
Cable assemblies, cables, connectors and passive microwave components -
Screening attenuation measurement by the reverberation chamber method (IEC
61726:1999)

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English version

**Cable assemblies, cables, connectors and passive microwave components
Screening attenuation measurement by the reverberation chamber method
(IEC 61726:1999)**

Câbles, cordons, connecteurs et
composants hyperfréquence passifs
Mesure de l'atténuation d'écran par la
méthode de la chambre réverbérante
(CEI 61726:1999)

Konfektionierte Kabel, Kabel,
Steckverbinder und passive
Mikrowellenbauteile - Messung der
Schirmdämpfung mit dem
Strahlungskammerverfahren
(IEC 61726:1999)

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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

The text of document 46A/356/FDIS, future edition 1 of IEC 61726, prepared by SC 46A "Coaxial cables" des IEC TC 46 "Cables, wires, waveguides, r.f. connectors, and accessories for communication and signalling", was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61726 on 2000-01-01.

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) 2000-10-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2003-01-01

Annexes designated "informative" are given for information only.
In this standard, annexes A, B, C and D are informative.

Endorsement notice

The text of the International Standard IEC 61726:1999 was approved by CENELEC as a European Standard without any modification.

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NORME
INTERNATIONALE
INTERNATIONAL
STANDARD

CEI
IEC

61726

Deuxième édition
Second edition
1999-11

**Câbles, cordons, connecteurs
et composants hyperfréquence passifs –
Mesure de l'atténuation d'écran
par la méthode de la chambre réverbérante**

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Commission Electrotechnique Internationale
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CABLE ASSEMBLIES, CABLES, CONNECTORS AND
PASSIVE MICROWAVE COMPONENTS –
SCREENING ATTENUATION MEASUREMENT BY THE
REVERBERATION CHAMBER METHOD**

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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- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 61726 has been prepared by subcommittee 46A: Coaxial cables, of IEC technical committee 46: Cables, wires, waveguides, r.f. connectors, and accessories for communication and signalling.

This second edition cancels and replaces the first edition, which was issued as a type 3 technical report in 1995. It constitutes a technical revision and now has the status of an International Standard.

This bilingual version (2001) replaces the English version.

The text of this standard is based on the following documents:

FDIS	Report on voting
46A/356/FDIS	46A/359/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.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

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

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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INTRODUCTION

The requirements of modern electronic equipment have indicated a demand for a method of testing screening attenuation of microwave components over their whole frequency range. Convenient test methods exist for low frequencies and components of regular shape and these test methods are described in the relevant IEC product specifications.

For higher frequencies and for components of irregular shape a new test method has become necessary and such a test method is described in this International Standard.

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CABLE ASSEMBLIES, CABLES, CONNECTORS AND PASSIVE MICROWAVE COMPONENTS – SCREENING ATTENUATION MEASUREMENT BY THE REVERBERATION CHAMBER METHOD

1 Scope

This International Standard describes the measurement of screening attenuation by the reverberation chamber test method, sometimes named mode stirred chamber, suitable for virtually any type of microwave component and having no theoretical upper frequency limit. It is only limited toward low frequencies due to the size of the test equipment, which is frequency dependent and is only one of several methods of measuring screening attenuation.

For the purpose of this standard, examples of microwave components are waveguides, phase shifters, diplexers/multiplexers, power dividers/combiners etc.

2 Basic description of the reverberation chamber method

The reverberation chamber method for measurement of the screening attenuation of microwave components consists of exposing the device under test (DUT) to an almost homogeneous and isotropic electromagnetic field and then measuring the signal level induced into the device.

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These conditions are achieved by the use of a shielded enclosure, which acts as an oversized cavity (in terms of wavelength), with a high quality factor. Its boundary conditions are continuously agitated by a rotating reflective surface (mode stirrer), mounted within the chamber, which enables the field to approach homogeneous and isotropic conditions during one revolution.

Electromagnetic power is fed to the chamber by means of an input or transmitting antenna.

The strength of the field inside the chamber is measured through a reference antenna. The ratio of the injected power (input antenna) to the received power (reference antenna) is the insertion loss of the cavity. The insertion loss is strongly frequency dependent and is also dependent on the quality factor of the cavity.

It has been shown that, due to the isotropic field, any antenna placed inside the cavity behaves as if its gain was unity [1]¹⁾, therefore no directional effect is to be expected. If the device under test is electrically short, its screening attenuation will be directly related to usual transfer parameters (Z_t and Z_r). If the device under test is not electrically short the screening attenuation may still be related to Z_t and Z_r in some simple cases (evenly distributed leakage, periodically distributed leakage) using summing functions derived from antenna network theory.

¹⁾ Figures in square brackets refer to the Bibliography.

3 Measurement of the screening attenuation of the device under test (DUT)

The measurement of screening attenuation is based on the comparison of the electromagnetic field power outside the DUT to the electromagnetic field power induced into the DUT. The screening attenuation is then defined as:

$$a_s = -10 \log_{10} \left(\frac{P_{\text{DUT}}}{P_{\text{REF}}} \right) \quad (1)$$

or

$$a_s = -10 \log_{10} \left(\frac{P_{\text{DUT}}}{P_{\text{INJ}}} \right) - \Delta_{\text{ins}} \quad (2)$$

where

P_{DUT} is the power coupled to the device under test (W);

P_{REF} is the power coupled to the reference antenna (W);

P_{INJ} is the power injected into the chamber (W);

Δ_{ins} is the insertion loss of the chamber in decibels (dB).

4 Description of the test set-up

4.1 Reverberation chamber

The reverberation chamber is a shielded enclosure having any shape, provided that its smallest dimension exceeds three wavelengths at the lowest test frequency. A perfect cubic shape should be avoided for optimum performance at lower frequencies. It shall be made of conductive materials (copper, aluminium or steel) and shall not contain lossy materials.

The upper frequency limit depends only on the screening attenuation, which shall exceed 60 dB for the whole frequency range. However, this value is not critical if the spectrum analyzer and the connecting devices of the test set-up are sufficiently screened and if the quality factor of the cavity remains sufficiently high. The quality factor shall be checked to verify that during one revolution of the mode stirrer the ratio between the maximum and the minimum power at the output of the reference antenna exceeds 20 dB. As a minimum, the test chamber and the test instrumentation shall have a combined screening attenuation at each test frequency that is 10 dB greater than the screening requirement of the DUT.

The shielded enclosure is drilled with four coaxial feed-throughs: two for the output of the antennas and two for the output of the measuring loop. For further details see annex A.

4.2 Mode stirrer

The mode stirrer shall be large with respect to wavelength and be bent at angles to the walls of the chamber. The mode stirrer shall be at least two wavelengths from tip to tip at the lowest test frequency. An example of a mode stirrer is described in annex B.

4.3 Antennas

The reverberation chamber is equipped with input and reference antennas. Both antennas shall present limited resonances in the frequency range and shall not introduce losses; their return loss shall be better than 6 dB.