RECOMMENDATION ITU-R BT.1210-1

TEST MATERIALS TO BE USED IN SUBJECTIVE ASSESSMENT

(Question ITU-R 211/11)

(1995-1997)

The ITU Radiocommunication Assembly,

considering

a)   that television system performance must be expressed by both objective and subjective measures;

b)   that the picture quality of the system is evaluated mainly by subjective assessment;

c)   that in subjective assessment, test procedures, viewing conditions and the test materials used may have a great influence on the assessment result;

d)   that digital bit-rate reduction systems, the picture quality of which is generally dependent on and sensitive to the picture contents, are increasingly introduced in the broadcasting chain;

e)   that the use of worldwide common test materials is one of the bases necessary to attain universal assessment result;

f)   that a set of materials that provide the characteristics suitable for test purposes must be properly chosen in the assessment;

g)   that the test materials must be up to date in accordance with progress in television technology,

recommends

1   that the test materials listed in Annex 1 (issued in Recommendations ITU-R BT.710, ITU-R BT.802 and ITU-R BT.1128) should be preferably used in picture quality evaluation test of television systems;

2   that the test materials should be accompanied by the information shown in Annex 1 as it is useful in the selection of the materials and the statistics that serve to characterize them; candidates for suitable statistics are given in Annex 2;

3   that the latest information on test materials should be provided by the ITU-R computer system so that organizations wanting such materials can get the proper information through on-line access;

4   that the ITU-R computer system should accept the information about candidate test materials on a "draft" basis so that newly developed materials can be registered;

5   that test materials that are not listed in Annex 1 but used in picture quality evaluation tests should be documented along with Annex 1 and be included in one ITU list, particularly if the test results have been submitted to the ITU.

ANNEX 1

Information to be accompanied by test materials

TABLE 1

Test materials for standard definition TV (SDTV)

Scene No.	Title	Contents	Represen-tative of	Attributes to be examined	Motion	Source	Availability		Statistic	Copyright status	Delivery format	Provider name
							525	625				
1	Formal pond	To be filled	To be filled	Luminance resolution	Still	Slide	o	o	To be filled	To be filled	D1 tape	To be filled
2	Boats	To be filled	To be filled	Luminance and colour resolution	Still	Slide	o	o	To be filled	To be filled	D1 tape	To be filled
3	Clown	To be filled	To be filled	Horizontal resolution	Still	Slide	o	o	To be filled	To be filled	D1 tape	To be filled
4	Boy with toys	To be filled	To be filled	Skin and colour edges	Still	Slide	o	o	To be filled	To be filled	D1 tape	To be filled
5	Girl with toys	To be filled	To be filled	Skin and colour edges	Still	Slide	o	o	To be filled	To be filled	D1 tape	To be filled
6	Young couple	To be filled	To be filled	Luminance and fine detail	Still	Slide	o	o	To be filled	To be filled	D1 tape	To be filled
7	Blackboard	To be filled	To be filled	Colour, vertical resolution	Still	Slide	o	o	To be filled	To be filled	D1 tape	To be filled
8	Tree	To be filled	To be filled	Luminance patterns	Still	Slide	o	o	To be filled	To be filled	D1 tape	To be filled
9	Old master	To be filled	To be filled	Chroma key FG	Still	Video	–	o	To be filled	To be filled	D1 tape	To be filled
10	Old master	To be filled	To be filled	Chroma key BG	Still	Video	–	o	To be filled	To be filled	D1 tape	To be filled
11	Still life	To be filled	To be filled	Chroma key FG	Still	Video	o	o	To be filled	To be filled	D1 tape	To be filled
12	Still life	To be filled	To be filled	Chroma key BG	Still	Video	o	o	To be filled	To be filled	D1 tape	To be filled
13	Kiel Harbour-1	To be filled	To be filled	High resolution	Still	8 × 10 slide	o	o	To be filled	To be filled	D1 tape	To be filled

TABLE 1 (*continued*)

Scene No.	Title	Contents	Represen-tative of	Attributes to be examined	Motion	Source	Availability		Statistic	Copyright status	Delivery format	Provider name
							525	625				
14	Sailboat	To be filled	To be filled	Luminance resolution	Slow	Video	o	o	To be filled	To be filled	D1 tape	To be filled
15	Flower garden	To be filled	To be filled	Colour details	Slow pan	Video	o	o	To be filled	To be filled	D1 tape	To be filled
16	Susie	To be filled	To be filled	Skin tones	Slow	Video	o	o	To be filled	To be filled	D1 tape	To be filled
17	Diva with noise	To be filled	To be filled	Rapid entropy changes	Prod. wipe	Video	o	o	To be filled	To be filled	D1 tape	To be filled
18	Dinner party	To be filled	To be filled	Chroma key BG		Video	o	o	To be filled	To be filled	D1 tape	To be filled
19	Boy with toys	To be filled	To be filled	Skin and colour edges	Pan (H, V)	Slide	–	o	To be filled	To be filled	D1 tape	To be filled
20	Old master	To be filled	To be filled	Chroma key FG	Slow pan	Video	–	o	To be filled	To be filled	D1 tape	To be filled
21	Old master	To be filled	To be filled	Chroma key BG	Slow pan	Video	–	o	To be filled	To be filled	D1 tape	To be filled
22	Clown	To be filled	To be filled	Luminance and colour horizontal resolution	Pan (H, V)	Slide	–	o	To be filled	To be filled	D1 tape	To be filled
23	BBC disc	To be filled	To be filled	Random movement	Circular	Video	–	o	To be filled	To be filled	D1 tape	To be filled
24	Kiel Harbour-2	To be filled	To be filled	Cycle motion (narrow filter)	Rapid rocking	Component	o	o	To be filled	To be filled	D1 tape	To be filled
25	Kiel Harbour-3	To be filled	To be filled	Cycle motion (wide filter)	Rapid rocking	Component	o	o	To be filled	To be filled	D1 tape	To be filled
26	Kiel Harbour-4	To be filled	To be filled	High resolution in H, V, T dimensions	Slow pan/zoom	Component	o	o	To be filled	To be filled	D1 tape	To be filled
27	Balls of wool	To be filled	To be filled	Moving colours	Medium	Video	o	o	To be filled	To be filled	D1 tape	To be filled
28	Popple	To be filled	To be filled	Moving colours	Pan/rotate	Video	o	o	To be filled	To be filled	D1 tape	To be filled

TABLE 1 (*continued*)

Scene No.	Title	Contents	Represen-tative of	Attributes to be examined	Motion	Source	Availability		Statistic	Copyright status	Delivery format	Provider name
							525	625				
29	Table tennis	To be filled	To be filled	Multiple rapid motions Standards conversion	Pan/zoom/cut	Video	o	o	To be filled	To be filled	D1 tape	To be filled
30	Mobile and calendar	To be filled	To be filled	Random motion of objects Standards conversion	Slow	Video	o	o	To be filled	To be filled	D1 tape	To be filled
31	Autumn leaves	To be filled	To be filled	Colour details	Slow pan/zoom	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
32	Summer flowers	To be filled	To be filled	Saturated colours, texture	Slow pan	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
33	Birches	To be filled	To be filled	Luminance details, sky	Slow tilt up	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
34	Horse riding	To be filled	To be filled	Landscape	Zoom	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
35	Bicycles	To be filled	To be filled	Bicycle wheels	Complex, fast	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
36	Ferris wheel	To be filled	To be filled	Luminance and colour details	Fast, complex	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
37	Shinjuku	To be filled	To be filled	Horizontal and vertical detail	Slow pan	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
38	Football	To be filled	To be filled	Sports	Rapid motion	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
39	Cheerleaders	To be filled	To be filled	Fast, complex	Zoom	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
40	Ciao!	To be filled	To be filled	CK, FG, luminance, colour details	Slow pan/zoom	Camera	o	o	To be filled	To be filled	D1 tape	To be filled
41	Ciao!	To be filled	To be filled	CK, BG, luminance, colour details	Slow pan/zoom	Camera	o	o	To be filled	To be filled	D1 tape	To be filled
42	Portrait de famille	To be filled	To be filled	Progressive utilization	Wipe	Camera/SE	o	–	To be filled	To be filled	D1 tape	To be filled

TABLE 1 (*continued*)

Scene No.	Title	Contents	Represen-tative of	Attributes to be examined	Motion	Source	Availability		Statistic	Copyright status	Delivery format	Provider name
							525	625				
43	Diva	To be filled	To be filled	Cuts on titles/busy scene	Cuts	Camera/SE	o	–	To be filled	To be filled	D1 tape	To be filled
44	Tempête	To be filled	To be filled	H, V, luminance, colour details	Random motion	Camera	o	o	To be filled	To be filled	D1 tape	To be filled
45	Tempête with noise	To be filled	To be filled	H, V, luminance, colour details	Random motion	Camera	o	o	To be filled	To be filled	D1 tape	To be filled
46	TV trip	To be filled	To be filled	3D graph, H, V, luminance, colour details	Zoom/rotate	Graphics	o	–	To be filled	To be filled	D1 tape	To be filled
47	Cruising	To be filled	To be filled	Animated freeze frames	2-10 freezes	Camera	o	o	To be filled	To be filled	D1 tape	To be filled
48	Decoded NTSC	To be filled	To be filled	Cross luminance colour	Slow pan/zoom	Camera	o	–	To be filled	To be filled	D1 tape	To be filled
49	Decoded PAL	To be filled	To be filled	Cross luminance colour	Slow pan/zoom	Camera	–	o	To be filled	To be filled	D1 tape	To be filled
50	Un générique	To be filled	To be filled	Rolling and crawling titles	Crawl/roll	Camera/CG	o	o	To be filled	To be filled	D1 tape	To be filled
51	Error recovery	To be filled	To be filled	Frame and calibration	Slow	Camera/Key	o	o	To be filled	To be filled	D1 tape	To be filled
52	Text for 625 diva	To be filled	To be filled	Cuts on titles	Cuts	SE		o	To be filled	To be filled	D1 tape	To be filled
53	Basketball	Basketball match	Sport	Complex large area motion, high detail background	High	CCD camera recorded directly as YUV in D1 format	–	o	To be filled	Free	D1 tape	DoCA[1]

[1] Available from Director, Communications Laboratory, Department of Communications and the Arts, Australia.   Tel.:   +616 274 8412
Fax: **+616 274 8440**.

NOTE 1 – Statistics are studied by Radiocommunication Working Party 11E.

TABLE 2

Test materials for conventional TV

Scene No.	Title	Contents	Represen-tative of	Attributes to be examined	Motion	Source	Availability		Statistic	Copyright status	Delivery format	Provider name
							525	625				
	Stills											
1	Formal pond	To be filled	To be filled	Luminance resolution	Still	Slide	o	o	To be filled	To be filled	D1/MT	To be filled
2	Boats with lighthouse	To be filled	To be filled	Luminance and colour resolution	Still	Slide	o	o	To be filled	To be filled	D1/MT	To be filled
3	Clown	Clown making up	To be filled	Horizontal resolution	Still	Slide	o	o	To be filled	To be filled	D1/MT	To be filled
4	Boy with toys	Boy playing with several coloured toys	Skin and colour edges		Still	Slide	o	o	To be filled	To be filled	D1/MT	To be filled
5	Girl with toys	Girl playing with several coloured toys	Skin and colour edges		Still	Slide	o	o	To be filled	To be filled	D1/MT	To be filled
6	Young couple	Man and woman with striped clothes	Fine detail	Luminance resolution	Still	Slide	o	o	To be filled	To be filled	D1/MT	To be filled
7	Toys and blackboards		To be filled	Colour, vertical resolution	Still	Slide	o	o	To be filled	To be filled	D1/MT	To be filled
8	Tree	Luminance patterns	To be filled	To be filled	Still	Slide	o	o	To be filled	To be filled	D1/MT	To be filled
9	Male head		To be filled	To be filled	Still	Slide			To be filled	To be filled	D1/MT	To be filled
10	Kiel Harbour	Detailed view of the Kiel Harbour	Fine resolution	Spatial resolution	Still	Slide	o	o	To be filled	To be filled	D1/MT	To be filled
11	Latin text	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	D1/MT	To be filled
12	Graph	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	D1/MT	To be filled

TABLE 2 (*continued*)

Scene No.	Title	Contents	Represen- tative of	Attributes to be examined	Motion	Source	Availability		Statistic	Copyright status	Delivery format	Provider name
							525	625				
13	Test card	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	D1/MT	To be filled
14	Zone plate	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled	D1/MT	To be filled
	Stills – Chroma key											
15	Comb and pencil	To be filled	To be filled	To be filled	Still	To be filled			To be filled	To be filled	D1/MT	To be filled
16	Twigs and ribbon	To be filled	To be filled	To be filled	Still	To be filled			To be filled	To be filled	D1/MT	To be filled
17	Old master – foreground	To be filled	Chroma key FG	To be filled	Still	To be filled	–	o	To be filled	To be filled	D1/MT	To be filled
18	Old master – background	To be filled	Chroma key BG	To be filled	Still	To be filled	–	o	To be filled	To be filled	D1/MT	To be filled
19	Dummy with comb	To be filled	To be filled	To be filled	Still	To be filled			To be filled	To be filled	D1/MT	To be filled
	Moving sequences											
20	BBC disc 1	Rotating disc with several features attached on it. The axis of rotation is parallel to the viewing axis	Circular motion	To be filled	To be filled	To be filled	–	o	To be filled	To be filled	D1/MT	To be filled
21	BBC disc 2	Idem. Increased speed	Circular motion	To be filled	To be filled	To be filled			To be filled	To be filled	D1/MT	To be filled
22	BBC disc 3	Idem. Increased speed	Circular motion	To be filled	To be filled	To be filled			To be filled	To be filled	D1/MT	To be filled

NOTE 1 – Statistics are studied by WP 11E.

TABLE 3

Test materials for 1125/60 high definition television (HDTV)

Scene No.	Title	Contents	Representative of	Attributes to be examined	Motion	Source	Statistic	Copyright status	Delivery format	Provider name
1	Woman	Bust shot of a woman with a red flower against uniform background	– Studio still portrait	– False contour, *Y/C* phase difference – Flesh tint and texture reproduction	Still	Slide	To be filled	To be filled	Slide/MT	ITE
2	Yacht harbour	Long shot of a yacht harbour with highly detailed yachts	– Outdoor still	– Waveform distortion – Aliasing – Sharpness	Still	Slide	To be filled	To be filled	Slide/MT	ITE
3	Sweaters and bag	Loose shot of sweaters, towels of various colours, a leather bag, metal pitcher, etc.	– Studio still – Textured objects	– Texture reproduction – Lustre	Still	Slide	To be filled	To be filled	Slide/MT	ITE
4	Eiffel tower	Long shot of Eiffel tower and landscape of Paris behind it	– Outdoor still	– Resolution – Sensation of reality	Still	Slide	To be filled	To be filled	Slide/MT	ITE
5	A hat shop	Scene of a stall and a couple talking beside it	– Drama	– Gray scale reproduction – Interlace artefacts	Still	Slide	To be filled	To be filled	Slide/MT	ITE
6	A couple in the snow	Loose shot, taken against the light, of a couple facing each other in the snow	– Scene taken against the light	– Gray scale reproduction – Uniformity – Large area flicker	Still	Slide	To be filled	To be filled	Slide/MT	ITE
7	Guide board	Full shot of a guide board written in various kinds of characters in different sizes	– Outdoor still	– Waveform distortion – Registration legibility	Still	Slide	To be filled	To be filled	Slide/MT	ITE
8	Tulip garden	Wide shot of a garden with red and yellow tulips in various sizes	– Highly saturated colours	– Chrominance/luminance resolution – Colour reproduction	Still	Slide	To be filled	To be filled	Slide M/T	ITE
9	Chromakey	A woman sitting against blue back with detailed flowers	– Chroma key	– Chroma key process – False contour	Still	Slide	To be filled	To be filled	Slide M/T	ITE

TABLE 3 (*continued*)

Scene No.	Title	Contents	Representative of	Attributes to be examined	Motion	Source	Statistic	Copyright status	Delivery format	Provider name
10	Cognac and fruit	To be filled	To be filled	General picture quality	To be filled	Camera	To be filled	To be filled	DVTR	ITE
11	Flower basket	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
12	Woman with bird cage	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
13	Entrance hall	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
14	Boy and toys	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
15	Intersection	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
16	European market	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
17	Walk through the square	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
18	Calligraphy practice	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
19	Streetcar	To be filled	To be filled	General picture quality Standards conversion	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
20	Buildings along the canal	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
21	Harbour scene	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
22	Church	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
23	Yacht harbour	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
24	Yachting	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
25	Whale show	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE

TABLE 3 (*continued*)

Scene No.	Title	Contents	Representative of	Attributes to be examined	Motion	Source	Statistic	Copyright status	Delivery format	Provider name
26	Rustling leaves	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
27	Wintertime river	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
28	Opening ceremony	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
29	Soccer action	To be filled	To be filled	General picture quality Standards conversion	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
30	Baseball	To be filled	To be filled	General picture quality	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
31	Marching in	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
32	Green leaves	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
33	Swinging	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
34	Japanese room	To be filled	To be filled	Distortion and aliasing	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled
35	Japanese harp	To be filled	To be filled	Distortion and aliasing	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled
36	Today's catch	To be filled	To be filled	Aliasing	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled
37	Summertime tanning	To be filled	To be filled	Skin colour and texture	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled
38	Knitting	To be filled	To be filled	Colour production and texture	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled
39	Crowded crosswalk	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled
40	Flamingos	To be filled	To be filled	Resolution for moving area	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled
41	Buddhist images	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	To be filled	To be filled

TABLE 3 (*continued*)

Scene No.	Title	Contents	Representative of	Attributes to be examined	Motion	Source	Statistic	Copyright status	Delivery format	Provider name
42	Group game	To be filled	To be filled	Performance of motion-compensated processing and of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
43	Ice hockey	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
44	Horse race	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
45	Aeroplane landing	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
46	Driving	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
47	Skyscrapers	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
48	Weather report	To be filled	To be filled	Sharpness	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
49	Flash photography	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
50	Race track with credits	To be filled	To be filled	Performance of motion-compensated processing and of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
51	View from sky with credits	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
52	Bronze with credits	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
53	Chromakey (fish bowl)	To be filled	To be filled	Performance of chroma key	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
54	Chromakey (flowers)	To be filled	To be filled	Performance of chroma key	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
55	Chromakey (sprinkling)	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
56	Chromakey (picture cuts)	To be filled	To be filled	Performance of motion-compensated processing and of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE

TABLE 3 (*continued*)

Scene No.	Title	Contents	Representative of	Attributes to be examined	Motion	Source	Statistic	Copyright status	Delivery format	Provider name
57	Overlap	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
58	Character pattern	To be filled	To be filled	Legibility	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
59	Rotating disk (without shutter)	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
60	Rotating disk (with 1/250 s shutter)	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
61	Rotating disk (with 1/1000 s shutter)	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
62	Pendulum (without shutter)	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
63	Pendulum (with 1/250 s shutter)	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
64	Pendulum (with 1/1000 s shutter)	To be filled	To be filled	Performance of motion-compensated processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
65	Woman in flowers	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
66	Woman in flowers with noise (S/N 35 dB)	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
67	Woman in flowers with noise (S/N 30 dB)	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
68	Woman in flowers with noise (S/N 25 dB)	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE
69	Woman in flowers with noise (S/N 20 dB)	To be filled	To be filled	Performance of digital signal processing	To be filled	To be filled	To be filled	To be filled	DVTR	ITE

DVTR: digital video tape recorder

ITE: Institute of Television Engineers

NOTE 1 – Statistics are studied by Radiocommunication Working Party 11E.

TABLE 4

Test materials for 1250/50 HDTV

Scene No.	Title	Contents	Representative of	Attributes to be examined	Motion	Source	Statistic	Copyright status	Delivery format	Provider name
1	English street	Natural street scene with mainly unsaturated colours; it includes zooming and motion	– Outdoor shooting – Documentary – Zoom	– Dynamic resolution – Block-switching – Artefacts	Zoom	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU
2	Geranium (BBC)	Natural scene with erratic motion in saturated coloured area; it includes a scene cut	– Outdoor shooting – Nature documentary	– Chrominance block switching – Colour blindness	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU
3	Arcade (RAI)	A background with complex texture foreground movement. Spectacular reflections on foreground rippled water	– Outdoor shooting – Panning	– Dynamic resolution – Block switching artefacts	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU
4	Noel (BBC)	Close-up of talking head. Background is in soft focus. Slight cameral motion	– Studio production – Talk shows – News, etc.	– Resolution at static motion boundary – Natural facial motion – Chrominance resolution	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU
5	Singers (EU95)	Pan/zoom across detailed background with foreground singers. Foreground and background in focus	– Studio production – Culture programmes	– Portrayal of moving detail – Block switching artefacts – Natural facial motion	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU

TABLE 4 (*continued*)

Scene No.	Title	Contents	Representative of	Attributes to be examined	Motion	Source	Statistic	Copyright status	Delivery format	Provider name
6	Winter Olympic (Thompson)	Pan across high coloured background to follow skier	– Outdoor shooting – Sports coverage	– Chrominance block switching – Colour blindness – Chrominance noise – Standards conversion	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU
7	Olympic ceremony (Barcelona, 1250)	Wide angle and close-up shots of brightly dressed performers	– Outdoor shooting – Scene with large area of saturated colours	– Coherence luminance chrominance block decision – Chrominance noise	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU
8	Tennis (BBC)	Wide angle shot of complex motion. Cameral pan to track players	– Outdoor spectacle – Sports events – Logo insertion	– Block switching – Dynamic resolution – Standards conversion	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU
9	Seats and grass (Barcelona, 1250)	Pan over empty stadium seating onto grass	– Outdoor sports – Field events	– Portrayal of moving fine detail – Behaviour for periodic structures – Luminance noise – Standards conversion	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU
10	Kiel Harbour (FI-DBP)	Still of harbour scene with non-saturated colours and highly detailed yachts on calm water	– Outdoor stills	– Resolution of still pictures – Block switching – Noise	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU

TABLE 4 (*continued*)

Scene No.	Title	Contents	Representative of	Attributes to be examined	Motion	Source	Statistic	Copyright status	Delivery format	Provider name
11	Tram (EU95)	Still of street scene. Fine text and periodic structures in buildings	– Outdoor stills	– Resolution of still pictures – Block switching artefacts	To be filled	To be filled	To be filled	To be filled	4 × D1 Exabyte	EBU
12	Mobile and calendar 2	Miniature train circulating in front of a coloured setting	To be filled	– Saturated colours – Zoom – Standards conversion	To be filled	To be filled	To be filled	To be filled	4 × D1	CCETT
13	Bicross	Mountain bike race	To be filled	– Foliage – Quick motion	To be filled	To be filled	To be filled	To be filled	4 × D1	CCETT
14	Saint Jacques	Plane landing	To be filled	– Quick motion	To be filled	To be filled	To be filled	To be filled	4 × D1	CCETT
15	Saint Malo	Sailing boats into harbour and buildings	To be filled	– Fine details – Irregular motions	To be filled	To be filled	To be filled	To be filled	4 × D1	CCETT
16	Table tennis 2	Play	To be filled	– Saturated colours – Irregular motions – Standards conversion	To be filled	To be filled	To be filled	To be filled	4 × D1	CCETT

CCETT: Centre commun d'études de télédiffusion et télécommunications (Joint Research Center for Broadcast and Telecommunications)

EBU: European Broadcasting Union

RAI: Radiotelevisione Italiana

NOTE 1 – Statistics are studied by Radiocommunication Working Party 11E.

ANNEX 2

Choice of statistics that can serve for characterization
of materials and expression of criticality

1 Introduction

Many test sequences for subjective assessment are described in Annex 1, and have been used in various evaluation tests. These sequences contain many different attributes as a whole, while each sequence provides a few attributes. It is important in actual evaluation tests to choose the sequences suitable for the test purposes.

2 Statistics measured by the Broadcasting Technology Association of Japan (BTA)

The BTA has conducted the statistics measurement for each of the ITE standard test sequences (see Table 3). The measurement has been completed for the 60 sequences. These statistics are useful in choosing proper sequences for the assessment purpose, as well as in analysing the quality degradation of the system to be evaluated.

Many kinds of statistics are considered to serve for the characterization of test materials, while most of them require an enormous time for measurement or calculation. The BTA selected the statistic items to be measured as listed below:

–   AC energy of DCT coefficients;

–   spectral entropy of DCT coefficients;

–   motion vector; and

–   motion-compensated prediction error.

In selecting these statistics, the BTA took into consideration that there are increasing opportunities to conduct the evaluation tests of digital bit-rate reduction systems, the picture quality of which is generally sensitive to the picture contents, and therefore proper test materials must be used in the evaluation tests.

The measurement was carried out only for the luminance signals. A block size of 8×8 (samples) was applied for the DCT calculation, while 16×8 (samples) was applied for the motion vector detection and motion compensation. The values of the above items were calculated for every block and were averaged over a field (or frame) to express the characteristics of that field (or frame). Since each of the ITE test sequences has a 15 s duration, each statistic consists of 900 data (in the case of intra-field calculation) or 450 data (intra-frame calculation) for a sequence.

2.1 AC energy

This represents the degree of picture activity, such as fineness, and is defined to be the square sum of the DCT coefficients except for the DC coefficient, as shown below:

(1)

$$ac_k =$$

where $C(m, n)$ denotes the DCT coefficients and N the number of blocks in a field (or frame). AC_{max} is a normalizing factor and the theoretically maximum value of AC energy is taken here, which is obtained with such a picture that a half area within a block is black and the rest of the area within the block is white.

Four types of AC energy were calculated, i.e. intra-field DCT, intra-frame DCT, intra-field DCT for frame-difference signals, and intra-field DCT for motion-compensated frame-difference signals. Table 5 shows the calculation parameters of these four. The same parameter combinations are also applied for the calculation of spectral entropy, which is described in § 2.2.

TABLE 5

Calculation parameters for AC energy and spectral entropy

Type	Signal	DCT block	Averaging
Field DCT	Normal	8 pixels × 8 lines in field	In a field
Frame DCT	Normal	8 pixels × 8 lines in frame	In a frame
Field DCT-FD	Frame-difference (FD)	8 pixels × 8 lines in field	In a field
Field DCT-MCFD	Motion-compensated frame-difference (MCFD)	8 pixels × 8 lines in field	In a field

2.2   Spectral entropy

This represents the degree of randomness of the DCT coefficients, and could be useful to estimate the necessary bit rate of a DCT-based bit reduction system. It is defined by equation (2):

$$SE \;=\; \tag{2}$$

where:

$$se_k \;=\; -\;\log_2$$

$$A \;=\;$$

2.3   Motion vector

Motion vectors are calculated by the block matching method, in which the vector of a block is defined such that the sum of absolute difference between the current frame and the previous frame displaced by the vector is minimum. A block consists of 16 pixels × 8 lines in a field, and it corresponds to almost a square area (16-pixel width × 16-line height on the screen). The calculation was performed with a sample precision, i.e. a pixel precision in horizontal direction and two-line precision in vertical direction.

To express the degree of motion of the picture, two kinds of statistics were used, i.e. mean magnitude of the vectors averaged over a field and standard deviation within the field. They were calculated separately in horizontal and vertical directions as follows:

$$\mu_X \;=\; \quad \text{and} \quad \mu_Y \;=\; \tag{3}$$

$$\tag{4}$$

where:

    X_k and Y_k: horizontal and vertical components of the vector in a block

    μ_X and μ_Y: mean magnitude of X_k and Y_k averaged over a field

    σ_X and σ_Y: standard deviation of X_k and Y_k, respectively

    M: number of blocks in a field.

The mean magnitudes represent the degree of motions as a whole, while the standard deviations represent the degree of non-uniform motions.

2.4   Motion-compensated prediction error power

The motion-compensated frame-difference signal, i.e. prediction error, is expressed by equation (5):

$$e_k(x, y) \; = \; f_0(x, y) \; - \; f_1(x \, - \, u_k, y \, - \, v_k) \tag{5}$$

where $e_k(*)$, $f_0(*)$ and $f_1(*)$ denote the motion-compensated frame-difference signal in the k-th block, the current frame signal, and the previous frame signal, respectively, while u_k and v_k the horizontal and vertical components of motion vector in the block.

The power of the prediction error, EP, is defined to be the mean square value of the difference signals as follows:

$$EP \; = \tag{6}$$

where:

$$ep_k \; =$$

This statistic value could be useful to estimate whether the sequence is critical for a bit reduction system using motion compensation.

2.5   Measurement results

Examples of the statistics are shown in Fig. 1. The ordinate of each chart indicates the statistic value, and the abscissa the field number, counting from the beginning of the sequence (300 fields correspond to 5 s). These are obtained for the sequence number 29, "Soccer", which contains fine details with large motions in different directions. It can be seen that there are two large horizontal motions around the field number 200 and 600, which suppress fine detail components due to the integration effect of the camera, resulting in reduced AC energy and spectral entropy.

Similar figures have been prepared for each sequence. Numerical data for every field of all the sequences are also available in electronic materials. Table 6 lists the statistics averaged over the 60 sequences.
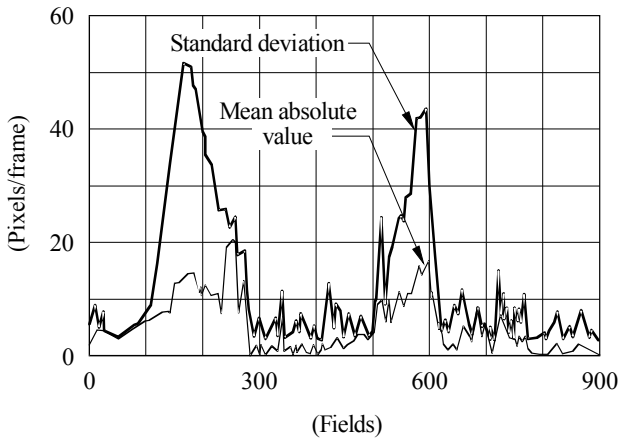
FIGURE 1

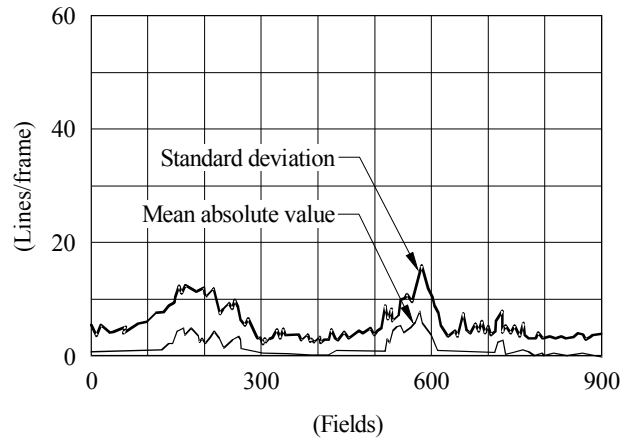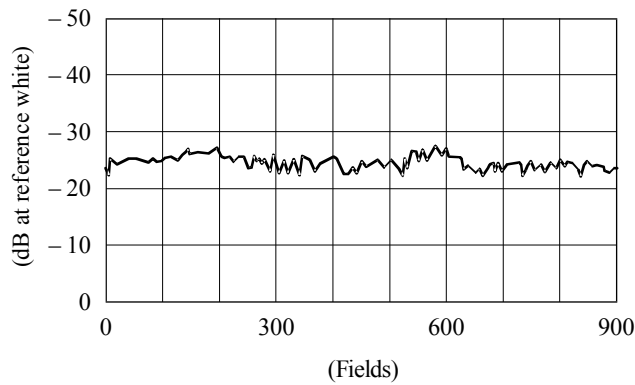**Example of statistics of motion sequences measured by BTA**
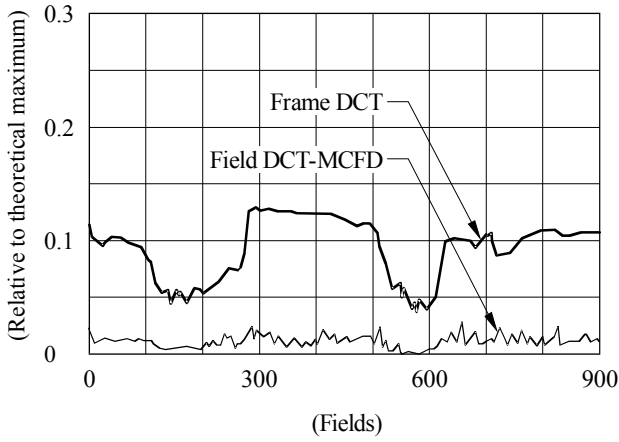
a) AC energy
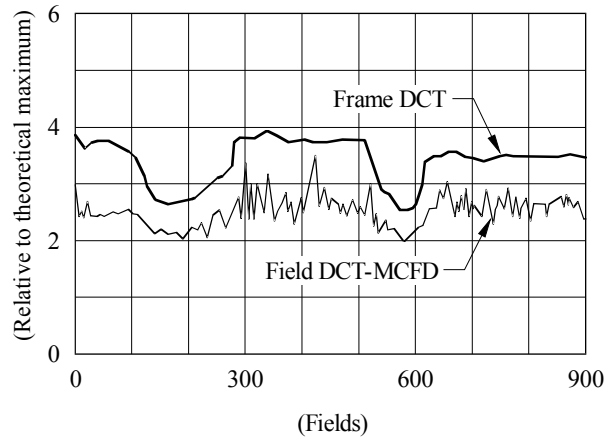
b) Spectral entropy

c) Motion vector (horizontal)

d) Motion vector (vertical)

e) Motion-compensated interframe prediction errors

1210-01

TABLE 6

Mean value of statistics over 60 sequences

Statistics		Average over 60 sequences
AC energy	Field DCT	0.059
	Frame DCT	0.052
	Field DCT-FD	0.047
	Field DCT-MCFD	0.010
Spectral entropy	Field DCT	2.5
	Frame DCT	2.3
	Field DCT-FD	2.1
	Field DCT-MCFD	1.5
MC prediction error power		−30.4 dB

3 Entropy-based criticality

3.1 Rate-buffer occupancy method

The Independent Television Commission of the United Kingdom and the EBU conducted a study on criticality under the RACE MOSAIC project. The MPEG-1+ coding algorithm with subjectively optimized quantizers was used to measure the criticality of broadcast programmes and test sequences. The criticality was calculated by means of a parallel processing computer using the rate-buffer occupancy, and was expressed in terms of bit/pixel. An example of criticality measurement is shown in Fig. 2.

3.2 Fixed quantizer method

Criticality is defined as "the number of output bits per pixel from MPEG-2 encoder with a fixed quantizer". The quantizer characteristics are linear and comply with the MPEG-2 standard. The parameter value of "quantizer_scale_code", which gives a quantizer step closely related to picture quality, is set to 6, which can be selected arbitrarily from 1 through 31. The number of output bits is measured in each whole frame and is converted into criticality dividing by the number of pixels in a frame. Field-based prediction is used, and no bidirectional prediction is employed. Intra macroblock refreshment, having cycles of 0.5 s, is used.

Examples of the criticality are shown in Fig. 3. Figure 3a) shows the fluctuation of criticality over a 5 s interval. Criticality distribution of broadcast television programmes has been measured on NHK channel for one week, a total of 130 h, from 15 through 22 February 1995. In the measurement, composite NTSC signals were converted into component Y/C signals. The frequency of occurrence of criticality for television programmes was calculated every 5×10^{-3} bit/pixel. Criticality distribution for different programme genres is shown in Fig. 3b). Sports programmes are relatively critical, while drama programmes are less critical. The statistical distribution of criticality for overall television programmes is shown in Fig. 3c). This figure also shows criticality for the test sequences.

FIGURE 2

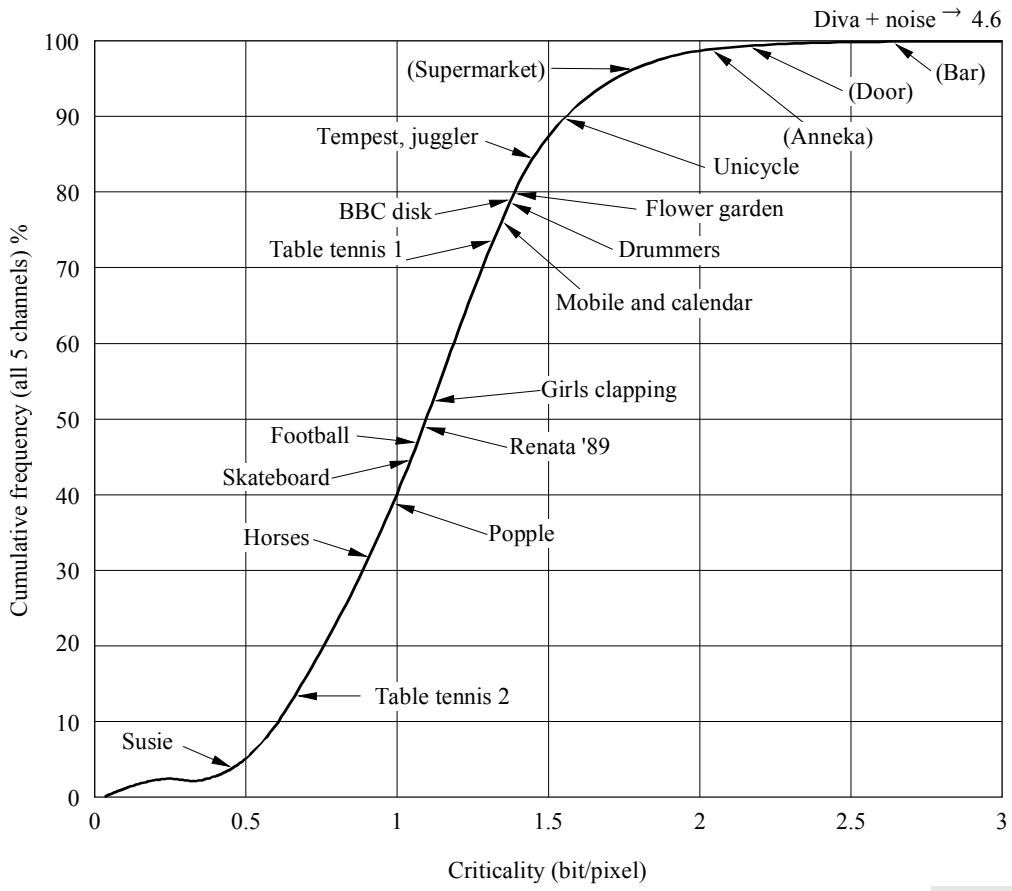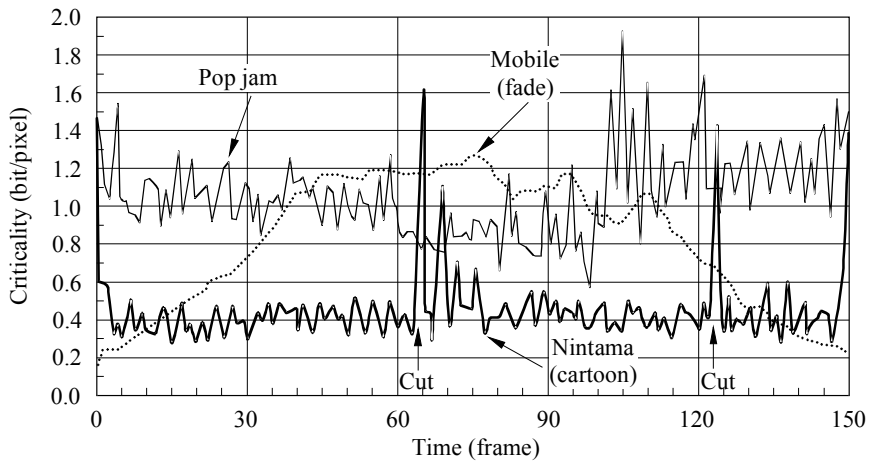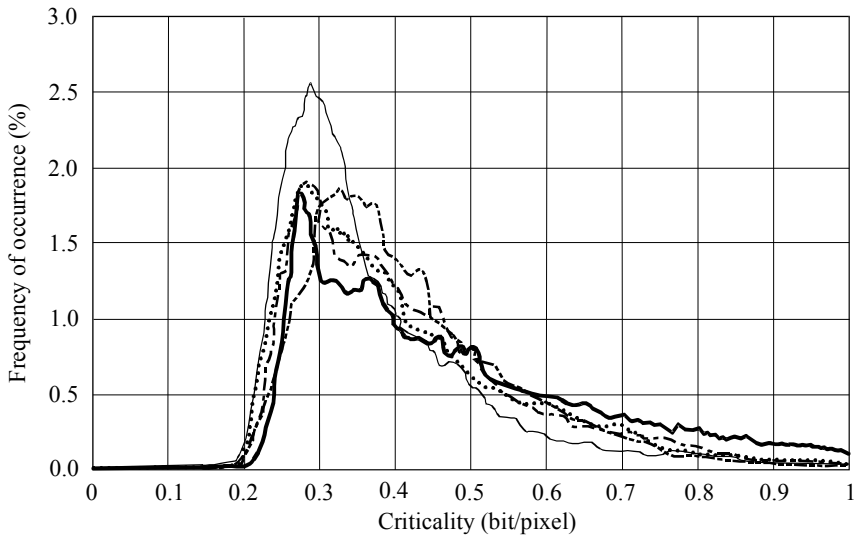**Criticality measurement result of rate-buffer occupancy method**

1210-02
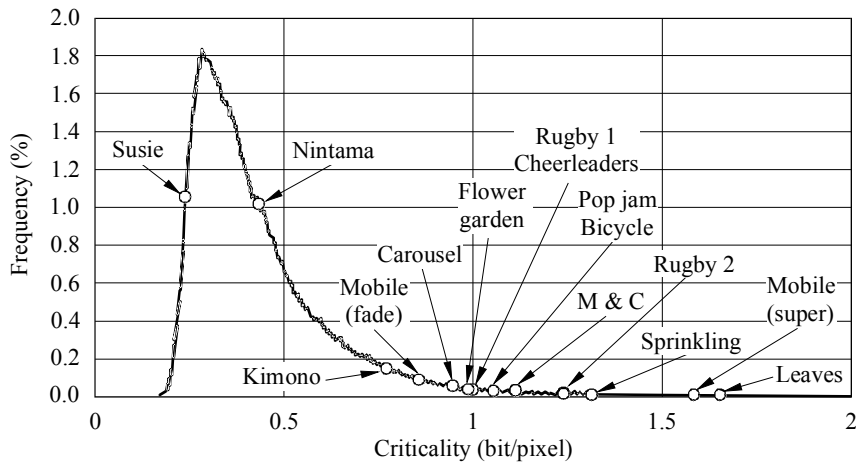
FIGURE 3

Criticality measurement results of fixed quantizer method

a) Fluctuation of criticality for 5 s interval

b) Criticality distribution for classified television programmes

——— Drama ·········· Culture – – – – – Variety

–·–·–· News ▬▬▬ Sports

c) Distribution of criticality for television programmes and criticality of test sequences

q_scale_code = 6

1210-03