



**Reference Specification**  
for  
**Digital Video Broadcasting (DVB)**  
**Set Top Box (STB)**  
for connection to  
**Cable TV Distribution Systems**

**IDA RS DVB-STB**

Issue 1, July 2001

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### NOTICE

**This Reference Specification is subject to review and revision.**

**Reference Specifications and Guides are informative documents, and are not used for type approval of customer equipment. They are either one of the following types of documents:**

- i. Informative and interim documents on customer equipment standards which are yet to be adopted by the network operators and where standardisation is still in progress.**
- ii. Informative documents describing the network standards adopted by the Public Telecommunication Networks in Singapore.**

# 1 SCOPE

1.1 This Specification defines the requirements for the Digital Video Broadcasting Set Top Box (DVB-STB) for connection to the cable TV transmission network. It refers to the list of DVB standards recommended by the Singapore National Cable Standard Committee (NCSC). Essentially, the DVB-STB (or the customer equipment) contains the Integrated Receiver Decoder (IRD) functionality for tuning to and navigating the large number of DVB transmission channels. It will also be equipped for the support of various interfaces, e.g. modem interface, video and audio signal outputs, data signal output, physical interfaces for control and the interface for the detachable conditional access module.

IRDs are classified according to three dimensions:

- i) "25 Hz" or "30 Hz" (It depends on the nominal video frame. In the case of TV transmission in Singapore, video is framed at 25 Hz.)
- ii) "SDTV" or "HDTV" (The capabilities of the Standard Definition Television IRD are a subset of those of the High Definition Television IRD.)
- iii) "with digital interface" or "baseline" (It depends on whether the IRD has an interface for digital bit-stream storage devices such as a digital VCR. The capabilities of the baseline IRD are a subset of those of the IRD with digital interface.)

## 1.2 References

### ETSI documents

- |             |  |
|-------------|--|
| ETR 154     | Digital Video Broadcasting (DVB); Implementation guidelines for the use of MPEG Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications |
| ETR 211     | Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)   |
| ETR 289     | Digital Video Broadcasting (DVB); Support for use of scrambling and Conditional Access (CA) within digital broadcasting systems  |
| EN 300 429  | Digital Video Broadcasting (DVB); DVB framing structure, channel coding and modulation for cable systems (DVB-C)   |
| EN 300 468  | Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems (DVB-SI)   |
| EN 300 472  | Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bit-streams (DVB-TXT)   |
| ETS 300 743 | Digital Video Broadcasting (DVB); DVB subtitling system (DVB-SUB)  |
| ETS 300 800 | Digital Video Broadcasting (DVB); Interaction channel for Cable TV distribution systems (CATV)   |
| TS 101 200  | Digital Video Broadcasting (DVB); A guideline for the use of DVB specifications and standards  |
| TS 102 200  | Digital Video Broadcasting (DVB); Interfaces for DVB Integrated Receiver Decoder (DVB-IRD)   |

### ISO/IEC documents

- |         |  |
|---------|--|
| 13818-1 | Information Technology – Generic Coding of Moving Pictures and Associated Audio Information. Part 1: Systems |
|---------|--|

13818-2 Information Technology – Generic Coding of Moving Pictures and Associated Audio Information. Part 2: Video

13818-3 Information Technology – Generic Coding of Moving Pictures and Associated Audio Information. Part 3: Audio

**ITU-T Recommendation**

J.83 Digital multi-programme systems for television, sound and data services for cable distribution

J.112 Transmission systems for interactive cable television services

H.222.0 Information Technology – Generic coding of moving pictures and associated audio information: systems

## **2 GENERAL REQUIREMENTS**

### **2.1 Power Supply**

The DVB-STB may be a.c. powered or d.c. powered. For an a.c. powered DVB-STB, the Specification shall be complied with when operating from an a.c. mains supply of voltage,  $230V \pm 10\%$  and frequency,  $50 \text{ Hz} \pm 2\%$ . Where external power supply is used, e.g. AC adaptor, it shall not affect the capability of the equipment to meet the Specification.

### **2.2 Identification of DVB-STB**

The DVB-STB shall be marked with the supplier or manufacturer's name or identification mark, and the supplier or manufacturer's model or type reference. The markings required shall be legible, indelible and readily visible.

NOTE

The following notations are used in the Specification:

- CR Conformance requirement defines features and functions that must be supported at minimum.
- M Mandatory requirement is where the equipment implementation shall conform to those clauses in that section relating to the operation of the equipment.
- O Optional requirement means it is optional whether equipment implements that function but if function is implemented, it shall conform to the clauses in that section relating to the operation of the equipment.
- NA Not Applicable is where the requirements specified in that section on the equipment shall not be applicable for attachment.
- GID The section provides General Information and Definitions.

### 3. SAFETY OF TERMINAL EQUIPMENT FOR CONNECTION TO TELECOMMUNICATION NETWORKS

The DVB-STB (mains or battery powered) shall be designed to comply with the principles of Singapore Standards (SS), International Electrotechnical Commission (IEC) or other safety standards e.g. IEC 60950, EN60950, BS EN41003, SS 337.

<b>3</b>	<b>Safety of Terminal Equipment for connection to telecommunication networks</b>	<b>CR</b>	<b>Remarks</b>
<b>3.1</b>	<b>General</b>	–	
3.1.1	Requirements applicable to the equipment (e.g. class of equipment, type of TNV circuit and types of components) covered in the following sections of IEC 60950 <sup>1</sup> shall be identified and complied with: Scope (1.1 of IEC 60950) Definitions (1.2 of IEC 60950) General requirements (1.3 of IEC 60950) General conditions for test (1.4 of IEC 60950) Components (1.5 of IEC 60950) Power interface (1.6 of IEC 60950) Marking and instructions (1.7 of IEC 60950) Protection from hazards (2 of IEC 60950) Wiring, connections and supply (3 of IEC 60950) Physical requirements (4 of IEC 60950) Electrical requirements and simulated abnormal conditions (5 of IEC 60950) Connection to telecommunication networks (6 of IEC 60950)	M	
<b>3.2</b>	<b>Protection of telecommunication network service personnel, and users of other equipment connected to the network, from hazards in the equipment</b>	–	
3.2.1	Circuitry intended to be directly connected to a telecommunication network shall comply with the requirements for an SELV <sup>2</sup> circuit or a TNV-1 <sup>3</sup> circuit (refer to 6.1.1 of IEC 60950).	M	
3.2.2	There shall be insulation between circuitry intended to be connected to a telecommunication network and any parts or circuitry that will be earthed (refer to 6.1.2 of IEC 60950).	M	
<b>3.3</b>	<b>Protection of equipment users from over voltages on telecommunication networks</b>	–	
3.3.1	Equipment shall provide adequate electrical separation between TNV-1 circuit and certain parts of the equipment (refer to 6.2.1 of IEC 60950).	M	
3.3.2	Compliance with 3.3.1 is checked by the electric strength test procedure of 6.2.2 of IEC 60950.	M	
<b>3.4</b>	<b>Protection of the telecommunication wiring system from overheating</b>	–	
3.4.1	Equipment intended to provide power over the telecommunication wiring system to remote equipment shall limit the output current to a value that does not cause damage to the telecommunication wiring system (refer to 6.3 of IEC 60950).	Note 1	
Note 1 – Requirements are mandatory if clause is applicable.			

<sup>1</sup> IEC 60950:1999

<sup>2</sup> Safety Extra Low Voltage (SELV) circuit is so designed and protected that under normal and single fault conditions, its voltages do not exceed a safe value of 42.4 V peak or 60 V d.c. under normal operating conditions.

<sup>3</sup> Only TNV-1 circuits are permitted for connection to the Singapore telecommunication network whose normal operating voltages do not exceed the limits for an SELV circuit (refer to 1.2.8.10 of IEC 60950)

#### 4. FRAME STRUCTURE, CHANNEL CODING AND MODULATION FOR CABLE TV DISTRIBUTION SYSTEMS (DVB-C)

The "System" for the framing structure, the channel coding and the modulation for the digital multi-programme service on cable networks is defined in the DVB-C (EN 300 429), which is similar to the system as specified under the ITU-T Rec. J.83, Annex A.

The System is based on MPEG-2 (ITU-T Rec. H.222.0 or ISO/IEC 13818-1) for the source coding and transport multiplexing, and is based on Quadrature Amplitude Modulation (QAM) allowing 16, 32, 64, 128 or 256-QAM constellations. The System characteristics for cable distribution are therefore outlined in Table 1.

<b>Table 1: Frame Structure, Channel Coding and Modulation for Cable TV Distribution Systems (DVB-C)</b>				
<b>TITLE</b>	<b>EN 300 429</b>	<b>ITU-T Rec. J.83</b>	<b>COMMENTS</b>	<b>CR</b>
<b>Cable system concept</b>	<b>4</b>	<b>A.2</b>	The adaptation of the baseband TV signals to the cable channel characteristics is as shown in Figure 1/EN 300 429 or Figure A.1/J.83.	M
<b>Baseband interfacing and sync</b>	<b>4.1</b>			M
<b>Sync 1 inversion and randomisation</b>	<b>4.2</b>			M
<b>Reed-Solomon (RS) coder</b>	<b>4.3</b>			M
<b>Convolutional interleaver</b>	<b>4.4</b>			M
<b>Byte to m-tuple conversion</b>	<b>4.5</b>			M
<b>Baseband shaping</b>	<b>4.6</b>			M
<b>Differential encoding</b>	<b>4.7</b>			M
<b>QAM modulation and physical interface</b>	<b>4.8</b>			M
<b>Cable receiver</b>	<b>4.9</b>			M
<b>MPEG-2 transport layer</b>	<b>5</b>	<b>A.3</b>	The MPEG-2 transport layer is defined in ITU-T Rec. H.222.0 or ISO/IEC 13818-1.	M
<b>Framing structure</b>	<b>6</b>	<b>A.4</b>	The framing organisation shall be based on the MPEG-2 transport packet structure. The System framing structure is shown in Figure 2/EN 300 429 or Figure 2/J.83.	M
<b>Channel coding</b>	<b>7</b>	<b>A.5</b>		M
<b>Randomisation for spectrum shaping</b>	<b>7.1</b>	<b>A.5.1</b>		M
<b>Reed-Solomon coding</b>	<b>7.2</b>	<b>A.5.2</b>		M
<b>Convolutional interleaving</b>	<b>7.3</b>	<b>A.5.3</b>		M
<b>Byte to symbol mapping</b>	<b>8</b>	<b>A.6</b>		M
<b>Modulation</b>	<b>9</b>	<b>A.7</b>	The modulation of the System shall be QAM with 16, 32, 64, 128 or 256 points in the constellation diagram.	M
<b>Baseband filter characteristics</b>	<b>Annex A</b>	<b>A.8</b>		M

## 5. MPEG-2 AUDIO-VIDEO CODING IN CABLE TV DISTRIBUTION SYSTEMS

As the DVB project has selected MPEG-2 for the source coding of audio and video, and for the creation of programme elementary streams and Transport Stream (TS), the baseline IRD shall be able to decode from the systems layer, video coding and audio coding as outlined in Table 2.

MPEG-2 is a packet-based multimedia multiplexing where the elementary bit streams are multiplexed with information to allow synchronised presentation of these elementary streams within a programme. The elementary stream data are segmented into Packetized Elementary Stream (PES) packets, and inserted into Transport Stream (TS) packets of 188 byte fixed length.

<b>TITLE</b>	<b>ETR 154</b>	<b>COMMENTS</b>	<b>CR</b>
<b>Systems layer</b>	<b>4</b>	All baseline IRDs shall be able to decode correctly following the preferred parameter values for DVB applications as defined in the ETR 154; and shall be upward compatible with future software enhancement.	M Note 1
<b>Broadcast bitstreams and baseline IRDs</b>	<b>4.1</b>	All baseline IRDs shall be able to demultiplex the MPEG-2 TS (ITU-T Rec. H.222.0 Intro. 1).	M Note 2
<b>Bit-streams from storage applications and IRDs with digital interfaces</b>	<b>4.2</b>		Note 3
<b>Video</b>	<b>5</b>	The "25 Hz SDTV" and the "25 Hz HDTV" IRDs shall comply with the requirements for decoding the MPEG-2 video in DVB broadcast bit-streams (ISO/IEC 13818-2)  To allow full compliance to the MPEG-2 standard and upward compatibility with future enhanced versions, the IRD shall be able to skip over data structures, which are currently "reserved", or which correspond to functions not implemented by the IRD.	M Note 1
<b>25 Hz SDTV IRDs and Bit-streams</b>	<b>5.1</b>	The 25 Hz SDTV IRD shall support the decoding of Main Profile Main Level bit-streams.	M
<b>25 Hz HDTV IRDs and Bit-streams</b>	<b>5.2</b>	The 25 Hz HDTV IRD shall support the decoding of Main Profile High Level bit-streams.  In addition to the above, a 25 Hz HDTV IRD shall be capable of decoding any bit-stream that a 25 Hz SDTV IRD is required to decode.	Note 1
<b>Audio</b>	<b>6</b>	The IRD shall comply with the requirements for decoding the MPEG-2 audio in DVB broadcast bit-streams (ISO/IEC 13818-3).  To allow full compliance to the ISO/IEC 13818-3 and upward compatibility with future enhanced versions, the IRD shall be able to skip over data structures which are currently "reserved", or which correspond to functions not implemented by the IRD.	M
<p>Note 1: Capabilities for decoding for the HDTV are optional . However, requirements are "M" if capabilities are implemented in the IRD.</p> <p>Note 2: Demultiplexing of Program Stream (ITU-T Rec. H.222.0 Intro. 2 &amp; 3) is optional.</p> <p>Note 3: "M" if bit-streams are transmitted via a digital interface intended for digital VCR applications.</p>			

## **6. SPECIFICATIONS FOR CONVEYING ITU-R SYSTEM B TELETEXT IN DVB BIT-STREAMS**

The IRD shall have a mechanism to enable the delivery of “analogue” Teletext to the receiver via DVB. This mechanism is described in EN 300 472 and is known as “DVB-TXT”. The Teletext data are conveyed in Packetized Elementary Stream (PES) packets which are carried by the Transport Stream (TS) as defined in ITU-T Rec. H.222.0 (ISO/IEC 13818-1).

## **7. DVB SUBTITLING SYSTEM**

The IRD shall allow the transmission of subtitles and graphical elements as part of the DVB bit-streams based on the mechanism described in the EN 300 743. The subtitling data are conveyed in Packetized Elementary Stream (PES) packets which are carried by the Transport Stream (TS) as defined in ITU-T Rec. H.222.0 (ISO/IEC 13818-1).

## **8. SPECIFICATION FOR SERVICE INFORMATION (SI) IN DVB SYSTEMS**

The IRD shall be able to tune to a large number of transmission channels by interpreting the navigational aids that are provided in the DVB bit-streams. This set of navigational aids known as the “DVB-SI” is described in the EN 300 468. A set of guidelines on the implementation and usage of Service Information (SI) is also provided in the ETR 211.

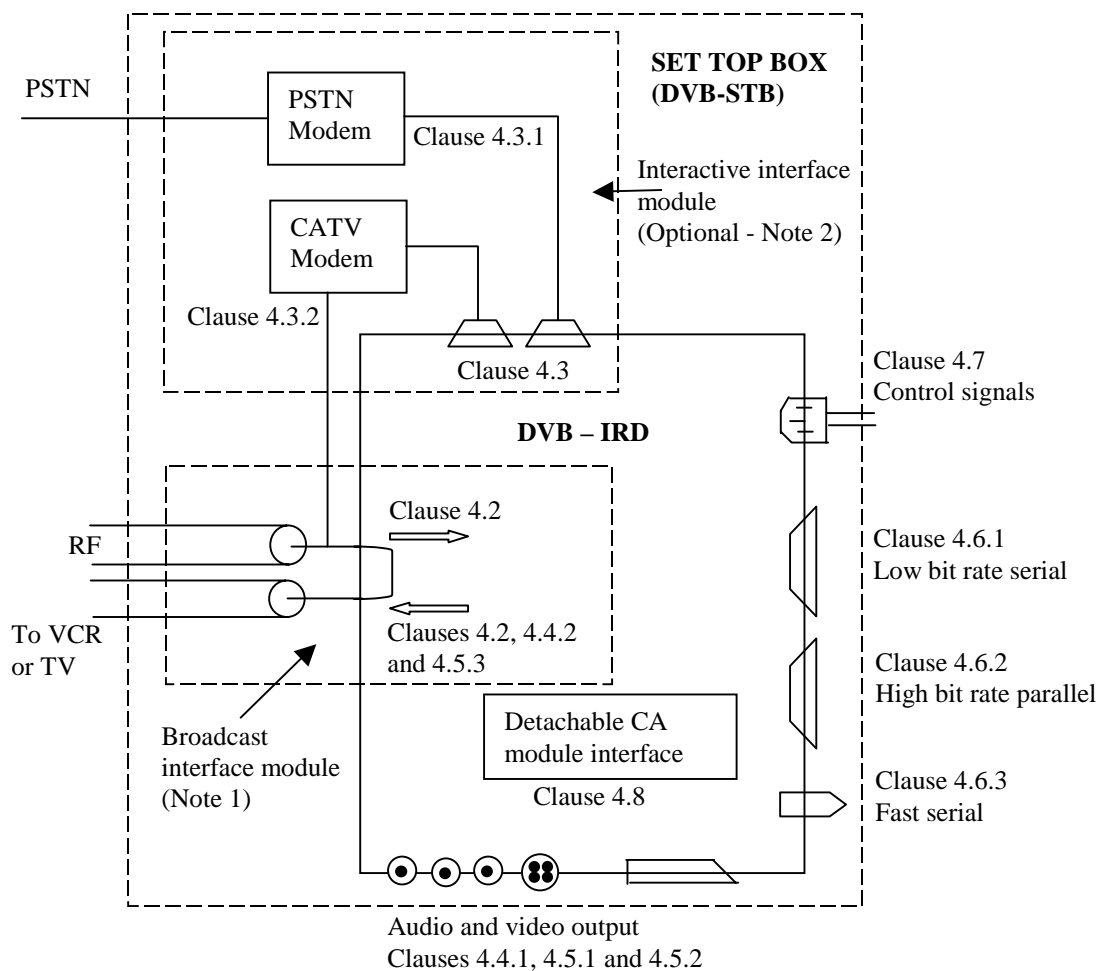
## **9. CONDITIONAL ACCESS (CA)**

If “Simulcrypt” is used to control the access to programmes and service, the IRD shall have one built-in CA system that allows viewers to access all programmes, which have been processed by one of the several CA systems.

If “Multicrypt” is used for the simultaneous operation of several CA systems, the IRD shall have a common interface for conditional access. This is achieved by inserting a PCMCIA module into the common interface such that different CA systems can be addressed sequentially by the IRD.

## 10. INTERFACE REQUIREMENTS FOR DVB – INTEGRATED RECEIVER DECODER (IRD)

The recommended interfaces for connections of Digital Video Broadcast Integrated Receiver Decoder (DVB-IRD) equipment are as shown in Figure 1, and are outlined in Table 3. Interfaces not mentioned in this Specification are not necessarily excluded. They may be included at a later stage according to the state of development and implementation.



Note 1: Singapore will adopt the Digital Video Broadcasting for Cable TV Distribution Systems (DVB-C) as recommended by the National Cable Standard Committee (NCSC). The broadcast interface requirements shall be in accordance with sections 4 and 5 of this Specification.

Note 2: The NCSC has recommended that the option for the return channel for interactive services be left open for commercial considerations.

Figure 1 (Figure A.1 of ETSI TS 102 201):  
**Generic diagram, showing all optional interfaces**

<b>Table 3: Interface Requirements for DVB-IRDs</b>			
<b>TITLE</b>	<b>TS 102 201</b>	<b>COMMENTS</b>	<b>CR</b>
<b>RF input in satellite IF range</b>	<b>4.1</b>		NA
<b>RF input/output in the VHF/UHF range</b>	<b>4.2</b>	Referring to the CATV installation	M
<b>Modem interface</b>	<b>4.3</b>	Subject to commercial arrangement	O
PSTN modem	4.3.1		O
CATV and SMATV modem	4.3.2		O
<b>Video signals</b>	<b>4.4</b>	Analogue video signal output can either be baseband RGB, Y/C(S-VHS) or CVBS format, or modulated on a RF carrier.	O
Baseband signals	4.4.1		O
RF modulated signals	4.4.2		O
<b>Audio signals</b>	<b>4.5</b>	Audio signal output can be either analogue or digital format, or modulated on RF carrier.	O
Analogue audio signals	4.5.1		O
Digital audio signals	4.5.2		O
<b>Data signals output</b>	<b>4.6</b>		O
Low bit rate serial data port	4.6.1	ANSI/EIA RS232	O
High bit rate parallel data port	4.6.2	IEEE 1284	O
High speed serial interface	4.6.3	IEEE 1394	O
<b>Physical interfaces for control signals</b>	<b>4.7</b>		M
<b>Interface for detachable Conditional Access (CA) module</b>	<b>4.8</b>		Note 1
<b>Connectors</b>	<b>4.9</b>		O
Note 1: "M" if "Multicrypt" is implemented.			