

MIL-STD-463

9 June 1966

MILITARY STANDARD
DEFINITIONS AND SYSTEM OF UNITS,
ELECTROMAGNETIC INTERFERENCE TECHNOLOGY



FSC MISC

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Definitions and System of Units,
Electromagnetic Interference Technology

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1. This Military Standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense.

2. Recommended corrections, additions, or deletions should be addressed to Commanding General, Electronics Command, ATTN: AMSEL-PP-EM-2, Fort Monmouth, New Jersey, 07703.

FOREWORD

All entries are in simple alphabetical order of the entire expression as if it were one word. Definitions, where applicable, are given with the spelled-out expression, rather than with abbreviation or acronym. The definition is given with the primary expression. For example, the definition for "Impulse bandwidth" is given with that entry. Acronyms and abbreviations are listed under both the abbreviated and spelled-out form. These may or may not be accompanied with a definition, depending on the nature of the expression.

The electromagnetic interference and compatibility language will undoubtedly continue to expand. It is, therefore, important that the constructive suggestions be made by all users of this document. No particular format is prescribed. For new terms, a complete definition should be provided, together with a sufficient explanation of the item for the benefit of the editorial staff. If definitions are quoted from any source, the source must be identified. Copyright material cannot be included in this standard. The active participation of individuals, organizations, and agencies in submitting changes, corrections, and additions is essential to the continued usefulness of this standard and is encouraged.

Whenever possible, definitions conform to those of the American Standards Association, the Institute of Electrical and Electronic Engineers, Society of Automotive Engineers, ASCC (Air Standardization Coordinating Committee), NATO, and applicable Department of Defense standards.

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DEFINITIONS AND SYSTEM OF UNITS,
ELECTROMAGNETIC INTERFERENCE
TECHNOLOGY

1. SCOPE

1.1 This standard contains general interference definitions, abbreviations, and acronyms used in MIL-STD-461 and MIL-STD-462. Definitions of abbreviations and terms are limited to statements of meaning as related to this and referenced standards, rather than encyclopedia or textbook discussions. A basic fundamental knowledge of the principles of interference is assumed.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of the standard to the extent specified herein.

STANDARDS

Military

MIL-STD-461 - Electromagnetic Interference Characteristics, Requirements for.

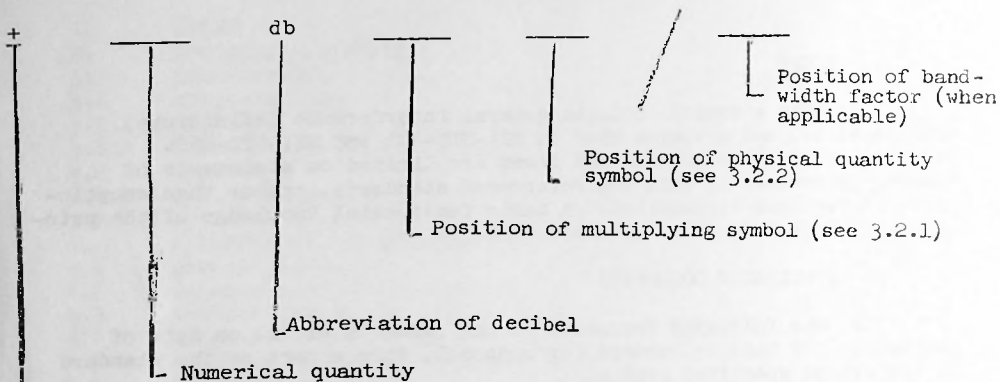
MIL-STD-462 - Electromagnetic Interference Characteristics, Measurement of.

(Copies of standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Abbreviations. All abbreviations used to designate quantities in this standard and in associated ones shall be applied in accordance with the rules hereinafter. Symbols for abbreviations shall be as shown hereinafter, and in the same sequence.

3.1.1 Decibels (db). When referencing the term, use the following notation:



- Indicates above (+) or below (-) reference. The + is used for numerical quantities greater than the reference and - is used for numerical quantities less than the reference. If no symbol is shown, a positive quantity is implied.

3.1.2 Other abbreviations

- CE - Conducted emission
- CS - Conducted susceptibility
- EM - Electromagnetic
- EMC - Electromagnetic compatibility
- EMI - Electromagnetic interference
- le - Antenna effective length for electric-field antennas
- lem - Antenna effective length for magnetic-field antennas
- RE - Radiated emission
- RFI - Radiofrequency interference
- RS - Radiated susceptibility

3.2 Symbols.

3.2.1 Multiplying symbols. The following symbols shall be used to indicate the applicable multiplier:

<u>Multiplier</u>	<u>Symbol</u>
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})	u
nano (10^{-9})	n
pico (10^{-12})	p
femto (10^{-15})	f
atto (10^{-18})	a

3.2.2 Physical quantities. The following symbols shall be used to indicate the applicable physical quantity:

<u>Physical quantity</u>	<u>SI unit^{1/}</u>	<u>Symbol</u>
Length	meter	m
Electric current	ampere	A
Electric potential	volt	V
Electric field strength (E-vector)	volt/meter	V/m
Magnetic field strength (H-vector)	ampere/meter	A/m
Magnetic flux density	tesla	T
Power	watt	W
Frequency	hertz	Hz
Time	second	s
Electric resistance	ohm	Ω
Electric capacitance	farad	F
Inductance	henry	H
Magnetic flux	weber	Wb

^{1/} This conforms with the International System of Units (SI) as adopted by the National Bureau of Standards, Administrative Bulletin 64-6, dated February 1964.

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4. DEFINITIONS AND TERMINOLOGY. The following definitions and terms are given for use in this and the referenced standards, and apply to the restricted field of electromagnetic interference.

4.1 Ambient level. Those levels of radiated and conducted signal and noise existing at a specified test location and time when the test sample is inoperative. Atmospherics, interference from other sources, and circuit noise or other interference generated within the measuring set compose the "ambient level."

4.2 Antenna effective length. The ratio of the antenna induced voltage to the intensity of the field component being measured.

4.3 Antenna factor. That factor which, when properly applied to the voltage at the input terminals of the measuring instrument, yields the electric field strength in volts/meter and the magnetic field strength in amperes/meter. This factor includes the effects of antenna effective length, and mismatch and transmission losses.

4.4 Antenna induced voltage. The voltage which is measured or calculated to exist across the open-circuited antenna terminals.

4.5 Antenna terminal conducted interference. Any undesired voltage or current generated within a receiver, transmitter, or their associated equipment appearing at the antenna terminals.

4.6 Broadband emission. That which has a spectral energy distribution sufficiently broad, uniform, and continuous so that the response of the measuring receiver in use does not vary significantly when tuned over a specified number of receiver impulse bandwidths.

4.7 Conducted emission. Desired or undesired electromagnetic energy which is propagated along a conductor. Such an emission is called "conducted interference" if it is undesired.

4.8 Counterpoise. The reference-plane portion (grounded or ungrounded) of an unbalanced antenna.

4.9 Cross-coupling. The coupling of a signal from one channel, circuit, or conductor to another, where it becomes an undesired signal.

4.10 Cross-modulation. Modulation of a desired signal by an undesired signal. This is a special case of intermodulation.

4.11 Crosstalk. An electromagnetic disturbance introduced by cross-coupling.

4.12. Electromagnetic compatibility. Capability of electronic equipments or systems to be operated with a defined margin of safety in the intended operational environment at designed levels or efficiency without degradation due to interference.

4.13 Emission. Electromagnetic energy propagated from a source by radiation or conduction.

4.14 Far-field region (Fraunhofer region). That volume of space extending beyond the far-field distance. The far-field distance is that distance between two antennas equal to D^2/λ or 3λ whichever is larger, where D is the maximum aperture dimension of the large antenna and λ is the wavelength at the fundamental frequency.

4.15 Field strength. The term "Field strength" shall be applied only to measurements made in the far field. The measurement may be of either the electric or the magnetic component of the field, and may be expressed as V/m, A/m, or W/m^2 ; any one of these may be converted to the others. It shall be abbreviated as FS. For measurements made in the near field, the term "electric field strength" (EFS) or "magnetic field strength" (MFS) shall be used, according to whether the resultant electric or magnetic field, respectively, is measured. The EFS shall be expressed as V/m, and the MFS as A/m. In this field region, the field measured will be the resultant of the radiation, induction and quasi static ($1/r$, $1/r^2$ and, if present, the $1/r^3$) components, respectively of the field where r is the distance from the source. Inasmuch as it is not generally feasible to determine the time and space phase relationships of the various components of this complex field, the energy in the field is similarly indeterminate.

4.16 Ground plane. A metal sheet or plate used as a common reference point for circuit returns and electrical or signal potentials.

4.17 Impulse. An electromagnetic 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.

4.18 Impulse bandwidth. The peak value divided by the area of the impulse response envelope.

4.19 Impulse emission. That produced by impulses having a repetition frequency not exceeding the impulse bandwidth of the receiver in use.

4.20 Impulse strength. The rms unmodulated sine-wave voltage 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 $\mu V/MHz$ or $dB\mu V/MHz$.

4.21 Interference emission. Any undesirable electromagnetic emission.

4.22 Intermodulation. Mixing of two or more signals in a nonlinear element, producing signals at frequencies equal to the sums and differences of integral multiples of the original signals.

4.23 Narrowband emission. That which has its principal spectral energy lying within the bandpass of the measuring receiver in use.

4.24 Open area. A site for radiated electromagnetic interference measurements which is open flat terrain at a distance far enough away from buildings, electric lines, fences, trees, underground cables, and pipe lines so that effects due to such are negligible. This site should have a sufficiently low level of ambient interference to permit testing to the required limits.

4.25 Radiated emission. Radiation and induction field components in space.

4.26 Spurious emission. Any electromagnetic emission from the intended output terminal of an electronic device, but outside of the designed emission bandwidth.

4.27 Spurious response. Any response of an electronic device to energy outside its designed reception bandwidth through its intended input terminal.

4.28 Standard reference output. A condition for a particular test sample that defines normal operation and is used in measuring any deviation from standard performance which occurs during susceptibility testing (eg signal plus noise-to-noise ratio on a receiver for a specified input signal). This value should be indicated in the individual equipment specification.

4.29 Susceptibility. The characteristic of electronic equipment that permits undesirable responses when subjected to electromagnetic energy.

4.30 Test antenna. One of specified characteristics designated for use under specified conditions in conducting tests in accordance with MIL-STD-461 and MIL-STD-462.

4.31 Test sample. Any separate and distinct unit which, if procured separately, would normally be subject to applicable tests, as required by MIL-STD-461.

5. PREPARATION FOR DELIVERY

5.1 Not applicable.

6. NOTES

6.1 Certain provisions of this standard are the subject of international standardization agreement, STANAG 3516. When amendment, revision, or cancellation of this standard is proposed, the departmental custodians will inform their respective Departmental Standardization Offices so that appropriate action may be taken respecting the international agreement concerned.

Custodians:

Army- EL
Navy - SH
Air Force -11

Preparing activity: EL

Project MISC-0349

Review activities:

Army - EL
Navy - SH, WP, YD
Air Force - 11, 17
NASA - Apollo Programs Office

User activities:

Army - EL, MI, TE
Navy - SH, WP, YD
Air Force - 11, 13, 14, 15, 17, 19, 71