SLOVENSKI STANDARD
SIST-TP ETR 154 E2:2005

01-november-2005

Digitalna videoradiodifuzija (DVB) – Smernice za uvajanje uporabe sistemov MPEG -2, videa in avdia v satelitskih, kabelskih in prizemnih radiodifuzijskih aplikacijah

Digital Video Broadcasting (DVB); DVB implementation guidelines for the use of MPEG-2 Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications

Ta slovenski standard je istoveten z: **ETR 154 Edition 2**

ICS:

33.170	Televizijska in radijska difuzija	Television and radio broadcasting

SIST-TP ETR 154 E2:2005 **en**

ETSI

ETSI TECHNICAL REPORT

ETR 154

October 1996

Second Edition

Source: EBU/CENELEC/ETSI JTC

Reference: RTR/JTC-00DVB-27

ICS: 33.060.20

Key words: DVB, digital, video, broadcasting, MPEG, system, TV, audio, satellite, cable, terrestrial

European Broadcasting Union | Union Européenne de Radio-Télévision

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Foreword

This ETSI Technical Report (ETR) has been produced by the Joint Technical Committee (JTC) of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI). This ETR is based on the DVB document TM 1214 revision 9, dated September 1996, and it may be converted into an ETS after market feedback. For this purpose, the wording of an ETS rather than an ETR is used.

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

NOTE: This EBU/ETSI Joint Technical Committee (JTC) was established in 1990 to co-ordinate the drafting of European Telecommunications Standards (ETSs) in the specific field of radio, television and data broadcasting.

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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Introduction

This ETR presents guidelines covering coding and decoding using the MPEG-2 system defined in ISO/IEC IS *1381*8 [1].

The guidelines presented in this ETR for the Integrated Receiver-Decoder (IRD) are intended to represent a minimum functionality that all IRDs are assumed to either meet or exceed. It is necessary to specify the minimum IRD functionality for basic parameters, if broadcasters are not to be prevented from ever using certain features. For example, if a significant population of IRDs were produced that supported only the Simple Profile, broadcasters would never be able to transmit Main Profile bit-streams.

Where a feature is mandatory, the word "shall" is used and the text is in italic; all other features are optional. The functionality is specified in the form of constraints on MPEG-2 systems, video and audio which the IRDs are required to decode correctly.

The specification of these baseline features in no way prohibits IRD manufacturers from including additional features, and should not be interpreted as stipulating any form of upper limit to the performance. The guidelines do not cover features, such as the IRD's up-sampling filter, which affect the quality of the displayed picture rather than whether the IRD is able to decode pictures at all. Such issues are left to the marketplace.

The guidelines presented for IRDs observe the following principles:

- wherever practical, IRDs should be designed to allow for future compatible extensions to the bit-stream syntax;
- all "reserved" and "private" bits in MPEG-2 systems, video and audio should be ignored by IRDs not designed to make use of them.

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 by Baseline IRDs. These may be mandatory or optional. Where a feature or constraint is mandatory, the word "shall" is used and the text is italic; all other features are optional.

Clauses 4 to 6 provide the guidelines for the Digital Video Broadcasting (DVB) systems layer, video and audio respectively. For information, some of the key features are summarized below, but clauses 4 to 6 should be consulted for all definitions:

Systems:

- MPEG-2 Transport Stream (TS) is used;
- Service Information (SI) is based on MPEG-2 program-specific information;
- scrambling is as defined in ETR 289 [5];
- conditional access uses the MPEG-2 Conditional Access CA_descriptor;
- Partial Transport Streams are used for digital VCR applications.

Video:

- MPEG-2 Main Profile at Main Level is used;
- the frame rate is 25 Hz;
- encoded pictures may have either 4:3, 16:9 or 2.21:1 aspect ratio;
- IRDs support 4:3 and 16:9 and optionally 2.21:1 aspect ratios;
- IRDs support the use of pan vectors to allow a 4:3 monitor to give a full-screen display of a 16:9 coded picture;
- IRDs support a full-screen display of 720 x 576 pixels (and a nominal full-screen display of 704 x 576);
- IRDs provide appropriate up-conversion to produce a full-screen display of 544 x 576 and 480 x 576 and a nominal full-screen display of 352 x 576 and 352 x 288 pixels.

Audio:

- MPEG-2 Layer I and Layer II is supported by the IRD;
- the use of Layer II is recommended for the encoded bit-stream;
- IRDs support single channel, dual channel, joint stereo, stereo and the extraction of at least a stereo pair from MPEG-2 compatible multi-channel audio;
- sampling rates of 32 kHz, 44,1 kHz and 48 kHz are supported by IRDs;
- the encoded bit-stream does not use emphasis.

1 Scope

This ETR provides implementation guidelines for the use of MPEG-2 audio-visual coding in satellite and cable broadcasting systems offering conventional resolution digital television. Guidelines for devices equipped with a digital interface intended for digital VCR applications are also given in this ETR. It does not cover applications such as interactive services or HDTV which are likely to be the subject of subsequent "Guidelines" documents.

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 by Baseline IRDs. These may be recommended or optional.

2 References

For the purposes of this ETR, the following references apply:

[1] ISO/IEC IS 13818-1 (1994): "Coding of moving pictures and associated audio - Part 1: Systems".

[2] ISO/IEC IS 13818-2 (1994): "Coding of moving pictures and associated audio - Part 2: Video".

[3] ISO/IEC IS 13818-3: "Coding of moving pictures and associated audio - Part 3: Audio".

[4] ISO/IEC IS 13818-9: "Coding of moving pictures and associated audio - Part 9: Extension for Real-Time-Interface for systems decoders ".

[5] ETR 289: "Digital Video Broadcasting (DVB); Common Scrambling (CS) system description".

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

[7] ETR 211: "Digital broadcasting systems for television, sound and data services; Guidelines for the usage of Service Information (SI) in Digital Video Broadcasting (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".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Baseline IRD: An IRD which provides the minimum functionality recommended in this ETR.

partial Transport Stream (TS): Bit-stream derived from an MPEG-2 Transport Stream (TS) by removing those TS packets that are not relevant to one particular selected programme, or a number of selected programmes.

3.2 Abbreviations

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

CA	Conditional Access
DVB	Digital Video Broadcasting
ES	Elementary Stream
ESCR	Elementary Stream Clock Reference
I-Frame	Intra-coded Frame
IRD	Integrated Receiver-Decoder
MPEG	Moving Pictures Experts Group
NIT	Network Information Table
PAT	Program Association Table
PCR	Program Clock Reference
PES	Packetized Elementary Stream
PID	Packet IDentifier
PMT	Program Map Table
PSI	Program Specific Information
PSW	Pan and Scan Window
SI	Service Information
STD	Standard Target Decoder
TS	Transport Stream
VCR	Video Cassette Recorder

4 Systems layer

This clause describes the guidelines for encoding the systems layer of MPEG-2 in DVB broadcast bit-streams, and for decoding this layer in the IRD. The source bit-stream may be transmitted via a satellite, cable or terrestrial channel, or via a digital interface. Subclause 2.1 applies to the encoding of all source bitstreams and their decoding by a Baseline IRD. Subclause 2.2 gives specific information relating to bit-streams transmitted via a digital interface intended for VCR applications and decoding by IRDs equipped with such an interface.

4.1 Broadcast bit-streams and Baseline IRDs

The multiplexing of baseband signals and associated data conforms to ISO/IEC IS 13818-1 [1]. Some of the parameters and fields are not used in the DVB System and these restrictions are described below. *To allow full compliance to ISO/IEC IS 13818-1 [1] and upward compatibility with future enhanced versions, a DVB IRD shall be able to skip over data structures which are currently "reserved", or which correspond to functions not implemented by the IRD. As an example of this capability, a descriptor tag not yet defined within the DVB System shall be interpreted as a no-action tag, its length field correctly decoded and subsequent data skipped.*

For the same reason, IRD design should be made under the assumption that any legal structure as permitted by ISO/IEC IS 13818-1 [1] may occur in the broadcast stream even if presently reserved or unused. Therefore, the following is assumed:

- *private data shall only be acted upon by decoders which are so enabled;*
- *filling out the bit-stream shall be carried out using the normal stuffing mechanism. Reserved fields shall not be used for this purpose. Data of reserved fields shall be set to 0xFF.*

The headings below in this subclause are based on ISO/IEC IS 13818-1 (1994) [1]. The numbers in brackets after the headings are the relevant chapter and section headings of ISO/IEC IS 13818-1 [1].

4.1.1 Introduction

(ISO/IEC IS 13818-1 [1], section 0)

MPEG-2 systems specify two types of multiplexed data stream: the transport stream and the program stream.

Encoding: *The transmitted multiplex shall use the transport stream.*

Decoding: *All Baseline IRDs shall be able to demultiplex the MPEG-2 transport stream.* Demultiplexing of program streams (as described in sections 0.2 and 0.3 of ISO/IEC IS 13818-1 [1]) is optional.

4.1.2 Packetized Elementary Stream (PES)

(ISO/IEC IS 13818-1 [1], section 0.4)

Encoding: The creation of a physical Packetized Elementary Stream (PES) by an encoder is not required. ESCR fields and ES rate fields need not be coded.

Decoding: ESCR fields and ES rate fields need not be decoded.

4.1.3 Transport stream system target decoder

(ISO/IEC IS 13818-1 [1], section 2.4.2)

Encoding: *The system clock frequency shall conform to the tolerance specified in section 2.4.2.1 of ISO/IEC IS 13818-1 [1].* It is recommended that the tolerance is within 5 parts per million.

Decoding: *The IRD shall operate over the full tolerance range of the system clock frequency specified in section 2.4.2.1 of ISO/IEC IS 13818-1 [1].*

4.1.4 Transport packet layer

(ISO/IEC *IS 1381*8-1 [1], section 2.4.3.2)

4.1.4.1 Null packets

Encoding: *The encoding of null packets (those with PID value 0x1FFF) shall be as specified in ISO/IEC IS 13818-1 [1].*

4.1.4.2 Transport packet header

4.1.4.2.1 transport_error_indicator

Encoding: It is recommended that any error detecting devices in a transmission path should set the **transport_error_indicator** bit when uncorrectable errors are detected.

Decoding: The **transport_error_indicator** flag is set in the transmitted stream it is recommended that the IRD should then invoke a suitable concealment or error recovery mechanism.

4.1.4.2.2 transport_priority

Decoding: The **transport_priority** bit has no meaning to the IRD, and may be ignored.