efficiency Video Coding |
| IEC: | International Electrotechnical Commission |
| IETF: | Internet Engineering Task Force |
| INT: | IP/MAC Notification Table |
| ISO: | International Organization for Standardization |
| ITU-T: | International Telecommunication Union, Telecommunication Standardization Sector |
| IP: | Internet Protocol |

| | |
|---|---|
| IPMP: | Intellectual Property Management and Protection |
| MAC: | Media Access Control |
| MFU: | Media Fragment Unit |
| MHEG: | Multimedia Hypermedia Expert Group |
| MMT: | MPEG Media Transport |
| MMTP: | MMT Protocol |
| MPU: | Media Processing Unit |
| MP: | MMT Package |
| NIT: | Network Information Table |
| NTP: | Network Time Protocol |
| PA: | Package Access |
| PAT: | Program Association Table |
| PCR: | Program Clock Reference |
| PES: | Packetized Elementary Stream |
| PID: | Packet Identifier |
| PMT: | Program Map Table |
| RAP: | Random Access Point |
| RFC: | Request For Comment (IETF standard) |
| ROHC: | RObust Header Compression |
| SL: | Sync Layer |
| TLV: | Type Length Value |
| TREF: | Timestamp Reference |
| TS: | Transport Stream |
| UDP: | User Datagram Protocol |
| ULE: | Unidirectional Lightweight Encapsulation |

# Chapter 2: Multiplexing System

## 2.1 Transmission by TS packet

### 2.1.1 Coded signals

Transmission of coded video and audio signals, data signals, metadata signals, the related information (necessary information for domestic subscribers to receive pay boradcasting services or for broadcasters to collect charges for the services, necessary information for broadcasters to make their broadcast programs to be received only by receivers that protect their rights of the programs, and other information notified separately by the Minister for Internal Affairs and Communications), and information indicating the right of broadcast programs (hereinafter referred to as "coded signals") shall comply with the following rules:

1. Coded signals shall be multiplexed by packets.
2. Coded signals shall be grouped to an arbitrary length. Their structures shall comply with PES packet and Section shown in Table No. 1.
3. PES packet and Section shall be transmitted by TS packet shown in Table No. 2.

Table No. 1: Structure of PES packet and Section

PES packet

| Header | Extension header | Payload |
|---|---|---|
| 48 bits | | |

Notes: 1. The header is used to identify the type of PES packet.
2. The extension header is used to transmit additional infromation of header.
3. The payload is used to transmit data.

Section

(1) General format

| Header | Payload |
|---|---|
| 24 bits | 8 × N bits |

(2) Extended format

| Header | Payload | CRC |
|---|---|---|
| 64 bits | 8 × N bits | 32 bits |

Notes: 1. N represents a positive integer.
2. The header is used to identify the type of Section.
3. The payload is used to transmit data.
4. The CRC is a code for detecting error.

Table No. 2: Structure of TS packet

| Header | Adaptation field and payload |
|---|---|
| 4 bytes | 184 bytes |

Notes: 1. One byte represents eight bits.
2. The header is used to identify the type of TS packet.
3. The adaptation field is used to transmit additional information of the header.
4. The payload is used to transmit PES packet and Section information.

(Paragraph 1 of Article 3, Ordinance)

### 2.1.2 Transmission control signal

(1) Structure of transmission control signal

Tranmission control for the coded signals transmitted by TS packets shall be performed by the following transmission control signals:

1. PAT specifying the PIDs (packet identifier) of the TS packets that carry the PMTs for the broadcast programs.
2. PMTs specifying the PIDs of the TS packets that carry coded signals comprising broadcast programs (excluding conditional access rerated information) and conditional access common information defined separately by the Minister for Internal Affairs and Communications.
3. CAT specifying the PID of the TS packets that carry conditional access individual information defined separately by the Minister for Internal Affairs and Communications, among the related information.
4. NIT that carries information correlating modulation frequencies with other information on transmission channel with broadcast programs.
5. Program arrangement information that indicates the arrangement sequence of broadcast programs on transmission channel.

(Paragraph 2 of Article 3, Ordinance)

(2) Transmission of transmission control signals

The structures of transmission control signals defined above shall comply with the applicable specified section format.

The transmission procedures for PES packet, section format and TS packet, and the structures of transmission control signals and identifiers shown in Table No. 3 shall comply with the notifications separately given by the Minister for Internal Affairs and Communications.

Table No. 3: Identifiers and their functions

| Identifier | Function |
|---|---|
| Table id | Identifies section type |
| Descriptor tag | Identifies descriptor type |
| Stream type id | Identifies coded signal type |
| Service type id | Identifies service type |
| Broadcast program number id | Identifies broadcast program number |
| Service id | Identifies broadcast program number |
| Network id | Identifies network |
| Transport stream id | Identifies transport stream |
| Conditional access system for reception id | Identifies conditional access system for reception |
| System management id | Identifies broadcasting or non-broadcasting and broadcasting signal standard |
| Hierachical coding id | Identifies hierachical coding |
| Scrambling method id | Identifies scrambling method |

(Paragraph 3 and Paragraph 4 of Article 3, Ordinance)

(For more information on the transmission procedures for PES packet, section format and TS packet, and the structures of transmission control signals and identifiers shown in Table No. 3, refer to Chapter 3.)

### 2. 1.3 Emergency alarm signal

The emergency alarm signal shall be transmitted by the emergency information descriptor, and the structure of this descriptor shall comply with the notification separately given by the Minister for Internal Affairs and Communications.

(Article 17, Ordinance)

(For more information on the structure of the emergency information descriptor, refer to Figure No. 11 inSection 3.11.1.)

## 2.2 IP packet transmission by TS packet

### 2.2.1 Coded signals

Transmission of coded signals shall comply with the following rules:

1. Coded signals shall be multiplexed by packets.
2. Coded signals shall be grouped to an arbitrary length. Their structures shall comply with IP packet and compressed IP packet (hereinafter referred to as “IP packet or the like”) shown in Table No. 22.
3. IP packet or the like shall be transmitted by ULE packet shown in Table No. 23.
4. ULE packet shall be transmitted by TS packet.

Table No. 22: Structure of IP packet

1. IPv4 packet

| IPv4 header | UDP header | Payload |
|---|---|---|
| | 64 bits | 8xN bits |

Notes: 1. IPv4 header and UDP header are used to identify the type of IPv4 packet.
2. The payload is used to transmit data.
3. N represents a positive integer.

2. IPv6 packet

| IPv6 header | UDP header | Payload |
|---|---|---|
| | 64 bits | 8xN bits |

Notes: 1. IPv6 header and UDP header are used to identify the type of IPv6 packet.
2. The payload is used to transmit data.
3. N represents a positive integer.

Table No. 23: Structure of ULE packet

| Header | Payload | CRC |
|---|---|---|
| | | 32 bits |

Notes: 1. The header is used to identify the type of ULE packet.
2. The payload is used to transmit data.
3. The CRC is a code for detecting error.

(Paragraph 1 of Article 24-3, Paragrapgh 1 of Article 27, Ordinance)

### 2.2.2 Transmission control signal

(1) Structure of transmission control signal

Transmission control for the coded signals transmitted by TS packets shall be performed by the transmission control signal defined in Section 2.1.2, and AMT (Transmission control signal correlating service id to identify broadcast program number with IP packet or the like) or INT (Transmission control signal correlating service id to identify broadcast program number with IP packet or the like).

(Paragraph 2 of Article 24-3, Paragrapgh 2 of Article 27, Ordinance)

(2) Transmission of transmission control signals

The structures of AMT and INT prescribed above shall comply with the applicable specified section format.

The transmission procedures for IP packet and ULE packet, and the structures of AMT and INT shall comply with the notifications separately given by the Minister for Internal Affairs and Communications.

(Paragraph 3 and 4 of Article 24-3, Paragrapgh 3 and 4 of Article 27, Ordinance)

(AMT and INT are defined in Article 24-3, Ordinance (V-Low multimedia broadcasting based on connected segment tranmission) and Article 27, Ordinance (V-High multimedia broadcasting based on connected segment tranmission), respectively.

### 2.2.3 Emergency alarm signal

The provision prescribed in Section 2.1.3 is applied.

(Paragraph 7 of Article 24, Article 32, Ordinance)

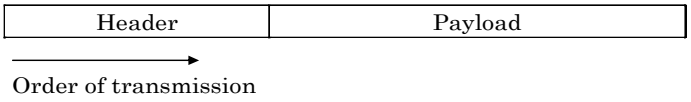
## 2.3 Transmission by TLV packet

### 2.3.1 Coded signals

Transmission of coded signals shall comply with the following rules:

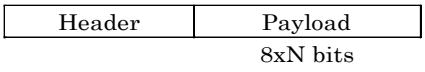
1. Coded signals shall be multiplexed by packets.
2. Coded signals shall be grouped to an arbitrary length. Their structures shall comply with MMTP packet shown in Table No. 59-2.
3. MMTP packet shall be transmitted by IP packet or compressed IP packet shown in Table No. 60.
4. IP packet or compressed IP packet shall be transmitted by TLV packet shown in Table No.61.

Table No. 59-2: Structure of MMTP packet




Notes: 1. The header is used to identify the type of MMTP packet.
2. The payload is used to transmit data.

Table No. 60: Structure of compressed IP packet




Notes: 1. The header is used to identify the type of the compressed IP packet.
2. The payload is used to transmit data.
3. N represents a positive integer.

Table No. 61: Structure of TLV packet

| Header | Payload |
|---|---|
| 32 bits | 8xN bits |

Notes: 1. The header is used to identify the type of TLV packet.
2. The payload is used to transmit data.

(Paragraph 1 of Article 58, Ordinance)

### 2.3.2 Transmission control signal

(1) Structure of transmission control signal of TLV packet

Transmission control for the coded signals tranmitted by TLV packets shall be perfromed by the following transmission control signals:

1. TLV-NIT that carries information correlating modulation frequencies and other information on transmission channel with broadcast programs.
2. AMT that correlates service identifier for identifing broadcast numbers and IP packet or compressed IP packet.

(Paragraph 2 of Article 58, Ordinance)

The structures of transmission control signal shall comply with the applicable specified section format.

(Paragraph 3 of Article 58, Ordinance)

(2) Structure of transmission control signal of MMTP packet

Transmission control for the coded signals tranmitted by MMTP packets shall be perfromed by the following transmission control signals:

1. PA message that carries broadcast programs table.
2. M2 section message that carries section format.
3. CA message that carries information on identifiers for scrambling method type.

(Paragraph 4 of Article 58, Ordinance)

(3) Transmission of tranmission control signal

The transmission procedures for MMTP packet, compressed IP packet and TLV packet, and the structures of transmission control signals and identifiers shown in Table No. 61-2 shall comply with the notification separately given by the Minister for Internal Affairs and Communications.

Table No. 61-2: Identifiers

| Identifier | Function |
|---|---|
| Description tag | Identifies description type |
| Conditional access system for reception id | Identifies conditional access system for reception id |
| Scrambling method type id | Identifies scrambling method type |
| Service id | Identifies broadcast program number |

(Paragraph 3 and 5 of Article 58, Ordinance)

(For more information on the transmission procedures for MMTP packet, compressed IP packet and TLV packet, the structures of transmission control signals and identifiers shown in Table No. 61-2, refer to Chapter 3.)

### 2.3.3 Emergency alarm signal

The emergency alarm signal shall be transmitted by the emergency information descriptors, and the structure of this descriptor shall comply with the notification separately given by the Minister for Internal Affairs and Communications.

(Article 17 and Article 66, Ordinance)

(For more information on the structure of emergency information descriptor, refer to Figure No.5 in Section 3.11.2.)

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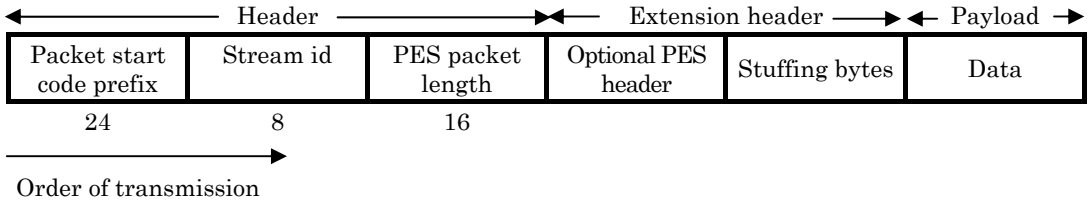
# Chapter 3: Multiplexed Signal Format

## 3.1 PES packet




Notes:

1. The value of a packet start code prefix shall be set to 0x000001 representing the start of PES packet.
2. The stream id shall be a field used for identifying the type and number of elementary stream (coded signals; the same shall apply hereinafter) and the assignments are given in the table below.
3. The PES packet length shall be a field that writes the number of bytes in the PES packet following this field..
   Note that the value is '0' when the payload of PES packet is video elementary stream, and the packet length is not specified and the boundary is not fixed.
4. The optional PES header shall comply with ITU-T Rec. H.222.0.
5. The value of the stuffing bytes shall be set to 0xFF and shall not exceed 32 bytes in length.

Table: Stream id

| Value | Assignment |
|---|---|
| 0xBC | Program stream map |
| 0xBD | Private stream 1 |
| 0xBE | Padding stream |
| 0xBF | Private stream 2 |
| '110xxxxx' | Audio stream number 'xxxxx' in ISO/IEC 13818-3, ISO/IEC 11172-3, ISO/IEC 13818-7 or ISO/IEC 14496-3 |
| '1110xxxx' | Video stream number 'xxxx' in ITU-T Rec. H.262, ISO/IEC 11172-2, ISO/IEC 14496-2, or ITU-T Rec. H.264 or ITU-T Rec. H265 |
| 0xF0 | ECM stream |
| 0xF1 | EMM stream |
| 0xF2 | DSMCC stream defined in ITU-T Rec. H.222.0 Annex A or ISO/IEC 13818-6 |
| 0xF3 | Stream defined in ISO/IEC 13522 |
| 0xF4 | ITU-T Rec. H.222.1 type A |
| 0xF5 | ITU-T Rec. H.222.1 type B |
| 0xF6 | ITU-T Rec. H.222.1 type C |
| 0xF7 | ITU-T Rec. H.222.1 type D |
| 0xF8 | ITU-T Rec. H.222.1 type E |
| 0xF9 | Auxiliary stream |
| 0xFA | SL-packetized stream defined in ISO/IEC 14496-1 |
| 0xFB | FlexMux stream defined in ISO/IEC 14496-1 |
| 0xFC | Meta data stream |
| 0xFD | Extended stream ID |

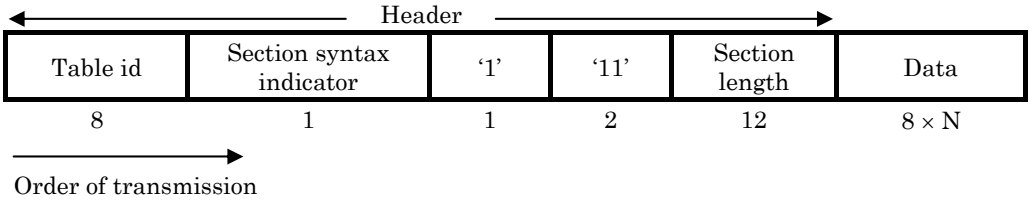
| | |
|---|---|
| 0xFE | Undefined |
| 0xFF | Program stream directory |

Numbers enclosed in ‘ ’ represents binary numbers.The same shall apply hereinafter.

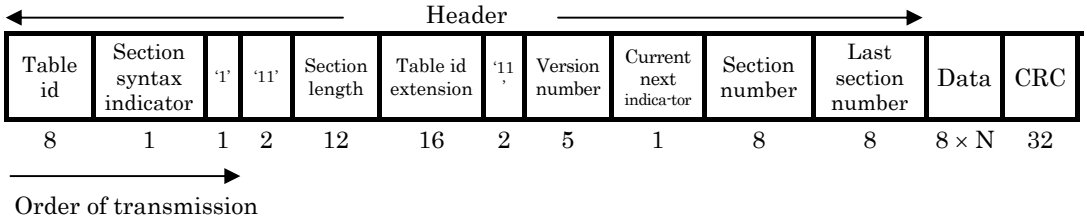
(Table No.4, Notification)

## 3.2 Section

1. Genaral format




2. Extended format

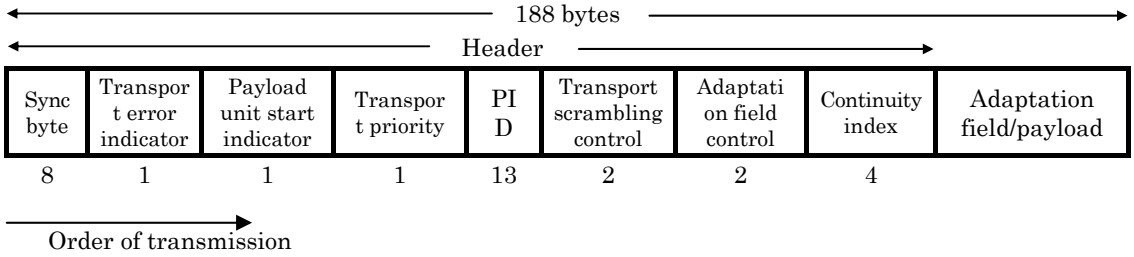



Notes:

1. The table id shall be a field used for identifying the table to which the section belongs.
2. The section syntax indicator shall be a field determining whether normal or extension format is used and shall be ‘0’ for normal format and ‘1’ for extension format.’
3. The section length shall be a field that writes the number of data bytes following this field and shall not exceed 4093.
4. The table id extension shall be a field extending the table identifier.
5. The version number shall be a field that writes the table version number.
6. The current next indicator shall contain ‘1’ and ‘0,’ respectively, when the table is currently used and when the table cannot be used at present but will be valid next.
7. The section number shall be a field that writes the number of the section comprising the table.
8. The last section number shall be a field that writes the number of the last section comprising the table.
9. The CRC shall comply with ITU-T Rec. H.222.0.

(Table No.5, Notification)

## 3.3 TS packet




Notes:

1. The sync byte shall be 0x47.
2. The transport error indicator shall be a flag that indicates whether there is any bit error or not in the TS packet. If this flag contains '1,' it indicates that the TS packet has an uncorrectable error of at least one bit.
3. The payload unit start indicator shall indicate that the payload of this TS packet starts at the PES packet start or pointer when it contains '1.'
4. The transport priority shall be a flag that indicates priority among packets with the same PID. The packet is given priority if this flag contains '1.'
5. The PID shall be a field used for identifying the payload data type and the assignment shall be as shown in Table No. 1.
6. The transport scrambling control shall be a field identifying the payload scrambling mode for TS packet. The value of this field shall be as shown in Table No. 2.
7. The adaptation field control shall be a field used for indicating the configuration of the adaptation field/payload, the value of which shall be as shown in Table No. 3.
8. The continuity index shall be a field specifying the sequence of TS packets with the same PID. The value of this field shall start with '0000' and be incremented by 1. The value shall change back to '0000' after '1111.'
   However, note that it shall be ensured that the same TS packet is transmitted only up to twice in a row and that in this case the value of this field shall not be incremented.
9. The adaptation field shall comply with ITU-T Rec. H.222.0.

Table No. 1: PID assignments

| Value | Description |
|---|---|
| 0x0000 | PAT |
| 0x0001 | CAT |
| 0x0002 – 0x000F | Reserved |
| 0x0010 | NIT |
| 0x0011 – 0x1FFE | May be assigned to other than PAT, CAT, NIT and Null packet |
| 0x1FFF | Null packet |

Table No. 2: Scrambling control value

| Value | Description |
|---|---|
| '00' | Not scrambling |
| '01' | Reserved |
| '10' | Scrambled by Even key |
| '11' | Scrambled by Odd key |

Table No. 3: Adaptation field control value

| Value | Description |
|---|---|
| '00' | Reserved |
| '01' | No adaptation field, payload only |
| '10' | Adaptation field only, no payload |
| '11' | Adaptation field followd by payload |

(Table No.6, Notification)

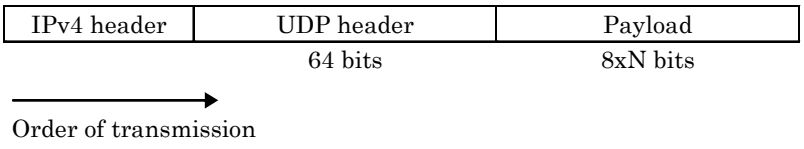
The usage criteria for PIDs shown in Table No. 1 shall be as follows (specified in ARIB STD-B10):

| Type | Value range | Notes |
|---|---|---|
| Specified by the the Ministry of Internal Affairs and Communications | 0x0000 – 0x0010, 0x1FFFF | Specified in the Notification |
| Specified by the standardization organization | 0x0011 – 0x002F(Note) | Used after deliberations |
| Specified by companies | ranges that do not interfere with the above | Registration and release |
| Used by companies | ranges that do not interfere with the above | Indirect designation by PMT |

(Note) 0x0015 and 0x0016 are specified and used by companies before formulation of ARIB STD-B10.

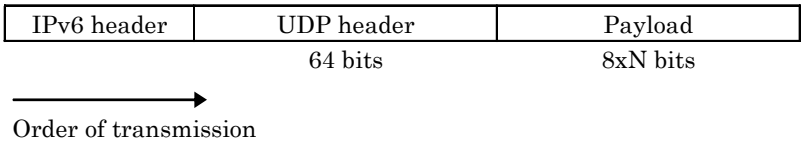
## 3.4 IP packet

1. IPv4 packet



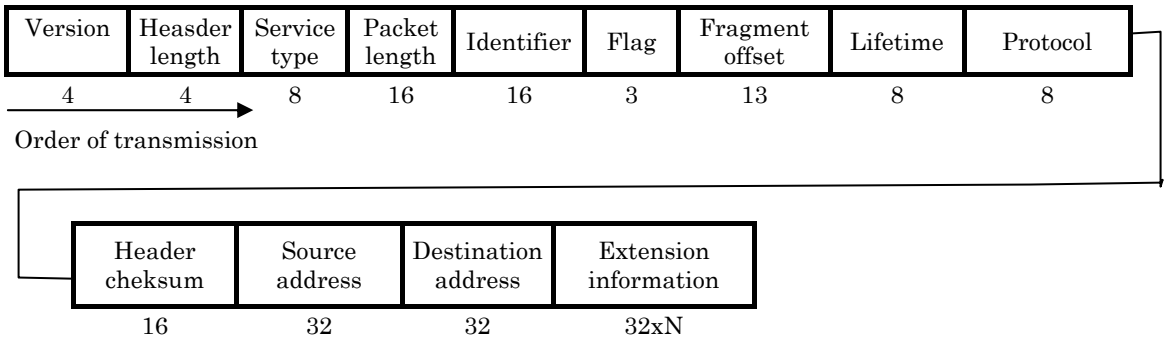

Notes: 1. The structure of IPv4 header is shown in the following No.1.
2. The structure of UDP headee is shown in the following No.2.

2. IPv6 packet



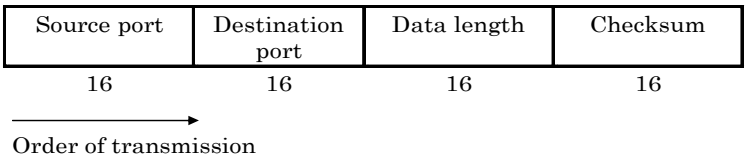

Notes: 1. The structure of IPv6 header is shown in the following No.3.
2. The structure of UDP headee is shown in the following No.2.

No1: Structure of IPv4 header



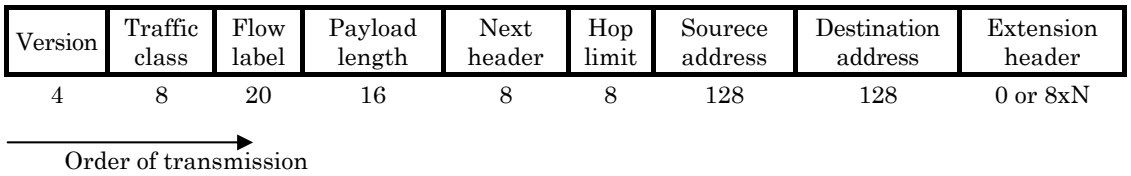

Note 1: Each item shall comply with IETF RFC 791.

No2: Structure of UDP header




Note 1: Each item shall comply with IETF RFC 768.

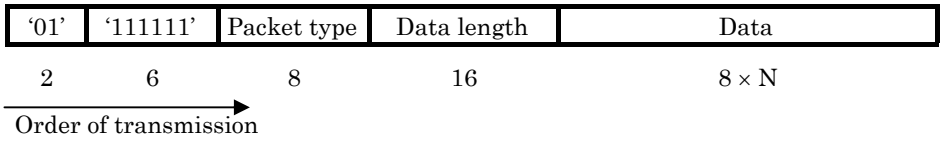
No3: Structure of IPv6 header




Note1: Each item shall comply with IETF RFC 2460.

(Table No.7, Notification)

## 3.5 TLV packet




Note 1: The packet type is a field used for identifying the type of packets stored in TLV and its assignment shall be shown as the table below.

2: The data length shall be a field that writes the number of data bytes following this field.

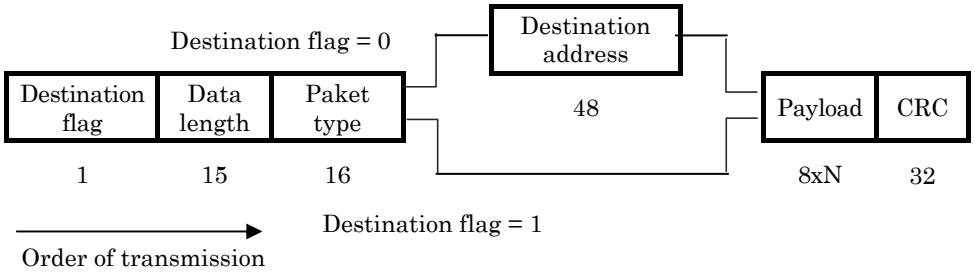
Packet type assignment

| Value of packet type | Assignment |
|---|---|
| 0x00 | Undefined |
| 0x01 | IPv4 packet |
| 0x02 | IPv6 packet |
| 0x03 | Header compressed IP packet |
| 0x04 - 0xFD | Undefined |
| 0xFE | Transmission control signal packet |
| 0xFF | Null packet |

Note: Null packet shall be the packet that writes the byte sequence of 0xFF having the length indicated in the data length on the data.

(Table No.11, Notification)

## 3.6 ULE packet




Notes:

1. The destination flag is a field used for identifying whether there is a destination address or not and its value shall be shown below.
2. The data length shall be a field that writes the number of data bytes following the packet type.
3. The packet type shall be a field used for identifying the type of packets stored in

the payload.

4. The destination address shall be a field that writes the ULE packet destination address.
5. The CRC shall comply with IETF RFC 4326.

Destination flag value

| Value | Description |
|---|---|
| 0 | Destination address field is present |
| 1 | Destination address field is absent |

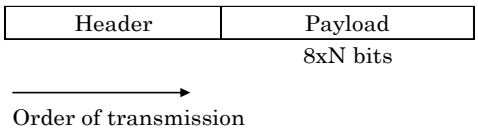
(Table No.8, Notification)

The packet type shall comply with the following assignment.

| Value | Description | Remarks |
|---|---|---|
| 0x0001 | Bridged frame | RFC 4326 |
| 0x0800 | IPv4 packet | Ether Type, RFC 4326 |
| 0x22F1 | Compressed IP packet by ROHC | Ether Type |
| 0x22F2 | Compressed IP packet by HCfB | Ether Type |
| 0x86DD | IPv6 packet | Ether Type, RFC 4326 |

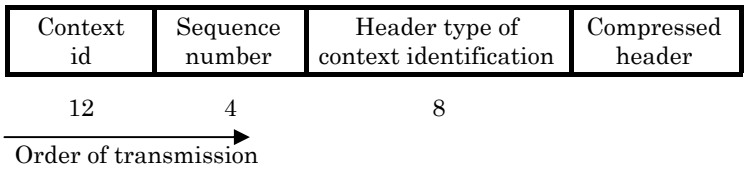
## 3.7 Compressed IP packet

(1) HCfB




Notes: 1. The structure of the header is shown in the following No.1.

No.1 Structure of the compressed IP packet header




Notes:

1. The context identifier shall represent a header compressed IP packet flow (an aggregate IP packet having the same combination of the value for five fields: IPv4 packet protocol or IPv6 packet next header, source address, destination address, source port and destination port).
2. The sequence number shall represent a sequence of the header compressed IP packet having the same context identifier.

3. The header type of context identification shall be a field used for identifying compressed header type and its assignment shall be shown in the following No. 2.
4. The compressed header shall be a field that writes IPv4 header or IPv6 header and UDP header as compressed information by the designated method specified in the context identification header type.

No.2 Assignment for the header type of context identification

| Header type value of context identification | Assignment |
|---|---|
| 0x20 | Partial IPv4 header and partial UDP header |
| 0x21 | IPv4 header identifier |
| 0x60 | Partial IPv6 header and partial UDP header |
| 0x61 | No compressed header |
| Other than the above | Undefined |

Notes:

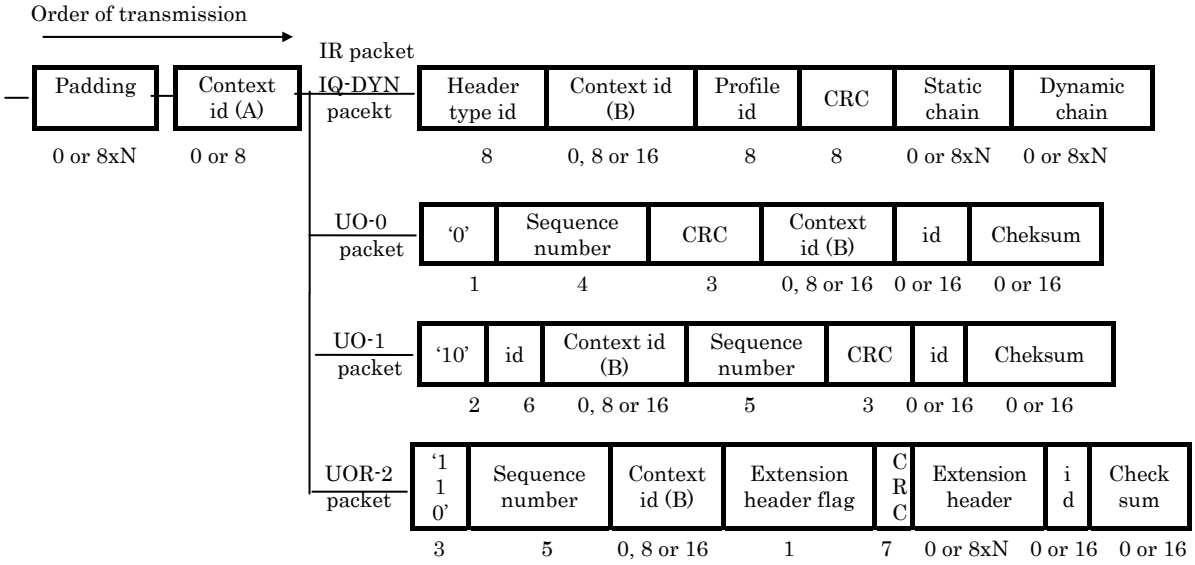
1. The partial IPv4 header shall be the header excluding packet length, header checksum and extension information from the IPv4 header.
2. The partial IPv6 header shall be the header excluding payload length from IPv6 header.
3. The partial UDP header shall be the header excluding data length and checksum from UDP header.

(Table No. 10, Notification)

(2) ROHC


Note 1: The structure of the header shall be shown below.

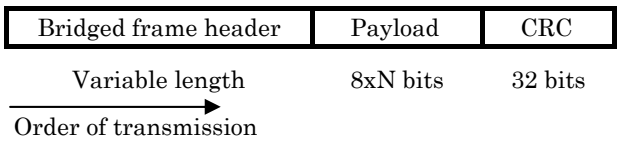
Structure of the ROHC header




Notes:

1. The context id (A) and context id (B) shall repesent the header compressed IP packet flow (an aggregate IP packet having the same combination of the value for five fields: IPv4 packet protocol or IPv6 packet next header, source address, destination address, source port and destination port). The context id (A) is used only when the number of IP packet flow is 15 and less. The context id (B) is used only when the number of IP packet flow is 16 and more.
2. The IR packet is used to initialize a context and its header type id shall be set to '11111101'.
3. The IR-DYN packet is used to update a part of the header information on the equal to or upper than IP layer and its header type id shall be set to '1111 1000'.
4. When the header information of UO-0packet, UO-1packet or UOR-2packet is not updated on the the equal to or upper tha IP layer, any of the packets transmit data.
5. The static chain is used only for IR packet. The dynamic chain is used for IR packet or IR-DYN packet.
6. The profile id shall be set to 0x0002 (UDP profile).
7. The padding, sequence number, CRC, identifier, checksum, static chain, dynamic chain,extension header flag and extension header shall comply with RFC 3095.

## 3.8 Bridged frame

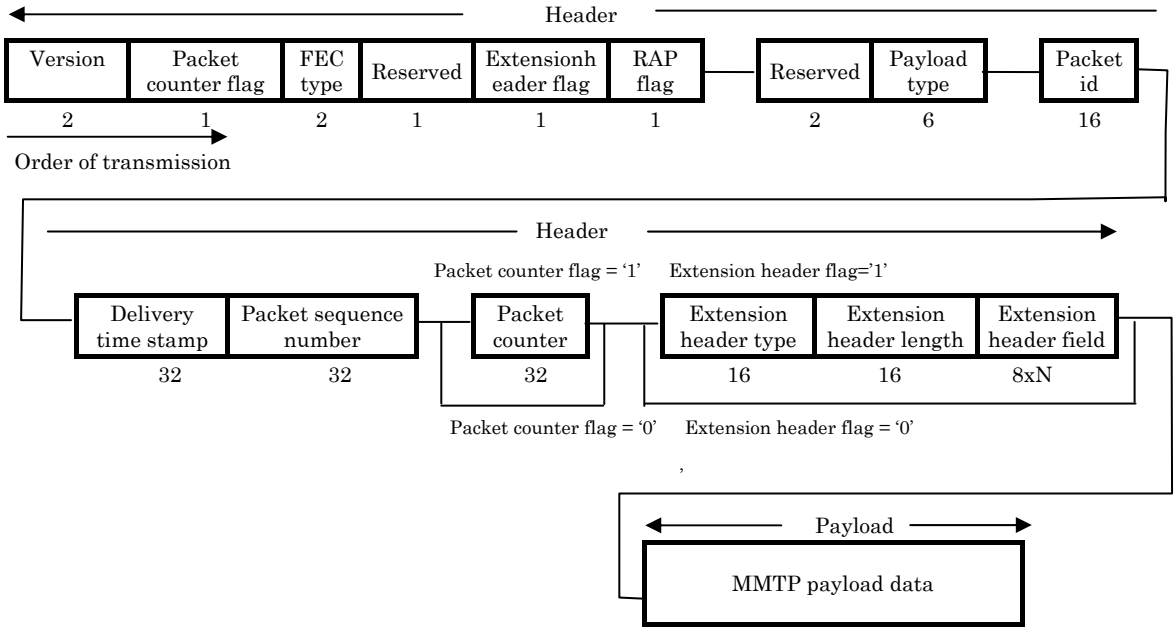



Notes:

1. The bridged frame header is used to identify the type of bridged frame. The structure of the bridged frame header shall comply with IETF RFC 4326. The details shall be set by the opration rules specified by operators.

2. The payload is used to transmit data.
3. N represents a positive integer.
4. The CRC is a code for detecting error.

## 3.9 MMTP packet




Notes:

1. The version shall be '00'.
2. The packet counter flag shall be '0' when the packet counter does not exist, and '1' when the counter exsits.
3. The FEC type shall represent information on AL-FEC (Decoding extracted information by using pre-generated information. The same shall apply hereinafter.) of this packet. The FEC type assignment shall be shown in the following table.

| Value | Assignment |
|---|---|
| 0 | Non-protected MMTP packet by AL-FEC |
| 1 | Source packet among MMTP packets protected by AL-FEC |
| 2 | Repair packet among MMTP packets protected by AL-FEC |
| 3 | Reserved |

4. The value of the extension header flag shall be '0' when the MMTP packet header is not extended and '1' when the header is extended.
5. The value of the RAP flag shall be '1' when the MMTP payload transmitted by MMTP packet contains the head of random access point and '0' otherwise.
6. The payload type represents a data type of MMTP payload and its assignment shall be shown in the following table.

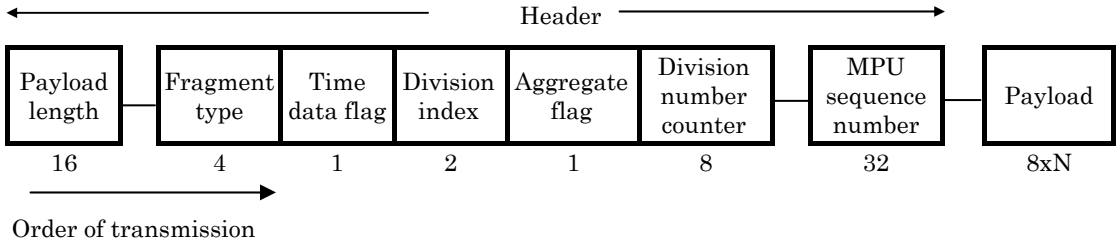
| Value | Assignment |
|---|---|
| 0x00 | MPU |
| 0x01 | Undefined |
| 0x02 | Contains one or more control messages |
| 0x03 - 0x3F | Undefined |

7. The packet id shall be a field used for identifying payload data type. The assignment shall be shown in the following table.

| Value | Assignment |
|---|---|
| 0x0000 | PA message |
| 0x0001 | CA message |
| 0x0002 - 0xFFFF | Undefined |

8. The delivery time stamp shall represent the time when the head byte of this MMTP packet is outputted from the broadcasting station by the short NTP time stamp described in IETF RFC 5905.
9. The packet sequence number shall be the sequence of MMTP packets having the same packet identifier.
10. The packet counter shall be the sequence of MMTP packets in the same IP data flow, regardless of the packet id value.
11. The extension header type shall be an extension type in the extension header field.
12. The extension header length shall be a field that writes the number of data byte in the extension field.
13. The extension header field shall be data byte for extending header.
14. The MMT payload data shall be shown in the following Figure No.1 or Figure No.2, respectively, when the payload type is 0x00 or 0x02.

Figure No. 1




Notes:

1. The payload length shall be a field that writes the number of data bytes following this field.
2. The fragment type represents a fragment type of information stored in the MMTP payload and its assignment shall be shown in the following table.

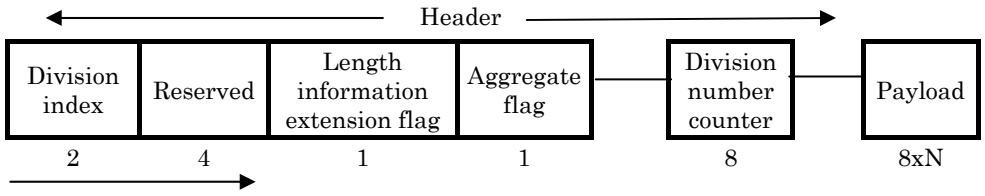
| Value | Assignment |
|---|---|
| 0 | MPU metadata |
| 1 | Movie fragment metadata |
| 2 | MFU (Part of coded video and audio signals, and etc. The same shall apply hereinafter.) |
| 3 - 15 | Reserved |

3. The time data flag shall be '0' when the data stored in the MMTP payload does not specify the presentation time and '1' when the data specify the time.
4. The division index represents a divided state of the data stored in the MMTP payload and its assignment shall be shown in the following table.

| Value | Assignment |
|---|---|
| '00' | Undivided |
| '01' | Divided, Including the head part of the data before division |
| '10' | Divided, Not including the head part and end part of the data before division |
| '11' | Divided, Including the end part of the data before division |

5. The aggregate flag shall be '0' when one data is stored in the MMTP payload and '1' when two or more data are stored in the payload.
6. The division number counter shall indicate a number of divided data after the data part stored in this MMTP payload, when the data are divided. The counter is restarted from '0' when this value exceeds 255. Note that the value is set to '0' when the aggregate flag is '1'.
7. The MPU sequence number shall represent a sequence number of MPU to which MPU metadata, movie fragment metadata and MFU belong in the case of storing them.

Figure No.2



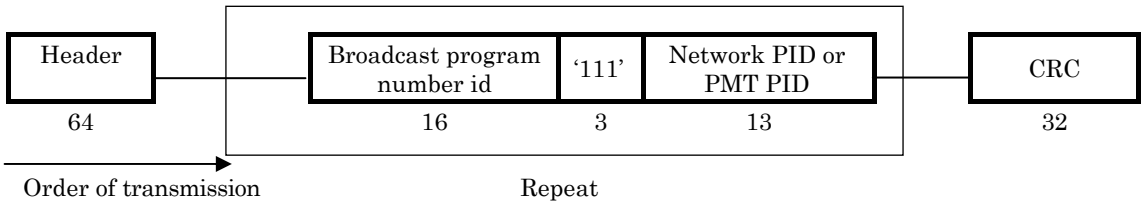

Notes:

1. The division index shall be a divided state of the data stored in the MMTP payload and be shown in the table of Note 4 in the above Figure No.1.
2. The length information extension flag shall be '0' or '1', respectively, when the message data length indicating message size is 16 bits or 32bits.

(Table No.9, Notification)

## 3.10 Transmission control signal

(1) PAT

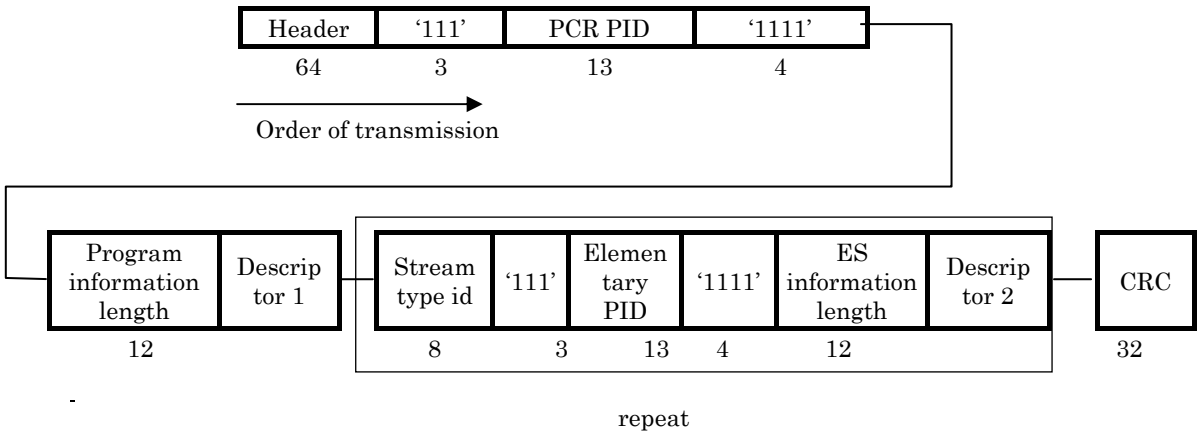



Notes:

1. The header and CRC shall be the same as those for extended section format shown in Section 3.2.
   Note that the content of the bit that follows the "section syntax indicator" shall be '0.'
2. The value of the "table id" within the header shall be 0x00, representing the PAT. The "table id extension" shall be used to transmit the transport stream id.
3. The broadcast program id number shall be used to identify broadcast program number. '0' shall be used for NIT.
4. The network PID or PMT PID represents NIT PID when the program number is '0,' and the value of this field shall be 0x0010. The network PID or PMT PID represents PMT PID when the program number is any number other than '0.'

(Notification)

(2) PMT




Notes:

1. The header and CRC shall be the same as those for extended section format shown in Section 3.2.
   Note that the content of the bit that follows the "section syntax indication" shall be '0.'
2. The value of the "table id" within the header shall be 0x02, representing the PMT. The "table id extension" shall be used to transmit the program number.
3. The PCR PID represents the PID of the TS packet that transmits the valid PCR field for the broadcast program specified by the broadcast program number id.

4. The value of the first two bits of the program information length shall be '00.' The remaining 10 bits shall be a field that writes the number of bytes in the descriptor that follows the program information length.
5. Descriptor 1 shall be a field that writes the descriptor related to the applicable broadcast program and descriptor 2 shall be a field that writes the descriptor related to the applicable elementary stream.
6. The stream type id shall be used to identify broadcast program element type and its assignment shall be shown below.
7. The elementary PID represents the PID for the TS packet that transmits related broadcast program element.
8. The value of the first two bits of the ES information length shall be '00.' The remaining 10 bits shall be a field that writes the number of bytes in the descriptor that follows the ES information length.

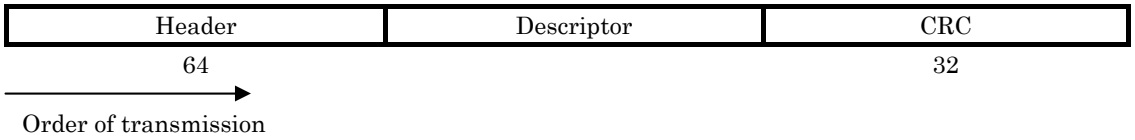
Table: Stream type identifier

| Value | Assignment |
|---|---|
| 0x00 | Undefined |
| 0x01 | Video stream defined in ISO/IEC 11172-2 |
| 0x02 | Video stream prescribed in ITU-T Rec. H.262 or constrained parameter video stream defined in ISO/IEC 11172-2 |
| 0x03 | Audio stream defined in ISO/IEC 11172 |
| 0x04 | Audio stream defined in ISO/IEC 13818-3 |
| 0x05 | Private sections prescribed in ITU-T Rec. H.222.0 |
| 0x06 | PES packets containing private data prescribed in ITU-T Rec. H.222.0 |
| 0x07 | MHEG defined in ISO/IEC 13522 |
| 0x08 | DSM-CC prescribed in ITU-T Rec. H.222.0 Annex A |
| 0x09 | ITU-T Rec. H.222.1 |
| 0x0A – 0x0D | ISO/IEC 13818-6 (type A – D) |
| 0x0E | Data type prescribed in ITU-T Rec. H.222.0 other than the above |
| 0x0F | Audio stream defined in ISO/IEC 13818-7 |
| 0x10 | Video stream defined in ISO/IEC 14496-2 |
| 0x11 | Audio stream defined in ISO/IEC 14496-3 |
| 0x12 | SL-packetized stream or FlexMux stream carried in PES packets defined in ISO/IEC 14496-1 |
| 0x13 | SL-packetized stream or FlexMux stream (defined in ISO/IEC 14496-1) carried in the sections (defined in ISO/IEC 14496) |
| 0x14 | Synchronized download protocol defiend in ISO/IEC 13818-6 |
| 0x15 | Metadata carried in PES packets |
| 0x16 | Metadata carried in metadata_sections |
| 0x17 | Metadata carried in Data carousel defined in ISO/IEC 13818-6 |
| 0x18 | Metadata carried in Object carousel defined in ISO/IEC 13818-6 |
| 0x19 | Metadata carried in Synchronized download protocol defined in ISO/IEC 13818-6 |
| 0x1A | IPMP stream defined in ISO/IEC 13818-11 |
| 0x1B | AVC video stream prescribed in ITU-T Rec. H.264 |
| 0x1C | Audio stream defined in ISO/IEC 14496-3 (not using additional transport structure) |
| 0x1D – 0x23 | Undefined |

| Value | Assignment |
|---|---|
| 0x24 | HEVC video stream or HEVC video sub bits stream in the time direction prescribed in ITU-T Rec. H265 |
| 0x25 | Vido subset of HEVC video stream in the time direction based on one or more profiles prescribed in ITU-T Rec. H265 Annex |
| 0x26 – 0x7E | Undefined |
| 0x7F | IPMP stream |

(Table No.16, Notification)

(3) CAT

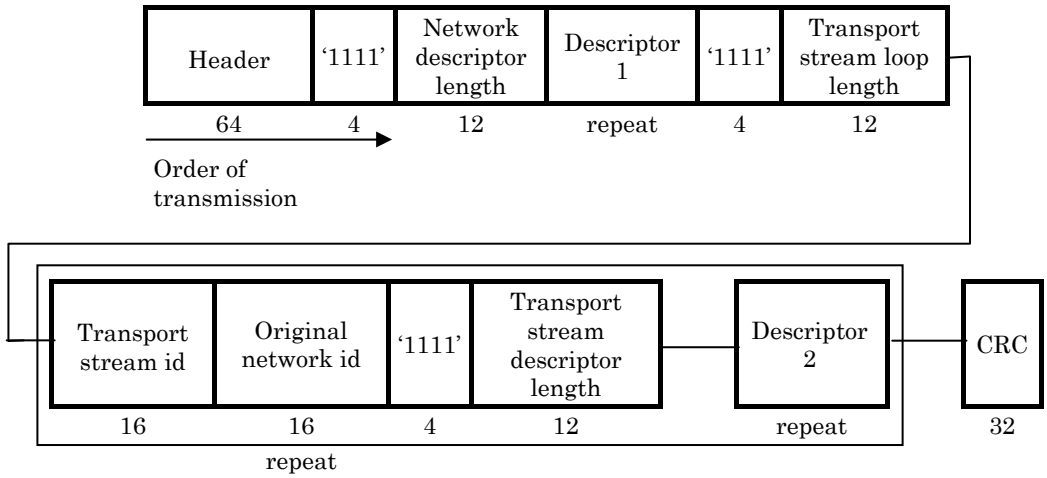



Notes:

1. The header and CRC shall be the same as those for the extended section format shown in Section 3.2.
   Note that the content of the bit that follows the "section syntax indication" shall be '0.'
2. The value of the "table id" within the header shall be 0x01, representing the CAT.
   The "table id extension" field is undefined.

(Table No.17 Notification)

(4) NIT



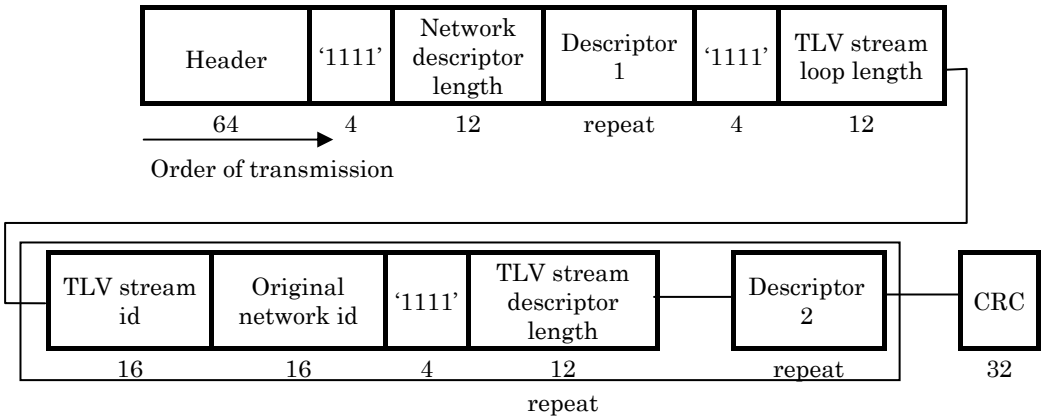

Notes:

1. The header and CRC shall be the same as those for section extension format shown in Section 3.2.
2. The value of the "table id" within the header shall be 0x40 for actual network and 0x41 for any other network. The "table id extension" shall be used to transmit network id.
3. The network id shall be a field used for identifying the network number.

4. The value of the first two bits of the network descriptor length shall be '00.' The remaining 10 bits shall be a field that writes the number of bytes in the descriptor that follows the network descriptor length.
5. The descriptor 1 or descriptor 2 shall be a field for writing the descriptor related to the applicable network.
6. The value of the first two bits of the transport stream loop length shall be '00.' The remaining 10 bits shall be a field that writes the number of data bytes just before the CRC following this field.
7. The transport stream id represents the identification number of the applicable transport stream.
8. The original network id represents the identification number of the original network of the applicable transport stream.
9. The transport stream descriptor length represents the number of bytes in all descriptors of the applicable transport stream just behind this field. Note that the value of the first two bits shall be '00.'

(Table No.18-1, Notification)

(5) TLV-NIT



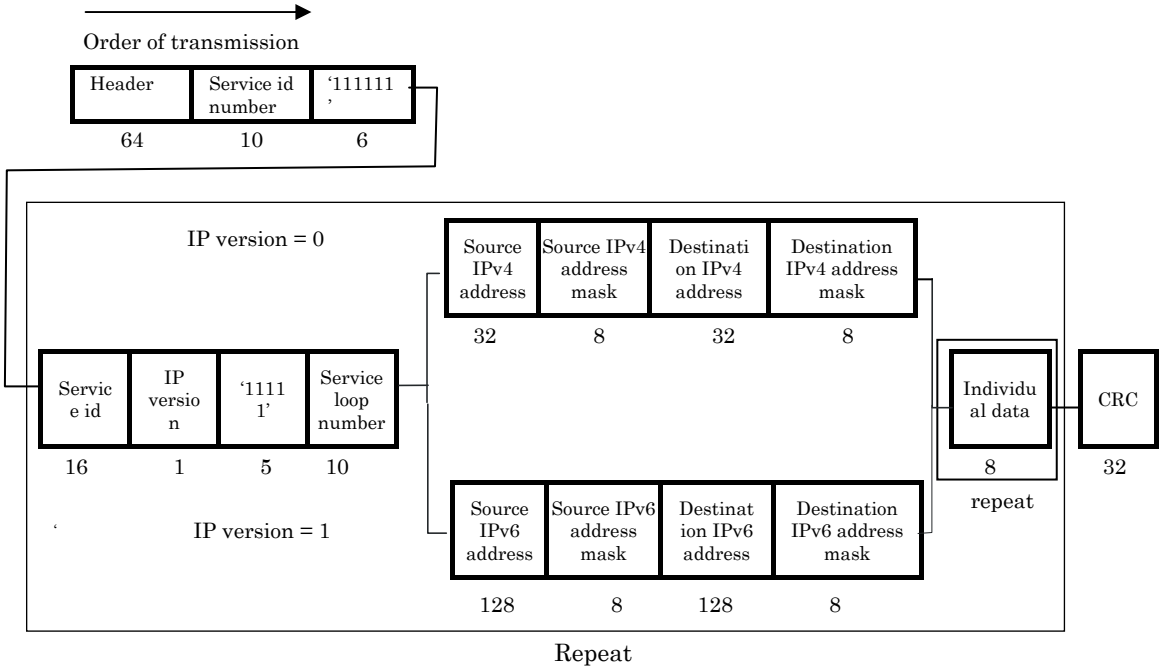

Notes:

1. The header and CRC shall be the same as those for section extension format shown in Section 3.2.
2. The value of the "table id" within the header shall be 0x40 for actual network and 0x41 for any other network. The "table id extension" shall be a field used to transmit network id.
3. The network id shall be a field used for identifying the network number.
4. The value of the first two bits of "the section length" within the header shall be '00.' The remaining 10 bits shall be a field that writes the number of data bytes following this field. Note that this vakue shall not exceed 1021.
5. The value of the first two bits of the network descriptor length shall be '00.' The remaining 10 bits shall be a field that writes the number of bytes in the descriptor that follows the network descriptor length.
6. The descriptor 1 or 2 shall be a field for writing the descriptor related to the applicable network.

7. The value of the first two bits of the TLV stream loop length shall be '00.' The remaining 10 bits shall be a field that writes the number of data bytes just before CRC following this field.
8. The TLV stream id shall be a field that writes the identification number of TLV stream.
9. The original network id shall be a field that writes identification number of the original network of the applicable TLV stream.
10. The TLV stream descriptor length represents the number of bytes in all descriptors of the applicable TLV stream just behind this field. Note that the value of the first two bits shall be '00.'

(Table 18-2, Notification)

(6) AMT




Notes:

1. The header and CRC shall be same as those for the extension format shown in Section 3.2.
2. The value of the "table id" within the header shall be 0xFE. The "table id extension" shall be be 0x0000 repersenting AMT.
3. The service id number shall represent the number of service id described in this AMT.
4. The service id shall be a field to be used for identifying broadcast program numbers.
5. The IP version shall represent the version and its assignemnt shall be shown in the following table.

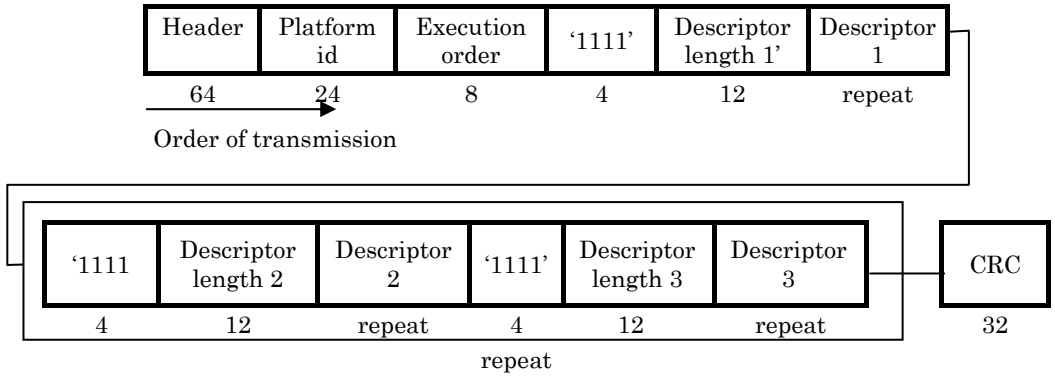
| Value | Assignment |
|---|---|
| 0 | IPv4 |
| 1 | IPv6 |

6. The service loop length shall represent the number of bytes from the field just behind this field to the next listed service id field or to the field just before CRC.

7. The source IPv4 address shall be a field that writes the source IP address for the IPv4 packet comprising broadcasting program.
8. The source IPv4 address mask shall be a field used for specifying the number of bits from the valid most significant bit for the IP address designated to the source IPv4 address.
9. The destination IPv4 address shall be a field that writes the destination IP address for the IPv4 packet comprising broadcast program.
10. The destination IPv4 address mask shall be a field used for specifying the number of bits from the valid most significant bit for the IP address designated to the destination IPv4 address.
11. The source IPv6 address shall be a field that writes the source IP address for the IPv6 packet comprising broadcast program.
12. The source IPv6 address mask shall be a field used for specifying the number of bits from the valid most significant bit for the IP address designated to the source IPv6 address.
13. The destination IPv6 address shall be a field that writes the destination IP address for the IPv6 packet comprising broadcast program.
14. The destination IPv6 address mask shall be a field used for specifying the number of bits from the valid most significant bit for the IP address designated to the destination IPv6 address.
15. The individual data shall be a field that writes the data defined individually.

(Table No.19, Notification)

(7) INT



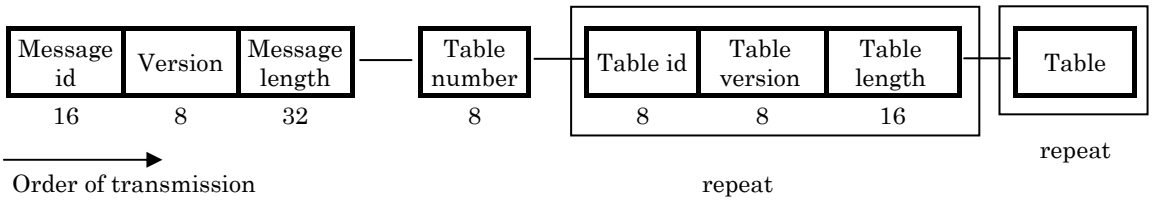

Notes:

1. The header and CRC shall be the same as those for section extension format shown in Section 3.2.
2. The value of the "table id" within the header shall be 0x4C. The "table id extension" is used to transmit auxiliary infromation to identify the execution type and platform id.
3. The platform id shall be a field used for identifying the platform type.
4. The descriptor length 1, descriptor length 2 or descriptor length 3 shall represent the byte length of each descriptor, respectively.
5. The descriptor 1 shall be a field that writes an applicable platform descriptor.
6. The descriptor 2 shall be a field that writes a descriptor identifying a receiver.

7. The descriptor 3 shall be a field that writes a descriptor for the receiver id specified by the descriptor 2.

(Table No.20, Notification)

(8) PA message




Notes:

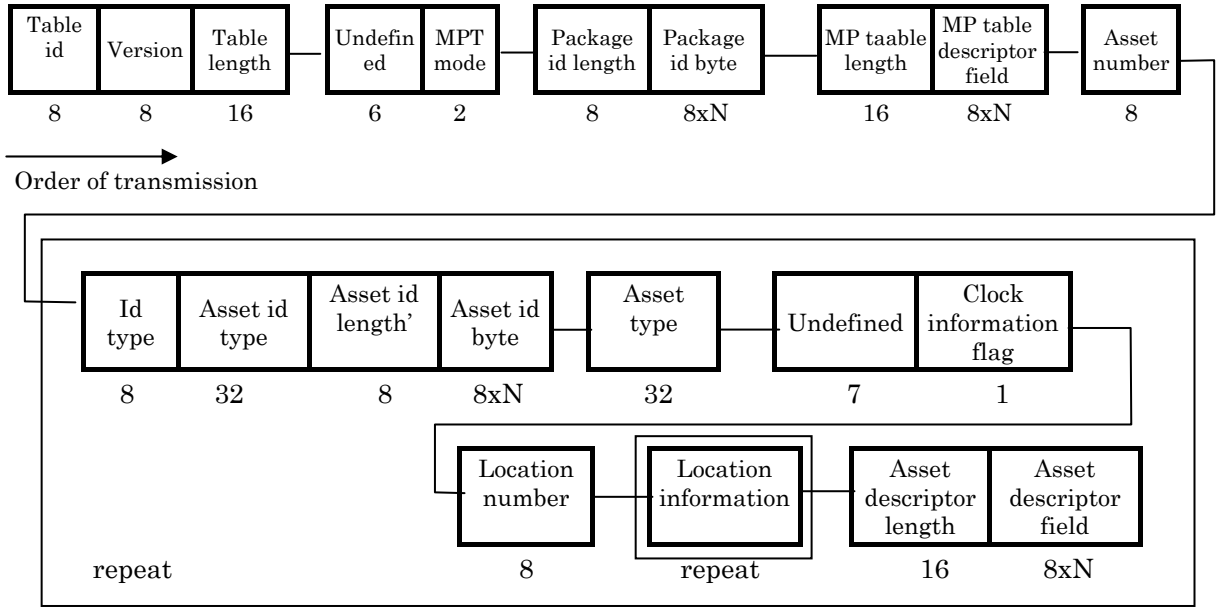
1. The message id shall be 0x0000 representing PA message.
2. The version shall be a field that writes the version number of PA message.
3. The message length shall be a field that writes the number of data bytes following this field.
4. The table number shall be a field that writes the number of table stored in this PA message.
5. The table id shall be a field used for identifying the table stored in this PA message. The assignment shall be shown in the following table.

| Value | Assignment |
|---|---|
| 0x00 - 0x10 | Undefined |
| 0x11 | Subset 0 MP table |
| 0x12 | Subset 1 MP table |
| 0x13 | Subset 2 MP table |
| 0x14 | Subset 3 MP table |
| 0x15 | Subset 4 MP table |
| 0x16 | Subset 5 MP table |
| 0x17 | Subset 6 MP table |
| 0x18 | Subset 7 MP table |
| 0x19 | Subset 8 MP table |
| 0x1A | Subset 9 MP table |
| 0x1B | Subset 10 MP table |
| 0x1C | Subset 11 MP table |
| 0x1D | Subset 12 MP table |
| 0x1E | Subset 13 MP table |
| 0x1F | Subset 14 MP table |
| 0x20 | Complete MP table |
| 0x21 - 0x81 | Undefined |
| 0x82, 0x83 | ECM |
| 0x84, 0x85 | EMM |

| | |
|---|---|
| 0x86 | CA table |
| 0x87 - 0xFF | Undefined |

6. The table version shall be a version of the table stored in PA message.
7. The table length shall be a field that writes the number of data bytes of the table stored in this PA message.
8. The table shall represent control information and be shown below.

MP TABLE




Notes:

1. The value of the table id shall be set to 0x20 when this MP table is a complete MP table and be 0x11 to 0x1F corresponding to the subset 0 to subset 14 when the one package configuration is described by some MP tables.
2. The version shall be a field that writes the version number for a table.
3. The table length shall be a field that writes the number of data bytes following this field.
4. The MPT mode represents the action when MP table is divided into subset. The mode assignment shall be shown in the following tabel.

| Value | Assignment |
|---|---|
| '00' | Processing in the order of subset |
| '01' | Processing of any subset having the same version after receiving MP table with subset 0 |
| '10' | Optional processing of MP table of subsets |
| '11' | Undefined |

5. The IP package length shall be a field that writes the number of data bytes for the package ID byte.

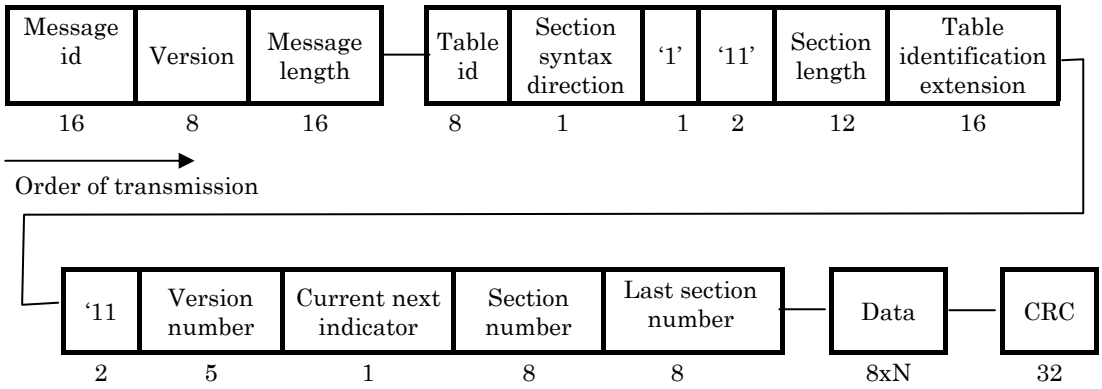
6. The package ID byte represents the package ID.
7. The MP table descriptor length shall be a field that writes the number of data bytes in the MP table descriptor field.
8. The MP table descriptor field shall be a field that stores MP table descriptor.
9. The asset number shall be a field that writes the number of asset providing this table information.
10. The value of id type shall be set to 0x00 representing asset id in the ID system of the MMTP packet flow.
11. The asset ID format shall be a field used for identifying program elements signal such as video, audio and data.
12. The asset ID length shall be a field that writes the number of data bytes of the asset ID byte.
13. The asset ID byte represents asset ID.
14. The asset type represents the type of asset and its assignment shall be shown in the following table.

| Code | Assignment |
|---|---|
| hvc1 | HEVC video stream prescribed in ITU-T Rec. H.265 |
| mp4a | Audio stream defined in ISO/IEC 14496-3 |

15. The clock information flag shall be '1' or '0' whether clock information id flag field and time scalable flag field exist or not.
16. The location number shall represent the number of asset location information.
17. The asset descriptor length shall be a field that writes the number of data bytes having the asset descriptor field size.
18. The asset descriptor field shall be a field that stores the descriptor indicating asset information.

(Table No.27, Notification)

(9) M2 section message

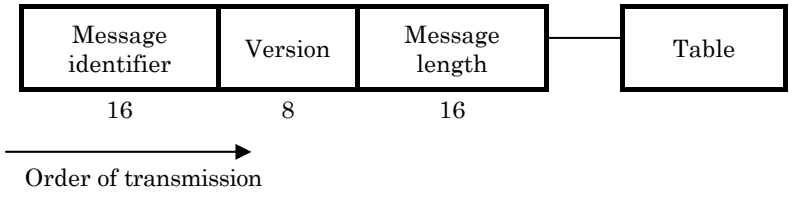



Notes:

1. The value of the message id shall be set to 0x8000 representing M2 section message.
2. The version shall be a field that writes a version number of M2 section message.
3. The message length shall be a field that writes a number of data bytes following this field.
4. The table id shall be a field used for identifying the table to which the section belongs.
5 The value of section syntax indicator shall be '1' representing the extension format among the formats shown in Section 3.2.
6. The section length shall be a field that writes a number of data bytes following this field.
7. The version number shall be a field that writes a table version number.
8. The current next indicator shall be '0' when the table is not currently available and will be valid next, and '1' when the table is available at present.
9. The section number shall be a field that writes a section number comprising table.
10. The last section number shall be a field that writes the last section number comprising table.
11. The CRC shall comply with ITU-T Recommendation H.222.0.

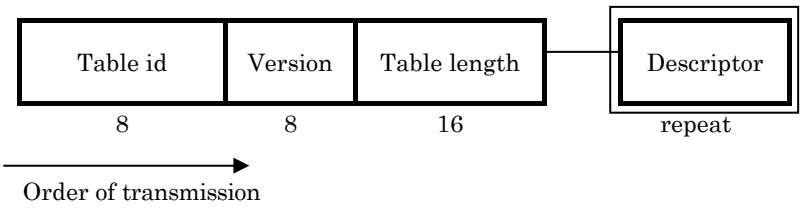
(Table No.28, Notification)

(10) CA message




Notes: 1. The value of message id shall be 0x8001 representing CA message.
2. The table represents control information and shall be shown below.

CA Table




Note: The value of table id shall be 0x86 representing CA table.

(Table No.29, Notification)

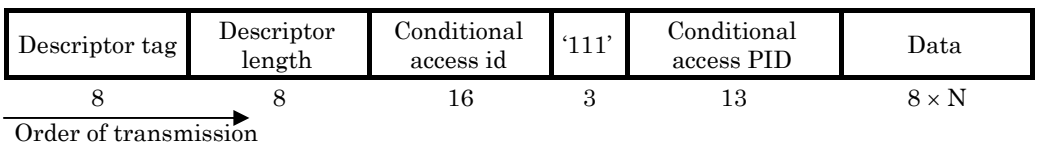
## 3.11 Descriptors

### 3.11.1 Transmission by TS packet and TLV packet

| Descriptor | Configuration | Transmission system* | |
|---|---|---|---|
| | | TS | TLV |
| Conditional access descriptor | As per Figure No. 1 | ○ | |
| Conditional playback descriptor | As per Figure No. 2 | ○ | |
| Partial reception descriptor | As per Figure No. 3 | ○ | |
| Terrestrial delivery system descriptor | As per Figure No. 4 | ○ | |
| Satellite delivery system descriptor | As per Figure No. 5 | ○ | ○ |
| Service list descriptor | As per Figure No. 6 | ○ | ○ |
| System management descriptor | As per Figure No. 7 | ○ | ○ |
| Data component descriptor | As per Figure No. 8 | ○ | |
| Carousel compatible composite descriptor | As per Figure No. 9 | ○ | |
| Copyright descriptor | As per Figure No. 10 | ○ | |
| Emergency information descriptor | As per Figure No. 11 | ○ | |
| IP/MAC stream arrangement descriptor | As per Figure No. 12 | ○(Note1) | |
| Access control descriptor | As per Figure No. 13 | ○ | |
| Hierarchical coding descriptor | As per Figure No. 14 | ○ | |
| Scrambling method descriptor | As per Figure No. 15 | ○ | |

* Refer to Section 2. Tranmission system availabe for each descriptor is shown by ○.
Note 1: Only used for INT.

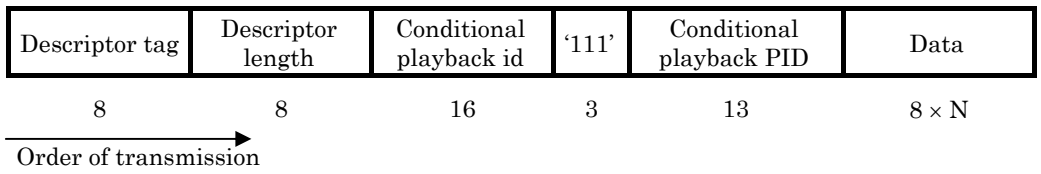
Figure No. 1: Conditional access descriptor




Notes:

1. The value of the descriptor tag shall be 0x09, representing the conditional access descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The conditional access identifier shall be a field used for identifying the conditional access.
4. The conditional access PID shall be a field that writes the PID of the TS packet that contains information related to the conditional access.
5. This descriptor may be tranmitted in the descriptor field of CAT or in the descriptor 1 or 2 field of PMT.

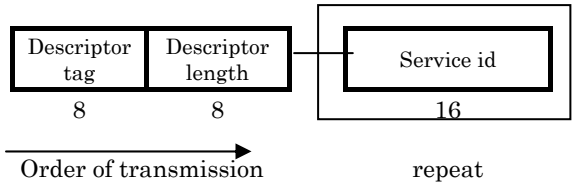
Figure No. 2: Conditional playback descriptor




Notes:

1. The value of the descriptor tag shall be 0xF8, representing the conditional playback descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The conditional playback identifier shall be a field used for identifying the conditional playback.
4. The conditional playback PID shall be a field that writes the PID of the TS packet that contains information related to the conditional playback.
5. This descriptor may be transmitted in the descriptor field of CAT or in the descriptor 1 or 2 field of PMT.

Figure No. 3: Partial reception descriptor

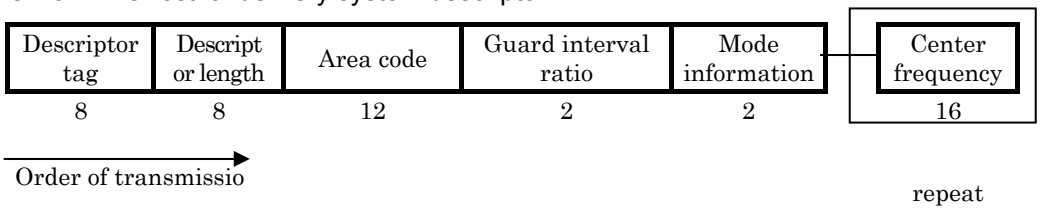



Notes:

1. The value of the descriptor tag shall be 0xFB, representing the partial reception descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The service id shall be a field used for identifying the program number of the broadcast program transmitted in the partial reception segment.
4. This descriptor shall be used only when there is a partial reception segment in digital terrestrial sound broadcasting, digital terrestrial television broadcasting, V-Low

multimedia broadcasting based on connected segment system or V-High multimedia broadcasting based on connected segment system. The descriptor may be transmitted in the descriptor 2 field of NIT.

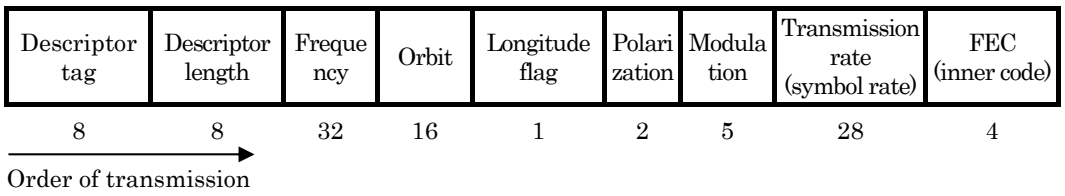
Figure No. 4: Terrestrial delivery system descriptor




Notes:

1. The value of the descriptor tag shall be 0xFA, representing the terrestrial delivery system descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The area code shall be a field used for identifying the coverage area.
4. The guard interval ratio is a field used for identifying the ratio of guard interval to valid symbol length. '00,' '01,' '10' and '11' shall represent 1/32, 1/16, 1/8 and 1/4, respectively.
5. The mode information shall represent modes 1, 2, and 3 when its value is '00,' '01' and '10,' respectively. '11' shall be undefined.
6. The center frequency shall be a center frequency of the frequency band used to transmit a broadcast program. The value shall be expressed in 1/7 MHz units.
7. This descriptor shall be used only for digital terrestrial sound broadcasting, digital terrestrial television broadcasting, V-Low multimedia broadcasting based on connected segment system or V-High multimedia broadcasting based on connected segment system. The descriptor may be transmitted in the descriptor 2 field of NIT.

Figure No. 5: Satellite delivery system descriptor

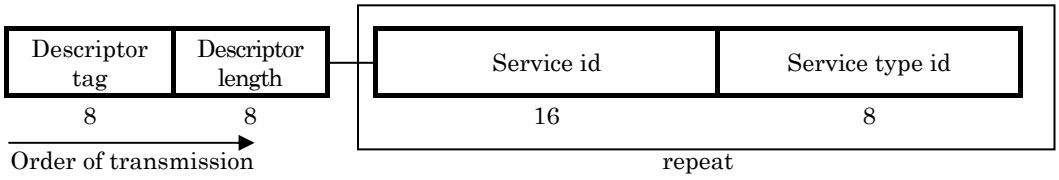



Notes:

1. The value of the descriptor tag shall be 0x43, representing the satellite delivery system descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The frequency shall be a field that writes a frequency (GHz). An 8-digit number, each digit of which consists of a 4-bit BCD code, shall be used to write a frequency. The lower four digits represent the fractional part.

4. The orbit shall be a field that writes an orbital position (degrees). A 4-digit number, each digit of which consists of a 4-bit BCD code, shall be used to write a position. The lower four digits represent the fractional part.
5. The longitude flag shall represent west and east longitude when its value is '0' and '1,' respectively.
6. The polarization is a field used for identifying the polarization type. It shall represent horizontally, vertically, left-handed and right-handed polarized waves when its value is '00,' '01,' '10' and '11, respectively.'
7. The modulation is a field used for identifying the modulation type. It shall represent 4-phase modulation, undefined, modulation for BS digital broadcasting and wide band CS digital broadcasting, modulation for advanced narrowband CS digital broadcasting and modulation for advanced BS digital broadcasting and advnaced wide band CS digital broadcasting, when its value is '00001', '01001', '01000', '01010' and '01011', respectively.
8. The transmission rate is a field that writes symbols transmitted per second (Mbaud). A 7-digit number, each digit of which consists of a 4-bit BCD code, shall be used to write a speed. The lower four digits represent the fractional part.
9. The FEC is a field identifying the coding rate of inner code. It shall represent coding rates of 1/2, 2/3, 3/4, 5/6 and 7/8 when its value is '0001,' '0010,' '0011,' '0100', and '0101', respectively. It also shall represent the coding rate of inner code for BS digital broadcasting and wide band CS digital broadcasting, for advanced narrowband CS digital broadcasting and for advanced BS digital broadcasting and advnaced wide band CS digital broadcasting, when its value is '1000', '1010' and '1011', respectively. '1111' indicates that there is no inner code.
10. This descriptor shall be used only for satellite digital audio broadcasting, BS digital or broadband CS digital broadcasting. The descriptor may be transmitted in the descriptor 2 field of NIT or TLV-NIT.

Figure No. 6: Service list descriptor



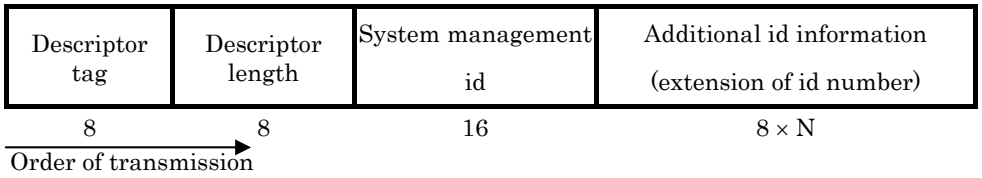

Notes:

1. The value of the descriptor tag shall be 0x41, representing the service list descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The service id shall be a field used for identifying the broadcast program number.
4. The service type id shall be a field used for identifying type of broadcasting. Service type assignment shall be shown below.

| Value | Description |
|---|---|
| 0x00 | Undefined |
| 0x01 | Television broadcasting |
| 0x02 | Ultra-short wave broadcasting |
| 0x03 – 0x7F | Undefined |
| 0xC0 | Data broadcasting |
| 0xC1 | Storage broadcasting using TLV |
| 0xC2 | Multimedia broadcasting |
| 0xC3 – 0xFF | Undefined |

5. The descriptor shall be transmitted in the descriptor 2 field of NIT or TLV-NIT.

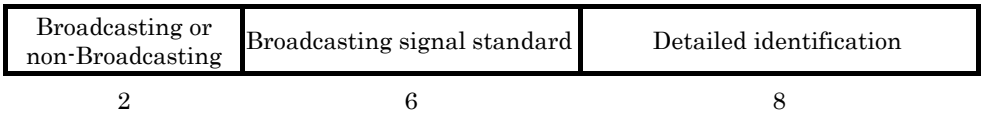
Figure No. 7: System management descriptor




Notes:

1. The value of the descriptor tag shall be 0xFE, representing the system management descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The system management id is used to identify the type (such as broadcasting or non-broadcasting). Its structure shall be as shown below.

System management identifier




Broadcasting or non-Broadcasting type

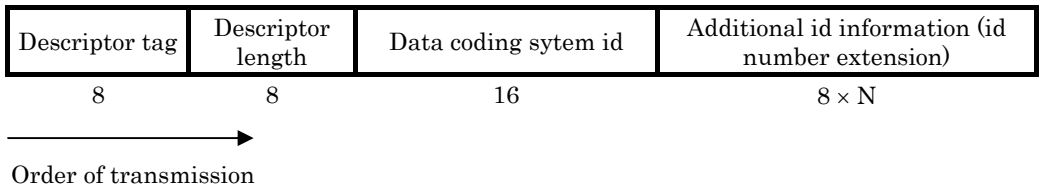
| Value | Assignment |
|---|---|
| '00' | Broadcasting |
| '01', '10' | Non-broadcasting |
| '11' | Undefined |

Broadcasting standard type

| Value | Assignment |
|---|---|
| '000000' | Undefied |
| '000001' | Narrowband CS digital broadcasting |
| '000010' | BS digital broadcasting |
| '000011' | Digital terrestrial television broadcasting |
| '000100' | Wide band CS digital broadcasting |
| '000101' | Digital terrestrial sound broadcasting |
| '000110' | Undefined |
| '000111' | Advanced narrowband CS digital broadcasting |
| '001000' | Advanced BS digital broadcasting |
| '001001' | Advanced wide band CS digital broadcasting |
| '001010' | V-High multimedia broadcasting based on connected segment transmission system |
| '001011' | V-Low multimedia broadcasting based on connected segment transmission system |
| '001100' – '111111' | Undefined |

4. The additional identifier information shall be a field used for extending idetification number.
5. For digital terrestrial sound, digital terrestrial television, V-High multimedia and V-Low multimedia based on connected segment transmission system, BS digital, wide band CS digital, advanced BS digital or advanced wide band CS digital broadcasting transmitted by TS packets, this descriptor shall be transmitted in the descriptor 1 field of PMT or in the descriptor 1 or 2 field of NIT. If this descriptor is transmitted in plural fields, the priority is given to descriptor 1 of PMT, followed by descriptor 2 of NIT and then descriptor 1 of NIT.
6. For narrowband CS digital broadcasting, this descriptor shall be transmitted in the descriptor 1 field of PMT.
7. For advanced BS digital broadcasting and advanced wide band CS digital broadcasting transmitted by TS packets, this descriptor shall be transmitted in the descriptor 1 or 2 field of TLV-NIT. If this descriptor is transmitted in plural fields, the priority is given to descriptor 1 and then descriptor 2.

Figure No. 8: Data component descriptor

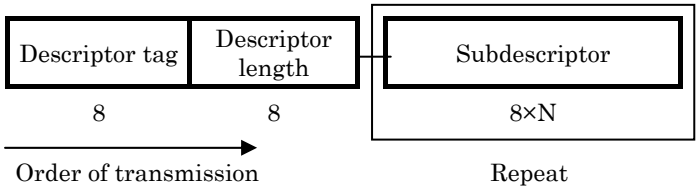



Notes:

1. The value of the descriptor tag shall be 0xFD, representing the data coding system descriptor.

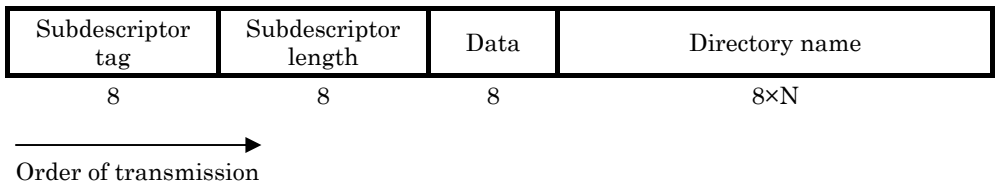
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The data coding system id shall be a field used for identifying the data coding system standard.
4. The additional id information shall be a field that writes additional infromation on the data coding system standard shown in the data coding system id..
5. This descriptor may be transmitted in the descriptor 2 field of PMT.

Figure No. 9: Data structure of carousel compatible composite descriptor



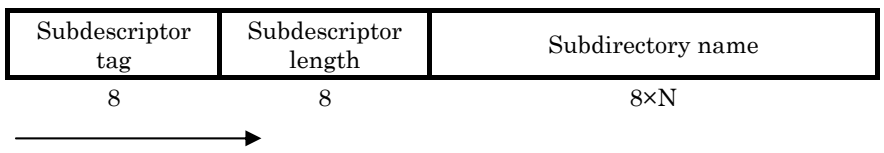

Notes:
1. The value of the descriptor tag shall be 0xF7, representing the carousel compatible composite descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The subdescriptor shall be a filed to write information including the subdescriptors described in (1) to (3) below.

(1) Accumulation route subdescriptor




a. The value of the subdescriptor tag shall be 0xC5, representing the accumulation route subdescriptor.
b. The subdescriptor length shall be a field that writes the number of data bytes following this field.
c. The directory name shall be a field that describes the name in text format of the uppermost directory in the directory structure used when accumulating programs in the receiving equipment.

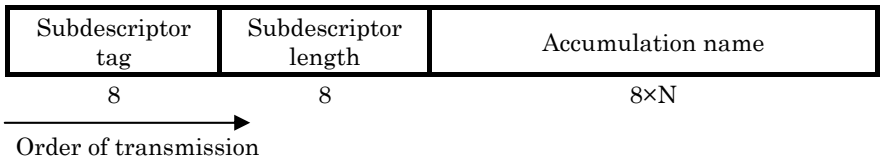
(2) Subdirectory subdescriptor



Order of transmission

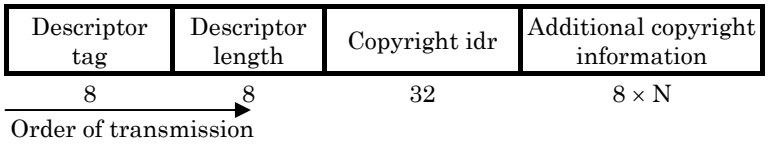
a. The value of the subdescriptor tag shall be 0xC6, representing the subdirectory subdescriptor.
b. The subdescriptor length shall be a field that writes the number of data bytes following this field.
c. The subdirectory name shall be a field that describes a directory structure in text formatused for accumulating programs in the receiving equipment , excliding the structure specified by the accumulation route subdescriptor.

(3) Accumulation name subdescriptor



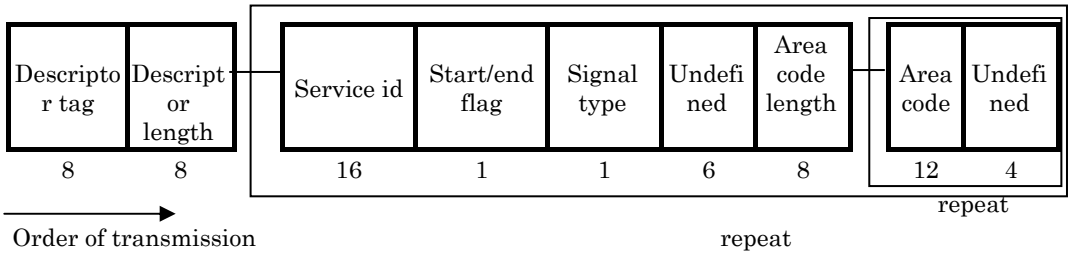

a. The value of the subdescriptor tag shall be 0x02, representing the accumulation name subdescriptor.
b. The subdescriptor length shall be a field that writes the number of data bytes following this field.
c. The accumulation name shall be a field that describes a name in text formatused for accumulating programs in the receiving equipment.

Figure No. 10: Copyright descriptor




Notes:
1. The value of the descriptor tag shall be 0x0D, representing the copyright descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The copyright identifier shall be a field identifying the copyright.

Figure No. 11: Emergency information descriptor




Notes:

1. The value of the descriptor tag shall be 0xFC, representing the emergency information descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The service id shall be used to identify the broadcast program number.
4. The value of the start/end flag shall be '1' when transmission of emergency information signal starts or is in progress and '0' when the transmission ends.
5. The value of the signal type shall be '0' and '1,' respectively, when transmitting Class 1 and 2 start signals defined in Paragraph 1 of Article 138-2 of the Regulations for Operating Radio Station, (Radio Regulatory Commission Rule No. 17, 1950).
6. The area code length shall be a field that writes the number of data bytes following this field.
7. The area code shall be a field transmitting the area code defined in Table No. 1 in (Notification No. 405 (Defining the structure of emergency alarm signal by the provisions in Article 9-3, Radio Equipment Regulations) of the Ministry of Posts and Telecommunications 1985.
8. This descriptor may be used only for digital terrestrial sound, digital terrestrial television, mutimedia, BS digital, wide band CS digital, advanced BS digital or advanced wide band CS digital broadcasting transmitted by TS packets. The descriptor may be tranmsitted in the descriptor 1 field of PMT or in the descriptor 1 or 2 field of NIT.

Figure No. 12: IP/MAC stream arrangement descriptor

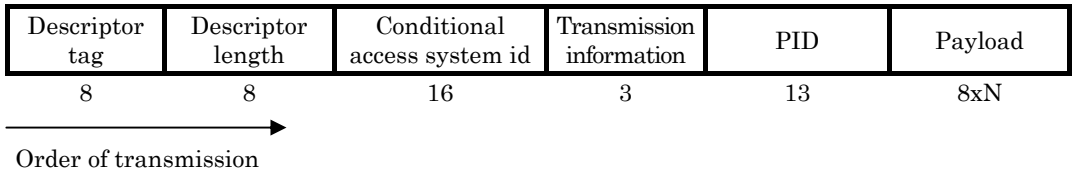
| INT descriptor tag | Descriptor length | Network id | Original network id | Transport stream id | Service id | Component tag |
|---|---|---|---|---|---|---|
| 8 | 8 | 16 | 16 | 16 | 16 | 8 |

Order of transmission

Notes:

1. The value of INT descriptor tag shall be set to 0x13 representing IP/MAC stream arrangement descriptor.
2. The descriptor length shall be a field that writes the number of data bytes after this field.
3. The network id shall be a field used for identifying the network number.
4. The original network id shall represent an identification number of the original network for the relevant transport stream.
5. The transport stream id shall represent the identification number of transport stream.
6. The service id shall be a field used for identifying the broadcast program number.
7. The component tag shall be a field that writes the tag value of the stream transmitting the object ULE packet.
8. This descriptor may be transmitted in the descriptor 1 or descriptor 3 field of INT.

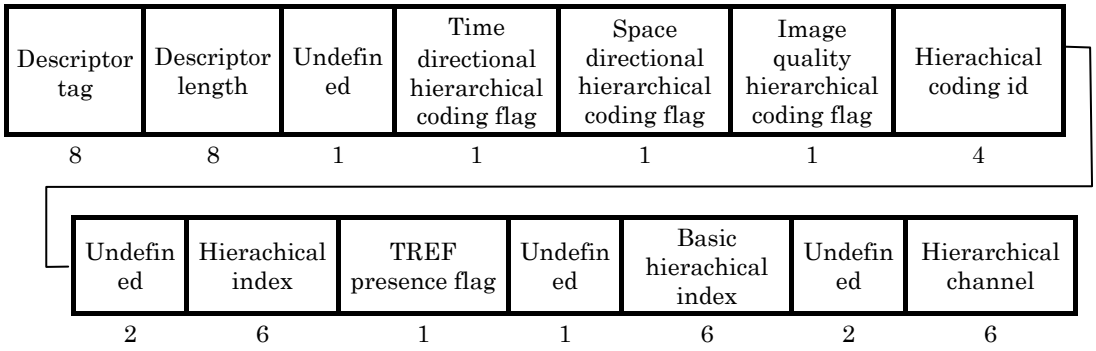
Figure No.13: Structure of access control descriptor




Notes:

1. The value of the descriptor tag shall be set to 0xF6 representing access control descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. Conditional access system for reception id shall be a field used for identifying the type of conditional access system.
4. Transmission information shall be a field used for identifying the relevant information transmission.
5. PID shall be a field that writes PID of TS packet including the related information.
6. This descriptor may be transmitted in the descriptor field of CAT, or in the descriptor 1 or descriptor 2 field of PMT.

Figure No14: Structure of hierarchical coding descriptor




Notes:

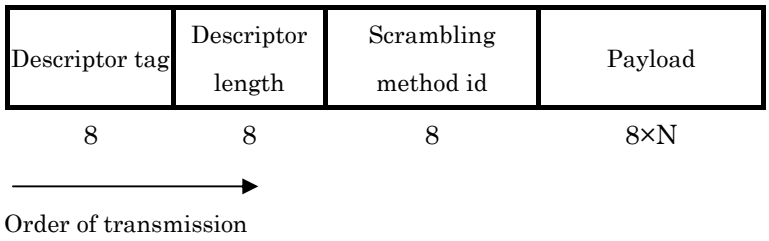
1. The value of the descriptor tag shall be 0x04, representing hierachical coding descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The time directional hierarchical coding flag shall be '0' when frame rates of program elements bit stream are improved by the basic hierarchical index and '1' when the frame rates are not improved.
4. The space directional hierarchical coding flag shall be '0' when spatial resolution of program elements bit stream is improved by the basic hierarchical index and '1' when the resolution is not improved
5. The image quality hierarchical coding flag shall be '0' when SNR quality or fidelity of program elements bit stream is improved by the basic hierarchical index and '1' when the quality or fidelity is not improved.

6. The hierarchical coding identifier is a field used for identifying the hierarchical coding type that has been used and its assignment shall be shown in the following table.

| Value | Assignment |
|---|---|
| 0 | Undefined |
| 1 | Space directional hierarchical coding |
| 2 | Image quality hierarchical coding |
| 3 | Time directional hierarchical coding |
| 4 - 7 | Undefined |
| 8 | Mixed hierarchical coding |
| 9 - 14 | Undefined |
| 15 | Video stream specified in ITU-T Rec. H.265 or time directional video sub bit stream specified in ITU-T Rec.265 |

7. The hierarchical index shall be a unique value used for the relevant program in the coding hierarchical table.
8. TREF existing flag shall be '0' and '1', respectively, when there is TREF field or not in the PES packet header of the relevant elementary stream.
9. The basic hierarchical index shall be a hierarchical program elements index.
10. The hierarchical channel shall represent an object channel number for the related program element among a series of transmission channels having ranking order.
11. This descriptor shall be transmitted in the descriptor 2 field of PMT.

Figure No. 15: Structure of scrambling method descriptor




Notes:

1. The descriptor tag value shall be set to 0xF5 indicating the scrambling method description.
2. The descriptor length shall be a field that writes the number of data bytes after this field.
3. The scrambling method id shall be a field used for identifying encryption algorithm in the case of scrambling. The assignment shall be shown in the following table.

| Value | Assignment |
|---|---|
| '00000000' | Undefined |
| '00000001' | AES (limited to a key length of 128 bits) |
| '00000010' | Camellia (limited to a key length of 128 bits) |
| '00000011'-'11111111' | Undefined |

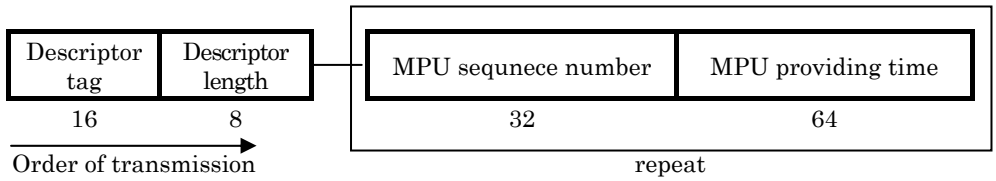
4. This descriptor may be transmitted in the descriptor field of CAT, or the descriptor 1 or descriptor 2 field of PMT.

(Table No.21, Notification)

### 3.11.2 Transmission by MMTP packet

| Descriptor | Configuration |
|---|---|
| MPU time stamp descriptor | As shown in No.1 below |
| Dependency descriptor | As shown in No.2 below |
| Access control descriptor | As shown in No.3 below |
| Scrambling method descriptor | As shown in No.4 below |
| Emergency information descriptor | As shown in No.5 below |

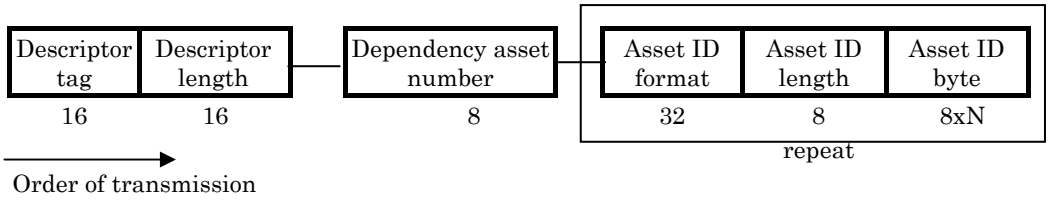
No. 1: Structure of MPU time stamp descriptor




Notes:

1. The value of descriptor tag shall be 0x0001 representing MPU time stamp descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The MPU sequence number shall be a field that writes the sequence number of MPU describing time stamp.
4. The MPU providing time shall be a 64 bits NTP timestamp defined in IETF RFC 5905.
5. This descriptor may be transmitted in the field of asset descriptor in the MPU table.

No. 2: Structure of dependency relation descriptor



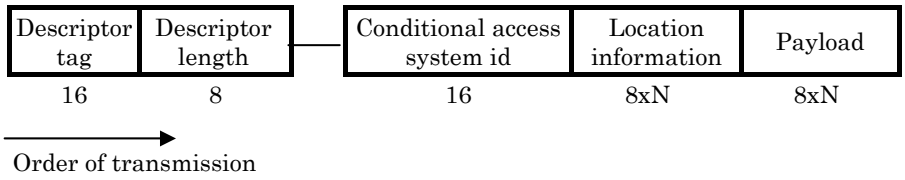

Notes:

1. The value of descriptor tag shall be 0x0002 representing dependency relation descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.

3 The dependency asset shall represent the asset in which this descriptor is inserted and the number of asset.

4. The asset ID format shall represent the asset ID format for the complementary asset.
5. The asset ID length shall be a field that writes the data bytes of asset ID byte for the complementary asset.
6. The asset ID byte shall represent the asset ID for complementary asset.
7. This descriptor may be transmitted in the field of asset descriptor in MPU table.

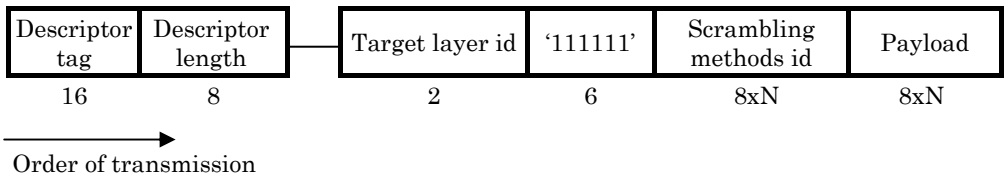
No. 3: Structure of access control descriptor




Notes:

1. The value of descriptor tag shall be 0x8004 representing access control descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The conditional access system id shall represent the type of conditional access system.
4. The location information shall represent the location of MMTP packet including the related information.
5. This descriptor may be transmitted in CA table descriptor field in the CA message, MP table descriptor field in MP table or asset descriptor field.

No. 4: Structure of access scrambling method descriptor



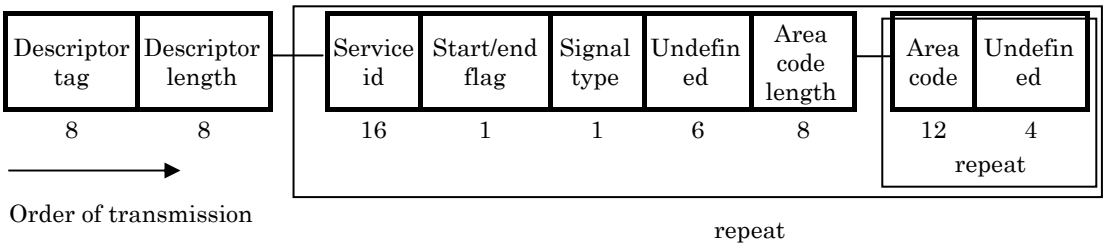

Notes:

1. The value of the descriptor tag shall be 0x8005 representing scrambling method descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3 The target layer id shall represent the encryption target at the time of scrambling (IP packet and MMTP packet).
4. The scrambling method id represents an encryption algorithm type at the time of scrambling and its assignment shall be shown in the following table.

| Value | Assignment |
|---|---|
| '00000000' | Undefined |
| '00000001' | AES (limited to 128 bit key length) |
| '00000010' | Camellia (limited to 128 bit key length) |
| '00000011'-'11111111' | Undefined |

5. This descriptor may be transmitted in CA table descriptor field in the CA message, MP table descriptor field in MP table or asset descriptor field.

No. 5: Structure of emergency information descriptor




Notes:

1. The value of descriptor tag shall be 0x8007 representing emergency information descriptor.
2. The descriptor length shall be a field that writes the number of data bytes following this field.
3. The service id shall be used for identifying the number of broadcast program.
4. The value of the start/end flag shall be '1' when transmission of emergency information signal starts or is in progress and '0' when the transmission ends.
5. The value of the signal type shall be '0' and '1,' respectively, when transmitting Class 1 and 2 start signals defined in Paragraph 1 of Article 138-2 of the Regulations for Operating Radio Station, Radio Regulatory Commision Rule No.17, 1950).
6. The area code length shall be a field that writes the number of data bytes following this field.
7. The area code shall be a field that transmits the area code defined in the Appended table No.1, Notification No. 405 of the Ministry of Post and Telecommunications, 1985 (Defining the configuration of emergency alarm signal pursuant to the provisions of Article 9-3, Radio Equipment Regulations).
8. This descriptor may be transmitted in the MP table descriptor field in MP table.

(Table No.30, Notification)

## 3.12 Identifiers

### 3.12.1 Transmission by TS packet or TLV packet

| Identifier | Configuration |
|---|---|
| Table id | As shown in Section 3.10 (1) to (7) and Section 3.13 |
| Descriptor tag | As per Section 3.11.1 and ITU-T Rec. H.222.0 |
| Stream type id | As shown in Section 3.10 (2) |
| Service type id | As shown in Section 3.11.1 |
| Broadcast program number id | As shown in Section 3.10 (1) |
| Service id | As shown in Section 3.11.1 |
| Network id | As shown in Section 3. 10 (4) and (5) |
| Transport stream id | As shown in Section 3.10(4) and (5) |
| CA system id | As shown in Section 3.11.1 |
| System management id | As shown in Section 3.11.1 |
| Hierarchical coding id | As shown in Section 3.11.1 |
| Scrambling method id | As shown in Section 3.11.1 |

(Table No.22, Notification)

### 3.12.2 Transmission by MMTP packet

| Identifier | Configuration |
|---|---|
| Descriptor tag | As per Section 3.11.2 and ISO/IEC 23008-1 |
| Conditional access system id | As shown in Section 3.11.2 |
| Scramble system id | As shown in Section 3.11.2 |
| Service id | As shown in Section 3.11.2 |

(Table No.31, Notofication)

## 3.13 Structure and transmission procedure of conditional access related information

1. Among conditional access common information, ECM, whose scope of scrambling is the TS packet (excluding that for sending transmission control signal and conditional access related infromation) payload in the standard transmission system of digital broadcasting (hereinafter referred to as “standard system”) among standard television broadcasting and the like, shall contain program information, key information for de-scrambling, and control information instructing a forced switching of the receiver's de-scrambling function. The structure and transmission procedure of ECM shall be as shown in Table No. 1.
2. Among conditional access common information, ACI, whose scope of scrambling is limited to the section format signals in the standard system, shall contain program information, key information for de-scrambling, and control information which

instruct a forced switching of the receiver's de-scrambling function. ACI shall include a protocol number showing the ACI structure, an entity id to identify the entity who performs scrambling, and an encryption key id to identify the encryption key used for encrypting the information contained in ACI and be transmitted as modules defined in Paragraph 2, Notification No. 301 of the Ministry of Internal Affairs and Communications (Defining transmission procedure for video signal and audio signal by section format.

3. The conditional access individual information (hereinafter referred to as "EMM") shall contain domestic subscribers' specific contract information and key information for decrypting ECM. The structure and transmission procedure of EMM shall be as shown in Table No. 2.

Table No. 1: Structure and transmission procedure of ECM

| Header | ECM | CRC |
|---|---|---|
| 64 | 8 × N | 32 |

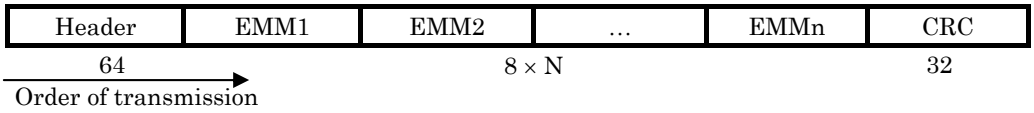
Order of transmission →

Notes:

1. Each number without a unit shall represent the number of bits for that field. The same shall apply hereinafter.
2. Numbers following "0x" shall represent hexadecimal numbers. The same shall apply hereinafter.
3. Each field shall be transmitted from MSB (most significant bit) to LSB (least significant bit). The same shall apply hereinafter.
4. ECM shall be transmitted in the extended section format given in Section 3.2.
5. The value of the "table id" within the header shall be 0x82 or 0x83, representing the ECM. The "table id extension" shall be a field to identify type of information contained in ECM.
6. ECM shall consist of information including those listed below. Howevev, note that for advanced BS broadcasting and advanced wide band CS digital broadcasting, Protocol number, Entity id, and Data and time may not be contained In addition note that for narrowband CS digital broadcasting Entity id may not be contained. Information other than the protocol number, entity id, and encryption key id can be encrypted using the key identified by the encryption key id.

| Items |
|---|
| Protocol number |
| Entity id |
| Encryption key id |
| De-scrambling key |
| |
| Date and time |

Table No. 2: Structure and transmission procedure of EMM




Notes:

1. EMM shall be transmitted in the extended section format shown in Section 3.2. Multiple EMMs may be multiplexed within that extent mentioned above.
2. The value of the "table id" within the header shall be 0x84 or 0x85, representing the EMM. The "table id extension" shall be a field used to identify type of information contained in EMM.
3. For digital terrestrial sound, digital terrestrial television, multimedia, BS digital, advanced BS dgital, wide band CS digital, or advanced CS digital broadcasting, the value of the "table id" within the header shall be 0x85 when information to send message information to the receiver (referred to as an "EMM message") is contained in EMM,. The value of the "table identifier extension" shall be 0x0000 and 0x0001 through 0xFFFF respectively when EMM message is transmitted to specific receivers and to all receivers notwithstanding Note.2..
4. EMM shall consist of EMM messages or information including those listed below. Note that decoder id number shall be id number and protocol number may not be contained for advanced BS digital broadcasting and advanced wide band CS digital broadcasting.

   In addition the following information can be encrypted:

   - Information other than the protocol number for broadcasting except for advanced BS digital broadcasting and advanced wide band CS digital broadcasting
   - Information other than id number for advanced BS digital broadcasting and advanced wide band CS digital broadcasting.

| Items |
|---|
| Decoder id |
| Protocol number |

(Notification)

# Annex A: Technical methods applied to digital broadcasting

Table A-1 and Table A-2 show technical methods applied to the digital broadcasting standard systems defined in the Ordinance (Ordinance of the Ministry of Internal Affairs and Communications No.87, 2011 or No.94, 2011)

Table A-1 Technical methods applied to standard systems (Coded signals transmission) (○: Applied)

| Digital broadcasting | | Digital terrestrial sound broadcasting | Digital terrestrial television broadcasting | V-Low multimedia broadcasting (Note 1) | V-High multimedia broadcasting (Note 1) | BS digital broadcasting | Advanced BS digital broadcasting | | Narrowband CS digital broadcasting | Advanced narrowband CS digital broadcasting | Wide band CS digital broadcasting | Advanced CS digital broadcasting | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | TS | TLV | | | | TS | TLV |
| Coded signals transmission | PES packet | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | |
| | Section | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | |
| | TS packet | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | |
| | IP packet | | | ○ | ○ | | | ○ | | | | | ○ |
| | HCfB | | | ○ (Note 2) | ○ (Note 2) | | | ○ | | | | | ○ |
| | ROHC | | | ○ (Note 2) | ○ (Note 2) | | | | | | | | |
| | ULE packet | | | ○ | ○ | | | | | | | | |
| | TLV packet | | | | | | | ○ | | | | | ○ |
| | MMTP packet | | | | | | | ○ | | | | | ○ |

(Note 1) Based on connected segment transmission system

(Note 2) Not specified in the Ministerial Ordinance and Notification

Table A-2 Technical methods applied to standard systems (Transmission control signal and Emergency alarm signal) (○: Applied)

| Digital broadcasting | | Digital terrestrial sound broadcasting | Digital terrestrial television broadcasting | V-Low multimedia broadcasting (Note 1) | V-High multimedia broadcasting (Note 1) | BS digital broadcasting | Advanced BS digital broadcasting | | Narrowband CS digital broadcasting | Advanced narrowband CS digital broadcasting | Wide band CS digital broadcasting | Advanced CS digital broadcasting | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | TS | TLV | | | | TS | TLV |
| Transmission control signal | PAT | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | |
| | PMT | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | |
| | CAT | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | |
| | NIT | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | |
| | TLV-NIT | | | | | | | ○ | | | | | ○ |
| | AMT | | | ○ | | | | ○ | | | | | ○ |
| | INT | | | | ○ | | | | | | | | |
| | PA message | | | | | | | ○ | | | | | ○ |
| | M2 section message | | | | | | | ○ | | | | | ○ |
| | CA message | | | | | | | ○ | | | | | ○ |
| Emergency alarm signal | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

(Note 1) Based on connected segment transmission system

VIDEO CODING, AUDIO CODING, AND
MULTIPLEXING SPECIFICATIONS FOR
DIGITAL BROADCASTING

ARIB STANDARD

ARIB STD-B32 VERSION 3.11-E1 (Fascicle3)
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