



**TECHNICAL STANDARD ON
DIGITAL TERRESTRIAL TELEVISION BROADCASTING**

MTSFB 002:2005

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Acknowledgment

Committee representation

The Working Group on Digital Terrestrial Television Broadcasting which developed this Technical Standard consists of the following organisations:

Celcom (M) Berhad
DiGi Telecommunication Sdn. Bhd.
Dimensitek Sdn. Bhd.
Malaysian Communications and Multimedia Commission
Malaysian Technical Standard Forum Berhad
Measat Broadcast Network Systems Sdn. Bhd.
MITV Corporation Sdn Bhd
Nat Seven Sdn. Bhd.
NTL Broadcast Sdn. Bhd.
PTT Unitrunk Sdn. Bhd.
Radio Televisyen Malaysia
ROHDE & SCHWARZ Malaysia Sdn. Bhd.
Sistem Television Malaysia Berhad
Telekom Malaysia Berhad

Foreword

This document was developed by the Working Group on Digital Terrestrial Television Broadcasting (DTTB) in response to a mandate from the Malaysian Communications and Multimedia Commission under the Communications and Multimedia Act, CMA 1998 (CMA) and the relevant provisions on technical regulation of Part VII of the CMA. This standard is a partial adoption of ETSI DVB Specifications and Standards.

This TSR specifies the standards to be used or adopted for the application of Digital Terrestrial Television Broadcasting in Malaysia. This standard will define and serve as guideline for the specifications to manufacture and design of all electronic devices or equipment, which relates to the transmission and reception of Digital Terrestrial Television Broadcasting in Malaysia.

NOTE:

Compliance with a Technical Standard does not of itself confer immunity from legal obligations.

1 Introduction

Digital Terrestrial Television Broadcasting (DTTB) opens the possibilities of more channels and better quality pictures to viewers. DTTB will create opportunities for new media products and services, enhancing choice for the consumer.

The key to the success of the DTTB launch is making receivers affordable. Apart from making an initial choice of standards, the bigger issue would be how to use the benefits of the digital transmission for the maximum business success of the broadcasting enterprise.

The technologies and standards that can be applied to DTTB also allow the application of variant compression technology available currently. The new breed of variant compression able to give better value to the spectrum in such a way that the frequency spectrum bandwidth utilization is further optimized. In addition to adding more TV programs into the spectrum, the variant compression also allows enhanced version of services to be offered over the same frequency spectrum such as HDTV, IPTV, data casting and interactive services.

The technology base of the TV broadcasting in Malaysia is essentially of European origin, being built on the 50Hz PAL analogue TV system, with national broadcasters being still predominant as opposed to the US where there is a highly competitive localized broadcasting industry.

There are three competing standards worldwide for, DTTB namely:

- i) American Advanced Television System Committee (ATSC) system
- ii) European Digital Video Broadcasting (DVB) system and
- iii) Japanese Integrated Service Digital Broadcasting (ISDB-T) system.

Although there is high level of convergence between the North American and European DTTB Systems, the two essentially have different systems of modulation – the US single carrier 8-VSB modulation and the European multiple carrier Coded Orthogonal Frequency Division Multiplex (COFDM) modulation system. The third Japanese system offers segmentation of the RF channel using a similar modulation as the European system.

2 Available DTTB International Standards

2.1 Advanced Television System Committee (ATSC)

In December 1996, the US Federal Communication Commission (FCC) adopted the ATSC system. The standard provides for the transmission of DTTB in a 6MHz channel, similar to the existing NTSC channel. It provides for a range of video image formats based on MPEG-2 (Motion Picture Expert Group-2) video compression. The RF modulation scheme used is known as 8-VSB, which allows a 6MHz terrestrial broadcast channel to support a digital bit rate of 19.3Mbps. The audio transmission is based on the Dolby AC-3 system supporting 5 discrete surround sound channels plus a subwoofer channel.

The US standard does not mandate requirements with respect to scanning formats, aspect ratios and line resolution. This allows for various picture formats (e.g. HDTV or SDTV) and allows for computer monitors to be adapted to receive DTTB transmission. In general the ATSC has a possibility of 36 combinations of picture formats for transmission. For HDTV it has 1080 and 720 lines options, while 480 lines option for SDTV. The 480 lines option is aligned with the 525 NTSC standard definitions, which has frames comprising a raster of 486 active lines.

2.2 Integrated Services Digital Broadcasting–Terrestrial (ISDB–T)

Japan has its own Digital Broadcast Expert Group or DiBEG and has developed a DTTB standard called the Integrated Services Digital Broadcast–Terrestrial (ISDB–T), which is a variant of the DVB–T since it also uses OFDM as its modulation scheme. It is based on MPEG–2 video compression and MPEG–2 Advanced Audio Compression or AAC where a more complex multiplex and transport schemes are needed.

As the word ‘Integrated’ indicates, ISDB can handle a variety of services, which include digital audio, video, data, and interactive services. The term ISDB–T now caters for wideband services or ISDB–Tw and narrowband services or ISDB–Tn. ISDB–Tw is for transmitting multi-channel SDTV or single channel HDTV. ISDB–Tn is for Radio. It can be adapted for 6, 7 and 8MHz RF channel bandwidth. In practice, it is possible to use a single transmitter for both Radio and TV.

2.3 Digital Video Broadcast–Terrestrial (DVB–T)

The European standard was developed by the DVB group, which consists of broadcasters, manufacturers and regulatory bodies; and was formed to oversee the development of DTTB in Europe. The DVB standard comprises a core system which is intended to provide for a family of systems covering all transmission media: satellite broadcasting, cable broadcasting, television distribution, terrestrial broadcasting for 6, 7 or 8MHz RF channel bandwidth, multi-point distribution broadcasting below 10GHz, and multi-point distribution broadcasting above 10GHz. The DVB–T system uses the common picture coding and compression based on MPEG–2, shared with other members of the DVB family of specifications. DVB–T uses a transmission system based on Orthogonal Frequency Division Multiplexing (OFDM) modulation. DVB–T have been adopted by the European Television Standard Institute (ETSI) for acceptance as a European standard.

DVB–T uses the MPEG–2 compression for video and MPEG layer–2 compression standard audio. The audio compression, also known as Musicam, provides two-channel stereo. The two audio channels can also carry Dolby Pro–Logic matrixed four channel sounds. DVB–T provides viewers with mono, stereo or Pro–Logic four channel surround sound systems. DVB–T can also be adapted to carry the ATSC surround sound system i.e. Dolby AC–3, which was chosen by the Australian and Singapore with their DVB–T standard.

3 Assessment Report on DTTB Standards

This report outlines the merits of the three systems in the context of the Malaysian broadcast environment and the process of planning for the transition to digital television broadcasting. Some of the consideration features and elements of the DVB–T standards, based on characteristics of transmitted terrestrial signal, are outlined briefly here to explain the choice of standards for the Malaysian Digital Terrestrial Standards

i) Robustness

Digital signals are received better as compared with analogue. Signals can be well received by portable receivers in the case of DVB–T. Complex multi–path issue is also overcome with adoption of the DVB–T standard.

ii) Mobile

Mobile performance is important and strong interests in this application are foreseen, especially in trans-country coaches, trains and other public transportation. Mobile reception is possible with DVB–T and DVB–H.

iii) Interference & Multi-path Effects

Interference impulse noise sources (electrical interference) will affect the DVB-T and ISDB-T system more than ATSC. The 8K variant of DVB-T and ISDB-T is however expected to give better performance. These interferences have been proven through field trials results in Australia and Singapore. Signal reflected from buildings and other physical obstructions in the signal path will cause multi-path distortions of the received signals leading to data errors. DVB-T and ISDB-T signals are less susceptible to multi-path distortion as compared to ATSC.

iv) Reception (Indoor and Outdoor)

Poor reception areas for existing analogue services especially in built-up urban centre will receive DTTB better. DVB-T would have an advantage of extended coverage with digital transmission in a built-up environment, which normally suffers significant multi-path and various effects of interference. DVB-T Technology further enables better reception, which includes indoor reception using innovative antenna designs. Indoor antenna will become increasingly significant in the reception of Digital Terrestrial Television signals. External outdoor antennas have resulted in the degradation of the aesthetic appearance in the urban centre.

v) Frequency Spectrum Utilization

With the growing increased in the demand for TV channels, there is a need to use frequencies efficiently within the VHF and UHF bands. With DTTB, it is possible to use channels adjacent to existing analogue channels, which were taboo for analogue broadcasts. One of the benefits of terrestrial digital television is efficient frequency usage that can only be attained through discontinuation of present analogue services after an appropriate transition period. Care should be taken that the terrestrial digital system may be operated in all participating organization without interferences.

It is also feasible to use Single Frequency Network (SFN) or Multi Frequency Network (MFN) for DVB-T applications with different topologies. DVB-T enables more efficient frequency usage with the use of Single Frequency Networks (SFN), especially now when spectrum availability is becoming more difficult to allocate. SFN could be deployed for National or Regional basis, on the other hand, MFN topology could be utilized for Regional and Local deployment.

4 Availability of DTTB Equipment

Components of DTTB transmission and reception equipment are more complex than the traditional analogue system.

For the broadcasters, new equipment are required like encoders, multiplexers, network systems and IP-based systems. For the receivers, new equipment like the set-top boxes or integrated television receivers are required and there are additional choices need to be made between SDTV and HDTV formats.

Malaysia's relatively small consumer market size implies that there is a need for commonality with other larger markets to minimize the cost of equipment. Set-Top Boxes for SDTV format are already available but the price is still relatively high for the population at large. At the initial launch of DTTB, the consumers may have the choice of either using a Set Top Box with his existing analogue TV set or acquiring a new Digital Integrated TV receiver.

The availability of these components will influence the readiness of DTTB implementation.

5 DVB Family of Standards

It is preferable to have common standards for the three main delivery media. This interoperability would allow the usage of a common technology platform should the standards be derived from the same family of standards. For example the DVB family of standards comprises DVB-S for satellite, DVB-C for cable, DVB-T for terrestrial and DVB-H for Handheld. It should be noted that the existing satellite TV service in Malaysia uses DVB-S.

6 Set-Top-Box

Set-top box for all three delivery systems using smart card is possible for the same family of standards. All three systems use MPEG-2 Transport Stream source coding. The main difference is in the modulation scheme used. This has been made possible by the use of PCMCIA interface card slotted into the DVB-T set-top box to decode the modulation and strip the data. Set-top-box may be used for Free-To-Air (FTA) and Pay-TV services. There can 3 types of functionality level namely basic, interactive and conditionally accessed. All 3 different types of set-top-box must be able to allow the reception of FTA service.

7 Audio Standards

DVB-T supports MPEG-2 Transport Stream with Sub-band coding of Audio in Dolby Digital.

Dolby AC-3 carries a total of 5 channels of audio and a single channel of a small bandwidth low frequency audio. Dolby AC-3 however, does not cater for the multi-lingual transmission. This may be a consideration for a multi-racial country such as Malaysia. Dolby AC-3 is also a proprietary system in which the rights to the design are held by Dolby Research Labs. A concern here is that the cost of the set-top boxes may be higher if they are built with Dolby AC-3 decoding circuits.

The MPEG Layer-2 audio has been widely used as a quality audio standard. It supports up to 8 separate audio channels with variable bit rates, modes and sample rates. Each of these channels could be used to support multi-lingual transmission as well as a combination of 8 channels sound system to accompany the video. The encoders are less complex and in addition to that it is a non-proprietary system. This reduces the cost of decoders. The DVB-T standard now also incorporates both the Dolby AC-3 as well as the MPEG Layer-2 Audio.

8 Conclusion and Recommendation

In conclusion the recommended standard to be adopted for DTTB in Malaysia is DVB-T standard.

The coder-decoder (codec) for the video and audio services is not restricted to the MPEG-2 codec in order to allow new type of codec and compression to be applied as part of the DVB-T implementation. However any codec implementation must be done for both encoder and decoder at the head-end and client-end, respectively.

9 Reference documents

The following reference documents are to be used in order to further define the details of the technical standards that has been published and made available for the public.

1	DVB-T	Digital broadcasting systems for television, sound and data services; Framing structure, channel coding and modulation for digital terrestrial television	ETS 300 744 (V1.5.1 (2004-11): 01/01)
2	DVB-T	User Requirements for Terrestrial Digital Broadcasting Services	
3	DVB-T	Implementation guidelines for DVB terrestrial services; Transmission aspects	TR 101 190 (V1.1.1: 12/97)
4	DVB-SFN	Specification of a Mega-frame for SFN Synchronisation	TS 101 191 (V1.3.1: 12/00)
5	DVB-IRD	Interface for DVB-IRDs	TS 101 191 (V1.3.1: 12/00)
6	DVB-IRD	Interface for DVB Integrated Receiver Decoder (DVB-IRD)	TS 102 201 (V1.1.1: 03/99)
MULTIPLEXING			
7	DVB-SI	Digital broadcasting systems for television, sound and data services; Specification for Service Information (SI) in Digital Video Broadcasting (DVB) systems	ETS 300 468 (V1.4.1: 12/00)
8	DVB-SI	Guidelines on implementation and usage of service information	TR 101 211 V1.4.1 (07/00)
9	DVB-SI	Digital broadcasting systems for television, sound and data services; Allocation of Service Information (SI) codes for Digital Video Broadcasting (DVB) systems	TR 101 162 V1.2.1 (02/01)
10	DVB-TXT	Digital broadcasting systems for television, sound and data services; Specification for conveying ITU-R System B Teletext in Digital Video Broadcasting (DVB) bitstreams	EN 300 472 (V1.2.2: 08/97)
11	DVB-VBI	Specification for the delivery of VBI data in DVB streams	EN 301 775 V1.1.1 (11/00)
12	DVB-DATA	Specification for the transmission of data services in DVB bitstreams	EN 301 192 (V1.2.1: 06/99)
13	DVB-DATA	Implementation guidelines for Data Broadcasting	TR 101 202 (V1.1.1: 02/99)
14	DVB-SUB	Digital broadcasting systems for television, sound and data services; Subtitling systems	ETS 300 743 (V.1: 09/97)
15	BROADCAST	Protocol for a TV Guide using electronic data transmission	ETSI ETS 300 707 ed.1 (1997-05)
CONDITIONAL ACCESS			
16	DVB-CSA	The Common Scrambling system description	ETR 289 (V1: 10/96)
17	DVB-CSA	DVB Common Scrambling Algorithm - Distribution Agreements	
18	DVB-SIM	Technical specification of SimulCrypt in DVB systems	TS 101 197 (V1.2.1: 02/02)
19	DVB-SIM	Head-End Implementation of DVB SimulCrypt	TS 103 197 (V1.2.1: 02/02)
INTERFACING			
20	DVB-CI	Common Interface Specification for Conditional Access and other Digital Video Broadcasting	EN 50221 (V1: 02/97)

		Decoder Applications	
21	DVB-CI	Guidelines for Implementation and Use of the Common Interface for DVB Decoder Applications	R 206 001 (V1: 03/97)
22	DVB-CI	Digital Video Broadcasting (DVB); Extensions to the Common Interface Specification (EN 50221)	TS 101 699 V1.1.1: 11/99)
23	DVB-PI	Interfaces for CATV/SMATV Headends and similar Professional Equipment	EN 50083-9 (V2: 06/98)
24	DVB-PI	Implementation Guidelines for the Asynchronous Serial Interface	TR 101 891 V1.1.1 (01/01)
25	DVB-PDH	DVB interfaces to PDH networks	ETS 300 813 (V1: 12/97)
26	DVB-SDH	DVB interfaces to SDH networks	ETS 300 814 (V1: 03/98)
27	DVB-ATM	DVB interfaces to ATM networks	TR 100 815 (V1.1.1: 02/99)
	INTERACTIVITY		
28	DVB-NIP	Network Independent Protocols for DVB Interactive Services	ETS 300 802 (V1: 11/97)
29	DVB-NIP	Guidelines for the use of the Network Independent Protocols for DVB Interactive Services	TR 101 194 (V1.1.1: 06/97)
30	DVB-RCC	DVB interaction channel for Cable TV distribution system (CATV)	ETS 200 800 (V1.3.1: 11/01)
31	DVB-RCC	Guidelines for the implementation and usages of the specification for DVB interaction channel for Cable TV distribution systems (CATV)	TR 101 196 (V1.1.1: 12/97)
32	DVB-RCP	DVB interaction channel through the Public Switched Telecommunications System (PSTN) / Integrated Services Digital Network (ISDN)	ETS 300 801 (V1: 08/97)
33	DVB-RCD	DVB interaction channel through Digital Enhanced Cordless Telecommunications (DECT)	EN 301 193 (V1.1.1: 07/98)
34	DVB-RCL	DVB interaction channel for LMDS distribution systems	EN 301 199 (V1.2.1: 06/99)
35	DVB-RCL	Guidelines for the implementation and usage of the DVB interaction channel for LMDS distribution systems	TR 101 205 (V1.1.2: 07/01)
36	DVB-RCG	DVB Interaction Channel for Satellite Master Antenna Television (SMATV) system; Guidelines for version based on satellite and coaxial sections	TR 101 201 (V1.1.1: 10/97)
	MULTIMEDIA HOME PLATFORM		
37	DVB-MHP	Multimedia Home Platform	TS 101 812 (V1.3.1: 10/01)
	MEASUREMENT		
38	DVB-M	Measurement guidelines for DVB systems	TR 101 290 (V1.2.1: 01/01)
39	DVB-M	Usage of the DVB test and measurement signalling channel (PID 0x001D) embedded in an MPEG-2 Transport Stream (TS)	TR 101 291 (V1.1.1: 06/98)

40	DVB-H	Digital Video Broadcast (DVB); Transmission System for Handheld Terminals (DVB-H)	EN 302 304 v1.1.1 (2004-11)
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10 Scope of Standard

The scope of the standard covers the following in reference to ETSI and ISO recommendations and standards:

- i) Baseband Standards
- ii) Compression Standards
- iii) Delivery, Distribution and Transport mechanism
- iv) Transmission Standards
- v) Reception Standards
- vi) Interactivity and Applications
- vii) Measurement

Distribution of TV Signal to Transmitting Stations;

From the playout centre, TV signals are to be encoded as MPEG-2 (Motion Pictures Expert Group version 2), which is DVB-T compliant as stated in the following documents;

MEPG			
1	DVB-MPEG	Digital broadcasting systems for television; Implementation guidelines for the use of MPEG-2 systems; Video and audio in satellite, cable and terrestrial broadcasting applications	TR 101 154 (V1.4.1: 07/00)
2	DVB-MPEG	Implementation guidelines for the use of MPEG-2 systems; Video and Audio in Contribution Applications	TR 102 154 (V1.1.1: 01/01)

This document incorporates by dated and undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this document only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1]	ISO/IEC 13818-1 (1996): "Coding of moving pictures and associated audio - Part 1: Systems".
[2]	ISO/IEC 13818-2 (1996): "Coding of moving pictures and associated audio - Part 2: Video".
[3]	ISO/IEC 13818-3 rev1 (1997): "Coding of moving pictures and associated audio - Part 3: Audio".

[4]	ISO/IEC 13818-9 (1996): "Coding of moving pictures and associated audio - Part 9: Extension for Real-Time-Interface for systems decoders".
[5]	document 289: "Digital Video Broadcasting (DVB); Common Scrambling (CS) system description".
[6]	prEN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".
[7]	document 211: "Digital Video Broadcasting (DVB); Guidelines for the usage of Service Information (SI) in DVB systems".
[8]	ISO/IEC 11172-1: "Information Technology - Coding of moving pictures and associated audio for digital storage media up to about 1,5 Mbit/s - Part 1: Systems".
[9]	ITU-T Recommendation J.17 (1988): "Pre-emphasis used on sound-programme circuits".
[10]	IEC CD - 100C/1883: Parts 1 and 4.
[11]	EBU Recommendation R.68: "Alignment level in digital audio production equipment and in digital audio recorders".

11 Definitions

For the purposes of this document, the following definitions apply:

25Hz HDTV bitstream	A bitstream which contains only Main Profile, High Level (or simpler) video at 25Hz or 50Hz frame rates as specified in this document.
25Hz HDTV IRD	An IRD that is capable of decoding and displaying pictures based on a nominal video frame rate of 25Hz or 50Hz from MPEG-2 Main Profile, High Level bitstreams as specified in this document, in addition to providing the functionality of a 25Hz SDTV IRD.
25Hz SDTV bitstream	A bitstream which contains only Main Profile, Main Level video at 25Hz frame rate as specified in this document.
25Hz SDTV IRD	An IRD which is capable of decoding and displaying pictures based on a nominal video frame rate of 25Hz from MPEG-2 Main Profile, Main Level bitstreams as specified in this document.
30Hz HDTV bitstream	A bitstream which contains only Main Profile, High Level (or simpler) video at 24000/1001, 24, 30000/1001, 30, 60/1001 or 60Hz frame rates as specified in this document.
30Hz HDTV IRD	An IRD that is capable of decoding and displaying pictures based on nominal video frame rates of 24000/1001, 24, 30000/1001, 30, 60/1001 or 60Hz from MPEG-2 Main Profile, High Level bitstreams as specified in this document, in addition to providing the functionality of a 30Hz SDTV IRD.

30Hz SDTV bitstream	A bitstream which contains only Main Profile, Main Level video at 24000/1001, 24, 30000/1001 or 30Hz frame rate as specified in this document.
30Hz SDTV IRD	An IRD which is capable of decoding and displaying pictures based on a nominal video frame rate of 24000/1001 (approximately 23,98), 24, 30000/1001 (approximately 29,97) or 30Hz from MPEG-2 Main Profile at Main Level bitstreams as specified in this document.
baseline IRD	An IRD which provides the minimum functionality to decode transmitted bitstreams as recommended in this document. It is not required to have the ability to decode Partial Transport Streams (TSs) as may be received from a digital interface connected to digital bitstream storage device such as a digital VCR.
broadcaster (service provider)	An organization which assembles a sequence of events or services to be delivered to the viewer based upon a schedule.
bundle	The data carrier as provided by ETS 300 708 [1]. It comprises a number of streams.
CA components	Those components brought by a CA provider for integration into a host head-end system.
CA_subsystem_ID	The CA_subsystem_ID is defined in the present document to handle multiple connections to ECMGs with the same CA_system_ID value. The combination of CA_system_ID and CA_subsystem_ID is called Super_CAS_ID.
CA_system_id	Conditional Access (CA) System IDs are defined in table 3 "CA_system_ID" of ETR 162 [3].
CATV (Community Antenna Television system)	A system designed primarily to provide sound and television signals to communities
channel	An application specific representation of an open Transport Control Protocol (TCP) connection, allowing the association of application specific parameters with such a connection. Channels correspond on a one to one basis to TCP connections.
client	A software entity on a host making use of one or more resources offered by a server.
composite	A composite decoder is able to receive and to decode EPGs from more than one network and to combine them into a single composite EPG.
Conditional Access (CA) system	A system to control subscriber access to broadcast services and events e.g. Videoguard, Eurocrypt.
control data	This term is used to denote a combination of data fields in the EPG data structures which undergo a special encoding procedure.

Control Word (CW)	A data object used for scrambling.
Control Word Generator (CWG)	This component receives a CW request from the SimulCrypt Synchronizer (SCS) and returns a CW.
Crypto Period (CP)	The period when a particular Control Word (CW) is being used by the scrambler.
Custodian	Distribution authority for the DVB Scrambling Algorithm
Entitlement Control Message (ECM)	Private Conditional Access (CA) information which carries the CW in a secure manner and private entitlement information.
Entitlement Control Message Generator (ECMG)	This generator produces the ECM messages but does not support ECM repetition.
Entitlement Management Message (EMM)	Private Conditional Access (CA) information which, for example, specifies the authorization levels of subscribers or groups of subscribers for services or events.
Entitlement Management Message Generator (EMMG)	This generator produces the EMM messages and repeatedly plays them out at the appropriate times. See subclause 4.2.4.
escape sequence	A means of introducing additional, more complex display components into text strings (e.g. national characters, pictures).
event	A predefined action which may be selected in a product's user interface menu.
far programme	A programme which is not a near programme.
Filtered (EPG)	The EPG presented to the user is filtered if it contains less information than the EPG transmission. The filter in the decoder disregards unwanted or undesirable items, e.g. networks or programmes of certain types.
fixed stuff	Bytes that are used to fill up unused data positions.
forbidden	The term "forbidden" when used in the present document indicates that the value shall never be used.
full EPG	A Multiple Channels EPG which, as a broadcast type includes navigation and sorting information, or as a decoder type makes use of such information if it is available.
generator	A component producing data.
Hamming 8 / 4	A code for error protection as used within Teletext transmission. It allows single bit errors to be identified and corrected, and double bit errors to be detected.
header	The banner introducing the menu on the screen.
host	A computer system uniquely identified by its Internet Protocol (IP) address, and as such addressable in a computer network. It may take both client and server roles.

host head-end	A system which is composed of those components required before a CA provider can be introduced into the head-end.
Impulse Noise Interference	Interference due to burst of one or more short pulses whose amplitude, duration and time of occurrence are random.
IRD with digital interface	An IRD which has the ability to decode Partial Transport Streams (TSs) received from a digital interface connected to digital bitstream storage device such as a digital VCR as specified in this document, in addition to providing the functionality of a Baseline IRD.
level 1.5, level 2.5, level 3.5	These are Teletext presentation levels.
menu	An arrangement of events displayed via a product's user interface, requiring user interaction.
MPEG-2	Refers to the standard ISO/IEC 13818 [1].
MPEG-2 Transport Stream (TS) packet	A data packet possessing a length of 188 bytes including 4 bytes of header information. The header contains MPEG related data.
multipath	Signal that follow several propagation path
multiple channel	An EPG broadcast type which comprises information on programmes from more than one network on which the EPG is delivered, or an EPG decoder type which can acquire and display information on programmes from more than one network regardless of the channel to which the receiver is tuned to.
multiplex	A stream of all the digital data within a single physical channel carrying one or more services or events.
navigation	The user interaction via menus leading to the selection of information.
near programme	A programme that starts during the course of the day or the next day up to at least the end of the evening's programmes.
nibble	A data entity of 4 bits.
page	In the sense of memory capacity this is space for a Teletext page or 1 kbyte.
pan vector	Horizontal offset in video frame centre position.
parity	A code for error detection as used within Teletext transmission.
Partial Transport Stream (TS)	Bitstream derived from an MPEG-2 TS by removing those TS Packets that are not relevant to one particular selected programme, or a number of selected programmes.
point-and-click	An easy way to program a TV or VCR from within the EPG by a cursor which is moved over the wished programme and a confirmation of the action is issued.

PVR	Personal Video Recorder used to record TV programs similar to VCR concept but utilizing digital storage such as HDD or DVD-R
RS coded MPEG-2 Transport Stream (TS) packet	A data packet possessing a length of 204 bytes. Bytes 1 to 188 contain an MPEG-2-TS packet. Bytes 189 to 204 contain the parity-check bytes for the error correction of the preceding bytes of this packet. These parity-check bytes are generated using a shortened Reed-Solomon code RS(204,188).
SMATV (Satellite Master Antenna Television system)	A system designed to provide sound and television signals to the households of a building or group of buildings. Two system configurations are defined in EN 300 473 [18] as follows: <ul style="list-style-type: none"> • SMATV system A, based on transparent transmodulation of QPSK satellite signals into QAM signals to be distributed to the user; • SMATV system B, based on direct distribution of QPSK signals to the user, with two options: <ul style="list-style-type: none"> • SMATV-IF distribution on the satellite IF band (above 950 MHz); • SMATV-S distribution on the VHF/UHF band, for example the extended S-band (230 MHz to 470 MHz).
stream	A data sequence organized in a block structure as described in ETS 300 708 [1].
string	A data type covering text strings and references.
string data	This term is used to denote a combination of data fields in the EPG data structures which undergo a special encoding procedure.
structure	A data type.
Teletext	A data delivery system within television transmission.
this channel	An EPG broadcast type which comprises information only on the programmes of the network on which the EPG is delivered, or an EPG decoder type which can only acquire and display information on the programmes of the channel to which the receiver is tuned to.

12 Abbreviations

For the purposes of this document, the following abbreviations apply:

AAL	ATM Adaptation Layer
AC	Access Criteria
ACCP	Accumulated Phase
ACCT	Accumulated Time
ACI	Adjacent Channel Interference
ADSL	Asymmetric Digital Subscriber Loop
AF	Adaptation Field
AFC	Automatic Frequency Control
AI	Application Information (Structure)
API	Application Programming Interface

APS	Automatic Protection Switching
ASCII	American Standard Code for Information Interchange
ASI	Asynchronous Serial Interface
ASI-C	Asynchronous Serial Interface on coaxial cable
ASI-O	Asynchronous Serial Interface on optical fiber
ATM	Asynchronous Transfer Mode
ATS	Auto Tuning System
AU	Administrative Unit
BCH	Bose - Chaudhuri - Hocquenghem code
BER	Bit Error Rate
BI	(Data Broadcasting) Bundle Inventory
bslbf	bit string, left bit first
BSS	Broadcast Satellite Service
BW	BandWidth
CA	Conditional Access
CAS	Conditional Access System
CAT	Conditional Access Table
CATV	Community Antenna Television
CBDS	Connectionless Broadband Data Services
CI	Conditional Access Information Structure
COP	Code Of Practice
CP	Crypto Period
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CS	Convergence Sublayer
CVBS	Composite Video, Blanking and Sync
CW	Control Word
CWG	Control Word Generator
D/A	Digital-to-Analogue converter
DBPSK	Differential Binary Phase Shift Keying
DECT	Digital Enhanced Cordless Telecommunications
DFB	Distributed Feedback
DFT	Discrete Fourier Transform
DJ	Deterministic Jitter
DNS	Domain Name Server
DRCS	Dynamically Redefinable Character Sets
DSM-CC	Digital Storage Media – Command and Control
DTE/DCE	Data Terminal Equipment/Data Communication Equipment
DTTB	Digital Terrestrial Television Broadcast
DVALID	data valid
DVB	Digital Video Broadcasting
DVB-T	DVB-Terrestrial
DVB-H	DVB-Handheld Receiving Device
DVC	Digital Video Cassette
ECM	Entitlement Control Message
EDTV	Enhanced Definition TeleVision
EIRP	Equivalent Isotropic Radiated Power
EIS	Event Information Scheduler
EIT	Event Information Table
EMC	Electro Magnetic Compatibility
EMF	Equipment Management Function
EMM	Entitlement Management Messages
EMMG	Entitlement Management Message Generator
EPG	Electronic Programme Guide, also referred to as TV Guide or TV Information
ES	Elementary Stream

ESCR	Elementary Stream Clock Reference
ETSI	European Telecommunications Standards Institute
FAS	Frame Alignment Signal
FC	FIBRE Channel
FEC	Forward Error Correction
FFT	Fast Fourier Transform
FIFO	First In First Out
FM	Frequency Modulation
FSS	Fixed Satellite Service
FWHM	Full Width Half Max
GEO	Geostationary Earth Orbit
GSM	Global System for Mobile Communications
HDTV	High Definition TeleVision
HEC	Header Error Control
HEX	HEXadecimal notation
HFC	Hybrid Fiber-Coaxial
HI	Helper Information (Structure)
HOA	Higher Order Assembler
HOVC	Higher Order Virtual Container
HP	High Priority bit stream
ID	Identifier
IEC	International Electrotechnical Commission
IF	Intermediate Frequency
IFFT	Inverse Fast Fourier Transform
I-Frame	Intra-coded Frame
IP	Internet Protocol
IPR	Intellectual Property Rights
IRD	Integrated Receiver Decoder
ISDN	Integrated Services Digital Network
ISO	International Standards Organisation
ITU-R	International Telecommunication Union Radiocommunication
ITU-T	International Telecommunication Union Telecommunication
LCD	Liquid Crystal Display
LDTV	Limited Definition TeleVision
LI	Language Information (Structure)
LMDS	Local Multipoint Distribution System
LNB	Low Noise Block converter
LO	Local Oscillator
LOF	Loss Of Frame
LOP	Loss Of Pointer
LOS	Loss Of Signal
LOVC	Lower Order Virtual Container
LP	Low Priority bit stream
LSB	Least Significant Bit
LVDS	Low Voltage Differential Signalling
MAA	MPEG ATM Adaptation
MAC	Medium Access Control
MATV	Master Antenna Television
MCMC	Malaysian Commission of Multimedia and Communication
MI	Message Information (Structure)
MIP	Magazine Inventory Page
MJD	Modified Julian Date
MMDS	Multipoint Microwave Distribution System
MMI	Man Machine Interface
MON	MONitored

MP	Management Points
MPEG	Motion Picture Expert Group
MPI	MPEG Physical Interface
MSB	Most Significant Bit
MSOH	Multiplex Section OverHead
MUX	MULTipleX
NA	not applicable
NCC	Network Control Center
NDA	Non-Disclosure Agreement
NE	Network Element
NI	Navigation Information (Structure)
NICAM	Near-Instantaneous Companded Audio Multiplex
NIT	Network Information Table
NRZ	Non-Return-to-Zero
OAM	Operation Administration and Maintenance
OCT	OCTal notation
OFDM	Orthogonal Frequency Division Multiplexing
OI OSD	Information (Structure)
OR	Quadrature Phase Shift Keying (4-PSK)?
OSD	On Screen Display
OSI	Open System Interconnection
PAL	Phase Alternating Line
PAPI	Path Access Point Identifier
PAT	Program Association Table
PCMCIA	Personal Computer Memory / Card International Association
PCR	Program Clock Reference
PDC	Programme Delivery Control
PDG	Private Data Generator
PDH	Plesiochronous Digital Hierarchy
PDU	Protocol Data Unit
PES	Packetized Elementary Stream
PI	Programme Information (Structure)
PID	Packet IDentifier
PLL	Phase Lock Loop
PMD	Physical Medium Dependent
PMT	Program Map Table
POH	Path OverHead
PPI	PDH Physical Interface
PPT	PDH Path Termination
PRBS	Pseudo-Random Binary Sequence
PSI	Program Specific Information
PSTN	Public Switched Telephone Network
PSW	Pan and Scan Window
PSYNC	Packet Synchron
PT	Path Trace
PTY	Programme TYpe
QAM	Quadrature Amplitude Modulation
QEF	Quasi Error Free
QOS	Quality Of Service
QPSK	Quaternary (quadrature) Phase Shift Keying
RCCL	Return Channel – Cable and LMDS
RCST	Return Channel Satellite Terminal
RCT	Return Channel Terrestrial
R&TTE	Radio Equipment and Telecommunications Terminal Equipment Regulations
RD	Running Disparity

RDI	Remote Defect Indication
REI	Remote Error Indication
RF	Radio Frequency
RFC	Request For Comment
RFI	Remote Failure Indication
RIN	Relative Intrinsic Noise
RJ	Random Jitter
RLE	Run Length Encoding
RR	Radio-Relay
RS	Reed-Solomon
RSOH	Regenerator Section OverHead
SAR	Segmentation And Re-assembly Sublayer
SCR	(DVB compliant) Scrambler
SCS	SimulCrypt Synchronizer
SDH	Synchronous Digital Hierarchy
SDT	Service Description Table
SDTV	Standard Definition Television
SECAM	Système Séquentiel Couleur A Mémoire
SETG	Synchronous Equipment Timing Generator
SETPI	Synchronous Equipment Timing Physical Interface
SETS	Synchronous Equipment Timing Source
SI	Service Information
SIG	Service Information Generator
SLC	Signal Label Checking
SMATV	Satellite Master Antenna TeleVision
SMPT	Society of Motion Picture and Television Engineers
SMS	Subscriber Management System
SmTT	Sm Trail Termination
SN	Sequence Number
SOH	Section OverHead
SPI	Synchronous Parallel Interface
SSI	Synchronous Serial Interface
SSI-C	Synchronous Serial Interface on coaxial cable
SSI-O	Synchronous Serial Interface on optical fiber
ST	Stuffing Table
STB	Set Top Box
STD	System Target Decoder
STM	Synchronous Transport Module
tcimbsf	two's complement integer MSB (sign) bit first
TCM	Tandem Connection Monitoring
TCP	Transport Control Protocol
TDT	Time and Date Table
TI	Title Information (Structure)
TLV	Type, Length, Value
TOP / FLOF	Means of navigation within certain Teletext pages
TPS	Transmission Parameter Signalling
Tr	rise-time
TS	Transport Stream
TSDT	Transport Stream Description Table
T-STD	Transport Stream System Target Decoder
TV	TeleVision
UDP	User Datagram Protocol
UHF	Ultra-High Frequency (300...3000 MHz)
UI	Update Information (Structure)
uimbsf	unsigned integer, most significant bit first8B/10B eight to ten bit conversion

UTC	Universal Time, Co-ordinated
VBI	Vertical Blanking Interval
VCR	Video Cassette Recorder
VGA	Video Graphics Adapter
VHF	Very High Frequency (30...300 MHz)
VOD	Video On Demand
VP	Virtual Path
VPE	VP Entity
VPME	VP Multiplexing Entity
VPS	Video Programming System
VPT	Video Programming by Teletext
WST	World Standard Teletext

13 MPEG Baseband

13.1 Introduction

The document presents guidelines covering contribution/primary distribution coding and decoding using the MPEG-2 system layer, video coding and audio coding as defined in ISO/IEC 13818-1 [1], ISO/IEC 13818-2 [2], ISO/IEC 11172-3 [10] and ISO/IEC 13818-3 [3] respectively.

13.2 MPEG Decoder Processor on Primary and Secondary Distribution

The use of MPEG decoder processor on primary secondary distribution applications refers to document ETSI TR 102 154 v1.1.1 (2001–04)

The guidelines presented in the document for the Contribution/Primary Distribution Integrated Receiver-Decoder (herewith designated "Contribution IRD") are intended to represent a minimum functionality that all Contribution IRDs of a particular class are required to either meet or exceed.

Contribution IRDs are classified in two dimensions as:

- "25Hz" or "30Hz", depending on whether the nominal video frame rates based on 25Hz or 30 000/1001Hz (approximately 29,97Hz) are supported.
- "SDTV" or "HDTV", depending on whether or not they are limited to decoding pictures of conventional TV resolution. The capabilities of an SDTV Contribution IRD are a sub-set of those of an HDTV Contribution IRD.

To give a complete definition of a Contribution IRD, both dimensions need to be specified, for example 25Hz SDTV Contribution IRD.

13.3 DVB Guidelines on system layering, video and audio

The guidelines for Digital Video Broadcasting (DVB) systems layering, video, and audio refers to document ETSI TR 102 154 V1.1.1 (2001-04).

13.4 MPEG–2 Audio–Visual Coding

The use of MPEG-2 audio-visual coding in contribution and primary distribution applications refers to document ETSI TR 102 154 v1.1.1 (2001–04).

Both Standard Definition Television (SDTV) and High Definition Television (HDTV) are covered. The rules of operation for the encoders are features and constraints which the encoding system should adhere to in order to ensure that the transmissions can be correctly decoded. These constraints may be mandatory, recommended or optional.

14 Transmission

14.1 Background

Malaysia is presently using PAL B and PAL G which operates on 7 MHz (VHF) and 8 MHz (UHF) bandwidth respectively. As such standards have to be based on existing conditions within the Malaysian broadcasting context. For the purposes of Malaysian Standard specification, the following standards and reports listed below have been researched to ensure it meets the Malaysian DTTB transmission requirements.

14.2 Digital Video Broadcasting (DVB); Framing Structure, Channel Coding and Modulation G–2 for DTTB

The use of DVB framing structure, channel coding and modulation for DTTB applications refers to document ETSI EN 300 744.

This document describes the baseline transmission system for digital terrestrial Television broadcasting. It specifies the channel coding and modulation system intended for digital multi-programmes such as LDTV, SDTV, EDTV and HDTV terrestrial services.

ETSI EN 300 744 has been referred to for implementation in Malaysia and is fully adopted for the Malaysian DTTB standard.

14.3 Digital Video Broadcasting (DVB); Implementation Guidelines for DVB Terrestrial Services; Transmission aspects

The use of implementation guidelines for DVB terrestrial services with respect to the transmission aspects refers to document ETSI TR 101 190 v1.1.1 (1997-12).

This document gives the guidelines for implementation of Digital Video Broadcasting Terrestrial (DVB-T) transmitting networks. Its primary intention is to be a guide to the transmission aspects, while receiver aspects have not been dealt with. This document describes the main features of the DVB Terrestrial (DVB-T) system and gives guidelines for setting up of DVB-T transmitting networks. This includes a general description of network topologies for Single Frequency Networks (SFN) and Multi-Frequency Networks (MFN), the possibilities and constraints when sharing transmitting sites with analogue TV and a summary of planning parameters.

ETSI TR 101 190 has been referred to for Malaysian application and answers questions that arise when planning and setting up a DVB-T network.

14.4 Digital Video Broadcasting (DVB); DVB Mega-Frame for Single Frequency Network (SFN) Synchronisation

The use of DVB mega-frame for SFN synchronisation refers to document ETSI TS 101 191 v1.3.1.

The document specifies a mega-frame, including a mega-frame initialization packet (MIP), which may be used for synchronisation of the Single Frequency Networks (SFN) as well as for the optional control of other important parameters in an SFN.

ETSI TS 101 191 V 1.3.1 (2001 -01) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard.

14.5 Audio Coding for DTTB Broadcast

The use of audio coding for DTTB broadcast refers to the document ITU BS 1196 annex 2.

To ensure that Malaysia benefits from international usage of other coding systems, the Dolby Digital (AC-3) audio coding is specified in this document.

ITU-R BS.1196, Annex 2, has been identified as suitable for Malaysian application and is adopted for the Malaysian DTTB transmission standard.

15 Multiplexing

14.1 Definition ETSI EN 300 468 V1.4.1 (2000-11)

The definition for multiplexing refers to the document ETSI EN 300 468 v1.4.1 (2000-11).

The document specifies the Service Information (SI) data which forms a part of DVB bitstreams. To provide information assisting in selection of services and/or events within the bitstream, ISO/IEC 13818-1 [1] as Program Specific Information (PSI) specifies additional data which complements the PSI by providing data to aid automatic tuning of IRDs, and additional information intended for display to the user.

Rules of operation for the implementation of the document (i.e. EN 300 468) are specified in ETR 211 [7].

15.2 Guidelines on DVB-SI Coding

The guidelines on DVB-SI coding refers to the document ETSI TR 101 211 v1.4.1 (2000-07).

The document provides implementation guidelines for the use and implementation of the DVB service. The guidelines are to be highly recommended rules for the usage of the DVB SI syntax specified in EN 300 468 [1]. As such, they facilitate the efficient and reliable implementation of basic user-interaction functions in the ETSI TR 101 162 V1.2.1 (2001-01-30) DVB Standard Information (SI).

15.3 Specification on ITU-R System B Teletext

The specification on ITU-R system B teletext refers to the document EN 300 472 v1.2.2 (1997-08).

The document specifies the method by which ITU-R System B Teletext (ITU-R Recommendation 653 [3]), may be carried in DVB bitstreams. This transport mechanism is intended to satisfy requirements to support the transcoding of the Teletext data into the Vertical Blanking Interval (VBI) of analogue video.

15.4 VBI Standard on MPEG-2

The VBI standard on MPEG-2 refers to the document ETSI EN 301 775 v1.1.1 (2000-11).

The document specifies a new VBI standard in addition to MPEG-2 in which DVB to handle the transmission of data intended to be transcoded into the VBI of MPEG-2 decoded video as described in ETSI EN 300 472 [2].

15.5 Transport Stream Media on MPEG-2

The use of transport stream media on MPEG-2 application refers to the document ETSI EN 301 192 v1.2.1 (1999-06).

The document is designed in conjunction with EN 300 468 [2] and ETR 211 [4]. The DVB System and is a means of delivering MPEG-2 Transport Streams (TS) via a variety of transmission media.

15.6 Specification for Data Broadcasting

The specification of data broadcasting refers to the document ETSI EN 301 192 v1.4.1 (2004-06).

The document specifies specification for data broadcasting guidelines. The document EN 301 192 also relates to the document ETSI TR 101 202 V1.1.1 (1999-02).

15.7 Update Notification Table

The use of update notification table the document ETSI TS 102 006-1 v1.1.1 (2001-12).

An Update Notification Table (UNT) that can be used to enhance the system software update functionality in an upward compatible way. The table provides a standard mechanism for carrying additional information for example, update scheduling information, extensive selection and targeting information, action, notification, filtering descriptors.

The present document has to be seen in context with ETR 162 [3] and EN 300 468 [4] because it describes additional descriptors used for system software update.

15.8 Standard Mechanism for Signaling a Software

The use of standard mechanism for signaling a software refers to document ETSI TS 102 006-1 v1.1.1 (2001-12).

The document specifies a standard mechanism for signaling a software update service and the means to transport the data for such a software update service.

The document does not define the mandatory character of this protocol in a specific context, and it does not exclude the use of proprietary mechanisms for doing a software update.

16 DVB Subtitling

16.1 Subtitling Systems

The use of subtitling system refers to the document DVB Bluebook Document A009 Rev.1 (02/02)

This document specifies the method by which subtitles, logos and other graphical elements may be coded and carried in DVB bitstreams. The system applies Colour Look-Up Tables (CLUTs) to define the colours of the graphical elements. The transport of the coded graphical elements is based on the MPEG-2 system described in ISO/IEC 13818-1.

DVB Bluebook Document A009 Rev. 1 (02/02) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard

17 Network Independent Protocols

17.1 Network-independent Protocols for DVB Interactive Services

The use of network-independent protocols for DVB interactive services refers to the document ETSI TS 300 802 (November 1997).

This document covers the core Digital Video Broadcasting (DVB) requirements to enable interactive services supporting broadcasting to the home with narrowband return channels. The system defined provides a generic solution for a variety of future interactive services, through the adoption of DSM-CC User-to-User, Download and Object Carousel protocols, as specified in TR 101 194.

The interactive services are provided on systems consisting of a high bitrate downstream channel (up to the maximum bitrate of the Broadcast channel) from the Service Providers to Service consumers and low bitrate interaction channels (up to 150 kbit/s). The Broadcast Service Provider and the Interactive Service Provider need not operate from the same location.

There are many possible network configurations covering the currently and future specified DVB broadcast options including satellite, terrestrial, cable, SMATV and MMDS in conjunction with PSTN, ISDN, cable and other Interactive channel options. The implications for interactive services via these types of networks will be described in a separate guidelines document TR 101 194 which will also summarise the functionality of the protocols identified in this Standard. The network protocols are subjected to the standards adopted by the Malaysian Authority.

ETSI Document ETS 300 802 (November 1997) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard.

17.2 Commercial Requirements for Asymmetric Interactive Services Supporting Broadcast to the Home with Narrowband Return Channels

The commercial requirement for asymmetric interactive services supporting broadcast to home with narrow band channels refers to DVB Bluebook A008 (10/95).

This document specifies the commercial requirements for asymmetric interactive services supporting broadcast to the home with narrowband return channels, where the term narrowband refers to the number of bits per second available, up to about 150 kbit/s (e.g. 2 times 64 kbps B channels with 16 kbps D channel ISDN). It also describes a set of service types, gives typical examples and provides a system overview illustrating the signal paths.

The aim is to specify the commercial requirements for the physical and transport layers and to leave the development of the application layer and the terminal hardware and software (e.g. operating system, remote control, etc.) up to competitive market forces. It is not the intention of this document to define a standardised DVB end user terminal for interactive applications.

DVB Bluebook Document A008 (10/95) has been referred to for implementation in Malaysia and answers questions related to commercial requirements for asymmetric interactive services supporting broadcast to the home with narrowband return channels.

17.3 Guidelines for Implementation and Usage of the Specification of Network Independent Protocols for DVB Interactive Services

Guidelines for implementation and usage of network independent protocols refers to document TR 101 194 v1.1.1 (1997-06).

This document explains the ways in which the network independent protocols specified in ETS 300 802 can be used in conjunction with an interaction network as specified for instance in ETS 300 801 to implement the full range of Interactive Services (IS) complementing broadcast television services according to the commercial requirements defined in the "Commercial Requirements for Asymmetric Interactive Services supporting Broadcast to the Home with Narrowband Return Channels" mentioned in Section 7.1.2 above.

TR 101 194 V1.1.1 (1997-06) has been referred to for Malaysian application and answers questions that arise when planning and using network independent protocols for DVB interactive services.

18 Interaction Channel through Public Switched Telecommunications Network (PTSTN)/ Integrated Services Digital Network (ISDN)

The use of interaction channel through PSTN or ISDN refers to document ETS 300 801 v1 (08/97).

This document is the baseline specification for the provision of Return Channel (RC) based on PSTN and ISDN to Digital Video Broadcasting (DVB) systems. It is not intended to specify a RC solution associated to each broadcast system because the inter-operability of different delivery media to transport the RC is desirable. Therefore the PSTN/ISDN solutions for the RC apply to satellite, cable, SMATV, terrestrial, MMDS or any future DVB system. The solutions here provided for RC through PSTN/ISDN are a part of a wider set of alternatives to implement interactive services for DVB systems.

ETSI Document ETS 300 801 V1 (08/97) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard

19 Interaction Channel through the Global System for Mobile Communications (GSM)

The use of interaction channel through GSM refers to document EN 301 195 v1.1.1 (1992-02).

This document is the baseline specification for the provision of an interaction channel based on Global System for Mobile communications (GSM) to Digital Video Broadcasting (DVB) systems. It does not intend to specify an interaction channel solution associated to each broadcast system because the interoperability of different delivery media to transport the interaction channel is desirable. Therefore the GSM solution for the interaction channel applies to satellite, cable, MATV, SMATV, terrestrial, microwave or any future DVB compliant broadcasting or distribution system. The solutions provided in the document for an interaction channel through GSM are a part of a wider set of alternatives to implement interactive services for DVB compliant systems.

ETSI Document EN 301 195 V1.1.1 has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard.

20 Interaction Channel for Satellite Master Antenna TV (SMATV) Distribution System

The use of interaction channel for SMATV distribution systems refers to DVB Bluebook A034 (03/98).

This document provides guidelines and recommendations for the implementation of an Interaction Channel based on two-way satellite links, to users connected to Satellite Master Antenna Television (SMATV) systems. The system provides the Interaction Channel through the concatenation of a Satellite section and a Coaxial section in a seamless fashion. Guidelines and recommendations here provided are valid for the implementation of very cost effective solutions matched to the SMATV scenario as well as for the reuse of already operating satellite networks.

This document also describes the key points of the system to cope with the commercial requirements established at the DVB for asymmetric interactive services supporting broadcast to home with narrowband return channel.

The system here described is an open system allowing the inter-operability between the two sections irrespective of the technology supported. Guidelines are provided in this sense, allowing the use of alternative technologies for each section (satellite and coaxial) with the aim the users or operators can select the technology best suited for each situation depending on the type of SMATV network, required services, quality of services, number of users, traffic requirements, etc.

The SMATV coaxial section solutions here described allow also the use of alternative delivery media such as terrestrial, microwaves, etc., facilitating in this way inter-operable DVB-RC systems for the SMATV environment.

The system described here is compatible with the DVB Network Independent Protocols specification for Interactive services, as specified in section 7.1 above. The document also provides reference examples for the implementation of an Interaction Channel system to cope with two different scenarios- one which is suited for an environment with asymmetric interactive services supporting broadcast to home with narrowband return channel, and one with wideband Multimedia services where the satellite based infrastructure can play a very effective role.

DVB Bluebook Document A034 (03/98) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard.

21 Interaction Channel for Satellite Distribution Systems

The use of interaction channel for satellite distribution systems refers to document ETSI EN 301 790 v1.2.2 (12/00).

This document is the baseline specification for the provision of the interaction channel for GEO satellite interactive networks with fixed return channel satellite terminals (RCST).

This document facilitates the use of RCSTs for individual or collective installation (e.g. SMATV) in a domestic environment. It also supports the connection of such terminals with in-house data networks.

This document may be applied to all frequency bands allocated to GEO satellite services.

The solutions provided in the present document for interaction channel for satellite interactive networks are a part of a wider set of alternatives to implement interactive services for Digital Video Broadcasting (DVB) systems.

ETSI Document EN 301 790 V1.2.2 (12/00) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard.

22 Guidelines for the Implementation and Usage of the DVB Interaction Channel for Satellite Distribution Systems

The guidelines for implementation and usage for DVB interaction channel for satellite distribution systems refers to TR 101 790 v1.1.1 (09/01).

This document provides the first guidance to manufacturers, network operators and service providers on equipment design for and operations of a Geostationary Satellite Interactive Network, where a large number of Return Channel Satellite Terminals (RCST) are controlled by a central Network Control Centre (NCC).

It is applicable to satellite systems as defined in ETSI Document EN 301 790 V1.2.2 (12/00). In such a system the RCSTs receive a Forward Link based on the DVB-S specifications. The Return Link signal transmitted from the RCST is received by one or more Gateways, which also interact with the NCC. The system as defined in ETSI Document EN 301 790 V1.2.2 (12/00) may be used in all frequency bands allocated to FSS or BSS services, and the first expected implementations are in the bands listed in Annex E of the above mentioned document.

Information concerning the most relevant international regulations and recommendations (ITU, ETSI, DVB, etc.) which in some cases could be applicable to the DVB-RCS terminals is included in Clause 2 of the document.

This Guideline Document (GD), as well as the ETSI Document EN 301 790 V1.2.2 (12/00), covers two RCST profiles, Type A which is able to support IP services only, and Type B which shall be able to operate as RCST Type A and also to support native ATM protocols by encapsulating ATM cells within an MPEG2 Transport Stream on the forward link.

TR 101 790 V1.1.1 (09/01) has been referred to for Malaysian application and answers questions that arise when planning and using satellite systems for DVB interactive services.

23 Specification of Interaction Channel for DTTB including Multiple Access OFDM

Specification of interaction channel for DTTB including multiple access OFDM refers to document ETSI EN 301 958 v1.1.1 (03/02).

This document is the baseline specification for the provision of the interaction channel for digital terrestrial television distribution system, DVB-T defined in the EN 300 744 standard.

This document:

- gives a general description of the baseline system for interactive DTTB;
- specifies the channel coding/modulation;
- specifies the medium access control protocol;
- provides guidelines on the radio frequency spectrum management.

The purpose of the Medium Access Control (MAC) section is to redefine a set of MAC messages based on the DVB-RCCL MAC message set, adapted to suit the specific characteristics of the physical layer of the DVB-RCT specification.

The solution provided in the present document for return channels through terrestrial broadcast systems is part of a wider set of alternatives for implementing interactive services for DVB systems.

ETSI Document EN 301 958 V1.1.1 (03/02) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard.

24 Interaction Channel for Cable TV Distribution Systems

The use of interaction channel for cable TV distribution systems refers to DVB Bluebook A023 (02/02).

This document is the baseline specification for the provision of the interaction channel for CATV networks.

It is not intended to specify a return channel solution associated to each broadcast system because the inter-operability of different delivery media to transport the return channel is desirable.

The solutions provided in the present document for interaction channel for CATV networks are a part of a wider set of alternatives to implement interactive services for Digital Video Broadcasting (DVB) systems.

DVB Bluebook Document A023 Rev 2 (02/02) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard.

25 Guidelines for the use of the Specification on DVB Interaction Channel for Cable TV Distribution Systems

The use of guidelines for the use of the DVB interaction channel for cable TV distribution systems refers to DVB Bluebook A031 (03/98).

Hybrid Fibre Coax (HFC) networks is a sub-class of Cable Television (CATV) networks in which the subscribers are divided into groups by using optical transmission technology in the trunk network.

The CATV infrastructures can support the implementation of the Return Channel for interactive services suitable for DVB broadcasting systems. CATV can be used to implement interactive services in the DVB environment, providing a bi-directional communication path between the user terminal and the service provider.

DVB Bluebook Document A031 (03/98) has been referred to for Malaysian application and answers questions that arise when planning and using cable TV systems for interaction channel.

26 Interaction Channel through the Digital Enhanced Cordless Telecommunications (DECTS)

The use of interaction channel through DECT refers to document ETSI EN 301 193 v1.1.1 (07/98).

This document is the baseline specification for the provision of an interaction channel based on the Digital Enhanced Cordless Telecommunications (DECT) to Digital Video Broadcasting (DVB) systems.

This standard does not intend to specify an interaction channel solution associated to each broadcast system because the interoperability of different delivery media to transport the interaction channel is desirable. Therefore, the DECT solution for the interaction channel apply to satellite, cable, MATV, Satellite Master Antenna TeleVision (SMATV), terrestrial, microwave or any future DVB compliant broadcasting or distribution system.

The solutions provided in the present document for an interaction channel through the DECT are a part of a wider set of alternatives to implement interactive services for DVB systems.

ETSI Document EN 301 193 V1.1.1 (07/98) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard.

27 Interaction Channel for Local Multipoint Distribution System (LMDS) Distribution Systems

The use of interaction channel for LMDS distribution systems refers to document ETSI EN 301 199 v1.2.1 (06/99).

This document is the baseline specification for the provision of the interaction channel for LMDS networks.

It is not intended to specify a return channel solution associated to each broadcast system because the inter-operability of different delivery media to transport the return channel is desirable.

The solutions provided in this document for interaction channel for LMDS networks are a part of a wider set of alternatives to implement interactive services for Digital Video Broadcasting (DVB) systems.

This document is not limited to a given frequency range. All the frequencies refer to IF frequencies as defined in sub-clause 5.1.2. of the document.

ETSI Document EN 301 199 V1.2.1 (06/99) has been referred to for implementation in Malaysia and is adopted for the Malaysian DTTB standard.

28 Multimedia Home Platform (MHP)

28.1 Introduction

MHP is a set of standards that completely describe the DVB's open middleware system. DVB introduced the concept of a "Profile" in order to aid implementation of the standards.

A "Profile" refers to an application area and, as a consequence, set-top-box capabilities. Whilst there are three profiles, there are only two MHP specifications. The reason is that the MHP functionality behind the first two is almost the same, and both profiles are incorporated in one document.

MHP is based around three profiles:

- i) **Enhanced Broadcast Profile** ES 201 812 (MHP 1.0)

- | | | |
|------|--------------------------------|----------------------|
| ii) | Interactive TV Profile | ES 201 812 (MHP 1.0) |
| iii) | Internet Access Profile | TS 102 812 (MHP 1.1) |

In addition to the profile definition, the MHP standards cover issues such as the DVB-J (Java™) platform, the MHP security mechanisms, application download protocols, etc.

28.1.1 Enhanced Broadcast Profile

MHP's "Enhanced Broadcast Profile" was designed to mirror in many ways the functionality of existing middleware systems and the applications that run on them.

As suggested by the title, this profile calls for a set-top-box with no or limited return channel capabilities and represents the lowest of the three profiles in terms of set-top-box performance.

Profile 1 is fully defined in ES 201 812 - the MHP 1.0 specification.

28.1.2 Interactive TV Profile

Also specified in ES 201 812 - MHP 1.0, the Interactive TV profile calls for a set-top-box with a more significant interactive channel.

One of the differences between the two profiles is that applications can be downloaded via the return channel in Profile 2, whereas this is only possible via the broadcast channel in Profile 1. There is also greater support of the interactive channel with appropriate APIs, etc.

28.1.3 Internet Access Profile

The Internet Access Profile targets a more sophisticated set-top-box, with greater processing power and memory than in profiles 1 & 2. This profile is consistent with the accessing of Internet content on the set-top-box.

Profile 3 contains an optional HTML element, called DVB-HTML

28.2 Multimedia Home Platform

The use of Multimedia Home Platform applications refers to document MHP A057 revision 2.

This specification is firstly intended for implementers of MHP's on various hardware and software platforms. Secondly it is intended for developers of applications that use the MHP functionality and APIs. The MHP specification aims to ensure interoperability between MHP applications and different MHP implementations. Implementers should consult the publisher of this specification regarding conformance.

This specification defines the interfaces visible to applications. Application developers should not assume that other related interfaces are available unless they are specifically listed.

The DTTB committee Work Group has therefore unanimously agreed that the MHP specifications should conform to the A057 Rev. 2 standards. Any standards agreed by ETSI, EBU or ITU, which is adopted hereafter by the DVB-T standards, would automatically supersede any earlier standards for MHP.

28.3 Java Documentation for MHP version 1.0.2

The use of Java documentation for MHP v1.0.2 refers to document TS 101 812 v1.1.3.

The implementation of Java interfacing for all MHP version 1.0.2 applications should conform to the TS 101 812 Version 1.1.3 Java specifications.

28.4 Java Documentation for MHP version 1.1.0

The use of Java documentation for MHP version 1.1.0 refers to document TS 102 812 v1.1.1.

The implementation of Java interfacing for all MHP version 1.1.0 applications should conform to the TS 102 812 Version 1.1.1 Java specifications.

28.5 Multimedia Platform User and Market Requirements: Enhanced and Interactive Digital Broadcasting in the Local Cluster

The use enhanced and interactive digital broadcasting based on multimedia platform user and market requirements refers to document A062 - DVB Commercial Module.

The Multimedia Home Platform encompasses the user terminal (including low and high functionality implementations), its associated peripherals and the in-home digital network. In order to deliver bridging between:

- the hardware and the software worlds;
- the consumer and computer worlds;
- the existing and future business environments;

thus, providing an evolution from today's fragmented vertical markets to future unfragmented horizontal markets user and market requirements have been identified and reported in this document. Particular attention has been given to the existing and near-future penetration of equipment based on an agreed realistic feasible solution defined in an open standard, and the success of early services. In that framework, this report addresses user and market requirements for the so-called "local cluster", i.e. the user terminal and its close peripherals. Issues related to an enlarged Multimedia Home Platform including e.g. the In-Home Digital Network will be considered at a later stage building on the existing ISCM requirements. The API is considered as the key enabler. The ultimate target is the definition of a generic API based on a common reference model. Nevertheless, taking into account the current market situation, a migration path has to be defined starting from the separation of data from the application.

The DTTB Work Group agreed that the 'DVB Commercial Module - Multimedia Home Platform User and Market Requirements: Enhanced and interactive digital broadcasting in the local cluster' specifications should conform to the A062 standards. Any standards agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter would automatically supersede any earlier standards for MHP.

28.6 Multimedia Home Platform (MHP) Implementation Arrangements and Associated Agreement

The use of MHP implementation arrangements and associated agreement refers to document A066 v1.0.

With the adoption of a specification for the Multimedia Home Platform¹, the Malaysian DTTB Work Group has made a provision, through the television receiver, of digital services to the consumer. In addition to accommodating digital television, the MHP can also provide access to Internet connectivity, e-commerce, and e-government services. This TV-centric development pushes the Information Society beyond the personal computer; it enfranchises consumers who risked being on the fringes of the digital revolution. By setting a specification for an application programming interface, MHP opens a more vast market for digital applications and services.

This section of the MHP standards explains the legal arrangements for the conformance testing and licensing of certain intellectual property rights essential to MHP. The DVB consideration of this important issue ran parallel to its standard-setting work. It required the attention of its Steering Board, the IPR Module and several groups created ad hoc to address matters at the cutting edge of law and technology. Need to study this statement

The DTTB Work Group has therefore agreed that the Multimedia Home Platform (MHP) MHP implementation arrangements and associated agreements specifications should conform to the A066 standards. Any standards agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter would automatically supersede any earlier standards for MHP.

29 Internet Protocol

29.1 Digital Video Broadcasting (DVB); Architectural Framework for the Delivery of DVB-Services over IP-Based Networks

The use of architectural framework for delivery of DVB services over IP-based networks refers to document DVB A 071 (02/02).

The standard describes the architectural framework for the delivery of DVB-services over IP-based networks. It is the baseline document introducing the reference model and basic service class descriptions. The DVB Commercial Requirements as developed in DVB phase II form the guiding principles for this architecture.

A wide range of specifications will be built upon this basic architecture document in order to define the usage and implementation of IP-based DVB-services. Taking into account that DVB will specify only the necessary interfaces, leaving implementation of the system and system components to the industry, this architectural framework aims to explain how various sets of interfaces work together to enable the different service classes.

The DVB-IP architecture is applicable to all system and service implementations using Integrated Receiver Decoders, TV sets and multimedia PCs as well as clusters of such devices, connected to Home Networks. It is intended for use by implementers of both systems and services.

The document explains the overall system architecture and the related concepts with an abstract layer model, furthermore a detailed description of the home network architecture is given. This greater detail is provided because the interfaces on the home network and especially the network interface of the home network end devices are the prime targets for standardization, to enable high-volume production of interoperable devices.

A description of the services namely:

- Entertainment Services;
- General Information Services;
- Educational Services;
- Messaging Services;
- Communication Services;
- Service Information;

enabled by this architecture is provided in document DVB A071 (02/02) Informative Annex A has been identified as suitable for implementation in Malaysia and is adopted for the Malaysian DTTB transmission Standard.

30 Conditional Access

30.1 Digital Video Broadcasting (DVB); Support for use of Scrambling and Conditional Access (CA) within Digital Broadcasting Systems.

The use of support for use of scrambling and conditional access within DVB systems refers to document ETSI ETR 289 V1 (10/96).

This standard addresses the addition of Conditional Access (CA) elements to the ISO/IEC 13818-1 (MPEG-2) [1]. The Conditional Access System (CAS) is a very sensitive area, and this standard describes the minimum set of common CA elements necessary to achieve interoperability between different CA Systems. The standard specifies those aspects, which are required for co-existence of multiple Conditional Access Systems in a single data stream. It is reasonable to expect these common CA elements to be incorporated in every piece of consumer receiver equipment for digital TV. In additional clauses, some CA elements are defined which are not needed from an interoperability point of view, but will enhance commonality in cable TV (CATV) receiver equipment.

ETSI ETR 289 V1 (10/96) has been identified as suitable for implementation in Malaysia and is adopted for the Malaysian DTTB transmission Standard.

30.2 Digital Video Broadcasting (DVB); Head-End Implementation of DVB Simulcrypt ETSI TS 103 197V1.2.1 (02/02)

The head-end implementation of DVB simulcrypt refers to document ETSI TS 103 197 v1.2.1 (02/02).

The standard for DVB-Simulcrypt addresses the requirements for interoperability between two or more conditional access systems at a head-end. It specifies the system architecture, timing relationships, messaging structures, extended interoperability and control. The components within the system architecture represent functional units. The boundaries between physical units are not required to match the boundaries between functional units. It is possible that the SCS could be in the MUX or the SCS and MUX could be built independently. Neither architecture is mandated. The DVB-Simulcrypt system is based on the concept of a shared scrambling and descrambling method.

ETSI TS 103 197 V1.2.1 (02/02) has been identified as suitable for implementation in Malaysia and is adopted for the Malaysian DTTB transmission Standard.

31 Measurement

31.1 Digital Video Broadcasting (DVB); Measurement Guidelines for DVB Systems

The measurement guidelines for DVB systems refers to the document ETSI TR 101 290 v1.2.1 (01/01).

The Digital Video Broadcasting (DVB) set of digital TV standards specify baseline systems for various transmission media: satellite, cable, terrestrial, etc. Each baseline system standard defined the channel coding and modulation schemes for that transmission medium. The source coding was adapted from the MPEG-2 standard. The design of these new systems

has created a demand for a common understanding of measurement techniques and the interpretation of measurement results.

The standard provides recommendations in this field by defining a number of measurement techniques in such detail that the results are actually comparable as long as the measurement is carried out in compliance with the given definition.

The inclusion of each parameter in the standard is based on requirements from those who envisage having to work alongside the defined procedures. This includes network operators and providers of equipment for network installation, as well as manufacturers of Integrated Receiver Decoders (IRD) or test and measurement equipment.

The recommendations of the standard can be used:

- to set-up test beds or laboratory equipment for testing hardware for DTTB and other related services;
- to set these instruments to the appropriate parameters;
- to obtain unambiguous results that can be directly compared with results from other test set-ups;
- to form a potential basis for communicating results in an efficient way by using the definitions in the present document as references.

ETSI TR 101 290 V1.2.1 (01/01) has been identified as suitable for implementation in Malaysia and is adopted for the Malaysian DTTB transmission standard.

31.2 Digital Video Broadcasting (DVB); Usage of the DVB Test and Measurement Signalling Channel (PID 0X001D) Embedded in an MPEG-2 Transport Stream (TS)

The usage of DVB test and measurement signaling channel embedded in MPEG-2 TS refers to document ETSI TR 1010 291 v1.1.1 (06/98).

The Digital Video Broadcasting (DVB) set of digital TV standards specify baseline systems for various transmission media: satellite, cable, terrestrial, etc. Each baseline system standard defines the channel coding and modulation schemes for that transmission medium. The source coding adopted was from the MPEG-2 standard.

The design of these new systems has created a demand for a common understanding of measurement techniques and the interpretation of measurement results, this led to the introduction of the "DVB Measurement Guidelines" ETR 290 [3].

The deployment of complex digital broadcasting network architectures raised the following requirements:

- In order to make the test data independent of any PSI / SI table within a TS and to allow the packets to be freely defined without disturbing any current equipment, a specific PID from the DVB reserved range has been assigned. The number assigned was 0x1D.
- Test data may be inserted into existing TS by replacing null packets with packets containing the test data with the assignment PID 0x1D. Alternatively test data may be introduced via a multiplexer in which case it is at the discretion of the multiplex operator to assign sufficient bandwidth to PID 0x1D.

The standard provides details of the usage and the various applications for PID 0x1D.

ETSI TR 101 291 V1.1.1 (06/98) has been identified as suitable for implementation in Malaysia and is adopted for the Malaysian DTTB transmission standard.

32 DVB-H

32.1 Introduction

DVB-H is a technology that enables the simultaneous transmission of multiple television, radio and video channels to mobile handheld devices. It combines traditional broadcasting standards with specific features for handheld devices. To receive DVB-H transmissions, handsets require an additional integrated receiver.

32.2 Digital Video Broadcasting (DVB); Transmission System for Handheld Terminals (DVB-H)

The use of DVB transmission system for handheld terminals refers to the document ETSI EN 302 304 v1.1.1 (2004-11).

The Transmission System for Handheld terminals (DVB-H) specify an efficient way of carrying multimedia services over digital terrestrial broadcasting network s to handheld terminals (DVB-H).

ETSI EN 300 744 V1.5.1 (2004-11) has been identified as suitable for implementation in Malaysia and is adopted for the Malaysian DTTB transmission Standard.

33 MULTIMEDIA APPLICATIONS

DTTB transmission may be used or coupled with return channels to provide multimedia applications such as;

- High Speed Internet to personal computer (PC) by using DVB receivers attached to the PC via peripheral interfaces such as USB, PCMCIA, PCI or Ethernet.
- Interactive TV
- Internet Protocol TV (IPTV)
- Return Channels through communication network such as PSTN, SFDMA, GSM, Wi-Fi etc via peripherals or interfaces such as USB, PCI, PCMCIA, Bluetooth, infrared, Ethernet, IEEE802.11 etc.
- Data Transmission
- Video or Audio streaming

34 Provision For HDTV

The provision for HTDV or HD transmission shall be based on DVB standard. HDTV broadcast will be commercially viable when cheaper and readily available high resolution display devices are readily available and HD content are ready.

Allowing broadcasters freedom to select the format that suits their needs and the needs of their audiences. HDTV shall adopt the minimum 1080 horizontal display resolution as per ITU-R and EBU recommendations.

In order to help consumers understand whether a particular display is ready for HDTV, HD-ready label can only be attached to displays sold and used in Malaysia if they meet the following conditions:

- Having a minimum of 1080 horizontal lines display;
- Able to accept HD inputs via
 - Analogue Y-Pb-Pr
 - DVI or HDMI and the DVI or HDMI input supports content protection HDCP.
- Able to accept also 720p/50 inputs in order to be downward compatibility.

35 Set Top Box (STB) and Integrated TV

35.1 Set Top Box

It is the intention to have a common STB for all service providers, however based on market demand, various version of STB that may be available in the market are;

- Basic – able to view FTA channels without restrictions
- Premium – having any or combination of MHP, CAS, PVR or Data functionality

All version of STB should be capable to receive any digital FTA broadcast.

35.2 Integrated TV

Integrated TV primarily TV set with either one or combination of STB functions of both basic and premium STB. All versions of integrated TV should be capable to receive any FTA broadcast.

36 DVB Defined Interfaces

The definition of the network aspects of the transmission of MPEG-2 Transport Streams is based to the maximum extent on existing international and European standards. The equipment considered in this ETS is the Network Adapter performing the adaptation between MPEG-2 transport streams and the possible interfaces as per following;

36.1 DVB Interfaces to Plesiochronous Digital Hierarchy (PDH) Networks

The use of DVB interfaces to PDH networks refers to document DVB A018.

This European Telecommunication Standard (ETS) specifies the transmission of MPEG-2 transport streams between two DVB interfaces as defined in EN 50083-9 within PDH networks working at the ITU-T Recommendation G.702 hierarchical bit-rates of 1 544 kbit/s, 2 048 kbit/s, 6 312 kbit/s, 8 448 kbit/s, 34 368 kbit/s, 44 736 kbit/s and 139 264 kbit/s. The use of any of these bit rates is optional, if however one or more rates are selected the complete specification applies.

The definition of the network aspects of the transmission of MPEG-2 Transport Streams is based to the maximum extent on existing international and European standards. The equipment considered in this ETS is the Network Adapter performing the adaptation between MPEG-2 transport streams and the interfaces of PDH networks.

The Digital Terrestrial TV Work Group has therefore agreed that the DVB Interfaces to Plesiochronous Digital Hierarchy (PDH) networks specifications should conform to the A018 standards. Any standards agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter, would automatically supersede any earlier interface standards.

36.2 DVB Interfaces to Synchronous Digital Hierarchy (SDH) Networks

The use of DVB interfaces to SDH networks refers to document DVB A019.

This document specifies the transmission of MPEG-2 transport streams between two DVB interfaces as defined in EN 50083-9 within SDH networks working at the Rec. ITU-T G.707 hierarchical bit rate of 155520 kbit/s or at a bit rate of 51840 kbit/s. The use of any of these bit rates is optional, if however one or more rates are selected the complete specification applies.

The definition of the network aspects of the transmission of MPEG-2 transport streams is based to the maximum extent on existing international and European standards. The equipment considered in this document is the Network Adapter performing the adaptation between MPEG-2 transport streams and the interfaces of SDH networks.

The Digital Terrestrial TV Work Group has therefore agreed that the DVB Interfaces to Synchronous Digital Hierarchy (SDH) networks specifications should conform to the A019 standards. Any standards agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter, would automatically supersede any earlier interface standards.

36.3 Guidelines for Handling of ATM Signals in DVB Systems

The guidelines for handling of ATM signals in DVB systems refer to the document DVB A044.

The present document provides the mapping scheme to be used for the transport of ATM cells over MPEG-2 Transport Stream packets. The purpose of encapsulating ATM cells directly into an MPEG-2 transport stream is to:

- interconnect ATM networks via DVB systems or provide ATM services to end-users using DVB systems;
- offer differentiated quality of service to end-users by utilizing the ATM mechanisms.

The main constraints of this problem are to:

- providing an efficient encapsulation mechanism;
- maintaining DVB/MPEG-2 compatibility when transporting ATM cells;
- respecting ATM Quality-of-Service requirements throughout DVB/MPEG systems.

The Digital Terrestrial TV Work Group has therefore agreed that the DVB Guidelines for the handling of ATM signals in DVB systems should conform to the A044 standards. Any standards agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter, would automatically supersede any earlier interface standards.

36.4 Home Access Network (HAN) with an Active Network Termination (NT)

The use of HAN with an active network termination refers to the document DVB A039.

The DVB In-home Digital Network (IHDN) can be subdivided into a Home Access Network (HAN) for the connection to external networks and a Home Local Network (HLN) for interconnections of user equipment to clusters and between rooms. In addition to the DVB access technologies DVB-S, DVB-C, DVB-T, DVB-SMATV, DVB-MC and DVB-MS with the interaction channels for interactive broadcast services, the IHDN-HAN specification will focus on the definition of new interfaces and network terminations (NT), such as an xDSL modem or an external cable modem.

The existing DVB transmission systems form part of the HAN architecture, but access the IRD without any influence from other sections of the HAN. Different versions of HAN are possible. The HAN for use with an active Telco NT is based on an ATM interface operating at 25 or 51 Mbps. The IEEE 1394 interface with the long reach extension has been selected for the HLN.

The Digital Terrestrial TV (Work Group has therefore y agreed that the Home Access Network (HAN) with an active Network Termination (NT) standards should conform to the A039 standards. Any standards agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter, would automatically supersede any earlier interface standards.

36.5 In-Home Digital Network (IHDN) Home Local Network (HLN)

The use of IHDN home local network refers to the document DVB A060.

This specification standardizes the topology, physical interfaces and a complete stack of protocols for the Home Local Network (HLN). This includes the specification of the APIs that an application on an HLN device can use to access the services provided by this HLN device or any other HLN device, as well as a Java language binding for these APIs. This allows e.g. Java applications to be downloaded to a DVB Receiver and use the services from other HLN devices such as storage devices.

The Digital Terrestrial TV Work Group has therefore agreed that the In-Home Digital Network (IHDN) Home Local Network (HLN) standards should conform to the A060 standards. Any standard agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter will automatically supersede any earlier interface standards.

36.6 User and Market Requirements for In-Home Digital Networks A029

The user and market requirement for in-home digital networks refers to the document DVB 029.

Existing in-home coaxial distribution systems will meet the initial needs of many users for carrying services from set top boxes to video recorder and TV sets. Over the next 5 years or so, however, it is likely that an increasing number of users will wish to have a more flexible means of interconnecting services within the home. DVB should therefore prepare the necessary specifications for an in-home digital network interface in a suitably early time-frame.

The implementation of this interface shall be optional, but if it was implemented then, the Digital Terrestrial TV Work Group has therefore agreed that the User and Market Requirements for In-Home Digital Networks should conform to the A029 standards. Any standard agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter will automatically supersede any earlier interface standards.

36.7 Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications and Extensions to the Common Interface Specifications

The use of common interface specification for CA and other DVB decoder applications and extensions to the common interface refers to document DVB A025 and A053.

This standard has two main purposes. The first is to explain why the Common Interface Specification is designed the way it is. This will be done in the 'Rationale' sections throughout the document. The second purpose is to give guidance on how to implement and use the Common Interface. This will include recommendations for various design options where specific limits were not set in the specification.

These guidelines contain recommendations for implementation in various places which extend the Common Interface specification. These represent the best efforts of contributors to this document to ensure that modules and hosts are fully interoperable. Designers are free to accept or ignore them. However if a recommendation is ignored the designer should be confident that he fully understands the implications of doing this and the effect this may have on the interoperability of his product.

The Digital Terrestrial TV Work Group has therefore agreed that the Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications and its extensions should conform to the A025 and A055 standards respectively. Any standards agreed by ETSI, EBU or ITU which is adopted by the DVB-T standards hereafter will automatically supersede any earlier interface standards.

36.8 Interfaces for CATV/SMATV Headends and Similar Professional Equipment

The use of interfaces for CATV/SMATV headends and similar professional equipment refers to document DVB A010 revision 1.

This specification describes physical interfaces for the interconnection of signal processing devices for professional CATV/SMATV headend equipment or for similar systems, such as in uplink stations. Especially this document specifies the transfer of MPEG 2 data signals in the standardized transport layer format between devices of different signal processing functions.

The Digital Terrestrial TV Work Group has therefore agreed that the Interfaces for CATV/SMATV Headends and similar Professional Equipment should conform to the A010 Revision 1 standards. Any standards agreed by ETSI, EBU or newer revisions which are adopted by the DVB-T standards hereafter will automatically supersede any earlier interface standards.

36.9 Digital Video Broadcasting (DVB); Professional Interfaces: Guidelines for the Implementation and Usage of the DVB Asynchronous Serial Interface (ASI) A055

The guideline for the implementation and usage of professional interfaces for DVB asynchronous serial interface refers to document DVB A055.

The DVB Asynchronous Serial Interface (ASI) is a very popular standard interface for conveying MPEG-2 transport streams between professional equipment. However, there are concerns over interoperability in the market place, based on system integrators' experiences with available equipment from multiple suppliers. This note is intended to explain some of the causes of problems and to offer guidelines to ASI implementers that will encourage maximum interoperability.

The Digital Terrestrial TV Work Group has therefore agreed that the Digital Video Broadcasting (DVB); Professional Interfaces: Guidelines for the implementation and usage of the DVB Asynchronous Serial Interface (ASI) should conform to the A055 standards. Any standards agreed by ETSI, EBU or ITU which is adopted by the DVB-T standards hereafter will automatically supersede any earlier interface standards.

36.10 Interfaces for DVB-IRDs A016 Revision 2.

The use of interfaces for DVB IRDs refers to the document DVB A016.

The present document is an application standard, identifying recommended interfaces for connections of Digital Video Broadcast Integrated Receiver Decoder (DVB-IRD) equipment. If a recommended interface is supported, then the full specification of that interface, which may include options, applies.

Interfaces not mentioned in the present document are not excluded, and especially interfaces that are under development at the time of drafting the present document, may be added at a later stage. For mechanical and electrical details of the interfaces, reference is made to existing standards of IEC or CENELEC wherever possible, or standards which are known to be in an advanced state of development.

The Digital Terrestrial TV Work Group has therefore agreed that the Interfaces for DVB-IRDs should conform to the A016 standards. Any standards agreed by ETSI, EBU or newer revisions which are adopted by the DVB-T standards hereafter will automatically supersede any earlier interface standards.

37 Measurement Recommendation for DTTB Transmission Signals

37.1 Introduction

Due to the highly complex nature of DTTB as a terrestrial transmission path, the requirements for measurements is much greater in DVB-T as to compared with other transmission path systems. DVB-T is much more complex due to the technicalities of DVB-T modulator and analogue IQ modulator.

Methods of testing shall be in accordance with ETR 290 and also beyond these, whereby the following test instruments are required for measuring DTTB signals:-

- i) A modern Spectrum Analyzer
- i) A DVB-T Test Receiver with Constellation Analyzer
- ii) A DVB-T Test Signal Transmitter for measurement on DVB-T receivers.

With the above mentioned necessary equipment, it is thus possible to run the basic and essential scope of measurements for DTTB.

- i) Bit Error Rates
- ii) DTTB Signals Spectrum Analysis
- iii) Constellation Analysis
- iv) Crest Factor
- v) Amplitude, Phase and Group Delay Response

- vi) Impulse Response
- vii) Shoulder Attenuation

37.2 Bit Error Rate Measurement

A DVB-T test receiver will be able to detect 3 bit error rates which are meant for inner and outer error protection. These 3 error rates are to indicate problems with the data stream within the DVB-T transmission.

- Bit Error Rate before Viterbi
- Bit Error Rate before Reed Solomon
- Bit Error Rate after Reed Solomon

37.3 DTTB Signals Spectrum Analysis

A spectrum Analyzer is essential for the measurement of DTTB signals. Corresponding to DTTB, it must be noted that the signal bandwidth of the DVB-T signal is:

- 7.61 MHz in the 8MHz channel
- 6.66 MHz in the 7MHz channel
- 5.71 MHz in the 6MHz channel

The DVB-T channel power can be measured. Naturally, a thermal power meter would be used for the purpose of measuring power, but in principle, a spectrum analyzer will be able to provide a good estimate of Carrier/Noise ratio. Detailed methodologies on how to measure Signals, Spectrum and Power will be found in the appendixes.

37.4 Constellation Analysis

The Constellation analysis can be made utilizing Test Receiver with constellation analysis capability. OFDM sub-carriers are analyzed utilizing constellation analysis. Apart from pure payload carriers (which are analyzed), the pilot carriers and TPS carriers can be measured but not analyzed. The following values can be measured with constellation analysis:

- Signal/Noise ratio
- Phase Jitter
- I/Q amplitude imbalance
- I/Q phase error
- Modulation Error Ratio (MER)

37.5 Crest Factor

The crest factor for transmission is limited to 12dB in power transmitters, this measurement can be made utilizing a test receiver. The crest factor is intuitively interpreted on the test receiver.

37.6 Amplitude, Phase and Group Delay Response

Amplitude, Phase and Group Delay Response can be measured via a Test receiver. This is meant to measure linear distortion, whereby referenced to pilot carriers (scattered pilots and continual pilots)

37.7 Impulse Response

Impulse Response is meant to measure the maximum length of received impulse of DTTB signals. From the impulse, multiple echoes can be easily identified and classified in terms of delay and path attenuation.

37.8 Shoulder Attenuation

The DVB-T does not fully utilize full channel bandwidth, but however due to non-linearities in components, there are still outband components. This mentioned out band components, would affect on the spectrum and it's shape has given to the phenomenon "Shoulder Attenuation". In practice, the following shoulder attenuations should be achieved:

- Power amplifier, undistorted: approximate 30dB
- Power amplifier, equalized: approximate 40dB
- Output after Band Pass Filter: approximate 45dB

37.9 Other Advanced Measurement Techniques

The measurement for DTTB shall include the following advance techniques of measurement. Due to the high requirements related to digital terrestrial transmission, measurement of interference effects must additionally be considered as in general the concept of Digital transmission is to counter the effects of interferences. Below is the description of measuring techniques to cover measurement of interference effects:

- i) Additive White Gaussian Noise (AWGN)
- ii) Phase Jitter
- iii) Interference Sources
- iv) Echoes, Multi-path Reception
- v) Doppler Effect
- vi) I/Q Errors of the Modulator
- vii) Cause and Effect of I/Q Errors in DTTB
- viii) Modulation Error Ratio (MER)

Acknowledgement

Working Group on Digital Terrestrial Television Broadcast members:

Dato' Ismail Osman (Chairman)	MITV Corporation Sdn. Bhd.
Abdullah Shahadan (Vice Chairman)	Measat Broadcast Network Systems Sdn. Bhd.
Tony Fogl (Secretary)	ROHDE & SCHWARZ Malaysia Sdn. Bhd.
Moraini Mohamed	DiGi Telecommunications Sdn. Bhd.
Ir. Mohd Jaafar Mohd Daud	Dimensitek Sdn. Bhd.
Mohd Hakim Othman	Malaysian Communications and Multimedia Commission
Rizal Abd Malek	Malaysian Technical Standards Forum Berhad
Zul Deresid	Measat Broadcast Network Systems Sdn. Bhd.
Alvin Lee	MITV Corporation Sdn. Bhd.
Dato' Rosman Ridzwan	MITV Corporation Sdn. Bhd.
Mustafa Kamal b. Mamat	MITV Corporation Sdn. Bhd.
Abu Samah Hitam	Nat Seven Sdn. Bhd.
Sukumar	Nat Seven Sdn. Bhd.
Sanjeev Fernandes	NTL Broadcast Sdn. Bhd.
Azmar Abdullah	PTT Unittrunk Sdn. Bhd.
Ir. Abu Fatah Sanusi	PTT Unittrunk Sdn. Bhd.
Zulkefli Othman	Radio Televisyen Malaysia
Zulkifli Ab. Rahim	Radio Televisyen Malaysia
Alan Seah	ROHDE & SCHWARZ Malaysia Sdn. Bhd.
Kenny Anthony	ROHDE & SCHWARZ Malaysia Sdn. Bhd.
Arshad Ahmad	Telekom Malaysia Berhad
Ghazali Sulaiman	Telekom Malaysia Berhad
Khairuddin Mokhtar	Telekom Malaysia Berhad



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THE MALAYSIAN TECHNICAL STANDARDS FORUM BHD

23-1B Jalan Bandar 9
Pusat Bandar Puchong
47100 Puchong
Selangor Darul Ehsan
Malaysia

Tel: (+603) 5882 2485
Fax: (+603) 5882 2475

Website: www.mtsfb.org.my