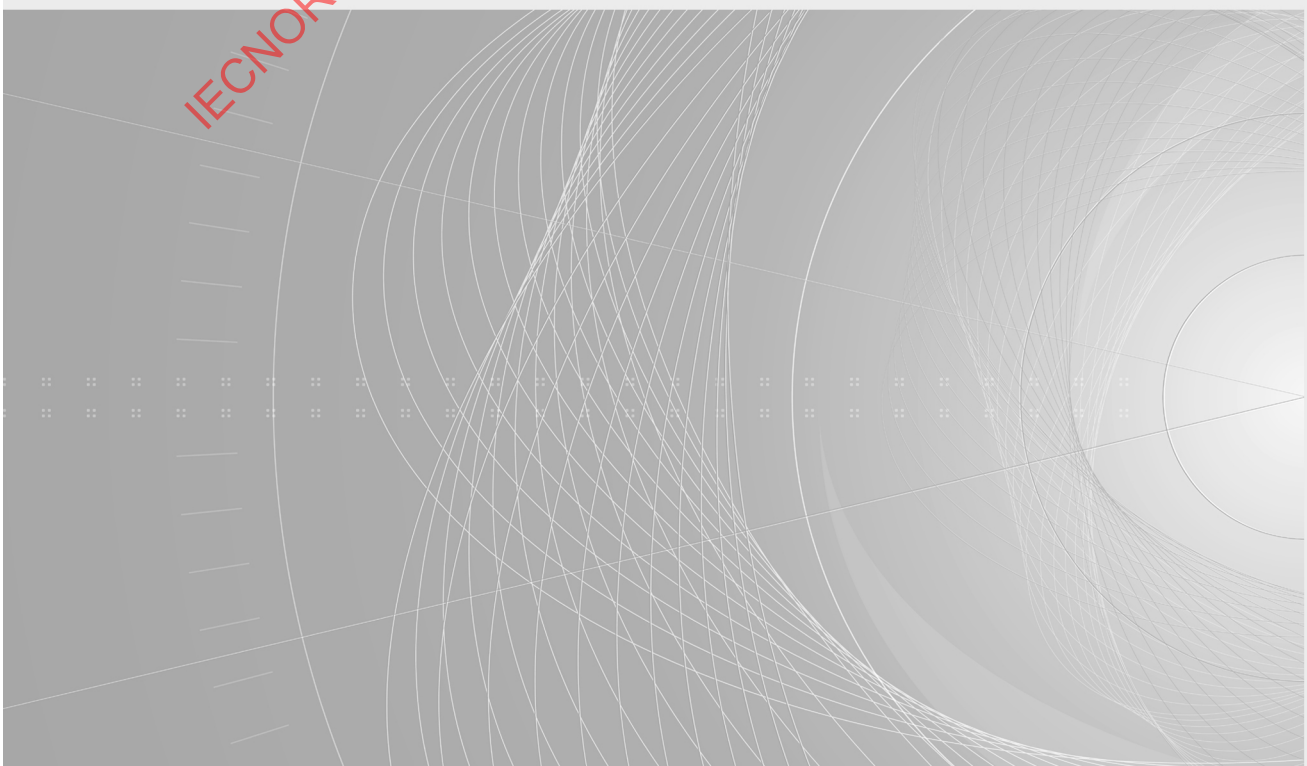
IEC 62360

Edition 2.0 2008-09

INTERNATIONAL STANDARD

Baseline specifications of satellite and terrestrial receivers for ISDB (Integrated Services Digital Broadcasting)



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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

BASELINE SPECIFICATIONS OF SATELLITE AND TERRESTRIAL RECEIVERS FOR ISDB (INTEGRATED SERVICES DIGITAL BROADCASTING)

FOREWORD

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International Standard IEC 62360 has been prepared by technical area 1: Terminals for audio, video and data services and content, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition cancels and replaces the first edition, published in 2004 and constitutes a technical revision.

The main changes with respect to the previous edition are listed below.

– The non-volatile memory size for terrestrial, BS and CS receiver has been specified.
– Desirable reception channel range of the receiver for VHF and MID band has been specified.
– DVI interface and HDMI interface have been specified as digital interface.
– Down mixing formula from multi-channel to 2-channel stereo has been changed.

The text of this standard is based on the following documents:

CDV	Report on voting
100/1323/CDV	100/1423/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

This International Standard is based on, and is the subset of ARIB[1] STD-B21 Version 4.5 which is established with regard to digital broadcasting receivers. It contains baseline specifications of receivers for satellite and terrestrial ISDB systems. It does not contain EPG (Electronic Program Guide), CA (Conditional Access), bi-directional communication function, data decoder function and high speed digital interface connector specification which were covered by the ARIB STD-B21.

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1 The Association of Radio Industries and Businesses establishes ARIB standards for the basic technical requirements such as various radio-equipment specifications for various radio signal utilization systems, with the participation of broadcasting-equipment manufacturers, broadcasting service providers, radio-equipment manufacturers, telecommunication companies, and their users.

ARIB standards are private standards established by compiling private and voluntary standards that have been developed to increase convenience for broadcasting-equipment manufacturers, broadcasting service providers, radio-equipment manufacturers, telecommunication companies, and their users, such as by ensuring the appropriate quality of and compatibility between broadcasting and radio facilities. These standards are intended to be used in conjunction with national technical standards established to ensure the efficient use of available frequencies and to avoid radio interference between users.

In order to ensure fairness and transparency in the establishment process, the standard was determined by consensus of all participants in our standard meeting, selected without bias from a broad range of interested parties – foreign and domestic, firms and individuals – including broadcasting-equipment manufacturers, broadcasting service providers, radio equipment manufacturers, common carriers, and their users.

BASELINE SPECIFICATIONS OF SATELLITE AND TERRESTRIAL RECEIVERS FOR ISDB (INTEGRATED SERVICES DIGITAL BROADCASTING)

1 Scope

This International Standard specifies the basic functions, ratings, and performance of receivers for the Integrated Services Digital Broadcasting (ISDB) system. It applies to: receivers for standard digital television broadcasting, high-definition television broadcasting, and radio broadcasting from satellite broadcasting stations in the frequency band of 11,7 GHz to 12,2 GHz (hereinafter referred to as “BS digital broadcasting”); receivers for standard digital television broadcasting with a bandwidth of 34,5 MHz from satellite broadcasting stations in the frequency band of 12,2 GHz to 12,75 GHz (hereinafter referred to as “broadband CS digital broadcasting”); and receivers for the standard digital television broadcasting and high-definition television broadcasting from terrestrial broadcasting stations (hereinafter referred to as “digital terrestrial television broadcasting”).

With regard to the receiver, it may be designed for receiving only one broadcast service from the above-mentioned digital broadcasting or for receiving multiple broadcast services. Various types of receivers for receiving digital terrestrial television broadcasts may be designed, that is, receivers intended for fixed, for mobile and for portable reception.

This standard defines the BS digital-broadcasting receiver, the dual-purpose receiver for BS digital broadcasting and broadband CS digital-broadcasting (hereinafter referred to as a “BS and broadband CS digital broadcasting dual-purpose receiver”), as well as the receiver for digital terrestrial television broadcasting using an outdoor fixed receiving antenna and with a large display. For a small-sized simple receiver, a vehicle-mounted receiver, a portable receiver, and the like, this standard should be applied as far as practical.

In this standard, the BS digital-broadcasting receiver and the BS and broadband CS digital-broadcasting dual-purpose receiver are generically described as digital satellite broadcasting receivers.

In addition, when it is necessary to distinguish between the BS digital-broadcasting receiver and the BS and broadband CS digital-broadcasting dual-purpose receiver, [BS] is additionally used to specify a BS digital-broadcasting receiver, and [BS • CS] is used likewise to specify a BS and broadband CS digital-broadcasting dual-purpose receiver.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 13818-1, *Information technology – Generic coding of moving pictures and associated audio information: Systems*

ISO/IEC 13818-2, *Information technology – Generic coding of moving pictures and associated audio information: Video*

ISO/IEC 13818-7, *Information technology – Generic coding of moving pictures and associated audio information – Part 7: Advanced Audio Coding (AAC)*

ITU-R BT.419-3, *Directivity and polarization discrimination of antennas in the reception of television broadcasting*

ITU-R BT.709, *Parameter values for the HDTV standards for production and international programme exchange*

ITU-R BT.1361, *Worldwide unified colorimetry and related characteristics of future television and imaging systems*

IETF Standard: RFC2046, *Multipurpose Internet Mail Extension (MIME) Part Two: Types*

3 Abbreviations and symbols

AAC	Advanced Audio Coding
ADTS	Audio Data Transport Stream
ARIB	Association of Radio Industries and Businesses
BS	Broadcast Satellite
bslbf	bit string, left bit first
CRC	Cyclic Redundancy Check
CS	Communication Satellite
DDB	Download Data Block Message
DDWG	Digital Display Working Group
DEMUX	de-Multiplex
DII	Download Info Indication Message
DIRD	Digital Integrated Receiver Decoder
DQPSK	Differential Quadrature Phase Shift Keying
DSM-CC	Digital Storage Media Command and Control
DTS	Display Time-Stamp
DVI	Digital Visual Interface
ECM	Entitlement Control Message
EPG	Electronic Program Guide
HDMI	High-Definition Multimedia Interface
HDTV	High Definition Television
IEC	International Electrotechnical Commission
IF	Intermediate Frequency
IRD	Integrated Receiver Decoder
ISDB	Integrated Services Digital Broadcasting
ISO	International Organization for Standardization
LC	Low Complexity
LFE	Low Frequency Enhancement
MJD	Modified Julian Date
MPEG	Moving Picture Experts Group
MSB	Most Significant Bit
OFDM	Orthogonal Frequency Division Multiplex
PCR	Program Clock Reference
PES	Packetized Elementary Stream

PID	Packet IDentifier
PMT	Program Map Table
PSI	Program System Information
PTS	Presentation Time-Stamp
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RS	Reed-Solomon
SDTT	Software Download Trigger Table
SDTV	Standard Definition Television
SHB	Super Hi-Band
SP	Scattered Pilot
TMCC	Transmission and Multiplexing Configuration Control
uimsbf	unsigned integer most significant bit first
16QAM	16-level Quadrature Amplitude Modulation
64QAM	64-level Quadrature Amplitude Modulation

4 Configuration of the receiver

4.1 General

The basic configuration of the “receiver” specified here is shown in Figure 1.

The basic configuration of the DIRD is shown in Figure 2.

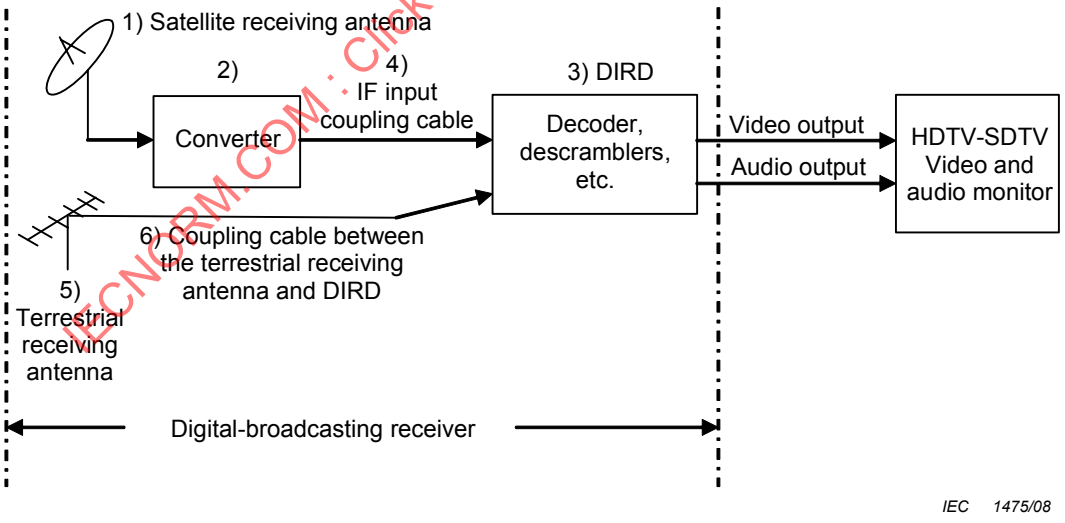

Figure 1 – Basic configuration of the receiver

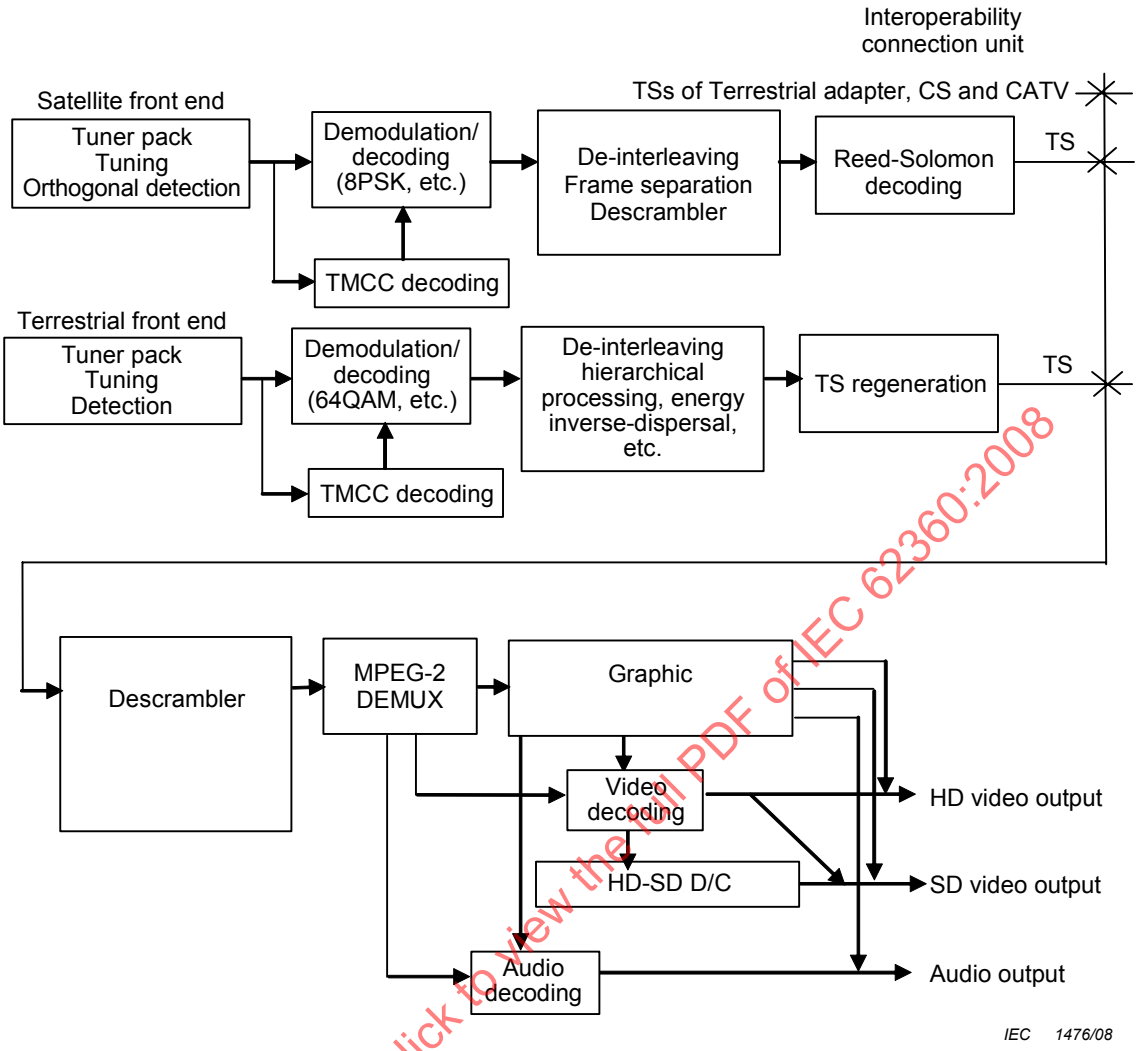

Figure 2 – Basic configuration of DIRD

4.2 Satellite receiver

The satellite receiver is composed of the following units:

- satellite receiving antenna;
- converter;
- DIRD;
- coupling cable between the converter and the DIRD.

However, the satellite receiving antenna (including a feed horn) may be integrated with the converter.

4.3 Terrestrial receiver

The terrestrial receiver is composed of the following units:

- terrestrial receiving antenna;
- DIRD;
- coupling cable between the terrestrial receiving antenna and the DIRD.

5 Ratings and specifications of the units of the digital satellite broadcasting receiver

5.1 General

In the descriptions in this clause, [BS] indicates the ratings and specifications only for BS digital broadcast receivers, and [BS • CS] indicates those of the BS and broadband CS digital broadcast dual-purpose receivers.

5.2 Satellite receiving antenna

Table 1 – Satellite receiving antenna rating

Item	Rating
Received frequency range	[BS] 11,710 23 GHz to 12,166 69 GHz [BS • CS] 11,710 23 GHz to 12,748 25 GHz
Receiving polarization	[BS] Right-hand circular [BS • CS] Right-hand/left-hand circular
Antenna diameter	The desired antenna diameter is not specified, as the necessary antenna diameter varies depending on the receiving conditions
Output structure	The output structure shall be composed of a WRJ-120-type wave-guide and a BRJ-120 flange, and shall be provided with waterproof packing. Not applicable to the all-in-one type with a converter

5.3 Converter

Table 2 – Converter rating

Item	Rating
Input structure	The input structure shall be composed of a WRJ-120-type wave-guide and a BRJ-120 flange, and shall be provided with waterproof packing. Not applicable to the all-in-one type with a converter
Range of input-signal level	For one channel: BS band: –90 dB(mW) to –70 dB(mW) CS band: –94 dB(mW) to –70 dB(mW)
Overall gain	BS band: 52 dB ± 4 dB CS band: 52 dB ± 6 dB
Intermediate frequency	BS band: 1 032,23 MHz to 1 488,69 MHz CS band: 1 575,75 MHz to 2 070,25 MHz
First local frequency	10,678 GHz
Output impedance	75 Ω
Output structure	Waterproof receptacle equivalent to a high-frequency coaxial C15-type connector
Power supply	[BS] DC +15 V +10 % –12 %, 4 W or less [BS • CS] Right-hand circular, DC 13,5 V to 16,5 V (15 V), 4 W or less Left-hand circular, DC 9,5 V to 12,0 V (11 V), 3 W or less

5.4 Coupling cable

Table 3 – Coupling cable rating

Item	Rating
Type	Equivalent to S-4CFB (see JIS C3502, Bibliography) or upper grade
Cable length	The assumed maximum length is 30 m. Loss generated in the cable in conjunction with the achievement of broadband performance is compensated for by inserting a booster between the converter and DIRD
Connection connector	Converter side: high-frequency coaxial C15-type waterproof plug DIRD side: F-type plug

5.5 Specifications of DIRD

5.5.1 General

DIRD shall satisfy the following specifications.

5.5.2 IF input

The input-terminal structure is equivalent to a high-frequency coaxial C15-type connector (female); its main characteristics are:

- Impedance: 75 Ω
- Received frequency: [BS] 1 032 MHz to 1 489 MHz
  [BS • CS] 1 032 MHz to 2 071 MHz
- Input-signal level: –61 dB(mW) to –28 dB(mW)

5.5.3 Intermediate frequency

Intermediate frequency: either 402,78 MHz or 479,5 MHz; otherwise, direct conversion shall be performed. However, as the intermediate frequencies lie in the frequency band for terrestrial television UHF broadcasting, it is necessary to consider possible interference.

5.5.4 Bandwidth of the intermediate frequency

The bandwidth shall be within an occupied bandwidth of 34,5 MHz.

5.5.5 Second local oscillator frequency

The second local oscillator frequency shall be above the received frequency.

5.5.6 Front-end signal processing

The front-end signal processing requires the following procedures.

- Channel selection: A channel shall be selected from the IF range, in accordance with the channel-selection control signal.
- Demodulation: The modulated signal is demodulated. The necessary timings for a super frame, a frame, and a packet are generated through clock regeneration, clock distribution, and synchronization acquisition. Burst signals for carrier synchronization shall be eliminated.
- Waveform shaping: Waveforms with a roll-off factor of 0,35 and a raised cosine characteristic shall be distributed via a

transmission/reception route. The sending side shall conduct aperture compensation using x/sin(x).

- Error-correction (inner code): Trellis/Viterbi decoding shall be carried out.
- TMCC decoding: TMCC is extracted from the decoded signal and decoded.
- Frame reconstruction: A frame structure shall be reconstructed from the decoded signal.
- Energy inverse-dispersal: The inverse-dispersal is performed with the 15th M-sequence PN signal.
- Error-correction (outer code): Shortened Reed-Solomon code (204, 188) is decoded.

5.5.7 Transport stream processing

A TS packet is selected in accordance with a TS selection signal from a TS packet stream that is frame-structured (made up of 48 slots) and is output.

It is mandatory for the DIRD to have a section filtering function that supports the following three section formats for data stipulated by ISO/IEC13818-1:

a) one section is composed of one TS packet;

b) multiple sections are included in one TS packet (however, the maximum number of sections included in one TS packet is limited to 10.);

c) one section is composed of two or more TS packets.

5.5.8 Memories

5.5.8.1 Memory for storage of the DIRD program

The receiver shall have non-volatile memory for the storage of program codes.

5.5.8.2 Memory for storage data common to all receivers

As a non-volatile memory area for data common to all receivers, the BS digital broadcast receiver shall have a memory area of 10 kB and the BS and broadband CS digital broadcast dual-purpose receivers shall have memory areas of 30 kB, the terrestrial, BS and broadband CS digital-compatible receiver shall have a memory area of 40 kB, for a genre table, a program characteristic table, and the reserved words, etc. Various common use receivers shall be able to share the memory for the genre table, the reserved word table and the like that are commonly used in all transmission media. In addition, each receiver shall have a data area for the storage of logo data. In which logotype among the six types the logo data is to be stored depends on the implementation of the receiver. The required memory capacity in each logotype is shown in Table 4.

Table 4 – Size of logo data

(Three hundred types of logo data and a thousand types of services are assumed for the BS and the broadband CS, respectively.)

Logo data		Size
HD large	(1/2 compression)	354 kB
HD small	(3/4 compression)	300 kB
SD4:3 large	(1/2 compression)	397 kB
SD4:3 small	(3/4 compression)	267 kB
SD16:9 large	(1/2 compression)	300 kB
SD16:9 small	(3/4 compression)	202 kB

5.5.9 Video decoding and its output

The video output is described in Clause 7.

5.5.10 Audio decoding and its output

The audio output is described in Clause 7.

5.5.11 External interfaces

The following units/items are external interfaces.

a) IF input
   One IF input terminal shall be provided.
b) Video output (except for the integrated TV)
   This is described in Clause 7.
c) Audio output (except for the integrated TV)
   This is described in Clause 7.

5.5.12 Remote controller and channel access

5.5.12.1 General

No requirements are made for the shape or keys of the remote controller, the channel access method, or the like. However, commonality of the keys used for basic functions (power supply/ channel access/system setting, etc.) should be provided wherever possible, in order to increase convenience for the user.

5.5.12.2 Recommended keys

The following keys should be provided to enable the user to enjoy digital broadcast services:

- power-supply key (key that the user operates to switch between the on- and standby-mode);
- ten keys, a decision key, channel up-and-down keys, and a menu key;
- keys for “move upward,” “move downward,” “move rightward,” and “move leftward” (A joystick or the like may replace these keys.).

For the BS and broadband CS dual-purpose receivers, the following key should be provided in addition to the above-mentioned keys:

- network change key.

5.5.12.3 Channel access

The channel access method is not specified, but is left to those involved in product planning. However, a service ID, a channel name, and a logo are designated by the broadcast service provider. The method of accessing a channel, that is, whether it is done by entering the service ID or by operating the ten keys, a channel addressing key, or the like, is left for the product planning.

6 Ratings and specifications of the receiving units for the digital terrestrial television broadcasting

6.1 Receiving antenna

Table 5 – Ratings of the receiving antenna

Item	Rating
Range of received frequency	UHF channel 13 to 62 (470 MHz to 770 MHz)
Received polarized wave	Horizontal or vertical
Antenna gain	Antenna gain is not specified, as it varies depending on the reception conditions [a]
Directional pattern	A directional pattern is not specified, as it varies depending on the reception conditions. [b]
[a] When the antenna is permanently installed outdoors (stationary reception), the antenna gain should be equivalent to or greater than that of a 14-element Yagi antenna (7 dB/UHF channel 13).	
[b] When the antenna is permanently installed outdoors, installation should be according to ITU-R BT.419-3 (see Figure 3).	

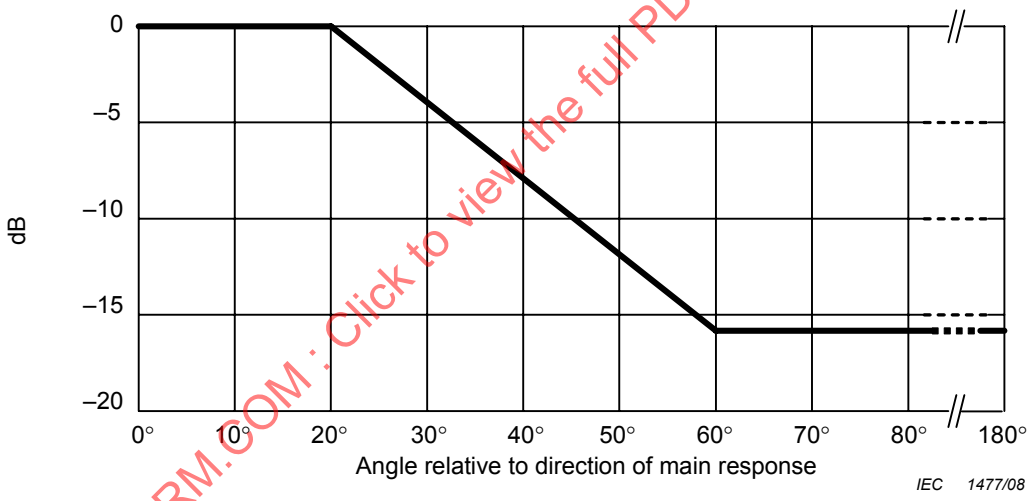

Figure 3 – Directional pattern of the antenna (excerpt from ITU-R recommendation BT.419-3)

6.2 Specifications of the DIRD

6.2.1 General

The DIRD shall satisfy the following specifications.

6.2.2 Input

The main input characteristics are:

- Impedance: 75 Ω
- Received frequency: UHF channel 13 to 62
- Centre frequency: 473 + 1/7 MHz (channel 13), 479 + 1/7 MHz (channel 14), and 767 + 1/7 MHz (channel 62)

For a stationary digital terrestrial television broadcasting receiver to serve as community receiving equipment, the reception channel range should include the SHB (Super Hi-Band) band (channel C23 to C63) in addition to the UHF band. It is also desirable that the reception channel range of the receiver includes the VHF band (channel 1 to channel 12) and the MID band (channel C13 to channel C22).

6.2.3 First intermediate frequency

The first intermediate frequency characteristics are:

- Centre frequency: 57 MHz
- Local oscillator frequency: Above the received frequency

6.2.4 Synchronization range of the received frequency

Synchronization range of the received frequency: ±30 kHz or wider

6.2.5 Synchronization range of the received clock

Synchronization range of the received clock: $\pm 20 \times 10^{-6}$ or wider

6.2.6 Characteristics of the tuning unit

A tuning unit for receiving 13 segments and a tuning unit for receiving 1 segment located in the central part of the 13 segments shall satisfy the following specifications:

- Minimum input level: –75 dB(mW) or lower (target value)
- Maximum input level: –20 dB(mW) or higher.

However, when the input level in a one-segment receiver is measured in terms of electric power per segment, the level shall be reduced by a factor equivalent to the bandwidth (i.e. 1/13, or –11 dB).

Table 6 – Protection ratios of the 13-segment receiver

Undesired signal	Item	Protection ratio
Analogue television	From the co-channel	18 dB or less
	From the lower adjacent channel (undesired signal on the lower side)	–33 dB or less
	From the upper adjacent channel (undesired signal on the upper side)	–35 dB or less
Digital television	From the co-channel	24 dB or less
	From the lower adjacent channel (undesired signal on the lower side)	–26 dB or less
	From the upper adjacent channel (undesired signal on the upper side)	–29 dB or less
NOTE The transmission parameters used for the measurement shall be as follows: Mode 3, guard interval ratio of 1/8, no time interleaving, modulation of 64 QAM, and an inner-code of 7/8.		

The one-segment receiver shall satisfy the above specifications. An improvement in performance can be expected due to the fact that the segment in the centre of 13 segments is allocated apart from the video and audio carriers of the analogue television signal for the co-channel interference. Further, in the interference from adjacent channels, an improvement in performance can be expected due to the separation of frequency locations.

6.2.7 Front-end signal processing

6.2.7.1 Signal processing in the 13-segment receiver

The signal processing in the 13-segment receiver requires the following procedures.

- Receiver block diagram

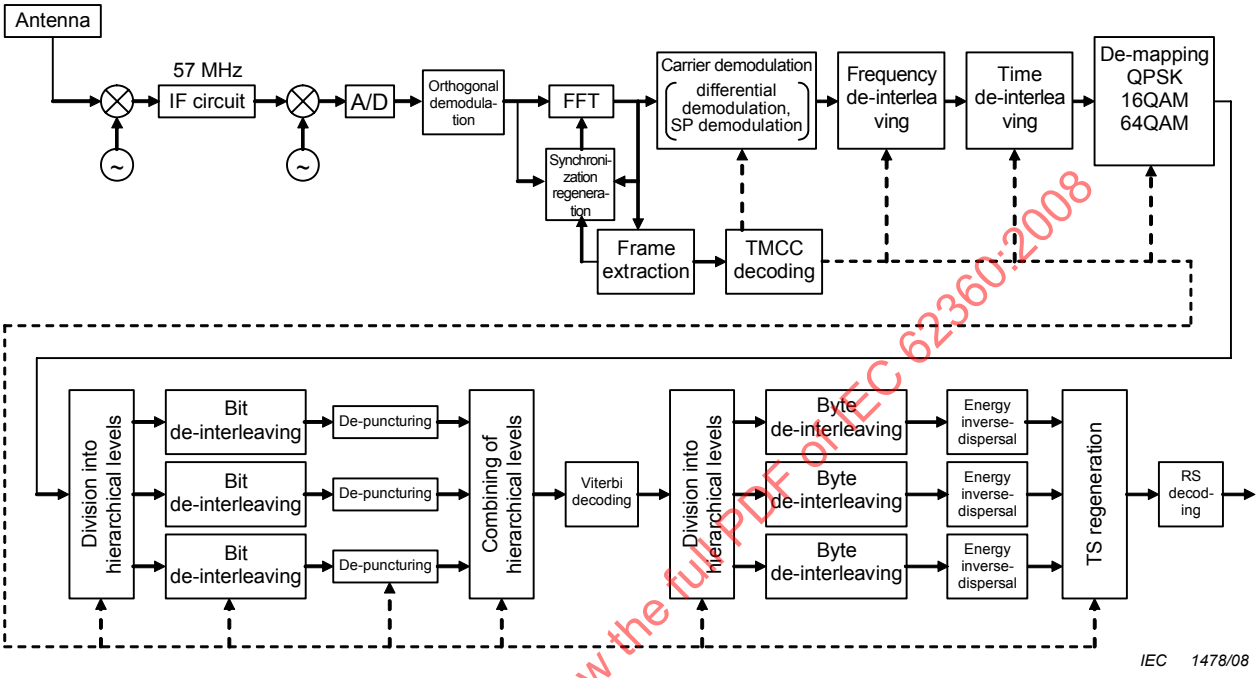

Figure 4 – Receiver block diagram of the 13-segment receiver

- Channel selection: A channel of UHF television broadcasting is selected.
- Synchronization regeneration: The signal in a selected channel is orthogonally demodulated. OFDM symbol synchronization and an FFT sample frequency are regenerated through synchronization regeneration in accordance with the mode and the guard interval length. The mode and the guard interval length can be judged with the correlation of the guard interval period of the OFDM signal.
- FFT: FFT operation is executed for a period corresponding to an effective OFDM symbol duration. Due to the multipath reception, FFT processing shall be performed for a suitable period.
- Frame extraction: OFDM frame synchronization signal is extracted from the TMCC signal.
- TMCC decoding: TMCC information is extracted from the TMCC signal and used to perform various controls.
- Carrier demodulation: In accordance with the TMCC information, differential demodulation for DQPSK (Differential Quadrature Phase Shift Keying), synchronous demodulation through the use of scattered pilot (SP) for QPSK (Quadrature Phase Shift Keying), 16QAM, or 64QAM is performed, to detect amplitude and phase information.
- De-interleaving: Frequency and time de-interleaving is performed.

- De-mapping: De-mapping of QPSK, 16QAM, or 64QAM is executed in accordance with the amplitude and phase information and bit information is extracted.
- Division into hierarchical levels: When TMCC information indicates hierarchical transmission, the signal is divided into hierarchical levels. Note that the division is performed of 204 bytes between the byte next to the synchronization byte (47 H) of the TS packet and the synchronization byte of the next TS packet.
- Bit de-interleaving: Bit de-interleaving is executed in each level of hierarchy.
- De-puncturing: Bit-interpolation is executed for each level of hierarchy, in accordance with the convolution coding rate indicated in the TMCC information.
- Viterbi decoding: Viterbi decoding with a coding rate of 1/2 is executed. In Viterbi decoding, a soft-decision algorithm is employed to improve performance. Further, to avoid error propagation due to the convolutional code, termination processing is performed based on the fact that the synchronization byte (47 H) of the TS packet is already known.
- Byte de-interleaving: De-interleaving is executed on a byte-by-byte basis.
- Energy inverse-dispersal: Inverse dispersal is performed by means of exclusive ORing with the 15th M-sequence PN signal on a bit-by-bit basis, except for the synchronization byte of the TS packet. Note that during the period of the synchronization byte, a shift register is in operation, and initialized at every OFDM frame.
- TS regeneration: Processing for regeneration of a transport stream is performed. The order of the TS packets and the temporal location of the PCR shall be the same as on the transmitting side.
- RS decoding: Shortened Reed-Solomon code RS(204, 188) is decoded. During RS decoding, if an error is detected following a correction, transport_error_indicator, which is positioned at the 9th bit of the transport stream packet (specifically, MSB in the second byte), is set to “1.”

6.2.7.2 Signal processing in the one-segment receiver

In digital terrestrial television broadcasting, only one segment in the central part (segment index of 0) of the 13 segments can be transmitted as a hierarchical level of partial-reception. Such a signal can be received by the 13-segment receiver described in 6.2.7.1. In order to reduce power consumption, only one segment can be received by reducing the size of FFT with the lower clock rate.

Receiver block diagram

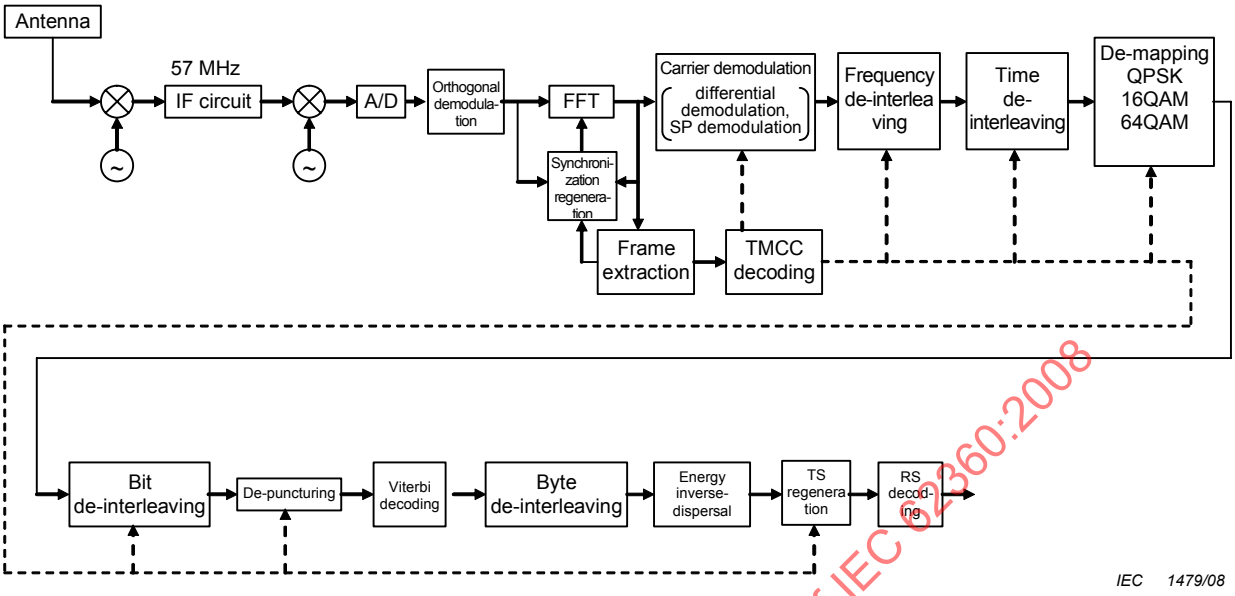

Figure 5 – Receiver block diagram of the one-segment receiver

- Channel selection: A channel of UHF television broadcasting is selected. As the partially received segment is always selected at the centre of the 13 segments, it can be selected by channel designation as in 6.2.7.1.
- Synchronization regeneration: As in 6.2.7.1
- FFT: As in 6.2.7.1
  Note that it is preferable to set the number of FFT size as 256 points (Mode 1), 512 points (Mode 2), or 1 024 points (Mode 3).
- Frame extraction: As in 6.2.7.1
- TMCC decoding: As in 6.2.7.1
- Carrier demodulation: As in 6.2.7.1
  Note that, as there is only one level in the hierarchy in the case of one-segment reception, it is not necessary to demodulate simultaneously for plural levels described in the 13-segment receiver.
- De-interleaving: As in 6.2.7.1
- De-mapping: As in 6.2.7.1
- Bit de-interleaving: As in 6.2.7.1
- De-puncturing: As in 6.2.7.1
- Viterbi decoding: As in 6.2.7.1
- Byte de-interleaving: As in 6.2.7.1
- Energy inverse-dispersal: As in 6.2.7.1
- TS regeneration: As in 6.2.7.1

- RS decoding: As in 6.2.7.1

6.2.8 Transport stream processing

It is mandatory that the DIRD has a section filtering function to support the following three types of section formats for data specified in ISO/IEC13818-1:

a) each section composed of one TS packet;

b) multiple sections are included in one TS packet (However, the maximum number of sections included in one TS packet is limited to 10.);

c) each section composed of two or more TS packets.

6.2.9 Memories

6.2.9.1 Memory for storing DIRD programs

The receiver shall have non-volatile memory for storing the program codes.

6.2.9.2 Memory for storing data common to all receivers

As a non-volatile memory area for data common to all receivers, the terrestrial broadcast receiver shall contain 10 kB of storage area and the terrestrial, BS and broadband CS-compatible receiver shall have 40 kB of storage area, for the genre table, the program characteristic table, reserved words, and the like. The common use receivers shall be able to share the memory for the genre table, the reserved word table and the like that are commonly used in all transmission media. In which logotype among the six types the logo data is to be stored depends on the implementation of the receiver. The required memory capacity to store each logotype is shown in Table 7. For dual-purpose receivers for satellite and terrestrial broadcasting, the required memory capacity shall be increased by the value shown in Table 4 in the previous clause. Note that storage area used for frequency list data and alteration information data shall be provided.

Table 7 – Size of logo data

(One hundred and eighty types of logo data and four hundred and eighty types of services are assumed for the terrestrial digital broadcast)

Logo data		Size
HD large	(1/2 compression)	211 kB
HD small	(3/4 compression)	179 kB
SD4:3 large	(1/2 compression)	237 kB
SD4:3 small	(3/4 compression)	159 kB
SD16:9 large	(1/2 compression)	179 kB
SD16:9 small	(3/4 compression)	120 kB

6.2.10 Video decoding and its output

The video decoding and its output are described in Clause 7.

6.2.11 Audio decoding and its output

The audio decoding and its output are described in Clause 7.

6.2.12 External interfaces

a) Antenna input

One antenna input terminal shall be provided.

b) Video output (except for the integrated digital TV)

The video output is described in Clause 7.

c) Audio output (except for the integrated digital TV)

The audio output is described in Clause 7.

6.2.13 Remote controller and channel access

6.2.13.1 General

No requirements are made for the shape of the remote controller, the keys, the channel access method, or the like. However, commonality of the keys used for basic functions (power supply/channel access/system setting, etc.) should be provided wherever possible, in order to increase convenience for the user.

6.2.13.2 Recommended keys

The following keys should be provided to enable the user to enjoy digital broadcast services:

- power-supply key (key that the user operates to switch between the on- and standby-mode);
- ten keys, a decision key, channel up-and-down keys, and a menu key;
- keys for “move upwards,” “move downwards,” “move right,” and “move left” (A joystick or the like may replace these keys.);
- the following key should be provided in addition to the above-mentioned keys for the receiver that can also receive Digital Satellite Broadcasting;
- network change key.

6.2.13.3 Channel access

The channel access method is not specified, but is left to those involved in product planning. However, a service ID, a channel name, and a logo are designated by the broadcast service provider. The method of accessing a channel, that is, whether it is done by entering the service ID or by operating the 10 keys, a channel addressing key, or the like, is left to those involved in product planning.

6.3 Analogue broadcast receiving function

It is assumed that, for terrestrial television broadcasting, a period of approximately eight years may be required from the introduction of digitalization until its completion. There may be cases in which a viewer having purchased the digital receiver will move to an area in which digitalization has not yet been introduced. Therefore, the integrated digital TVs, to be introduced on the market prior to the completion of digitalization, should have a receiving function for analogue broadcasting.

7 Decoding process of video and audio, and those output signals

7.1 Video decoding process and output signals

7.1.1 Video decoding process

The receiver shall be capable of decoding an MPEG-2 (ISO/IEC13818-2) stream that complies with the constrained coding parameters given in Table 10 (a case in which the display-screen area is not specified by sequence_display_extension) and Table 11 (a case in which the display-screen area is specified by sequence_display_extension). Timing of video and audio decoding and output shall be controlled by the PTS and DTS in PES header, and the control of decoding using vbv_delay shall not be performed. Table 8 shows the meanings of the code

indexes of the MPEG-2 coding parameters in Tables 10 and 11. The positions of active lines of the video signal are as given in Table 9.

Table 8 – Meaning of the code index of the MPEG-2 coding parameters in Tables 10 and 11

Code index	Meaning
aspect_ratio_information	2 = 4:3 display 3 = 16:9 display
frame_rate_code	4 = 30/1,001 Hz 7 = 60/1,001 Hz
progressive_sequence	0 = Interlaced scanning scheme 1 = Progressive scanning scheme
color_primaries	1 = Rec. ITU-R BT.709 (BT.1361)
transfer_characteristics	1 = Rec. ITU-R BT.709 (BT.1361)
matrix_coefficients	1 = Rec. ITU-R BT.709 (BT.1361)

Table 9 – Positions of active lines

Video output-signal format	Number of lines to be decoded	Active lines
525i	480	Lines 23 to 262 and lines 286 to 525
525p	480	Lines 45 to 524
750p	720	Lines 26 to 745
1125i	1080	Lines 21 to 560 and lines 584 to 1 123

Table 10 – Constraints of coding parameters 1 (case in which the display screen area is not specified by sequence_display_extension)

Constraints of sequence_header				Constraints of sequence_ extension	Constraints conditions of sequence_display_extension [d]			Other parameters [f]
vertical_ size_value	horizontal_ size_value	aspect_ratio_ information	frame_ rate_code	progressive_ sequence	color_ primaries	transfer_ characteristics	matrix_ coefficients	
1 080 [a]	1 920, 1 440	3	4 [c]	0	1 [e]	1 [e]	1 [e]	Value specified for MP@HL
720	1 280	3	7 [c]	1				
480	720	3	7 [c]	1				Value specified for MP@H14L
480	720, 544, 480 [b]	3	4 [c]	0				Value specified for MP@HL
		2						

[a] In MPEG-2 coding (ISO/IEC 13818-2), 1 088 lines are actually coded. Eight lines of fictional video data (dummy data) are added under the valid lines by the encoder, and the coding process is made as video data of actually 1 088 lines. A video signal with 1 080 lines of valid line excluding dummy data, which is the 1 080th line from the top of the 1 088 lines of video data, is output at the decoder.

[b] When horizontal_size_value is 544 samples, center position is adjusted with 720 samples and constructed of 544 samples adding 2 samples of fictional video data (black base) on both sides of the actual video data 540 samples.

[c] In the case of film material, encoding by controlling flags of repeat_first_field, top_field_first, and progressive_frame without changing frame_rate_code is also enabled.

[d] When sequence_display_extension is not transmitted, the receiver should process assuming that the values of display_vertical_size and display_horizontal_size are equal to those of vertical_size_value and horizontal_size_value in sequence_header. However, when horizontal_size_value is 544 samples, a region of 540 samples, which is formed by eliminating 2 samples from both sides of the 544 samples, is displayed in the same manner as when display_horizontal_size is transmitted as 540 samples.

[e] When sequence_display_extension is not transmitted, the receiver should process assuming that the values of color_primaries, transfer_characteristics, and matrix_coefficients are each equal to "1."

[f] A value specified in (ISO/IEC13818-2) adapted to each level of Main Profile. Bit_rate_value should be not more than the maximum transmittable capacity in the BS digital broadcasting for MP@HL and MP@H14L, and 15 Mbps or less for MP@ML. It is operated on a variable bit rate basis, and vbv_delay should always be set to 0xFFFF.

Table 11 – Constraints of coding parameters 2 (case in which the display-screen area is specified by sequence_display_extension)

Constraints of sequence_header				Constraints of sequence_ extension	Constraints of sequence_display_extension					Other parameters [g]
vertical_ size_value	horizontal_ size_value	aspect_ratio_ information[c]	frame_ rate_code[d]	progressive_ sequence	display_ vertical_ size	display_ horizontal_ size [e]	color_ primaries	transfer_ characteristics	matrix_ coefficients	
1 080 [a]	1 920, 1 440	3	4	0	1 080	1 920,1 440	1 [f]	1 [f]	1 [f]	Value specified for MP@HL
	1 920	2				1 440				
	1 440					1 080				
720	1 280	3	7	1	720	1 280				
		2				960				
480	720	3	7	1	480	720				Value specified for MP@H14L
		2				540				
480	720, 544, 480[b]	3	4	0	480	720, 540, 480				Value specified for MP@ML
	720	2				540				
	720, 544, 480[b]	2			720, 540, 480					
		3			360					

[a] In MPEG-2 coding (ISO/IEC13818-2), 1 088 lines are actually coded. Eight lines of fictional video data (dummy data) are added under the valid lines by the encoder, and the coding process is made as image data of actually 1 088 lines. A video signal with 1080 lines of valid line excluding dummy data, which is the 1080th line from the top of the 1088 lines of valid data is output at the decoder.

[b] When horizontal_size_value is 544 samples, center position is adjusted with 720 samples and constructed of 544 samples adding 2 samples of fictional video data (black base) on both sides of the actual video data 540 samples.

[c] When sequence_display_extension is transmitted, aspect_ratio_information indicates the aspect ratio of a region specified by display_vertical_size and display_horizontal_size, which is specified in the MPEG-2 standard.

[d] In the case of a film material, encoding by controlling flags of repeat_first_field, top_field_first, and progressive_frame without changing frame_rate_code is also enabled.

[e] When there are multiple numbers in one field of display_horizontal_size, the same numbers as those of horizontal_size_value can be selected (however, when horizontal_size_value is 544, only 540 can be selected).

[f] When neither color_primaries, transfer characteristics, nor matrix_coefficients in the sequence_display_extension is transmitted, the receiver should process assuming that each value is equal to "1."

[g] A value specified in (ISO/IEC13818-2) is adapted to each level of the main profile. Bit_rate_value should be not more than the maximum transmittable capacity in BS digital broadcasting in MP@HL and MP@H14L, and 15 Mbps or less for MP@ML. It is operated on a variable bit rate basis, and vbv_delay should always be set to 0xFFFF.

7.1.2 Video output signals

7.1.2.1 Video output for display

The receiver shall output the video signal for display in one or more formats selected from among 1125i, 750p, 525p, and 525i signals, regardless of the settings of the video coding parameter values of a stream to be decoded.

The receiver shall have a function for changing the video-signal format in accordance with the video-signal formats that can be handled by a display to be connected in a switchable manner. When the format is 525i, the receiver shall have a further function for changing the aspect ratio in accordance with the aspect ratio (4:3 or 16:9) of the display to be connected.

The relationship between the parameter values of sequence_display_extension of the stream and the video-signal output shall be specified in Table 12 for the 525i signal, in Table 13 for the 1125i or 525p signal, in Table 14 for the 750p signal. However, this requirement shall not apply to cases in which the data broadcasting and EPG are displayed.

7.1.2.2 Video output for recording

The receiver shall output the NTSC video signal (composite video signal and Y/C video signal) as a video signal for recording simultaneously with the output of the video signal for display. The video output for recording should have followed the processing shown in Table 12, in accordance with the parameter values of sequence_display_extension of the stream and the aspect ratio (4:3 or 16:9) of the display. Note that the data broadcasting and the EPG need not be included in the video output for recording.

Table 12 – Relationship between the parameter values of sequence_display_extension of a stream and video-signal output 1

Reference drawing[d]	Parameter values of sequence_header			Parameter values of sequence_ extension	Parameter values of sequence_display_ extension		Output video signal in 525i format to a 4:3 monitor (720 pixels horizontally)			Output video signal in 525i format to a 16:9 monitor (720 pixels horizontally)		
	vertical_ size_value (*A*)	horizontal_ size_value (*B*)	aspect_ratio _information[a]	progressive_ sequence [b]	display_ vertical_ size (*C*)	display_ horizontal_ size (*D*)	Vertical scaling ratio (L: line)	Horizontal scaling ratio	Re-mark[c]	Vertical scaling ratio	Horizontal scaling ratio (S: sample)	Re-mark[c]
1)	1 080	1 920	3	0	1 080	1 920	*A* × (1/3) + 120L black	*B* × (3/8)	1	*A* × (4/9)	*B* × (3/8)	2
		1 440				1 440		*B* × (1/2)			*B* × (1/2)	
	720	1 280	3	1	720	1 280	*A* × (1/2) + 120L black	*B* × (9/16)		*A* × (2/3)	*B* × (9/16)	
	480	720	3	1	480	720	*A* × (3/4) + 120L black	*B* × 1		*A* × 1	*B* × 1	
	480	720	3	0	480	720	*A* × (3/4) + 120L black	*B* × 1		*A* × 1	*B* × 1	
		544				540		*D* × (4/3)			*D* × (4/3)	
		480				480		*B* × (3/2)			*B* × (3/2)	
2)	1 080	1 920	2	0	1 080	1 440	*A* × (4/9)	*D* × (1/2)	3	*A* × (4/9)	*B* × (3/8)	4
		1 440				1 080		*D* × (2/3)			*B* × (1/2)	
	720	1 280	2	1	720	960	*A* × (2/3)	*D* × (3/4)		*A* × (2/3)	*B* × (9/16)	
	480	720	2	1	480	540	*A* × 1	*D* × (4/3)		*A* × 1	*B* × 1	
	480	720	2	0	480	540	*A* × 1	*D* × (4/3)		*A* × 1	*B* × 1	
3)	480	720	2	0	480	720	*A* × 1	*B* × 1	5	*A* × 1	*B* × (3/4) + 180S black or *B* × 1	6
		544				540		*D* × (4/3)			*D* × 1 + 180S black or *D* × (4/3)	
		480				480		*B* × (3/2)			*B* × (9/8) + 180S black or *B* × (3/2)	
4)	480	720	3	0	360	720	*A* × 1	*B* × 1	7	*C* × (4/3) or *A* × 1	*B* × 1	8
		544				540		*D* × (4/3)			*D* × (4/3)	
		480				480		*B* × (3/2)			*B* × (3/2)	

NOTE 1 When sequence_display_extension exists, aspect ratio information represents the aspect ratio of the region specified by display_vertical_size(*C*) and display_horizontal_size(*D*), which is defined in the MPEG standard.

NOTE 2 When sequence_display_extension is not transmitted, the receiver should process assuming that the values of display_vertical_size(*C*) and display_horizontal_size(*D*) are equal to those of vertical_size_value(*A*) and horizontal_size_value(*B*) in sequence_header. However, when *B* is 544, signal should be processed so that 540 samples obtained by removing two samples from each side of the 544 samples are displayed in the same manner as when *D* is 540. When *D* happens to be transmitted as 544, the receiver should conduct the processing in the same manner as when *D* is not transmitted.

NOTE 3 The functions of the receiver may be limited based on the assumption that processing is conducted using frame_center_horizontal_offset(FCHO) and frame_center_vertical_offset(FCVO) in picture_display_extension normally being zero. When picture_display_extension is not transmitted, FCHO and FCVO should be interpreted as zero.

NOTE 4 The scaling ratio of the 4:3 monitor stipulated here should not apply to S1 (type with a 4:3 monitor with a vertical deflection amplitude that can be altered)-compliant apparatuses.

[a] "2" indicates "4:3 display". "3" indicates "16:9 display".

[b] "0" indicates "interlaced scanning scheme". "1" indicates progressive scanning scheme".

[c] Remark list

- 1: An image transmitted in the squeeze format is displayed in a letterbox format on a 4:3 monitor. In the vertical direction, *A* x scaling ratio = 360, and 120 lines of black (zero signal) are added (see case 1 of Figure 6).
- 2: An image transmitted in the squeeze format is displayed in full-screen mode on a 16:9 525i monitor (see case 1 of Figure 6).
- 3: An image, 720 effective samples, is generated from the image data in a region specified by *D*, and displayed in full-screen mode on a 4:3 monitor (see case 2 of Figure 6).
- 4: An image transmitted in the squeeze format is displayed on a 16:9 525i monitor. In the case of a fake 16:9 video made up of a transmitted active image in a 4:3 aspect ratio with black regions attached to both sides thereof, 720 valid samples consist of [90 black level samples] + [540 active samples] + [90 black level samples] (see case 2 of Figure 6).
- 5: An image transmitted in a 4:3 aspect ratio is displayed in full-screen mode on a 4:3 monitor (see case 3 of Figure 6).
- 6: An image transmitted in a 4:3 aspect ratio is displayed on a 16:9 525i monitor. Video data is displayed using signals in the squeeze format that consist of [90 black level samples] + [540 active samples] + [190 black level samples], making *B*(*D*) x scaling ratio = 540; and level video data can be displayed using signals in the same format as that for the 4:3 monitor by means of the deflection system of the monitor side (see case 3 of Figure 6).
- 7: An image transmitted in the letterbox format is displayed in the letterbox format on the 4:3 monitor (see case 4 of Figure 6).
- 8: An image transmitted in the letterbox format, which contains the 16:9 active image with 360 valid lines is converted into a squeeze format with 480 valid lines and displayed in full-screen mode on the 16:9 monitor using a signal in the squeeze format; and the representation can be performed using a signal in the same format as that of the 4:3 monitor by means of the deflection system on the monitor side (see case 4 of Figure 6).

[d] See Figure 6 as a reference drawing.

Table 13 – Relationship between the parameter values of sequence_display_extension of a stream and the video signal output 2

Reference drawing [d]	Parameter values of the sequence_header			Parameter values of the sequence_ extension	Parameter values of the sequence_display_ extension		Output video signal in 1125i format to a 16:9 monitor (1920 pixels horizontally)			Output video signal in 525p format to a 16:9 monitor (720 pixels horizontally)		
	vertical_ size_value (*A*)	horizontal size_value (*B*)	aspect_ ratio_ information [a]	progressive _sequence [b]	display_ vertical_ size (*C*)	display_ horizontal _size (*D*)	Vertical scaling ratio	Horizontal scaling ratio (S: sample)	Re-mark [c]	Vertical scaling ratio	Horizontal scaling ratio (S: sample)	Re-mark [c]
1)	1 080	1 920	3	0	1 080	1 920	*A* × 1	*B* × 1	9	*A* × (4/9)	*B* × (3/8)	9
		1 440				1 440		*B* × (4/3)			*B* × (1/2)	
	720	1 280	3	1	720	1 280	*A* × (3/2)	*B* × (3/2)		*A* × (2/3)	*B* × (9/16)	
	480	720	3	1	480	720	*A* × (9/4)	*B* × (8/3)		*A* × 1	*B* × 1	
	480	720	3	0	480	720	*A* × (9/4)	*B* × (8/3)		*A* × 1	*B* × 1	
		544				540		*D* × (32/9)			*D* × (4/3)	
		480				480		*B* × 4			*B* × (3/2)	
2)	1 080	1 920	2	0	1 080	1 440	*A* × 1	*B* × 1	10	*A* × (4/9)	*B* × (3/8)	10
		1 440				1 080		*B* × (4/3)			*B* × (1/2)	
	720	1 280	2	1	720	960	*A* × (3/2)	*B* × (3/2)		*A* × (2/3)	*B* × (9/16)	
	480	720	2	1	480	540	*A* × (9/4)	*B* × (8/3)		*A* × 1	*B* × 1	
	480	720	2	0	480	540	*A* × (9/4)	*B* × (8/3)		*A* × 1	*B* × 1	
3)	480	720	2	0	480	720	*A* × (9/4)	*B* × 2 + 480S black	11	*A* × 1	*B* × (3/4) + 180S black	11
		544				540		*D* × (8/3) + 480S black			*D* × 1 + 180S black	
		480				480		*B* × 3 + 480S black			*B* × (9/8) + 180S black	
4)	480	720	3	0	360	720	*C* × 3	*B* × (8/3)	12	*C* × (4/3)	*B* × 1	12
		544				540		*D* × (32/9)			*D* × (4/3)	
		480				480		*B* × 4			*B* × (3/2)	

NOTE 1 When sequence_display_extension exists, aspect_ratio_information represents the aspect ratio of the region specified by display_vertical_size(*C*) and display_horizontal_size(*D*), which is defined in the MPEG standard.

NOTE 2 When sequence_display_extension is not transmitted, the receiver should process assuming that the values of display_vertical_size(*C*) and display_horizontal_size(*D*) are equal to those of vertical_size_value(*A*) and horizontal_size_value(*B*) in sequence_header. However, when *B* is 544, the signal should be processed so that 540 samples obtained by removing two samples from each side of the 544 samples are displayed in the same manner as when *D* is 540. When *D* happens to be transmitted as 544, the receiver should conduct the processing in the same manner as when *D* is not transmitted.

NOTE 3 The functions of the receiver may be limited based on the assumption that processing is conducted using frame_center_horizontal_offset(FCHO) and frame_center_vertical_offset(FCVO) in picture_display_extension is normally zero. When picture_display_extension is not transmitted, FCHO and FCVO should be interpreted as zero.

[a] "2" indicates "4:3 display". "3" indicates "16:9 display".

[b] "0" indicates "interlaced scanning scheme". "1" indicates progressive scanning scheme".

[c] Remark list

- 9: An image transmitted in the squeeze format is displayed in a full-screen format on a 16:9 monitor of 1125i, 525p, or 750p (see case 1 of Figure 6).
- 10: An image transmitted in the squeeze format is displayed on a 16:9 monitor of 1125i, 525p, or 750p. In cases in which the transmitted video is fake 16:9 video made up of the active image part with an aspect ratio of 4:3 and black regions attached to both sides thereof, the valid 1 920 samples of the 1125i signal consist of [240 black level samples] + [1 440 active samples] + [240 black level samples]. Similarly, the 720 valid samples of the 525p signal consist of [90 black level samples] + [540 active samples] + [90 black level samples], and the 1 280 valid samples of the 750p signal consist of [160 black level samples] + [960 active samples] + [160 black level samples] (see case 2 of Figure 6).
- 11: An image transmitted in a 4:3 aspect ratio is displayed on a 16:9 monitor of 1125i, 525p, or 750p. The 1920 valid samples of the 1125i signal consist of [240 black level samples] + [1 440 active samples] + [240 black level samples], the 720 valid samples of the 525p signal consist of [90 black level samples] + [540 active samples] + [90 black level samples], and the 1 280 valid samples of the 750p signal consist of [160 black level samples] + [960 active samples] + [160 black level samples], each of which is a signal in the squeeze format and is input into the 16:9 monitor (see case 3 of Figure 6).
- 12: An image transmitted in the letterbox format, which contains the 16:9 active image with 360 effective lines is converted into a signal in the squeeze format with 1 080 valid lines (in the case of 1125i signals), 480 valid lines (in the case of 525p signals), or 720 valid lines (in the case of 750p signals), and displayed in full-screen mode on a 16:9 monitor of 1125i, 525p, or 750p (see case 4 of Figure 6).

[d] See Figure 6 as a reference drawing.

Table 14 – Relationship between the parameter values of sequence_display_extension of a stream and video signal output 3

Reference drawing[d]	Parameter values of sequence_header			Parameter values of sequence_ extension	Parameter values of sequence_display_extension		Output video signal in 750p format to a 16:9 monitor (1280 pixels horizontally)		
	vertical_size_ value(*A*)	horizontal size_value (*B*)	aspect_ratio_ information[a]	progressive_ sequence[b]	display_vertical_ size (*C*)	display_ horizontal_size (*D*)	Vertical scaling ratio	Horizontal scaling ratio (S: sample)	Re-mark[c]
1)	1 080	1 920	3	0	1 080	1 920	*A* × (2/3)	*B* × (2/3)	9
		1 440				1 440		*B* × (8/9)	
	720	1 280	3	1	720	1 280	*A* × 1	*B* × 1	
	480	720	3	1	480	720	*A* × (3/2)	*B* × (16/9)	
	480	720	3	0	480	720	*A* × (3/2)	*B* × (16/9)	
		544				540		*D* × (64/27)	
		480				480		*B* × (8/3)	
2)	1 080	1 920	2	0	1 080	1 440	*A* × (2/3)	*B* × (2/3)	10
		1 440				1 080		*B* × (8/9)	
	720	1 280	2	1	720	960	*A* × 1	*B* × 1	
	480	720	2	1	480	540	*A* × (3/2)	*B* × (16/9)	
	480	720	2	0	480	540	*A* × (3/2)	*B* × (16/9)	
3)	480	720	2	0	480	720	*A* × (3/2)	*B* × (4/3) + 320S black	11
		544				540		*D* × (16/9) + 320S black	
		480				480		*B* × 2 + 320S black	
4)	480	720	3	0	360	720	*C* × 2	*B* × (16/9)	12
		544				540		*D* × (64/27)	
		480				480		*B* × (8/3)	

NOTE 1 When sequence_display_extension exists, aspect_ratio_information should represent the aspect ratio of the area specified by display_vertical_size(*C*) and display_horizontal_size(*D*), which is defined in the MPEG standard.

NOTE 2 When sequence_display_extension is not transmitted, the receiver should process assuming that the values of display_vertical_size(*C*) and display_horizontal_size(*D*) are equal to those of vertical_size_value(*A*) and horizontal_size_value(*B*) in sequence_header. However, when *B* is 544, the signal should be processed so that 540 samples obtained by removing two samples from each side of the 544 samples are displayed in the same manner as when *D* is 540. When *D* happens to be transmitted as 544, the receiver should conduct the processing in the same manner as when *D* is not transmitted.

NOTE 3 The functions of the receiver may be limited based on the assumption that the processing is conducted using frame_center_horizontal_offset(FCHO) and frame_center_vertical_offset(FCVO) in picture_display_extension is normally zero. When picture_display_extension is not transmitted, FCHO and FCVO should be interpreted as zero.

[a] "2" indicates "4:3 display". "3" indicates "16:9 display".

[b] "0" indicates "interlaced scanning scheme". "1" indicates progressive scanning scheme".

[c] Remark list

- 9: An image transmitted in the squeeze format is displayed in a full-screen format on a 16:9 monitor of 1125i, 525p, or 750p (see case 1 of Figure 6).
- 10: An image transmitted in the squeeze format is displayed on a 16:9 monitor of 1125i, 525p, or 750p. In cases in which the transmitted video is fake 16:9 video made up of the active image part with an aspect ratio of 4:3 and black regions attached to both sides thereof, the valid 1920 samples of the 1125i signal consist of [240 black level samples] + [1440 active samples] + [240 black level samples]. Similarly, the 720 valid samples of the 525p signal consist of [90 black level samples] + [540 active samples] + [90 black level samples], and the 1280 valid samples of the 750p signal consist of [160 black level samples] + [960 active samples] + [160 black level samples] (see case 2 of Figure 6).
- 11: An image transmitted in a 4:3 aspect ratio is displayed on a 16:9 monitor of 1125i, 525p, or 750p. The 1920 valid samples of the 1125i signal consist of [240 black level samples] + [1440 active samples] + [240 black level samples], the 720 valid samples of the 525p signal consist of [90 black level samples] + [540 active samples] + [90 black level samples], and the 1280 valid samples of the 750p signal consist of [160 black level samples] + [960 active samples] + [160 black level samples], each of which is a signal in the squeeze format and is input into the 16:9 monitor (see case 3 of Figure 6).
- 12:An image transmitted in the letterbox format, which contains the 16:9 active image with 360 effective lines is converted into a signal in the squeeze format with 1080 valid lines (in the case of 1125i signals), 480 valid lines (in the case of 525p signals), or 720 valid lines (in the case of 750p signals), and displayed in full-screen mode on a 16:9 monitor of 1125i, 525p, or 750p (see case 4 of Figure 6).

[d] See Figure 6 as a reference drawing.

Video source	525i signal Displayed on a 4:3 monitor	525i/p, 1125i, or 750p signal Displayed on a 16:9 monitor
1) 16:9 program case 1 Case in which the values of *C* and *D* equal those of *A* and *B*, respectively (including a case in which *C* and *D* are not transmitted)	The program is output in the letterbox format on a 4:3 monitor.	The program is displayed, as is, on a 16:9 monitor.
2) 16:9 program case 2 Case in which the value of *D* is set to 3/4 the value of *B* (including a case of a fake 16:9 program formed by adding side panels to a 4:3 program)	The program is displayed in 480 × 720 full mode on a 4:3 monitor by cutting away both side panels.	The program is displayed, as is, on a 16:9 monitor. The grey parts are used to indicate two possible cases: one in which real images exist in the side panels, and one in which the side panels are black.
3) 4:3 program Case in which the value of *C* equals that of *A* (The case in the letterbox format in which *C* is not transmitted and the case in which the value of *C* equals that of *A* belong to case 3.)	The 4:3 program is displayed, as is, on a 4:3 monitor.	The program is displayed in either of the following manners on a 16:9 monitor: side panels are added to the program image, or (for 525i signals only) by means of the deflection system on the monitor side.
4) 4:3 program in the letterbox format Case in which the value of *C* is set to 3/4 the value of *A*	The program is displayed, as is, on a 4:3 monitor.	The video is displayed in either of the following manners on a 16:9 monitor: the number of valid lines is changed to 480, 720, or 1080 by being multiplied by 4/3, 2, or 3 in the vertical direction; or (for 525i signals only) by means of the deflection system on the monitor side.

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Figure 6 – Desirable representation formats on monitors with a 4:3 aspect ratio and a 16:9 aspect ratio

7.1.3 Video-signal output

7.1.3.1 Analogue output

The receiver shall be equipped with at least one video output terminal. In cases in which the receiver is equipped with an output terminal for the component signals (Y, P_B, P_R), it is preferred that at least one D-type connector be provided (which is optional for the integrated receiver). Digital broadcasting receivers equipped with a D-type connector shall conform to the following standards of the Japan Electronics and Information Technology Industries Association (the former Electronic Industries Association of Japan; EIAJ).

- JEITA standard: EIAJ CP-4120
- JEITA standard: EIAJ RC-5237

The assumed formats of the output signal are given in the following tables.

Table 15 – 1080i component output

Signal format	Luminance (Y)/color difference signal	Red/green/blue signal
Output level	*Y*: +700 mV P_B, P_R: ±350 mV Sync signal: ±300 mV, superimposed on Y	700 mV (peak-to-peak value) Sync signal (*VD, HD*): –300 mV, not superimposed on *G, B*, or *R*
Colorimetric parameter	See Table 21	
Impedance	75 Ω	75 Ω
Connector	The use of D-type connector is recommended	Phono pin × 3, sync-signal pin × 2

Table 16 – 720p component output

Signal format	Luminance (Y)/color difference signal	Red/green/blue signal
Output level	*Y*: +700 mV P_B, P_R: ±350 mV Sync signal: ±300 mV, superimposed on Y	700 mV (peak-to-peak value) Sync signal (*VD, HD*): –300 mV, not superimposed on *G, B*, or *R*
Colorimetric parameter	See Table 21	
Impedance	75 Ω	75 Ω
Connector	The use of D-type connector is recommended	Phono pin × 3, sync-signal pin × 2

Table 17 – 480p component output

Signal format	Luminance (Y)/color difference signal	Red/green/blue signal
Output level	*Y*: +700 mV P_B, P_R: ±350 mV Sync signal: –300 mV, superimposed on Y	700 mV (peak-to-peak value) Sync signal (*VD, HD*): –300 mV, not superimposed on G, B, or R
Colorimetric parameter	See Table 21	
Impedance	75 Ω	75 Ω
Connector	The use of D-type connector is recommended	Phono pin × 3, sync-signal pin × 2

Table 18 – 480i component output

Signal format	Luminance (Y)/color difference signal	Red/green/blue signal
Output level	*Y*: +700 mV P_B, P_R: ±350 mV Sync signal: –300 mV, superimposed on Y	700 mV (peak-to-peak value) Sync signal (*VD, HD*): –300 mV, not superimposed on *G, B*, or *R*
Colorimetric parameter	See Table 21	
Impedance	75 Ω	75 Ω
Connector	The use of D-type connector is recommended	Phono pin × 3, sync-signal pin × 2

Table 19 – NTSC composite output

Signal format	NTSC composite signal
Output level	1,0 V (peak-to-peak value), positive polarity
Impedance	75 Ω
Connector	Phono pin

Table 20 – NTSC Y/C output

Signal format	NTSC Y/C signal
Output level	Luminance signal: 1,0 V (peak-to-peak value) Burst signal: 286 mV (peak-to-peak value)
Impedance	75 Ω
Connector	4 pin Y/C connector

Table 21 – Colorimetric parameters

Item	480i, 480p			1080i, 720p		
Primary-color chromaticity	The CIE chromaticity coordinates shall be as follows:			The CIE chromaticity coordinates shall be as follows:		
		x	y		x	y
	G	0,310	0,595	*G*	0,300	0,600
	B	0,155	0,070	*B*	0,150	0,060
	R	0,630	0,340	*R*	0,640	0,330
Reference white	D65. The CIE chromaticity coordinates shall be as follows: x = 0,312 7, y = 0,329 0			D65. The CIE chromaticity coordinates shall be as follows: x = 0,312 7, y = 0,329 0		
Luminance (Y) /color-difference signal equation	The equations of *Y*, P_B, and P_R shall be as follows: $Y = 0{,}587 \times G + 0{,}114 \times B + 0{,}299 \times R$ $P_B = 0{,}564 \times (B–Y)$ $P_R = 0{,}713 \times (R–Y)$ Note that *G*, *B*, and *R* correspond to gamma pre-corrected signals.			The equations of *Y*, P_B, and P_R shall be as follows: $Y = 0{,}715\,2 \times G + 0{,}072\,2 \times B + 0{,}212\,6 \times R$ $P_B = 0{,}538\,9 \times (B–Y)$ $P_R = 0{,}635\,0 \times (R–Y)$ Note that *G*, *B*, and *R* correspond to gamma pre-corrected signals.		
Gamma correction characteristic	$V_c = 1{,}099 \times L_c$ (^0,4500) – 0,099 $(0{,}018 \le L_c \le 1)$ $= 4{,}500 \times L_c$ $(0 \le L_c \le 0{,}018)$ where V_c is the video-signal camera output, and L_c is the input light of the camera. Both values shall be normalized by the reference white			$V_c = 1{,}099 \times L_c$ (^0,4500) – 0,099 $(0{,}018 \le L_c \le 1)$ $= 4{,}500 \times L_c$ $(0 \le L_c \le 0{,}018)$ where V_c is the video-signal camera output, and L_c is the input light of the camera. Both values shall be normalized by the reference white		

NOTE 1 This standard is not intended to define terminal names.

NOTE 2 With respect to Tables 19 and 20 luminance (Y)/synchronizing signals should have a V/S ratio of +714 mV/–286 mV.

NOTE 3 This standard is designed for use with BS digital broadcasting and, in particular, is not intended to define the permissible deviation.

7.1.3.2 Identification output of the format type

The output of identification signals of the format type is optional. However, with the adoption of a D-type connector, it can transmit format identification signals (480i, 480p, 720p, 1080i) and the aspect ratio to a television broadcasting receiver.

7.1.3.3 Digital output

7.1.3.3.1 Digital video output

Receiver units equipped with DVI interfaces shall comply with the Digital Visual Interface issued by the Digital Display Working Group (DDWG).

7.1.3.3.2 Digital audio-video output

Receiver units equipped with HDMI interfaces shall comply with the High-Definition Multimedia Interface Specification issued by the HDMI Licensing, LLC.

7.1.4 Copy protection

The receiver shall be equipped with a copy protect management system specified by the broadcast service carrier.

7.2 Audio decoding process and output signals

7.2.1 General

The following specification shall be applied to any audio elementary stream if not specified otherwise.

7.2.2 Audio decoding process

It shall conform to the LC profile of MPEG2-AAC (ISO/IEC 13818-7) and ADTS (Audio Data Transport Stream) system. Furthermore, it shall conform to the following restrictions.

a) Sampling frequency: Corresponds to 48 kHz, 44,1 kHz, 32kHz, 24 kHz, 22,05 kHz, 16 kHz

b) Quantifying bit number: Corresponds to reproduction at 16 bits

c) Decodable number of channels: Corresponds to AAC stream up to 5.1 channels per ADTS.

d) Number of maximum multiple ADTS: Corresponds to a maximum of 8 ADTS streams within the same program.

e) Audio decoding functions: Decodes audio modes of mono, stereo, multi-channel stereo (3/1, 3/2, 3/2+LFE) and 2-audio (dual mono).

NOTE Multi-channel stereo (3/1, 3/2, 3/2+LFE) means the number of audio channels to the assumed front and rear speakers. (Example: 3/1 = 3 speakers in front + 1 at rear, 3/2 = 3 speakers in front + 2 at rear). LFE is an abbreviation of Low Frequency Enhancement, which means low frequency enhanced channel.

f) Decoding process when switching the audio mode and coded parameter at the transmission side

It shall return to normal operation without making noise within the muting time of audio parameter switching.

g) Down mixing function from multi-channel to 2-channel stereo.

1) Down mixing process to 2-channel stereo

When a receiver with the capability of 2-channel stereophonic reproduction reproduces the multi-channel audio stream, it shall perform the down mixing process given in Table 22. There is hereby a possibility of overloading but noise shall not occur even in this case (it may not be turned back even at maximum audio level or more).

NOTE For the method to realize the above fuctions, there are several methods such as automatic volume adjustment after AAC decoder or preventing overload by increasing quantifying bit number, etc. along with simple methods as implementing a clipping process. The realization method should be decided by the product planning division.

Table 22 – Formula of down mixing audio signal to 2-channel stereo

<table>
<tr><th colspan="3">Bit value of the received AAC stream</th><th colspan="2">Signalprocess
at receiver</th></tr>
<tr><th>matrix_mix
down_idx_
present</th><th>pseudo_
surround
enable</th><th>matrix
mixdown
_idx</th><th>Value
of k</th><th>Formula of down mixing audio signal: [a]</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">0/1: [e]</td><td>0</td><td>1/√2</td><td rowspan="4">Set1: [b, c]
Lt = a × (L+1/√2 × C+k × Sl)
Rt = a × (R+1/√2 × C+k × Sr)
A = 1/√2</td></tr>
<tr><td>1</td><td>1/2</td></tr>
<tr><td>2</td><td>1/2√2</td></tr>
<tr><td>3</td><td>0</td></tr>
<tr><td>0 [f]</td><td colspan="2"></td><td></td><td>Set3: [c, d]
Lt = (1/√2) × (L+1/√2 × C+1/√2 × Sl)
Rt = (1/√2) × (R+1/√2 × C+1/√2 × Sr)</td></tr>
</table>

[a] *L* means the left front channel of the 3/2 system audio, *C*, the center channel, *R*, the right front channel, *Sl*, the left rear channel, and *Sr*, the right rear channel. *Lt* and *Rt* indicate the stereo audio left and right channels, respectively, generated by down mixing.

[b] The above formulas are different from those described in 8.5.4.2 "Matrix-mixdown process" in ISO/IEC 13818-7 as to the a-value of the total audio volume term. The a-value is defined so as to make the audio volume generated by the 2-channel stereo audio stream as close as possible to the volume of the 2-channel stereo audio generated by decoding the multi-channel audio stream and down mixing. For the detailed information, refer to Annex B.

[c] The set 1 or set 3 formulas are also used when transmitting LFE signals in the 3/2 + LFE multi-channel stereo.

[d] Because k cannot be transmitted in the 3/1 system, the down mixing process is expressed by substituting *Sl* and Sr for the surround signal *S* of the 3/1 system in the Set 3 formulas (*S* = *Sl* = *Sr*).

[e] The set 1 formulas are used regardless of the pseudo_surround_enable value. As described in g)-2), however, the set 2 formulas can be added as an option when pseudo_surround_enable = "1".

[f] When PCE is not acquired, the down mixing process for the case of matrix_mixdown_idx_present = "0" shall be used.

2) Down mixing process for external pseudo-surround processor

When down mixing to 2-channel stereo signals for surround audio reproduction using an external pseudo-surround processor, the down mixing process shown in Table 23 can be added as an option.

Table 23 – Formula of down mixing audio signal for external pseudo-surround processor

Bit value of the received AAC stream			Signalprocess at receiver	
matrix_mix down_idx_ present	pseudo_ surround _enable	matrix_ mixdown _idx	Value of k	Formula of down mixing audio signal
1	1	0	1/√2	Set2: NOTE
		1	1/2	$Lt = a \times (L+1/\sqrt{2} \times C-k(Sl+Sr))$
		2	1/2√2	$Rt = a \times (R+1/\sqrt{2} \times C+k(Sl+Sr))$
		3	0	$a = 1/\sqrt{2}$
NOTE The above formulas are different from those described in 8.5.4.2 "Matrix-mixdown process" in ISO/IEC 13818-7 as to the a-value of the total audio volume term. The a-value is defined so as to make the audio volume generated by the 2-channel stereo audio stream as close as possible to the volume of the 2-channel stereo audio generated by decoding the multi-channel audio stream and down mixing. For the detailed information, refer to Annex B				

3) Down mixing process for stereo audio field extension

To reproduce a simulated surround stereo audio field in 2-channel stereo reproduction, down mixing can be added as an option. Although the details of the down mixing process shall be decided by the product planning division, the process shall satisfy the following requirements.

– The audio volume generated by the 2-channel stereo audio stream shall be as close as possible to the volume of the 2-channel stereo audio generated by decoding the multi-channel audio stream and down mixing.

– Overloading may occur when audio volume is sustained during down mixing, but noise shall not occur even in this case.

7.2.3 Audio mode detection and indication

a) Mono, stereo and multi-channel stereo (3/1, 3/2, 3/2+LFE), 2 audio (dual mono) audio mode correspond to each detection and indication. However, the audio mode of an entire program comprised of multiple audio elementary streams shall be a combination of the above audio modes.

b) It shall correspond to detection and indication of bilingual/2-audio mode.

c) It shall correspond to detection and indication of mode 1/mode 2/mode 3.

7.2.4 Audio-signal output

7.2.4.1 Audio output function

It shall be equipped with an audio output function of 2-channel stereo or more.

7.2.4.2 Analogue audio output

a) Output level (r.m.s. value): 250 mV +103,1 mV/ −73,0 mV

b) Output impedance: 2,2 kΩ or less

c) Load impedance: 10 kΩ

d) Output terminal type: Phono pin connector

7.2.4.3 Audio-signal output interface for multi-channel

Recommended to conform to the standard of IEC 61937-6(2006-01) Digital audio-Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 – Part 6:Non-linear PCM bitstreams according to the MPEG-2 AAC and MPEG-4 AAC audio formats, or have IEEE-1394 compliant output.

7.2.4.4 Audio output using Bluetooth[2]

Recommended to conform to the standard of Bluetooth SIG: Advanced Audio Distribution Profile (A2DP).

NOTE See http://www.bluetooth.org/foundry/adopters/document/A2DP_Spec_V1_0/

7.3 Receiver's function of hierarchical modulation in digital satellite broadcasting

7.3.1 Identification of hierarchical modulation

Hierarchical modulation can be identified as follows:

a) The presence of hierarchical modulation shall be identified by means of a hierarchical transmission descriptor in the received MPEG stream PMT.

For every stream having a hierarchical structure, an elementary stream PID to be checked for reference is obtained and identified by means of reference_PID of the hierarchical transmission descriptor.

b) The hierarchies shall be of two levels.

High and low hierarchies shall be identified by means of quality_level of the hierarchical transmission descriptor.

c) Signals of high and low hierarchies shall be transmitted in the same TS and in the same service ID, respectively.

7.3.2 Reception processing of hierarchical modulation

Reception processing of hierarchical modulation can be done as follows.

a) When the error rate of the received signal or its equivalent index exceeds a fixed value, the receiver shall automatically switch over from the high hierarchy to the low hierarchy and display the received signal.

b) In cases in which the same video information is simultaneously transmitted in both the high and low hierarchies, a function for representing and outputting video of both hierarchies simultaneously in the receiver is not required. Moreover, with respect to the audio, such a function is also unnecessary.

7.3.3 Display of low-hierarchy video in hierarchical modulation

The format for the video output signals shall conform to the definition described in 7.1.2. Note that in the case of the output of a reduced resolution moving picture, the relationship between the parameter values of sequence_display_extension of the low hierarchical video stream and the video-signal output should conform to

Table 24, when the video signal is output in the 525i signal,

Table 25 when it is output in the 1125i or 525p signal,

Table 26, when it is output in the 750p signal.

Further, in the case of the output of a still picture, the above-mentioned relationship should conform to

Table 27, when the video signal is output in the 525i signal,

Table 28, when it is output in the 1125i or 525p signal,

Table 29, when it is output in the 750p signal.

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2 Bluetooth is the trade name of a product supplied by Bluetooth SIG. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

7.4 MP@LL moving picture and still picture of terrestrial digital television broadcast

7.4.1 Display on receiving equipment

The format of the video output signals shall conform to the definition described in 7.1.2.

The relationship between the parameter value of sequence_display_extension of the stream of the MP@LL moving picture and/or still picture and the video output signal should comply with

Table 24, when the signal is 525i reduced resolution moving picture output signal,

Table 25, when it is 1125i or 525p reduced resolution moving picture output signal,

Table 26, when it is 750p reduced resolution moving picture output signal.

With regard to the still picture output signal, the relationship should comply with

Table 27, when the signal is 525i,

Table 28, when it is 1125i or 525p,

Table 29, when it is 750p.

Table 24 – Relationship between the parameter values of sequence_display_extension of reduced resolution moving pictures and video output signals (1)

Reference drawing[d]	Parameter values of sequence_header			Parameter values of sequence_ extension	Parameter values of sequence_display_ extension		Output video signal in 525i format to a 4:3 monitor (720 pixels horizontally)			Output video signal in 525i format to a 16:9 monitor (720 pixels horizontally)		
	vertical_ size_value (*A*)	horizontal_ size_value (*B*)	aspect_ ratio_ information[a]	progressive_ sequence[b]	display_ vertical_ size (*C*)	display_ horizontal _size (*D*)	Vertical scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark[c]	Vertical scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark [c]
1)	240	352	3	1	240	360	$A \times (3/2)$ + 120L black	$B \times 2$ + 16S black	1	$A \times 2$	$B \times 2$ + 16S black	5
2)					480	720	$A \times (3/4)$ + 300L black	$B \times 1$ + 368S black	2	$A \times 1$ + 240L black	$B \times 1$ + 368S black	6
3)	240	352	2	1	240	360	$A \times 2$	$B \times 2$ + 16S black	3	$A \times 2$	$B \times (3/2)$ + 192S black	7
4)					480	720	$A \times 1$ + 240L black	$B \times 1$ + 368S black	4	$A \times 1$ + 240L black	$B \times (3/4)$ + 456S black	8

[a] "2" indicates "4:3 display". "3" indicates "16:9 display".

[b] "0" indicates "interlaced scanning scheme". "1" indicates progressive scanning scheme".

[c] Remark list

- 1: An image transmitted in a 16:9 aspect ratio is displayed in the letterbox format on a 4:3 monitor (see type 1 of Figure 7).
- 2: An image transmitted in a 16:9 aspect ratio is displayed in a window on a 4:3 monitor (see type 2 of Figure 7).
- 3: An image transmitted in a 4:3 aspect ratio is displayed in full-screen mode on a 4:3 monitor (see type 3 of Figure 7).
- 4: An image transmitted in a 4:3 aspect ratio is displayed in a window on a 4:3 monitor (see type 4 of Figure 7).
- 5: An image transmitted in a 16:9 aspect ratio is displayed in full-screen mode on a 16:9 monitor (see type 1 of Figure 7).
- 6: An image transmitted in a 16:9 aspect ratio is displayed in a window on a 16:9 monitor (see type 2 of Figure 7).
- 7: A an image transmitted in a 4:3 aspect ratio is displayed on a 16:9 monitor. The active image region is located in the middle of the monitor, and lateral margins external to the region are shown in black (see type 3 of Figure 7).
- 8: An image transmitted in a 4:3 aspect ratio is displayed in a window on a 16:9 monitor (see type 4 of Figure 7).

[d] See Figure 7 as a reference drawing.

Table 25 – Relationship between the parameter values of sequence_display_extension for reduced resolution moving pictures and video output signals (2)

Reference drawing [d]	Parameter values of sequence_header			Parameter values of sequence_ extension	Parameter values of sequence_display_ extension		Output video signal in 525p format to a 16:9 monitor (720 pixels horizontally)			Output video signal in 1125i format to a 16:9 monitor (1920 pixels horizontally)		
	vertical_ size_value (*A*)	horizontal_ size_value (*B*)	aspect_ ratio_ information [a]	progressive_ sequence [b]	display_ vertical_ size (*C*)	display_ horizontal _size (*D*)	Vertical scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark [c]	Vertical scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark [c]
1)	240	352	3	1	240	360	*A* × 2	*B* × 2 + 16S black	5	*A* × (9/2)	*B* × (16/3) + 43S black	5
2)					480	720	*A* × 1 + 240L black	*B* × 1 + 368S black	6	*A* × (9/4) + 540L black	*B* × (8/3) + 982S black	6
3)	240	352	2	1	240	360	*A* × 2	*B* × (3/2) + 192S black	7	*A* × (9/2)	*B* × 4 + 512S black	7
4)					480	720	*A* × 1 + 240L black	*B* × (3/4) + 456S black	8	*A* × (9/4) + 540L black	*B* × 2 + 1216S black	8

[a] "2" indicates "4:3 display". "3" indicates "16:9 display".

[b] "0" indicates "interlaced scanning scheme". "1" indicates progressive scanning scheme".

[c] Remark list

- 5: An image transmitted in a 16:9 aspect ratio is displayed in full-screen mode on a 16:9 monitor (see type 1 of Figure 7).
- 6: An image transmitted in a 16:9 aspect ratio is displayed in a window on a 16:9 monitor (see type 2 of Figure 7).
- 7: An image transmitted in a 4:3 aspect ratio is displayed on a 16:9 monitor. The active image region is located in the middle of the monitor, and lateral margins external to the region are shown in black (see type 3 of Figure 7).
- 8: An image transmitted in a 4:3 aspect ratio which is displayed in a window on a 16:9 monitor (see type 4 of Figure 7).

[d] See Figure 7 as a reference drawing.

Table 26 – Relationship between the parameter values of sequence_display_extension for reduced resolution moving pictures and video output signals (3)

Reference drawing [d]	Parameter values of sequence_header			Parameter values of sequence_ extension	Parameter values of sequence_display_extension		Output video signal in 750p format to a 16:9 monitor (1280 pixels horizontally)		
	vertical_ size_value (*A*)	horizontal_ size_value (*B*)	aspect_ratio_ information [a]	progressive_ sequence [b]	display_ vertical_ size (*C*)	display_ horizontal_ size (*D*)	Vertical scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark [c]
1)	240	352	3	1	240	360	*A* × 3	*B* × (32/9) + 29S black	5
2)					480	720	*A* × (3/2) + 360L black	*B* × (16/9) + 655S black	6
3)	240	352	2	1	240	360	*A* x 3	*B* × (8/3) + 342S black	7
4)					480	720	*A* × (3/2) + 360L black	*B* × (4/3) + 811S black	8

[a] "2" indicates "4:3 display". "3" indicates "16:9 display".

[b] "0" indicates "interlaced scanning scheme". "1" indicates progressive scanning scheme".

[c] Remark list

- 5: An image transmitted in a 16:9 aspect ratio is displayed in full-screen mode on a 16:9 monitor (see type 1 of Figure 7).
- 6: An image transmitted in a 16:9 aspect ratio is displayed in a window on a 16:9 monitor (see type 2 of Figure 7).
- 7: An image transmitted in a 4:3 aspect ratio is displayed on a 16:9 monitor. The active image region is located in the middle of the monitor, and lateral margins external to the region are shown in black (see type 3 of Figure 7).
- 8: An image transmitted in a 4:3 aspect ratio is displayed in a window on a 16:9 monitor (see type 4 of Figure 7).

[d] See Figure 7 as a reference drawing.

NOTE 1 When sequence_display_extension is not transmitted, the receiver should process assuming that the values of display_vertical_size(*C*) and display_horizontal_size(*D*) are equal to those of vertical_size_value(*A*) and horizontal_size_value(*B*) in sequence_header. However, when *B* is 352, the signal processing should be conducted in the same manner as when *D* is 360. When *D* is transmitted as 352, the receiver should process in the same manner as when *D* is not transmitted.

NOTE 2 The functions of the receiver may be limited based on the assumption that low hierarchical video is displayed using frame_center_horizontal_offset (FCHO) and frame_center_vertical_offset (FCVO) in picture_display_extension is normally zero. When picture_display_extension is not transmitted, FCHO and FCVO are interpreted as zero.

NOTE 3 The scaling ratio of the 4:3 monitor should not apply to S1 (type having a 4:3 monitor and a vertical deflection amplitude that can be altered) compliant apparatuses.

Table 27 – Relationship between the parameter values of sequence_display_extension for still pictures and video output signals (1)

Reference drawing [d]	Parameter values of sequence_header			Parameter values of sequence_ extension	Parameter values of sequence_display_ extension		Output video signal in 525I format to a 4:3 monitor (720 pixels horizontally)			Output video signal in 525i format to a 16:9 monitor (720 pixels horizontally)		
	vertical_ size_value (*A*)	horizontal_ size_value (*B*)	aspect_ ratio_ information [a]	progressive_ sequence [b]	display_ vertical_ size (*C*)	display_ horizontal_ size (*D*)	Vertical scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark [c]	Vertical scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark [c]
1)	1 080	1 920	3	0	1 080	1 920	*A* × (1/3) + 120L black	*B* × (3/8)	1	*A* × (4/9)	*B* × (3/8)	5
		1 440				1 440		*B* × (1/2)			*B* × (1/2)	
	480	720	3	1	480	720	*A* × (3/4) + 120L black	*B* × 1		*A* × 1	*B* × 1	
	480	720	3	0	480	720	*A* × (3/4) + 120L black	*B* × 1		*A* × 1	*B* × 1	
	240	352	3	1	240	360	*A* × (3/2) + 120L black	*B* × 2 + 16S black		*A* x 2	*B* × 2 + 16S black	
2)					480	720	*A* × (3/4) + 300L black	*B* × 1 + 368S black	2	*A* × 1 + 240L black	*B* × 1 + 368S black	6
3)	480	720	2	0	480	720	*A* × 1	*B* × 1	3	*A* × 1	*B* × (3/4) + 180S black	7
	240	352	2	1	240	360	*A* × 2	*B* × 2 + 16S black		*A* × 2	*B* × (3/2) + 192S black	
4)					480	720	*A* × 1 + 240L black	*B* × 1 + 368S black	4	*A* × 1 + 240L black	*B* × (3/4) + 456S black	8

[a] "2" indicates "4:3 display". "3" indicates "16:9 display".

[b] "0" indicates "interlaced scanning scheme". "1" indicates progressive scanning scheme".

[c] Remark list

- 1: An image transmitted in a 16:9 aspect ratio is displayed in the letterbox format on a 4:3 monitor (see type 1 of Figure 7).
- 2: An image transmitted in a 16:9 aspect ratio is displayed in a window on a 4:3 monitor (see type 2 of Figure 7).
- 3: An image transmitted in a 4:3 aspect ratio is displayed in full-screen mode on a 4:3 monitor (see type 3 of Figure 7).
- 4: An image transmitted in a 4:3 aspect ratio is displayed in a window on a 4:3 monitor (see type 4 of Figure 7).
- 5: An image transmitted in a 16:9 aspect ratio is displayed in full-screen mode on a 16:9 monitor (see type 1 of Figure 7).
- 6: An image transmitted in a 16:9 aspect ratio is displayed in a window on a 16:9 monitor (see type 2 of Figure 7).
- 7: An image transmitted in a 4:3 aspect ratio which is displayed on a 16:9 monitor. The active image region is located in the middle of the monitor, and lateral margins external to the region are shown in black (see type 3 of Figure 7).
- 8: An image transmitted in a 4:3 aspect ratio is displayed in a window on a 16:9 monitor (see type 4 of Figure 7).

[d] See Figure 7 as a reference drawing.

Table 28 – Relationship between the parameter values of sequence_display_extension for still pictures and video output signals (2)

Reference drawing [d]	Parameter values of sequence_header			Parameter values of sequence_ extension	Parameter values of sequence_display_ extension		Output video signal in 525p format to a 16:9 monitor (720 pixels horizontally)			Output video signal in 1125i format to a 16:9 monitor (1920 pixels horizontally)		
	vertical_ size_value (*A*)	horizontal_ size_value (*B*)	aspect_ ratio_ information [a]	progressive_ sequence [b]	display_ vertical_ size (*C*)	display_ horizontal_ size (*D*)	Vertical enlarged scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark [c]	Vertical scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark [c]
1)	1 080	1 920	3	0	1 080	1 920	*A* × (4/9)	*B* × (3/8)	5	*A* × 1	*B* × 1	5
		1 440				1 440		*B* × (1/2)			*B* × (4/3)	
	480	720	3	1	480	720	*A* × 1	*B* × 1		*A* × (9/4)	*B* × (8/3)	
	480	720	3	0	480	720	*A* × 1	*B* × 1		*A* × (9/4)	*B* × (8/3)	
	240	352	3	1	240	360	*A* × 2	*B* × 2 + 16S black		*A* × (9/2)	*B* × (16/3) + 43S black	
2)					480	720	*A* × 1 + 240L black	*B* × 1 + 368S black	6	*A* × (9/4) + 540L black	*B* × (8/3) + 982S black	6
3)	480	720	2	0	480	720	*A* × 1	*B* × (3/4) + 180S black	7	*A* × (9/4)	*B* × 2 + 480S black	7
	240	352	2	1	240	360	*A* × 2	*B* × (3/2) + 192S black		*A* × (9/2)	*B* × 4 + 512S black	
4)					480	720	*A* × 1 + 240L black	*B* × (3/4) + 456S black	8	*A* × (9/4) + 540L black	*B* × 2 + 1216S black	8

[a] "2" indicates "4:3 display". "3" indicates "16:9 display".

[b] "0" indicates "interlaced scanning scheme". "1" indicates progressive scanning scheme".

[c] Remark list

- 5: An image transmitted in a 16:9 aspect ratio is displayed in full-screen mode on a 16:9 monitor (see type 1 of Figure 7).
- 6: An image transmitted in a 16:9 aspect ratio is displayed in a window on a 16:9 monitor (see type 2 of Figure 7).
- 7: An image transmitted in a 4:3 aspect ratio is displayed on a 16:9 monitor. The active image region is located in the middle of the monitor, and lateral margins external to the region are shown in black (see type 3 of Figure 7).
- 8: An image transmitted in a 4:3 aspect ratio is displayed in a window on a 16:9 monitor (see type 4 of Figure 7).

[d] See Figure 7 as a reference drawing.

Table 29 – Relationship between the parameter values of sequence_display_extension for still pictures and video output signals (3)

Reference drawing[d]	Parameter values of sequence_header			Parameter values of sequence_ extension	Parameter values of sequence_display_extension		Output video signal in 750p format to a 16:9 monitor (1280 pixels horizontally)		
	vertical_ size_value (*A*)	horizontal_ size_value (*B*)	aspect_ratio_ information[a]	progressive_ sequence [b]	display_ vertical_ size (*C*)	display_ horizontal_ size (*D*)	Vertical scaling ratio (L: line)	Horizontal scaling ratio (S: sample)	Remark [c]
1)	1 080	1 920	3	0	1 080	1 920	*A* × (2/3)	*B* × (2/3)	5
		1 440				1 440		*B* × (8/9)	
	480	720	3	1	480	720	*A* × (3/2)	*B* × (16/9)	
	480	720	3	0	480	720	*A* × (3/2)	*B* × (16/9)	
	240	352	3	1	240	360	*A* × 3	*B* × (32/9) + 29S black	
2)					480	720	*A* × (3/2) + 360L black	*B* × (16/9) + 655S black	6
3)	480	720	2	0	480	720	*A* × (3/2)	*B* × (4/3) + 320S black	7
	240	352	2	1	240	360	*A* × 3	*B* × (8/3) + 342S black	
4)					480	720	*A* × (3/2) + 360L black	*B* × (4/3) + 811S black	8

[a] "2" indicates "4:3 display". "3" indicates "16:9 display".

[b] "0" indicates "interlaced scanning scheme". "1" indicates progressive scanning scheme".

[c] Remark list

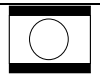
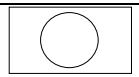
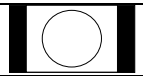
- 5: An image transmitted in a 16:9 aspect ratio is displayed in full-screen mode on a 16:9 monitor (see type 1 of Figure 7).
- 6: An image transmitted in a 16:9 aspect ratio is displayed in a window on a 16:9 monitor (see type 2 of Figure 7).
- 7: An image transmitted in a 4:3 aspect ratio is displayed on a 16:9 monitor. The active image region is located in the middle of the monitor, and lateral margins external to the region are shown in black (see type 3 of Figure 7).
- 8: An image transmitted in a 4:3 aspect ratio is displayed in a window on a 16:9 monitor (see type 4 of Figure 7).

[d] See Figure 7 as a reference drawing.

NOTE 1 When sequence_display_extension is not transmitted, the receiver should process assuming that the values of display_vertical_size(*C*) and display_horizontal_size(*D*) are equal to those of vertical_size_value(*A*) and horizontal_size_value(*B*) in sequence_header. However, when *B* is 352, the signal processing should be conducted in the same manner as when *D* is 360. When *D* is transmitted as 352, the receiver process in the same manner as when *D* is not transmitted.

NOTE 2 The functions of the receiver may be limited based on the assumption that processing is conducted with frame_center_horizontal_offset (FCHO) and frame_center_vertical_offset (FCVO) in picture_display_extension normally being zero. When picture_display_extension is not transmitted, FCHO and FCVO are interpreted as zero.

NOTE 3 The scaling ratio of the 4:3 monitor stipulated here should not apply to S1 (type with a 4:3 monitor with a vertical deflection amplitude that can be altered)-compliant apparatuses.

Type	Encoder input image	4:3 monitor	16:9 monitor
1)	16:9		
2)			
3)	4:3		
4)			

IEC 1481/08

Figure 7 – Reference drawing

8 Downloading function

8.1 General

The downloading function used to update software/data stored in non-volatile memory shall possess certain characteristics as described below. First, an information transmission scheme is specified, along with preferable specifications for the receiver to be updated by this downloaded information.

8.2 Terms and definitions, service variation

8.2.1 Terms and definitions

8.2.1.1
notification information
information used for notification such as the service ID for downloading, scheduling information thereof, and the targeted model of receiver to be updated; it is transmitted using SDTT

8.2.1.2
receiver information
information on the receiving set, such as maker ID, model number, group number, version number, etc; this information is stored in non-volatile memory such as flash memory before shipping

8.2.1.3
compulsory downloading
downloading that shall be executed

8.2.1.4
discretionary downloading
executable downloading displayed on the screen and executed in accordance with the viewer's content selections

8.2.2 Service variation

8.2.2.1 Receiver internal information renewal

Receiver internal information renewal service stored in the memory defined in this standard varies as follows:

- engineering service;
- PNG logo service in CDT in TS provided by each digital terrestrial television station;
- simple logo service transmitted by logo transmission descriptor in SDT in TS provided by each digital terrestrial television station;
- information transmission service including needs information of renewal, methods information of renewal, and repacking information for the mobile receiver that is transmitted by SDTT used for strong hierarchical layer in TS provided by all digital terrestrial television stations.

Receiver internal information renewal service defined in this standard does not cover specific memory data storing service that is provided by EPG, data service and/or video/audio service.

8.2.2.2 Engineering service

8.2.2.2.1 General

Engineering service is defined as the service transmitted by data carousel mechanism and is shown below. In principle, engineering services shall be notified by SDTT transmitted by TS of all broadcast stations.

8.2.2.2.2 Functional renewal of receiver software

This function enables the receiving equipment software to be renewed or added. (terrestrial digital television, BS/ broadband CS digital broadcast)

8.2.2.3 Renewal of common data in the receiving equipment

Data used commonly in the receiving equipment is updated such as:

- genre code table, program characteristic code table, reserved words table (terrestrial digital television, BS/ broadband CS digital broadcast);
- logo data (BS/ broadband CS digital broadcast);
- frequency list, change information (terrestrial digital television).

8.3 Transmission scheme relevant to downloading

8.3.1 General

In this subclause, requirements of the transmission scheme are provided for both notification information concerning download scheduling, etc., and download contents.

8.3.2 Transmission scheme of notification information

8.3.2.1 Software download trigger table

To provide notice of download information, a software download trigger table is used. However, specific download contents transmitted in the subclause form described in 8.3.3.3 does not need software download trigger table.

Table 30 – Data structure of software download trigger table

Data structure	Number of bits	Representation of bit string
software_download_trigger_section(){		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
table_id_ext	16	uimsbf
reserved	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	uimsbf
section_number	8	uimsbf
last_section_number	8	uimsbf
transport_stream_id	16	uimsbf
original_network_id	16	uimsbf
service_id	16	uimsbf
num_of_contents	8	uimsbf
for(i=0;i<num_of_contents;i++){		
group	4	bslbf
target_version	12	uimsbf
new_version	12	uimsbf
download_level	2	bslbf
version_indicator	2	bslbf
content_description_length	12	uimsbf
reserved	4	bslbf
schedule_description_length	12	uimsbf
schedule_time-shift_information	4	bslbf
for(i=0;i<N;i++){		
start_time	40	uimsbf
duration	24	uimsbf
}		
for(j=0;j<N2;j++){		
descriptors()		
}		
}		
CRC_32	32	rpchof
}		

Definitions for the software download trigger table:

- **table_id** This shall be assigned to be 0xC3.
- **section_syntax_indicator** This shall be assigned to be 0x01.
- **section_length** This field contains the number of bytes from immediately after the section-length field to a section end, including CRC. Section length shall not exceed 4093.
- **table_id_ext**

Data structure	Number of bits	Representation of bit string
maker_id	8	uimsbf
model_id	8	uimsbf

- **version_number** This field indicates a version number of a subtable. The version number is incremented, accompanied with a change of information in the subtable. When the value reaches 31, it returns to 0.
- **current_next_indicator** This shall be assigned to be 0x01.
- **section_number** This field indicates the section number.
- **last_section_number** This field indicates the last section number of the subtable to which the section belongs.
- **transport_stream_id** A label with which the transport stream is identified from other multiplexed transport streams in the network.
- **original_network_id** A label that designates the network identification of the original delivery network.
- **service_id** A label with which a service that transmits the download contents is identified.
- **num_of_contents** This field indicates the number of download contents covered by this table.
- **group** This field contains group_id.
- **target_version** This field indicates version number of the contents to be updated.
- **new_version** This field indicates a version number of the contents to be downloaded.
- **download_level** “01” indicates compulsory downloading, and “00” indicates discretionary downloading.
- **version_indicator**

Table 31 – Version indicator

version_indicator	Description
00	All versions are targeted (version specification is invalid)
01	Version(s) specified or later are targeted
02	Version(s) specified or earlier are targeted
03	Only specified version is targeted

- **content_description_length** This field indicates total byte length of a schedule loop and a descriptor loop.
- **schedule_description_length** This field is common among all receivers and indicates byte length of the schedule loop. When the intended download content is being transmitted, the value of this field is 0.
- **schedule_time-shift_information**

Table 32 – Schedule time-shift information

Schedule_time-shift_information	Description
0	Identical download contents using plural service_id are transmitted on identical schedule
1-12	Identical download contents using plural service_id are transmitted with 1 to12 hours time-shifting transmission on service_id bases
13-14	Reserved
15	Download contents are transmitted using single service_id

- **start_time** This field indicates time of distribution of download content, using Japan Standard Time (JST) and Modified Julian Date (MJD).
- **duration** This field indicates duration time of distribution in seconds.
- **descriptors()** Download content descriptor shown in Table 33 is placed.

Table 33 – Structure of download content descriptor

Data structure	Number of bits	Representation of bit string
download_content_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
reboot	1	bslbf
add_on	1	bslbf
compatibility_flag	1	bslbf
module_info_flag	1	bslbf
text_info_flag	1	bslbf
reserved	3	bslbf
component_size	32	uimsbf
download_id	32	uimsbf
time_out_value_DII	32	uimsbf
leak_rate	22	uimsbf
reserved	2	bslbf
component_tag	8	uimsbf
if (compatibility_flag == '1') {		
compatibilityDescriptor()		
}		
if (module_info_flag == '1') {		
num_of_modules	16	uimsbf
for (i=0; i<num_of_modules; i++) {		
module_id	16	uimsbf
module_size	32	uimsbf
module_info_length	8	uimsbf
for (i=0; i< module_info_length; i++) {		
module_info_byte;	8	uimsbf
}		
}		
}		
private_data_length	8	uimsbf
for (i=0; i<private_data_length ; i++) {		
private_data_byte	8	uimsbf
}		
if (text_info_flag == '1') {		
ISO_639_language_code	24	uimsbf
text_length	8	uimsbf
for(i=0;i<N;i++){		
text_char	8	uimsbf
}		
}		
}		

- **descriptor_tag** A label with which the download content descriptor is identified. The value is 0xC9.
- **reboot** Flag indicating whether it is necessary to restart the receiver upon completion of downloading. “1” indicates restart, and “0” indicates continuous operation.
- **add_on** Flag indicating whether an overwrite of an existing module or addition occurs. “1” indicates addition, and “0” indicates overwrite.
- **compatibility_flag** Flag indicating the presence/absence of a compatibilityDescriptor() in the descriptor. “1” indicates that compatibilityDescriptor() is present, and “0” indicates that it is not.
- **module_info_flag** Flag indicating the presence/absence of information for each module in the descriptor. “1” indicates that information for each module is present, and “0” indicates that it is not.
- **text_info_flag** Flag indicating the presence/absence of service description at the end of the descriptor. “1” indicates that the service description is present, and “0” indicates that it is not.
- **component_size** This field contains the sum of data sizes that are transmitted in the carousel in bytes.
- **download_id** This field specifies download identification for the purpose of identifying an application number for this download. The download identification specified here is also specified in DII/DDB when actual distribution is done.
- **time_out_value_DII** This field indicates recommended time-out value in milliseconds for all DII section reception of the corresponding carousel.
- **leak_rate** Leak rate of the transport buffer of the receiver. Unit is 50 bytes/s.
- **reserved** This 2-bit field is reserved for future use.
- **component_tag** This 8-bit field contains a component tag of a corresponding stream that is given by a stream identification descriptor in PMT.
- **compatibilityDescriptor()** This field contains compatibilityDescriptor which is the same as that in DII. Any target to be updated by this download which cannot be specified by table_id_ext/group in SDTT shall be specified by using information here.
- **number_of_modules** This field indicates the number of modules.
- **module_id** Identification of a module in the carousel to download contents.
- **module_size** This field indicates byte length of the module concerned. “0” indicates undefined length.
- **module_info_length** Byte length of module_info_byte.
- **module_info_byte** This field contains necessary descriptors, i.e. type descriptor, name descriptor, info descriptor, or control descriptor as described in DII.
- **private_data_length** Byte length of private_data_byte.
- **private_data_byte** Use of this area is beyond the scope of this specification.

- **ISO_639_language_code** This field specifies language of character description used for the service description.
- **text_length** Length of the service description in bytes.
- **text_char** Description concerning the service of the download contents to be transmitted.

8.3.2.2 Transmission of SDTT

The terrestrial digital television broadcast scheme has hierarchical transmission which enables simultaneous transmission of a plural signal that has multiple transmission parameters. The robust hierarchical layer, where the transmission mechanism has a strong error resistance, is used for transmitting the signal to mobile receivers. The less robust hierarchical layer, where the transmission mechanism has mass transmission capability, is used for transmitting the signal to fixed receivers. By this way, each receiver can receive different SDTT(Software Download Trigger Table) respectively. To distinguish each SDTT transmitted in the robust hierarchical layer or less robust hierarchical layer, different PID is allocated to each SDTT. Note that the data structure of SDTT and table_id here are identical.

8.3.3 Transmission scheme of the content

8.3.3.1 General

The download contents are transmitted using data carousel or section table.

8.3.3.2 Download contents data carousel transmission scheme

8.3.3.2.1 General

Additional specifications concerning download to the DSM-CC data carousel transmission specifications are described below.

The information concerning the downloading contents is transmitted through the use of the DDB of the DSM-CC data carousel.

8.3.3.2.2 Use of compatibilityDescriptor in DII

It is necessary to use a compatibility descriptor in DII to specify the target receiver for downloading. It is assumed that the semantics and syntax of the compatibilityDescriptor are used. The syntax is shown in Table 34.

Table 34 – compatibilityDescriptor format

Syntax	Number of bytes
compatibilityDescriptor(){	
compatibilityDescriptorLength	2
descriptorCount	2
for (i=0 ; i<descriptorCount ; i++){	
descriptorType	1
descriptorLength	1
specifierType	1
specifierData()	3
model	2
version	2
subDescriptorCount	1
for (j=0 ; j< subDescriptorCount ; j++){	
subDescriptor()	
}	
}	
}	
subDescriptor() {	
subDescriptorType	1
subDescriptorLength	1
for (k=0 ; k< subDescriptorLength ; k++){	
additionalInformation	1
}	
}	

Additional specifications to the original DSM-CC data carousel are described to specify the target receiver flexibly and in detail.

Maker identification (maker_id), model identification (model_id) and version identification (version_id) shall be contained in the compatibilityDescriptor in the header of DII (Download Info Indication).

By including a plurality of descriptors in this compatibilityDescriptor, describing models that should download the software, it becomes possible for models from multiple makers to download the software at the same time. Note that if there are two or more descriptors of the same descriptorType, the models that should download the software shall be specified by an OR (logical sum) operation of the descriptors; however, if there are two or more descriptors of each different descriptorType, the models that should download the software shall be specified by an AND (logical product) operation.

A method of specifying models of the target receivers for downloading shall be specified by the descriptorType, and specification by hardware and/or by software shall be possible.

Identification fields of the model information are shown in Table 35.

Table 35 – Identification field

Field	Content	Number of bits
specifierType	0xFF	8
specifierData()	Code indicating “ARIB”(0x819282)	24
model	Equivalent to (maker_id)	8
	Equivalent to (model_id)	8
version	Assigned to (group_id)	4
	Equivalent to (version_id)	12

The version field is divided between a version_id of 12 bits and a group_id of 4 bits (group identification). Here, the group_id is provided to divide the receivers that should download the software into several groups with the intention to mitigate power plant load.

It is possible to consider the Virtual Machine as a specific model, and hence, all receivers having a Virtual Machine are made to download the same software.

8.3.3.2.3 Addition of descriptor for DII Module Info

Information of the download contents shall be described in Module Information area in a DII message of DSM-CC data carousel. The information is transmitted using several descriptors that have already been defined. The DII (Download Info Indication Message) format is shown in Table 36.

Table 36 – DII (Download Info Indication Message) format

Syntax	Number of bytes
downloadInfoIndication(){	
dsmccMessageHeader()	
downloadId	4
blockSize	2
windowSize	1
ackPeriod	1
tCDownloadWindow	4
tCDownloadScenario	4
compatibilityDescriptor()	
numberOfModules	2
for (i=0 ; i< numberOfModules ; i++){	
moduleId	2
moduleSize	4
moduleVersion	1
moduleInfoLength	1
for (j=0 ; j< moduleInfoLength ; j++){	
moduleInfoByte	1
}	
}	
privateDataLength	2
for (i=0 ; i< privateDataLength ; i++){	
privateDataByte	1
}	
}	

Descriptors contained in the moduleInfoByte for the use of download will be described below.

The type descriptor contains module type description that indicates the module carrying download content. A receiver discriminates whether the module carries content of the data services or content of the download by this descriptor. Notation of module type follows the “Media Type” notations in RFC2046.

EXAMPLE application/x-download indicates that it is the download contents.

Though actual description of module type may vary by targeted receiver model, the notation shall always follow that in RFC2046.

A module name is described in the name descriptor. The name shall be unique in all the module names in a receiver system. For example, if all software components of a receiver system consist of module based manner on a file system, the path of the targeted module on the file system is described in this name descriptor.

Further additional information of the module to be downloaded is described in info descriptor. The information content in info descriptor shall be in plain text. Control descriptor is utilized when any byte data is added to the module.

8.3.3.3 Section transmission scheme of download contents

8.3.3.3.1 General

CDT (Common Data Table) is used when download contents are transmitted in the section form.

8.3.3.3.2 Common for all receiver Data Table (CDT)

CDT is utilized to transmit the common data that shall be stored in the non-volatile memory and shall be transmitted in the section form to all receivers. In the terrestrial digital television broadcast scheme, it is possible that the service provider’s service logo data is transmitted using the data_module_byte in CDT where logo data is allocated. Data structure of CDT is shown in Table 37.

Table 37 – CDT syntax

Data structure	Number of bits	Representation of bit string
common_data_section () {		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
download_data_id	16	uimsbf
reserved	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
original_network_id	16	uimsbf
data_type	8	uimsbf
reserved_future_use	4	bslbf
descriptors_loop_length	12	uimsbf
for(i=0;i<n;i++) {		
descriptor()		
}		
for(j=0;j<m;j++) {		
data_module_byte	8	uimsbf
}		
CRC_32	32	rpchof
}		

Definitions for the CDT:

- **table_id** This shall be assigned to be 0xC8.
- **section_syntax_indicator** This 1 bit field shall be assigned to be “1”.
- **section_length** This field size is 12 bits. This field contains the number of bytes from immediately after the section_length field to a section end, including CRC. To restrict the total section length to 4096 bytes, section_length shall be 4093 or less.
- **download_data_id** This field size is 16 bits. This specifies the download identification to apply a number for this download to all receiver. Download data identification shall be unique in respective original network identification (original_network_id). If the download content is the service logo, this value corresponds to the download_data_id in the logo transmission descriptor described later and allocated in SDT.

- **version_number** This field size is 5 bits, and means a version number of the subtable. The version number increases if there is any change of the information in the subtable. When the value reaches “31”, it returns “0”. If current_next_indicator is “1”, version_number corresponds to the version number of the current subtable that is defined by table identification and network identification. If the current_next_indicator is “0”, the version number corresponds to the version number of the next subtable defined by the table identification and the network identification.
- **current_next_indicator** If this 1 bit field is “1”, it means that the subtable shall be used to the current subtable. If it is “0”, it means that the subtable shall not be used but shall be used as the next subtable.
- **section_number** This 8 bits field indicates the section number. The section number of the first section in the subtable shall be 0x00. The section number increases, when the section equipped with identical table identification and identical network identification is added.
- **last_section_number** This 8 bits field indicates the number of the last section of the subtable where the section belongs. The last section has the maximum section number in the subtable.
- **original_network_id** This 16 bits field is a label that designates the network identification of the original delivery network.
- **data_type** This 8 bits field indicates the type of download data to be transmitted.
- **descriptors_length** This 12 bits field indicates the total bytes length of the following descriptor.
- **data_module_byte** This field contains download data described in the form of the syntax defined by the respective data_type.
- **CRC_32** This 32 bits field indicates CRC value that the register value becomes 0 after processing the whole section.

8.3.3.3.3 Identification method of download data

Download data is identified by the download data identification. Download data identification is done by the descriptor that varies by the download contents or download purposes. In the terrestrial television broadcast scheme, service logo data is specified by the logo transmission descriptor allocated in SDT (Service Description Table).

The data structure of the logo transmission descriptor is shown in Table 38.

Table 38 – Logo transmission descriptor syntax

Data structure	Number of bits	Representation of bit string
logo_transmission_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
logo_transmission_type	8	uimsbf
if(logo_transmission_type==0x01){		
reserved_future_use	7	bslbf
logo_id	9	uimsbf
reserved_future_use	4	bslbf
logo_version	12	uimsbf
download_data_id	16	uimsbf
}		
else if(logo_transmission_type==0x02){		
reserved_future_use	7	bslbf
logo_id	9	uimsbf
}		
else if(logo_transmission_type==0x03){		
for(i=0;i<N;i++){		
logo_char	8	uimsbf
}		
}		
else{		
for(j=0;j<M;j++){		
reserved_future_use	32	bslbf
}		
}		
}		

- **logo_transmission_type** This 8 bits field indicates transmission type of the logo shown in Table 39.

Table 39 – Logo transmission type

Logo_transmission_type	Description
0x01	CDT transmission type 1: CDT is referred directly by the download data identification.
0x02	CDT transmission type 2: CDT is referred indirectly by the download data identification through logo identification.
0x03	Simple logo method
other	Reserved for future use