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MPEG91/330

Task Group CMTT-2

SPECIAL RAPPORTEUR OF TG CMTT-2 FOR SECONDARY DISTRIBUTION OF DIGITAL TV AND HDTV

REPORT OF THE ACTIVITIES OF THE GROUP OF EXPERTS ASSISTING THE SPECIAL RAPPORTEUR

1. Introduction

The group, known as SRG Special Rapporteur's Group, met four times (see Annex A). Several contributions (see Annex B) were presented by the members (see Annex C) and have been the basis for this report.

2. Liaison aspects with other bodies

As stated in doc. TG CMTT/2/TEMP/6 (Tokyo, March 1991) an important aspect of the work of the SRG is to take into account the work in other groups with related objectives and to actively interact with those groups. The groups concerned are: CCITT SG XV WG1 Experts Group for ATM video coding, ISO/IEC JTC1/SC2/WG11-MPEG, CCIR SG 11/B, 11/E and 10-11/S.

Interaction has been obtained by exchange of several liaison letters and attached reports to them. Although the first meeting of SRG was held in Paris just before the MPEG and CCITT SG XV Experts Group meetings, joint sessions with them have not been held so far and are not considered advantageous for the progress of our work, for the moment. However, many administrations and organisations participating in the SRG are also active in those groups.

Up to now the liaison activities with MPEG and CCITT SG XV Experts Group have been limited to the problems of requirements and compatibility. It is expected that in a few months these groups will define a test model and it will be taken into the due account by our group. At that stage of our activities, it is likely that one or more joint meetings will be useful.

An overview of the liaison information exchange among the said groups is given by the documents listed in Annex D.

3. Input/Output formats

In secondary distribution different signal formats for Conventional definition TV (CTV), Enhanced Definition TV (EDTV) and High Definition TV (HDTV) have to be considered. Formats for CTV are indicated in Rec. 601, some basic parameter values for HDTV are in Rec. 709 and proposals are listed in Report 801. Rec. 709 points out that the objective for the system is defined to be progressive scanning, i.e. 1:1 interlace ratio. For current implementations, an

interlace ratio of 2:1, or an equivalent sample rate reduction process may be used. Discussions are carried out in various bodies about the introduction of EDTV formats.

As a preliminary basis for our studies the following formats were taken into consideration. However, taking into account the compatibility and related implementation complexity problems, the group believes that a more limited number of formats should be considered for his work. Comments received from the Chairman of the US CMTT Committee (doc. SRG-023) indicate that additional formats are considered in the USA.

The issue of progressive and interlaced formats was discussed: it has an important impact on coding schemes and efficiency. Some coding algorithms, among those discussed by the group, operate on pseudo-progressive formats to encode interlaced pictures. Starting from this approach, it is possible to define a single coding scheme accepting both the progressive and the interlaced formats, although this has implications on the processing complexity and speed. It is however not certain that a decoder able to handle all formats would be economically acceptable.

Ref.	Aspect ratio H:V	Dimension of Image: Horiz. [pels/ active line]	Vert. [lines/ active frame]	Temp. [fields/ second]	Inter-lace ratio	Pel-rate [Mpel/ second]
HDTV-P (Rec. 709)	16:9	1920	1152	50	1:1	110
	16:9	1920	1035	60	1:1	120
	16:9	1920	960	59.94	1:1	110
HDTV-I (Rec. 709)	16:9	1920	1152	50	2:1	55
	16:9	1920	1035	60	2:1	60
	16:9	1920	960	59.94	2:1	55
EDTV-P	16:9	960	576	50	1:1	28
	16:9	960	480	59.94	1:1	28
EDTV-I	16:9	960	576	50	2:1	13.8
	16:9	960	480	59.94	2:1	13.8
CTV (Rec. 601 Rec. 656)	4:3	720	576	50	2:1	10.4
	4:3	720	see note	59.94	2:1	10.4

Note: Rec. 601 does not specify the number of active lines for the 525-line format, but Report 624 describes the vertical blanking interval lines for the existing analogue formats and their number is ranging from 19 to 21. On the other hand, Rec. 656 defines the digital TV format specifying that the vertical blanking lines are 18 per frame. Therefore the number of active lines to be considered for the 525-line format should be clarified. It must be noted that, if the number of active lines is 483, the simple ratio of 15/7 is preserved between the 1125-line HDTV format (i.e. the 1035 active line format) and the 525-line CTV format.

4. Objectives in terms of quality and bit-rates

During the second meeting of the SRG an output document (SRG-014) providing the preliminary functional requirements mentioned that coding algorithms producing approximately 1 bit/pel (where pel includes all bits representing the RGB or Y, C_R, C_B, signals) should achieve the quality levels being considered and the full definition of the input formats. Demonstrations provided during the third meeting seem to confirm that this goal is achievable.

Comments were received from the Chairman of the US CMTT Committee (doc. SRG-023) and from EBU (doc. SRG-020): they point out that current proposals and studies seem indicate that a reduction factor corresponding to about 0.5 bit/pel is a target being studied.

It is evident that a better definition of the quality requirements is necessary and particularly of the absolute quality. EBU (doc. SRG-020) hopes to make proposals in this area in coming months. Useful indications should also come from the relevant CCIR Sub Groups, 11/B, 11/E and 10-11/S. For the moment Report 1211 can be taken into consideration, since it provides some indication on the requirements for distribution codecs for CTV signals at 34-45 Mbit/s in terms of quality and failure characteristics.

5. Compatibility aspects

5.1 CTV/HDTV Compatibility

Various picture formats, see section 3, for CTV, EDTV and HDTV (interlaced and progressive) are currently under consideration. The level of compatibility achievable and implementable is not yet defined and further studies are necessary.
We are confident that a family of formats can be identified for 50 or 59.94/60 Hz systems and that the same algorithm scheme can be adopted for both the families without significant differences in terms of complexity and coding efficiency. Compatibility, at decoder level, between 50 Hz and 59.94/60 Hz is not a requirement.

Compatibility aspects are discussed in docs SRG-018 and 019, some technical problems are pointed out:

a Aspect ratio conversion
b Aliasing due to decimation of interlaced lines
c Additional processing due to the interlace structure
d Different requirements in terms of bit-rate for the compatible component in the HDTV stream and for CTV
e Consequences, due to the different aspect ratio for compatible component and CTV, for the clock frequency at the decoder side

Compatible coding schemes are presented in docs SRG-004, 017, 021, 025, 026, 033 and 034: some of them suggest solution for the above problems. However, compatibility requirements were not fully evident when such schemes were devised, therefore they could not be completely taken into account.

To facilitate the processing, the number of active pels and active lines for HDTV and CTV/EDTV should be in an integer ratio. This is verified in the case of the 1152 lines/50 Hz format. In the case of the 1035 lines/60 Hz format, the ratio between the number of active lines for HDTV and for TV is 15/7.

Figures 1 and 2 show two examples of basic compatible coding schemes for CTV, EDTV and HDTV. These schemes are based on two layered pyramid coding and can achieve both downward and upward compatibilities. The following video formats (active portions of the picture) are considered:

CTV: 483 or 576 lines / 720 pels / 4:3 aspect ratio
EDTV: 483 or 576 lines / 960 pels / 16:9 aspect ratio
HDTV: 1035 or 1152 lines / 1920 pels / 16:9 aspect ratio

Compatible Coding scheme 1 (Figure 1)

Input CTV format is adapted to the 483 or 576 lines/960 pels format, i.e. the EDTV format, then COD1 is able to encode both CTV and EDTV formats. After being decoded by DEC1, the EDTV format is directly obtained, while the CTV format can be obtained by post-processing.
Input HDTV format is down-sampled (Horizontally by a factor of 1/2, Vertically by a factor of 7/15 or 1/2) and a component compatible with the EDTV format is obtained. This component is coded by COD1 and the residual component (difference between input HDTV and locally-decoded output of COD1) is coded by COD2.
At the HDTV decoder, upsampling (H: 2/1, V: 15/7 or 2/1) is carried out for the output of DEC1 and the resulting information, combined with the output of DEC2, reconstructs the whole HDTV picture.
Downward compatibility is achieved when coded data from COD1 of HDTV is decoded by DEC1 of CTV or EDTV. Upward compatibility is achieved when coded data from COD1 of CTV or EDTV is decoded by DEC1 of HDTV.

Compatible Coding scheme 2 (Figure 2)

The basic structure is the same of that of scheme 1. Differences are the following:

- a common virtual picture format (518 lines/960 pels) is employed for CTV and EDTV in the case of 60 Hz TV formats. Therefore pre and post-processing are necessary for the 60 Hz EDTV format (this is not the case for scheme 1).
- at the HDTV coder, downsampling ratio is 1/2 for both the horizontal and the vertical directions.

5.2 Compatibility with other applications

CMTT/2 is charged with the development of Recommendations concerning the Secondary Distribution. In principle CCIR SG 11 would be expected to be responsible for the development of digital emission systems. However, it is quite likely that these two activities will be the two sides of the same coin. The viewer will need a common receiver for both types of service, and in any case the ISDN will carry, among other services, programmes also broadcast. There would thus be clear benefits in a single baseband coding scheme for both ISDN Secondary Distribution and for digital broadcasting. To achieve this, it is essential to start with the most demanding path, i.e. the terrestrial broadcasting network.

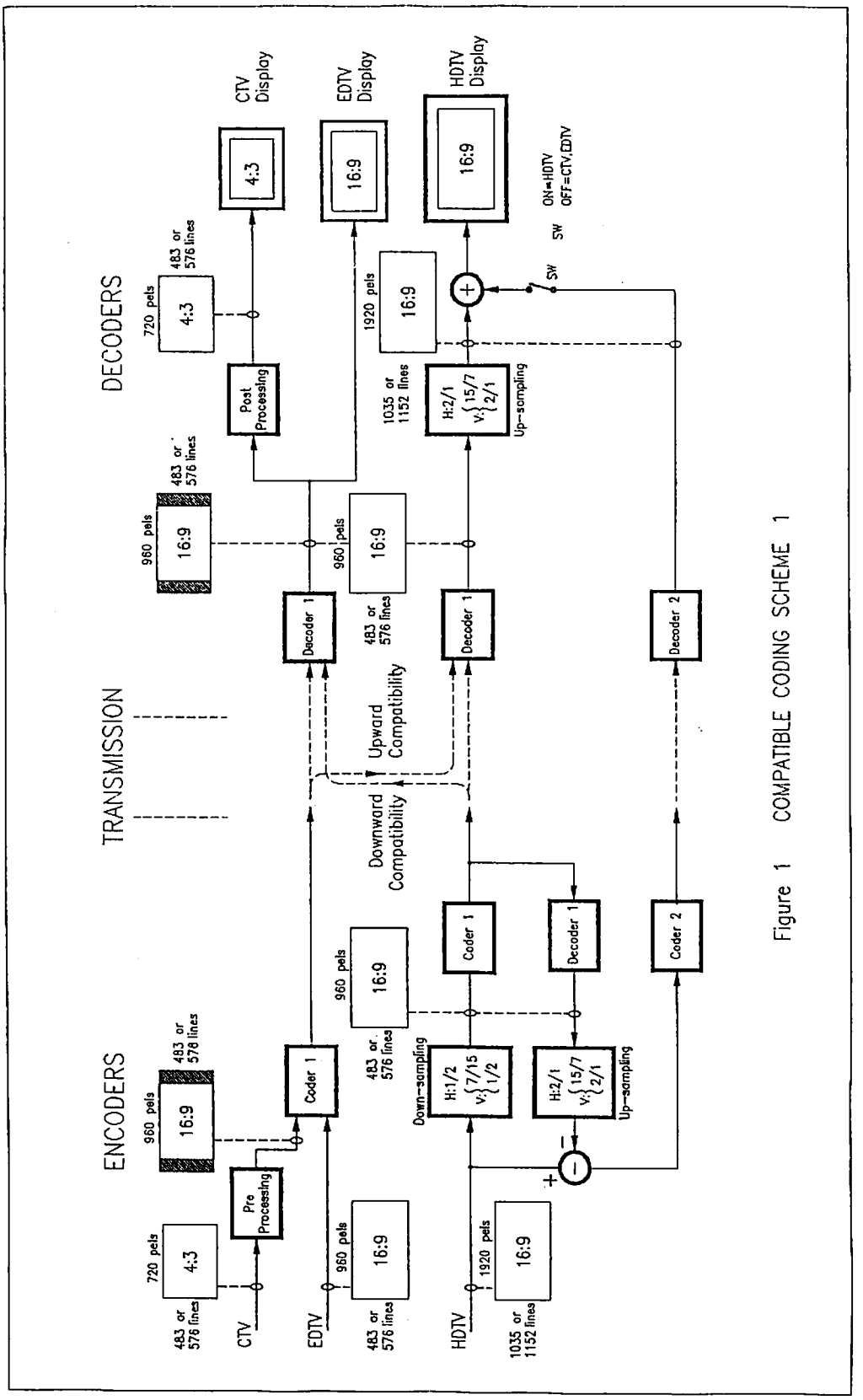

Figure 1 COMPATIBLE CODING SCHEME 1

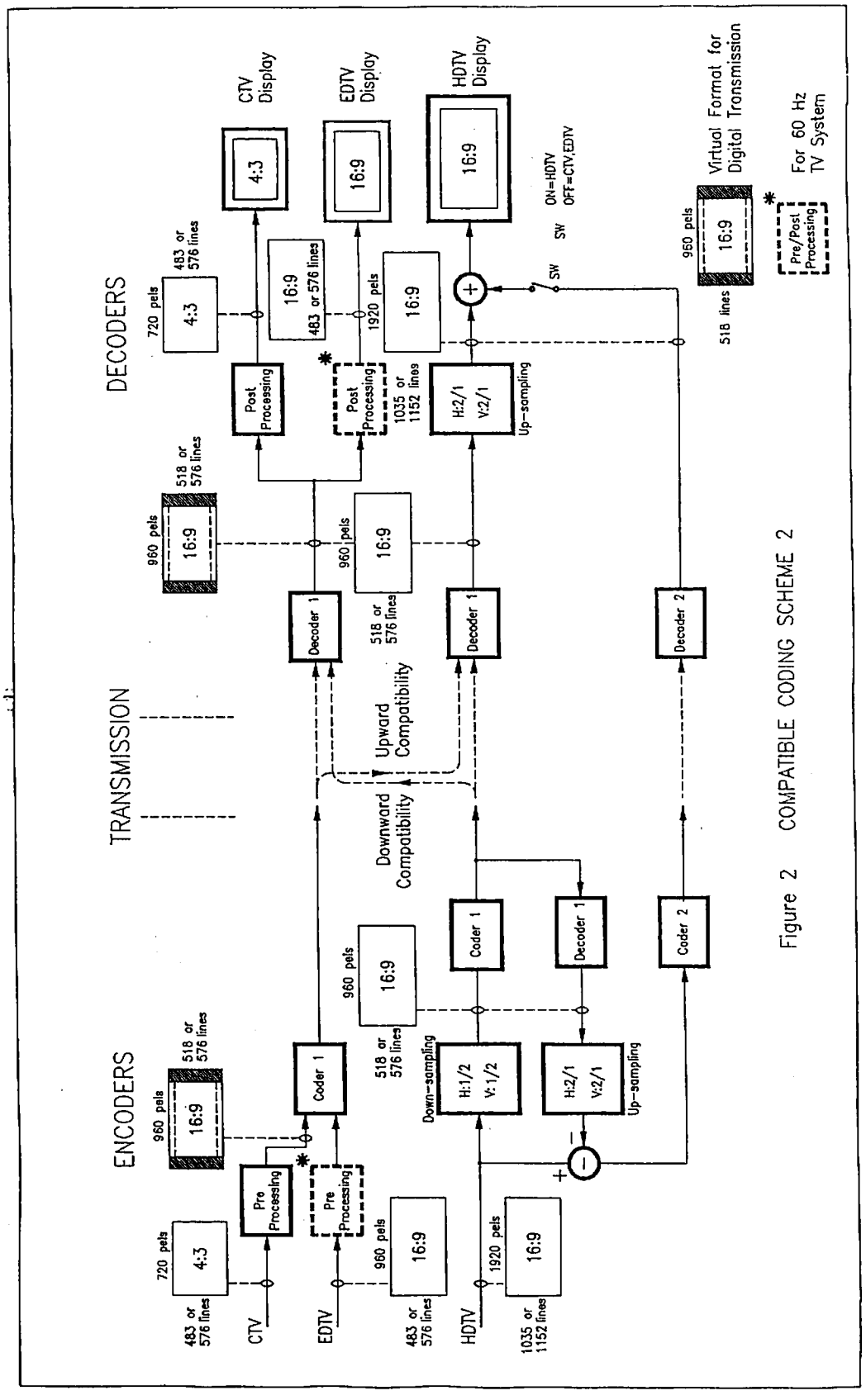

Figure 2 COMPATIBLE CODING SCHEME 2

MPEG and CCITT SGXV are developing coding standards for CTV formats, namely MPEG-2 and H.26x. Compatibility with those systems is considered desirable, as indicated in Figure 3, however realistic implementation may not be easy. Compatibility with standards for contribution quality (Rec. 723) and for lower quality applications (MPEG-1 and H.261) are not considered essential.

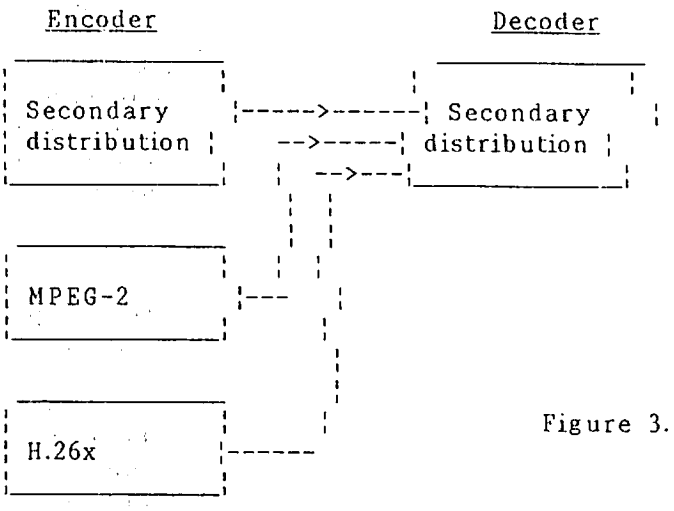

Figure 3.

6. Algorithms and systems being discussed

Several possible algorithms were submitted by SRG members. Their characteristics are briefly discussed below. At this stage most algorithms are not considered as formal proposals submitted as inputs to a selection process, but rather as outline description of possible solutions. Nevertheless Japan considers its proposal for bit-rate reduction scheme (doc. SRG-024) as a formal one.

Docs SRG-010 and SRG-021 (France) present the possibilities of a coding method, based on Pseudo Quadrature Mirror Filter (PQMF) banks. The coding algorithm is a hybrid motion compensated inter/intra scheme in which the decorrelative process is achieved by means of a regular 8 by 8 subband splitting. Some interesting features of this method are its high coding efficiency, its moderate hardware complexity (due to the existence of fast algorithms for the implementation of the PQMF bank) and the possibility to derive embedded bit stream compatible systems. A non compatible coding scheme for interlaced standards and a compatible one for the progressive formats have been defined. In the latter case, a two loop prediction system was used. The study of compatible coding of interlaced formats has just started and has been first focused on the way to obtain an acceptable compatible sequence from the subband decomposition of the source.
Some simulation results were presented for interlaced formats including (non compatible) coded TV sequences at 4 and 9 Mbit/s and compatible sequences derived from the subband decomposition of the source.

Doc SRG-034 (Thomson LER) describes another motion compensated subband coding scheme. The main differences with the previous method are the use of a hierarchical subband splitting (16 bands for Y, 7 bands for Cr and Cb) based on a Quadrature Mirror Filter and the fact that the inter prediction is done in the subband domain. With this scheme, compatibility may be achieved

by using the same structure for CTV and HDTV decoders (being memory size and hardware speed in accordance with the specific resolution), by organising the bit-stream with synchronising words allowing the extraction of lower resolution information and by processing the motion compensated prediction on different resolution loops.

Doc. SRG-025 (Netherlands) reports studies on compatible HDTV/TV coding schemes in accordance with the functional requirements contained in doc. SRG-014, The coded signal contains an embedded low-resolution channel. In the tests which were performed, bandsplitting was implemented with a 16 by 16 DCT, but this is not considered as an essential characteristic of the algorithm. The main originality of this contribution is that the prediction in the high-resolution loop of the coder uses low-frequency information in such a way that a high-resolution decoder only needs one prediction loop. So far this approach has been studied only for the compatible coding of progressive signals.

Doc. SRG-026 (Belgium) suggests a possible approach for the compatible coding of interlaced formats. The difficulty of bandsplitting for interlaced formats is circumvented by inserting the coding algorithm between pre- and post-processing operators which are basically a deinterlacer at the coder input and a reinterlacer at the decoder output. In this way the coding algorithm operates on a progressive format. As deinterlacing and reinterlacing remain a difficult operation, the problem is solved by transmitting the deinterlacer-reinterlacer error as side information. The coding algorithm, which thus operates on a progressive format, uses 8 by 8 DCT motion compensated hybrid loops both for the low-resolution and high-resolution channels. Down and up-sampling is performed using classical filters.

In the subsequent document SRG-033 (Belgium) the idea of transmitting the deinterlacer-reinterlacer error was not pursued. The algorithm operates on a pseudo-progressive 25 Hz format obtained by field merging. Down and up-sampling is performed by vertical decimation applied inside the fields and using classical filters. This technique is claimed to provide a very good quality for the compatible CTV or EDTV stream.

A common feature in docs SRG-025, 026 and 033 is that the quantising and motion accurancies of the low and high-resolution loops are matched to the different viewing angles of TV and HDTV. The quantising error of the low-resolution channel is recirculated in the high-resolution loop. For both cases simulation results were presented at 1 bit/pel.

Doc. SRG-024 (Japan) proposes a source coding scheme to be employed in secondary distribution coding systems, for HDTV and conventional TV, based on Rec. 723. Taking into account HDTV signal characteristics and coding improvement, some modifications are introduced to the coding scheme of Rec. 723. Those are motion compensation for inter-field prediction, loop filter, adaptive quantisation suitable for each coding mode and differential coding of DC coefficients. The proposed scheme does not include specifications of input/output conditions, preprocessing, video framing, error protection and channel framing. These undefined specifications would be completed taking the possibility of compatibility into consideration. For this document, there was an extensive discussion on whether a commonality with Rec. 723 is needed or not and the possibility to adapt this algorithm to lower bit-rates.

Doc. SRG-032 (Italy-Spain) is a progress-report on the development of the Eureka 256 HDTV codec, based on the algorithm adopted in Rec. 723. The codec has been successfully demonstrated at Telecom '91 operating at a transmission rate down to 45 Mbit/s. At this rate the quality was informally evaluated and it is claimed that it is suitable for distribution purposes.

Doc. SRG-017 (Japan) introduces TV/HDTV compatible coding schemes which are based on the embedded bit-stream concept. The first scheme employs two-layered pyramid coding where the compatible component (corresponding to CTV) is extracted from the input HDTV by low-pass filtering and down-sampling. The coded compatible component and coded residual component are multiplexed and transmitted. Downward compatibility is achieved by decoding only the compatible component. The second scheme employs four-subband splitting and two-layered pyramid coding, where the compatible component is extracted from the LL-subband by further low-pass filtering and sub-sampling. There was a discussion concerning the horizontal pixel numbers. Down and up-sampling operations can be simplified by an adequate choice of the number of pixels per line.

Amongst these suggested algorithms, several were supported by demonstrations based on computer simulations. In some documents a very strong emphasis was put on compatible coding considerations. This helped a lot for a better understanding of the compatibility concept and of its practical implications. Some suggested algorithms are quite close to formal proposals submitted by SRG members to the Kurihama tests to be performed by MPEG.

7. Test procedures and test material

Useful information for defining test procedures and test material can be inferred by Report 1211 and by the report of the IWP 11/7 ad-hoc groups (doc. CCIR 1986-1990 IWP 11/7-249, CMTT/2-97) who were responsible for the testing of codecs proposed for TV and contribution quality. These documents have been provided to MPEG, as they requested (doc. SRG-027).

For the moment the informal evaluation on the algorithms and system being discussed will be carried out by using TV test sequences.
The following test sequences have been agreed in order to allow preliminary evaluations based on a common picture material, taken from the CCIR Library Tape (Report 1213):

Mobile and Calendar (LT-30)
Flower Garden (LT-15)

Material in HDTV and progressive scanning formats should also be provided in order to examine the compatibility problems.

8. Future Work

So far it has not be possible to define a reference model. Broadly speaking the proposed compatible schemes can be distributed in two classes: subband coding and pyramidal coding.

For the latter there is a good convergence among the members of the group toward a double loop system using a motion compensated hybrid DCT algorithm.

In order to define a reference model before May 1992, i.e. the milestone for CMTT/2, the group has adopted the following workplan in three steps:

1. Definition of candidates for the reference model and their evaluation procedure
2. Evaluation of candidates and choice of the model
3. Draft specification of the reference model.

Annexes: 4

ANNEX A

AGENDA

1st MEETING OF THE
SPECIAL RAPPORTEUR'S GROUP OF CMTT/2
ON SECONDARY DISTRIBUTION
(27 May 1991, Paris, France)

Address:
TDF/CERIM
10 rue d'Oradour sur Glane
75732 PARIS CEDEX 15

Room 520 - Building C - 5th Floor

1. Approval of the Agenda

2. Status of the MPEG activity
   2.1 Fields of application and requirements
   2.2 Time schedule
   2.3 Compatibility issues
   2.4 Liaison between MPEG and other groups

3. Draft Requirements on Secondary Distribution

4. Coordination of studies in CMTT/2 and MPEG

5. Any Other Business

6. Planning of the next meeting (Geneva, 12 June 1991)

Comments: The scope of this first meeting is to determine the modality and form of coordination between the activity of CMTT/2 and ISO/IEC JTC1/SC2/WG11-MPEG. Therefore an analyses of the present status of MPEG is necessary, particularly in terms of requirements and time schedule. Information and comments from experts participating in MPEG are welcome.

List of partecipants:
M. Barbero, H. Brusewitz, P. Delogne, G. Dimino (RAI, observer), Y. Le Pannerer, J. Oest, V. Thomas.
D. Lemay (Bell-Northern Research), S. Okubo (NTT), G. Madec (CCETT), O. Poncin (UCL), D. Schinkel (PTT Research), Y. Shishikui (NHK), T. Tanaka (NTT), G. Zedler (DBP-Telekom)

AGENDA

2nd MEETING OF THE SPECIAL RAPPORTEUR'S GROUP OF CMTT/2 ON SECONDARY DISTRIBUTION (10-12 June 1991, Geneva, Switzerland)

Address:
EBU - Technical Department
Ancienne Route 17A
GRAND-SACONNEX (Geneva)
Switzerland

1. Approval of the Agenda

2. Liason aspects with other bodies
   - 2.1 Report on the MPEG meeting of Paris
   - 2.2 Liason with MPEG
   - 2.3 Liason with CCITT SG XV

3. Draft Functional Requirements for Secondary Distribution
   - 3.1 Objectives in terms of quality and bit-rate for TV and HDTV
   - 3.2 Compatibility aspects among TV, HDTV and other applications
   - 3.3 Reference configuration for secondary distribution (transmission channel)
   - 3.4 Input/output formats

4. Examination of proposed algorithms and systems

5. Any Other Business

6. Date and place of the next meeting

NOTE: Input contribution documents are invited particularly for items 3 and 4

List of partecipants:
M. Barbero, L. Cheveau (part time), K. Davies, P. Delogne, J. Johann, Y. Le Pannerer, N. Lodge, P. Marklund, J. Oest, H. P. Poffet, K. Sawada, R. Ter Horst, V. Thomas, D. Wood (part time).

AGENDA

3rd MEETING OF THE
SPECIAL RAPPORTEUR'S GROUP OF CMTT/2
ON SECONDARY DISTRIBUTION
(9-11 September 1991, Torino, Italy)

Address:
RAI - Centro Ricerche
Corso Giambone 68
I 10135 TORINO
Italy

1. Approval of the Agenda

2. Liason aspects with other bodies: report on the MPEG and CCITT SG XV meeting in California

3. Draft Functional Requirements for Secondary Distribution
   - 3.1 Objectives in terms of quality and bit-rate for TV and HDTV
   - 3.2 Compatibility aspects among TV, HDTV and other applications
   - 3.3 Reference configuration for secondary distribution (transmission channel)
   - 3.4 Input/output formats

4. Examination of proposed algorithms and systems

5. Draft specification of the reference model

6. Test procedures and choice of the test material

7. Any Other Business

8. Date and place of the next meeting

NOTE: Contribution are invited particularly for items 4 and 6.

List of partecipants:
M. Barbero, H. Brusewitz (substituting P. Marklund), L. Chiariglione (part time, Convenor of MPEG), P. Delogne, S. Matsumoto, Y. Ohtsuka, H.P. Poffet, K. Sawada, R. Ter Horst, V. Thomas, M. Stroppiana (RAI).

AGENDA

4th MEETING OF THE SPECIAL RAPPORTEUR'S GROUP OF CMTT/2 ON SECONDARY DISTRIBUTION (7-8 November 1991, Paris, France)

Address:

TDF/CERIM
10 rue d'Oradour sur Glane
75732 PARIS CEDEX 15

Room 520 - Building C - 5th Floor

1. Approval of the Agenda
2. Report of the Activities of the Group of Experts assisting the Special Rapporteur.
3. Draft specification of the Reference Model
4. Any Other Business
5. Date and place of the next meeting

List of partecipants:
M. Barbero, H. Brusewitz (substituting P. Marklund), P. Delogne, J. Johann, S. Matsumoto, J. Oest, Y. Ohtsuka, H.P. Poffet, K. Sawada, V. Thomas.

ANNEX B

Doc. CMTT/2-SRG-003
Rev. 4
November 1991

Special Rapporteur's Group (SRG) of CMTT/2
for Secondary Distribution of Digital TV and HDTV

List of Documents

001 Appointment of a Special Rapporteur and Work Plan for Studies on Digital TV and HDTV Secondary Distribution
(Rev. 1 to Doc. CMTT-2/TEMP/6, Tokyo 28 March 1991)

002 List of members

003 List of documents

004 M. Pecot, P.J. Tourtier and Y. Thomas: *Compatible Coding of Television Images. Part 1 (Coding Algorithm) and Part 2 (Compatible System)*
(Thomson-CSF, in Signal Processing: Image Communication 2 (1990), Elsevier, pp. 245-268).

005 Scanning standard to be used on secondary distribution channels
(Thomson-CSF, 23 Feb. 1990)

006 Impact of digital transmission on HDTV sampling parameters
(Thomson-CSF)

007 Digital terrestrial HDTV activities at STR
(Sweden, 7 June 1991)

008 Target Bit-rates for HDTV Secondary Distribution
(Japan, 6 June 1991)

009 HDTV Coding Scheme based on Rec. 723 for Secondary Distribution
(Japan, 4 June 1991)

010 Coding Schemes for Secondary Distribution
(CCETT, Juen 1991)

011 Digital televison transmission in the terrestrial UHF band
(A. G. Mason and N. K. Lodge)

012 Some consideration on digital television codign for primary and secondary distribution
(Belgium, March 1991, doc. TG CMTT/2-16)

013 Liason statement to ISO/IEC JTC1/SC2/WG11 (MPEG): Common interest in video coding
(SRG, 11 June 1991)

014 Preliminary functional requirements for secondary distribution of TV and HDTV signals
(SRG, 12 June 1991)

015 Liason statement to CCITT SG-XV WP
(SRG, 12 June 1991)

016 Comments to MPEG about the Kurihama tests
(SRG, 11 June 1991)

017 A Compatible Coding Scheme for TV and HDTV
(Japan, 15 July 1991)

018 Comment on CDTV/HDTV Compatible Coding
(Japan, 29 July 1991)

019 Comment on Document SRG-014 (functional requirements ...)
(Sweden, 6 September 1991)

020 Requirements for Secondary Distribution of TV and HDTV Signals
(EBU, August 1991)

021 Coding Schemes for Secondary Distribution
(CCETT, September 1991)

022 Liason Statements to TG CMTT/2
(CCITT SG XV, Annex 7 to Doc. AVC-106R, 23 August 1991)

023 Comments on document SRG-014
(Fax from J.J. Grath, US Chairman CMTT, 26 August 1991)

024 Proposal of Source Coding Scheme to be adopted in Secondary Distribution Coding System for HDTV and TV
(Japan, November 1991)

025 Information on Developments towards HDTV/TV Compatible Coding for Secondary Distribution
(Royal PTT Nederland NV, 2 September 1991)

026 A Compatible Scheme for TV/HDTV Coding
(Belgium, 6 September 1991)

027 Liason Statement to CMTT/2 SRG in Response to TG CMTT/2-SRG-016 and 014
(MPEG)

028 IVS Baseline Document (Annex 3)
(CCITT SG XVIII, doc AVC-68)

029 Proposal Package Description for MPEG Phase 2
(MPEG doc. 91/100 rev, 23 August 1991)

030 Report of the Second Meeting of the Experts Group for ATM video Coding in Santa Clara (August 14-23, 1991)
(Extract of CCITT SG XV doc. AVC-106R, 23 August 1991)

031 Report of the Activities of the Group of Experts Assisting the Special Rapporteur
(Special Rapporteur of TG CMTT/2 for Secondary Distribution of Digital TV and HDTV, rev. version, 8 November 1991)

032 Eureka 256 Codecs for Conventional TV and HDTV: Progress Report - October 1991
(Italy-Spain, 4 November 1991)

033 Compatible Coding Scheme Proposed for the Secondary Distribution of TV and HDTV Signals
(Belgium, 7-8 November 1991)

034 Summary of proposal #34 for MPEG-2
(Jean-François Vial, Thomson-CSF/LER, October 1991)

035 Intyegrated Video Services (IVS) in Broadband ISDN - Meeting Report
(ITU IVS Co-ordination Meeting, 25-27 September 1991)

ANNEX C

Doc. CMTT/2-SRG-002
rev. 2
10 September 1991

Special Rapporteur's Group (SRG) of CMTT/2 for Secondary Distribution of Digital TV and HDTV

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ANNEX D

- Document CMMT-2/TEMP/7 (Tokyo, 28 March 1991): Common areas of interest between CCIR/CCITT Task Group CMTT/2 and CCITT Study Group XV

- SRG (Geneva, 06.91) TEMP1: ISO/IEC JTC1/SC2/WG11 "Report-minutes of the liason meeting" held Wednesday 29/05/91

- Document CMTT-2/TEMP/1: (Tokyo, 28 March 1991) Liason Statement to CCIR WG 11B (Establishment of user requirements for secondary distribution)

- Document CMTT-2/TEMP/9 (Tokyo, 28 March 1991): Information to ISO/IEC JTC1/SC2/WG11 (MPEG)

- Document CMTT/2-SRG-013: Liason statement to ISO/IEC JTC1/SC2/WG11 (MPEG) "Common interests in video coding" (including SRG-014)

- Document CMTT/2-SRG-015: Liason statement to CCITT SG-XV WP (including SRG-014)

- Document CMTT/2-SRG-016: Comments to MPEG about the Kurihama tests.

- Document CMTT/2-SRG-022: Liason statements from CCITT SG-XV to TG CMTT/2

addition to AVC-174

Documents
CCIR Study Groups
Period 1990-1994

Corrigendum 1 to
Document CMTT-2/TEMP/11-E only
13 November 1991
Original: English

CMTT-2

REPORT OF THE ACTIVITIES OF THE GROUP OF EXPERTS ASSISTING THE SPECIAL RAPPORTEUR

Modification of Document CMTT-2/TEMP/11

Modify the introduction as follows:

1. Introduction

TG CMTT-2 is responsible for Question 25/CMTT dealing with standards for secondary distribution of TV and HDTV signals. During the first meeting of TG CMTT-2 (Tokyo, March 1991) a Special Rapporteur was appointed to deal with this matter, assisted by a Group of Experts, known as SRG, i.e. Special Rapporteur's Group.

The background information coming from Report 1239 (CCIR study period 1990-1994) is contained in Appendix 1.

SRG met four times (see Annex A) ...

Replace the last indent of section 5.1 "- at the HDTV codec ..." with:

- at the HDTV coder and decoder, downsampling and upsampling ratios are 1/2 and 2/1, respectively, for both the 50 and 60 Hz HDTV systems

Replace the words "a double loop system" in the second paragraph of section 8 with: "a pyramidal scheme".

Add the Appendix 1 as shown.

APPENDIX 1

Background information

1. Introduction

Secondary distribution must be understood as the delivery of television programmes to consumers. Particular attention must be paid to the digital delivery of television signals over future Broadband Integrated Services Digital Networks (B-ISDN) which will be used for both communicative and distributive services including a whole range of visual services from videotelephony to television distribution according to future high definition standards.

To ensure that these studies are aligned with those on the broadband ISDN, the Plenary Assembly decided that CMTT should undertake its projected video coding studies for secondary distribution with the objective of consistency with the broadband ISDN being specified in CCITT Study Group XVIII and with coding for videotelephony in CCITT Study Group XV. Consistency with the video coding for broadcasting services should also be considered.

Different picture transmission requirements have hitherto led to the consideration of different bit rate reduction algorithms for each application and each transmitting channel. For instance, CCITT Study Group XV, IWP CMTT/2 and the ISO have proposed often similar but not identical algorithms for videotelephony, television contribution and distribution and still picture transmission respectively.

Greater compatibility between bit rate reduction algorithms will be required for the secondary distribution of pictures (mainly, but not exclusively in the broadband ISDN).

2. Interconnection requirements

There is already an increasing need for interconnection between services and many administrations require the new HDTV service to be compatible with the television service, i.e., for a television receiver to be connectable to an HDTV source as cheaply as possible. This need is likely to develop with the arrival of new visual services in the user's premises (still pictures, videotelephony, etc.). Some terminals will even be of the "multiservice" type and will permit the reception and simultaneous display (by windowing) of several pictures (e.g., videophone conference picture insert on a television or HDTV screen). Because it uses ATM technology, the broadband ISDN will in addition permit the interconnection of terminals originally designed to operate at different bit rates; in other words, terminals (and bit rate reduction algorithms) will no longer be tied strictly to a single channel bit rate.

The need for interconnection imposes certain constraints on the picture sampling structure. In particular, practical consideration should, as has been proposed for HDTV, be given to a hierarchy of resolution standards based principally on progressive scanning. According to this proposal, the HDTV image has twice as many lines and points per line as a conventional television image. It is even possible to extend this hierarchy to lower resolutions and consider a 1/4 TV format.

3. Compatibility

In order to meet the need for interconnection between services using different video coding standards or different picture formats, forward and backwards, upwards and downwards compatibility is desirable for secondary distribution standards. Document [CCIR 1990-1994a] gives definitions of compatibility and several compatibility methods.

A video transmission system employing two standards is:

- forward compatible if a new standard decoder is able to decode pictures from the signal or part of the signal of an existing standard encoder;
- backward compatible if an existing standard decoder is able to decode pictures from the signal or part of the signal of a new standard decoder;
- upward compatible if a higher-resolution receiver is able to decode pictures from a signal transmitted by a lower-resolution encoder;
- downward compatible if a lower-resolution receiver is able to decode pictures from the signal or part of the signal transmitted by a higher-resolution encoder.

Possible compatibility methods for forward or backward compatibility are:

- simulcasting (backward, forward (optional));
- embedded bit stream (forward and backward);
- syntactic extension (forward);
- switchable encoder (forward and backward).

Standard families are those standards having many commonalities, although they need not be compatible.

Coding methods for secondary distribution of digital television should be defined with the objective of conformity with the features of the B-ISDN developed in CCITT Study Group XVIII.

Some general considerations on digital television coding for primary and secondary distribution are presented in [CCIR 1990-1994b]. An attempt was made to define a general common coding scheme for upward/downward compatible distribution of TV and HDTV in a wide range of conditions: several types of transmission channels, STM and ATM environments, constant and variable bit rate modes, interlaced and progressive formats. The layered structure of such a coding scheme should also provide a fall-back mode for cell loss in an ATM network.

4. Codecs and display devices

Conformity of video coding studies for secondary distribution by CCITT Study Group XV and CMTT with the B-ISDN studies of CCITT Study Group XVIII will allow the advantages available through a multiservices network to be extended to the end user by minimizing the number of video terminals needed to access a range of interactive and distributive video and still image based services. The objective is to achieve the highest level of service integration through minimizing the number of coding techniques used across a wide range of video services and maximizing commonality of display devices.

To achieve this objective there will be a requirement for video terminals to be able to present video and still image material from a range of services other than that of their primary application, but within the limits of the display resolution. Thus, for example, a videotelephone terminal should be able to access and present (at the quality limit imposed by its low resolution display) a video signal originating as high resolution TV quality. The use of layered coding may be necessary to allow a terminal to extract only that part of the coded video signal that it is capable of representing. This layered coding structure means that information describing the different levels of image resolution are separately transmitted in a way that permits their selective reception and reconstruction at a decoder. The coding methods may also need to be matched to the characteristics of ATM, the cell-based information transfer mode of B-ISDN.

Use of a common display device goes some way toward rationalization of a user's terminal needs for access to multiple video services. However, when this is combined with a single common decoder utilizing a layered coding structure, the objective of maximizing the commonality between interactive and distributive services can best be realized. An important issue however, is where and to what extent is conversion between different video formats to be performed. The question of whether this function should be performed at the source or in the display or a combination of both, requires further study.

Another important issue requiring further study is the definition of an interface between the codec (or other video sources) and the display, including the fundamental issue of whether the interface should be analogue or digital.

5. Conclusion

Given the increasing need for compatibility between various visual services which will be eventually provided over future digital networks for distribution to the home, it will be necessary to ensure that coding algorithms have the following characteristics:

i) simple, efficient and compatible coding algorithms in order to minimize the costs of terminal equipment;

ii) an image quality which is equivalent to, or better than that presently available at the home;

References

CCIR Documents

[1990-1994]: a. TG CMTT-2/10 (Netherlands); b. TG CMTT-2/16 (Belgium).