

American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

C63[®]

Accredited Standards Committee C63[®]—Electromagnetic Compatibility

Accredited by the
American National Standards Institute

ANSI C63.10-2020
(Revision of ANSI C63.10-2013)

ANSI C63.10-2020
(Revision of ANSI C63.10-2013)

American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Accredited Standards Committee C63®—Electromagnetic Compatibility
accredited by the
American National Standards Institute

Secretariat

Institute of Electrical and Electronics Engineers, Inc.

Approved 10 September 2020

American National Standards Institute

C63®

Abstract: The procedures for testing the compliance of a wide variety of unlicensed wireless transmitters (also called intentional radiators and license-exempt transmitters) including, but not limited to, remote control and security unlicensed wireless devices, frequency hopping and direct sequence spread spectrum devices, antipilferage devices, cordless telephones, medical unlicensed wireless devices, Unlicensed National Information Infrastructure (U-NII) devices, intrusion detectors, unlicensed wireless devices operating on frequencies below 30 MHz, automatic vehicle identification systems, and other unlicensed wireless devices authorized by a radio regulatory authority are covered in this standard. Excluded by this standard are test procedures for unlicensed wireless devices already covered in other published standards (e.g., Unlicensed Personal Communication Services (UPCS) devices).

Keywords: ANSI C63.10, compliance testing, intentional radiators, license-exempt transmitters, spread spectrum devices, test procedures, Unlicensed National Information Infrastructure (U-NII), unlicensed wireless devices

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2021 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 29 January 2021. Printed in the United States of America.

IEEE is a registered trademark in the U.S. Patent & Trademark Office, owned by The Institute of Electrical and Electronics Engineers, Incorporated.

C63 is a registered trademark in the U.S. Patent & Trademark Office, owned by the Accredited Standards Committee on Electromagnetic Compatibility.

PDF: ISBN 978-1-5044-7227-2 STD24509
Print: ISBN 978-1-5044-7228-9 STDPD24509

IEEE prohibits discrimination, harassment, and bullying.

For more information, visit <http://www.ieee.org/web/aboutus/whatis/policies/p9-26.html>.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Authorization to photocopy portions of any individual standard for internal or personal use is granted by The Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to Copyright Clearance Center. To arrange for payment of licensing fee, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; (978) 750-8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Errata

Users are encouraged to check the IEEE Errata URL (<http://standards.ieee.org/findstds/errata/index.html>), and the one for ASC C63[®] at http://www.c63.org/explanations_interpretations_request.htm, for errata periodically.

Interpretations (ASC C63[®] standards)

Current interpretations are essential to the understanding of all ASC C63[®] standards. To assist in the meanings of requirements, informative interpretations are available at the following URL: http://www.c63.org/documents/misc/posting/new_interpretations.htm. Users are cautioned that, although interpretations do not and cannot change the requirements of a standard, they serve to clarify the meanings of requirements. All interpretations are informative rather than normative, until such time as the standard is revised (consistent with ASC C63[®] ANSI-accredited operating procedures) to incorporate the interpretation as a normative requirement.

Patents

NOTE—The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights.

By publication of this standard, no position is taken with respect to the validity of any such claim(s) or of any patent rights in connection therewith. If a patent holder has filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, then details may be obtained from the standards developer (<http://www.c63.org/documents/misc/patents>).

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE Standards documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page (<https://standards.ieee.org/ipr/disclaimers.html>), appear in all standards and may be found under the heading “Important Notices and Disclaimers Concerning IEEE Standards Documents.”

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE SA) Standards Board. IEEE develops its standards through an accredited consensus development process, which brings together volunteers representing varied viewpoints and interests to achieve the final product. IEEE Standards are documents developed by volunteers with scientific, academic, and industry-based expertise in technical working groups. Volunteers are not necessarily members of IEEE or IEEE SA, and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE makes no warranties or representations concerning its standards, and expressly disclaims all warranties, express or implied, concerning this standard, including but not limited to the warranties of merchantability, fitness for a particular purpose and non-infringement. In addition, IEEE does not warrant or represent that the use of the material contained in its standards is free from patent infringement. IEEE standards documents are supplied “AS IS” and “WITH ALL FAULTS.”

Use of an IEEE standard is wholly voluntary. The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity, nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: THE NEED TO PROCURE SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Translations

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE is the approved IEEE standard.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, nor be relied upon as, a formal position of IEEE. At lectures,

symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that the presenter's views should be considered the personal views of that individual rather than the formal position of IEEE, IEEE SA, the Standards Committee, or the Working Group.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE or IEEE SA. However, **IEEE does not provide interpretations, consulting information, or advice pertaining to IEEE Standards documents.**

Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its Societies and Standards Coordinating Committees are not able to provide an instant response to comments, or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in evaluating comments or in revisions to an IEEE standard is welcome to join the relevant IEEE working group. You can indicate interest in a working group using the Interests tab in the Manage Profile & Interests area of the [IEEE SA myProject system](#). An IEEE Account is needed to access the application.

Comments on standards should be submitted using the [Contact Us](#) form.

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not constitute compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Data privacy

Users of IEEE Standards documents should evaluate the standards for considerations of data privacy and data ownership in the context of assessing and using the standards in compliance with applicable laws and regulations.

Copyrights

IEEE draft and approved standards are copyrighted by IEEE under US and international copyright laws. They are made available by IEEE and are adopted for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making these documents available for use and adoption by public authorities and private users, IEEE does not waive any rights in copyright to the documents.

Photocopies

Subject to payment of the appropriate licensing fees, IEEE will grant users a limited, non-exclusive license to photocopy portions of any individual standard for company or organizational internal use or individual, non-commercial use only. To arrange for payment of licensing fees, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400; <https://www.copyright.com/>. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every 10 years. When a document is more than 10 years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit [IEEE Xplore](#) or [contact IEEE](#). For more information about the IEEE SA or IEEE's standards development process, visit the IEEE SA Website.

Errata

Errata, if any, for all IEEE standards can be accessed on the [IEEE SA Website](#). Search for standard number and year of approval to access the web page of the published standard. Errata links are located under the Additional Resources Details section. Errata are also available in [IEEE Xplore](#). Users are encouraged to periodically check for errata.

Patents

IEEE Standards are developed in compliance with the [IEEE SA Patent Policy](#).

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE SA Website at <https://standards.ieee.org/about/sasb/patcom/patents.html>. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

IMPORTANT NOTICE

IEEE Standards do not guarantee or ensure safety, security, health, or environmental protection, or ensure against interference with or from other devices or networks. IEEE Standards development activities consider research and information presented to the standards development group in developing any safety recommendations. Other information about safety practices, changes in technology or technology implementation, or impact by peripheral systems also may be pertinent to safety considerations during implementation of the standard. Implementers and users of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.

Participants

At the time it approved this standard, Accredited Standards Committee C63®—Electromagnetic Compatibility had the following membership:

Daniel Hoolihan, Chair
Dan Sigouin, Vice Chair
Jerry Ramie, Secretary
Allen Crumm, Technical Secretary
Jennifer Santulli, Secretariat

<i>Organization Represented</i>	<i>Name of Representative</i>
American Association for Laboratory Accreditation (A2LA)	Megan Riebau
.....	Rob Miller (<i>Alt.</i>)
American Council of Independent Laboratories (ACIL).....	Richard Reitz
American Radio Relay League (ARRL).....	Edward F. Hare
.....	Kermit Carlson (<i>Alt.</i>)
ANSI National Accreditation Board (ANAB).....	Randy Long
.....	Ross Quan (<i>Alt.</i>)
Apple, Inc.	Jyun-cheng Chen
.....	Michael O’Dwyer (<i>Alt.</i>)
Bay Area Compliance Laboratories Corp.....	Lisa Tang (<i>Alt.</i>)
Cisco Systems.....	Andy Griffin
.....	Dave Case (<i>Alt.</i>)
Dell Inc.	Vacant
Element Materials Technology.....	David Schaefer
.....	Jody House (<i>Alt.</i>)
Ericsson AB.....	Kent Skoglund
.....	Bruno Liska (<i>Alt.</i>)
ETS-Lindgren.....	Zhong Chen
.....	Doug Kramer (<i>Alt.</i>)
Federal Communications Commission.....	Steve Jones
Food and Drug Administration.....	Jeffery L. Silberberg
.....	Don Witters (<i>Alt.</i>)
Google, LLC.....	Warwick Wong
.....	George He (<i>Alt.</i>)
Hearing Industries Association.....	John Becker
.....	Ken Gjerde (<i>Alt.</i>)
IEEE Electromagnetic Compatibility (EMC) Society	John Norgard
.....	Henry Benitez (<i>Alt.</i>)
Information Technology Industry Council	John Hirvela
.....	Stephanie Barrett (<i>Alt.</i>)
Innovation, Science and Economic Development Canada	Jason Nixon
.....	Horia Popovici (<i>Alt.</i>)
Intertek	Nicholas Abbondante
Keysight Technologies	Nate Potts
.....	Mark Terrien (<i>Alt.</i>)
Laird Connectivity.....	Khairul Zainal
.....	Laura Zehnder (<i>Alt.</i>)

Motorola Solutions	Deanna Zakharia
.....	Sze Khian Ho (<i>Alt.</i>)
National Institute of Standards and Technology.....	Jason Coder
Nokia Bell Labs.....	Vacant
PCTEST Engineering Laboratory, Inc.	Greg Snyder
.....	Dennis Ward (<i>Alt.</i>)
Qualcomm Technologies, Inc.....	John Forrester
.....	Andy White (<i>Alt.</i>)
Resideo	Vacant
Rohde & Schwarz.....	Jeremy Cline
.....	Wally Arceneaux (<i>Alt.</i>)
Society of Automotive Engineers	Kimball Williams
.....	Rick Lombardi (<i>Alt.</i>)
TCB Council, Inc.	Chris Harvey
TÜV Rheinland of North America	William Graff
.....	Bruce Fagley (<i>Alt.</i>)
TÜV SÜD America, Inc.	William (Mac) Elliot
.....	Ryan McGann (<i>Alt.</i>)
Underwriters Laboratories (UL) LLC	Bob Delisi
.....	Michael Antola (<i>Alt.</i>)
U.S. Department of Defense – Joint Spectrum Center	Marcus Shellman
.....	Michael Duncanson (<i>Alt.</i>)
U.S. Department of the Navy—SPAWAR.....	Chris Dilay
.....	Tomasz Wojtaszek (<i>Alt.</i>)
Individual Members.....	Stephen Berger
.....	Dave Case
.....	Daniel Hoolihan
.....	John Lichtig
.....	Mits Samoto
.....	Werner Schaefer
.....	Dan Sigouin
.....	Dave Zimmerman
Members Emeritus.....	Herbert Mertel
.....	H. R. (Bob) Hofmann
.....	Art Wall

At the time this standard was completed, ASC C63[®] Subcommittee 4 had the following membership:

Bob Delisi, Chair
Dave Case, Vice Chair
Jerry Ramie, Secretary

Mike Antola
David Chamberlain
Zhong Chen
Thomas Dickten
William (Mac) Elliot
Jonas Friden
William Graff
Harry Hodes

Dan Hoolihan
Steve Jones
Greg Kiemel
Jeff Klinger
Doug Kramer
Edmond Lee
Dan Mansergh
Ernesto Mendoza
Jason Nixon

Dan Pino
John Rapella
Dan Sigouin
Kent Skoglund
Mark Terrien
David Waitt
Denis Ward
Dave Zimmerman

At the time this standard was completed, the C63.10 Working Group had the following membership:

Jason Nixon, *Chair*
Dave Case, *Vice Chair*
Bob Delisi, *Secretary*

Nicholas Abbondante
Mike Antola
Mark Arthurs
Aurelian Bria
Mark Briggs
Ross Carlton
David Chamberlain
Daniel E Crowder
J. C. Chen
Erin Elder
William (Mac) Elliot
John Forrester

Tim Harrington
Michael Heckrotte
Harry Hodes
Steve Jones
Greg Kiemel
Jeff Klinger
Victor Kuczynski
Edmund Lee
Grace Lin
Dan Mansergh
Ryan McGann

Hamish Parikh
Robert PaxmanDan Pino
John Rapella
Chad Rossmeissl
Werner Schaefer
David Schramm
Dan Sigouin
Art Wall
Dennis Ward
Lisa Ward
Khairul Zainal
Deanna Zakharia

Introduction

This introduction is not part of ANSI C63.10-2020, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

This standard provides procedures for testing the compliance of a wide variety of unlicensed wireless devices (transmitters). For information concerning those devices that are covered or not covered by this standard, see 1.2. Procedures for testing of some of these devices were previously provided in ANSI C63.4-2014,¹ but they will be removed in a future revision of that standard. The intention is to include all procedures in this standard for testing unlicensed wireless devices, except any devices excluded from the scope; for example, test procedures for Unlicensed Personal Communication Systems devices are addressed by ANSI C63.17-2013 [B5].²

¹ Information on references can be found in Clause 2.

² The numbers in brackets correspond to those of the bibliography in Annex N.

Contents

1. Overview	15
1.1 Scope	15
1.2 Purpose and applications	15
1.3 Stating requirements and recommendations	17
1.4 Measurement uncertainty.....	18
1.5 Dimensional tolerances.....	18
2. Normative references.....	19
3. Definitions, acronyms, and abbreviations	20
3.1 Definitions	20
3.2 Acronyms and abbreviations	22
4. Measurement instrumentation	23
4.1 Emission measuring instrumentation.....	23
4.2 Line impedance stabilization network	31
4.3 Antennas	36
4.4 Calibration of measuring equipment.....	40
5. General measurement and setup considerations	42
5.1 General requirements.....	42
5.2 Radiated emission test site.....	42
5.3 Radiated emission test distance	42
5.4 Measurements around the EUT	43
5.5 Frequency range of radiated emission measurements.....	44
5.6 Number of fundamental frequencies to be tested in EUT transmit band	44
5.7 Swept-frequency device measurements.....	46
5.8 EUT antenna requirements	46
5.9 Restricted frequency bands of operation.....	46
5.10 General unlicensed wireless device configurations and test setups	46
5.11 Operational requirements during testing.....	48
5.12 Applied modulation	49
5.13 Variations in supply voltage	49
5.14 Special accessories	50
6. Standard test methods.....	50
6.1 General	50
6.2 Standard test method for ac power-line conducted emissions from unlicensed wireless devices.....	51
6.3 Radiated emissions testing-common requirements.....	55
6.4 Radiated emissions from unlicensed wireless devices below 30 MHz.....	57
6.5 Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz.....	62
6.6 Radiated emissions from unlicensed wireless devices from 1 GHz to 40 GHz	64
6.7 Antenna-port conducted emission measurements.....	68
6.8 Frequency stability tests	68
6.9 Occupied bandwidth tests	69
6.10 Band-edge testing	71
6.11 On-site (in situ) radiated emission measurements	76
6.12 Figures for Clause 6.....	77
7. Additional tests and requirements for specific devices.....	82
7.1 Test method for determining compliance of cordless telephone handset security code	82
7.2 Frequency pairing of cordless phones	83
7.3 Input power to final RF stage for certain types of unlicensed wireless devices	83
7.4 Procedure for determining compliance of unlicensed wireless devices having periodic operation....	84

7.5 Procedure for determining the average value of pulsed emissions	84
7.6 Evaluation of certain unlicensed wireless devices with periodic emissions against limits	86
7.7 Procedure for determining compliance of inductive-loop devices.....	88
7.8 Evaluation of frequency-hopping device parameters.....	91
8. Procedures for determining emissions from FM transmitters designed for use in vehicles.....	96
8.1 General	96
8.2 Wireless transmission between FM source and vehicle antenna	97
8.3 Injection into a vehicle’s wiring system via the CLA socket.....	97
8.4 In situ measurement procedure for vehicles	98
8.5 Conducted power measurement.....	99
8.6 Capacitive coupling to a vehicle FM antenna.....	100
8.7 Procedure for determining occupied bandwidth of FM transmitter	100
8.8 Figures for Clause 8.....	101
9. Procedures for testing millimeter-wave systems	104
9.1 Instrument and test sites.....	104
9.2 Equations	107
9.3 Emission bandwidth - relative measurement procedure	109
9.4 Occupied bandwidth—Power bandwidth (99%) measurement procedure	110
9.5 Frequency stability measurement procedure	110
9.6 Exploratory radiated measurements.....	111
9.7 Maximizing procedure for measurements	112
9.8 Measurement of the fundamental emission using spectrum analyzer.....	112
9.9 Measurement of the fundamental emission using an RF detector	113
9.10 Measurement of unwanted emissions above 40 GHz	115
9.11 Measurement of unwanted emissions at or below 40 GHz.....	116
10. Procedures for measuring ultra-wideband devices	116
10.1 Evaluation of –10 dB bandwidth	116
10.2 Radiated measurement procedure below 960 MHz	117
10.3 Radiated measurement procedure above 960 MHz	117
11. Procedures for testing DTS devices.....	120
11.1 General	120
11.2 Power limits, definitions, and device configuration	120
11.3 Acceptable measurement configurations	121
11.4 Test suite considerations.....	122
11.5 Reference level/attenuation/headroom.....	122
11.6 Duty cycle (D), transmission duration (T), and maximum power control level	122
11.7 Transmit antenna performance considerations	123
11.8 DTS bandwidth.....	124
11.9 Fundamental emission output power	124
11.10 Maximum power spectral density level in the fundamental emission	130
11.11 Emissions in non-restricted frequency bands	135
11.12 Emissions in restricted frequency bands.....	136
12. Testing of Unlicensed National Information Infrastructure (U-NII) devices	144
12.1 General considerations.....	144
12.2 Duty cycle (D), transmission duration (T), and maximum power control level	144
12.3 Addressing wide band signal measurement issues	145
12.4 Maximum conducted output power	147
12.5 Emission bandwidth and occupied bandwidth.....	152
12.6 Peak power spectral density.....	152
12.7 Unwanted emissions measurement.....	153
12.8 Elevation mask procedures	158

13. Procedures for measuring device operating using antenna arrays with beam-steering and/or beamforming capability	161
13.1 Definitions specific to this clause	161
13.2 Baseline scan methodologies	161
13.3 Final tests	163
13.4 Occupied bandwidth, power density, output power, and band-edge tests	163
13.5 Spurious emissions tests	163
14. Procedures for combining emissions and computing directional gain from devices with multiple outputs	164
14.1 Scope	164
14.2 Purpose	164
14.3 Limitations	164
14.4 Methodologies for combining emissions from multiple outputs	164
14.5 Guidance for combining emissions from multiple outputs of a transmitter or from multiple transmitters	165
14.6 Directional gain calculations	166
14.7 MIMO with cross-polarized antenna	173
14.8 Transmitters with non-detachable antennas for MIMO operation	173
15. Whitespace device testing	176
15.1 Test configuration requirements	176
15.2 Permissible channels of operation	176
15.3 Fixed TVBDs Power measurements	176
15.4 Personal/Portable TVBDs	177
15.5 Band-edge measurement	177
15.6 Adjacent-channel measurement	178
16. Procedures for measuring devices equipped with wireless power transfer functionality	179
16.1 Definitions specific to Clause 16	179
16.2 Scope	180
16.3 Test procedures	181
17. Test reports	185
Annex A (informative) Cross-references between regulatory requirements and ANSI C63.10 test methods	187
Annex B (informative) Example test report contents	199
B.1 General	199
B.2 Test report content	199
Annex C (informative) Pulse desensitization considerations for emission measurements using a spectrum analyzer or EMI receiver (Schaefer [B69])	202
C.1 Narrowband emission	202
C.2 Broadband emission	204
C.3 Application procedure	205
Annex D (informative) Detector functions	207
D.1 Introduction	207
D.2 Detector types	207
D.3 Detector accuracy	210
D.4 Associated output/display devices	210
D.5 Comparison of detector functions	211
Annex E (informative) Measurements above 1 GHz-instrumentation perspective	212
E.1 Introduction	212
E.2 Test equipment	212

Annex F (informative) Broadband measurement discussion.....	217
F.1 Introduction	217
F.2 General discussion.....	217
Annex G (informative) Basic relationships among field strength, power, effective radiated power, and equivalent isotropically radiated power	221
G.1 Introduction	221
G.2 Field strength approach (linear terms)	221
G.3 Power approach (logarithmic terms).....	221
G.4 Relationship between ERP and EIRP	222
G.5 Applications.....	222
Annex H (informative) Rationale for making radiated emission measurements using two different methods	224
H.1 Introduction	224
H.2 Conventional (single EUT orientation) and three-axis method rationale.....	224
H.3 Rationale for method of 6.6.5	226
Annex I (informative) Site considerations for measuring inductive-loop devices in the near-field	228
I.1 Introduction	228
I.2 Site Considerations.....	228
I.3 Manufacturer’s test site data.....	229
I.4 Other sources on the basis of 60 dB per decade roll-off.....	231
Annex J (informative) Developing a transfer function for FM transmitters (alternative procedure for determining compliance of unlicensed FM transmitters)	232
J.1 Introduction.....	232
J.2 Background	232
J.3 Derivation of a transfer function	232
J.4 Measurement data	234
J.5 Using all in situ measurement results.....	238
J.6 Using tabletop measurements.....	239
J.7 A comparison of all in situ and tabletop measurements.....	241
J.8 Summary and conclusion	241
Annex K (informative) Discussion on Dynamic Frequency Selection (DFS) for Operation in the 5250 MHz to 5350 MHz and 5470 MHz to 5725 MHz bands	243
K.1 Detection Threshold values	244
Annex L (informative) Desensitization factor and sweep time considerations for measurements of FMCW signals.....	245
L.1 Desensitization for peak detection	245
L.2 Desensitization for average detection.....	247
L.3 Sweep time for peak detection	247
L.4 Sweep time for average detection	247
Annex M (informative) Glossary	251
Annex N (informative) Bibliography	262

American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1. Overview

1.1 Scope

This standard specifies U.S. consensus standard methods and instrumentation and test facilities requirements for measurement of radio frequency (RF) signals and noise emitted from unlicensed wireless devices (also called unlicensed transmitters, intentional radiators, and license-exempt transmitters) operating in the frequency range 9 kHz to 231 GHz. It does not include generic or product specific emission limits. It also does not cover measurement of radio emissions from unintentional radiators, as mentioned in 1.2. Where possible, the specifications herein are harmonized with other national and international standards used for similar purposes.

As described in 1.2 of this standard, measurement methods are provided for radiated and conducted emissions that can be generated by a variety of devices. For terms and phrases contained in the text that do not represent obvious or common usage, definitions are provided. In most cases, measurement instrumentation and calibration requirements, which should be used with this standard, are generally characterized in deference to standards dedicated to these subjects, which should be used in conjunction with this standard. Requirements for operation of test samples during measurements are presented for devices in general, as well as for specific types of devices that are frequently measured. Specific requirements for emission test data recording and reporting are presented with reference to general requirements contained in documents dedicated to standard laboratory practices, which should be used in conjunction with this standard. The main text is augmented by a series of annexes that provide details for certain measurement methods and facilities.

1.2 Purpose and applications

Various unlicensed wireless devices (also known as unlicensed transmitters, intentional radiators, and license-exempt transmitters) are subject to certain regulatory requirements. The primary way to show compliance in meeting regulatory requirements is by testing such devices in a repeatable and reproducible manner. This standard presents the methods of measurement to show compliance with the technical specifications for the majority of current wireless devices in wide use. It is not expected that all unlicensed wireless devices on the market will in fact be covered by this standard.

This standard does not consider test methods for unlicensed wireless devices already covered in other published standards, such as, but not limited to:

- a) Unlicensed Personal Communications Services devices covered under ANSI C63.17-2013
- b) Dynamic Frequency Selection (DFS) functionality required for U-NII devices in the United States