SLOVENSKI STANDARD
SIST ETS 300 174 E1:2003

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Omreǵni vidiki (NA) ï Digitalno kodiranje komponent televizijskih signalov za aplikacije z dodano kakovostjo v obmoļ ju 34ï 45 Mbit/s

Network Aspects (NA); Digital coding of component television signals for contribution quality applications in the range 34 - 45 Mbit/s

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Foreword

This European Telecommunication Standard (ETS) has been prepared by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

The draft was agreed by a coding experts group including personnel from the European Broadcasting Union (EBU) and approved by the ETSI NA Technical Committee.

The draft was then approved under the ETSI Accelerated approval Procedure No. 3 (AP 3). However, due to technical improvements and reasons of compatibility with CCITT "CCIR Joint Study Group" - CMTT/2 work, alterations were submitted for National Voting using ETSI Vote No. 26. The nationally agreed changes are incorporated into this ETS.

The draft constitutes a common standard for the coding and transmission of television signals in the range of 34 - 45 Mbit/s, in the format specified by CCIR Recommendation 601 [1], and is in line with other relevant CCIR and CCITT Recommendations as referenced.

Annexes A, B, C and D are informative.

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1 Scope

This European Telecommunication Standard (ETS) constitutes a common standard for the coding and transmission of component television signals at bit-rates in the range of 34 - 45 Mbit/s in the format specified by CCIR Recommendation 601 [1]. The standard embraces the coding algorithm needed for digital picture coding at about 34 and 45 Mbit/s, and their interfaces with the transmission network. The video coding algorithms are based on a hybrid predictive/transform scheme incorporating arrangements for Variable word-Length Coding (VLC), synchronisation and video framing. Provision is made for the transmission of audio and teletext services to accompany the video and for the application of scrambling for conditional access.

Network adaptation is specified to both plesiochronous and synchronous digital hierarchies.

2 Normative references

This ETS incorporates, by dated or 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.

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[1] CCIR Recommendation 601: "Encoding Parameters of Digital Television for Studios".

[2] CCITT Recommendation G.751 (1988): "Digital multiplex equipments operating at the third order bit rate of 34 368 kbit/s and the fourth order bit rate of 139 264 kbit/s and using positive justification".

[3] CCITT Recommendation G.752 (1988): "Characteristics of digital multiplex equipments based on a second order bit rate of 6312 kbit/s and using positive justification".

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[4] CCITT Recommendation G.707 (1988): "Synchronous digital hierarchy bit rates".

[5] CCITT Recommendation G.708 (1988): "Network node interface for the synchronous digital hierarchy".

[6] CCITT Recommendation G.709 (1988): "Synchronous multiplexing structure".

[7] CCITT Recommendation H.261 (1988): "Codec for audiovisual services at n x 384 kbit/s".

[8] CCIR Report 624: "Characteristics of television signals".

[9] EBU Tech. 3250 (1985): "Specification of the digital audio interface" (also exists as draft AES Recommendation AES 18 - 19xx).

[10] CCIR Recommendation 724: "Transmission of digital studio quality sound signals over H1 channels".

[11] ISO Standard 3309-2 (1984): "Information processing systems -- Data communication -- High-level data link control procedures -- Frame structure".

[12] CCIR Recommendation 653: "Teletext systems".

[13] EBU Technical Document 3217 (3rd edition, reissued 1986): "Specification of insertion data signal equipment for international transmissions".

[14] CCIR Recommendation 656: "Interfaces for digital component video signals in 525-line and 625-line television systems".

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[15] IEC Publication 461 (1986): "Timecode and control code for video tape recorders".

[16] CCITT Recommendation V.24 (1988): "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".

[17] CCITT Recommendation V.28 (1988): "Electrical characteristics for unbalanced double-current interchange circuits".

[18] ISO Standard 2110 (1980): "Data communication - 25-pin DTE/DCE interface connector and pin assignments".

[19] CCIR Report 1206: "Methods for picture quality assessments in relation to impairments from digital coding of television signals".

[20] BBC Research Department Report BBC RD 1986/2; Clarke, C.K.P. (1986): "Colour encoding and decoding techniques for line-locked sampled PAL and NTSC television signals".

[21] EBU Technical Statement D29-1980 (1980): "Line identification of the D_R/D_B sequence of SECAM signals".

3 Definitions, symbols and abbreviations

For the purposes of this ETS, the following definitions, symbols and abbreviations apply.

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3.1 Arithmetic operators

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+	Addition
-	Subtraction or negation
*	Multiplication
/	Integer division
Σ	Summation
LCM	Lowest Common Multiple
XOR	Exclusive OR binary operation (modulo-2 addition)

3.2 Relational operators

=	Equal
≠	Not equal
>	Greater than
<	Less than
≥	Greater than or equal to
≤	Less than or equal to

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3.3 General abbreviations and usage

binary	A number system with base 2
hexadecimal	A number system with base 16. In written form, equivalents of the decimal numbers 10 to 15 are replaced by the letters A to F
XY hex	Values expressed in hexadecimal notation
bit	A contraction of the words "binary digit"
word	A group or sequence of bits treated together
octet	A sequence of 8 bits operated on as a data group or word
MSB	Most Significant Bit of a word or octet of bits
LSB	Least Significant Bit of a word or octet of bits
Y	Luminance signal or sample
R	Red chrominance signal
B	Blue chrominance signal
C_R	Scaled colour difference signal or sample Y-R
C_B	Scaled colour difference signal or sample Y-B
PLL	Phase Locked Loop
FEC	Forward Error Correction
ATM	Asynchronous Transfer Mode
SDH	Synchronous Digital Hierarchy
PDH	Plesiochronous Digital Hierarchy
PAL	Acronym for Phase Alternate Line - a composite analogue colour transmission system
SECAM	Acronym for Sequential Colour with Memory - a composite analogue colour transmission system
NTSC	Acronym for the National Television System Committee which developed the composite analogue colour transmission system that is used in the majority of countries using 525-line, 60 Hz scanning parameters
MAC	Acronym for Multiplexed Analogue Components. An analogue component colour transmission system. Usually prefixed with letters and/or numbers denoting the variant
FSW	Frame Synchronisation Word
VLC	Variable Length (word) Coding
CIW	Container Identification Word
CW	Control Word

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ECM	Entitlement Control Message
ECW	Even Control Word
EMM	Entitlement Management Message
PRG	Pseudo-Random (sequence) Generator
IW	Initialisation Word loaded into pseudo-random sequence generators for descrambling
OCW	Odd Control Word
PPI	Phase Parity Identifier indicating which CW must be used for descrambling

Other abbreviations and specialised terminology is noted where it occurs in the document.

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4 Summary specification of component tv codecs for 34 - 45 Mbit/s

Table 1

VIDEO INPUT/OUTPUT	Standard	525-line or 625-line digital video in component form. Manual or automatic selection of the video standard is at the manufacturer's discretion (see NOTE 1).
	Coding	4:2:2 level of CCIR Recommendation 601 [1].
	Interfaces	Bit-serial (10-bit, 270 Mbit/s serial interface). CCIR Recommendation 656 [14] bit-parallel interfaces shall also be provided.
SIGNAL PREPROCESS-ING	Horizontal	Full digital active line of 720 samples for luminance (Y) and 360 samples for each colour-difference (CR, CB).
	Vertical	525 line : 248 lines per field (see NOTE 2). Field 1 : lines 16 to 263 Field 2 : lines 278 to 525 625 line : 288 lines per field Field 1 : lines 23 to 310 Field 2 : lines 336 to 623
	Numerical represen-tation	Digital input samples of Y, CR and CB conform to the CCIR Recommendation 601 [1] numerical range. These samples are converted to an 8-bit 2's complement representation for the purpose of processing within the codec.
CODING	Modes	Three modes (intra-field, inter-field and motion compensated inter-frame) are used. The following three processing operations are applied either on 8x8 intra-field blocks (intra-field mode) or on differential blocks obtained by difference between the current 8x8 intra-field block and a reference block taken in the previous field (inter-field mode) or in the field with the same parity in the previous frame (inter-frame mode) (see subclause 5.1).
	DCT	Discrete Cosine Transform applied on rectangular blocks of 8 lines of 8 samples for the three components Y, CR, CB (see subclause 5.2).
	Prediction of the block	For each block processed according to inter-field mode, the reference block is determined with pixels of the previous field without motion compensation. For each block processed according to interframe mode, the reference block is taken from the position of the current block by application of a displacement vector (see subclause 5.3).
	Motion compensation	Motion compensation is applied to "macro-blocks". Each macro-block (two adjacent 8x8 blocks for Y and the two co-positioned CR and CB blocks) is assigned a single displacement vector with half-pel accuracy (see subclause 5.4).
	Quantisation	A different quantisation characteristic is used for each coefficient. Its parameters are adapted to the buffer occupancy, the type of block (luminance/chrominance), and the criticality of the block. The shape of the characteristic is nearly uniform (see Clause 6).
	Variable length coding	VLCs are used to encode the quantised DCT coefficients and motion information (see Clause 7).

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