

Methods of measurement on receivers for satellite broadcast transmissions in the 12 GHz band —

Part 2: Electrical measurements on DBS tuner units

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- British Radio and Electronic Equipment Manufacturers' Association
- British Telecommunications plc
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- Radio, Electrical and Television Retailers' Association
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National foreword

This Part of BS EN 61079 has been prepared by Technical Committee EPL/12 and is the English language version of EN 61079-2:1993 *Methods of measurement on receivers for satellite broadcast transmissions in the 12 GHz band — Part 2: Electrical measurements on DBS tuner units*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1079-2:1992, published by the International Electrotechnical Commission (IEC).

BS EN 61079 is a multipart standard. The other Parts published to date are:

- *Part 1:1995, Radio-frequency measurements on outdoor units.*
- *Part 3:1995, Electrical measurements of overall performance of receiver systems comprising an outdoor unit and a DBS tuner unit.*
- *Part 5:1995, Electrical measurements on decoder units for MAC/packet systems.*

This Part of BS EN 61079 defines the conditions and methods of measurement to be applied to the tuner unit of a receiver for the direct reception of satellite broadcast transmissions in the 12 GHz band. The channels are those defined by WARC BS-77 and RARC SAT-83 and the systems are those defined in CCIR Recommendation 650. Performance requirements are not specified.

Cross-references

Publication referred to	Corresponding British Standard
IEC 107-1:1977	BS 3549 <i>Methods of measuring and expressing the performance of television receivers</i> Part 1:1979 <i>General considerations and electrical measurements other than those at audio-frequencies</i>
EN 61079-1:1993 (IEC 1079-1:1992)	BS EN 61079 <i>Methods of measurement on receivers for satellite broadcast transmissions in the 12 GHz band</i> Part 1:1995 <i>Radio-frequency measurements on outdoor units</i>
IEC 569:1977	BS 5876:1980 <i>Guide for subjective viewing tests for television receivers</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 36, 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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English version

Methods of measurement on receivers for satellite
broadcast transmissions in the 12 GHz band
Part 2: Electrical measurements on DBS tuner units

(IEC 1079-2:1992)

Méthodes de mesure sur les récepteurs
d'émissions de radiodiffusion par satellite dans
la bande 12 GHz
Partie 2: Mesures électriques sur les
syntoniseurs pour la radiodiffusion directe par
satellite
(CEI 1079-2:1992)

Meßverfahren für Empfänger für
Satelliten-Rundfunkübertragung im
12-GHz-Bereich
Teil 2: Elektrische Messungen an
Satellitenempfängern
(IEC 1079-2:1992)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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Foreword

At the request of the 73rd CENELEC Technical Board, the International Standard IEC 1079-2:1992 was submitted to the CENELEC Unique Acceptance Procedure (UAP) in November 1992 for acceptance as a European Standard.

The text of the International Standard was approved by CENELEC as EN 61079-2 on 22 September 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-09-01
- latest date of withdrawal of conflicting national standards (dow) 1994-09-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given only for information. In this standard, Annex A is informative and Annex ZA is normative.

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Section 1. General

1.1 Scope

This part of IEC 1079 applies to the tuner unit of a receiver for the direct reception of satellite broadcast transmissions in the 12 GHz band. The channels are those defined by WARC BS-77 and RARC SAT-83 [1]¹⁾ and the systems are those of CCIR Recommendation 650 [1].

The object of this part of IEC 1079 is to define the conditions and methods of measurement to be applied. This part does not specify performance requirements.

The tuner unit comprises the channel selector and FM demodulator. The input to this unit is a group of intermediate frequency signals, usually in the range 1 GHz to 2 GHz, which is provided from an associated outdoor unit. The outdoor unit includes at least a microwave antenna and the frequency converter to the first intermediate frequency.

Methods of measurement on outdoor units are described in Part 1 of International Standard IEC 1079.

A decoder for baseband and data signals may be included in the tuner unit. Methods of measurement of the decoder, however, are described in Parts 4 and 5 of International Standard IEC 1079 (under consideration).

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 1079. 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 1079 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 107-1:1977, *Recommended methods of measurement on receivers for television broadcast transmissions — Part 1: General considerations — Electrical measurements other than those at audio-frequencies*.

IEC 1079:1992, *Methods of measurement on receivers for satellite broadcast transmissions in the 12 GHz band — Part 1: Radio-frequency measurements on outdoor units*.

IEC 569:1977, *Informative guide for subjective tests on television receivers*.

CCIR Recommendation 421-1:1966, *Requirements for the transmission of television signals over long distances (System I excepted)*.

CCIR Recommendation 500-3:1986, *Method for the subjective assessment of the quality of television pictures*.

1.3 Definitions

For the purpose of this part of IEC 1079, the following definitions apply.

1.3.1

DBS tuner unit

the function of this unit is to select a desired channel from a group of signals received and converted to a first intermediate frequency by the outdoor unit and to provide demodulated outputs

the exact configuration of the unit depends on the overall product design and the related transmission standards that the equipment is designed to receive. In the description of the measurement methods, it is assumed that the arrangement of the units is similar to the notional block diagrams shown in Figure 1. Examples are given of units for the MAC systems and the digital sub-carrier/NTSC system a decoder for the baseband signals may be incorporated in the unit or attached to it as a separate unit. In the latter case, it is assumed that the tuner unit has the following interfaces to the decoder:

- a) MAC systems:
 - output for MAC composite video and data signal
 - output for MAC data signal (optional).
- b) Digital sub-carrier/NTSC system:
 - output for NTSC video signal
 - output for digital sound/data signal.

1.3.2

first intermediate frequency (first i.f.)

the first intermediate frequency produced by the outdoor unit is usually in the band of 1 GHz to 2 GHz

¹⁾ The figures in square brackets refer to the Bibliography (Annex A).

Section 2. General notes on measurement

2.1 General conditions

2.1.1 Introduction

Measurements shall be made in accordance with the following conditions to ensure repeatable results. The methods described here assume the use of the following transmission systems: digital sub-carrier/NTSC, B-MAC, C-MAC/packet, D-MAC/packet and D2-MAC/packet. Information pertaining to these systems may be found in the references listed in Annex A.

2.1.2 Test site

Measurements shall be carried out at a location that is not subject to external interferences from radio-frequency energy. If interference cannot be avoided, the measurements shall be carried out in a screened room.

2.1.3 Environmental conditions

Sections 3, 4 and 5 of IEC 107-1 shall be applied.

2.1.4 Power supply

A power supply equivalent to the rated voltage and rated frequency of the unit shall be used. The fluctuations of the power supply voltage and frequency during the tests shall not exceed $\pm 2\%$ and harmonic components of the power supply shall not exceed 5 %.

2.1.5 Accuracy of measuring instruments

The accuracy of the measuring instruments used, if known, shall either be stated as a percentage or in decibels as appropriate. Alternatively, the precision class may be quoted as stated in the relevant publications.

2.1.6 Stabilization period

Unless otherwise specified, measurements should be started at the time that stabilization of the characteristics is obtained.

2.2 Video, audio and digital test signals

2.2.1 Video test signals

- a) 50 % grey level signal;
- b) two riser staircase signal;
- c) five riser staircase signal followed by grey signals;
- d) ten riser staircase signal with colour sub-carrier followed by grey signals (digital sub-carrier/NTSC system only);

- e) eight riser staircase signal with 6 MHz sinewave followed by grey signals (MAC systems only);
- f) composite sinewave signal (sinewave on 50 % grey level signal);
- g) 1 μ s pulse on black and on 50 % grey level signals;
- h) VIR signal (colour bar at 70 % level plus 50 % luminance bar) (digital subcarrier/NTSC system only);
- i) complex wobble signal — imaginary part (MAC systems only);
- j) complex wobble signal — real part (MAC systems only);
- k) rising ramp signal (MAC systems only);
- l) pulse and bar signal for *K*-rating measurements;
- m) field frequency square wave signal.

Examples are shown in Figure 2. The waveforms a) to c), f), g) and l) are directly applicable to the digital subcarrier/NTSC system. For the MAC systems, it is necessary to change the level of the line blanking interval and to insert the data burst.

NOTE 1 The levels of the signals are expressed as a percentage of the difference between the black level and white level.

NOTE 2 The grey signals in the waveforms c), d) and e) are used to change the average picture level (APL) in the range of 10 % to 90 %.

NOTE 3 The digital sub-carrier/NTSC test signals include a composite sync component. The MAC test signals include a data burst in the line blanking interval. To avoid the necessity of recovering the MAC sync signal from the data burst, line and field sync pulses may be provided from the test signal generator directly to the measuring instruments, bypassing the equipment under test.

2.2.2 Audio test signals

Since all the systems covered by this part of IEC 1079 use digital modulation for sound transmission and as this part is only concerned with the signals at the FM demodulator, there is no specific requirement for audio modulation. However, where it is convenient to apply such modulation, a 1 kHz sinewave signal should be used.

2.2.3 Data signal content

The systems covered by this part of IEC 1079 all include a digital component. The methods of measurement related to these digital signals are included in IEC 1079. When a digital component is included in a test signal for use with this part, the data shall consist of a suitable pseudo random binary sequence whose characteristics shall be stated with the results.

2.3 Radio-frequency input signals

2.3.1 Input signals

The following radio-frequency input signals shall be used:

- a) unmodulated carrier signal;
- b) carrier signals modulated by the test signals for the system in use.

Unless otherwise specified, the carrier frequencies shall be selected from the relevant first intermediate frequencies corresponding to the satellite broadcast channels which are specified by the system standards for which the equipment under test is designed.

2.3.2 Input signal levels

Input signal levels to a tuner unit shall be expressed in terms of available power level in dB(mW).

2.3.3 Setting of input signal level

Input signal levels should be specified for unmodulated carriers even when modulated carriers are used. The level setting can be done with a spectrum analyzer.

2.4 Reference signals

2.4.1 Reference video signal

For the measurements of noise and interference, a composite sinewave signal as shown in Figure 2 f) shall be used. The frequency of the sinewave is set at the frequency (f_o) shown in Table 1.

The frequency (f_o) corresponds to the 0 dB reference frequency of the pre-emphasis network.

Table 1 — Frequencies for reference video signals

System	f_o MHz
Digital sub-carrier/NTSC	0,75
B-MAC	2,64
C-MAC D2-MAC D-MAC	1,37

2.4.2 Reference audio signal

- a) Digital sub-carrier/NTSC system

A 1 kHz sinewave signal at a level corresponding to full scale minus 18 dB in digital coding shall be used.

- b) MAC systems

The data burst carrying a pseudo random binary sequence shall be used.

2.5 Standard measuring conditions

Unless otherwise specified, the following conditions apply:

- a) Audio input signal: none
- b) Digital sub-carrier in the digital sub-carrier/NTSC system: off
- c) Energy dispersal signal: none
- d) MAC system data burst: on

The data burst includes sync information.

The input signal is applied to the DBS tuner unit through a coupling network specified in 2.6.7 and the video output signal is measured through a lowpass filter specified in 2.6.10.

2.6 Measuring instruments

2.6.1 Test signal generator

The test generators shall be capable of providing baseband video signals as specified in 2.2.1. For digital sub-carrier/NTSC signals, a suitably modulated sub-carrier shall also be included. For MAC test signals, when data burst is included, it shall include line synchronization and a pseudo random binary sequence.

2.6.2 First i.f. modulator

The first i.f. modulator shall be capable of frequency modulating the first i.f. carrier corresponding to the carrier of each broadcast channel in the 12 GHz band with the base-band signal provided by the test signal generator in accordance with the system tested. It should have a maximum output level of – 20 dB(mW) and provide an on/off switch for an energy dispersal signal.

Notional block diagrams of the modulators are shown in Figure 3.

2.6.3 C.W. signal generator

The c.w. signal generator shall be capable of generating stable radio-frequency signals in the frequency band of 26 MHz to 7 000 MHz with a maximum output level of – 10 dB(mW).

2.6.4 SWR bridge

An SWR bridge for the i.f. band should be used. The nominal impedance of the SWR bridge shall be equal to that of the i.f. input of the tuner under test.

2.6.5 Spectrum analyzer

The spectrum analyzer should have a frequency range of 26 MHz to 7 000 MHz.

2.6.6 Directional coupler

The directional coupler should have a coupling factor of about 3 dB and a directivity better than 20 dB in the i.f. band.

2.6.7 Input coupling network

When connecting an i.f. signal source to the input terminal of a tuner unit, it is necessary to block the d.c. power supply voltage for an associated outdoor unit. The input coupling network shall be a coaxial line in which a capacitor is directly inserted into the centre conductor of the line.

2.6.8 Bias network

See IEC 1079-1.

2.6.9 Bandpass filter

When interference ratios in the video signal are measured, the wanted signal is modulated by the reference video signal specified in 2.4.1 and a bandpass filter is used to eliminate random noise included in the output signal.

The filter should have a 3 dB bandwidth of about 200 kHz centred at the frequency specified in Table 1.

An example of the circuit and its frequency characteristics is shown in Figure 4.

2.6.10 Lowpass filter

For the measurements of video baseband signals at the output of the tuner, the lowpass filter specified in the system standard shall be used. An example is shown in Figure 5.

2.6.11 Variable bandpass filter

See 3.10.2.2, note 1.

2.6.12 Video noise meter

The video noise meter shall be capable of measuring the noise component of a grey level signal and provide an output terminal for this component. The noise meter is also used as an amplifier for frequency components superimposed on the grey level signal. Its bandwidth shall be in accordance with the system in use.

2.6.13 Group delay measuring instrument

See 3.13.1.

2.6.14 Video monitor

This monitor is used to perform subjective evaluations. It should include an appropriate decoder for the system in use.

Section 3. Methods of measurement

3.1 Impedance matching at input terminal

3.1.1 Introduction

This test measures the extent of impedance matching of the input terminal. A c.w. signal is applied to the input terminal and levels of the direct and reflected signals are measured using an SWR bridge. Return loss is calculated from the two signal levels.

3.1.2 Method of measurement

Measurement shall be made according to the following conditions and procedure. Arrangement of the test equipment is shown in Figure 6.

3.1.2.1 Measuring conditions

- Test frequency: centre frequency of each channel in the first i.f. band.
- Test signal level: – 30 dB(mW).

3.1.2.2 Measurement procedure

- Apply a c.w. signal with a test frequency as specified above, then set the level at the output terminal of the SWR bridge by adjusting the variable attenuator (see Figure 6).
- Short the test terminal of the bridge with a short-circuit termination and measure the output signal level L_{P_0} dB(mW).
- Connect the test terminal to the input terminal of the indoor unit under test and measure the output signal level L_P dB(mW).
- Calculate the return loss by the following equation:

$$\text{return loss} = L_{P_0} - L_P \text{ (dB)}$$
- Change the test signal frequency and repeat a) to d) in the same way.

3.1.3 Presentation of results

The results shall be listed in a table and/or presented graphically.

3.2 Signal-to-noise ratio of video signal (unweighted)

3.2.1 Introduction

This test measures the signal-to-noise ratio of a video output signal when the first i.f. input signal contains random noise.

The signal-to-noise ratio of the input i.f. signal is measured with various carrier-to-noise ratios (C/N).

3.2.2 Method of measurement

Measurement shall be made according to the following conditions and procedure. Arrangement of the test equipment is shown in Figure 7.

3.2.2.1 Measuring conditions

- a) Test channel: the centre channel in the first i.f. band.
- b) Test signal level: – 30 dB(mW), – 45 dB(mW) and – 60 dB(mW).
- c) Test video signal: 50 % grey level signal.
- d) C/N of input i.f. signal: 4 dB to 24 dB in 1 dB steps.
- e) All other measuring conditions are standard (see 2.5).

3.2.2.2 Measurement procedure

- a) Apply an unmodulated i.f. signal to the unit under test and set the signal level at one of the values specified above.
- b) Apply white noise to the unit through a power combiner together with the signal and set the C/N at 24 dB (see Figure 7).
- c) Modulate the i.f. signal with the test video signal and measure the unweighted signal-to-noise ratio using a video noise meter.
- d) Repeat a) to c) at the other specified signal levels and C/N values in the same way.

3.2.3 Presentation of results

The results shall be listed in a table or presented graphically. A graphical example is shown in Figure 8. In the case of MAC signals, it shall be noted with the results that they refer to measurement of the compressed video signal.

3.3 Truncation noise

3.3.1 Introduction

This subjective test assesses truncation noise in the picture caused by the presence of fast transitions associated with amplitude peaks at white level in the video signal.

The assessment uses a modulated first i.f. signal.

In the case of the digital sub-carrier/NTSC system, truncation noise in the sound is also assessed.

3.3.2 Method of measurement

Measurement shall be made according to the following conditions and procedure. Arrangement of the test equipment is shown in Figure 9.

3.3.2.1 Measuring conditions

- a) Test channel: the centre channel in the first i.f. band.
- b) Test signal level: – 45 dB(mW).

c) Video test signal:

— for the NTSC system:

1 μ s pulse on black level signal and 1 μ s pulse on 50 % grey level signal. In both cases the peak pulse level shall be variable over the range 90 % to 140 %;

— for MAC systems: under consideration.

d) Digital sub-carrier: present (digital sub-carrier/NTSC system only).

e) Audio test signal: reference audio signal (digital sub-carrier/NTSC system only).

f) Energy dispersal signal: on.

g) All other measuring conditions are standard (see 2.5).

3.3.2.2 Measurement procedure

- a) Apply an unmodulated i.f. signal to the unit under test and set the input signal level at the specified value.
- b) Modulate the i.f. signal at 90 % peak value with a 1 μ s pulse on 50 % grey level and in the case of the digital sub-carrier/NTSC system with the reference audio signal.
- c) Increase the peak level of the modulating video signal gradually up to 140 % and note the amplitude at which truncation noise is just perceptible on the video monitor. In the digital sub-carrier/NTSC system, also note the amplitude at which truncation noise is just perceptible in the sound output.
- d) Repeat a) to c) with the video signal set to black level.

3.3.3 Presentation of results

The results shall be listed in a table.

For precise results, the assessment conditions given in CCIR Recommendation 500-3 should be observed.

3.4 Input signal level to output signal level characteristics

3.4.1 Introduction

This test measures variations of output signal levels delivered by the FM demodulator due to changes of the input i.f. signal level.

3.4.2 Method of measurement

Measurement shall be made according to the following conditions and procedure. Arrangement of the test equipment is shown in Figure 10.