



TCBC Workshop

Summary of Changes to C63.4- 2003 (and other items of interest)

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IEEE Standards

C63.4

American National Standard for
Methods of Measurement of Radio-
Noise Emissions from Low-Voltage
Electrical and Electronic Equipment
in the Range of 9 kHz to 40 GHz

ANSI C63.4-2003
(Revision of ANSI C63.4-2001)

Accredited by the American National Standards Institute

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Accredited Standards Committee on Electromagnetic Compatibility, C63



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Overview

- How does the FCC use ANSI C63.4?
- What instrumentation will the FCC accept?
- What guidance is provided for the use of Spectrum Analyzers?
- How do you measure pulse emission?
- What are the other differences between C63.4-2003 with C63.4-2001?
- Acknowledgement and Summary



How is C63.4-2003 referenced in the FCC Rules?

- ANSI C63.4 is incorporated into the FCC Rules by reference in three rule sections:
 - 2.948(b)(8)(i) – *Description of measurement facilities*
 - 15.31(a)(3) -- *Measurement Standards*
 - 15.38(b)(6) -- *Incorporation by reference*
- The latest edition of ANSI C63.4-2003 was incorporated into the rules in FCC ET Docket 03-201, FCC 04-165, adopted on 7/8/04 (http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-165A1.doc)
- ANSI C63.4 may be used for most devices subjects to Part 15 of the FCC Rules, but not all.

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What instrumentation is acceptable?

- For radiated and conducted emission measurements, a test laboratory may use any instrument that follows
 - ANSI C63.4-2003, which references
 - ANSI C63.2-1996
 - CISPR Publication 16-1(2003-11)
 - Section 15.35(a) – *Measurement of detector functions and bandwidths* also references the CISPR Quasi-peak detector in CISPR Publication 16.
- Other instruments (e.g., Spectrum Analyzer) may be used in place of an instrument meeting C63.4 or CISPR 16, provided the guidance in C63.4 and the FCC Rules is followed.

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What instrumentation is acceptable?

- Spectrum analyzers are permissible, although without additional accessories they will not meet C63.2 or CISPR 16-1.
 - The key is to know the proper use and limitations of the instrument with respect to the signal being measured.
 - For example, peak measurements are generally acceptable, since the results will be higher than measurements with a quasi-peak detector
 - Most spectrum analyzers have a different resolution bandwidth, which is acceptable since larger bandwidths are permissible.

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What guidance is available for use of Spectrum Analyzers?

- Instruments that meet the requirements in CISPR 16 and C63.2 are well defined instruments; however, they are not the same, which may lead to different results. This is particularly true for measurements above 1 GHz due to different bandwidth specifications.
- It is the **responsibility** of the test lab and TCB to know the limitations of the instrumentation being used and to know how the differences may effect the test results.

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What guidance is available for use of Spectrum Analyzers?

- *Clause 4.1.1* – specifies that instrumentation must comply with either
 - ANSI C63.2-1996, or
 - CISPR 16-1-1
- *Clause 4.1.1* – revised to allow for the use of spectrum analyzers, but in case of dispute a compliant receiver takes precedence
- *Clauses 4.1.1.1, 4.1.1.2, 4.2 & 5.1.2* – provides additional clarification on use of spectrum analyzers and what additional features are needed; e.g., input filters, overload protection, etc.

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What guidance is available for use of Spectrum Analyzers?

- *Clause 4.1.1.1* – *Automatic scanning receivers may be used, subject to*
 - scan rate of the system and repetition rate of the measured signal.
 - In case of dispute, the reference receivers take precedence.
 - Notes:
 - The log of the measured signal must be taken after detector.
 - The bandwidth specifications for ANSI and CISPR compliant receivers are different above 1 GHz leading to different results.

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What guidance is available for use of Spectrum Analyzers?

- *Clause 4.1.1.2* – a SA without additional accessories will not meet the requirements for ANSI or CISPR compliant receivers
 - a CISPR detector is required below for emissions below 1 GHz. Measurement of peak emission are permissible since peak are considered worst case.
 - Resolution bandwidths are different

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What are the FCC requirements for measuring pulsed emissions?

- 47 CFR 15.35 – Detector and bandwidth requirements -- Limits for unintentional and intentional radiators are in terms of
 - Peak
 - Quasi-peak
 - Linear average
 - RMS average

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What are the FCC requirements for measuring pulsed emissions?

- Measurements < 1 GHz
 - Most Part 15 devices are subject to Q-P limit
 - If a peak detector is used, proper consideration for pulse desensitization must be taken into account.
 - A peak detector is required when the device has a pulse repetition rate of 20 Hz or less.
 - For pulsed RF devices such as R/C transmitter, the limits are in terms of peak and average. The average value of the measured emission shall be computed by multiplying the time-on over 100 ms interval by the level of the peak emission. The peak emission shall be no more 20 dB above the average.
 - The true peak must be determined by using a PDCF, if necessary.
 - For pulsed emissions, an average detector should not be used.

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What are the FCC requirements for measuring pulsed emissions?

- Measurements > 1 GHz
 - Most Part 15 devices are subject to limit using a average detector with a peak limit of no more 20 dB above the average limit. The resolution bandwidth of the measuring instrument shall 1 MHz or greater.
 - If a peak detector is used, proper consideration for peak desensitization must be taken into account. A peak detector is required when the device has a pulse repetition rate of 20 Hz or less.

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What is Pulse Desensitization?

- Measurement of radiated emissions of some intentional radiators (e.g., intrusion detectors, pulsed water tank level gauges, etc.) with a spectrum analyzer may not display the true peak level of an emission. This effect, called “pulse desensitization,” is caused by a limitation of the instrument to adequately respond to extremely narrow pulses due number of factors; e.g., resolution bandwidth, pulse width, pulse repetition rate, etc.
- Manufacturers, test laboratories and TCBs are reminded that the test report must provide measurements showing the true peak level of emissions, when required. This will require the use of a “pulse desensitization correction factor” or PDCF.

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Pulse Desensitization (continued)

- A good source for determining PDCF is HP Application Note 150-2, entitled “*Spectral Analysis - Pulse RF*”, November, 1971.
- Another source is “*Spectrum and Network Measurements*,” 297 Pages, Robert A. Witte, and Publisher: Noble Publishing, 2001, originally published: 1993 by Prentice-Hall.
- Since the HP is no longer available, C63 agreed to provide some guidance on the use of PDCF in a future edition of C63.4.

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What are the other changes to C63.4-2003?

- *Clause 1.2* – clarified the use of “shall” statements
- *Clause 1.2* – temporary hold “telecom port measurements”
- *Clause 2* – added ISO/IEC Standard 17025
- *Clause 3.1.22* – aligned the definition of “personal computer” with FCC definition
- *Clause 4.1.5.3* – for antenna calibration either C63.5-1988 or 1998 may be used until the publication of C63.5-2003

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Other changes to C63.4

- *Clause 4.4.1* – instrumentation calibration interval clarified (1 or 2 years, or manufacturer’s recommendation)
- *Clause 4.4.5* – cable insertion loss shall be characterized and checked frequently for deterioration caused by use and environmental exposure
- *Clause 5.2.2* – conditions for use of vertical conducting plane clarified
- *Table 2, page 23* – corrected 3rd column to show a source height of 2 m

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Other changes to C63.4

- *Clause 6.2.1.2 & 6.2.2.2* – Clarification of placement of a table top peripheral
- *Clause 6.2.1.2* – new set-ups for testing power accessories (e.g., power packs)
- *Clause 6.2.2.3* – clarification for placement of inter-connecting cables for floor standing EUT
- *Clause 7.2.3* – clarification that all power cords associated with the system shall be checked for conducted emissions during exploratory tests

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Other changes to C63.4

- *Clause 8.3.1.1* – caution about not searching 1-4 m during exploratory tests.
- *Clause 10.1.8.1* – clarification re reporting conducted emission results
- *Clause 11.1.1.1 & 11.1.1.2* – clarification of EUT set-ups when EUT is host and when is not a host.
- *Clause 11.1.2 & 11.2* – clarification of the minimum number of ports that need to be populated with cables and accessories, including ports with I/O protocols
- *Clause 11.1.2.1* – clarification of EUT set-ups of peripheral/accessory
- *Clause 12.2.5* – clarification of bandwidth requirements for Unintentional Radiators (not ITE)

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Other changes to C63.4

- **Clause 13.1.1** – clarified test frequencies for Intentional Radiators
- **Annex A** – correction of formula in table A.1
- **Annex C** – “Site Attenuation Deviations” is removed
- **Annex D** – (formerly Annex E) – removed 6dB bandwidth references
- **Annex E** – (formerly Annex F) caution added re effects of filters when making LISN impedance measurements; clarification of instructions for calibration of LISN impedances
- **Annex G** – (formerly Annex H) – additional instruction on how to set sweep time and video bandwidth; introduction of impulse bandwidth in determining the 1 MHz bandwidth for this test; precautions added re use of double shielded coaxial cables

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Other changes to C63.4

- **Annex H** – (formerly Annex I) – additional instruction on how to set instrumentation, including frequency scan, video and resolution bandwidth; 1 MHz impulse bandwidth for this test, which is in CISPR 16.
- **Annex I** – (formerly Annex J) correction to the reference clauses; addition of Annex M re TEM waveguide
- **Annex L** – (formerly Annex M) – provides additional explanation of the complexities of testing an EUT in a TEM device where the internal turntable is not horizontal with the floor of the test area
- **Figure 7** – corrected note to show Tables 1, 3 & 4
- **Figure 8c** – corrected note showing transmit height and deleted rear antenna position.

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Other changes to C63.4

- *Figure 10d* – removed extraneous “+” signs
- *Figure 12b* – corrected arrows to show the closest distance between EUT and the LISN
- *Figure 13* – clarified figure to show positioning of parts of the EUT which should flush with the table top edge and that the nominal 1 x 1.5 m table top may be extended in both directions.
- *Annex L* – (formerly Annex M) – corrected the expressions for the mean and standard deviation; corrected the equations shown in Table L1.1

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Acknowledgement and Summary

- Acknowledgement is given to Donald N. Heirman for providing the list of changes between ANSI C63.4-2003 and C63.4-2001.
- ANSI C63.4 is used by the FCC for measuring radiated and conducted emission from many unintentional and intentional radiators, but not all devices.
- The Spectrum Analyzer is widely used for making emission measurements, but should be used with a thorough understanding of its limitations.
- Measurement of pulse emissions with a low repetition rate require special consideration and may require the use of a PDCF.

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Thank you for your attention

Question and answer time