AS/NZS IEC 61000.4.3:2021
IEC 61000-4-3:2020

Australian/New Zealand Standard™

Electromagnetic compatibility (EMC)

Part 4.3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test



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Australian Communications and Media Authority
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Consumer Electronics Suppliers Association
Department of Defence (Australian Government)
EMC Society of Australia
Energy Networks Australia
Engineers Australia
Free TV Australia
Lighting Council New Zealand
NZ Ministry of Business, Innovation and Employment (MBIE)
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Electromagnetic compatibility (EMC)

Part 4.3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test

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Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee TE-003, Electromagnetic Compatibility, to supersede AS/NZS IEC 61000.4.3:2013.

The objective of this document is to establish test levels and required test procedures for the immunity requirements of electrical and electronic equipment to radiated electromagnetic energy.

The object of this document is to establish a common reference for evaluating the immunity of electrical and electronic equipment when subjected to radiated, radio-frequency electromagnetic fields. The test method documented in this document describes a consistent method to assess the immunity of an equipment or system against RF electromagnetic fields from RF sources not in close proximity to the EUT. The test environment is specified in Clause 6.

Particular considerations are devoted to the protection against radio-frequency emissions from digital radiotelephones and other RF emitting devices.

This document is an independent test method. It is not possible to use other test methods as substitutes for claiming conformity to this document.

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-3: Testing and measurement techniques – Radiated, radio-frequency electromagnetic field immunity test

FOREWORD

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International Standard IEC 61000-4-3 has been prepared by subcommittee 77B: High frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

It forms part 4-3 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

This fourth edition cancels and replaces the third edition published in 2006, Amendment 1:2007 and Amendment 2:2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) testing using multiple test signals has been described;
b) additional information on EUT and cable layout has been added;
c) the upper frequency limitation has been removed to take account of new services;
d) the characterization of the field as well as the checking of power amplifier linearity of the immunity chain are specified.

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The text of this International Standard is based on the following documents:

FDIS	Report on voting
77B/830/FDIS	77B/825/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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

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INTRODUCTION

IEC 61000 is published in separate parts according to the following structure:

Part 1: General

General considerations (introduction, fundamental principles)

Definitions, terminology

Part 2: Environment

Description of the environment

Classification of the environment

Compatibility levels

Part 3: Limits

Emission limits

Immunity limits (in so far as they do not fall under the responsibility of the product committees)

Part 4: Testing and measurement techniques

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines

Installation guidelines

Mitigation methods and devices

Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into several parts, published either as international standards or as technical specifications or technical reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

This part is an international standard which gives immunity requirements and test procedures related to radiated, radio-frequency, electromagnetic fields.

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-3: Testing and measurement techniques – Radiated, radio-frequency electromagnetic field immunity test

1 Scope

This part of IEC 61000 is applicable to the immunity requirements of electrical and electronic equipment to radiated electromagnetic energy. It establishes test levels and the required test procedures.

The object of this document is to establish a common reference for evaluating the immunity of electrical and electronic equipment when subjected to radiated, radio-frequency electromagnetic fields. The test method documented in this part of IEC 61000 describes a consistent method to assess the immunity of an equipment or system against RF electromagnetic fields from RF sources not in close proximity to the EUT. The test environment is specified in Clause 6.

NOTE 1 As described in IEC Guide 107, this is a basic EMC publication for use by product committees of the IEC. As also stated in Guide 107, the IEC product committees are responsible for determining whether this immunity test standard should be applied or not, and if applied, they are responsible for determining the appropriate test levels and performance criteria. TC 77 and its sub-committees are prepared to co-operate with product committees in the evaluation of the value of particular immunity tests for their products.

NOTE 2 Immunity testing against RF sources in close proximity to the EUT is defined in IEC 61000-4-39.

Particular considerations are devoted to the protection against radio-frequency emissions from digital radiotelephones and other RF emitting devices.

NOTE 3 Test methods are defined in this part for evaluating the effect that electromagnetic radiation has on the equipment concerned. The simulation and measurement of electromagnetic radiation is not adequately exact for quantitative determination of effects. The test methods defined in this basic document have the primary objective of establishing an adequate reproducibility of testing configuration and repeatability of test results at various test facilities.

This document is an independent test method. It is not possible to use other test methods as substitutes for claiming compliance with this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-161, *International Electrotechnical Vocabulary (IEV) – Part 161: Electromagnetic compatibility* (available at www.electropedia.org)

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 and the following apply.

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
amplitude modulation
AM
modulation in which the amplitude of a periodic carrier is a given function, generally linear, of the instantaneous values of the modulating signal

[SOURCE: IEC 60050-702:2016, 702-06-17]

3.1.2
anechoic chamber
shielded enclosure which is lined with radio-frequency absorbers to reduce reflections from the internal surfaces

3.1.3
fully anechoic chamber
shielded enclosure whose internal surfaces are totally lined with anechoic material

3.1.4
semi-anechoic chamber
shielded enclosure in which all surfaces except the metal floor are covered with material that absorbs electromagnetic energy (i.e. RF absorber) in the frequency range of interest

3.1.5
modified semi-anechoic chamber
semi-anechoic chamber which has additional absorbers installed on the ground plane

3.1.6
antenna
that part of a radio transmitting or receiving system which is designed to provide the required coupling between a transmitter or a receiver and the medium in which the radio wave propagates

Note 1 to entry: In practice, the terminals of the antenna or the points to be considered as the interface between the antenna and the transmitter or receiver should be specified.

Note 2 to entry: If a transmitter or receiver is connected to its antenna by a feed line, the antenna may be considered to be a transducer between the guided waves of the feed line and the radiated waves in space.

[SOURCE: IEC 60050-712:1992, 712-01-01]

3.1.7
balun
device for transforming an unbalanced voltage to a balanced voltage or vice versa

[SOURCE: IEC 60050-161:1990 161-04-34]

3.1.8
common mode absorption device
CMAD
device that may be applied on cables leaving the test area in radiated immunity tests to damp resonances on cables

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3.1.9
continuous wave
CW
sinusoidal electromagnetic wave, the successive oscillations of which are identical under steady-state conditions, which can be interrupted or modulated to convey information

3.1.10
electromagnetic wave
wave characterized by the propagation of a time-varying electromagnetic field

Note 1 to entry: An electromagnetic wave is produced by variations of electric charges or of electric currents

[SOURCE: IEC 60050-705:1995, 705-01-09]

3.1.11
far field
that region of the electromagnetic field of an antenna wherein the predominant components of the field are those which represent a propagation of energy and wherein the angular field distribution is essentially independent of the distance from the antenna

Note 1 to entry: In the far field region, all the components of the electromagnetic field decrease in inverse proportion to the distance from the antenna.

Note 2 to entry: For a broadside antenna having a maximum overall dimension D which is large compared to the wavelength λ, the far field region is commonly taken to exist at distances greater than $2D^2/\lambda$, from the antenna in the direction of maximum radiation.

[SOURCE: IEC 60050-712:1992, 712-02-02, modified – the word "region" has been removed from the term]

3.1.12
field strength
magnitude of the electromagnetic field at a given point

[SOURCE: IEC 60050-705:1995, 705-08-31, modified – the rest of the definition after "given point" has been deleted.]

3.1.13
frequency band
continuous set of frequencies lying between two specified limiting frequencies

Note 1 to entry: A frequency band is characterized by two values which define its position in the frequency spectrum, for instance its lower and upper limiting frequencies.

[SOURCE: IEC 60050-702:1992, 702-01-02]

3.1.14
full illumination method
test method in which the EUT being tested fits completely within the uniform field area (UFA)

Note 1 to entry: This test method may be applied for all test frequencies.

3.1.15
human body-mounted equipment
equipment which is intended for use when attached to or held in close proximity to the human body.

Note 1 to entry: This term includes hand-held devices which are carried by people while in operation (e.g. pocket devices) as well as electronic aid devices and implants.

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3.1.16
intentional RF emitting device
device which radiates (transmits) an electromagnetic field intentionally

EXAMPLE: Digital mobile telephones and other radio devices.

3.1.17
intermodulation
interaction in non-linear device or transmission medium between the spectral components of the input signal or signals producing new spectral components having frequencies equal to linear combination with integral coefficients of the frequencies of the input spectral components

Note 1 to entry: Intermodulation can result from a single non-sinusoidal input signal or from several sinusoidal or non-sinusoidal input signals applied to the same or to different inputs

[SOURCE: IEC 60050-161:2017, 161-06-20]

3.1.18
isotropic field probe
field sensor, whose detection properties are independent of direction of propagation and polarization of an electromagnetic wave

[SOURCE: IEC 60050-731:1991, 731-03-08, modified – wording modified to apply to field probe.]

3.1.19
maximum RMS value
highest short-term RMS value of a modulated RF signal during an observation time of one modulation period

Note 1 to entry: The short-term RMS is evaluated over a single carrier cycle. For example, in Figure 1 b), the maximum RMS voltage is: $U_{\text{maximum rms}} = U_{\text{p-p}}/(2 \times \sqrt{2}) = 1{,}8$ V

3.1.20
modulation factor
in linear amplitude modulation, the ratio, generally expressed as a percentage, of the difference between the maximum and minimum amplitudes of the modulated signal to the sum of these amplitudes, expressed as:

$$m = 100 \times \frac{U_{\text{p-p,max}} - U_{\text{p-p,min}}}{U_{\text{p-p,max}} + U_{\text{p-p,min}}}$$

SEE Table 2 and Figure 1.

[SOURCE: IEC 60050-702:1992, 702-06-19, modified – the formula has been added and the note removed.]

3.1.21
non-constant envelope modulation
RF modulation scheme in which the amplitude of the carrier wave varies slowly in time compared with the period of the carrier itself

EXAMPLE Conventional amplitude modulation and time division multiple access (TDMA).

3.1.22
partial illumination method
test method used when the EUT face cannot be illuminated at once using a single UFA

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3.1.23
polarization
orientation of the electric field vector of a radiated field

3.1.24
reference ground plane
RGP
flat conductive surface that is at the same electric potential as the reference ground, which is used as a common reference, and which contributes to a reproducible parasitic capacitance with the surroundings of the equipment under test (EUT)

[SOURCE: IEC 60050-161:2014, 161-04-36, modified – notes have been deleted.]

3.1.25
shielded enclosure
screened room
mesh or sheet metallic housing designed expressly for the purpose of separating electromagnetically the internal and the external environment

[SOURCE: IEC 60050-161:1990, 161-04-37]

3.1.26
time division multiple access
TDMA
multiple access technique in which the various terminals having access to a link are allotted separate recurrent time intervals for transmission

[SOURCE: IEC 60050-725:1994, 725-14-12]

3.1.27
transceiver
transmitter-receiver
combination in a single unit of a radio transmitter and a radio receiver employing common circuit components and usually the same antenna for both transmitting and receiving

[SOURCE: IEC 60050-713:1998, 713-08-02, modified – the note has been deleted.]

3.1.28
uniform field area
UFA
vertical plane in which field strength variations are acceptably small

SEE: 6.3.

3.2 Abbreviated terms

AE	Auxillary equipment
AM	Amplitude modulation
CMAD	Common-mode absorption device
CW	Continuous wave
DECT	Digital enhanced cordless telecommunications
EM	Electromagnetic
ERP	Effective radiated power
EUT	Equipment under test
GSM	Groupe Special Mobile, later renamed to: Global System for Mobile Communications

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IMD	Intermodulation distortion
ISM	Industrial, scientific, medical
LTE	Long-term evolution (name for family of wireless radio transmissions)
MU	Measurement uncertainty
OFDM	Orthogonal frequency division multiplexing
PA	Power amplifier
PM	Power meter
PVC	Polyvinylchloride
RF	Radio frequency
RBW	Resolution bandwidth
RGP	Reference ground plane
RMS	Root mean square
SDH	Synchronous digital hierarchy
TDMA	Time division multiple access
TV	Television
UFA	Uniform field area
UMTS	Universal mobile telecommunications system
VRC	voltage reflection coefficient
VSWR	Voltage standing wave ratio
Wi-Fi	Name of wireless transmission service
WiMAX	Name of wireless transmission service

4 General

Electronic equipment can, in some manner, be affected by electromagnetic radiation. This radiation is frequently generated by various sources, such as small hand-held radio transceivers, fixed-station radio and television transmitters, vehicle radio transmitters and industrial electromagnetic sources. Many of these services use modulation techniques with a non-constant envelope.

In addition to electromagnetic energy deliberately generated, there is also radiation caused by the operation of devices such as welders, thyristors, fluorescent lights, switches operating inductive loads, etc. Conducted electrical interference is dealt with in other parts of the IEC 61000-4 series. Methods employed to prevent effects from electromagnetic fields will normally also reduce the effects from these sources.

In this document, the electromagnetic environment is characterized by the strength of the electromagnetic field. The field strength is not easily measured without sophisticated instrumentation nor is it easily calculated by classical equations and formulas because of the effect of surrounding structures or the proximity of other equipment that will distort and/or reflect the electromagnetic waves.

5 Test levels and frequency ranges

5.1 Selection of test level

The test levels are given in Table 1.

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Table 1 – Test levels

Level	Test field strength V/m
1	1
2	3
3	10
4	30
x	Special
x can be any level, above, below or in between the others. The level shall be specified in the product standard.	

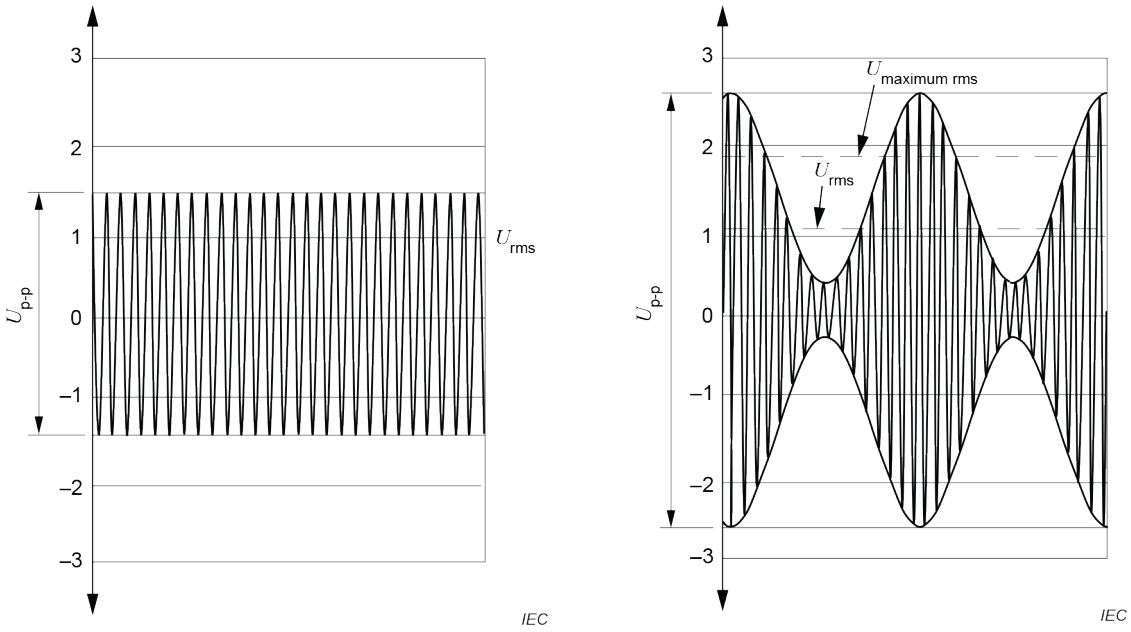
This document does not suggest that a single test level is applicable over the entire frequency range. The product committees shall select the frequency range(s) to be tested as well as the appropriate test level(s). See Annex E giving guidance for product committees on the selection of test levels.

The test field strength column in Table 1 gives values of the unmodulated carrier signal. For testing of equipment, this carrier signal is amplitude modulated with a 1 kHz sine wave to simulate actual threats (see Figure 1 and Table 2). Details of how the test is performed are given in Clause 8.

Table 2 – Amplitude modulation characteristics at output of signal generator

Amplitude modulation	Internal or external, m = (80 ± 10) %, as measured on the output of the signal generator. With modulation factor m: $m = 100 \times \frac{U_{\text{p-p,max}} - U_{\text{p-p,min}}}{U_{\text{p-p,max}} + U_{\text{p-p,min}}}$ 1 kHz ± 0,1 kHz sine wave

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a) Unmodulated RF signal

$$U_{rms,a} = 1\ V$$

$$U_{p\text{-}p,a} = U_{rms,a} \times \sqrt{2} \times 2 = 2{,}82\ V$$

b) Modulated RF signal 80 % AM

$$U_{p\text{-}p.max} = U_{p\text{-}p,a} \times \frac{100 + m}{100} = 5{,}09\ V$$

$$U_{p\text{-}p.min} = U_{p\text{-}p,a} \times \frac{100 - m}{m} = 0{,}57\ V$$

$$U_{rms,b} = U_{rms,a} \times \sqrt{1 + \frac{\left(\frac{m}{100}\right)^2}{2}} = 1{,}15\ V$$

Figure 1 – Definition of the 80 % amplitude modulated (AM) test signal and the waveshapes occurring

Product committees may select alternative modulation schemes for equipment under test (see Annex A).

5.2 Test frequency ranges

This document defines testing in the frequency range above 80 MHz, limited only by the capability of the test instrumentation.

See Annex F for more information on the selection of frequency ranges and test methods defined in other basic standards, as well as the application of this document below 80 MHz.

The frequencies or frequency ranges to be selected for testing by product committees may be limited to those where intentional RF emitting devices actually operate.

Product committees can require a specific test level and type of modulation (as alternative to 80 % AM).

If the product is intended to conform only to the requirements of particular countries, testing may be reduced to cover just the specific frequency bands allocated to digital mobile telephones and other intentional RF emitting devices in those countries.

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NOTE IEC TR 61000-2-5 and CISPR TR 31 contain information about frequencies and power levels known to be allocated to specific radio services.

6 Test equipment

6.1 Test instrumentation

The following types of test equipment are recommended:

– Anechoic chamber: of a size adequate to maintain a uniform field of sufficient dimensions with respect to the equipment under test (EUT). Additional absorbers may be needed to damp reflections.

– EMI filters: care shall be taken to ensure that the filters introduce no additional resonance effects on the connected lines.

– RF signal generator(s): capable of covering the frequency band of interest and as a minimum being capable of amplitude modulation as specified in Table 2.

  The use of low-pass or band-pass filters can be necessary to avoid problems caused by harmonics.

– Power amplifiers: to amplify the signal (unmodulated and modulated) and provide antenna drive to the necessary field level.

– Field generating antennas: biconical, log periodic, horn, combination of antennas or any other linearly polarized antenna system capable of satisfying frequency requirements (see Annex B).

– Isotropic field sensor: with adequate frequency range and sensitivity to measure the generated field strength (see Annex K about the calibration method for E-field probes).

– Power measurement device for the forward power: a directional coupler and a power meter may be used, or a forward power detector or monitor could be inserted between amplifier and antenna.

– Associated equipment to record the power levels: necessary for the required field strength and to control the generation of that level for testing.

Care shall be taken to ensure adequate immunity of the test instrumentation. For the measurement uncertainty due to test instrumentation see Annex J.

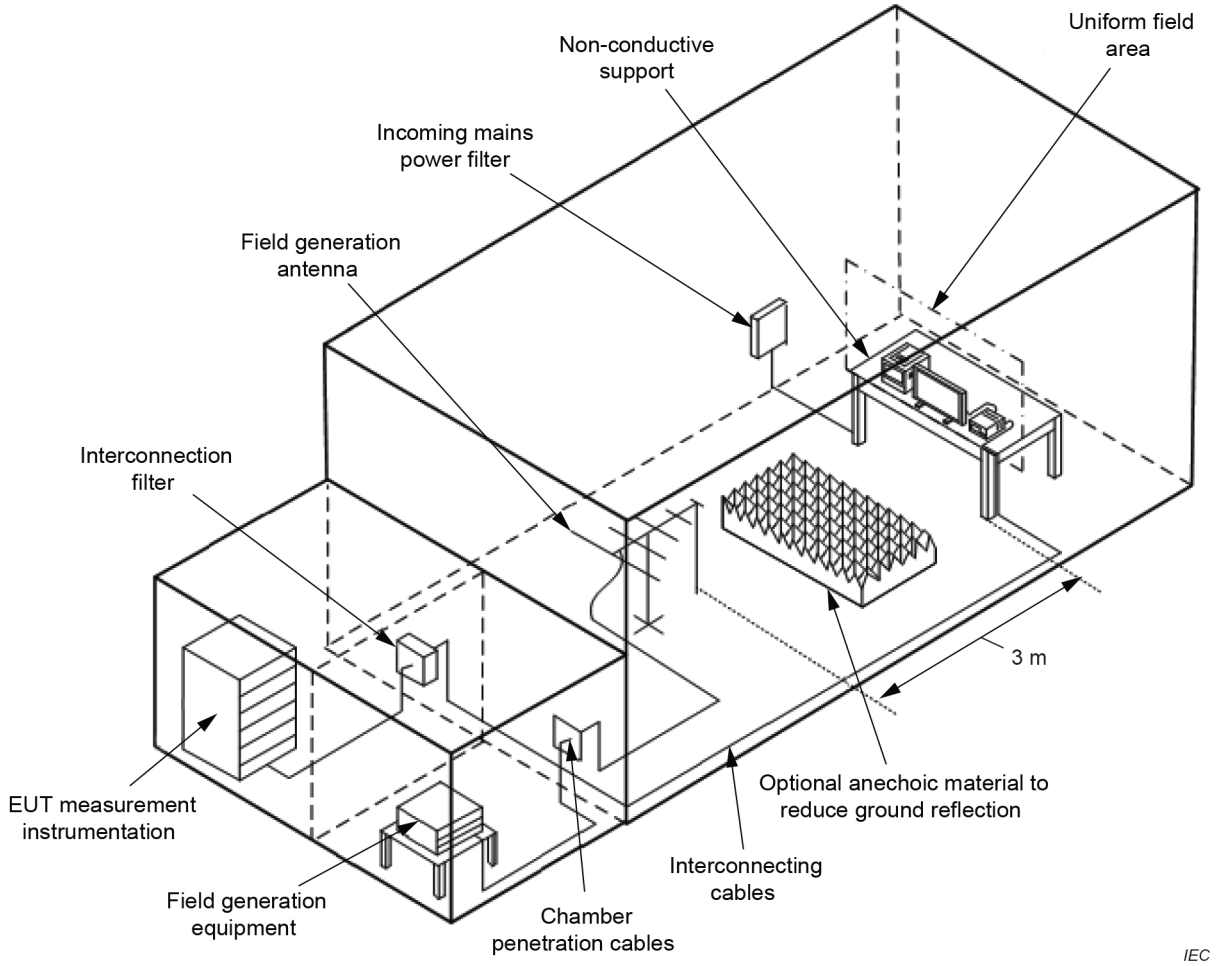
6.2 Description of the test facility

Because of the magnitude of the field strengths generated, the tests shall be made in a shielded enclosure in order to comply with various national and international laws prohibiting interference with radio communications. In addition, since most test equipment used to collect data is sensitive to the electromagnetic field generated during the execution of the immunity test, the shielded enclosure provides the necessary "barrier" between the EUT and the required test instrumentation. Care shall be taken to ensure that the interconnection wiring penetrating the shielded enclosure is adequately isolated from the conducted and radiated emission and preserves the integrity of the EUT signal and power responses.

The test facility typically consists of an absorber-lined shielded enclosure large enough to accommodate the EUT whilst allowing adequate control over the field strengths. This includes anechoic chambers or modified semi-anechoic chambers, an example of which is shown in Figure 2. Associated shielded enclosures should accommodate the field generating and monitoring equipment, and the equipment which exercises the EUT.

Further guidance on the use of anechoic chambers is given in Annex C.

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NOTE Anechoic lining material on walls and ceiling has been omitted for clarity.

Figure 2 – Example of suitable test facility

6.3 Uniform field area (UFA)

6.3.1 Characteristics of the UFA

This document uses the concept of a uniform field area (UFA, see Figure 3 and Figure 4), which is a vertical plane of the field in which variations are within limits specified below. The methods given in 6.3.2 and 6.3.3 are used to demonstrate the capability of the test facility and the test equipment to generate the uniform field for testing. Data for setting the required field strength for the immunity test is obtained and is used to test all EUTs.

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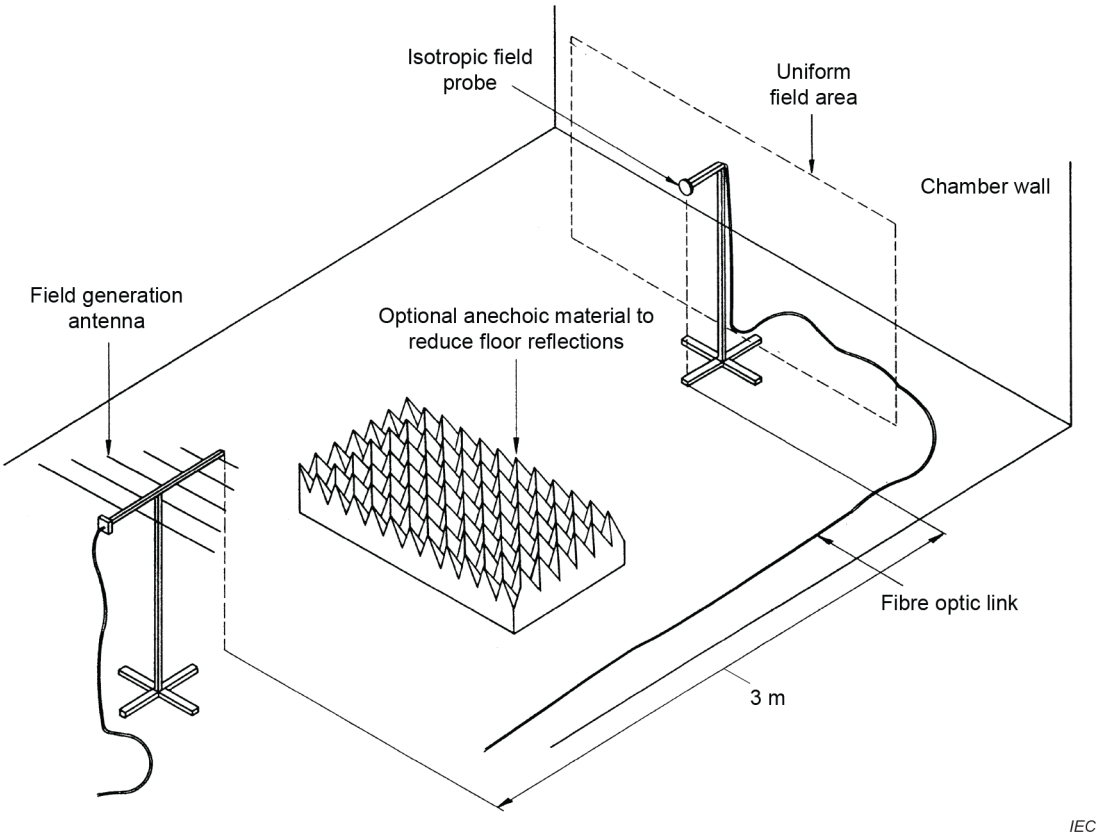


Figure 3 – Level setting setup

The uniform field level setting is performed with no EUT in place (see Figure 3). In this procedure, the relationship between field strength within the UFA and forward power applied to the antenna is determined. During the test, the required forward power is calculated from this relationship and the target field strength. The actual test field strength E_T can be different from the level setting field strength E_L provided that the linearity of the system can be demonstrated (see 6.3.2 or 6.3.3 and Annex D). The level setting is valid as long as the setup of the test instrumentation used remains unchanged for testing. Since even small displacements can significantly affect the field, it is important, especially at high frequencies, that the position of test instrumentation such as antennas, absorbers, cables, etc., is recorded.

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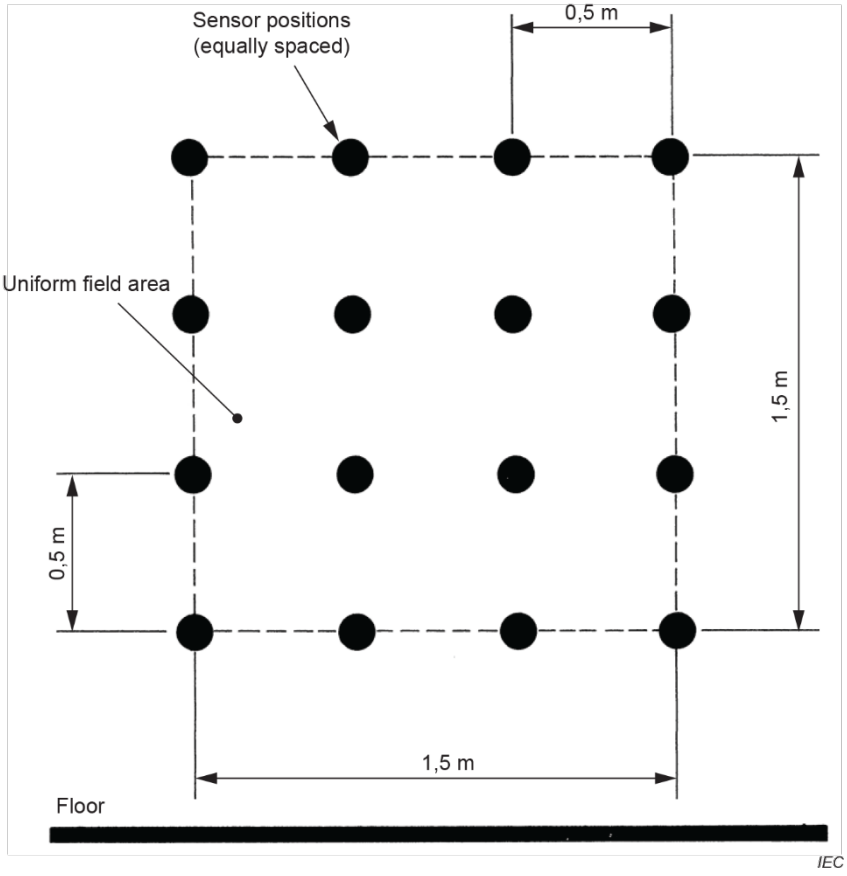


Figure 4 – Dimensions of sixteen-point uniform field area

The lower edge of the UFA can be at any height, if the criteria in 6.3.1 can be met. It is the intention that the EUT is fully illuminated by the field. However, it is difficult to establish a UFA close to a metallic floor, therefore fully illumination might not be possible for all EUTs. See Clause 7 for details.

It is intended that the full field level setting process should be carried out at least annually and when changes have been made in the enclosure configuration (absorber replaced, area moved, equipment changed, etc.).

The distance between the transmitting antenna and the UFA shall be such that the UFA requirements can be met. A distance of 3 m between the antenna and the UFA is preferred (see Figure 3). The minimum distance shall be 1 m. This distance is measured from the centre of a biconical antenna, or from the front tip of a log periodic or combination antenna, or from the front edge of horn or double ridge wave guide antenna. The distance used shall be recorded and shall be the same distance adopted for the test.

The preferred dimension for the UFA is 1,5 m × 1,5 m, however, if the EUT and its cabling (see 7.4) can be fully illuminated with a smaller UFA, a smaller UFA is allowed down to 0,5 m × 0,5 m minimum. For the minimum UFA of 0,5 m × 0,5 m, a fifth grid point is placed in the centre of the UFA. See Figure 5.

NOTE 1 Sampling with closer grid spacing over a portion of the UFA could be used to verify the homogenous nature of the field distribution.

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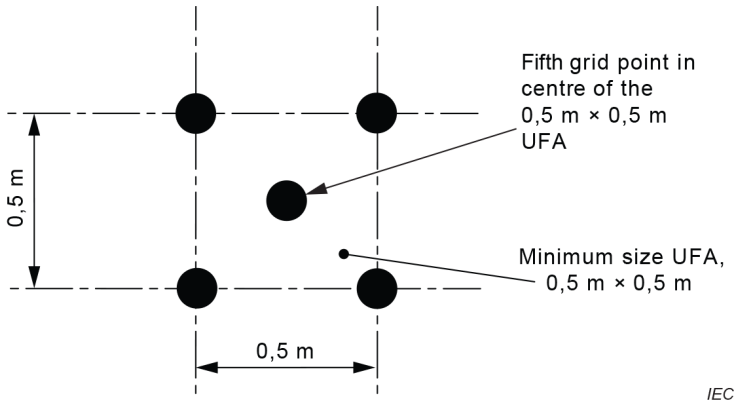


Figure 5 – Minimum UFA size having a fifth grid point in the centre

It is difficult to establish a UFA close to a metallic floor. Additional absorbing material can reduce or solve this problem (see Figure 2).

For the purpose of level setting, the UFA is subdivided into a grid with a grid spacing of 0,5 m (see Figure 4 as an example of an 1,5 m × 1,5 m UFA). At each frequency, a field is considered uniform if its magnitude measured at the grid points is within 0 dB to +6 dB of the nominal value for not less than 75 % of all grid points (e.g. if at least twelve of the sixteen points of an 1,5 m × 1,5 m UFA measured are within the tolerance). For the minimum UFA of 0,5 m × 0,5 m, the field magnitude for all five grid points shall lie within the specified tolerance.

A UFA does not need to be a square as long as it can be constructed from 0,5 m × 0,5 m square elements. The UFA shape selected is used up to at least 1 GHz.

NOTE 2 At different frequencies, different measuring points can be within the tolerance.

The tolerance has been expressed as 0 dB to +6 dB to ensure that the field strength does not fall below nominal with an acceptable probability. The tolerance of 6 dB is considered to be the minimum achievable in practical test facilities.

In the frequency range up to 1 GHz, a tolerance up to +10 dB, but not less than 0 dB is allowed for a maximum of 3 % of the test frequencies, provided that the actual tolerance is stated in the test report. In case of dispute, the test performed with a 0 dB to +6 dB tolerance takes precedence.

If the area intended to be occupied by the face of the actual EUT is larger than 1,5 m × 1,5 m and a UFA with sufficient dimensions (preferred method) cannot be realised, then the area to be occupied by the EUT, and above the lower edge of the UFA, may be illuminated in a series of tests ("partial illumination"), using either method below:

– a characterization shall be performed at different radiating antenna locations so that the combined UFAs cover the area which will be occupied by the face of the EUT, and the EUT shall then be tested with the antenna in each of these positions successively,
– the EUT shall be moved to different positions so that each part of it falls within the UFA during at least one of these tests.

Each of the antenna positions requires a full field level setting. It is not intended to illuminate the portion of a EUT that extends below the lower edge of the UFA (i.e. floor standing equipment). Additionally characterization of the field in the area below the UFA may be recorded. See 7.3.

Table 3 demonstrates the concepts of full illumination and partial illumination as well as where and how they can be applied.

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The preferred method for all frequencies is full illumination. If full illumination cannot be used, one or more of the frequency-dependent alternative methods can be applied.

Table 3 – Requirements for uniform field area for application of full illumination and partial illumination

Requirements for UFA / Frequency range	Full illumination: the EUT and its cabling (see 7.4) fits completely within the UFA (preferred method)	Partial illumination: the EUT and its cabling (see 7.4) does not fit completely within the UFA
Up to at least 1 GHz	Minimum UFA size 0,5 m × 0,5 m. UFA size in 0,5 m grid size steps (e.g., 0,5 m × 0,5 m; 0,5 m × 1,0 m; 1,0 m × 1,0 m; 1,5 m × 1,5 m; 1,5 m × 2,0 m; 2,0 m × 2,0 m, etc). Characterization in 0,5 m × 0,5 m grid steps. At least 75 % of measured points within specifications if UFA is larger than 0,5 m × 0,5 m. 100 % (all five points) shall be in specifications if a UFA of only 0,5 m × 0,5 m is used.	Minimum UFA size 1,5 m × 1,5 m. UFA size in 0,5 m grid size steps (e.g., 1,5 m × 1,5 m; 1,5 m × 2,0 m; 2,0 m × 2,0 m, etc). Characterization in 0,5 m × 0,5 m grid steps. 75 % of measured points within specifications.
Above 1 GHz		Minimum UFA size 0,5 m × 0,5 m. UFA size in 0,5 m grid size steps (e.g., 0,5 m × 0,5 m; 0,5 m × 1,0 m; 1,0 m × 1,0 m; 1,5 m × 1,5 m; 1,5 m × 2,0 m; 2,0 m × 2,0 m, etc). Characterization in 0,5 m × 0,5 m grid steps. At least 75 % of measured points within specifications if UFA is larger than 0,5 m × 0,5 m. 100 % (all five points) shall be in specifications if a UFA of only 0,5 m × 0,5 m is used.

Generally, the characterization of the field in anechoic and semi-anechoic chambers can be performed using the test setup shown in Figure 6.

The characterization shall always be performed with an unmodulated carrier for both horizontal and vertical polarizations in accordance with the steps given below. It is required to ensure that the amplifiers can reproduce the modulation within the linearity requirements during testing (see 6.3.2 or 6.3.3 and Annex D). For 80 % AM, the level setting process is performed with a field strength at least 1,8 times as high as the field strength to be applied to the EUT. Denote this level setting field strength by E_L. E_L is the value which is applicable only to the field level setting. The test field strength E_T shall not exceed E_L/1,8.

NOTE 3 Other methods to ensure avoiding saturation can be used (see Annex D for further information).

If modulations other than 80 % AM are used, a suitable saturation check should be performed based upon the peak power of the modulated signal.

Two different characterization methods are described below using an 1,5 m × 1,5 m UFA (sixteen grid points) as an example. These methods are considered as giving the same field uniformity and test level setting.

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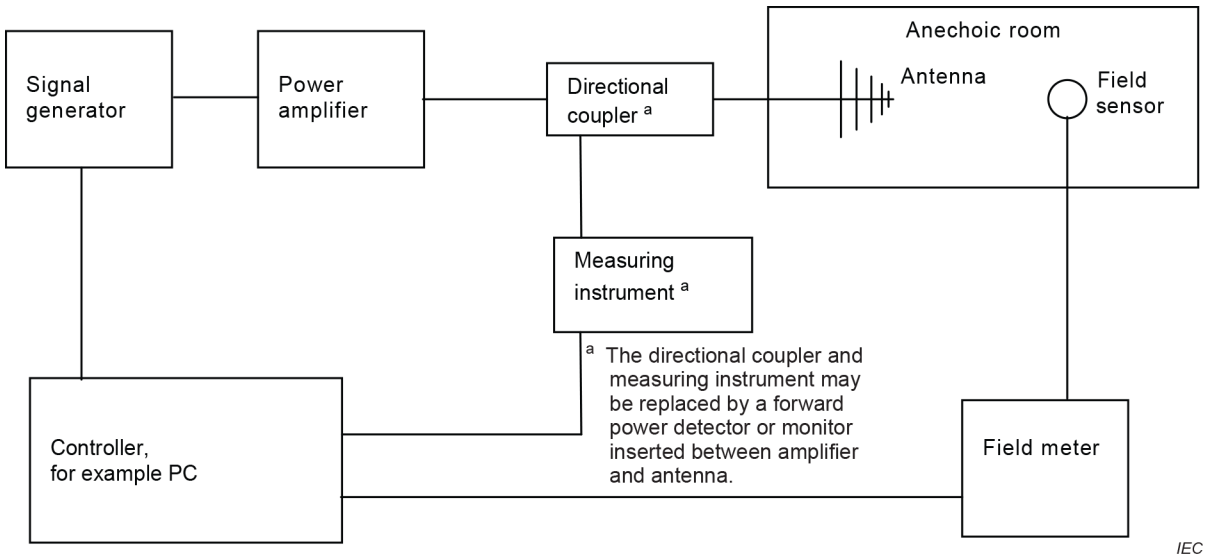


Figure 6 – Measuring setup

6.3.2 Constant field strength level setting method

The constant field strength of the uniform field shall be:

- established at each particular frequency. The particular frequencies are determined by using the frequency step described in 8.4
- established at each of the points of the UFA, one after the other (see Figure 4);
- established by adjusting the forward power accordingly.
- measured via a calibrated field sensor.

The forward power necessary to establish the field strength chosen shall be measured in accordance with Figure 6 and is to be recorded in dBm for the sixteen points.

Procedure to be followed at both horizontal and vertical polarizations:

a) Position the sensor at one of the sixteen points in the grid (see Figure 4), and set the frequency of the signal generator output to the lowest frequency in the range of the test (for example 80 MHz).

NOTE 1 To lower the uncertainty of the field measurement, the probe is oriented in the same manner at each of the grid points as it was oriented during the probe calibration.

b) Adjust the forward power to the field generating antenna so that the field strength obtained (with field probe correction factors for frequency applied) is equal to the level setting field strength E_L. Record the forward power reading.

c) Increase the frequency using the step size given in Clause 8.

d) Repeat steps b) and c) until the next frequency in the sequence would exceed the highest frequency in the range of the test. Finally, repeat step b) at the maximum frequency of the test range (for example 1 GHz).

e) Repeat steps a) to d) for each point in the grid.

At each frequency:

1) Sort the sixteen forward power readings into ascending order.

2) Start at the highest value and check if at least the eleven readings below this value (75 % of grid points) are within the tolerance of –6 dB to 0 dB of that value.

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