ATIS-0100801.01.1995(R2006)

Digital Transport of Video Teleconferencing/Video Telephony Signals – Video Test Scenes for Subjective and Objective Performance Assessment

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Contents

Foreword (This foreword is not part of American National Standard T1.801.01-1995.)

The availability of standard test material for testing the performance of video codecs is a recognized industry need. In 1992, the CCIR (now known as ITU-R) published Recommendation 802. This Recommendation primarily addressed the need for studio quality test pictures and sequences for subjective assessments of digital codecs conveying signals produced according to CCIR Recommendation 601. Committee T1A1 has produced a set of test scenes appropriate for testing Video Teleconferencing/Video Telephony (VTC/VT) systems. A few of the VTC/VT test scenes that were selected by T1 members were obtained from CCIR Recommendation 802 source material (whose test segments are in the public domain). The other test scenes were submitted directly by members of T1. These VTC/VT test scenes have subsequently been used to conduct both subjective tests and objective tests.

The program of work for the VTC/VT project includes the development of a standard video test tape to be used in the correlation of subjective and objective test results. The resulting test tape, in D2 digital format, is available from the Alliance for Telecommunications Industry Solutions, 1200 G Street, NW, Suite 500, Washington, DC. This text document provides an explanation of the content of the tape and its use.

This standard contains four annexes. Annex A is normative and is considered part of this standard. Annexes B, C, and D are for information only.

Suggestions for improvement of this standard will be welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, 1200 G Street, NW, Suite 500, Washington, DC 20005.

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee on Telecommunications, T1. Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the T1 Committee had the following members:

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American National Standard for Telecommunications –

Digital Transport of Video Teleconferencing/Video Telephony Signals – Video Test Scenes for Subjective and Objective Performance Assessment

1 Scope, purpose, and application

1.1 Scope

This standard specifies a collection of test scenes that have been used for subjective assessment and may be used in future objective assessment of Video Teleconferencing/Video Telephony (VTC/VT). The scenes represent limited examples of the content that may be found in VTC/VT usage. The collection does not constitute a balanced set of scenes in any known way, and use of the scenes to determine an overall performance assessment is beyond the scope of this standard. Other test scenes may be used in video performance assessment, but their specification is also beyond the scope at this time. The test scenes identified within this standard are applied at the analog input interface shown in figure 1. Service channel interfaces (analog input and analog output) are between VTC/VT transmission service providers and end-users.

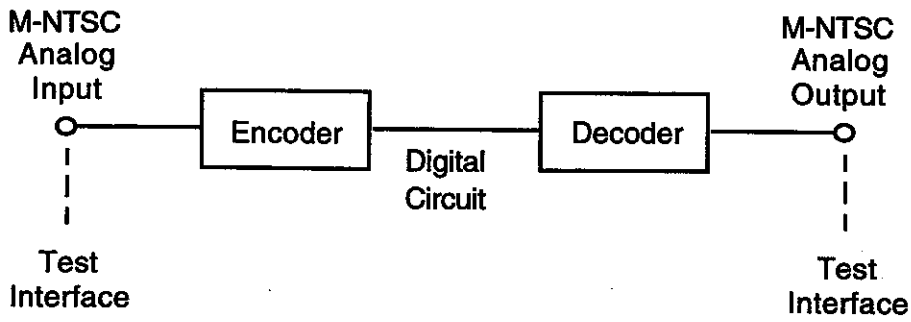


Figure 1 – Digital transmission service channel with interfaces

1.2 Purpose

The purpose of this standard is to make available to the industry a collection of video test scenes for the subjective performance evaluation of VTC/VT transmission systems on digital transport. It is intended to provide a common understanding by manufacturers, carriers, and their customers; and to aide in the development of objective test methodologies that statistically correlate to the subjective performance.

1.3 Application

The primary application of this collection of test scenes is in the assessment of VTC/VT transmission systems according to standardized methods. Some test scenes have an accompanying audio track, but the audio must be used carefully if at all because of the variation in master audio quality. Test

methodologies and quantitative measurement criteria, for testing transmission systems, utilizing these test scenes will be addressed in a separate document.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

SMPTE 170M, *SMPTE Standard for television – Composite analog video signal – NTSC for studio applications, sections 11 and 13*[1)]

SMPTE EG 27, *Supplemental information for SMPTE 170M and background on the development of NTSC color standards, table 2*[1)]

3 Abbreviations

ANSI	American National Standards Institute
ATIS	Alliance for Telecommunications Industry Solutions
CCIR	International Radio Consultative Committee
HRC	Hypothetical Reference Circuit
ITU-R	International Telecommunications Union – Radiocommunication Sector
NTSC	National Television System Committee
SMPTE	Society of Motion Picture and Television Engineers
VTC/VT	Video Teleconferencing/Video Telephony

4 Test tape

4.1 Description of test scenes

Table 1 provides a description of the video scenes on the test tape. Video scenes have been grouped according to one of five scene content categories (A, B, C, D, and E). A single image from each of the test scenes is provided in table 2.

[1)] Available from the Society of Motion Picture and Television Engineers (SMPTE), 595 West Hartsdale Avenue, White Plains, NY 10607.

Table 1 *(concluded)*

Scene content category	Scene abbreviation	Video description	Audio description
C (More than one person)	3inrow	Men at table, camera pan	Voice Background – low level, low frequency noise
	5row1	Five people in a row sitting at a table	Voice Background – low level, narrowband noise; table mike has picked up some handling noise
	intros	Introductions of people sitting at table, camera pans	–
	3twos	Three pairs of people, scene cuts	–
	2wbord	Two people at white board, scene cuts	–
	split6	Split screen, 6 people	
D (Graphics with pointing)	washdc	Washington DC map with hand and pencil motion	–
	cirkit	Circuit diagram, camera pan	–
	rodmap	Road map with hand and pen motion, camera pan	–
	filter	Filter diagram on yellow pad with hand motion	Voice Background – moderate level, narrowband noise
	ysmite	Yosemite map with hand motion (slowly varying intensity fluctuations)	Voice Background – moderate level, narrowband noise
E (High object and/or camera motion)	flogar	Flower garden with windmill, camera pan	–
	ftball	Football game	–
	fredas	Fred Astaire tap dancing (Black and White, VHS Source)	Music and taps – level jumps up 5 seconds after start Background – quality consistent with older black and white movie soundtracks

Table 2 – Sample images of test scenes

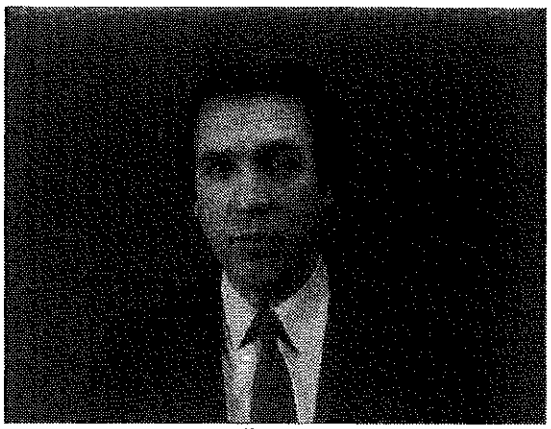
A. One person, mainly head and shoulders	
 vtc1nw	 susie
 disguy	 disgal

Table 2 *(continued)*

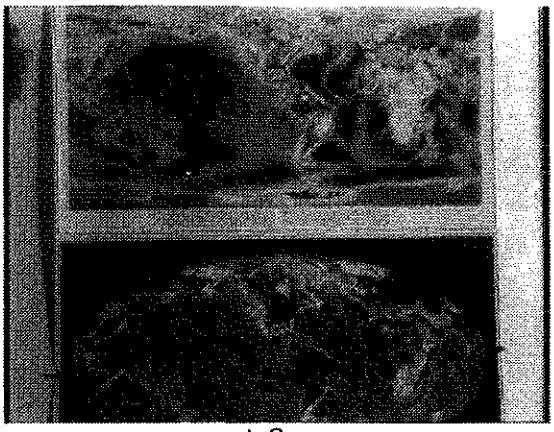
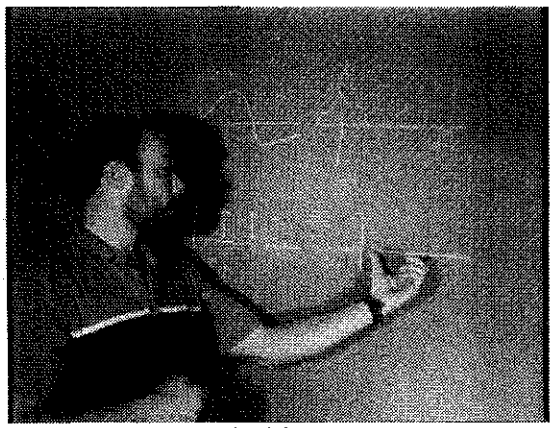
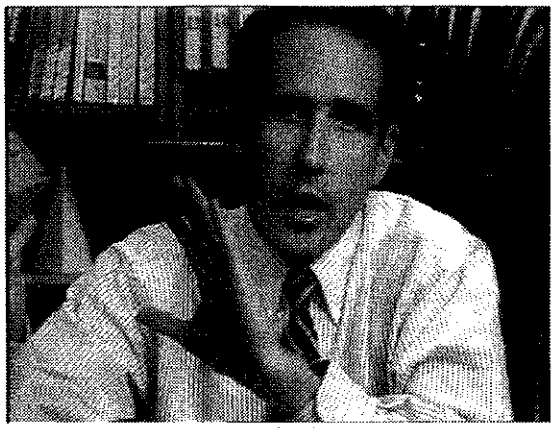
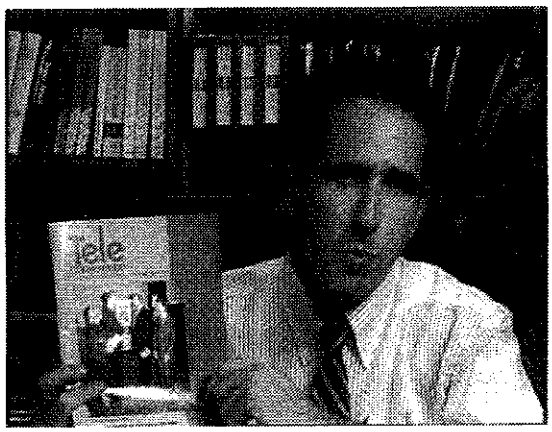
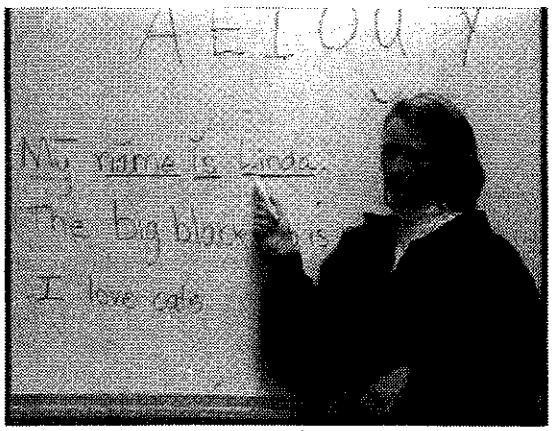
B. One person with graphics and/or more detail	
 vtc2mp	 vtc2zm
 boblec	 smity1
 smity2	 vowels

Table 2 *(continued)*

B. One person with graphics and/or more detail

inspec

Table 2 *(continued)*

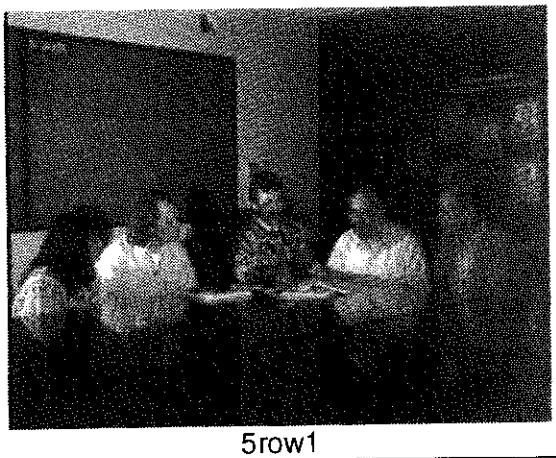
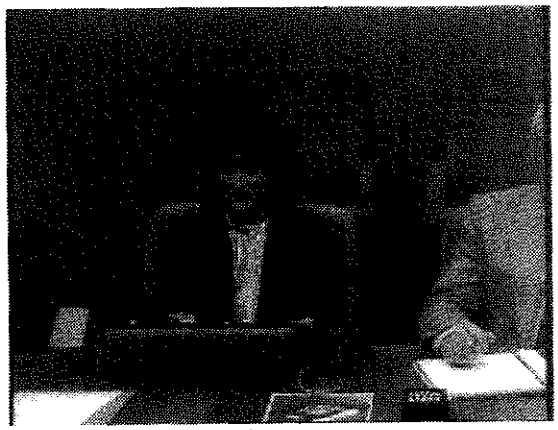
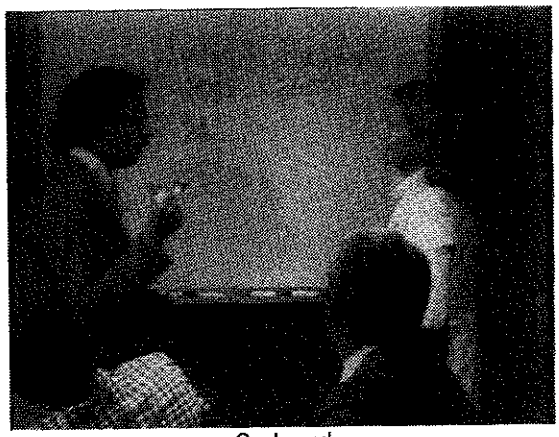
C. More than one person	
 3inrow	 5row1
 intros	 3twos
 2wbord	 split6

Table 2 *(continued)*

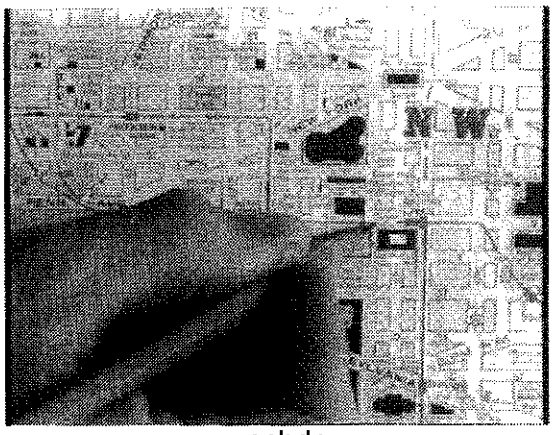
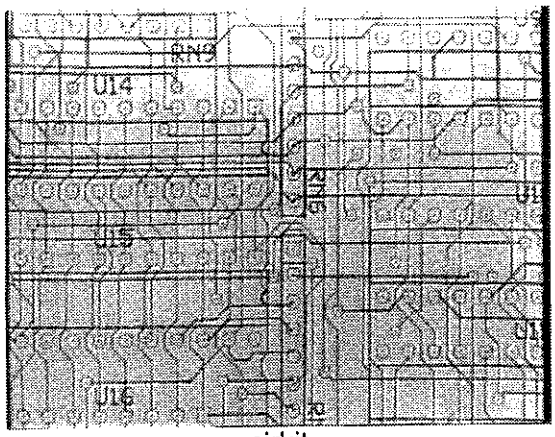
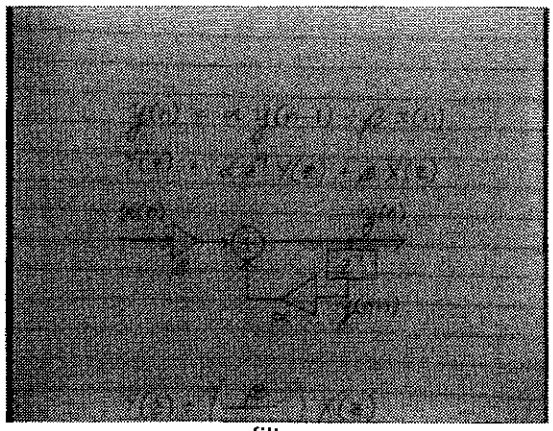
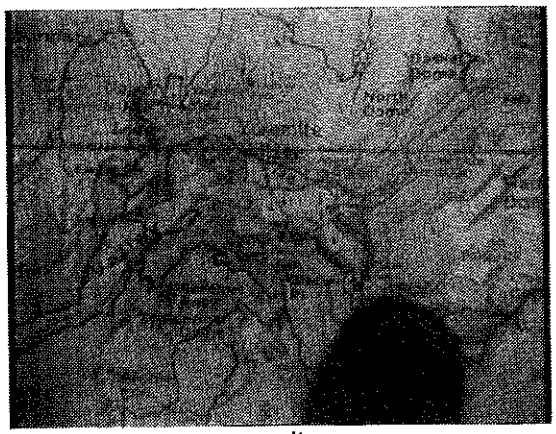
D. Graphics with pointing	
 washdc	 cirkit
 rodmap	 filter
 ysmite	

Table 2 *(concluded)*

E. High object and/or camera motion	
 flogar	 ftball
 fredas	

4.2 Availability of test tape

All of the video test scenes described in this standard are in the public domain. The master tape containing the scenes is kept by ATIS. This master tape is in the D2 digital format. Copies of the master tape are available in the D2 digital format. Copies of the master tape in other formats may be negotiated. Tapes provided by ATIS in analog formats should not be duplicated for testing purposes.

4.3 Calibration of test tape playback equipment

The test tape playback equipment shall meet the following specifications given in SMPTE 170M:

a) Color frequency (subcarrier), section 11.1;
b) Line frequency (horizontal), section 11.2;[2)]
c) Field frequency (horizontal), section 11.3;
d) Horizontal timing, table 2, section 13.1;
e) Vertical timing, table 3, section 13.3.

The 75% SMPTE color bar test signal that appears at the beginning of the test tape (see annex A) shall be used to calibrate the video and chroma levels of the test tape playback equipment so that these levels are in accordance with table 2 of SMPTE EG 27.

[2)] Time base correction may be required.

Annex A
(normative)

Test tape timing description

Table A.1 – Test tape timing description

Scene	Begin time code (hh:mm:ss:ff)	Duration (seconds)	Comments
75% Color Bar	00:00:00:00	60	Includes 1 khz audio test tone
Tape Header	00:01:00:00	60	ANSI T1.801.01-1995, American *National Standard for Telecommunications – Digital transport of video teleconferencing/video telephony signals - Video test scenes for subjective and objective performance assessment*
vtc1nw (title)	00:02:00:00	3	
shallow ramp	00:02:03:00	3	
vtc1nw	00:02:06:00	13	
susie (title)	00:02:19:00	3	
shallow ramp	00:02:22:00	3	
susie	00:02:25:00	13	
disguy (title)	00:02:38:00	3	
shallow ramp	00:02:41:00	3	
disguy	00:02:44:00	13	
disgal (title)	00:02:57:00	3	
shallow ramp	00:03:00:00	3	
disgal	00:03:03:00	13	
vtc2mp (title)	00:03:16:00	3	
shallow ramp	00:03:19:00	3	
vtc2mp	00:03:22:00	13	
vtc2zm (title)	00:03:35:00	3	
shallow ramp	00:03:38:00	3	
vtc2zm	00:03:41:00	12	
boblec (title)	00:03:53:00	3	
shallow ramp	00:03:56:00	3	
boblec	00:03:59:00	13	
smity1 (title)	00:04:12:00	3	
shallow ramp	00:04:15:00	3	
smity1	00:04:18:00	13	

(continued)

Table A.1 *(continued)*

Scene	Begin time code (hh:mm:ss:ff)	Duration (seconds)	Comments
smity2 (title)	00:04:31:00	3	
shallow ramp	00:04:34:00	3	
smity2	00:04:37:00	13	
vowels (title)	00:04:50:00	3	
shallow ramp	00:04:53:00	3	
vowels	00:04:56:00	13	
inspec (title)	00:05:09:00	3	
shallow ramp	00:05:12:00	3	
inspec	00:05:15:00	13	
3inrow (title)	00:05:28:00	3	
shallow ramp	00:05:31:00	3	
3inrow	00:05:34:00	13	
5row1 (title)	00:05:47:00	3	
shallow ramp	00:05:50:00	3	
5row1	00:05:53:00	13	
intros (title)	00:06:06:00	3	
shallow ramp	00:06:09:00	3	
intros	00:06:12:00	13	
3twos (title)	00:06:25:00	3	
shallow ramp	00:06:28:00	3	
3twos	00:06:31:00	13	
2wbord (title)	00:06:44:00	3	
shallow ramp	00:06:47:00	3	
2wbord	00:06:50:00	13	
split6 (title)	00:07:03:00	3	
shallow ramp	00:07:06:00	3	
split6	00:07:09:00	13	
washdc (title)	00:07:22:00	3	
shallow ramp	00:07:25:00	3	
washdc	00:07:28:00	13	
cirkit (title)	00:07:41:00	3	
shallow ramp	00:07:44:00	3	
cirkit	00:07:47:00	13	

(continued)

Table A.1 *(concluded)*

Scene	Begin time code (hh:mm:ss:ff)	Duration (seconds)	Comments
rodmap (title)	00:08:00:00	3	
shallow ramp	00:08:03:00	3	
rodmap	00:08:06:00	13	
filter (title)	00:08:19:00	3	
shallow ramp	00:08:22:00	3	
filter	00:08:25:00	13	
ysmite (title)	00:08:38:00	3	
shallow ramp	00:08:41:00	3	
ysmite	00:08:44:00	13	
flogar (title)	00:08:57:00	3	
shallow ramp	00:09:00:00	3	
flogar	00:09:03:00	13	
ftball (title)	00:09:16:00	3	
shallow ramp	00:09:19:00	3	
ftball	00:09:22:00	13	
fredas (title)	00:09:35:00	3	
shallow ramp	00:09:38:00	3	
fredas	00:09:41:00	13	

Annex B
(informative)

Calibration and test setup

A possible calibration and test setup is shown in figure B.1. A Tektronix VM 700 Video Measurement Set is used to test the video signal from the tape playback equipment. The VM 700 can function as both a vector scope and a waveform monitor. In addition, it has the capability for measuring line by line jitter. This measurement can be used to ensure the time base accuracy. Two examples are included below. Figure B.2 shows the jitter from a commercial quality VHS tape player and figure B.3 shows the jitter from a Betacam SP tape player which has a built-in time base corrector. As can be seen from figures B.2 and B.3, the Betacam SP signal has only 6 ns peak-to-peak (p-p) jitter while the VHS signal has 180 ns p-p jitter.

The shallow ramp test signal before each test scene can be used to monitor signal-to-noise ratio degradations of the test tape. It is recommended that when the signal-to-noise ratio of the test tape falls below 50 dB for any scene, that the test tape be discarded.

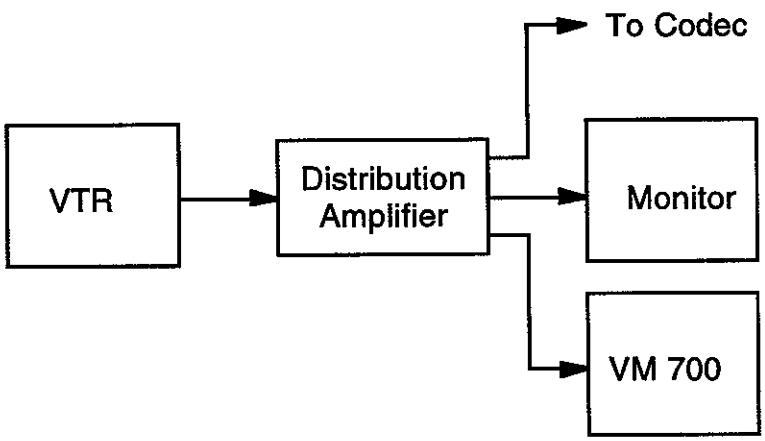


Figure B.1 – Calibration and test setup

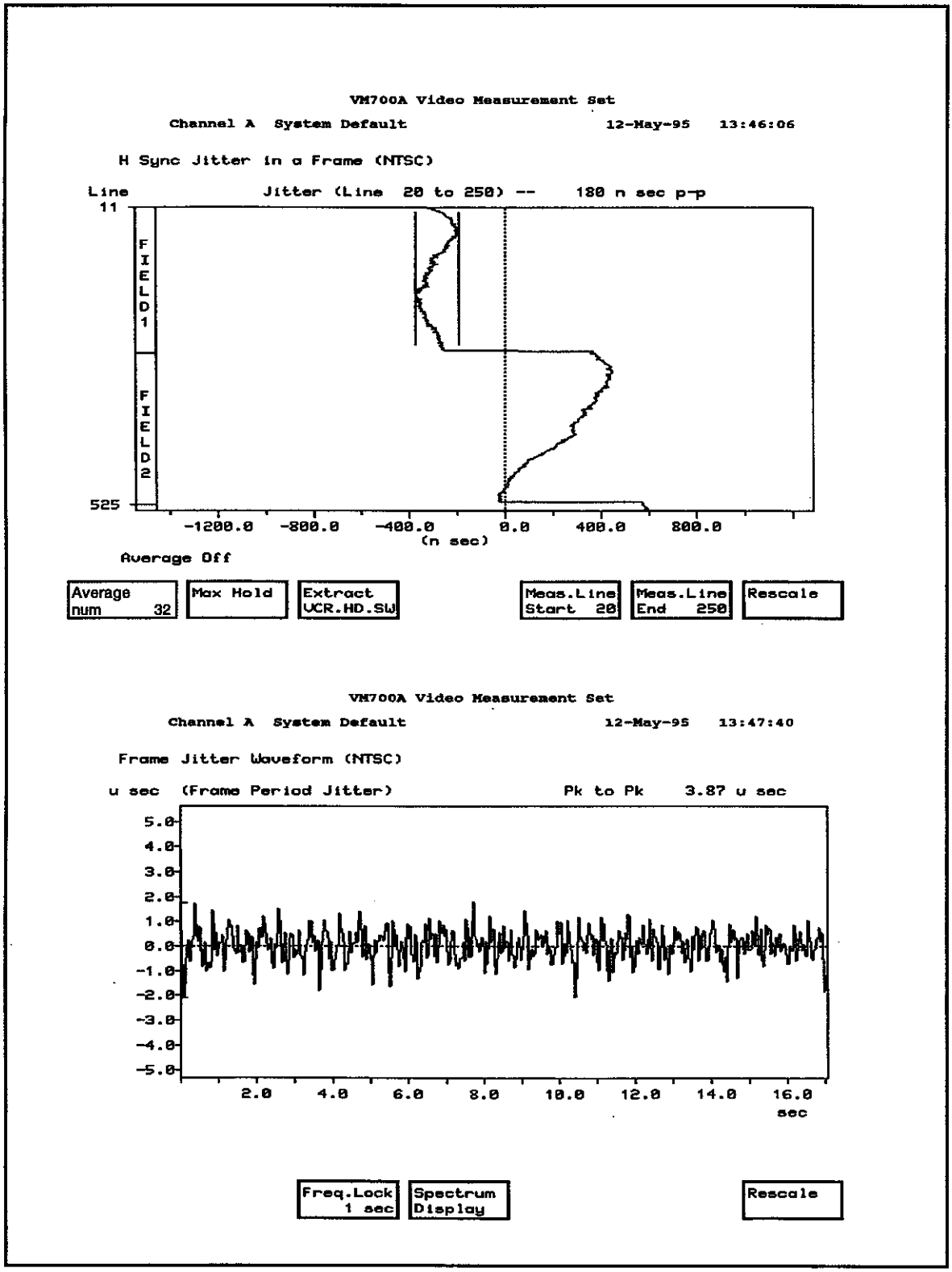


Figure B.2 – Horizontal sync jitter of commercial quality VHS tape player

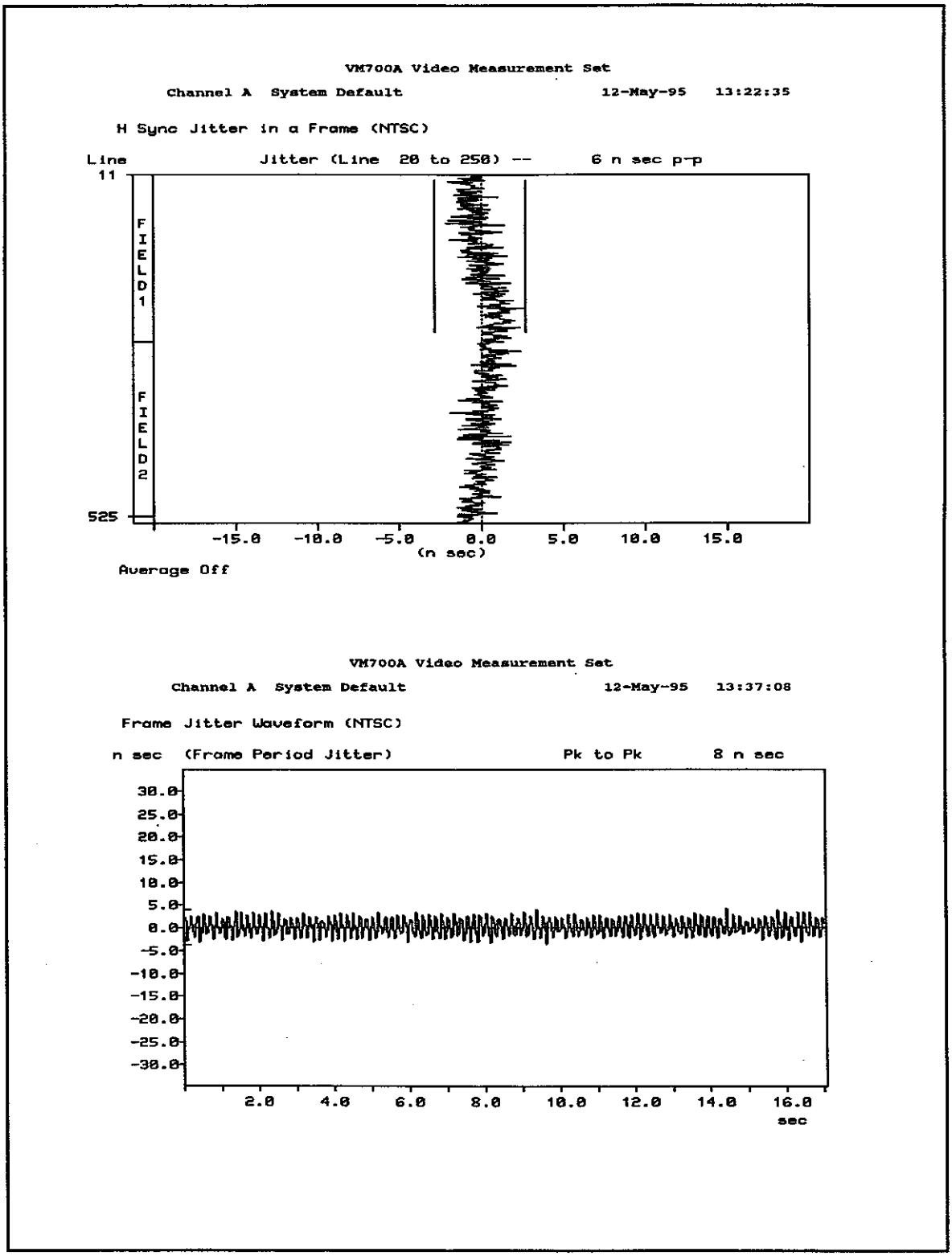


Figure B.3 – Horizontal sync jitter of Betacam SP tape player

Annex C
(informative)

Brief statistics for 25 scenes rated for video quality

This informative annex is intended as a brief guide to the use of the 25 scenes that were tested and calibrated as part of the T1A1.5 program for developing measures of video quality. The scenes themselves are not remarkable; the data collected about these scenes, however, make them a unique resource. For further information about the testing program and its results, see Morton (Subjective Test Plan, T1A1.5/94-118R1) and Cermak & Fay (T1A1.5 Video Quality Project, T1A1.5/94-148).

C.1 Scenes

Briefly, 25 scenes were chosen to represent five categories that are typical of video telephony, video teleconferencing, and limited entertainment video. These categories cover a wide range of movement and detail. Each scene was edited to a length of nine seconds (plus at least three seconds of leader to allow the coding system to stabilize). The video footage was donated by members of the committee. The categories are:

a) One person, mainly head and shoulders (vtc1nw, susie, disguy, disgal);
b) One person with graphics and/or more detail (vtc2mp, vtc2zm, boblec, smity1, smity2, vowels, inspec);
c) More than one person (3inrow, 5row1, intros, 3twos, 2wbord, split6);
d) Graphics with pointing (washdc, cirkit, rodmap, filter, ysmite);
e) High object and/or camera motion (flogar, ftball, fredas).

C.2 HRCs

Each scene was processed through each of 25 actual video systems (Hypothetical Reference Circuits, or HRCs) chosen to span a broad range of video quality. The 25 HRCs represented the following categories (see Morton, Subjective Test Plan, T1A1.5/94-118R1 for a fuller description of the individual HRCs). These systems cover a range of (nominal) bit rates from 112 kb/s to 70 Mb/s. Categories:

- High quality;
- Vector quantization, medium rate;
- Proprietary, low to medium rate;
- Proprietary, medium to high rate;
- QCIF, low rate;
- QCIF, medium rate;
- CIF, low rate;
- CIF, medium rate;
- CIF, high rate.

C.3 Ratings

One hundred and fourteen judges rated each scene; the judges were from three geographically distinct areas: Boston, Boulder, and Washington, DC. Roughly half of the sample of judges was experienced with video teleconferencing. Each presentation of a scene consisted first of the scene in its original form, then the scene as processed through one of the 25 HRCs. The judge rated the processed scene on the following five-point scale taken from ITU-R Recommendation BT.500-6:

5. Imperceptible (difference from the original)
4. Perceptible, but not annoying
3. Slightly annoying
2. Annoying
1. Very annoying

C.4 Results

The two sources of variation that influence the capability of a particular scene to discriminate among the systems being tested are the variance due to the HRC (denoted as σ^2_{HRC}) and the variance due to the viewer (denoted as σ^2_V). Figure C.1 and table C.1 provide graphical and tabular representations of these two variances for one scene and several HRCs. A scene that is better able to discriminate among the HRCs being tested has a smaller σ^2_V (i.e., the viewers tend to agree) and a larger σ^2_{HRC} (i.e., the different HRCs produce quality responses that are spread out on the quality axis).

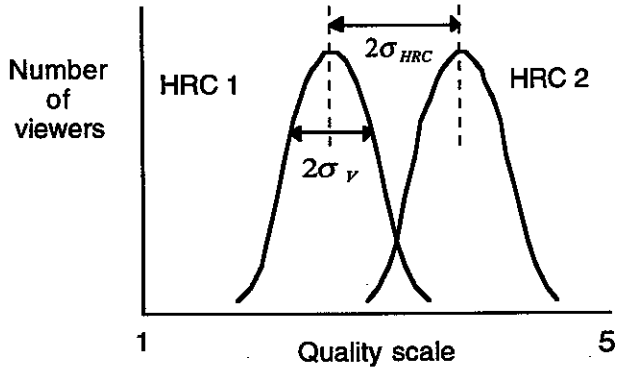


Figure C.1 – Graphical representation (1 scene)

Table C.1 – Tabular representation (1 scene)

HRC	MOS	Viewer scores			
		#1	#2	#3	.
1	4.2	4	3	4	.
2	2.1	2	2	3	.
3	3.5	3	4	3	.
.	.	.	.	.	.

large σ^2_{HRC} desirable for discrimination

small σ^2_v desirable for viewer rating stability

Results from subjective experiments indicate that the viewer variance σ^2_v tends to be similar across scenes. Thus, the HRC variance σ^2_{HRC} is the primary determinant for how well a particular scene can discriminate among the systems being tested. To obtain an estimate of the HRC standard deviation σ_{HRC}, the following procedure was used:

1) For each scene/HRC combination, scores were first averaged over the viewers to produce a mean opinion score (MOS).This removes much of the effects due to subject variability and noise;

2) These MOSs were then averaged over the HRCs to produce a mean and standard deviation (i.e., σ_{HRC}) for each scene.These values are shown in table C.2.

The more important statistic in table C.2 is the standard deviation because it indicates the ability of the particular scene to discriminate among video systems. A larger standard deviation is due to a greater spread in the values and therefore indicates a greater ability of the scene to differentiate between HRCs. The mean of the HRC MOSs is also of some interest when selecting scenes. Scenes with mean values near 5 or 1 show especially poor discrimination in the sense that they make nearly all HRCs look equally good or bad.

Table C.2 is broken down into 10 columns. The scene is designated by the scene abbreviation given in table 1. The category, denoted by uppercase letter, corresponds to those listed above and in table 1. The mean (Mean) and standard deviation (Stdev) are given for each of four classes of HRCs, so the scenes are calibrated with respect to classes of HRCs and not just in general. The first class is all 25 HRCs (All). The second class is 10 HRCs with nominal bit rates below 300 kb/s (<300 kb/s). The third class is nine HRCs with nominal bit rates between 300 kb/s and 800 kb/s (300-800 kb/s). The fourth class is six HRCs with nominal bit rates above 800 kb/s (>800 kb/s).

By using the results below, one can choose scenes better able to discriminate among the systems being tested. Also, one might decide not to test two scenes with nearly identical results in the table (e.g., smity1 and smity2, vowels and inspec) if resources for testing are constrained.

Table C.2 – Mean and standard deviation results of the HRC MOSs

		All		< 300 kb/s		300-800 kb/s		> 800 kb/s	
Category	Scene	mean	stdev	mean	stdev	mean	stdev	mean	stdev
A	vtc1nw	3.67	0.80	3.15	0.58	3.81	0.73	4.54	0.34
A	susie	3.25	0.96	2.38	0.44	3.62	0.45	4.46	0.39
A	disguy	3.65	0.78	2.99	0.45	3.90	0.54	4.60	0.20
A	disgal	3.59	0.82	2.95	0.65	3.85	0.50	4.53	0.39
B	vtc2mp	3.65	0.90	3.01	0.60	3.90	0.86	4.60	0.31
B	vtc2zm	3.15	0.80	2.55	0.43	3.27	0.47	4.23	0.49
B	boblec	2.80	1.10	1.84	0.45	3.13	0.61	4.28	0.59
B	smity1	2.54	1.12	1.65	0.28	2.67	0.40	4.25	0.67
B	smity2	2.50	1.12	1.64	0.40	2.57	0.43	4.22	0.67
B	vowels	3.08	0.93	2.31	0.42	3.33	0.50	4.30	0.51
B	inspec	3.07	0.97	2.26	0.56	3.37	0.55	4.30	0.47
C	3inrow	3.01	0.89	2.30	0.38	3.22	0.54	4.18	0.61
C	5row1	3.34	0.98	2.55	0.57	3.65	0.78	4.49	0.39
C	intros	2.76	0.99	1.99	0.39	2.96	0.56	4.05	0.78
C	3twos	3.12	0.90	2.37	0.51	3.38	0.61	4.26	0.42
C	2wbord	2.31	1.19	1.38	0.23	2.48	0.65	4.00	0.93
C	split6	2.72	1.19	1.62	0.28	3.12	0.61	4.36	0.45
D	washdc	2.67	0.88	2.06	0.39	2.74	0.49	3.89	0.75
D	cirkit	2.22	1.02	1.52	0.24	2.25	0.47	3.70	0.93
D	rodmap	2.57	1.07	1.72	0.34	2.75	0.52	4.06	0.82
D	filter	3.51	0.96	2.81	0.66	3.76	0.84	4.55	0.24
D	ysmite	2.69	1.15	1.71	0.43	3.01	0.73	4.24	0.37
E	flogar	2.65	0.88	2.05	0.24	2.65	0.42	3.96	0.79
E	ftball	2.09	1.11	1.40	0.30	2.00	0.45	3.76	1.10
E	fredas	2.66	1.12	1.66	0.44	2.98	0.52	4.23	0.43

Annex D
(informative)

Bibliography

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ITU-R Recommendation BT.500-6, *Methodology for the subjective assessment of the quality of television pictures* [4)]

ITU-R Recommendation BT.601-4, *Encoding parameters of digital television for studios*[4)]

ITU-R Recommendation BT.802-1, *Test pictures and sequences for subjective assessments of digital codecs conveying signals produced according to ITU-R Recommendation BT.601-4* [4)]

Cermak, G. W., and Fay, D. A., "T1A1.5 Video Quality Project: GTE Labs Analysis," American National Standards Institute contribution number T1A1.5/94-148, September, 1994[5)]

Morton, A. C., "Subjective Test Plan," American National Standards Institute contribution number T1A1.5/94-118R1, October, 1993[5)]

[3)] At the time of publication this standard was undergoing the approval process. Contact the secretariat for more recent information.

[4)] Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

[5)] Available from the T1 Secretariat, Alliance for Telecommunications Industry Solutions, 1200 G Street, NW, Suite 500, Washington, DC 20005.