American National Standard Dictionary for Technologies of Electromagnetic Compatibility (EMC), Electromagnetic Pulse (EMP), and Electrostatic Discharge (ESD)

(Dictionary of EMC/EMP/ESD Terms and Definitions)

Accredited Standards Committee On Electromagnetic Compatibility, C63

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American National Standards Institute

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

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Foreword

[This foreword is not a part of American National Standard Dictionary for Technologies of Electromagnetic Compatibility (EMC), Electromagnetic Pulse (EMP), and Electrostatic Discharge (ESD) (Dictionary of EMC/EMP/ESD Terms and Definitions).]

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), electromagnetic pulse (EMP), and electrostatic discharge (ESD).

In developing the definitions for these terms, international usage, as reflected in Chapter 161 of IEC 50(161)(1990), International Electrotechnical Vocabulary, has been adopted wherever possible. In addition, military usage has been incorporated.

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

Suggestions for improvement of this standard are welcome. They should be sent to:

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Contents

SECTION PAGE

1. Scope 1

2. References 1

3. Quantities, Units, Multiplying Factors, Symbols, and Abbreviations 2

3.1 Quantities 2
3.2 Multiplying Factors and Symbols 3
3.3 Frequency Spectrum Designations and Symbols 3
3.4 Abbreviations 4

4. Definitions and Terminology 4

American National Standard Dictionary for Technologies of Electromagnetic Compatibility (EMC), Electromagnetic Pulse (EMP), and Electrostatic Discharge (ESD)

(Dictionary of EMC/EMP/ESD Terms and Definitions)

1. Scope

This document provides definitions of terms associated with electromagnetic compatibility (EMC), electromagnetic pulse (EMP), and electrostatic discharge (ESD). In addition to definitions, it includes symbols and abbreviations.

2. References

[1] ANSI C63.4-1991, American National Standard Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.[1]

[2] ANSI C63.7-1988, American National Standard Guide for Construction of Open Area Test Sites for Performing Radiated Emission Measurements.

[3] IEEE Std 100-1988, IEEE Standard Dictionary of Electrical and Electronics Terms—4th ed. (ANSI).[2]

[4] MIL-STD-463A-1977, Military Standard, Definitions and System of Units, Electromagnetic Interference and Electromagnetic Compatibility Technology.[3]

[5] Collin, Robert E., *Field Theory of Guided Waves*, 2nd ed., New York: IEEE Press, 1991.

[6] FCC 47 CFR Part 15, Radio Frequency Devices (1990).[4]

[7] IEC 50(161)(1990), International Electrotechnical Vocabulary, Chapter 161: Electromagnetic compatibility. Also: parts of Chapters 604 and 826.[5]

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[1]ANSI C63 publications are available from the Institute of Electrical and Electronics Engineers, Service Center, 445 Hoes Lane, P. O. Box 1331, Piscataway, NJ 08855-1331, USA, or from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

[2]IEEE publications are available from the Institute of Electrical and Electronics Engineers.

[3]Military publications are available through appropriate channels within respective US Army, Navy, and Air Force project program offices. Information on military document availability also can be obtained from the Director, US Navy Publications and Printing Service, Eastern Division, 700 Robbins Avenue, Philadelphia, PA 19111, USA.

[4]This document is available from the Superintendent of Documents, US Government Printing Office, Document Control Branch, Washington, DC 20402, USA.

[5]IEC publications are available from the International Electrotechnical Commission, 3 rue de Varembe, Case Postale 131, CH-1211, Geneve 20, Switzerland/Suisse. In the United States, IEC publications are available from the American National Standards Institute.

[8] International Telecommunication Union (ITU) Radio Regulations, 1990 ed.[6]

[9] Jordan, E. C. *Reference Data for Engineers: Radio, Electronics, Computer, and Communications*, 7th ed. Howard W. Sams & Co., Inc. 1985.

[10] MIL-B-5087B(ASG)-1964, Military Specification, Bonding, Electrical, and Lightning Protection, for Aerospace Systems.[7]

[11] MIL-E-6051D-1967, Military Specification, Electromagnetic Compatibility Requirements, Systems.

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

[13] National Institute of Standards and Technology (NIST) Special Publication 330, International System of Units (SI), July 1986.[8]

[14] National Telecommunication and Information Administration (NTIA) Manual: Manual of Regulations and Procedures for Federal Radio Frequency Management. May, 1989, with revisions dated January, 1991.[9]

[15] NATO STANAG No. 3968-1988, NATO Glossary of Electromagnetic Terminology (Edition 2) (First Draft) (Undated); NATO AAP-6, NATO Glossary of Terms and Definitions (English and French).[10]

3. Quantities, Units, Multiplying Factors, Symbols, and Abbreviations

3.1 Quantities. The following units and symbols shall be used to indicate the applicable quantity. The quantities, units, and unit symbols presented comply with the International System of Units (SI). See NIST [13][11].

Quantity	SI Unit	Symbol of SI Unit
Capacitance	farad	F
Electric current	ampere	A
Electric field strength (E-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

[6]Copies of the Radio Regulations are available from the Secretary General, International Telecommunications Union, Place des Nations, CH-1211, Geneva 20, Switzerland/Suisse.

[7]See footnote 3.

[8]This document is available from the Superintendent of Documents, US Government Printing Office.

[9]This publication is available from the Superintendent of Documents, US Government Printing Office.

[10]Information on the availability of NATO STANAGS can be obtained from Headquarters, US Air Force/XOXX-ISO, Washington, DC 20330-5058, USA.

[11]The numbers in brackets correspond to those of the references in Section 2.

Quantity	SI Unit	Symbol of SI Unit
Length	meter	m
Magnetic field strength (H-vector)	ampere per meter	A/m
Magnetic flux	weber	Wb
Magnetic flux density (B-vector)	tesla	T
Power	watt	W
Pulse Rise Time (T_r)	second	s
Pulse Fall Time (T_f)	second	s
Pulse width (T_w)	second	s
Time	second	s
Wavelength	meter	m

3.2 Multiplying Factors and Symbols. The following symbols shall be used to indicate the applicable multiplier:

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 and Symbols. The following symbols shall be used to indicate the applicable portion of the frequency spectrum. (NTIA [14])

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)

3.4 Abbreviations

BER	bit-error rate
C-E	communication-electronic
CE	conducted emission
CS	conducted susceptibility
ECCM	electronic counter-countermeasure
ECM	electronic countermeasure
EFS	electric field strength
EIRP	equivalent isotropic radiated power
EM	electromagnetic
EMC	electromagnetic compatibility
EMCP	electromagnetic compatibility program
EMCS	electromagnetic compatibility standardization
EMI	electromagnetic interference
EMIM	electromagnetic immunity
EMISM	electromagnetic interference safety margin
EMP	electromagnetic pulse
EMS	electromagnetic susceptibility
EMV	electromagnetic vulnerability
ERP	effective radiated power
EUT	equipment under test
EW	electronic warfare
FIM	field-intensity meter
FSM	field-strength meter
FSVM	frequency-selective voltmeter
HERF	hazards of electromagnetic radiation to fuel
HERO	hazards of electromagnetic radiation to ordnance
HERP	hazards of electromagnetic radiation to personnel
Hz	hertz
IBW	impulse bandwidth
lG	impulse generator
ISM	industrial, scientific, and medical
kHz	kilohertz
l_e	antenna effective length for electric-field antennas
l_{em}	antenna effective length for magnetic-field antennas
MDS	minimum discernible signal
MFS	magnetic field strength
MHz	megahertz
MPMVS	midpulse minimum visible signal
MVS	minimum visible signal
POE	point of entry
RADHAZ	radiation hazard
RE	radiated emission
RFI	radio-frequency interference
RS	radiated susceptibility

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 compatibility, and the fields related to the phenomena associated with electromagnetic pulse and electrostatic discharge.

4.1 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.

4.2 absorber, fire safety. Absorber material that corresponds to fire safety specifications.

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, intended to assess the maximum radio-frequency (RF) power emitted by the appliance or device. (IEC 50(161)(1990) [7])

4.5 absorption. The irreversible conversion of the energy of an electromagnetic wave into another form of energy as a result of its interaction with matter. (IEEE Std 100-1988 [3])

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 accuracy. (1) The quality of freedom from mistake or error, that is, of conformity to truth or to a rule. (IEEE Std 100-1988 [3]) (2) The specification of the maximum plus-or-minus error deviation from the true value for a unit or system level measurement. The accuracy may be specified in terms of peak or rms deviation.

4.8 ambient level (electromagnetic). The values of radiated and conducted signal and noise existing at a specified test location and time when the test sample is not activated. (IEEE Std 100-1988 [3]) For example, atmospheric noise, and signals from man-made and other natural sources all contribute to the “ambient level.”

4.9 anechoic enclosure [radio frequency (RF)]. An enclosure whose internal walls have low reflection characteristics. (IEEE Std 100-1988 [3])

4.10 antenna beamwidth (half-power beamwidth). In a radiation pattern cut 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. (IEEE Std 100-1988 [3])

4.11 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, polarized coincident with the polarization that the antenna would radiate. (IEEE Std 100-1988 [3])

4.12 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 in the direction of the antenna polarization. (IEEE Std 100-1988 [3])

4.13 antenna, elevatable. An antenna adjusted either automatically, semiautomatically, or manually, through differing elevation angles or antenna heights with respect to an elevation angle and/or height reference.

4.14 antenna factor, receive. The ratio of the strength of the field in which the antenna is immersed to the output voltage across the load connected to the antenna.

4.15 antenna factor, transmit. The ratio of the strength of the field produced by the antenna at a specified distance to the driving input voltage across the antenna input terminals.

4.16 antenna, fixed elevation. An antenna used at a single selected elevation angle and/or antenna height with respect to an elevation angle and/or height reference.

4.17 antenna gain (in a given direction). 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. (Based on IEEE Std 100-1988 [3].)

4.18 antenna induced voltage. The voltage that is measured at, or calculated to exist across, the open-circuited antenna terminals.

4.19 antenna, isotropic. A hypothetical, lossless antenna that radiates or receives energy of all polarizations equally well in all directions. An isotropic antenna is a lossless point source used as the theoretical reference to describe the absolute gain of a real antenna. (Based on IEEE Std 100-1988 [3].)

4.20 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. (IEEE Std 100-1988 [3])

4.21 antenna, reference. A designated measurement antenna whose measurement data are preferred and take precedence in the case of a discrepancy, such as between signal strength levels measured with the reference antenna and those measured with any other antenna.

4.22 antenna, rotatable. An antenna that is rotated in the azimuth plane during measurements.

4.23 antenna terminal conducted interference (disturbance). Any undesired conducted voltage or current, generated within a receiver, transmitter, or their associated equipment, appearing at the antenna terminals. (IEEE Std 100-1988 [3])

4.24 antenna, test. An antenna, of known performance characteristics, associated with the measurement equipment.

4.25 aperture. An opening, or discontinuity, in an electromagnetic (EM) barrier or shield through which EM fields can propagate.

4.26 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 50(161)(1990) [7])

4.27 assurance, EMC. Those inspection, test, and evaluation procedures and activities performed during design, development, production, and installation that confirms the efficacy and suitability of the EMC hardening of products, and technical documentation. A consistent subset of quality assurance.

4.28 attenuation. A general term used to denote a decrease in signal (power, voltage, or current) magnitude in transmission from one point to another. (IEEE Std 100-1988 [3])

4.29 balanced line. A transmission line consisting of two conductors in the presence of ground capable of being operated in such a way that the voltages and currents on the two conductors at all transverse planes are equal in magnitude and opposite in phase. (Based on IEEE Std 100-1988 [3].)

4.30 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. (IEEE Std 100-1988 [3])

4.31 balun. A device for transforming an unbalanced voltage to a balanced voltage or vice versa. (IEC 50(161)(1990) [7])

4.32 bandwidth, impulse. The ratio of the maximum value of the voltage at the output of a network (when properly corrected for network sine-wave gain at the stated reference frequency) to the spectrum amplitude of the pulse applied at the input. In networks with a single-humped response, the reference frequency is taken as that at which the gain is maximum. *Note:* For a spectrum analyzer, the peak value of the time response envelope divided by the spectrum amplitude (assumed flat within the bandpass) of an applied pulse. (IEEE Std 100-1988 [3])

4.33 bandwidth, necessary. For a given class of emission, the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed under specified conditions. Emissions useful for the good functioning of the receiving equipment as, for example, the emission corresponding to the carrier of reduced carrier systems, shall be included in the necessary bandwidth. (NTIA [14])

4.34 bandwidth, occupied. The frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission. In some cases, for example multichannel frequency division systems, 0.5% may lead to certain difficulties in the practical application of the definition of occupied bandwidth; in such cases, a different percentage may prove useful. (NTIA [14]) (IEEE Std 100-1988 [3])

4.35 bandwidth, required acceptance. The receiver bandwidth that includes the fundamental frequency response and extends from the lowest to the highest frequencies on the selectivity outside of which the image response and all other responses are at specified levels below the response at the fundamental frequency.

4.36 barrier. A closed, conducting surface, enclosing a volume of space, that has a degree of shielding effectiveness, usually measured in decibels (dB) of impenetrability to impinging electromagnetic fields, whether by diffusion, radiation, or conductive means. The so-called completely enclosed “Faraday cage” is the ideal case.

4.37 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. (IEEE Std 100-1988 [3])

4.38 bond. *Noun:* The electrical connection between two metallic surfaces established to provide a low resistance (impedance) path between them. (MIL-HDBK-419A-1987 [12])

4.39 bonding. The process of establishing the required degree of electrical continuity between the conductive surfaces of members to be joined. (MIL-HDBK-419A-1987 [12])

4.40 bonding jumper. (1) A reliable conductor to ensure the required electrical conductivity between metal parts required to be electrically connected. (2) A braided wire or metal strap that provides the necessary electrical conductivity between the unit and structure, which would otherwise not be in sufficient electrical contact. (MIL-B-5087B [10])

4.41 broadband radio noise. Radio noise having a spectrum broad in width as compared to the nominal bandwidth of the measuring instrument, and whose spectral components are sufficiently close together and uniform that the measuring instrument cannot resolve them.

4.42 burst. A sequence of a limited number of distinct pulses or an oscillation of limited duration. (IEC 50(161)(1990) [7])

4.43 cable. A lead assembly (wire assembly) of two or more wires; e.g., a power cable has two or more power leads.

4.44 calibration. The comparison of measuring and test equipment (M&TE) or measurement standard of unknown accuracy to a measurement standard of known accuracy in order to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the instrument being compared.

4.45 certification. The procedure by which written assurance is given that a product or service conforms to a standard or specification.

4.46 certification mark (mark of conformity). The sign or symbol owned or controlled by the certification body that is used exclusively by the third party certification program to identify products or services as being certified. It is registered as a certification mark with the US Patent and Trademark Office under the Trade Mark Act of 1946.

4.47 certification, third-party. A form of certification in which the producer's claim of conformity is validated, as part of a third-party certification program, by a technically and otherwise competent body other than one controlled by the producer or the buyer.

4.48 certification, third-party program. An organized system (1) under which similar products or services of any number of producers may be certified as conforming to the referenced standards or specifications on a uniform and equitable basis; (2) that uses or is operated by a third-party inspection/testing body; and (3) that authorizes the use of controlled certification marks or certificates of conformity as evidence of conformity.

4.49 click. (1) A disturbance of a duration less than a specified value when measured under specified conditions. *Note:* For the specified values and conditions, guidance may be found in International Special Committee on Radio Interference (CISPR) publications 14-1985, 16-1987, and 22-1985. (ANSI C63.4-1992 [1]). (2) An electromagnetic disturbance that, when measured in a specified way, has a duration not exceeding a specified value. (IEC 50(161)(1990) [7])

4.50 click rate. The number of clicks per unit of time, generally per minute, that exceeds a specified level. (IEC 50(161)(1990) [7])

4.51 commercial off-the-shelf equipment (COTS). Equipment that has been designed and manufactured for commercial applications.

4.52 common-mode radio noise. Conducted radio noise that appears between a common reference plane (ground) and all wires of a transmission line, causing their potentials to be changed simultaneously and by the same amount relative to the common reference plane (ground). (IEEE Std 100-1988 [3])

4.53 communication device, low-power. A restricted radiation device, exclusive of those employing conducted or guided RF techniques, used for the transmission of signs, signals (including control signals), writing, images, and sounds of intelligence of any nature by radiation of electromagnetic energy. Examples of such devices include cordless telephones, wireless microphones, phonograph oscillators, radio-controlled garage door openers, and radio-controlled models. (NTIA [14])

4.54 communication-electronic (C-E) equipment. Any item intentionally generating, transmitting, conveying, acquiring, storing, processing, or utilizing electronic and electromagnetic information in the broadest sense. Such devices are used to meet a variety of operational requirements, such as communications, surveillance, identification, navigation, guided missile control, SONAR, countermeasures, and space operations.

4.55 compatibility, intersystem electromagnetic. The condition that enables a system to function without perceptible degradation due to electromagnetic sources in another system.

4.56 compatibility, intrasystem electromagnetic. The condition that enables the various portions of a system to function without perceptible degradation due to electromagnetic sources in other portions of the same system.

4.57 computing device. *See:* **digital device; information technology equipment (ITE).**

4.58 conducted radio noise. Radio noise produced by equipment operation, which exists on the powerline and interconnecting cables of the equipment, and is measurable under specified conditions as a voltage or current. (IEEE Std 100-1988 [3]) *Note:* Radio noise can also be induced by natural sources, such as lightning.

4.59 consensus standard. An object, process, or criterion that is used as a de facto standard by agreement of the vendor and purchaser when no formal, recognized US national standard is available.

4.60 counterpoise (antenna). A system of conductors, elevated above and insulated from the ground, forming a lower system of conductors of an antenna. (IEEE Std 100-1988 [3])

4.61 Crawford cell. A transverse electromagnetic (TEM) cell used as a combination antenna and shielded enclosure based on the concept of an expanded transmission line operating in a TEM mode. (TEM cells are better than standard antennas in terms of bandwidth, linear phase response, and accuracy.) *See:* **transverse electromagnetic (TEM) cell.**

4.62 critical area. A location on a platform or installation containing equipment or subsystems that, if malfunctioning due to unwanted electromagnetic energy, could degrade the overall system performance and result in failure or abortion of a primary mission. All locations on a submarine and surface ship are considered critical areas. “Critical area” is essentially a military term.

4.63 criticality categories, subsystem and/or equipment. All subsystems and/or equipment installed in or associated with the system shall be assigned to one of the EMC criticality categories. These assignments shall be based on the impact of an electromagnetic interference (EMI), or susceptibility malfunction, or degradation of performance on the assigned mission. (MIL-E-6051D-1967 [11])

(1) *Category I.* EMC problems that could result in loss of life, loss of vehicle, mission abort, costly delays in launches, or unacceptable reduction in system effectiveness.

(2) *Category II.* EMC problems that could result in injury, damage to vehicle, or reduction in system effectiveness that would endanger success of mission.

(3) *Category III.* EMC problems that result only in annoyance, minor discomfort, or loss of performance but do not reduce desired system effectiveness. (MIL-E-6051D-1967 [11])

4.64 cross-coupling (transmission medium). (1) A measure of the undesired power transferred from one channel to another. (IEEE Std 100-1988 [3]) (2) the undesired coupling between two or more different communication channels, circuit components, or parts.

4.65 cross-modulation. (1) A type of intermodulation due to the modulation of the carrier of the desired signal by an undesired signal wave. (IEEE Std 100-1988 [3]) (2) Modulation of the carrier of a wanted signal by an unwanted signal, produced by interaction of the signals in nonlinear equipment, electrical networks, or transmission media. (IEC 50(161)(1990) [7])

4.66 crosstalk. An undesired signal disturbance introduced in a transmission circuit by mutual electric (capacitive) or magnetic (inductive) field coupling with other transmission circuits.

4.67 cumulative amplitude probability distribution. A cumulative distribution showing the probability that all amplitudes equal to, or above, a stated value are exceeded as a function of that value. (IEEE Std 100-1988 [3])

4.68 current probe. A device for measuring the current in a conductor without interrupting the conductor and without introducing significant impedance into the associated circuits. (IEC 50(161)(1990) [7])

4.69 damage. Permanent malfunction or degradation to a system from EMI stress, affecting operational effectiveness or suitability to such a degree that critical mission objectives are disrupted until operability restitution and repair are completed.

4.70 damped sinusoidal (DS) waveform. A time-varying voltage [$v(t)$] or current [$i(t)$] waveform, characterized by a frequency of oscillation (f), exponential damping factor (a), peak amplitude A_o, and phase angle b, as follows:

$$v(t) \text{ or } i(t) = A_o\, e^{-at} \sin(2\pi ft + b)$$

4.71 decade. (1) Synonymous with power of 10. (IEEE Std 100-1988 [3]). (2) A ratio (typically frequency) of 10 to 1, or 3.32 octaves.

4.72 decibel (dB) (general). One-tenth of a bel, the number of decibels denoting the ratio of the two amounts of power being ten times the logarithm to the base 10 of this ratio. With P_1 and P_2 designating two amounts of power and n the number of decibels denoting their ratio,

$$n = 10 \log_{10} (P_1/P_2) \text{ dB}$$

When the conditions are such that ratios of currents or ratios of voltages (or analogous quantities in other fields) are the square roots of the corresponding power ratios, the number of decibels by which the corresponding powers differ is expressed by the following equations:

$$n = 20 \log_{10} (I_1/I_2) \text{ dB}$$

$$n = 20 \log_{10} (V_1/V_2) \text{ dB}$$

where I_1/I_2 and V_1/V_2 are the given current and voltage ratios, respectively. By extension, these relations between numbers of decibels and ratios of currents or voltages are sometimes applied where these ratios are not the square roots of the corresponding power ratios; to avoid confusion, such usage should be accompanied by a specific statement of this application. It is preferred that such extensions of the term described be avoided. (IEEE Std 100-1988 [3])

4.73 decibels (power) referred to one milliwatt [dBm, or dB(mW)]. Narrowband power level expressed in decibels referred to one milliwatt (mW). (IEEE Std 100-1988 [3])

4.74 decibels (voltage) referred to one microvolt [dB(μV)]. Narrowband voltage level expressed in decibels referred to one microvolt (μV).

4.75 decibels (current) referred to one microampere [dB(μA)]. Narrowband current level expressed in decibels referred to one microampere (μA).

4.76 decibels (impedance) referred to one ohm [dB(ohm)]. Impedance level expressed in decibels referred to one ohm (Ω).

4.77 decibels (electric field) referred to one microvolt per meter [dB(μV/m)]. Narrowband electric field level expressed in decibels referred to one microvolt per meter (μV/m).

4.78 decibels (magnetic H-field intensity) referred to one microampere per meter [dB(μA/m)]. Narrowband magnetic field intensity expressed in decibels referred to one microampere per meter (μA/m).

4.79 decibels (magnetic B-field flux density) referred to one picotesla [dB(pT)]. Narrowband magnetic flux density expressed in decibels referred to one picotesla (pT).

4.80 decibels (broadband voltage) referred to one microvolt per megahertz bandwidth [dB(μV/MHz)]. Broadband voltage level expressed in decibels referred to one microvolt per megahertz bandwidth (μV/MHz).

4.81 decibels relative to one milliwatt per square meter [dB(mW/m^2)], radiated power density. A measure of radiated power density of a narrowband signal referred to one milliwatt per square meter (mW/m^2). *Note:* The power density units shall not be used whenever the power distribution is not uniform across the area measured, such as in the near-field of an antenna.

4.82 degradation. Any specified condition or parameter that is out-of-tolerance during EMC or other testing.

degradation criteria. A military requirement used to define and evaluate malfunctions and unacceptable and undesired responses.

degradation of performance. An undesired departure in the operational performance of any device, equipment, or system from its intended performance. *Note:* The term “degradation” can apply to temporary or permanent failure. (IEC 50(161)(1990) [7])

4.83 desensitization. A reduction of the wanted output of a receiver due to an **unwanted signal.** (IEC 50(161)(1990) [7])

4.84 detector, average. A detector whose output voltage is the average value of the envelope of an applied signal. *Note:* The average value must be taken over a specified time interval. (IEC 50(161)(1990) [7])

4.85 detector, peak. A detector whose output voltage approximates the true peak value (maximum instantaneous value during a given interval of time) of an applied signal or noise. (Based on IEEE Std 100-1988 [3].)

4.86 detector, quasi-peak. A detector having specified electrical time constants that, when regularly repeated pulses of constant amplitude are applied to it, delivers an output voltage that is a fraction of the peak value of the pulses, the fraction increasing towards unity as the pulse repetition rate is increased. (IEEE Std 100-1988 [3]) (IEC 50(161)(1990) [7])

4.87 detector, rms. A detector whose output voltage approximates the root-mean-square (rms) value of an applied signal or noise. (IEEE Std 100-1988 [3]) *Note* (from (IEC 50(161)(1990) [7]): The rms value must be taken over a specified time interval.

4.88 deviation from normal, allowable. Changes in indication that are acceptable during a susceptibility test, provided they do not deviate beyond the tolerance given in the individual equipment specification.

4.89 differential-mode radio noise. Conducted radio noise that causes the potential of one side of the signal transmission path to be changed relative to another side. (IEEE Std 100-1988 [3])

4.90 digital device (EMC). (Previously defined as a computing device.) (1) An unintentional radiator (device or system) that generates and uses timing signals or pulses at a rate in excess of 9000 pulses (cycles) per second and uses digital techniques; inclusive of telephone equipment that uses digital techniques or any device or system that generates and uses RF energy for the purpose of performing data processing functions, such as electronic computations, operations, transformations, recording, filing, sorting, storage, retrieval, or transfer. *Note:* Computer terminals and peripherals that are intended to be connected to a computer are digital devices. [FCC Rules and Regulations Part 15 (Title 47 of the Code of Federal Regulations), Section 15.3] (2) A device that operates on the basis of

discrete numerical techniques in which the variables are represented by coded pulses or states. (IEEE Std 100-1988 [3])

4.91 double exponential (DE) waveform. A mathematical term or function typically containing two exponential expressions of the form

$$A(t) = A_o [e^{-at} - e^{-bt}]$$

The above equation is typically used in analysis or simulation to represent or approximate voltage, current, electric field, and magnetic field unipolar transient waveforms as a function of the time parameter, t. The waveform represented is characterized by the values of the amplitude, A_o, and the parameters a and b. Typically, the waveform has a value of zero at $t = 0$, rises relatively sharply to a peak value, and exponentially decays relatively slowly towards zero as t increases indefinitely.

4.92 duty cycle. (1) *General.* The time interval occupied by a device on intermittent duty in starting, running, stopping, and idling. (2) *Pulse systems.* The ratio of the sum of all pulse durations to the total period, during a specified period of continuous operation. (IEEE Std 100-1988 [3])

4.93 earthing. The process of making a satisfactory electrical connection between the structure, including the metal skin, of an object or vehicle, and the mass of the earth, to ensure a common potential with the earth. *See also:* **bonding; grounding.** (NATO [15])

4.94 electroexplosive subsystem. All components required to control, monitor, and initiate an electrically initiated ordnance/pyrotechnic function. (NATO [15])

4.95 electromagnetic compatibility (EMC). (1) The capability of electrical and electronic systems, equipments, and devices to operate in their intended electromagnetic environment within a defined margin of safety, and at design levels of performance, without suffering or causing unacceptable degradation as a result of electromagnetic interference. (NATO [15]) (2) The condition or situation whereby a device or system is able to function satisfactorily in the electromagnetic environment without introducing intolerable disturbance to that environment (or to other devices). (IEEE Std 100-1988 [3])

4.96 electromagnetic compatibility analysis. The compilation and interpretation of electromagnetic compatibility data to determine the degree of electromagnetic interference. (NATO [15])

4.97 electromagnetic compatibility program (programme). Systematic activities for ensuring the electromagnetic compatibility of a system or equipment. (NATO [15])

4.98 electromagnetic compatibility program (programme) plan. Description of all organizational and technical activities to achieve electromagnetic compatibility. The plan includes a schedule and a specification of aims and decision criteria. (NATO [15])

4.99 electromagnetic compatibility test plan. Description of the tests required in each phase of the electromagnetic compatibility program (programme). (NATO [15])

4.100 electromagnetic disturbance. Any electromagnetic phenomenon that may degrade the performance of a device, piece of equipment, or system, or adversely affect living or inert matter. (IEC 50(161)(1990) [7])

4.101 electromagnetic environment (EME). *See:* **environment, electromagnetic.**

4.102 electromagnetic environment effects (E^3). The impact of the electromagnetic environment upon the operational capability of electronic or electrical systems, equipment, or devices. It encompasses all electromagnetic disciplines, including electromagnetic compatibility; electromagnetic interference; electromagnet-ic vulnerability; electromagnetic pulse; electronic countermeasures; hazards

of electromagnetic radiation to ordnance and volatile materials; and natural phenomena effects of lightning and precipitation static (p-static). (NATO [15])

4.103 electromagnetic interference (EMI). (1) Any electromagnetic disturbance, whether intentional or not, that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronic or electrical equipment. (NATO [15]). (2) Degradation of the performance of a piece of equipment, transmission channel, or system caused by an electromagnetic disturbance. (IEC 50(161)(1990) [7])

4.104 electromagnetic interference (EMI) control. The control of radiated and conducted energy such that the emissions unnecessary for system, subsystem, or equipment operation are minimized or reduced. Electromagnetic radiated and conducted emissions, regardless of their origin within the equipment, subsystem, or system are therefore controlled such that they do not cause unacceptable system degradation. Successful EMI control, along with susceptibility control, leads to electromagnetic compatibility (EMC).

4.105 electromagnetic interference safety margin (EMISM). The ratio between the susceptibility threshold and the level of interference present at a critical system test point or on a signal line.

4.106 electromagnetic pulse (EMP). The electromagnetic radiation caused by Compton-recoil electrons and photoelectrons from photons scattered in the materials of the nuclear device or in a surrounding medium as a result of a nuclear explosion or lightning. The resulting electric and magnetic fields may couple with electrical and/or electronic systems to produce damaging current and voltage surges. *See:* **nuclear electromagnetic pulse.**

4.107 electromagnetic pulse, high altitude (HEMP). The electromagnetic pulse produced by an exoatmospheric nuclear explosion.

4.108 electromagnetic radiation hazard (EMRADHAZ). A condition that would expose personnel, equipment, munitions, or fuel to a dangerous level of electromagnetic radiation. The electromagnetic energy is of sufficient intensity to cause sparking, ignition of volatile combustibles, harmful biological effects on humans, inadvertent operation of electroexplosive de-vices, or failures or progressive degradation in safety critical circuits. (NATO [15])

4.109 electromagnetic vulnerability. The characteristics of a system, device, or piece of equipment that cause it to suffer degradation in performance of, or inability to perform, its specified task as a result of electromagnetic interference. (NATO [15]) *See also:* **susceptibility, electromagnetic.**

4.110 electromagnetic waves. A propagating energy phenomenon resulting when there are two forms of energy, specifically in electric and magnetic field components, whereby the time rate of change of one component leads to a time change of the other. Specifically, change in magnetic flux density as a function of time produces a time-change in the associated electric field, and vice versa.

4.111 electrostatic discharge (ESD). A transfer of electric charge between bodies of different electrostatic potential in proximity or through direct contact. (IEC 50(161)(1990) [7])

4.112 emission. Electromagnetic energy propagated from a source by radiation and/or conduction.

4.113 emission, broadband. (EMC) An emission that has a bandwidth greater than that of a particular measuring apparatus or receiver. *Syn:* broadband interference. (IEC 50(161)(1990) [7])

4.114 emission, conducted. Electromagnetic emissions propagated along a metallic conductor, which could be a powerline, signal line, and/or an unintentional or fortuitous conductor such as a metallic pipe, etc.

4.115 emission control. Selective control of emitted electromagnetic or acoustic energy. The aim can be twofold:

(1) To minimize the enemy's detection of emissions and exploitation of the information so gained, or

(2) To improve the performance of friendly sensors. (NATO [15])

4.116 emission, electromagnetic interference. Any conducted or radiated emission that may cause system or subsystem degradation.

4.117 emission, harmonic. Electromagnetic radiation from a transmitter or local oscillator that is not part of the information signal, but whose frequency is an integral multiple of the carrier frequency.

4.118 emission, impulse. An emission characterized by transient disturbances separated in time by quiescent intervals. *Syn:* impulsive noise.

4.119 emission, narrowband. (EMC) An emission that has a bandwidth less than that of a particular measuring apparatus or receiver. *Syn:* narrowband interference.

4.120 emission, parasitic. Electromagnetic radiation from a transmitter that is not part of the information signal or harmonically related to the carrier, but is caused by undesired oscillations due to parasitic resonances in the circuitry.

4.121 emission, radiated. Desired or undesired electromagnetic energy, in the form of electric and magnetic fields, that is propagated through space.

4.122 emission spectrum. The distribution of the amplitude (and sometimes phase) of the components of an emission as a function of frequency.

4.123 emission, spurious. Any electromagnetic emission at a frequency or frequencies that are outside the range of the necessary emission bandwidth, the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include parasitic emissions and intermodulation products, but exclude emissions in the immediate vicinity of the necessary emission bandwidth that are a result of the modulation process and that are necessary for the transmission of information. Harmonic components are sometimes considered to be spurious emissions.

4.124 environment, electromagnetic. (1) The time distribution of the levels of power, voltage(s), current(s), and electric and magnetic field(s), within various frequency ranges, of the conducted and radiated electromagnetic emissions that may be encountered in the environment of a system or subsystem when performing its assigned mission. (2) The totality of electromagnetic phenomena existing at a given location. (IEC 50(161)(1990) [7]) (NATO [15])

4.125 environment, operational. The aggregate of all conditions and influences that may affect the operation of a system.

4.126 equipment. Any electrical, electronic, or electromechanical device, or collection of items intended to operate as an integral unit to perform a singular function.

4.127 equipment, telecommunications. Any equipment that transmits, emits, or receives signs, signals, images, sound, or information of any nature by wire, radio, visual, or other electromagnetic means.

4.128 equipment under test (EUT). The device, equipment, subsystem, or system to be tested or that is under test.

4.129 equipotential bonding. Electrical connection putting various exposed conductive parts and extraneous conductive parts at an equal potential.

4.130 equipotential bonding conductor. A protective conductor for ensuring equipotential bonding. *See:* **bonding jumper.**

4.131 error rate (bit, block, character, element). The ratio of the number of characters of a message incorrectly received to the number of characters of the message received.

4.132 error rate, bit (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}, etc.

4.133 facsimile. (1) A process, or the result of a process, by which fixed graphic material, including text, pictures, and/or images, is scanned and the information converted to signal waves that are used either locally or remotely to produce, in record form, a likeness (facsimile) of the subject copy. (2) A system of telecommunication for the transmission of fixed images, with or without halftones, with a view to their reproduction in permanent form.

4.134 far-field. That distance between two directional antennas equal to D^2/λ or 3λ, whichever is larger, where D is the maximum aperture dimension of the largest antenna, and λ is the wavelength at the fundamental frequency. If the test antenna aperture (D_2) is larger than one tenth of the aperture (D_1) of the antenna being measured, then the minimum test site distance is $(D_1 + D_2)^2/\lambda$. This is the minimum range that will yield a satisfactory approximation of the far-field pattern. For directional antennas, these formulas apply primarily to the on-axis distance required to be in the far-field of the main beam. Generally, the required distance decreases as a function of the angle off the main beam axis.

4.135 far-field region. The region of the field of an antenna where the angular field distribution is essentially independent of the distance from a specified point in the antenna region. (IEEE Std 100-1988 [3]) *Notes:* (1) In the free space, if the antenna has a maximum overall dimension, D, that is large compared to the wavelength, the far-field region is commonly taken to exist at distances greater than $2D^2/\lambda$ from the antenna, λ being the wavelength. (IEEE Std 100-1988 [3]) For directional antennas, these formulas apply primarily to the on-axis distance required to be in the far field of the main beam. Generally, the required distance decreases as a function of the angle off the main beam axis. (2) For an antenna focused at infinity, the far-field region is sometimes referred to as the Fraunhofer region.

4.136 field strength meter (FSM). A calibrated radio receiver for measuring (electric and/or magnetic) field strength. (IEEE Std 100-1988 [3])

4.137 field strength. A general term that usually means the magnitude of the electric field vector, commonly expressed in volts per meter, but may also mean the magnitude of the magnetic H-field vector, commonly expressed in amperes per meter. (IEEE Std 100-1988 [3])

4.138 flicker. An impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time. (IEC 50(161)(1990) [7])

4.139 frequency allocation. Entry in the table of frequency allocations of a given frequency band for the purpose of its use by one or more (terrestrial or space) radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned. (NTIA revised 1/90 [14].) (ITU Radio Regulations, 1982 Edition)

4.140 frequency band, assigned. 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 revised 1/90 [14].) (ITU Radio Regulations, 1982 Edition)

4.141 frequency assignment. Assignment of a radio frequency or radio frequency channel; authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions. (NTIA revised 1/90 [14].) (ITU Radio Regulations, 1982 Edition)

4.142 frequency, characteristic. A frequency that can be easily identified and measured in a given emission. (NTIA [14])

4.143 frequency, reference. A frequency having a fixed and specified position with respect to the assigned frequency. (NTIA [14])

4.144 frequency-selective voltmeter (FSVM). A frequency-selective radio receiver, with provisions for output indication. (IEEE Std 100-1988 [3])

4.145 frequencies, standard test. That group of frequencies to which transmitters and/or receivers are tuned during a specified test procedure.

4.146 frequency tolerance. The maximum permissible departure by the center frequency of the frequency band occupied by an emission from the assigned frequency, or by the characteristic frequency of an emission from the reference frequency. The frequency tolerance is usually expressed in parts per million (parts in 10^6) or in hertz (Hz). (NTIA [14])

4.147 frequency, waveguide cutoff. For a given transmission mode in a nondissipative (ideal) waveguide, the frequency at which the propagation constant is zero. (IEEE Std 100-1988 [3]) *Note:* For ideal waveguides with walls of infinite conductivity, propagation along the guide ceases abruptly for frequencies below the cutoff frequency. For practical waveguides with dissipation, i.e., with waveguide walls of finite conductivity, propagation along the waveguide does not stop abruptly at a "cutoff" frequency. Instead, a transition range of frequencies exists over which transition occurs from propagation to rapidly increased attenuation of modes as frequency decreases. (See [5], pages 340–342.)

4.148 gigahertz transverse electromagnetic (GTEM) cell. A tapered TEM cell or anechoic chamber hybrid intended for general radiated emissions and susceptibility testing. It is designed to be useful over the entire range of typical EMC test frequencies; to exhibit a precise, uniform field over the recommended test volume; to provide high sensitivity with minimal background noise; and to provide good correlation to standard-type ground screen measurements.

4.149 ground (earth). The conductive mass of the earth, whose electric potential at any point is conventionally taken as equal to zero. (IEC 50(161)(1990) [7])

4.150 ground electrode (earth electrode). A conductive part or a group of conductive parts in intimate contact with and providing an electrical connection with earth (ground). (IEC 50(161)(1990) [7])

4.151 ground, facility system. The electrically interconnected system of conductors and conductive elements that provides multiple current paths to earth. The facility ground system includes the earth electrode subsystem, lightning protection subsystem, signal reference subsystem, fault protection subsystem, as well as the building structure, equipment racks, cabinets, conduit, junction boxes, raceways, ductwork, pipes, and other normally non-current-carrying metal elements. (MIL-HDBK-419A-1987 [12])

4.152 grounding. (1) The bonding of an equipment case, frame, or chassis to an object or a vehicle structure to ensure a common potential. (NATO [15]) (2) The connecting of an electric circuit or equipment to earth or to some conducting body of relatively large extent that serves in place of earth.

4.153 grounding conductor (earthing conductor). A protective conductor connecting the main earthing (grounding) terminal or bar to the earth (ground) electrode. (IEC 50(161)(1990) [7])

4.154 grounding network (earthing network). The part of an earthing (grounding) installation that is restricted to the earth (ground) electrodes and their interconnections. (IEC 50(161)(1990) [7])

4.155 grounding terminal, main. (main earthing terminal). A terminal or bar provided for the connection of protective conductors, including equipotential bonding conductors and conductors for functional earthing (grounding), if any, to the means of earthing (grounding). (IEC 50(161)(1990) [7])

4.156 ground, multipoint. A scheme of circuit/shield/enclosure grounding at various points to an equipotential ground reference (such as a ground plane) used for high frequencies so as to minimize common impedance coupling.

4.157 ground plane. A conducting surface or plate used for equipment as a common reference for circuit returns and electric or signal potentials, and that reflects electromagnetic waves. Specifically: **ground (reference) plane.** A flat, conductive surface whose potential is used as a common reference. (IEC 50(161)(1990) [7])

4.158 ground plane, equipotential. A ground reference scheme used for high frequencies to minimize common impedance coupling. A grid, sheet, mass, or masses of conducting material that, when bonded together, offers a negligible impedance to current flow. (MIL-HDBK-419A-1987 [12])

4.159 ground, single-point. A scheme of circuit or shield grounding in which each circuit or shield has only one physical connection to ground, ideally at the same point, for a given system or subsystem. This technique prevents undesirable voltage potentials from developing between circuit ground and system ground due to currents flowing through ground impedance(s).

4.160 GTEM cell. *See:* **gigahertz transverse electromagnetic (GTEM) cell.**

4.161 harden (EMC). to reduce the susceptibility of a piece of equipment, system, or facility to electromagnetic environmental effects. The reduction in susceptibility is normally measured in decibel (dB) units.

4.162 hazards of electromagnetic radiation to fuel (HERF). Potential for electromagnetic radiation to cause spark ignition of volatile combustibles, such as aircraft fuel.

4.163 hazards of electromagnetic radiation to ordnance (HERO). Potential for munitions or electroexplosive devices to be adversely affected by electromagnetic radiation.

4.164 hazards of electromagnetic radiation to personnel (HERP). Potential for electromagnetic radiation to produce harmful biological effects in humans.

4.165 hertz. The unit of frequency, one cycle per second. (IEEE Std 100-1988 [3])

4.166 host. A device to which other devices (peripherals) are connected and that generally controls those devices.

4.167 image frequency. A term that applies to heterodyne frequency converters, in which one of the two sidebands produced by beating is selected. Also refers to an undesired input frequency capable of producing the selected frequency by the same process. *Note:* The word “image” implies the mirrorlike

symmetry of signal and image frequencies about the beating oscillator frequency or the intermediate frequency, whichever is higher. (IEEE Std 100-1988 [3])

4.168 image rejection (image response). Response of a superheterodyne receiver to the image frequency, as compared to the response to the desired frequency. (IEEE Std 100-1988 [3])

4.169 immunity (to a disturbance). The ability of a device, piece of equipment, or system to perform without degradation in the presence of an electromagnetic disturbance. (IEC 50(161)(1990) [7])

4.170 impedance control point (ICP). The physical point along a power lead at which the impedance is controlled. The impedance is measured between this point and the ground plane.

4.171 impulse. (1)An electrical pulse of short duration relative to a cycle at the highest frequency being considered. Mathematically, it is a pulse of infinite amplitude, infinitesimal duration, and finite area. Its spectral energy density is proportional to its volt-time area, and is uniformly and continuously distributed through the spectrum up to the highest frequency at which it may be considered an impulse. Regularly repeated impulses of uniform level will generate a uniform spectrum of discrete frequencies (Fourier components) separated in frequency by an amount equal to the repetition frequency. (2) A pulse that, for a given application, approximates a unit pulse or a Dirac delta function (IEC 50(161)(1990) [7]).

4.172 impulse bandwidth. *See:* **bandwidth, impulse.**

4.173 impulse generator. A standard reference source of broadband impulse energy. (IEEE Std 100-1988 [3])

4.174 impulse strength or spectrum amplitude. (1) The rms unmodulated sine-wave voltage, at the tuned frequency, required to produce in a circuit a peak response equal to that produced by the impulse in question, divided by the impulse bandwidth of the circuit. For the purpose of this standard, it is expressed in terms of microvolts per megahertz (μV/MHz) or decibel microvolts per megahertz [dB(μV/MHz)]. (2) The area under the amplitude-time relation for the impulse. (IEEE Std 100-1988 [3])

4.175 impulsive noise. Noise that, when incident on a particular piece of equipment, manifests itself as a succession of distinct pulses or transients. (IEC 50(161)(1990) [7])

4.176 industrial radio frequency (RF) heating equipment. Any apparatus that generates and uses RF energy for, or in connection with, industrial heating operations in a manufacturing or production process.

4.177 industrial, scientific, and medical equipment (ISM). Apparatus intended for generating RF energy for industrial, scientific, or medical purposes. (IEEE Std 100-1988 [3])

4.178 industrial, scientific, medical (ISM) qualifier. Qualifies equipment or appliances designed to generate and use locally RF energy for industrial, scientific, medical, domestic, or similar purposes, excluding applications in the field of telecommunications. (IEC 50(161)(1990) [7])

4.179 information technology equipment (ITE). Equipment designed for the purpose of (1) receiving data from an external source (such as data input line or via a keyboard); (2) performing some processing functions on the received data (such as computation, data transformation or recording, filing, sorting, storage, or transfer of data); (3) providing a data output (either to other equipment or by the reproduction of data or images). *Note:* This definition includes electrical or electronic units or systems that predominantly generate a multiplicity of periodic binary pulsed electrical or electronic waveforms and are designed to perform data processing functions, such as word processing, electronic computation, data transformation, recording, filing, sorting, storage, retrieval and transfer, and reproduction of data as images. (IEC 50(161)(1990) [7])

4.180 insertion loss. Resulting from the insertion of a transducer in a transmission path or system: the ratio of (1) the power delivered to that part of the system following the transducer, before insertion of the transducer, to (2) the power delivered to that same part of the system after insertion of the transducer. It is generally expressed as a ratio in decibels (dB). (IEEE Std 100-1988 [3])

4.181 interconnecting cable. Any lead assembly external to subsystems or equipment enclosures that provides functions other than power distribution. Subsets are (1) *Power cable.* Any lead assembly providing primary power. (2) *Signal cable.* Any lead assembly that provides functions other than power.

4.182 interference (disturbance), broadband. An undesired emission that has a spectral energy distribution sufficiently broad that the response of the measuring receiver in use does not vary more that 3 dB when tuned over the frequency range of plus or minus two impulse bandwidths. *See:* **emission, broadband.**

4.183 interference (disturbance), conducted. Undesired electromagnetic energy that is propagated along a conductor, usually defined in terms of a voltage and/or current level.

4.184 interference (disturbance), electromagnetic. Any conducted or radiated electromagnetic energy that interrupts, obstructs, or otherwise degrades or limits the effective performance of telecommunications or other electrical and electronic equipment.

4.185 interference, radiated. Undesired electromagnetic energy, in the form of electric and/or magnetic fields, that is radiated from an electrical source associated with or part of any unit, antenna, cable, or interconnecting wiring that causes performance degradation.

4.186 intermodulation. The mixing of two or more signals in a nonlinear element to produce signals at new frequencies that are sums and differences of the input signals or their harmonics. The nonlinear element(s) may be internal to the system, subsystem, or equipment, or may be some external device(s).

4.187 jitter. (1) Short-time instability of a signal. The instability may be in either amplitude or phase or both. (2) A random departure from regular repetition.

4.188 jitter, phase. A phenomenon, from causes known or unknown, that results in a relative shifting in the phase of the signal. The shifting in phase may appear to be random, cyclic, or both. The amount of phase jitter may be expressed in degrees with any cyclic component expressed in hertz.

4.189 jitter, time. A measure of the uncertainty of the repetitive position of a time mark. Time-related, abrupt, spurious variations in the duration of any specified, related time interval.

4.190 lead. One wire of a cable, cord, or bundle.

4.191 lightning electromagnetic pulse (LEMP). The electromagnetic radiation associated with a lightning discharge. The resulting electric and magnetic fields may couple with electrical/electronic systems to produce damaging current and voltage surges. (NATO [15])

4.192 lightning surge. A transient electric disturbance in an electrical and/or electronic circuit caused by a lightning discharge.

4.193 line impedance stabilization network (LISN). A network inserted in the supply mains lead of apparatus to be tested that provides, in a given frequency range, a specified load impedance for the measurement of disturbance voltages and that may isolate the apparatus from the supply mains in that frequency range.

4.194 malfunction. (EMC) A failure of a system or associated subsystem and/or equipment due to electromagnetic interference or susceptibility that results in system damage, personal injury, permanent unacceptable reduction in system effectiveness, or degradation of performance.

4.195 measurement standards. Those devices used to calibrate measuring and test equipment (M&TE) or other measurement standards and provide traceability to National Institute of Standards and Technology (NIST) standards.

4.196 measuring and test equipment (M&TE). Any device used to measure, gauge, test, inspect, or otherwise determine compliance of electric or electronic devices with prescribed technical requirements.

4.197 medical diathermy equipment. Any apparatus (other than surgical diathermy apparatus designed for intermittent medical operation with low power), that generates and uses RF energy for therapeutic purposes.

4.198 midpulse minimum visible signal (MPMVS). The minimum input pulse signal power level that permits visibility of the center of the output pulse. This level is obtained in the same manner as the minimum discernible signal (MDS).

4.199 minimum discernible signal (MDS). *See:* **susceptibility threshold.**

4.200 mode-stirred chamber. An electromagnetic reverberation chamber (i.e., a nonanechoic shielded chamber) used to generate an average, uniformly homogeneous electromagnetic field that is achieved by rotating an irregularly shaped mode stirrer or tuner.

4.201 modulation techniques, baseband

(1) *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. (IEEE Std 100-1988 [3])

(2) *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.

(3) *Frequency-shift keying (FSK).* That form of frequency modulation in which the modulating signal shifts the output frequency between predetermined values, and the output wave has no phase discontinuity. (IEEE Std 100-1988 [3])

(4) *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. (IEEE Std 100-1988 [3])

(5) *Pulse-amplitude modulation (PAM).* (a) Modulation in which the modulating wave is caused to amplitude-modulate a pulse carrier. (IEEE Std 100-1988 [3]) (b) A baseband modulation technique where an analog waveform is converted to a digital or discrete waveform by successive samples of pulses whose amplitudes are derived from the input waveform.

(6) *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 that 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. (IEEE Std 100-1988 [3])

(7) *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. *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. (IEEE Std 100-1988 [3])

(8) *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. (IEEE Std 100-1988 [3])

4.202 modulation types

(1) *Amplitude modulation (AM).* The process by which a continuous wave (carrier) is caused to vary in amplitude by the action of another wave containing information. (IEEE Std 100-1988 [3])
(2) *Continuous wave (CW).* Waves of which the successive oscillations are identical under steady-state conditions. (IEEE Std 100-1988 [3])
(3) *Double sideband (DSB).* AM transmission accompanied by both sidebands. The carrier may or may not be suppressed.
(4) *Frequency modulation (FM).* The cyclic or random dynamic variation, or both, of instantaneous frequency about a mean frequency during steady-state electric system operation. (IEEE Std 100-1988 [3])
(5) *Independent sideband (ISB).* AM with the carrier either suppressed or reinserted, accompanied by both sidebands, each of which contains separate information.
(6) *Phase modulation (PM).* Angle modulation in which the angle of a carrier is caused to depart from its reference value by an amount proportional to the instantaneous value of the modulating function. (IEEE Std 100-1988 [3])
(7) *Single sideband (SSB).* (a) AM in which one sideband is transmitted and the other sideband is suppressed. The carrier wave may be either transmitted or suppressed. (b) Modulation whereby the spectrum of the modulating function is translated in frequency by a specified amount either with or without inversion (IEEE Std 100-1988 [3]).

4.203 narrowband interference. *See:* **emission, narrowband.**

4.204 National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NAVLAP). An accreditation of laboratories by NIST based upon their ability to perform specific testing methods. This includes an evaluation of proper test equipment and calibration, qualifications of test personnel, procedures for handling test samples, record keeping, test report preparation, and proficiency testing as applicable in certain areas.

4.205 National Institute of Standards and Technology (NIST) traceability. The process by which the determined value of a measurement is compared, directly or indirectly, through a series of analytical and/or laboratory calibrations, including a comprehensive analysis and determination of the cumulative error of each successive comparison, to the value that would be obtained if the measurement had been determined by using the primary national standard established by NIST for that type of measurement. (ANSI) *Note:* Ascertaining NIST traceability using antenna calibration as an example: The requirement to show traceability of all antenna calibrations to NIST does not necessarily mean that all antennas must be individually calibrated by NIST. In fact, there are several ways to demonstrate the required traceability to NIST. For example, an antenna could be calibrated by the owner or an independent agency using a technique that is recognized to be reliable and theoretically correct, such as the well-known three-antenna method. If one can show traceability of the instrumentation used in this procedure (such as signal generators and RF voltage standards) to primary voltage standards at NIST, then one can establish traceability of the antenna calibration to NIST. It is also possible for a user to calibrate an antenna by comparing its performance with a “check standard” that has been calibrated by NIST, if it can be demonstrated that this check standard is stable and repeatable. However, it is desirable that the standard technique and equipment employed be specifically traceable to NIST standards.

4.206 near-field regions

(1) *Radiating.* The region of the field of an antenna between the reactive near-field region and the far-field region wherein radiation fields predominate and wherein the angular field distribution is dependent upon the distance from the antenna. (IEEE Std 100-1988 [3]) *Notes:* (a) If the antenna has a maximum overall dimension that is not large compared to the wavelength, this field region may not exist. (b) For an antenna focused at infinity, the radiating near-field region is sometimes referred to as the Fresnel region on the basis of analogy to optical terminology. (IEEE Std 100-1988 [3])

(2) *Reactive.* That portion of the near-field region immediately surrounding the antenna, wherein the reactive field predominates. *Note:* For a very short dipole, or equivalent radiator, the outer boundary is commonly taken to exist at a distance $\lambda/2\pi$ from the antenna surface, where λ is the wavelength. (IEEE Std 100-1988 [3])

4.207 neutral conductor (*N*). A conductor connected to the neutral point of a system and capable of contributing to the transmission of electrical energy.

4.208 noise, impulsive. *See:* **emission, impulse.**

4.209 noise, random. (1) Noise that comprises transient disturbances occurring at random. *Note:* The part of the noise that is unpredictable except in a statistical sense. (IEEE Std 100-1988 [3]) (2) Noise whose values at given instants are not predictable. (IEC 50(161)(1990) [7])

4.210 noncritical area. A location in a ground installation where EMI disturbances will not result in failure or abortion of a mission or degradation of the overall system performance. Examples of areas that may be considered noncritical are office buildings, recreational areas, laundry areas, food servicing areas, drafting rooms, and woodworking shops. This term is primarily of military use.

4.211 normalized site attenuation (NSA). Site attenuation divided by the antenna factors of the radiating and receiving antennas (all in linear units).

4.212 nuclear electromagnetic pulse (NEMP). The electromagnetic radiation caused by Compton-recoil electrons and photoelectrons from photons scattered in the materials of the nuclear device or in a surrounding medium as a result of a nuclear explosion. The resulting electric and magnetic fields may couple with electrical and/or electronic systems to produce damaging current and voltage surges. (NATO [15])

4.213 octave. In electric communication, the interval between two frequencies having a ratio of 2 to 1. (IEEE Std 100-1988 [3])

4.214 open-area test site (OATS). A site for electromagnetic measurements that is open, flat terrain at a distance far enough away from buildings, electric lines, fences, trees, underground cables, pipelines, and other potential reflective objects, so that the effects due to such are negligible. See ANSI C63.7-1988 [2] for guidance on the construction of open-area test sites.

4.215 operate. The ability of a piece of equipment, subsystem, or system to perform its intended function, without unacceptable degradation, while exposed to the electromagnetic environment.

4.216 operation, duplex. The operation of transmitting and receiving apparatus at one location in conjunction with associated transmitting and receiving equipment at another location, the processes of transmission and reception being concurrent. (IEEE Std 100-1988 [3])

4.217 operation, simplex. A method of operation in which communication between two stations takes place in one direction at a time. *Note:* This includes ordinary transmit-receive operation, press-to-talk operation, voice-operated carrier, and other forms of manual or automatic switching from transmit to receive. (IEEE Std 100-1988 [3])

4.218 out-of-band emission. (1) Emission of a frequency or frequencies outside a specified frequency range. (2) Emission on a frequency or frequencies immediately outside the necessary bandwidth that results from the modulation process but excluding spurious emissions. (ITU [8])

4.219 parasitic oscillation. An unwanted oscillation produced in equipment at a frequency independent of both the operating frequencies and of frequencies related to the generation of desired oscillations. (IEC 50(161)(1990) [7])

4.220 phase lock loop. (1) A circuit that, normally, automatically controls an oscillator so that it remains in a fixed phase relationship with a reference signal. The phase lock loop is used in a variety of applications, such as tracking filters and frequency discriminators. (2) A circuit for synchronizing a variable local oscillator with the phase of a transmitted signal. (IEEE Std 100-1988 [3])

4.221 photon noise (quantum noise). (Fiber optics) Noise attributable to the discrete or particle nature of light. (IEEE Std 100-1988 [3])

4.222 plane wave. (1) A wave in which the only spatial dependence of the field vectors is through a common exponential factor whose exponent is a function only of position with respect to the coordinate in the direction of propagation. The equiphase surfaces of the wave form a family of parallel planes. (IEEE Std 100-1988 [3]) (2) A wave in which the wave fronts are everywhere parallel planes normal to the direction of propagation.

4.223 point, critical. A point in a system or subsystem considered most susceptible to interference, due to sensitivity, inherent susceptibility, importance to mission objectives, or exposure to the electromagnetic environment. The critical point is electrical in nature and normally precedes the subsystem output stage.

4.224 point, monitor. Describes one or more points in a system or subsystem used to observe or measure responses of the system or subsystem. Monitor points for determining unacceptable response shall be at the system or subsystem output and need not be electrical in nature. Monitor points used in conjunction with critical points to determine that no inadvertent response exists may be located at either internal system points or at the system or subsystem output. If monitor points are chosen at internal subsystem locations, particular caution must be exercised to ensure that the monitoring instrumentation does not influence the test results.

4.225 point of entry (or exit) (POE). A localized critical point of a system resulting in appreciable propagation of energy to, or from, the system, subsystem, or equipment.

4.226 power. The rate of generating, transferring, or using energy. The basic unit is the *watt*, or joule per second. (IEEE Std 100-1988 [3])

4.227 power, carrier. The average power supplied to the antenna transmission line by a transmitter during one RF cycle under conditions of no modulation. This definition does not apply to pulse-modulated emissions. (NTIA [14])

4.228 power density. (1) Of a traveling wave, the time-average value of the Poynting vector. (2) Emitted power per unit cross-sectional area normal to the direction of wave propagation. (IEEE Std 100-1988 [3])

4.229 power, effective radiated (ERP). (1) The product in a given direction of the effective gain of the antenna in that direction over a half-wave dipole antenna, and the antenna power input. (IEEE Std 100-1988 [3]) (2) The power supplied to the antenna multiplied by the relative gain of the antenna in a given direction.

4.230 power, equivalent (effective) isotropically radiated (EIRP). (1) In a given direction, the gain of a transmitting antenna multiplied by the net power accepted by the antenna from the con-

nected transmitter. (IEEE Std 100-1988 [3]) (2) The product of the power of an emission as supplied to an antenna and the antenna gain in a given direction relative to an isotropic antenna.

4.231 power, mean. (1) The magnitude of power averaged over a specified interval of time. (2) The power supplied to the antenna transmission line by a transmitter during normal operation, averaged over a time sufficiently long compared with the period of the lowest frequency encountered in the modulation. A time of 0.1 s during which the mean power is greatest will normally be selected. (NTIA [14])

4.232 power, peak envelope. The average power delivered to the antenna transmission line by a transmitter during one RF cycle at the highest crest of the modulation envelope, taken under conditions of normal operations. (NTIA [14])

4.233 precipitation static (P-static). (1) Electromagnetic interference effects primarily on antenna-connected receivers caused by corona discharge at sharp edges or points of structure, arcing across nonconductive surfaces, and arcing between conductive joints or panels that are not electrically bonded. (NATO [15]) (2) Electromagnetic disturbance caused by the (random) electrostatic discharge created as a result of the potential buildup caused by the charge (electron) transfer between air, moisture, and airborne particles and the structure of a vehicle moving in the atmosphere, such as an aircraft or spacecraft.

4.234 probability density function. The first derivative of the probability distribution function; it represents the probability of obtaining a given value. (IEEE Std 100-1988 [3]) *Note:* The function in question is assumed to satisfy proper mathematical conditions such that the derivative can be defined.

4.235 pulse. An abrupt variation of short duration of a physical quantity followed by a rapid return to the initial value. (IEC 50(161)(1990) [7])

4.236 pulse duration (pulse width, pulse length). The duration between the 50% amplitude points on the leading edge and the trailing edge of the pulse, unless otherwise specified. (The 10% amplitude points are also often used.)

4.237 pulse rise time. The interval between the instant at which the instantaneous amplitude first reaches specified lower and upper limits, namely, 10% and 90% of the peak pulse amplitude, unless otherwise stated. (IEEE Std 100-1988 [3])

4.238 quiet zone. The region in an anechoic shielded enclosure where the reflexivity is controlled to a design level.

4.239 radar. A system that detects targets by radiating electromagnetic energy and detecting the echo of the radiated wave returned as a reflection from the target. (The nature of the echo signal provides information about the target.)

4.240 radar absorbing material (RAM). *See:* **absorber.**

4.241 radar cross section (RCS). A measure of the reflective strength of a radar target; usually represented by the symbol σ (Greek sigma), measured in square meters, and defined as 4π times the ratio of the power-per-unit solid angle scattered in a specified direction to the power- per-unit area in a plane wave incident on the scatterer from a specified direction. (IEEE Std 100-1988 [3])

4.242 radiation. The emission of energy in the form of electromagnetic waves. (IEEE Std 100-1988 [3])

4.243 radiation, electromagnetic. (1) The emission of energy in the form of electromagnetic waves. (IEEE Std 100-1988 [3]) (2) The phenomenon by which energy in the form of electromagnetic waves

emanates from a source into space. (3) Energy transferred through space in the form of electromagnetic waves. *Note:* By extension, the term “electromagnetic radiation” sometimes is also used to include induction phenomena. (IEC 50(161)(1990) [7])

4.244 radiation device, incidental. A device that generates RF energy during the course of its operation although the device is not intentionally designed to emit or radiate this energy.

4.245 radiation device, restricted. A device in which the generation of RF energy is intentionally incorporated into the design, and in which the RF energy is conducted along wires or is radiated, exclusive of transmitters for which provisions are made under those parts of Chapter 7 of the NTIA Manual (excluding nonlicensed devices and industrial, scientific, and medical (ISM) equipment). (NTIA [14])

4.246 radio. A general term applied to the use of electromagnetic waves in the RF region of the spectrum.

4.247 radio altimeter. An altimeter using radar principles for height measurement. Height is determined by measurement of propagation time of a radio signal transmitted from an airborne or spacecraft vehicle and reflected back to the vehicle from the terrain below. *Syn:* radar altimeter. (IEEE Std 100-1988 [3])

4.248 radio astronomy. The branch of astronomy dealing with the passive reception and analysis of electromagnetic radiations of radio wavelength from extraterrestrial sources. (IEEE Std 100-1988 [3])

4.249 radiocommunication. Telecommunication by means of electromagnetic (radio) waves.

4.250 radio frequency (RF). (1) A frequency in the portion of the electromagnetic spectrum that is between the audio-frequency portion and the infrared portion. (2) A frequency useful for radio transmission. *Note:* The present practical limits of radio frequency are roughly 9 kHz to 3 THz (3000 GHz). (IEEE Std 100-1988 [3]) (FCC [6])

4.251 radio frequency (RF) stabilized arc welder. Any welding equipment that utilizes RF energy to initiate and stabilize the arc. An RF stabilized arc welder includes the source of the RF and welding current, the welding torch, and all interconnecting cables.

4.252 radio frequency (RF) systems, wired. Systems employing restricted radiation devices in which the RF energy is conducted or guided along wires or in cables, including electric power and telephone lines.

4.253 radio noise meter. A device for measuring any unwanted disturbance within the RF band, such as undesired electromagnetic waves in any transmission channel or device. (Based on IEEE Std 100-1988 [3].)

4.254 radio waves (or Hertzian waves). Electromagnetic waves of radio frequencies. *Note:* Current usage includes frequencies up to 3 THz (3000 GHz). (IEEE Std 100-1988 [3])

4.255 reference test site. A test site for electromagnetic radiation measurements that is an open, flat area (open-area test site), characteristic of cleared, level terrain. Essentially, such a site shall be void of buildings, electric lines, fences, trees, underground cables, pipelines, etc., except as required to perform the test. Such a site shall meet the **test site acceptability criterion.**

4.256 reflection coefficient. At a given frequency, at a given point, and for a given mode of propagation, the ratio of some quantity associated with the reflected wave to the corresponding quantity in the incident wave.

4.257 reflectivity. The ratio of the level of reflected or spurious energy to the level of the direct energy at the specified test region.

4.258 response, image. The response of a superheterodyne receiver to the image frequency, as compared to the response of the desired frequency. (IEEE Std 100-1988 [3]) This is often expressed in decibels (dB).

4.259 response, malfunction level. A deviation from the standard reference output that could cause (or indicate) a malfunction.

4.260 response, spurious. Any response, other than the desired response, of an electric transducer or device. (IEEE Std 100-1988 [3])

4.261 response, standard. A device response, to a stimulus or signal, that falls within the specified limits or standard(s) for a given piece of equipment or system.

4.262 response, undesirable. A deviation from the standard reference output that exceeds the tolerances as defined in the equipment specification.

4.263 safety margin. The difference expressed in decibels (dB) between the interference susceptibility threshold and the actual or expected interference level that exists at the place of influence. (NATO [15])

4.264 scatter, ionospheric. The propagation of radio waves by scattering as a result of irregularities or discontinuities in the physical properties of the ionosphere. (NTIA [14])

4.265 scatter, tropospheric. The propagation of radio waves by scattering as a result of irregularities or discontinuities in the physical properties of the troposphere. (NTIA [14])

4.266 selectivity. The ability or a measure of the ability of a receiver to discriminate between a given wanted signal and unwanted signals. (IEC 50(161)(1990) [7])

4.267 self-compatibility. A requirement that the operational performance of a piece of equipment or subsystem shall not be degraded, nor shall it malfunction when all of the units or devices in the equipment or subsystem are operating together at their designed levels of efficiency or their nominal design capability.

4.268 semi-anechoic chamber. *See:* **anechoic enclosure [radio frequency (RF)].**

4.269 shield. A housing, screen, or other object, usually conducting, that substantially reduces the effect of electric or magnetic fields on one side thereof, upon devices or circuits on the other side. (IEEE Std 100-1988 [3])

4.270 shielded enclosure. (1) A housing or other type of enclosure, constructed of conducting material, that reduces the effects of electric and/or magnetic fields on one side thereof on devices, circuits, or systems located on the other side. (2) For measurements, a specially designed enclosure that affords attenuation to outside RF ambients, thereby permitting measurements of electromagnetic emissions from the test sample to be measured without interference from undesired external electromagnetic radiators.

4.271 shielded enclosure (screened room). A mesh or sheet metallic housing designed expressly for the purpose of separating electromagnetically the internal and the external environment. (IEC 50(161)(1990) [7])

4.272 shielding effectiveness. A measure of the ability of a shield to exclude or confine electromagnetic waves. Usually expressed as the ratio (in the frequency domain) of the incident to the penetrating signal amplitudes in decibels (dB). (IEEE Std 100-1988 [3])

4.273 signal reference subsystem. A subsystem that establishes a common reference for communication-electronics (C-E) equipment, thereby minimizing voltage differences between pieces of equipment. The signal reference subsystem can be a multiple point or equipotential ground plane, or a single point system.

4.274 signal-to-noise ratio. The ratio of the wanted signal level to the electromagnetic noise level as measured under specified conditions. (IEC 50(161)(1990) [7]) *Note:* Other types of noise are usually present, such as shot noise, etc., but are not considered as part of EMC considerations.

4.275 specification. (1) A statement of requirements to be satisfied by a product, material, service, or process. (2) A statement of a set of requirements to be satisfied by a product, a material or process indicating, wherever appropriate, the procedure by means of which it may be determined whether the requirements given are satisfied. (IEEE Std 100-1988 [3])

4.276 spectral power density. The power density per unit bandwidth.

4.277 spectrum amplitude. The amplitude vs. frequency characterization of a waveform. (See IEEE Std 100-1988 [3].)

4.278 specular region. Areas of chamber surfaces that could reflect energy from the radiating surface directly into the quiet zone with one bounce.

4.279 spike. A unidirectional pulse of short duration. (IEC 50(161)(1990) [7])

4.280 spurious emission. *See:* **emission, spurious.**

4.281 standard. A prescribed set of conditions and requirements, established by authority or agreement, for continuous application. A standard takes the form of a document containing a set of conditions to be fulfilled, or an object of comparison. For the purposes of this document, the provisions of a standard as defined and utilized shall be suitable to and capable of certification.

4.282 standard reference output. The output level of a particular test sample for a given input level that defines normal operational performance, and is used as a reference level when relating any deviation from normal operational performance that occurs during susceptibility testing (e.g., signal-plus-noise ratio in the receiver for a specified input signal). The standard reference output should be defined in the individual equipment specification.

4.283 station. One or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment necessary at one location for providing a telecommunications service.

4.284 stripline. A transmission line consisting of a strip conductor above or between extended parallel conducting surfaces. (IEEE Std 100-1988 [3])

4.285 subsystem. A portion of a system containing two or more integrated components that, while not completely performing the specific function of a system, may be isolated for design, test, or maintenance. For the purpose of establishing EMC requirements, either of the following shall be considered as subsystems. In either case, the devices or equipment may be physically separated when in operation and will be installed in fixed or mobile stations, vehicles, or systems.

(1) A collection of devices or equipment designed and integrated to function as a single entity but wherein no device or equipment is required to function as an individual device or equipment.

(2) A collection of equipment and subsystems as defined in (1), designed and integrated to function as a major subdivision of a system and to perform an operational function or functions. Some activities consider these collections as systems; however, as noted above, they will be considered as subsystems.

4.286 suppression. The reduction or elimination of undesired emissions by such techniques as filtering, bonding, shielding, absorption, and grounding, or any combination thereof.

4.287 suppression, disturbance. Action that reduces or eliminates the electromagnetic disturbance. (IEC 50(161)(1990) [7])

4.288 survive. The ability of a piece of equipment, subsystem, or system to resume functioning without evidence of degradation following temporary exposure to an adverse electromagnetic environment. This implies that the system performance will be degraded during exposure to the environment, but the system will not experience any damage, such as component burnout, that prevents it from operating when the adverse electromagnetic effects are removed or reduced below allowable susceptibility levels.

4.289 susceptibility, conducted. A measure of the interference signal current and/or voltage required on power, control, and/or signal leads to cause an undesirable response or degradation of performance.

4.290 susceptibility, electromagnetic. The inability of a device, piece of equipment, or system to perform without degradation in the presence of an electromagnetic disturbance. *Note:* Susceptibility is a lack of immunity. (IEC 50(161)(1990) [7])

4.291 susceptibility, radiated. A measure of the radiated electric or magnetic interference field level required to cause equipment, subsystem, or system performance degradation.

4.292 susceptibility threshold. The minimum input signal power level that permits visibility of the output signal on a display unit. This level is obtained by initially setting the input signal level above the detection threshold and then slowly decreasing the amplitude. *Syn:* **minimum discernible signal (MDS).**

4.293 system. A composite of equipment, subsystems, skilled personnel, and techniques capable of performing or supporting a defined operational role. A complete system includes related facilities, equipment, subsystems, materials, services, and personnel required for its operation to the degree that it can be considered self-sufficient within its operational or support environment.

4.294 tailoring. The process by which the requirements of a standard are adapted (that is, modified, deleted, or supplemented) to accommodate the peculiarities, characteristics, or operational requirements of a specific piece of equipment, system, or subsystem specification. The tailoring process does not constitute a waiver or deviation from the requirements of a standard.

4.295 telecommunication. Any transmission, emission, or reception of signs, signals, writings, images, digital data, and sounds or intelligence of any nature by wire, radio, visual, or other electromagnetic techniques.

4.296 telegraphy. A system of telecommunication that is involved in any process providing transmission and reproduction at a distance of documentary matter, such as written or printed matter or fixed images, or the reproduction at a distance of any kind of information in such a form.

4.297 telemetering (remote metering). (1) Measurement with the aid of intermediate means that permits the measurement to be interpreted at a distance from the primary detector. (IEEE Std 100-1988 [3]) (2) The use of telecommunication for automatically indicating or recording measurements at a distance from the sensing or measuring instrument.

4.298 telephony. A system of telecommunication set up for the transmission of speech, other sounds, or digital data.

4.299 TEM cell. *See:* **transverse electromagnetic (TEM) cell.**

4.300 test sample (see equipment under test (EUT). The device, equipment, subsystem, or system to be tested or that is under test.

4.301 test site acceptability criterion. A measurement site shall be considered acceptable for electromagnetic radiation measurements if the measured site attenuation is within ± 4 dB of the calculated normalized site attenuation for an ideal site. This criterion includes instrumentation calibration errors, measurement technique errors, and site performance errors.

4.302 text-only capability. A system that displays and processes only alphanumeric symbols, without graphics and specialized mathematical operations capability.

4.303 time urgent (HEMP). A system whose time of degradation from HEMP stress either from damage or upset must be limited and controlled. The criteria for time urgency measures are determined by the specified functions and missions of the system or link.

4.304 transient. (1) A single electromagnetic event, or single-shot voltage, current, electric and/or magnetic field impulse or pulse, such as generated by lightning, electromagnetic pulse (EMP), or switching action. (2) Such an event with a low, and often random, repetition rate, generated by switching action, relay closure, or other low-repetition, cyclic operation. (3) *Adjective or noun:* Pertaining to or designating a phenomenon or a quantity that varies between two consecutive steady states during a time interval short compared with the time scale of interest. (IEC 50(161)(1990) [7])

4.305 transmission line. Typically, a uniform conductor pair, forming a continuous path from an electrical energy source to a receptor, for directing (conducting) the transmission of electromagnetic energy along this path. In practice, typical transmission line configurations include telephone lines, power cables, coaxial cables, and computer cables.

4.306 transverse electromagnetic (TEM) cell. An enclosed system, often a rectangular coaxial line, in which a wave is propagated in the transverse electromagnetic mode to produce a specified field for testing purposes. (IEC 50(161)(1990) [7])

4.307 unwanted emissions. Emissions that consist of spurious and out-of-band emissions. (ITU [8])

4.308 unwanted signal. A signal that may impair the reception of a wanted signal. *Note:* Sometimes the term “undesired signal” is used.

4.309 vulnerability, electromagnetic (EMV). *See:* **electromagnetic vulnerability.**