

RECOMMENDATION ITU-R BR.1220*

**REQUIREMENTS FOR THE GENERATION, RECORDING AND PRESENTATION
OF HDTV PROGRAMMES INTENDED FOR RELEASE IN THE
“ELECTRONIC CINEMA”**

(1995)

The ITU Radiocommunication Assembly,

considering

- a) that programmes produced in high-definition television can be intended for release on a variety of media, including release in cinemas;
- b) that release in cinemas can be effected by distribution on conventional 35 mm film print copies (transferred from HDTV video tape recordings) by distribution of HDTV signals over transmission links such as satellite ones and by distribution of recordings on HDTV video tapes;
- c) that the electronic presentation of HDTV programmes in cinema theatres by means of HDTV videotape may become of widespread use in the future,

recommends

1 that for the generation, recording and presentation of HDTV programmes intended for release in the “electronic cinema”, the guidelines given in Annex 1 should preferably be followed.

NOTE 1 – The term “electronic cinema” describes a viewing experience parallel to the one encountered in conventional cinema theatres. Electronic cinema screenings are watched in darkened halls on very large screens, under conditions similar to those that apply to conventional cinema viewing.

NOTE 2 – It should be noted that the screen illumination and the contrast ratio given in Annex 1 are marginal for conventional cinema presentation. The values in Annex 1 are the current minimum values and they should be reviewed when high performance HDTV projectors become popular.

ANNEX 1

1 Viewing conditions for the electronic cinema

The electronic cinema is designed to parallel the viewing experience of conventional cinema theatres. Electronic cinema screenings are watched in darkened halls on very large screens, under conditions similar to those that apply to conventional cinema viewing:

- A screen base of at least 5 m is normally used.
- Stray light in the screening hall is low and mainly comes from emergency exit signs.
- The maximum contrast capability for images on the screen is quite high, similar to the contrast ratio obtainable when projecting film print copies; a value of 50 or more, including the effect of stray light, is typical.
- Viewers’ seats are arranged in a way similar to the one typical of cinemas, with rows located at an approximate distance from the screen from two to five times the screen height, and with seats located within a reasonable angle from the normal to the screen centre (see Note 1).
- Concerning sound, stereo sound facilities are provided in all electronic cinema presentations, and in many cases, surround sound facilities are also provided, conforming with the Recommendation of Study Group 10 for HDTV presentations.

* This Recommendation should be brought to the attention of the International Organization for Standardization (ISO).

NOTE 1 – In the case of a 7-m screen base, audience seats would be arranged in rows at a distance from the screen of 8 m for the nearest row and 20 m for the farthest row. This arrangement would accommodate a seated audience of 250 persons or more depending on the size of the seats.

2 Screen illumination in the electronic cinema

Some simple computations may help to place screen illumination into perspective:

- if the screen has a reflectance coefficient of 0.8, a luminance of about 35 cd/m² on non-specular whites along the normal to the screen centre will be obtained with an illumination of about 40 lux;
- for an aspect ratio of 16/9:
 - a screen with a 3-m base has a surface of 5 m² (it serves about 30 persons);
 - a screen with a 5-m base has a surface of 14 m² (it serves about 100 persons);
 - a screen with a 7-m base has a surface of 28 m² (it serves about 250 persons);
 - a screen with a 10-m base has a surface of 56 m² (it serves about 500 persons);
- three-CRT large-screen HDTV projectors are often rated for an output of 300 lm; high-output light-valve HDTV projectors are often rated for an output of 3 000 lm or more.

In the assumption that all the light provided by the projector falls on the screen with no overspill, it is seen that light-valve HDTV projectors can amply accommodate a screen with a 10-m base (diagonal about 460 in.), even if the screen is not a directional one. These projectors are normally placed behind the audience area; they generally must be placed in a soundproof enclosure, since their operation is rather noisy.

Three-CRT large-screen projectors can accommodate a screen with a 5-m base (diagonal about 230 in.), on condition that the screen has good reflectance and some directional gain (see Note 1). These projectors are normally placed at the front of the audience area, since they are designed to operate at a comparatively small distance from the screen; their operation is almost noiseless.

(New projector types are currently being introduced in the market, that use polarizing light intensifiers, or liquid crystal electro-optical transducers; they provide improved performance with respect to the types described.)

This information on screen size, lumens required on a non-directional screen and audience seats is summarized in Table 1.

TABLE 1

Screen base (m)	Screen area (m ²)	Lumens required	Nearest seat row (m)	Farthest seat row (m)	Approximate seats
3	5	200	3.4	8.4	30
5	14	560	5.6	14	100
7	28	1 120	8	20	250
10	56	2 240	11	28	500

The computations above apply to the case when stray light in the screening hall is at a low level, comparable to the one found in cinema theatres. However, it sometimes happens that stray light cannot be perfectly controlled in temporary electronic cinema halls; in this case a higher screen illumination will be required in order to preserve an adequate contrast ratio on the screen, and this will influence the maximum screen size that can be used.

NOTE 1 – It should be noted that 2, 3 or even 4 three-CRT projectors are sometimes stacked to project on the same screen, in order to increase the screen luminance or its size.

3 Main technical requirements for the electronic cinema

The main technical requirements for the electronic cinema derive from the viewing conditions specified for cinema theatres, as described in § 1, and from the screen illumination requirements described in § 2. The specific requirements are highlighted below.

3.1 The luminance of the image on the screen must be comparable to the one typical of cinema theatres, and it must be consistent with the existing level of stray light, in order to meet the contrast ratio requirement § 3.2.

3.2 To achieve an image on screen with a contrast capability of at least 50, the source image must have a contrast capability exceeding 100 (this refers to the maximum contrast capability, not to the actual contrast of each image of the programme, which is a matter of creative judgement).

In addition, the HDTV projector must keep internal stray light down to a low level, in order not to degrade the contrast of the source image (see Note 1); in this way the only source of contrast degradation will come from ambient light and from light reflected back to the screen from the walls of the screening hall.

NOTE 1 – It should be noted in this respect that the level of internal stray light in some light-valve HDTV projectors depends on the average level of the image and it increases on low-key images.

3.3 Screens with directional gains greater than about two should preferably not be used, since they limit the viewing angle at which an image of adequate brightness can be seen. This in turn reduces the number of seats that can be accommodated at the sides of the screening hall, away from the normal to the screen centre.

3.4 Since some members of the audience may sit at a distance from the screen equal to 2.5 times picture height or even less, HDTV cameras with the highest resolution must be used for electronic cinema productions, and the projected images must retain that resolution as far as possible (again, this refers to resolution capability, rather than to actual resolution of each image, which is a matter of creative judgement) (see Note 1).

In particular, the required light emission from the projector must be attained with a minimum loss of resolution on image highlights, or the image rendition will suffer and the viewing experience will be impaired.

Given a choice:

- the finest image sampling structure at source should be used;
- programme recording means should be used that retain the full sampling fineness;
- projection means should be used that provide the highest resolution, for the required light output.

NOTE 1 – Any loss of resolution will be much more perceived by the electronic cinema audience, than it would be perceived by an audience at home, since HDTV consumer receivers do not yet normally match the resolution capability of modern HDTV cameras, and viewers in the home do not normally sit so close to the display.
