COMMITTEE T1
CONTRIBUTION

Document Number: T1A1.5/94-123

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STANDARDS PROJECT: Analog Interface Performance Specifications for Digital Video Teleconferencing/Video Telephony Service

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TITLE: Copy of Rapporteur's Report on ITU-T Study Group 12, Question 22 (Audiovisual Quality in Multimedia Services)

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ISSUE ADDRESSED: Audiovisual Quality in Multimedia Services

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SOURCE: National Telecommunications and Information Administration
Institute for Telecommunication Sciences
(Arthur Webster)

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DATE: 28 March 1994

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DISTRIBUTION TO: T1A1.5

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KEYWORDS: Multimedia, Audiovisual Quality, Video Quality, Video Performance Specifications, Objective Quality, Subjective Quality

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ITU - Telecommunication Standardization Sector

Temporary Document No.7-E / rev 1

WORKING PARTY 2/12

Original: English

Geneva, 21-22 February, 1994

Question: 22/12

SOURCE: RAPPORTEUR

TITLE: STATUS OF THE QUESTION

1. Introduction

The wording of Q. 22/12 "Audiovisual quality in multimedia services" (continuation of Question 31/12 studied in 1989-1992) can be found in Comm. 12-1, pag.21.
The goal of the Question is the definition of one-way and two-way opinion test methods to evaluate transmission performance of audiovisual quality. At present the main topics of the question are the definition of a Video Reference Unit and the definition of methods for viewing tests, combined audio/video tests and conversational tests.

2. New documentation

Com.12 - 21 : **VIRIS, An Experimental Video Reference Impairment System** (Bellcore)
This contribution reports initial efforts to design a Video Reference Impairment System that simulates blocking, blurring, mosquitoes and noise for the evaluation of digital video coders and for use as a general purpose video laboratory tool. This work is a valuable contribution to drafting of new Recommendation P.VRU, "A video impairment reference unit"

Com.12 - 20 : **Experimental Combined Audio/Video Subjective Test Method** (Bellcore)
This contribution describes a combined audio/video test method. It uses nine-point discrete quality scale to judge, first, quality based on the combined audio/video effects and then in separate blocks of trials, the quality resulting from the separate audio and video effects. A long term goal for this work is to contribute towards the creation of new draft Recommendation P.AVQ, "Global audio/video quality evaluation by subjective means".

Del.D. 15 : **Tasks for use in assessment of audiovisual connections** (Canada: Bell-Northern Research)
This contribution suggests the criteria to define the tasks for two-way audiovisual tests. Two attribute categories are proposed: rate of information exchange and the degree of audio and video signal utilization.
This contribution provides useful information for drafting new Recommendation P.CTM "Conversation test methods to evaluate audiovisual transmission performance"

Del. D. 22 : **Proposed Attributes of a Video Reference Unit (VRU) and the Need for a Standardized Set of Video Test Scenes** (USA)

This contribution proposes a set of attributes that should be taken into account during the development of the VRU. The need for the specification of a standardized set of video test sequences is also emphazised

T.D. 2 : **Proposal for a subjective assessment method for video and audiovisual quality** (NTT, Japan)
A quality evaluation method is proposed for video and audiovisual tests.
Test signals and anchor signals are evaluated against reference signals. These last signals are obtained

by adding different levels of white noise to the source signals. The quality is measured by converting the votes corresponding to each test conditions into the S/N of the anchor that obtained the same vote.

T.D. 6 : **Draft Recommendation on conversation opinion test methods in audiovisual communications.** (Rapporteur)
This contribution provides the text which, at the last meeting, was agreed to form the basis for new draft Recommendation P.CTM, "Conversation test methods to evaluate audiovisual transmission performance".

T.D. 8 : **Performance reference models of multimedia communications**

This contribution presents a preliminary definition of an overall video performance reference model for audiovisual/multimedia services.

T.D. 9 : **Report on the liaison activities with the JCG-AVMMS** (Rapporteur)
This contribution reports the extracts of the letters and the documents circulated by the chairman of the JCG-AVMMS and relevant to SG 12.

3. Discussion

Concerning the definition of a VRU, it was agreed that the approach presented in Com.12-21 will be adopted in the draft Recommendation **P.VRU**, though some more impairments, as jerky movements, should be included in the proposed system. In this phase coding impairments will be only considered, leaving for further studies the definition of a VRU, which simulates also the effects of line errors. A set of test sequences will be defined to evaluate the performance of the VRU. A first draft of Rec. P.VRU will be prepared by the rapporteur with the support of BellCore, NTIA and NTT.
To use with

Concerning Rec. **P.CTM**, it was agreed that it will be submitted at the next meeting for approval. The version that will be presented in November should include further information about the task definition and the laboratory set up. Both these aspects should be defined taking into account the specific applications to which the test is addressed.
Contributions to drafting this Recommendation will be provided by COMSAT and BNR.

For the next meeting of SG 12 the draft of Rec. **P.VQ** will be also prepared with the support of BellCore, Telia Research, PKI, FRANCE TELECOM, NTT, BNR and NTIA.

In order to fulfil the request of the VPA group, the task-oriented subgroup of JCG-AVMMS, a preliminary **Video Performance Reference Model** for audiovisual communications has been defined. This model will be attached to the liaison statment to JCG-AVMMS. The text of this liaison statement is attached as Appendix I. It was also agreed to send the description of the video performance reference model in a liaison statement for action to all the SGs involved in AVMMS activity (i.e. SGs 1,2,7,8,9,11,12,13 and 15), attached to this report as Appendix II.

During the discussion it was suggested to organize a workshop with experts on audio/video coding and audio/video quality evaluation.

During the last meeting the need was recognized for **validation tests** for all the Recommendations that will be submitted in the framework of Q.22. In order to be able to organize this activity, the Rapporteur asked the companies interested to provide her with a list of the tools and the equipment available in the respective laboratories that could be useful both to produce the test material and/or to carry out the tests.
This information is required by the end of April.
The rapporteur will propose some test plans, based on the equipment and tools available.

At the last meeting a mailing list was set up to work by correspondence. This mailing list was updated. The new names included are the following ones:

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4. Workplan

Study item: SUBJECTIVE VIDEO QUALITY EVALUATION

Target: New Recommendation (P.VQ) on the definition of subjective test procedures (experimental design, test material, timing, rating scales, etc.) laboratory set up (viewing conditions, tools, etc.) and data analysis procedures for the subjective evaluation of quality of images coded at low bitrates.

Milestone	Schedule	Status
Basic documentation	available	available
First draft	Nov. 94	
Validated draft	Sept. 95	

Study item: VIDEO IMPAIRMENT REFERENCE UNIT

Target: Draft Recommendation (P.VRU) to define the structure and the operations of the video impairment reference unit

Milestone	Schedule	Status
Collection of documentation, report	Feb. 94	Achieved
First draft	Nov. 94	

Study item: GLOBAL QUALITY EVALUATION (one way tests)
Target: Draft Recommendation (P.AVQ) on the definition of subjective test procedures, laboratory set up and data analysis procedures for the subjective evaluation of combined audio and video quality.

Milestone	Schedule	Status
Collection of documentation, report	Nov. 94	
First draft	Sept. 95	

Study item: CONVERSATIONAL TESTS
Target: Draft Recommendation (P.CTM) on the definition of a methodology for conversational tests on audiovisual terminals.

Milestone	Schedule	Status
First draft	Feb. 94	Achieved
Validation activities	1994/95	

Study item: VIDEO PERFORMANCE REFERENCE MODEL
Target: Definition of video performance reference model for guiding the video performance assessment effort.

Milestone	Schedule	Status
Preliminary definition	Feb. 94	Achieved
Updated definition	1994/95	

5. List of documents

New documents

Com.12- 21	VIRIS, An Experimental Video Reference Impairment System (Bellcore)
Com.12- 20	Experimental Combined Audio/Video Subjective Test Method (Bellcore)
Del. D. 15	Tasks for use in assessment of audiovisual connections (Canada: BNR)
Del. D. 22	Proposed Attributes of a Video Reference Unit (VRU) and the Need for a Standardized Set of Video Test Scenes (USA)
T.D. 2	Proposal for a subjective assessment method for video and audiovisual quality (NTT, Japan)
T.D. 6	Draft Recommendation on conversation opinion test methods in audiovisual communications (Rapporteur).
T.D. 8	Performance reference models of multimedia communications (Rapporteur)
T.D. 9	Report on the liaison activities with the JCG-AVMMS (Rapporteur)

Previous documents

D. 10	Proposal for the activities related to the Question (CSELT-Italy)
D 11	Assessment of audiovisual terminal performance in the presence of transmission delay (Comsat)
TD 38	Report of interim joint coordination group for video performance assessment (J.Rosenberger)
TD 19	Liaison statement to Study Group 12 (Chairman of SG 1)
TD 17	Liaison statement to Study Group 15 for action and study groups 8 and 12 for information on user requirements for PSTN videotelephony and mobile videotelephony (Study Group 1 - Q. 20/1)
TD 53	Liaison statement from special Rapporteur for very low bit rate coding for visual telephony to the speech quality experts group (Chairman of SQEG)

APPENDIX I

Source: SG 12

Title: Proposed liaison statement to JCG-AVMMS (for action)

1. Introduction

SG 12 appreciates the work carried out by JCG-AVMMS to start the coordination among the SGs involved in activities related to audiovisual and multimedia services. In particular SG 12 acknowledges the prompt reply to its request for information in the previous liaison statement (TD 2/1-14) .

The following documentation has been received from the chairman of JCG-AVMMS so far:

1. the progress report that will be submitted to TSAG
2. the final version of the "Terms of reference" with the attachment on Video Performance Assessment (VPA)
3. a framework for Recommendations for AVMMS
4. a list of questions relevant to AVMMS.

This liaison statement provides SG 12 suggestions on items which require coordination, the comments to the above documentation and reports the actual status of the Questions of SG 12 related with AVMMS activity.

According to the requests of the VPA subcommittee (ref.: attachment of the "Terms of references") the definition of a performance reference model for audiovisual services is attached in Annex I.

2. Points which require coordination by JCG-AVMMS

The chairman of JCG-AVMMS required SGs to identify the items related to AVMMSs which require coordination.
SG 12 already stressed the need for coordination among SGs working on VPA and it is opinion of SG 12 that the apportionment of responsibilities outlined in the attachment of the "Terms of reference" requires further clarifications.
A more detailed division was already attempted in TD 2/12-38 "Report of the Interim Joint Project Group for Video Performance Assessment" Sec. 5, pag. 4. Copy of this proposal is attached in Annex II.
This document reflects the positions of both SGs 1 and 12 and could be a useful starting point for the coordination of activities in VPA.

3. Workplans and Recommendations relevant to AVMMS
In the previous liaison statement of SG 12, a detailed description of the work plans of Q. 21/12 and 22/12 was included. SG 12 is presenting now an updated version of these work plans and a list of the documents produced by SG12 and relevant to AVMMS.

{ Work plans and the list of documents should be included after the discussion of Q.21/12 and 22/12 }.

4. JCG-AVMMS meeting
A meeting of the representatives of SGs involved in AVMMS activity may be useful.
The proposed date and place (next May. in Geneva) are acceptable for SG 12.

5. Conclusions
SG 12 is working on several aspects related to transmission performance assessment of audiovisual and multimedia services and will continue its work with JCG-AVMMS to set up a framework for an efficient and harmonized development of Recommendations.
Comments are requested about:
1. the division of responsibilities proposed in TD 2/12-38
2. the work plans of Q. 21 and 22/12

SG 12 also awaits details about the agenda of the JCG-AVMMS meeting.

Attachments:

AnnexI : Appendix II of this rapporteur report removing Sec.6 " Proposed actions"
AnnexII: TD 2/12-38 "Report of the Interim Joint Project Group for Video Performance Assessment" Sec. 5 "Responsibilities of the participating SGs", pag. 4.

APPENDIX II

Source: SG 12

Title: Liaison statement to SGs1.2,7,8,9.11.12,13 and 15 (for action)

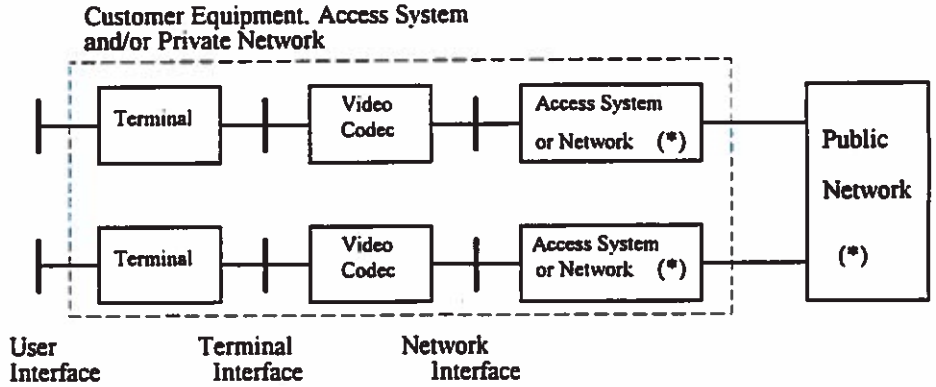
Subject: Performance reference models of multimedia communications

Abstract
This contribution presents a preliminary definition of an overall video performance reference model for audiovisual/multimedia services (AVMMS). This model is intended to provide a common reference to the SGs involved in Video Performance Assessment (VPA).

Introduction
In the attachment to the "Terms of reference" of the JCG-AVMMS, SG 12 is required to provide the description of an end-to-end video performance reference model " for guiding the video performance

assessment effort". It is also require to establish the " apportionment of the end-to-end performance objectives between the various segments of the reference model".
In order to fulfil the request of the JCG-AVMMS, during the last meeting (Geneva 15-25 of February), SG 12 defined a preliminary video performance reference model.
This document provides the results of the work carried out by SG 12 on this topic and requires information and suggestions to improve this preliminary model.
The model is made up of three main segments: terminal, codec and network.
For each of these segments a set of objective and/or subjective measurements should be specified.
The model is intended to take into account different aspects of transmission performance, oriented both to users and service providers.

1. General description
Three different segments can be identified in an audiovisual/multimedia connection: terminal, codec and network.
Each of these segments may affect, in many way, the customer's opinion. It is important to evaluate the impact of each of these segments in order to maximize the overall quality of the service.
A general scheme of the reference model is illustrated in figure below.



(*) may include MCU

Video performance reference model

In many applications the video codec is included in the terminal. This case will be addressed in section 3.

2. Terminal
Several studies have been carried out to specify the characteristics of a video terminal, related both to the reproduction and the recording aspects. Concerning the former point, a set of parameters as screen size, screen resolution, frame rate, colour, brightness, contrast, reflection of the screen, etc. may have an impact on images that are reproduced.
Concerning the latter point, not only the characteristics of the camera, namely the technology used and the resolution, must be taken into account, but also other aspects related to the recording lighting conditions and the position of the camera within the terminal. A number of solutions have been proposed to correct the parallax error between the user viewing direction and the camera orientation.

3. Codec
The effects of video codecs on transmission performance are mainly related to coding delay, lack of audio/video synchronization and coding artefacts.
The impact of this last point can be evaluated by means of perceptual ratings and performance tests.
New test methods are under study.

Coding delay and lack of audio/video synchronization may have an impact mainly on conversation naturalness. Therefore conversational tests should be adopted to evaluate the impact of these impairments and to specify the maximum acceptable delay.
When codecs are included in a terminal, video quality depends not only on the codec performance but also on camera, display and other electronic processing equipment which are included between the codec and the camera or display. Therefore in this case the points where objective end to end measurements are carried out must be clearly specified.

4. Network

To evaluate transmission performance a distinction between point-to-point and multipoint communications should be made. In fact the introduction of multiplexing (i.e. Multipoint Control Units) by the customer or in the public network may have considerable impact on customer's opinion.
Several network parameters should be controlled as transmission time, bit error rate, burstiness, cell loss, etc.

{ A description of different network architecture and relative performance measures should be included here by the concerned SGs}

Subjective tests should be carried out to evaluate the impact of delay and transmission errors on the end-user opinion and to optimize the performance of multipoint videocommunications.

5. Conclusion

A preliminary description of a video performance reference model has been presented. This model is intended to provide a common reference to the SGs involved in VPA. For each transmission segment, suitable subjective and/or objective measurements should be specified in order to evaluate the performance of that segment and to investigate its impact on the overall video quality.

6. Proposed actions

SG. 12 would appreciate ~~to have~~ any available information on the following points:

- Network Performance expected for different types of networks (PSTN, ATM, ISDN, etc.)
- impact of network architecture on Quality of Service, in particular the impact of the introduction of one or more MCU in a connection.
- expected quality of terminals and codecs for different multimedia applications
- any kind of suggestions and comment on the proposed model