RECOMMENDATION ITU-R BT.1118-1*

Enhanced compatible widescreen television based on conventional television systems

(Question ITU-R 10/6)

(1994-1997)

The ITU Radiocommunication Assembly,

considering

a) that both broadcasters and viewers have a large investment in equipment for conventional television, and broadcasters are therefore committed to maintaining the existing service;

b) that many broadcasting organizations may wish to enhance the quality of their existing services to meet competition;

c) that there are proposals to introduce new systems of television broadcasting with improved quality of picture and sound, including wider aspect ratio;

d) that the quality goal for such new services has been defined in Recommendation ITU-R BT.1127;

e) that the introduction of such new enhanced services will be supported by some existing production equipment;

f) that modern technology allows cost-effective integration of enhancement technology into new consumer receivers and new studio equipment;

g) that despite the advent of advanced television services in the future, enhanced systems could have sufficient life expectancy to justify investment in all areas of the broadcasting system;

h) that a modular approach to enhancement will allow flexibility for broadcasters, manufacturers and consumers,

recommends

that for enhanced television:

1 the display format should be 16:9. (As an interim arrangement the aspect ratio of transmitted images could be optimized to suit the populations of existing 4:3 receivers and new 16:9 receivers);

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* Radiocommunication Study Group 6 made editorial amendments to this Recommendation in 2002 in accordance with Resolution ITU-R 44.

2 the transmission of wide aspect ratio images should use the letter-box technique (as an interim arrangement, the window technique may be used) when displayed on conventional 4:3 receivers;

3 any additional signals which may be required to convey information to receivers for the enhancements being transmitted should be carried within the nominal 6, 7 or 8 MHz RF channel occupied by the conventional signal;

4 the minimum protection ratios and the transmission power required by the enhanced television signal, either for conventional or enhanced receivers, should be the same as for conventional signals;

5 when enhancements to existing television systems are made, some or all of the modular enhancements and features listed in Annex 1 should be used,

further recommends

1 that enhanced terrestrial television broadcasting should not cause interference subjectively greater than that considered acceptable with current broadcasting services in the VHF/UHF bands;

2 that the enthusiasm among creative staff for producing in 16:9 should be recognized and promoted;

3 that the circumstances of developing countries should be given careful consideration in terms of priorities.

NOTE 1 – Administrations are invited to conduct further studies with the aim of making detailed proposals.

ANNEX 1

Modules and features of enhanced television

When enhancements to existing NTSC, PAL or SECAM television transmission systems are made, some or all of the following modular enhancement methods and features should be used according to the following:

1 Picture enhancement modules

1.1 Coder requirements for accommodating wide aspect ratio signals

– Preferred image format: 16:9,

– method of format conversion from 16:9 to 4:3,

– method of preserving the vertical resolution information:

  – method of deriving additional information,

  – method of processing the additional information,

  – method of including the additional information in the broadcast signal.

1.2 Coder requirements for reducing cross-effects and making optimal use of the signal spectrum

– Method of luminance filtering,

– method of chrominance filtering,

– method of modulation,

– method of combining luminance and chrominance.

1.3 Ghost cancellation

– Insertion test waveform,

– position in the signal.

1.4 Coder requirements for increased resolution

– Method to derive extra information,

– method of including the extra information in the channel.

1.5 Data signalling

– Details of the data waveform,

– position in the signal,

– data to be transmitted.

2 Sound enhancement modules

– Details of sound coding technique,

– method of including the sound signal.

3 Other features

– Methods to reduce impairments that might be created on the 4:3 conventional receivers by the enhancement signals should also be taken into consideration;

– the possibility of the need for in-vision subtitles in the lower black part of the screen for existing 4:3 receivers without teletext decoders should be taken into account;

– the possibility of transmitting such an enhanced signal through the existing satellite-broadcasting service and other media should be taken into account.

The main features of such a system, emphasizing the modular approach, are shown in the block diagram given in Fig. 1.

FIGURE 1

Block diagram of an enhanced television encoder

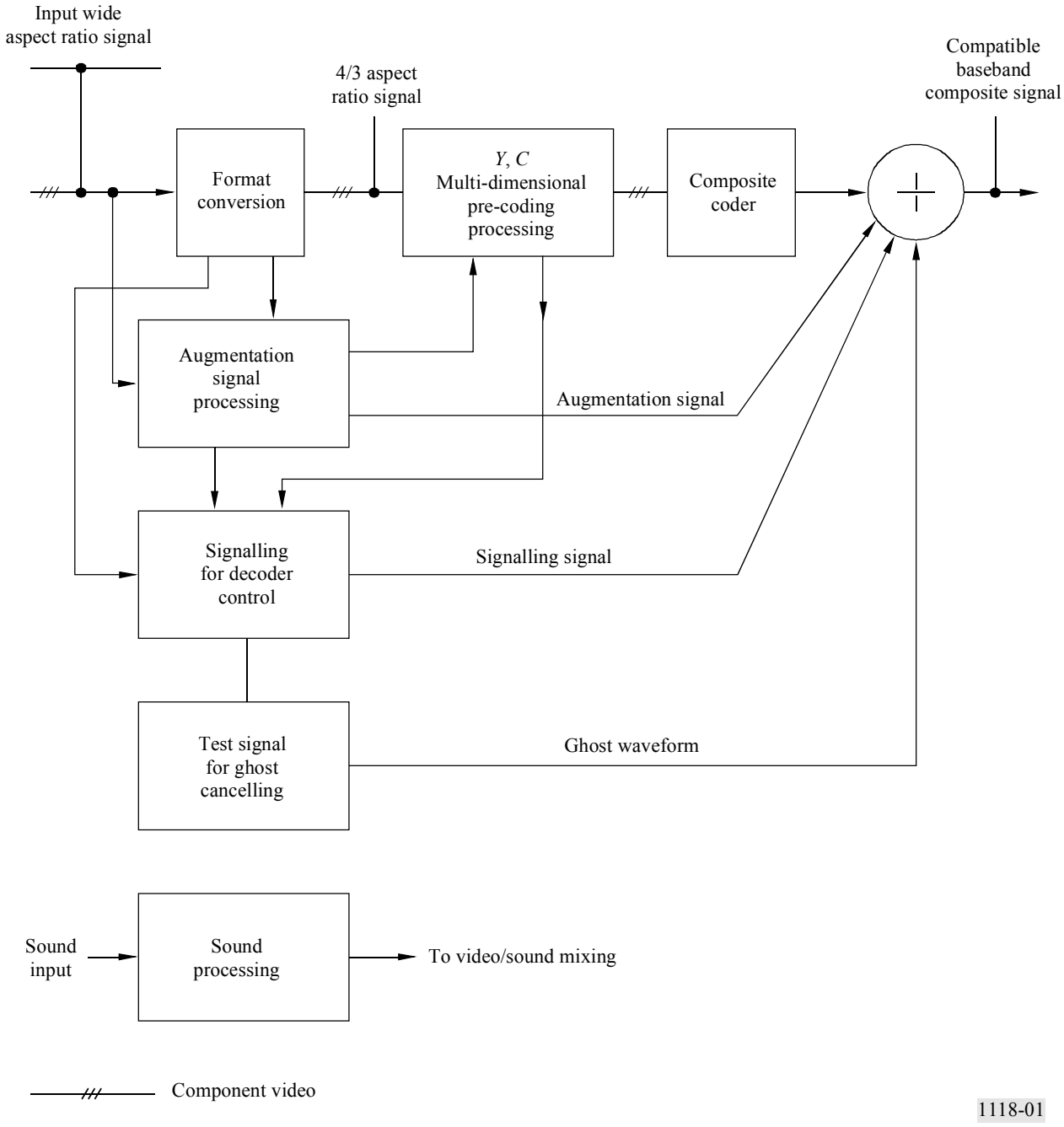

Table 1 provides a summary of methods and parameter values for PAL and NTSC for the above optional enhancement modules.

TABLE 1

Parameter values or methods for enhancement modules

	Optional modules	Method or value	
		NTSC	PAL
1	Picture enhancements		
1.1	Wide image aspect ratio	16:9	
1.2	Method for transmitting widescreen within 4:3 raster: – Widescreen source material – Other source material Method for preserving vertical resolution	 Letterbox Window or letterbox Vertical helper signals in the black bands (see Recs. ITU-R BT.1298 and ITU-R BT.1197)	
1.3	Reduced cross effects: – Serving existing receivers	Comb-filter encoders	
	– Serving new receivers	Rec. ITU-R BT.1298	Motion adaptive colour plus (see Rec. ITU-R BT.1197)
	Making optimal use of the signal spectrum	At the encoder, vertical/temporal pre-filtering from higher than 525/2:1 or 625/2:1 rates	
1.4	Ghost cancellation	Rec. ITU-R BT.1124	
1.5	Increased resolution: – Vertical/Temporal	VT/VH, Rec. ITU-R BT.1298	
	– Horizontal	HH, Rec. ITU-R BT.1298	
1.6	Widescreen signalling	Rec. ITU-R BT.1119	
2	Sound enhancement		
2.1	Digital multichannel sound		Rec. ITU-R BS.707

Some enhancement methods are discussed in Annex 2 for 625-line systems.

ANNEX 2

Enhancement methods for 625-line systems

1 Picture enhancement techniques

1.1 Wide aspect ratio coding

Two practical approaches to accommodating the wide aspect ratio frame in a conventional 4:3 signal are:

1.1.1 The letter-box format

Widescreen displays with a 16:9 aspect ratio are being made in Europe for enhanced television services. The most straightforward way to convey the 16:9 signal in the 625-line PAL/SECAM channel, and at the same time preserve the correct geometry for the viewer with a standard 4:3 receiver, is to use a letter-box format. In this format approximately 432 of the 575 active lines are used to carry the 16:9 active picture area.

In the widescreen receiver, approximately 432 lines are arranged, by up-conversion or other means, to fill the full height of the display. In the standard 4:3 receiver the viewer sees black bands above and below the active picture.

1.1.2 Window options

There are several possible choices for a compromise "letter-box" window solution, and one of these could be the mean aspect ratio between 4:3 and 16:9, i.e., 14:9. In this case, the black bands displayed on a conventional 4:3 aspect ratio receiver would be reduced from the 12.5% of a 16:9 letter-box to some 6% of full picture height at top and bottom. However, in practice, the viewer would be likely to see only about 2% black bands, due to the typical receiver overscan.

In the case of the widescreen receiver, options could exist to allow the 14:9 picture to be displayed filling the full width of the visible screen by incorporating a small amount of geometry error – typically 8%.

1.2 Reduction of cross-effects

Two approaches have been considered for reducing cross-effects in the PAL system, known in broad terms as band segregation and phase segregation.

Band segregation is the simplest method to understand because the luminance and chrominance components are separated in the frequency domain. A motion adaptive technique has been developed in Europe known as "motion adaptive colour plus" which has been designed to allow optimum chrominance/luminance separation with both electronic camera and film sources. In the phase segregation method, high-frequency luminance and chrominance signals are effectively carried on orthogonally-phased subcarriers. Both methods involve complex multi-dimensional comb filter processing.

It remains to be seen whether similar techniques can be applied in the SECAM system.

1.3 Ghost cancellation

Proposals for ghost cancellation require the use of a test line or "training" signal. Various possibilities exist for the form of the training signal. (See Recommendation ITU-R BT.1124.)

1.4 Increased resolution

In the circumstance where the source signal standard contains more resolution than conventional composite signals, there are proposals to include this information in the compatible enhanced signal. Such information might be accommodated by spectrum folding techniques and conveyed in the signal by coding methods such as:

– quadrature modulation of the vision RF carrier,

– signals carried in the video spectrum to take advantage of the Fukinuki hole in vision,

– signals carried in the vertical blanking interval,

– signals carried at the extremities of each active picture line, that would not normally be visible on conventional televisions due to overscan.

1.5 Data signalling

At its simplest, data signalling is desirable that would indicate to the receiver the aspect ratio of the transmission. The enhanced encoder would in addition need to convey other information to the decoder. For example, the status of the coder processing methods, the film or camera mode, if such improvements are incorporated in the system, to the decoder. Refer to Recommendation ITU-R BT.1119.

2 Sound coding

It is expected that improved quality sound coding, by digital means, will form an important enhancement to the broadcast composite signal. The choice of technique needs to be made in association with other requirements in the signal. (See Recommendation ITU-R BS.707.)