Technical Specifications for Set-Top Boxes for Multimedia Content Distribution Platform on a Fixed Telecommunications Network

1. Legal Accordance

The Specifications are stipulated pursuant to Paragraph 1 of Article 42 of the Telecommunications Act.

2. Scope of Applications

The Specifications are applicable to terminal equipment of Internet Protocol (IP) physical interface that is equipped with an Ethernet port and able to receive and demodulate signals transmitted by multimedia content distribution platforms for subscribers to receive video, audio or information. Set-top boxes that are integrated into the television shall be exempt from the tests as described in Article 5.8 and Article 5.9 of the Specifications.

3. Technical Standards

The specifications are stipulated in accordance with CNS 13438, CNS 14336-1, CNS 14357 series, CNS 14676-4, CNS 14676-5 and international technical standards, including ETSI EN 300 468, EN 300 743, TS 101 154.

4. Definition of Terms

4.1 Set-top box: refers to set-top box of multimedia content distribution platform.

4.2 Multimedia content distribution platform head-ends (hereinafter referred to as the head-ends): refers to the equipment and its location for receiving, demodulating and transmitting cable radio and television signals to the cable transmission network.

4.3 Multimedia content distribution platform signal: refers to signals that local network business operators transmit to broadcast video, audio or information for direct public reception via cables.

4.4 Video compression standards

    4.4.1 SDTV adopts MPEG-2 or H.264/MPEG-4 AVC compression standards.

    4.4.2 HDTV adopts H.264/MPEG-4 AVC compression standards.

4.5 Audio compression standards: adopts MPEG-1, MPEG-2, AC-3 (Dolby Digital 5.1 channel), or HE-AAC compression standards.

4.6 High-Definition Programs: refers to digital programs with resolution of above 1280 x 720p and compressed with the H.264/MPEG-4 AVC or VC-1 standards.

4.7 Standard Quality Programs: refers to digital programs with resolution above 720 x 480i and below 1280 x 720p, and compressed with MPEG-2, H.264/MPEG-4 AVC or VC-1 standards.

4.8 MPEG-2: as referred in CNS 14357 series standards. Among them, the system coding is defined in Part I, video coding in Part II, and sound coding in Part III.

4.9 Service Information (SI): refers to digital data used to describe the delivery system, content, schedule and time series of broadcast data stream, and program specific information (PSI) based on CNS 14357-1 MPEG-2, such as Electronic Program Guides (EPGs).

4.10 Program Channels: refer to channels that load programs and advertisements among television channels.

4.11 Transport Stream (TS): an information structure defined according to CNS 14357-1 (Information technology-Generic coding of moving pictures and associated audio in formation-Part 1:Systems).

4.12 Real-Time Transport Control Protocol (RTCP): according to the definition of RFC 3550.

4.13 Real-Time Streaming Protocol (RTSP): according to the definition of RFC 2326.

4.14 Inserted Characters: refer to text or graphics appearing on the TV screen that have been edited and compiled and not part of the original contents being transmitted.

4.15 Non-Video on Demand: refers to program videos of broadcasting television channels on the multimedia content transporting platform.

5. Testing Items and Approval Standards

5.1 EMC: the EMI of EMC shall comply with CNS 13438.

5.2 Electrical Safety (Safety) shall comply with CNS 14336-1.

5.3 Reliability:

5.3.1 No crash occurs during a continuous twelve-hour broadcast.

5.3.2 No locking effect, frame freezing, frame skipping, crackling or ceased audio during the broadcasted program. A minimum four-hour test shall be conducted.

5.4 Video and audio format:

5.4.1 Video signals:

5.4.1.1 Standard definition (SD): shall accurately decode and broadcast video signals that comply with CNS 14357-2 MPEG-2 MP@ML, ISO/IEC MPEG-4 AVC/H.264 HP@L4, ETSI TS 101 154, or the new generation video compression standards.

5.4.1.2 High definition (HD): shall accurately decode and broadcast video signals that comply with ISO/IEC MPEG-4 AVC/H.264 HP@L4, ETSI TS 101 154, or the new generation video compression standards.

5.4.2 Audio signals: shall accurately decode and broadcast audio signals that comply with ETSI TS 101 154 or the new generation audio compression standards.

5.5 Duration for switching program channels:

5.5.1 Time required for the appearance of images of next program channel after the conclusion of video of the previous channel program shall be ≦2 seconds.

5.5.2 The program switch tests as described in 5.5.1 shall be switched from non-VOD SD programs to non-VOD HD programs, non-VOD HD programs to non-VOD SD programs, and non-VOD HD programs to non- VOD HD programs.

5.6 Video and audio synchronization shift: within ±20 milliseconds (ms).

5.7 Service Information (SI)

5.7.1 Setting the reception and time of rated programs: only after entering the correct password (minimum 4 digits), users shall be able to access the video on demand (VOD) service, set the reception, the time channel programs can be received, and change password.

5.7.2 Reception of rating programs

5.7.2.1 Program rating shall be displayed in the information bar and electronic program guide.

5.7.2.2 Programs with restricted content:

(1) Password shall be required for receiving programs with restricted content. However, password may be omitted for switching to other programs with restricted content.

(2) Prior to the password being entered, all program video and audio must be hidden.

(3) When switching from non-restricted programs to programs with restricted content, the password requirement as described in (1) shall be applied.

(4) When images of programs with restricted content appear in the startup screen, the password requirement as described in (1) shall be applied.

5.7.2.3 Parental lock programs refer to programs that require password, apart from those with restricted content:

(1) A password shall be required for receiving parental lock programs. However, the password may be omitted for switching to other parental lock programs.

(2) Prior to the password being entered, program images and audio must be hidden.

(3) When switching non-parental lock programs to parental lock programs, the password requirement as described in (1) shall be applied.

(4) When switching back to parental lock programs from non-parental lock programs, the password requirement as described in (1) shall be applied. However, if the equipment allows user not to enter the password during a specific period, the user may not enter the password during the set period.

(5) When switching parental lock programs to programs with restricted content, the password requirement as described in 5.7.2.2 (1) shall be applied.

(6) When images of parental lock programs appear in the startup screen, the password requirement as described in (1) shall be applied.

5.7.3 Setting the time of reception:

5.7.3.1 Only after entering the correct password will users be able to set the time of reception and change the password.

5.7.3.2 During the designated time of non-reception, program images and audio must be hidden prior to the password being entered.

5.7.3.3 The password shall be entered when changing the reception time setting.

5.7.4 Multiple language subtitles:After the online firmware update of this function, the set-top box hardware shall provide traditional Chinese and English subtitles, and support the subtitle selection function. Users may activate or hide the subtitle display and select subtitles of different languages through the user interface. The default for subtitle display shall be activated and the default language shall be traditional Chinese.

5.7.5 Electronic Program Guide (EPG): shall receive EPG information transmitted by head-ends and accurately decode and display the information. See attached Table 1 for relevant rules.

5.7.6 Firmware Auto-Update: shall feature an online firmware auto-update (that is, the update of firmware is conducted by the head-end system online) and functions checking firmware version.

5.7.7 Display of Inserted Subtitles:

5.7.7.1 Shall receive the content of inserted subtitles transmitted by head-ends; the content shall be accurately decoded and displayed.

5.7.7.2 The transmission location, display time and number of message characters shall comply with filial laws stipulated according to Paragraph 2 of Article 39 of Cable Radio and Television Act.

5.7.8 Information concerning Natural Disasters and Emergencies: shall receive information concerning a natural disaster or emergency transmitted by head-ends, complying with the control signals transmitted by head-ends as follows:

5.7.8.1 The same information shall be displayed in all program channels, and shall be enforced to switch to a designated program channel and broadcast relevant information;

5.7.8.2 Natural disaster and emergency information shall be displayed as inserted subtitles in all, partial or designated program, channel(s).

5.7.9 Multi-Track Output: shall comply with ETSI EN 300 468, receive the content of at least two sets of tracks, and accurately decode and display the content.

5.7.10 The click and select function of electronic program guides (shall be able to receive signals transmitted by head-ends):

5.7.10.1 Shall be equipped with subscriber paid channel function (paid content shall be included).

(1) Add / cancel a single channel.

(2) Add / cancel a channel package (multiple channels).

5.7.10.2 Shall be equipped with the customized menu function (such as customized channel number or order, my favorite channels etc.), where the subscribers can customize EPG by ordering the channels based on "channel number", "program name" or "program type, or by adding "my favorite channel".

5.8 Audio Output

5.8.1 General audio format shall support stereo output (individual channel of L+R shall be able to output audio).

5.8.2 Signal Level: ≥1 Vrms. The testing signal shall be 1 kHz sine wave under 0 dBFS MPEG and the load impedance shall be 100 kΩ.

5.8.3 Total Harmonic Distortion with Noise (THD+N): ≤0.3%. The testing signal shall be 20 Hz to 20 kHz sine wave under -3 dBFS MPEG and the load impedance shall be 100 kΩ.

5.8.4 Frequency Response: within ±0.5 dB. The testing signal shall be 20 Hz to 20 kHz sine wave under 0 dBFS MPEG and the load impedance shall be 100 kΩ.

5.8.5 Signal to Noise Ratio (SNR): ≥70 dB, including unweighted and A-weighted modes. The testing signal shall be 1 kHz sine wave under 0 dBFS MPEG and the load impedance shall be 100 kΩ.

5.8.6 L.R Cross Talk): ≤-70 dB. The testing signal shall be 1 kHz sine wave under -20 dBFS MPEG and the load impedance shall be 100 kΩ.

5.8.7 L.R Phase Difference: ≤5 degrees. The testing signal shall be 20 Hz to 20 kHz sine wave under 0 dBFS MPEG and the load impedance shall be 100 kΩ.

5.8.8 L.R Power Level Difference: ≤0.5 dB. The testing signal shall be 20 Hz to 20 kHz sine wave under 0 dBFS MPEG and the load impedance shall be 100 kΩ.

5.8.9 Dynamic Range: ≥70 dB. The testing signal shall be 1 kHz sinusoidal audio signal under -60 dBFS MPEG and the load impedance shall be 100 kΩ.

5.8.10 Other rules: those whose testing signal is sine wave within the frequency band of from 20 Hz to 20 kHz shall test at least 31 frequency points during this range. See attached Table 2 for frequency point related details.

5.9 Video Output

5.9.1 Support video encoded in the standard NTSC format.

5.9.2 Feature the composite video and component video or HDMI output functions.

5.9.3 Composite Video (Composite Video Broadcast Signal; shortened as 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 milliseconds (us) ± 0.5 milliseconds (us).

5.9.3.2 K-Factor

(1) Distortion of 2T Sine Wave (K-2T): within ±1.5 %.

(2) Ratio of 2T Squared Sine Wave and Bar Amplitude (K-PB): within ±3 %.

5.9.3.3 Frequency Response and Distortion (Multi burst): see attached Table 3 for relevant rules. The video output of multi burst images with 6 different frequency packets.

5.9.3.4 Gain Distortion of Luminance Non-Linearity: within ± 5 %.

5.9.3.5 Distortion of Chrominance Non-Linearity

(1) Gain Distortion: within ±3 %.

(2) Phase Distortion: within ±2 degrees.

(3) Distortion of Chrominance to Luminance: within ±2 %.

5.9.3.6 Distortion of Chrominance to Luminance

(1) Gain Inequality: within 100±10 %.

(2) Delay Inequality: within ±30 nanoseconds (ns)

5.9.3.7 Chrominance AM / PM Noise

(1) Amplitude Modulation Noise (AM Noise): ≦-45 dB rms.

(2) Phase Modulation Noise (PM Noise): ≦-45 dB rms.

5.9.3.8 Distortion of Differential Gain & Differential Phase

(1) Distortion of Differential Gain (Diff. Gain): within ±5 %.

(2) Distortion of Differential Phase (Diff. Phase): within ±5 degrees.

5.9.3.9 Noise Spectrum Level

(1) Noise level for frequency range between 0.1 MHz to 4.2 MHz: ≦-52 dB rms.

(2) Noise level for unified weighting: ≦-58 dB rms.

5.9.3.10 Characteristics of Color Bar Signals: See attached Table 4 for relevant rules.

5.9.4 Component Video Output:

5.9.4.1 Shall support the quality and performance requirements for resolutions of at least 720p and 1080i.

5.9.4.2 Characteristics of Channel Delay

(1) Channel Delay of "Y"to"Pb": within ±40 nanoseconds (ns).

(2) Channel Delay of "Y"to"Pr": within ±40 nanoseconds (ns).

(3) Channel Delay of "Pb"to"Pr": within ±40 nanoseconds (ns).

5.9.4.3 Characteristics of Color Bar Amplitude: see attached Table 5 for relevant rules.

5.9.4.4 Characteristics of Noise Spectrum: see attached Table 6 for relevant rules.

5.9.5 HDMI Output：

5.9.5.1 Shall support the quality and performance requirements for resolutions of at least 720p and 1080i.

5.9.5.2 The transmission interface shall comply with HDMI 1.1 or above.

5.10 Reception interface

5.10.1 The set-top box shall adopt RJ45 interface or wireless interface such as WiFi, and shall also support RTCP or RTSP communications protocol. Where RTCP or RTSP takes place, the connector shall be limited in receiving head-ends data.

5.10.2 Transmission circuit durability: the set-top box shall be properly connected and broadcast signals when complying with the following transmission circuit standard circumstances:

5.10.2.1 Numbers of lost IP packet: the set-top box shall be able to function normally when missing the IP packet for more than four times in an hour or once within five minutes.

5.10.2.2 Set-top box shall be able to function normally when receiving packet jitter more than 50 ms.

5.10.3 Receiving and processing capability

5.10.3.1 Those that are equipped with single program stream (SPTS) shall be able to process transport stream more than 20 Mbps.

5.10.3.2 Those that are equipped with multi program transport stream (MPTS) shall be able to process transport stream more than 60 Mbps.

5.10.3.3 The test as described in 5.10.3 shall be proceeded with at least one or multiple HD programs.

5.10.4 Receiving Decoding Capability

5.10.4.1 Those whose standard high-quality program is transmitted with the MPEG-2 compression technology, the flow shall be > 3Mbps; those who have adopted the MPEG-4 AVC (H.264) or VC-1 compression technology for the transmission, the flow shall be >1.75 Mbps。

5.10.4.2 Those whose high-quality program format is transmitted with the MPEG-2 compression technology, the flow shall be >17 Mbps; those who have adopted the MPEG-4 AVC (H.264) or VC-1 compression technology for the transmission, the flow shall be >10 Mbps.

5.10.5 Electromagnetic Susceptibility (EMS):

    5.10.5.1 Shall comply with CNS 14676-4 (the power line shall comply with the level of 1KV; signal line shall comply with the level of 500V).

    5.10.5.2 Shall comply with CNS 14676-5 (the power, neutral and ground lines shall comply with the level of 2KV; the level of 1KV shall be complied with between lines).

5.11 Those that include the feature of USB extended interface shall provide at least one set of minimum USB 2.0 interface. The socket type shall adopt TYPE A or TYPE C interface.

5.12 For those with the recording function, the broadcast shall be limited to the set-top box and smart card or other encryption mechanism used during the recording.

5.13 For those whose reception information is uploaded to head-ends, the content of the said information must not contain information that can directly identify the specific person.

5.14 For those that include the features of WiFi, bluetooth or other radio-frequency interface, their radio-frequency performance shall comply with Low-power Radio-frequency Devices Technical Specifications.

5.15 Working Environment:Shall maintain normal operation between a temperature range of 5°C to 40°C, and relative humidity range of 45% to 80% (R.H.).

5.16 Testing fixture and location required for item 5.7.4, 5.7.6 to 5.7.8, 5.7.10, 5.12 and 5.13 shall be provided by the applicant.

Attached Table 1: EPG Items and Functional Requirements

No	Items	Functional Requirements	Notes
1	Displayed content of EPG.	Schedule of program broadcast.	
2		Information on programs both currently and to be broadcasted.	
3		Display of current time.	
4		Support program introduction.	
5	Method of displaying EPG content.	Browse according to the program channel.	
6		Browse according to the order of broadcasting programs.	Option
7		Browse according to the program type.	
8	Manipulation of EPG	Enter the EPG from the menu bar to browse.	
9		Enter the EPG by pressing the shortcut key of remote control to browse.	
10	Reception capability of EPG	Each channel shall support the function of displaying at least a 7-day program timetable. Each program shall support the program introduction function of minimum 255 bytes.	
11	Update of EPG	Support the auto update of EPG content.	
12	Display of EPG Program Rating	Support the display and update of program rating information.	

Attached Table 2: 31 testing frequency points within the frequency band of from 20Hz to 20kHz

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

Attached Table 3: Limit values for the test of the video output frequency response distortion characteristics

Packets	Frequency Points	Approval Standards
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

Attached Table 4: Limit values for the test of video color bar signal characteristics

Items		Approval Standards
uminance 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 IRE
	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

Attached Table 5: Limit values for the characteristics of color bar amplitude of 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

Attached Table 6: Limit values for the noise spectrum level of component video

Items	Approval Standards
Y Component, 0.1 MHz to 4.2 MHz	$\leqq$-52 dB rms
Y Component, Unified Weighted	$\leqq$-58 dB rms
Pb Component, 0.1 MHz to 4.2 MHz	$\leqq$-52 dB rms
Pb Component, Unified Weighted	$\leqq$-58 dB rms
Pr Component, 0.1 MHz to 4.2 MHz	$\leqq$-52 dB rms
Pr Component, Unified Weighted	$\leqq$-58 dB rms