SLOVENSKI STANDARD
SIST EN 302 304 V1.1.1:2005

01-november-2005

Digitalna videoradiodifuzija (DVB) ï Prenosni sistem za roļ ne terminale (DVB-H)

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

Ta slovenski standard je istoveten z: EN 302 304 Version 1.1.1

ICS:

33.170	Televizijska in radijska difuzija	Television and radio broadcasting

SIST EN 302 304 V1.1.1:2005 **en**

ETSI EN 302 304 V1.1.1 (2004-11)

European Standard (Telecommunications series)

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

European Broadcasting Union

Union Européenne de Radio-Télévision

EBU·UER

Reference

DEN/JTC-DVB-155

Keywords

broadcasting, digital, DVB, terminal, video, audio, data, mobile, TV

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Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

This European Standard (Telecommunications series) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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Founded in September 1993, the DVB Project is a market-led consortium of public and private sector organizations in the television industry. Its aim is to establish the framework for the introduction of MPEG-2 based digital television services. Now comprising over 200 organizations from more than 25 countries around the world, DVB fosters market-led systems, which meet the real needs, and economic circumstances, of the consumer electronics and the broadcast industry.

National transposition dates	
Date of adoption of this EN:	22 October 2004
Date of latest announcement of this EN (doa):	31 January 2005
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 July 2005
Date of withdrawal of any conflicting National Standard (dow):	31 July 2005

Introduction

Overview of the system

The present document specifies the transmission system using ETSI Digital Video Broadcasting standards to provide an efficient way of carrying multimedia services over digital terrestrial broadcasting networks to handheld terminals (DVB-H). It identifies ETSI standards in which functionalities and parameters shall be implemented in order to deliver DVB-H compliant services.

Although the DVB-T transmission system has proven its ability to serve fixed, portable and mobile terminals, handheld terminals (defined as a light battery powered apparatus) require specific features from the transmission system serving them:

- as battery powered, the transmission system shall offer them the possibility to repeatedly power off some part of the reception chain to increase the battery usage duration;
- as targeting nomadic users, the transmission system shall ease access to the DVB-H services when receivers leave a given transmission cell and enter a new one;
- as expected to serve various situations of use (indoor and outdoor, pedestrian and inside moving vehicle), the transmission system shall offer sufficient flexibility/scalability to allow reception of DVB-H services at various speeds, while optimizing transmitter coverage;
- as services are expected to be delivered in an environment suffering high levels of man-made noise, the transmission system shall offer the means to mitigate their effects on the receiving capabilities;
- as DVB-H aims to provide a generic way to serve handheld terminals, in various part of the world, the transmission system shall offer the flexibility to be used in various transmission bands and channel bandwidths.

A full DVB-H system is defined by combining elements in the physical and link layers as well as service information. DVB-H makes use of the following technology elements for the link layer and the physical layer:

- Link layer:
  - time-slicing in order to reduce the average power consumption of the terminal and enabling smooth and seamless frequency handover;
  - forward error correction for multiprotocol encapsulated data (MPE-FEC) for an improvement in C/N-performance and Doppler performance in mobile channels, also improving tolerance to impulse interference.
- Physical layer:

  DVB-T (EN 300 744 [1]) with the following technical elements specifically targeting DVB-H use:
  - DVB-H signalling in the TPS-bits to enhance and speed up service discovery. Cell identifier is also carried on TPS-bits to support quicker signal scan and frequency handover on mobile receivers;
  - 4K-mode for trading off mobility and SFN cell size, allowing single antenna reception in medium SFNs at very high speed, adding thus flexibility in the network design;
  - in-depth symbol interleaver for the 2K and 4K-modes for further improving their robustness in mobile environment and impulse noise conditions.

NOTE: As stated in the present document, to provide DVB-H services time-slicing, cell identifier and DVB-H signalling are mandatory; all other technical elements may be combined arbitrarily.

It should be mentioned that both time-slicing and MPE-FEC technology elements, as they are implemented on the link layer, do not touch the DVB-T physical layer in any way. It is also important to notice that the payload of DVB-H are IP-datagrams or other network layer datagrams encapsulated into MPE-sections.

The conceptual structure of a DVB-H receiver is depicted in figure 1. It includes a DVB-H demodulator and a DVB-H terminal. The DVB-H demodulator includes a DVB-T demodulator, a time-slicing module and a MPE-FEC module.

- The DVB-T demodulator recovers the MPEG-2 Transport Stream packets from the received DVB-T (EN 300 744 [1]) RF signal. It offers three transmission modes 8K, 4K and 2K with the corresponding Transmitter Parameter Signalling (TPS). Note that the 4K mode, the in-depth interleavers and the DVB-H signalling have been defined while elaborating the DVB-H standard.
- The time-slicing module, provided by DVB-H, aims to save receiver power consumption while enabling to perform smooth and seamless frequency handover.
- The MPE-FEC module, provided by DVB-H, offers over the physical layer transmission, a complementary forward error correction allowing the receiver to cope with particularly difficult receiving situations.

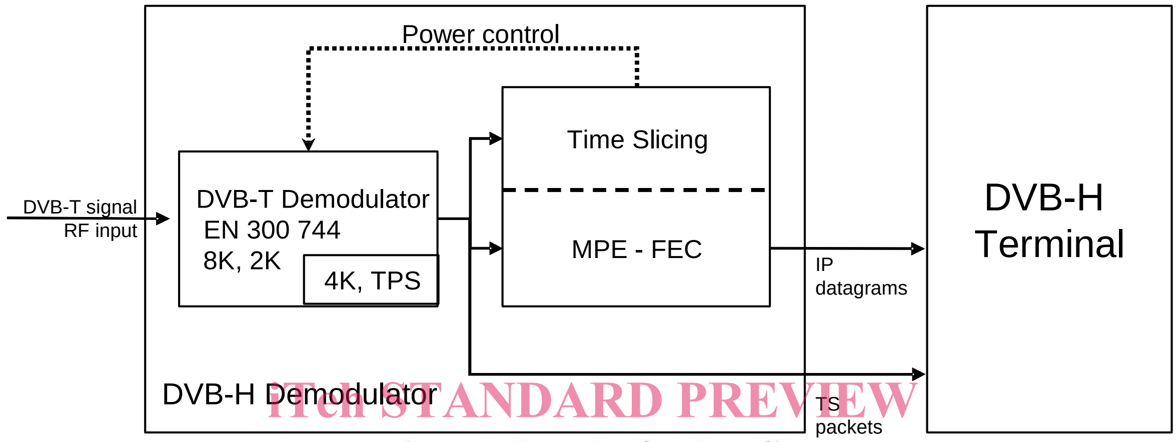

Figure 1: Conceptual structure of a DVB-H receiver

An example of using DVB-H for transmission of IP-services is given in figure 2. In this example, both traditional MPEG-2 services and time-sliced "DVB-H services" are carried over the same multiplex. The handheld terminal decodes/uses IP-services only.

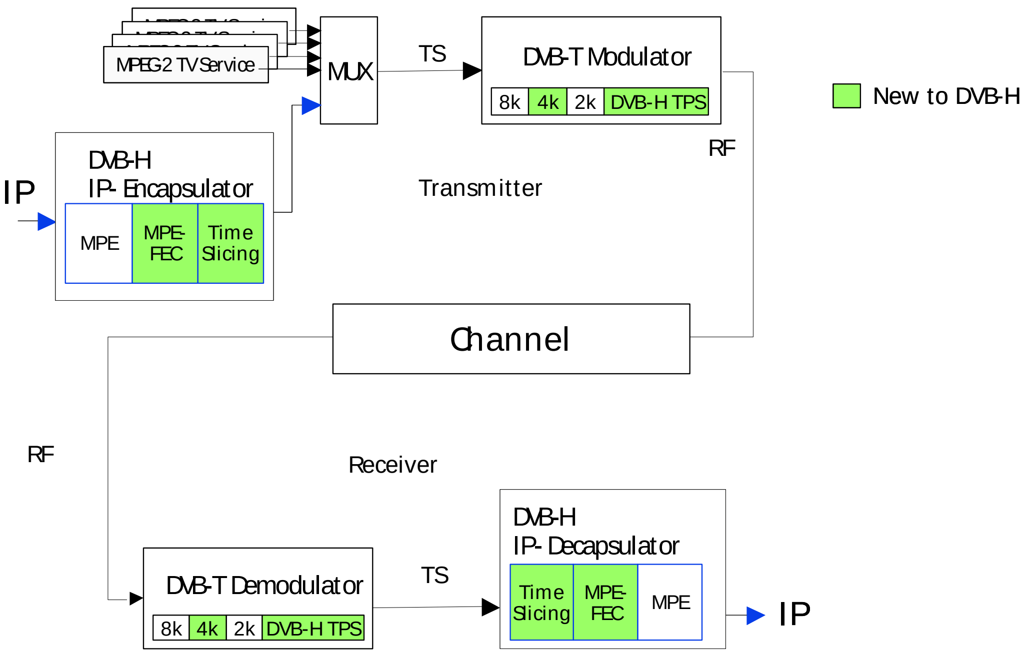

Figure 2: A conceptual description of using a DVB-H system (sharing a MUX with MPEG2 services)

Time-slicing

The objective of time-slicing is to reduce the average power consumption of the terminal and enable smooth and seamless service handover. Time-slicing consists of sending data in bursts using significantly higher instantaneous bit rate compared to the bit rate required if the data were transmitted using traditional streaming mechanisms.

To indicate to the receiver when to expect the next burst, the time (delta-t) to the beginning of the next burst is indicated within the burst. Between the bursts, data of the elementary stream is not transmitted, allowing other elementary streams to use the bandwidth otherwise allocated. Time-slicing enables a receiver to stay active only a fraction of the time, while receiving bursts of a requested service. Note that the transmitter is constantly on (i.e. the transmission of the transport stream is not interrupted).

Time-slicing also supports the possibility to use the receiver to monitor neighbouring cells during the off-times (between bursts). By accomplishing the switching of the reception from one transport stream to another during an off period it is possible to accomplish a quasi-optimum handover decision as well as seamless service handover.

Time-slicing is always used in DVB-H as is defined in the main body of the present document (see clause 4.3).

MPE-FEC

The objective of the MPE-FEC is to improve the C/N- and Doppler performance in mobile channels and to improve the tolerance to impulse interference.

This is accomplished through the introduction of an additional level of error correction at the MPE layer. By adding parity information calculated from the datagrams and sending this parity data in separate MPE-FEC sections, error-free datagrams can be output after MPE-FEC decoding despite a very bad reception condition. The use of MPE-FEC is optional as defined in the main body of the present document (see clause 4.3).

With MPE-FEC a flexible amount of the transmission capacity is allocated to parity overhead. For a given set of transmission parameters providing 25 % of parity overhead, the MPE-FEC may require about the same C/N as a receiver with antenna diversity.

The MPE-FEC overhead can be fully compensated by choosing a slightly weaker transmission code rate, while still providing far better performance than DVB-T (without MPE-FEC) for the same throughput. This MPE-FEC scheme should allow high-speed single antenna DVB-T reception using 8K/16-QAM or even 8K/64-QAM signals. In addition MPE-FEC provides good immunity to impulse interference.

The MPE-FEC, as standardized, works in such a way that MPE-FEC ignorant (but MPE capable) receivers will be able to receive the data stream in a fully backwards-compatible way, provided it does not reject the used stream_type.

4K mode and in-depth interleavers

The objective of the 4K mode is to improve network planning flexibility by trading off mobility and SFN size. To further improve robustness of the DVB-T 2K and 4K modes in a mobile environment and impulse noise reception conditions, an in-depth symbol interleaver is also standardized.

The additional 4K transmission mode is a scaled set of the parameters defined for the 2K and 8K transmission modes. It aims to offer an additional trade-off between Single Frequency Network (SFN) cell size and mobile reception performance, providing an additional degree of flexibility for network planning.

Terms of the trade-off can be expressed as follows:

- The DVB-T 8K mode can be used both for single transmitter operation and for small, medium and large SFNs. It provides a Doppler tolerance allowing high speed reception.
- The DVB-T 4K mode can be used both for single transmitter operation and for small and medium SFNs. It provides a Doppler tolerance allowing very high speed reception.
- The DVB-T 2K mode is suitable for single transmitter operation and for small SFNs with limited transmitter distances. It provides a Doppler tolerance allowing extremely high speed reception.