TECHNICAL CODE

**SPECIFICATION FOR
DIRECT-TO-HOME (DTH) SATELLITE BROADCAST RECEIVER
(DTH SET-TOP BOX)**

Developed by

Registered by

Malaysian Technical Standards Forum Bhd

**SKMM
MCMC**

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DEVELOPMENT OF TECHNICAL CODES

The Communications and Multimedia Act 1998 ('the Act') provides for Technical Standards Forum designated under section 184 of the Act or the Malaysian Communications and Multimedia Commission ('the Commission') to prepare a technical code. The technical code prepared pursuant to section 185 of the Act shall consist of, at least, the requirement for network interoperability and the promotion of safety of network facilities.

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Committee Representation

The Satellite Broadcast Terminal Working Group under the Malaysian Technical Standards Forum Bhd (MTSFB) which developed this Technical Standard consists of representatives from the following organisations:

Jaring Communications Sdn Bhd

Measat Broadcast Network Systems Sdn Bhd (ASTRO)

Packet One Networks (Malaysia) Sdn Bhd

SIRIM Berhad

Telekom Malaysia Berhad

Transform Star Sdn Bhd

YP Yau Trading

FOREWORD

This technical code for the Specification for Direct-to-Home (DTH) Satellite Broadcast Receiver (DTH Set-Top Box) ('this Technical Code') was developed pursuant to section 185 of the Act 588 by the Malaysian Technical Standard Forum Berhad ('MTSFB') via its Satellite Broadcast Terminal Working Group.

This Technical Code was developed for the purpose of certifying communications equipment under the Communications and Multimedia (Technical Standards) Regulations 2000.

This Technical Code cancels and replaces the Technical Specification for Satellite Receiving Station - Satellite Broadcast Receiver, RPS 005-01, which was previously saved under Section 275, CMA 1998.

This Technical Code shall continue to be valid and effective until reviewed or cancelled.

SPECIFICATION FOR DIRECT TO HOME SATELLITE BROADCAST RECEIVER (DTH SET-TOP BOX)

1. Scope

This specification defines the technical requirements for Direct to Home Satellite Broadcast Receiver (DTH Set-Top Box) to be used for Ku Band signals reception. The inputs to the Set Top Box are L-Band composite carriers in the frequency range 950 to 2150 MHz coming from the satellite receiving antenna systems downlink.

The DTH Set-Top Box shall at least include:-

- L band Set-Top Box input tuner

- Composite Video Baseband Signal (CVBS) video output

- Component Video (Y, Pb, Pr)

- Audio output

- Infrared Remote Control

- User-friendly software

- Flash Memory

- RAM

- Access to a renewable security system (smart card) (to comply with the requirements of a licensed broadcast service provider)

All the requirements defined in this document shall be supported as a minimum except the requirements that are defined as optional.

Direct-to-Home Satellite Receiver (DTH Set-Top Box) is illustrated in Annex A.

2. Normative References

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

BS 1363: Part 1	13A plugs, socket-outlets, adaptors and connection units – Part 1: Specification for rewirable and non-rewirable 13A fused plugs
BS 6500	Electric cables Flexible cords rated up to 300/500 V, for use with appliances and equipment intended for domestic, office and similar environments
BS EN 50075	Specification for flat non-wirable two-pole plugs 2.5A 250V, with cord, for the connection of class II-equipment for household and similar purposes

EN 300 421	Digital Video Broadcasting (DVB); Framing Structure, Channel Coding and Modulation for 11/12 GHz Satellite Service
EN 50049-1	Domestic or similar electronic equipment interconnection requirements: Peritelevision connector
ETSI 300 743	Digital Video Broadcasting (DVB); DVB subtitling systems
ETSI EN 302 307	Digital Video Broadcasting (DVB); Second Generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite application (DBV-S2)
ETSI TR 102 154	Digital Video Broadcasting (DVB); Implementation guidelines for the use of video and audio coding in contribution and primary distribution application based on the MPEG-2 Transport stream
ETSI TS 101 154	Digital Video Broadcasting (DVB); Implementation guidelines for the use of video and audio in broadcasting applications based on the MPEG-2 Transport stream
IEC 1114-2	Methods of measurement on Receiving Antennas for Satellite Broadcast Transmission in the 11/12 GHz band – Part 2: Mechanical and environmental test on individual and collecting receiving antennas
IEC 60227-5	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 5: Flexible cables (cords)
IEC 60245-4	Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables
IEC 62368-1	Safety requirements – Audio, video and similar electronic apparatus
ISO 639	Codes for the representation of names of language
ISO/IEC 7816-1,2,3	Identification Cards – Integrated circuit(s) cards with contact – Part 1: Physical Characteristic; Part 2: Dimension and Location of the contacts; Part 3: Electrical Interface and Transmission Protocol
ISO/IEC 14496-10	Information Technology – Coding of audio visual objects – Part 10: Advanced Coding
ISO IS11172-3	Information Technology – Coding of moving pictures and associated audio for digital storage media at up to about 1.5Mbit/s – Part 3: Audio
ISO IS13818-1	Information Technology – Generic coding of moving pictures and associated audio information systems
MS 140	Specification for insulated flexible cords and cables
MS 406	Specification for voltages and frequency for alternating current transmission and distribution systems
MS 589: Part 1	Specification for 13A plugs, socket outlets, adaptors and connection unit – Part 1: Specification for rewirable and non-rewirable 13A fused plugs
MS 1578	Specification for flat non-rewirable two-pole plugs, 2.5A, 250V, with cord, for the connection of class II – Equipment for household and similar purposes

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MS CISPR 13   Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and methods of measurement

MS IEC 60038   IEC standard voltages

3. Abbreviations

For the purpose of this Technical Specification, the following abbreviations apply.

DTH   Direct to Home

DVB   Digital Video Broadcasting

EMC   Electromagnetic Compatibility

IEC   International Electrotechnical Commission

LNB   Low Noise Block Downconverter

MPEG-2   Motion Picture Expert Group

MS   Malaysian Standard

SRA   Satellite Receiving Antenna

STB   Set-Top Box

4. Requirement

4.1 General Requirement

4.1.1 Power Supply Requirements

The Receiver may be AC or DC powered. For AC powered equipment, the operating voltage shall be 240 V +5 %, -10 % and frequency 50 Hz ± 1 % as according to MS 406 or 230 V ± 10 % and frequency 50 Hz ± 1 % as according to MS IEC 60038 whichever is current.

Where external power supply is used, e.g AC adaptor, it shall not affect the capability of the equipment to meet this specification. Adaptor must be pre-approved by the relevant regulatory body before it can be used with the equipment.

4.1.2 Power Supply Cord and Mains Plug

The receiver shall be fitted with a suitable and appropriate approved power supply cord and mains plug. Both are regulated products and must be pre-approved by the relevant regulatory body before it can be used with the receiver.

The power supply cord shall be certified as according to:

a) MS 140; or

b) BS 6500; or

c) IEC 60227-5; or

d) IEC 60245-4.

The main plug shall be certified as according to:

 a) 13 A fused plugs: MS 589: Part 1 or BS 1363: Part 1; or

 b) 2.5 A, 250 V, flat non-rewirable two-pole plugs: MS 1578 or BS EN 50075.

4.1.3   Electromagnetic Compatibility

The receiver shall comply with the EMC emissions requirements as defined in the MS CISPR 13 or equivalent international standards. The requirements shall cover radiated and conducted emission. (Req)

4.1.4   Electrical Safety

The receiver shall comply with the safety requirements as defined in IEC 62368-1 The supplier shall submit full type test report of MS IEC 62368-1 or equivalent international standards. (Req)

4.1.5   Marking

The STB and/or its component shall be marked with the following information:

a) supplier/manufacturer's name or identification mark;

b) supplier/manufacturer's model or type reference; and

c) other markings as required by the relevant standards referred in this document.

The markings shall be legible, indelible and readily visible. All information on the marking shall
be either in Bahasa Melayu or English Language.

All equipment must have been designed with the ability to be serviced. Ease of maintenance must be a feature of the equipment.

The Set-Top Box shall be supplied with an operation and installation manual in English or Bahasa Melayu.

4.1.6   Reliability

The Set-Top Box shall meet the performance requirements as defined in this standard for a life span which shall be at least five years.

4.2   Technical Requirement

Unless stated to the contrary for specific sections of the Set-Top Box technical specifications, the Set-Top Box shall be in compliance with the MPEG-2, ISO IS13818-1 Part-1 (system), Part-2 (video), and Part-3 (audio), Main profile, Main level standards, the referenced ETSI Standards, and the applicable Guidelines and Recommendations of Digital Video Broadcast (DVB).

4.2.1   Tuner

The tuner shall have an input operating frequency range of 950-2150 MHz. The frequency plan for Malaysia is shown in Table1. However channel spacing and frequencies shall be configurable by over-the-air download. The channel selection frequency will be synthesized with a step size chosen to be consistent with this plan.

Table 1. Tuner Frequency Plan for Malaysia

Frequency Range	Band
10.70 – 11.70 GHZ	Lower Band
11.70 – 12.75 GHz	Upper Band

4.2.2 Demodulator DVB S

The demodulator shall demodulate QPSK signals which have been modulated in accordance with the referenced ETSI Standard prETS300 421, section 4.5, "Baseband shaping and modulation".

After demodulation, a matched filter shall perform the complimentary pulse shaping square-root raised cosine filtering with a roll-off factor of 35%. The tuner shall provide a minimum channel bandwidth of 40.5 MHz. A variable symbol rate of 15-30 Mega Symbol/second (MS/s) shall be provided.

A carrier/clock recovery unit shall recover the demodulator synchronization over the full demodulator C/N range.

4.2.3 Demodulator DVBS2

The DVB-S2 front-end shall support a DVB-S2 implementation according to the ETSI EN 302 307 standard for the entire front-end unit of tuner, demodulator, demultiplexer. The DVB S2 tuner shall be fully backward compatible for tuning and demodulating legacy DVB-S streams according to EN 300 421.

The STB shall support modulation modes QPSK and 8PSK for broadcast application through linear satellite transponders. It shall support a transponder roll-off factor of alpha=0.35, alpha=0.25 and alpha=0.20.

4.2.4 Conditional Access (CA)

The STB design shall incorporate DVB CA conform to one smart card reader and it is compliant to ISO/IEC 7816-1, 2, 3. The smart card reader slot is dedicated to the Conditional Access System.

The DVB Common Scrambling algorithm shall be supported by the STB. It should be able to descramble the encrypted broadcast stream with crypto period set from 2 to 10 seconds. The Conditional Access System provider shall be specified by the operator.

4.2.4.1 Renewable Security

The STB design shall not preclude the ability to revise or replace the conditional access algorithm for control word generation, if the system becomes compromised.

4.2.5 Middleware

The STB shall support middleware system with Electronic Program Guide (EPG) application as specified by the operators.

4.2.6 Software Download

The STB shall support over the air download capability to replace the entire software system in the STB. The over the air download method and specification shall be agreed with the operator.

4.2.7 Processor and Memory

The Central Processing Unit (CPU) and the memory footprint shall be defined by the operator but it shall support as a minimum the requirement defined in this document.

4.2.8   Transport

The transport shall be compatible with ISO IS13818-1, MPEG-2 systems layer standard. The STB shall be able to decode an MPEG-2 system layer bitstream.

4.2.9   Video Decoder

4.2.9.1 Compression Format

The STB shall be able to decode bitstream which are in conformance with the Main Profile/ Main Level, ISO IS13818-2 MPEG-2 Video layer standard.

The STB shall be able to select 16:9 or 4:3 display modes either manually or by responding to the transmitted signal. When 16:9 material is transmitted, the 4:3 display shall be produced by using pan vectors as defined in the MPEG video layer standard, or in the absence of pan and scan data, the 4:3 picture shall be centered. [Check on wide screen signaling]

4.2.9.2 Compression Quality of Performance

The STB shall conform to the requirements of ISO IS13818-4, MPEG-2 Standard for Conformance Testing, when subjected to a compliant MPEG-2 main profile main level bitstream. The video decoder in the SBR shall provide a decoded picture quality of at least 4.0 on the CCIR 500-4 scale of 5 when decoding an MPEG defined test sequence at a bit rate of 4 Mbps.

4.2.9.3 Resolution Requirements

The SBR shall support decoding of horizontal resolutions up to 704 and vertical resolutions up to 576 at 25 Hz.

4.2.9.4 Video Bit Rate Range

The video decoder in the SBR shall be capable of decoding video bitstreams with bit rates between 1.0 Mbps and 15 Mbps. The SBR shall be capable of accommodating dynamic video bit rate changes anywhere within this range (for statistical multiplexing purposes).

4.2.9.5 Error Concealment

The video decoder in the SBR shall provide error detection and concealment. The SBR shall provide a method to reconstruct and substitute for an erroneous frame in a group of pictures.

4.2.9.6 SDTV Format

Table 2. SDTV Format

Broadcast Format	Frame Rate (Hz)
576i (720x576)	25
576p (720x576)	25 (Optional)

4.2.10   Advance Video Coding Decoder (Standard Definition)

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Unless is stated contrarily the implementation of the AVC in the STB shall comply with the guidelines defined in the ETSI TS 101 154 v1.7.7.

4.2.10.1 Level and Profile

The AVC decoder shall support decoding and displaying of Advance Video Coding ISO/IEC 14496-10 [16] /MPEG 4 part 10 or ITU-T Rec. H.264 of Main Profile Level 3 bit streams for Standard Definition TV use. Preferably level 4 bit streams to be supported in future at no additional cost.

If the H.264/AVC SDTV decoder encounters an extension which is cannot decode, it shall discard the following data until the next start code prefix (to allow backward compatible extensions to be added in the future).

The decoder shall be able to extract and decode MPEG-4 content which is transported over MPEG-2 systems as specified in ISO/IEC 13818-1 or over IP format via the return channel. The H.264/AVC decoder shall be able to decode the H.264/AVC bit streams in real time or in non-real time for Push VOD type services which are to be recorded on the HDD.

The STB shall be able to decode both MPEG-2 and H.264/AVC video transmitted together in a single MPEG-2 DVB transport stream.

4.2.10.2 Compression Format

The STB shall support data rates from 0.1 Mbps to 6 Mbps.

4.2.10.3 Supplemental Enhancement Information and Video Usability Information

H.264 / AVC decoder shall support some part of the 'Supplemental Enhancement Information (SEI) and the 'Video Usability Information (VUI) syntax elements as specified in ITU-T Rec. H.264\ ISO/IEC 14496-10 Annexes D and E [16].

4.2.10.4 Random Access Point (RAP)

The decoder shall be able to start decoding and displaying an H.264/AVC bit stream at an H.264/AVC RAP.

4.2.11 Advanced Video Coding Decoder (High Definition) (Optional)

The requirements in this section are only applicable if High Definition Decoder is supported by the STB. The STB shall be backward compatible with Standard Definition (SD) video.

The STB product shall be capable of decoding any DVB compliant video stream according to ETR 154 Digital Video Broadcasting (DVB) – Implementation Guidelines For The Use of Mpeg-2 Systems, Video and Audio in Satellite, Cable and Terrestrial Broadcasting Applications [Version: 3 01-Sep-1997].

The HD video decoder shall support the following broadcast formats:

Table 3. HD Video Decoder Broadcast Format

Broadcast Format	Frame Rate (Hz)
576i	25
576p	50

720p	50
1080i	25

The STB shall be capable of supporting MPEG-2 MP@ML and AVC (H.264) decoding at the following resolutions:

Table 4. MPEG-2 MP@ML and AVC (H.264) Decoding Resolutions

Horizontal Pixel Count	Vertical Pixel Count
1920	1080
1280	720
720	576
704	576
544	576
480	576
352	576
352	288

4.2.11.1 High Definition Profiles

The STB shall support the following HD profiles:

(a) MPEG-2 MP@HL profile shall be supported

(b) MPEG-4 Part 10 MP@L3.2 1280 x 720p at 60 Hz, 50 Hz profile

(c) MPEG-4 Part 10 MP@L4.1 1920 x 1080i at 25 Hz or 30 Hz profile

(d) MPEG-4 Part 10 HP@L4.1 1920 x 1080i at 25 Hz or 30 Hz profile

(e) MPEG-2 MP@ML profile shall be supported

4.2.11.2 HD Down scaling

The STB shall support video data rates up to 15 Mbps in Standard Definition and 30 Mbps for High Definition. The video decoder shall support down scaling from any supported HD video resolution to any supported SD video resolution. The down scaling signal shall be provided at the composite and component output.

The component output (Y, Pb, Pr) shall support SD 576i only.

4.2.11.3 HD Upscaling

The STB shall support upscaling feature to display upscaled SD content on the HDMI output whenever an SD programme is selected.

4.2.11.4 HDMI (High Definition Multimedia Interface)

The STB shall support HDMI v1.3a type A female output connector. All the features available under HDMI v1.3a specification with the HDMI Compliance Test Specification (CTS) v1.3c shall be supported.

The STB shall also support VESA-EDID (Video Electronics Standards Association- Extended display identification data) standard.

4.2.11.5 HDCP Protection

The STB HDMI output shall be protected with HDCP version 1.2 digital content protections. HDCP copy protection shall be enabled at all time but under the control of CA/Middleware. The HDMI output shall be constrained or muted under the CA/Middleware control if an HDCP connection cannot be established. The HDCP management shall be enabled by default.

HDCP copy protection shall be enabled and disabled under the control of CA/Middleware.

4.2.12   Video Specification

The video composite encoder and interface shall have the characteristics defined in table 5.

Table 5. Characteristics of Video Composite Encoder and Interface

Bandwidth	5 MHz
Signal to noise ratio (weighted)	> 55dB
Field time distortion	< 5%
Bar tilt	< 3%
2T/bar ratio	100 + or - 10 %
Chroma to luma gain inequality	< 5%
Chroma to luma delay	< 40 ns
Non-linearity	< 5%
Differential gain	< 10%
Differential phase	< 5°
Bar amplitude	700 mV +/- 10 %

4.2.13   Component Output (Y, Pb, Pr)

The STB shall support analog output component video signal for 625 lines. The applicable standard use as reference shall be detailed in the response. It shall comprise of three channels interface as designated to carry specific signal as per Table 6.

Table 6. Channel Interface

	Y PBPR Component Set	
Channel 1	Luminance	Y
Channel 2	Scaled B-Y	PB
Channel 3	Scaled R-Y	PR

The connector used shall be RCA type Phono connector. The connector colour code is shown in the table 7.

Table 7. RCA Type Phono Connector Color Code

	Signal Assignment	Connector Color Code
Channel 1	Y	Green
Channel 2	PB	Blue
Channel 3	PR	Red

Each of the three signals shall be carried on an unbalanced coaxial cable whose impedance is 75 ohms. Return loss of at least 30dB over frequency range of 1 KHz to the maximum of the frequency range used shall be supported.

The STB shall provide the analog component video output as the following:

Y: 1Vpp - 75 ohm

Pb: 0.7Vp – 75 ohm

Pr: 0.7Vpp – 75 ohm

The implementation shall comply with EIA-770.1 Interlaced and EIA-770.2 Progressive standards.

The component output shall NOT produce any high definition video. Only standard definition is allowed.

4.2.14 Audio Decoder

The STB shall provide an audio decoder which shall decode a stereo or monaural audio bitstream which has been coded in conformance with ISO IS11172-3 Audio Standard, Layer I or Layer II. Audio sample rates of 32, 44.1 and 48 KHz shall be supported by the decoder. Audio error detection and concealment shall be provided. The ancillary data port of the audio bitstream will not be provided at a decoder output port.

4.2.14.1 Bit-rate

Audio sample rates of 32, 44.1 and 48 kHz shall be supported by the decoder. The audio quality shall be CD quality or better for a stereo audio bit stream with a data rate of 192 kbps.

The following bitrate in kbps shall be supported for Layer 1 audio.
32, 64, 96, 128, 160, 192, 224, 256, 288, 320, 352, 384, 416 or 448.

The following bitrate in kbps shall be supported for Layer 2 audio.
32, 48, 56, 64, 80, 96, 112, 128, 160, 192, 224, 256, 320, 384.

4.2.14.2 Error concealment

Audio error detection and concealment shall be provided. Recovery of audio (sound) after a signal outage shall be smooth without discernible audio artifacts (chirps) by invoking suitable error concealment or muting techniques.

4.2.14.3 Audio mode

The decoder shall provide a pass through of the various audio modes:

(a) single mono

(b) dual mono

(c) stereo

(d) joint stereo

In the case of dual mono mode, audio routing of left to left, right to right shall be supported. The decoder shall also support software fading and muting.

4.2.14.4 Audio Reconstruction

The output of the audio decoder shall be reconstructed into an analogue signal. Output shall be via a Stereo Cinch pair (L & R).

4.2.14.5 MP3

MP3 audio format shall also be supported which is MPEG 1 layer 3.

MPEG 1 Layer 3 shall support sampling frequencies of 32, 44.1 and 48 KHz. The decoder shall provide CD quality audio with bitrate at 128 Kbps.

The following audio bitrate shall be supported.
32, 48, 56, 64, 80, 96, 112, 128, 160, 192, 224, 256, 320 kbps.

4.2.15 Advance Audio Coding (AAC) Decoder

The STB shall be able to decode AAC audio streams compliant to MPEG-4 version 3 ISO/IEC 14496-3[17]. Unless it is stated contrarily the implementation of AAC audio shall conform to the guidelines in Annex H of ETSI TS 101 154 V1.7.7.

The following profile shall be supported.

(a) Plain AAC Profile providing CD quality audio at 96 kbps

(b) HE-AAC is required at hardware level only.

The decoder shall support the MPEG-4 AAC Dynamic Range Control (DRC) as defined in ISO/IEC 14496-3[17]. In the event no DRC data is transmitted in the streams, the decoder shall not apply the DRC tool.

The ISO 639 language descriptor shall be used to indicate the language of the content of the AAC.

Audio sample rates of 32, 44.1 and 48 kHz shall be supported by the decoder.

Audio bitrate 16, 32, 48, 64, 96, 128 kbps shall be supported by the decoder.

4.2.16 Audio Specification

The audio signal interface shall be in conformance with the following characteristics.

Table 8. Characteristics for Audio Signal Interface

Level	EN 50049-1
Frequency response	20 Hz to 20 kHz at + or - 0.3 dB
Out of band residue	< -60dB reference to max level

Distortion	< 0.2 %
Signal to noise	>65dB CCIR 2k weighted wrt - 20dBfs reference
Dynamic range	> 78 dB at unity Gain
Phase difference	< 2 °
Cross talk	60 Db

The exact level of audio component shall be adjustable from the application software. Audio levels shall be adjustable on RCA Stereo outputs.

It shall be possible to mute the analogue audio outputs under application control.

For the fading feature, the variable range, under software control shall be +6dB/-60 dB in 2 dB steps. The nominal level 0dB is measured at 1Vrms (+/- 5%) on a full scale sinusoidal signal on the D/A converter.

4.2.17 Dolby Digital(Optional)

The requirements in this section are only applicable if the Dolby Digital (AC3) is supported by the STB.

Dolby Digital (AC3) shall support both Dolby Digital (AC3) decoder and also pass through mode.

Dolby Digital (AC3) shall be supported via S/PDIF interface in pass through mode only for a connection to home theater systems as depicted in figure below.
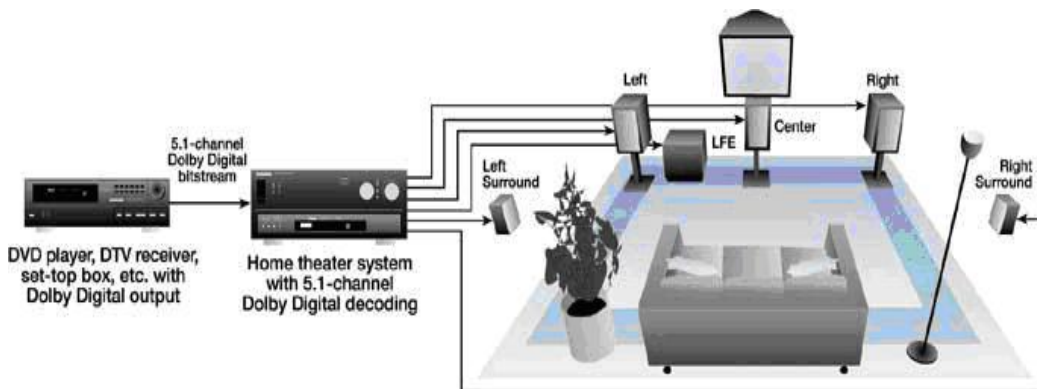

Figure 1. Connection for Home Theatre System

Dolby Digital shall provide up to five full-range channels as the following:

− Left

− Right

− Center,

− Left surround

− Right Surround

Plus
− Low-frequency effects.

It shall process minimum 20-bit dynamic range digital audio signals over frequency range 20 Hz to 20 KHz +/- 0.5 dB. The base effects channels shall cover 20 to 120 Hz +/- 0.5dB.

Sampling rates 32, 44.1 and 48 KHz shall be supported. Data range from 32 kbps to 440 kbps. Typically for 5.1 channel Dolby surround consumer format 384 kbps shall be used and 192 kbps for two channel audio distribution.

Once Dolby Digital (AC3) decoder is chosen, down mixing capability shall be enabled for STB.

The Dolby Digital implementation shall follow the Guidelines as describe in Annex C of ETSI TR 102 154 v1.1.1.

The ISO 639 language descriptor shall be used to indicate the language of the content of the Dolby Digital stream.

4.2.17.1 S/PDIF connector

The Dolby Digital 5.1 audio shall be output via S/PDIF connector as described in table below. Only coaxial connector shall be supported.

Table 9. S/PDIF Connector

Cabling	75 ohm coaxial
Connector	RCA (orange colour)
Signal level	0.5-1V
Modulation	Biphase-mark-code
Sub code information	SCMS copy protection info
Max. resolution	20 bits(24 bit optional)

It shall be possible to mute the analog and digital audio outputs simultaneously under application control.

The Dolby Digital logo shall be printed on the STB subject to service providers approval.

4.2.17.2 Dolby Digital Plus (Decoder)

Dolby Digital Plus (E-AC3) shall also be supported to work with H.264/MPEG-4 video content supporting data rates from 30kbps to 640 kbps.

It shall support only up to 7.1 full-range channels.

Dolby Digital Plus (E-AC3) implementation shall provide the same high quality even more efficiently than traditional Dolby Digital, with data rate improvement of up to 50 percent. The Dolby Digital Plus (E-AC3) logo shall be printed on the STB subject to service providers approval.

4.2.18 Subtitling

The STB shall include facilities for on-screen Subtitle display based on the ETSI 300 743, Region-based Graphics (RbG). These facilities shall allow the OSD to be used for multilingual subtitling. Manufacturer shall be able to retrieve the PES subtitle packet from the stream and send them to the middleware to be displayed.

In most cases subtitles shall be displayed at the bottom of the screen with 2 lines. Nevertheless the subtitle area shall be able to be changed dynamically and shall not be restricted to a specific area on the screen.

4.2.19 Teletext

Teletext shall be extracted from the received downlink signal and re-inserted in the video composite signal. The STB in itself shall not include a Teletext decoder.

4.2.20 Infra Red Protocol

A generic design of remote control will be proposed to operate with the STB. It shall support a RC6 or XMP infra red protocol.

Devices Supported:

Consumer Model	:	Satellite Receiver
Batteries Required	:	AAA (2)
Operating Range	:	6 meters at 0 degrees viewing angle

The STB shall be able to support the capability to use an infra-red QWERTY keyboard to send (and receive) text messages with the same infra-red protocol.

4.2.21 STB Interfaces

Table 10. STB Interfaces

RF L Band signal Input	-25 to -65 dBm per carrier. The SBR shall not be damaged by input signal levels of up to -10 dBm per carrier (assuming 21 carriers)
RF Impedance	75 ohms
RF Connector	Type F Female (IEC 169-24)
RF Return Loss	> 8dB
DC Voltage (to LNB of TVRO)	On connector center conductor. The SBR shall not be damaged by an input short circuit. 10.0VDC to 14.0VDC, 200mA for vertical polarisation, 16.0VDC to 20.0VDC, 200mA for horizontal polarization
Band Switching	22KHz tone shall be used to switch between upper and lower band.
Audio Output	600 ohm impedance 2 V RMS, 85 dB dynamic range

4.2.22 Connectors

Table 11. Connectors

Description	Type of Connector	Location	Qty
Power	IEC 83, C5 Alternate II or BS 1363, TYPE-G	Rear Panel	1
RF L-Band Connector (Input)	Type F Female - 75 ohms (RF Return Loss > 8dB 10 dB typical)	Rear Panel	1
Audio Outputs	Phono sockets, Left, Right	Rear Panel	1 set

	600 ohms impedance 1 V RMS Dynamic Range > 78 dB.		
Composite Video Output	CVBS: Phono socket RCA	Rear Panel	1
Component Video Output	Y, Pb, Pr : Phono socket RCA	Rear Panel	1 set
HDMI Output (Optional)	HDMI v1.3a type A female output connector.	Rear Panel	1
Digital Audio (Optional)	Coaxial 75 ohm	Rear Panel	1
Ethernet Port (Optional)	RJ-45	Rear Panel	1
USB 2.0 (Optional)	Series 'A' connectors – 'A' Receptacles	Rear Panel	1
USB 2.0 (Optional)	Series 'A' connectors – 'A' Receptacles	Front Panel	1

4.2.23 STB Mechanical

4.2.23.1 Front Panel Control

The front panel shall have the minimum a standby button to turn the STB to On and put it on standby state. The front panel design and specification shall be agreed with the operator.

4.2.23.2 Service Continuity

The STB shall not cause any disruption of services (video, audio, data, or interactive transactions) due to non-service related STB activities or processing (e.g. guide acquisition, CA processing, callback, etc.).

4.2.24 USB Port (Optional)

The requirements in this section are only applicable if the USB port supported by the STB.

The serial interface shall be compliant with Universal Serial Bus Revision 2.0 Specification.

Connection of STB to the PC in HOST to HOST mode shall also be supported via external adapter connected between the PC and the STB.

4.2.24.1 Speed performances

USB 2.0 is "backward-compatible" with USB 1.0/1.1 thus the following speed performance in table below shall be supported which comprises the low speed, mid-speed and high speed data ranges.

Table 12. Speed Performances

Performance	Application	Attributes
Low Speed Interactive Devices 10-100kb/s	Game Peripherals	Lower cost Hot plug-unplug Ease-of-use Multiple Peripherals
Medium Speed Audio, compressed video, data 500kb/s – 10Mb/s	Transferring MP3 file to other Av devices or PC.	Low Cost Ease-of-use Guaranteed Latency Guaranteed bandwidth Dynamic attached –detach Multiple Devices
High-speed Video, Disk	Video	High Bandwidth

25-400Mb/s		Guaranteed latency Ease-of-use

The USB port shall be able to power up external peripheral devices such as web camera, mouse and external 2.5 inch Hard Disk Drive. The USB port shall output 500mA with 5V power.

Series 'A' receptacle connectors shall be used for both USB ports. Electrically series A functions as an output form the host system.

The port shall be able to operate with USB cable consisting of four conductors, 2 power conductors and 2 signal conductors.

4.2.25 Ethernet Port (Optional)

The requirements in this section are only applicable if the Ethernet port is supported by the STB.

The STB shall have built-in one 100BaseT Ethernet ports with 100 Mbps. It shall use RJ-45 connectors. It shall comply with the following standard.

IEEE 802.3 - Hardware standards for Ethernet cards and cables

The Ethernet port shall be used mainly for Home Networking to connect to the Master terminal using TCP/IP protocol.

At least two configurations shall be supported.

(a) Direct connection to another device (Master terminal)

(b) Connection to external Ethernet switch.

At the beginning the Ethernet port shall be used to connect to the Master terminals in the basic Home Networking architecture without any external Ethernet switch.

4.2.26 Environmental Conditions

The unit must operate with an ambient temperature range of 5 - 40°C without forced air cooling.

The STB shall meet all of the performance requirements of this standard when operated intermittently or continuously under the following conditions:

1. Ambient Temperature : 5°C to 40°C (Operating)

   0°C to 60°C (Non-operating)

2. Relative Humidity : 95% noncondensing

4.2.27 Software Download

The STB shall be capable of supporting over the air download to replace the entire software systems such as the Bootloader, Middleware, Conditional Access and the EPG. The details of the requirements shall be defined by the operators.

Annex A
(Normative)

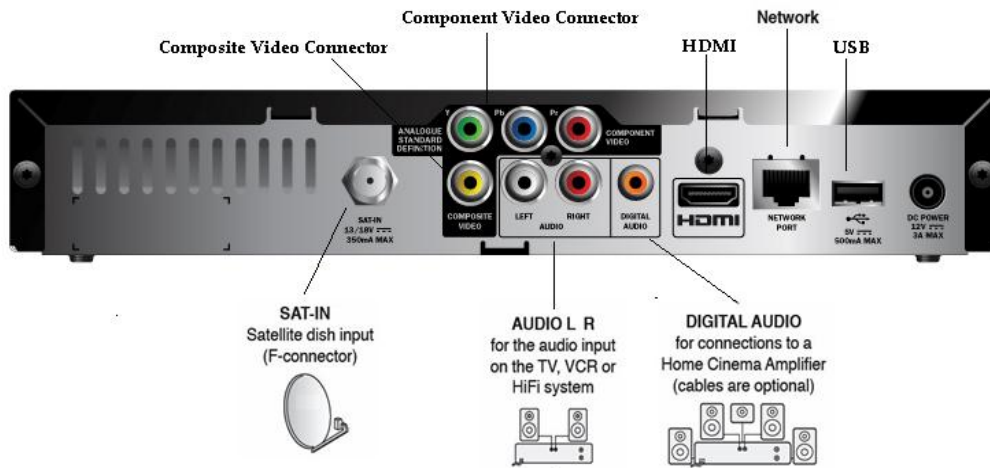**Illustration of DTH Set-Top Box and their interfaces**

Figure A1. Illustration of DTH Set-Top Box and their interfaces

Acknowledgement