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Working Party XV/1
Specialists Group on Coding for Visual Telephony

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SOURCE: CHAIRMAN OF THE SPECIALISTS GROUP ON CODING FOR VISUAL TELEPHONY
TITLE : REPORT OF THE TENTH MEETING IN RED BANK (October 13-16, 1987)

CONTENTS

1. General

The Specialists Group met in Red Bank, New Jersey, USA, from October 13 to 16, 1987 at the kind invitation of Bell Communications Research with the support of AT&T.

Before the session, Chairman informed the meeting that Mr. Campenhausen retired from Core Member.

The list of participants appears at the end of this report.

At the closing session, Chairman thanked the hosting organization for the meeting facilities provided and the excellent organization.

2. Documents for the Meeting (TD 2)

For this meeting, 30 normal documents and 11 temporary documents have been available. Annex 1 shows the outline of each document.

3. Tape Demonstrations (TD 5)

A number of tape demonstrations as listed in Annex 2 were presented during the meeting.

4. Discussion on n x 384 kbit/s

4.1 Hardware progress (#249, #254, #271)

Progress of each Flexible Hardware development was reported with hardware processed picture demonstration.

Japan: In one project, whole of the hardware has been completed and put into parameter optimization, transmission tests, compatibility check with the test signal generator. In another project, source coder and source decoder are operating. Whole of the codec will work in November.

France: Source coder and source decoder are operating under hardware simulation for video multiplex. Local decoder output is demonstrated. The hardware will also include 10 x 10 filter and 2-D VLC.

FRG/Netherlands: Flexible encoder is assembled and will work in two weeks. Motion compensation, pre- and post-processing, transform and classifier are working. Decoder with different architecture will come later.

UK: Source coder and source decoder are operating. Video multiplex coder will come in 3 weeks, video multiplex decoder is under development. The hardware also includes 2-D VLC, buffer with up to 128 Kbits.

For the compatibility check among different Flexible Hardwares, Mr. Morrison expressed it will be initiated in November in Europe, and Mr. Mukawa expressed his hardware will be transported to BTRL early January for a back-to-back test.

4.2 Pre-processing (#258)

Information was provided on the comparison of two NTSC/CIF conversion filters for the purpose of reducing vertical aliasing distortion.

4.3 Source Coding

4.3.1 Transform (#255, #261)

The first work on the effect of mismatch between the two inverse transforms in the coder and decoder was presented in Doc. #255, while several problems facing the specification of the transform part were pointed out in Dec. #261.

After some questions and answers, the meeting requested Mr. Haskell to coordinate a small group meeting with the task of;

a. Listing up possible solutions to specify the transform part which allows compatibility among coder and decoder, hopefully with the use of commercial VLSI chip(s),
b. Evaluating them,
c. Deciding what we should do inside the Group, identifying who will contribute to that, and
d. Deciding what we should expect outside the Group.

The outcome is attached as Annex 3.

During the discussion, it was pointed out that Fig. 1/Doc. #255 differs from the Flexible Hardware specification in the way of getting the 2D transform output at the inverse transformer, which should be rounding. It was also noted that the order of horizontal and vertical transforms in the forward transformer is reversed in the UK implementation, though this aspect is outside the specification.

4.3.2 Quantization (#256)

Parameter optimization results obtained with the Flexible Hardware were presented concerning such quantization aspects as luminance/chrominance adaptive quantization, number of quantizing levels and overload distortion, the first represented value on a quantizer and the required number of quantizers.

Corresponding data in other hardware experiments are requested toward finalizing the draft Recommendation.

4.3.3 Discarding higher sequency coefficients (#257, #260)

Two experimental results were presented for information, which were obtained with hardware and simulation, respectively. They are both oriented to the idea that we can reduce the mosquito noise by discarding the unnecessary higher sequency coefficients, thus reducing the step size. The technique in Doc. #260 also includes adaptive scanning which affects compatibility.

The meeting noticed a remarkable improvement in the numerical data and reproduced picture provided by Doc. #260, awaiting the hardware verification.

4.3.4 Variable block size (#257)

An experimental result was presented for information, showing improvements in zooming or panning scenes in particular. Mr. Guichard stated that French hardware is planned to implement a variable block size scheme. Experimental results are welcome.

4.3.5 Loop filter (#267)

Experimental results on pixel domain and transform domain filtering in the loop were presented for information. Mr. Plompen stated, in response to a question, that the transform domain filtering does not show significant blocking.

4.3.6 Macro blocks (#266)

Simulation results obtained in three laboratories were provided, for information at the moment. During the presentation, it was stressed that this technique outperforms RM4 at 64 kbit/s while it gives a same level performance at 384 kbit/s, thus indicating a possibility of downward compatibility between 384 kbit/s and 64 kbit/s.

The meeting recognized that this technique is still open for consideration regarding hardware optimization and compatibility issue.

4.4 Video multiplex coding (#272)

A code set example for two-dimensional VLC was presented for information, which includes considerations on consecutive zeros and buffer underflow.

During the discussion, Mr. Morrison expressed that this consecutive zero consideration does not give a complete answer to the North American network restriction, because there are other places where violation may occur. The meeting took note of that this aspect will be discussed at the next meeting together with the transmission coding described in §4.5.1.

4.5 Transmission Coding

4.5.1 Zero byte replacement (#252)

A method to cope with the network restriction in North America was proposed, which carries out zero byte replacement using 8/4 overhead bits per 384 kbit/s

channel in the Application channel.

Before investigating the details of the proposed scheme, there was discussion on more general aspects.

a. Should the problem be solved on a service by service basis? Is there any universal solution which covers 64 kbit/s as well?
b. Should the function be installed at the terminal or at some network gateway?
c. Can the network not become transparent in the near future?

Considering the realities that this network restriction will last during the network transition period, and that interworking between North America and other regions is necessary, the meeting recognized some countermeasures are required in the n x 384 kbit/s codec.

Members are requested to contribute to deciding on how the problem is solved, with what technique and whether it should be optional including how to allocate necessary flags in the Application Channel at the next meeting. They are also requested to make contact with Mr. Bryan, at an early occasion, if they have comments on his proposal.

4.5.2 Message channel (#263)

An overview of the message channel implemented in the European videoconferencing and audio conferencing systems was provided for information.

4.6 Test signal generator (#259; TD10)

The first result of compatibility check between the DIS test signal generator and a Japanese hardware was given. Some problems were noticed from the reproduced pictures;

- The sliding bar moves in a slightly jerky way.
- The reversing bars are not as designed. They have three different states.

It was also clarified that the signal generator lacks chrominance clearing, hence color signals remaining in the memory appears.

Troubleshooting should be continued. Other organizations are requested to inform their compatibility check results as soon as they become available.

Mr. Randall expressed that DIS will supply new PROMs which include a color feature and one detailed block.

4.7 Draft Recommendation (TD4; #249)

Chairman prepared a framework for the draft Recommendation H.12x which describes a list of items to be specified with some key words, according to the action plan agreed in the previous meeting (see §4.5.3/#246R). After some questions and answers, the meeting requested Mr. Morrison to coordinate a small group meeting with the task of;

a. Deciding a structure of H.12x,
b. Identifying those parts transferable from Doc. #249,
c. Identifying those parts requiring further study, and

d. Deciding a drafting work plan.

The outcome is attached as Annex 4. Chairman stressed that those items requiring further study, indicated with question mark in TD4, should be clarified as soon as possible toward getting Recommendation during this study period.

4.8 Intellectual Properties

4.8.1 Disclosed patents (#262)

BT informed the Group that it applied a patent concerning an implementation of the classifier.

Members were recalled that they are requested to inform the Group as soon as their patents are disclosed (see §8/#181R).

It had been agreed in the Specialists Group that members would make known any new patents related to the Flexible Hardware. It now appears that the policy regarding disclosure to the Specialists Group of such patents varies between companies due to individual company policies and national patent laws. Participating organizations in the group agreed to provide statements regarding their policy on the time of disclosure to the chairman by 30th November 1987. The chairman will distribute these responses to all participating organizations in order to achieve a workable disclosure agreement at the next meeting.

4.8.2 List of known relevant patents (TD3)

Chairman provided a list of known patents which may be relevant to the Flexible Hardware specification based on the contributions submitted to the Group. It was noted that 'being relevant' does not mean 'relevant in a legal sense'.

Mr. Pearson made a comment that it would be beneficial if legal experts are consulted to evaluate these patents in each country.

The meeting recognized that we should continue to search for patents relevant to the Flexible Hardware specification and the possible Recommendation.

4.8.3 Future actions (§4.6/#246R; TD6)

Chairman reported the correspondence with CCITT Secretariat seeking its guidance. The conclusion obtained is that we should follow the content of the CCITT code of practice which is described in Annex 3 to the Part V of the report of WP XV/1 (COM XV-R22).

According to this guidance, Chairman proposed the following actions which the meeting agreed upon.

a. Complete the list of relevant patents as stated in §4.8.1 and §4.8.2.
b. Seek a contribution to the Specialists Group stating the patent holder's licensing policy, if a relevant patent is found.
c. Report the discussion we had in Stockholm, including the BT's proposal to set up a special CCITT group involving legal experts, to the next Working Party XV/1 meeting to be held in November as a part of the Specialists Group progress report.

5. Discussion on m x 64 kbit/s

5.1 Communication procedures (#250)

To form a common background for the discussion of frame structure, Doc. #250 was reviewed, recognizing that the responsibility for this topic is in WPXV/1.

1) Terminal types which should be interworkable: It was pointed out that a 2B type videophone which allocates video to both B channels (VP-C) should be explicitly included in Table 1/Doc.#250, until a standard for 2B type videophone is established.

2) Interworking among audiovisual terminals: There was a comment that not only maximum interworking but also minimum interworking should be indicated in Table 2/Doc.#250.

3) Videophone communications phasing, negotiation protocols, correspondence between frame structures and communication procedures for each phase: These concepts were recognized useful for establishing videophone Recommendations, including that for the frame structure.

5.2 Frame structure

5.2.1 Requirements and candidates (#247, #251, #253, #268, #273)

Priorities to the identified requirements for the frame structure of m x 64 kbit/s videophone were proposed in Doc. #268. Evaluation results of Y.221 against the 'essential' requirements were given in Doc. #273.

The meeting recognized the priorities proposed in Doc. #268 appropriate and felt necessity to review other candidates according to them toward reaching agreements.

5.2.2 Synchronization of two B channels (#269)

A method to use Y.221 FAS was proposed in Doc. #269, where first bits of the FAW of frames 0, 2, 4 and 6 are used for the multiframe numbering. The meeting recognized this proposal as a possible solution.

During the discussion, it was pointed out that there exists an environment where the slip between two B channels occur as in private satellite networks. ISDN, however, ensures a constant delay difference between 2 B channels after the call set-up.

5.2.3 Problems in current Draft Y.221 (#251, #253)

Since Y.221 is intended to provide a common infrastructure to all the audiovisual services, it should also meet such requirements as those specific to videophone.
After some information exchange, the following problems were pointed out to the current draft Y.221 as opinions of Japan (a, b) and PictureTel (a - f).

a. Allocate transmission capacity as much as possible to video for the 1B case, in particular, by efficiently transmitting low speed data signals.

b. Rapid changeover of bit allocation to transmit burst data. Voice activation suffers now around 210 ms delay.

c. Change bit rate during a session. In some general private networks, variable rate transmission capability is provided. The m x 64 kbit/s codec to be standardized is nice if it adapts to such environments as well.

d. Efficient audio coding with variable bit rate.

e. No error correction procedure has been defined. Because of the hardware impact, this aspect should be agreed upon at the same time as the other elements of the frame structure.

f. The format is not byte-oriented.

As to the item b, there was another opinion that this 210 ms delay does not pose a problem compared to the more than 200 ms video coding delay.

5.2.4 Evaluation (#270)

The meeting could not reach an agreement on the m x 64 kbit/s videophone frame structure. We will continue the evaluation further taking into account the requirements with priorities (§5.2.1) and the claimed problems in the current Y.221 (§5.2.3).

Judging from the opinions expressed during the meeting, Chairman requested of each country to consider his following proposal toward the WP XV/1 meeting in November in order to get an agreement at the earliest occasion.

'Y.221 is used for the m x 64 kbit/s video codec after being modified as necessary to provide efficient videophone signals transmission.'

5.3 Picture Format (#248, #264)

European view to support CIF for m x 64 kbit/s as well as n x 384 kbit/s was expressed by responding to the questions raised in Doc. #248. Other countries are requested to present their positions in the next meeting.

During the discussion, the following points were raised,

-For compatibility with 384, more important thing is common coding algorithm than common picture format. It is much easier to realize multiple resolutions in one codec with flexible addressing. (Hein)

-To make equipment cheaper, volume of the same hardware should be increased. It is beneficial for manufactures to provide a worldwide market. (Speidel)

-There is evidence (based on the capabilities of existing switching systems) that the expansion of video services on ISDNs and the transition to broadband networks will be helped if a single codec can operate in the range 64-384 kbit/s. (Nicol)

-mx64 kbit/s terminal can not be only for simple face-to-face videophone. It may work as data base access terminal, motion intermixed graphic terminal, etc. etc., thus the picture format should be flexible. (Haskell)

-U.S. position has not changed from Stockholm. Though 240 x 256 is de facto standards in the US, CIF-64 was proposed with consideration on equal burdenship. (Ericsson)

- We can expect rapid improvements in coding efficiency if we look at this one year achievement. There is possibility to make cheap equipment by using DSPs and dedicated VLSIs. (Geuen)

- Algorithm is much more cost dependent than resolution conversion. Complex algorithm to cope with higher resolution may raise the equipment price. (Bernstein)

-Cost of the algorithm is roughly proportional to the number of pels per second. (Ericsson)

- If the format is reduced at the input, future improvement is restricted by it. (Morrison)

5.4 Source Coding

5.4.1 Algorithm (#265, #266, #267, #275)

A method to reduce the number of bits for motion compensation and to obtain more correct motion field by increasing the correlation of neighboring vectors was presented for information in Doc. #265. For Doc. #266, Doc. #267 and Doc. #275, see §4.3.6, §4.3.4 and §4.3.3, respectively.

5.4.2 Provision of test sequences (§5.5.2/#246R, #274; TD11)

France has distributed 'Claire' sequence to Japan at this meeting, and will send it later to the US after confirmation in Japan. The US and Japan are requested to distribute their sequences as soon as possible.

6. Future Meetings

1) 11th meeting

- Time : January 26 (Tue) - 29 (Fri)
- Place : Tokyo
- Host : NEC and FUJITSU

2) 12th meeting

- Time : March 22 (Tue) - 25 (Fri), tentative
- Place : Netherlands
- Host : DNL

7. Others

It is envisaged that the Specialists Group should continue its activities in the next study period to accomplish the mandates. This will be requested of the Working Party XV/1 in November.

Annexes

Annex 1: Documents for the Red Bank meeting
Annex 2: List of tape demonstrations
Annex 3: Standard transform specification
Annex 4: Report of small group on drafting of Recommendation for nx384 kbit/s

LIST OF PARTICIPANTS
(Red Bank; October 13-16, 1987)

Chairman	S. Okubo	- NTT, Japan
Core Members		
F. R. of Germany	J. Speidel	- PKI
	G. Zedler	- FTZ
Canada	D. Lemay	- BNR (acting for S. Sabri)
USA	M. L. Liou	- BELLCORE (acting for H. Gharavi)
	B. G. Haskell	- AT&T Bell Laboratories
	R. A. Schaphorst	- DIS
France	G. Eude	- CNET
	J. Guichard	- CNET
Italy	M. Guglielmo	- CSELT (acting for L. Chariglione)
Japan	Y. Hatori	- KDD
	N. Mukawa	- NTT
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United Kingdom	D. G. Morrison	- BTRL
Observer		
Korea	J-S. Lee	- ETRI

Annex 1/Doc. #276R

DOCUMENTS FOR THE RED BANK MEETING

Normal Documents

#246R REPORT OF THE NINTH MEETING IN STOCKHOLM (CHAIRMAN)

Points agreed upon and/or left for further study in the previous meeting are recorded to provide backgrounds for the discussion in this meeting.

#247 COMPARISON OF PROPOSALS ON FRAME STRUCTURE FOR mx64 kbit/s CODEC (CHAIRMAN)

This document provides a discussion material for further investigation on the frame structure by summarizing the views expressed in contributions and meetings. Requirements from the system and proposals at hand, Y.221 approach and packet approach, are first recognized. Performance of each proposal to the requirements are described in a matrix form.

#248 DISCUSSION ON PICTURE FORMAT FOR mx64 kbit/s CODEC (CHAIRMAN)

This document provides a discussion material for further investigation of the picture format. The guideline of securing direct inter-regional connectivity, established at the start of sub-primary rate coding study, is first recalled. Proposals at hand, CIF and CIF-64 (reduced format), are next identified. Finally, ten questions are raised to sort out the views expressed in contributions and meetings.

#249 UPDATED SPECIFICATION FOR THE FLEXIBLE PROTOTYPE nx384 kbit/s VIDEO CODEC (CHAIRMAN)

This document is an update of the specification incorporating the amendments agreed in San Jose into Doc. #182. It also provides as Annex the values of programmable items to be used in the initial compatibility checks.

#250 COMMUNICATION CONTROL PROCEDURES FOR mx64 kbit/s VIDEOPHONE (JAPAN)

A communication control procedure is proposed for videophone with considerations on interconnection with other audiovisual terminals. The procedure extends the concept contained in draft G.72y. In order to minimize the complexity in other audiovisual terminals, the proposal divides the procedure into two parts; the first part (AV procedure) is common to all audiovisual terminals while the second part (videophone procedure) is specific to videophone terminals. Some new BAS codes are required for capability exchange, switching to videophone mode and videophone negotiation.

#251 FRAME STRUCTURE FOR mx64 kbit/s VIDEOPHONE (JAPAN)

Requirements for transmitting multimedia signals in the information transfer phase is sorted out for 1B videophone. Problems associated with the draft Y.221 are clarified and two possible methods are provided with details; modification of Y.221 and use of packet format. It is concluded that one of these two methods should be adopted after due consideration of the problems.

#252 PROPOSED ALGORITHM FOR ZERO BYTE REPLACEMENT WITH nx384 kbit/s VIDEO CONFERENCING (AT&T)

An algorithm is proposed to cope with the network restriction of not allowing consecutive zeros. A 384 kbit/s channel is divided into 1.25ms (60 bytes) or 2.5ms (120 bytes) sub-blocks. If a sub-block contains any zero bytes, it is indicated with one bit in the AC. The algorithm consists of the following steps for a typical sub-block.

1) The first byte is replaced with a non-zero number indicating the address of the first zero byte.
2) The first zero byte is replaced with a non-zero number indicating the address of the next zero byte.
3) .....
4) The last zero byte is replaced with a value of the first byte.

#253 FRAME STRUCTURE FOR mx56/64 kbit/s VIDEO TELEPHONY (PictureTel Corp)

Examples on the application to 56/64 kbit/s and 2x56/64 kbit/s are shown to complement the packet approach proposal in Doc. #241. After a comparison is made between Y.221 and the packet approach, problems with Y.221 are summarized.

#254 PROGRESS REPORT OF JAPANESE HARDWARE PROJECTS (NTT, KDD, NEC, FUJITSU)

Current statuses of two projects are reported. In the first project, overall operation at 384 kbit/s transmission is demonstrated with transmission error effects included. Higher bit rate operation is also presented. In the second project, source coder/decoder operation is presented.

#255 ACCURACY OF DCT CALCULATION (NTT, KDD, NEC, FUJITSU)

Required accuracy is discussed from the two points; minimum accuracy for each transform calculation element, and mismatch between coder and decoder processing. The former requirement is summarized as number of bits in each stage; 12, 12 and 16 for transform matrix elements, transfer data and multiplication results, respectively. Rounding-off is stressed for easier implementation. For the mismatch, it is revealed that any difference in the calculation method or accuracy causes visible degradation sooner or later. A conclusion is further study is needed on how to specify the transform hardware in the Recommendation.

#256 STUDIES ON QUANTIZING CHARACTERISTICS BASED ON FLEXIBLE HARDWARE (NTT, KDD, NEC, FUJITSU)

1) Experimental results show finer quantization for chrominance is required due to chrominance dirty window. Reducing the step size for chrominance to half of that for luminance is suggested. It is also reported that halving the dead zone for chrominance gives a similar improvement.
2) Number of quantizing levels are discussed against overload distortion. Low sequency intra AC is problematic in case of still pictures where very low step size is applied. Possible approaches to solve this problem are commented.

3) Required number of quantizers is discussed by reducing it from 17 to 6 in the picture basis feed-forward control. It is reported that the number was not so critical in that range.

#257 EXPERIMENTS ON DISCARDING THE HIGHER PART OF TRANSFORM COEFFICIENTS AND VARIABLE BLOCK SIZE PROCESSING (NTT, KDD, NEC, FUJITSU)

Two experiments have been carried out using a picture basis feedback control. Processed pictures are demonstrated. It is reported that the discarding of higher sequecy coefficients resulted in reduction of mosquito noise without observable loss of resolution, while variable block size processing contributed to reduction of blocking distortion and localizing mosquito noise in smaller areas.

#258 FILTER USED IN NTSC-CIF CONVERSION (NTT, KDD, NEC, FUJITSU)

Aliasing noise generated in case of rapid change, scene-cut in particular, is discussed. Two filter sets for NTSC/CIF conversion are compared to indicate a possibility of reducing the aliasing noise.

#259 PRESENT STATUS OF COMPATIBILITY CHECK USING TEST SIGNAL GENERATOR (NTT, KDD, NEC, FUJITSU)

A Japanese hardware decoder was connected to the DIS test signal generator. It is reported that reproduced picture patterns were as intended, except luminance levels being different from the specification.

#260 ADAPTIVE ZONAL SCANNING FOR A 384 kbit/s VIDEO CODEC (UK)

A scheme to adaptively discard higher sequency coefficients outside a rectangular zone is experimented. The zone consists of 4, 9, 64 coefficients, one of which is selected according to the step size. A significant and visually noticeable improvement in image quality is reported for the Split-Trevor sequence, in particular a reduction in block edge artifacts.

#261 THE TRANSFORM - THE REALITIES (UK)

The following problems are pointed out, which we have to cope with when defining the transform part in the final Recommendation.

1) Quantitative consequences for the mismatch between two inverse transforms in the coder and decoder are not known.
2) Periodic forced updating might solve the problem, but there is difficulty in determining the update period.
3) The implementations of the Flexible Hardware specification are not viable for final products.
4) LSI transform chips can be a solution, but there are problems in availability of CCITT specified transform, multiple sourcing, use of proprietary chip, lack of industry standard.
5) One glimmer of hope is in graphics chip to perform general purpose matrix multiplier.
6) Compatibility with mx64 kbit/s which will be DSP based, thus favors fast algorithm instead of matrix multiplier.

#262 PATENT APPLICATION FOR CLASSIFIER IMPLEMENTATION (BT)

Patent application on a method to implement the classifier is informed.

#263 INFORMATION ON USE OF MESSAGE CHANNEL FOR TELECONFERENCE PROTOCOL (BT)

A message channel to enhance the 'automatic' multipoint system is introduced. This control data channel is employed in a European Project MIAC, having the following features.

- Data rate: 4 kbit/s
- Permanently available for the duration of a teleconferencing session.
- Allows various message routings with MCI.
- Data communication protocol based on the OSI 7 layer model.

#264 COMMENTS ON CCITT DOCUMENT #248 (UK)

Some answers are provided to each question raised in 4 of Doc. #248. It is concluded that CIF should be adopted for 64 as well as 384 kbit/s.

#265 PREDICTIVE MOTION ESTIMATION (SWEDEN)

Simulation results show that the correlation of the motion vector field can be increased by using prediction from previous vectors, thus bit rates necessary for transmitting motion vectors can be substantially reduced by applying DPCM or transform coding to the motion field. The conclusion is that the standard on mx64 kbit/s should be flexible for future algorithm study, e.g. to allow the possibility to transmit motion field information more efficiently.

#266 DEMONSTRATIONS OF HYBRID CODING AT nx384 kbit/s and mx64 kbit/s (NETHERLANDS, FRG, FRANCE)

Coding results are presented, where RM4 is modified by introducing macro blocks. The macro block is reported to reduce the overhead significantly. It is suggested that with the introduction of this attribute, the compatibility towards the 384 kbit/s approach could be guaranteed.

#267 THE EVALUATION OF FILTERING INSIDE THE HYBRID DPCM/TRANSFORM CODING LOOP (NETHERLANDS)

Effects of pixel and transform domain filters are evaluated in the model modified RM4 (with macro block attributes). It is concluded that;

1) Filtering + MC improves SNR by 3-4 dB compared with MC alone, while the improvement becomes 1.5 dB less when compared with Filtering alone.
2) For the pixel domain filtering, a single 3 tap filter seems to be sufficient.
3) Transform domain filtering is performed by scaling of the transform domain coefficients.
4) The high frequency noise can not be further reduced due to the integer motion displacement.

#268 REQUIREMENTS FOR mx64 kbps FRAME STRUCTURE FOR VISUAL TELEPHONY (US)

Requirements and priorities are listed for evaluating all contending frame structures against a common set of requirements. Priorities are defined as

'essential', 'desirable but not essential', or 'nice if it's convenient'. Discussion of the Specialists Group meeting is supported that will evaluate Draft Y.221 against criteria listed here.

#269 PROPOSAL FOR ADDITIONS TO DRAFT RECOMMENDATION Y.221
(BELL COMMUNICATIONS RESEARCH)

The following two amendments are proposed.
1) Provision of synchronization between two B channels by assigning 4 bit patterns (mod 16) to the first bits of the FAW of frames 0, 2, 4, 6 (R1, R2, R3, R4).
2) Making the CRC procedure defined but optional. When the CRC is not used, C1-C4 are set to 1.

#270 FRAME STRUCTURE FOR mx64 kbit/s VIDEOPHONE
(NETHERLANDS, FRANCE, SWEDEN, NORWAY, FRG, UK, ITALY)

This document evaluates different frame structures which appear in Doc. #247, #241+#253 (PictureTel), #250+#251 (Japan) in terms of multiplexing, service aspects and costs. It is concluded that;
1) Y.221 has advantages in ease of implementations on a public network, full interworking with telephony and other AV services, multipoint and call transfer.
2) Two mixed approaches of Japan imply either a change of Y.221 or a packet mode structure which is not yet fully defined.
3) The PictureTel approach does not provide any interworking functions with telephone and other AV services.

#271 VIDEOTAPE ABOUT THE FIRST RESULTS ON THE nx384 kbit/s FLEXIBLE PROTOTYPE
(FRANCE)

Source coder and decoder are operated in different bit rates, 128 kbit/s, 384 kbit/s and 2 Mbit/s, with video multiplex coder simulated in hardware.

#272 MODIFICATION OF 2D-VLC CODE WORDS (NTT, KDD, NEC, FUJITSU)

A specific example of the two-dimensional code set is presented. It differs from the one described in Doc. #224 in the following points;
- 8 bit zero runs are avoided.
- A code word representing zero run length and zero level is added for the underflow protection.
- Maximum number of bits is now 22.

#273 AN EVALUATION OF DRAFT RECOMMENDATION Y.221 AGAINST THE REQUIREMENTS PROPOSED IN THE US CONTRIBUTION (BELL COMMUNICATION RESEARCH)

After evaluating the draft Y.221 against 'essential' requirements in Doc. #269, it is concluded that Y.221 answers most of those requirements. It could be enhanced to allow for synchronization of several channels. It could also be slightly modified to allow operation over 56 kbit/s links. For other 'desirable' and 'nice' requirements, Y.221 demonstrates good performance regarding most of them.

#274 A TAPE CONTAINING A RANGE OF VIDEOPHONE SCENES (DIS)

This contribution describes alternative locations of videophone equipment in the office, describes a video tape containing 9 brief scenes which cover a wide range of videophone locations and camera fields of view, and stimulates thought to be sure that the mx56/64 kbit/s codec is designed for the most representative videophone scene(s).

#275 ADAPTIVE ZONAL SCANNING FOR A 64 kbit/s VIDEO CODEC (UK)

Companion contribution to #260.

Temporary Documents

No. 1 Agenda (Chairman)
No. 2 Available documents (Chairman)
No. 3 Patents relevant to the Flexible Hardware specification (Chairman)
No. 4 Framework for draft Recommendation H.12x (Chairman)
No. 5 List of tape demonstrations (Chairman)
No. 6 Correspondence with CCITT Secretariat on intellectual properties related to Recommendations (Chairman)
No. 7 Standard transform specification (Mr. Haskell)
No. 8 Report of small group on drafting of Recommendation for nx384 kbit/s (Mr. Morrison)
No. 9 Draft report of the tenth meeting in Red Bank (Chairman)
No.10 Enhancements to the test signal generator (DIS)
No.11 Questionnaire for the 64 kbit/s application (DIS)

Annex 2/Doc. #276R

LIST OF TAPE DEMONSTRATIONS (October 13, 1987)

Topics	Source	Document
a. Flexible Hardware overall performance (First project)	Japan	#254
b. Discarding higher sequency coefficients	Japan	#257
c. Variable block size	Japan	#257
d. Chrominance overload for color bar signal in forced update	Japan	#256
e. Flexible Hardware progress (Second project)	Japan	#254
f. CIF conversion filters	Japan	#258
g. Flexible Hardware at 128 kbit/s, 383 kbit/s, 2 Mbit/s	France	#271
h. Flexible Hardware, MC + Filter	UK	-
i. Zonal coding at 384 kbit/s	UK	#260
j. Zonal coding at 64 kbit/s	UK	#275
k. mx64 kbit/s MARIS hardware at 64 kbit/s and 96 kbit/s	UK	-
l. Mismatch in DCT calculation	Japan	#255
m. Flexible Hardware performance at 1.5 Mbit/s	Japan	#254
n. Decoded picture for Test signal Generator	Japan	#259
o. Effect of transmission errors to Flexible Hardware	Japan	#254
p. Quantizer optimization	Japan	#256
q. Macro block technique at 384 and 5x384 kbit/s	FRG	#266
r. Predictive motion estimation at mx64 kbit/s	Sweden	#265
s. Macro-block technique at 64 kbit/s (Claire + Miss America + Trevor)	France	#266
t. Loop filter comparison at 64 kbit/s	NL	#267
u. Hybrid coding at 384 kbit/s and 64 kbit/s	NL	#266
v. Hardware coded picture at 64 kbit/s	Norway	-
w. Videophone scenes	US	#274

Annex 3

STANDARD TRANSFORM SPECIFICATION

A small group met to discuss the problem of transform specification. Experimental results (Document #255) indicate that there is likely to be picture quality degradation if the inverse transforms at the coder and decoder do not match. Several possible solutions were examined:

1. Write a specification for a matrix multiplier implementation, as was done for the flexible hardware.

2. Write an accuracy specification in order to allow for alternative implementations that do not follow exactly the standard transform.

3. Write a specification for a fast algorithm implementation.

4. Accept an existing chip design.

Solution 1 was objected on the basis that it might preclude availability of chips. Solutions 1 + 2 or 2 + 3 have the drawback that much experimental work is required and, moreover, a specification on cyclic refresh is needed. Thus, it was decided to pursue solution 4.

For this purpose, the letter below was drafted. We plan to send it to all potential chip manufacturers and solicit their interest in having a design considered for standardization.

LETTER

Dear Sirs and Mesdames

The CCITT video coding experts group is currently finalizing a standard for ISDN video conferencing at channel bit-rates of n x 384 kbits/sec, where n varies from one to five. Part of this standard algorithm involves a separable transform of 8 x 8 blocks of data, and for this we will require a VLSI chip implementation. We hereby solicit proposals for a chip design that will be designated as a CCITT standard.

The chip design should have the following properties:

1. Forward transform input 9-bits signed, output 12-bits signed, approximating a DCT.
2. Inverse transform input 12-bits, output 9-bits.
3. Back-to-back operation as transparent as possible.
4. Transform algorithm amenable to DSP implementation.
5. Low cost, high availability, etc., etc., etc.

In addition, could each proposal address the following questions:

1. Which patents are relevant? Is non-discriminatory licensing available? What are the terms?
2. When will a technical specification exist?
3. When will samples exist? Price?
4. When will chips in quantity be available?
5. Will there be second sources?
6. Can mask data be licensed? Symbolic data?
7. What market size is required?

We look forward to your response by January 1, 1988. Please send to:

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Annex 4

REPORT OF SMALL GROUP ON DRAFTING OF RECOMMENDATION FOR N X 384 kbit/s

The group decided that TD4 was a suitable structure for Recommendation H.12x.

For the first draft, lines beginning with numbers will be included. Parts which can be expanded and presented to the next meeting of the specialists group are 1, 2, 3.1 and some items in 6.

Mr. Morrison will prepare the draft by November 20, and distribute (by electronic mail, if possible) to Messrs. Haskell, Guglielmo, Guichard, Speidel, Plompen, and Mukawa. Comments will be received by the end of 1987, and the resulting document made available at the Tokyo meeting in January.

D. G. Morrison
October 15, 1987