SLOVENSKI STANDARD
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Receiving antennas for satellite broadcast transmissions in the 11/12 GHz band - Part 1: Electrical measurements (IEC 61114-1:1999)

Receiving antennas for satellite broadcast transmissions in the 11/12 GHz band -- Part 1: Electrical measurements

Empfangsantennen für Satelliten-Rundfunkübertragung im 11/12-GHz-Bereich -- Teil 1: Elektrische Messungen

Antennes de réception des émissions de radiodiffusion par satellite dans la bande de 11/12 GHz -- Partie 1: Mesures électriques

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EUROPEAN STANDARD

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Receiving antennas for satellite broadcast transmissions in the 11/12 GHz band Part 1: Electrical measurements (IEC 61114-1:1999)

Antennes de réception des émissions de radiodiffusion par satellite dans la bande de 11/12 GHz
Partie 1: Mesures électriques
(CEI 61114-1:1999)

Empfangsantennen für Satelliten-Rundfunkübertragung im 11/12-GHz-Bereich
Teil 1: Elektrische Messungen
(IEC 61114-1:1999)

This European Standard was approved by CENELEC on 1999-04-01. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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Foreword

The text of document 100A/109/FDIS, future edition 2 of IEC 61114-1, prepared by SC 100A, Multimedia end-user equipment, of IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61114-1 on 1999-04-01.

This European Standard supersedes EN 61114-1:1993.

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) 2000-01-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2002-04-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annexes C and ZA are normative and annexes A, B, D and E are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61114-1:1999 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60153	NOTE: Harmonized as HD 123 (not modified).
IEC 60154	NOTE: Harmonized as HD 129 or EN 60154 (not modified).
IEC 61319-1	NOTE: Harmonized as EN 61319-1:1996 (not modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050(712)	1992	International Electrotechnical Vocabulary (IEV) Chapter 712: Antennas	-	-
IEC 61079-1	1992	Methods of measurement on receivers for satellite broadcast transmissions in the 12 GHz band Part 1: Radiofrequency measurements on outdoor units	EN 61079-1	1993

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Partie 1: Mesures électriques

Receiving antennas for satellite broadcast transmissions in the 11/12 GHz band –

Part 1: Electrical measurements

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Part 1: Electrical measurements

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61114-1 has been prepared by subcommittee 100A: Multimedia end-user equipment, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition cancels and replaces the first edition published in 1992 and constitutes a technical revision.

The text of this standard is based on:

FDIS	Report on voting
100A/109/FDIS	100A/117/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annex C forms an integral part of this standard.

Annexes A, B, D and E are for information only.

RECEIVING ANTENNAS FOR SATELLITE BROADCAST TRANSMISSIONS IN THE 11/12 GHz BAND –

Part 1: Electrical measurements

1 Scope

This part of IEC 61114 applies to individual and collective receiving antennas for satellite broadcast transmissions in the 11/12 GHz band.

This standard mainly applies to paraboloidal reflector antennas, which include offset paraboloidal reflector antennas, Cassegrain reflector antennas and other equivalent types. It also applies to planar array antennas. However, the supporting mast and the radome are not included in this standard.

This standard applies to the following six types of antennas.

a) Antenna of a single antenna system to receive signals from a single satellite
   1) linearly polarized single-beam antenna;
   2) circularly polarized single-beam antenna.

b) Antenna of a single antenna system to receive signals from two or more than two satellites
   1) linearly polarized multiple beam antenna;
   2) circularly polarized multiple beam antenna.

c) Antenna of a multiple antenna system to receive signals from two or more than two satellites
   1) linearly polarized system of single-beam antenna;
   2) circularly polarized system of single-beam antenna.

Typical configurations of these six types are illustrated in figure 1.

The object of this part of IEC 61114 is to define the conditions and methods of measurement to be applied. This standard does not specify performance requirements.

It is assumed that for some measurements the SHF converter will be removed from the antenna, leaving access to an r.f. port.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61114. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and the parties to agreement based on this part of IEC 61114 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

IEC 60050(712):1992, *International Electrotechnical Vocabulary (IEV) – Chapter 712: Antennas*

IEC 61079-1:1992, *Methods of measurement on receivers for satellite broadcast transmissions in the 12 GHz band – Part 1: Radio-frequency measurements on outdoor units*

3 Terms and definitions

For the purpose of this part of IEC 61114, the following general definitions apply.

3.1
receiving antenna
SHF antenna intended for use in individual and collective reception of satellite broadcast signals

A polarization switching device is included in an antenna, if the antenna is able to receive two orthogonal polarized waves.

3.2
paraboloidal reflector antenna
antenna usually comprising main reflector, a primary (and sometimes a secondary) radiator with or without a feedome, an SHF converter, supporting structures for a primary radiator or subreflector and pointing structures

3.3
planar array antenna

antenna usually comprising radiating elements, a feed network, an SHF converter, supporting structures, pointing structures and a radome

3.4
standard antenna
antenna which is used as a gain reference for receiving antennas under test

3.5
source antenna
antenna which is used as a transmitting antenna for measurements

3.6
polarization switcher
device which can select one type of polarization

4 General notes on measurements

4.1 General conditions

4.1.1 Introduction

Measurements should be carried out in accordance with the following conditions to ensure repeatable results.

4.1.2 Testing site

Measurements shall be carried out at a facility where external radio interference and reflections from the ground and from surrounding structures have been minimized and their residual effects have been measured.

The testing site for G/T measurement is provided in 4.3.3.

4.1.3 Power supply

If an SHF converter is used as an integral part of the antenna, a power supply equivalent to the rated voltage of the converter shall be used. The fluctuation of the power supply voltage during tests shall not exceed ±2 %.

4.1.4 Accuracy of measuring instruments

Requirements for the accuracy of measurements are not included in this part of IEC 61114, because they depend only on the purpose for which the measurements are required. 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 relevant publications (under consideration).

4.1.5 Residual standing wave ratio (SWR) of test instruments

The residual SWR of the test instruments shall be less than 1,1 for measuring the antenna gain and the impedance matching, and less than 1,5 for measuring the radiation pattern, the cross-polar pattern and the cross-polarization discrimination.

4.1.6 Stabilization period

Unless otherwise specified, measurements should be started once stabilization of the characteristics is obtained.

4.2 Test signal and test frequencies

Unless otherwise specified, the test signal shall be a c.w. signal and its frequency shall be the lowest, middle and highest frequencies in the 11/12 GHz band as specified by the standard of the country or countries for which the antenna under test was designed.

If there is interference at these frequencies, the test frequency can be shifted slightly to avoid the disturbance.

If the characteristics of the antenna are strongly frequency-dependent, the measurements shall also be carried out at those frequencies where significant changes occur.

4.3 Arrangement of source and receiving antennas

4.3.1 Antenna distance

The distance R between the aperture planes of the source antenna and the antenna under test shall satisfy the following equations:

$$R > 2D_1^2 / \lambda$$

$$R > D_1 D_2 / 0{,}32\,\lambda$$

where

D_1 is the largest aperture diameter of the antenna under test, in metres (m);

D_2 is the largest aperture diameter of the source antenna, in metres (m);

λ is the free-space wavelength at the test frequency, in metres (m).

4.3.2 Spatial variation of the field

The spatial variation of the field at the aperture plane of the antenna under test shall be minimized. The variation in the power received from a standard antenna shall be within ±0,5 dB on the aperture plane of the antenna. If the antenna under test is designed to receive two orthogonal circularly polarized waves, the variation shall satisfy the above value for both right- and left-hand circularly polarized waves. If the antenna under test is designed to receive two orthogonal linearly polarized waves, the variation shall satisfy the above value for both horizontal and vertical linearly polarized waves. The method of measurement of the variation is described in 5.1.

If a larger variation is observed, the position and height of the antenna should be changed to obtain the value specified above.

4.3.3 Environmental conditions for G/T measurements

When the measurements of G/T are made (see 5.8), the following conditions shall be maintained:

– the sky shall be clear;

– there shall be no noise sources such as the sun, a satellite, buildings and trees within 10° around the beam axis of the antenna under test.

4.4 Other conditions

If an SHF converter is used, the field intensity at the aperture plane shall be chosen so as not to overload the converter. The overload level of the converter is described in IEC 61079-1.

4.5 Measuring instruments

4.5.1 Circularly polarized standard antennas

A right-hand circularly polarized antenna and a left-hand circularly polarized antenna which have a nominal gain of more than 20 dB shall be provided as standard antennas.

An example of a suitable antenna is described in annex A.

The gain shall be calibrated at the test frequencies.

NOTE – A linearly polarized horn antenna can be used as the standard antenna. However, the accuracy of the gain measurement may be slightly reduced.

4.5.2 Linearly polarized standard antenna

A linearly polarized antenna which has a nominal gain of more than 20 dB shall be provided as the standard antenna. An example of a suitable antenna is described in annex B. The gain shall be calibrated at the test frequencies.

4.5.3 Circularly polarized source antennas

A right-hand circularly polarized antenna and a left-hand circularly polarized antenna shall be provided as the source antennas. These antennas shall have the same nominal characteristics and a cross-polarization discrimination of more than 30 dB.

These values can be confirmed by the standard antenna (see annex C).

4.5.4 Linearly polarized source antenna

A linearly polarized antenna shall be provided as the source antenna. The antenna shall have a cross-polarization discrimination of more than 30 dB.

4.5.5 Variable attenuator

A waveguide type precision attenuator having a variable range of 30 dB with an accuracy of better than ±0,2 dB is required.

If an additional attenuator is introduced to set power at an appropriate level, it is not required to have the above accuracy.

5 Methods of measurement

5.1 Calibration of field intensity

5.1.1 Introduction

Prior to measuring the characteristics of the antenna under test, calibration of the field intensity at the aperture plane of the antenna shall be carried out using a standard antenna. A circularly or linearly polarized standard antenna is used as the standard antenna corresponding to the polarization of the antenna under test.

5.1.2 Method of measurement

The arrangement of the test equipment is shown in figure 2.

The measurement shall be made using the following procedure:

a) set the source antenna and the antenna under test according to the measuring conditions described in clause 4;

b) replace the antenna under test with the standard antenna;

c) transmit the test signal from the source antenna at one of the test frequencies and move the standard antenna horizontally and vertically on the plane where the aperture plane of the antenna under test was located. Measure the received power at each point at a distance of two to four times the wavelength. The difference between the maximum and minimum measured values shall not exceed 1 dB. Then calculate the average value from the measured values and note it as P_{HA};

d) place the standard antenna apart from the antenna under test on a plane in which the aperture of the antenna under test is included. The distance between the centre of the antenna under test and that of the standard antenna shall be greater than 1,5 times the diameter of the antenna under test. Then measure the received power and note it as P_H;

e) calculate the difference $\Delta\alpha$ between P_H and P_{HA}

$$\Delta\alpha = P_H - P_{HA};$$

f) repeat b) to e) at other test frequencies;

g) if the antenna under test is designed to receive two orthogonal polarized waves, replace both the source antenna and the standard antenna with those of orthogonal polarization. Repeat a) to f) to calibrate the field intensity for orthogonal polarization, and note $\Delta\alpha$ for each polarization.