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CODED REPRESENTATION OF PICTURE AND AUDIO INFORMATION

ISO-IEC/JCT1/SC2/WG11
MPEG 91 / 346 Rev.1
November 1991

Source : Tsuneyoshi Hidaka, Chairman of MPEG/Test
Title : Subjective Test Results of MPEG-2, Kurihama Meeting
Purpose : Report

General

The MPEG/Test meeting, for the Subjective Test, took place at the JVC Kurinama Technical Center, Japan in four(4) full days, (November 18, to 21).
Before starting the subjective test, two (A and B) assessment groups were organized and then brief instruction was made to all assessers.

1. Proposal

There are 32 proposals have been submitted to the MPEG 2 test, 11 from 625/50 and 21 from 525/60 country. (see Table 1)

2. MPEG-2 subjective assessment schedule

The 32 proposals were divided and edited into 13 test tapes. There were 13 sessions of official and 4 sessions of additional subjective test have been carried out under the schedule showing below,

Nov. 18 (Mon)	2 official sessions	1 additional session
Nov. 19 (Tue)	4 official sessions	1 additional session
Nov. 20 (Wed)	3 official sessions	1 additional session
Nov. 21 (Thu)	4 official sessions	1 additional session

3. Test results

The results of the subjective test was reported at the plenary meeting on 22nd, Friday and 26th, Tuesday. The detailed data were shown in following tables.

* Table 3 - Table 10 : Test results, 625 / 50
* Fig. 5 - Fig. 10 : Test results, 625 / 50

* Table 11 - Table 18 : Test results, 525 / 60
* Fig. 11 - Fig. 18 : Test results, 525 / 60

* Table 19 - Table 26 : Test results, Additional test
* Fig. 19 - Fig. 22 : Test results, Additional test

A detailed report

1. Proposals

We have received 32 proposals by October 18, 1991 out of 40 preregistrations for the MPEG 2 subjective test in Kurihama. Those are 11 proposal from 625/50 and 21 from 525/60 formats. (see Table 1)

Table 1 Table of proposals

TV STD	Proposer	Collaborating organisations
525/60	ATT	
	Aware 1	
	Aware 2	
	Bellcore	NTT
625/50	VADIS(Group 2) 1 BBC	CCETT, FI/DBP, Nokia, NTA, RAI, Retevision, Simens, DTB, Telefonica, Telenoma, Telettra, U.Hannover, UP Madrid, RTT, NTL, BBC
	VADIS(Group 2) 2 NTA	idem
	VADIS(Group 2) 3 RTT	UCL + idem
	BT	CNET, NTUA, Siemens, Intracom, Italtel
	CCETT	EPFL, HHI, LER, Siemens, UCL
525/60	GCT	Waseda U, Toppan, Sharp, NEC, NHK
625/50	HHI	
525/60	Hitachi	Fujitsu
	IBM	
	JVC	JVC Lab of America
	KDD	
625/50	LEP	PRL, PTT Research, Philips CE
525/60	PTT Research	LEP, PRL, Philips CE
	Matsushita	
	MIT	
	Mitsubishi	
	NEC	GCT, NHK, Sharp, Toppan, Waseda U
	NHK	NEC, Sharp, Toppan, GCT, Waseda U
625/50	Philips CE	David Sarnoff RC, PTT Research, Thomson CE
525/60	Thomson CE	David Sarnoff RC, PTT Research, Philips CE
	Sharp	GCT, Waseda U, Toppan, NEC, NHK
	Sony	
625/50	Thomson LER	
525/60	Toshiba	
625/50	UCL	
525/60	Waseda U	
	Columbia U	
625/50	EPFL	

2. Assessors

Thanks to all assessors who made an enormous effort to complete the MPEG 2 Subjective Test. Table 2 is the list of assessors.

Table 2

Assessor's Name

No.	Assessor's Name	Company	Country
1	Jechang Jedng	Sam Sung	Korea
2	Touradj Ebrahimi	EPFL	CH
3	Tony Lessman	Bellcore	USA
4	Oliver Poncin	RTT	B
5	Saito	TI	J
6	Toshinori Odaka	Toshiba	J
7	Mark Adler	Hughes A/C	USA
8	Yoshino		
9	B.Hammer	Simens	D
10	R.Atavind	ATT	USA
11	T.Yoshida	Canon	J
12	Kato	Sony	J
13	Jan Van Del Meer	Philips C.E.	NL
14	S.Matsumura	Pioneer	J
15	Hirohisa Yamaguchi	KDD	J
16	Philippe M. Cassereau	Aware	USA
17	Jean-Francois Vial	Thomson/LER	F
18	Holly Faubel	Intel	USA
19	Guenther Schamel	HHI	D
20	Arian Koster	PTT Res.	NL
21	T.Kummerow	Telenorma	D
22	G.Eude	BT Lab.	GB
23	Van Caillie	(UCL)->Thomson	D
24	Ichiro Ando	JVC	J
25	Masahiro Iwahashi	GCT	J
26	Donald Shaver	TI	J
27	O.Weruer		
28	Katsunori Aoki	NHK	J
29	Dimitris Anastassiou	Univ.Columbia	USA
30	Joseph Stampleman	MIT	USA

No.	Assessor's Name	Company	Country
31	Makiko Konoshima	Fujitsu	J
32	Choon Lee	KAIST	Korea
33	Tomoko Aono	Sharp	J
34	Hirobumi Nishikawa	Mitsubishi	J
35	J.Bording	NTA	N
36	G.Madec	CCETT	F
37	N.Wells	BBC	GB
38	Bill Buttera	ITT Intermetal	D
39	Mark Tayer	GI	USA
40	Gilles Nocture	LEP	F
41	Satoshi Nogaki	NEC	J
42	Yutaka Machida	Matsushita	J
43	Toshimitsu Honma	Toppan	J
44	Tsuyoshi Hanamura	Univ.Waseda	J
45	J.O.Morris	Philips C.E.	NL
46	Andrew Jue	National S.C.	USA
47	H.Ide	Cashio	J
48	Don Mead	Hughes A/C	USA
49	Jyunichi Kimura	Hitachi	J
50	Manfred Kuhn	DBP/FI	D
51	Takayuki Sugawara	JVC	J
52	Motoki		
53	M.Tinker	Intel	USA
54	R.Burns	Hughes A/C	USA

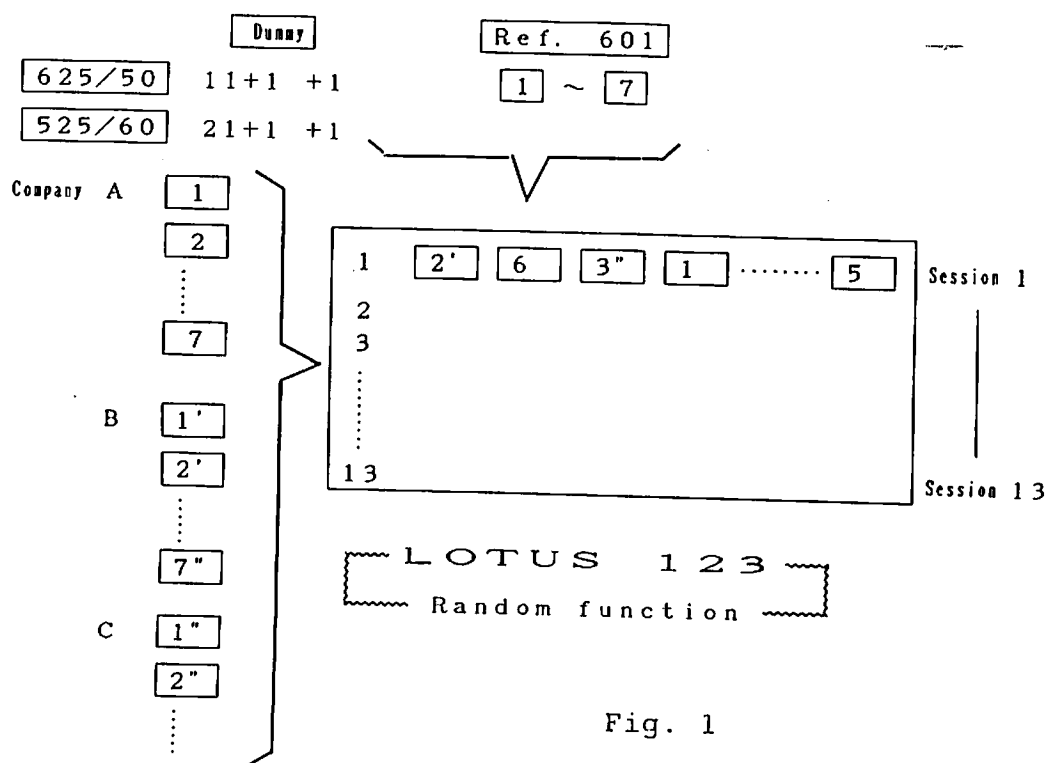
3. Preparation of the session tape

Each proposer submitted seven(7) corded pictures, three(3) for 4 Mbps and four (4) for 9 Mbps. Those pictures were shuffled and mixed with other proposals in random order by using of "Random Function programme", Lotus 123. CCIR 601 original pictures out of D-1 machine and Dummy pictures, which repeated one of proposal, were also added in condition of at random.

The purpose of adding 601 original signal, as a reference, is that to make sure an assessor has capabilities to judge a quality of the reference picture. For the reason of the Dummy signal is to evaluate a quality of assessment group.

Then a combination of one of the above test picture and 601 ref. makes a pair of test sequence correspond to A/B or B/A. A reference picture and test picture are displayed in random order, and this combination A/B is repeated twice for voting at the second session.

As a result, 625/50 systems accounted for a total of 5 sessions and 8 sessions for 525/60 formats. (see Fig.1)



4. Each session tape (Fig. 2)

One session is divided into a first and second half, and each half of the session individual test picture are displayed twice in differing sequences. If the first and second halves of a session produce substantially different results (over 20 in score) with the same combination of reference and test picture, both of them will be dropped.

Each Session

Fig. 2

1st Half (20 max)

Company	A
	B
	C
	D
	E
	...
	T

2nd Half

Company	C
	D
	B
	S
	K
	...
	E

Deviation > 20 (one scale) → drop from the data
 ...
 in same picture

5. Voting and Score Sheet

Pair of A and B lines 100 mm long were used as the 5-gradation assessment scale. During subjective evaluation, the assessor voted by making a short horizontal bar for each of the pictures A and B.

Figure 3 shows a voting sheet used in the assessment.

Fig. 3
MPEG-2

'91 November Meeting
VOTING SHEET

Please check your pos.

Monitor

4H ① ②

6H ③ ④ ⑤

DATE Nov. 1991

SESSION No. F/S

MONITOR No.

NAME CODE

NAME

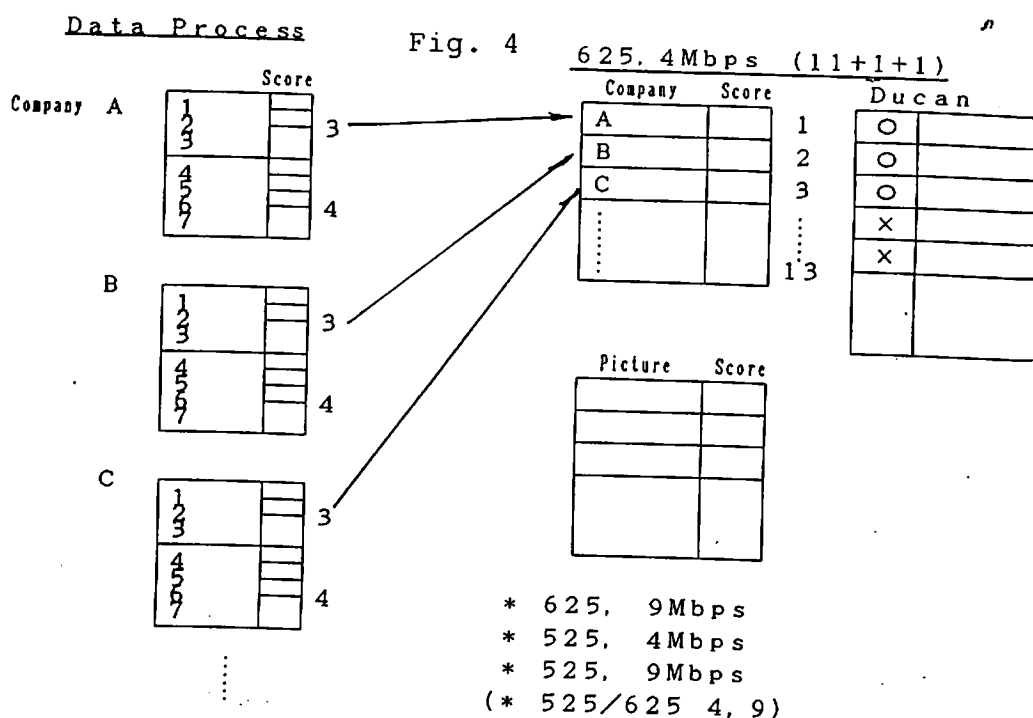
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B
Excellent																				
Good																				
Fair																				
Poor																				
Bad																				

6. Data Process

Data processing was performed using Lotus 1-2-3 on a personal computer. The total score of each organization was calculated per format and per bit-rate. At the same time the method of Duncan's Multiple Range Test was used for analysis of variance for the subjective test results. The method will be used to get better understanding of algorithms which are not significantly different than the algorithm ranked first. (Proposed by BNR, Canada, MPEG 91/112)

The data was also calculated the average score according to picture type for the purpose of evaluating a difficulty in coding.

Figure 4 shows a method of data process.



7. Test Results

- (1) Table 3 shows the average score of the picture in 625/50, 4 Mbps. The most difficult picture in this case was Mobile & Calendar and Table Tennis was relatively easy one.
- (2) Table 4: 625/50, 9 Mbps
- (3) Table 5 shows assessment ranking of organization per individual test sequence.

MPEG-2 Subjective Assessment

625/50 4Mbps PICTURES

Table 3

DATA SOURCE	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	OMIT%	AVG	S.D.	RANK	AVG4H	AVG6H	DIFF.	D1AVGD	2AVGD	3AVGD	4AVGD	5AVGD	DIFF.
Flower G.	545	579	16	31	24.06	-	33	31	2	32	32	30	30	33	3
Table T.	553	696	15	27	26.39	-	29	25	4	28	27	29	19	30	11
Mobile & C.	506	562	22	34	23.70	-	35	33	2	38	32	35	30	33	8
-	1604	623	18	30	24.95	-	32	31	1	33	30	31	26	32	7

625/50 9Mbps PICTURES

Table 4

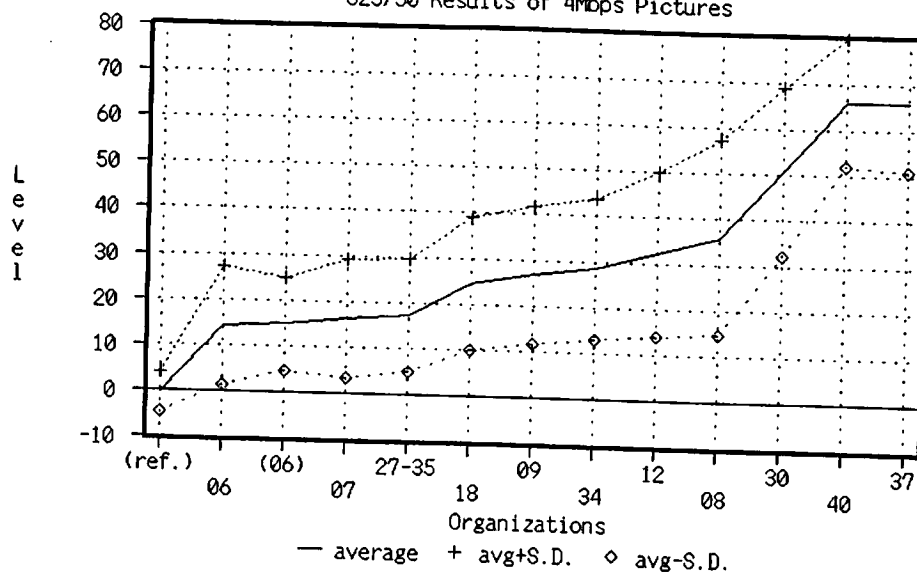
DATA SOURCE	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	OMIT%	AVG	S.D.	RANK	AVG4H	AVG6H	DIFF.	D1AVGD	2AVGD	3AVGD	4AVGD	5AVGD	DIFF.
Flower G.	608	516	6	17	22.71	-	18	16	2	18	19	16	14	17	5
Table T.	574	310	12	10	17.60	-	11	9	2	10	12	11	8	8	4
Mobile & C.	581	291	11	13	17.05	-	14	12	1	10	16	13	12	14	5
Popple	553	208	15	8	14.41	-	10	8	2	7	9	11	7	8	4
-	2316	597	14	22	24.44	-	23	23	1	24	23	23	18	22	6

625/50 ASSESSMENT RANKING Table 5

DATA ORGANIZATION	4M PICTURE				9M PICTURE				
	FG	TT	MC	ALL	FG	TT	MC	PP	ALL
(06)	4	2	4	2	6	4	6	2	3
(ref.)	1	1	1	1	1	1	1	1	1
06	5	3	5	4	3	3	2	3	2
07	8	5	2	5	5	6	4	9	4
08	9	8	10	9	10	5	11	7	10
09	6	7	7	6	9	7	9	5	7
12	3	11	8	10	4	9	10	10	9
18	10	6	9	8	7	8	8	4	6
27-35	2	4	3	3	8	2	5	8	5
30	11	10	11	11	12	13	3	11	11
34	7	9	6	7	2	10	7	6	8
37	12	13	13	13	13	11	13	12	13
40	13	12	12	12	11	12	12	13	12

DATA ORGANIZATION	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	OMIT%	AVG	S.D.	RANK	AVG4H	AVG6H	DIFF.	D1	AVGD2	AVGD3	AVGD4	AVGD5	AVGDIFF.
(ref.)	146	19	3	0	4.33	1	-1	0	0	-1	1	-1	-1	0	2
(06)	109	167	27	14	12.93	2	16	13	2	17	19	12	10	12	9
27-35	138	100	8	15	10.01	3	17	14	3	13	18	14	14	15	5
06	128	168	15	16	12.96	4	17	16	1	19	18	16	14	15	5
07	113	150	25	17	12.26	5	21	15	6	23	15	14	15	18	9
09	126	216	16	25	14.69	6	27	23	4	27	25	27	20	24	7
34	99	231	34	27	15.21	7	30	25	6	22	36	21	26	28	15
18	105	236	30	28	15.35	8	30	28	2	31	28	30	27	26	4
08	128	329	15	32	18.14	9	34	31	3	39	31	34	24	33	15
12	118	459	21	36	21.42	10	37	35	2	38	39	39	23	41	18
30	120	343	20	51	18.52	11	53	49	4	56	37	61	40	58	23
40	136	196	9	66	13.99	12	68	65	3	70	68	61	63	69	9
37	138	228	8	66	15.11	13	66	66	0	66	69	66	62	68	7
-	1604	623	18	30	24.95	-	32	31	1	33	30	31	26	32	7

Fig. 5 MPEG-2 Subjective Assessment
625/50 Results of 4Mbps Pictures

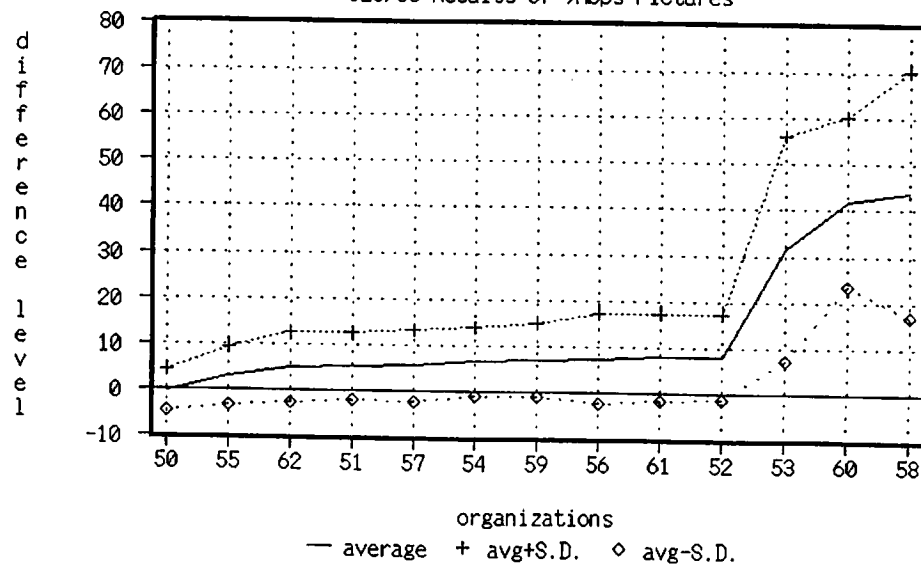


(4) Table 6 shows overall average score of organizations in 625/50, 4 Mbps. The company (06) was dummy, data containing the same picture as for 06.

(5) Figure 5 shows graph indicating the data of Table 6.

DATA ORGANIZATION	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	OMIT%	AVG	S.D.	RANK	AVG4H	AVG6H	DIFF.	D1AVGD	2AVGD	3AVGD	4AVGD	5AVGD	DIFF.
(ref.)	196	20	2	0	4.43	1	0	0	0	0	0	-1	-1	0	2
06	182	41	9	3	6.38	2	3	3	0	0	3	4	3	5	5
(06)	182	58	9	5	7.62	3	6	4	2	3	5	6	5	6	4
07	186	54	7	5	7.34	4	7	4	3	7	4	5	4	5	3
27-35	171	60	15	6	7.73	5	7	5	2	4	9	4	6	4	6
18	190	56	5	7	7.47	6	6	7	-1	7	7	9	4	7	5
09	192	63	4	7	7.96	7	8	6	1	8	8	6	6	6	3
34	190	96	5	7	9.81	8	9	6	3	7	8	8	6	7	2
12	174	89	13	8	9.46	9	10	6	4	6	9	12	7	5	6
08	188	86	6	8	9.27	10	9	7	2	8	10	8	6	8	5
30	166	598	17	32	24.45	11	34	30	5	28	33	34	27	36	9
40	166	340	17	42	18.45	12	44	40	4	44	44	43	36	43	8
37	133	710	34	44	26.65	13	45	43	2	53	49	37	38	46	16
-	2316	597	14	22	24.44	-	23	23	1	24	23	23	18	22	6

Fig. 6 MPEG-2 Subjective Assessment
625/50 Results of 9Mbps Pictures



(6) Table 7: 625/50, 9 Mbps

(7) Figure 6 shows graph indicating the data of Table 7. The curve indicates that the differences of the average score in 9 organizations were very little.

DATA	ALL DATA						Duncan' s range			
ORGANIZATION	COUNT	VAR	DEV	1/Count	AVG	RANK	DI_AVG	Rp_1	JUDGE	RANGE
(ref.)	146	19	2739	0.0068	-0.35	1	0.00			1
(06)	109	167	18219	0.0092	14.14	2	14.49	3.69	×	2
27-35	138	100	13828	0.0072	14.78	3	15.12	3.89	×	2
06	128	168	21483	0.0078	16.30	4	16.65	4.02	×	2
07	113	150	16972	0.0088	17.19	5	17.54	4.11	×	2
09	126	216	27194	0.0079	24.60	6	24.94	4.19	×	3
34	99	231	22913	0.0101	26.75	7	27.10	4.25	×	3
18	105	236	24729	0.0095	28.40	8	28.75	4.30	×	3
08	128	329	42133	0.0078	32.09	9	32.44	4.34	×	4
12	118	459	54119	0.0085	35.96	10	36.31	4.38	×	5
30	120	343	41168	0.0083	50.68	11	51.03	4.62	×	6
40	136	196	26636	0.0074	66.13	12	66.48	4.62	×	7
37	138	228	31501	0.0072	66.14	13	66.49	4.62	×	7
-	1604	623	998691	0.0006	30.45	-				

SSe= 343633

MSe= 215.99

Syi= 1.33

DATA	ALL DATA						Duncan' s range			
ORGANIZATION	COUNT	VAR	DEV	1/Count	AVG	RANK	DI_AVG	Rp_1	JUDGE	RANGE
(ref.)	196	20	3845	0.0051	-0.21	1	0.00			1
06	182	41	7397	0.0055	2.96	2	3.18	2.63	×	2
(06)	182	58	10558	0.0055	4.87	3	5.09	2.77	×	2
07	186	54	10031	0.0054	5.25	4	5.46	2.86	×	2
27-35	171	60	10211	0.0058	5.51	5	5.73	2.93	×	2
18	190	56	10606	0.0053	6.60	6	6.81	2.99	×	3
09	192	63	12176	0.0052	6.94	7	7.16	3.02	×	3
34	190	96	18285	0.0053	7.28	8	7.50	3.06	×	3
12	174	89	15570	0.0057	7.78	9	8.00	3.09	×	3
08	188	86	16162	0.0053	8.00	10	8.21	3.12	×	3
30	166	598	99243	0.0060	31.57	11	31.79	3.29	×	4
40	166	340	56499	0.0060	41.96	12	42.17	3.29	×	5
37	133	710	94450	0.0075	43.66	13	43.88	3.29	×	5
-	2316	597	1383195	0.0004	21.64	-				

SSe= 365031

MSe= 158.50

Syi= 0.95

- (8) Table 8 and 9 shows ranking with Duncan's M.R.T. which indicated the first 4 (3) organizations will be within a same level in quality of the picture.

DATA ORGANIZATION	4M PICTURE				9M PICTURE				
	FG	TT	MC	ALL	FG	TT	MC	PP	ALL
(06)	22	5	19	14	6	2	10	1	5
(ref.)	0	0	0	0	0	0	0	0	0
06	23	6	22	16	4	1	5	2	3
07	25	11	15	17	6	3	6	6	5
08	30	20	44	32	11	3	15	4	8
09	24	19	31	25	11	3	11	3	7
12	21	56	31	36	5	7	11	8	8
18	31	17	33	28	9	4	11	3	7
27-35	15	11	18	15	9	1	7	5	6
30	53	45	54	51	55	46	6	23	32
34	24	27	30	27	4	11	10	4	7
37	68	64	66	66	59	16	69	30	44
40	69	64	65	66	52	46	37	30	42

Fig. 7 MPEG-2 Subjective Assessment
625/50 4Mbps Pictures

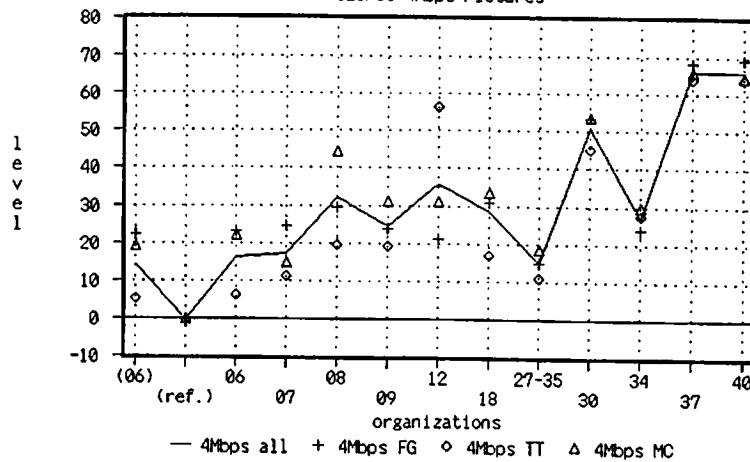
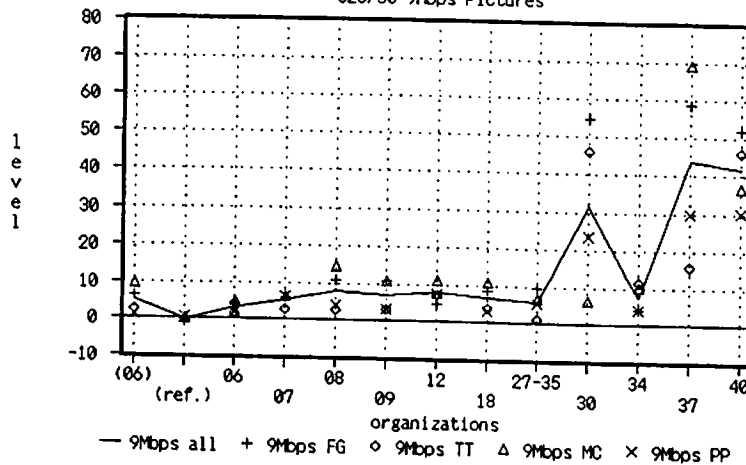
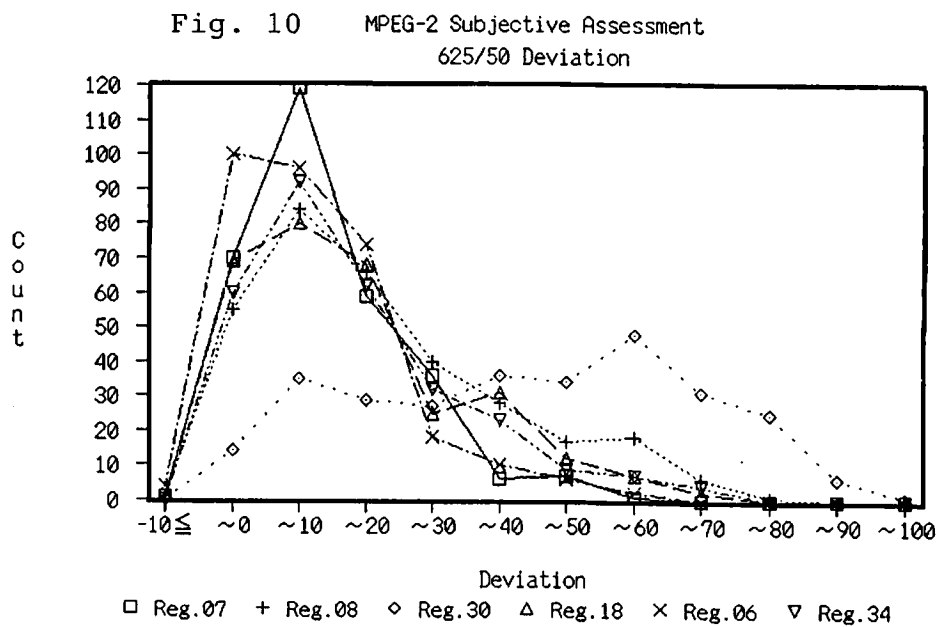
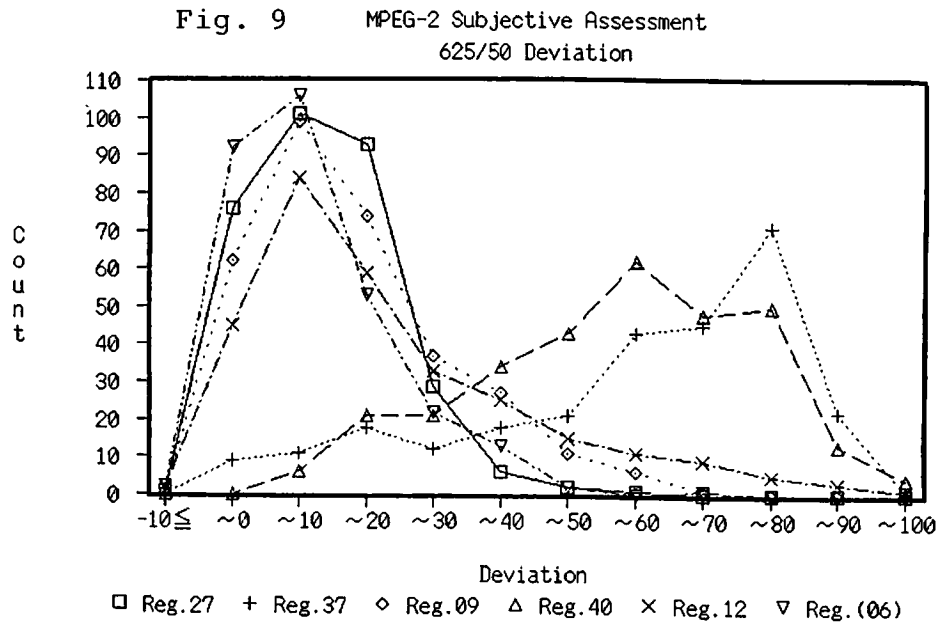


Fig. 8 MPEG-2 Subjective Assessment
625/50 9Mbps Pictures



(9) Figure 7 and 8 shows graphs indicating the overall average and the average according to picture type obtained in the 625/50 standard of Table 10.

(10) Figure 9 and 10 shows graph of deviation in variou different registration of 625/50 standard.



- (11) Table 11: 525/60, 4 Mbps Pictures
 (12) Table 12: 525/60, 9 Mbps Pictures
 (13) Table 13: 525/60, Assessment Ranking

525/60 4Mbps PICTURES

Table 11

DATA SOURCE	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	OMIT%	AVG	S.D.	RANK	AVG4H	AVG6H	DIFF.	D1	AVGD2	AVGD3	AVGD4	AVGD5	AVGDIFF.
Flower G.	1014	325	12	29	18.02	-	32	28	4	28	28	30	33	28	5
Table T.	939	386	18	31	19.65	-	33	29	3	29	31	31	32	30	2
Mobile & C.	960	436	17	34	20.88	-	36	32	4	29	36	36	36	32	7
-	2913	385	16	31	19.61	-	33	32	1	29	32	32	33	30	4

525/60 9Mbps PICTURES

Table 12

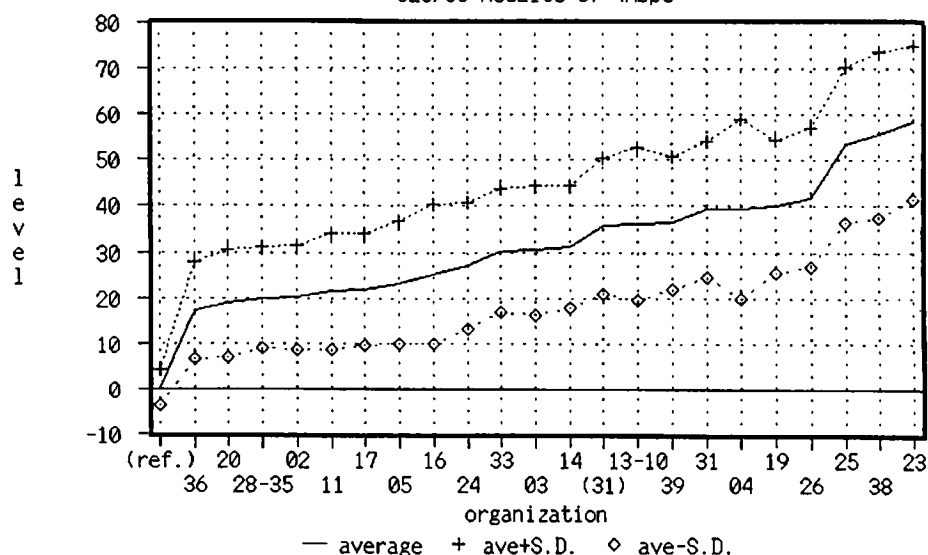
DATA SOURCE	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	OMIT%	AVG	S.D.	RANK	AVG4H	AVG6H	DIFF.	D1	AVGD2	AVGD3	AVGD4	AVGD5	AVGDIFF.
Flower G.	1060	532	8	18	23.07	-	19	17	3	17	19	17	19	17	3
Table T.	1020	571	11	20	23.90	-	21	19	1	20	19	21	23	17	6
Mobile & C.	1044	552	9	22	23.49	-	23	21	2	22	20	23	22	22	3
Popple	1000	598	13	16	24.45	-	17	15	3	16	15	16	16	15	1
-	4124	461	13	26	21.46	-	27	27	1	24	26	26	28	24	4

525/60 ASSESSMENT RANKING Table 13

DATA PROPOSAL No.	4M				9M				
	FG	TT	MC	ALL	FG	TT	MC	PP	ALL
(31)	13	14	16	14	15	18	16	14	18
(ref.)	1	1	1	1	1	1	1	1	1
02	5	3	7	5	3	3	4	7	3
03	9	16	10	12	10	17	10	20	15
04	21	17	13	18	18	11	13	16	14
05	6	9	3	8	9	15	7	2	10
11	10	4	4	6	6	2	2	6	2
13-10	14	13	17	15	12	14	15	4	13
14	11	12	14	13	8	13	11	3	9
16	12	6	9	9	16	5	17	13	12
17	3	8	8	7	4	9	9	11	8
19	18	15	20	19	13	16	19	15	17
20	4	5	5	3	5	6	5	5	5
23	23	21	23	23	21	20	21	21	21
24	7	11	11	10	7	8	6	12	6
25	22	22	21	21	22	21	22	22	22
26	19	18	18	20	17	12	14	19	16
28-35	8	2	6	4	11	7	8	9	7
31	16	20	19	17	19	19	18	10	19
33	15	10	12	11	14	10	12	18	11
36	2	7	2	2	2	4	3	8	4
38	20	23	22	22	20	22	20	17	20
39	17	19	15	16	-	-	-	-	-

DATA	ALL DATA						POSITION			DISPLAY					
PROPOSAL No.	COUNT	VAR	DMIT%	AVG	S.D.	RANK	AVG4H	AVG6H	DIFF.	D1	AVGD2	AVGD3	AVGD4	AVGD5	AVGD1FF.
(ref.)	147	15	2	0	3.91	1	0	1	-1	0	0	-1	2	1	3
36	137	114	9	17	10.67	2	19	17	2	14	16	16	24	17	10
20	125	139	17	19	11.78	3	21	17	4	13	22	19	24	16	12
28-35	128	122	15	20	11.03	4	22	19	4	18	19	26	20	17	9
02	132	131	12	20	11.45	5	22	19	3	20	17	24	21	18	7
11	123	162	18	21	12.72	6	24	20	4	17	23	22	26	18	9
17	124	151	17	22	12.27	7	24	21	3	20	23	22	23	22	3
05	138	179	8	23	13.39	8	25	22	3	19	23	29	23	21	11
16	110	233	27	25	15.26	9	31	22	10	22	28	31	25	21	9
24	128	190	15	27	13.79	10	30	26	4	25	30	27	25	29	5
33	124	178	17	30	13.34	11	33	29	4	30	29	29	33	31	4
03	120	198	20	30	14.06	12	33	29	4	33	24	30	33	31	9
14	124	175	17	31	13.24	13	33	30	3	29	34	35	27	30	8
(31)	122	216	19	36	14.70	14	37	35	1	35	41	33	38	31	9
13-10	125	274	17	36	16.55	15	38	35	4	32	42	31	41	34	10
39	118	206	21	36	14.35	16	38	35	2	33	36	38	42	32	10
31	120	217	20	39	14.73	17	43	37	5	37	49	36	37	40	13
04	124	385	17	39	19.63	18	43	37	6	32	46	37	42	40	14
19	124	211	17	40	14.53	19	42	38	4	36	45	46	37	38	10
26	132	227	12	42	15.08	20	44	40	4	41	37	42	47	43	10
25	141	288	6	54	16.97	21	55	53	2	50	48	52	66	53	18
38	125	331	17	56	18.19	22	57	55	3	56	57	59	56	51	8
23	122	284	19	58	16.85	23	61	56	5	52	59	64	60	56	12
-	2913	385	16	31	19.61	-	33	32	1	29	32	32	33	30	4

Fig. 11 MPEG-2 Subjective Assessment
525/60 Results of 4Mbps



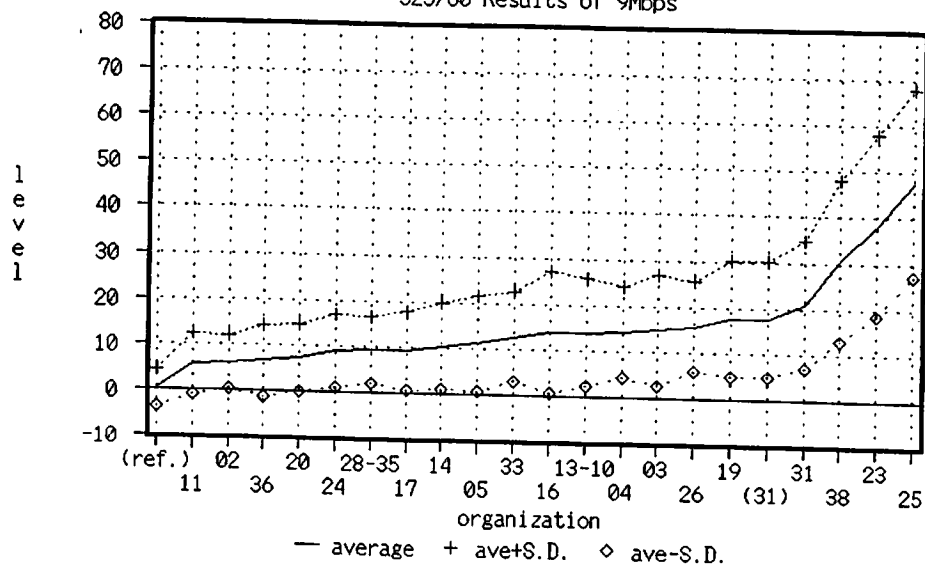
(14) Table 14: 525/60, Ranking of Organizations, 4 Mbps

(15) Figure 11: Graph of Table 14

Table 15

DATA	ALL DATA						POSITION			DISPLAY					
PROPOSAL No.	COUNT	VAR	DMIT%	AVG	S.D.	RANK	AVG4H	AVG6H	DIFF.	D1AVGD	2AVGD	3AVGD	4AVGD	5AVGD	DIFF.
(ref.)	195	16	3	0	4.02	1	0	1	-1	0	0	-1	1	2	3
11	196	44	2	6	6.60	2	7	5	2	4	7	7	5	4	3
02	194	34	3	6	5.86	3	7	6	1	4	4	7	9	6	4
36	183	61	9	6	7.84	4	7	6	2	7	4	5	9	7	4
20	187	53	7	7	7.27	5	9	6	2	8	8	7	8	7	2
24	182	63	9	9	7.96	6	11	8	4	11	9	8	9	8	3
28-35	194	53	3	9	7.28	7	10	9	1	10	10	11	8	6	5
17	190	75	5	9	8.68	8	10	9	1	10	8	9	10	10	2
14	187	91	7	10	9.55	9	12	9	3	7	12	9	12	12	5
05	182	108	9	11	10.40	10	11	11	1	10	11	15	9	11	5
33	173	95	14	13	9.76	11	14	12	2	12	9	11	19	12	10
16	176	178	12	14	13.36	12	16	13	3	14	12	12	18	14	6
13-10	171	138	15	14	11.76	13	16	13	3	14	15	13	16	13	4
04	180	100	10	14	10.02	14	16	13	3	14	11	19	16	12	8
03	168	147	16	15	12.11	15	16	14	3	13	12	16	20	14	8
26	162	95	19	16	9.76	16	18	14	3	17	18	15	15	14	4
19	152	161	24	18	12.68	17	19	17	3	17	17	18	17	19	2
(31)	174	160	13	18	12.65	18	20	16	4	19	22	16	15	17	7
31	179	193	11	21	13.88	19	22	20	2	19	18	19	28	21	10
38	166	310	17	30	17.60	20	33	28	5	32	27	34	29	31	7
23	160	391	20	38	19.78	21	41	36	5	39	31	43	41	34	12
25	173	413	14	48	20.31	22	48	47	0	45	52	52	49	39	13
-	4124	461	13	26	21.46	-	27	27	1	24	26	26	28	24	4

Fig. 12 MPEG-2 Subjective Assessment
525/60 Results of 9Mbps



- (16) Table 15: 525/60, Ranking of Organizations, 9 Mbps
 (17) Figure 12: Graph of Table 15

DATA	ALL DATA						Multiple range			
PROPOSAL No.	COUNT	VAR	DEV	1/Count	AVG	RANK	DI_AVG	RP_1	JUDGE	RANGE
(ref.)	147	15	2252	0.0068	0.22	1	0.00		○	1
36	137	114	15603	0.0073	17.31	2	17.08	3.49	×	2
20	125	139	17333	0.0080	18.79	3	18.57	3.68	×	2
28-35	128	122	15559	0.0078	20.05	4	19.83	3.81	×	2
02	132	131	17318	0.0076	20.16	5	19.93	3.90	×	2
11	123	162	19888	0.0081	21.43	6	21.21	3.97	×	3
17	124	151	18665	0.0081	21.92	7	21.69	4.02	×	3
05	138	179	24748	0.0072	23.28	8	23.05	4.07	×	3
16	110	233	25627	0.0091	25.30	9	25.08	4.11	×	4
24	128	190	24324	0.0078	27.11	10	26.88	4.15	×	4
33	124	178	22053	0.0081	30.32	11	30.10	4.38	×	5
03	120	198	23707	0.0083	30.41	12	30.18	4.38	×	5
14	124	175	21752	0.0081	31.10	13	30.88	4.38	×	5
(31)	122	216	26373	0.0082	35.71	14	35.49	4.38	×	6
13-10	125	274	34257	0.0080	36.19	15	35.97	4.38	×	6
39	118	206	24296	0.0085	36.37	16	36.15	4.38	×	6
31	120	217	26047	0.0083	39.43	17	39.20	4.38	×	6
04	124	385	47787	0.0081	39.47	18	39.24	4.38	×	6
19	124	211	26169	0.0081	40.04	19	39.82	4.38	×	7
26	132	227	30009	0.0076	41.87	20	41.65	4.38	×	7
25	141	288	40625	0.0071	53.52	21	53.30	4.38	×	8
38	125	331	41339	0.0080	55.65	22	55.42	4.38	×	8
23	122	284	34630	0.0082	58.26	23	58.04	4.38	×	9
-	2913	385	1120719	0.0003	31.23	-				

SSe= 580359

MSe= 200.82

Syi= 1.26

DATA	ALL DATA						Multiple range			
PROPOSAL No.	COUNT	VAR	DEV	1/Count	AVG	RANK	DI_AVG	RP_1	JUDGE	RANGE
(ref.)	195	16	3153	0.0051	0.36	1	0.00			1
11	196	44	8533	0.0051	5.61	2	5.24	2.32	×	2
02	194	34	6665	0.0052	6.03	3	5.66	2.45	×	2
36	183	61	11246	0.0053	6.47	4	6.11	2.53	×	2
20	187	53	9896	0.0053	7.37	5	7.01	2.59	×	2
24	182	63	11527	0.0053	9.03	6	8.66	2.64	×	3
28-35	194	53	10281	0.0052	9.22	7	8.86	2.67	×	3
17	190	75	14301	0.0053	9.32	8	8.96	2.71	×	3
14	187	91	17066	0.0053	10.35	9	9.98	2.73	×	3
05	182	108	19683	0.0055	11.16	10	10.80	2.76	×	3
33	173	95	16492	0.0058	12.71	11	12.35	2.91	×	4
16	176	178	31415	0.0057	13.95	12	13.58	2.91	×	4
13-10	171	138	23649	0.0058	14.01	13	13.64	2.91	×	4
04	180	100	18057	0.0056	14.35	14	13.99	2.91	×	4
03	168	147	24649	0.0060	14.78	15	14.42	2.91	×	4
26	162	95	15434	0.0062	15.66	16	15.30	2.91	×	5
19	152	161	24432	0.0066	17.66	17	17.29	2.91	×	5
(31)	174	160	27837	0.0057	17.69	18	17.33	2.91	×	5
31	179	193	34493	0.0056	20.82	19	20.45	2.91	×	6
38	166	310	51436	0.0060	30.40	20	30.04	2.91	×	7
23	160	391	62596	0.0063	38.20	21	37.84	2.91	×	8
25	173	413	71395	0.0058	47.61	22	47.24	2.91	×	9
-	4124	461	1899358	0.0002	25.76	-				

SSe= 514236

MSe= 125.39

Syi= 0.84

(18) Table 16: 525/60, Duncan's M. R. T., 4 Mbps

(19) Table 17: 525/60, Duncan's M. R. T., 9 Mbps

(20) Table 18: 525/60, Assessment Average

525/60

ASSESSMENT AVERAGE

Table 18

DATA	4M				9M				
PROPOSAL No.	FG	TT	MC	ALL	FG	TT	MC	PP	ALL
(31)	31	36	40	36	14	28	24	9	18
(ref.)	0	0	1	0	0	0	1	1	0
02	21	16	24	20	5	5	9	6	6
03	24	38	29	30	10	22	13	15	15
04	45	38	34	39	17	11	16	12	14
05	23	27	20	23	9	20	12	5	11
11	28	16	21	21	7	4	6	5	6
13-10	32	35	42	36	11	17	23	5	14
14	28	32	34	31	9	14	14	5	10
16	30	18	28	25	16	7	24	9	14
17	15	25	28	22	7	11	12	8	9
19	36	38	48	40	12	20	26	10	18
20	19	16	21	19	7	8	10	5	7
23	57	52	64	58	41	39	42	30	38
24	23	29	30	27	7	9	12	8	9
25	49	53	58	54	45	40	50	54	48
26	42	39	44	42	17	13	18	14	16
28-35	23	14	24	20	10	8	12	7	9
31	34	40	45	39	20	32	24	8	21
33	33	28	30	30	13	11	14	13	13
36	14	21	17	17	5	7	8	6	6
38	43	65	59	56	29	43	40	12	30
39	34	40	35	36	-	-	-	-	-

(21) Figure 13 and 14, Graph of Table 18

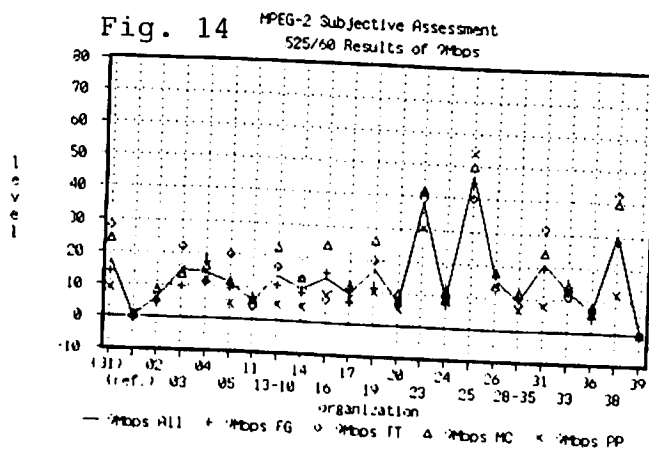
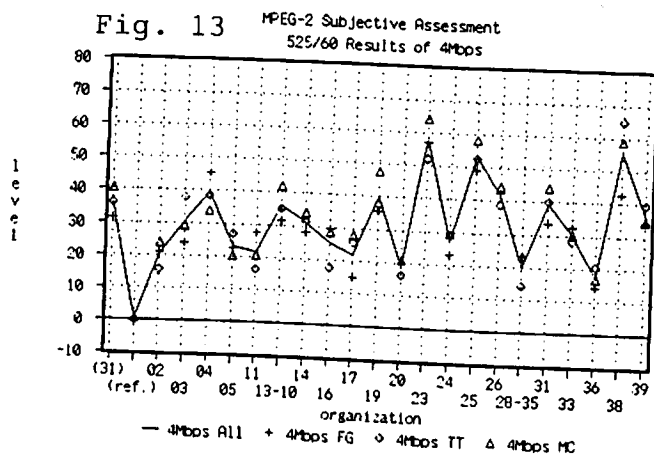


Fig. 15

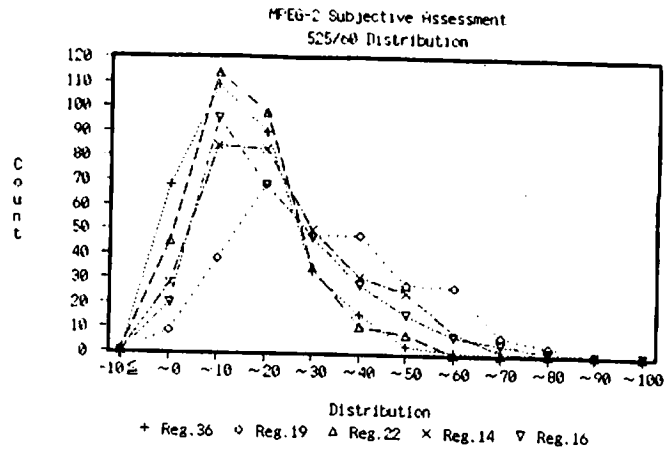


Fig. 16

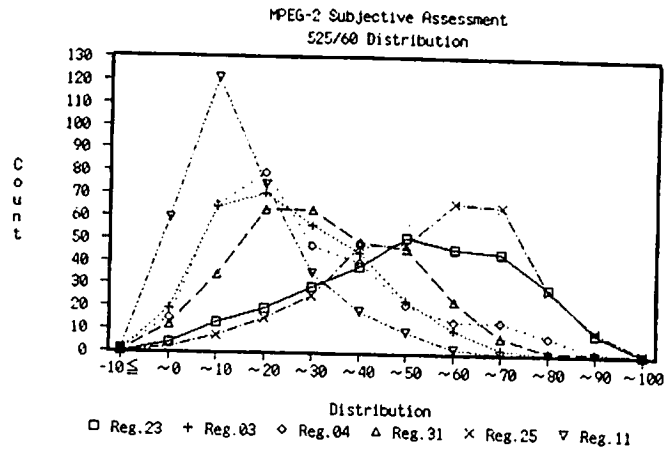


Fig. 17

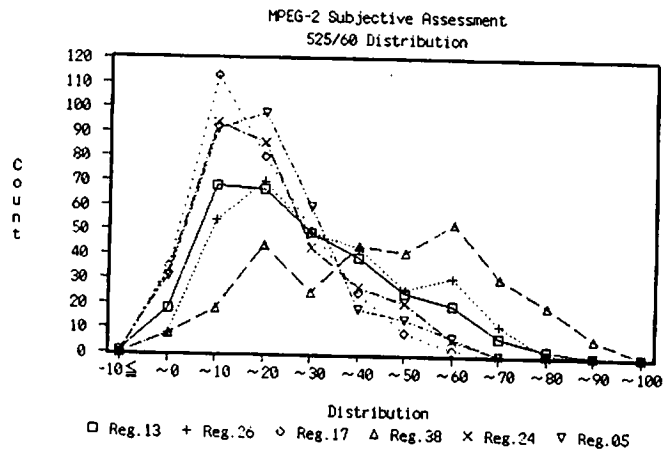
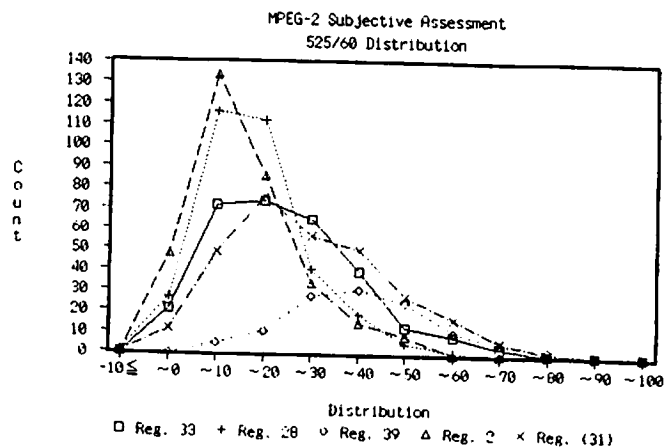


Fig. 18



(22) Figure 15 to 18 are showing graphs of deviation in individual proposal of 525/60 standard.

8. Additional Test

In addition to formal subjective testing in accordance with CCIR Rec. 500-3, an experimental subjective test were carried out with viewing distance at 2H and 4H. It was a recommendation of Test subgroup at the previous Santa Clara Meeting.

In the first three days the number of assessors for the additional testing were only 11 to 13, that is not good enough to gather the data with confidence level. In the last session of the additional testing, however, 25 assessors were participated by the effort of Dr. Mead, Hughes Aircraft.

- (1) Table 19 and 20 showing the comparison of the test results with viewing distance at 4H/6H and 2H/4H respectively. The data was converted in graph as shown in Figure 15.
- (2) Table 21 and 22 showing the test result when D-1 tape of session 6 was used. Figure 16 shows comparison chart of Table 21 and 22.
- (3) Table 23 and 24: Original session 7
Figure 17: Graph of Table 23 and 24
- (4) Table 25 and 26: Test results from 25 assessors
Figure 18: Graph of Table 25 and 26

9. Conclusion

A series of subjective test of the MPEG 2 video have been completed by the cooperations of MPEG Members and Assessors.

The data out of test result indicated many informations of the nature of each proposed algorithm. It is very important to analyze and use those data for the next step of collaboration work, but not necessary to see only the total score.

The test sequence Football was not used, unfortunately, this time for the testing due to the some error in D-1 tape on 625/50 system. However, it is important to study such high speed motion video for evaluating MPEG 2 standard.

Further study is also needed on the viewing distance whether 2H, 4H or 6H.

Thanks to Messrs D. Lemay and R. O'Shaughnessey (BNR, Canada) who supported us to analyze the test result by using method of Duncan's Multiple Range Test.

Org. Ses. 4 (625/50) Assessment position test

Table 19

DATA SOURCE	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	OMITX	AVG	S.D.	RANK	AVG1	HAVG	HDIFF	D1	AVGD2	AVGD3	AVGD4	AVGD5	AVGD1FF
41570	44	89	12	15	9.43	12	16	15	1	15	22	10	14	13	13
41600	48	188	4	69	13.72	18	71	68	2	76	70	60	73	69	16
41620	25	197	50	22	14.03	15	24	22	2	32	19	14	22	24	19
42500	50	18	0	0	4.19	1	-1	0	0	-1	1	-3	0	1	4
42610	38	417	24	56	20.42	16	55	57	-2	70	60	50	40	62	30
43600	42	200	16	65	14.15	17	65	64	1	73	70	51	67	62	22
43620	38	123	24	19	11.10	14	20	19	2	18	33	16	12	13	21
91520	50	69	0	11	8.31	11	11	10	0	12	17	9	5	9	11
91550	42	52	16	4	7.21	6	6	3	3	2	7	3	5	6	4
92500	50	18	0	0	4.19	2	-1	0	0	-1	1	-3	0	1	4
92580	30	137	40	16	11.69	13	17	14	3	28	26	13	3	11	25
92620	42	19	16	2	4.40	4	2	2	0	0	6	0	1	4	6
93530	44	51	12	6	7.16	8	6	6	0	3	13	5	4	5	10
93570	50	68	0	7	8.24	9	7	6	0	2	17	7	5	2	15
94520	44	47	12	4	6.85	5	5	3	2	5	5	4	3	4	3
94570	25	36	50	5	6.03	7	8	4	4	6	7	3	8	6	5
94610	40	106	20	8	10.32	10	9	6	3	2	13	16	6	5	13
94620	46	27	8	1	5.17	3	1	1	0	2	0	2	1	0	2

Add. Ses. 21 (625/50) Assessment position test

Table 20

DATA SOURCE	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	OMITX	AVG	S.D.	RANK	AVG2	HAVG	HDIFF	D1	AVGD2	AVGD3	AVGD4	AVGD5	AVGD1FF
41570	16	95	68	20	9.75	11	20	19	1	24	14	15	28	15	15
41600	18	76	64	78	8.72	17	80	76	3	81	76	15	75	15	15
41620	11	143	78	26	11.96	13	28	25	3	29	23	15	33	15	15
42500	22	11	56	1	3.24	1	2	-1	3	0	0	15	5	15	15
42610	22	106	56	65	10.32	15	65	66	-1	66	65	15	63	15	15
43600	20	143	60	69	11.96	16	73	66	7	69	69	15	73	15	15
43620	18	189	64	29	13.75	14	36	24	12	29	26	15	46	15	15
91520	20	74	60	10	8.63	7	10	10	0	14	5	15	17	15	15
91550	22	63	56	7	7.96	6	8	6	2	9	3	15	14	15	15
92500	22	11	56	1	3.24	1	2	-1	3	0	0	15	5	15	15
92580	12	94	76	25	9.68	12	29	23	6	21	22	15	41	15	15
92620	22	18	56	2	4.29	2	4	1	3	0	3	15	4	15	15
93530	20	56	60	12	7.48	8	16	8	8	14	8	15	20	15	15
93570	20	49	60	5	7.00	4	8	3	6	5	3	15	15	15	15
94520	14	196	72	14	13.98	10	11	16	-5	20	6	15	18	15	15
94570	11	38	78	7	6.17	5	6	7	-1	2	10	15	14	15	15
94610	20	149	60	13	12.20	9	15	10	5	10	10	15	35	15	15
94620	20	67	60	5	8.18	3	7	3	4	4	5	15	7	15	15

Fig. 19

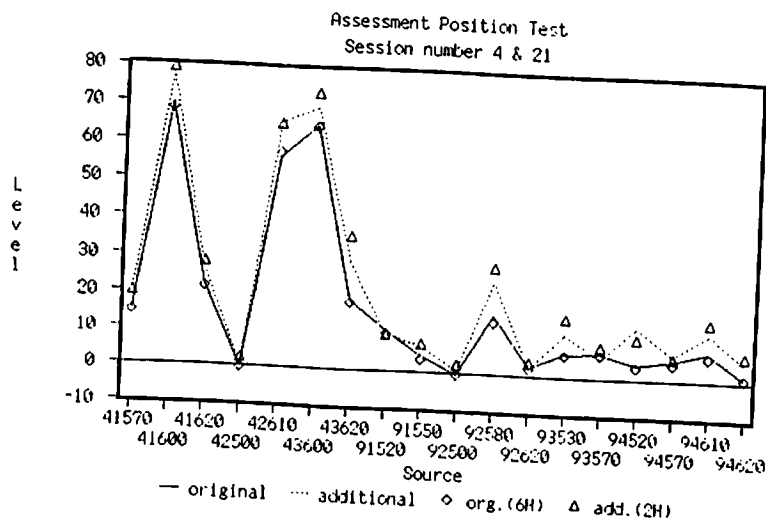


Table 21

DATA SOURCE	ALL DATA						POSITION			DISPLAY						
	COUNT	VAR	OMIT%	AVG	S.D.	RANK	AVG2H	AVG4H	DIFF	D1	AVGD2	AVGD3	AVGD4	AVGD5	AVGD6	DIFF
41100	45	352	10	49	18.76	21	51	49	2	53	39	51	56	53	17	
41110	41	190	18	28	13.80	15	28	26	2	27	26	26	35	25	10	
41120	43	290	14	32	17.04	16	33	31	2	33	26	22	46	30	24	
41150	41	375	18	43	19.36	20	46	42	4	46	36	50	52	36	16	
42030	45	155	10	16	12.46	11	19	15	4	9	15	16	30	14	21	
43000	49	22	2	1	4.65	1	0	2	-1	0	0	-2	5	2	7	
43010	47	161	6	17	12.70	12	19	17	2	9	18	14	31	17	22	
91050	45	216	10	16	14.71	10	19	16	3	17	11	8	33	19	24	
91060	43	525	14	41	22.90	19	46	39	7	44	34	36	57	40	23	
91120	41	89	18	11	9.46	7	11	11	1	10	13	7	17	9	10	
91180	45	100	10	13	10.01	8	14	13	1	12	11	9	23	13	14	
92050	49	59	2	7	7.71	4	9	7	2	5	4	4	14	10	11	
92060	39	350	22	39	18.71	17	41	39	2	40	26	39	49	37	23	
92070	41	169	18	22	12.98	13	25	21	3	15	17	21	35	21	20	
92100	43	538	14	40	23.19	18	41	41	0	45	29	48	49	30	20	
93000	49	22	2	1	4.65	2	0	2	-1	0	0	-2	5	2	7	
93010	47	101	6	8	10.06	5	10	8	2	4	6	8	14	11	10	
93030	43	58	14	10	7.62	6	13	8	6	10	8	8	16	12	8	
93090	45	169	10	24	13.01	14	26	24	2	26	18	19	37	23	19	
94040	45	60	10	5	7.72	3	7	3	4	2	5	5	8	4	5	
94070	37	228	26	15	15.11	9	21	12	9	8	13	17	27	19	20	

Table 22

DATA SOURCE	ALL DATA						POSITION			DISPLAY						
	COUNT	VAR	OMIT%	AVG	S.D.	RANK	AVG2H	AVG4H	DIFF	D1	AVGD2	AVGD3	AVGD4	AVGD5	AVGD6	DIFF
41100	20	260	60	56	16.13	20	58	53	5	56	49	65	15-	15-	15-	
41110	20	157	60	31	12.53	14	36	26	10	22	31	45	15-	15-	15-	
41120	14	244	72	45	15.63	18	50	41	9	33	66	57	15-	15-	15-	
41150	14	164	72	54	12.82	19	60	47	13	46	60	60	15-	15-	15-	
42030	22	46	56	14	6.81	6	13	15	-2	14	12	17	15-	15-	15-	
43000	24	19	52	-1	4.33	1	-2	0	-2	0	-3	-1	15-	15-	15-	
43010	22	293	56	22	17.13	11	20	23	-3	15	16	39	15-	15-	15-	
91050	24	175	52	20	13.23	10	24	16	8	20	16	25	15-	15-	15-	
91060	20	277	60	43	16.65	17	46	40	6	34	36	62	15-	15-	15-	
91120	22	51	56	12	7.11	5	12	12	-1	11	15	10	15-	15-	15-	
91180	22	146	56	17	12.07	7	19	15	4	15	14	26	15-	15-	15-	
92050	20	45	60	9	6.67	3	9	10	-1	8	10	11	15-	15-	15-	
92060	10	155	80	38	12.46	15	38	37	1	36	40	15-	15-	15-	15-	
92070	22	164	56	19	12.80	9	19	18	1	19	12	30	15-	15-	15-	
92100	20	610	60	40	24.70	16	43	38	4	53	28	27	15-	15-	15-	
93000	24	19	52	-1	4.33	1	-2	0	-2	0	-3	-1	15-	15-	15-	
93010	22	95	56	10	9.74	4	11	9	2	8	5	18	15-	15-	15-	
93030	22	176	56	17	13.27	8	18	16	2	11	17	33	15-	15-	15-	
93090	24	178	52	26	13.34	13	30	22	8	21	21	41	15-	15-	15-	
94040	24	22	52	1	4.69	2	3	0	3	1	1	2	15-	15-	15-	
94070	16	327	68	23	18.08	12	34	16	18	8	22	45	15-	15-	15-	

Fig. 20

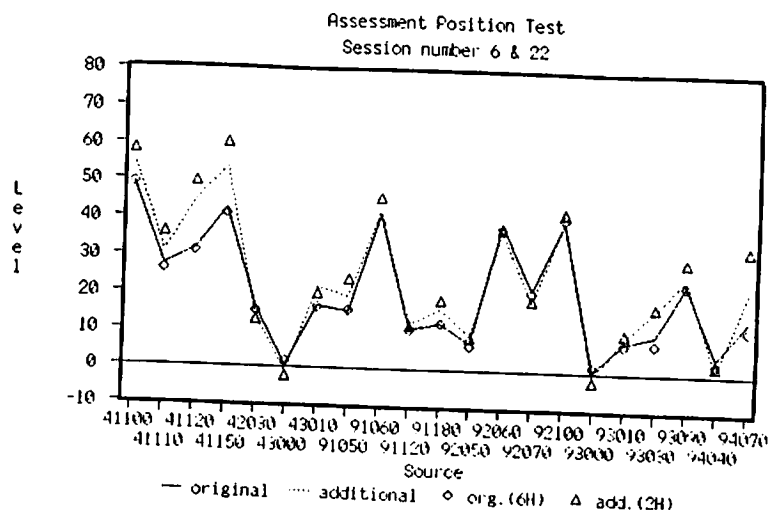


Table 23

DATA SOURCE	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	DMIT%	AVG	S.D.	RANK	AVG1	AVG6	DIFF.	1AVGD2	2AVGD3	3AVGD4	4AVGD5	5AVGD6	DIFF.
41070	36	124	28	24	11.12	14	26	23	3	30	18	15	28	29	15
41180	46	137	8	33	11.72	18	35	31	5	41	26	29	35	33	15
42010	44	110	12	21	10.48	13	22	20	1	22	13	22	25	21	12
42070	38	126	24	38	11.22	19	41	36	5	39	36	29	41	42	13
42180	40	92	20	28	9.58	17	30	27	4	27	24	30	29	32	7
91010	44	22	12	5	4.68	1	6	4	2	5	3	2	6	6	5
91070	46	44	8	10	6.66	6	11	8	3	11	7	9	13	7	6
92010	46	50	8	7	7.06	3	8	5	3	11	5	8	6	5	6
92020	38	87	24	20	9.32	12	20	21	-1	21	15	23	21	20	8
92130	40	70	20	13	8.38	10	16	11	5	20	8	13	14	9	13
93020	44	185	12	26	13.61	16	27	26	2	37	18	28	25	28	19
93080	44	101	12	16	10.03	11	19	14	4	23	10	18	16	17	13
93150	44	239	12	40	15.47	20	46	36	9	47	38	33	37	45	14
93160	48	93	4	12	9.65	7	13	11	2	22	5	11	10	9	17
93220	40	134	20	24	11.57	15	27	21	5	27	23	25	22	21	6
94010	46	64	8	6	7.99	2	8	6	1	9	4	2	10	9	8
94090	44	62	12	8	7.89	4	10	7	3	10	4	6	8	12	8
94140	48	66	4	8	8.15	5	10	7	2	12	2	7	10	11	9
94150	44	85	12	12	9.22	8	14	11	3	19	5	16	11	13	14
94180	38	147	24	13	12.12	9	17	11	6	16	8	10	20	14	12

Add. Ses. 23 (525/60) ASSESSMENT POSITION TEST

Table 24

DATA SOURCE	ALL DATA						POSITION			DISPLAY					
	COUNT	VAR	DMIT%	AVG	S.D.	RANK	AVG2	AVG4	DIFF.	1AVGD2	2AVGD3	3AVGD4	4AVGD5	5AVGD6	DIFF.
41070	20	178	60	23	13.35	12	26	22	4	16	37	21	17-	17-	17-
41180	24	321	52	36	17.92	18	40	33	7	23	49	42	17-	17-	17-
42010	22	271	56	29	16.47	16	34	25	9	21	40	24	17-	17-	17-
42070	18	380	64	48	19.51	20	51	47	4	41	61	44	17-	17-	17-
42180	22	354	56	34	18.81	17	40	29	11	27	43	31	17-	17-	17-
91010	26	35	48	4	5.94	1	5	3	2	4	4	3	17-	17-	17-
91070	26	35	48	9	5.93	4	10	8	2	7	12	8	17-	17-	17-
92010	24	116	52	10	10.76	5	11	10	1	6	12	15	17-	17-	17-
92020	22	216	56	28	14.70	14	33	24	8	25	34	23	17-	17-	17-
92130	22	166	56	15	12.88	9	18	13	5	11	12	25	17-	17-	17-
93020	22	344	56	26	18.54	13	32	22	10	22	22	37	17-	17-	17-
93080	22	140	56	16	11.84	10	22	11	11	17	12	17	17-	17-	17-
93150	20	566	60	47	23.80	19	58	40	18	37	51	67	17-	17-	17-
93160	24	154	52	13	12.41	7	17	10	7	17	11	13	17-	17-	17-
93220	20	274	60	28	16.55	15	37	22	14	22	36	26	17-	17-	17-
94010	24	67	52	5	8.18	2	7	3	4	6	0	9	17-	17-	17-
94090	22	58	56	7	7.60	3	12	4	8	8	6	8	17-	17-	17-
94140	22	98	56	10	9.88	6	15	7	8	7	8	18	17-	17-	17-
94150	16	434	68	19	20.82	11	26	15	11	8	28	31	17-	17-	17-
94180	24	165	52	14	12.85	8	17	12	5	10	16	22	17-	17-	17-

Assessment Position Test
Session number 7 & 23

Fig. 21

