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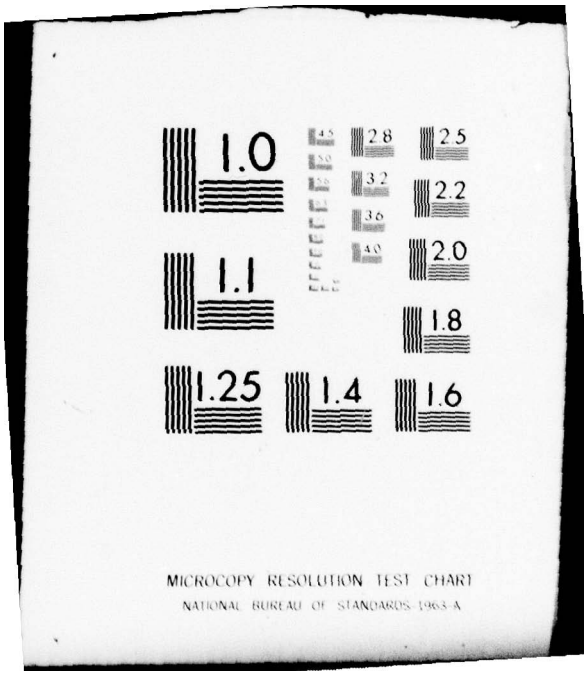
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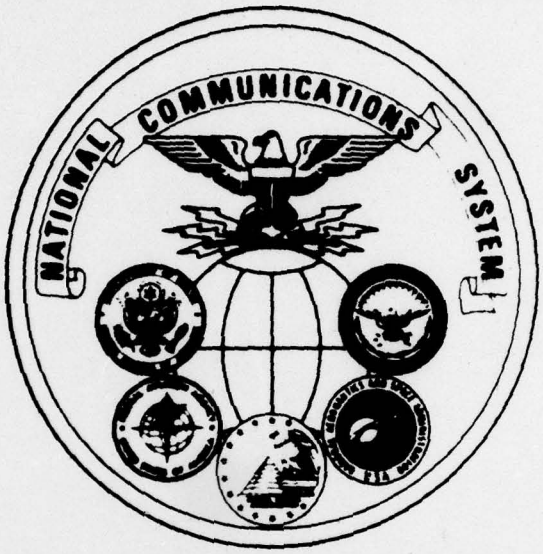

TECHNICAL INFORMATION BULLETIN 79-7

CCITT CRITERIA FOR THE EVALUATION OF TWO - DIMENSIONAL FACSIMLE CODING TECHNIQUES

AUGUST 1979

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This Technical Information Bulletin (TIB) describes the USA contribution submitted to CCITT Study Group XIV (COM XIV - No. 66-E) on proposed evaluation criteria for facsimile compression algorithms. The basis for this contribution is contained in NCS TIB 79-6. In addition, CCITT contribution COM XIV - No. 70-E delineates modifications to Contribution COM XIV - No. 66E.

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NCS TECHNICAL INFORMATION BULLETIN 79-7

CCITT

CRITERIA FOR THE EVALUATION OF

TWO-DIMENSIONAL FACSIMILE CODING TECHNIQUES

AUGUST 1979

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FOREWORD

Among the responsibilities assigned to the Office of the Manager, National Communications System, is the management of the Federal Telecommunication Standards Program which is an element of the overall GSA Federal Standardization Program. Under this program, the NCS, with the assistance of the Federal Telecommunication Standards Committee, identifies, develops, and coordinates proposed Federal Standards which either contribute to the interoperability of functionally similar Federal telecommunication systems or to the achievement of a compatible and efficient interface between computer and telecommunication systems. In developing and coordinating these standards a considerable amount of effort is expended in initiating and pursuing joint standards development efforts with appropriate technical committees of the Electronic Industries Association, the American National Standards Institute, the International Organization for Standardization, and the International Telegraph and Telephone Consultative Committee of the International Telecommunication Union. This Technical Information Bulletin presents an overview of an effort which is contributing to the development of compatible Federal, national, and international standards in the area of digital facsimile standards. It has been prepared to inform interested Federal activities of the progress of these efforts. Any comments, inputs or statements of requirements which could assist in the advancement of this work are welcome and should be addressed to:

Office of the Manager
National Communications System
ATTN: NCS-TS
Washington, D.C. 20305
(202) 692-2124

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BACKGROUND

NCS Technical Information Bulletin (TIB) 79-6 described proposed criteria to evaluate the relative technical/economic merits of competing two-dimensional compression algorithms to CCITT Study Group XIV for adoption as an international standard. Appendix A of the above document contained a draft proposed contribution by the United States of America to the CCITT entitled "Criteria for the Evaluation of Two-Dimensional Coding Techniques for use in Digital Facsimile Terminals."

The proposed USA contribution was reviewed by the Electronic Industries Association TR 29 Committee on "Facsimile Systems and Equipment." Several changes were made and incorporated with the original proposal. Appendix 1 of this TIB contains the actual USA contribution (COM XIV - No. 66-E) submitted to the CCITT.

CCITT Study Group XIV, at their December 1978 Working Panel meeting, held in Geneva, agreed in general with the measurement parameters contained in the USA proposal. Some changes were deemed appropriate and are identified in Appendix 2 of this TIB (COM XIV - No 70-E).

The principal purpose of this TIB is to bring together in one place the criteria which has been adopted by the CCITT to evaluate competing facsimile coding techniques submitted by member countries for adoption as an international standard.

NCS TIB 79-7

A P P E N D I X 1

UNITED STATES OF AMERICA

TECHNICAL CONTRIBUTION TO THE

INTERNATIONAL TELEGRAPH AND TELEPHONE

CONSULTATIVE COMMITTEE

(CCITT)

STUDY GROUP XIV

CRITERIA FOR THE EVALUATION OF TWO-DIMENSIONAL CODING TECHNIQUES FOR USE IN DIGITAL FACSIMILE TERMINALS

International Telegraph and Telephone
Consultative Committee
(CCITT)

COM XIV-No. 66-E*)

Period 1977-1980

Original : English

Question : 2/XIV

Date : January 1979

STUDY GROUP XIV - CONTRIBUTION No. 66

SOURCE : UNITED STATES OF AMERICA

TITLE : CRITERIA FOR THE EVALUATION OF TWO-DIMENSIONAL CODING TECHNIQUES FOR USE IN DIGITAL FACSIMILE TERMINALS

1. SUMMARY

This document proposes the use of four criteria for the evaluation of two-dimensional coding techniques for use in digital facsimile terminals.

* Compression Factor
* Error Sensitivity Factor
* Cost of Implementation
* Compatibility with other Facsimile Codes

The proposed criteria are applicable for both Group 4 machines and the optional extension of the Group 3 machine to include a two-dimensional code. The proposal is applicable for both the normal resolution (3.85 lines/mm) and high resolution (7.7 lines/mm) scanning standards.

*) Contribution retardée publiée seulement dans la langue reçue (anglais), sans traductions supplementaires, conformément aux dispositions de la Résolution N° 1, paragraphe III.4.d) adoptée par la VIe Assemblée (1976).

Late Contribution published only in the language received (English), without further translations, in accordance with Resolution No.1, paragraph III.4.d)VIth Plenary Assembly (1976).

Contribución retardada publicado sólo en el idioma en que se recibió (inglés), sin otras traducciones de conformidad con la Resolución N.°1, párrafo III.4.d), VI Asamblea Plenaria (1976).

2. BACKGROUND

The CCITT is actively reviewing and considering the standardization of two-dimensional coding techniques for both Group 4 machines and the optional extension of the Group 3 one-dimensional code[1]. In the future, consideration will also be given to coding techniques for Group 4 apparatus[2]. Several papers have been published recently describing particular two-dimensional coding techniques and their performance in terms of compression ratio and error sensitivity[3,4,5]. Unfortunately, it is difficult to compare the results of different coding techniques and different investigators because the performance measurements are frequently not carried out under the same conditions. The primary purpose of this document is to define a set of pragmatic test conditions in sufficient detail so that all organizations that wish to have a coding technique selected as a standard by the CCITT will have guidelines to follow to insure all proposals will be evaluated on a common, meaningful basis.

Much has been proposed to the CCITT and published in the literature relative to the subject of this paper. This proposal has attempted to draw upon and integrate this prior work as much as possible. Section 4 is a list of references which have been noteworthy and helpful.

3. PROPOSED CRITERIA

3.1 Compression Factor

3.1.1 Test Documents

Experimenters in the field of facsimile data compression have utilized a wide range of test documents to measure compression ratio and error sensitivity. The 8 CCITT test documents have achieved a wider range of acceptance than other documents and are somewhat representative of the pages likely to be transmitted through digital facsimile systems. Consequently, the 8 CCITT documents have been selected for use in the evaluation process described herein. The French PTT Administration has scanned these 8 CCITT documents at both the standard and high resolutions as specified for Group 3 machines. They have also quantized each pel to be either black or white and stored the resultant image on magnetic tape. Further, the French PTT has provided copies of these tapes to experimenters in the data compression field so that facsimile performance data can be compared on a meaningful basis. For these reasons, it is recommended that the measurements proposed herein be performed using the tapes supplied by the French PTT Administration.

3.1.2 Measurement of Compression Factor (CF)

Any proposed encoding technique must be fully defined in sufficient detail to permit other investigators to duplicate the performance measurement process. The Compression Factor (CF) will be determined for each of the 8 CCITT test documents and for both the standard and high resolution.

The first step in the measurement process is to simulate the encoding function and accumulate a count of the code bits required to transmit each document. The CF for each document is then computed by dividing the total number of picture elements (pels) per test page* by the number of transmitted code bits.

---

* The picture tapes from the French PTT contain the following pels
Standard Resolution - (1064 lines) (1728 pels/line) = 1,838,592 pels
High Resolution - (2128 lines) (1728 pels/line) = 3,677,184 pels

Two different compression factors will be determined. The first establishes the CF of the basic algorithm and excludes overhead (for example synchronization and fill bits) from the transmitted code bits. This parameter is not only useful to represent the performance of the basic algorithm but also closely approximates the actual compression performance which will be achieved when operating in a Group 4 configuration. For this reason the compression factor is designated CF_4.

The second compression factor parameter (CF_3) is designed to represent the compression ratio when the algorithm is employed in a typical Group 3 machine. In this case all overhead such as the beginning-of-message, end-of-line, end-of-message, and fill bits are included in the code bits. Fill bits will be generated assuming a minimum line transmission time of 10 ms and a transmission bit rate of 4800 bits/sec. Although 10 ms is not the standard minimum line transmission time, it has been selected because it is expected that two-dimensional coding techniques will provide a higher compression ratio than the standard Group 3 machine.

3.2 Error Sensitivity

This section describes the criteria for evaluating the sensitivity of two-dimensional coding techniques to transmission errors. The criteria are valid for Group 3 machines. Measurement of error sensitivity is required for standard resolution (3.85 lines/mm) and for high resolution (7.7 lines/mm).

To evaluate the error sensitivity, both the coding technique and the decoding algorithm must be completely defined and disclosed in sufficient detail to permit computer simulation by any experimenter. If more than one decoding algorithm is proposed (for example, to achieve differing levels of error control), each must be tested separately and fully disclosed.

Both an Objective Measure and a Subjective Measure of error sensitivity will be provided. The Objective Measure will provide a numerical estimate of error-sensitivity, while the Subjective Measure will provide pictorial material for committee evaluation.

3.2.1 Objective Measure

The Objective Measure of error sensitivity is obtained by selecting test documents, encoding them with the proposed technique, subjecting the resulting bit stream to transmission errors, decoding the transmission to obtain the received image, and comparing the original image with the received image to determine the number of pels in error.

3.2.1.1 Test Documents

The Test Documents to be used for the error sensitivity test are CCITT Test documents 1, 4, and 7. Each of the documents would be coded according to the proposed coding technique. All overhead will be included. This encoding will have been done as part of the measurement of Compression Factor for Group 3 Machines (see section 3.1.2).

3.2.1.2 Error Patterns

A record of actual bit errors incurred over telephone lines will be established as a test standard condition. This will be obtained by transmitting a known pseudo-random sequence at 4800 bits/sec. using a V27 ter modem over a switched telephone

network. The average bit error rate will be approximately 1×10^{-3} (between 7×10^{-4} and 1.4×10^{-3}), and the length will be at least 10^6 transmission bits (corresponding to about 3.5 minutes of transmission time). Measurements of this type have already been made by the Federal Republic of Germany [4,6,7] and may be available to experimenters for this purpose. The measured error record will be converted to the bit locations of errors and can be supplied on magnetic tape or punched cards.

The supplied error record is applied to the encoded transmission, causing a bit reversal at each point where an error is indicated. There will be three runs for each normal resolution (3.85 lines/mm) test document. For the first run, the first bit of the error record is aligned with the first bit of the encoded transmission. For subsequent runs, the transmission is delayed 1,024 bits relative to the previous run so as to obtain a different phasing of errors relative to critical code words. A count is made of the number of errors that actually impinge on each transmission.

3.2.1.3 Decoding Transmission

The transmission containing errors is then decoded by the proposed decoding algorithm to produce a received image. The decoding algorithm should define the polarity of every pel in the output image. If, for some reason, the proposed algorithm does not define a pel value, it will be arbitrarily set to white. Note that any error correction schemes may be used providing they are fully disclosed as part of the proposed coding techniques.

3.2.1.4 Error Calculation

Each pel of the received image is compared to the corresponding pel in the original image to determine if it matches, or if it is in error. A count of the number of pels in error is made. In general, there is one scan line in the output image for every line in the input image. Occasionally, however, a transmission will cause an entire line to be dropped, or an extra line to be added. When this occurs the comparison algorithm will assess the appropriate error count for the first time that the original line is matched against a different line in the received image. After this, the corresponding lines will be compared. This will prevent a line count error, which is barely noticeable, from causing a large number of errors on the rest of the page.

The Error Sensitivity Factor (ESF) is calculated as the total number of pels in error divided by the total number of transmission bits that are in error. This calculation is performed for each run of each test document.

The average ESF for each test document is calculated as:

$$ESF_{avg} = \frac{ESF_1 + ESF_2 + ESF_3}{3}$$

In order to determine the statistical significance of the average ESF, the estimate of the standard deviation of the average ESF is calculated as:

$$\sigma_\ell = \left[\frac{(ESF_1)^2 + (ESF_2)^2 + (ESF_3)^2 - 3(ESF_{avg})^2}{6} \right]^{\frac{1}{2}}$$

The standard deviation of the estimate of the ESF is useful as a check on the adequacy of the sample size and gives an indication of whether measured differences between the ESF's of contending coding techniques are statistically significant. As a rule of thumb, the difference between the average ESF's should be equal to or greater than the sum of their standard deviations to be considered statistically significant.

3.2.1.5 High Resolution Simulation

The Error Sensitivity Factor will be determined for high resolution data by performing only two simulation runs rather than three. This is justified due to the greater number of bits in the high resolution image. In this case the standard deviation is calculated as:

$$\sigma_h = \left[\frac{(ESF_1)^2 + (ESF_2)^2 - 2(ESF_{avg})^2}{2} \right]^{\frac{1}{2}}$$

3.2.2 Subjective Measure

Each of the ten received images generated for the Objective Measure will be made into a hard-copy image using a high-quality (high resolution, high contrast) process. It is hoped that a common facility will become available for reproducing high-quality images from magnetic tape, or that a recommendation will be made for a suitable machine to be used by experimenters.

The images will be evaluated by the committee to determine the Subjective nature of the errors. This will include how noticeable the errors are, how objectionable they are, and an overall judgment of image quality.

3.3 Cost of Implementation

The cost to implement the candidate coding techniques is one of the important parameters in the selection process. Unfortunately, it is unrealistic to expect, or request, equipment design information from organizations proposing a compression algorithm. In addition, different vendors of facsimile equipment would probably implement a given algorithm in a variety of different ways depending upon the volume of manufacture and other factors. Having recognized the difficulty of quantitatively measuring this parameter there are two general comments listed below which apply.

* Most of the circuitry used to implement the candidate coding is digital and consequently benefits from the continuous cost reduction of digital components. Therefore, the cost differential between alternative techniques will probably diminish with time.

* It is essential that a proposed coding technique be internationally available. Should an algorithm not be offered royalty free, a full licensing disclosure must be submitted with the proposal.

3.4 Commonality with other Facsimile Machines

3.4.1 Group 3/Group 4 Compatibility

It is possible that the ideal code for the Group 4 machine would differ from the ideal code for the Group 3 extension from the one-dimensional code. The best overall performance for Group 3 and Group 4 systems must be taken into account.

It is very critical for the two possible Group 3 machines (one-dimensional code, and two-dimensional code) to be compatible. To minimize the cost of this compatibility it would be desirable to select a two-dimensional code which is based upon an extension of the one-dimensional code as much as possible.

3.4.2 Machines with Greater Document Width

It is desirable to select a compression algorithm which can be economically extended for application to documents wider than that for the Group 3 machines. For example, it may be desired to double the document width so that a total of 3,456 pels/line would be transmitted. It would then be advantageous for the code for the wide document to be merely an extension of the normal width code for reasons of compatibility and cost minimization.

3.5 Relative Importance of the Criteria

One major purpose of this document is to assist persons or committees in selecting a standard facsimile coding algorithm. Toward this end it would be helpful to rank the four evaluation criteria in terms of their relative importance. Unfortunately, this is very difficult to do because of the widely varying perspectives and orientations of different committees and committee members. For example, it is inevitable that facsimile manufacturers and common carrier organizations would view the evaluation parameters differently. In addition, the market orientation of a vendor will greatly affect his position on the evaluation criteria. For example, a company which manufactures high volume products which stress conventional picture quality would view the situation very differently from a vendor who stresses the low volume/high quality market. Having recognized the difficulty of precisely ranking the criteria, the following general comments are provided for each of the evaluation parameters.

Compression Factor

It is very possible that the Compression Factor of the candidate compression techniques will not vary widely, in which case this parameter may not be critical in the decision process. If, however, one coding alternative exhibits an unusually high or low Compression Factor, this parameter would obviously become important.

Error Sensitivity

The Error Sensitivity Factor relates to Group 3 machines and not to Group 4 machines. This parameter is particularly difficult to rank due to the potential high degree of interaction with other evaluation criteria. For example, some facsimile systems can automatically reduce the transmission rate to the point where an acceptable error rate is achieved. This results in a trade-off between error sensitivity and transmission rate.

Another trade-off could exist between error sensitivity and implementation cost. At one extreme could be a compression system which is very sensitive to transmission errors but which employs a very complex post-decoder, error-reduction scheme to minimize the visual effect of errors. At the other extreme could be a coder which inserts sufficient redundancy into the transmitted code to correct for some transmission errors. In this case, the system is relatively insensitive to channel errors, may be less expensive, and would have a reduced compression ratio.

Cost of Implementation

This parameter could become important for some candidates which involve very complex error correctors or large buffers. Refer to paragraph 3.3 for other cost considerations.

Compatibility with other Facsimile Machines

The compatibility issue between Group 3 and Group 4 machines is discussed in Section 3.4.1. It is highly desirable that the structure of the two-dimensional code be as similar as possible to the one-dimensional Group 3 code and that it be extendable to greater document widths.

Tabulation of Quantitative Evaluation Criteria

Table 1.0 is a form for the tabulation of the quantitative evaluation criteria - Compression Factors and Error Sensitivity Factors.

PARAMETER		VERT. RESOL.	CCITT TEST DOCUMENT NUMBER							
			1	2	3	4	5	6	7	8
Compression Factor (CF)	CF_4 Algorithm	3.85								
		7.7								
	CF_3 Group 3	3.85								
		7.7								
Error Sensitivity Factor (ESF)	Phase 1	3.85								
	Phase 2	3.85								
	Phase 3	3.85								
	Phase 1	7.7								
	Phase 2	7.7								

TABLE 1.0 TABULATION OF QUANTITATIVE EVALUATION CRITERIA

4. REFERENCES

1. CCITT Study Group XIV, "Report of the Meeting held in Geneva," 14-18 November 1977, December 1977.

2. United States of America, "Guidelines to Establish Standardizations of Group 4 Apparatus," CCITT Study Group XIV - Contribution XIV - Contribution No. 36E, June 1978.

3. Japan, "Proposal Concerning Selection of Two-Dimensional Coding System for Redundancy Reduction," CCITT Study Group XIV - Contribution No. 15, September 13, 1977.

4. CCITT Study Group XIV, "Report of the Meeting held in Geneva," 14-18 November 1977, December 1977.

5. Japan, "Proposal for Draft Recommendation of Two-Dimensional Coding Scheme," CCITT Study Group XIV - Contribution No. 42, August 1978.

6. Federal Republic of Germany, "Sensibility of Redundancy Reducing Codes to Transmission Bit Errors," CCITT Study Group XIV - Contribution No. 5, February 1977.

7. Federal Republic of Germany, "Part 1 - Comments by the Administration of the Federal Republic of Germany on the choice of a coding system for Group 3 facsimile machines; Part 2 - Proposal for the Improvement of Line Synchronization for Group 3 Facsimile Machines," CCITT Study Group XIV - Contribution No. 14, August 1977.

8. French Administration, "Method for Evaluating the Error Sensibility of Coding Systems for Digital Facsimile Machines," CCITT Study Group XIV - Contribution No. 4, March 1977.

9. United Kingdom Post Office, "The Effect of Transmission Errors on the EIA Modified Huffman Code and the Development of an Improved Huffman Code" CCITT Study Group XIV - Contribution No. D4, November 1977.

10. Special Rapporteur, "Minutes of Meeting of the Special Rapporteur Group on Group 3 Machines held in Paris from 2 to 5 November 1976, "CCITT Study Group XIV - Contribution No. 7, March 1977.

APPENDIX 2

CCITT DOCUMENT COM XIV NO 70-E

REPORT OF THE MEETING HELD IN GENEVA, 11-15 DECEMBER 1978

International Telegraph and Telephone
Consultative Committee
(CCITT)

Period 1977-1980

COM XIV-No. 70-E

Original : English

Date : January 1979

STUDY GROUP XIV - CONTRIBUTION No. 70

SOURCE : STUDY GROUP XIV AND ITS WORKING PARTIES

TITLE : REPORT OF THE MEETING HELD IN GENEVA, 11-15 DECEMBER 1978

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Note by the CCITT Secretariat : The reports of the Working Parties published in this document are not yet approved by Study Group XIV.

SECTION I

PLENARY MEETING

1. Introduction

The meetings of Working Parties XIV/1, 2 and 3 were held at ITU Headquarters in Geneva from Monday 11 to Friday 15 December 1978.

Prior to these Working Parties' meetings the Plenary of Study Group XIV was held in the morning of 11 December under the chairmanship of Mr. M. Blanc (France) in order to discuss certain urgent matters such as facsimile protocols in PDN, and standardization of the fourth group document facsimile apparatus which require guidance by Study Group XIV for work by its Working Parties.

The list of participants in the meeting is published as Annex 1 to this Report.

2. Meeting schedule for the rest of the current study period

The Secretariat informed the Study Group of its tentative meeting schedule for the rest of the current study period, as follows :

- the third meeting of Study Group XIV and its Working Parties - 18-22 June 1979, (as announced in CCITT Circular-letter No. 107, 17 July 1978),
- the final meeting of Study Group XIV - spring 1980.

The date of the next meeting mentioned above had been fixed before the decision of deferring the current meeting from August/September 1978 was made, and therefore the interval between now and the next meeting seems rather too short. The Secretariat indicated the possibility of holding the next meeting towards the end of 1979, although it may result in a similar situation between the third and the final meetings.

The Study Group agreed that the date of the next meeting will be fixed taking account of the result of the current meeting.

3. Working schedule of the current meeting

The meeting agreed the following working schedule as proposed in Collective-letter No. 48 :

	a.m.	p.m.
11 December (M)	XIV plenary	WP 1
12 December (Tu)	WP 3	WP 2
13 December (W)	WP 3	WP 2
14 December (Th)	WP 3	WP 2
15 December (F)	WP 3	WP 2

The Study Group also agreed that Working Party 1 may hold an additional half-day meeting in order to examine the report on the first day meeting sometime at the end of the meeting.

4. Collaboration of Study Groups concerned in the study of facsimile and teletex control procedures

For the study of the above-mentioned subject, Special Rapporteurs have been designated in Study Groups I, VII, VIII and XIV.

In order to identify the area of work within each Rapporteur's Group and to formulate a rational interworking philosophy in order to minimize duplication and to avoid conflicting results, the Special Rapporteurs involved met recently at the British Post Office Research Centre, Ipswich, England.

The draft Report of this meeting was presented in COM XIV-No. 57 by Dr. A.H. Robinson (BPO) on behalf of Mr. A.T. Bence, Study Group XIV Special Rapporteur for this Question.

The meeting approved this Report will the following comments :

- point 3.1, read the first paragraph : "Study Group VII to define the structure of the models";
- point 3.2, read the last line : "Special Rapporteur (Study Group XIV); Study Group XIV representative at the Study Group I Special Rapporteur's Group on FACSIMILE service";
- point 3.5 Joint Meetings of the protocol group.

The Study Group authorized Mr. Bence to hold joint VII/XIV meetings as proposed here, provided that its result should be published as White Contributions.

In this connection Administrations*) are requested to submit contributions on this subject.

COM XIV-No. 52 (Study Group VII) was presented by Mr. S. Tomita, Special Rapporteur on Question 35/VII. This paper summarizes points to be studied for implementation of facsimile service in the public data networks and also stresses the importance of establishing a close collaboration with Study Group XIV in this study. Mr. Tomita added that in light of the outcome of the Ipswich meeting, subjects for study listed in this paper will have to be reviewed at the next Study Group VII meeting in April 1979.

The meeting, after examining these documents, concluded that no special action or change of working organization will be required at this point in time for further study of the protocol question.

5. Standardization of Group 4 apparatus

Several contributions which propose the standardization of the fourth facsimile apparatus were submitted to the current meeting.

Before entrusting the study of such a machine to the competent Working Parties, the Study Group considered that the principle on the need of Group 4 apparatus should be established.

After lengthy discussion, the Chairman summarized the majority views as follows :

- Group 3 apparatus should be for use over general switched telephone network as presently defined in Recommendation T.0.

- The majority are in favour of standardizing Group 4 apparatus and it should be designed primarily for use over the public data networks, taking into account new services, (e.g. teletex) or user facilities provided by these networks.

- compatibility between Group 3 and Group 4 apparatus should be maintained.

The Study Group, noting that Study Group I facsimile group will meet in January 1979, agreed that the opinion of Study Group I on this subject, in particular interworking possibility of the different groups of machines, should be sought. A paper for such an enquiry to Study Group I will be drafted by a small drafting group during the meeting.

The meeting concluded that further study of Group 4 machine should be carried out by Working Parties 2 and 3 with a view to defining the apparatus in the light of contributions and various views expressed during this Plenary session.

6. Others

Due to the shortage of time, the Study Group did not examine contributions to those Questions to be dealt with directly by the Plenary and left them for further study.

As for Contribution COM XIV-No. 29(CCIR) on Maritime Mobile Satellite Service, Mr. Otaki (CCIR Secretariat) informed the meeting briefly of further development of study in CCIR, making reference to CCIR Report (588-1) on "Black and White facsimile transmissions over combined metallic and radio circuits in the Maritime Mobile Service and in the Maritime Mobile Satellite Service" which was approved at their XIVth Plenary Assembly (Kyoto, 1978).

7. Republication of delayed contributions as white documents

In accordance with the original objective of "delayed contributions" the meeting endeavoured to reduce to the minimum the number of delayed contributions to be reissued as white documents. These reissued documents will however be published only in the language(s) received.

Study Group XIV requested the CCITT Secretariat to make reference to these delayed contributions in the Final Report of the meeting.

A list of all delayed contributions published during the meeting is given in Annex 2 to Section I of this report. Those who wish to have a copy of the delayed contributions which have not been reissued are requested to address themselves to the author organizations.

Annexes : 2

Annexe 1
(à la Section I)

LISTE DES PARTICIPANTS

Annex 1
(to Section I)

LIST OF PARTICIPANTS

Anexo 1
(à la Sección I)

LISTA DE PARTICIPANTES

Président :
Chairman : M. M. BLANC (France - Francia)
Presidente :

Allemagne, R.F. - Germany, F.R. - Alemania, R.F.	**MM. F. BARDUA**
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Danemark - Denmark - Danimarca	**N. VINKEL**
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Western Union International	**M. FELDMAN**
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SIP	**A. RICCI**
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KDD	**N. FUJI** **Y. KAWASUMI** **H. TERAMURA** **M. TSUKADA** **Y. YAMAZAKI**
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Pays-Bas - Netherlands - Países Bajos	**E.J. DE JONG** **M.E. GOLDBACH**

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Kalle Infotec	R. REUTER K. SATO
Rank Xerox	H. MAHR
SEL	H. HAMPEL
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CCITT SECRETARIAT
SECRETARIA DEL CCITT

MM. L. BURTZ, Directeur, Director
E. HUMMEL, Conseiller supérieur, Senior Counsellor, Consejero superior
T. OKABE, Conseiller, Counsellor, Consejero

Annexe 2 (à la Section I)

Annex 2 (to Section I)

Anexo 2 (à la Sección I)

LISTE DES CONTRIBUTIONS TARDIVES PUBLIEES PENDANT LA REUNION

LIST OF DELAYED CONTRIBUTIONS PUBLISHED DURING THE MEETING

LISTA DES CONTRIBUCIONES TARDIAS PUBLICADOS DURANTE LA REUNION

Note : Pour plus de renseignements sur les contributions tardives non publiées sous forme de documents "blancs", on est prié de s'adresser aux organisations qui ont présenté ces contributions.

Note : For further information on these delayed contributions which have not been re-issued, please address directly to the author organizations.

Observación : Para más detalles sobre las contribuciones tardias no publicados como documentos blancos, se ruega dirigirse directamente a las organizaciones que las han preparado.

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N°	Question Cuestión	Origine Source Origen	Titre Title Título	Publié comme Re-issued as Republicado como
D.1		Siemens-Hell	Minimum line transmission time for Group 3 equipment	
2		IBM Europe	Proposed new question for the study of the definition of a new digital document transmission apparatus for operation on public data networks and the general telephone network	COM XIV-No. 59
3		CIT ALCATEL & Graphic Sciences	Group 3 machine control procedure Procédure de commande des appareils du Groupe 3	COM XIV-No. 60
4		Muirhead Ltd.	Proposed rules governing the T.30 Protocol	
5	8/VIII 7B/XIV 8/XIV	IBM Europe	Control procedures for end-to-end document exchange	COM XIV-No. 62/ COM VIII-No. 85
6		3M Company	Proposed tolerance on the index of cooperation for Group 3 apparatus	
7		USA	High-speed digital facsimile service	
8		KDD	Standardization of common protocol to general switched telephone network and public data network for facsimile communications	COM XIV-No. 63
9		IBM Europe	Proposal for two-dimensional coding scheme	COM XIV-No. 64
10	2/XIV, pointB	Kalle Infotec	Performance of Group 3 facsimile machines using 16 point (4 x 4) QAM modem	
11	2/XIV, 7A/XIV	Kalle Infotec	Comments on definition of Return to Control (RTC)	

N°	Question Cuestión	Origine Source Origen	Titre Title Título	Publié comme Re-issued as Republicado como
D.12	7/XIV point A2	Kalle Infotec	Proposed amendment to the line control procedure for Group 3 machines	
13		Siemens-Hell	Implementation of a 2-minute mode for Group 2 apparatus (amendment of Rec. T.30)	
14		Siemens-Hell	Implementation of a 2-minute mode for Group 2 apparatus (Amendment of Rec. T.3)	
15	3/XIV	Fed.Rep.Germany	Proposed amendment to Recommendation T.3	
16	2/XIV	AT & T	Selection criteria for advanced facsimile coding schemes	COM XIV-No. 65
17	2/XIV	USA	Criteria for the evaluation of two-dimensional coding techniques for use in digital facsimile terminals	COM XIV-No. 66
18	3/XIV, 7/XIV	SECRE France	2-minute mode of operation of Group 2 facsimile apparatus	
19	6/XIV	ITT Corp.	Two minute mode operation of Group 2 terminals (proposed amendment of Rec. T.30 and T.3)	
20	7/XIV	France	Principes d'identification automatique d'un appareil récepteur appelé	COM XIV-No. 67
21	2/XIV	France	Response to SG XVII questions regarding facsimile modem requirements Réponses aux questions de la Commission d'études XVII concernant les caractéristiques du modem pour télécopie	
22	2/XIV	France	Subjective evaluation of acceptable error rate in the case of two-dimensional coding Evaluation subjective des taux d'erreurs acceptables dans le cas d'un codage bidimensionnel	

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N°	Question Cuestión	Origine Source Origen	Titre Title Título	Publié comme Re-issued as Republicado como
D.23	7/XIV	Siemens-Hell	Proposed amendment to the bit allocation in binary coded control procedure in Rec. T.30	
24	7/XIV	Kalle Infotec	Proposed amendments to binary coded signalling system for Group 3 machines	
25	7/XIV	Kalle Infotec	Choice of speed of handshaking for Group 3 machines	COM XIV-No. 68
26		France	Lignes directrices pour l'étude des appareils futurs de facsimile	
27	3/XIV	Fed.Rep.Germany, Denmark and 3M Co.	Proposed amendment to Recommendation T.3	COM XIV-No. 69
28		Japan	Transmission test results of two-dimensional coding scheme	

SECTION II

REPORT OF WORKING PARTY XIV/1 ON ANALOGUE FACSIMILE EQUIPMENT

Chairman : Mr. A.J. Bott (British Post Office)

1. Introduction

Working Party XIV/1 met in the afternoon of 11 December 1978 under the chairmanship of Mr. A.J. Bott (BPO).

The following agenda proposed by the Chairman was accepted :

1) Question 5/XIV : Facsimile transmission power levels

Documents : COM XIV-Nos. 27 and 39

2) Question 7.a.1/XIV : Points arising from Recommendations T.2 and T.3 (Characteristics of circuits)

Documents : COM XIV-No. 26 and 56

3) Question 3/XIV : Analogue facsimile equipment

3.1 Two minute mode

Documents : D14, D18 and D19

3.2 Tolerances to Recommendation T.3

Document : D15

4) Question 7.a.2/XIV : Points arising from Recommendation T.30

Documents : COM XIV-Nos. 33, 40, 49, D13, D18, D19, D20

5) Any other business

2. Question 5/XIV (Agenda item 1)

2.1 Documents examined

- Contributions COM XIV-Nos. 27 (JWP/LTG), and 39 (WP IV/1)

2.2 Examination of documents

COM XIV-No. 27 (JWP/LTG)

The document was introducted by the CCITT Secretariat.

This paper contains the following three points for consideration by Study Group XIV :

- specification of the signal power level in terms of the 1-minute mean power,

- reduction of the peak signal power level of AM phototelegraph apparatus to Recommendation T.1,

- possibility of standardizing a new generation phototelegraph apparatus.

As for the first point, no particular opposition was expressed by the delegates and the Working Party therefore agreed to the proposal by JWP/LTG in view of the fact that further shortening of the reference time is currently studied by JWP/LTG.

The revised text of Recommendation T.10 and T.10bis published in Annex 1 to Section II of COM XIV-No. 25 will be amended accordingly.

As for the second point, JWP/LTG proposes to reduce the peak signal power to -3 dBm0 from 0 dBm0 for AM phototelegraph apparatus specified in Recommendation T.1.

In view of the specific technical characteristics (the maximum power for white, high contrast ratio, etc.) of AM phototelegraphy and a limited use of such a service, certain delegates expressed their reluctance to accept this proposal or to make tests.

The meeting, however, noted a test report made by NTT which is referred to in COM XIV-No. 27 and requested the Secretariat to publish it as a white contribution for consideration at its next meeting.

This point was therefore left for further study.

As for the third point, no interest was expressed by the Administrations to take up such a question in the CCITT.

COM XIV-No. 39 (Working Party IV/1)

This document also refers to the reduction of signal power level of AM phototelegraphy and was therefore examined together with COM XIV-No. 27. The meeting noted the test result in USSR attached to this document.

3. Question 7.a.1/XIV (Agenda item 2)

3.1 Documents examined

- Contributions COM XIV-No. 26 (JWP/LTG) and No. 56 (Study Group XVII)

3.2 Examination of documents

The meeting noted with interest both documents which discuss the standardization of the second special quality telephone-type leased circuit currently studied by Study Groups IV, XVII and JWP/LTG.

The new special quality lines are primarily for data transmission but it may also have bearing on facsimile transmission when high speed machines for use over telephone-type circuits are to be standardized (Ref. Question 3/XIV, point 3a).

If there are any comments on these documents, contributions should be sent to the next meeting.

4. Question 3/XIV (Agenda item 3)

4.1 Two-minute mode apparatus

4.1.1 Documents examined

- Delayed documents D14 (Siemens-Hell), D18 (SECRE) and D19 (ITT)

4.1.2 Examination of documents

Based on the discussion that had taken place at the last Study Group XIV meeting, Delayed Contributions D14, D18 and D19 were submitted by three manufacturers to the current meeting.

After introduction and brief discussion for clarification of these documents the Working Party considered the need of extending Recommendation T.3 to include the proposed 2-minute mode.

Although certain attractive merits of such a mode were stressed by certain delegates, the majority of Administrations*) was not in favour of including this mode in Recommendation T.3 from the viewpoint of guaranteed transmission quality, and possible operational complexity.

The Working Party concluded that the 2-minute mode will not be standardized in the CCITT. However, those members who wish to press this subject may submit further contributions in good time before the next meeting.

4.2 Tolerances to Recommendation T.3 (Agenda item 3.2)

Document examined

- Delayed contribution D15 (Germany, FR)

Document D15 proposes to modify some of the figures in Recommendation T.3 with a view to improving the operation of Group 2 machine to Recommendation T.3.

The following three points were discussed :

Phasing tolerances

It is proposed to confine the tolerance of ± 2 % to the receiving end only.

The Working Party, noting that this proposal was just made in a Delayed Contribution, agreed to leave this point for further study rather than take a hasty conclusion. Document D15 should therefore be published as a white paper. Meanwhile the Federal Republic of Germany is invited to propose a definitive text for revision of Recommendation T.3.

It was also agreed that when a new value of tolerance is proposed, its measuring method should be specified.

During the discussion it was pointed out that a certain tolerance should also be allowed to the transmitter and in this connection a manufacturer indicated a possible value of ± 0.5 % for transmitter and ± 1 % for receiver.

Scanning line frequency tolerance

The Federal Republic of Germany proposes to tighten the tolerance from ± 10 parts in 10^6 to ± 5 parts in 10^6 of the nominal value.

Some manufacturers mentioned that the use of a crystal oscillator may meet such a stringent requirement but is costly and expressed their doubt whether such an expensive solution is worthwhile for gaining a few millimetres.

Some other manufacturers mentioned that they had never encountered any difficulty with the presently specified tolerance.

After further discussion the Working Party concluded as follows :

- ask manufacturers to study the closest tolerances achievable without making machines significantly more expensive,

- ask Study Group I to provide information on facsimile service with respect to the exact usable size of documents that they expect.

Total and usable scanning line length

The values between 215 and 220 mm are proposed for the total scanning line length by the Federal Republic of Germany in order to prevent loss of information.

As reported in COM XIV-No. 25, this point was also discussed in detail and left for further study to date. In this connection Contribution COM XIV-No. 9 (Nordic countries) on this subject was referred to.

The Working Party asked a group composed of the delegates from the Federal Republic of Germany, Denmark and 3M to discuss further this question during the meeting.

A document prepared by Federal Republic of Germany and 3M is published as Contribution COM XIV-No. 69 for further study as the Working Party had no time to examine it.

5. Question 7.a.2/XIV (Agenda item 4)

5.1 Documents concerned

- COM XIV-Nos. 33 (3M), 40 (SECRE), D13 (Siemens-Hell), D18 (SECRE) D19 (ITT), D20 (France)

In view of the conclusion under agenda item 3.1, contributions concerning 2-minute mode, i.e. D13, D18 and D19, were not examined here.

5.2 Examination of documents

COM XIV-No. 33 (3M)

The document proposes a revision of Recommendation T.30, Section 4.3.2.2.

After discussion the Working Party concluded as follows :

- accept the proposed amendment for the time being; if any problem is noted it should be submitted in a contribution.
- No minimum delay will be specified.

COM XIV-No. 40 (SECRE)

The contribution proposes to change the duration of the Group Command (GC) signal specified in Recommendation T.30, Section 4.3.2.2. It was stressed that such a modification is necessary for future machines.

After discussion the proposal with a minor change was accepted and Section 4.3.2.2 should read as follows :

"4.3.2.2 Group Command Signals (GC) : GC1 = 1 300 Hz ± 2.5 % for a duration of more than 1.5 sec. and less than 10 sec. GC2 = 2 100 Hz ± 10 Hz for a duration of more than 1.5 sec. and less than 10 sec.

Function (as proposed in Document COM XIV-No. 33)

To indicate to the receiver the group that the transmitter has chosen. GC signal starts at the end of the GI signal with a maximum delay of 1.0 sec. as measured on the line at the transmitter."

Delayed Contribution D.20 (France)

This contribution discusses the possibility of using a digital form of the called station identification.

The Chairman noted it as a valuable contribution which needs further study at leisure and suggested to republish it as a white contribution (now published as COM XIV-No.67).

The CCITT Secretariat referred to COM XIV-No. 53 (Study Group I) and mentioned that they would have interest in this study by Study Group XIV, since they also envisage the use of such a digital identification method for facsimile services.

Mr. Brussol, Study Group XIV representative to the Study Group I facsimile group, would inform their next meeting in January 1979 of the situation of Study Group XIV.

6. Any other business (Agenda item 5)

No particular point was discussed at this meeting. It is agreed that the minute of this meeting will be examined some time towards the end of the week at an extra meeting of the Working Party.

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SECTION III

REPORT OF WORKING PARTY XIV/2 ON DIGITAL FACSIMILE EQUIPMENT

Chairman : Dr. H. Teramura (KDD/Japan)
Vice-Chairman : Mr. F. Bardua (Federal Republic of Germany)

1. Introduction

Working Party XIV/2 met under the chairmanship of Dr. Teramura (KDD), assisted by the Vice-Chairman, Mr. F. Bardua (Federal Republic of Germany).

The following Agenda was accepted :

1) Introduction

2) Review of the list of documents :

COM XIV-Nos. 30, 34, 36, 42, 43, 44, 46, 53 (TD3), 54 (TD5), 57 (TD8)
Delayed Documents D1, D2, D6, D9, D10, D16, D17, D22, D26

3) Adoption of Agenda

4) Question 2/XIV - Digital facsimile equipment

4.1 Modem

COM XIV-Nos. 30, 43, 44, 46, 54, D10, D21

4.2 Transmission time per scanning line

D1

4.3 Index of cooperation

D6

4.4 Two dimensional coding

COM XIV-Nos. 42, D9, D16, D17, D22

5) Question 7B1.1

5.1 Group 4 machines

COM XIV-Nos. 34, 36, 53, 57, D2, D26

6) Other business

2. Item 4.1 (Modem)

The documents COM XIV-Nos. 43, 46 and D21 containing answers to the questionnaire drawn up by Study Group XVII (Documents COM XIV-Nos. 30 and 54) were presented and clarified by the authors. As regards the answers to the Question No. 21 (COM XIV-No. 54) it came out that the DTE part of the facsimile machine has to select the correct speed rate.
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Document D10 (Kalle Infotec) shall be presented to Study Group XVII for further consideration.

Considering the fact that it was not possible to discuss all answers to the questionnaire in detail within the main group, it was agreed to install a small sub-working party consisting of specialists for modem problems under the chairmanship of Mr. Amilhat (France). This group should elaborate answers to the questionnaire as well as establish a list of priority for the various questions.

The report of the Sub-Working Party which was subsequently approved by Working Party XIV/2, with certain amendments, is published in Annex 1 to Section III of this report. It will be sent to Study Group XVII for their consideration.

3. Item 4.2 (Transmission time per scanning line)

The Document D1 from Siemens is proposing to incorporate into Recommendation T.30 the possibility of indicating different line scanning time together with different resolutions. The other proposal concerns the incorporation of a 0ms line scanning time. The proposals were agreed upon in principle. As regards the bit assignment for the DIS capabilities KDD submitted a proposal (COM XIV-No. 58) for consideration by Working Party XIV/3.

4. Item 4.3 (Index of cooperation)

Document D6 from 3M Company is presented to establish the need for an index of cooperation tolerance for Group 3 apparatus. The proposed figure of $\pm$ 2.5 % is only given for information of the other manufacturers and will be subject to further study.

5. Item 4.4 (Two dimensional coding)

5.1 Preliminary discussion

5.1.1 The Chairman stated the urgent need for a standardization of a two dimensional coding system as early as possible. This wish became more clear during the discussions as there are a great number of manufacturers in Japan producing machines with two dimensional coding capability, whereas the coding systems used so far differ from another.

5.1.2 Japan proposes its READ coding system (Document No. 42), whilst IBM presented a proposal in Document D9. Both codes are extensions of a one dimensional code.

5.1.3 Document D16 from AT&T lists a set of 8 criteria which are proposed to be used when selecting facsimile coding schemes. Amongst these criteria are those which have already been used in the past when the one dimensional coding system was chosen, others refer to more complex evaluations.

5.1.4 Document D17 from USA defines a set of pragmatic test conditions together with four evaluation criteria of two dimensional coding techniques.

5.1.5 Document D22 from France presents the results of subjective evaluation when errors are applied to the RAC-code with parameter K = 4.

5.1.6 After clarification of the presented papers a long discussion went on concerning the possibilities of how to proceed with the standardization of an appropriate two dimensional coding scheme. Two divergent opinions were established, the one proposing to draft a Recommendation on the basis of the two proposals from Japan and IBM, the other to delay a decision but to establish an agreed set of evaluation criteria and to apply it for further testing. Finally a compromise solution was agreed upon which consists in that a sub-working party was created under the chairmanship of Dr. Robinson (UK) with the following terms of reference :

1) Compare the two proposals and draw up a draft Recommendation for a two dimensional coding system for Group 3 apparatus on the basis of the proposals of Japan and IBM.

2) Establish a set of evaluation criteria for testing the code proposed under 1) and any other proposal which might be proposed during the period up to the next meeting of Study Group XIV or its Working Parties (probably in autumn or by the end of 1979).

As regards the patent problem some delegates felt that the procedure followed by other CCITT Study Groups should be adopted in the manner that patent licences should be granted on a non-discriminatory non-exclusive basis on reasonable terms and conditions. It was also noted that the one dimensional coding scheme is freely available.

5.2 Conclusion

At the subsequent meeting the Working Party thoroughly examined the report of the Sub-Working Party chaired by Dr. Robinson.

A long discussion was undertaken concerning :

- the timetable for submitting new code proposals and testing coding schemes
- evaluating coding schemes and comparing them
- selecting the code finally to be adopted.

5.2.1 It was stated and agreed that the submission of new code proposals should be done as early as possible in order that all other parties would have sufficient time for studying the proposals. The deadline of 31 March 1979 for the submission of new proposals was agreed and is stated in point 9 of Annex 2 to this report. On the other hand testing of the coding schemes will need more time. With the understanding that the next meeting will probably be held in December 1979, the CCITT Secretariat proposed that the submission of test results should be made by the first of October 1979 at the latest.

5.2.2 The Japanese delegation stated that the reference code should be established for evaluating various two dimensional codes in the similar manner as was taken in the case of selecting one dimensional MH-code, and also stated that this reference code should be READ-code which is the only code submitted in white contribution from the Administration. The delegate of UKPO expressed their view supporting READ-code as the reference code could be found in point 7 of Annex 2.

Delegations of USA and Federal Republic of Germany stated that there might not be a need for defining a reference code without further evaluation testing and also stated that on the occasion of next study group meeting it should evaluate and select the best one.
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5.2.3 Difficulties arose when the method of selecting a coding scheme was discussed. Different opinions were expressed, however final agreement on the method of selecting a coding scheme was not reached.

The CCITT Secretariat stated that in the case where the proposed codes are approximately equal with respect to all evaluation criteria, then a code should be adopted as the standard which is by that time the most used in facsimile machines, such procedure having been applied in the CCITT work during the past for many kinds of techniques to be standardized.

5.2.4 Finally, the proposal was made by the delegate of USA to define the READ-coding scheme as a comparison coding. This was agreed and suitable wording can be found in point 9 of Annex 2 to this Working Party XIV/2 report.

5.2.5 The report of the Sub-Working Party as amended and approved by Working Party XIV/2 is published in Annex 2 to this Working Party XIV/2 report.

6. Item 5 (Group 4 machine)

6.1 For this item another Sub-Working Party under the chairmanship of Mr. Pugh (UK) was created with the following terms of reference :

1) Prepare a draft paper to be forwarded to Study Group I containing information on future technical development of facsimile machines and asking for guidance from a service viewpoint.

2) Prepare a proposal for the definition of Group 4 machine. This paper is not intended to be discussed during the meeting of Working Party 2, but will be treated during the next meeting in 1979 only.

6.2 The report of the Sub-Working Party on the above-mentioned two items is published in Annexes 3 and 4 respectively to Section III of this report.

Annex 3 as approved by the Working Party will be sent to Study Group I for their consideration. As for Annex 4 on the definition of Group 4 machines the meeting agreed to leave it for further study as it still involves the outstanding questions such as data signalling rates.

Annexes : 4

Annex 1

(to Section III)

SOURCE : SWG ON RESPONSE TO STUDY GROUP XVII QUESTIONNAIRE

TITLE : RESPONSE TO STUDY GROUP XVII QUESTIONNAIRE
(AS AMENDED AND APPROVED BY WORKING PARTY XIV/2)

The group dealt at first with the questions 4-10 and 13, 14, 16, 17, 19, 20, 21 for which an agreement could be reached in a simple way. The responses to these questions are as follows :

Question 4 : There is no requirement for a backward channel.

Question 5 : Auto-answer capability is not required from this modem.

Question 6 : Because the modulation and demodulation systems will be built into the facsimile machine, Study Group XIV thinks that there is no need for defining a DTE/DCE interface.

Question 7 : Performances of V.series modems will be sufficient.

Question 8 : See the response to question 7.

Question 9 : The decision of using a fall back speed is under the control of the terminal.

Question 10: See response to question 7.

Question 13: There is no requirement for echo suppressor disabling.

Question 14: Speed selection is under the control of the terminal.

Question 16: Test loops are interesting but not required.

Question 17: Re-equalization is under the control of the terminal.

Question 19: Recovery from line drop-outs is under the control of the terminal.

Question 20: There is no requirement for the use of acoustic couplers.

Question 21: (See Annex 1 of COM XIV-No. 54 from Study Group XVII) - The terminal will select the correct output.

After that, the group dealt with Questions 1, 2, 3, 11, 12, 15 and 18, which seem to be the basic ones.

Questions 1, 2 and 3 :

The data rates will be 2400 bit/s and 4800 bit/s for use on both switched and leased lines; the rate of 9600 bit/s is required for use on leased lines and desirable for use on switched lines, if possible.

The modes of operation are described in the following table :

		Simplex	Half-duplex	Duplex
GSTN	2 wires	Yes	Yes	No
Leased lines	2 wires	Yes	Yes	No
	4 wires	Yes	Yes	Yes

Question 11 :

The permissible set-up time at start of call could be as long as that of V 27 ter modems (long training sequence).

Question 12 :

The turn-around time will be as long as the set up time at start of call (see Question 11), because in both cases (turn-around and start of call) the same training sequence must be used.

Question 15 :

According to draft Recommendation T.4, the modulation systems as per Recommendations V.27 ter/V.29 will be employed until a new wide range modem is introduced. The new modulation system to be introduced will preferably be compatible with V.27 ter/V.29 system, unless the new modem is remarkably advantageous compared with the existing V-series modems in terms of performance and price. For this new modem, with regard to the modulation system, compatibility with at least V.27 ter modem in fall-back mode at 2400 bit/s is required. It is provisionally suggested that for pure fac-simile transmission purposes only the long training sequence will be used; but in the view of interoperability with other services using V.27 ter modems, the modem will provide also the possibility of having the short training sequence for turn-around instants; the choice of the turn-around training sequence length will be controlled by the terminal.

Question 18 :

It is preferred that the cost of the new modulation and demodulation systems should be less than those of Recommendation V.27 ter/V.29.

Annex 2

(to Section III)

SOURCE : SWP ON TWO DIMENSIONAL (2D) CODING FOR GROUP 3 MACHINES

TITLE : REPORT OF THE MEETING (17.30-24.00, 14 DECEMBER 1978)
(AS AMENDED AND APPROVED BY WORKING PARTY XIV/2)

Chairman : Dr. A.H. Robinson
Secretary : Mr. U. Rothgordt

1. Terms of reference :

1) Attempt to draft a Recommendation for 2D-code based on the Japanese and IBM proposals.

2) Establish a list of criteria for evaluating 2D proposals for Group 3 machines and methods of testing them.

2. The Sub-Group agreed to discuss the second point first.

The Sub-Group agreed that the following criteria should be considered :

1) Compression factor (CF);

2) Error susceptibility;

3) Complexity and implementation cost;

4) Test documents;

5) Patentability;

6) Criteria listed in AT&T paper.

3. Discussion on the test documents and magnetic tape copies (item 4)

Discussion started with the test documents. It turned out that there were several versions of the test documents on magnetic tape in existence which led to different test results. Also the lack of a single method of obtaining a standard resolution version of a document from the high resolution record was emphasized. It was agreed to use the one-bit/pel version of the French Administration magnetic tapes*). Because the documents were recorded with 1680 pels/scanline it was agreed that all testing would be carried out on 1728 pels/scanline by adding 48 pels (white) to the right hand side of every scanline. It is understood that each document is recorded at high resolution (8.0 ℓ/mm) with 2376 lines. For tests at high resolution all these scanlines should be used. It was agreed that for standard resolution every odd scanline should be used.

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*) It may be necessary that fresh tapes be generated and distributed.

There were proposals to extend the range of documents to include grey-scale and screened documents as well as examples of noisy documents and documents scanned with higher resolutions (up to 1000 ℓ/inch). This was not agreed to by the Sub-Group.

4. Error susceptibility (item 2)

It was agreed by the Sub-Group that this was an important item. After a short discussion four testing methods were proposed.

The method as outlined in D22 was regarded as very valuable for testing of Group 3 algorithms. This contribution reports on tests of the RAC-code and similar testing of the READ-code would be desirable.

The method outlined in D17 related to bit error patterns occurring on real telephone lines. It was agreed that tests should be carried out according to section 3.2 amended as follows :

3.2.1.1 The test documents to be used for .... documents 1, 4, 5 and 7.

3.2.1.2 In the first two sentences the words "will be" will be changed to "has been". In the third sentence these words will be changed to "is". In the next sentence the words "may be" will be changed to "are".

After section 3.2.1.2 add the following sentence :

"Measurements of the ESF (as defined in section 3.2.1.4) are labelled ESF_1, ESF_2 and ESF_3 for these runs respectively."

In section 3.2.2 change "ten" to "twenty" and also change "the committee" to read "Study Group XIV".

In the discussion concerning the objective measure its significance for Group 3 type equipment was questioned, but some delegates found that it was important.

The third method was based on statistics that could be provided by the US Government.

The fourth method was to use the error patterns in evaluating error control systems for data transmission (V.41 and supplements to Volume VIII).

It was agreed that the first two testing methods would be used, since they take into account the implications of the V.27 ter modem.

The French Administration agreed that if it were necessary then they would use the first method to test a compromise code and a limited number of other codes if such codes were proposed. However, it was agreed that it would be undesirable and put undue burden on the French Administration which has already undertaken very valuable testing.

In the discussion on subjective measure (section 3.2.2 of D17) the following procedure was agreed.

The experimenters proposing the various coding systems will prepare magnetic tapes of the pictures produced by their coding algorithms when subjected to the transmission errors as recorded on the German Administration magnetic tapes.

These tapes will be sent to Dr. J. Mitchell (IBM, TJ Watson Research Center, PO Box 218, Yorktown Heights, NY 10566). Dr. Mitchell will produce one high quality copy of each recorded picture on a photocomposer.

Mr. Bodson will produce photo-offset copies and distribute them to the Study Group XIV delegates.

5. Compression factor (CF) (item 1)

The Sub-Group agreed that compression results would be reported in terms of the actual number of bits required to compress a document as well as the CF itself.

In addition the following line statistics should be reported, namely the minimum, maximum, average and median numbers of bits/line and the one sigma (σ (1)) points of the line scan statistics.

In the discussion concerning the line statistics their significance for Group 3 type equipment was questioned, but again some delegates thought that they were important.

The Sub-Group agreed to the following parameters :

For standard resolution $K = 2, K = \infty$

For high resolution $K = 4, K = \infty$

For both resolutions the minimum line times of 5, 10 and 20 ms with EOL-code and zero minimum line time without EOL-code. All these measurements to be at 4800 bit/s.

6. Patent situation (item 5)

The Chairman repeated the position of the CCITT concerning this matter. Mr. Okabe suggested that it would be very useful if Study Group XIV asked that the existence of patents covering contributions be made known in good time.

It was agreed by a number of delegates that if all delegates made known the importance of early disclosure to their respective organizations this would minimize Study Group XIV's difficulties.

One of the delegates disclosed that his organization would soon make a contribution for a 2D Group 3 code which would be patent free.

7. Discussion on the possibility of a compromise 2D-code

Both IBM and Japan agreed, that it would be very difficult to produce and agree upon a compromise code. They both agreed that the codes were very similar.

Mr. Okabe stated that a dual standard was undesirable and that if absolutely necessary a single standard would be agreed in Study Group XIV by a vote taken by the Administrations.

The Japanese delegation pointed out that they have developed a number of 2D-coding schemes for Group 3. These schemes have been submitted to CCITT for consideration in the last few years. Within Japan a compromise has been reached by manufacturers, RPOAs and by the Administration. As a result the READ code has been proposed to Study Group XIV in Contribution COM XIV-No.42. Group 3 machines using the two dimensional coding scheme are now being manufactured and already 15,000 machines have been delivered in the last year. This number is increasing at a rate of 6,000 per year.

The Japanese would have difficulties in making changes to their equipment. They, therefore, suggested that the READ-code be adopted as a reference code until a better code is submitted as a white paper.

RCA Global Communication, Inc. stated that they are offering a facsimile service in making changes to those equipment using the READ-code. They would be prepared to support a compromise code otherwise they will take the risk and continue with this equipment. The BPO stated that as the Japanese Administration is supporting the READ-code it would be prepared to accept it as a reference code until a better system is proposed.

This was not agreed by the Sub-Working Party as a whole during the meeting.

In testing this code the Chairman found that the READ-code was the best 2D-code so far proposed in a white document. However, he believed that it could be further improved with minor changes. In particular the use of the same EOL as used in the 1D-code and the use of an adaptive K-value was suggested.

After much discussion it became clear that there was no strong support for the creation of a compromise code.

8. Continuation of discussion on testing criteria

It was agreed that the Sub-Group would not recommend a ranking of the relative importance of the different criteria.

9. It was agreed that the coding scheme contained in COM XIV-No. 42 be used as a comparison coding scheme for evaluation with all other two dimensional coding schemes proposed as the two dimensional option for the Group 3 machine on the basis of all the evaluation criteria approved by Working Party XIV/2 December 1978.
Coding schemes received by the CCITT Secretariat after 31 March 1979 will not be acceptable.

The meeting also noted that in Delayed Document D16 exist further evaluation criteria.

Annex 3

(to Section III)

SOURCE : CHAIRMAN OF AD HOC DRAFTING GROUP ON GROUP 4 FACSIMILE APPARATUS

TITLE : STATEMENT TO STUDY GROUP I
(AS APPROVED BY WORKING PARTY XIV/2)

The definition of new groups of facsimile equipment is a subject for urgent study within Study Group XIV. In order that recommendations can be produced which correctly represent the requirements for non-speech services over public networks, Study Group XIV urgently requests the views of Study Group I on future facsimile services.

At the June 1978 meeting of Study Group I, the report of the Special Rapporteur on facsimile (COM I-No. 100) was presented. In this document it is noted that there are no facsimile machines which have been specifically defined for data networks.

At a meeting of the Working Parties of Study Group XIV in December 1978, there was discussion on the possible definition of facsimile apparatus for such networks provisionally called Group 4. The majority view of the delegates was that Group 4 apparatus should be specified primarily for use over public data networks although they may alternatively be used over the general switched telephone network with the inclusion of an appropriate modulation/demodulation system. This multipurpose aspect of Group 4 apparatus is considered important in view of the intent of Study Group I to provide public facsimile services over any telecommunications network i.e. data networks or telephone (see Study Group I report of June 1978 meeting.)

It is Study Group XIV's intention to include an appropriate redundancy reduction scheme in this machine, but before a decision on the particular system or systems to be implemented can be taken, it is essential to know whether Study Group I requires interworking between Group 3 and Group 4 apparatus. It is anticipated that Group 4 apparatus would utilise error correction facilities which would enable documents to be received error free. It is also important to know the extent to which Study Group I anticipates a requirement to interwork with the new services which are being developed, e.g. TELETEX.

Study Group XIV has also noted Study Group I's requirements for both manual and automatic operation, however the only recommendation for suitable facsimile procedures presently available is T.30 which has been defined for the general switched telephone network only. The preliminary work on the production of a new procedural recommendation for use on data networks and "enhanced" operation on the GSTN has been started by the appointment of a Special Rapporteur by Working Party 3 of Study Group XIV.

The Special Rapporteur has anticipated the requirement for facsimile apparatus to interwork with new services and joint meetings with the appropriate Special Rapporteurs in Study Groups VII, VIII and XIV have been arranged to try to ensure the maximum amount of commonality between all types of services.

Annex 4

(to Section III)

SOURCE : CHAIRMAN OF AD HOC DRAFTING GROUP ON GROUP 4 MACHINES

TITLE : DRAFT DEFINITION OF GROUP 4 FACSIMILE APPARATUS
(WORKING PARTY XIV/2 DECIDED TO LEAVE THIS PROPOSAL FOR FURTHER STUDY)

The ad hoc group has proposed the wording given below as an initial definition of Group 4 facsimile apparatus.

Group 4

Apparatus which incorporates means for reducing the redundant information in the document signal prior to transmission via Public Data Networks (PDN) or via the General Telephone Network (GTN). The apparatus will utilise procedures applicable to the PDN and GTN and will assure error free reception of the document. Over the GTN, an appropriate modulation process will be utilised.

SECTION IV

REPORT OF WORKING PARTY XIV/3 ON FACSIMILE PROCEDURES

Chairman : Mr. A.R. Pugh (British Post Office)
Secretary : Mr. C. Jacobson (Xerox Corporation)

1. Introduction

The meeting of Working Party XIV/3 was convened by its Chairman, Mr. Pugh (BPO). Mr. Jacobson (Xerox) agreed to serve as Secretary. The Agenda proposed in a temporary document was accepted with the addition of further delayed contributions (see Annex 1).

It was agreed to concentrate the efforts of this Working Party on facsimile standardization as a first priority with extension to additional capabilities being considered of lesser urgency.

2. Tonal procedures (Agenda item 5.1)

Mr. Bott, Chairman of Working Party XIV/1, gave a brief statement of the results of his Working Party on the previous day where these affected control procedures on the GSTN. These statements are contained in Section II of this report.

3. Speed of handshaking (Agenda item 5.2.1)

Contributions were presented which defined two opposing view points regarding the signalling rate for the binary coded handshaking procedure of T30. The two positions can be summarized as follows :

1) Retain the 300 bit/s signalling rate that is presently described in Section 5 of T30.

2) Change the signalling rate to 2400 bit/s according to the modulation system defined for Group 3 apparatus in draft Recommendation T4.

Additionally, several contributions suggested a combination of these two solutions either as a standard or optionally.

Following considerable discussions on this subject a small drafting group suggested a solution. After some rewording by the entire Working Party, it was agreed that Recommendation T30 should be modified by replacing the first note at the beginning of Section 5 with the following :

"300 bits per second is the standard signalling rate for the transmission of binary coded procedural data. Additionally, signalling of the binary coded procedural data at 2400 bits per second is allowed as a recognized option. To take into account new developments of facsimile machines, it is suggested that the Group 3 machines can be made to work at 2400 bits per second for the handshaking procedure. The exact procedures of this inter-operation are the subject of further study, taking into account the Group 3 2400 bits per second recognized option."

Finally, it was agreed that a new Question should be formulated to address this inter-operability. This Question should address :

1) the eventual modification of the procedure (ref. COM XIV-Nos. 45, 48 and D12);

2) interworking between 300 bit/second and 2400 bit/second of the binary coded procedural data (ref. COM XIV-No. D3);

3) interworking with Group 4 apparatus.

The CCITT Secretariat agreed to reword the amendment and the Questions (if necessary) to make them suitable for insertion into Recommendation T30. However, the Working Party stressed that any changes must take into account the spirit in which the compromise had been achieved.

4. Additions and amendments to signal functions and formats (Agenda item 5.2.2)

The eight documents were presented relating to the additions and amendment to signal functions and formats.

Following some discussion it was agreed that the TCF signal within Recommendation T.30 should be modified to be a series of 0's for 1.5 seconds. No HDLC frame would be required. Mr. Cartalano was requested to submit a white document on this subject if this proved to be unacceptable to him.

It was decided that the RTC signal would be retained at the high speed data rate. Post message commands would be sent only at the low speed (300 bit/s) handshaking rate. Contributions on the number of post message commands required were requested.

A discussion of the need of a forward (transmitter to receiver) Procedure Interrupt (COM XIV-No. 44) signal led to a request that Administrations should make contributions on whether the signal should be mandatory.

Similarly, Administrations were urgently requested to make contributions on the need for and definition of an identification signal from the called station (see COM XIV-No. 49). By way of this report, Study Group I should take note that such a signal containing numerical information of the called station is judged to be technically feasible in equipment utilizing binary coded handshaking procedures.

A delayed contribution was presented by KDD as an alternative method of making the bit assignments to extend some capabilities of Recommendation T30. It was agreed that this should be re-submitted in a slightly modified form for consideration at the next meeting (published as COM XIV-No. 58).

5. Flow diagrams (Agenda item 5.2.3)

It was agreed that the flow diagram contained on page 26 of Contribution COM XIV-No. 47 should be used as a reference until it is amended at subsequent working party meetings.

6. Procedures on public data network (Agenda item 6)

Mr. Bence, of the BPO, introduced COM XIV-No. 57. This document outlined the model for the protocol recommended for apparatus operating on various networks and the responsibility of various CCITT Study Groups to reach a final agreement on this matter.

An introduction of the contributions followed with relatively little discussion. The conclusion was reached that a definition of Group 4 apparatus as well as the procedures for such apparatus is required. Contributions toward this end are urgently requested.

Mr. Bence informed the meeting that there would be a joint meeting of Study Group VIII/XIV Special Rapporteurs' Groups on teletex/facsimile procedure on 26-28 March 1979 in Geneva. (Further information will be given when details on this meeting are fixed.) Contributions to this effort were solicited urgently.

7. Delayed contributions

It was requested that the large number of delayed contributions should be restricted at future meetings. All contributors were urged to submit their documents at the earliest possible time.

The Working Party agreed that the following documents should be distributed as white documents by the CCITT Secretariat : D2, D3, D4, D5, D6, D8, D9, D16, D17 and D20. It will be noted on these documents that they have been considered by the various Working Parties during this series of meetings.

Annex : 1

Annex 1

(to Section IV)

SOURCE : CHAIRMAN OF WORKING PARTY XIV/3

TITLE : AGENDA FOR WORKING PARTY XIV/3

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1. Introduction

2. List of documents

COM XIV-Nos. 31, 32, 34, 35, 36, 37, 38, 41, 44, 45, 47, 48, 49

Delayed Contributions D3, D4, D5, D8, D11, D12, D23, D24, D25

3. Adoption of Agenda

4. Introduction of documents and brief discussion of points of clarification

Question 7/XIV Point A

5. Procedures on general switched telephone network

5.1 Tonal procedures - report by Chairman of Working Party XIV/1

5.2 Binary coded signalling

5.2.1 Speed of handshaking - COM XIV-Nos. 37, 45, 48, D3, D25

5.2.2 Additions and amendments to signal functions and formats - COM XIV-Nos. 32, COM XIV-Nos. 32, 44, 47, 49, D11, D12, D23, D24

5.2.3 Flow diagram - COM XIV-Nos. 32, 41, 44, 47, D4

Question 7/XIV Point B

6. Procedures on public data network

6.1 Report of Special Rapporteur

6.2 Discussion of documents - COM XIV-Nos. 31, 34, 35, 36, 38, D5 D8.
