Technical Specifications for the Terminal Equipment for Fixed Communications Multimedia Content Transmission Platforms

National Communications Commission

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1   Source of law
    The Specifications are promulgated pursuant to Paragraph 1, Article 44 of the Telecommunications Management Act.

2   Scope of application
    The Specifications apply to devices that receive and demodulate signals transmitted from the head end of a multimedia content transmission platform as a piece of terminal equipment that allows subscribers of the multimedia content transmission platform to receive video, audio or information and is equipped with an IP (Internet protocol) interface of Ethernet port. In case that a set-top box is an integral part of a television set, the requirements in 5.8 and 5.9 in the Specifications may be exempted.

3   Technical standards
    The Specifications are based on CNS 13438, CNS 14336-1, CNS 14357 series, CNS 14676-4 and CNS 14676-5, and international technical standards ETSI EN 300 468, ETSI EN 300 743 and ETSI TS 101 154.

4   Definition of terms
    4.1   Set-top box: the set-top box of multimedia content transmission platform.
    4.2   Head end of a multimedia content transmission platform (hereinafter as "headend"): the equipment and place where signals are received, demodulated and transmitted to a wired transmission network.
    4.3   Multimedia content transmission platform signal: video, audio or information signal transmitted via cables laid by local network business providers for the direct reception of the public.
    4.4   Ultra-High Definition (UHD) program: a digital program with video definition equal to or greater than 3840×2160.
    4.5   High Definition (HD) program: a digital program with video definition between 1280×720 and 3840×2160.
    4.6   Standard Definition (SD) program: a digital program with video definition between 720×480 and 1280×720.
    4.7   MPEG-2: see CNS 14357 series standards, where system coding is defined in Part 1, video coding is defined in Part 2 and audio coding is defined in Part 3.
    4.8   Service Information (SI): digital data used to describe the delivery system, contents and scheduling of broadcasting data stream and extended definitions made for program-specific information (PSI) based on CNS 14357-1 MPEG-2, such as Electronic Program Guide (EPG).
    4.9   Program channel: a television channel that carries programs and commercials.
    4.10   Transport stream (TS): a data structure defined based on CNS 14357-1 (Information technology - Generic coding of moving pictures and associated audio information - Part 1: Systems).
    4.11   Real-time transport control protocol (RTCP): per the definition of RFC 3550.
    4.12   Real-time streaming protocol (RTSP): per the definition of RFC 2326.
    4.13   On-screen live caption: the texts or graphics that are additionally produced and edited to display on a television screen and not a part of the original broadcasting contents.
    4.14   Non-on-demand video: program video feeds in a television channel of a multimedia content transmission platform system.

5   Test items and acceptance criteria
    5.1   Electromagnetic compatibility (EMC): the EMI shall comply with CNS 13438.

5.2 Electric safety: the electric safety shall comply with CNS 14336-1.

5.3 Reliability:

    5.3.1 No system crashing for 12 consecutive hours of broadcasting;

    5.3.2 No locking effect, frame freezing, frame skipping, crackles or audio pauses during program broadcasting; the test shall last 4 hours at least.

5.4 Video and audio formats:

    5.4.1 Video:

        Test items include 5.4.1.1, 5.4.1.2 and 5.4.1.3, where 5.4.1.3 is optional:

        5.4.1.1 For SD: the video feed shall be decoded corrected and played in a video format or updated image compression standard, such as CNS 14357-2 MPEG-2 MP @ ML, ISO/IEC MPEG-4 AVC/H.264 HP@L4 or ETSI TS 101 154;

        5.4.1.2 For HD: the video feed shall be decoded corrected and played in a video format or updated image compression standard, such as ISO/IEC MPEG-4 AVC/H.264 HP@L4 or ETSI TS 101 154.

        5.4.1.3 For UHD: the video feed shall be decoded corrected and played in an HEVC video format or updated image compression standard, such as ETSI TS 101 154.

    5.4.2 Audio:

        The audio feed shall be decoded corrected and played in an audio format or audio compression standard such as ETSI TS 101 154 MPEG-1 or MPEG-2, AC-3 (Dolby Digital 5.1) or HE-AAC.

5.5 Time to switch to any program channel:

    5.5.1 Time from the moment that the images of the previous program channel end to the moment that the images of the next program channel appear $\leqq 2$ seconds.

    5.5.2 The test items for 5.5.1 are shown as follows, where (2), (3) and (6) are optional:

        (1) Switching between non-on-demand SD program format and non-on-demand HD program format;

        (2) Switching between non-on-demand SD program format and non-on-demand UHD program format;

        (3) Switching between non-on-demand HD program format and non-on-demand UHD program format;

        (4) Switching between non-on-demand SD program format and non-on-demand SD program format;

        (5) Switching between non-on-demand HD program format and non-on-demand HD program format;

        (6) Switching between non-on-demand UHD program format and non-on-demand UHD program format.

5.6 Allowable time for shift in video and audio synchronization: within ±20 milliseconds (ms)

5.7 Service information (SI)

    5.7.1 Rated program reviewing, viewing time control: the provision of on-demand viewing, rated program viewing, viewing time control setting and change of password are allowed only upon entering the correct password (4 digits or more).

    5.7.2 Requirements for rated program viewing:

        5.7.2.1 The program rating shall be shown in the information bar and EPG.

        5.7.2.2 Programs of restricted rating (R-rated):

        (1) The correct password shall be entered for viewing of R-rated programs; however, the password may not be needed for switching between R-rated programs.

        (2) The contents of program shall be blanked out and muted before the correct password is entered.

        (3) The requirement in (1) for password entering applies to the switching between non-R-rated and R-rated programs.

(4)   The requirement in (1) for password entering applies when the start-up screen contains contents of an R-rated program.

5.7.2.3   Parental-controlled program is a program that requires a password for viewing although it is not an R-rated program:

(1)   The correct password shall be entered for viewing of parental-controlled programs; however, the password may not be needed for switching between parental-controlled programs.

(2)   The contents of program shall be blanked out and muted before the correct password is entered.

(3)   The requirement in (1) for password entering applies to the switching between non-parental-controlled and parental-controlled programs.

(4)   The requirement in (1) for password entering applies to the switching from a parental-controlled program to a non-parental-controlled program and then back to a parental-controlled program; however, the equipment shall provide a function that requires no password within a certain period of time during which there is no need to enter a password.

(5)   The requirement in 5.7.2.2 (1) for password entering applies to the switching from a parental-controlled program to an R-rated program.

(6)   The requirement in (1) for password entering applies when the start-up screen contains contents of a parental-controlled program.

(7)   The requirement in (1) for password entering applies to the change of parental-controlled program settings.

5.7.3   Viewing time control:

5.7.3.1   The correct password shall be entered for the access to viewing time settings and change of password.

5.7.3.2   In case that a period of time is set to be prohibited from viewing, the contents of program shall be blanked out and muted before the correct password is entered.

5.7.3.3   A password shall be entered for the change of viewing time control settings.

5.7.4   Multilingual captions:

Captions in traditional Chinese and English, as well as selection of captions, shall be supported after the firmware is updated online for set-top box hardware. The user may activate or hide the display of captions and select between captions of different languages via the user interface. By default, the caption display is activated and the language is traditional Chinese.

5.7.5   Electronic program guide (EPG): the EPG information transmitted from the headend shall be received and correctly decoded for the display of contents; more details are provided in Table 1.

5.7.6   Automatic firmware update: the functions of automatic online firmware update (i.e. firmware update online from the headend system) and inquiry of current firmware version shall be provided.

5.7.7   On-screen live caption display:

5.7.7.1   The contents of on-screen live caption transmitted from the headend shall be received, decoded correctly and displayed.

5.7.7.2   The regulations promulgated according to Paragraph 2, Article 39 of the Cable Radio and Television Act shall be met for the inserted location, display time and number of words in the message for on-screen live captions.

5.7.8   Natural disaster or emergency event message information: the natural disaster or emergency accident message information shall be received from the headend and the following actions performed according to the control signals from the headend:

5.7.8.1   The same message shall be broadcast on all program channels and the television shall

be switched to the specified program channel for broadcasting of relevant message(s);

5.7.8.2 The contents of natural disaster or emergency event message shall be broadcast on all, partial or specified program channels in the form of on-screen live captions.

5.7.9 Multi-track output: according to ETSI EN 300 468, 2 sets or more of audio tracks shall be received from the headend, decoded correctly, and displayed.

5.7.10 Functions of selection on EPG (transmission from the headend shall be received):

5.7.10.1 The function of personal selection of paid channels, including paid contents, shall be provided;

(1) Addition and cancellation of single channels;

(2) Addition and cancellation of multi-channel package.

5.7.10.2 The function of personalized menu (e.g. user-defined channel numbers or sequence, my favorite channels) shall be provided to allow the presentation of personalized menu by adding channel numbers, program names or program types or by adding my favorite channels.

5.8 Audio output

5.8.1 General audio formats shall support stereo output (audio output shall be possible at individual L+R sound channels).

5.8.2 Signal level: $\geq$1 Vrms; the test signal is a sine wave at 1000 Hz (1 kHz) with 0 dBFS MPEG coding; the load impedance is 100 kΩ.

5.8.3 Total harmonic distortion with noise (THD+N): $\leq$0.3%; the test signal is a sine wave at 20 Hz to 20 kHz with -3 dBFS MPEG coding; the load impedance is 100 kΩ.

5.8.4 Frequency response: within ±0.5 dB; the test signal is a sine wave at 20 Hz to 20 kHz with 0 dBFS MPEG coding; the load impedance is 100 kΩ.

5.8.5 Signal to noise ratio (SNR): $\geq$70 dB, including unweighted and A-weighted modes; the test signal is a sine wave at 1 kHz with 0 dBFS MPEG coding; the load impedance is 100 kΩ.

5.8.6 L.R cross talk: $\leq$70 dB; the test signal is a sine wave at 1 kHz with -20 dBFS MPEG coding; the load impedance is 100 kΩ.

5.8.7 L.R phase difference: $\leq$5 degrees; the test signal is a sine wave at 20 Hz $\sim$ 20 kHz with 0 dBFS MPEG coding; the load impedance is 100 kΩ.

5.8.8 L.R power level difference: $\leq$0.5 dB; the test signal is a sine wave at 20 Hz to 20 kHz with 0 dBFS MPEG coding; the load impedance is 100 kΩ.

5.8.9 Dynamic range: $\geq$70 dB; the test signal is a sine wave at 1 kHz with -60 dBFS MPEG coding; the load impedance is 100 kΩ.

5.8.10 Others: for test signals that are of sine wave between 20 Hz and 20 kHz, the test shall be performed at 31 frequency points at least in this frequency range; see Table 2 for details of frequency points.

5.9 Video output

5.9.1 Video feeds coded in NTSC standard format shall be supported.

5.9.2 Composite video and component video or HDMI output shall be provided.

5.9.3 Composite video broadcast signal (CVBS) output:

5.9.3.1 Amplitude characteristics

(1) Bar amplitude): within 100 IRE ± 5 IRE;

(2) Sync amplitude): within 40 IRE ± 2 IRE;

(3) Bar width): within 18 microseconds (us) ± 0.5 us.

5.9.3.2 K-factor)

(1) 2T sine wave distortion (K-2T): within ±1.5 %;

(2) 2T since square wave to bar impulse amplitude ratio (K-PB): within ±3 %.

5.9.3.3 Frequency response distortion characteristics: see Table 3 for details. The video output of multi-burst image with 6 different frequency packets is used.

5.9.3.4 Luminance non-linearity gain distortion: within ± 5 %;

5.9.3.5 Chrominance non-linearity distortion
(1) Gain distortion: within ±3 %;
(2) Phase distortion: within ±2 degrees;
(3) Chrominance to luminance intermodulation distortion: within ±2 %;

5.9.3.6 Chrominance to luminance distortion
(1) Gain inequality: within 100±10 %;
(2) Delay inequality: within ±30 nanoseconds (ns).

5.9.3.7 Chrominance AM and PM noises
(1) AM noise): ≦-45 dB rms;
(2) PM noise): ≦-45 dB rms.

5.9.3.8 Differential gain and differential phase distortion
(1) Differential gain distortion: within ±5 %;
(2) Differential phase distortion: within ±5 degrees.

5.9.3.9 Noise spectrum level
(1) The noise level with frequency range between 0.1 MHz and 4.2 MHz: ≦-52 dB rms;
(2) Unified weighting noise level: ≦-58 dB rms.

5.9.3.10 Characteristics of color bar signals: see Table 4 for details.

5.9.4 Component video output:
5.9.4.1 The quality and performance requirements for resolution of 720p, 1080i or above shall be supported.

5.9.4.2 Channel delay characteristics
(1) "Y" to "Pb" channel delay: within ±40 ns;
(2) "Y" to "Pr" channel delay: within ±40 ns;
(3) "Pb" to "Pr" channel delay: within ±40 ns.

5.9.4.3 Color bar amplitude characteristics: see Table 5 for details.

5.9.4.4 Noise spectrum characteristics: see Table 6 for details.

5.9.5 HDMI output function:
5.9.5.1 The quality and performance requirements for resolution of 720p, 1080i or above shall be supported.

5.9.5.2 The transmission interface shall be HDMI 1.1 or higher version.

5.10 Receiving interface
5.10.1 RJ45 interface or wireless WiFi interface shall be used on set-top box and RTCP or RTSP communication protocol shall be supported. When RTCP or RTSP is used, the received is limited only to receive headend data.

5.10.2 Transmission circuit durability test:
A set-top box shall connect to network, decode and play correctly with the compliance with the following transmission circuit criteria:

5.10.2.1 Number of lost packets that were received: the set-top box shall function normally when 4 IP packets are lost during an hour or one or more packets are lost in 5 consecutive minutes.

5.10.2.2 The set-top box shall function normally under 50ms or more of receiving packet jitters.

5.10.3 Receiving and processing capability
5.10.3.1 Those that are capable of single program transport stream (SPTS) shall be capable of processing transport stream ≧20 Mbps.

5.10.3.2 Those that are capable of multiple program transport stream (MPTS) shall be capable of processing transport stream ≧60 Mbps.

5.10.3.3 The test item 5.10.3 shall be performed with one or more HD programs.

5.10.4 Capability of receiving and decoding:
Test items include 5.10.4.1, 5.10.4.2 and 5.10.4.3, where 5.10.4.3 is optional:

5.10.4.1 For SD program formats transmitted using MPEG-2 compression, the traffic volume >

3Mbps; for those transmitted using MPEG-4 AVC (H.264) or VC-1 compression, the traffic volume >1.75 Mbps.

5.10.4.2 For HD program formats transmitted using MPEG-2 compression, the traffic volume >17 Mbps; for those transmitted using MPEG-4 AVC (H.264) or VC-1 compression, the traffic volume >10 Mbps.

5.10.4.3 For UHD program formats transmitted using MPEG-H Part2 (HEVC/H.265) compression, the volume >25 Mbps.

5.10.5 Electromagnetic susceptibility (EMS):

5.10.5.1 CNS 14676-4 shall be met (the power line shall meet the 1KV level; the signal line shall meet the 500V level).

5.10.5.2 CNS 14676-5 shall be met (the 2KV level shall be met between the power line, neutral line and ground line; the 1KV level shall be met between lines).

5.11 For those with USB expansion interface, one USB 2.0 port or more shall be provided. The port(s) provided shall be of TYPE A or TYPE C.

5.12 For those with recoding function, the playback shall only be possible for the set-top box and smart card or other encryption mechanism used during recording.

5.13 For those with WiFi, Bluetooth or other RF interface, the RF performance shall comply with the Technical Specifications for Low-Power Radio Frequency Material.

5.14 Working environment:

The device to be tested shall function properly at the temperature range between 5°C and 40°C and relative humidity range between 45% and 80% (R.H.).

5.15 The test fixtures and places needed for test items 5.7.4, 5.7.6～5.7.8, 5.7.10 and 5.12 shall be provided by the applicant.

Table 1: EPG items and functional requirements

No.	Item	Functional requirements	Remark
1	EPG display content	Program schedule	
2		Information of program currently being played and that to be played next	
3		Display of current time	
4		Support for program introduction	
5	EPG content display method	Browsing by program channel	
6		Browsing by program schedule	Optional
7		Browsing by program type	
8	EPG operation method	EPG browsing via menu	
9		EPG browsing via remote control shortcuts	
10	EPG receiving capability	Every channel shall support program schedule information display for at least 7 days, and 225 bytes of program introduction for every single program.	
11	EPG updates	Support for automatic update of EPG contents in real time	
12	EPG program rating display	Support for display and update of program rating information	

Table 2: 31 test frequency points between 20 Hz and 20 kHz

Frequency (in Hz)						
20	25	32	40	50	63	80
101	127	160	202	254	320	403
508	640	806	1000	1260	1587	2000
2520	3175	4000	5040	6350	8000	10074
12699	16000	20000				

Table 3: Test limits for frequency response distortion characteristics for video output

Packet	Frequency point	Criteria
Packet 1 amplitude	0.5 MHz	Within ± 0.5 dB
Packet 2 amplitude	1.0 MHz	Within ± 0.5 dB
Packet 3 amplitude	2.0 MHz	Within ± 0.5 dB
Packet 4 amplitude	3.0 MHz	Within ± 0.5 dB
Packet 5 amplitude	3.58 MHz	Within ± 0.5 dB
Packet 6 amplitude	4.2 MHz	Within ± 0.5 dB

Table 4: Test limits for characteristics of color bar signals

Item		Criteria
Luminance Amplitude	White	Within 100.0 IRE±2 IRE
	Yellow	Within 68.97 IRE±2 IRE
	Cyan	Within 56.13 IRE±2 IRE
	Green	Within 48.22 IRE±2 IRE
	Magenta	Within 36.15 IRE±2 IR
	Red	Within 28.24 IRE±2 IRE
	Blue	Within 15.41 IRE±2 IRE
	Black	Within 7.50 IRE±2 IRE
Chrominance Amplitude (p-p)	Yellow	Within 62.07 IRE±2 IRE
	Cyan	Within 87.74 IRE±2 IRE
	Green	Within 81.93 IRE±2 IRE
	Magenta	Within 81.93 IRE±2 IRE
	Red	Within 87.74 IRE±2 IRE
	Blue	Within 62.07 IRE±2 IRE
Chrominance Phase	Yellow	Within 167.1 degrees ±2 degrees
	Cyan	Within 283.5 degrees ±2 degrees
	Green	Within 240.7 degrees ±2 degrees
	Magenta	Within 60.7 degrees ±2 degrees
	Red	Within 103.5 degrees ±2 degrees
	Blue	Within 347.1 degrees ±2 degrees

Table 5: Limits for color bar amplitude characteristics for component video

Items	720p, 1080i		
	Y component	Pb component	Pr component
White	700.0 mV±35 mV	0.0 mV±5 mV	Within 0.0 mV±5 mV
Yellow	649.5 mV±32.5 mV	-350.0 mV±17.5 mV	Within 32.1 mV±3 mV
Cyan	551.2 mV±27.5 mV	80.2 mV±4 mV	Within -350.0 mV±17.5 mV
Green	500.6 mV±25 mV	-269.8 mV±13.5 mV	Within -317.9 mV±16 mV
Magenta	199.4 mV±10 mV	269.8 mV±13.5 mV	Within 317.9 mV±16 mV
Red	148.8 mV±7 mV	-80.2 mV±4 mV	Within 350.0 mV±17.5 mV
Blue	50.5 mV±3 mV	350.0 mV±17.5 mV	Within -32.1 mV±3 mV
Black	0.0 mV±5 mV	0.0 mV±5 mV	Within 0.0 mV±5 mV

Table 6: Limits for noise spectrum level for component video

Items	Criteria
Y Component, 0.1 MHz～4.2 MHz	$\leqq$-52 dB rms
Y Component, Unified Weighted	$\leqq$-58 dB rms
Pb Component, 0.1 MHz～4.2 MHz	$\leqq$-52 dB rms
Pb Component, Unified Weighted	$\leqq$-58 dB rms
Pr Component, 0.1 MHz～4.2 MHz	$\leqq$-52 dB rms
Pr Component, Unified Weighted	$\leqq$-58 dB rms