



American National Standard for RF Immunity of Audio Office Equipment to General Use Transmitting Devices with Transmitter Power Levels up to 8 Watts

Accredited by the American National Standards Institute

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Accredited Standards Committee on Electromagnetic Compatibility, **C63[®]**

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Accredited Standards Committee on Electromagnetic Compatibility, C63[®]

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Secretariat

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C63[®]

Abstract: This standard provides recommended test methods and limits for assuring the radio frequency (RF) immunity of office equipment to general use transmitters with transmitter power up to 8 watts.

Keywords: audio interference, EMI, immunity, interference, office equipment, RF, RFI susceptibility

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Introduction

This introduction is not a part of ANSI C63.9-2008, American National Standard for RF Immunity of Audio Office Equipment to General Use Transmitting Devices with Transmitter Power Levels up to 8 Watts.

In recent years, the offering of different types of electronic products for use in offices has rapidly increased. The use of electronic products in close proximity to other electronic devices requires that they have a sufficient level of radio frequency (RF) immunity to ensure that they can function as intended in the target environment. While fluorescent lights, microwave ovens, portable wireless devices, nearby commercial radio and TV stations and other RF sources have been part of the EMI environment for a number of years, interference problems with many types of equipment have been exacerbated by the recent dramatic growth in personal RF devices such as cellular telephones, wireless network connections, and cordless telephones. It is common today to have two or more wireless connections actively used in the same 6' by 8' office cubicle. Similarly, a conference room may have multiple wireless devices operating simultaneously during a meeting with an active conference call and audio visual equipment being used. Further, traditional mobile phones, laptop computers, PDAs, and other types of products are merging to become multifunctional, often including a wireless transmitter with other functionality. The term "Transmitting Portable Electronic Devices" has been used in several standards to encompass this larger class of RF transmitting devices. Standards for assuring a degree of immunity exist in some global regions, but these have proven insufficient for this new, aggressive RF environment. This standard addresses the need to evaluate the RF immunity of devices for use in the kinds of environments they are likely to experience.

A second distinction of this standard is that it addresses the exceedingly high-quality expectations in today's office environment. RF interference is unacceptable unless the effect is so small as to be virtually imperceptible. Accordingly, this standard has been written to provide protection sufficient to satisfy these stringent expectations.

It should also be noted that office equipment like internet protocol (IP) Phones, IEEE Std 802.11^a network connections, PDAs, etc. are used in other than typical office environments like manufacturing plants, warehouses, ships, and even mines. In these environments the problem is compounded because not only can the field strength from an RF emitter become more concentrated, but resultant malfunctions can pose more serious operational problems.

For office equipment manufacturers this poses new problems as far as the adequate evaluation of product immunity is concerned. The current standard used to evaluate immunity of office equipment, CISPR 24 (which is the basis for EN 55024), is often inadequate to realistically simulate an interference scenario as described above. For example, radiated immunity tests are performed with a spacing of 3 m (or 1 m) between the device and the radiating antenna. In an office environment, the separation between devices is very often just centimeters. Furthermore, the current radiated immunity testing, based on the method described in IEC 61000-4-3, uses amplitude modulated CW signals, and only in specific cases is pulse modulation applied. Modern wireless communication devices use digital modulation which are impulsive signals. These broadband signals pose a different interference potential since the exposure mechanism is very different from the one in a test where a simple CW or amplitude-modulated signal is used. This matter is further compounded by the dependency of the equipment under test (EUT) behavior on the data rate and protocols employed by interfering devices operating in the near area, such as GSM, CDMA, TDMA, Wi-Fi, and amplitude modulation (AM) devices, as well as by the power of the interferer.

^a Information on reference can be found in Clause 2.

ANSI/TIA-631-A focuses specifically on the RF immunity requirements for telephone equipment. While this and other existing standards have continuing value they do not address the specific issues or provide the level of protection being addressed in this standard. By some methods of comparison AM is more severe than pulse modulation and it can be argued therefore that testing with AM overstresses a product. However, multiple companies have reported to the committee developing this standard that they have found not all failure conditions are revealed when testing with AM modulation. These reports that motivated the committee to utilize more complex modulations for this standard.

This standard was developed in response to the recognized need for a more suitable immunity standard for electronic office equipment for some environments and users. This standard serves manufacturers, purchasers, and users of office equipment by providing tests and performance targets that will give a reasonable assurance that the RF immunity of office equipment is suitable to withstand the typical RF environments created by portable transmitters. It must be emphasized that no standard can guarantee the interference-free operation of a device. A compromise must be made between design cost (and thus the cost of a product), testing effort, and acceptable performance. This standard represents the consensus compromise opinion of the committee on the proper balance of these competing factors.

This document provides evaluation methods of product immunity to electromagnetic radiation in the range below 10 GHz, and via paths that are not intended to be RF channels. Problems with interference among IR remote controls and plasma displays, for example, or blinding of one RF device by another incompatible but nearby RF device, are outside the scope of this document.

It is to be noted also that for a test to be acceptable, it need not duplicate an operational environment. Testing that exposes the same flaws, but in different ways, can be acceptable. For practical reasons, it may be desirable, as an example, to use Gigahertz transverse electromagnetic (GTEM) (rarely found in a normal office environment). The test methodology provided in this standard is believed to have been sufficiently validated and can be expected to stress the EUT in a manner that will uncover product vulnerability and reveal the RF immunity of the product.

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1. Overview

1.1 Scope

This standard provides test methods and limits for assuring the radio frequency (RF) immunity of audio office equipment to general use transmitting portable electronic devices with transmitter power up to 8 watts.

1.2 Purpose

This standard provides test methods and limits for evaluation of the RF immunity of audio office equipment, e.g., microphones, telecommunication end point equipment, speakerphones, public address systems, and their associated equipment. The purpose of the document is to provide the required tests and parameters so that office equipment will operate properly in the RF environments commonly found in the vicinity of portable transmitters or stationary emitters, e.g., wireless routers.

2. Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

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

ANSI C63.14-1998, American National Standard Dictionary for Electromagnetic Compatibility (EMC), Electromagnetic Pulse (EMP), and Electrostatic Discharge (ESD) (Dictionary of EMC/EMP/ESD Terms and Definitions).

ANSI C63.19-2007, American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

CISPR 24 Ed. 1.0, Information technology equipment—Immunity characteristics—Limits and methods of measurement.²

EN 55024, Information Technology Equipment—Immunity Characteristics—Limits and Methods of Measurement.³

IEC 61000 4-3 (2002-09), Electromagnetic Compatibility for Electrical and Electronic Equipment—Part 4: Testing and Measurement Techniques—Section 3: Radiated, Radio Frequency, Electromagnetic Field Immunity Test.⁴

IEC 61000-4-20 (2003-01), Electromagnetic compatibility (EMC)—Part 4-20: Testing and measurement techniques—Emission and immunity testing in transverse electromagnetic (TEM) waveguides.

IEEE Std 269™-2004, IEEE Standard Methods for Measuring Transmission Performance of Analog and Digital Telephone Sets, Handsets, and Headsets.^{5, 6}

IEEE Std 299™-2006, IEEE Standard for Measuring the Effectiveness of Electromagnetic Shielding Enclosures.

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² CISPR 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.

³ EN publications are available from the European Committee for Standardization (CEN), 36, rue de Stassart, B-1050 Brussels, Belgium (<http://www.cenorm.be>).

⁴ IEC 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, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (<http://www.ansi.org/>).

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IEEE Std 1309™-2005, IEEE Standard Method for the Calibration of Electromagnetic Field Sensors and Field Probes, Excluding Antennas, from 9 kHz to 40 GHz.

IEEE Std 1329™-1999, IEEE Standard Method for Measuring Transmission Performance of Handsfree Telephone Sets.

UKAS LAB34, edition 1, The Expression of Uncertainty in EMC Testing, August 2002.⁷

3. Definitions, acronyms, and abbreviations

For the purposes of this standard, the following terms and definitions apply. *The Authoritative Dictionary of IEEE Standards Terms*, [B2]⁸ and ANSI C63.14-1998⁹ should be referenced for terms not defined in this clause.

3.1 Definitions

The ANSI C63.14-1998 and *The Authoritative Dictionary of IEEE Standards Terms* [B2] definitions apply throughout this document, unless otherwise noted below. The definitions contained in this subclause take precedence if duplicate definitions are available.

3.1.1 far-end: The receiving terminal of a communications channel.

3.1.2 near-end: The energized terminal of a communications channel.

3.1.3 semi-anechoic enclosure: An RF shielded enclosure in which the conductive walls and ceiling are treated with absorber material so that these surfaces have low RF reflection characteristics.

Note that for radio frequency applications, the enclosure is shielded against RF ingress or egress.

3.2 Acronyms and abbreviations

AM	amplitude modulation
ANSI	American National Standards Institute
AWS	Advanced Wireless Services
CDMA	code division multiple access
CFR	Code of Federal Regulations
CODEC	Coder-Decoder
CW	Carrier Wave

⁷ UKAS documents are available at the UKAS website, URL: http://www.ukas.com/information_centre/publications.asp

⁸ The numbers in brackets correspond to those of the bibliography in Annex H.

⁹ Information on references can be found in Clause 2.

dB	decibel
dB SPL	decibels referenced to a sound pressure level
dB SPL (A)	dB SPL, A-Weighted
dBrnC	decibels relative to noise, C-Weighted (see glossary for C-message noise)
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EUT	equipment under test
FCC	Federal Communications Commission
GSM	Global System for Mobile
GTEM	Gigahertz transverse electromagnetic
iDEN ^{®10, 11}	Integrated Digital Enhanced Network
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IQ	in-phase and quadrature
P	transmitter power (Watts)
PCS	personal communications services
PDA	personal digital assistant
QAM	quadrature amplitude modulation
RETP	receive electrical test point
RF	radio frequency
SETP	send electrical test point
SPL	sound pressure level
TDMA	time division multiple access
TEM	transverse electromagnetic
TX	transmitter
UMTS	universal mobile telecommunications system
VSWR	voltage standing wave ratio
WCDMA	wideband code division multiple access
WiFi	wireless fidelity

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