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| **Report ITU-R SM.2179**  **(09/2010)** |
| **Short-range radiocommunication**  **devices measurements** |
| **SM Series**  **Spectrum management** |

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Annex 1 of Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU‑T/ITU‑R/ISO/IEC and the ITU-R patent information database can also be found.

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| Series of ITU-R Reports  (Also available online at <http://www.itu.int/publ/R-REP/en>) | |
| **Series** | Title |
| **BO** | Satellite delivery |
| **BR** | Recording for production, archival and play-out; film for television |
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| **BT** | Broadcasting service (television) |
| **F** | Fixed service |
| **M** | Mobile, radiodetermination, amateur and related satellite services |
| **P** | Radiowave propagation |
| **RA** | Radio astronomy |
| **RS** | Remote sensing systems |
| **S** | Fixed-satellite service |
| **SA** | Space applications and meteorology |
| **SF** | Frequency sharing and coordination between fixed-satellite and fixed service systems |
| **SM** | **Spectrum management** |

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| ***Note****: This ITU-R Report was approved in English by the Study Group under the procedure detailed   in Resolution ITU-R 1.* |

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REPORT ITU-R SM.2179

Short-range radiocommunication devices measurements

(2010)

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# 1 Introduction

Short-range device (SRD) applications and their associated frequency bands are described in Report ITU-R SM.2153 (former Recommendation ITU-R SM.1538).

Some SRD applications also could benefit from true worldwide harmonization.

Monitoring methods for SRD are described in Report ITU-R SM.2154.

This Report is meant to complete the set of Recommendations and Reports by documenting the measurement methods available for SRDs.

# 2 The reasons for SRD measurements

Technical SRD measurements performed in test laboratories and performing type approval procedures in addition to and/or supporting spectrum monitoring tasks can be performed for the following reasons:

– Type approval

Type approval is a condition granted to a product when a minimum set of regulatory, technical and/or safety requirements are met. The process of approval is performed on a specific item of a specific manufacturer using one or a set of standards and/or one or more national regulatory frameworks. Type approval is usually performed by governmental institutions and lost much of its popularity due to conformity/compliance testing against technical standards. Usually a product specific labelling and coding method is used to indicate that a product is approved.

– Conformance/Compliance testing

Conformance/Compliance testing are two words for the same process comparable with type approval but with some specific differences. Testing is performed against technical standards that can be relevant in more than a single country. Testing against such a standard may grant a product “approved” in more than a single country. Conformance/Compliance testing is frequently performed by independent institutes operating under a regime agreed by regulators and standardisation institutes. These institutes are called notified bodies. Usually a generic label is used for compliant products.

NOTE 1 – In Europe under the R&TTE Directive there is no requirement to use a notified body to demonstrate compliance.

The main reason for these tests is putting products on the market.

– Enforcement purposes

Enforcement performs measurements for other reasons than putting a product on the market. The most important reason for enforcement measurements is to determine if the product is constructed according the standards for type approval or conformance/compliance. This is usually done when the product is already on the market. The standard for the particular product should guarantee conformance with the regulation if its procedures and limits are followed. It is therefore logical that enforcement uses the same measurement methods as described in the standards. On the other hand enforcement functions often as a feedback between the regulatory body and the standardisation institute to guarantee that the standards fulfil the regulatory requirements. Alternative measurements could be recommended by the enforcement body.

Another enforcement reason is tracing the origin of a device and the manufacturer/distributor responsible for putting it on the market. This is usually done as part of a normal enforcement measurement procedure and involves checking the markings on the device but also typical technical properties. These properties may be determined by specific measurement procedures such as the behaviour of a device under a specific stimulus. Also the real life behaviour of a device may be a sign of its nature but this is more a monitoring task.

– Assistance in the spectrum monitoring task of measuring spectrum occupancy

Spectrum monitoring of short range devices differs to some extent from monitoring of other spectrum users, because of their low power and specific geographical distribution to be effective, some specific guidelines need to be observed such as described in Report ITU-R SM.2154.

To characterise the spectrum occupancy in terms of the number of devices and their location in a RF band where SRDs operate it is necessary to translate the specific time behaviour of a device in actual occupancy. For example a device that sends a 1ms pulse every second can be considered active for 100% of time (activity factor) but producing an actual occupancy figure of less than 0.1% (duty cycle). Checking the relevant standards and using the described measurement methods can be used to obtain insight in the working of a device and analyse the occupancy figures properly. This avoids the use of complicated and expensive time domain measurements in the SRD bands.

# 3 Selection of a measurement method

The selection of a measurement method is described from the point of view of a regulatory body.

The measurement methods contained in technical standards are usually used by industry to place products on the market. This means that the testing methods are sometimes detailed in both setup and procedures, the reason is to have a legal base. For enforcement purposes it is not needed to follow these detailed measurement instructions in all cases. An e.r.p. measurement for example can be performed at a standard test site with standard measurement equipment as long as the value of this parameter can be determined with the same or better uncertainty as with the method in the standard.

Testing is a often a time consuming and expensive process therefore many enforcement agencies use a method called “pre compliance testing”, the used methods are basically the same as described in the standard but with a higher measurement uncertainty and shorter measurement time. This pre compliance test is used to make a selection of devices to be “full compliance tested” (tested in more detail) by the enforcement agency or a in a dedicated test facility. The reason for this two stage process is to work in a more cost effective way and to enhance the probability of finding non compliant devices. Pre compliance testing may be also performed in the field without a test range as described in the standard.

Standards can be divided into product specific and non specific standards. The reason for this distinction is that certain products use alternative and sometimes complicated methods to fulfil a regulatory requirement that cannot be made mandatory for all devices under the same regulatory regime. It is commonly accepted that if a product specific standard exist the specific product needs to fulfil the requirements in the product specific standard.

A special case of non specific standards are the standards that are used to test for EMC and EMF compliance. These standards do not deal directly with spectrum use but relate to safety limits for health and EMC. The choice for a particular standard and test method has to be based on the type of regulation for which the testing takes place. (i.e., spectrum regulation, EMC regulation and EMF regulation.)

Annex 1  
  
Standards containing measurement methods within CEPT

# 1 Regulation of short range devices in CEPT countries

In the CEPT countries regulation of Short range devices is documented in ERC Recommendation 70‑03. The recommendation contains a list of frequency bands with regulatory parameters for SRDs and a table listing the implementation status of these bands in the CEPT countries. If a country implements a frequency band it can be assumed that national regulation according the technical parameters stated in the ERC Recommendation 70-03 is in force in that particular country.

For a group of CEPT countries (EU/EEA[[1]](#footnote-1) member states) it is mandatory to implement the EC decisions listed in Appendix 2 of ERC Recommendation 70-03. The technical annexes of these EC Decisions states the frequency bands and the relevant essential regulatory parameters for SRDs. The parameters in the EC Decisions listed may be subject to a derogation for an individual EU country and are detailed in Appendix 3 of ERC Recommendation 70‑03.

# 2 Measurement procedures for short range devices in CEPT countries

This section contains the ETSI harmonized standards as used in CEPT countries for SRDs. The list can be divided into standards for non specific use, also called generic standards, and application specific standards. Non specific standards are indicated in the notes column. Documents can be found and downloaded free of charge at the web site: <portal.etsi.org> and located using the search engine at that web site.

| Standard | Name | Notes |
| --- | --- | --- |
| EN 300-220 | Technical characteristics and test methods for radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW | To be used for non specific SRDs |
| EN 300-328 | Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques |  |
| EN 300 330 | Technical characteristics and test methods for radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz | To be used for non specific SRDs |
| EN 300 422 | Wireless microphones in the 25 MHz to 3 GHz frequency range |  |
| EN 300 440 | Radio equipment to be used in the 1 GHz to 40 GHz frequency range | To be used for non specific SRDs |
| EN 300 674 | Road Transport and Traffic Telematics (RTTT); Technical characteristics and test methods for Dedicated Short Range Communication (DSRC) transmission equipment (500 kbit/s/250 kbit/s) operating in the 5.8 GHz Industrial, Scientific and Medical (ISM) band |  |
| EN 300 718 | Avalanche Beacons; Transmitter-receiver systems |  |
| EN 300 761 | Automatic Vehicle Identification (AVI) for railways operating in the 2.45 GHz frequency range |  |
| EN 301 091 | Road Transport and Traffic Telematics (RTTT) |  |
| EN 301 357 | Consumer radio microphones and in-ear monitoring systems operating in the CEPT harmonized band 863 MHz to 865 MHz |  |
| EN 301 391 | Data communications using short range devices; Access protocol, occupation rules and corresponding technical characteristics for the transmission of data |  |
| EN 301 839 | Radio equipment in the frequency range 402 MHz to 405 MHz for Ultra Low Power Active Medical Implants and Accessories |  |
| EN 301 840 | Digital radio microphones operating in the CEPT Harmonized band 1 785 MHz to 1 800 MHz |  |
| EN 301 893 | 5 GHz high performance RLAN |  |
| EN 302 195 | Radio equipment in the frequency range 9 kHz to 315 kHz for Ultra Low Power Active Medical Implants (ULP-AMI) and accessories |  |
| EN 302 054 | Radiosondes to be used in the 400.15 MHz to 406 MHz frequency range with power levels ranging up to 200 mW |  |
| EN 302 065 | Short Range Devices (SRDs) using Ultra Wide Band technology (UWB) for communications purposes |  |
| EN 302 066 | Ground- and Wall- Probing Radar applications |  |
| EN 302 195 | Radio equipment in the frequency range 9 kHz to 315 kHz for Ultra Low Power Active Medical Implants (ULP-AMI) and accessories |  |
| EN 302 208 | Radio Frequency Identification Equipment operating in the band 865 MHz to 868 MHz with power levels up to 2 W |  |
| EN 302 264 | Road Transport and Traffic Telematics (RTTT) |  |
| EN 302 291 | Close Range Inductive Data Communication equipment operating at 13.56 MHz |  |
| EN 302 288 | Road Transport and Traffic Telematics (RTTT) |  |
| EN 302 372 | Equipment for Detection and Movement |  |
| EN 302 435 | Technical characteristics for SRD equipment using Ultra Wide Band technology (UWB) |  |
| EN 302 500 | Location Tracking equipment operating in the frequency range from 6 GHz to 8.5 GHz |  |
| EN 302 510 | Radio equipment in the frequency range 30 MHz to 37.5 MHz for Ultra Low Power Active Medical Membrane Implants and Accessories |  |
| EN 302 536 | Radio equipment in the frequency range 315 kHz to 600 kHz |  |
| EN 302 537 | Ultra Low Power Medical Data Service Systems operating in the frequency range 401 MHz to 402 MHz and 405 MHz to 406 MHz |  |
| EN 302 567 | 60 GHz Multiple-Gigabit WAS/RLAN Systems |  |
| EN 302 608 | Radio equipment for Eurobalise railway systems |  |
| EN 302 609 | Radio equipment for Euroloop railway systems |  |
| EN 302 645 | Global navigation satellite systems (GNSS) repeaters |  |
| EN 301 489 | Electromagnetic compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short‑Range Devices (SRDs) operating on frequencies between 9 kHz and 40 GHz |  |
| EN 300 683 | EMC standard for Short Range Devices (SRDs) operating on frequencies between 9 kHz and 25 GHz |  |
| ETSI TR 101 870 | Exposure to non-ionising electromagnetic fields; Guidelines for working conditions | Applicable to but not specifically meant for SRDs |

Annex 2  
  
USA (FCC) SRD regulation containing accepted measurement methods

# 1 Regulation of short range devices in the United States of America

In the United States of America, short range device (SRD) regulations are based on the establishment of basic technical standards for these devices which facilitate spectrum sharing among license-exempt devices, including short-range devices, using designated bands. The technical requirements placed on these devices ensure adequate protection of radiocommunication services operating in the same or adjacent frequency bands. Because of the nature of these devices, the regulation of SRDs is primarily a national matter and does not require any modifications to the Radio Regulations or the need for international regulations. The regulations in the United States of America are contained in Part 15 of the FCC Rules and Regulations (Title 47, Code of Federal Regulations, Part 15), which covers a broad range of intentional, unintentional and incidental radiation devices, including SRDs. Report ITU-R SM.2153 – Technical and operating parameters and spectrum use for short range radiocommunication devices, Appendix 2 to Annex 2 describes the regulation of SRDs and other devices under FCC Part 15 Rules in more detail.

# 2 Measurement procedures for SRDs in the United States of America

General measurement procedures applicable to short-range devices are described in Section 15.31 – Measurement standards, in Part 15 of FCC Rules. These procedures have evolved and expanded as these devices have increased in sophistication and popularity. Recent work in the United States of America by the Accredited Standards Committee on Electromagnetic Compatibility, C63® Committee, has collected, updated and summarized a number of measurement procedures that were contained in FCC Rules, Orders and in some technical notes on the FCC “Knowledge Data Base” website (KDB) into a new consolidated document, ANSI C63.10-2009, which covers general wireless devices. Nevertheless, there are a number of additional references that are necessary for clarification and also special measurement procedures for certain categories of equipment.

The measurement procedures described and/or accepted by the FCC for SRDs include the following:

Radio Frequency Devices/Intentional Radiators – Part 15

|  |  |  |
| --- | --- | --- |
| Standard | Name | Remarks |
| Title 47 CFR 15.31 | FCC Rules Subpart A – General Section 15.31 – Measurement Standards (General Guidance) | <http://edocket.access.gpo.gov/cfr_2009/octqtr/47cfr15.31.htm> |
| ANSI C63.4-2003 or ANSI C63.4-2009 | 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 | Available from IEEE at: <http://standards.ieee.org/prod-serv/index.html>  or <http://webstore.ansi.org/> |
| ANSI C63.10-2009 | American National Standard for Testing Unlicensed Wireless Devices | Available from IEEE at: <http://standards.ieee.org/prod-serv/index.html>  or <http://webstore.ansi.org/> |
| ANSI C63.17-2006 | Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices | Available from IEEE at: <http://standards.ieee.org/prod-serv/index.html> or <http://webstore.ansi.org/> |
| FCC Public Notice DA 02-2850 | FCC Clarifies Equipment Certification Procedures for “Learned Mode” or “Trainable” Transmitters | <http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-02-2850A1.pdf> |
| FCC Public Notice DA 04-3946 | OET Clarifies Equipment Authorization Policy for Measurement of Broadband Emissions. Use of “pulse desensitization correction factor” (PDCF) | <http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-04-3946A1.pdf> |
| KDB Publication No. 200443 | Millimeter Wave Test Procedures | <https://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?switch=P&id=20677> |

Frequency Hopping and Digitally Modulated Devices under FCC Part 15.247

|  |  |  |
| --- | --- | --- |
| Standard | Name | Remarks |
| FCC Public Notice DA 00-705 | Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems | <http://www.fcc.gov/Bureaus/Engineering_Technology/Public_Notices/2000/da000705.doc> |
| KDB Publication No. 558074 | Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247) | <https://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=21124&switch=P> |

Additional Guidance on Modular Transmitters under FCC Part 15.212

|  |  |  |
| --- | --- | --- |
| Standard | Name | Remarks |
| Title 47 CFR 15.212 | FCC Rules Subpart C – Intentional Radiators Section 15.212 – Modular Transmitters | <http://edocket.access.gpo.gov/cfr_2009/octqtr/47cfr15.212.htm> |
| KDB Publication No. 996369 | Guidance for Equipment Authorization of transmitter module devices | <http://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=44637&switch=P> |

Unlicensed National Information Infrastructure (UNII) – Part 15 Sub-Part E

|  |  |  |
| --- | --- | --- |
| Standard | Name | Remarks |
| FCC Order ET Docket No. 03-122 (FCC 06-96) | Compliance Measurement Procedures for Unlicensed-National Information Infrastructure Devices Operating in the 5.25‑5.35 GHz and 5.47-5.725 GHz Bands Incorporating Dynamic Frequency Selection | <http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-96A1.pdf> |
| FCC Public Notice DA 02-2138 | Measurement Procedure Updated for Peak Transmit Power in the Unlicensed National Information Infrastructure (U-NII) Bands | <http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-02-2138A1.pdf> |

Ultra Wideband (UWB) – Part 15 Sub-Part F

|  |  |  |
| --- | --- | --- |
| Standard | Name | Remarks |
| FCC Order, ET Docket No. 98-153 (FCC 02-48) | Ultra Wideband Transmission Systems | <http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-02-48A1.pdf> |
| KDB Publication  No. 393764 | Frequently Asked Questions (FAQ) Regarding Ultra‑wideband Compliance Measurements | <https://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=20253&switch=P> |

Measurement evaluation of Specific Absorption Rate (SAR) for Short Range Device Approval

|  |  |  |
| --- | --- | --- |
| Standard | Name | Remarks |
| KDB Publication No. 447498 | Clarification and Guidance Pertaining To RF Exposure Requirements For Mobile And Portable Device Equipment Authorizations, including USB “Dongle” transmitters | <http://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=20676&switch=P> |
| KDB Publication No. 616217 | Specific Absorption Rate (SAR) Evaluation Considerations for Laptop Computers with Transmitter Modules | <https://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=33240&switch=P> |
| KDB Publication No. 248227 | Specific Absorption Rate (SAR) Measurement Procedures for 802.11 a/b/g Transmitters | <https://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=28238&switch=P> |
| KDB Publication No. 615223 | 802.16e/WiMax Specific Absorption Rate (SAR) Measurement Guidance | <https://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?switch=P&id=41734> |

References

FCC Part 15 – <http://www.access.gpo.gov/nara/cfr/waisidx_09/47cfr15_09.html>.

ANSI documents – <http://shop.ieee.org/ieeestore/> or <http://www.ansi.org/>.

(NOTE 1 – The ANSI documents can be purchased at the above links).

FCC Office of Engineering and Technology.

Laboratory Knowledge Database (KDB) – <http://www.fcc.gov/labhelp>.

FCC Orders and Dockets <http://hraunfoss.fcc.gov/edocs_public/edocsLink.do?mode=basic&type=n>.

Annex 3  
  
Canadian standards containing measurement methods

This Annex contains the standards used in Canada for SRDs.

| Standard | Name | Notes |
| --- | --- | --- |
| RSS-Gen | General Requirements and Information for the Certification of Radiocommunication Equipment | ANSI C63.4-2009 IEEE C63.4-2009 IEEE C63.10-2009 |
| RSS-102 | Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) (Issue 4, March 2010) | Industry Canada accepted KDBs (FCC) Procedures for SAR Measurements Health Canada Safety Code 6 FCC Bulletin OET 65, Supplement C IEEE Std. 1528a-2005 IEC 62209-1:2005 IEC 62209-2:2010 IEEE Std. C95.3-2002 |
| RSS-125 | Land Mobile and Fixed Radio Transmitters and Receivers, 1.705 to 50 MHz, Primarily Amplitude Modulated (Issue 2, Revision 1, 25 March 2000) | RSP-100 TRC-49 CP-01 CS-03 RSS-102 |
| RSS-136 | Land and Mobile Station Radiotelephone Transmitters and Receivers Operating in the 26.960 – 27.410 MHz General Radio Service Band (Issue 5, October 2002) | Radio Standards Procedure 100 |
| RSS-137 | Location and Monitoring Service in the Band 902‑928 MHz | RSS-Gen RSS-210 Annex 7 & 8 |
| RSS-181 | Coast and Ship Station Single Sideband Radiotelephone Transmitters and Receivers Operating in the 1.605-28.000 kHz Band (Issue 1, 1 April 1971) | Radio Standards Procedure 100 Radio Standards Specification 111 |
| RSS-210 | Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment (Issue 7 June 2007) |  |
| RSS-220 | Devices Using Ultra – Wideband (UWB)Technology (Issue 1, March 2009) | RSS-Gen |
| RSS-243 | Medical Devices Operating in the 401‑406 MHz Frequency Band (Issue 3, February 2010) | ETSI EN 301 839-1 ETSI EN 302 537-1 ITU-R RS.1346 |
| RSS-310 | Low-power Licence-exempt Radiocommunication Devices (All frequency Bands) Category II Equipment (Issue 2 June 2007) |  |
| ICES-001 | Industrial, Scientific and Medical (ISM) Radio Frequency Generators (Issue 4, June 2006) | CAN/CSA-CEI /IEC CISPR 11-04 IEC Publication No. 50(161) (1990) |
| ICES-002 | Spark Ignition Systems of Vehicles and Other Devices Equipped with Internal Combustion Engines (Issue 5, August 2009) | Canadian Standards Association Standard CAN/CSA-C108.4-06, *Limits and Methods of Measurement* |
| ICES-003 | Digital Apparatus (Issue 4, February 2004) | Canadian Standards Association Standard CAN/CSA-CEI/IEC CISPR 22:02, "Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment" |
| ICES-004 | Alternating Current High Voltage Power Systems (Issue 3, December 2001) | CSA Standard C108.1.1-1977 entitled *Electromagnetic Interference Measuring Instrument*– C.I.S.P.R. Type, published February, 1977 in the English language |
| ICES-005 | Radio Frequency Lighting Devices (RFLDs) (Issue 3, May 2009) | Canadian Standards Association Standard C108.1.1-1977, *Electromagnetic Interference Measuring Instrument – C.I.S.P.R. Type* Canadian Standards Association Standard C108.1.5-M85-CAN3, *Line Impedance Stabilization Network (LISN)* |
| ICES-006 | AC Wire Carrier Current Devices (Unintentional Radiators) (Issue 2, June 2009) | CSA Standard C108.1.5 M-85, *Line Impedance Stabilization Network (LISN)* CSA Standard C108.1.1-1977, *Electromagnetic Interference Measuring Instrument-C.I.S.P.R. Type* Industry Canada Radio Standards Specification 210 (RSS-210), *Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)* Industry Canada Radio Standards Specification Gen (RSS-Gen), *General Requirements and Information for the Certification of Radiocommunication Equipment* ANSI C63.4.-2003, *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* |

Annex 4  
  
Standards containing measurement methods used within IEC/ISO

This Annex contains the IEC/ISO standards for SRDs.

| Standard | Name | Notes |
| --- | --- | --- |
| ISO/IEC 18046-1 | Information technology – Radio frequency identification device performance test methods – Part 1: Test methods for system performance |  |
| ISO/IEC 18046-2 | Information technology – Radio frequency identification device performance test methods – Part 2: Test methods for interrogator performance |  |
| ISO/IEC 18046-3 | Information technology – Radio frequency identification device performance test methods – Part 3: Test methods for tag performance |  |
| ISO/IEC TR 18047-2 | Information technology – Radio frequency identification device conformance test methods – Part 2: Test methods for air interface communications below 135 kHz |  |
| ISO/IEC TR 18047-3 | Information technology – Radio frequency identification device conformance test methods – Part 3: Test methods for air interface communications at 13.56 MHz |  |
| ISO/IEC TR 18047-4 | Information technology – Radio frequency identification device conformance test methods – Part 4: Test methods for air interface communications at 2.45 GHz |  |
| ISO/IEC TR 18047-6 | Information technology – Radio frequency identification device conformance test methods – Part 6: Test methods for air interface communications at 860 MHz to 960 MHz |  |
| ISO/IEC TR 18047-7 | Information technology – Radio frequency identification device conformance test methods – Part 7: Test methods for active air interface communications at 433 MHz |  |
| ISO 18000-2 | Air interface for < 135 kHz – Type A (FDX), Type B (HDX) – Optional anti-collision, Tags & System provides interoperability | Published |
| ISO 18000-3 | Air interface at 13,56 MHz – Mode 1 based on ISO 15693, 2 speeds 26 & 52 kB – Mode 2 high speed interface, 424 kB, 8 return channels | Published |
| ISO 18000-4 | Air Interface at 2,45 GHz – Mode 1 passive tag – Mode 2 battery assisted & long range, High speed 384 kB or R/O at 76 kB | Published |
| ISO 18000-6 | Air Interface at 860-960 MHz – Type A, pulse interval encoding & adaptive Aloha anti-collision algorithm – Type B, Manchester encoding & adaptive binary-tree anti‑collision algorithm – Type C, pulse interval Encoding, EPC Global Gen2 | Published |
| ISO 18000-6 A1 | Amendment 1 – Mode C | Published as AMD1 2006 |
| ISO 18000-7 | Air interface at 433 MHz – only applicable for active tags because of max 10 mW emission level | Published |
| ISO 18000-7 R1 | Revision 1 | Published |
| ISO 24730-1 | Real Time Locating Systems (RTLS) – Part 1: Application Program Interface (API) | Published |
| ISO 24730-2 | Real Time Locating Systems (RTLS) – Part 2: 2,4 GHz – Direct sequence Spread spectrum (DSSS) | Published |
| ISO 11785 | Radio Frequency Identification of Animals Technical concept ace |  |
| ISO 14223 | Radio Frequency Identification of Animals Advanced Transponders Part 1: Air Interface | Published |
| ISO 15693 | Identification cards – Contactless integrated circuit(s) cards; Vicinity Integrated Circuit(s) Card; Part 2: Radio frequency power and signal interface | Published |
| ISO 14443 | Identification cards Contactless integrated circuit cards Proximity cards Part 1: Physical characteristics | Published |

1. EU:  European Union; EEA: European Economic Area. [↑](#footnote-ref-1)