

American National Standard Dictionary of Electromagnetic Compatibility (EMC) including Electromagnetic Environmental Effects (E3)

C63[®]

Accredited Standards Committee C63[®] — Electromagnetic Compatibility

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Secretariat

The Institute of Electrical and Electronics Engineers, Inc.

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American National Standards Institute

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Abstract: Terms associated with electromagnetic compatibility (EMC) and electromagnetic environmental effects (E3) are defined including electromagnetic pulse (EMP) and electrostatic discharge (ESD) terms. Quantities, units, multiplying factors, symbols, and abbreviations are covered.

Keywords: ANSI C63.14, electromagnetic compatibility (EMC), electromagnetic environmental effects (E3), electromagnetic pulse (EMP), electrostatic discharge (ESD)

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Introduction

This introduction is not part of ANSI C63.14-2014, American National Standard Dictionary of Electromagnetic Compatibility (EMC) including Electromagnetic Environmental Effects (E3).

This document is intended to serve as a standard dictionary of terms and definitions commonly used and related by usage to activities pertaining to electromagnetic compatibility (EMC), including electromagnetic environmental effects (E3).

The title of this document was changed in 2009 to reflect the common usage of the term “electromagnetic environmental effects” used by the U.S. Department of Defense and industry to represent the broad category of engineering disciplines that had been commonly included under the term “electromagnetic compatibility.” Because some people still think of EMC as a term representing many related categories, the term was retained in the title to provide continuity for title searches. The other terms in the previous title, “electromagnetic pulse” (EMP) and “electrostatic discharge” (ESD), were just two of many categories of supporting disciplines with specific terms that were included within the scope of E3 and so were removed from the title. The other categories of E3, as listed in the definition herein, include electromagnetic interference; electromagnetic vulnerability; electromagnetic pulse; electronic protect; electrostatic discharge; hazards of electromagnetic radiation to personnel, ordnance, and fuels (volatile materials); and natural phenomena effects of lightning and precipitation static.

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Since the time this document was introduced in 1998, the landscape of terms related to the broad category of E3 and EMC has increased or changed by the design and evaluation activities of the U.S. Department of Defense and industry. Terms that were considered common and not specifically related to the E3 and EMC fields and are defined by the *IEEE Standards Dictionary Online* were removed from this document.

New or modified terms defined by ANSI C63[®] documents and U.S. Military Standards are introduced in this document.

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Dictionary of Electromagnetic Compatibility (EMC) including Electromagnetic Environmental Effects (E3)

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1. Scope

This standard provides definitions of terms associated with electromagnetic environmental effects including electromagnetic compatibility (EMC), electromagnetic pulse (EMP), and electrostatic discharge (ESD). In addition to definitions, several symbols and abbreviations are included.

2. Normative references

The following referenced documents are indispensable for the application of this ~~standard~~-document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

2.1 Commercial

~~[B1]~~ ANSI C63.2-1996, American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz -Specifications. ¹~~Description.~~¹⁸

ANSI C63.4-²⁰⁰⁹, ~~2003~~ American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.¹

ANSI C63.5-2006, American National Standard for ~~Electromagnetic Compatibility (EMI) Control (9 kHz to 40 GHz)~~. Calibration of Antennas Used for Radiated Emission Measurements in Electro Magnetic Interference.

ANSI C63.7-2005, American National Standard Guide for Construction of Open-Area Test Sites for Performing Radiated Emission Measurements.

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[ANSI C63.9-2008, American National Standard for RF Immunity of Audio Office Equipment to General Use Transmitting Devices with Transmitter Power Levels up to 8 Watts.](#)

[ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.](#)

ANSI C63.011-2000, American National Standard for Limits and Methods of Measurement of Radio Disturbance Characteristics of Industrial, Scientific, and Medical (ISM) Radio-Frequency Equipment.

ANSI C63.12-1999, American National Standard Recommended Practice for Electromagnetic Compatibility Limits.

ANSI C63.13-1991, American National Standard Guide on the Application and Evaluation of EMI Power-Line Filters for Commercial Use.

[ANSI C63.15-2010, American National Standard Recommended Practice for the Immunity Measurement of Electrical and Electronic Equipment.](#)

ANSI C63.16-1993, American National Standard Guide for Electrostatic Discharge Test Methodologies and Criteria for Electronic Equipment.^{[2](#)}

ANSI C63.17-[2013](#) ~~2006~~, American National Standard Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices.

ANSI C63.19-[2011](#), ~~2007~~-American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

² [Administratively withdrawn.](#)

ANSI C63.22-2004, American National Standard Guide for Automated Electromagnetic Interference Measurements.

[ANSI C63.23-2012, American National Standard Guide for Computations and Treatment of Measurement Uncertainty.](#)

~~[B3]~~ CISPR 16-1-1:~~2007~~~~1993~~, Specification for radio disturbance and immunity measuring apparatus and methods— Part 1: Radio disturbance and immunity measuring apparatus—Measuring apparatus.³

[Code of Federal Regulations Title 47 Part 15 \(47CFR15\), Telecommunication, Chapter I—Federal Communications Commission, Part 15—Radio Frequency Devices.](#)⁴

[Collin, R. E., *Field Theory of Guided Waves*, 2nd ed. New York: IEEE Press, 1991.](#)

[ESD ADV1.0-2012, ESD Association's Glossary of Terms.](#)^{5, 6}

³ CISPR documents are available from the International Electrotechnical Commission (<http://www.iec.ch/>). They are also available in the United States from the American National Standards Institute (<http://www.ansi.org/>).

⁴ CFR publications are available from the U.S. Government Printing Office (<http://www.gpo.gov/>).

⁵ ESD publications are available from the Electrostatic Discharge Association at (<http://www.esda.org/documents/>).

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IEC 60050-161:1990 (ed. 1.0), ~~(Amendment 1 1997-10; Amendment 2 1998-04)~~, International Electrotechnical Vocabulary. Chapter 161: Electromagnetic Compatibility.^{[7](#), [8](#), [9](#) ⁴}

IEEE/ASTM SI 10™-1997, Standard for Use of the International System of Units (SI)—The Modern Metric System.^{[6](#)¹⁰, [11](#)}

[IEEE Standards Dictionary Online.](#)^{[12](#)}

IEEE Std 260.1TM~~1993~~²⁰⁰⁴, American National Standard Letter Symbols for Units of Measurement.^{[7](#)}

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[IEEE Std 1900.1™-2008, IEEE Standard Definitions and Concepts for Dynamic Spectrum Access: Terminology Relating to Emerging Wireless Networks, System Functionality, and Spectrum Management.](#)

International Telecommunication Union (ITU), Radio Regulations, [2012](#) ~~2004~~ ed. ¹³~~10~~

ISO/IEC Guide 2: [2004](#) ~~1996~~ (ed. 8.0), Standardization and Related Activities—General Vocabulary. ⁹

14, 15

[ISO/IEC 17000:2004 \(ed. 1.0\), Conformity Assessment—Vocabulary and General Principles.](#) ¹⁵

ISO/IEC 17025:2005, (ed. [2.0](#)), General Requirements for the Competence of Testing and Calibration Laboratories. ¹⁶

2.2 Military

[DoD Directive 3222.3, DoD Electromagnetic Environmental Effects \(E3\) Program, U.S. Department of Defense, 2004.](#) ¹⁷

¹³ ITU-T publications are available from the International Telecommunications Union, ~~Place des Nations, CH 1211, Geneva 20, Switzerland/Suisse~~ (<http://www.itu.int/>).

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¹⁷ US DoD publications are available from U.S. Department of Defense at (<http://www.defenselink.mil/>).

[DoD Instruction 4650.01, Policy and Procedures for Management and Use of the Electromagnetic Spectrum, U.S. Department of Defense, 2009.](#)

Joint Publication 1-02, 2004, Department of Defense Dictionary of Military and Associated Terms.

[Joint Publication 1-02, 2010 \(amended 2013\), Department of Defense Dictionary of Military and Associated Terms.](#)

[MIL-HDBK-235-1C, 2010, Department of Defense Handbook: Military Operational Electromagnetic Environmental Profiles, Part 1C, General Guidance.](#) ¹⁸

~~[B13]~~ MIL-HDBK-237C, 2001, [Department of Defense Handbook: Electromagnetic Environmental Effects and Spectrum Certification Guidance for the Acquisition Process](#) ²⁵.

[MIL-HDBK-237D, 2005, Department of Defense Handbook: Electromagnetic Environmental Effects and Spectrum Supportability Guidance for the Acquisition Process.](#)

MIL-HDBK-240, 2002, [Department of Defense Handbook: Hazards of Electromagnetic Radiation to Ordnance \(HERO\) Test Guide.](#) ¹²

[MIL-HDBK-240A, 2011, Department of Defense Handbook: Hazards of Electromagnetic Radiation to Ordnance \(HERO\) Test Guide.](#)

[MIL-HDBK-274A, 2011, Department of Defense Handbook: Electrical Grounding for Aircraft Safety.](#)

~~[B14]~~ MIL-HDBK-335, 1992, [Military Handbook: Management and Design Guidance Electromagnetic Radiation Hardness for Air Launched Ordnance Systems.](#)

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MIL-HDBK-419A, 1987, [Military Handbook](#): Grounding, Bonding, and Shielding for Electronic Equipments and Facilities. Volumes I (Basic Theory) and II (Applications).

~~[B15]~~ MIL-STD-188-100, 1976, [Military Standard](#): Common Long Haul and Tactical Communication System Technical Standards.

[MIL-STD-188-125-1, 1998, Department of Defense Interface Standard: High-Altitude Electromagnetic Pulse \(HEMP\) Protection for Ground-Based C4I Facilities Performing Critical, Tim-Urgent Missions, Part 1, Fixed Facilities.](#)

[MIL-STD-188-141C, 2011, Department of Defense Interface Standard: Interoperability and Performance Standards for Medium and High Frequency Radio Systems.](#)

~~[B17]~~—MIL-STD-449D, 1976, [Military Standard](#): Radio Frequency Spectrum Characteristics Measurement of.

MIL-STD-461F, 2007, [Department of Defense Interface Standard](#): Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment.

~~[B18]~~ MIL-STD-463A, 1995, [Military Standard](#): Definitions and System of Units, Electromagnetic Interference and Electromagnetic Compatibility Technology. (Superseded by IEEE-C63.14)

MIL-STD-464A, 2002, Electromagnetic Environmental Effects—Requirements for Systems.

MIL-STD-464-~~A~~ [C](#), 2010, [Department of Defense Interface Standard](#): Electromagnetic Environmental Effects—Requirements for Systems.

MIL-STD-469B, 1996, Department of Defense Interface Standard: Radar Engineering Interface Requirements, Electromagnetic Compatibility. [\(Cancelled\)](#)

~~{B19}~~ MIL-STD-1310G, 1996, [Department of Defense Standard Practice: for](#) Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility and Safety.

[MIL-STD-1310H, 2009, Department of Defense Standard Practice: Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility, Electromagnetic Pulse \(EMP\) Mitigation, and Safety.](#)

~~{B20}~~ MIL-STD-1377, 1971, [Department of Defense Test Method Standard:](#) Effectiveness of Cable, Connector, and Weapon Enclosure Shielding and Filters in Precluding Hazards of Electromagnetic Radiation to Ordnance, Measurement of.

~~{B21}~~ MIL-STD-1541A, 1987, [Military Standard:](#) Electromagnetic Compatibility Requirements for Space Systems.

~~{B22}~~ MIL-STD-1542B, 1991, [Military Standard:](#) Electromagnetic Compatibility and Grounding Requirements for Space System Facilities.

~~{B23}~~ MIL-STD-1605A(SH), 2009, ~~1973,~~ [Department of Defense Test Method Standard:](#) Procedures for Conducting a Shipboard Electromagnetic Interference (EMI) Survey (Surface Ships).

National Telecommunication and Information Administration (NTIA) ~~Manual:~~ Manual of Regulations and Procedures for Federal Radio Frequency Management ([Redbook](#)), May 1989, ~~with~~ revised ~~dated~~ January 2007. ¹⁹~~13~~

¹⁹ This publication is available at <http://www.ntia.doc.gov/page/2011/manual-regulations-and-procedures-federal-radio-frequencymanagement-redbook>.

¹³ ~~This publication is available from the Superintendent of Documents, U.S. Government Printing Office.~~

NATO STANAG 3968-1999, NATO Glossary of Electromagnetic Terminology (Edition 3, Amendment 1).²⁰¹⁴

~~[B24]~~ NATO STANAG 4436, 1993, Electromagnetic Compatibility Testing Procedure and Requirements for Naval Electrical and Electronic Equipment (Surface Ships, Non-metallic Hull).²⁶

~~ESD ADV 1.0 1994, ESD Association Advisory for Electrostatic Discharge Terminology, Glossary.~~²

~~ESD ADV 2.0 1994, ESD Association Advisory for Protection and Sensitivity Testing of Electrostatic Discharge Susceptible Items.~~

~~FCC 47 CFR Part 15, U.S. Code of Federal Regulations, Title 47 Telecommunication, Chapter I—Federal Communications Commission, Part 15—Radio Frequency Devices.~~³

~~IEC 60050 161:1990 09 (Amendment 1 1997 10; Amendment 2 1998 04), International Electrotechnical Vocabulary. Chapter 161.:~~⁴

²⁰ NATO STANAGs publications and other documents are available from the Headquarters of the United States Air Force/XOXXISO at ~~Washington, DC 20330-5058~~ (<http://www.nato.int/docu/standard.htm>).

²⁶ ~~NATO STANAGs publications and other documents are available from the Headquarters of the United States Air Force/XOXXISO, Washington, DC 20330-5058, USA (<http://www.nato.int/docu/standard.htm>).~~

² ~~ESD publications are available from the Sales Department, ElectroStatic Discharge Association, 7900 Turin Road, Bldg 3, P.O. Box 913, Rome, NY 13440-2069 USA. ESD standards are available from the Internet at (<http://www.esda.org/standards.html>).~~

³ ~~FCC publications are available from U. S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 USA (<http://www.gpoaccess.gov/>).~~

~~NOTE—IEC has a website for the IEV at (<http://www.electropedia.org>), which may be useful; however, if there are any conflicts in definitions, then this document shall take precedent.~~⁵

~~International vocabulary of basic and general terms in metrology (VIM), 2nd ed., 1993. (Edited in common by BIPM, IEC, ISO, and OIML.)~~⁸

~~ISO/IEC 17025:2005, General Requirements for the Competence of Testing and Calibration Laboratories.~~

~~ITU, International Telecommunication Union Radio Regulations, 2004 ed.~~¹⁰

~~SAE-ARD-50040, 1992 (draft), High Intensity Radiated Field (HIRF) Advisory Circular.~~¹¹

~~MIL-STD-469B, 1996, Department of Defense Interface Standard for Radar Engineering Interface Requirements, Electromagnetic Compatibility.~~

⁵~~Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.~~

⁸~~This publication is available from Global Engineering, 15 Inverness Way East, Englewood, CO 80112-5704;~~

¹⁰~~ITU—International Telecommunications Union, Place des Nations, CH 1211, Geneva 20, Switzerland/Suisse (<http://www.itu.int/>).~~

¹¹~~SAE publications are available from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096, USA(<http://www.sae.org/>).~~

3. Quantities, units, multiplying factors, symbols, and abbreviations

3.1 Quantities

The units and symbols listed in Table 1 shall be used to indicate the applicable quantity. The quantities, units, and unit symbols presented comply with the International System of Units (SI). (See IEEE Std 260.1TM-1993¹ and IEEE/ASTM SI 10-1997.)¹⁵²¹ In case of variance, this standard takes precedence.

Table 1 — Units of a quantity

Quantity	SI unit	Symbol of SI unit
Capacitance	Farad	F
Electric current	Ampere	A
Electric field strength (<i>E</i> -vector)	Volt per meter	V/m
Electric potential (Potential difference, electromotive force)	Volt	V
Electric resistance	Ohm	Ω
Energy	Joule	J
Frequency	Hertz	Hz
Inductance	Henry	H
Length	Meter	m
Magnetic field strength (<i>H</i> -vector)	Ampere per meter	A/m
Magnetic flux	Weber	Wb
Magnetic flux density (<i>B</i> -vector)	Tesla	T
Power	Watt	W
Pulse rise time (t_r)	Second	s
Pulse fall time (t_f)	Second	s
Pulse width time (t_w)	Second	s
Time	Second	s
Wavelength	Meter	m

²¹ Information on references can be found in Clause 2.

3.2 Multiplying factors and symbols

The symbols listed in Table 2 shall be used to indicate the applicable multiplier.

Table 2 — Symbols for multiplying factors

Multiplier	Symbol
Tera (10^{12})	T
Giga (10^9)	G
Mega (10^6)	M
Kilo (10^3)	k
Hecto (10^2)	h
Deka (10^1)	da
Deci (10^{-1})	d
Centi (10^{-2})	c
Milli (10^{-3})	m
Micro (10^{-6})	μ
Nano (10^{-9})	n
Pico (10^{-12})	p
Femto (10^{-15})	f
Atto (10^{-18})	a

3.3 Frequency spectrum designations

The designations in Table 3 shall be used to indicate the applicable portion of the frequency spectrum.

Table 3 – Designations of frequency spectrum^a

Frequency subdivision	Frequency range
ELF (extremely low)	30 Hz to 300 Hz
VF (voice)	300 Hz to 3 kHz
VLf (very low)	3 kHz to 30 kHz
LF (low)	30 kHz to 300 kHz
MF (medium)	300 kHz to 3000 kHz (3 MHz)
HF (high)	3 MHz to 30 MHz
VHF (very high)	30 MHz to 300 MHz
UHF (ultra high)	300 MHz to 3000 MHz (3 GHz)
SHF (super high)	3 GHz to 30 GHz
EHF (extremely high)	30 GHz to 300 GHz
(Undesignated)	300 GHz to 3000 GHz (3 THz)

^a Reprinted from the National Telecommunication and Information Administration (NTIA) Manual.

3.4 Abbreviations and acronyms

ABM1 audio band magnetic signal—desired

ABM2 audio band magnetic signal—undesired

AM amplitude modulation

AMN Artificial Mains Network (see LISN)

ANOVA analysis of variance

ANSI American National Standards Institute-

~~ARD~~ ~~Aerospace Resource Document (SAE)~~

B emission bandwidth

BBN	broadband noise
BCI	bulk current injection
BER	bit error rate
BW	bandwidth
C-E	communication-electronic
CE	conducted emission
CI	conducted ~~immunity~~ <u>interference</u>
CISPR	International Special Committee on Radio Interference
CM	common mode
COTS	commercial off the shelf
CS	conducted susceptibility
CW	continuous wave
dB	decibel
dB(μ V)	decibels referenced to 1 microvolt (μ V)

dB($\mu\text{V}/\text{m}$)	decibels referenced to 1 microvolt per meter ($\mu\text{V}/\text{m}$)
dB(A)	decibels referenced to 1 ampere (A)
dBm	decibels referenced to 1 milliwatt (mW)
DM	differential mode
DS	damped sinusoidal
DSB	double sideband
E3	electromagnetic environmental effects
EFS	electric field strength
EID	electrically initiated device
EIRP	equivalent isotropically radiated power
EM	electromagnetic
EMC	electromagnetic compatibility
EMCP	electromagnetic compatibility program
EME	electromagnetic environment
EMI	electromagnetic interference

EMP	electromagnetic pulse
EMRADHAZ	electromagnetic radiation hazard
EMV	electromagnetic vulnerability
EP	electronic protection
ERP	effective radiated power
ESC	equipment spectrum certification
ESD	electrostatic discharge
EUT	equipment under test
FCC	Federal Communications Commission
FIM	field-intensity meter
FM	frequency modulation
FSAF	free-space antenna factor
FSK	frequency-shift keying
FSVM	frequency-selective voltmeter
GSCF	geometry-specific correction factor

GTEM	gigahertz transverse electromagnetic cell
HEMP	high-altitude electromagnetic pulse
HERF	hazards of electromagnetic radiation to fuel (volatile materials)
HERO	hazards of electromagnetic radiation to ordnance
HERP	hazards of electromagnetic radiation to personnel
HIRF	high-intensity radiated field(s)
IBW	impulse bandwidth
ICP	impedance control point
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMI	intermodulation interference
IRAN	input referenced ambient noise
IRIL	input referenced interference level
ISB	independent sideband
ISM	industrial, scientific, medical

ISO International Organization for Standardization

ITE information technology equipment

LBT listen before transmit

l_e antenna effective length for electric-field antennas

l_{em} antenna effective length for magnetic-field antennas

LEMP lightning electromagnetic pulse

LIC least interfered channel

LISN line impedance stabilization network-

M&TE measuring and test equipment

MAE maximum allowable environment

MDS minimum discernible signal

MIF modulation interference factor

MNFC maximum no-fire current

MOV metal oxide varistor

NATO North Atlantic Treaty Organization

NDI	non-developmental item
NEMP	nuclear electromagnetic pulse
NIST	National Institute of Standards and Technology
NSA	normalized site attenuation
NTIA	National Telecommunications and Information Administration
NVLAP	National Voluntary Laboratory Accreditation Program
OATS	open-area test site
P	power
PAM	pulse-amplitude modulation
PCI	pulsed current injection
PCM	pulse-code modulation
PDM	pulse-duration modulation
<u>P_{EUT}</u>	<u>peak transmit power</u>
POE	point of entry
PPM	pulse-position modulation

PSD	power spectral density
PSK	phase-shift keying
P-static	precipitation static
PTM	pulse-time modulation
PWM	pulse-width modulation
RADHAZ	radiation hazard
RAM	radar absorbing material
RBW	resolution bandwidth
RCS	radar cross section
RE	radiated emission
RF	radio frequency
RFI	radio-frequency interference
RI	radiated immunity
RS	radiated susceptibility
<u>RSSI</u>	<u>received signal strength indication</u>

Rx receiver

SAE Society of Automotive Engineers

SM spectrum management

[SPL](#) [sound pressure level](#)

SS spectrum supportability

SSB single sideband

[T-coil](#) [telecoil](#)

TDR time-domain reflectometry

TEM transverse electromagnetic

[TL](#) [threshold limit](#)

TPD terminal protection device

TPL tri-plate line

Tx transmitter

[U](#) [expanded uncertainty](#)

[U-NII](#) [Unlicensed National Information Infrastructure](#)

UPCS unlicensed personal communications service

UPS uninterruptible power system

WB TEM wideband transverse electromagnetic

Z_t transfer impedance

4. Definitions and terminology

The following definitions and terms are given for use in applicable situations and documents. They are intended to be applied to the general field of electromagnetic environmental effects ([E3](#)) (e.g., electromagnetic compatibility), and the fields related to the phenomena associated with electromagnetic pulse ([EMP](#)) and electrostatic discharge ([ESD](#)). For the purposes of this document, the following terms and definitions apply. [The IEEE Standards Dictionary Online and IEC 60050-161:1990 \(ed. 1.0\) should be referenced for terms not defined in this clause.](#)

~~The IEEE Standards Dictionary: Glossary of Terms & Definitions¹⁶ and IEC 60050-161, 1998-04, should be referenced for terms not defined in this clause.~~

~~Terms that may be considered to have special meaning in specific applications are recognized by a parenthetical statement identifying the originating organization or specific application.~~

4.1 above deck: An area on ships, ~~which~~ that is directly exposed to the external electromagnetic environment and is not considered to be below deck as defined herein. (MIL-STD-464A, 2002)

¹⁶~~The IEEE Standards Dictionary: Glossary of Terms & Definitions is available at <http://shop.ieee.org/>.~~

4.2 absorber: A material that causes the irreversible conversion of the energy of an electromagnetic wave into another form of energy (normally heat) as a result of its interaction with the absorber material. ([MIL-STD-463A, 1995](#)). *See also:* **fire safety absorber**.

4.3 absorber performance: The ratio of absorbed energy to incident radiated energy impinging upon an absorber surface.

4.4 absorbing clamp: A measuring device, movable along the mains leads (or interface cables) of an appliance or similar device, which is intended to assess the maximum radio-frequency power emitted by the appliance or device. [IEC 60050-161,~~1998-04~~:1990 (ed. 1.0)]

4.5 absorption (radio-wave propagation): The irreversible conversion of the energy of an electromagnetic wave into another form of energy as a result of wave interaction with matter. (~~The~~ *IEEE Standards Dictionary: Glossary of Terms & Definitions* [Online](#))

4.6 absorption loss: That part of a transmission loss due to the dissipation or conversion of either sound or electromagnetic energy into other forms of energy, either within the transmission medium or attendant upon a reflection and interaction with matter.

4.7 activate: [Apply power to the equipment under test \(EUT\); the EUT is running, but user-level communication is not occurring. For example, for a voice system after activation, the two ends of the link are synchronized, but no voice communication has begun. See also: initiate. \(ANSI C63.17-2013\)](#)

4.8 air discharge method: A method of electrostatic discharge (ESD) testing in which the charged electrode of the ESD simulator approaches the equipment under test (EUT) or coupling plane regardless of the conductivity of the ESD receptor. The discharge is actuated by a spark in air to the EUT or the coupling plane. (ANSI C63.16-1993)

4.9 alternate test site: An alternate test site used for radiated electromagnetic interference (EMI) compliance testing and complying with the requirements in ANSI C63.4-2009. (ANSI C63.22-2004)

4.10 ambient level (electromagnetic): **(A)** The values of radiated and conducted signal and noise existing at a specified test location and time when the test sample is not activated. ~~(The IEEE Standards Dictionary: Glossary of Terms & Definitions)~~(ANSI C63.4-2009) (IEEE Standards Dictionary Online) **(B)** The magnitude of radiated and conducted signals and noise existing at a specific test location in the absence of signals from a test sample. (ANSI C63.5-2006)

NOTE—For example, atmospheric noise and signals from man-made and other natural sources all contribute to the *ambient level*.²²

4.11 analysis of variance (ANOVA): A collection of statistical models and their associated procedures in which the observed variance is partitioned into components due to different explanatory variables. ANOVA is a general technique that can be used to test the hypothesis that the means among two or more groups are equal, under the assumption that the sampled populations are normally distributed. (ANSI C63.23-2012)

4.12 anechoic enclosure [radio frequency (RF)]: An enclosure ~~with~~whose internal walls ~~that~~ have low-reflection characteristics. ~~(The IEEE Standards Dictionary: Glossary of Terms & Definitions Online)~~(ANSI C63.19-2011)

NOTE—This implies that all six surfaces of the enclosure have low-reflection characteristics for incident waves. For audio use, the anechoic enclosure may not necessarily be a metallic enclosure; for RF applications, the anechoic enclosure is a shielded (against RF ingress or egress) metallic enclosure. Both types of enclosures use absorbing material (suited to the frequency range of use) to implement the low-reflection characteristics desired. (ANSI C63.19-2011)

²² Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

4.13 anomaly: An anomaly is a response of the system to extraneous conducted or radiated electromagnetic energy that involves degradation of the intended input-output relationship, by an amount and for a time duration, which is not explicitly permitted by the item specification or provided for in the applicable error budget. An *anomaly* is also known as an improper response or a malfunction. (MIL-STD-1541A, 1987-~~B21~~¹⁷)

4.14 antenna: That part of a transmitting or receiving system that is designed to radiate or to receive electromagnetic waves. (IEEE Std 145TM-1993)

4.15 antenna beamwidth: In a radiation pattern cut in a specific radiation plane containing the direction of the maximum of the lobe, the angle between the two directions in which the radiation power intensity is one half the maximum value. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions Online~~) See also: **half-power beamwidth**.

4.16 antenna effective area: In a given direction, the ratio of the power available at the terminals of an antenna to the incident power density of a plane wave, from a given direction for a given polarization, polarized coincident with the polarization that the antenna would radiate. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions Online~~)

4.17 antenna effective length (l_e or l_{em}) (linearly polarized antenna): The ratio of the magnitude of the open-circuit voltage developed at the terminals of the antenna to the magnitude of the electric field strength (EFS) in the direction of the antenna polarization. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions Online~~)

4.18 antenna factor: Ratio of the electric field strength E in the polarization direction of the antenna to the voltage induced across the load connected to the antenna terminals V_o and expressed in decibel form $[20 \log (E/V_o)]$. (ANSI C63.5-2006) (ANSI C63.4-2009) See also: **receive antenna factor; transmit antenna factor**.

¹⁷~~The numbers in brackets correspond to those of the bibliography in Annex A.~~

4.19 antenna gain: The ratio of the radiated field strength, in a given direction, produced by a given antenna, to the radiated field strength that would be obtained if the power accepted by the antenna were radiated isotropically.

NOTE—Gain does not include losses arising from impedance and polarization mismatches. When not otherwise specified, the gain figure for an antenna refers to the gain in the direction of the radiation main lobe. In applications using scattering modes of propagation, the full gain of an antenna may not be realizable in practice, and the apparent gain may vary with time. See also **gain** in the *IEEE Standards Dictionary*: ~~Glossary of Terms & Definitions~~ [Online](#).

4.20 antenna induced voltage: The voltage that is measured at, or calculated to exist across, the open-circuited antenna terminals. ([MIL-STD-463A, 1995](#))

4.21 antenna pattern: A graphical representation of the radiation properties of the antenna as a function of space coordinates.

NOTE—In the usual case, the radiation pattern is determined in the far-field region and is represented as a function of directional coordinates. Radiation properties include power flux density, electric or magnetic field strength, phase, and polarization. See also **radiation pattern** in the *IEEE Standards Dictionary*: ~~Glossary of Terms & Definitions~~ [Online](#).

4.22 antenna terminal conducted interference (disturbance): Any undesired conducted voltage or current, generated within a receiver (Rx), transmitter (Tx), or its associated equipment, appearing at the antenna terminals. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ [Online](#))

4.23 antenna transfer switch: A device used to alternate between the reception of over-the-air [radio-frequency](#) (RF) signals via connection to an antenna and the reception of RF signals received by any other method.

4.24 aperture: An opening, or discontinuity, in an electromagnetic (EM) barrier or shield through which EM fields can penetrate.

4.25 a priori distribution: [A distribution in which the probability curve is an isosceles triangle symmetrical about the center of the base \[e.g., the result of casting \(rolling\) a pair of fair dice\]. \(ANSI C63.23-2012\) Syn.: **triangular distribution.**](#)

4.26 architectural effects: The impact of building architectural construction (e.g., solid metal screens, metal walls, steel reinforcing rods in concrete, window reflection/glare treatments, and metallic cabinets) on the propagation of electromagnetic waves.

4.27 artificial hand: An electric network simulating the impedance of the human body, under average operational conditions, between a hand-held electrical appliance and earth. [IEC 60050-161~~1998-04~~:1990 (ed. 1.0)]

4.28 assigned frequency band: The frequency band within which the emission of a station is authorized; the width of the band equals the necessary bandwidth plus twice the absolute value of the frequency tolerance. Where space stations are concerned, the assigned frequency band includes twice the maximum Doppler shift that may occur in relation to any point of the earth's surface. (NTIA Manual)

4.29 atmospheric radio noise: Electromagnetic noise in the radio-frequency range having its sources in natural atmospheric phenomena. (ANSI C63.12-1999)

4.30 attenuation: The reduction in magnitude (as a result of absorption and scattering) of an electric or magnetic field or a current or a voltage, usually expressed in [decibels](#) (dB).

4.31 audio band: [The audio-frequency range. \(ANSI C63.19-2011\) See: **audio frequency.**](#)

4.32 audio band magnetic signal—desired (ABM1): [Measured quantity of the desired magnetic signal. \(ANSI C63.19-2011\)](#)

4.33 audio band magnetic signal—undesired (ABM2): Measured quantity of the undesired magnetic signal, such as interference from battery current and similar non signal elements. (ANSI C63.19-2011)

4.34 audio coupling mode: Transmission of a signal between two pieces of equipment using sound. (ANSI C63.19-2011)

4.35 audio frequency: Any frequency corresponding to a normally audible sound wave. (*IEEE Standards Dictionary Online*) (ANSI C63.19-2011)

NOTE 1—Audio frequencies range roughly from 15 Hz to 20 000 Hz. This standard generally addresses audio frequencies from 50 Hz to 10 kHz.

NOTE 2—This term is frequently shortened to *audio* and used as a modifier to indicate a device or system intended to operate at audio frequencies, for example, an audio amplifier.

4.36 average detector: A detector with an output voltage that is the average value of the envelope of an applied signal. (*MIL-STD-463A, 1995*)

NOTE—The average value must be taken over a specified time interval. [IEC 60050-161, ~~1998-04~~;1990 (ed. 1.0)]

4.37 balanced line: A transmission line, consisting of two conductors in the presence of ground that is capable of being operated in such a way so that the voltages and currents on the two conductors at all transverse planes are equal in magnitude and opposite in phase. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ *Online*)

4.38 balanced voltages (on a balanced line): Voltages relative to ground on the two conductors of a balanced line that, at every point along the line, are equal in magnitude and opposite in polarity. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ *Online*)

4.39 balun: A device for transforming an unbalanced voltage to a balanced voltage or vice versa. [IEC60050-161,~~1998-04~~:1990 (ed. 1.0)]

4.40 band: Frequency range between two defined limits. ([IEEE Standards Dictionary Online](#)) ([ANSI C63.19-2011](#))

4.41 bandwidth (BW): (A) The difference between the limiting frequencies within which performance of a device, in respect to some characteristic, falls within specified limits. (B) The difference between the limiting frequencies of a continuous frequency band. (MIL-STD-188-100, 1976 [~~B15~~]) (See also IEC 60050-161-06) (C) The range of frequencies within which performance, with respect to some characteristic, falls within specific limits. ([IEEE Standards Dictionary Online](#)) ([ANSI C63.19-2011](#))

4.42 barrier: See: **electromagnetic barrier**.

4.43 baseband: The band of frequencies occupied by the signal before it modulates the carrier (or subcarrier) frequency to form the transmitted line or radio signal. (~~The~~ [IEEE Standards Dictionary Glossary of Terms & Definitions Online](#))

4.44 baseband modulation techniques: Includes the following items. See also: **modulation types**.

- a) *Baseband:* The band of frequencies occupied by the signal before it modulates the carrier (or subcarrier) frequency to form the transmitted line or radio signal. (~~The~~ [IEEE Standards Dictionary Glossary of Terms & Definitions Online](#))
- b) *Composite modulation:* Applying more than one baseband process to a single carrier for the transmission of digital information. It is possible to superimpose pulse-amplitude modulation (PAM) on frequency-shift keying (FSK) or phase-shift keying (PSK) signals as a means of increasing the information throughput rate without significantly increasing the system bandwidth. Likewise, pulse-position modulation (PPM) and pulse-duration modulation (PDM) or PAM and PPM may coexist in the same channel. ([MIL-STD-463A, 1995](#))

- c) *Frequency-shift keying (FSK)*: The form of frequency modulation in which the modulating signal shifts the output frequency between predetermined values, and the output wave has no phase discontinuity. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ [Online](#))
- d) *Phase-shift keying (PSK)*: The form of phase modulation in which the modulating function shifts the instantaneous phase of the modulated wave between predetermined discrete values. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ [Online](#))
- e) *Pulse-amplitude modulation (PAM)*:
- Modulation in which the modulating wave is caused to amplitude-modulate a pulse carrier. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ [Online](#))
 - A baseband modulation technique where an analog waveform is converted to a digital or discrete waveform by successive samples of pulses having amplitudes that are derived from the input waveform.
- f) *Pulse-code modulation (PCM)*: The type of pulse modulation where the magnitude of the signal is sampled and each sample is approximated to a nearest reference level (this process is called *quantizing*). Then a code, which represents the reference level, is transmitted to the distant location. The main advantage of PCM is the fact that at the receiving end only the presence or absence of a pulse must be detected. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ [Online](#))
- g) *Pulse-duration modulation (PDM) or pulse-width modulation (PWM)*: Pulse-time modulation in which the value of each instantaneous sample of the modulating wave is caused to modulate the duration of a pulse. ([MIL-STD-463A, 1995](#))

NOTE—In PDM, the modulating wave may vary the time of occurrence of the leading edge, the trailing edge, or both edges of the pulse. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ [Online](#))

- h) *Pulse-position modulation (PPM)*: Pulse-time modulation in which the value of each instantaneous sample of a modulating wave is caused to modulate the position in time of a pulse. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ [Online](#))
- i) *Pulse-time modulation (PTM)*: Modulation in which the value of instantaneous samples of the modulating wave are caused to modulate the time of occurrence of some characteristics of a pulse carrier.

NOTE—Pulse-duration modulation, pulse-position modulation, and pulse-interval modulation are particular forms of pulse-time modulation. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ [Online](#))

4.45 below deck: An area on ships that is surrounded by a metallic structure ~~or an area that provides an equivalent attenuation to electromagnetic radiation,~~ such as the ~~metal~~ hull or superstructure of ~~a~~[a metallic](#) surface ships, the hull of a submarine, ~~and~~ the screened [areas or rooms in of](#) non-metallic ships, [the screened areas of ships utilizing a combination of metallic/non-metallic material for hull and superstructure or a deck mounted metallic shelter.](#) (MIL-STD-464C, 2010)

4.46 bit error rate (BER): The number of erroneous bits divided by the total number of bits over some stipulated period of time. Transmission BER is the number of erroneous bits received versus the total number of bits transmitted. Information BER is the number of erroneous decoded (corrected) bits versus total number of decoded (corrected) bits. The BER is usually expressed in scientific notation (e.g., 2×10^{-5}). ([MIL-STD-463A, 1995](#))

4.47 bond: A reliable connection to assure the required electrical conductivity between conductive parts required to be electrically connected. (~~The IEEE Standards Dictionary: Glossary of Terms & Definitions~~ [Online](#))

4.48 bonding: The process of establishing the required degree of electrical continuity between the conductive surfaces of members to be joined. (MIL-HDBK-419A, 1987) *See also:* **earthing.**