



**Suruhanjaya Komunikasi dan Multimedia Malaysia**  
***Malaysian Communications and Multimedia Commission***

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**COMMUNICATIONS AND MULTIMEDIA ACT 1998**

**COMMISSION DETERMINATION ON THE MANDATORY STANDARD  
FOR FREE TO AIR TRANSMISSION  
OF DIGITAL TERRESTRIAL TELEVISION SERVICE  
DETERMINATION NO. 2 OF 2006**

Pursuant to the Ministerial Direction on Free To Air Transmission Of Digital Terrestrial Television Service, Direction No. 2 of 2006 and in exercise of the powers conferred by sections 55 and 104(2) of the Communications and Multimedia Act 1998 [Act 588], the Commission hereby determines as follows:

**Citation and commencement**

1. This Determination may be cited as the **Commission Determination on the Mandatory Standard for Free to Air Transmission of Digital Terrestrial Television Service Determination No. 2 of 2006** and shall come into force on 9 November 2006.

**Interpretation**

2. In this Determination, unless the context otherwise requires:

“Digital Terrestrial TV Work Group” means the Malaysian Technical Standard Forum Berhad Working Group on Digital Terrestrial TV Broadcasting.

3. Any terms used in this Determination shall, unless the context otherwise requires, have the same meaning as in the Act or the Regulations made under it.

4. Unless the context otherwise requires, words in the singular include the plural and vice versa.

**Licensees subject to this mandatory standard**

5. All holders of network facilities provider licences and network service provider licences shall be subject to this mandatory standard.

## **Standard for Free to Air Transmission of Digital Terrestrial Television Service**

6. The mandatory standard for Free to Air Transmission of Digital Terrestrial Television Service is as set out below:

### **(1) Scope of Standard**

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

- (a) Baseband Standards
- (b) Compression Standards
- (c) Delivery, Distribution and Transport mechanism
- (d) Transmission Standards
- (e) Reception Standards
- (f) Interactivity and Applications
- (g) Measurement

### **(2) MPEG Baseband**

#### **(A) MPEG-4 Audio-Visual Coding**

The use of MPEG-4 audio-visual coding in contribution and primary distribution applications with the variation be decided in the setting up of the minimum standard for set-top-box.

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.

### **(3) Transmission**

#### **(A) Background**

Malaysia is presently using PAL B and PAL G which operates on 7 MHz (VHF) and 8 MHz (UHF) bandwidth respectively. As such, standard 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.

(B) 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 this mandatory standard.

(C) 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.

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.

(D) 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.

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 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

(4) **Multiplexing**

(A) Definition ETSI EN 300 468

The definition for multiplexing refers to the document ETSI EN 300 468.

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].

(B) Guidelines on DVB-SI Coding

The guidelines on DVB-SI coding refers to the document ETSI TR 101 211.

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 DVB Standard Information (SI).

(C) Specification on ITU-R System B Teletext

The specification on ITU-R system B teletext refers to the document EN 300 472.

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.

(D) VBI Standard on MPEG-2

The VBI standard on MPEG-2 refers to the document ETSI EN 301 775.

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].

(E) Transport Stream Media on MPEG-2

The use of transport stream media on MPEG-2 application refers to the document ETSI EN 301 192.

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

(F) Specification for Data Broadcasting

The specification for data broadcasting refers to the document ETSI EN 301 192.

The document specifies specification for data broadcasting guidelines. The document EN 301192 also relates to the document ETSI TR 101 202.

(G) Update Notification Table

The use of update notification table refers to the document ETSI TS 102 006-1.

An Update Notification Table (UNT) that can be used to enhance the system software updates 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 and 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.

(H) Standard Mechanism for Signaling a Software

The use of standard mechanism for signaling a software refers to document ETSI TS 102 006-1.

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.

(5) **DVB Subtitling**

(A) Subtitling Systems

The use of subtitling system refers to the document DVB Bluebook Document A009

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 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

(6) **Network Independent Protocols**

(A) 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.

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 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

#### (B) 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.

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) 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 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.

(C) **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.

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 paragraph 6(6)(B) above.

TR 101 194 has been referred to for Malaysian application and answers questions that arise when planning and using network independent protocols for DVB interactive services.

(7) **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.

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 part of a wider set of alternatives to implement interactive services for DVB systems.

ETSI Document ETS 300 801 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

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

The use of interaction channel through GSM refers to document EN 301 195.

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 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

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

The use of interaction channel for SMATV distribution systems refers to DVB Bluebook A034.

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 and traffic requirements.

The SMATV coaxial section solutions here described, allow also the use of alternative delivery media such as terrestrial, microwaves, 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 paragraph 6(6)(B) 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 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

**(10) Interaction Channel for Satellite Distribution Systems**

The use of interaction channel for satellite distribution systems refers to document ETSI EN 301 790.



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 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

**(11) 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.

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. 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 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 TR 101 790.

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 stipulated in EN 301 790.

This Guideline Document (GD), as well as the ETSI Document EN 301 790, 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 has been referred to for Malaysian application and answers questions that arise when planning and using satellite systems for DVB interactive services.

**(12) 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.

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

This document:

- (a) gives a general description of the baseline system for interactive DTTB;
- (b) specifies the channel coding/modulation;
- (c) specifies the medium access control protocol; and
- (d) 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 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

**(13) Interaction Channel for Cable TV Distribution Systems**

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

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 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

**(14) 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.

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 has been referred to for Malaysian application and answers questions that arise when planning and using cable TV systems for interaction channel.

**(15) Interaction Channel through the Digital Enhanced Cordless Telecommunications (DECTS)**

The use of interaction channel through DECT refers to document ETSI EN 301 193.

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 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

**(16) 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.

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 the document.

ETSI Document EN 301 199 has been referred to for implementation in Malaysia and is adopted for this mandatory standard.

#### **(17) Internet Protocol**

##### **(A) 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.

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:

- (a) Entertainment Services;
- (b) General Information Services;
- (c) Educational Services;
- (d) Messaging Services;
- (e) Communication Services; and
- (f) Service Information;

enable by this architecture is provided in document DVB A071 Informative Annex A has been identified as suitable for implementation in Malaysia and is adopted for the this mandatory standard.

(18) **Measurement**

- (A) Digital Video Broadcasting (DVB); Measurement Guidelines for DVB Systems

The measurement guidelines for DVB systems refers to the document ETSI TR 101 290.

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:

- (a) to set-up test beds or laboratory equipment for testing hardware for DTTB and other related services;
- (b) to set these instruments to the appropriate parameters;
- (c) to obtain unambiguous results that can be directly compared with results from other test set-ups; and

- (d) 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 has been identified as suitable for implementation in Malaysia and is adopted for this mandatory standard.

- (B) 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.

The Digital Video Broadcasting (DVB) set of digital TV standards specify baseline systems for various transmission media such as satellite, cable and terrestrial. 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, which led to the introduction of the "DVB Measurement Guidelines" ETR 290 [3].

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

- (a) 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.
- (b) 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 has been identified as suitable for implementation in Malaysia and is adopted for this mandatory standard.

#### (19) **Provision For HDTV**

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

Broadcasters are allowed 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:

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

#### (20) **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:

##### (A) **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.

## (B) 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.

## (C) 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:

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

The main constraints of this problem are:

- (a) providing an efficient encapsulation mechanism;
- (b) maintaining DVB/MPEG-2 compatibility when transporting ATM cells;
- (c) 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.



(D) 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 agreed that the Home Access Network (HAN) with an active Network Termination (NT) standard 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.

(E) 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 standards agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter, will automatically supersede any earlier interface standards.

(F) 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 standards agreed by ETSI, EBU or ITU, which is adopted by the DVB-T standards hereafter, will automatically supersede any earlier interface standards.

(G) 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.

(H) 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.

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.

- (I) 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.

- (J) Interfaces for DVB-IRDs A016

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.

## **(21) Measurement Recommendation for DTTB Transmission Signals**

- (A) Introduction

Due to the highly complex nature of DTTB as a terrestrial transmission path, the requirements for measurements are much greater in DVB-T as to compare 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:

- (a) A modern Spectrum Analyzer.
- (b) A DVB-T Test Receiver with Constellation Analyzer.
- (c) 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:

- (a) Bit Error Rates
  - (b) DTTB Signals Spectrum Analysis
  - (c) Constellation Analysis
  - (d) Crest Factor
  - (e) Amplitude, Phase and Group Delay Response
  - (f) Impulse Response
  - (g) Shoulder Attenuation
- (B) 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.

- (a) Bit Error Rate before Viterbi
- (b) Bit Error Rate before Reed Solomon
- (c) Bit Error Rate after Reed Solomon

(C) 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:

- (a) 7.61 MHz in the 8MHz channel
- (b) 6.66 MHz in the 7MHz channel

(c) 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 Annexes of ETR 290.

(D) 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:

- (a) Signal/Noise ratio
- (b) Phase Jitter
- (c) I/Q amplitude imbalance
- (d) I/Q phase error
- (e) Modulation Error Ratio (MER)

(E) 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.

(F) 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).

(G) 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.

(H) 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 outband components, would affect the spectrum and its shape, which given to the phenomenon

“Shoulder Attenuation”. In practice, the following shoulder attenuations should be achieved:

- (a) Power amplifier, undistorted: approximate 30dB
  - (b) Power amplifier, equalized: approximate 40dB
  - (c) Output after Band Pass Filter: approximate 45dB
- (l) 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:

- (a) Additive White Gaussian Noise (AWGN)
- (b) Phase Jitter
- (c) Interference Sources
- (d) Echoes, Multi-path Reception
- (e) Doppler Effect
- (f) I/Q Errors of the Modulator
- (g) Cause and Effect of I/Q Errors in DTTB
- (h) Modulation Error Ratio (MER)

**(22) Reference documents**

The detailed specifications for this mandatory standard are listed in Table 1.

**Table 1: Reference documents**

	<b>Category</b>	<b>Description</b>	<b>Standard Identification Code</b>
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
2.	DVB-T	Implementation guidelines for DVB terrestrial services; Transmission aspects	TR 101 190

3.	DVB-SFN	Specification of a Mega-frame for SFN Synchronisation	TS 101 191
4.	DVB-IRD	Interface for DVB-IRDs	TS 101 191
5.	DVB-IRD	Interface for DVB Integrated Receiver Decoder (DVB-IRD)	TS 102 201
<b>MULTIPLEXING</b>			
6.	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
7.	DVB-SI	Guidelines on implementation and usage of service information	TR 101 211
8.	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
9.	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
10.	DVB-VBI	Specification for the delivery of VBI data in DVB streams	EN 301 775
11.	DVB-DATA	Specification for the transmission of data services in DVB bitstreams	EN 301 192
12.	DVB-DATA	Implementation guidelines for Data Broadcasting	TR 101 202
13.	DVB-SUB	Digital broadcasting systems for television, sound and data services; Subtitling systems	ETS 300 743
14.	BROADCAST	Protocol for a TV Guide using electronic data transmission	ETSI ETS 300 707
<b>MPEG</b>			
15.	DVB-MPEG	Digital Video Broadcasting (DVB); Implementation guidelines for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream	TS 101 154
16.	DVB-MPEG	Digital Video Broadcasting (DVB); Implementation guidelines for the use of Video and Audio Coding in Contribution and Primary Distribution Applications based on the MPEG-2 Transport Stream	TS 102 154

<b>INTERFACING</b>			
17.	DVB-CI	Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications	EN 50221
18.	DVB-CI	Guidelines for Implementation and Use of the Common Interface for DVB Decoder Applications	R 206 001
19.	DVB-CI	Digital Video Broadcasting (DVB); Extensions to the Common Interface Specification (EN 50221)	TS 101 699
20.	DVB-PI	Interfaces for CATV/SMATV Headends and similar Professional Equipment	EN 50083-9
21.	DVB-PI	Implementation Guidelines for the Asynchronous Serial Interface	TR 101 891
22.	DVB-PDH	DVB interfaces to PDH networks	ETS 300 813
23.	DVB-SDH	DVB interfaces to SDH networks	ETS 300 814
24.	DVB-ATM	DVB interfaces to ATM networks	TR 100 815
<b>INTERACTIVITY</b>			
25.	DVB-NIP	Network Independent Protocols for DVB Interactive Services	ETS 300 802
26.	DVB-NIP	Guidelines for the use of the Network Independent Protocols for DVB Interactive Services	TR 101 194
27.	DVB-RCC	DVB interaction channel for Cable TV distribution system (CATV)	ETS 200 800
28.	DVB-RCC	Guidelines for the implementation and usages of the specification for DVB interaction channel for Cable TV distribution systems (CATV)	TR 101 196
29.	DVB-RCP	DVB interaction channel through the Public Switched Telecommunications System (PSTN) / Integrated Services Digital Network (ISDN)	ETS 300 801
30.	DVB-RCD	DVB interaction channel through Digital Enhanced Cordless Telecommunications (DECT)	EN 301 193
31.	DVB-RCL	DVB interaction channel for LMDS distribution systems	EN 301 199
32.	DVB-RCL	Guidelines for the implementation and usage of the DVB interaction channel for LMDS distribution systems	TR 101 205



33.	DVB-RCG	DVB Interaction Channel for Satellite Master Antenna Television (SMATV) system; Guidelines for version based on satellite and coaxial sections	TR 101 201
<b>MEASUREMENT</b>			
34.	DVB-M	Measurement guidelines for DVB systems	TR 101 290
35.	DVB-M	Usage of the DVB test and measurement signalling channel (PID 0x001D) embedded in an MPEG-2 Transport Stream (TS)	TR 101 291

### (23) Publications

The publications used to further describe the details of this mandatory standard are listed in Table 2.

**Table 2: Publications**

<b>Publications</b>	
1.	ISO/IEC 13818-1: "Coding of moving pictures and associated audio - Part 1: Systems".
2.	ISO/IEC 13818-2: "Coding of moving pictures and associated audio - Part 2: Video".
3.	ISO/IEC 13818-3: "Coding of moving pictures and associated audio - Part 3: Audio".
4.	ISO/IEC 13818-9: "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: "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".

## (24) Abbreviations

The abbreviations used in this mandatory standard are listed in Table 3.

**Table 3: Abbreviations**

ASI	Asynchronous Serial Interface
ATM	Asynchronous Transfer Mode
BSS	Broadcast Satellite Service
CA	Conditional Access
CATV	Community Antenna Television
DECT	Digital Enhanced Cordless Telecommunications
DSM-CC	Digital Storage Media – Command and Control
DTTB	Digital Terrestrial Television Broadcast
DVB	Digital Video Broadcasting
DVB-T	DVB-Terrestrial
EDTV	Enhanced Definition TeleVision
ETSI	European Telecommunications Standards Institute
FSS	Fixed Satellite Service
GEO	Geostationary Earth Orbit
GSM	Global System for Mobile Communications
HDTV	High Definition TeleVision
HFC	Hybrid Fiber-Coaxial
IEC	International Electrotechnical Commission
IF	Intermediate Frequency
IP	Internet Protocol
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
LDTV	Limited Definition TeleVision
LMDS	Local Multipoint Distribution System
MAC	Medium Access Control
MATV	Master Antenna Television
MIP	Magazine Inventory Page
MMDS	Multipoint Microwave Distribution System
MPEG	Motion Picture Expert Group
MPI	MPEG Physical Interface

MSB	Most Significant Bit
NCC	Network Control Center
OFDM	Orthogonal Frequency Division Multiplexing
PAL	Phase Alternating Line
PDH	Plesiochronous Digital Hierarchy
PI	Programme Information (Structure)
PID	Packet IDentifier
PSI	Program Specific Information
PSTN	Public Switched Telephone Network
RCCL	Return Channel – Cable and LMDS
RCST	Return Channel Satellite Terminal
RCT	Return Channel Terrestrial
SDH	Synchronous Digital Hierarchy
SDTV	Standard Definition Television
SI	Service Information
SMATV	Satellite Master Antenna TeleVision
TPS	Transmission Parameter Signalling
TS	Transport Stream
TV	TeleVision
UHF	Ultra-High Frequency (300...3000 MHz)
VBI	Vertical Blanking Interval
VHF	Very High Frequency (30...300 MHz)

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