

Methods of measurement for radio transmitters —

Part 10: Methods of measurement for television transmitters and transposers employing insertion test signals

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British Standard

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National foreword

This Part of BS EN 60244 has been prepared under the direction of the Electronic Equipment Standards Policy Committee and is the English language version of EN 602044-10:1993, *Methods of measurement for radio transmitters*.

Part 10: Methods of measurement for television transmitters and transposers employing insertion test signals, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical to IEC 244-10:1986, published by the International Electrotechnical Commission (IEC) and is part of a multi-part series describing recommended methods of measurement for assessing the performance of radio transmitters.

This Part of BS EN 60244 covers the application of insertion test signal measurement to television transmitters and transposers operating in accordance with television systems for monochrome and colour transmission employing 625 or 525 lines. It may also be used as an alternative means for performing some of the line time measurements described in EN 60244-5¹⁾ or EN 60244-9¹⁾.

It is anticipated that the other Parts of IEC Publication 244 will be published as identical British Standards, subject to their harmonization by CENELEC.

For ease of publication, some of the figures also include the French text

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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 42, 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.

¹⁾ In preparation. It is envisaged that identical British Standards, designated BS EN 60244-5 and BS EN 60244-9, will be published in due course.

English version

Methods of measurement for radio transmitters
Part 10: Methods of measurement for television
transmitters and transposers employing
insertion test signals

(IEC 244-10:1986)

Méthodes de mesure applicables aux
émetteurs radioélectriques
Dixième partie: Méthodes de mesure
applicables aux émetteurs et réémetteurs de
télévision, et utilisant les signaux d'insertion
(CEI 244-10:1986)

Meßverfahren für Funksender
Teil 10: Meßverfahren für Fernsehsender
und-umsetzer mit Prüfzeilensignalen
(IEC 244-10:1986)

This European Standard was approved by CENELEC on 1993-03-09. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

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

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

Foreword

At the request of 72nd Technical Board, HD 236.10 S1:1988 (IEC 244-10:1986) was submitted to the CENELEC voting procedure for conversion into a European Standard.

The text of the International Standard was approved by CENELEC as EN 60244-10 on 9 March 1993.

The following dates were fixed:

- latest date of publication
of an identical national
standard (dop) 1994-06-01
- latest date of withdrawal
of conflicting national
standards (dow) —

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

In this standard, Annex ZA is normative.

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Introduction

This standard is one of a series of parts of IEC Publication 244: Methods of Measurement for Radio Transmitters, describing recommended methods of measurement for assessing the performance of radio transmitters.

In this standard reference is made to other parts of IEC Publication 244, especially Publication 244-5:Part 5: Measurements Particular to Transmitters and Transposers for Monochrome and Colour Television, and Publication 244-9:Part 9: Transposers for Monochrome and Colour Television.

1 Scope

This standard applies to television transmitters and transposers operating in accordance with television systems for monochrome and colour transmission employing 625 or 525 lines as described in CCIR publications. For details of the characteristics of the various systems, see the CCIR Report [1] mentioned in Appendix C.

2 Object

This standard deals with the application of insertion test signal measurement to television transmitters and transposers.

This method of measurement is useful for checking the line time performance of the transmitters or transposers during programme service and provides a convenient method of testing transmission performance stability during acceptance tests. It may also be used as an alternative means of carrying out some of the line time measurements as described in IEC Publication 244-5 or 244-9 (including supplements).

Section 1. Test signals and line selection

3 Introduction

Test signals inserted on selected lines in the field-blanking interval of the composite video signal are termed "insertion test signals" and may be inserted by an appropriate instrument, for example an insertion test signal generator.

Table I — Characteristics of the video signals at the transmitter input and demodulator output for different television standards

	625-line systems				525-line systems
	$U_n = 700 \text{ mV}$ $U_s = 300 \text{ mV}^a$				$U_n = 714 \text{ mV}$ $U_s = 286 \text{ mV}^a$
	B, G, H, K ₁	D, K	I	L	M, N
δ_1 (%)	10	12.5 or 15	20	100	10
δ_2 (%) ^b	75	75	76	30	75
U_0 (mV)	808	840 or 875	950	300	824
U_{n0} (mV) ^c	700	700	700	700	714
U_{s0} (mV)	269	280 or 292	300	300	275

^a Characteristics of the video signal at the input of the (test) transmitter
 U_n = nominal value of the luminance bar amplitude,
 U_s = nominal value of the synchronizing pulse amplitude.

^b Characteristics of the vision signal at the output of the transmitter (or transposer)
 δ_1 = nominal peak white level in percentage of peak carrier*,
 δ_2 = nominal blanking level in percentage of peak carrier*.
 *In accordance with the CCIR Report [1] mentioned in Appendix C; for System L, without taking into account the chrominance sub-carrier.

^c Characteristics of the video signal at the output of the demodulator
 U_{n0} = nominal value of the luminance bar amplitude, i.e. the voltage between blanking level and nominal white reference level,
 U_0 = the value to which the voltage between zero-carrier and blanking level is to be adjusted, so that $U_{n0} = U_n$,
 U_{s0} = nominal value of the synchronizing pulse amplitude, i.e. the voltage between blanking level and nominal synchronizing level.

4 Insertion test signals

A representative range of insertion test signals is shown in Figure 1 to Figure 8. For ease of reference they are indicated by roman numerals.

The test signals I to IV for 625-line systems are given in Figure 1 to Figure 4, pages 17 and 18.

Figure 5 and Figure 6, page 19, show the test signals V and VI for 525-line systems.

The test signals I to VI are based on the CCIR Recommendation reproduced in Appendix A, to which reference should be made for further details.

The test signals VII and VIII are included for the measurement of certain characteristics not included in the CCIR Recommendation.

Test signal VII, shown in Figure 7, page 20, is used for measuring the in-band intermodulation products caused by intermodulation between the vision and sound carriers and the sideband component corresponding to the chrominance subcarrier

in 625-line equipment, particularly for transmitters and transposers employing common amplification of the vision and sound channels. A similar test signal may be used for testing 525-line equipment.

Test signal VIII, shown in Figure 8, page 20, comprising a signal at blanking level for the full line interval, is used for measuring noise in 625-line equipment. A similar test signal may be used for testing 525-line equipment.

5 Line selection

For out-of-programme service tests, the test signals may be, in principle, inserted in any line in the field-blanking interval.

For tests during programme service, the lines selected for the test signals should be in accordance with relevant CCIR Recommendations and Reports (see Appendix C, reference [4]).

6 Content of the active picture period

It is assumed that all insertion test signals are simultaneously present on the selected lines of the field-blanking interval.

Because the measurement result may depend on the picture content of the other lines, the average signal level during in-programme measurements shall be stated in the presentation of results.

Out-of-programme measurements may be made for different values of average picture level with the luminance level of the active picture lines successively adjusted to correspond to an “all-black picture” and an “all-white picture”, and, if required, also to a “mid-grey picture”. This shall also be stated in the presentation of results.

Section 2. General conditions of measurement and initial adjustment of the equipment

7 Manual and automatic methods of measurement

Measurements with insertion test signals can be made either “manually” by means of discrete items of test equipment, such as an oscilloscope, noise meter, etc., or “automatically” by using an insertion test signal analyzer. The analyzer continually scans sequentially the selected performance characteristics and may provide a digital read-out and give an indication when the measured values exceed a predetermined threshold (for example, see the CCIR Reports [5] and [6] mentioned in Appendix C).

The advantages of the automatic method include:

- reduction of measuring time,
- greater measurement accuracy for most characteristics,
- the possibility of recording on paper or tape.

Except where a distinction is made in particular clauses between manual and automatic methods of measurement, the measurement procedures given in this standard are valid for both methods. However, although in the case of automatic measurements the procedure is carried out automatically by the insertion test signal analyzer, the various steps are described as if they were performed manually.

When an automatic method of measurement is used, the analyzer will indicate the mean value of the characteristic measured and the presentation of results shall state the period over which the results are averaged.

8 Measuring arrangement

The measuring arrangement shown in Figure 9, page 21, comprises the following items of equipment:

- For out-of-programme tests, a video test signal generator capable of delivering a composite video signal, including the colour burst, in accordance with the television standard concerned.
- An insertion test signal generator, capable of delivering the insertion test signals given in Clause 4 above.
- A vestigial-sideband (VSB) demodulator provided with “zero-carrier reference”, preferably of the type employing switchable synchronous/envelope detection.

Envelope detection should preferably be used for the measurement of differential phase. If envelope detection is also used for the measurement of other characteristics, any errors due to quadrature distortion should be taken into account (for example, see the CCIR Report [7] mentioned in Appendix C).

- An insertion test signal analyzer for the automatic method of measurement, or an oscilloscope with line selector for the manual method of measurement.
- In addition, for the measurement of transposers, a test transmitter capable of delivering modulated vision and sound signals in accordance with the television standard concerned.

In this case, the overall performance of the combination of test transmitter and demodulator, excluding the transposer, must be known and allowed for. See, for example, [PODEMSKI] and also Part E of the CCIR Recommendation [2] mentioned in Appendix C.

9 Conditions of operation

The transmitter or transposer shall be set up to its rated output conditions and tested under the general conditions of operation appropriate to the equipment concerned in accordance with IEC Publication 244-5 or 244-9.

10 Adjustment of the VSB demodulator

10.1 Introduction

Insertion test signal analyzers are normally calibrated for measurements on a composite video signal of standard level in video distribution networks, for example the signal at the input of a transmitter. The reference voltage employed for all measurements is that voltage corresponding to the nominal value of the luminance bar (or picture) amplitude of the video signal, i.e. 714 mV for Systems M and N and 700 mV for all other systems.

If the analyzer is used for the measurement of the signal at the output of a demodulator, the latter shall be adjusted as set out in Sub-clause 10.2 below, so that the voltage between blanking level and nominal white reference level at the demodulator output is equal to the reference voltage, i.e. the nominal luminance bar amplitude at the transmitter input.

As, unless otherwise stated, the measurement procedures given in this standard are applicable to both automatic and manual methods of measurement, the adjustment procedure described in Sub-clause 10.2 shall also be used in the latter case.

10.2 Adjustment procedure

The procedure described below applies both to systems employing positive modulation and also to systems employing negative modulation of the vision signal.

- a) Connect the output of the VSB demodulator to an oscilloscope.
- b) Set the video test signal generator to provide an “all black” picture.
- c) By means of the “zero-carrier reference” of the demodulator and its output level control, adjust the voltage between blanking level and zero-carrier to the value of U_0 given in Table I for the television standard concerned or to the value calculated from the formula 10.3a given below.

10.3 Example of calculation of U_0 and of demodulator output signal waveform

The values of U_0 shown in Table I are based on the nominal values, δ_1 and δ_2 , of peak white level and blanking level stated in the CCIR Report [1] mentioned in Appendix C.

In the case of an equipment specification requiring another value of δ_1 and/or δ_2 within the tolerances stated in the CCIR Report, the value of U_0 shall be calculated from the formula:

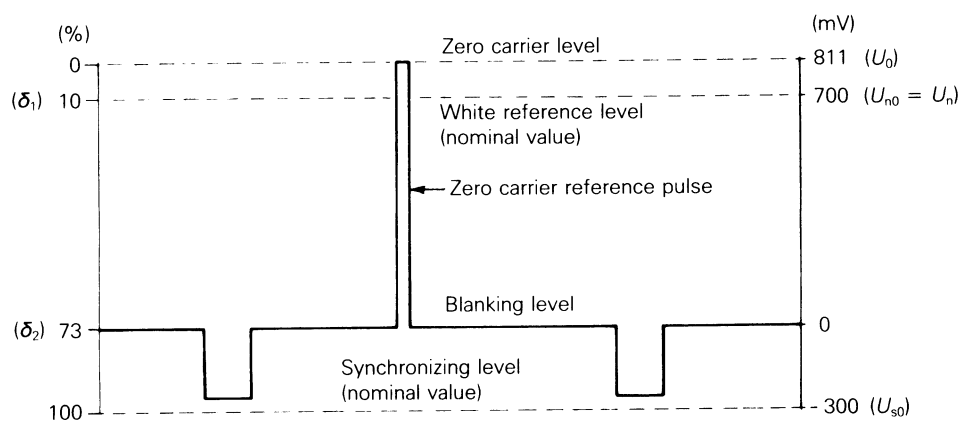
$$U_0 = \frac{\delta_2}{\delta_2 - \delta_1} U_n \quad (10.3a)$$

where U_n is the nominal value of the luminance bar amplitude.

The nominal value of the synchronizing pulse amplitude at the demodulator output is equal to:

$$U_{s0} = \frac{100 - \delta_2}{\delta_2 - \delta_1} U_n \quad (10.3b)$$

For example, substituting $\delta_1 = 10\%$, $\delta_2 = 73\%$ and $U_n = 700\text{ mV}$ yields $U_0 = 811\text{ mV}$ and $U_{s0} = 300\text{ mV}$, and results in the demodulator output signal waveform shown in the figure below for a television transmitter with negative modulation, which is adjusted in accordance with Sub-clause 10.2 above and shows a slight synchronizing pulse amplitude error.



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NOTE Except for Systems I and L, the values of δ_1 and δ_2 given in Table I result in the nominal amplitude, U_{s0} , of the synchronizing pulse at the demodulator output to be different from the nominal value U_s at the transmitter input (i.e. 300 mV for all systems, except Systems M and N where $U_s = 284\text{ mV}$).

In the case of automatic methods of measurement, this will give rise to a synchronizing pulse amplitude error which is also present when the amplitude of the synchronizing pulse is correct. This fixed error may be taken into account by calculating the actual error in accordance with Item d) of Sub-clause 13.2.

Section 3. Measurement of performance characteristics

11 Conformity with other standards

In this standard the definition of each performance characteristic to be measured by a particular test signal is given in the introduction to each measurement procedure. Generally these definitions are in accordance with CCIR Recommendations, for example, reference [3] of Appendix C. In some instances indicated by a note accompanying the particular introduction, the characteristics are also defined in IEC Publications 244-5 and 244-9. The note will explain any divergencies between the definitions and the measurement results obtained.

12 Luminance bar amplitude error

12.1 Introduction

The luminance bar amplitude error is the difference between the actual luminance bar amplitude and its nominal value, expressed as a percentage of the nominal value.

The sign of the error is positive if the bar amplitude is greater than the nominal value.

12.2 Measurement procedure

- a) Select test signal I for 625-line systems or test signal V for 525-line systems.
- b) Measure the difference in level between points b_1 and b_2 , and record this value $U_{1,2}$ in mV.
- c) Calculate the error from the expression:

$$100 \frac{U_{1,2} - U_n}{U_n} \quad (\%) \quad (12.2a)$$

where U_n is the nominal value of the luminance bar amplitude given in Table I.

NOTE For television systems with negative modulation the nominal amplitude of the residual carrier should correspond to nominal white reference level.

The residual carrier error, expressed as a percentage of the nominal peak amplitude of the vision carrier, may be calculated by multiplying the luminance bar amplitude error according to Item c) above with a constant equal to

$$-\frac{U_n}{U_0 + U_{s0}} \quad (12.2b)$$

where U_0 and U_{s0} are the values given in Table I or calculated from the formulae 10.3a and 10.3b.

13 Synchronizing pulse amplitude error

13.1 Introduction

The synchronizing pulse amplitude error is the difference between the actual amplitude of the synchronizing pulse and its nominal value, expressed as a percentage of the nominal value.

The sign of the error is positive if the synchronizing pulses are larger than the nominal value.

13.2 Measurement procedure

- a) Select test signal I for 625-line systems or test signal V for 525-line systems.
- b) Measure the difference in level between points b_8 and b_9 , and record this value $U_{8,9}$ in mV.
- c) If a manual method of measurement is used, calculate the error from the formula:

$$S_0 = 100 \frac{U_{8,9} - U_{s0}}{U_{s0}} \quad (\%) \quad (13.2a)$$

where U_{s0} is the nominal value of the synchronizing pulse amplitude at the output of the demodulator given in Table I or calculated from the formula 10.3b.

d) In the case of an automatic method of measurement, the analyzer will give the error as a percentage of the nominal value (U_s) of the synchronizing pulse amplitude at the input of the transmitter, according to the formula:

$$S = 100 \frac{U_{8,9} - U_s}{U_s} \quad (\%) \quad (13.2b)$$

In those cases where U_{s0} is not equal to U_s , correct this value with the aid of the formula:

$$S_0 = \frac{U_s}{U_{s0}} (S + 100) - 100 \quad (\%) \quad (13.2c)$$

14 Luminance bar tilt

14.1 Introduction

The luminance bar tilt is the difference between the level of the luminance bar (section B_2) at point b_3 of the demodulated test signals I or V, 1 μ s after the half-amplitude point of its leading edge, and the level at point b_4 , 1 μ s before the nominal half-amplitude point of its trailing edge, expressed as a percentage of the luminance bar amplitude.

NOTE The value of 1 μ s is in accordance with CCIR Recommendation [3] mentioned in Appendix C. However, when excessive ringing is present a value of 1.5 μ s would be preferable in order to improve the accuracy of the measurement.

The sign of the bar tilt is positive if the level of the luminance bar at point b_4 is higher than the level at point b_3 .

Except for System I, the measurements are made with the bandwidth of the demodulated video signal limited by the network described in Clause 5 of Appendix B, or by an equivalent filter.

14.2 Measurement procedure

- Select test signal I for 625-line systems or test signal V for 525-line systems.
- Measure the difference in level, $U_{3,4}$, between points b_3 and b_4 .
- Calculate the bar tilt from the expression:

$$100 \frac{U_{3,4}}{U_{1,2}} \quad (\%) \quad (14.2)$$

15 Base-line distortion

15.1 Introduction

Base-line distortion is expressed as the difference between the level at point b_7 of the demodulated test signals I or V, 1 μ s after the half-amplitude point of the trailing edge of the luminance bar (section B_2), and the level at reference point b_1 , expressed as a percentage of the luminance bar amplitude.

The sign of the base-line distortion is positive if the level at point b_7 is higher than the level at point b_1 .

The measurements are made with the bandwidth of the demodulated video signal limited by the network described in Clause 5 of Appendix B, or by an equivalent filter, as for example for System I.

15.2 Measurement procedure

- Select test signal I for 625-line systems or test signal V for 525-line systems.
- Measure the difference in level, $U_{1,7}$, between points b_1 and b_7 .
- Calculate the distortion from the expression:

$$100 \frac{U_{1,7}}{U_{1,2}} \quad (\%) \quad (15.2)$$

16 2T pulse/bar ratio error

16.1 Introduction

The 2T sine-squared pulse/bar ratio error is the difference between the amplitudes of the 2T pulse (section B_1) and the luminance bar (section B_2) of the demodulated test signals I or V, expressed as a percentage of the luminance bar amplitude. The amplitude of the 2T pulse is the difference between the level at point b_{11} and the level at reference point b_7 .

The sign of the error is positive if the amplitude of the 2T pulse is greater than the luminance bar amplitude.

Some measuring equipment may indicate the 2T pulse/bar ratio itself, rather than the error.

16.2 Measurement procedure

- Select test signal I for 625-line systems or test signal V for 525-line systems.
- Measure the amplitude of the 2T pulse, $U_{7,11}$, between points b_{11} and b_7 .
- Calculate the error from the expression:

$$100 \frac{U_{7,11} - U_{1,2}}{U_{1,2}} \quad (\%) \quad (16.2)$$

17 2T pulse shape distortion

17.1 Introduction

2T pulse shape distortion relates to the departure of the 2T pulse from its ideal shape. The performance with respect to this type of distortion is normally given in terms of a rating factor, K , for which numerical limits are assigned in the equipment specification. It is measured by means of an appropriate graticule for the relevant television standard and equipment specification.

17.2 Measurement procedure for a manual method of measurement

- a) Select test signal I for 625-line systems or test signal V for 525-line systems on the oscilloscope.
- b) Employ the oscilloscope graticule shown in Figure 10, page 22, and adjust the oscilloscope so that:
 - the sweep velocity corresponds to the time scale of the graticule;
 - blanking level coincides with the horizontal axis through level reference point “0 %” of the graticule;
 - the peak of the $2T$ pulse falls on the horizontal line through level reference point “100 %”;
 - the half-amplitude points of the $2T$ pulse are symmetrically disposed about the vertical axis through time reference point “0”.
- c) State whether the waveform is within the specified K -rating tolerance, or state the measured K -rating factor.

17.3 Measurement procedure for an automatic method of measurement

This sub-clause is still under consideration because at the present time the results of automatic methods of measurement do not correspond with those obtained by manual methods.

18 Amplitude/video-frequency characteristic

18.1 Introduction

The amplitude/video frequency characteristic is determined by measuring the ratio between (1) the peak-to-peak amplitude of each sine-wave signal at the different video frequencies in section C_2 of the demodulated test signal II or VI and (2) the peak-to-peak amplitude of the reference luminance signal in section C_1 when test signal II is used, or half the peak-to-peak amplitude when test signal VI is used.

Alternatively, the luminance bar in section B_2 of test signals I or V may be taken as the reference luminance signal.

18.2 Measurement procedure

- a) Select test signal II for 625-line systems or test signal VI for 525-line systems.
- b) Measure the peak-to-peak amplitude U_{C1} between the mid-duration points of the reference luminance signal in section C_1 .
- c) Measure the peak-to-peak amplitude U_{C2} at the mid-duration point of each sine-wave signal in section C_2 , for each frequency up to the highest in accordance with the television standard concerned.
- d) For each frequency of the sine-wave signal, calculate the ratio
for 625-line systems:

$$20 \log \frac{U_{C2}}{U_{C1}} \quad (\text{dB}) \quad \text{or} \quad 20 \log \frac{U_{C2}}{0.6 U_{1,2}} \quad (\text{dB}) \quad (18.2a)$$

for 525-line systems:

$$20 \log \frac{2U_{C2}}{U_{C1}} \quad (\text{dB}) \quad \text{or} \quad 20 \log \frac{2U_{C2}}{U_{1,2}} \quad (\text{dB}) \quad (18.2b)$$

- e) Tabulate the ratios as a function of video frequency.

19 Chrominance-luminance gain inequality

19.1 Introduction

Chrominance-luminance gain inequality is the difference between the peak-to-peak amplitude of the chrominance signal in section G_1 or G_2 (or in section G) of the demodulated test signal IV (or VI) and the amplitude of a reference luminance signal, expressed as a percentage of this amplitude.

The amplitude of the reference luminance signal is equal to the amplitude of the luminance bar in section B_2 of test signal I when test signal IV is used, and is equal to 0.8 times the amplitude of the luminance bar in section B_2 of test signal V when test signal VI is used.

The sign of the gain inequality is positive if the amplitude of the chrominance signal is greater than that of the luminance bar.