SLOVENSKI STANDARD
SIST-TS TS 101 191 V1.4.1:2005

01-november-2005

Digitalna videoradiodifuzija (DVB) ï Mega-struktura DVB za sinhronizacijo enofrekvenļ nih omreģij (SFN)

Digital Video Broadcasting (DVB); DVB mega-frame for Single Frequency Network (SFN) synchronization

Ta slovenski standard je istoveten z: TS 101 191 Version 1.4.1

ICS:

33.170	Televizijska in radijska difuzija	Television and radio broadcasting

SIST-TS TS 101 191 V1.4.1:2005 en

ETSI TS 101 191 V1.4.1 (2004-06)

Technical Specification

Digital Video Broadcasting (DVB); DVB mega-frame for Single Frequency Network (SFN) synchronization

European Broadcasting Union

Union Européenne de Radio-Télévision

EBU·UER

Digital Video Broadcasting

Reference

RTS/JTC-DVB-164

Keywords

broadcasting, digital, DVB, TV, video

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:
http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, send your comment to:
editor@etsi.org

Copyright Notification

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) 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.

European Broadcasting Union
CH-1218 GRAND SACONNEX (Geneva)
Switzerland
Tel: +41 22 717 21 11
Fax: +41 22 717 24 81

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.

1 Scope

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

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ISO/IEC 13818-1 (1994): "Information technology - Generic coding of moving pictures and associated audio - Part 1: Systems".

[2] ETSI EN 300 744: "Digital Video Broadcasting (DVB); framing structure, channel coding and modulation for digital terrestrial television".

[3] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

cell: See EN 300 468 [3], clause 3.1.

DVB-T frame: See EN 300 744 [2], clause 4.4.

DVB-T super-frame: See EN 300 744 [2], clause 4.4.

3.2 Abbreviations

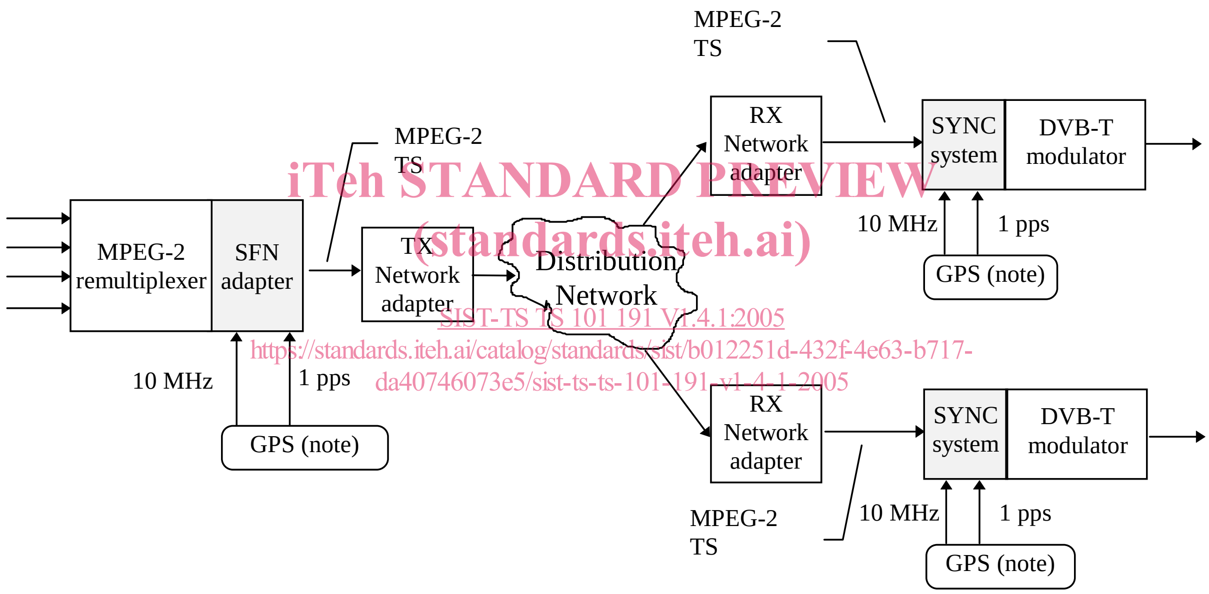
For the purposes of the present document, the following abbreviations apply:

CRC	Cyclic Redundancy Check
DVB	Digital Video Broadcasting
DVB-T	DVB-Terrestrial
ERP	Effective Radiated Power
GPS	Global Positioning System
HP	High Priority
LP	Low Priority
MFN	Multi Frequency Network
MIP	Mega-frame Initialization Packet
MPEG	Moving Pictures Expert Group

MSB	Most Significant Bit
PID	Packet IDentifier
pps	pulse per second
RF	Radio Frequency
RS	Reed-Solomon
RX	Receiver
SFN	Single Frequency Network
SI	Service Information
STS	Synchronization Time Stamp
SYNC	SYNChronization
TPH	Transport Packet Header
TPS	Transport Parameter Signalling
TS	Transport Stream
TX	Transmitter

4 General description

Figure 1 shows a block diagram of a complete SFN system.



NOTE: Could be any common available frequency reference.

Figure 1: DVB-T primary distribution with SFN adaptation

The SFN functionality is an extension to the DVB system. The blocks associated with SFN functionality are the grey boxes in figure 1. These blocks could be implemented either as separate equipment or integrated in the multiplexer and/or the DVB-T modulator.

SFN system blocks

MPEG-2 re-multiplexer

The MPEG-2 re-multiplexer re-multiplexes the programmes from various input channels, updates the SI and provides an MPEG-2 TS, which, after SFN adaptation, is transmitted via the DVB-T modulators in the SFN.

SFN adapter

The SFN adapter forms a mega-frame, consisting of n TS-packets corresponding to 8 DVB-T frames in the 8K mode or 32 frames in the 2K mode, and inserts a Mega-frame Initialization Packet (MIP) with a dedicated PID value. Inserted anywhere within a mega-frame of index M, the MIP of that mega-frame, MIP_M, allows to uniquely identify the starting point (i.e. the first packet) of the mega-frame M+1. This is accomplished by using a pointer carried by the MIP_M itself to indicate its position with regards to the start of the mega-frame M+1.

The time difference between the latest pulse of the "one-pulse-per-second" reference, derived e.g. from GPS, that precedes the start of the mega-frame M+1 and the actual start (i.e. first bit of first packet) of this mega-frame M+1 is copied into the MIP_M. This parameter is called Synchronization Time Stamp (STS).

The time duration of a mega-frame is only dependent on the channel bandwidth and the guard interval proportion, i.e. the mega-frame duration is independent of the duration T_U, constellation and code rate of the DVB-T signal. The mega-frame durations are provided below for all combinations of channel bandwidth and guard interval proportion provided by EN 300 744 [2] (exact values, except where otherwise stated):

Table 1a: Mega-frame duration for all combinations of channel bandwidth and guard interval proportions

	Channel bandwidth			
Guard Interval	**8 MHz**	**7 MHz**	**6 MHz**	**5 MHz**
$\Delta / T_U = 1/32$	0,5026560 s	0,5744640 s	0,6702080 s	0,8042496 s
$\Delta / T_U = 1/16$	0,5178880 s	0,5918720 s	*0,6905173 s*	0,8286208 s
$\Delta / T_U = 1/8$	0,5483520 s	0,6266880 s	0,7311360 s	0,8773632 s
$\Delta / T_U = 1/4$	0,6092800 s	0,6963200 s	*0,8123733 s*	0,9748480 s
NOTE: Approximate values in *Italics*.				

The output of the SFN adapter shall be fully DVB/MPEG-2 TS compliant.

Transmitter/Receiver network adapter

The network adapters shall provide a transparent link for the MPEG-2 TS from the central to the local units. The maximum network delay - caused by the different paths of the transmission network - the SYNC system can handle is 1 s.

SYNC system

The SYNC system will provide a propagation time compensation by comparing the inserted STS with the local time reference and calculate the extra delay needed for SFN synchronization. See annex B for an example of the synchronization process.

DVB-T modulator

The modulator should provide a fixed delay from the input to the air interface. The information inserted in the MIP could be used for the direct control of the modulator modes or control of other transmitter parameters. The modulator clocks at the different sites have to be synchronized. Since it is a requirement of an SFN that all transmitted signals be identical, the MPEG-2 TS inputs to the various DVB-T modulators have to be bit identical.

Global Positioning System (GPS)

GPS is one among many possible time references but it is the only one available globally. GPS receivers are available which provide both a 10 MHz frequency reference and a 1 pulse per second (1 pps) time reference. The 1 pps time reference, used in SFN synchronization, is divided into 100 ns steps of the 10 MHz clock. The 10 MHz system clock is assumed to be available at all nodes in the network.

The functional blocks "SFN adapter" and "SYNC system" are additional elements for SFN use, and not necessary in MFN applications.

5 Mega-frame definition

The output of the SFN adapter shall be a valid MPEG-2 TS, where the individual packets are organized in groups, which constitute a mega-frame. Each mega-frame consists of n packets, where n is an integer number, which depends on the number of RS-packets per super-frame in the DVB-T mode that will be used for DVB-T emission of the MPEG-2 TS (see EN 300 744 [2], clause 4.7). In the 8K mode n is (the number of RS-packets per super-frame) × 2. In the 4K mode n is (the number of RS-packets per super-frame) × 4. In the 2K mode n is (the number of RS-packets per super-frame) × 8.

Each mega-frame contains exactly one Mega-frame Initialization Packet (MIP). The actual position may vary in an arbitrary way from mega-frame to mega-frame. The pointer value in the MIP is used to indicate the start of the following mega-frame. In figure 2 the overall structure of the mega-frame, including the positioning of the MIP, is given. The exact definition of the MIP format is given in clause 6.

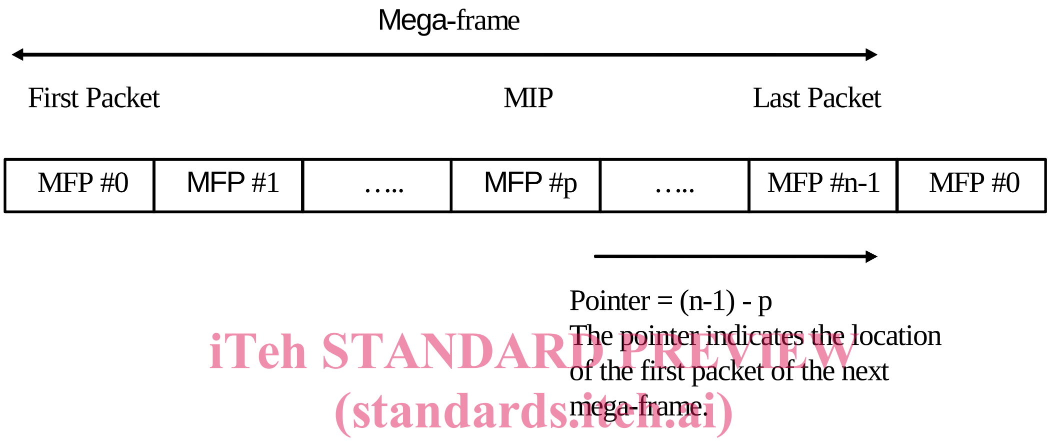


Figure 2: Overall mega-frame structure

The start of a mega-frame in the DVB-T signal is in the present document defined to coincide with the beginning of a DVB-T super-frame and the start of an inverted sync byte, being part of transport multiplex adaptation.

The use of a mega-frame and the insertion of a MIP are additional elements for SFN use, and not necessary in MFN applications.

6 Mega-frame Initialization Packet (MIP)

The MIP is an MPEG-2 compliant Transport Stream (TS) packet, made up of a 4-byte header and a 184-byte data field. The organization of the MIP is shown in table 1b.

Table 1b: Mega-frame Initialization Packet (MIP)

Syntax	Number of bits	Identifier
`mega-frame_initialization_packet(){`		
`transport_packet_header`	32	bslbf
`synchronization_id`	8	uimsbf
`section_length`	8	uimsbf
`pointer`	16	uimsbf
`periodic_flag`	1	bslbf
`future_use`	15	bslbf
`synchronization_time_stamp`	24	uimsbf
`maximum_delay`	24	uimsbf
`tps_mip`	32	bsblf
`individual_addressing_length`	8	uimsbf
`for (i=0;i<N;i++){` *`tx_identifier`* *`function_loop_length`* *`for(i=0;i<N;i++){`* *`function()`* *`}`* *`}`*	*16* *8*	*uimsbf* *uimsbf*
`crc_32`	32	rpchof

`for (i=0, i<N,i++){`
`stuffing_byte`
`}`
`}`
	8	uimsbf

NOTE 1: Optional parameters are shown in italic.
NOTE 2: All parameter values in the MIPM apply to mega-frame M+1, i.e. to the mega-frame pointed out by the pointer, except for the tps_mip which describes the parameters of mega-frame M+2. See annex C for details.
NOTE 3: For the definition of the CRC decoder model, see annex A.
NOTE 4: The length of a MIP shall always be 188 bytes.

transport_packet_header: The transport_packet_header shall comply with ISO/IEC 13818-1 [1], clause 2.4.3.2, tables 3 and 4.

The PID value for the Mega-frame initialization Packet (MIP) shall be 0×15.

The payload_unit_start_indicator is not used by the SFN synchronization function and shall be set to 1.

The transport_priority value is not used by the SFN synchronization function and shall be set to 1.

The transport_scrambling_control value shall be set to 00 (not scrambled).

The adaptation_field_control value shall be set to 01 (payload only).

All other parameters are according to ISO/IEC 13818-1 [1], clause 2.4.3.2.

The Transport Packet Header (TPH) is mandatory.

Mandatory SFN parameters

synchronization_id: The synchronization_id is used to identify the synchronization scheme used (see table 2).