

Electromagnetic compatibility (EMC) —

Part 2: Environment —

Section 9: Description of HEMP environment — Radiated disturbance — Basic EMC publication

The European Standard EN 61000-2-9:1996 has the status of a
British Standard

ICS 29.020

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National foreword

This British Standard has been prepared by Technical Committee GEL/210 and is the English language version of EN 61000-2-9:1996 *Electromagnetic compatibility (EMC) Part 2: Environment Section 9: Description of HEMP environment — Radiated disturbance — Basic EMC publication*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1000-2-9:1996, published by the International Electrotechnical Commission (IEC).

IEC 1000 has been designated a Basic EMC publication for use in the preparation of dedicated product, product family and generic EMC standards.

IEC 1000 will be published in separate Parts in accordance with the following structure.

- *Part 1: General;*
- *Part 2: Environment;*
- *Part 3: Limits;*
- *Part 4: Testing and measurement techniques;*
- *Part 5: Installation and mitigation guidelines;*
- *Part 6: Generic standards;*
- *Part 9: Miscellaneous.*

Cross-reference

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

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 22, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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English version

Electromagnetic compatibility (EMC)
Part 2: Environment
Section 9: Description of HEMP environment — Radiated disturbance
Basic EMC publication

(IEC 1000-2-9:1996)

Compatibilité électromagnétique (CEM)
Partie 2: Environnement
Section 9: Description de l'environnement
IEMN-HA Perturbations rayonnées
Publication fondamentale en CEM
(CEI 1000-2-9:1996)

Elektromagnetische Verträglichkeit (EMV)
Teil 2: Umgebungsbedingungen
Hauptabschnitt 9: Beschreibung der
HEMP-Umgebung-Stöhrstrahlung
EMV-Grundnorm
(IEC 1000-2-9:1996)

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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

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Foreword

The text of document 77C/27/FDIS, future edition 1 of IEC 1000-2-9, prepared by SC 77C, Immunity to high altitude nuclear electromagnetic pulse (HEMP), of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61000-2-9 on 1996-03-05.

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) 1996-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-12-01

Annexes designated “normative” are part of the body of the standard. In this standard, annex ZA is normative. Annex ZA has been added by CENELEC.

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1 Scope and object

This section of IEC 1000-2 defines the high-altitude electromagnetic pulse (HEMP) environment that is one of the consequences of a high-altitude nuclear explosion.

Those dealing with this subject consider two cases:

- high-altitude nuclear explosions;
- low-altitude nuclear explosions.

For civil systems, the most important case is the high-altitude nuclear explosion. In this case, the other effects of the nuclear explosion: blast, ground shock, thermal and nuclear ionizing radiation are not present at the ground level. However the electromagnetic pulse associated with the explosion may cause disruption of, and damage to, communication, electronic and electric power systems thereby upsetting the stability of modern society.

The object of this standard is to establish a common reference for the HEMP environment in order to select realistic stresses to apply to victim equipment for evaluating their performance.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this section of IEC 1000-2. At the time of publication, the edition indicated was valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 1000-2 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 50(161):1990, *International Electrotechnical Vocabulary — Chapter 161: Electromagnetic compatibility*.

3 General

A high-altitude (above 30 km) nuclear burst produces three types of electromagnetic pulses which are observed on the earth's surface:

- early-time HEMP (fast);
- intermediate-time HEMP (medium);
- late-time HEMP (slow):

Historically, most interest has been focused on the early-time HEMP which was previously referred to as simply "HEMP". Here we will use the term high-altitude "EMP" or "HEMP" to include all three types. The term NEMP¹⁾ covers many categories of nuclear EMP's including those produced by surface bursts (SREMP)²⁾ or created on space systems (SGEMP)³⁾.

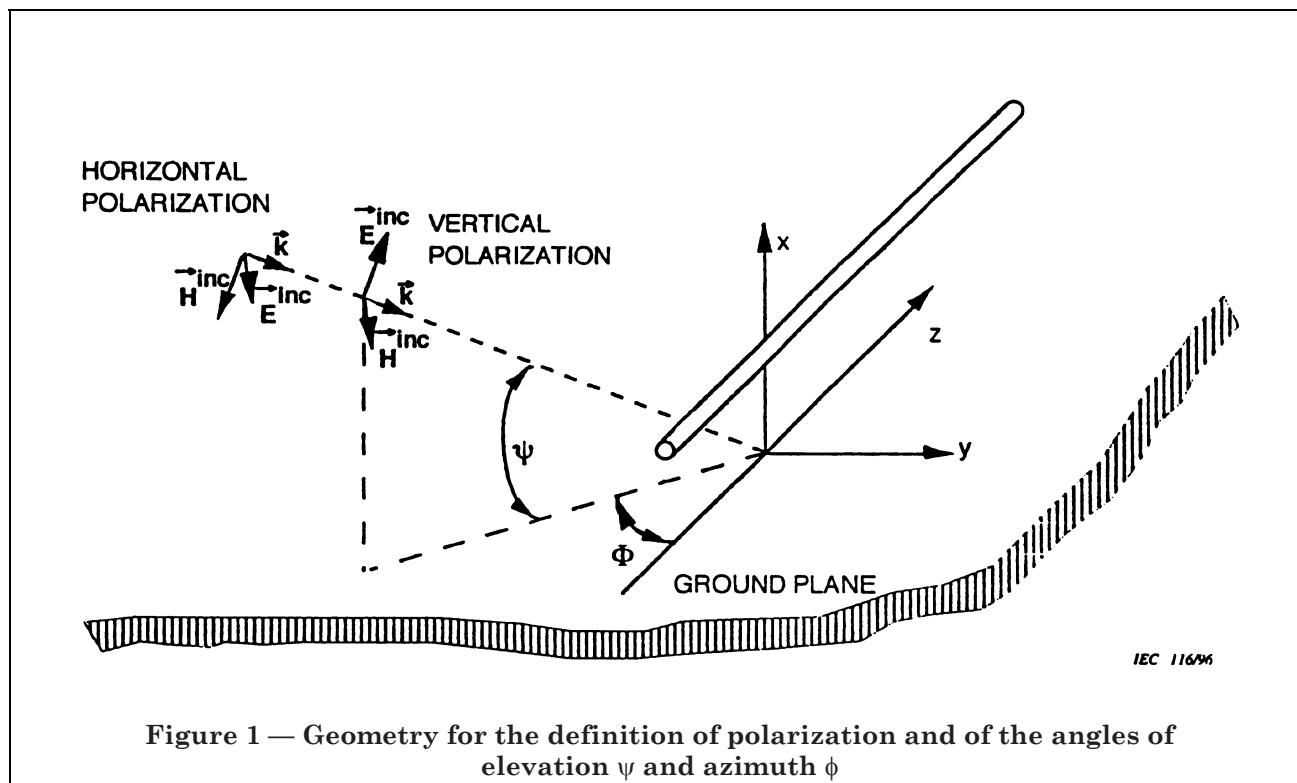
Because the HEMP is produced by a high-altitude detonation, we do not observe other nuclear weapon environments such as gamma rays, heat and shock waves at the earth's surface. HEMP was reported from high-altitude U.S. nuclear tests in the South Pacific during the early 1960's, producing effects on electronic equipment far from the burst location.

¹⁾ NEMP: Nuclear ElectroMagnetic Pulse.

²⁾ SREMP: Source Region EMP.

³⁾ SGEMP: System Generated EMP.

4 Definitions



4.1

angle of elevation in the vertical plane Ψ

angle ψ measured in the vertical plane between a flat horizontal surface such as the ground and the propagation vector (see Figure 1)

4.2

azimuth angle, ϕ

angle between the projection of the propagation vector on the ground plane and the principal axis of the victim object (z axis for the transmission line of Figure 1)

4.3

composite waveform

waveform which maximizes the important features of a group of waveforms

4.4

coupling

interaction of the HEMP field with a system to produce currents and voltages on system surfaces and cables. Voltages result from the induced charges and are only defined at low frequencies with wavelengths larger than the surface or gap dimensions

4.5

direction of propagation of the electromagnetic wave

direction of the propagation vector $\vec{k}$, perpendicular to the plane containing the vectors of the electric and the magnetic fields (see Figure 2)

4.6

E_1, E_2, E_3

terminology for the early, intermediate and late-time HEMP electric fields

4.7

EMP

any electromagnetic pulse, general description

4.8

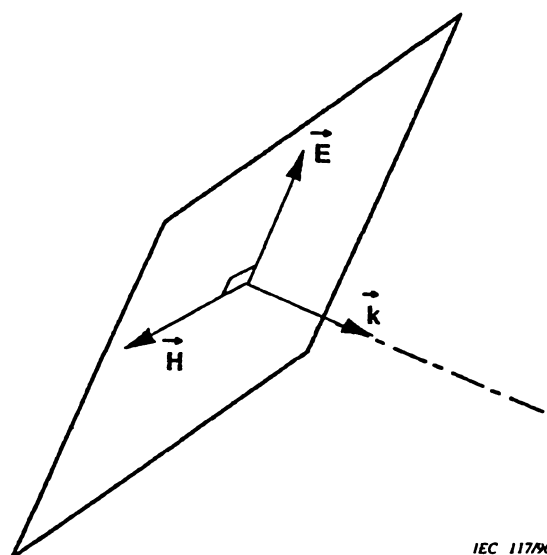
energy fluence

integral of the Poynting vector over time; presented in units of J/m^2

4.9

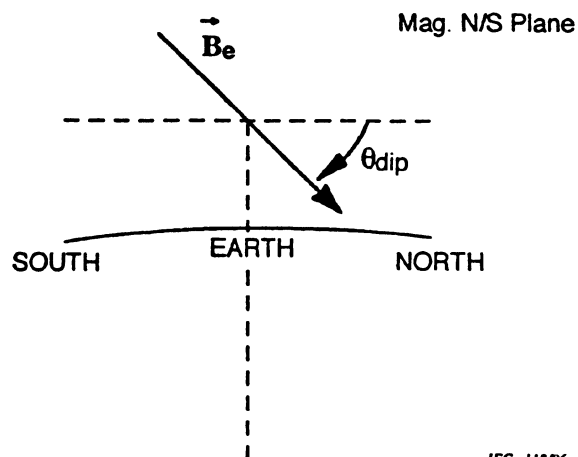
geomagnetic dip angle, θ_{dip}

dip angle of the geomagnetic flux density vector $\vec{B}_e$, measured from the local horizontal in the magnetic north-south plane. $\theta_{\text{dip}} = 90^\circ$ at the magnetic north pole, -90° at the magnetic south pole



IEC 117/96

Figure 2 — Geometry for the definition of the plane wave



IEC 118/96

Figure 3 — Geomagnetic dip angle

4.10**ground zero**

point on the earth's surface directly below the burst;
sometimes called surface zero

4.11**HEMP**

high-altitude nuclear EMP

4.12**high-altitude (nuclear explosion)**

height of burst above 30 km altitude

4.13**HOB**

height of burst

4.14**horizontal polarization**

an electromagnetic wave is horizontally polarized if the magnetic field vector is in the incidence plane and the electric field vector is perpendicular to the incidence plane and thus parallel to the ground plane (Figure 1). (This type of polarization is also called perpendicular or transverse electric (TE).)