BRITISH STANDARD

BS EN
50147-1 : 1997

Anechoic chambers

Part 1. Shield attenuation measurement

The European Standard EN 50147-1 : 1996 has the status of a British Standard

ICS 17.220.01; 29.020

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee GEL/210, Electromagnetic compatibility, upon which the following bodies were represented:

Association of Consulting Scientists
Association of Control Manufacturers (TACMA) (BEAMA Ltd.)
Association of Manufacturers of Domestic Electrical Appliances
Association of Manufacturers of Power Generating Systems
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Amendments issued since publication

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Contents

National foreword

This British Standard has been prepared by Technical Committee GEL/210 and is the English language version of EN 50147-1 : 1996 *Anechoic chambers Part 1: Shield attenuation measurement*, published by the European Committee for Electrotechnical Standardization (CENELEC).

Cross-reference

Publication referred to	Corresponding British Standard
IEC 50(161) : 1990	BS 4727 *Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms Part 1. Terms common to power, telecommunications and electronics* Group 09 : 1991 *Electromagnetic compatibility*

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 50147-1

March 1996

ICS 17.220.00; 29.020

Descriptors: Electromagnetic compatibility, measurements, tests, anechoic chambers, specifications

English version

Anechoic chambers
Part 1: Shield attenuation measurement

Chambres anéchoïques
Partie 1: Mesure d'atténuation de blindage

Absorberräume
Teil 1: Schirmdämpfungsmessung

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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

This European Standard was prepared by working group WG 4 of CENELEC Technical Committee TC 210, EMC.

It was submitted to the CENELEC Unique Acceptance Procedure (UAP) in August 1994 and was approved by CENELEC as EN 50147-1 on 1995-07-04.

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) 1996-09-01
- latest date by which national standards conflicting with the EN have to be withdrawn (dow) 1996-09-01

Contents

1 Scope

This standard applies to measurements of shielding attenuation of shielded enclosures (chambers, rooms) in the frequency range 9 kHz – 40 GHz. The object of this standard is to establish a common measurement procedure for validating the shielding effectiveness of a shielded enclosure.

2 Normative references

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 listed hereafter. 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.

IEC 50(161) 1990 *International Electrotechnical Vocabulary (IEV) Chapter 161: Electromagnetic Compatibility*

3 Definitions

For the purposes of this standard the definitions contained in IEC 50(161) apply.

4 General points relating to shielding effectiveness

4.1 Shielding

Shield attenuation can be calculated only in ideal cases. The most significant factor is that the shielded enclosure should be homogeneous and consist of materials whose properties are defined in every respect. In practice, deviations from these conditions may be so great that the calculation results only in approximate values.

4.2 Shield attenuation

The shield attenuation is given by (see figure 1):

$a_s = 20 \log(E_0/E_1)$ for the electric field

$a_s = 20 \log (H_0/H_1)$ for the magnetic field

where:

a_s is the shield attenuation in dB.

E_0 and H_0 are the E and H field strengths at a location without shielding between the transmitting and receiving antennas (reference level).

E_1 and H_1 are the E and H field strengths at the same location as above with shielding between the transmitting and receiving antennas.

Figure 2 shows typical shield attenuation values of a state of the art shielded enclosure.

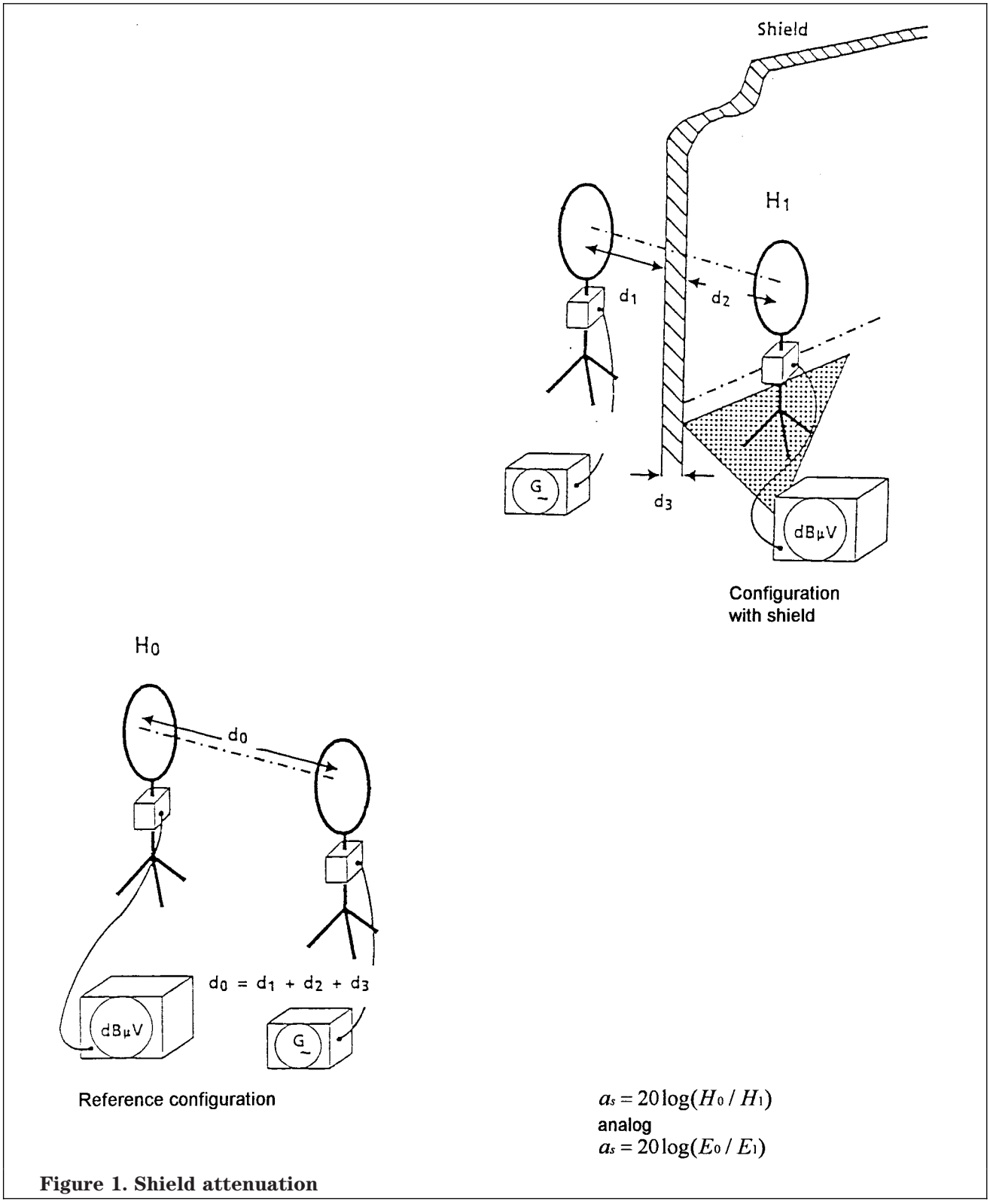
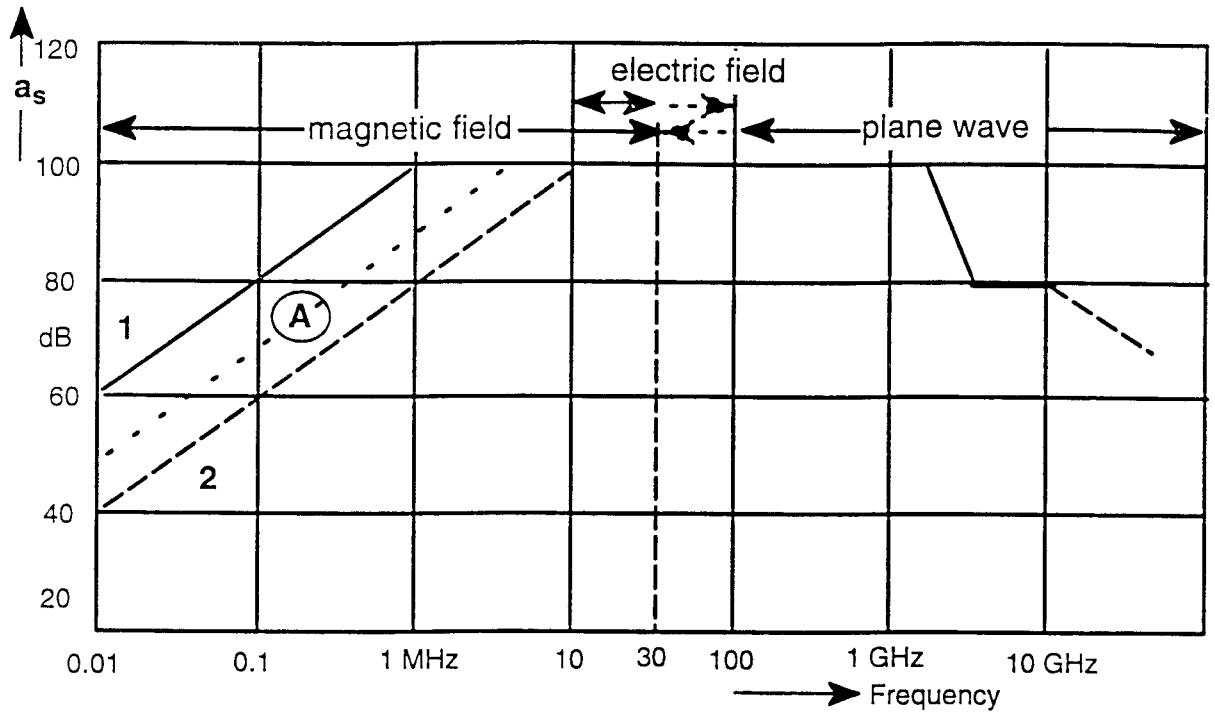


Figure 1. Shield attenuation



a_S = shield attenuation in dB

curve A = tolerated performance of the door seams for high performance shielded enclosure

curve 1 = high performance of a shielded enclosure

curve 2 = standard performance of a shielded enclosure

Figure 2. Typical shield attenuation values

5 Shield attenuation measurement

The measurement is normally carried out with all the shielding components in place and, in the case of filters, with all wires and cables connected.

NOTE. The procedure is derived from NSA 65-6-October 1964; National Security Agency Specification for R.F. Shielded Enclosures for Communication Equipment.

5.1 Test equipment

The following types of equipment shall be used in performing the shield attenuation test, depending on the frequency range given in the specification of the enclosure. The measurement equipment shall have sufficient dynamic range to enable the test to be performed:

a) CW signal sources covering 9 kHz to 40 GHz with adequate frequency stability. If unavailable in the microwave region (1 – 40 GHz), pulsed sources may be substituted;

NOTE. The starting frequency for shield attenuation measurements may be 10 kHz if the measurement equipment offers no other alternative.

b) loop antennas for magnetic field measurements;

c) tunable or broadband dipoles, monoples with ground planes for electric field and plane wave measurements, and horn antennas for plane waves at microwave frequencies;

d) probes for joint leakage tests;

e) receivers with adequate sensitivity.

5.2 Acceptance tests

Acceptance tests shall be performed in accordance with the procedures described below and illustrated in figures 3 and 4.

Measurements shall be taken at several positions around the enclosure as given in the specification of the enclosure. In general, these measurements are made before absorber installation.

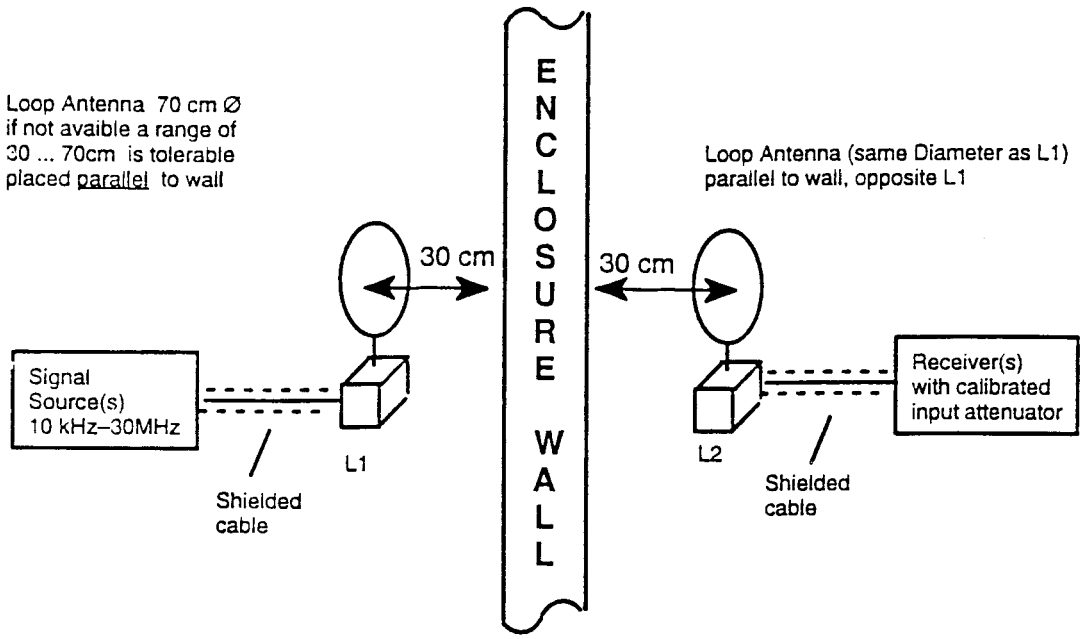
If the ambient noise level is low enough, all tests should be run with the receiver outside and the transmitter inside the enclosure.

5.2.1 *Leakage test*

Prior to acceptance tests leakage tests should be made all around the door frame, through accessible joints, around the filters and all around the air ducts. In addition, the magnitude and location of the maximum signal level emanating from the enclosure should be found by moving the antennas to at least four locations, preferably on different walls.

5.2.2 *Electric and magnetic field measurements*

Electric and magnetic field attenuation tests (reference measurements) shall be made with the antennas located directly opposite each other and separated by a distance shown in figures 3 and 4 plus the wall thickness.



NOTE. For electric field measurements in this range, use same set-up but substitute loop antennas with suitable monopoles with ground plane.

Figure 3. Test set-up for magnetic (electric) field measurement

Magnetic fields shall be measured with the loops parallel to a wall panel directly opposite each other.

Recommended test frequencies for magnetic fields are 10 kHz, 100 kHz, 1MHz, 10 MHz and 30 MHz and 10 MHz and 30 MHz for electric field.

5.2.3 *Plane wave measurements*

Measurements shall be taken at the frequencies 100 MHz, 400 MHz, 1 GHz, 10 GHz and 40 GHz at least, depending on the frequency range given in the specification of the enclosure.

The test set-up is shown in figure 4.

5.3 Reference level

When undertaking the reference measurement it is important to note that in many countries the transmission of radio frequency energy is licensed and reference must be made to the country authority to determine if any such regulations apply. After the country requirements have been satisfied the reference measurement shall be made in the following manner.

The reference level shall be recorded with the outside antenna position unchanged and the inside antenna moved outside and positioned opposite plus a distance equivalent to the wall thickness. The value of signal levels may be recorded in decibels [dB] relative to 1 microvolt or 1 mW.

If local country provisions preclude the determination of the reference level as described above, alternative methods may be used provided these give technically equivalent results.

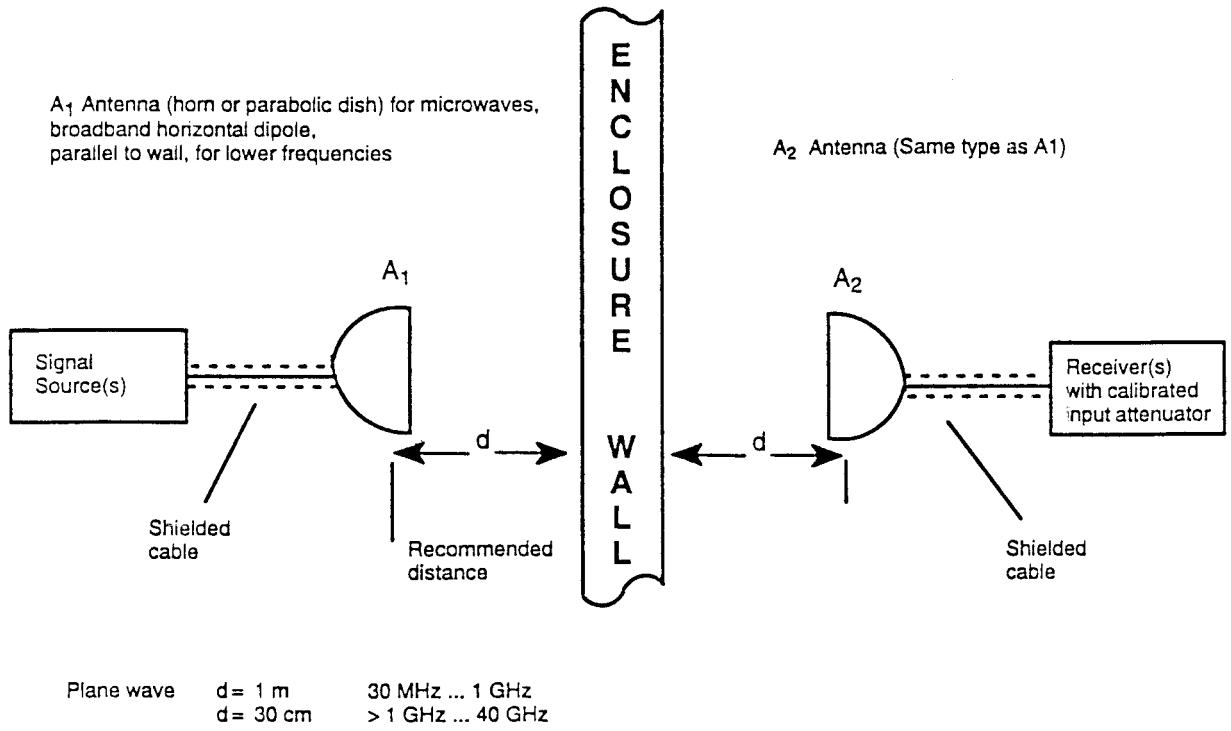


Figure 4. Test set-up for plane wave measurements (30 MHz – 40 GHz)

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List of references

See national foreword.

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