

Video cameras (PAL/SECAM/NTSC) — Methods of measurement —

Part 1: Non-broadcast single-sensor cameras

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British Standard

ICS 33.160.40

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- Association of British Theatre Technicians
- Audio Engineering Society
- British Broadcasting Corporation
- British Educational Suppliers' Association
- British Federation of Audio
- British Radio and Electronic Equipment Manufacturers' Association
- British Telecommunications plc
- Federation of the Electronics Industry
- Independent Television Association (ITVA)
- Institute of Sound and Communication Engineers
- Institution of Electrical Engineers
- International Association of Broadcasting Manufacturers
- Professional Lighting and Sound Association
- Royal Institute of British Architects
- Royal National Institute for Deaf People
- Society of Cable Television Engineers

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National foreword

This British Standard has been prepared by Subcommittee EPL/100/3, and is the English language version of EN 61146-1:1996 *Video cameras (PAL/SECAM/NTSC) Methods of measurement — Part 1: Non-broadcast single-sensor cameras*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1146-1:1994, published by the International Electrotechnical Committee (IEC).

Cross-references

Publication referred to	Corresponding British Standard
HD 527 S1:1989 (IEC 883:1987)	BS 7595:1992 <i>Measuring method for chrominance signal-to-noise ratio for video tape recorders</i>

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 88, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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Descriptors: Video equipment, motion-picture cameras, measurements, performance evaluation, shot, luminance, test results, comparison, signal to noise ratio, chrominance, amplitude frequency characteristics, distortion, colour, test chart

English version

**Video cameras (PAL/SECAM/NTSC)
Methods of measurement
Part 1: Non-broadcast single-sensor cameras**

(IEC 1146-1:1994)

Caméras vidéo (PAL/SECAM/NTSC)
Méthodes de mesure
Partie 1: Caméras monocapteurs hors
de la radiodiffusion
(CEI 1146-1:1994)

Meßverfahren für Videokameras
(PAL/SECAM/NTSC)
Teil 1: Kameras mit einem
Aufnahmesensor für den Gebrauch
außerhalb des Rundfunks
(IEC 1146-1:1994)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

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Foreword

The text of the International Standard IEC 1146-1:1994, prepared by TC 84 (transformed into SC 100C, Equipment and systems in the field of audio, video and audiovisual engineering, of IEC TC 100, Audio, video and multimedia systems and equipment), was submitted to the formal vote and was approved by CENELEC as EN 61146-1 on 1996-07-02 without any modification.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-06-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-06-01

Annexes designated “normative” are part of the body of the standard.

Annexes designated “informative” are given for information only.

In this standard, Annex A, Annex B, Annex C, Annex D and Annex ZA are normative and Annex E is informative. Annex ZA has been added by CENELEC.

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Section 1. General

1 Scope

This part of IEC 1146 is applicable to the assessment of performance of non-broadcast colour video cameras equipped with a single-tube or solid-state imager.

This part of IEC 1146 defines test patterns and measurement conditions, so as to make possible the comparison of the results of measurements. The methods of measurement are designed to make possible the assessment of the performance of the camera by using the lens input and any electrical output terminals of the device (e.g. Y/C and composite).

This part of IEC 1146 does not specify limiting values for various characteristics.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 1146. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 1146 are encouraged to investigate the possibility of applying the most recent editions of the normative documents listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 883:1987, *Measuring method for chrominance signal-to-random noise ratio for video tape recorders*.

CCIR Recommendation 567-3, *Transmission performance of television circuits designed for use in international connections (1978-1982-1986-1990)*.

CCIR Report 624-4:1974-1978-1982-1986-1990, *Characteristics of television systems*.

CIE 15:1971, *Colorimetry: Official Recommendation of the International Commission on Illuminants*.

Supplement 2:1987, *Recommendation on uniform colour space. Colour difference equation — psychometric colour terms*.

CIE 13-2:1988, *Method of measuring and specifying colour rendering of light sources*.

CIE 01:1986, *Colorimetric illuminants*.

CIE 02:1986, *Colorimetric observers*.

IEC 27, *Letter symbols to be used in electrical technology*.

IEC 50(845):1987, *International Electrotechnical Vocabulary (IEV) — Chapter 845: Lighting*.

3 Conditions

3.1 Environmental conditions

All measurements shall be carried out within the environmental conditions as specified by the manufacturer.

The environmental conditions during measurement, at least the temperature and the relative humidity, shall be reported together with the presentation of the results of measurements.

An adequate warm-up time shall be allowed.

3.2 Conditions of measurements

Except when otherwise indicated, the measurements shall be carried out by measuring the output signal of the camera when it is shooting different test charts, depending on the characteristic to be measured.

Each test pattern shall be specified, together with the lighting conditions (illumination intensity, correlated colour temperature of the light source, etc.).

The use of transparent test charts instead of the reflection types may be allowed; however, the reflection types should be used in questionable cases.

Unless otherwise stated, all measurements shall be made in automatic mode.

3.3 Conditions of shooting

Unless otherwise stated, the conditions of shooting shall be as follows.

- The subject illumination of a reflective test chart shall be $2\,000\text{ lx} \pm 5\%$ (see note).
- The luminance of a transparent test chart, at peak white, shall be $636\text{ cd/m}^2 \pm 5\%$.
- The non-uniformity of the subject illumination shall be less than 5 %.
- The correlated colour temperature of the light source shall be $3\,100\text{ K} \pm 100\text{ K}$.
- The white balance shall be set manually or automatically to $3\,100\text{ K} \pm 100\text{ K}$.
- The test chart shall be shot by the camera so that the frame limited by the arrows coincides exactly with the edges of the picture displayed on the video monitor in underscan mode.
- The focus control shall be in auto or manual mode, and shall be in optimum focus.
- The iris control shall be in auto or manual mode.
- In order to obtain the desired exposure level, it may be advantageous to add an illuminated white card or a black area, and also to adjust the lens zoom so that the measurement does not depend on exactly filling the screen to the arrows of the test chart.
- The gain control, if any, shall be set to “0 dB” gain.
- The optical filter, if any, shall be set to “open position”.

NOTE Measured by a luxmeter at the centre of the test chart, the receptor pointing in the direction of the camera.

3.4 Reference conditions

Unless otherwise specified, the reference luminance output signal level is assumed to be 700 mV peak-to-peak (p.-p.) for PAL and SECAM systems and 714 mV peak-to-peak for NTSC systems (from the blanking level to the peak white level).

NOTE In the following clauses, it is also assumed, for the purpose of giving examples of output voltage obtained under certain conditions, that the rated output voltage is also 700 mV p.-p. or 714 mV p.-p.

Section 2. Luminance video characteristics

4 Luminance sensitivity

4.1 Characteristic to be specified

The minimum subject illumination for which the video camera produces a luminance output level of one-half the rated level.

4.2 Method of measurement

- a) The equipment arrangement and the grey-scale test chart shall be as shown in Figure 1.
- b) The conditions of shooting shall be those mentioned in 3.3.
- c) Either the screen size or the zoom condition may be changed, or a black or white subject may be added, to give the rated output level, if this level is not obtained due to the automatic light control.
- d) In order to simulate a decrease of the subject illumination without changing the correlated colour temperature of the observed light, a neutral density filter such as the Kodak Wratten¹⁾ density filter No. 96 or equivalent shall be placed in front of the camera lens.

The density of the filter shall be increased until the video output level E'_y decreases to half the rated output level corresponding to the level of the white area in the centre of the grey scale test pattern (see Figure 1).

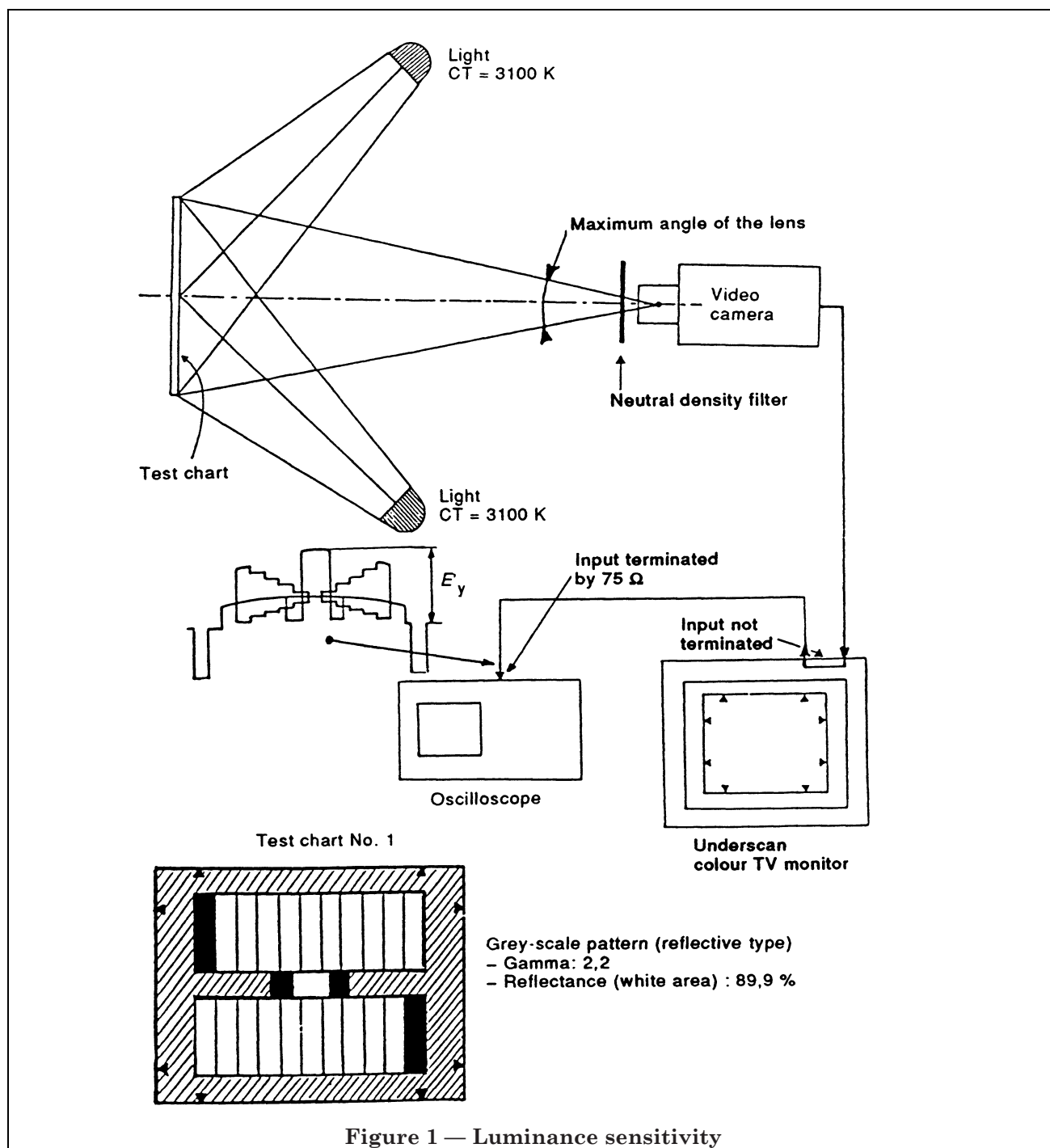
The density (D) of the filter is read, and the sensitivity is then calculated by means of the following formula:

$$\text{Sensitivity} = \frac{\text{illumination}}{\text{attenuation of filter}} = \frac{2\,000}{10^D} (\text{lx})$$

¹⁾ The Kodak Wratten density filter is an example of a suitable product available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by the IEC of this product.

4.3 Presentation of results

The value of the sensitivity shall be reported in lux.



5 Luminance resolution

5.1 Characteristic to be specified

The resolution power of the luminance channel is:

- for the horizontal resolution, the number of vertical black and white bars within a horizontal dimension equal to the picture height (TV lines);
- for the vertical resolution, the number of horizontal black and white bars within the picture height.

5.2 Method of measurement

- a) The equipment arrangement and the test chart shall be as shown in Figure 2.

The test chart is either a radial resolution chart with circles corresponding to the number of TV lines or the conventional EIAJ-A chart or equivalent. This allows the measurement of both the horizontal and the vertical resolution.

- b) The conditions of shooting shall be those mentioned in 3.3.

- c) The resolution shall be evaluated on a monochrome TV monitor whose frequency response shall exceed the bandwidth of the camera under test.

- d) The horizontal resolution is defined by the number of TV lines corresponding to the limit of visibility of the vertical bars. The number of vertical bars may be measured as the depth of modulation measured by an oscilloscope. It is estimated that a depth of modulation of 5 % corresponds to the limit of visibility of the human eye (note).

- e) The vertical resolution is defined by the number of TV lines corresponding to the limit of visibility of the horizontal bars.

NOTE In case it is difficult to read the depth of modulation of 5 % on an oscilloscope, the number of black and white lines at a modulation depth of 10 % may be reported, together with the value of the modulation depth.

5.3 Presentation of results

The results shall be reported as follows:

- | | |
|--------------------------|-----------|
| — horizontal resolution: | TV lines; |
| — vertical resolution: | TV lines. |

Horizontal resolution in lines per picture width, is the number of TV lines per picture height multiplied by the aspect ratio.

In cases of cameras equipped with exchangeable lens, the type shall be reported. If possible, the characteristics of the lens used in the test should be reported.

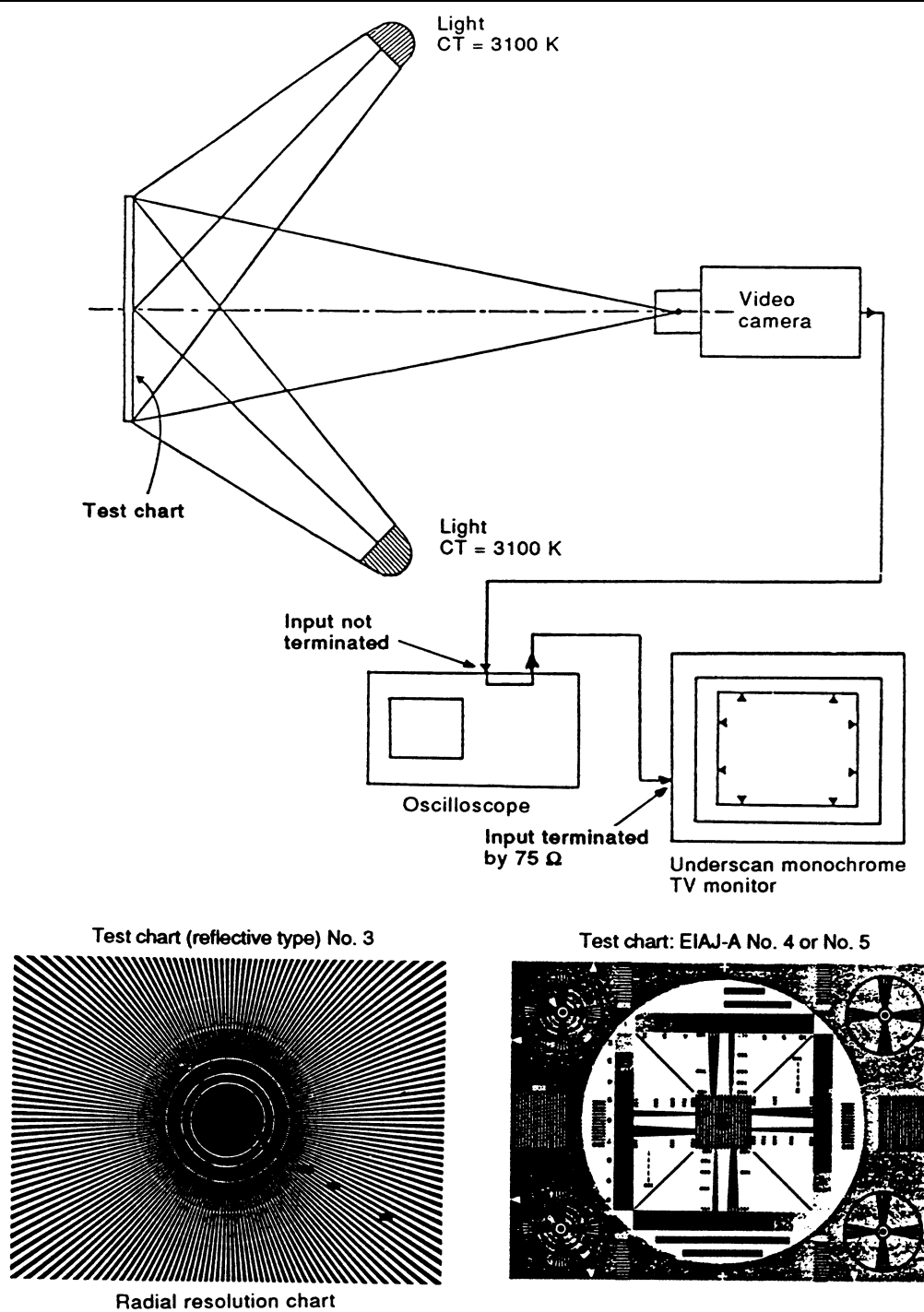


Figure 2 — Luminance resolution

6 Luminance signal-to-noise ratio

6.1 Characteristics to be specified

The noise behaviour of the luminance channel, expressed as the signal-to-noise ratio.

6.2 Method of measurement

- a) The equipment arrangement and the test chart shall be as shown in Figure 3a and Figure 3b, respectively.
- b) The conditions of shooting shall be those mentioned in 3.3, except for the following:
 - 1) subject illumination: Measurement shall be made at 2 000 lx and at the minimum illumination level defined in clause 4, luminance sensitivity (see note).

NOTE A neutral density filter may be placed in front of the lens in order to obtain the same illumination condition as in the measurement of the luminance sensitivity in clause 4. If required, an additional measurement may be made at an intermediate luminance value.

- 2) focusing shall be adjusted to infinity to be out of focus.
- c) The noise superimposed on the output signal shall be measured by a noise meter having the following characteristics:
 - 1) the noise meter shall have a gating function in order to perform noise measurement in the steady flat portion of the signal only;
 - 2) the measuring instrument shall be preceded by the following band-limiting filters:
 - low-pass filter according to CCIR Recommendation 567, annex II with:
 - $f_c = 5$ MHz for the 625 line/50 field system (PAL/SECAM);
 - $f_c = 4,2$ MHz for the 525 line/60 field system (NTSC);
 - high-pass filter according to CCIR Recommendation 567, annex III, with $f_c = 200$ kHz;
 - the chrominance subcarrier trap filter shall be switched on (see Figure C.1 and Figure C.2). In the case of SECAM, the chrominance subcarrier trap filter shall have an attenuation of more than 46 dB for 4,25000 MHz and 4,40625 MHz (see Figure C.3);
 - the weighting network, according to CCIR Recommendation 567, annex II, shall be switchable ON and OFF,
 - 3) the meter shall read the r.m.s. value of the noise $V_{N_{rms}}$
- d) The reference level V_{ref} shall be the amplitude of the 100 % white output picture signal level, i.e from the blanking level to the white level.
- e) The signal-to-noise ratio, S/N, shall be calculated as follows:

$$S/N = 20 \lg (V_{ref}/V_{N_{rms}}) \text{ (dB)}$$

6.3 Presentation of results

The results, i.e the unweighted and weighted values of S/N (dB) shall be stated for the two conditions of illumination defined in 6.2, that is:

- a) at 2 000 lx;
- b) at the minimum sensitivity illumination (clause 4).

The luminance signal level shall be reported in this measurement.

6.4 Alternative method

6.4.1 Method of measurement

- a) The equipment arrangement of Figure 3a shall be used, except that a neutral density filter shall be put in the middle of the white chart, as in Figure 3c, or alternatively, the vertical grey-scale test chart can be used to measure the S/N ratio at different luminance levels (see note 1).
- b) The conditions of shooting mentioned in 6.2 b) are applicable.
- c) The lens zoom may be adjusted in order to obtain a grey level of 50 % in the middle of the active line, as shown in Figure 3e.
- d) The noise superimposed on the output signal shall be measured by a noise meter having the same characteristics as that mentioned in 6.2 c), but having a gate function in order to permit noise measurement in the middle of the active field period, as shown in Figure 3d and Figure 3e.
- e) In order to measure the signal-to-noise ratio, 6.2 d) and 6.2 e) shall be applied.

NOTE 1 The vertical grey-scale chart may be a conventional grey-scale chart vertically placed (see Figure 3f).

NOTE 2 The visual effects of correlated noise may not be represented adequately by this measurement.

6.4.2 Presentation of results

The presentation of the results shall be as mentioned in 6.3.

7 Luminance amplitude/frequency response

7.1 Characteristic to be specified

The amplitude/frequency response of the luminance channel, i.e., the amplitude of the output signal relative to a reference level as a function of frequency.

7.2 Method of measurement

- a) The equipment arrangement and the test chart shall be as shown in Figure 4.
The test chart shall be the multiburst chart having sinusoidal patterns of different pitch, as given in Figure 4.
The multiburst frequencies are:
0,5 – 1,0 – 1,5 – 2,0 – 2,5 – 3,0 – 4,0 – 5,0 – 6,0 MHz.
- b) The conditions of shooting shall be those mentioned in 3.3. A black or white subject may be added in order to obtain a luminance signal level of half of the rated level for the background of the chart.
- c) For SECAM, a trap filter shall be inserted after the camera output (see Figure 4) in order to suppress the chrominance subcarriers. The attenuation shall be greater than 46 dB for 4,25000 MHz and 4,40625 MHz (see Annex C and note 1).
- d) The output signal shall be measured on an oscilloscope (note 2). The reference level V_{ref} shall be the level corresponding to the burst 0,5 MHz. The peak-to-peak amplitude $V_{\text{n(p-p)}}$ of each frequency burst of the output signal shall be related to the reference level V_{ref} to obtain the amplitude frequency response A, as indicated by the following expression:

$$A = 20 \lg \frac{V_{\text{n(p-p)}}}{V_{\text{ref}}} \text{ (dB)}$$

NOTE 1 In the case of separated Y/C signals, the trap filter is not used.

NOTE 2 In some cases, it may be necessary to separate the amplitude of the wanted signals and alias frequencies by measuring the output signal in the frequency domain by a spectrum analyser (aliases caused by undersampling and optical low-pass filter characteristics).

NOTE 3 If sinusoidal patterns are not available, rectangular shaped black and white patterns (bars) can also be used.

7.3 Presentation of results

The results shall be reported in a table or a graph with the X axis representing the frequencies, the Y axis representing the amplitude in dB and the measured amplitudes indicated by dots.

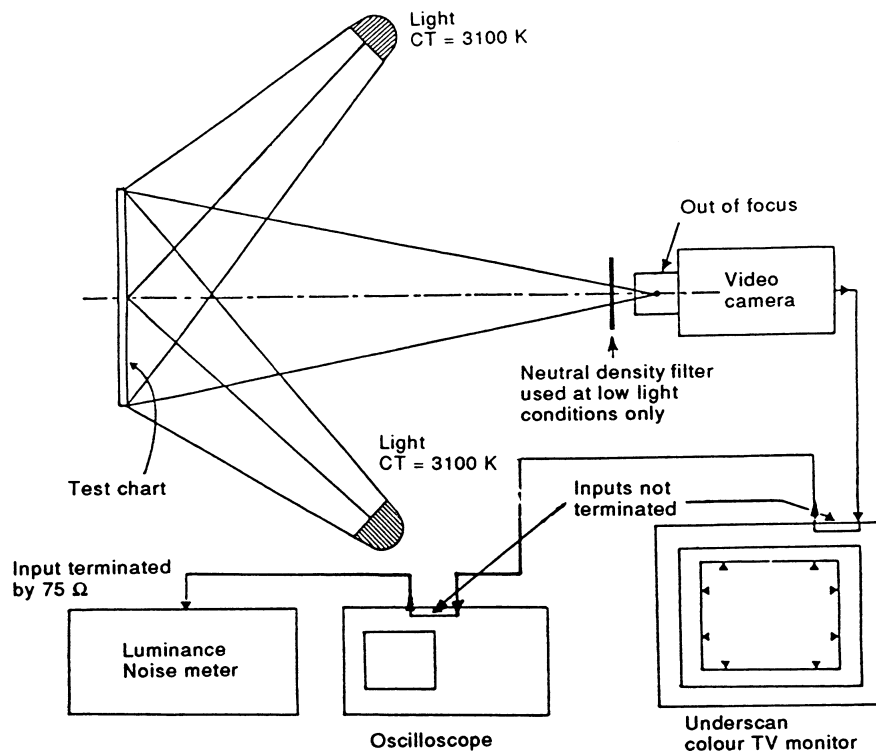


Figure 3a – Equipment arrangement

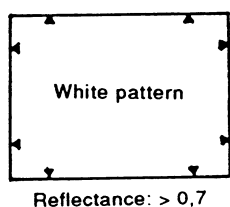


Figure 3b – Test chart No. 2 (reflective type)

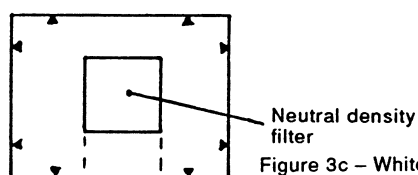


Figure 3c – White test pattern

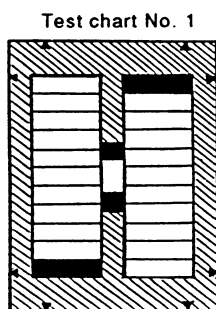


Figure 3f – Grey scale pattern (reflective type)

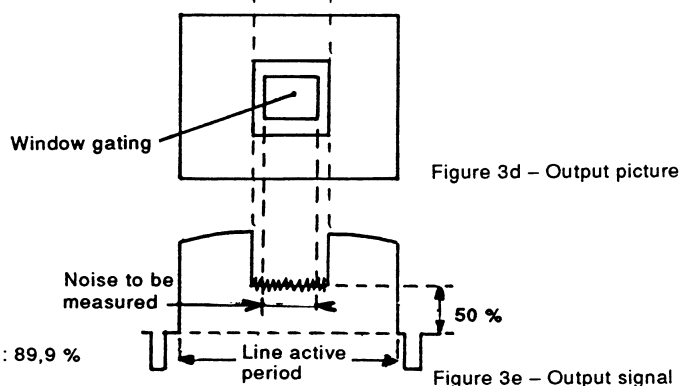


Figure 3d – Output picture

Figure 3e – Output signal

Figure 3 — Luminance signal-to-noise ratio

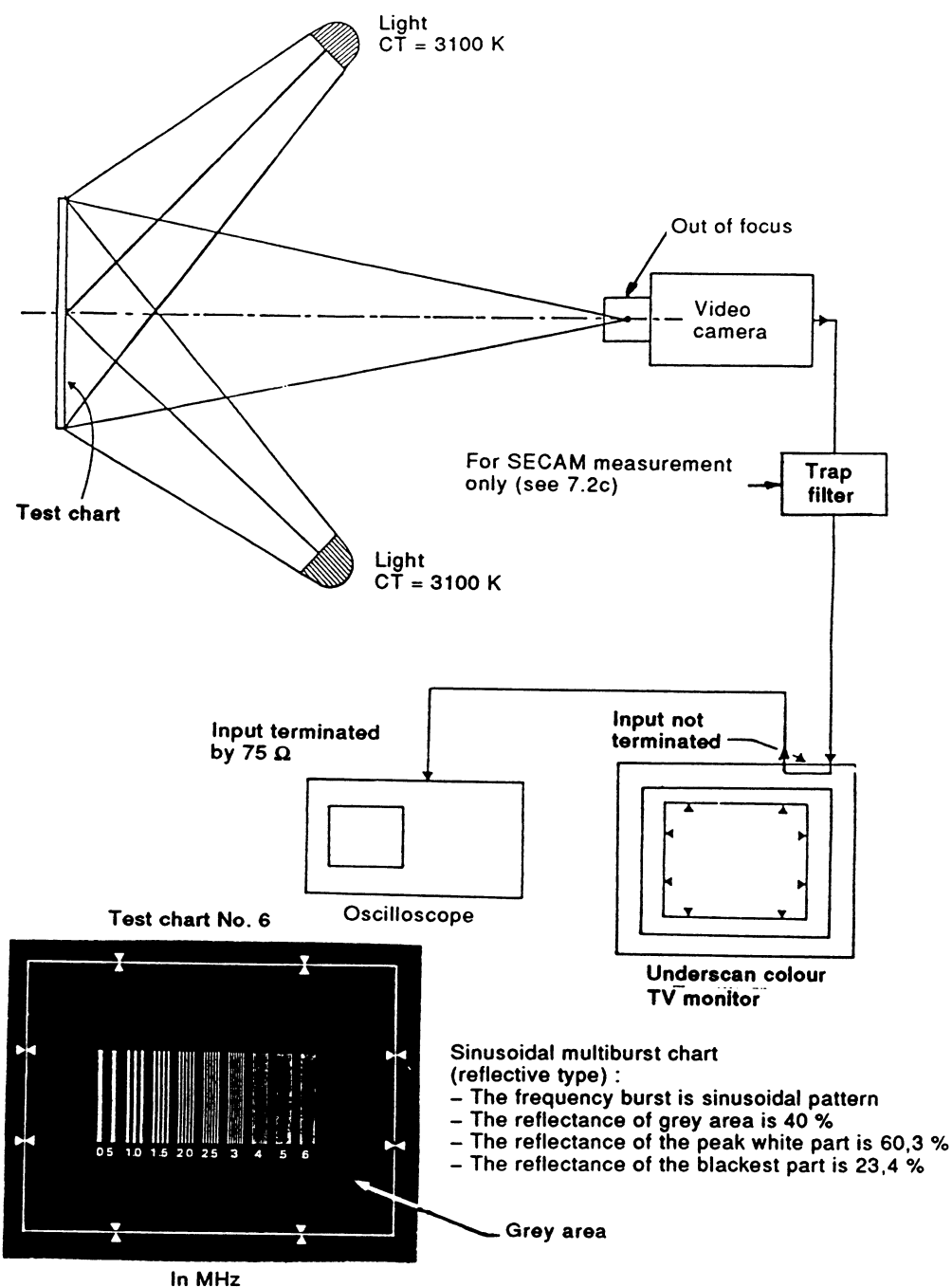


Figure 4 — Luminance amplitude/frequency response

8 Luminance waveform distortion and pulse response

8.1 Characteristics to be specified

The distortions of a bar signal and of a 2T pulse caused in the luminance channel.

8.2 Method of measurement

- a) The equipment arrangement and the test chart shall be as shown in Figure 5a.
- b) The conditions of shooting shall be those mentioned in 3.3.
- c) The output signal shall be measured by an oscilloscope on two selected lines L and M. The following distortions shall be calculated by means of the formulae given with the respective figures:

1) <i>Selected line L</i>		
— overshoot	Amplitude	Figure 5b
	Duration	Figure 5c
— undershoot	Amplitude	Figure 5b
	Duration	Figure 5d
— smear	Amplitude	Figure 5e
	Duration	Figure 5e
— streaking	Amplitude	Figure 5f
	Duration	Figure 5f
2) <i>Selected line M</i>		
— 2T pulse	Amplitude	Figure 5g

8.3 Presentation of results

The results of measurement shall be reported in a table showing distortions and values in percentage or in microseconds.

NOTE To improve the apparent sharpness of the visible picture, some cameras may produce an overshoot at the edges of a bar signal. Taking this into account, it should be noticed that a smaller amplitude of overshoots and undershoots does not necessarily indicate better picture quality.

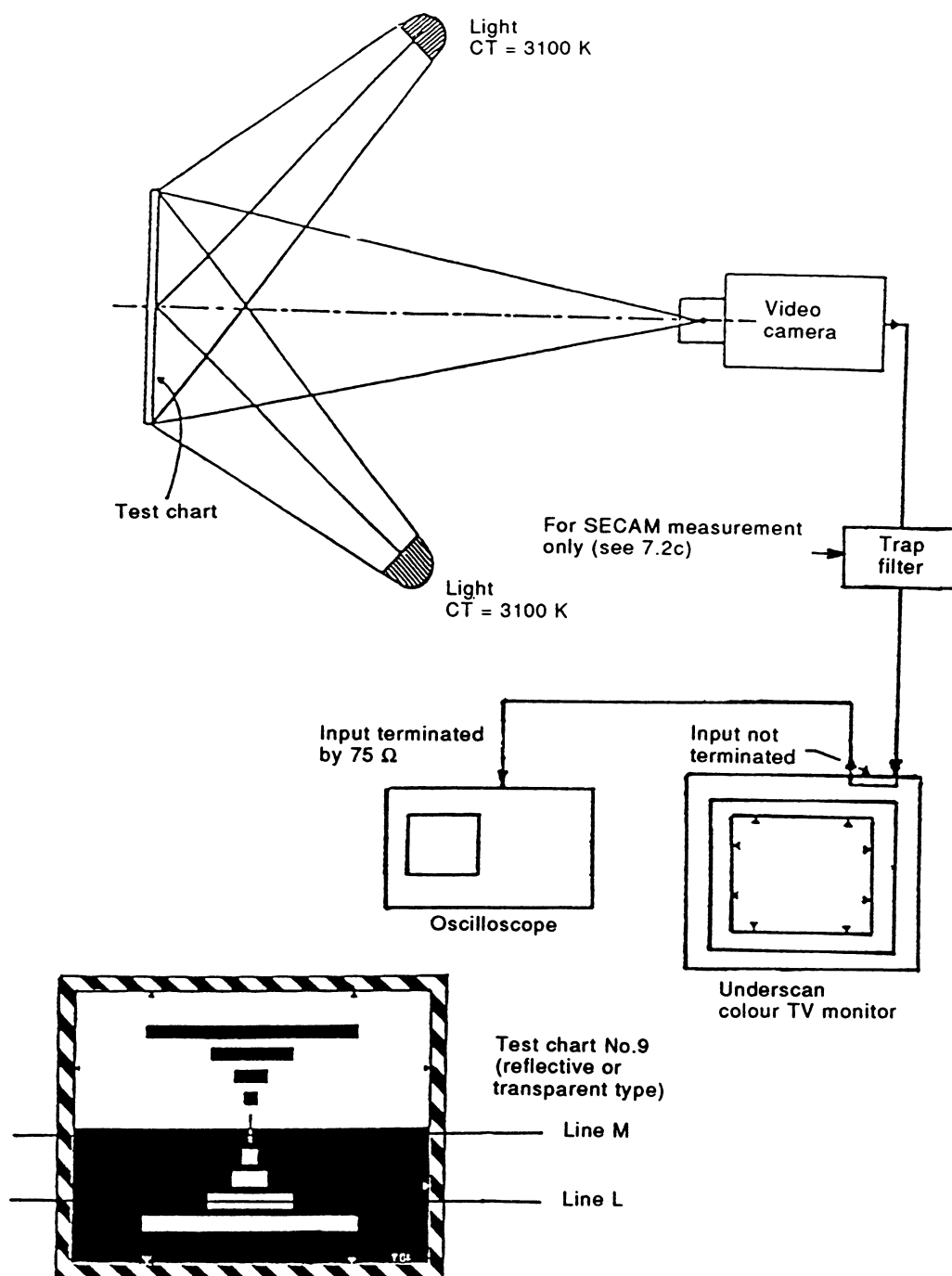


Figure 5a – Equipment arrangement and test chart

Figure 5 — Luminance waveform distortion and pulse response

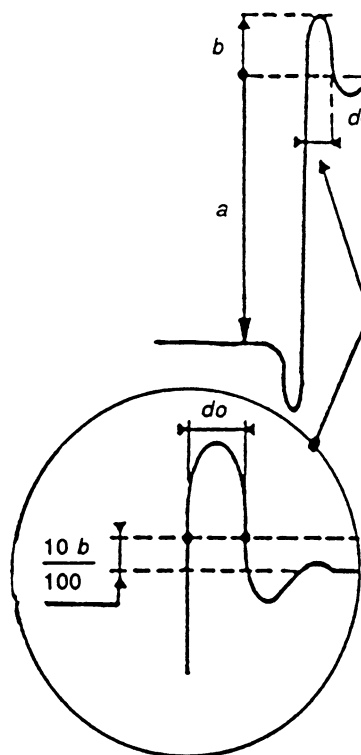


Figure 5c – Overshoot duration

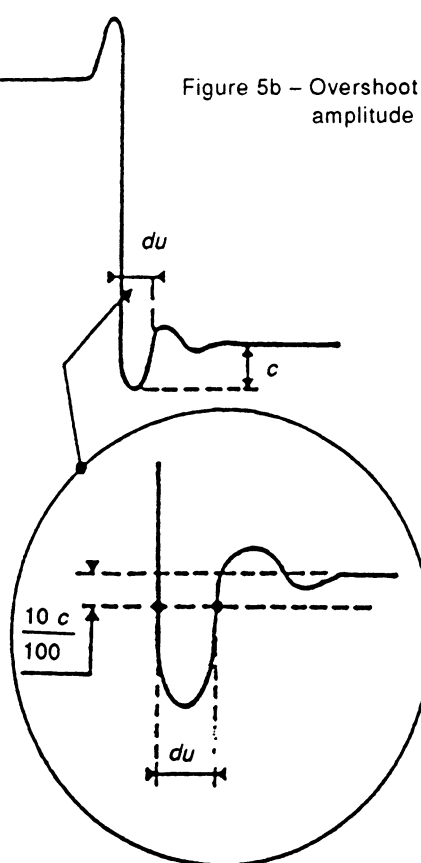
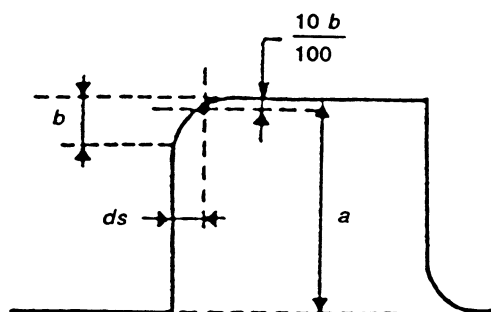


Figure 5d – Undershoot duration

Figure 5c – Overshoot: Amplitude = $\frac{b}{a} \times 100$
Duration = do in μs

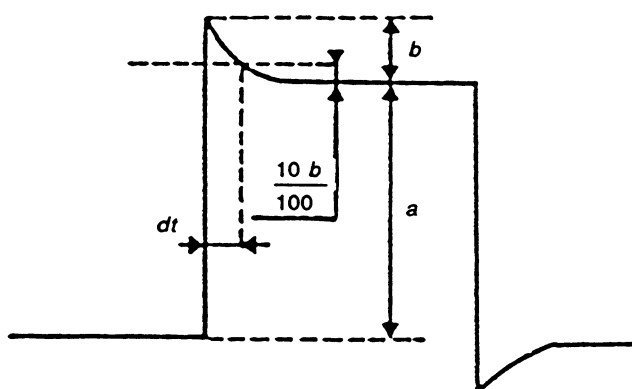
Figure 5d – Undershoot: Amplitude = $\frac{c}{a} \times 100$
Duration = du in μs

Figure 5 — Luminance waveform distortion and pulse response (continued)



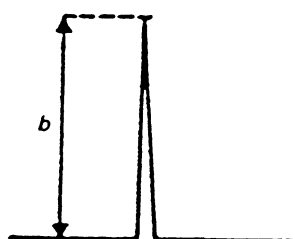
Amplitude: $\frac{b}{a} \times 100$
Duration ds in μs

Figure 5e – Smear



Amplitude: $\frac{b}{a} \times 100$
Duration dt in μs

Figure 5f – Streaking



Amplitude: $\frac{b}{a} \times 100$
 a = amplitude specified in figure 5f

Figure 5g – 2T pulse amplitude

Figure 5 — Luminance waveform distortion and pulse response (concluded)

9 Luminance gamma characteristics

9.1 Characteristics to be specified

The behaviour of the gamma correction applied to the luminance signal in order to compensate the non-linear characteristics of the cathode ray tube used for television display (see note).

NOTE The characteristic of the cathode ray tube used for television display is an exponential function $L_0 = AV^\gamma$, where the exponent γ is in the order of 2,2. This non-linearity is compensated by a gamma correction in the analyser (video camera) whose characteristic is given by the formula:

$$V = K (L_a)^{1/\gamma}$$

where

- V is the output signal of the camera;
- L_0 is the luminance of the TV display screen;
- K is the constant (gain of the camera amplifier);
- L_a is the luminance signal at the output of the imager.

The overall characteristics of the analyser plus the electro-optic converter will be:

$$L_0 = A (K(L_a)^{1/\gamma})^\gamma = mL_a$$

where

- A is the constant (gain of the TV set amplifier);
- m is the phosphor dot brightness efficiency.

The result mL_a shows that the proportionality condition is satisfactory to obtain a correct colour reproduction (see Figure 6b, Figure 6c and Figure 6d).

9.2 Method of measurement

- a) The equipment arrangement shall be as shown in Figure 6a.
- b) The test chart shall be a grey-scale chart. The reflectance of each area from black to white shall vary according to a curve having a gamma of 2,2 (see Figure 6c).
- c) The conditions of shooting shall be those mentioned in 3.3.
- d) For SECAM, see 7.2, item c).
- e) The output signal shall be measured by an oscilloscope.

If the camera has a gamma of 0,45 (that is the inverse of the grey scale 2,2), the video output signal represents a grey scale having a gamma of 1; this means that the amplitude of the steps related to the black level are in equal increments (see Figure 6d and Figure 6e).

- f) The amplitude $V_0(n)$ of each step n of the output signal, that is from the level at the step $n = 3$ to the level at the step $n = 10$, shall be measured (see Figure 6e).
- g) The reference level V_{ref} shall be the amplitude from blanking level to white level (see Figure 6e). However, step $V_0(0)$ may be taken as reference; this should be reported with the results of measurement.
- h) The gamma error shall be calculated as the percentage NL (n) of the deviation of the level at each $V_0(n)$, from the theoretical level $V_t(n)$ of the corresponding step. The errors shall be calculated from step $n = 3$ to step $n = 10$, as shown in the following formula:

$$NL(n) = (V_0(n) - V_t(n)/V_t(n) \times 100 \text{ (\%)})$$

where

$$V_t(n) = V_{\text{ref}} n/10 \text{ for } n = 3 \text{ to } n = 10$$

9.3 Presentation of results

The results shall be reported in a table showing the number n of each step, and the gamma error in percentage for the two references, as follows:

- a) blanking level;
- b) step $V_0(0)$.

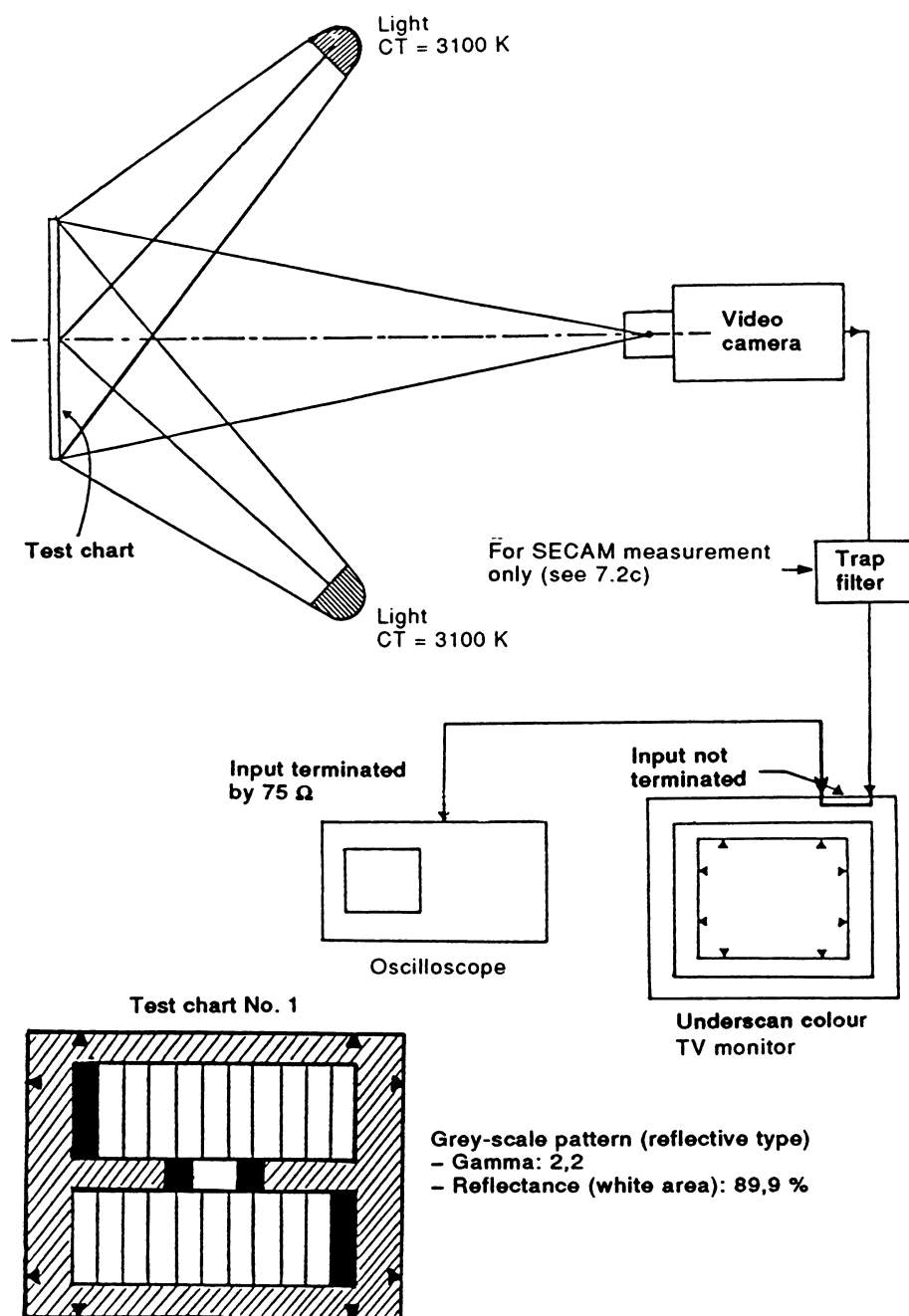


Figure 6a – Equipment arrangement and test chart

Figure 6 — Luminance gamma characteristics

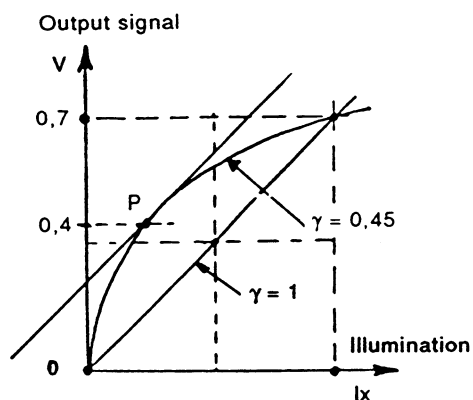


Figure 6b – Camera

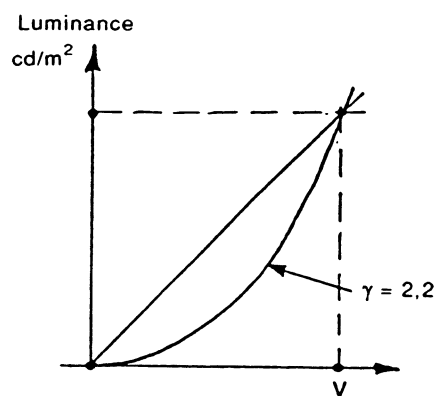


Figure 6c – Cathode ray tube

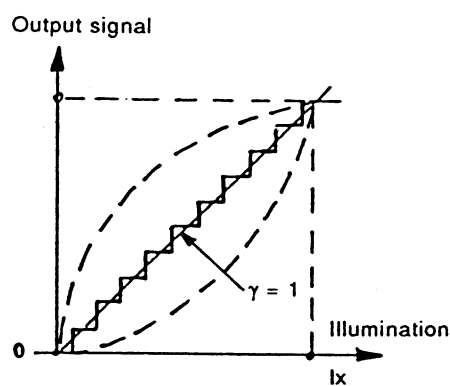


Figure 6d – Camera output signal

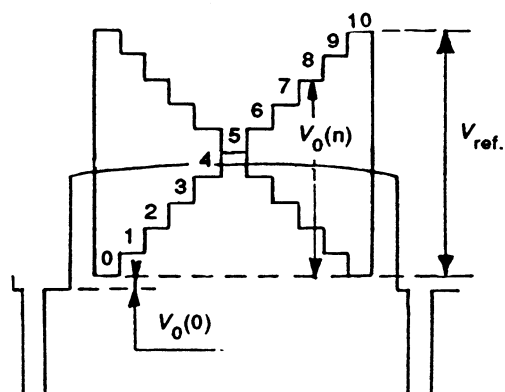


Figure 6e – Video output signal

Figure 6 — Luminance gamma characteristics (concluded)

10 Luminance white clipping and compression rate

10.1 Characteristics to be specified

The white clipping level of the luminance signal is the level at which the white saturation appears. This level is compared to the rated reference luminance signal, and expressed in per cent.

The compression rate is defined as the maximum subject illumination for which details can be distinguished from the next lower illumination level below the white saturation level.

10.2 Method of measurement

- a) The equipment arrangement and the grey-scale test chart shall be as shown in Figure 7.
- b) The conditions of shooting shall be those mentioned in 3.3.
- c) The output signal from the black level shall be measured by an oscilloscope.
- d) Adjust the lens zoom ratio in order to increase the angle of view, and thus the output signal amplitude to saturation level, that is until the two steps having the highest reflectivity, the 9th and 10th steps, of the grey scale just reach the saturation level.
- e) The white clipping level V_{cw} shall be read from the oscilloscope screen and related to V_{ref} (see 3.4) (100 % = luminance rated level), as shown below:

$$\text{white clipping} = (V_{cw}/V_{ref}) \times 100 \text{ (\%)}$$
- f) The compression rate shall be calculated using the reflectance of the two steps, one giving 100 % level, being L_{ref} and the other being the 9th step, L_9 , as shown below:

$$\text{compression rate} = (L_9/L_{ref}) \times 100 \text{ (\%)}$$

If no level related to each of the grey steps corresponds to the 100 % level, the reflectance of the nearest step or the linearly interpolated reflectance shall be adopted for L_{ref} .

10.3 Presentation of the results

The results of the measurements shall be reported in percentage for the two characteristics.

11 Luminance dynamic range and contrast range

11.1 Characteristics to be specified

- a) The dynamic range: the range between the maximum illumination level causing neither blooming nor smear, and the light level corresponding to the minimum signal level limited by the noise in the luminance channel.
- b) The contrast range: the range between the level of the compression rate in dB and the signal-to-noise ratio in dB of the luminance signal, specified in clauses 10 and 6, respectively.

11.2 Method of measurement

- a) The equipment arrangement and the test chart shall be as shown in Figure 25.
- b) The conditions of shooting shall be those mentioned in 3.3.
- c) The *dynamic range* of the luminance signal shall be calculated as the sum of the measured overexposure 10^D specified in 22.2 or 23.2 and the signal-to-noise ratio S/N specified in 6.2 as shown below:

$$\begin{aligned} \text{dynamic} &= 20 \lg 10^D + \text{luminance S/N (dB)} \\ &= 20 \times D + \text{luminance S/N (dB)} \end{aligned}$$

where the exponent D, specifying the blooming or the smear shall be the smallest one.

- d) The *contrast range* of the luminance signal shall be calculated as the sum of the measured results the compression rate and the signal-to-noise ratio specified in 10.2 and 6.2, respectively, as shown below:

$$\text{contrast range} = 20 \lg \frac{L_9}{L_{ref}} + \text{luminance S/N (dB)}$$

11.3 Presentation of results

The results of the measurement shall be reported in dB for the two parameters.

12 Luminance white non-uniformity

12.1 Characteristic to be specified

The deviation of the luminance signal amplitude in the vertical and horizontal direction of the output picture.

12.2 Method of measurement

- a) The equipment arrangement and the test chart shall be as shown in Figure 8a.
- b) The conditions of shooting shall be those mentioned in 3.3. The maximum signal amplitude will probably be 30 % to 40 % below the amplitude of a small area peak white signal. That amplitude is in the order of 0,5 V, depending on the auto iris control system of the camera under test.
- c) For SECAM, see 7.2 c).
- d) The output signal shall be measured by an oscilloscope.
- e) *Vertical white non-uniformity*: during the active period, the luminance amplitude shall be measured at the top (U), at the peak point (P), and at the bottom (B) of the output picture, as shown in Figure 8b. The vertical white non-uniformity shall be calculated by relating the deviations (U) and (B) to the amplitude (P) as shown below:

$$\text{— upper white non-uniformity} = \frac{P - U}{P} \times 100 (\%)$$

$$\text{— lower white non-uniformity} = \frac{P - B}{P} \times 100 (\%)$$

- f) *Horizontal white non-uniformity*: the line (P) corresponding to the peak point in the vertical white non-uniformity measurement shall be selected and displayed on the oscilloscope. The amplitudes (L) and (R) shall be measured as shown in Figure 8c. The horizontal white non-uniformity shall be calculated by relating the deviations (L) and (R) to the amplitude (P) as shown below:

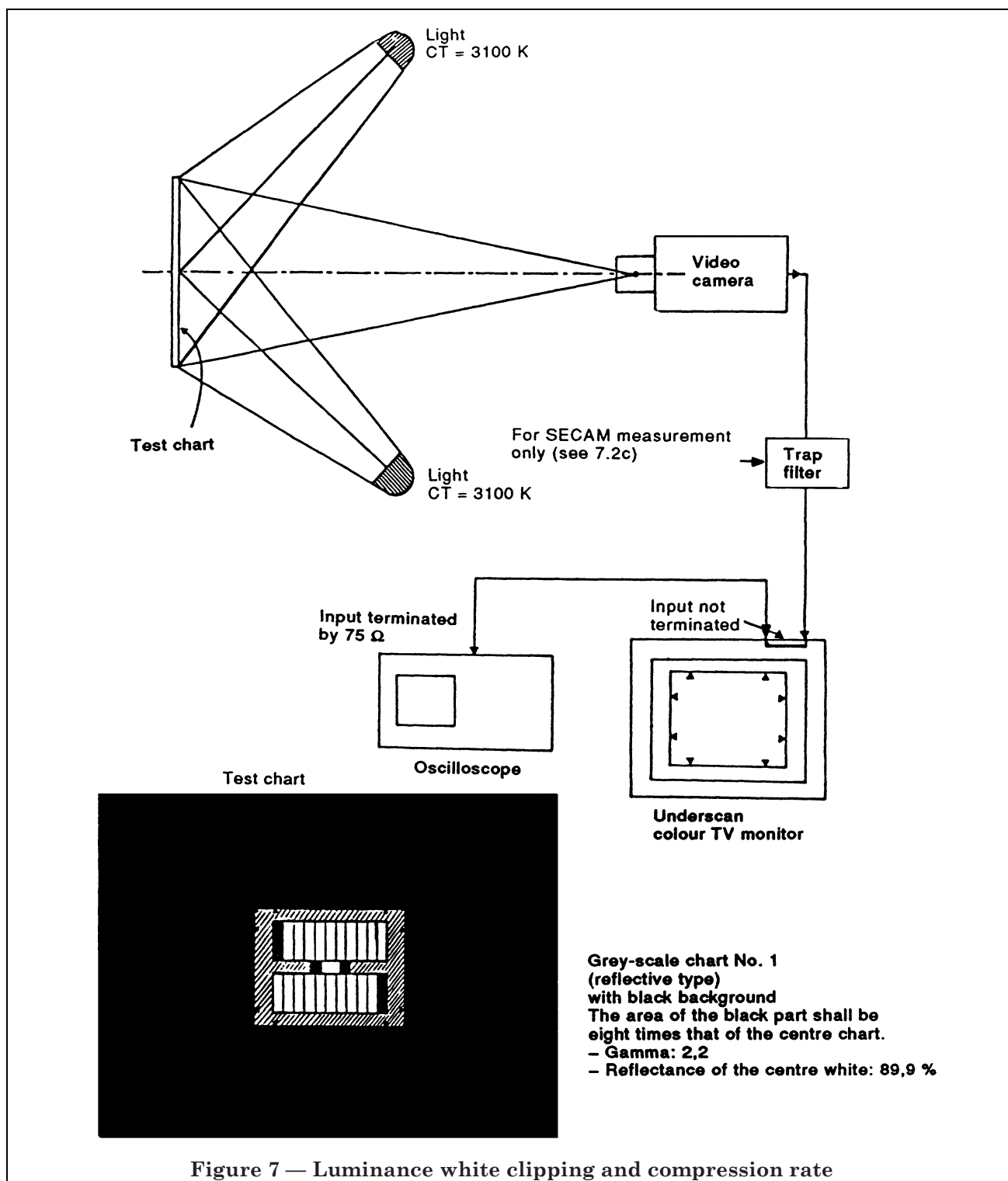
$$\text{— left white non-uniformity} = \frac{P - L}{P} \times 100 (\%)$$

$$\text{— right white non-uniformity} = \frac{P - R}{P} \times 100 (\%)$$

12.3 Presentation of results

The results shall be reported in a table as shown below:

Vertical	upper:	%
	lower:	%
Horizontal	left:	%
	right:	%



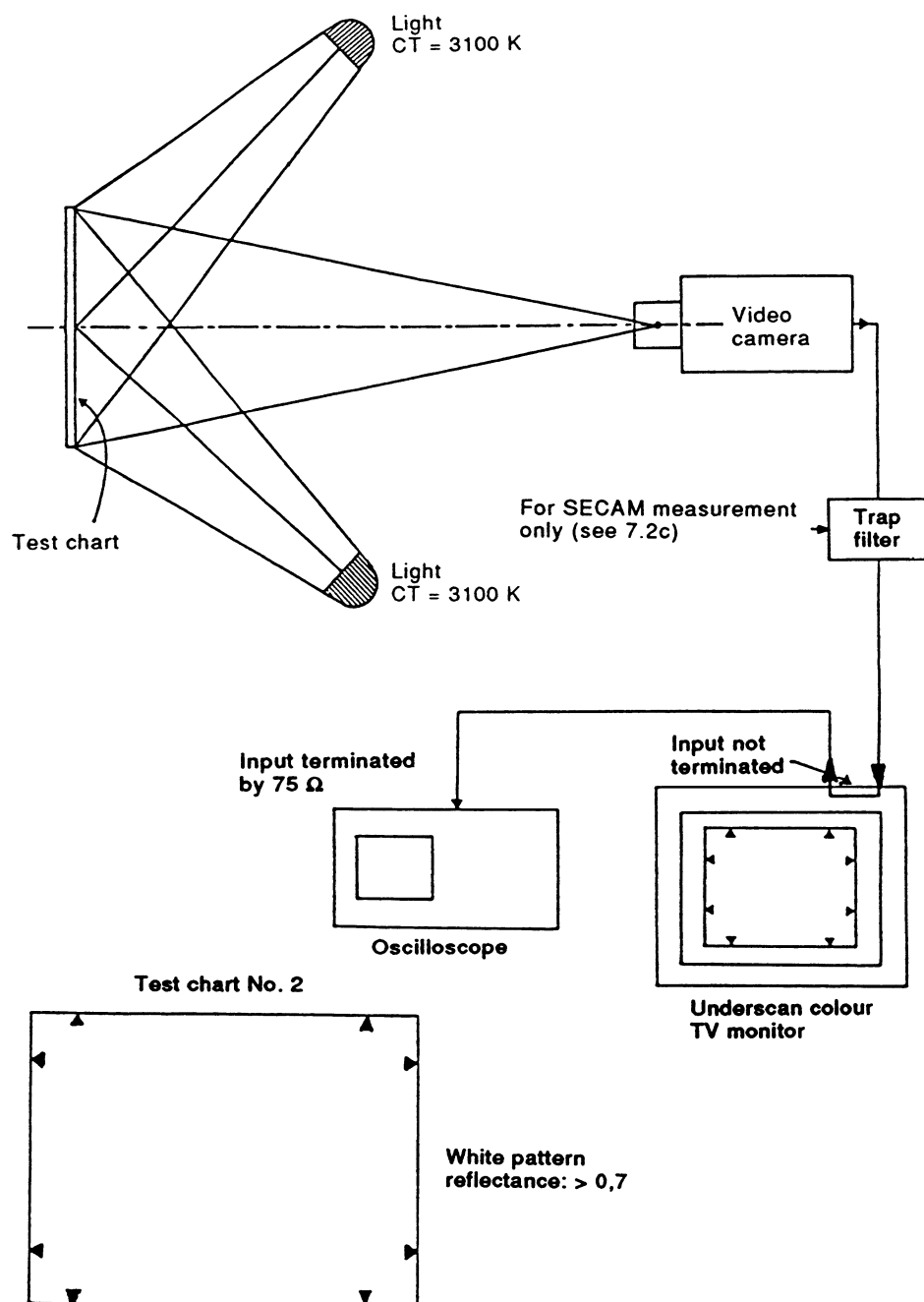


Figure 8a – Equipment arrangement and test chart

Figure 8 — Luminance white non-uniformity

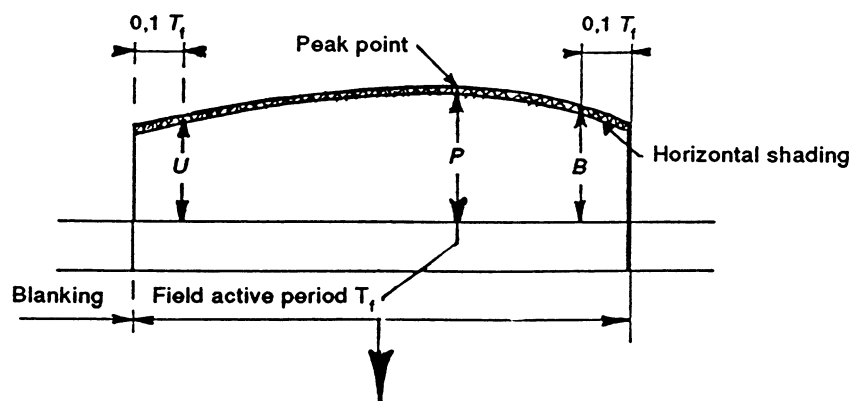


Figure 8b – Vertical non-uniformity

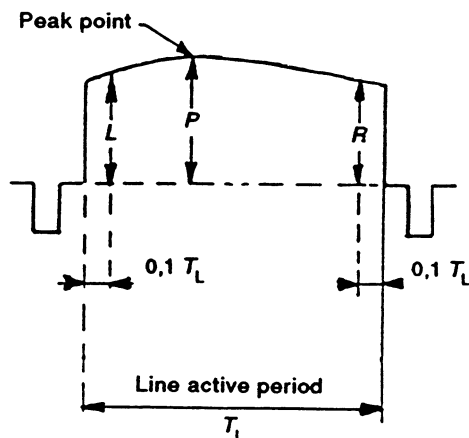


Figure 8c – Horizontal non-uniformity

Figure 8 — Luminance white non-uniformity (concluded)

Section 3. Chrominance video characteristics

13 Chrominance signal-to-noise ratio

13.1 Characteristic to be specified

The noise behaviour of the chrominance channel expressed as the signal-to-noise ratio.

13.2 Method of measurement for PAL/NTSC

- a) The equipment arrangement shall be as shown in Figure 9.