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(Revision of
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American National Standard Recommended Practice for Electromagnetic Compatibility Limits

Accredited Standards Committee on Electromagnetic Compatibility, C63

accredited by the

American National Standards Institute

Secretariat

Institute of Electrical and Electronics Engineers, Inc.

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Abstract: This recommended practice presents a rationale for developing limits and recommends sets of limits that are representative of current practice. These limits may be adjusted in particular applications as circumstances dictate.

Keywords: electromagnetic compatibility, electromagnetic noise, radio noise

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Introduction

[This introduction is not part of ANSI C63.12-1999, American National Standard Recommended Practice for Electromagnetic Compatibility Limits.]

The problem of electromagnetic compatibility has existed from the early days of radio when spark gaps were used for transmitting and receivers picked up many signals unintentionally. Radio transmission has evolved from those early days into a highly sophisticated science. However, the need for compatibility is even greater today than it was in earlier times since modern society has come to depend on radio waves in all facets of life, from garage door openers and licensed broadcasting to sophisticated airplane and missile guidance systems. The proliferation of unintentional radiators, such as personal computers and video games, has increased the need for electromagnetic compatibility.

The need for an electromagnetic compatibility document was recognized by the American National Standards Committee C63 and as a result, the first official issue of C63.12 was approved 2 December 1983 and published by IEEE in 1984. Changes in national and international standards since that time prompted Committee C63 to request that Subcommittee Number 1 undertake a first revision, which was published by IEEE in 1988. Further changes in international and in military immunity techniques and requirements, as well as requests by potential users of C63.12, led to the current revision.

This recommended practice suggests emission limits based on maintaining existing ambient levels and protection of licensed radio services. Immunity limits are based on ensuring satisfactory equipment operation in the presence of likely disturbance levels due to man-made and natural noise sources.

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American National Standard Recommended Practice for Electromagnetic Compatibility Limits

1. Overview

Over the years many electromagnetic compatibility measurement and control standards have been developed. Many of these are of concern to particular classes of devices such as receivers, transmitters, incidental radiation devices, etc. In establishing limits, it is necessary to relate the measurement technique that is used to determine compliance with a given limit to the field conditions under which the device being controlled will actually operate. This recommended practice presents a rationale for developing limits¹ and recommends sets of limits that are representative of current practice. These limits may be adjusted in particular applications as circumstances dictate.

As part of the development of limits, the following parameters should be considered:

- a) The general properties of both man-made and natural environmental electromagnetic noise (disturbances)²
- b) An understanding of the devices commonly used for measurement of such disturbances and their properties, which will assist the practitioner in selecting such equipments and associated measurement techniques for the particular application
- c) The rationale that can be used in selecting a consistent set of limits for emission and immunity (susceptibility), subject to various environmental constraints (good engineering practice)

These practices are intended to be applicable to individual equipments as well as systems of various sizes and, if properly applied, will provide guidance for obtaining both intrasystem and intersystem compatibility.

This recommended practice is organized as follows: Clause 2 references instrumentation and measurement methods; Clause 3 contains a list of definitions; Clause 4 describes environmental radio noise; Clause 5 describes the selection of measurement parameters; Clause 6 discusses limit setting; and Annex A is a bibliography.

¹It should be noted that the limits and measurement techniques described herein are proposed for general use to the extent that they are not covered in the regulations of the United States federal government agencies. Clearly, in circumstances where such regulations apply and could be considered to be in conflict with these practices, those regulations take precedence.

²The terms radio noise, electromagnetic noise, and electromagnetic disturbance generally connote the same phenomena, except that radio noise is restricted to phenomena at frequencies above 9 kHz. Otherwise, these terms are used interchangeably in this document.

2. References

Instrumentation and measurement methods used for determining equipment emission characteristics are described in more detail in ANSI C63.2-1996 and ANSI C63.4-1992. These documents should be reviewed before proceeding to make measurements. When standards referred to in this standard are superseded by a revision, the revision shall apply.

ANSI C63.2-1996, American National Standard Specifications for Electromagnetic Noise and Field Strength Instrumentation, 10 kHz to 40 GHz.³

ANSI C63.4-1992, 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.

ANSI C63.7-1992, American National Standard Guide for Construction of Open-Area Test Sites for Performing Radiated Emission Measurements.

ANSI C63.14-1998, 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).

CISPR Publication 11 (1990), Interference from industrial, scientific, and medical radio frequency apparatus.⁴

CISPR Publication 13 (1990), Limits and methods of measurement of radio interference characteristics of sound and television receivers, includes Amendment No. 1, April, 1992, Amendment No. 2, May, 1993 and Amendment No. 3, Jan, 1995.

CISPR Publication 22 (1993), Limits and methods of measurement of radio interference characteristics of information technology equipment. Second Ed. 1993.

FCC 47 CFR 15 B, Technical Standards for Computing Devices.⁵

FCC 47 CFR 18, Technical Standards for Industrial, Scientific and Medical Equipment.

FCC 47 CFR 68, FCC Rules for Registration of Telephone Equipment.

IEC 61000-4-2 (1995-01), Electromagnetic compatibility (EMC)—Part 4: Testing and measurement techniques—Section 2: Electrostatic discharge immunity test.⁶

IEC 61000-4-3 (1995-02), Electromagnetic compatibility (EMC)—Part 4: Testing and measurement techniques—Section 3: Radiated, radio frequency, electromagnetic field immunity test.

IEC 61000-4-4 (1995-01), Electromagnetic compatibility (EMC)—Part 4: Testing and measurement techniques—Section 4: Electrical fast transient/burst immunity test.

³ANSI C63 documents are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

⁴CISPR documents are available from the International Electrotechnical Commission, 3, rue de Varembe, Case Postale 131, CH 1211, Genève 20, Switzerland/Suisse (<http://www.iec.ch/>). They are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

⁵FCC publications are available from the Superintendent of Documents, U.S. Government Printing Office, Document Control Branch, Washington, DC 20402, USA.

⁶IEC publications are available from the Sales Department of the International Electrotechnical Commission, Case Postale 131, 3, rue de Varembe, CH-1211, Genève 20, Switzerland/Suisse (<http://www.iec.ch/>). IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

IEC 61000-4-5 (1995-02), Electromagnetic compatibility (EMC)—Part 4: Testing and measurement techniques—Section 5: Surge immunity test.

IEC 61000-4-6 (1996-04), Electromagnetic compatibility (EMC)—Part 4: Testing and measurement techniques—Section 6: Immunity to conducted disturbances induced by radio-frequency fields.

IEEE Std 473-1985 (Reaff 1997), IEEE Recommended Practice for an Electromagnetic Site Survey (10 kHz to 10 GHz).⁷

IEEE Std C62.41-1991 (Reaff 1995), IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

IEEE Std C62.45-1992 (Reaff 1998), IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

MIL-STD-461D, 11 Jan 1993, Requirements for the control of electromagnetic interference emissions and susceptibility, U.S. Department of Defense.⁸

MIL-STD-462D, 11 Jan 1993, Measurement of Electromagnetic interference characteristics, U.S. Department of Defense.

3. Definitions

For definitions of terms not included in this standard, see ANSI C63.14-1998.

3.1 amplitude probability distribution (APD): The fraction of the total time interval for which the envelope of a function is above a given level as a function of x .

3.2 atmospheric radio noise: Electromagnetic noise in the radio frequency range having its sources in natural atmospheric phenomena.

3.3 electromagnetic disturbance: Any electromagnetic phenomenon that may degrade the performance of a device, equipment, or system, or adversely affect living or inert matter.

3.4 electromagnetic noise: A time-varying electromagnetic phenomenon apparently not conveying information and that may be superimposed on or combined with a wanted signal.

3.5 environmental radio noise: The total electromagnetic disturbance complex in which an equipment subsystem or system may be immersed, exclusive of its own electromagnetic contribution.

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

3.7 intrasystem electromagnetic compatibility: 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.

⁷IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

⁸MIL publications are available from Customer Service, Defense Printing Service, 700 Robbins Ave., Bldg. 4D, Philadelphia, PA 19111-5094.