

# Cable assemblies, cables, connectors and passive microwave components — Screening attenuation measurement by the reverberation chamber method

The European Standard EN 61726:2000 has the status of a British Standard

ICS 33.120.10

---

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

**BSI**  
Documents



Document Sharing Hub

# National foreword

This British Standard is the official English language version of EN 61726:2000. It is identical with IEC 61726:1999.

The UK participation in its preparation was entrusted by Technical Committee EPL/46, Cables, wires, waveguides, RF connectors and accessories for comms and signalling, to Subcommittee EPL/46/1, Communication cables, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

## Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

## Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 21 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 June 2000

© BSI 06-2000

ISBN 0 580 34309 X

## Amendments issued since publication

| Amd. No. | Date | Comments |
|----------|------|----------|
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |

**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)

This European Standard was approved by CENELEC on 2000-01-01. 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

### 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.

---

## CONTENTS

|                                                                                              | Page |
|----------------------------------------------------------------------------------------------|------|
| INTRODUCTION .....                                                                           | 4    |
| Clause                                                                                       |      |
| 1 Scope .....                                                                                | 5    |
| 2 Basic description of the reverberation chamber method .....                                | 5    |
| 3 Measurement of the screening attenuation of the device under test (DUT).....               | 6    |
| 4 Description of the test set-up.....                                                        | 6    |
| 4.1 Reverberation chamber .....                                                              | 6    |
| 4.2 Mode stirrer .....                                                                       | 6    |
| 4.3 Antennas .....                                                                           | 6    |
| 4.4 Test equipment .....                                                                     | 7    |
| 4.5 Device under test (DUT).....                                                             | 8    |
| 4.6 Linking devices .....                                                                    | 8    |
| 5 Measurement procedure .....                                                                | 9    |
| 5.1 General .....                                                                            | 9    |
| 5.2 Measurement of the DUT .....                                                             | 9    |
| 5.3 Measurement of the insertion loss of the cavity .....                                    | 9    |
| 5.4 Control of the test set-up.....                                                          | 10   |
| 5.5 Revolution speed of the mode stirrer .....                                               | 11   |
| 5.6 Test frequencies .....                                                                   | 11   |
| 5.7 Voltage standing wave ratio (VSWR) .....                                                 | 11   |
| 6 Evaluation of the test results .....                                                       | 11   |
| 6.1 Screening attenuation .....                                                              | 11   |
| 6.2 Relationship between transfer impedance parameters and screening attenuation .           | 12   |
| 6.3 Electromagnetic field surrounding the DUT .....                                          | 12   |
| Annex A (informative) Design of the reverberation chamber .....                              | 13   |
| Annex B (informative) Design of the mode stirrer .....                                       | 14   |
| Annex C (informative) Example of a calibrator .....                                          | 16   |
| Annex D (informative) Relationship between transfer impedance and screening attenuation..... | 17   |
| Bibliography.....                                                                            | 19   |

## 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 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.

## **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.

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]<sup>1)</sup>, 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  $Z_f$ ). If the device under test is not electrically short the screening attenuation may still be related to  $Z_t$  and  $Z_f$  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

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

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

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

$\Delta_{\text{ins}}$  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.