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Sistemi digitalne radiodifuzije za televizijske, zvokovne in podatkovne storitve – Struktura okvirov, kodiranje kanalov in modulacija za kabelske sisteme

Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for cable systems

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33.060.40	Kabelski razdelilni sistemi	Cabled distribution systems
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Digital broadcasting systems for television, sound and data services; Framing structure, channel coding and modulation for cable systems

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Foreword

This European Telecommunication Standard (ETS) has been produced under the authority of the Joint Technical Committee (JTC) of the European Broadcasting Union (EBU) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC was established in 1990 to co-ordinate the drafting of ETS in the specific field of radio, television and data broadcasting.

The EBU is a professional association of broadcasting organisations 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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This ETS describes framing structure, channel coding and modulation for digital multi-programme television by cable, it has been prepared by the Project Team PT-55V. The work of the Project Team was based on the studies carried out by the European Digital Video Broadcasting (DVB) Project under the auspices of Ad hoc Group for Digital Television by Cable (DTVC). This joint group of industry, cable operators and broadcasters provided the necessary information on all relevant matters to the Project Team, see DTVB 1190/DTVC 38 (bibliography).

This ETS is Part of the complete "Multivision system" (this name is currently under review) which covers the baseband image coding, baseband sound coding, baseband data service coding, multiplexing, channel coding and modulation for satellite services, channel coding and modulation for cable and Satellite Master Antenna Television (SMATV) distribution and common scrambling system.

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1 Scope

This European Telecommunication Standard (ETS) describes the framing structure, channel coding and modulation (denoted "the System" for the purposes of this ETS) for a digital multi-programme television distribution by cable. The aim of this ETS is to present a harmonized transmission standard for cable and satellite, based on the MPEG-2 System Layer ISO/IEC DIS 13818-1 [1], with the addition of appropriate Forward Error Correction (FEC) technique. This System can be used transparently with the modulation/channel coding system used for digital multi-programme television by satellite, see ETS 300 421 (bibliography). The System allows for further evolution as technology advances as described in Reimers document (see bibliography). It is capable of starting a reliable service as of now. The System is based on Quadrature Amplitude Modulation (QAM). It allows for 16, 32, or 64-QAM constellations and permits for future extension to higher constellations, such as 128-QAM and 256-QAM.

The System FEC is designed to improve Bit Error Ratio (BER) from 10^{-4} to a range, 10^{-10} to 10^{-11}, ensuring "Quasi Error Free" (QEF) operation with approximately one uncorrected error event per transmission hour.

2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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

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

3 Symbols and abbreviations

3.1 Symbols

For the purposes of this ETS, the following symbols apply:

α	Roll-off factor
A_k, B_k	Most Significant Bits at the output of the Byte to m-tuple converter
f_0	Channel centre frequency
f_N	Nyquist frequency
g(x)	RS code generator polynomial
HEX	Hexadecimal
I	Interleaving depth (bytes)
I, Q	In-phase, Quadrature phase components of the modulated signal
j	Branch index
k	Number of bytes mapped into n symbols
m	Power of 2^m-level QAM: 4,5,6 for 16-QAM, 32-QAM, 64-QAM, respectively
M	Convolutional interleaver branch depth for j = 1, M = N/I
n	Number of symbols mapped from k bytes
N	Error protected frame length [bytes]
p(x)	RS field generator polynomial
r_m	In-band ripple (dB)
R	Randomized sequence
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
q	Number of bits: 2,3,4 for 16-QAM, 32-QAM, 64-QAM, respectively
T	Number of bytes which can be corrected in RS error protected packet
T_s	Symbol period

3.2 Abbreviations

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

BB	Baseband
BER	Bit Error Ratio
DTVC	Digital Television by Cable
EBU	European Broadcasting Union
ETS	European Telecommunication Standard
FEC	Forward Error Correction
FIFO	First In First Out
IF	Intermediate Frequency
IRD	Integrated Receiver Decoder
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
RF	Radio Frequency
RS	Reed-Solomon
SMATV	Satellite Master Antenna Television
TDM	Time Division Multiplex
TV	Television

4 Cable System concept

The cable System shall be defined as the functional block of equipment performing the adaptation of the baseband TV signals to the cable channel characteristics (see figure 1). In the cable head-end, the following TV baseband signal sources can be considered:

- satellite signal(s);
- contribution link(s);
- local program source(s).

The processes in the following subclauses shall be applied as shown in figure 1.

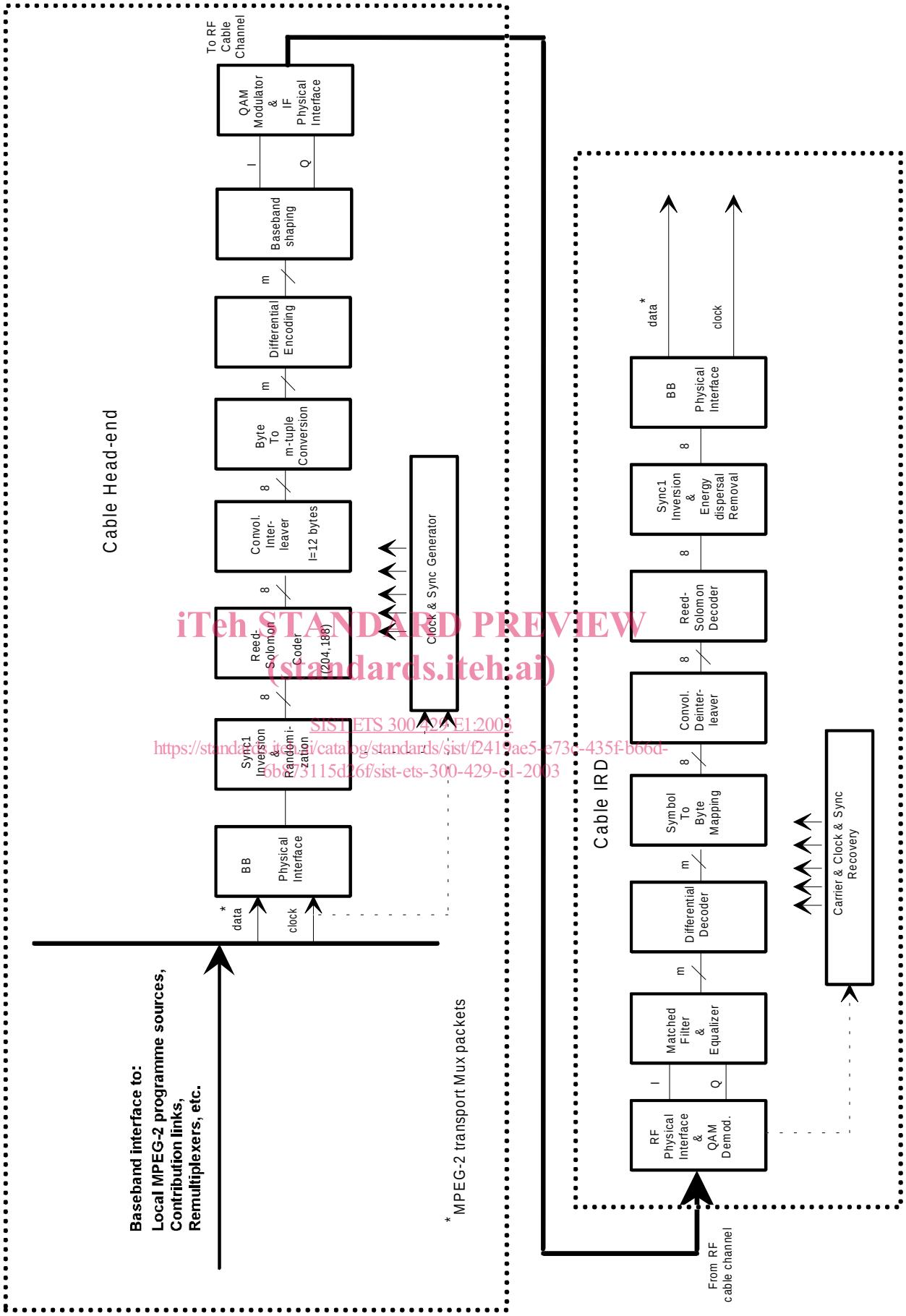

Figure 1: Conceptual block diagram of elements at the cable head-end and receiving site