SLOVENSKI STANDARD
SIST EN 300 473 V1.1.2:2003

01-december-2003

Digitalna videoradiodifuzija (DVB) – Distribucijski sistemi s satelitsko televizijo prek glavne antene (SMATV)

Digital Video Broadcasting (DVB); Satellite Master Antenna Television (SMATV) distribution systems

Ta slovenski standard je istoveten z: EN 300 473 Version 1.1.2

ICS:

33.120.40	Antene	Aerials
33.170	Televizijska in radijska difuzija	Television and radio broadcasting

SIST EN 300 473 V1.1.2:2003 **en**

EN 300 473 V1.1.2 (1997-08)

European Standard (Telecommunications series)

Digital Video Broadcasting (DVB); Satellite Master Antenna Television (SMATV) distribution systems

European Telecommunications Standards Institute

Reference
REN/JTC-00DVB-48 (4do00idc.PDF)

Keywords
DVB, digital, video, broadcasting, MPEG, TV, SMATV

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X.400
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Foreword

This second edition, previously as an ETS now an EN, contains changes of an entirely editorial nature as follows:

1) add the DVB logo to the front page of the deliverable;
2) change the title from: "Digital broadcasting systems for television, sound and data services; etc." to "Digital Video Broadcast (DVB); etc.";
3) add in the foreword the DVB acknowledgement.

This European Standard (Telecommunications series) 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).

NOTE: The EBU/ETSI JTC was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC 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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Digital Video Broadcasting (DVB) Project

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.

Proposed national transposition dates	
Date of adoption of ETS 300 473:	26 December 1994
Date of latest announcement of ETS 300 473 (doa):	31 August 1995
Date of latest publication of new National Standard or endorsement of ETS 300 473 (dop/e):	29 February 1996
Date of withdrawal of any conflicting National Standard (dow):	29 February 1996

1 Scope

The present document describes the transmission system proposal for digital multi-programme television suitable for distribution in Satellite Master Antenna Television (SMATV) systems.

The present document is complementary to the EN 300 429 [1] and it is aligned with EN 300 421 [2].

The System described in the present document is compatible with the modulation and channel coding systems used for digital multi-programme television by cable and satellite transmissions (see EN 300 429 [1] and EN 300 421 [2], respectively).

The System described in the present document is based on the MPEG-2 System Layer, see ISO/IEC DIS 13818-1 [3], with the addition of appropriate Forward Error Correction (FEC) technique.

The System described in the present document allows for further evolution as technology advances as described in document EN 300 429 [1] and is capable of starting a reliable service as of now (see also annex D, bibliography).

2 Normative references

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] EN 300 429: "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for cable systems".

[2] EN 300 421: "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for 11/12 GHz satellite services".

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

[4] Forney, G.D. IEEE Trans. Comm. Tech., COM-19, pp. 772-781, (October 1971): "Burst-correcting codes for the classic bursty channel".

3 Symbols and abbreviations

3.1 Symbols

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

$\propto$	roll-off factor
f_0	channel centre frequency
R_s	symbol Rate corresponding to the bilateral Nyquist bandwidth of the modulated signal
R_u	useful bit Rate after MPEG-2 transport multiplexer
$R_{u'}$	bit Rate after RS outer coder
T	number of bytes which can be corrected in RS error protected packet
T_s	symbol period

3.2 Abbreviations

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

BB	BaseBand
BER	Bit Error Ratio
BW	BandWidth
C/N	Signal-to-Noise ratio
DTVC	Digital TeleVision by Cable
DVB	Digital Video Broadcasting
ETS	European Telecommunication Standard
FEC	Forward Error Correction
FIR	Finite Impulse Response
IF	Intermediate Frequency
IRD	Integrated Receiver Decoder
LNB	Low Noise Block
LSB	Least Significant Bit
MPEG	Moving Pictures Experts Group
MSB	Most Significant Bit
MUX	Multiplex
PDH	Plesiochronous Digital Hierarchy
PRBS	Pseudo Random Binary Sequence
QAM	Quadrature Amplitude Modulation
QEF	Quasi Error Free
QPSK	Quaternary Phase Shift Keying
RF	Radio Frequency
RS	Reed-Solomon
SMATV	Satellite Master Antenna TeleVision (as defined in clause 4)
SMATV-DTM	SMATV system based on Digital TransModulation
SMATV-IF	SMATV system based on distribution at IF
SMATV-S	SMATV system based on distribution at extended Super band
TDL	Tapped Delay Line
TDM	Time Division Multiplex
TDT	Transparent Digital Transmodulation
TV	Television
UHF	Ultra High Frequency
VHF	Very High Frequency

4 SMATV distribution system concepts

A Satellite Master Antenna Television (SMATV) system is defined as a system which is intended for the distribution of television and sound signals to households located in one or more adjacent buildings.

These signals are received by a satellite receiving antenna and may be combined with terrestrial TV signals. SMATV distribution systems are also known as community antenna installations or domestic TV cable networks.

A SMATV system represents a means for sharing the same resources among several users for satellite and terrestrial reception.

The SMATV System is designed to perform the adaptation of the satellite TV signals to the SMATV channel characteristics.

The primary consideration of the SMATV System is the transparency of the SMATV head-end to the digital TV multiplex from a satellite reception without baseband interfacing, delivering that signal to the user home Integrated Receiver Decoder (IRD); thus permitting simple and cost effective head-end as required for the consumer profile of SMATV equipment.

The present document considers two main SMATV System approaches for distribution of digital TV signals in SMATV installations, as follows:

SMATV System A

The System A approach consists of the transmodulation from satellite Quaternary Phase Shift Keying (QPSK) signals as defined in EN 300 421 [2] to a Quadrature Amplitude Modulation (QAM) scheme (16-QAM, 32-QAM or 64-QAM) using either:

a.1) a full implementation of the System described in EN 300 429 [1] (see subclause 5.1), or

a.2) a simplified transmodulation process as described in subclause 5.2 of the present document.

This process of transmodulation without baseband interfacing is also known as "Transparent Transmodulation".

SMATV System B

The System B approach consists of direct distribution of QPSK satellite signals as defined in EN 300 421 [2] using frequency conversion of the received satellite signal to a frequency band appropriate to the characteristics of the distribution network.

The use of one of the System A or System B approaches depends on the technical performance and cost trade-offs in each particular situation.

NOTE: Digital terrestrial specification is not the subject of the present document.

5 SMATV System A

SMATV System A is based on the use of the transmodulation from satellite QPSK signals to a QAM modulation scheme (see figure 1). This system is also known as SMATV-DTM.

The System comprises the following elements:

- **Head-end transmodulation unit:** this performs the required decoding and adapts the signal modulation coding to the cable distribution network. This unit is also known as the Transparent Digital Transmodulator (TDT).
- **SMATV UHF distribution network:** this is a physical cable structure for distribution of the signal to several users. The reference channel response of SMATV distribution network is given in annex A.
- **User IRD:** this unit performs the required equalization to compensate the channel distortion as well as demodulating and decoding the QAM signal.

5.1 Full implementation of SMATV System A

A full implementation of the QAM System shall be performed according to EN 300 429 [1] and EN 300 421 [2] with a transparent interface between them.

To this end, the full implementation of SMATV System A shall make use of the MPEG-2 transport layer, the framing structure, the channel coding, the byte-to-symbol mapping and modulation consistent with EN 300 429 [1] and EN 300 421 [2].

The channel coding shall include the randomization for spectrum shaping, the Reed-Solomon (RS) coding and the convolutional interleaving according to Forney [4]. This configuration is shown in figure 2.

5.2 Simplified implementation of SMATV System A

In the complete implementation architecture of SMATV System A, outer error protection (i.e. RS and convolutional interleaving) is performed twice, i.e. independently for the satellite link and the cable link. Therefore, the cable link is fed by a Quasi Error Free (QEF) bit stream.

In cases when an adequate satellite link margin is achieved, one RS decoder-encoder and deinterleaving-interleaving process could be eliminated from the System. In such cases, a single RS decoder at the user IRD is capable of correcting errors generated in the cable link added to the remaining burstly errors after Viterbi decoding.

This configuration is shown in figure 2 when removing the dashed line blocks.

NOTE: This simplified configuration may imply a non-negligible saving in terms of the number of gates and thus in the total equipment cost.
Due to consumer type character of SMATV head-ends, this saving is important when an economy of scale is achieved.
Consequently, manufacturers could decide whether to adopt the simplified SMATV System A architecture.

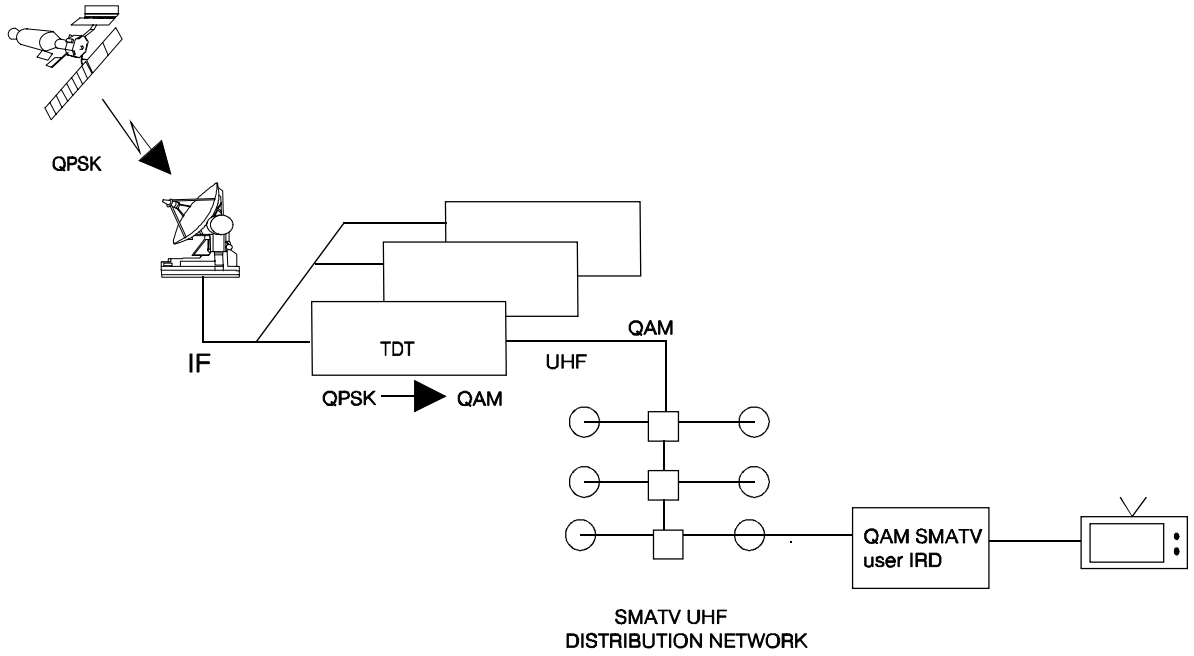

Figure 1: SMATV System A configuration

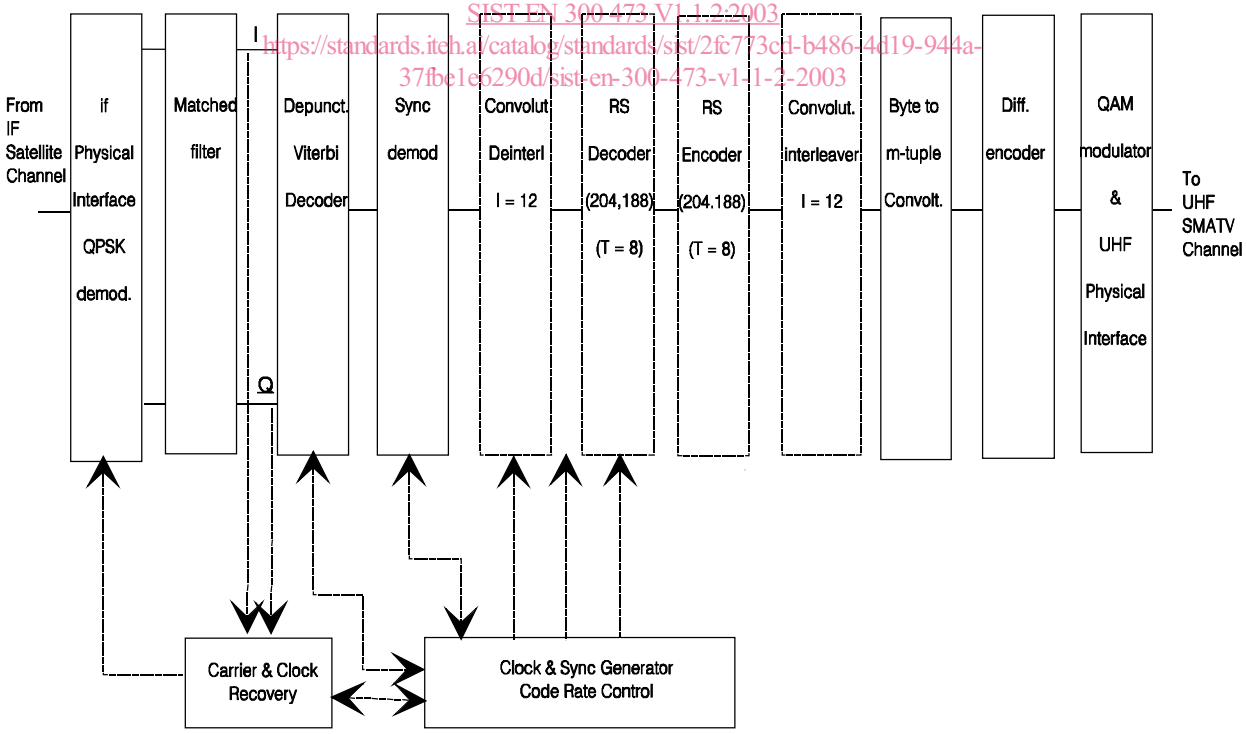

Figure 2: Functional diagram of a SMATV System A