

American National Standard Validation Methods for Radiated Emission Test Sites, 1 GHz to 18 GHz

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Accredited Standards Committee C63[®]—Electromagnetic Compatibility

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American National Standards Institute

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ANSI C63.25.1-2018

American National Standard Validation Methods for Radiated Emission Test Sites, 1 GHz to 18 GHz

Accredited Standards Committee C63®—Electromagnetic Compatibility
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Secretariat

The Institute of Electrical and Electronics Engineers, Inc.

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Abstract: This standard specifies methods for the validation of test sites used for radiated emission measurements in the frequency range of 1 GHz to 18 GHz.

Keywords: ANSI C63.25.1, radiated emission test sites, site voltage standing-wave ratio, test site validation

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Introduction

This introduction is not part of ANSI C63.25.1-2018, American National Standard Validation Methods for Radiated Emission Test Sites, 1 GHz to 18 GHz.

After several years of using various methods for determining test site validation for 1 GHz to 18 GHz contained in ANSI C63.4, documents from the International Special Committee on Radio Interference (CISPR), and more recently as given in published papers, ASC C63[®] decided it was time to consolidate these along with their parameters and measurement methods into the new ANSI C63.25.1.¹ The CISPR technique for site validation above 1 GHz, called the Site-VSWR (SVSWR) approach, did not have to be included in ANSI C63.4 because it is contained wholly in 8.3 of CISPR 16-1-4:2017-01; hence it is included by reference in this document. A different approach to test site validation using time-domain measurements has been shown to be effective. This time-domain method has several useful features such as requiring less time to perform the validation, and giving an indication of where the site or chamber is deficient (allowing use of corrective measures to bring it into compliance), and more.

The ability to select the method either specified in a requirement or for maintaining the performance of a test site was considered appropriate. Hence in this document, the user has the option of selecting among the techniques noted above. Because the time-domain approach is relatively new and as yet not adopted universally, detailed specifics of how to perform the test are provided.

¹ Concerning site validation for 30 MHz to 1000 MHz, a new project was approved 11/7/2017 by ASC C63[®] to transpose and consolidate the methods and parameters from ANSI C63.4 and ANSI C63.5 into a new ANSI C63.25.2; for more information see: http://www.c63.org/documents/misc/matrix/c63_standards.htm.

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American National Standard Validation Methods for Radiated Emission Test Sites, 1 GHz to 18 GHz

1. Scope and purpose

The purpose of this standard is to describe validation methods of test sites used for radiated emissions measurements in the 1 GHz to 18 GHz frequency range as required by ASC C63[®] standards. The site validation requirements described in this document are applicable to fully anechoic rooms (FAR) and open-area test sites (OATS) as well as semi-anechoic chambers (SAC) that are configured with absorber on the ground plane.

NOTE—Site validation methods for frequencies above 18 GHz are outside the scope of this standard. Concerning site validation for 18 GHz to 40 GHz, the following text from 5.5.1 of ANSI C63.4-2014 [B4]² gives an example provision from other ASC C63[®] standards:

“There are no test site validation requirements applicable to the frequency range of 18 GHz to 40 GHz. A test site that satisfies the requirements stated in this subclause from 1 GHz to 18 GHz is deemed to be suitable for use over the frequency range of 18 GHz to 40 GHz.”

2. Normative references

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

ANSI C63.5-2017, American National Standard for Electromagnetic Compatibility—Radiated Emission Measurements in Electromagnetic Interference (EMI) Control—Calibration of Antennas (9 kHz to 40 GHz).³

CISPR 16-1-4:2017-01, Specification for radio disturbance and immunity measuring apparatus and methods—Part 1-4: Radio disturbance and immunity measuring apparatus—Antennas and test sites for radiated disturbance measurements, Edition 3.2.⁴

² Numbers in square brackets correspond to numbers in the bibliography in Annex C.

³ ASC C63[®] publications are available from the Institute of Electrical and Electronics Engineers (<http://www.standards.ieee.org>) or from the American National Standards Institute (<http://www.ansi.org/>).

3. Terms, definitions, and acronyms

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* and ANSI C63.14 [B6] should be consulted for terms not defined in this clause.⁵

3.1 Terms and definitions

antenna ring-down time: Characteristic of an antenna, exhibiting as an oscillatory response after the main peak (in the time domain), caused by internal reflections.

calibration: The set of operations that establish, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system, or values represented by a material measure, and the corresponding known values of a measurand. (ISO/IEC 17025:2005 [B9])

fully anechoic room (FAR): Shielded enclosure, the internal surfaces of which are lined with radio-frequency energy absorber material that absorbs electromagnetic energy in the frequency range of interest.

open-area test site (OATS): A site for electromagnetic measurements that has a reflective ground plane and 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 objects are negligible.

quiet zone: A described volume within an anechoic chamber where electromagnetic waves reflected from the walls, floor, and ceiling are stated to be below a certain specified minimum. (IEEE Std 1128-1998 [B8])

NOTE—Quiet zones evaluated with the methods of this standard typically have a cylindrical shape, but can have other shapes. Note that the quiet zone evaluated establishes the maximum shape and dimensions allowed for EUTs to be contained within.

semi-anechoic chamber (SAC): A room or enclosure (either shielded or unshielded) with all its surfaces, except the floor, lined with radio-frequency absorber material. The floor is covered with a good conductor.

test site: A location meeting appropriate validation criteria, if identified, to perform electromagnetic compatibility measurements on equipment under test (EUT). This may also include in situ locations or areas where the EUT is installed or operated.

validation: Provision of objective evidence that a given item fulfils specified requirements. (JCGM 200:2012, 2.44 [B10])

3.2 Acronyms

ANSI	American National Standards Institute
ASC	Accredited Standards Committee
EMC	electromagnetic compatibility
EUT	equipment under test
NSA	normalized site attenuation
OATS	open area test site

⁴ CISPR 16-1-4:2017-01 Ed. 3.2 is a consolidated version consisting of CISPR 16-1-4:2010-04 Ed. 3, its corrigendum CISPR 16-1-4:2010-04/COR1:2010-12, its amendment 1 CISPR 16-1-4:2010-04/AMD1:2012-07, and its amendment 2 CISPR 16-1-4:2010-04/AMD2:2017-01.

⁵ The *IEEE Standards Dictionary Online* is available at: <http://dictionary.ieee.org>. An IEEE Account is required for access to the dictionary, and one can be created at no charge on the dictionary sign-in page.

SA	site attenuation
SAC	semi-anechoic chamber
S _{VSWR}	site voltage standing-wave ratio
TD	time domain
VNA	vector network analyzer

4. Antennas

Table 1 contains the complete list of receive antennas that are permitted for making *test site validation measurements* and identifies the frequency ranges over which they may be used for such measurements. The antennas listed in Table 1 may be used from 1 GHz to 18 GHz, or over their useable frequency range if less than 18 GHz.

Only antenna types specifically listed in Table 1, when used over the frequency ranges listed for their operation in Table 1 (and used in a manner consistent with the normative footnotes in Table 1) shall be used for making test site validation measurements.⁶

Antennas shall be calibrated in accordance with ANSI C63.5-2017.

The transmit antenna shall be as specified in 8.3.3.1.2 of CISPR 16-1-4:2017-01.

Table 1—Receive antennas for use in performing test site validation measurements

Row	Receive antenna types ^a
1	Log-periodic dipole array (LPDA)
2	Double-ridged guide horn (passive) ^b
3	Double-ridged guide horn (active) ^{b, c}
4	Waveguide horn

^a When performing test site validation by means of the *S_{VSWR} Method*, it is required that the same type of receive antenna(s) used for test site validation measurements above 1 GHz also be used for performing EUT radiated emissions measurements above 1 GHz.

^b The aperture dimensions of these horn antennas shall be small enough so that the measurement distance (in meters) is equal to or greater than the Rayleigh distance (i.e., $R_m = D^2 / 2\lambda$), where D is the largest dimension of the antenna aperture (in meters) and λ is the free-space wavelength (in meters) at the frequency of measurement.

^c The use of an active horn antenna is permitted for *S_{VSWR} Method* test site validation measurements in any environment. However, users are cautioned to verify that no overload or saturation condition of the preamplifier portion of the active horn antenna occurs. In case of preamplifier overload or saturation corrective actions shall be taken (e.g., use of a notch filter, reorientation of the measurement axis) to eliminate such condition.

5. Test site and measurement equipment requirements for 1 GHz to 18 GHz

5.1 General

Test sites above 1 GHz are meant to replicate a free-space environment. The test site validation determines deviations from free space conditions which shall meet a defined tolerance as the acceptance criterion. Radiated emission test sites meeting the acceptance criterion discussed below are deemed suitable for making final compliance radiated emissions measurements in the frequency range of 1 GHz to 18 GHz. The site requirement above 1 GHz is independent from the test site validation requirement in the frequency range 30 MHz to 1 GHz (see ANSI C63.4a-2017 [B4]); this means that a test site can meet the stated

⁶ All footnotes have equal importance—the shading of the table footnotes is intended only to enhance readability.