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**Technical and operating parameters
and spectrum use for short-range
radiocommunication devices**

SM Series
Spectrum management



International
Telecommunication
Union

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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REPORT ITU-R SM.2153-2*

**Technical and operating parameters and spectrum use
for short-range radiocommunication devices****

(2009-2010-2011)

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* This Report replaces Recommendation ITU-R SM.1538.

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1 Introduction

This Report sets out common technical and non-technical parameters for short-range radiocommunication devices (SRDs) and widely recognized approaches for managing their use on a national basis. When using this Report it should be remembered that it represents the most widely accepted views but it should not be assumed that all given parameters are accepted in all countries.

It should also be remembered that the pattern of radio use is not static. It is continuously evolving to reflect the many changes that are taking place in the radio environment; particularly in the field of technology. Radio parameters must reflect these changes and the views set out in this Report are therefore subject to periodic review.

Moreover, almost all administrations still have national regulations. For these reasons, those wishing to develop or market SRDs based on this Report are advised to contact the relevant national administration to verify that the position set out herein applies.

SRDs are used virtually everywhere. For example, data collection with auto identification systems or item management in warehousing, retail and logistic systems, baby monitors, garage door openers, wireless home data telemetry and/or security systems, keyless automobile entry systems and hundreds of other types of common electronic equipment rely on such transmitters to function. At any time of day, most people are within a few metres of consumer products that use SRDs.

SRDs operate on a variety of frequencies. They must share these frequencies with other radio applications and are generally prohibited from causing harmful interference to or claiming protection from those radio applications. If an SRD does cause interference to authorized radiocommunications, even if the device complies with all of the technical standards and equipment authorization requirements in the national rules, then its operator will be required to cease operation, at least until the interference problem is solved.

However, some national administrations may establish radiocommunication services, using SRDs, whose importance to the public requires that these devices be protected to some degree from harmful interference, without any adverse effect on other administrations. One example for this kind of arrangement is the ultra low power active medical implant communication device as defined below, which is governed by national regulations.

This Report has two annexes. Annex 1 contains technical parameters of several types of additional applications. Annex 2 provides information on national/regional rules which contain technical and operational parameters and spectrum use: those are given in the Appendices to Annex 2.

2 Definition of short-range radio devices

For the purpose of this Report the term short-range radio device, is intended to cover radio transmitters which provide either unidirectional or bidirectional communication and which have low capability of causing interference to other radio equipment.

Such devices are permitted to operate on a non-interference and non-protected basis.

SRDs use either integral, dedicated or external antennas and all types of modulation and channel pattern can be permitted subject to relevant standards or national regulations.

Simple licensing requirements may be applied, e.g., general licences or general frequency assignments or even licence exemption, however, information about the regulatory requirements for placing short-range radiocommunication equipment on the market and for their use should be obtained by contacting individual national administrations.

3 Applications

Due to the many different applications provided by these devices, no description can be exhaustive, however, the following categories are amongst those regarded SRDs:

3.1 Telecommand

The use of radiocommunication for the transmission of signals to initiate, modify or terminate functions of equipment at a distance.

3.2 Telemetry

The use of radiocommunication for indicating or recording data at a distance.

3.3 Voice and video

In connection with SRDs, voice covers applications like walkie-talkie, baby monitoring and similar use. Citizen band (CB) and private mobile radio (PMR 446) equipment is excluded.

With video applications, non-professional cordless cameras are meant mainly to be used for controlling or monitoring purposes.

3.4 Equipment for detecting avalanche victims

Avalanche beacons are radio location systems used for searching for and/or finding avalanche victims, for the purpose of direct rescue.

3.5 Broadband radio local area networks

Broadband radio local area networks (RLANs) were conceived in order to replace physical cables for the connection of data networks within a building, thus providing a more flexible and, possibly, a more economic approach to the installation, reconfiguration and use of such networks within the business and industrial environments.

These systems often take advantage of spread spectrum modulation or other redundant (i.e., error correction) transmission techniques, which enable them to operate satisfactorily in a noisy radio environment. In the lower frequency bands, satisfactory in-building propagation may be achieved but systems are limited to low data rates (up to 1 Mbit/s) because of spectrum availability.

To ensure compatibility with other radio applications in the 2.4 GHz and 5 GHz band a number of restrictions and mandatory features are required. Other studies on RLANS are going on in the Radiocommunication Study Groups.

3.6 Railway applications

Applications specifically intended for use on railways comprise mainly the following three categories:

3.6.1 Automatic vehicle identification

The automatic vehicle identification (AVI) system uses data transmission between a transponder located on a vehicle and a fixed interrogator positioned on the track to provide for the automatic and unambiguous identification of a passing vehicle. The system also enables any other stored data to be read and provides for the bidirectional exchange of variable data.

3.6.2 Balise system

Balise is a system designed for locally defined transmission links between train and track. Data transmission is possible in both directions. The physical data transmission path length is of the order of 1 m, i.e., it is significantly shorter than a vehicle. The interrogator is secured under the locomotive and the transponder is positioned at the centre of the track. Power is supplied to the transponder by the interrogator.

3.6.3 Loop system

The loop system is designed for the transmission of data between train and track. Data transmission is possible in both directions. There are short loops and medium loops which provide for intermittent and continuous transmissions. In case of short loops the contact length is of the order of 10 m. The contact length in the case of medium loops is between 500 m and 6 000 m. No train location functions are possible in the case of continuous transmission. The contact length is greater than in the case of intermittent transmission and generally exceeds the length of a block. A block is a section of the track in which only one train may be situated.

3.7 Road transport and traffic telematics

(Also referred to as dedicated short-range communications for transport information and control systems (TICSs).)

Road transport and traffic telematics (RTTT) systems are defined as systems providing data communication between two or more road vehicles and between road vehicles and the road infrastructure for various information-based travel and transport applications, including automatic toll-collection, route and parking guidance, collision avoidance and similar applications.

3.8 Equipment for detecting movement and equipment for alert

Equipment for detecting movement and equipment for alert are low power radar systems for radiodetermination purposes. Radiodetermination means the determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves.

3.9 Alarms

3.9.1 Alarm in general

The use of radiocommunication for indicating an alarm condition at a distant location.

3.9.2 Social alarms

The social alarm service is an emergency assistance service intended to allow people to signal that they are in distress and allow them to receive the appropriate assistance. The service is organized as any assistance network, generally with a team available on a 24 h basis in a station where alarm signals are received and appropriate steps are taken to provide the required assistance (calling a doctor, the fire brigade, etc.).

The alarm is usually sent via the telephone line, automatic dialling being ensured by fixed equipment (local unit) connected to the line. The local unit is activated from a small portable radio device (trigger) worn by the individual.

Social alarm systems are typically designed to provide as high a level of reliability as is practically feasible. For radio systems, the interference risk would be limited if frequencies were reserved for their exclusive use.

3.10 Model control

Model control covers the application of radio model control equipment, which is solely for the purpose of controlling the movement of the model (toy), in the air, on land or over or under the water surface.

3.11 Inductive applications

Inductive loop systems are communication systems based on magnetic fields generally at low RF frequencies.

The regulations for inductive systems are different in various countries. In some countries this equipment is not considered as radio equipment, and neither type approval nor limits for the magnetic field are set. In other countries inductive equipment is considered as radio equipment and there are various national or international type approval standards.

Inductive applications include for example car immobilizers, car access systems or car detectors, animal identification, alarm systems, item management and logistic systems, cable detection, waste management, personal identification, wireless voice links, access control, proximity sensors, anti-theft systems including RF anti-theft induction systems, data transfer to handheld devices, automatic article identification, wireless control systems and automatic road tolling.

3.12 Radio microphones

Radio microphones (also referred to as wireless microphones or cordless microphones) are small, low power (50 mW or less) unidirectional transmitters designed to be worn on the body, or hand held, for the transmission of sound over short distances for personal use. The receivers are more tailored to specific uses and may range in size from small hand units to rack mounted modules as part of a multichannel system.

3.13 RF identification systems

The object of any RF identification (RFID) system is to carry data in suitable transponders, generally known as tags, and to retrieve data, by hand- or machine-readable means, at a suitable time and place to satisfy particular application needs. Data within a tag may provide identification of an item in manufacture, goods in transit, a location, the identity of persons and/or their belongings, a vehicle or assets, an animal or other types of information. By including additional data the prospect is provided for supporting applications through item specific information or instructions immediately available on reading the tag. Read-write tags are often used as a decentralized database for tracking or managing goods in the absence of a host link.

A system requires, in addition to tags, a means of reading or interrogating the tags and some means of communicating the data to a host computer or information management system. A system will also include means for entering or programming data into the tags, if this is not undertaken at the source by the manufacturer.

Quite often an antenna is distinguished as if it were a separate part of an RFID system. While its importance justifies this attention it should be seen as a feature that is present in both readers and tags, essential for the communication between the two. While the antenna of tags is an integral part of the device, the reader or interrogator can have either an integral or separate antenna in which case it shall be defined as an indispensable part of the system (see also § 7: Antenna requirements).

3.14 Ultra low power active medical implant

The ultra low power active medical implant (ULP-AMIs) are part of a medical implant communication systems (MICS) for use with implanted medical devices, like pacemakers, implantable defibrillators, nerve stimulators, and other types of implanted devices. The MICS uses transceiver modules for radiofrequency communication between an external device referred to as a programmer/controller and a medical implant placed within a human or animal body.

These communication systems are used in many ways, for example: device parameter adjustment (e.g., modification of the pacing parameters), transmission of stored information (e.g., electrocardiograms stored over time or recorded during a medical event), and the real time transmission of monitored vital life signs for short periods.

MICS equipment is used only under the direction of a physician or other duly authorized medical professional. The duration of these links is limited to the short periods of time necessary for data retrieval and reprogramming of the medical implant related to patient welfare.

3.15 Wireless audio applications

Applications for wireless audio systems include the following: cordless loudspeakers, cordless headphones, cordless headphones for portable use, i.e., portable compact disc players, cassette decks or radio receivers carried on a person, cordless headphones for use in a vehicle, for example for use with a radio or mobile telephone, etc., in-ear monitoring, for use in concerts or other stage productions.

Systems should be designed in such a way that in the absence of an audio input no RF carrier transmission shall occur.

3.16 RF (radar) level gauges

RF level gauges have been used in many industries for many years to measure the amount of various materials, primarily stored in an enclosed container or tank. The industries in which they are used are mostly concerned with process control. These SRDs are used in facilities such as refineries, chemical plants, pharmaceutical plants, pulp and paper mills, food and beverage plants, and power plants among others.

All of these industries have storage tanks throughout their facilities where intermediate or final products are stored, and which require level measurement gauges.

Radar level gauges may also be used to measure the level of water of a river (e.g., when fixed under a bridge) for information or alarm purposes.

Level gauges using an RF electromagnetic signal are insensitive to pressure, temperature, dust, vapours, changing dielectric constant and changing density.

The types of technology used in RF level gauge products include:

- pulsed radiating; and
- frequency modulated continuous wave (FMCW).

4 Technical standards/regulations

There are a number of conformity assessment standards on SRDs produced by various international standards organizations, and national standards that have gained international recognition. These are, *inter alia*, the European Telecommunications Standards Institute (ETSI), International Electrotechnical Commission (IEC), European Committee for Electrotechnical Standardization (CENELEC), International Organization for Standardization (ISO), Underwriters Laboratories Inc. (UL), Association of Radio Industries and Business (ARIB), Federal Communications Commission (FCC) Part 15, among others. In many cases there are mutual agreements of the recognition of these standards between administrations and/or regions which avoids the need to have the same device assessed for conformity in each country where it is to be deployed (see also § 8.3).

It should be noted that in addition to the technical standards on the radio parameters of devices there may be other requirements which have to be met before a device can be placed on the market in any country such as electromagnetic compatibility (EMC), electrical safety, etc.

5 Common frequency ranges

There are certain frequency bands which are used for SRDs in all regions of the world. These common bands are indicated in Table 1. Although this table represents the most widely accepted set of frequency bands for SRDs it should not be assumed that all of these bands are available in all countries.

However, it should be noted that SRDs may generally not be permitted to use bands allocated to the following services:

- radio astronomy;
- aeronautical mobile;
- safety of life services including radionavigation.

It should further be noted that the frequency bands mentioned in RR Nos. 5.138 and 5.150 are designated for industrial, scientific and medical (ISM) applications (see RR No. 1.15 for definition of ISM). SRDs operating within these bands must accept harmful interference which may be caused by these applications.

Since SRDs generally operate on a non-interference, no protection from interference basis (see definition of SRDs in § 2), ISM bands, among others, have been selected as home for these devices.

In the different regions there are a number of additional recommended frequency bands identified to be used for short-range radio applications. Details of those frequency bands may be found in the appendices.

TABLE 1

Commonly used frequency ranges

ISM within bands under RR Nos. 5.138 and 5.150	
	6 765-6 795 kHz
	13 553-13 567 kHz
	26 957-27 283 kHz
	40.66-40.70 MHz
	2 400-2 483.5 MHz
	5 725-5 875 MHz
	24-24.25 GHz
	61-61.5 GHz
	122-123 GHz
	244-246 GHz
Other commonly used frequency ranges	
9-135 kHz:	Commonly used for inductive short-range radiocommunication applications
3 155-3 195 kHz:	Wireless hearing aids (RR No. 5.116)
402-405 MHz:	Ultra low power active medical implants Recommendation ITU-R RS.1346
5 795-5 805 MHz:	Transport information and control systems Recommendation ITU-R M.1453
5 805-5 815 MHz:	Transport information and control systems Recommendation ITU-R M.1453
76-77 GHz:	Transport information and control system (radar) Recommendation ITU-R M.1452

NOTE 1 – See also Recommendation ITU-R SM.1756 – Framework for the introduction of devices using ultra-wideband technology.

6 Radiated power or magnetic or electric field strength

The radiated power or magnetic or electric field-strength limits shown in Tables 2 to 5 are the required values to allow satisfactory operation of SRDs. The levels were determined after careful analysis and are dependent on the frequency range, the specific application chosen and the services and systems already used or planned in these bands.

6.1 European Conference of Postal and Telecommunications Administrations member countries

Radiated power and magnetic or electric field-strength limits for SRDs in CEPT countries can be found amongst frequency bands and other parameters in Table 9, Appendix 1 to Annex 2 of this Report.

6.2 United States of America Federal Communications Commission (FCC), Brazil and Canadian general limits

TABLE 2
General limits for any intentional transmitter

Frequency (MHz)	Electric field strength ($\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	$2\,400/f$ (kHz)	300
0.490-1.705	$24\,000/f$ (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Exceptions or exclusions to the general limits are listed in Appendix 2.

6.3 Japan

TABLE 3
Tolerable value of electric field strength 3 m distant from a radio station emitting extremely low power

Frequency band	Electric field strength ($\mu\text{V/m}$)
$f \leq 322$ MHz	500
$322 \text{ MHz} < f \leq 10$ GHz	35
$10 \text{ GHz} < f \leq 150$ GHz	$3.5 \times f^{(1), (2)}$
$150 \text{ GHz} < f$	500

⁽¹⁾ f (GHz).

⁽²⁾ If $3.5 \times f > 500 \mu\text{V/m}$, the tolerable value is $500 \mu\text{V/m}$.

6.4 The Republic of Korea

TABLE 4

The limit of electric field strength of the low power device

Frequency band	Electric field strength measured at the distance of 3 m ($\mu\text{V/m}$)
$f \leq 322 \text{ MHz}$	500 ⁽¹⁾
$322 \text{ MHz} < f \leq 10 \text{ GHz}$	35
$f \geq 10 \text{ GHz}$	$3.5 \times f^{(2)}$, but not greater than 500

(1) The measured value for the frequency of less than 15 MHz should be multiplied by the near field measurement compensation factor (6π wavelength (m)).

(2) Frequency in GHz.

7 Antenna requirements

Basically three types of transmitter antennas are used for short-range radiocommunication transmitters:

- integral (no external antenna socket);
- dedicated (type approved with the equipment);
- external (equipment type approved without antenna).

In most cases short-range radiocommunication transmitters are equipped with either integral or dedicated antennas, because changing the antenna on a transmitter can significantly increase, or decrease, the strength of the signal that is ultimately transmitted. Except for some special applications, the RF requirements are not based solely on output power but also take into account the antenna characteristics. Thus, a short-range radiocommunication transmitter that complies with the technical standards with a particular antenna attached could exceed the power limits given if a different antenna is attached. Should this happen a serious interference problem to authorized radiocommunications such as emergency, broadcast and air-traffic control communications could occur.

In order to prevent such interference problems, short-range radiocommunication transmitters shall be designed to ensure that no type of antenna can be used other than one which has been designed and type approved by the manufacturer to show conformity with the appropriate emission level. This means that normally short-range radiocommunication transmitters must have permanently attached, or detachable antennas with a unique connector. A unique connector is one that is not of a standard type found in electronic supply stores or not normally used for RF connection purposes. National administrations may define the term unique connector differently.

It is recognized that suppliers of short-range radiocommunication transmitters often want their customers to be able to replace an antenna in case of breakage. With this in mind, manufacturers are allowed to design transmitters in such a way that the user can replace a broken antenna with an identical one.

8 Administrative requirements

8.1 Certification and verification

8.1.1 CEPT countries

CEPT countries that are not EU/EFTA member states and have not implemented the radio and telecommunications terminal equipment (R&TTE) Directive, have national regulations and use specifications for radio equipment which are based on transposed ENs or still in some cases based on their predecessors as CEPT Recommendations or fully national standards. Within European Union and European Free Trade Association (EFTA) member states, the radio and telecommunications terminal equipment (R&TTE) Directive now defines the rules for placing on the market and putting into service most products using the radio frequency spectrum. Each national authority is responsible for transposing the provisions of the R&TTE Directive into its legislation.

The easiest route for a manufacturer to demonstrate compliance with the R&TTE Directive is to comply with a relevant harmonized standards which, for spectrum aspects, are developed by [ETSI](#). It is now possible to send notifications of the intention to place equipment on the market electronically using a [one-stop procedure](#) to a number of spectrum authorities simultaneously.

The purpose of marking equipment is to indicate its conformance to relevant European Union (EU) Directives.

8.1.2 United States of America FCC

A Part 15 transmitter must be tested and authorized before it may be marketed. There are two ways to obtain authorization: certification and verification.

Certification

The certification procedure requires that tests be performed to measure the levels of radio frequency energy that are radiated by the device into the open air or conducted by the device onto the power lines. A description of the measurement facilities of the laboratory where these tests are performed must be on file with the Commission's laboratory or must accompany the certification application. After these tests have been performed, a report must be produced showing the test procedure, the test results, and some additional information about the device including design drawings, internal and external photos, expository statement, etc. The specific information that must be included in a certification report is detailed in Part 2 of the FCC Rules and in the rules that govern the equipment.

Verification

The verification procedure requires that tests be performed on the transmitter to be authorized using a laboratory that has calibrated its test site or, if the transmitter is incapable of being tested at a laboratory, at the installation site. These tests measure the levels of radio frequency energy that are radiated by the transmitter into the open air or conducted by the transmitter onto the power lines. After these tests are performed, a report must be produced showing the test procedure, the test results, and some additional information about the transmitter including design drawings. The specific information that must be included in a verification report is detailed in Part 2 of the FCC Rules and the rules governing the device.

Once the report is completed, the manufacturer (or importer for an imported device) is required to keep a copy of it on file as evidence that the transmitter meets the technical standards in Part 15. The manufacturer (importer) must be able to produce this report on short notice should the FCC ever request it.

TABLE 5

Authorization procedures for Part 15 transmitters

Low-power transmitter	Authorization procedure
Amplitude modulation (AM) band transmission systems on the campuses of educational institutions	Verification
Cable locating equipment at or below 490 kHz	Verification
Carrier current systems	Verification
Devices, such as a perimeter protection systems, that must be measured at the installation site	Verification of first three installations with resulting data immediately used to obtain certification
Leaky coaxial cable systems	If designed for operation exclusively in the AM broadcast band: verification; otherwise: certification
Tunnel radio systems	Verification
All other Part 15 transmitters	Certification

A detailed description of the certification and verification procedures as well as marking requirements is contained in Appendix 2. Additional guidance on authorization processes for specific low power devices can be found in Part 15 of the FCC rules.

8.1.3 The Republic of Korea

A radio transmitter must be tested and registered according to Article 46 of the Radio Waves Act, before it may be marketed. The test is carried out by authorized test laboratories.

8.1.4 Brazil

In 2008, Anatel republished the Regulation on Restricted Radiation Radio Communications Equipment in Brazil, approved by Resolution No. 506, of 1 July 2008. This Regulation specifies the characteristics of restricted radiation equipment and establishes the conditions for the use of radio frequencies so that such equipment can be used without a station operating license or a grant for authorization to use radio frequencies.

All telecommunication products to be used in Brazil must be certificated, independently if they are classified as restricted radiation communications equipment or not. The Regulation on The Certification and Authorization of Telecommunication Products, approved by Resolution No. 242, of 30 November 2000 establishes the general rules and procedures related to the certification and authorization of telecommunications products, including the assessment of the conformity of telecommunication products with the technical regulations issued or adopted by Anatel and the requirements concerning the authorization of telecommunication products. more detailed description of the certification and authorization procedures is contained in Appendix 6 to Annex 2.

8.2 Licensing requirements

Licensing is an appropriate tool for administrations to regulate the efficient use of the frequency spectrum.

There is a general agreement that when the efficient use of the frequency spectrum is not at risk and as long as harmful interference is unlikely, the installation and use of the spectrum or radio equipment may be exempt from a general licence or an individual licence.

SRDs are generally exempt from individual licensing. However, exceptions may be made based on national regulations.

When radio equipment is subject to an exemption from individual licensing, generally speaking, anyone can buy, install, possess and use the radio equipment without any prior permission from the administration. Administrations will not register the individual equipment but the use of the equipment can be subject to national provisions. Furthermore, the sale and possession of some short-range radiocommunication equipment such as ultra low power active medical implant devices may be controlled by either the manufacturer or the national administration.

8.3 Mutual agreements between countries/regions

Administrations have in many cases found it beneficial and efficient to establish mutual agreements between countries/regions providing for the recognition by one country/region of the conformity test results of a recognized/accredited test laboratory in the other country/region.

The EU, inspired by this approach, has now established on a broader basis mutual recognition agreements (MRAs) between the EU on the one hand and the United States of America, Canada, Australia and New Zealand on the other.

These MRAs enable manufacturers to have the conformity of their products assessed in accordance with the regulatory requirements of the relevant third country by appropriately designated laboratories, inspection bodies and conformity assessment bodies (CABs) in their own countries, hence reducing the costs of such assessments and the time needed to access markets.

The agreements comprise a framework agreement which establishes the mutual recognition principles and procedures, and a series of sectoral annexes which detail, for each sector, the scope in terms of products and operations, the respective legislation, and any specific procedures.

8.3.1 The MRA with the United States of America

The MRA between the EU and the United States of America entered into force on 1 December 1998.

The MRA aims to avoid duplication of controls, increase transparency of procedures, and reduce time-to-market for products in six industrial sectors: telecommunications equipment, EMC, electrical safety, recreational craft, medicinal products, and medical devices. The Agreement should benefit manufacturers, traders and consumers.

8.3.2 MRAs – Canada

Canada has entered into MRAs with the EU, European Economic Area – European Free Trade Association (EEA-EFTA), the Asia-Pacific Economic Cooperation (APEC), Switzerland and the Inter-American Telecommunication Commission (CITEL). By virtue of these agreements manufacturers in these countries will be able to have the conformity of their products assessed in line with Canadian regulatory requirements by appropriately recognized laboratories and certification bodies. This reduces assessment costs and time-to-market, while Canadian manufacturers will benefit from the same advantages in respect of their market.

8.3.3 The MRAs with Australia and New Zealand

The MRAs between the EU and Australia and New Zealand entered into force on 1 January 1999.

The agreements provide for the reciprocal acceptance of the testing, certification and approval of products by each party against the regulatory requirements of the other party. Products can therefore be certified by recognized CABs in Europe to Australian and New Zealand requirements and then be placed on those markets without the need for any further approval procedures.

8.3.4 MRAs – The Republic of Korea

Korea has entered into MRA with Canada, United States, Viet Nam and the Republic of Chile. The test reports from the designated laboratories in those countries should be recognized.

8.3.5 Global harmonization of regulations

As long as the regulations in the countries/regions are not globally harmonized in the same way as the R&TTE Directive provides for EEA-wide harmonization, MRAs are the next best solution to facilitate trade between countries/regions for the benefit of manufacturers, suppliers and users.

9 Additional applications

Additional applications of SRDs continue to be developed and implemented. Annex 1 contains the technical parameters of several types of these additional applications. These so far are SRDs operating in 57-64 GHz band for use for high-speed data communications and RF level gauges.

Annex 1

Additional applications

1 SRDs operating in the 57-64 GHz band

SRDs transmitting in the 57-64 GHz oxygen absorption band will make use of large amounts of contiguous spectrum for very high-speed data communications at rates of 100 Mbit/s to greater than 1 000 Mbit/s.

Applications may include digital video links, position sensors, short-range wireless point to multipoint data links, wireless local-area networks, and broadband wireless access for both fixed and mobile information appliances.

In many cases, the proposed applications will operate over the 57-64 GHz band with broadband or swept signals. Often, due to the very high data rates, or the large number of frequency channels required for a network, the entire 57-64 GHz spectrum will be used by a pair, or group, of SRDs. Also, short-range position sensors used to generate accurate position information for machine tools operate with swept signals, could encompass the entire 57-64 GHz band.

The FCC developed a spectrum etiquette to govern operation of SRDs in the 57-64 GHz frequency band.

The United States of America etiquette consists of the following limits:

- Total transmitter output power limit = 500 mW peak

Interference probability is most directly related to total transmitter output power.

- Total transmitter output power limit = 500 mW (emission bandwidth/100 MHz) for emission bandwidth < 100 MHz

Narrow-band transmitters can interfere with broadband communications if there is any overlap of frequencies. This provision protects broadband communicators.

- e.i.r.p. = (transmitter output power) × (antenna gain) = 10 W average, 20 W peak

By limiting the intensity of focused beams, the maximum range over which interference can occur is limited to less than 1 km even for very narrow beams. The FCC specifies this radiated power limit as a power density of $18 \mu\text{W}/\text{cm}^2$ measured at a distance of 3 m from the source.

In addition, the United States of America has imposed an additional interference mitigation requirement on 57-64 GHz SRDs. This requires that short-range radiocommunication transmitter broadcast identification at intervals of at least 1 s.

The FCC has dealt separately with fixed field disturbance sensors operating in the 61-61.5 GHz band. It has limited radiated power to an e.i.r.p. of 20 mW peak, which is equivalent to a power density of $18 \mu\text{W}/\text{cm}^2$ measured at a distance of 3 m from the source.

In Europe, SRDs power limits in the band 61-61.5 GHz are: e.i.r.p. = 100 mW.

2 RF level gauges

The operating parameters and spectrum uses of RF level gauges which are in operation today throughout the world are indicated in Tables 6 to 8.

2.1 Pulsed systems

Pulsed systems are low cost and have low power consumption. Today they operate at 5.8 GHz which is the centre frequency of the ISM allocation. However, manufacturers are expecting products in the 10 GHz, 25 GHz, and 76 GHz ranges. The exact frequency of operation will depend on a particular product. Typical characteristics are in Table 6.

TABLE 6

Characteristic	Value
Bandwidth	$0.1 \times \text{frequency}$
Tx power (peak) (dBm)	0 to 10
Pulse width	200 ps to 3 ns
Duty cycle (%)	0.1 to 1
Pulse repetition frequency (MHz)	0.5 to 4

Pulse RF systems radiate a pulse with or without a carrier through air.

2.2 FMCW systems

This type of system is well developed. The FMCW is robust and uses advanced signal processing which provides good reliability. The characteristics of FMCW systems are in Table 7.

TABLE 7

Characteristic	Value
Frequency (GHz)	10, 25
Bandwidth (GHz)	0.6, 2
Tx power (dBm)	0 to 10

2.3 RF level gauge operating parameters and spectrum use

TABLE 8

Frequency band (GHz)	Power	Antenna	Duty cycle (%)
0.5-3	10 Mw	Integral	0.1 to 1
4.5-7	100 Mw		0.1 to 1
8.5-11.5	500 mW		0.1 to 1
24.05-27	2 W		0.1 to 1
76-78	8 W		0.1 to 1

NOTE 1 – Operation of these gauges may not be possible and/or may require certification in certain portions of these frequency ranges in accordance with existing national and international regulations.

NOTE 2 – The frequency band 0.5-3 GHz will not be assigned in CEPT countries for RF level gauges.

NOTE 3 – The frequency band for operation of RF level gauges in the 10 GHz range is limited within CEPT countries to frequency band 8.5-10.6 GHz.

Annex 2

This annex provides information on national/regional rules which contain technical and operational parameters and spectrum use. Those are given in Appendices 1 through 7 to this annex.

Appendix 1 to Annex 2

(Region 1; CEPT Countries)

Technical and operating parameters and spectrum use for SRDs

1 Recommendation CEPT/ERC/REC 70-03

Recommendation CEPT/ERC/REC 70-03 – Relating to the use of short-range devices (SRD), sets out the general position on common spectrum allocations for SRDs for countries within the CEPT. It is also intended that it can be used as a reference document by the CEPT member countries when preparing their national regulations. The Recommendation describes the spectrum management requirements for SRDs relating to allocated frequency bands, maximum power levels, equipment antenna, channel spacing, duty cycle, licensing and free circulation.

2 Frequency bands and corresponding parameters

The following applications and frequency bands are covered by annexes of Recommendation CEPT/ERC/REC 70-03 which can be downloaded from the website of the European Communications Office: (<http://www.cept.org/eco>). It should be remembered that it represents the most widely accepted position within the CEPT member states but it should not be assumed that all frequency allocations are available in all countries.

2.1 Non-specific short-range devices

Table 9A covers frequency bands and regulatory as well as informative parameters recommended primarily for telemetry, telecommand, alarms and data in general and other similar applications. Video applications should be preferably used above 2.4 GHz.

This Table also includes references to the generic UWB regulation which was primarily developed to allow communication applications using UWB technology in bands below 10.6 GHz, but also enables other types of radio applications.

TABLE 9A
Regulatory parameters

	Frequency band	Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
A	6 765-6 795 kHz	42 dB(μ A/m) at 10 m	No requirement	No spacing		
B	13.553-13.567 MHz	42 dB(μ A/m) at 10 m	No requirement	No spacing		
C	26.957-27.283 MHz	42 dB(μ A/m) at 10 m 10 mW e.r.p.	No requirement	No spacing	ERC/DEC/(01)02	
D	40.660-40.700 MHz	10 mW e.r.p.	No requirement	No spacing	ERC/DEC/(01)03	
E	138.20-138.45 MHz	10 mW e.r.p.	< 1.0% (Note 1)	No spacing		
F	433.050-434.790 MHz (Note 4)	10 mW e.r.p.	< 10% (Note 1)	No spacing		
f1	433.050-434.790 MHz (Note 4bis)	1 mW e.r.p. -13 dBm/10 kHz	No requirement	No spacing		Power density limited to -13 dBm/ 10 kHz for wideband modulation with a bandwidth greater than 250 kHz
f2	434.040-434.790 MHz (Note 4bis)	10 mW e.r.p.	No requirement	Up to 25 kHz		

TABLE 9A (continued)

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
G	863-870 MHz (Notes 3, 4 and 6)	≤ 25 mW e.r.p.	$\leq 0.1\%$ or LBT (Notes 1 and 5)	≤ 100 kHz for 47 or more channels (Note 2)		FHSS modulation
		≤ 25 mW e.r.p. (Note 6) Power density: -4.5 dBm/100 kHz (Note 7)	$\leq 0.1\%$ or LBT+AFA (Notes 1, 5 and 6)	No spacing		DSSS and other wideband modulation other than FHSS
		≤ 25 mW e.r.p.	$\leq 0.1\%$ or LBT+AFA (Notes 1 and 5)	≤ 100 kHz, for 1 or more channels modulation bandwidth ≤ 300 kHz (Note 2)		Narrow-/ wideband modulation
g1	868.000-868.600 MHz (Note 4)	≤ 25 mW e.r.p.	$\leq 1\%$ or LBT+AFA (Note 1)	No spacing, for 1 or more channels (Note 2)		Narrow-/ wideband modulation. No channel spacing, however the whole stated frequency band may be used
g2	868.700-869.200 MHz (Note 4)	≤ 25 mW e.r.p.	$\leq 0.1\%$ or LBT+AFA (Note 1)	No spacing, for 1 or more channels (Note 2)		Narrow-/ wideband modulation. No channel spacing, however the whole stated frequency band may be used
g3	869.400-869.650 MHz	≤ 500 mW e.r.p.	$\leq 10\%$ or LBT+AFA (Note 1)	25 kHz (for 1 or more channels)		Narrow-/ wideband modulation. The whole stated frequency band may be used as 1 channel for high speed data transmission

TABLE 9A (end)

	Frequency band	Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
g4	869.700-870.000 MHz (Note 4bis)	≤ 5 mW e.i.r.p. ≤ 25 mW e.i.r.p.	No requirement up to 1% or LBT+AFA (Note 1)	No spacing (for 1 or more channels)		Narrow-/ wideband modulation. No channel spacing, however the whole stated frequency band may be used
h	2 400.0-2 483.5 MHz	10 mW e.i.r.p.	No requirement	No spacing		
i	5 725-5 875 MHz	25 mW e.i.r.p.	No requirement	No spacing		
j	24.00-24.25 GHz	100 mW e.i.r.p.	No requirement	No spacing		
k	61.0-61.5 GHz	100 mW e.i.r.p.	No requirement	No spacing		
l	122-123 GHz	100 mW e.i.r.p.	No requirement	No spacing		
m	244-246 GHz	100 mW e.i.r.p.	No requirement	No spacing		
n	3.1-4.8 GHz 6-9 GHz	*	*	*	ECC/DEC/(06)04 ECC/DEC/(06)12	Generic UWB regulation * See detailed requirements in related ECC Decisions

NOTE 1 – When either a duty cycle, listen before talk (LBT) or equivalent technique applies then it shall not be user dependent/adjustable and shall be guaranteed:

- by appropriate technical means;
- for LBT devices without Adaptive Frequency Agility (AFA), or equivalent techniques, the duty cycle limit applies;
- for any type of frequency agile device the duty cycle limit applies to the total transmission unless LBT or equivalent technique is used.

NOTE 2 – The preferred channel spacing is 100 kHz allowing for a subdivision into 50 kHz or 25 kHz.

NOTE 3 – Sub-bands for alarms are excluded (see Table 9G for alarms).

NOTE 4 – Audio and video applications are allowed provided that a digital modulation method is used with a maximum bandwidth of 300 kHz.

Analogue and digital voice applications are allowed with a max. bandwidth ≤ 25 kHz.

In sub-band 863-865 MHz voice and audio conditions of Annexes 10 and 13 of ERC/REC 70 – 03 apply respectively.

Notes relating to Table 9A (end):

NOTE 4bis – Audio and video applications are excluded. Voice applications (analogue or digital) are allowed with a maximum bandwidth ≤ 25 kHz, spectrum access technique such as LBT or equivalent and a power output sensor controlling the transmitter to a maximum transmit period of 1 minute for each transmission.

NOTE 5 – Duty cycle may be increased to 1% if the band is limited to 865-868 MHz.

NOTE 6 – For other wideband modulation than FHSS and DSSS with a bandwidth of 200 kHz to 3 MHz, duty cycle can be increased to 1% if the band is limited to 865-868 MHz and power to ≤ 10 mW e.r.p.

NOTE 7 – The power density can be increased to +6.2 dBm/100 kHz and -0.8 dBm/100 kHz, if the band of operation is limited to 865-868 MHz and 865-870 MHz respectively.

2.2 Tracking, tracing and data acquisition

Table 9B covers frequency bands and regulatory as well as informative parameters recommended for a number of specific devices including:

- detecting avalanche victims;
- meter reading;
- asset tracking and tracing.

TABLE 9B
Regulatory parameters

	Frequency band	Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	456.9-457.1 kHz	7 dB(μ A/m) at 10 m	No requirement	Continuous wave (CW) – no modulation	ECC/DEC/(04)01	Detection of avalanche victims. NOTE – Centre frequency is 457 kHz.
b	169.4-169.475 MHz	500 mW e.r.p.	< 10% duty cycle	Max 50 kHz	ECC/DEC/(05)02	Meter reading
c	169.4-169.475 MHz	500 mW e.r.p.	< 1% duty cycle	Max 50 kHz	ECC/DEC/(05)02	Asset tracking and tracing

2.3 Wideband data transmission systems

Table 9C covers frequency bands and regulatory as well as informative parameters recommended for wideband data transmission systems and wireless access systems including radio local area networks (WAS/RLANs) (formerly known as Radio Local Area Networks (RLANs)) within the band 2 400-2 483.5 MHz, for wireless access systems including radio local area networks (WAS/RLANs) within the bands 5 150-5 350 MHz, 5 470-5 725 MHz and 17.1-17.3 GHz, and for multiple-gigabit WAS/RLAN systems within the band 57-66 GHz.

TABLE 9C

Regulatory parameters

	Frequency band	Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	2 400.0-2 483.5 MHz	100 mW e.i.r.p.	See Note 1	No spacing	ERC/DEC/(01)07	For wide band modulations other than FHSS, the maximum e.i.r.p. density is limited to 10 mW/MHz.
b	5 150-5 350 MHz	200 mW mean e.i.r.p. See Note 3	See Notes 1 and 2	No spacing	ECC/DEC/(04)08	Restricted to indoor use. The maximum mean e.i.r.p. density shall be limited to 10 mW/MHz in any 1 MHz band.
c	5 470-5 725 MHz	1 W mean e.i.r.p. See Note 3	See Notes 1 and 2	No spacing	ECC/DEC/(04)08	Indoor as well as outdoor use allowed. The maximum mean e.i.r.p. density shall be limited to 50 mW/MHz in any 1 MHz band.
d	17.1-17.3 GHz	100 mW e.i.r.p.	No requirement	No spacing		
e	57-66 GHz	40 dBm mean e.i.r.p.	See Note 1	No spacing		Fixed outdoor installations are not allowed. The maximum mean e.i.r.p. density is limited to 13 dBm/MHz.

NOTE 1 – The equipment shall implement an adequate spectrum sharing mechanism in order to facilitate sharing between the various technologies and applications.

NOTE 2 – WAS/RLANs operating in the bands 5 250-5 350 MHz and 5 470-5 725 MHz shall use mitigation techniques that give at least the same protection as the detection, operational and response requirements described in ETSI EN 301 893 to ensure compatible operation with radiodetermination systems (radars). Such mitigation techniques shall equalise the probability of selecting a specific channel for all available channels so as to ensure, on average, a near-uniform spread of spectrum loading. Specific information about the applicability of ETSI EN 301 893 can be found at: <http://ec.europa.eu/comm/enterprise/rte/harstand.htm>.

NOTE 3 – WAS/RLANs operating in the bands 5 250-5 350 MHz and 5 470-5 725 MHz shall employ transmitter power control (TPC), which provides, on average, a mitigation factor of at least 3 dB on the maximum permitted output power of the systems. If transmitter power control is not in use, the maximum permitted mean e.i.r.p. and the corresponding mean e.i.r.p. density limits shall be reduced by 3 dB.

2.4 Railway applications

Table 9D covers frequency bands and regulatory as well as informative parameters recommended for applications specifically intended for use on railways.

The sub-bands below are intended for the following applications:

- band a): automatic vehicle identification systems for railways including automatic vehicle identification for railways (AVI);
- band b): balise tele-powering and downlink (train to ground) systems including Eurobalise and activation of the Loop/Euroloop;
- band c): balise uplink (ground to train) systems including Eurobalise;
- bands d1) and d2): loop uplink (ground to train) systems including Euroloop.

TABLE 9D

Regulatory parameters

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	2 446-2 454 MHz	500 mW e.i.r.p.	No requirement			Transmitting only in presence of trains. 5 channels, each 1.5 MHz wide within the band 2 446-2 454 MHz.
b	27.090-27.100 MHz	42 dB(μ A/m) at 10 m	No requirement	No spacing		Tele-powering and downlink signal for Balise/Eurobalise. May also be optionally used for the activation of the Loop/Euroloop. NOTE – Centre frequency is 27.095 MHz.
c	984-7 484 kHz	9 dB(μ A/m) at 10 m	< 1% duty cycle	No spacing		Transmitting only on receipt of a Balise/Eurobalise tele-powering signal from a train. NOTE – Centre frequency is 4 234 kHz.
d1	516-8 516 kHz	7 dB(μ A/m) at 10 m	No requirement	No spacing		Not intended for new applications, existing applications to be phased out by 2010. NOTE – Centre frequency is 4 516 kHz.
d2	7.3-23.0 MHz	-7 dB(μ A/m) at 10 m	No requirement	No spacing		Maximum field strength specified in a bandwidth of 10 kHz, spatially averaged over any 200 m length of the loop. Transmitting only in presence of trains. Spread spectrum signal, code length: 472 chips. NOTE – Centre frequency is 13.547 MHz.

2.5 Road transport and traffic telematics (RTTT)

Table 9E covers frequency bands and regulatory as well as informative parameters recommended for road transport and traffic telematics (RTTT) including radar system installations to be used in vehicles.

TABLE 9E
Regulatory parameters

	Frequency band	Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	5 795-5 805 MHz	2 W e.i.r.p. 8 W e.i.r.p.	No requirement		ECC/DEC/(02)01	
b	5 805-5 815 MHz	2 W e.i.r.p. 8 W e.i.r.p.	No requirement		ECC/DEC/(02)01	Individual license required.
c	63-64 GHz			No spacing	ECC/DEC/(02)01	Vehicle to vehicle and road to vehicle systems. Power level and spectrum access and mitigation requirement to be determined.
d	76-77 GHz	55 dBm peak e.i.r.p.	No requirement	No spacing	ECC/DEC/(02)01	Power level 55 dBm peak power e.i.r.p. 50 dBm average power –23.5 dBm average power for pulse radar only. Vehicle and infrastructure radar systems.
e	21.65-26.65 GHz	*	*	*	ECC/DEC/(04)10	For automotive short-range radars (SRR) * See detailed requirements in related ECC Decision. New SRR equipment may only be placed on the market until 1 July 2013.
f	77-81 GHz	*	*	*	ECC/DEC/(04)03	For automotive short-range radars (SRR). * See detailed requirements in related ECC Decision.
g1	24.050-24.075 GHz	100 mW e.i.r.p.	No requirement			For vehicle radars

TABLE 9E (end)

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
g2	24.075-24.150 GHz	0.1 mW e.i.r.p.	No requirement			For vehicle radars
		100 mW e.i.r.p.	$\leq 4 \mu\text{s}/40 \text{ kHz}$ dwell time every 3 ms (Note 1)			For vehicle radars. The spectrum access and mitigation requirement is given for devices mounted behind a bumper. If mounted without a bumper, the requirement should be $3 \mu\text{s}/40 \text{ kHz}$ maximum dwell time every 3 ms.
			$\leq 1 \text{ ms}/40 \text{ kHz}$ dwell time every 40 ms (Note 1)			The spectrum access and mitigation requirement is given for devices mounted either behind a bumper or mounted without a bumper.
g3	24.150-24.250 GHz	100 mW e.i.r.p.	No requirement			For vehicle radars

NOTE 1 – A requirement for minimum frequency modulation range (applicable to FMCW or step frequency signals) or minimum instantaneous bandwidth (applicable to pulsed signal) of 250 kHz applies in addition to the requirement on maximum dwell time.

2.6 Radiodetermination applications

Table 9F covers frequency bands and regulatory as well as informative parameters recommended for SRD radiodetermination applications including SRD radar systems, equipment for detecting movement and alert. Radiodetermination is defined as the determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves.

TABLE 9F

Regulatory parameters

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	2 400.0-2 483.5 MHz	25 mW e.i.r.p.	No requirement	No spacing	ERC/DEC/(01)08	
b	9 200-9 500 MHz	25 mW e.i.r.p.	No requirement	No spacing		
c	9 500-9 975 MHz	25 mW e.i.r.p.	No requirement	No spacing		

TABLE 9F (end)

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
d	10.5-10.6 GHz	500 mW e.i.r.p.	No requirement	No spacing		
e	13.4-14.0 GHz	25 mW e.i.r.p.	No requirement	No spacing		
f	24.05-24.25 GHz	100 mW e.i.r.p.	No requirement	No spacing		
g	4.5-7.0 GHz	-41.3 dBm/MHz e.i.r.p.	No requirement	No spacing		
h	8.5-10.6 GHz	-41.3 dBm/MHz e.i.r.p.	No requirement	No spacing		
i	24.05-27.00 GHz	-41.3 dBm/MHz e.i.r.p.	No requirement	No spacing		
j	57-64 GHz	-41.3 dBm/MHz e.i.r.p.	No requirement	No spacing		
k	75-85 GHz	-41.3 dBm/MHz e.i.r.p.	No requirement	No spacing		
l	17.1-17.3 GHz	+26 dBm e.i.r.p.	DAA	No spacing	Ground-based synthetic aperture radar (GBSAR) (Note 1).	
m	30 MHz-12.4 GHz	*	*	*	ECC/DEC/(06)08	For ground- and wall-probing radar (GPR/WPR) imaging systems, subject to an appropriate licensing regime. * See detailed requirements in related ECC Decision.
n	2.2-8 GHz	*	*	*	ECC/DEC/(07)01	For building material analysis (BMA) devices. * See detailed requirements in related ECC Decision..

NOTE 1 – Specific requirements for the radar antenna pattern and for the implementation of detect and avoid (DAA) technique apply as described in ETSI EN 300 440 for ground-based synthetic aperture radar (GBSAR) systems.

2.7 Alarms

Table 9G covers frequency bands and regulatory as well as informative parameters recommended exclusively for alarm systems including social alarms and alarms for security and safety.

The sub-bands below are intended for the following applications:

- *alarms in general*: bands a), b), c) and e)
- *social alarms*: bands d), f) and g).

TABLE 9G

Regulatory parameters

	Frequency band	Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	868.6-868.7 MHz	10 mW e.r.p.	< 1.0% duty cycle	25 kHz		The whole frequency band may also be used as 1 channel for high speed data transmissions.
b	869.250-869.300 MHz	10 mW e.r.p.	< 0.1% duty cycle	25 kHz		
c	869.650-869.700 MHz	25 mW e.r.p.	< 10% duty cycle	25 kHz		
d	869.200-869.250 MHz	10 mW e.r.p.	< 0.1% duty cycle	25 kHz		Social alarms
e	869.300-869.400 MHz	10 mW e.r.p.	< 1.0% duty cycle	25 kHz		
f	169.4750-169.4875 MHz	10 mW e.r.p.	< 0.1% duty cycle	12.5 kHz	ECC/DEC/(05)02	Social alarms (exclusive use)
g	169.5875-169.6000 MHz	10 mW e.r.p.	< 0.1% duty cycle	12.5 kHz	ECC/DEC/(05)02	Social alarms (exclusive use)

2.8 Model control

Table 9H covers frequency bands and regulatory as well as informative parameters recommended for the application of model control equipment, which is solely for the purpose of controlling the movement of the model, in the air, on land or over or under the water surface. Although the bands are not harmonized, the parameters given in the table are common in a majority of CEPT countries. It should be noted that the bands are not exclusive for this type of application.

TABLE 9H

Regulatory parameters

	Frequency band	Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	26.995, 27.045, 27.095, 27.145, 27.195 MHz	100 mW e.r.p.	No requirement	10 kHz	ERC/DEC/(01)10	
b	34.995-35.225 MHz	100 mW e.r.p.	No requirement	10 kHz	ERC/DEC/(01)11	Only for flying models
c	40.665, 40.675, 40.685, 40.695 MHz	100 mW e.r.p.	No requirement	10 kHz	ERC/DEC/(01)12	

2.9 Inductive applications

Table 9I covers frequency bands and regulatory as well as informative parameters recommended for inductive applications include for example car immobilizers, animal identification, alarm systems, cable detection, waste management, personal identification, wireless voice links, access control, proximity sensors, data transfer to handheld devices, automatic article identification, wireless control systems, automatic road tolling and anti-theft systems including RF anti-theft induction systems. It should be noted that other types of anti-theft systems can be operated in accordance with other relevant annexes.

TABLE 9I
Regulatory parameters

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a1	9-90 kHz	72 dB(μ A/m) at 10 m (Note 1)	No requirement	No spacing		In case of external antennas only loop coil antennas may be employed. Field-strength level descending 3 dB/oct at 30 kHz.
a2	90-119 kHz	42 dB(μ A/m) at 10 m	No requirement	No spacing		In case of external antennas only loop coil antennas may be employed.
a3	119-135 kHz	66 dB(μ A/m) at 10 m (Note 1)	No requirement	No spacing		In case of external antennas only loop coil antennas may be employed. Field-strength level descending 3 dB/oct at 119 kHz.
b	135-140 kHz	42 dB(μ A/m) at 10 m	No requirement	No spacing		In case of external antennas only loop coil antennas may be employed.
c	140-148.5 kHz	37.7 dB(μ A/m) at 10 m	No requirement	No spacing		In case of external antennas only loop coil antennas may be employed.
d	6 765-6 795 kHz	42 dB(μ A/m) at 10 m	No requirement	No spacing		
e	7 400-8 800 kHz	9 dB(μ A/m) at 10 m	No requirement	No spacing		
f	13.553-13.567 MHz	42 dB(μ A/m) at 10 m	No requirement	No spacing		
f1	13.553-13.567 MHz	60 dB(μ A/m) at 10 m	No requirement	No spacing		For RFID and EAS only.
g	26.957-27.283 MHz	42 dB(μ A/m) at 10 m	No requirement	No spacing	ERC/DEC/(01)16	

TABLE 9I (continued)

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
h	10.200-11.000 MHz	9 dB(μ A/m) at 10 m	No requirement	No spacing		
k	3 155-3 400 kHz	13.5 dB(μ A/m) at 10 m	No requirement	No spacing		In case of external antennas only loop coil antennas may be employed.
l1	148.5 kHz-5 MHz	-15 dB(μ A/m) at 10 m	No requirement	No spacing		In case of external antennas only loop coil antennas may be employed. The maximum field strength is specified in a bandwidth of 10 kHz. The maximum allowed total field strength is -5 dB(μ A/m) at 10 m for systems operating at bandwidths larger than 10 kHz whilst keeping the density limit (-15 dB(μ A/m) in a bandwidth of 10 kHz).
l2	5-30 MHz	-20 dB(μ A/m) at 10 m	No requirement	No spacing		In case of external antennas only loop coil antennas may be employed. The maximum specified in a bandwidth of 10 kHz. The maximum allowed total field strength is -5 dB(μ A/m) at 10 m for systems operating at bandwidths larger than 10 kHz whilst keeping the density limit (-20 dB(μ A/m) in a bandwidth of 10 kHz).

TABLE 9I (end)

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
13	400-600 kHz	-8 dB(μ A/m) at 10 m	No requirement	No spacing		For RFID only. In case of external antennas only loop coil antennas may be employed. The maximum field strength is specified in a bandwidth of 10 kHz. The maximum allowed total field strength is -5 dB(μ A/m) at 10 m for systems operating at bandwidths larger than 10 kHz measured at the centre frequency whilst keeping the density limit (-8 dB(μ A/m) in a bandwidth of 10 kHz). These systems should operate with a minimum operating bandwidth of 30 kHz.

NOTE 1 – Limit is reduced to 42 dB(μ A/m) at 10 m.

Station	Frequency (kHz)	Protection bandwidth (Hz)	Maximum field strength at 10 m (dB(μ A/m))	Location
MSF	60	\pm 250	42	United Kingdom
RBU	66.6	\pm 750	42	Russian Federation
HBG	75	\pm 250	42	Switzerland
DCF77	77.5	\pm 250	42	Germany
DCF49	129.1	\pm 500	42	Germany

Standard frequency and time signals to be protected within 9-90 kHz and 119-135 kHz.

2.10 Radio microphone applications including aids for the hearing impaired

Table 9J covers frequency bands and regulatory as well as informative parameters recommended for radio microphone applications (also referred to as wireless microphones or cordless microphones) including aids for the hearing impaired (also referred to as assistive listening devices). Radio microphones are small, low power (typically 50 mW or less) transmitters designed to be worn on the body, or hand-held, for the transmission of sound. The receivers are more tailored to specific uses and may range from small and portable to rack-mounted modules as part of a multichannel system. This Annex covers professional and consumer radio microphones, both hand-held and body-worn, and aids for the hearing impaired.

Because of the difficulty in determining harmonised frequency bands for radio microphones, frequency band limits should be regarded as tuning ranges within which a device can be designated to operate. In most cases, parts of the range are not available in individual countries, but this does not apply to the broadcasting bands at 174-216 MHz and 470-862 MHz where national geographical and licensing restrictions are likely to exist and the national administration should be contacted.

The sub-bands below are intended for the following applications:

- *aids for the hearing impaired*: sub-bands b), c), d), h1), h2), i);
- *radio microphones*: sub-bands a), c), d), e1), e2), e3), e4), f), g).

Aids for the hearing impaired are specific radio microphone applications which capture an acoustic signal that is transmitted by radio to the hearing aid receivers.

TABLE 9J

Regulatory parameters

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	29.7-47.0 MHz	10 mW e.r.p.	No requirement	50 kHz		On a tuning range basis. The frequency bands 30.3-30.5 MHz, 32.15-32.45 MHz and 41.015-47.00 MHz are harmonized military bands.
b	173.965-174.015 MHz	2 mW e.r.p.	No requirement	50 kHz		Aids for the hearing impaired.
c	863-865 MHz	10 mW e.r.p.	No requirement	No spacing		
d	174-216 MHz	50 mW e.r.p.	No requirement	No spacing		On a tuning range basis. Individual licence required.
e1	470-786 MHz	50 mW e.r.p.	No requirement	No spacing		On a tuning range basis. Individual licence required.

TABLE 9J (continued)

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
e2	786-789 MHz	12 mW e.r.p.	No requirement	No spacing		On a tuning range basis. Individual licence required. See technical conditions for PMSE (including radio microphones) in Annex 3 of Decision ECC/DEC/ (09)03 section 3.1.
e3	823-826 MHz	20 mW e.i.r.p. 100 mW e.i.r.p.	No requirement	200 kHz		Individual licence required. 100 mW restricted to body worn microphones. See technical conditions for PMSE (including radio microphones) in Annex 3 of Decision ECC/DEC/ (09)03 section 3.1.
e4	826-832 MHz	100 mW e.i.r.p.	No requirement	200 kHz		Individual licence required. See technical conditions for PMSE (including radio microphones) in Annex 3 of Decision ECC/DEC/ (09)03 section 3.1.
f	1 785-1 795 MHz	20 mW e.i.r.p. 50 mW e.i.r.p.	No requirement	No spacing		Individual licence required. 50 mW restricted to body-worn microphones.
g	1 795-1 800 MHz	20 mW e.i.r.p. 50 mW e.i.r.p.	No requirement	No spacing		50 mW restricted to body-worn equipment.
h1	169.4000-169.4750 MHz	10 mW e.r.p.	No requirement	Max 50 kHz	ECC/DEC/(05)02	Aids for the hearing impaired. (Personal hearing aid system).
		500 mW e.r.p.	No requirement	Max 50 kHz	ECC/DEC/(05)02	Aids for the hearing impaired. (Public hearing aid system). Individual licence may be required.

TABLE 9J (*end*)

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
h2	169.4875-169.5875 MHz	10 mW e.r.p.	No requirement	Max 50 kHz	ECC/DEC/(05)02	Aids for the hearing impaired. (Personal hearing aid system).
		500 mW e.r.p.	No requirement	Max 50 kHz	ECC/DEC/(05)02	Aids for the hearing impaired. (Public hearing aid system). Individual licence may be required.
i	169.4-174.0 MHz	10 mW e.r.p.	No requirement	Max 50 kHz		Aids for the hearing impaired. On a tuning range basis. Administrations should consider channel plan for band 169.4-169.8125 MHz detailed in ECC/DEC/(05)02 and the risk of interference towards systems operated in the band 169.6-169.8125 MHz when developing their national frequency table.

2.11 Radio-frequency identification applications

Table 9K covers frequency bands and regulatory as well as informative parameters recommended for radio-frequency identification (RFID) applications including for example automatic article identification, asset tracking, alarm systems, waste management, personal identification, access control, proximity sensors, anti-theft systems, location systems, data transfer to handheld devices and wireless control systems. It should be noted that other types of RFID systems can be operated in accordance with other relevant annexes.

TABLE 9K

Regulatory parameters

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a1	2 446-2 454 MHz	≤ 500 mW e.i.r.p.	No requirement	No spacing		
a2	2 446-2 454 MHz	> 500 mW-4 W e.i.r.p.	≤ 15% duty cycle FHSS techniques should be used	No spacing		Power levels above 500 mW are restricted to be used inside the boundaries of a building and the duty cycle of all transmissions shall in this case be ≤ 15% in any 200 ms period (30 ms on /170 ms off).
b1	865.0-865.6 MHz	100 mW e.r.p.	No requirement	200 kHz		
b2	865.6-867.6 MHz	2 W e.r.p.	No requirement	200 kHz		
b3	867.6-868.0 MHz	500 mW e.r.p.	No requirement	200 kHz		

2.12 Active medical implants and their associated peripherals

Table 9L covers frequency bands and regulatory as well as informative parameters recommended for active medical implants and their associated peripherals.

TABLE 9L

Regulatory parameters

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	402-405 MHz	25 μW e.r.p.	See Note 3	25 kHz	ERC/DEC/(01)17	For ultra low power active medical implants covered by the applicable harmonized standard. Individual transmitters may combine adjacent channels for increased bandwidth up to 300 kHz.

TABLE 9L (continued)

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a1	401-402 MHz	25 μ W e.r.p.	LBT or duty cycle \leq 0.1% (see Note 2)	25 kHz		For ultra low power active medical implants and accessories covered by the applicable harmonized standard and not covered by band a. Individual transmitters may combine adjacent 25 kHz channels for increased bandwidth up to 100 kHz (see Note 1).
a2	405-406 MHz	25 μ W e.r.p.	LBT or duty cycle \leq 0.1% (see Note 2)	25 kHz		For ultra low power active medical implants and accessories covered by the applicable harmonized standard and not covered by band a. Individual transmitters may combine adjacent 25 kHz channels for increased bandwidth up to 100 kHz (see Note 1).
b	9-315 kHz	30 dB(μ A/m) at 10 m 9-315 k	< 10%	No spacing		The application is for ultra low power active medical implant systems using inductive loop techniques for telemetry purposes.
c	315-600 kHz	-5 dB(μ A/m) at 10 m	< 10%	No spacing		The application is for animal implantable devices.
d	30.0-37.5 MHz	1 mW e.r.p.	< 10%	No spacing		The application is for ultra low power medical membrane implants for blood pressure measurements.

TABLE 9L (end)

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
e	12.5-20.0 MHz	-7 dB(μ A/m) at 10 m	< 10% duty cycle	No spacing		The application is for ULP active animal implantable devices (ULP-AID), limited to indoor only applications. The maximum field strength is specified in a bandwidth of 10 kHz. The transmission mask of ULP-AID is defined as follows: 3 dB bandwidth 300 kHz 10 dB bandwidth 800 kHz 20 dB bandwidth 2 MHz.
f	2 483.5-2 500 MHz	10 dBm e.i.r.p.	LBT+AFA and < 10% duty cycle. See Note 3	1 MHz		For low power active medical implants and associated peripherals, covered by the applicable harmonized standard. Individual transmitters may combine adjacent channels on a dynamic basis for increased bandwidth higher than 1 MHz. Peripheral units are for indoor use only.

NOTE 1 – Due to the limited available spectrum of 1 MHz, a maximum bandwidth of 100 kHz is proposed for these bands to ensure that several users could access the band concurrently.

NOTE 2 – Systems not providing frequency agility based on ambient RF field sensing, be limited to a maximum permitted e.r.p. of 250 nanowatts with a duty cycle of $\leq 0.1\%$.

NOTE 3 – The equipment shall implement a spectrum access mechanism as described in the applicable harmonized standard or an equivalent spectrum access mechanism.

2.13 Wireless audio applications

Table 9M covers frequency bands and regulatory as well as informative parameters recommended for applications for wireless audio systems including the following, cordless loudspeakers; cordless headphones; cordless headphones for portable use, for example portable CD, cassette or radio devices carried on a person; cordless headphones for use in a vehicle, for example for use with a radio or mobile telephone, etc.; in-ear monitoring, for use with concerts or other stage productions.

TABLE 9M

Regulatory parameters

Frequency band		Power/ magnetic field	Spectrum access and mitigation requirement	Channel spacing	ECC/ERC Decision	Notes
a	863-865 MHz	10 mW e.r.p.	No requirement	No spacing		
b	864.8-865.0 MHz	10 mW e.r.p.	No requirement	50 kHz		Narrow-band analogue voice devices
c	1 795-1 800 MHz	20 mW e.i.r.p.	No requirement	No spacing		
d	87.5-108.0 MHz	50 nW e.r.p.	No requirement	200 kHz		

3 Technical requirements**3.1 ETSI standards**

The ETSI is responsible for producing harmonized standards for telecommunications and radiocommunications equipment. These standards which are used for regulative purposes are known as European Norms (prefixed with EN).

Harmonized standards for radio equipment contain requirements relating to effective use of the spectrum and avoidance of harmful interference. These can be used by manufacturers as part of the conformity assessment process. The application of harmonized standards developed by ETSI is not mandatory, however where they are not applied a notified body must be consulted. The national standardization organizations are obliged by EU law to transpose European Standards for Telecommunications (ETs or ENs) into national standards, and to withdraw any conflicting national standards.

With regard to SRDs, ETSI developed four generic standards (EN 300 220; EN 300 330, EN 300 440 and EN 305 550) and a number of specific standards covering specific applications. All SRDs relevant standards are listed in Appendix 2 of Recommendation CEPT/ERC/REC 70-03.

3.2 EMC and safety**3.2.1 EMC**

All CEPT countries have EMC requirements, mostly based on IEC and CISPR standards or in some cases on Cenelec and ETSI EMC standards. In the EU/EFTA, the European harmonized standards from ETSI and CENELEC are the reference documents for presumption of conformity with the essential requirements of EMC Directive 2004/108/EC (most of these European standards are referred to in Recommendation CEPT/ERC/REC 70-03). The manufacturer has to affix the CE marking to his electrical products and has to have available a CE declaration, signed by himself and a technical file. He can, base those documents on a conformity investigation carried out by himself. Most European harmonized standards in the EEA are based on IEC/CISPR standards.

The CEPT countries outside the EU/EFTA mostly accept a test report from an accredited EEA laboratory in the EU/EFTA as proof of conformity. However, some request a conformity test report from one of their national laboratories.

3.2.2 Electrical safety

In general, the European countries have (electrical) safety requirements, based on IEC standards. In most cases IEC 60950 + amendments apply to radiocommunication equipment.

In the EEA the European harmonized standards from CENELEC are the reference documents for presumption of conformity with the essential requirements of the low voltage Directive 2006/95/EC. The most relevant European harmonized standard for radiocommunication equipment is EN 60950 + amendments, which is based on IEC 60950.

The CEPT countries outside the EU/EFTA usually require, a CB scheme certificate (international certification scheme under IECEE), granted by one of the members of the CB scheme as proof of conformity to IEC 60950.

NOTE 1 – Most customs authorities of the EU, require that equipment coming from outside the EEA, should be CE-marked for EMC and (electrical) safety and that an EC declaration of conformity (of the manufacturer) should be presented, before they grant an import licence.

3.3 National type approval specifications

Members of CEPT that are no EU/ EFTA member states and have not implemented the R&TTE Directive, have national regulations, sometimes based on this Directive, and use specifications for radio equipment which are based on transposed ENs or still in some cases based on their predecessors as CEPT Recommendations or fully national standards.

4 Additional spectrum use

4.1 Radiated power or magnetic field strength

The radiated power or H-field-strength limits mentioned in Recommendation CEPT/ERC/REC 70-03 are the maximum values allowed for SRDs. The levels were determined after careful analysis within ETSI and CEPT ECC (respectively ERC) and are dependent on the frequency range and the applications chosen. The average H-field strength/power level is 5 dB(μ A/m) at 10 m.

4.2 Transmitter antenna source

Basically three types of transmitter antennas are used for SRDs:

- integral (no external antenna socket);
- dedicated (conformity assessment type approved with the equipment);
- external (equipment type approved without an antenna).

Only in exceptional cases can external antennas be used and these will be mentioned in the appropriate Annex to Recommendation CEPT/ERC/REC 70-03.

4.3 Channel spacing

Channel spacings for SRDs are defined according to the needs of the different applications. They may vary between 5 kHz and 200 kHz or in some cases even “no channel spacing – whole stated frequency band may be used” apply.

4.4 Duty cycle categories

ETSI EN 300 220-1 defines the duty cycle as follows:

For the purposes of this present text the duty cycle is defined as the ratio, expressed as a percentage, of the maximum transmitter “on” time monitored over one hour, relative to a one-hour period. The device may be triggered either automatically or manually and depending on how the device is triggered will also depend on whether the duty cycle is fixed or random.

For automatic operated devices, either software controlled or pre-programmed devices, the provider shall declare the duty cycle class or classes for the equipment under test, see Table 10.

TABLE 10

	Name	Transmitting time/full cycle (%)	Maximum transmitter “on” time ⁽¹⁾ (s)	Minimum transmitter “off” time ⁽¹⁾ (s)	Explanation
1	Very low	< 0.1	0.72	0.72	For example, 5 transmissions of 0.72 s within 1 h
2	Low	< 1.0	3.6	1.8	For example, 10 transmissions of 3.6 s within 1 h
3	High	< 10	36	3.6	For example, 10 transmissions of 36 s within 1 h
4	Very high	Up to 100	–	–	Typically continuous transmissions but also those with a duty cycle greater than 10%

⁽¹⁾ These limits are advisory with the view to facilitating sharing between systems in the same frequency band.

For manually operated or event-dependant devices, with or without software controlled functions, the provider shall declare whether the device, once triggered, follows a pre-programmed cycle, or whether the transmitter remains on until the trigger is released or the device is manually reset. The provider shall also give a description of the application for the device and include a typical usage pattern. The typical usage pattern as declared by the provider shall be used to determine the duty cycle and hence the duty cycle class.

Where an acknowledgement is required, the additional transmitter “on” time shall be included and declared by the provider.

For devices with a 100% duty cycle transmitting an unmodulated carrier most of the time, a time-out shut-off facility shall be implemented in order to improve the efficient use of the spectrum. The method of implementation shall be declared by the provider.

5 Administrative requirements

5.1 Licensing requirements

Licensing is an appropriate tool for administrations to regulate the use of radio equipment and the efficient use of the frequency spectrum.

There is a general agreement that when the efficient use of the frequency spectrum is not at risk and as long as harmful interference is unlikely, the installation and use of radio equipment can be exempted from a general licence or an individual licence.

In general the CEPT administrations apply similar systems of licensing and exemption from individual licensing. However, different criteria are used to decide whether radio equipment should be licensed or exempted from an individual licence.

Recommendation CEPT/ERC/REC 01-07 lists harmonized criteria for administrations to decide whether an exemption of individual licensing should be applied.

SRDs are generally exempted from individual licensing. Exceptions are stated in the annexes and Appendix 3 of Recommendation CEPT/ERC/REC 70-03.

When radio equipment is subject to an exemption from individual licensing, anyone can buy, install, possess and use the radio equipment without any prior permission from the administration. Furthermore, the administration will not register the individual equipment. The use of the equipment can be subject to general provisions.

5.2 Conformity assessment, marking requirements and free circulation

The purpose of marking an equipment is to indicate its conformance to relevant EC Directives, ECC or ERC Decisions or Recommendations and national regulations.

In almost 100% of cases, requirements for marking and labelling of approved and licensed equipment is set in national law. Most administrations require at least that the logo or name of the approval authority is shown on the label, along with the approval number which may also indicate the year of approval.

Recommendation CEPT/ERC/REC 70-03 recommends three different possibilities of marking and free circulation for SRDs dependent on the conformity assessment used.

For EU/EFTA member states the placing on the market and free movement of SRDs is covered by the R&TTE Directive (see § 7).

6 Operating parameters

SRDs in general operate in shared bands and are not permitted to cause harmful interference to other radio services.

SRDs cannot claim protection from other radio services.

The technical parameter limits should not be exceeded by any function of the equipment.

When selecting parameters for new SRDs, which may have inherent safety of human life implications, manufacturers and users should pay particular attention to the potential for interference from other systems operating in the same or adjacent bands.

7 The R&TTE Directive

Within European Union and EFTA countries, the radio and telecommunications terminal equipment (R&TTE) Directive now defines the rules for placing on the market and putting into service most products using the radio frequency spectrum. Each national authority is responsible for transposing the provisions of the R&TTE Directive into its legislation.

The easiest route for a manufacturer to demonstrate compliance with the R&TTE Directive is to comply with a relevant harmonized standards which, for spectrum aspects, are developed by [ETSI](#). It is now possible to send notifications of the intention to place equipment on the market electronically using a [one-stop procedure](#) to a number of spectrum authorities simultaneously.

Further information on the implementation and application of the R&TTE Directive can be found at (<http://europa.eu.int/comm/enterprise/rtte/>). This Directive is maintained by a standing committee, TCAM (Telecommunication Conformity Assessment and market Surveillance Committee).

Appendix 2 to Annex 2

(United States of America)

Understanding the FCC rules for legal low-power, non-licensed transmitters

1 Introduction

Part 15 of the Rules permits the operation of low power radio frequency devices without a licence from the Commission or the need for frequency coordination. The technical standards for Part 15 are designed to ensure that there is a low probability that these devices will cause harmful interference to other users of the spectrum. Intentional radiators, i.e., transmitters, are permitted to operate under a set of general emission limits or under provisions that allow higher emission levels, than those for unintentional radiators, in certain frequency bands. Intentional radiators generally are not permitted to operate in certain sensitive or safety-related bands, designated as restricted bands, or in the bands allocated for television broadcasting. The measurement procedures for determining compliance with the technical requirements for Part 15 devices are provided or referenced within the rules.

Low-power, non-licensed transmitters are used virtually everywhere. Cordless phones, baby monitors, garage door openers, wireless home security systems, keyless automobile entry systems, wireless access systems including radio local area networks and hundreds of other types of common electronic equipment rely on such transmitters to function. At any time of day, most people are within a few metres of consumer products that use low-power, non-licensed transmitters.

Non-licensed transmitters operate on a variety of frequencies. They must share these frequencies with licensed transmitters and are prohibited from causing interference to licensed transmitters. Licensed primary and secondary services are protected from Part 15 devices.

The FCC has rules to limit the potential for harmful interference to licensed transmitters by low-power, non-licensed transmitters. In its rules, the FCC takes into account that different types of products that incorporate low-power transmitters have different potentials for causing harmful interference. As a result, the FCC's Rules are most restrictive on products that are most likely to cause harmful interference, and less restrictive on those that are least likely to cause interference.

The actual version of Part 15 of the FCC Regulation 47 CFR Ch. may be downloaded free of charge from the website of the FCC: <http://www.fcc.gov/oet/info/rules/>.

2 Low-power, non-licensed transmitters – general approach

The terms low-power transmitter; low-power, non-licensed transmitter, and Part 15 transmitter, all refer to the same thing: a low-power, non-licensed transmitter that complies with the Rules in Part 15 of the FCC Rules. Part 15 transmitters use very little power, most of them less than 1 mW. They are non-licensed because their operators are not required to obtain a licence from the FCC to use them.

Although an operator does not have to obtain a licence to use a Part 15 transmitter, the transmitter itself is required to have an FCC authorization before it can be legally imported into or marketed in the United States of America. This authorization requirement helps ensure that Part 15 transmitters comply with the Commission's technical standards and, thus, are capable of being operated with little potential for causing interference to authorized radiocommunications.

If a Part 15 transmitter does cause interference to authorized radiocommunications, even if the transmitter complies with all of the technical standards and equipment authorization requirements in the FCC rules, then its operator will be required to cease operation, at least until the interference problem is corrected.

Part 15 transmitters receive no regulatory protection from interference.

3 Definition list

Biomedical telemetry device: An intentional radiator used to transmit measurements of either human or animal biomedical phenomena to a receiver.

Cable locating equipment: An intentional radiator used intermittently by trained operators to locate buried cables, lines, pipes and similar structures or elements. Operation entails coupling a RF signal onto the cable, pipe, etc., and using a receiver to detect the location of that structure or element.

Carrier current system: A system, or part of a system, that transmits RF energy by conduction over the electric power lines. A carrier current system can be designed such that the signals are received by conduction directly from connection to the electric power lines (unintentional radiator) or the signals are received over-the-air due to radiation of the RF signals from the electric power lines (intentional radiator).

Cordless telephone system: A system consisting of two transceivers, one a base station that connects to the public switched telephone network (PSTN) and the other a mobile handset unit that communicates directly with the base station. Transmissions from the mobile unit are received by the base station and then placed on the PSTN. Information received from the switched telephone network is transmitted by the base station to the mobile unit.

NOTE 1 – The domestic public cellular radio telecommunications service is considered to be part of the switched telephone network. In addition, intercom and paging operations are permitted provided these are not intended to be the primary modes of operation.

Field disturbance sensor: A device that establishes a radio frequency field in its vicinity and detects changes in that field resulting from the movement of persons or objects within its range.

Harmful interference: Any emission, radiation or induction that endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunications service operating in accordance with FCC Rules.

Perimeter protection system: A field disturbance sensor that employs RF transmission lines as the radiating source. These RF transmission lines are installed in such a manner that allows the system to detect movement within the protected area.

Spurious emission: Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

4 Technical standards

4.1 Conducted emission limits

Part 15 transmitters that obtain power from the electrical power lines are subject to conducted emission standards that limit the amount of RF energy they can conduct back onto these lines in the band 450 kHz-30 MHz. This limit is 250 μ V.

An exception to the conducted emission requirements is made for carrier current systems. These systems are not subject to any conducted emission limits unless they produce emissions (fundamental or harmonic) in the 535-1 705 kHz band and are not intended to be received by standard AM broadcast receivers, in which case they are subject to a 1 000 μ V limit.

Although carrier current systems are, for the most part, not subject to conducted emission limits, they are still subject to radiated emission limits.

4.2 Radiated emission limits

Section 15.209 contains general radiated emission (signal strength) limits that apply to all Part 15 transmitters using frequencies at 9 kHz and above. There are also a number of restricted bands in which low power, non-licensed transmitters are not allowed to operate because of potential interference to sensitive radiocommunications such as aircraft radionavigation, radio astronomy and search and rescue operations. If a particular transmitter can comply with the general radiated limits, and at the same time avoid operating in one of the restricted bands, then it can use any type of modulation (AM, FM, PCM, etc.) for any purpose.

With the exception of intermittent and periodic transmissions, and biomedical telemetry devices, Part 15 transmitters are not permitted to operate in the TV broadcast bands.

Special provisions have been made in the Part 15 Rules for certain types of transmitters that require a stronger signal strength on certain frequencies than the general radiated emission limits provide. For example, such provisions have been made for cordless telephones, auditory assistance devices and field disturbance sensors, among other things. The emission limit for each type of operation, and the type of detector used to measure emissions (average with a peak limit, "A", or quasi-peak, "Q") is specified. When a transmitter power limit is specified instead of an emission limit, no emission detector is specified.

TABLE 11
General limits for any intentional transmitter

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	$2\,400/f$ (kHz)	300
0.490-1.705	$24\,000/f$ (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Table 12 contains exceptions or exclusions (indicated) to the general limits, otherwise the general limits can still be used.

TABLE 12
Exception or exclusions from the general limits

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
9-45 kHz	Cable locating equipment	10 W peak output power	
45-101.4 kHz	Cable locating equipment	1 W peak output power	
101.4 kHz	Telephone company electronic marker detectors	$23.7 \mu\text{V/m}$ at 300 m	A
101.4-160 kHz	Cable locating equipment	1 W peak output power	
160-190 kHz	Cable locating equipment	1 W peak output power	
	Any	1 W input to final RF stage	
190-490 kHz	Cable locating equipment	1 W peak output power	
510-525 kHz	Any	$100 \mu\text{W}$ input to final RF stage	
525-1 705 kHz	Any	$100 \mu\text{W}$ input to final RF stage	
	Transmitters on grounds of educational institutions	$24\,000/f$ (kHz) $\mu\text{V/m}$ at 30 m outside of campus boundary	Q
	Carrier current and leaky coax systems	$15 \mu\text{V/m}$ at $47\,715/f$ (kHz) m from cable	
1.705-10 MHz	Any, when 6 dB bandwidth $\geq 10\%$ of centre frequency	$100 \mu\text{V/m}$ at 30 m	A
	Any, when 6 dB bandwidth $< 10\%$ of centre frequency	$15 \mu\text{V/m}$ at 30 m or bandwidth in (kHz)/ f (MHz)	
13.553-13.567 MHz	Any 15.225	$10\,000 \mu\text{V/m}$ at 30 m	Q

TABLE 12 (continued)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak	
26.96-27.28 MHz	Any 15.227	10 000 $\mu\text{V}/\text{m}$ at 3 m	A	
40.66-40.7 MHz	Intermittent control signals	2 250 $\mu\text{V}/\text{m}$ at 3 m	A or Q	
	Periodic transmissions	1 000 $\mu\text{V}/\text{m}$ at 3 m		
	Any 15.229	1 000 $\mu\text{V}/\text{m}$ at 3 m	Q	
	Perimeter protection systems	500 $\mu\text{V}/\text{m}$ at 3 m	A	
43.71-44.49 MHz	Cordless telephones	10 000 $\mu\text{V}/\text{m}$ at 3 m	A	
46.6-46.98 MHz				
48.75-49.51 MHz				
49.66-49.82 MHz				
49.82-49.9 MHz				Any 15.235
				Cordless telephones
49.9-50 MHz				Cordless telephones
54-70 MHz				Exclusively non-residential perimeter protection systems
70-72 MHz	Exclusively either intermittent control signals	1 250 $\mu\text{V}/\text{m}$ at 3 m	A or Q	
	Or periodic transmissions	500 $\mu\text{V}/\text{m}$ at 3 m		
	Or non-residential perimeter protection systems	100 $\mu\text{V}/\text{m}$ at 3 m	Q	
72-73 MHz	Auditory assistance devices	80 000 $\mu\text{V}/\text{m}$ at 3 m	A	
	Intermittent control signals	1 250 $\mu\text{V}/\text{m}$ at 3 m	A or Q	
	Periodic transmissions	500 $\mu\text{V}/\text{m}$ at 3 m		
74.6-74.8 MHz	Auditory assistance devices	80 000 $\mu\text{V}/\text{m}$ at 3 m	A	
	Intermittent control signals	1 250 $\mu\text{V}/\text{m}$ at 3 m	A or Q	
	Periodic transmissions	500 $\mu\text{V}/\text{m}$ at 3 m		
75.2-76 MHz	Auditory assistance devices	80 000 $\mu\text{V}/\text{m}$ at 3 m	A	
	Intermittent control signals	1 250 $\mu\text{V}/\text{m}$ at 3 m	A or Q	
	Periodic transmissions	500 $\mu\text{V}/\text{m}$ at 3 m		
76-88 MHz	Exclusively either intermittent control signals	1 250 $\mu\text{V}/\text{m}$ at 3 m	A or Q	
	Or periodic transmissions	500 $\mu\text{V}/\text{m}$ at 3 m		
	Or non-residential perimeter protection systems	100 $\mu\text{V}/\text{m}$ at 3 m	Q	
88-108 MHz	Intermittent control signals	1 250 $\mu\text{V}/\text{m}$ at 3 m	A or Q	
	Periodic transmissions	500 $\mu\text{V}/\text{m}$ at 3 m		
	Any 15.239 (≤ 200 kHz bandwidth)	250 $\mu\text{V}/\text{m}$ at 3 m	A	

TABLE 12 (continued)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak	
121.94-123 MHz	Intermittent control signals	1 250 μ V/m at 3 m	A or Q	
	Periodic transmissions	500 μ V/m at 3 m		
138-149.9 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11) \mu\text{V/m}$ at 3 m		
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11) \mu\text{V/m}$ at 3 m		
150.05-156.52475 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11) \mu\text{V/m}$ at 3 m		
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11) \mu\text{V/m}$ at 3 m		
156.52525-156.7 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11) \mu\text{V/m}$ at 3 m		
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11) \mu\text{V/m}$ at 3 m		
156.9-162.0125 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11) \mu\text{V/m}$ at 3 m		A or Q
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11) \mu\text{V/m}$ at 3 m		A or Q
167.17-167.72 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11) \mu\text{V/m}$ at 3 m		A or Q
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11) \mu\text{V/m}$ at 3 m		A or Q
173.2-174 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11) \mu\text{V/m}$ at 3 m	A or Q	
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11) \mu\text{V/m}$ at 3 m	A or Q	
174-216 MHz	Exclusively either intermittent control signals	3 750 μ V/m at 3 m	A or Q	
	Or periodic transmissions	1 500 μ V/m at 3 m	A or Q	
	Or biomedical telemetry devices	1 500 μ V/m at 3 m	A	
216-240 MHz	Intermittent control signals	3 750 μ V/m at 3 m	A or Q	
	Periodic transmissions	1 500 μ V/m at 3 m	A or Q	
285-322 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\,250/3) \mu\text{V/m}$ at 3 m	A or Q	
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\,500/3) \mu\text{V/m}$ at 3 m	A or Q	

TABLE 12 (continued)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
335.4-399.9 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\ 250/3) \mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\ 500/3) \mu\text{V/m}$ at 3 m	A or Q
410-470 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\ 250/3) \mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\ 500/3) \mu\text{V/m}$ at 3 m	A or Q
470-512 MHz	Exclusively either intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Or periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
512-566 MHz	Exclusively either intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Or periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Or biomedical telemetry devices for hospitals	200 $\mu\text{V/m}$ at 3 m	Q
566-608 MHz	Exclusively either intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Or periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
614-806 MHz	Exclusively either intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Or periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
806-890 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
890-902 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Signals used to measure the characteristics of a material	500 $\mu\text{V/m}$ at 30 m	A
902-928 MHz	Spread spectrum transmitters	1 W Output power	
	Digital modulation	1 W Output power	A
	Field disturbance sensors	500 000 $\mu\text{V/m}$ at 3 m	A
	Any 15.249	50 000 $\mu\text{V/m}$ at 3 m	Q
	Signals used to measure the characteristics of a material	500 $\mu\text{V/m}$ at 30 m	A
	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q

TABLE 12 (continued)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
928-940 MHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A or Q
	Signals used to measure the characteristics of a material	500 $\mu\text{V}/\text{m}$ at 30 m	A
940-960 MHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A or Q
1.24-1.3 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
1.427-1.435 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
1.6265-1.6455 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
1.6465-1.66 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
1.71-1.7188 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
1.7222-2.2 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
1.91-1.92 GHz	Asynchronous personal communications service devices	Varies	
1.92-1.93 GHz	Isochronous personal communications service devices	Varies	
2.3-2.31 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
2.39-2.4 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Asynchronous personal communications service devices	Varies	
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
2.4-2.435 GHz	Spread spectrum transmitters	1 W output power	
	Digital modulation	1 W output power	A
	Any 15.249	50 000 $\mu\text{V}/\text{m}$ at 3 m	A
2.435-2.465 GHz	Spread spectrum transmitters	1 W output power	
	Digital modulation	1 W output power	A
	Field disturbance sensors	500 000 $\mu\text{V}/\text{m}$ at 3 m	A
	Any 15.249	50 000 $\mu\text{V}/\text{m}$ at 3 m	A

TABLE 12 (continued)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
2.465-2.4835 GHz	Spread spectrum transmitters	1 W output power	
	Digital modulation	1 W output power	A
	Any 15.249	50 000 $\mu\text{V}/\text{m}$ at 3 m	A
2.5-2.655 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
2.9-3.26 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
	AVI systems	3 000 $\mu\text{V}/\text{m}$ per MHz of bandwidth at 3 m	A
3.267-3.332 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
	AVI systems	3 000 $\mu\text{V}/\text{m}$ per MHz of bandwidth at 3 m	A
3.339-3.3458 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
	AVI systems	3 000 $\mu\text{V}/\text{m}$ per MHz of bandwidth at 3 m	A
3.358-3.6 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
	AVI systems	3 000 $\mu\text{V}/\text{m}$ per MHz of bandwidth at 3 m	A
4.4-4.5 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
5.15-5.25 GHz	National information infrastructure devices	Indoor only. Output power: lesser of 50 mW or 4 dBm + 10 log B (where $B = 26$ dB bandwidth (MHz))	A
5.25-5.35 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	National information infrastructure devices	Output power: lesser of 250 mW or 11 dBm + 10 log B (where $B = 26$ dB bandwidth (MHz))	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
5.46-5.725 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
5.47-5.725 GHz	National information infrastructure devices	Output power: lesser of 250 mW or 11 dBm + 10 log B (where $B = 26$ dB bandwidth (MHz))	A

TABLE 12 (continued)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
5.725-5.825 GHz	National information infrastructure devices	Output power: lesser of 1 W or $17 \text{ dBm} + 10 \log B$ (where $B = 26 \text{ dB}$ bandwidth (MHz))	A
5.725-5.785 GHz	Spread spectrum transmitters	1 W output power	
	Digital modulation	1 W output power	A
	Any 15.249	50 000 $\mu\text{V/m}$ at 3 m	A
5.785-5.815 GHz	Spread spectrum transmitters	1 W output power	
	Digital modulation	1 W output power	A
	Field disturbance sensors	500 000 $\mu\text{V/m}$ at 3 m	A
	Any 15.249	50 000 $\mu\text{V/m}$ at 3 m	A
5.815-5.85 GHz	Spread spectrum transmitters	1 W output power	
	Digital modulation	1 W output power	A
	Any 15.249	50 000 $\mu\text{V/m}$ at 3 m	A
5.85-5.875 GHz	Any	50 000 $\mu\text{V/m}$ at 3 m	A
5.875-7.25 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
7.75-8.025 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
8.5-9 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
9.2-9.3 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
9.5-10.5 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
10.5-10.55 GHz	Field disturbance sensors	2 500 000 $\mu\text{V/m}$ at 3 m	A
	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic Transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
10.55-10.6 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
12.7-13.25 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
13.4-14.47 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
14.5-15.35 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A

TABLE 12 (*end*)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
16.2-17.7 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
21.4-22.01 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
23.12-23.6 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
24-24.075 GHz	Any 15.249	250 000 $\mu\text{V}/\text{m}$ at 3 m	A
24.075-24.175 GHz	Field disturbance sensors	2 500 000 $\mu\text{V}/\text{m}$ at 3 m	A
	Any 15.249	250 000 $\mu\text{V}/\text{m}$ at 3 m	A
24.175-24.25 GHz	Any 15.249	250 000 $\mu\text{V}/\text{m}$ at 3 m	A
24.25-31.2 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
31.8-36.43 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
36.5-38.6 GHz	Intermittent control signals	12 500 $\mu\text{V}/\text{m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V}/\text{m}$ at 3 m	A
46.7-46.9 GHz	Vehicle mounted field disturbance sensors	Varies	
57-64 GHz	Not aircraft, not satellite, not field disturbance sensors (with a qualified fixed exception)	Varies	
76-77 GHz	Vehicle mounted field disturbance sensors	Varies	

5 Antenna requirement

Changing the antenna on a transmitter can significantly increase, or decrease, the strength of the signal that is ultimately transmitted. Except for carrier current devices, tunnel radio systems, cable locating equipment or operation in the bands 160-190 kHz, 510-1 705 kHz, the standards in Part 15 are not based solely on output power but also take into account the antenna characteristics. Thus, a low power transmitter that complies with the technical standards in Part 15 with a particular antenna attached can exceed the Part 15 standards if a different antenna is attached. Should this happen it could pose a serious interference problem to authorized radiocommunications such as emergency, broadcast and air-traffic control communications.

In order to prevent such interference problems, each Part 15 transmitter must be designed to ensure that no type of antenna can be used with it other than the one used to demonstrate compliance with the technical standards. This means that Part 15 transmitters must have permanently attached antennas, or detachable antennas with unique connectors. A "unique connector" is one that is not of a standard type found in electronic supply stores.

It is recognized that suppliers of Part 15 transmitters often want their customers to be able to replace an antenna if it should break. With this in mind, Part 15 allows transmitters to be designed so that the user can replace a broken antenna. When this is done, the replacement antenna must be electrically identical to the antenna that was used to obtain FCC authorization for the transmitter. The replacement antenna also must include the unique connector described above to ensure it is used with the proper transmitter.

6 Restricted bands

Intentional radiators are not permitted to operate in the following bands:

TABLE 13
Restricted bands – spurious emissions only with limited exceptions (not indicated)

(MHz)	(MHz)	(MHz)	(GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1 240	7.25-7.75
4.125-4.128	25.5-25.67	1 300-1 427	8.025-8.5
4.17725-4.17775	37.5-38.25	1 435-1 626.5	9.0-9.2
4.20725-4.20775	73-74.6	1 645.5-1 646.5	9.3-9.5
6.215-6.218	74.8-75.2	1 660-1 710	10.6-12.7
6.26775-6.26825	108-121.94	1 718.8-1 722.2	13.25-13.4
6.31175-6.31225	123-138	2 200-2 300	14.47-14.5
8.291-8.294	149.9-150.05	2 310-2 390	15.35-16.2
8.362-8.366	156.52475-156.52525	2 483.5-2 500	17.7-21.4
8.37625-8.38675	156.7-156.9	2 655-2 900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3 260-3 267	23.6-24.0
12.29-12.293	167.72-173.2	3 332-3 339	31.2-31.8
12.51975-12.52025	240-285	3 345.8-3 358	36.43-36.5
12.57675-12.57725	322-335.4	3 600-4 400	38.6-46.7
13.36-13.41			46.9-59
			64-76
			Above 77 GHz

7 Equipment authorization

A Part 15 transmitter must be tested and authorized before it may be marketed. There are two ways to obtain authorization: certification and verification.

TABLE 14

Authorization procedures for Part 15 transmitters

Low power transmitter	Authorization procedure
AM-band transmission systems on the campuses of educational institutions	Verification
Cable locating equipment at or below 490 kHz	Verification
Carrier current systems	Verification
Devices, such as perimeter protection systems, that must be measured at the installation site	Verification of first three installations with resulting data immediately used to obtain certification
Leaky coaxial cable systems	If designed for operation exclusively in the AM broadcast band: verification; otherwise: certification
Tunnel radio systems	Verification
All other Part 15 transmitters	Certification

7.1 Certification

The certification procedure requires that tests be performed to measure the levels of radio frequency energy that are radiated by the device into the open air or conducted by the device onto the power lines. A description of the measurement facilities of the laboratory where these tests are performed must be on file with the Commission's laboratory or must accompany the certification application. After these tests have been performed, a report must be produced showing the test procedure, the test results, and some additional information about the device including design drawings. The specific information that must be included in a certification report is detailed in Part 2 of the FCC Rules.

Certified transmitters also are required to have two labels attached: an FCC ID label and a compliance label. The FCC ID label identifies the FCC equipment authorization file that is associated with the transmitter, and serves as an indication to consumers that the transmitter has been authorized by the FCC. The compliance label indicates to consumers that the transmitter was authorized under Part 15 of the FCC rules and that it may not cause, nor is it protected from, harmful interference.

The FCC ID. The FCC ID must be permanently marked (etched, engraved, indelibly printed, etc.) either directly on the transmitter, or on a tag that is permanently affixed (riveted, welded, glued, etc.) to it. The FCC ID label must be readily visible to the purchaser at the time of purchase.

The FCC ID is a string of 4 to 17 characters. It may contain any combination of capital letters, numbers, or the dash/hyphen character. Characters 4 through 17 may be designated, as desired, by the applicant. The first three characters, however, are the "grantee code", a code assigned by the FCC to each particular applicant (grantee). Any application filed with the FCC must have an FCC ID that begins with an assigned grantee code.

The Grantee Code. To obtain a code, new applicants must send in a letter stating the applicant's name and address and requesting a grantee code. This letter must be accompanied by a completed "Fee Advice Form" (FCC Form 159), and a processing fee.

The Compliance Label. The applicant for a grant of certification is responsible for having the compliance label produced and for having it affixed to each device that is marketed or imported. The wording for the compliance label is in Part 15, and may be included on the same label as the FCC ID, if desired.

The compliance label and FCC ID label may not be attached to any devices until a grant of certification has been obtained for the devices.

Once the report demonstrating compliance with the technical standards has been completed, and the compliance label and FCC ID label have been designed, the party wishing to get the transmitter certified (it can be anyone) must file a copy of the report, an "Application for Equipment Authorization" (FCC Form 731) and an application fee, with the FCC.

After the application is submitted, the FCC's lab will review the report and may or may not request a sample of the transmitter to test. If the application is complete and accurate, and any tests performed by the FCC's lab confirm that the transmitter is compliant, the FCC will then issue a grant of certification for the transmitter. marketing of the transmitter may begin after the applicant has received a copy of this grant.

7.2 Verification

The verification procedure requires that tests be performed on the transmitter to be authorized using a laboratory that has calibrated its test site or, if the transmitter is incapable of being tested at a laboratory, at the installation site. These tests measure the levels of radio frequency energy that are radiated by the transmitter into the open air or conducted by the transmitter onto the power lines. After these tests are performed, a report must be produced showing the test procedure, the test results, and some additional information about the transmitter including design drawings. The specific information that must be included in a verification report is detailed in Part 2 of the FCC Rules.

Once the report is completed, the manufacturer (or importer for an imported device) is required to keep a copy of it on file as evidence that the transmitter meets the technical standards in Part 15. The manufacturer (importer) must be able to produce this report on short notice should the FCC ever request it.

The Compliance Label. The manufacturer (or importer) is responsible for having the compliance label produced, and for having it affixed to each transmitter that is marketed or imported. The wording for the compliance label is included in Part 15. Verified transmitters must be uniquely identified with a brand name and/or model number that cannot be confused with other, electrically different transmitters on the market. However, they may not be labelled with an FCC ID or in a manner that could be confused with an FCC ID.

Once the report showing compliance is in the manufacturer's (or importer's) files and the compliance label has been attached to the transmitter, marketing of the transmitter may begin. There is no filing with the FCC required for verified equipment.

Any equipment that connects to the PSTN, such as a cordless telephone, is also subject to rules in Part 68 of the FCC Rules and must be registered by the FCC prior to marketing. The rules in Part 68 are designed to protect against harm to the telephone network.

8 Special cases

8.1 Cordless telephones

Cordless telephones are required to incorporate circuitry that uses digital security codes to help prevent the phone from unintentionally connecting to the PSTN when it encounters RF noise from another cordless phone or from some other source. Cordless phones that do not have this circuitry (phones that were manufactured or imported prior to 11 September 1991) are required to have a statement on the package in which they are sold that warns of the danger of unintentional line seizures and indicates what features the packaged phone has to help prevent them.

8.2 Tunnel radio systems

Many tunnels have naturally surrounding earth and/or water that attenuates radio waves. Transmitters that are operated inside these tunnels are not subject to any radiation limits inside the tunnel. Instead, the signals they produce must meet the Part 15 general radiated emission limits on the outside of the tunnel, including its openings. They also must comply with the conducted emission limits on the electric power lines outside of the tunnel.

Buildings and other structures that are not surrounded by earth or water (e.g., oil storage tanks) are not tunnels. Transmitters that are operated inside such structures are subject to the same standards as transmitters operated in an open area.

8.3 Home-built transmitters that are not for sale

Hobbyists, inventors and other parties that design and build Part 15 transmitters with no intention of ever marketing them may construct and operate up to five such transmitters for their own personal use without having to obtain FCC equipment authorization. If possible, these transmitters should be tested for compliance with the Commission's rules. If such testing is not practicable, their designers and builders are required to employ good engineering practices in order to ensure compliance with the Part 15 standards.

Home-built transmitters, like all Part 15 transmitters, are not allowed to cause interference to licensed radiocommunications and must accept any interference that they receive. If a home-built Part 15 transmitter does cause interference to licensed radiocommunications, the Commission will require its operator to cease operation until the interference problem is corrected. Furthermore, if the Commission determines that the operator of such a transmitter has not attempted to ensure compliance with the Part 15 technical standards by employing good engineering practices then that operator may be fined.

Non-residential operation is permitted under limited circumstances. For example, these home-built transmitters may be demonstrated at a trade show, but marketing is not allowed until authorization is obtained.

9 Commonly asked questions

9.1 What happens if one sells, imports or uses non-compliant low-power transmitters?

The FCC rules are designed to control the marketing of low-power transmitters and, to a lesser extent, their use. If the operation of a non-compliant transmitter causes interference to authorized radiocommunications, the user should stop operating the transmitter or correct the problem causing the interference. However, the person (or company) that sold this non-compliant transmitter to the user has violated the FCC marketing rules in Part 2 as well as federal law. The act of selling or leasing, offering to sell or lease, or importing a low-power transmitter that has not gone through the

appropriate FCC equipment authorization procedure is a violation of the Commission's rules and federal law. Violators may be subject to an enforcement action by the Commission that could result in:

- forfeiture of all non-compliant equipment;
- a criminal penalty for an individual/organization;
- a criminal fine totalling twice the gross gain obtained from sales of the non-compliant equipment;
- administrative fines.

9.2 What changes can be made to an FCC-authorized device without requiring a new FCC authorization?

The person or company that obtained FCC authorization for a Part 15 transmitter is permitted to make the following types of changes:

For certified equipment, the holder of the grant of certification, or the holder's agent, can make minor modifications to the circuitry, appearance or other design aspects of the transmitter. minor modifications are divided into three categories: Class I permissive changes Class II permissive changes and Class III permissive changes. major changes are not permitted.

Minor changes that do not increase the radio frequency emissions from the transmitter do not require the grantee to file any information with the FCC. These are called Class I permissive changes.

NOTE 1 – If a Class I permissive change results in a product that looks different to the one that was certified it is strongly suggested that photos of the modified transmitter be filed with the FCC.

Minor changes that increase the radio frequency emissions from the transmitter require the grantee to file complete information about the change along with results of tests showing that the equipment continues to comply with FCC technical standards. In this case, the modified equipment may not be marketed under the existing grant of certification prior to acknowledgement by the Commission that the change is acceptable. These are called Class II permissive changes.

Minor changes to the software of a software-defined radio transmitter that change the frequency range, modulation type or maximum output power (either radiated or conducted) outside the parameters previously approved, or that change the circumstances under which the transmitter operates in accordance with FCC rules, require the grantee to file a description of the changes and test results showing that the equipment complies with the applicable rules with the new software loaded, including compliance with the applicable RF exposure requirements. In this case, the modified software may not be loaded into the equipment, and the equipment may not be marketed with the modified software under the existing grant of certification, prior to acknowledgement by the Commission that the change is acceptable. These are called Class III permissive changes. Class III changes are permitted only for equipment in which no Class II changes have been made from the originally approved device.

Major changes require that a new grant be obtained by submitting a new application with complete test results. Some examples of major changes include: changes to the basic frequency determining and stabilizing circuitry; changes to the frequency multiplication stages or basic modulator circuit; and, major changes to the size, shape or shielding properties of the case.

No changes are permitted to certified equipment by anyone other than the grantee or the grantee's designated agent; except, however, that changes to the FCC ID without any other changes to the equipment may be performed by anyone by filing an abbreviated application.

For verified equipment, any changes may be made to the circuitry, appearance or other design aspects of the device as long as the manufacturer (importer, if the equipment is imported) has on file updated circuit drawings and test data showing that the equipment continues to comply with the FCC rules.

9.3 What is the relationship between $\mu\text{V/m}$ and W ?

Watts (W) are the units used to describe the amount of power generated by a transmitter. Microvolts per meter ($\mu\text{V/m}$) are the units used to describe the strength of an electric field created by the operation of a transmitter.

A particular transmitter that generates a constant level of power, W , can produce electric fields of different strengths ($\mu\text{V/m}$) depending on, among other things, the type of transmission line and antenna connected to it. Because it is the electric field that causes interference to authorized radiocommunications, and since a particular electric field strength does not directly correspond to a particular level of transmitter power, most of the Part 15 emission limits are specified in field strength.

Although the precise relationship between power and field strength can depend on a number of additional factors, a commonly-used equation to approximate their relationship is:

$$PG/4\pi D^2 = E^2/120\pi$$

where:

- P : transmitter power (W)
- G : numerical gain of the transmitting antenna relative to an isotropic source
- D : distance of the measuring point from the electrical centre of the antenna (m)
- E : field strength (V/m)
- $4\pi D^2$: surface area of the sphere centred at the radiating source whose surface is D m from the radiating source
- 120π : characteristic impedance of free space (Ω).

Using this equation, and assuming a unity gain antenna, $G = 1$ and a measurement distance of 3 m, $D = 3$, a formula for determining power (given field strength) can be developed:

$$P = 0.3 E^2$$

where:

- P : transmitter power (e.i.r.p.) (W)
- E : field strength (V/m).

Appendix 3 to Annex 2

(People's Republic of China)

Provisions and technical parameters requirements for SRDs in China

1 Technical parameters requirements

1.1 Analogue cordless telephone

Transmit frequencies used for base set (MHz):	45.000, 45.025, 45.050, ..., 45.475
Transmit frequencies used for hand set (MHz):	48.000, 48.025, 48.050, ..., 48.475
Total channel number:	20
Radiated power limit:	20 mW (e.r.p.)
Maximum occupied bandwidth:	16 kHz
Frequency tolerance:	1.8 kHz

1.2 Wireless audio transmitters and measuring devices for civilian purposes

– Operating frequency band (MHz):	87 to 108
– Radiated power limit:	3 mW (e.r.p.)
– Maximum occupied bandwidth:	200 kHz
– Frequency tolerance:	100×10^{-6}
– Operating frequency band (MHz):	75.4 to 76.0, 84 to 87
– Radiated power limit:	10 mW (e.r.p.)
– Maximum occupied bandwidth:	200 kHz
– Frequency tolerance:	100×10^{-6}
– Operating frequency band (MHz):	189.9 to 223.0
– Radiated power limit:	10 mW (e.r.p.)
– Maximum occupied bandwidth:	200 Hz
– Frequency tolerance:	100×10^{-6}
– Operating frequency bands (MHz):	470 to 510, 630 to 787
– Radiated power limit:	50 mW (e.r.p.)
– Maximum occupied bandwidth:	200 kHz
– Frequency tolerance:	100×10^{-6}

1.3 Model and toy remote-control devices

– Operating frequencies (MHz):	26.975, 26.995, 27.025, 27.045, 27.075, 27.095, 27.125, 27.145, 27.175, 27.195, 27.225, 27.255
– Radiated power limit:	750 mW (e.r.p.)
– Maximum occupied bandwidth:	8 kHz

	Frequency tolerance:	100×10^{-6}
–	Operating frequencies (MHz):	40.61, 40.63, 40.65, 40.67, 40.69, 40.71, 40.73, 40.75, 40.77, 40.79, 40.81, 40.83, 40.85
	Radiated power limit:	750 mW (e.r.p.)
	Maximum occupied bandwidth:	20 kHz
	Frequency tolerance:	30×10^{-6}
–	Operating frequencies (MHz):	72.13, 72.15, 72.17, 72.19, 72.21, 72.79, 72.81, 72.83, 72.85, 72.87
	Radiated power limit:	750 mW (e.r.p.)
	Maximum occupied bandwidth:	20 kHz
	Frequency tolerance:	30×10^{-6}
1.4	Citizen band private mobile radio equipment	
–	Operating frequencies (MHz):	409.7500, 409.7625, 409.7750, 409.7875, 409.8000, 409.8125, 409.8250, 409.8375, 409.8500, 409.8625, 409.8750, 409.8875, 409.9000, 409.9125, 409.9250, 409.9375, 409.9500, 409.9625, 409.9750, 409.9875
	Radiated power limit:	500 mW (e.r.p.)
	Modulation type:	F3E
	Channel spacing:	12.5 kHz
	Frequency tolerance:	5×10^{-6}
1.5	General radio remote-control devices	
–	Operating frequency bands (MHz):	470 to 566, 614 to 787
	Radiated power limit:	5 mW (e.r.p.)
	Maximum occupied bandwidth:	1 MHz
1.6	Biomedical telemetry transmitters	
–	Operating frequency bands (MHz):	174 to 216, 407 to 425, 608 to 630
	Radiated power limit:	10 mW (e.r.p.)
	Frequency tolerance:	100×10^{-6}
1.7	Equipment for lifting	
–	Operating frequencies (MHz):	223.100, 223.700, 223.975, 224.600, 225.025, 225.325, 230.100, 230.700, 230.975, 231.600, 232.025, 232.325
	Radiated power limit:	20 mW (e.r.p.)
	Maximum occupied bandwidth:	16 kHz
	Frequency tolerance:	4×10^{-6}

1.8 Equipment for weighing

–	Operating frequencies (MHz):	223.300, 224.900, 230.050, 233.050, 234.050
	Maximum occupied bandwidth:	50 kHz
	Radiated power limit:	50 mW (e.r.p.)
	Frequency tolerance:	4×10^{-6}
–	Operating frequencies (MHz):	450.0125, 450.0625, 450.1125, 450.1625, 450.2125
	Maximum occupied bandwidth:	20 kHz
	Radiated power limit:	50 mW (e.r.p.)
	Frequency tolerance:	4×10^{-6}

1.9 Radio remote-control equipment used in industry

–	Operating frequencies (MHz):	418.950, 418.975, 419.000, 419.025, 419.050, 419.075, 419.100, 419.125, 419.150, 419.175, 419.200, 419.250, 419.275
	Radiated power limit:	20 mW (e.r.p.)
	Maximum occupied bandwidth:	16 kHz
	Frequency tolerance:	4×10^{-6}

1.10 Equipment for transporting data

–	Operating frequencies (MHz):	223.150, 223.250, 223.275, 223.350, 224.050, 224.250, 228.050, 228.100, 228.200, 228.275, 228.425, 228.575, 228.600, 228.800, 230.150, 230.250, 230.275, 230.350, 231.050, 231.250
	Radiated power limit:	10 mW (e.r.p.)
	Maximum occupied bandwidth:	16 kHz
	Frequency tolerance:	4×10^{-6}

1.11 Radio control devices for civilian purposes

–	Operating frequency bands (MHz):	314 to 316, 430 to 432, 433 to 434.79
	Radiated power limit:	10 mW (e.r.p.)
	Maximum occupied bandwidth:	400 kHz
–	Operating frequency bands (MHz):	779 to 787
	Radiated power limit:	10 mW (e.r.p.)

1.12 Other SRDs

- Equipment A:

Operating frequency band (kHz):	9 to 190
Magnetic field-strength limit:	72 dB(μ A/m) at 10 m (in 9 to 50 kHz, quasi-peak detector)
	72 dB(μ A/m) at 10 m (in 50 to 190 kHz descending 3 dB/octave, quasi-peak detector)

- Equipment B:

Operating frequency bands (MHz):	1.7 to 2.1, 2.2 to 3.0, 3.1 to 4.1, 4.2 to 5.6, 5.7 to 6.2, 7.3 to 8.3, 8.4 to 9.9
Magnetic field-strength limit:	9 dB(μ A/m) at 10 m (quasi-peak detector)
Maximum 6 dB bandwidth:	200 kHz
Frequency tolerance:	100×10^{-6}

- Equipment C:

Operating frequency bands (MHz):	6.765 to 6.795, 13.553 to 13.567, 26.957 to 27.283
Magnetic field-strength limit:	42 dB(μ A/m) at 10 m (quasi-peak detector)
Frequency tolerance:	100×10^{-6}
Spurious emission limit:	9 dB(μ A/m) at 10 m (in 13.553 to 13.567 MHz, any emission removed by less than 140 kHz from the band edges, quasi-peak detector)

- Equipment D:

Operating frequency band:	315 kHz to 30 MHz (excluding Equipment A, B, C)
Magnetic field-strength limit:	–5 dB(μ A/m) at 10 m (in 315 kHz to 1 MHz, quasi-peak detector)
	–15 dB(μ A/m) at 10 m (in 1 to 30 MHz, quasi-peak detector)

- Equipment E:

Operating frequency band (MHz):	40.66 to 40.70
Radiated power limit:	10 mW (e.r.p.)
Frequency tolerance:	100×10^{-6}

- Equipment F (excluding digital cordless telephone, Bluetooth devices and WLAN devices):

Operating frequency band (MHz):	2 400 to 2 483.5
Radiated power limit:	10 mW (e.i.r.p.)
Frequency tolerance:	75 kHz

- Equipment G:

Operating frequency band (GHz):	24.00 to 24.25
Radiated power limit:	20 mW (e.i.r.p.)

1.13 Digital cordless telephone

- Operating frequency band (MHz): 2 400 to 2 483.5
- Radiated power limit: 25 mW (average e.i.r.p.)
- Frequency tolerance: 20×10^{-6}

1.14 Automotive radars (collision avoidance radars)

- Operating frequency band (GHz): 76 to 77
- Radiated power limit: 55 dBm (peak e.i.r.p.)

2 Operating parameters requirements

2.1 The use of SRDs is forbidden when it causes harmful interference to other legal radio stations. If it causes harmful interference, the operation must be stopped. It can be put into operation again only after special measures are taken to eliminate such interference.

2.2 The use of SRDs must avoid or bear the interference from other legal radio stations or radiation interference from ISM devices. There is no legal protection for SRDs when it encounters interference. But the user can make an appeal to the local radio regulatory office.

2.3 Its use is forbidden near airports or airplanes.

2.4 The use of SRDs need not be licensed, but the necessary examination or test from the radio regulatory office is required so as to ensure that the SRDs perform within the acceptance range.

2.5 In order to develop, produce or import SRDs, they must go through the relevant formalities according to the relevant rules issued by the State Radio Office.

2.6 SRDs, without type approval by the State Radio Office, cannot be produced, sold and used in China.

2.7 For SRDs having passed the type approval of the State Radio Office, manufacturers and users cannot change the operating frequency or increase the transmitting power arbitrarily (including the addition of an extra RF amplifier). They cannot install any external antenna or replace the original one by another transmitting antenna, and cannot change the original design specification and function arbitrarily.

2.8 SRDs must be installed inside an integrated cabinet. Its external adjustment and control are only used within the range of the technical specifications of the approved type.

2.9 When using the SRDs listed below the followed stipulations must be applied:

2.9.1 Wireless audio transmitters

They cannot be used locally when the used frequency is the same as that of the local radio or TV stations.

Their operation must be stopped if they interfere with local stations. They can be reused only after eliminating the interference and adjusting the frequency to a free one.

To avoid interference to biomedical telemetry equipment wireless audio transmitters cannot be used in the hospital. manufacturers of wireless audio transmitters have to demonstrate this stipulation in their product manuals.

2.9.2 Biomedical telemetry transmitters

Radio devices for transmitting measurement signals of either human or animal biomedical phenomena are allowed to be used by hospitals or medical institute and forbidden to cause interference to the radio astronomy service.

2.9.3 Equipment for lifting, equipment for weighing

Before installation, the EMC environment must be tested so as to avoid interference to other equipment which can cause unnecessary production accidents.

Their operation must be stopped immediately when they cause harmful interference. They can be reused only after removing the interference by adjusting the frequency to a free one.

In order to protect the radio astronomy service, devices operating at the following frequencies are forbidden to be used in Beijing and Pingtang, Guizhou Province.

223.100 MHz, 223.700 MHz, 223.975 MHz, 224.600 MHz, 225.025 MHz, 225.325 MHz,
230.100 MHz, 230.700 MHz, 230.975 MHz, 231.600 MHz, 232.025 MHz, 232.325 MHz.

2.9.4 Radio remote-control equipment used in industry

It must be used inside the industrial workshop (or inside the building).

2.9.5 Equipment for transporting data

It must be used inside the building.

In order to protect the radio astronomy service, devices operating at the following frequencies are forbidden to be used in Beijing and Pingtang, Guizhou Province.

223.150 MHz, 223.250 MHz, 223.275 MHz, 223.350 MHz, 224.050 MHz, 224.250 MHz,
228.050 MHz, 228.100 MHz, 228.200 MHz, 228.275 MHz, 228.425 MHz, 228.575 MHz,
228.600 MHz, 228.800 MHz, 230.150 MHz, 230.250 MHz, 230.275 MHz, 230.350 MHz,
231.050 MHz, 231.250 MHz.

2.9.6 Radio control devices for civilian purposes

They cannot be used for radio remote-control toys and models.

2.9.7 General radio remote-control devices

They cannot be used for radio remote-control toys.

They cannot be used locally when the used frequency is the same as that of local radio or TV stations.

Their operation must be stopped if they cause harmful interference to local radio or TV stations. They can be reused only after removing the interference by adjusting the frequency to a free one.

2.9.8 Model and toy remote-control devices

Remote-control devices for unmanned models and toys, such as plane models in the air, ship models over the water surface and automobile models on land, cannot be used for other types of radio equipment.

They are limited to one-way control.

They cannot be used for transmitting audio signals.

They are required to stop use during radio control period and within radio control area. To meet requirements of electromagnetic environment, all kinds of model and toy remote-control devices are forbidden to use within a radius of 5 000 m. The centre of a circle for this forbidden area is the middle of the airport runway.

Radio transmitters are forbidden to set up in models.

2.9.9 Digital cordless telephone

Digital cordless telephone operating in the 2 400-2 483.5 MHz band should use at least 75 hopping frequencies.

The average time of occupancy on any channel shall not be greater than 0.4 s within a period of 60 s.

3 General requirements

3.1 Frequency ranges of measurement for radiated spurious emissions

TABLE 15

Operating frequency range	Lower frequency of measurement range	Upper frequency of measurement range
9 kHz-100 MHz	9 kHz	1 GHz
100-600 MHz	30 MHz	10th harmonic
600 MHz-2.5 GHz	30 MHz	12.75 GHz
2.5-13 GHz	30 MHz	26 GHz
Above 13 GHz	30 MHz	2nd harmonic

3.2 Radiated spurious emission limits

3.2.1 Radiated spurious emission limits are shown in the following table when a transmitter is in the state of maximum emission power

TABLE 16

Frequency range	Testing bandwidth	Emission limit	Detector
9-150 kHz	200 kHz (6 dB)	27 dB(μ A/m) at 10 m (descending 3 dB/octave)	Quasi-peak
150 kHz-10 MHz	9 kHz (6 dB)		
10-30 MHz	9 kHz (6 dB)	-3.5 dB(μ A/m) at 10 m	Quasi-peak
30 MHz-1 GHz	100 kHz (3 dB)	-36 dBm	RMS
1-40 GHz	1 MHz (3 dB)	-30 dBm	RMS
Above 40 GHz	1 MHz (3 dB)	-20 dBm	RMS

Notes relating to Table 16 (end):

NOTE 1 – Magnetic field-strength measurement should be made on an open field site. Radiated power measurement should be performed in a fully anechoic chamber.

NOTE 2 – The state of a transmitter operating at frequencies below 30 MHz can be set up in the state single carrier transmission.

NOTE 3 – If the concrete technical parameter does not comply with the general requirements, the former should be adopted.

3.2.2 Radiated spurious emission limits are shown in the following table when a transmitter is in idle or standby state

TABLE 17

Frequency range	Testing bandwidth	Emission limit	Detector
9-150 kHz	200 kHz (6 dB)	6 dB(μ A/m) at 10 m (descending 3 dB/octave)	Quasi-peak
150 kHz-10 MHz	9 kHz (6 dB)		
10-30 MHz	9 kHz (6 dB)	-24.5 dB(μ A/m) at 10 m	Quasi-peak
30 MHz-1 GHz	100 kHz (3 dB)	-47 dBm	RMS
Above 1 GHz	1 MHz (3 dB)		

3.3 Radiated spurious emission should not exceed -54 dBm in 48.5-72.5 MHz, 76-108 MHz, 167-223 MHz, 470-566 MHz, and 606-798 MHz bands.

3.4 Conducted disturbance emissions at power ports, signal ports and telecommunication ports should comply with GB9254-1998: "Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement". This technical standard was issued by former State Administration of Quality and Technology Supervision of China in 1998.

3.5 For the bands above 30 MHz within operating frequency ranges mentioned above, radiated power can not exceed -80 dBm/Hz (e.i.r.p.) at the band edges. For the bands below 30 MHz, the edges of the occupied frequency bandwidth on any operating channel (99% of energy) cannot exceed operating frequency ranges mentioned above.

Manufacturers of SRDs should announce the condition extremes of operating environment for normal use. Emission power and frequency tolerance under the condition extremes should meet requirements mentioned above.

Appendix 4 to Annex 2

(Japan)

Japanese requirements for short-range radio devices

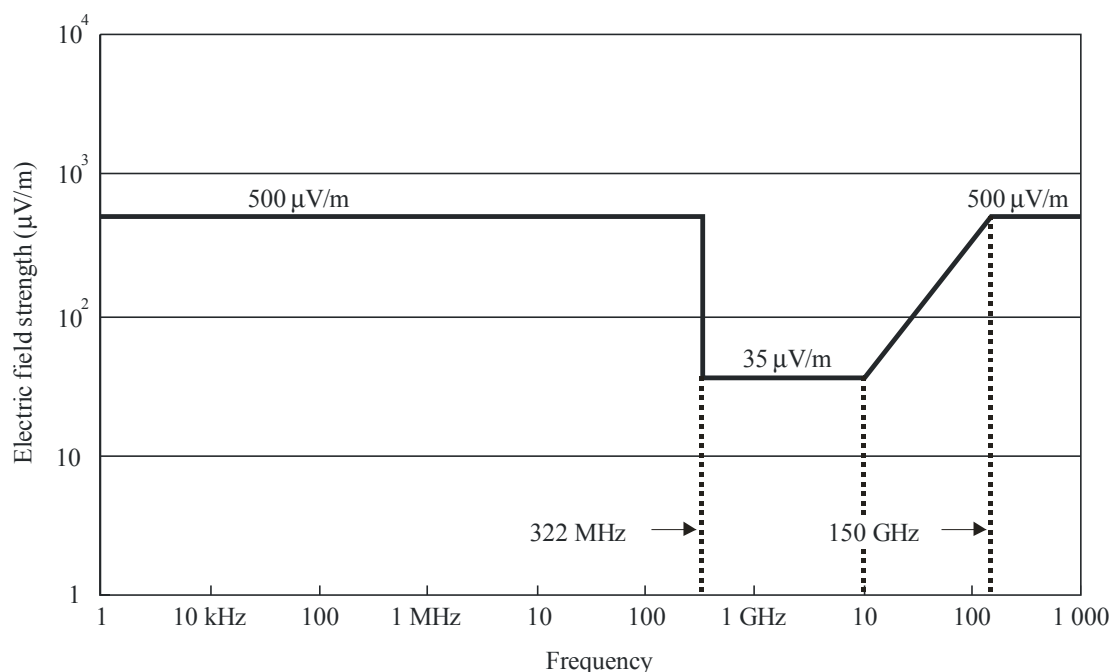
In Japan, establishment of a radio station requires a license from the ministry of Internal Affairs and Communications (MIC). However, radio stations listed in §§ 1) and 3) of Article 4 of the Radio Law (radio stations emitting extremely low power and low-power radio stations) can be established without obtaining a license from the minister of the MIC. A license, for a radio station which has had all its equipment granted certification of conformity with the required technical standards, can be obtained without a provisional license or radio station inspection.

Radio stations listed in §§ 1) and 3) of Article 4 of the Radio Law:

1 Radio stations emitting extremely low power

A radio station license is not required if the electric field strength meets the tolerable maximum value shown in Fig. 1 and Table 20 at a location 3 m distant from the radio equipment.

FIGURE 1
Tolerable maximum value of electric field strength 3 m distant from
a radio station emitting extremely low power*



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TABLE 18

**Tolerable value of electric field strength 3 m distant
from a radio station emitting extremely low power**

Frequency band	Electric field strength ($\mu\text{V/m}$)
$f \leq 322 \text{ MHz}$	500
$322 \text{ MHz} < f \leq 10 \text{ GHz}$	35
$10 \text{ GHz} < f \leq 150 \text{ GHz}$	$3.5 \times f^{(1), (2)}$
$150 \text{ GHz} < f$	500

(1) f (GHz).

(2) If $3.5 \times f > 500 \mu\text{V/m}$, the tolerable value is $500 \mu\text{V/m}$.

2 Low-power radio stations

Radio stations using only radio equipment 10 mW or less in antenna power and certified for technical standards compliance can be established without obtaining a license if they are intended for the following uses:

(limited only to stations using frequencies specified by the MIC)

- Telemeter and telecontrol and data transmission
- Wireless telephone
- Radio pager
- Radio microphone
- Medical telemeter
- Hearing aid
- Mobile land stations for personal handy phone (PHS)
- Radio stations for low-power data communication systems/wireless LAN
- Millimetre-wave radar
- Radio stations for cordless phones
- Radio stations for low-power security systems
- Radio stations for digital cordless phones
- Mobile land stations for dedicated short-range communication(DSRC) systems
- RF identification (RFID) systems
- Medical implant communication systems
- Sensors for detecting or measuring mobile objects
- Quasi-millimeter-wave communication systems
- Monitoring systems of animal's position
- Ultra wide band systems

TABLE 19

Technical regulations for representative low-power radio stations

Type of emission	Frequency band (MHz)	Occupied bandwidth (kHz)	Power level or spectral density (e.i.r.p.)	Antenna power and antenna gain	Carrier sense	
<i>Telemeter, telecontrol and data transmission</i>						
–	312-315.25	≤ 1 000	≤ 250 μW (–6 dBm)	–	Not required	
	312-315.05		≤ 25 μW (–16 dBm)			
F1D, F1F, F2D, F2F, F7D, F7F, G1D, G1F, G2D, G2F, G7D, G7F, D1D, D1F, D2D, D2F, D7D or D7F	426.025-426.1375 (12.5 kHz spacing)	≤ 8.5	≤ 1.6 mW (2.14 dBm)	≤ 1 mW ≤ 2.14 dBi	Not required	
	426.0375-426.1125 (25 kHz spacing)	> 8.5 ≤ 16	≤ 1.6 mW (2.14 dBm)	≤ 1 mW ≤ 2.14 dBi	Not required	
	429.1750-429.7375 (12.5 kHz spacing)	≤ 8.5	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	7 μV	
	429.8125-429.9250 (12.5 kHz spacing)					
	449.7125-449.8250 (12.5 kHz spacing)					
	449.8375-449.8875 (12.5 kHz spacing)					
	469.4375-469.4875 (12.5 kHz spacing)					
954.2 954.4 954.6 954.8 951-955.8 (200 kHz spacing) 954.3 954.5 954.7 951.1-955.5 (200 kHz spacing) 954.4 954.6 951.2-955.4 (200 kHz spacing) 1 216-1 217 (50 kHz spacing) 1 252-1 253 (50 kHz spacing) 1 216.0125-1 216.9875 (25 kHz spacing) 1 252.0125-1 252.9875 (25 kHz spacing)	954.2 954.4 954.6 954.8	≤ 200	≤ 20 mW (13 dBm)	≤ 10 mW ≤ 3 dBi	–75 dBm	
	951-955.8 (200 kHz spacing)		≤ 2 mW (3 dBm)	≤ 1 mW ≤ 3 dBi		
	954.3 954.5 954.7	> 200 ≤ 400	≤ 20 mW (13 dBm)	≤ 10 mW ≤ 3 dBi		
	951.1-955.5 (200 kHz spacing)	≤ 2 mW (3 dBm)	≤ 1 mW ≤ 3 dBi			
	954.4 954.6	> 400 ≤ 600	≤ 20 mW (13 dBm)	≤ 10 mW ≤ 3 dBi		
	951.2-955.4 (200 kHz spacing)	≤ 2 mW (3 dBm)	≤ 1 mW ≤ 3 dBi			
	1 216-1 217 (50 kHz spacing)	> 16 ≤ 32	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi		4.47 μV
	1 252-1 253 (50 kHz spacing)					
1 216.0125-1 216.9875 (25 kHz spacing)						
1 252.0125-1 252.9875 (25 kHz spacing)						

TABLE 19 (continued)

Type of emission	Frequency band (MHz)	Occupied bandwidth (kHz)	Power level or spectral density (e.i.r.p.)	Antenna power and antenna gain	Carrier sense
<i>Telemeter, telecontrol and data transmission</i>					
	1 216.5375-1 216.9875 (25 kHz spacing)	≤ 16			
	1 252.5375-1 252.9875 (25 kHz spacing)				
<i>Wireless telephone</i>					
F1D, F1E, F2D, F2E, F3E, F7W, G1D, G1E, G2D, G2E, G7E, G7W, D1D, D1E, D2D, D2E, D3E, D7E or D7W	422.2-422.3 (12.5 kHz spacing)	≤ 8.5	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	7 μV
	421.8125-421.9125 (12.5 kHz spacing)				
	440.2625-440.3625 (12.5 kHz spacing)				
	422.05-422.1875 (12.5 kHz spacing)				
	421.575-421.8 (12.5 kHz spacing)				
	440.025-440.25 (12.5 kHz spacing)				
F2D, F3E	413.7-414.14375 (6.25 kHz spacing)	≤ 8.5	1.6 mW (2.14 dBm)	≤ 1 mW ≤ (2.14 dBi)	Not required
	454.05-454.19375 (6.25 kHz spacing)				
<i>Radio pager</i>					
F1B, F2B, F3E, G1B or G2B	429.75 429.7625 429.775 429.7875 429.8	≤ 8.5	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	7 μV
<i>Radio microphone</i>					
F1D, F1E, F2D, F3E, F7D, F7E, F7W, F8E, F8W, F9W, D1D, D1E, D7D, D7E, D7W, G1D, G1E, G7D, G7E, G7W or NON	806.125-809.75 (125 kHz spacing)	Frequency modulation (except for frequency shift keying) ≤ 110 Frequency-modulation (limited to frequency shift keying), Phase-modulation or Quadrature amplitude-modulation ≤ 192	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	Not required

TABLE 19 (continued)

Type of emission	Frequency band (MHz)	Occupied bandwidth (kHz)	Power level or spectral density (e.i.r.p.)	Antenna power and antenna gain	Carrier sense
<i>Radio microphone</i>					
F3E, F8W, F2D or F9W	322.025-322.15 (25 kHz spacing)	≤ 30	≤ 1.6 mW (2.14 dBm)	≤ 1 mW ≤ 2.14 dBi	Not required
	322.25-322.4 (25 kHz spacing)				
F3E or F8W	74.58, 74.64, 74.70, 74.76	≤ 60	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	Not required
<i>Medical telemeter</i>					
F1D, F2D, F3D, F7D, F8D or F9D	420.05-421.0375, 424.4875-425.975, 429.25-429.7375, 440.5625-441.55, 444.5125-445.5 and 448.675-449.6625 (12.5 kHz spacing)	≤ 8.5			
F7D, F8D or F9D	420.0625-421.0125, 424.5-425.95, 429.2625-429.7125, 440.575-441.525, 444.525-445.475, 448.6875-449.6375 (25 kHz spacing)	> 8.5 ≤ 16	≤ 1.6 mW (2.14 dBm)	≤ 1 mW ≤ 2.14 dBi	Not required
F7D, F8D, F9D or G7D	420.075-420.975, 424.5125-425.9125, 429.275-429.675, 440.5875-441.4875, 444.5375-445.4375, 448.7-449.6 (50 kHz spacing)	> 16 ≤ 32			
F7D, F8D, F9D or G7D	420.1-420.9, 424.5375-425.8375, 429.3-429.6, 440.6125-441.4125, 444.5625-445.3625, 448.725-449.525, (100 kHz spacing)	> 32 ≤ 64			
F7D, F8D, F9D or G7D	420.3, 420.8, 424.7375, 425.2375, 425.7375, 429.5, 440.8125, 441.3125, 444.7625, 445.2625, 448.925, 449.425	> 64 ≤ 320	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	
<i>Hearing aid</i>					
F3E or F8W	75.2125-75.5875 (12.5 kHz spacing)	≤ 20	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	Not required
F3E or F8W	75.225-75.575 (25 kHz spacing)	> 20 ≤ 30			

TABLE 19 (continued)

Type of emission	Frequency band (MHz)	Occupied bandwidth (kHz)	Power level or spectral density (e.i.r.p.)	Antenna power and antenna gain	Carrier sense
<i>Hearing aid</i>					
F3E or F8W	75.2625-75.5125 (62.5 kHz spacing)	> 30 ≤ 80			
F3E or F8W	169.4125-169.7875 (25 kHz spacing)	> 20 ≤ 30	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	Not required
F3E or F8W	169.4375-169.75 (62.5 kHz spacing)	> 30 ≤ 80			
<i>PHS (land mobile station)</i>					
D1C, D1D, D1E, D1F, D1X, D1W, D7C, D7D, D7E, D7F, D7X, D7W, G1C, G1D, G1E, G1F, G1X, G1W, G7C, G7D, G7E, G7F, G7X or G7W	1 884.65-1 918.25	1 884.65-1 918. 25 MHz ≤ 288 1 884.95- 1 893.05 MHz ≤ 884	≤ 25 mW (14 dBm)	≤ 10 mW ≤ 4 dBi	159 μV
<i>Wireless LAN</i>					
SS (spread spectrum) (DS (direct sequence), FH (frequency hopping), FH/DS), OFDM or others	2 400-2 483.5	FH or FH/DS: ≤ 85.5 MHz OFDM ≤ 38 MHz Others: ≤ 26 MHz	FH or FH/DS: ≤ 4.9 mW/MHz (6.9 dBm/MHz) DS or OFDM: ≤ 16 mW/MHz (12.14 dBm/MHz) Others: ≤ 16 mW (12.14 dBm/MHz)	FH or FH/DS: ≤ 3 mW/MHz DS or OFDM: ≤ 10 mW/MHz Others: ≤ 10 mW ≤ 2.14 dBi	Not required
SS (DS, FH or FH/DS)	2 471-2 497	≤ 26 MHz	≤ 16 mW (12.14 dBm/MHz)	≤ 10 mW/MHz ≤ 2.14 dBi	Not required

TABLE 19 (continued)

Type of emission	Frequency band (MHz)	Occupied bandwidth (kHz)	Power level or spectral density (e.i.r.p.)	Antenna power and antenna gain	Carrier sense
<i>Wireless LAN</i>					
SS (DS), OFDM or others	5 150-5 250 (indoor use)	20 MHz system: ≤ 19 MHz 40 MHz system: ≤ 38 MHz	20 MHz system: ≤ 10 mW/MHz 40 MHz system: ≤ 5 mW/MHz	20 MHz system by DS or OFDM: ≤ 10 mW/MHz 20 MHz system by Others: ≤ 10 mW 40 MHz system: ≤ 5 mW/MHz Antenna gain is not required.	100 mV/m DFS/TPC is not required.
	5 250-5 350 (indoor use)		20 MHz system: ≤ 19 MHz 40 MHz system: ≤ 38 MHz		20 MHz system: With TPC: ≤ 10 mW/MHz Without TPC: ≤ 5 mW/MHz 40 MHz system: With TPC: ≤ 5 mW/MHz Without TPC: ≤ 2.5 mW/MHz
	5 470-5 725	≤ 19.7 MHz	≤ 50 mW/MHz (17 dBm/MHz)		
<i>Millimetre-wave radar</i>					
–	60.5 GHz 76.5 GHz	≤ 500 MHz	100 W 50 dBm	≤ 10 mW ≤ 40 dBi	Not required
<i>Radio stations for cordless phones</i>					
F1D, F2A, F2B, F2C, F2D, F2N, F2X or F3E	253.8625-254.9625 (12.5 kHz spacing) 380.2125-381.3125 (12.5 kHz spacing)	≤ 8.5	≤ 10 mW (10 dBm)	–	2 μ V
<i>Radio stations for low-power security systems</i>					
F1D, F2D or G1D	426.25-426.8375 (12.5 kHz spacing)	≤ 8.5	≤ 10 mW (10 dBm)	–	Not required
	426.2625-426.8375 (25 kHz spacing)	> 8.5 ≤ 16			
<i>Radio stations for digital cordless phones</i>					
G1C, G1D, G1E, G1F, G1X, G1W, G7C, G7D, G7E, G7F, G1X or G7W	1 893.65-1 905.95 (300 kHz spacing)	≤ 288	≤ 25 mW (14 dBm)	≤ 10 mW ≤ 4 dBi	159 μ V

TABLE 19 (continued)

Type of emission	Frequency band (MHz)	Occupied bandwidth (kHz)	Power level or spectral density (e.i.r.p.)	Antenna power and antenna gain	Carrier sense
<i>Mobile land stations for dedicated short-range communication (DSRC) system</i>					
A1D G1D	5.815-5.845 GHz (5 MHz spacing)	≤ 4.4 MHz	≤ 100 mW (20 dBm)	≤ 10 mW ≤ 10 dBi	Not required
<i>RF identification (RFID) systems</i>					
–	433.67-434.17 ⁽¹⁾	≤ 500 kHz (Interrogator) 200 kHz (Active tag)	≤ 0.4 mW (–4 dBm) ⁽²⁾ (Interrogator) ≤ 1 mW (0 dBm) (Active tag)	–	Not required
N0N, A1D, AXN, H1D, R1D, J1D, F1D, F2D or G1D	952-954	≤ 200*m kHz ⁽³⁾	≤ 4 W (36 dBm)	≤ 1 W ⁽⁴⁾ ≤ 6 dBi	–74 dBm
	952-955	≤ 200*n kHz ⁽⁵⁾	≤ 20 mW (13 dBm)	≤ 10 mW ≤ 3 dBi	–64 dBm
N0N, A1D, AXN, F1D, F2D or G1D	2 427-2 470.75	FH: ≤ 43.75 MHz DS: ≤ 5.5 MHz	≤ 30 W (44.77 dBm)	≤ 300 mW ⁽⁴⁾ ≤ 20 dBi	Not required
		5.5 MHz	≤ 1 W (30 dBm)	≤ 10 mW ≤ 20 dBi	
<i>Medical implant communication systems</i>					
A1D, F1D or G1D	402-405	≤ 300 kHz	≤ 25 μW (–16 dBm)	–	10 log B –150 + G dB (with 1 mW regarded as 0 dB) ⁽⁶⁾
	403.5-403.8		100 nW (–40 dBm)		Not required
<i>Sensors for detecting or measuring mobile objects</i>					
–	10.525 GHz (indoor use) 24.15 GHz	≤ 40 MHz ≤ 76 MHz	≤ 2.5 W (34 dBm)	≤ 10 mW ≤ 24 dBi	–
<i>Quasi-millimetre-wave communication systems</i>					
OFDM or others	24.77-25.23 GHz 27.02-27.46 GHz	≤ 18 MHz	≤ 100 mW/MHz (20 dBm/MHz)	≤ 10 mW/MHz ≤ 10 dBi	460 mW/m

TABLE 19 (*end*)

Type of emission	Frequency band (MHz)	Occupied bandwidth (kHz)	Power level or spectral density (e.i.r.p.)	Antenna power and antenna gain	Carrier sense
<i>Monitoring systems of animal's position</i>					
F1D, F2D, A1D or M1D	142.94-142.98 (10 kHz spacing)	≤ 16 kHz	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	Not required
<i>Ultra wide band systems for communication applications</i>					
	3.4-4.8 GHz ⁽⁷⁾ 7.25-10.25 GHz	>450 MHz	≤ -41.3 dBm/MHz	–	–

OFDM: orthogonal frequency division multiplexing

PSK: phase shift keying

(1) International logistics only.

(2) Power level (e.i.r.p.) from interrogators is limited in less than 0.1 mW (–10 dBm) when sending a signal for the start of switching active tags on.

(3) m : m represents the number of unit radio channels which are simultaneously used. ($n = 1-9$).

(4) A registration is required for establishment of this radio station though a licence is not required.

(5) n : n represents the number of unit radio channels which are simultaneously used. ($n = 1-3$).

(6) B is the maximum radiation bandwidth in the communication state (which refers to the bandwidth in which the radio equipment in a living body or the radio control equipment outside the living body radiates and is the larger of either of the upper limit and the lower limit frequency width (Hz) at which the attenuation from the maximum value of the radiation power during the maximum modulation becomes 20 dB). G is the absolute gain of the receiving antenna.

(7) Interference mitigation function (DAA, etc.) should be adopted in the band of 3.4-4.8 GHz. But in the band of 4.2-4.8 GHz interference mitigation function should not be adopted until 2010/12/31.

Appendix 5 to Annex 2

(The Republic of Korea)

Technical parameters and spectrum use for SRDs in Korea

1 Introduction

The radio station installed with the following apparatus is to be exempted from individual licence according to the Radio Wave Act in Korea. This category of apparatus is the subject of type registration.

- Low-power devices (LPD)
- Citizen-band transceiver
- Specified short range device

- Measurement instruments
- Receiver only
- Radio equipment used for relaying public radiocommunication service or broadcasting service to indoor shaded area.

2 Technical parameters and spectrum use for SRDs

2.1 Low-power devices and specific SRDs

TABLE 20

No.	Application	Frequency bands/ frequencies	Maximum field strength/RF output power	Remarks
1	Low power devices	0-322 MHz*	500 μ V/m @ 3 m	The measured value for the frequency of lower than 15 MHz should be multiplied by the near field measurement compensation factor ($6\pi/\lambda$), where λ is wavelength (m). ¹⁾ f: frequency (GHz).
		322 MHz-10 GHz*	35 μ V/m @ 3 m	
		10-150 GHz*	3.5f μ V/m @ 3 m ¹⁾	
		Above 150 GHz*	500 μ V/m @ 3 m	
2	Inductive applications	9-30 kHz	72 dB(μ A/m) @ 10 m	Detector type is quasi-peak mode ²⁾ f: frequency (kHz).
		30-90 kHz	72 – 10 log(f/30) dB(μ A/m) @ 10 m ²⁾	
		90-110 kHz	42 dB(μ A/m) @ 10 m	
		110-135 kHz	72 – 10log(f/30) dB(μ A/m) @ 10 m ²⁾	
		135-140 kHz	42 dB(μ A/m) @ 10 m	
		140-148 kHz	37.5 dB(μ A/m) @ 10 m	
		148-150 kHz	14.8 dB(μ A/m) @ 10 m	
3	Radio controller for model automobile and model ship craft	26.995, ..., 27.195 MHz (5 channels, 50 kHz space)	10 mV/m @10 m	
		40.255, ..., 40.495 MHz (13 channels, 20 kHz space)	10 mV/m @10 m	
		75.630, ..., 75.790 MHz (9 channels, 20 kHz space)	10 mV/m @10 m	
4	Radio controller for model aircraft	40.715, ..., 40.995 MHz (15 channels, 20 kHz space)	10 mV/m @10 m	
		72.630, ..., 72.990 MHz (19 channels, 20 kHz space)		
5	Radio controller for toy, security alarm or telecommand	13.552-13.568 MHz	10 mV/m @10 m	
		26.958-27.282 MHz		
		40.656-40.704 MHz		

TABLE 20 (continued)

No.	Application	Frequency bands/ frequencies	Maximum field strength/RF output power	Remarks
6	Data transmission	173.0250, ..., 173.2750 MHz (21 channels, 12.5 kHz space)	5 mW (e.r.p.)	The maximum occupied bandwidth (OBW) is 8.5 kHz.
		173.6250, ..., 173.7875 MHz (14 channels, 12.5 kHz space)	10 mW (e.r.p.)	
		219.000 (224.000), ..., 219.125 (224.125) (6 pair channels, 25 kHz space)	10 mW (e.r.p.)	The frequencies of 219.000 (224.000) MHz are for channel control OBW is 16 kHz. Frequencies in () are for duplex communication.
		311.0125, ..., 311.1250 MHz (10 channels, 12.5 kHz space)	5 mW (e.r.p.)	OBW is 8.5 kHz
		424.7000, ..., 424.9500 MHz (21 channels, 12.5 kHz space)	10 mW (e.r.p.)	The channel 424.7 MHz is for channel control. OBW is 8.5 kHz
		433.795-434.045 MHz	3 mW (e.r.p.)	Tire pressure monitoring system (TPMS) and car door lock and car immobilizer only. OBW is 250 kHz
		447.6000, ..., 447.8500 MHz (21 channels, 12.5 kHz space)	5 mW (e.r.p.)	OBW is 8.5 kHz
		447.8625, ..., 447.9875 MHz (11 channels, 12.5 kHz space)	10 mW (e.r.p.)	OBW is 8.5 kHz
7	Inducement of the visually handicapped	235.3000, 235.3125, 235.3250, 235.3375 MHz	10 mW (e.r.p.)	Fixed equipment OBW is 8.5 kHz
		358.5000, 358.5125, 358.5250, 358.5375 MHz	10 mW (e.r.p.)	Mobile equipment OBW is 8.5 kHz
8	Security application	447.2625, ..., 447.5625 MHz (25 channels, 12.5 kHz space)	10 mW (e.r.p.)	OBW is 8.5 kHz

TABLE 20 (continued)

No.	Application	Frequency bands/ frequencies	Maximum field strength/RF output power	Remarks
9	Data transmission or voice radio paging	219.150, 219.175, 219.200, 219.225 MHz (4 channels, 25 kHz space)	10 mW (e.r.p.)	OBW is 16 kHz
10	Wireless microphone or Audio transmission	72.610-73.910 MHz	10 mW (e.r.p.)	OBW is 60 kHz
		74.000-74.800 MHz		
		75.620-75.790 MHz		
		173.020-173.280 MHz	10 mW (e.r.p.)	OBW is 200 kHz
		217.250-220.110 MHz		
		223.000-225.000 MHz		
		740.000-752.000 MHz		
925.000-932.000 MHz				
11	Wireless access system including wireless LAN	5 150-5 250 MHz	2.5 mW/MHz	Nominal antenna gain is 6 dBi.
		5 250-5 350 MHz, 5 470-5 650 MHz	10 mW/MHz	$0.5 \text{ MHz} \leq \text{OBW} \leq 20 \text{ MHz}$ Nominal antenna gain is 7 dBi.
			5 mW/MHz	$20 \text{ MHz} \leq \text{OBW} \leq 40 \text{ MHz}$ Nominal antenna gain is 7 dBi.
		17 705-17 715 MHz	10 mW (e.r.p.)	OBW is 10 MHz Nominal antenna gain is 2.15 dBi.
		17 725-17 735 MHz		
		19 265-19 275 MHz		
19 285-19 295 MHz				

TABLE 20 (continued)

No.	Application	Frequency bands/ frequencies	Maximum field strength/RF output power	Remarks
12	Data communication	2 400-2 483.5 MHz, 5 725-5 825 MHz	3 mW/MHz ³⁾ (for FHSS type) 10 mW/MHz ⁴⁾ (for other spread spectrum type) 10 mW ⁵⁾ (other type)	The nominal antenna gain is 6 dBi (20 dBi for point-to- point application) ³⁾ The peak power of a hopping channel divided by whole hopping frequency band (MHz). ⁴⁾ 5 mW/MHz in case of OBW 26-40 MHz and 0.1 mW/MHz in case of OBW 40-60 MHz. ⁵⁾ OBW is 26 MHz for 2.4 GHz band and 70 MHz for 5.8 GHz band.
		2 410, 2 430, 2 450 and 2 470 MHz ⁶⁾	10 mW	The nominal antenna gain is 6 dBi (20 dBi for point-to- point application) OBW is 16 MHz ⁶⁾ Only for analogue video transmission.
		5 800 and 5 810 MHz ⁷⁾	10 mW (e.i.r.p.)	Nominal antenna gain is 22 dBi for road side unit and 8 dBi for on-board unit OBW is 8 MHz ⁷⁾ Only for dedicated short range communication (DSRC).
13	Vehicle identification system	2 440 (2 427-2 453) MHz	300 mW	The nominal antenna gain is 20 dBi.
		2 450 (2 434-2 465) MHz		
		2 455 (2 439-2 470) MHz		
14	Vehicle and infrastructure radar systems	76-77 GHz	10 mW	Power level 50 dBm peak power e.i.r.p.
15	Radio frequency identification applications(RFID)	13.552-13.568 MHz	93.5 dB(μ V/m) @ 10 m	
		433.670-434.170 MHz	3.6 mW (e.i.r.p.)	
		917-923.5 MHz (32 channels, 200 kHz step)	4 W (e.i.r.p.)	Passive RFID on channel No. 2, 5, 8, 11, 14 and 17.
			200 mW (e.i.r.p.)	Passive RFID Channel No. 20~32.
			10 mW (e.i.r.p.)	Any on channel No. 2, 5, 8, 11, 14, 17 and 19~32.
3 mW (e.i.r.p.)	Any on channel No. 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18.			

TABLE 20 (end)

No.	Application	Frequency bands/ frequencies	Maximum field strength/RF output power	Remarks
16	Cordless phone (digital)	1786.750-1791.950 MHz	100 mW (e.i.r.p.)	OBW is 1.728 MHz
		2 400-2 483.5 MHz	3 mW/MHz ³⁾ (for FHSS type) 10 mW/MHz ⁴⁾ (for other spread spectrum type) 10 mW/MHz ⁸⁾ (non-spread spectrum type)	The nominal antenna gain is 6 dBi. ⁸⁾ OBW is 26 MHz.
17	UWB device	3.1-4.8 GHz	-41.3 dBm/MHz (e.i.r.p.)	The minimum 10 dB bandwidth is 450 MHz. Interference mitigation function (DAA, LDC, etc.) should be adopted in the band of 3.1-4.8 GHz.
		7.2-10.2 GHz		
18	Non-specific SRD	57-64 GHz	10 mW	Nominal antenna gain is 17 dBi (47 dBi for point-to- point application).
19	Medical implant communication system (MICS)	402-405 MHz	25 µW (e.i.r.p.)	OBW is 300 kHz
20	Radar sensor system	10.5-10.55 GHz	25 mW (e.i.r.p.)	OBW is 50 MHz
		24.05-24.25 GHz	100 mW (e.i.r.p.)	OBW is 200 MHz
21	Citizen band transceiver (simplex)	26.965, 26.975, 26.985, 27.005, 27.015, 27.025, 27.035, 27.055, 27.065, 27.075, 27.085, 27.105, 27.115, 27.125, 27.135, 27.155, 27.165, 27.175, 27.185, 27.205, 27.215, 27.225, 27.235, 27.245, 27.255, 27.265, 27.275, 27.285, 27.295, 27.305, 27.315, 27.325, 27.335, 27.345, 27.355, 27.365, 27.375, 27.385, 27.395 and 27.405 MHz (40 channels, 10 kHz space)	3 W (The antenna should be whip type, and the limit of antenna length is 1 m for portable type, 3 m for built-in vehicle type (total height should not be higher than 4.5 m) and 6 m for fixed type)	OBW is 6 kHz for double side band and 3 kHz for single side band emission. The channel 27.065 MHz is designated for emergency communication (such as fire alarm). The channel 27.065 MHz is designated for meteorological, medical, traffic guide.
		448.7375, ..., 448.9250 MHz and 449.1500, ..., 449.2625 MHz (Total 26 channels, 12.5 kHz space)	500 mW (e.r.p.)	The channel 448.7375 MHz is designated for channel control. OBW is 8.5 kHz
		424.1375 (449.1375), ..., 424.2625 (449.2625) MHz (11 pair channels, 12.5 kHz space)	500 mW (e.r.p.)	The channels 424.1375 (449.1375) MHz are designated for channel control. OBW is 8.5 kHz.

(*) Intentional radiation is prohibited in the frequency bands specified in RR Nos. 5.82, 5.108, 5.109, 5.110, 5.149, 5.180, 5.199, 5.200, 5.223, 5.226, 5.328, 5.337, 5.340, 5.375, 5.392, 5.441, 5.444A, 5.448B, 5.497 and Nos. K16, K47, K63 and K116 of Table of Korean Frequency Allocation to protect safety services and passive services.

2.2 Measurement instruments

This category includes standard electric field generator, signal generator, etc.

2.3 Receiver

Receivers used for the sake of safety in maritime and aeronautical navigation or for radio astronomy/space radiocommunication services, which shall be notified to the Korean Administration according to the Radio Wave Act, are excluded from this category.

2.4 Radio equipment used for relaying public radiocommunication service or broadcasting service to shaded area

TABLE 21

Applications	Frequency	Power limit	Remark
Radio equipment for relaying public radiocommunication service or broadcasting service to indoor shaded area	The frequency assigned to the corresponding service station (broadcasting, fixed or base station)	10 mW/MHz	Radio equipment in this category cannot be installed without the agreement of the communication service provider. The spectral and technical criteria shall be the same as those applied for the radio equipment for the specific service.
Radio repeater for extending granted services into tunnel or underground space, or for relaying satellite-broadcasting services	The frequency assigned to the corresponding service station	10 mV/m @ 10 m	Unidirectional only

2.5 Measurement instruments

This category includes standard electric field generator, signal generator, etc.

2.6 Receiver

Receivers used for the sake of safety in maritime and aeronautical navigation or for radio astronomy/space radiocommunication services, which shall be notified to the Korean Administration according to the Radio Wave Act, are excluded from this category.

2.7 Radio equipment used for relaying public radiocommunication service or broadcasting service to shadowed area

TABLE 22

Applications	Frequency	Power limit	Remark
Radio equipment for relaying public radiocommunication service or broadcasting service to shadowed area.	The frequency assigned to the corresponding service station (broadcasting, fixed or base station).	10 mW/MHz	Radio equipment in this category cannot be installed without the agreement of the communication service provider The spectral and technical criteria shall be the same as those applied for the radio equipment for the specific service
Radio repeater for extending granted services into tunnel or underground space, or for relaying satellite-broadcasting services.	The frequency assigned to the corresponding service station.	10 mV/m @ 10 m	Unidirectional only

Appendix 6 to Annex 2

(Federative Republic of Brazil)

Regulation on restricted radiation radiocommunications equipment¹ in Brazil

1 Introduction

In 2008, Anatel republished the Regulation on Restricted Radiation Radio Communications Equipment² approved by Resolution No. 506, of July 2008. This Regulation specifies the characteristics of restricted radiation equipment and establishes the conditions for the use of radio frequencies so that such equipment can be used without a station operating license or a grant for authorization to use radio frequencies, pursuant to Art. 163, § 2, indent I, of Law No. 9472, of 16 July 1997.

¹ In Brazil, the short range devices (SRDs) are referred to as the “restricted radiation radiocommunications equipments”.

² The regulations can be found in the Anatel home page (<http://www.anatel.gov.br>).

2 Definitions

For purposes of the Regulation on Restricted Radiation Radio Communications Equipment, the following definitions and concepts shall apply:

Auditory assistance device refers to any apparatus used to provide auditory assistance to a handicapped person or persons. Such a device shall be used for auricular training in educational institutions, for auditory assistance at places of public gatherings, such as a church, theater, or auditorium, and for auditory assistance to handicapped individuals, exclusively, in other locations;

Biomedical telemetry device refers to equipment used to transmit measurements of human or animal biomedical phenomena to a receiver within a restricted area;

Periodic operation device refers to equipment operated in a discontinuous manner whose transmission duration time and silent period are specified in this Regulation;

Electromagnetic field disturbance emitter-sensor refers to any device that establishes a radiofrequency field in its vicinity and detects changes in such field resulting from the movement of living beings or objects within its operating range;

Radiocommunications signals blocking equipment refers to the equipment designed to avoid the use of a radio frequencies or a specific frequency band for communications;

Cable locating equipment refers to a device used intermittently to locate buried cables, lines, ducts, and similar elements or structures;

Restricted radiation radiocommunications equipment refers to the generic term given equipment, apparatus, or devices that use radio frequencies for a variety of applications, in which the corresponding emissions produce an electromagnetic field which strength falls within the limits established in this Regulation. Subsequently, this Regulation may specify a maximum transmission power or power density level in lieu of field strength;

General-purpose radiocommunications equipment refers to any portable unit capable of bidirectionally transmitting voice communications;

Spread spectrum refers to the technology by which the average energy of the transmitted signal is spread over a bandwidth significantly wider than the bandwidth containing the information. Systems employing such technology compensate for the use of a wider transmission bandwidth by means of a lower power spectral density and an improvement in the rejection of the interfering signals from other systems operating within the same frequency band;

Harmful interference refers to any emission, radiation, or induction that obstructs, seriously degrades, or repeatedly interrupts the telecommunication;

Cordless microphone refers to a system comprised of a microphone integrated to a transmitter and a receiver designed to enable the user freedom of movement without the restrictions imposed by physical transmission means (cables);

Digital modulation refers to the process by which some characteristic of the carrier wave (frequency, phase, amplitude, or combinations thereof) is varied in accordance with a digital signal (a signal consisting of coded pulses or states derived from quantized information);

Frequency hopping refers to the technique by which the energy is spread by changing the centre transmission frequency several times per second, according to a pseudorandom sequence of channels. Such sequence is used repeatedly, so that the transmitter continuously recycles the same sequence of changed channels;

Direct sequence refers to the technique by which the carrier is modulated by combining the signal information, which is usually digital, with a high-speed binary sequence. The binary code – a sequence of fixed-length pseudorandom bits that is continuously recycled by the system – dominates the modulating function and is the direct cause of the wide spreading of the transmitted signal;

Pseudorandom sequence refers to a binary data stream that is defined by properties of a random sequence and also a non-random sequence, at the same time;

Wireless access systems, including radio local access networks, refers to a term given equipment, apparatus, or devices employed in various applications in local wireless networks which require high transmission speeds, i.e., at least 6 Mbit/s, in the frequency bands and power levels established in this Regulation;

Perimeter protection system refers to an electromagnetic field disturbance emitter-sensor that employs radio-frequency transmission lines as the radiating source and is installed in such a way that allows the system to detect movement within the protected area;

Wireless PABX system refers to a system consisting of a base station connected to a Private Automatic Branch Exchange (PABX) and mobile terminal units that communicate directly with such base station. Transmissions from the mobile terminal unit are received by the base station and transferred to the PABX;

Indoor sound system refers to a system composed of a transmitter and receivers integrated with loudspeakers for purposes of substituting the physical means of interconnection of the sound source to the speakers;

Cordless telephone system refers to the system consisting of two transceivers, one of which is a base station that connects to the public switched telephone network and the other a mobile unit that communicates directly with the base station. Transmissions from the mobile unit are received by the base station and transferred to the fixed switched telephone service (FSTS) network. Information received from the public switched telephone network (PSTN) is transmitted by the base station to the mobile unit;

Telecommand refers to the use of telecommunication for the transmission of radio signals to initiate, modify, or terminate functions of equipment at a distance;

Telemetry refers to the use of telecommunication for automatic indicating or recording measurements at a distance from the measuring instrument.

3 General conditions

Radiocommunication stations associated with the restricted radiation equipment defined in Resolution No. 506 of Anatel are exempt from licensing requirements for their deployment and operation. When the operation of radiocommunications can be defined as the provision of telecommunications services, the telecommunication service provider is subject to the provisions set forth in the Regulation of Telecommunications Services, approved by Resolution No. 73 of Anatel, of 25 November 1998.

Radiocommunication stations associated with restricted radiation equipment operate on a secondary basis, meaning that such stations shall accept harmful interference caused by any other radiocommunication station and shall not cause interference to any system operating on a primary basis. Restricted radiation equipment that causes harmful interference to any system operating on a primary basis shall cease operations immediately until the cause of the interference has been removed.

The restricted radiation equipment operating in accordance with the provisions established in Resolution No. 506 shall bear a certification issued or approved by Anatel, under the terms of the directives in force. The certification shall include the status of restricted radiation conferred on the equipment, as well as the maximum allowable field strength within a determined distance and the type of antenna permitted during the use of the equipment. Alternatively, the certification shall specify a maximum transmitting power or power density level in place of the field strength.

The restricted radiation equipment shall bear a prominently located, permanent label with the following statement: "This equipment operates on a secondary basis and, consequently, must accept harmful interference, including from stations of the same kind, and may not cause harmful interference to systems operating on a primary basis". If the equipment is so small or its structure such that it is not practicable to place this statement on it, such statement shall be placed in a prominent location in the instruction manual supplied to the user by the manufacturer.

Except when explicitly stated otherwise in the Resolution No. 506, all restricted radiation equipment shall be designed to ensure that no antenna other than its own can be used. The use of an antenna (with permanent attachments) incorporated to the equipment shall be considered sufficient to comply with that. The use of standard antenna jacks or electric connectors is prohibited.

4 Restricted frequency bands

The use of restricted radiation equipment is prohibited in the frequency bands listed in Table 25. In these frequency bands, only spurious emissions from the restricted radiation equipment operating in another band shall be allowed.

TABLE 23

Restricted frequency bands *

(MHz)	(MHz)	(MHz)	(GHz)
0.090-0.110	13.36-13.41	399.9-410	5.35-5.46
0.495-0.505	16.42-16.423	608-614	6.65-6.6752
2.1735-2.1905	16.69475-16.69525	952-1215	8.025-8.5
4.125-4.128	16.80425-16.80475	1 300-1 427	9.0-9.2
4.17725-4.17775	21.87-21.924	1 435-1 646.5	9.3-9.5
4.20725-4.20775	23.2-23.35	1 660-1 710	10.6-11.7
6.215-6.218	25.5-25.67	1 718.8-1 722.2	12.2-12.7
6.26775-6.26825	37.5-38.25	2 200-2 300	13.25-13.4
6.31175-6.31225	73-74.6	2 483.5-2 500	14.47-14.5
8.291-8.294	74.8-75.2	2 655-2 900	15.35-16.2
8.362-8.366	108-138	3 260-3 267	20.2-21.26
8.37625-8.38675	149.9-150.05	3 332-3 339	22.01-23.12
8.41425-8.41475	156.52475-156.52525	3 345.8-3 352.5	23.6-24.0
12.29-12.293	156.7-156.9	4 200-4 400	31.2-31.8
12.51975-12.52025	242.95-243	4 800-5 150	36.43-36.5
12.57675-12.57725	322-335.4		Above 38.6

* Exceptionally, the Medical Implant Communications Systems (MICS) are authorized to operate in the 402 MHz to 405 MHz band, provided they comply with the provisions established in Resolution No. 506 of Anatel.

5 General emission limits

Except when explicitly stated otherwise in Resolution No. 506 Anatel, the emissions of restricted radiation equipment shall not be greater than the field-strength levels specified in Table 26.

TABLE 24
General emission limits

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	$2\,400/f$ (kHz)	300
0.490-1.705	$24\,000/f$ (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

In the 54-72 MHz, 76-88 MHz, 174-216 MHz, and 470-806 MHz bands, the operation of restricted radiation equipment shall only be permitted under the specific conditions established in Resolution No. 506 of Anatel.

The field strength of restricted radiation equipment operating within bands 26.96-27.28 MHz and 49.82-49.90 MHz shall not exceed:

- 10 000 ($\mu\text{V/m}$)/m at a distance of 3 m from the emitter for carrier frequency emissions;
- 500 ($\mu\text{V/m}$)/m at a distance of 3 m from the emitter for emissions appearing outside the frequency band, including harmonic frequencies, in any frequency appearing more than 10 kHz from the carrier.

The field strength of restricted radiation equipment operating within band 40.66-40.70 MHz shall not exceed 1 000 ($\mu\text{V/m}$)/m at a distance of 3 m from the emitter.

The mean field-strength limits measured at a distance of 3 m from the restricted radiation equipment operating within bands 902-907.5 MHz, 915-928 MHz, 2 400-2 483.5 MHz, 5 725-5 875 MHz, and 24.00-24.25 GHz frequency shall not exceed the levels specified in Table 36. The peak field strength of any emission shall not exceed the mean level of 20 dB. All emissions appearing outside the specified frequency band, except for harmonics, shall be attenuated, at a minimum, 50 dB below the fundamental or adhere to the general emission limits shown in Table 27, whichever value is lower.

The use of the 433-435 MHz radio-frequency band by restricted radiation equipment in an indoor area may be done with irradiated power limited to 10 mW (e.i.r.p.).

TABLE 25

Field strength limits for equipment operating within bands 902-907.5 MHz, 915-928 MHz, 2 400-2 483.5 MHz, 5 725-5 875 MHz and 24.00-24.25 GHz

Fundamental frequency	Field strength of fundamental frequency ($\mu\text{V/m}$)	Field strength of harmonics ($\mu\text{V/m}$)
902-907.5 MHz	50	500
915-928 MHz	50	500
2 400-2 483.5 MHz	50	500
5 725-5 875 MHz	50	500
24.00-24.25 GHz	250	2 500

6 Exception or exclusions from the general limits

Table 28 contains other exceptions or exclusions to the general limits in Brazil. Additionally, under special conditions telecommand systems can operate in some specific frequencies of 26 MHz, 27 MHz, 50 MHz, 71 MHz and 75 MHz bands.

TABLE 26

Exception or exclusions from the general limits

Frequency band	Type of use	Emission limit	Detector A-Average Q-Quasi-peak
40.66-40.7 MHz	Intermittent control signals	2 250 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	1 000 $\mu\text{V/m}$ at 3 m	A or Q
	Any	1 000 $\mu\text{V/m}$ at 3 m	Q
	Perimeter protection systems	500 $\mu\text{V/m}$ at 3 m	A
54-70 MHz	Exclusively non-residential perimeter protection systems	100 $\mu\text{V/m}$ at 3 m	Q
	Wireless microphone	50 mW	
	Telemetry devices	50 mW	
70-72 MHz	Intermittent control signals	1 250 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	500 $\mu\text{V/m}$ at 3 m	A or Q
	Non-residential perimeter protection systems	100 $\mu\text{V/m}$ at 3 m	Q
	Wireless microphone	50 mW	
72-73 MHz	Intermittent control signals	1 250 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	500 $\mu\text{V/m}$ at 3 m	A or Q
74.6-74.8 MHz	Intermittent control signals	1 250 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	500 $\mu\text{V/m}$ at 3 m	A or Q

TABLE 26 (continued)

Frequency band	Type of use	Emission limit	Detector A-Average Q-Quasi-peak
75.2-76 MHz	Intermittent control signals	1 250 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	500 $\mu\text{V/m}$ at 3 m	A or Q
76-88 MHz	Intermittent control signals	1 250 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	500 $\mu\text{V/m}$ at 3 m	A or Q
	Non-residential perimeter protection systems	100 $\mu\text{V/m}$ at 3 m	Q
	Wireless microphone	50 mW	
88-108 MHz	Intermittent control signals	1 250 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	500 $\mu\text{V/m}$ at 3 m	A or Q
	Wireless microphone	250 mW	
121.94-123 MHz	Intermittent control signals	1 250 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	500 $\mu\text{V/m}$ at 3 m	A or Q
138-149.9 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11)$ $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11)$ $\mu\text{V/m}$ at 3 m	A or Q
150.05-156.52475 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11)$ $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11)$ $\mu\text{V/m}$ at 3 m	A or Q
156.52525-156.7 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11)$ $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11)$ $\mu\text{V/m}$ at 3 m	A or Q
156.9-162.0125 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11)$ $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11)$ $\mu\text{V/m}$ at 3 m	A or Q
167.17-167.72 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11)$ $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11)$ $\mu\text{V/m}$ at 3 m	A or Q
173.2-174 MHz	Intermittent control signals	$(625/11) \times f(\text{MHz}) - (67\,500/11)$ $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(250/11) \times f(\text{MHz}) - (27\,000/11)$ $\mu\text{V/m}$ at 3 m	A or Q
174-216 MHz	Intermittent control signals	3 750 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	1 500 $\mu\text{V/m}$ at 3 m	A or Q
	Wireless microphone	50 mW	

TABLE 26 (continued)

Frequency band	Type of use	Emission limit	Detector A-Average Q-Quasi-peak
216-225 MHz	Intermittent control signals	3 750 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	1 500 $\mu\text{V/m}$ at 3 m	A or Q
225-240 MHz	Intermittent control signals	3 750 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	1 500 $\mu\text{V/m}$ at 3 m	A or Q
	Indoor sound system	580 000 $\mu\text{V/m}$ at 3 m	
240-242.95 MHz	Indoor sound system	580 000 $\mu\text{V/m}$ at 3 m	
243-270 MHz	Indoor sound system	580 000 $\mu\text{V/m}$ at 3 m	
285-322 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\,250/3) \mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\,500/3) \mu\text{V/m}$ at 3 m	A or Q
335.4-399.9 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\,250/3) \mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\,500/3) \mu\text{V/m}$ at 3 m	A or Q
402-405 MHz	Medical Implant Communication Systems (MICS)	25 μW (e.i.r.p.) per 300 kHz bandwidth	
410-462.53 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\,250/3) \mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\,500/3) \mu\text{V/m}$ at 3 m	A or Q
433-435 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\,250/3) \mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\,500/3) \mu\text{V/m}$ at 3 m	A or Q
	Any	10 mW (e.i.r.p.)	
462.53-462.74 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\,250/3) \mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\,500/3) \mu\text{V/m}$ at 3 m	A or Q
	General usage radio equipment	500 mW (e.r.p.)	
462.74-467.53 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\,250/3) \mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\,500/3) \mu\text{V/m}$ at 3 m	A or Q

TABLE 26 (continued)

Frequency band	Type of use	Emission limit	Detector A-Average Q-Quasi-peak
467-53-467.74 MHz	Intermittent control signals	$(125/3) \times f(\text{MHz}) - (21\ 250/3) \mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f(\text{MHz}) - (8\ 500/3) \mu\text{V/m}$ at 3 m	A or Q
	General usage radio equipment	500 mW (e.r.p.)	
470-512 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Wireless microphone	250 mW	
512-566 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Biomedical Telemetry devices for hospitals	200 $\mu\text{V/m}$ at 3 m	Q
	Wireless microphone	250 mW	
566-608 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Wireless microphone	250 mW	
614-806 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Wireless microphone	250 mW	
806-864 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
864-868 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Wireless PABX system	250 mW	
868-890 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
890-902 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Signals used to measure the characteristics of a material	500 $\mu\text{V/m}$ at 30 m	A
902-907.5 MHz	Signals used to measure the characteristics of a material	500 $\mu\text{V/m}$ at 30 m	A
	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q

TABLE 26 (continued)

Frequency band	Type of use	Emission limit	Detector A-Average Q-Quasi-peak
915-928 MHz	Signals used to measure the characteristics of a material	500 $\mu\text{V/m}$ at 30 m	A
	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
928-940 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Signals used to measure the characteristics of a material	500 $\mu\text{V/m}$ at 30 m	A
940-944 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
944-948 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
	Wireless PABX system	250 mW	
948-960 MHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A or Q
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A or Q
1.24-1.3 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
1.427-1.435 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
1.6265-1.6455 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
1.6465-1.66 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
1.71-1.7188 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
1.7222-2.2 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
1.91-1.93 GHz	Wireless PABX system	250 mW	
2.3-2.31 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
2.39-2.4 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
2.4-2.4835 GHz	Spread spectrum or OFDM transmitters	1 W e.i.r.p. ⁽¹⁾	
2.5-2.655 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A

TABLE 26 (continued)

Frequency band	Type of use	Emission limit	Detector A-Average Q-Quasi-peak
2.9-3.26 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
3.267-3.332 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
3.339-3.3458 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
3.358-3.6 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
4.4-4.5 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
5.15-5.25 GHz	Indoor RLAN	200 mW e.i.r.p.	A
5.25-5.35 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
	Indoor RLAN	200 mW e.i.r.p.	A
5.46-5.47 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
5.47-5.725 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
	RLAN	1 W e.i.r.p.	A
5.875-7.25 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
7.75-8.025 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
8.5-9 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
9.2-9.3 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
9.5-10.5 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
10.5-10.55 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
10.55-10.6 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
12.7-13.25 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
13.4-14.47 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A

TABLE 26 (*end*)

Frequency band	Type of use	Emission limit	Detector A-Average Q-Quasi-peak
14.5-15.35 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
16.2-17.7 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
19.156-19.635 GHz	Any P-MP radio system	100 mW output power	
21.4-22.01 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
23.12-23.6 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
24.25-31.2 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
31.8-36.43 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
36.5-38.6 GHz	Intermittent control signals	12 500 $\mu\text{V/m}$ at 3 m	A
	Periodic transmissions	5 000 $\mu\text{V/m}$ at 3 m	A
46.7-46.9 GHz	Vehicle-mounted field disturbance sensors	Varies ⁽²⁾	
76-77 GHz	Vehicle-mounted field disturbance sensors	Varies ⁽¹⁾	

⁽¹⁾ Limited to 400 mW e.i.r.p. when used in cities with population greater than 500 000 habitants.

⁽²⁾ Refer to the Regulation on Restricted Radiation Radio Communications Equipment in the Anatel homepage (<http://www.anatel.gov.br>).

7 Certification and authorization procedures

Regulation on The Certification and Authorization of Telecommunications Products, approved by Resolution No. 242 of Anatel, of 30 November 2000, establishes the general rules and procedures related to the certification and authorization of telecommunications products, including the assessment of the conformity of telecommunications products with the technical regulations issued or adopted by Anatel and the requirements concerning the authorization of telecommunication products.

7.1 Authorization validity and procedure

The conformity assessment process of a given product in relation to the regulations issued by Anatel or by it adopted constitutes the initial phase of such process and is aimed at obtaining the authorization of such product. The issuance of an authorization document is required for purposes of the commercialization and use, within the Country, of the products classified under Categories I, II, and III as follows:

- Category I: *telecommunication products* mean the terminal equipment intended for use by the general public for purposes of accessing collective interest telecommunication services;

- Category II: *telecommunication products* mean the equipment not covered by the definition of Category I products but which make use of the electromagnetic spectrum for the transmission of signals, which equipment includes antennas and those products characterized in specific regulations as restricted radiation radiocommunication equipment;
- Category III: *telecommunication products* mean any products or equipment not contained in the definitions of Category I and II products whose regulation is required to:
 - a) assure the interoperability of networks that support telecommunications services;
 - b) assure the reliability of networks that support telecommunications services; or
 - c) assure electromagnetic compatibility and electrical safety.

For purposes of demonstrating conformity assessment before Anatel, the interested party must, while observing the objectives of the authorization request and the applicable regulations, submit one of the following documents:

- a Declaration of Conformity;
- a Declaration of Conformity with an accompanying test report;
- a Certification of Conformity based on type-approval tests;
- a Certification of Conformity based on specific tests and periodic assessments of the product; or
- a Certification of Conformity with an accompanying quality system assessment.

The Declaration of Conformity is the conformity assessment document applicable to home-made products intended for individual use, which does not grant the right to authorize the commercialization of the product in the Country.

The Declaration of Conformity with accompanying test reports is the conformity assessment document applicable in exceptional cases in which the designated certification bodies establish terms of greater than three months for the commencement and completion of the process for issuance of the certification of conformity, not including the period required to perform tests, as a result of which cases Anatel shall undertake to direct the necessary conformity assessments. This rule shall apply when no designated and qualified certification bodies exist to direct the conformity assessments.

The Certification of Conformity based on type-approval tests is the conformity assessment certification document that applies to Category III Telecommunication Products.

The Certification of Conformity with accompanying tests and periodic assessments of the product the conformity assessment certification document applicable to Category II Telecommunication Products.

The Certification of Conformity with an accompanying quality system assessment is the conformity assessment certification document applicable to Category I Telecommunication Products.

7.2 Authorization

The following parties are defined as interested or responsible parties and considered legitimate for purposes of requesting the authorization of particular products by Anatel:

- the product manufacturer;
- the supplier of the product in Brazil;
- the natural or juridical person that applies for the authorization of the telecommunications product for individual use.

If the interested party is a natural person, such person must have full legal capacity, whereas if such party is a juridical person, it must be legally constituted under Brazilian law. Foreign juridical persons interested in the authorization of products must have a commercial representative legally constituted in Brazil with the capacity to assume, within the territorial boundaries of the country, all responsibilities associated with such products' commercialization and the related customer service.

The application for product authorization must include the following documents:

- a certificate or declaration of conformity demonstrating the product's conformity;
- proof of payment of the chargeable fees;
- a user manual for the product, written in Portuguese;
- the interested party's registration information, for which purpose it must use its own form;
- proof that the interested party is legally established according to Brazilian law or that it has a commercial representative established in Brazil, in a manner that permits such party to assume responsibility for the product's quality and supply and any technical assistance related thereto within the national territory.

Anatel shall deny the authorization of products: when the existence of a defect of form is identified in the certification or declaration of conformity; the certification of conformity is issued by an undesignated certification body; the certification of conformity is issued by a Designated Certification Body whose designation has been suspended or withdrawn; the certification or declaration of conformity is issued on the basis of regulations other than those applicable to the product and which are in force in the Country.

The product authorization subject to the certification of conformity may not be used by third parties when the product is produced in a manufacturing plant other than the one subject to evaluation, specifically in those cases involving a Certification of Conformity with an accompanying Quality System assessment; or the product is distributed in Brazil by a supplier other than the one that applied for the authorization and, in which case, this circumstance would have the effect of jeopardizing the duties of the Regulation.

Appendix 7 to Annex 2

UAE Regulations for the use of SRDs and low power equipment permitted usage

1.1 Usage of short-range devices is allowed on secondary basis: SRDs are used as fixed and mobile stations for telecommunication applications and as ISM devices for in industrial, scientific and medical (ISM) application. SRDs have applications in many fields and so generally categorized as non-specific which allows their use in diverse applications like keyless car entry, toy remotes, Bluetooth, etc.

1.2 SRDs require to be registered with the authority under the type approval regime and the use of short-range devices and ISM devices is allowed under class authorization whereby no radio-frequency authorization is required.

1.3 The use of low power wireless equipment requires radio-frequency authorization.

1.4 The wireless equipment can be identify as short-range devices, low power wireless equipment or otherwise based on the following criteria:

- 1.4.1 **Short-range device (SRD):** if meet the technical condition in Table 29 of this Regulation.
- 1.4.2 **Low-power wireless equipment (LPWE):** if meet the technical condition mentioned in Table 30 of this Regulation. Spectrum charges identified for LPWE shall apply.
- 1.4.3 Any wireless equipment which is not within the identified frequency range or radiated power exceeds the maximum radiated power criteria identified in this Regulation, will then be treated as any other fixed or mobile station. Spectrum charges identified for fixed or mobile services shall apply.

TABLE 27

Technical conditions for short-range devices

The following technical conditions shall apply on the use of SRD

Frequency range	Max radiated power or magnetic field strength	Application notes
9-315 kHz	30 dB(μ A/m) at 10 m	Non-specific
9.0-59.75 kHz	72 dB(μ A/m) at 10 m	Non-specific
59.750-60.250 kHz	42 dB(μ A/m) at 10 m	Non-specific
60.250-70.000 kHz	69 dB(μ A/m) at 10 m	Non-specific
70-119 kHz	42 dB(μ A/m) at 10 m	Non-specific
119-135 kHz	66 dB(μ A/m) at 10 m	Non-specific
135-140 kHz	42 dB(μ A/m) at 10 m	Non-specific
140-148.5 kHz	37.7 dB(μ A/m) at 10 m	Non-specific
148.5 kHz – 5 MHz	-15 dB (μ A/m) at 10 m	Non-specific
400-600 kHz	-8 dB(μ A/m) at 10 m	Non-specific
315-600 kHz	-5 dB(μ A/m) at 10 m	Non-specific
3 155-3 195 kHz	13.5 dB(μ A/m) at 10 m	Wireless hearing aids
3 195-3 400 kHz	13.5 dB(μ A/m) at 10 m	Non-specific
5-30 MHz	-20 dB(μ A/m) at 10 m	Non-specific
6 765-6 795 kHz	42 dB(μ A/m) at 10 m	Non-specific
7 400-8 800 kHz	9 dB(μ A/m) at 10 m	Non-specific
10.2-11.0 MHz	9 dB(μ A/m) at 10 m	Non-specific
11.1-20 MHz	-7 dB(μ A/m) at 10 m	Non-specific
13.553-13.567 MHz	60 dB(μ A/m) at 10 m	RFID and EAS only
26.957-27.283 MHz	42 dB(μ A/m) at 10 m	Non-specific
29.7-47.0 MHz	10 mW	Non-specific
30-37.5 MHz	1 mW	Non-specific
40.66-40.7 MHz	10 mW	Non-specific
87.5-108 MHz	50 nW	Audio transmitter devices
169.4-174.0 MHz	10 mW	Non-specific
174.0-216.0 MHz	50 mW	Non-specific
312-315 MHz	50 mW	Keyless car entry

TABLE 27 (*end*)

Frequency range	Max radiated power or magnetic field strength	Application notes
401-402 MHz 405-406 MHz	25 μ W	For microphones
402-405 MHz	25 μ W	For medical devices
433.050-434.790 MHz	50 mW	Non-specific
863.0-870.0 MHz	50 mW	Non-specific
870.0-875.4 MHz	10 mW	Non-specific
2 400-2 500 MHz	100 mW	Non-specific
5 725-5 875 MHz	50 mW	Non-specific
9 200-9 975 MHz	25 mW	Non-specific
13.4-14.0 GHz	25 mW	Non-specific
17.1-17.3 GHz 24.00-24.25 GHz 61.0-61.5 GHz 122-123 GHz 244-246 GHz	100 mW	Non-specific
4.5-7.0 GHz 8.5-10.6 GHz 24.05-27.0 GHz 57.0-64.0 GHz 75.0-85.0 GHz	24 dBm e.i.r.p. 30 dBm e.i.r.p. 43 dBm e.i.r.p. 43 dBm e.i.r.p. 43 dBm e.i.r.p.	For tank level probing radars only
76-77 GHz	55 dBm peak power 50 dBm average power 23.5 dBm average power	For pulsed radar only

TABLE 28

Technical conditions for low-power wireless equipment

The following technical conditions shall apply on the use of LPWE

Frequency range	Max radiated power or magnetic field strength	Application notes
433.050-434.790 MHz	100 mW	Non-specific
470-790 MHz	10 mW/100 mW/1 W	Electronic field production
863.0-870.0 MHz	100 mW	Non-specific
2 400-2 500 MHz	100-200 mW	Non-specific
5 725-5 875 MHz	50-200 mW	Non-specific

NOTE 1 – The UAE does not allow any SRD in the frequency range of 880-960 MHz.

Appendix 8 to Annex 2

Technical parameters and spectrum use for SRDs in the Regional Commonwealth in the Field of Communications countries

Information submitted in tables reflects state of affairs about the use SRDs in the Regional Commonwealth in the Field of Communications countries.

TABLE 29

Technical parameters and spectrum use for SRDs in Armenia (Republic of)

Frequency bands	Main technical parameters and notes
Non-specific short-range radiocommunication devices	
6 765-6 795 kHz	In use
13.559-13.567 MHz	In use
26.957-27.283 MHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m. Maximum 10 mW e.r.p.
40.66-40.70 MHz	Maximum 10 mW e.r.p.
138.20-138.45 MHz	The band is unsuitable for SRDs usage.
433.05-434.79 MHz	The band 433.05-434.79 MHz can be used by low-power car alarm systems with 5 mW maximum transmitter power and by low-power data transmission systems with 10 mW maximum transmitter power. Use of 433.075-434.79 MHz frequency band by low-power radio stations, as well as by devices for processing and transmission of the bar-codes information is limited to 10 mW radiated power.
868-870 MHz	In use
2 400.0-2 483.5 MHz	In use
5 725-5 875 MHz	Maximum 25 mW e.r.p.
24.00-24.25 GHz	Maximum 10 mW e.r.p.
Railway applications	
4 510-4 520 kHz	In use
27.957-27.283 MHz	Limited to 27.095 MHz for the use of automatic identification devices at the railways.
863-868 MHz	In use
2 400-2 483.5 MHz	Limited to 2 400-2 420 MHz and 2 446-2 454 MHz for the use of automatic identification devices.
Road transport and traffic telematics	
5 725-5 875 MHz	Limited to 5 795-5 805 MHz and 5 805-5 815 MHz for telematics devices.
63-64 GHz	In use
76-77 GHz	In use

TABLE 29 (continued)

Frequency bands	Main technical parameters and notes
Model control	
26.957-27.283 MHz	In use
28.0-28.2 MHz	Maximum 1 W e.r.p. The band is used by SRDs for model control (in the air, over and under the water surface and so on).
30-37.5 MHz	The sub-band is limited to 34.995-35.225 MHz.
40.66-40.70 MHz	Maximum 1 W e.r.p. The band is used by SRDs for model control (in the air, over and under the water surface and so on).
Radio microphones	
66-74 MHz	Maximum transmitter power is 10 mW for radio microphones type "Karaoke".
87.5-92 MHz	Maximum transmitter power is 10 mW for radio microphones type "Karaoke".
100-108 MHz	Maximum transmitter power is 10 mW for radio microphones type "Karaoke".
151-230 MHz	Concert microphones operating on the frequencies 165.70 MHz, 166.10 MHz, 166.50 MHz and 167.15 MHz. Maximum transmitter power is 20 mW. Some frequencies in the sub-bands 151-162.7 MHz, 163.2-168.5 MHz and 174-230 MHz can be used by other types of radio microphones. Maximum transmitter power is 5 mW.
174-216 MHz	The band is unsuitable for SRDs usage.
470-638 MHz	Some frequencies can be used by low-power concert radio microphones with 5 mW maximum transmitter power subject to not causing harmful interference into TV signal reception.
710-726 MHz	Some frequencies can be used by concert radio microphones with 5 mW maximum transmitter power subject to not causing harmful interference into TV signal reception.
1 795-1 800 MHz	In use
Radio-frequency identification (RFID) applications	
433.05-434.79 MHz	In use
863-868 MHz	In use
2 400-2 483.5 MHz	In use
Wireless audio applications	
87.5-92 MHz	In use
100-108 MHz	In use
863-868 MHz	Limited to sub-band 863-865 MHz.
1 795-1 800 MHz	In use
Inductive applications	
9-135 kHz	In use
6 765-6 795 kHz	In use
7 400-8 800 kHz	In use

TABLE 29 (*end*)

Frequency bands	Main technical parameters and notes
Inductive applications	
13.559-13.567 MHz	In use
26.957-27.283 MHz	In use
Wireless applications in Healthcare	
315-600 kHz	In use
3 155-3 400 kHz	For low-power wireless hearing devices.
33.2-48.5 MHz	Hearing and speech training radio devices for hearing impaired persons on fixed frequencies. Maximum transmitter power is 10 mW.
57-57.5 MHz	Hearing and speech training radio devices for hearing impaired persons on fixed frequencies. Maximum transmitter power is 10 mW.
402-405 MHz	In use
Detection of avalanche victims applications	
315-600 kHz	SRDs can be used for detection of avalanche victims only. Centre frequency is 457 kHz.
Radiodetermination applications	
2 400-2 483.5 MHz	In use
9 200-9 975 MHz	In use
10.5-10.6 GHz	In use
13.4-14 GHz	In use
24.00-24.25 GHz	In use
Alarms	
26 945 kHz	The frequency can be used by security alarm systems. Maximum transmitter power is 2 W.
26 957-27 283 kHz	The frequency 26 960 kHz can be used by security alarm systems. Maximum transmitter power is 2 W.
149.95-150.06 MHz	In use
433.050-434.79 MHz	The band 433.05-434.79 MHz can be used by low-power car alarm systems with 5 mW maximum transmitter power. Restricted to 10 mW transmitter power for low power systems for processing and transmission information.
868-870 MHz	In use
Radio local area networks	
2 400-2 483.5 MHz	Maximum transmitter power is 100 mW.
5 150-5 250 MHz	In use
17.1-17.3 GHz	The band is unsuitable for SRDs usage.
Monitoring devices	
457 kHz	The frequency is unsuitable for SRDs usage.

TABLE 30

Technical parameters and spectrum use for SRDs in Belarus (Republic of)

Frequency bands	Main technical parameters and notes
Non-specific short-range radiocommunication devices	
6 765-6 795 kHz	Maximum magnetic field strength is +42 dB μ A/m at 10 m.
13.553-13.567 MHz	Maximum magnetic field strength is +42 dB μ A/m at 10 m.
26.957-27.283 MHz	Maximum magnetic field strength is +42 dB μ A/m at 10 m. Maximum 10 mW e.r.p.
38.7-39.23 MHz	Maximum 10 mW e.r.p. The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs according to specification IEEE 802.11b/n (Wi-Fi).
40.660-40.700 MHz	Maximum 10 mW e.r.p.
138.20-138.45 MHz	Maximum 10 mW e.r.p. duty cycle less than 1.0%.
433.050-434.790 MHz	Maximum 10 mW e.r.p. duty cycle less than 10%. Maximum 1 mW e.r.p. duty cycle up to 100%. Power density is limited to -13 dBmV/10 kHz for wideband modulations with a bandwidth greater than 250 kHz.
434.040-434.790 MHz	Maximum 10 mW e.r.p., duty cycle to 100%, channel spacing to 25 kHz.
868.0-868.6 MHz	Maximum 25 mW e.r.p., duty cycle to 1%.
868.7-869.2 MHz	Maximum 25 mW e.r.p., duty cycle to 1%.
869.7-870.0 MHz	Maximum 5 mW e.r.p., duty cycle to 100%.
2 400.0-2 483.5 MHz	Maximum 10 mW e.i.r.p.
Wideband data transmission systems	
2 400.0-2 483.5 MHz	Maximum 100 mW e.i.r.p. Permitted to use SRDs (Bluetooth) for indoor and outdoor applications. The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs according to specification IEEE 802.15 (Bluetooth).
2 400.0-2 483.5 MHz	Maximum 100 mW e.i.r.p. Permitted to use SRDs (Wi-Fi) for indoor applications. For wideband modulations, other than FHSS maximum e.i.r.p. density is limited to 10 mW/MHz. The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs according to specification IEEE 802.11b/n (Wi-Fi).
2 400.0-2 483.5 MHz	Maximum 500 mW e.i.r.p. Permitted to use SRDs (Wi-Fi) for outdoor applications. Individual license is required.
5 150-5 350 MHz	Maximum 200 mW e.i.r.p. Restricted to indoor use. Maximum e.i.r.p. density is 10 mW/MHz.
5 470-5 725 MHz	Maximum 1W e.i.r.p. Restricted to outdoor use. Maximum e.i.r.p. density is 50 mW/MHz. Individual license is required.
5 650-5 725 MHz	Maximum 200 mW e.i.r.p. Maximum e.i.r.p. density is 50 mW/MHz.

TABLE 30 (continued)

Frequency bands	Main technical parameters and notes
Railway applications	
865 MHz, 867 MHz, 869 MHz	Maximum 2 W e.i.r.p., channel spacing to 200 kHz.
Road transport and traffic telematics	
5 797.5 MHz 5 802.5 MHz 5 807.5 MHz 5 812.5 MHz	Maximum 2 W e.i.r.p. Individual license is required.
76-77 GHz	Maximum 55 dBm e.i.r.p. (peak).
Radiodetermination applications	
10.5-10.6 GHz	Maximum 100 mW e.i.r.p.
24.05-24.25 GHz	Maximum 100 mW e.i.r.p.
Alarms	
26.945 MHz	Maximum transmitter power is 2 W. The frequency is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for burglar alarm transmitters and for distress signals transmission with 2 W transmitter power.
26.960 MHz	The frequency is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for burglar alarm transmitters and for distress signals transmission with 2 W transmitter power.
433.05-434.79 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for burglar alarm transmitters and for distress signals transmission with 5 W transmitter power.
868-868.2 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for burglar alarm transmitters and for distress signals transmission with 10 W transmitter power.
Model control	
28.0-28.2 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with 1 W transmitter power.
40.66-40.70 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with 1 W transmitter power.
Radio microphones	
29.7- 230 MHz	Some sub-bands in the range up to 230 MHz, except sub-bands 108-144 MHz, 148-151 MHz, 162.7-163.2 MHz, 168.5-174 MHz, is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for hearing and speech training radio devices for hearing impaired persons with output power no more than 10 mW.
66-74 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for radio microphones type "Karaoke" with maximum 10 mW transmitter power.
87.5-92 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for radio microphones type "Karaoke" with maximum 10 mW transmitter power.
774-782 MHz	Maximum 50 mW e.r.p.

TABLE 30 (*end*)

Frequency bands	Main technical parameters and notes
Radio frequency identification (RFID) applications	
433.050-434.790 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with maximum 10 mW transmitter power.
865.7 MHz, 866.3 MHz, 866.9 MHz, 867.5 MHz	Maximum 2 W e.i.r.p., channel spacing to 200 kHz.
Monitoring applications	
457 kHz	Maximum magnetic field strength is +7 dB(μ A/m) at 10 m. Duty cycle 0.1%. Continuous wave, no modulation. The frequency is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for detection and rescue of disaster victims.
Inductive applications	
9-59.750 kHz	Maximum magnetic field strength is +72 dB(μ A/m) at 10 m.
59.750-60.250 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
60.250-70.000 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
70-119 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
119-135 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
135-140 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
140-148.5 kHz	Maximum magnetic field strength is +37.7 dB(μ A/m) at 10 m.
6765-6795 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
13.553-13.567 MHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m. Maximum magnetic field strength is +60 dB(μ A/m) at 10 m for RFID and EAS only.
26.957-27.283 MHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.

TABLE 31

Technical parameters and spectrum use for SRDs in Kazakhstan (Republic of)

Frequency bands	Main technical parameters and notes
Non-specific short-range radiocommunication devices	
38.7-39.23 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with maximum 1 W transmitter power.
40.660-40.700 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with maximum 10 mW transmitter power.
433.050-434.790 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with 10 mW transmitter power.
863.933-864.045 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with maximum 2 W transmitter power.

TABLE 31 (continued)

Frequency bands	Main technical parameters and notes
Wideband data transmission systems	
2 400.0-2 483.5 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs according to specification IEEE 802.15 (Bluetooth) and according to IEEE.802.11, 802.11b, 802.11n (Wi-Fi) with maximum 100 mW transmitter power.
5 150-5 350 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs according to specifications IEEE 802.11a, IEEE.802.11n with maximum 100 mW transmitter power.
5 650-5 725 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs according to specifications IEEE 802.11a, IEEE.802.11n with maximum 100 mW transmitter power.
Alarms	
26.945 MHz, 26.960 MHz	Frequencies are included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for burglar alarm transmission and for distress signals transmission with maximum 2 W transmitter power.
433.05- 434.79 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for burglar alarm transmission and for distress signals transmission with maximum 5 mW transmitter power.
868-868.2 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for burglar alarm transmission and for distress signals transmission with maximum 2 W transmitter power.
Model control	
28.0-28.2 MHz	The band is included in the List Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with maximum 1 W transmitter power.
40.66-40.70 MHz	The band is included in the List Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with maximum 1 W transmitter power.
Radio microphones	
29.7-230 MHz	The some sub-bands in the range up to 230 MHz, except sub-bands 108-144 MHz, 148-151 MHz, 162.7-163.2 MHz, 168.5-174 MHz, is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for hearing and speech training radio devices for hearing impaired persons with output power no more than 10 mW.
66-74 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for radio microphones type “Karaoke” with maximum 10 mW transmitter power.
87.5-92 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for radio microphones type “Karaoke” with maximum 10 mW transmitter power.

TABLE 31 (*end*)

Frequency bands	Main technical parameters and notes
Radio frequency identification (RFID) applications	
13.553-13.567 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation).
433.050-434.790 MHz	The band is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for SRDs with maximum 10 mW transmitter power.
Monitoring applications	
457 kHz	The frequency is included in a List of Equipment of Custom Union (Belarus, Kazakhstan, Russian Federation) for detection and rescue of disaster victims.

TABLE 32

Technical parameters and spectrum use for SRDs in Kyrgyz Republic

Frequency bands	Main technical parameters and notes
Non-specific short-range radiocommunication devices	
433.050-434.790 MHz	The band is undesirable for SRDs usage.
863-870 MHz	The band is undesirable for SRDs usage.
Radiodetermination applications	
4.5-7.0 GHz	The band is undesirable for SRDs usage.
8.5-10.6 GHz	The band is undesirable for SRDs usage.
Alarms	
169.4750-169.4875 MHz	The band is undesirable for SRDs usage.
169.5875-169.6000 MHz	The band is undesirable for SRDs usage.
868.6-868.7 MHz	The band is undesirable for SRDs usage.
869.200-869.400 MHz	The band is undesirable for SRDs usage.
869.650-869.700 MHz	The band is undesirable for SRDs usage.
Model control	
34.995-35.225 MHz	The band is undesirable for SRDs usage.
Radio microphones	
3 155-3 400 kHz	Maximum transmitter power is 5 mW.
29.7-47.0 MHz	The band is undesirable for SRDs usage.
74.0-74.6 MHz	Maximum transmitter power is 5mW.
169.4-174.0 MHz	The band is undesirable for SRDs usage.
470-862 MHz	The band is undesirable for SRDs usage.
863-865 MHz	The band is undesirable for SRDs usage.
Radio frequency identification (RFID) applications	
865.0-868 MHz	The band is undesirable for SRDs usage.

TABLE 32 (*end*)

Frequency bands	Main technical parameters and notes
Wireless applications in Healthcare	
9-315 kHz	The band is undesirable for SRDs usage.
315-600 kHz	The band is undesirable for SRDs usage.
30.0-37.5 MHz	The band is undesirable for SRDs usage.
401-406 MHz	Not be allowed the use of active medical implants because of possible harmful interference from the other stations.
Wireless audio applications	
863-865 MHz	The band is undesirable for SRDs usage.
Monitoring applications	
169.4-169.475 MHz	The band is undesirable for SRDs usage.
Inductive devices	
148.5 kHz – 5 MHz	The band is undesirable for SRDs usage.
400-600 kHz	The band is undesirable for SRDs usage.

TABLE 33

Technical parameters and spectrum use for SRDs in Moldova (Republic of)

Frequency bands	Main technical parameters and notes ⁽¹⁾
Non-specific short-range radiocommunication devices	
6 765-6 795 kHz	In use
13.553-13.567 MHz	In use
26.957-27.283 MHz	In use
40.660-40.700 MHz	In use
138.20-138.45 MHz	In use
433.050-434.790 MHz	In use
864-865 MHz	In use
2 400.0-2 483.5 MHz	In use
5 725-5 875 MHz	In use
24.00–24.25 GHz	In use
61.0-61.5 GHz	In use
122-123 GHz	In use
244-246 GHz	In use

TABLE 33 (continued)

Frequency bands	Main technical parameters and notes ⁽¹⁾
Wideband data transmission systems	
2 400.0-2 483.5 MHz	In use
5 150-5 250 MHz	In use
5 250-5 350 MHz	In use
5 470-5 725 MHz	In use
17.1-17.3 GHz	In use
Railway applications	
4 234 kHz	In use
4 516 kHz	In use
11.1-16.0 MHz	In use
27.095 MHz	In use
2 446-2 454 MHz	In use
5 795-5 815 MHz	In use
63-64 GHz	In use
76-77 GHz	In use
Radiodetermination applications	
2 400.0-2 483.5 MHz	In use
4.5-7.0 GHz	In use
8.5-10.6 GHz	In use
9.2-9.5 GHz	In use
9.5-9.975 GHz	In use
10.5-10.6 GHz	In use
13.4-14.0 GHz	In use
17.1-17.3 GHz	In use
24.05-27.0 GHz	In use
57-64 GHz	In use
75-85 GHz	In use
Alarms	
169.4750-169.4875 MHz	In use
169.5875-169.6000 MHz	In use
868.6-868.7 MHz	In use
869.200-869.400 MHz	In use
869.650-869.700 MHz	In use

TABLE 33 (continued)

Frequency bands	Main technical parameters and notes ⁽¹⁾
Model control	
26.995 MHz, 27.045 MHz, 27.095 MHz, 27.145 MHz, 27.195 MHz	In use
34.995-35.225 MHz	In use
40.665 MHz, 40.675 MHz, 40.685 MHz, 40.695 MHz	In use
Radio microphones	
29.7-47.0 MHz	In use
169.4-174.0 MHz	In use
173.965-174.015 MHz	In use
174-216 MHz	In use
470-862 MHz	In use
863-865 MHz	In use
1 785-1 800 MHz	In use
Wireless applications in Healthcare	
9-315 kHz	In use
315-600 kHz	In use
12.5-20.5 MHz	In use
30.0-37.5 MHz	In use
401-406 MHz	In use
Radio-frequency identification (RFID) applications	
865.0-868 MHz	In use
2 446-2 454 MHz	In use
Wireless audio applications	
87.5-108.0 MHz	In use
863-865 MHz	In use
1 795-1 800 MHz	In use
Monitoring applications	
457 kHz	In use
169.4-169.475 MHz	In use

TABLE 33 (*end*)

Frequency bands	Main technical parameters and notes ⁽¹⁾
Inductive applications	
9-148.5 kHz	In use
148.5 kHz-5 MHz	In use
400-600 kHz	In use
3 155-3 400 kHz	In use
6 765-6 795 kHz	In use
7 400-8 800 kHz	In use
10.200-11.000 MHz	In use
13.553-13.567 MHz	In use
26.957-27.283 MHz	In use

⁽¹⁾ Main technical parameters SRDs in the Table are satisfied with requirements of ERC REC70-03.

TABLE 34

Technical parameters and spectrum use for SRDs in the Russian Federation

Frequency bands	Main technical parameters and notes
Non-specific short-range radiocommunication devices	
26.957-27.283 MHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m. Maximum transmitter power is 10 mW. Maximum antenna gain is 3 dB.
40.660-40.700 MHz	Maximum transmitter power is 10 mW. Maximum antenna gain is 3 dB.
433.075-434.790 MHz	Maximum transmitter power is 10 mW. Possible use of low power stations.
864-865 MHz	Maximum 25 mW e.r.p., duty cycle 0.1% or LBT. Forbidden to use at the airports (aerodromes).
868.700-869.200 MHz	Maximum 25 mW e.r.p.
5 725-5 875 MHz	Maximum 25 mW e.r.p., duty cycle 0.1% or LBT. Antenna height should not exceed 5 m.
Detection of avalanche victims	
456.9-457.1 kHz	Maximum magnetic field strength is +7 dB(μ A/m) at 10 m. Duty cycle is 100%. Continuous wave, no modulation. Centre frequency is 457 kHz.

TABLE 34 (continued)

Frequency bands	Main technical parameters and notes
Wideband data transmission systems	
2 400.0-2 483.5 MHz	1. SRDs with FHSS modulation. <ul style="list-style-type: none"> 1.1 Maximum 2.5 mW e.i.r.p. 1.2 Maximum 100 mW e.i.r.p. Permitted to use SRDs for outdoor applications without restrictions on installation height only for purposes of gathering telemetry information for automated monitoring and resources accounting systems. Permitted to use SRDs for other purposes for outdoor applications only when the installation height is not exceeding 10 m above the ground surface. 2. SRDs with DSSS and other modulations. <ul style="list-style-type: none"> 2.1 Maximum mean e.i.r.p. density is 2 mW/MHz. Maximum 100 mW e.i.r.p. 2.2 Maximum mean e.i.r.p. density is 20 mW/MHz. Maximum 100 mW e.i.r.p. Permitted to use SRDs for outdoor applications only for purposes of gathering telemetry information for automated monitoring and resources accounting systems or security systems.
2 400.0-2 483.5 MHz	1. SRDs with FHSS modulation. Maximum 100 mW e.i.r.p. Indoor applications. 2. SRDs with DSSS and other modulations. Maximum mean e.i.r.p. density is 10 mW/MHz. Maximum 100 mW e.i.r.p. Indoor applications.
5 150-5 250 MHz	SRDs using DSSS and other modulations. <ul style="list-style-type: none"> 1. Maximum mean e.i.r.p. density is 5 mW/MHz. Maximum 200 mW e.i.r.p. Indoor applications. 2. Maximum 100 mW e.i.r.p. Permitted to use on board aircraft.
5 250-5 350 MHz	Maximum 100 mW e.i.r.p. <ul style="list-style-type: none"> 1. Permitted to use for local networks of aircraft crew service communications on board aircraft in area of the airport and at all stages of flight. 2. Permitted to use for public wireless access local networks on board aircraft during a flight at the altitude not less than 3 000 m.
5 650-5 825 MHz	Maximum 100 mW e.i.r.p. Permitted to use on board aircraft during a flight at the altitude not less than 3 000 m.
Road transport and traffic telematics (RTTT)	
5 795-5 815 MHz	200 mW e.r.p. An authorization for using radio frequencies or channels should be obtained in established order.
Radiodetermination applications	
24.05-24.25 GHz	Vehicle radars. Maximum 100 mW e.i.r.p. No restrictions if emission bandwidth is not less than 9 MHz. If emission bandwidth is less than 9 MHz then the requirement should be 0.14 μ s/60 kHz maximum dwell time every 3 ms.

TABLE 34 (continued)

Frequency bands	Main technical parameters and notes
Radiodetermination applications	
24.05-24.25 GHz	Fixed radars. Maximum 100 mW e.i.r.p. <ol style="list-style-type: none"> 1. The equipment for detecting movement should be installed along roads at 4 m distance from controlled part of road. 2. The installation of equipment for detecting movement should be performed perpendicularly to movement direction of one- or multilane road with permissible deviation ± 15 degrees. 3. The installation height of equipment for detecting movement should not exceed 5 m above a road. 4. The tilt angle of the main beam to horizon should be minus 20° or less.
Vehicle short range radars	
22-26.65 GHz	Spectral mean e.i.r.p. density shall be: a) $-61.3 + 20 \times (f - 21.65)/1$ GHz [dBm/MHz] for $22.0 < f < 22.65$ GHz; b) -41.3 dBm/MHz for $22.65 < f < 25.65$ GHz; c) $-41.3 - 20 \times (f - 25.65)/1$ GHz [dBm/MHz] for $25.65 < f < 26.65$ GHz; where: f : operating frequency (GHz). SRDs should be automatically switched off in the 35 km range from the following towns: Dmitrov ($56^\circ 26' 00''$ N, $37^\circ 27' 00''$ E), Pushchino ($54^\circ 49' 00''$ N, $37^\circ 40' 00''$ E), Kalyazin ($57^\circ 13' 22''$ N, $37^\circ 54' 01''$ E), Zelenchukskaya ($43^\circ 49' 53''$ N, $41^\circ 35' 32''$ E).
Alarms	
26.939-26.951 MHz	Permitted to use by car alarm systems operating on frequency 26.945 MHz. Maximum transmitter power is 2 W. Duty cycle $< 10\%$. Maximum antenna gain is 3 dB.
26.954-26.966 MHz	Permitted to use by premises security alarm systems operating on frequency 26.960 MHz. Maximum transmitter power is 2 W. Duty cycle $< 10\%$. Maximum antenna gain is 3 dB.
149.95-150.0625 MHz	Permitted to use by alarm systems for security of remote objects. Maximum transmitter power is 25 mW. Duty cycle $< 10\%$. Maximum antenna gain is 3 dB.
433.05-434.79 MHz	Maximum transmitter power is 5 mW. Duty cycle $< 10\%$. Maximum antenna gain is 3 dB.
868-868.2 MHz	Maximum transmitter power is 10 mW. Duty cycle $< 10\%$. Maximum antenna gain is 3 dB.
Model control	
26.957-27.283 MHz	Maximum transmitter power is 10 mW. Channel spacing is 50 kHz. Maximum antenna gain is 3 dB. Operating frequencies 26.995 MHz, 27.045 MHz, 27.095 MHz, 27.145 MHz, 27.195 MHz.
28.0-28.2 MHz	Maximum transmitter power is 1 W. Maximum antenna gain is 3 dB.
40.66-40.7 MHz	Maximum transmitter power is 1 W. Maximum antenna gain is 3 dB. Channel spacing is 10 kHz.

TABLE 34 (continued)

Frequency bands	Main technical parameters and notes
Inductive applications	
9-59.75 kHz	Maximum magnetic field strength is +72 dB(μ A/m) at 10 m. In case of external antennas only loop coil antennas may be employed. Field strength level descending 3 dB/oct at 30 kHz.
59.75-60.25 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m. In case of external antennas only loop coil antennas may be employed.
60.25-70 kHz	Maximum magnetic field strength is +69 dB(μ A/m) at 10 m. In case of external antennas only loop coil antennas may be employed. Field strength level descending 3 dB/oct at 30 kHz.
70-119 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m. In case of external antennas only loop coil antennas may be employed.
119-135 kHz	Maximum magnetic field strength is +66 dB(μ A/m) at 10 m. In case of external antennas only loop coil antennas may be employed. Field strength level descending 3 dB/oct at 30 kHz.
6 765-6 795 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
7 400-8 800 kHz	Maximum magnetic field strength is +9 dB(μ A/m) at 10 m.
10.200-11.000 MHz	Maximum magnetic field strength is -4 dB(μ A/m) at 10 m.
13.553-13.567 MHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
26.957-27.283 MHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
Radio microphones and assistive listening devices	
33.175-40 MHz, 40.025-48.5 MHz, 57-57.575 MHz	Hearing and speech training radio devices for hearing impaired persons on fixed frequencies. Maximum transmitter power is 10 mW. Maximum antenna gain is 3 dB.
66-74 MHz, 87.5-92 MHz, 100-108 MHz	Maximum transmitter power is 10 mW. Maximum antenna gain is 3 dB.
151-162 MHz, 163.2-168.5 MHz	Maximum transmitter power is 5 mW. Maximum antenna gain is 3 dB.
Radio microphones and assistive listening devices	
165.55-167.3 MHz	Concert radio microphones operating on the frequencies 165.7 MHz, 166.1 MHz, 166.5 MHz, 167.15 MHz. Maximum transmitter power is 20 mW. Maximum antenna gain is 3 dB.
174-230 MHz, 470-638 MHz, 710-726 MHz	Concert radio microphones. Maximum transmitter power is 5 mW. Maximum antenna gain is 3 dB. Channel spacing is 200 kHz.
863-865 MHz	Maximum 10 mW e.i.r.p.
Radio frequency identification (RFID) applications	
13.553-13.567 MHz	Maximum magnetic field strength is +60 dB(μ A/m) at 10 m.
433.050-434.790 MHz	Maximum transmitter power is 10 mW.
866.0-867.6 MHz	Maximum 2 W e.r.p. Channel spacing is 200 kHz. The assignment of radio frequencies or channels should be performed in established order.

TABLE 34 (*end*)

Frequency bands	Main technical parameters and notes
Radio frequency identification (RFID) applications	
866-868 MHz	Maximum 500 mW e.r.p. Channel spacing is 200 kHz. The assignment of radio frequencies or channels should be performed in established order.
866.6-867.4 MHz	Maximum 100 mW e.r.p. Channel spacing is 200 kHz. The assignment of radio frequencies or channels is not required in when: a) LBT is applied; b) equipment is used at the airport.
Wireless audio applications	
87.5-108.0 MHz	Maximum –43 dBmW (50 nW) e.i.r.p. No spacing. Permitted to use inside cars and other vehicles, and also inside of the closed premises.
863-865 MHz	Maximum 10 mW e.r.p. Duty cycle 100%.

TABLE 35

Technical parameters and spectrum use for SRDs in Tajikistan (Republic of)

Frequency bands	Main technical parameters and notes
Non-specific short-range radiocommunication devices	
26.957-27.283 MHz	In use
Radio local area networks	
2 400.0-2 483.5 MHz	In use
5 470-5 725 MHz	In use
Model control	
26.995 MHz, 27.045 MHz, 27.095 MHz, 27.145 MHz, 27.195 MHz	In use
Radio microphones	
66-74 MHz	In use
87.5-92 MHz	In use
100-108 MHz	In use
169.4-174.0 MHz	The band is unsuitable for SRDs usage.
173.965-174.015 MHz	The band is unsuitable for SRDs usage.
470-862 MHz	In use
Ultra low power active medical implant	
401-406 MHz	The band is prospective for usage.
Monitoring applications	
169.4-169.475 MHz	The band is unsuitable for SRDs usage.

TABLE 36

Technical parameters and spectrum use for SRDs in Ukraine

Frequency bands	Main technical parameters and notes
Non-specific short-range devices	
6 765-6 795 kHz	Limited to the sub-band 6 767-6 794 kHz. Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
13.553-13.567 MHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
40.660-40.700 MHz	Maximum transmitter power is 10 mW.
138.20-138.45 MHz	The band is not used for SRDs in Ukraine.
433.050-434.790 MHz	Maximum transmitter power is 10 mW. Usage of devices with maximum transmitter power more than 10 mW is carried out on licensing basis.
868-868.6 MHz	Maximum transmitter power is 25 mW.
2 400.0-2 483.5 MHz	Is considered to use for this category SRDs.
Tracking, tracing and data acquisition	
457 kHz	Maximum magnetic field strength is +7 dB(μ A/m) at 10 m.
Wideband data transmission systems	
2 400.0-2 483.5 MHz	Maximum 100 mW e.i.r.p. (for DSSS) when integrated antennas is used. For FHSS maximum 500 mW e.i.r.p. when integrated antennas is used. Facilities Std. IEEE 802.11n to be used only indoors. Total e.i.r.p. of all base stations Std IEEE 802.11n installed in the same room is no more than 100 mW.
5 150-5 250 MHz	Maximum 200 mW e.i.r.p. when integrated antennas is used. Maximum e.i.r.p. density is 10 mW/MHz. Should be used transmitter power control (TPC) and dynamic frequency selection (DFS) techniques. Facilities Std. IEEE 802.11n to be used only indoors. Total e.i.r.p. of all base stations Std IEEE 802.11n installed in the same room is no more than 100 mW. Formula for constitution channel spacing for bandwidth 40 MHz (IEEE Std 802.11n-2009) is $F_n = 5\,000 \text{ MHz} + N \cdot 5 \text{ MHz}$, where $N = 38, 46, 56, 64$.
5 250-5 350 MHz	Maximum 200 mW e.i.r.p. when integrated antennas is used. maximum mean e.i.r.p. density is 10 mW/MHz in any 1 MHz. Should be used Transmitter Power Control (TPC) and Dynamic Frequency Selection (DFS) techniques. Facilities Std. IEEE 802.11n to be used only indoors. Total e.i.r.p. of all base stations Std IEEE 802.11n installed in the same room is no more than 100 mW. Formula for constitution channel spacing for bandwidth 40 MHz (IEEE Std 802.11n-2009) is $F_n = 5\,000 \text{ MHz} + N \cdot 5 \text{ MHz}$, where $N = 38, 46, 56, 64$.

TABLE 36 (continued)

Frequency bands	Main technical parameters and notes
Wideband data transmission systems	
5 470-5 725 MHz	For the frequency range 5 470-5 670 MHz only. Maximum 1 W e.i.r.p. Maximum mean e.i.r.p. density is 50 mW/MHz in any 1 MHz when integrated antenna is used. Facilities Std. IEEE 802.11n to be used only indoors. Total e.i.r.p. of all base stations Std IEEE 802.11n installed in the same room is no more than 100 mW. Formula for constitution channel spacing for bandwidth 40 MHz (IEEE Std 802.11n-2009) is $F_n = 5\,000 \text{ MHz} + N \cdot 5 \text{ MHz}$, where $N = 98, 106, 114, 122, 130$.
5 725-5 850 MHz	Maximum 2 W e.i.r.p. when integrated antennas is used. Facilities Std. IEEE 802.11n to be used only indoors. Total e.i.r.p. of all base stations Std IEEE 802.11n installed in the same room is no more than 100 mW. Formula for constitution channel spacing for bandwidth 40 MHz (IEEE Std 802.11n-2009) is $F_n = 5\,000 \text{ MHz} + N \cdot 5 \text{ MHz}$, where $N = 156, 162$.
17.1–17.3 GHz	The band is not used for SRDs in Ukraine.
Railway applications	
865 MHz, 867 MHz, 869 MHz	Maximum transmitter power is 2 W.
Road transport and traffic telematics (RTTT)	
5 795-5 805 MHz	Is considered to use for this category SRDs.
5 805-5 815 MHz	Is considered to use for this category SRDs.
21.65-26.65 GHz	Only frequency 24,125 GHz. Maximum e.i.r.p. is no more than 20 dBm. Duty cycle limited to 10%.
76-77 GHz	Maximum mean e.i.r.p. is 23.5 dBm.
Radiodetermination applications	
2 400.0-2 483.5 MHz	Is considered to use for this category SRDs.
10.5–10.6 GHz	Limited to the sub-band 10.51-10.54 GHz. In use.
17.1-17.3 GHz	The band is not used for SRDs in Ukraine.
24.05 – 24.25 GHz	Limited to the sub-band 24.0-24.25 GHz. Maximum 100 mW e.i.r.p. The band is used for Tank Level Probing Radars.
150 MHz, 250 MHz, 500 MHz, 700 MHz, 900 MHz	The frequencies is used for operating of the Earth sensing radars.
35-37.5 GHz	Maximum 100 mW e.i.r.p. The band is used for Tank Level Probing Radars.
Alarms	
868-868.6 MHz	Maximum transmitter power is 10 mW.
869.2-869.25 MHz	Maximum transmitter power is 10 mW.
869.2-869.25 MHz	Maximum transmitter power is 10 mW.
169.4750-169.4875 MHz	The bands are not used for SRDs.
169.5875-169.6000 MHz	

TABLE 36 (continued)

Frequency bands	Main technical parameters and notes
Model Control	
26.995 MHz, 27.045 MHz, 27.095 MHz, 27.145 MHz, 27.195 MHz	Maximum transmitter power is 10 mW.
34.995-35.225 MHz	Maximum transmitter power is 10 mW.
40.665 MHz, 40.675 MHz, 40.685 MHz, 40.695 MHz	Maximum transmitter power is 10 mW.
Inductive applications	
9-148.5 kHz	Maximum magnetic field strength is +72 dB(μ A/m) at 10 m, if operating sub-bands are limited to 9-59.75 kHz and 59.75-60.25 kHz. Maximum magnetic field strength is +42 dB(μ A/m) at 10 m, if operating sub-bands are limited to 59.75-60.25 kHz, 135-140 kHz and 70-119 kHz. Maximum magnetic field strength is +69 dB(μ A/m) at 10 m, if operating sub-band is limited to 60.250-70 kHz. Maximum magnetic field strength is +66 dB(μ A/m) at 10 m, if operating sub-band is limited to 119-135 kHz. Maximum magnetic field strength is +37.7 dB(μ A/m) at 10 m, if operating sub-band is limited to 140-148.5 kHz.
3 155-3 400 kHz	Maximum magnetic field strength is +9 dB(μ A/m) at 10 m.
6 765-6 795 kHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
7 400-8 800 kHz	Maximum magnetic field strength is +9 dB(μ A/m) at 10 m.
10.200-11.000 MHz	Maximum magnetic field strength is +13.5 dB(μ A/m) at 10 m.
13.553-13.567 MHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
26.957-27.283 MHz	Maximum magnetic field strength is +42 dB(μ A/m) at 10 m.
Radio microphones and assistive listening devices	
29.7-47.0 MHz	Limited to the sub-band 30.01-47 MHz. Maximum transmitter power is 10 mW.
863-865 MHz	Maximum transmitter power is 10 mW.
174-216 MHz	Permitted for usage subject to not causing harmful interference into the other systems operating in this band. Maximum transmitter power is 50 mW. Maximum transmitter power in the sub-bands 174.4-174.6 MHz and 174.9-175.1 MHz is 10 mW.
470-862 MHz	Permitted for usage subject to not causing harmful interference into the other systems operating in this band. Maximum transmitter power is 50 mW.
169.4000-169.4750 MHz	The bands are not used for SRDs.
169.4875-169.5875 MHz	
169.4-174.0 MHz	

TABLE 36 (*end*)

Frequency bands	Main technical parameters and notes
Active medical implants and their associated peripherals	
402-405 MHz	Maximum transmitter power is 25 μ W.
9-315 kHz	Maximum magnetic field strength is +30 dB(μ A/m) at 10 m.
315-600 kHz	Maximum magnetic field strength is -5 dB(μ A/m) at 10 m.
30.0-37.5 MHz	Maximum transmitter power is 1 mW.
Wireless audio applications	
863-865 MHz	Maximum transmitter power is 10 mW.
87.5-108.0 MHz	Limited to sub-bands 87.5-92 MHz; 100-108 MHz. Maximum transmitter power is 10 mW.
433.05-434.79 MHz	Maximum transmitter power is 10 mW.

TABLE 37

Technical parameters and spectrum use for SRDs in Uzbekistan (Republic of)

Frequency bands	Main technical parameters and notes
Non-specific short-range radiocommunication devices	
30-41 MHz	Maximum transmitter power is 10 mW.
46-49 MHz	Maximum transmitter power is 10 mW.
433 MHz	Maximum transmitter power is 10 mW.
433.075-434.790 MHz	Maximum transmitter power is 10 mW.
1 880-1 900 MHz	Maximum transmitter power is 250 mW.
Radio local area networks	
2 400.0-2 483.5 MHz	Used for data transmission in accordance with specifications IEEE 802.15 (Bluetooth) and IEEE 802.11 (Wi-Fi). Maximum transmitter power is 100 mW.
Alarms	
26.945 MHz	Maximum transmitter power is 2 W.
26.960 MHz	Maximum transmitter power is 2 W.
149.950-150.0625 MHz	Maximum transmitter power is 25 mW.
169.4750-169.4875 MHz	The band is unsuitable for SRDs usage.
169.5875-169.6000 MHz	The band is unsuitable for SRDs usage.
433.075-434.79 MHz	Maximum transmitter power is 10 mW.
868-868.2 MHz	Maximum transmitter power is 10 mW.
Model control	
26.957-27.283 MHz	Maximum transmitter power is 10 mW.
28.0-28.2 MHz	Maximum transmitter power is 1 W.
40.66-40.70 MHz	Maximum transmitter power is 1 W.

TABLE 37 (*end*)

Frequency bands	Main technical parameters and notes
Radio microphones	
66-74 MHz	Maximum transmitter power is 10 mW.
87.5-92 MHz	Maximum transmitter power is 10 mW.
100-108 MHz	Maximum transmitter power is 10 mW.
165.70 MHz, 166.100 MHz, 166.500 MHz, 167.150 MHz	Maximum transmitter power is 20 mW.
169.4-174.0 MHz	The band is unsuitable for SRDs usage.
173.965-174.015 MHz	The band is unsuitable for SRDs usage.
470-862 MHz	Maximum transmitter power is 5 mW.
710-726 MHz	Maximum transmitter power is 5 mW.
Ultra low power active medical implants	
30.0-37.5 MHz	Maximum transmitter power is 10 mW.
57.5 MHz	Maximum transmitter power is 10 mW.
401-406 MHz	The band is unsuitable for SRDs usage.
Monitoring applications	
169.4-169.475 MHz	The band is unsuitable for SRDs usage.

Appendix 9 to Annex 2

Technical parameters and spectrum use for SRDs in some APT member countries/territories (Brunei Darussalam, China (Hong Kong), Malaysia, Philippines, New Zealand, Singapore and Vietnam)

Technical regulations in Brunei Darussalam

Technical regulations for short-range radiocommunication devices							
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Applicable radio standards	Remarks ⁽¹⁾	
1	Induction loop system/ RFID	16-150 kHz	$\leq 66 \text{ dB}(\mu\text{A}/\text{m}) @ 3 \text{ m}$	$\geq 32 \text{ dB}$ below carrier at 3 m or EN 300 224-1	EN 300 224-1		
		150-5 000 kHz	$\leq 13.5 \text{ dB}(\mu\text{A}/\text{m}) @ 10 \text{ m}$				
		6 765-6 795 kHz	$\leq 42 \text{ dB}(\mu\text{A}/\text{m}) @ 10 \text{ m}$				
		7 400-8 800 kHz	$\leq 9 \text{ dB}(\mu\text{A}/\text{m}) @ 10 \text{ m}$				
		13.55-13.567 MHz	$\leq 94 \text{ dB}(\mu\text{V}/\text{m}) @ 10 \text{ m}$				
2	Radio detection, alarm system	0.016-0.150 MHz	$\leq 100 \text{ dB}(\mu\text{V}/\text{m}) @ 3 \text{ m}$	$\geq 32 \text{ dB}$ below carrier at 3 m or EN 300 330-1	FCC Part 15 or EN 300 330-1		
3		13.553-13.567 MHz	$\leq 94 \text{ dB}(\mu\text{V}/\text{m}) @ 10 \text{ m}$				
4		240.15-240.30 MHz 300.00-300.30 MHz 312.00-316.00 MHz 444.40-444.80 MHz	$\leq 100 \text{ mW (e.r.p.)}$				$\geq 32 \text{ dB}$ below carrier at 3 m or EN 300 220-1
5	Wireless microphone	0.51-1.60 MHz	$\leq 57 \text{ dB}(\mu\text{V}/\text{m}) @ 3 \text{ m}$				
6		88.00-108.00 MHz	$\leq 60 \text{ dB}(\mu\text{V}/\text{m}) @ 10 \text{ m}$				
7		470.00-742.00 MHz	$\leq 10 \text{ mW (e.r.p.)}$				

Technical regulations for short-range radiocommunication devices						
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Applicable radio standards	Remarks ⁽¹⁾
8	Remote controls of garage door, cameras, toys and miscellaneous devices	26.96-27.28 MHz	≤ 100 mW (e.r.p.)	≥ 32 dB below carrier at 3 m or EN 300 220-1	FCC Part 15 or EN 300 220-1	
		40.665-40.695 MHz	≤ 100 mW (e.r.p.)			
		72.13-72.21 MHz				
9	Remote controls of aircraft and glider models, telemetry, detection and alarm systems	26.96-27.28 MHz 29.70-30.00 MHz	≤ 100 mW (e.r.p.)			
10	Medical and biological telemetry	40.50-41.00 MHz	≤ 0.01 mW (e.r.p.)	≥ 32 dB below carrier at 3 m or EN 300 220-1	FCC Part 15 or EN 300 220-1	
		216.00-217.00 MHz	> 25 μ W to ≤ 100 mW (e.r.p.)			
		454.00-454.50 MHz	≤ 2 mW (e.r.p.)			
11	Wireless modem, data communication system	72.080 MHz 72.200 MHz 72.400 MHz 72.600 MHz	≤ 100 mW (e.r.p.)	≥ 43 dB below carrier over 100 kHz to 2 000 MHz; EN 300 390-1 or EN 300 113-1	EN 300 390-1 or EN 300 113-1	
12	Short-range radar systems such as automatic cruise control and collision warning systems for vehicle	76-77 GHz	≤ 37 dBm (e.r.p.) when vehicle is in motion ≤ 23.5 dBm (e.r.p.) when vehicle is stationary	FCC Part 15 § 15.253 (c) or EN 301 091	FCC Part 15 or EN 301 091	
13	Radio telemetry, telecommand system	433.05-434.79 MHz	≤ 10 mW (e.r.p.)	≥ 32 dB below carrier at 3 m or EN 300 220-1	FCC Part 15 or EN 300 220-1	

Technical regulations for short-range radiocommunication devices						
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Applicable radio standards	Remarks ⁽¹⁾
14	Radio telemetry, telecommand, RFID system	866-869 MHz 923-925 MHz	≤ 500 mW (e.r.p.)	≥ 32 dB below carrier at 3 m; EN 300 220-1 or EN 302 208	FCC Part 15; EN 300 220-1 or EN 302 208	
15	Radio frequency identification (RFID) systems	923-925 MHz	> 500 mW (e.r.p.) $\leq 2\ 000$ mW (e.r.p.)	≥ 32 dB below carrier at 3 m; EN 300 220-1 or EN 302 208	FCC Part 15; EN 300 220-1 or EN 302 208	Only RFID systems operating in the 923-925 MHz frequency band shall be allowed to transmit between 500 mW and 2 000 mW (e.r.p.), and approved on an exceptional basis.
16	Wireless video transmitter and other SRD applications	2.4000-2.4835 GHz	≤ 100 mW (e.i.r.p.)	FCC Part 15 § 15.209; § 15.249 (d) or EN 300 440-1	FCC Part 15 or EN 300 440-1	Radar gun devices are not allowed to operate under this provision.
17		10.50-10.55 GHz	≤ 117 dB(μ V/m) @ 10m			
18		24.00-24.25 GHz	≤ 100 mW (e.i.r.p.)			
19	Bluetooth	2.4000-2.4835 GHz	≤ 100 mW (e.i.r.p.)	FCC Part 15 § 15.209; or EN 300 328	FCC Part 15 § 15.247 or EN 300 328	
20	Wireless LAN only	2.4000-2.4835 GHz	≤ 200 mW (e.i.r.p.)			WLAN for non-localized operations shall be approved on an exceptional basis.

Technical regulations for short-range radiocommunication devices						
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Applicable radio standards	Remarks ⁽¹⁾
21	SRD applications	5.725-5.850 GHz	≤ 100 mW (e.i.r.p.)	FCC Part 15 § 15.209	FCC Part 15 § 15.247 or 15.407	
22	Wireless LAN	5.725-5.850 GHz	$\leq 1\ 000$ mW (e.i.r.p.)			Non-localized operations shall be approved on an exceptional basis.
23		5.725-5.850 GHz	$> 1\ 000$ mW (e.i.r.p.) $\leq 4\ 000$ mW (e.i.r.p.)			Operating under this provision shall be approved on an exceptional basis.
24	Wireless LAN	5.150-5.350 GHz	> 100 mW (e.i.r.p.) ≤ 200 mW (e.i.r.p.)	FCC Part 15 § 15.407 (b) or EN 301 893	FCC Part 15 § 15.407 or EN 301 893	WLAN operating in 5.250-5.350 GHz under this provision shall employ dynamic frequency selection (DFS) mechanism and implement transmit power control (TPC). Non-localized operations shall be approved on an exceptional basis.

Technical regulations for short-range radiocommunication devices						
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Applicable radio standards	Remarks ⁽¹⁾
25	Wireless LAN	5.150-5.350 GHz	≤ 100 mW (e.i.r.p.)	FCC Part 15 § 15.407 (b) or EN 301 893	FCC Part 15 § 15.407 or EN 301 893	WLAN operating under this provision shall implement DFS function in the frequency range 5.250-5.350 GHz. Non-localized operations shall be approved on an exceptional basis.

⁽¹⁾ Administrations may indicate additional information on channel spacing, necessary bandwidth and interference mitigation requirement.

Technical Regulations in China (Hong Kong)

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽²⁾
1		3-195 kHz	Electric field strength not to exceed 40 dB(μV/m) and magnetic field strength not to exceed 48.4 dB(μA/m) at 100 m from the apparatus	
2	Cordless phone	1 627.5-1 796.5 kHz	Electric field strength not to exceed 88 dB(μV/m) at 30 m from the apparatus	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽²⁾
3	RFID	13.553-13.567 MHz	(a) electric field strength not to exceed 80 dB(μ V/m) at 30 m from the apparatus; or (b) magnetic field strength not to exceed 42 dB(μ A/m) at 10 m from the apparatus	
4		26.96-27.28 MHz	Mean power not to exceed 0.5 W	
5	Wireless microphone	33-33.28 MHz	e.r.p. not to exceed 10 mW	
6	Model control	35.145-35.225 MHz	e.r.p. not to exceed 100 mW	
7	Wireless microphone	36.26-36.54 MHz	e.r.p. not to exceed 10 mW	
8	Wireless microphone	36.41-36.69 MHz	e.r.p. not to exceed 10 mW	
9	Wireless microphone	36.71-36.99 MHz	e.r.p. not to exceed 10 mW	
10	Wireless microphone	36.96-37.24 MHz	e.r.p. not to exceed 10 mW	
11	Model control	40.66-40.70 MHz	e.r.p. not to exceed 100 mW	
12		42.75-43.03 MHz	e.r.p. not to exceed 10 mW	
13	Cordless phone	43.71-44.49 MHz	Electric field strength not to exceed 10 mV/m at 3 m from the apparatus	
14		44.73-45.01 MHz	e.r.p. not to exceed 10 mW	
15	Cordless phone	46.6-46.98 MHz	Electric field strength not to exceed 10 mV/m at 3 m from the apparatus	
16		47.13-47.41 MHz	e.r.p. not to exceed 10 mW	
17	Cordless phone	47.43-47.56 MHz	e.r.p. not to exceed 10 mW	
18	Cordless phone	48.75-50 MHz	Electric field strength not to exceed 10 mV/m at 3 m from the apparatus	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽²⁾
19	Model control	72.00-72.02 MHz	Carrier power not to exceed 750 mW	
20		72.12-72.14 MHz		
21		72.16-72.22 MHz		
22		72.26-72.28 MHz		
23	Wireless microphone	173.96-174.24 MHz	e.r.p. not to exceed 20 mW	
24	Wireless microphone	187.5-188.0 MHz	e.r.p. not to exceed 10 mW	
25	Cordless phone	253.85-255 MHz	e.r.p. not to exceed 12 mW	
26		266.75-267.25 MHz	e.r.p. not to exceed 10 mW	
27		313.75-314.25 MHz	e.r.p. not to exceed 10 mW	
28		314.75-315.25 MHz	e.r.p. not to exceed 10 mW	
29	Cordless phone	380.2-381.325 MHz	e.r.p. not to exceed 12 mW	
30	Medical implant	402-405 MHz	e.i.r.p. not to exceed 25 μ W	
31	Portable radios	409.74-410 MHz	e.r.p. not to exceed 0.5 W	
32	RFID	433.92 MHz centred frequency and 500 kHz occupied bandwidth	e.r.p. not to exceed 2.2 mW	
33		819.1-823.1 MHz	(a) e.r.p. not to exceed 100 mW (b) power spectral density not to exceed 10 mW per 25 kHz	
34	Cordless phone	864.1-868.1 MHz	Carrier power or e.r.p. not to exceed 10 mW	
35	RFID	865-868 MHz	e.r.p. not to exceed 100 mW	
36	RFID	865.6-867.6 MHz	e.r.p. not to exceed 2 W	
37	RFID	865.6-868 MHz	e.r.p. not to exceed 500 mW	
38		919.5-920.0 MHz	e.r.p. not to exceed 10 mW	
39	RFID	920-925 MHz	e.i.r.p. not to exceed 4 W	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽²⁾
40	Cordless phone	1 880-1 900 MHz	(a) peak power not to exceed 250 mW for apparatus with antenna output terminal; or (b) peak e.i.r.p. not to exceed 250 mW for apparatus with integral antenna	
41	Cordless phone	1 895-1 906.1 MHz	(a) carrier power not to exceed 10 mW for apparatus with antenna output terminal; or (b) e.r.p. not to exceed 10 mW for apparatus with integral antenna	
42	WLAN, RFID	2 400-2 483.5 MHz	(a) peak e.i.r.p. not to exceed 4 W for frequency hopping spread spectrum modulation or digital modulation systems; or (b) aggregate e.r.p. not to exceed 100 mW for any modulation	
43	WLAN	5 150-5 350 MHz	e.i.r.p. not to exceed 200 mW using only digital modulation	
44	WLAN	5 470-5 725 MHz	e.i.r.p. not to exceed 1 W	
45	WLAN	5 725-5 850 MHz	(a) peak e.i.r.p. not to exceed 4 W for frequency hopping spread spectrum modulation or digital modulation systems; or (b) aggregate e.r.p. not to exceed 100 mW for any modulation	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽²⁾
46		18.82-18.87 GHz	(a) e.r.p. not to exceed 100 mW (b) power spectral density not to exceed 3 mW per 100 kHz	
47	Vehicle radar	76-77 GHz	Carrier power not to exceed 10 mW	

⁽²⁾ Administrations may indicate additional information on channel spacing, necessary bandwidth, interference mitigation requirement, unwanted emission limit and applicable radio standards.

Technical regulations in Malaysia

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power (mW)	Remarks ⁽³⁾
1	Short-range communication device	6.7650 to 6.7950 MHz 13.5530 to 13.5670 MHz 26.9570 to 27.2830 MHz 40.6600 to 40.7000 MHz 433.0000 to 435.0000 MHz	≤ 100 (e.i.r.p.)	
		2 400.0000 to 2 500.0000 MHz	≤ 500 (e.i.r.p.)	
		5 150.0000 to 5 250.0000 MHz 5 250.0000 to 5 350.0000 MHz 5 725.0000 to 5 875.0000 MHz 24.0000 GHz to 24.2500 GHz 61.0000 GHz to 61.5000 GHz 122.0000 GHz to 123.0000 GHz 244.0000 GHz to 246.0000 GHz	≤ 1 000 (e.i.r.p.)	
2	Personal radio service device	477.5250 to 477.9875 MHz	≤ 500	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power (mW)	Remarks ⁽³⁾
3	Cordless telephone	46.6100 to 46.9700 MHz 49.6100 to 49.9700 MHz	≤ 50 (e.i.r.p.)	
		866.0000 to 871.0000 MHz CT2/CT3 freq. Band*	≤ 50 (e.i.r.p.)	
		1 880.0000 to 1 900.0000 MHz 2 400.0000 to 2 483.5000 MHz	≤ 100 (e.i.r.p.)	
4	Two-way radio pager access device	279.0000 to 281.0000 MHz/ 919.0000 to 923.0000 MHz	$\leq 1\ 000$	
5	Radio telemetry access device	162.9750 to 163.1500 MHz	$\leq 1\ 000$	
6	Infra red device	187.5000 THz to 420.0000 THz	≤ 125	
7	Remote controlled consumer device – boat, car model/garage door/camera/toy robot, crane, etc.	26.9650 to 27.2750 MHz 40.0000 MHz 47.0000 MHz 49.0000 MHz 303.0000 to 320.0000 MHz 433.0000 to 435.0000 MHz	≤ 50 (e.i.r.p.)	
8	Security device – Radio detection and alarm	3.0000 kHz to 195.0000 kHz 228.0063 to 228.9937 MHz 303.0000 to 320.0000 MHz 400.0000 to 402.0000 MHz 433.0000 to 435.0000 MHz 868.1000 MHz 76.0000 GHz to 77.000GHz	< 50 (e.i.r.p.)	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power (mW)	Remarks ⁽³⁾
9	Wireless microphone system	26.95728 to 27.28272 MHz 40.4350 to 40.9250 MHz 87.5000 to 108.000 MHz 182.0250 to 182.9750 MHz 183.0250 to 183.4750 MHz 217.0250 to 217.9750 MHz 218.0250 to 218.4750 MHz 510.0000 to 798.0000 MHz	< 50 (e.i.r.p.)	
10	Free space optics device	193.5484 THz (wavelength of 1 550 nm) 352.9412 THz (wavelength of 850 nm)	≤ 650	
11	Industrial, scientific and medical (ISM) device	6 765.0000 kHz to 6 795.0000 kHz 13.5530 to 13.5670 MHz 26.9570 to 27.2830 MHz 40.6600 to 40.7000 MHz 2 400.0000 to 2 500.0000 MHz 5 725.0000 to 5 875.0000 MHz 24.0000 GHz to 24.2500 GHz 61.0000 GHz to 61.5000 GHz 122.0000 GHz to 123.0000 GHz 244.0000 GHz to 246.0000 GHz	< 500 (e.i.r.p.)	
12	Active medical implant	402.0000 MHz to 405.0000 MHz 9.0000 kHz to 315.0000 kHz	25 μW 30 dB(μA/m) at 10 m	* planned

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power (mW)	Remarks ⁽³⁾
13	RFID	13.5530 MHz to 13.5670 MHz 433.0000 MHz to 435.0000 MHz 869.0000 MHz to 870.3750 MHz 919.0000 MHz to 923.0000 MHz 2 400.000 MHz to 2 500.000 MHz	100 mW 100 mW 500 mW 2 W e.r.p. 500 mW	*planned

⁽³⁾ Administrations may indicate additional information on channel spacing, necessary bandwidth, interference mitigation requirement, unwanted emission limit and applicable radio standards.

Technical regulations in New Zealand

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽⁴⁾
1	Telemetry/Telecommand	0.009-0.03 MHz	Maximum permitted field strength is 2 400 ($\mu\text{V}/\text{m}$)/ f (kHz) measured using an average detector at 300 m – where f is the centre frequency.	
2	Telemetry/Telecommand	0.03-0.19 MHz	10 mW e.i.r.p.	
3	Telemetry/Telecommand	6.765-6.795 MHz	10 mW e.i.r.p.	
4	Telemetry/Telecommand	13.55-13.57 MHz	100 mW e.i.r.p.	
5	Unrestricted	26.95-27.3 MHz	1 000 mW e.i.r.p.	
6	Unrestricted	29.7-30 MHz	100 mW e.i.r.p.	
7	Unrestricted	35.5-37.2 MHz	100	
8	Unrestricted	40.66-40.7 MHz	1 000 mW e.i.r.p.	
9	Unrestricted	40.8-41.0 MHz	100 mW e.i.r.p.	

Technical regulations for short-range radiocommunication devices					
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽⁴⁾	
10	Auditory Aids	72-72.25 MHz	100 mW e.i.r.p.		
11	Unrestricted	72.25-72.50 MHz	100 mW e.i.r.p.		
12	Audio senders	88-108 MHz	0.00002 mW e.i.r.p.		
13	Unrestricted	107-108 MHz	25 mW e.i.r.p.		
14	Unrestricted	160.1-160.6 MHz	500 mW e.i.r.p.		
15	Unrestricted	173-174 MHz	100 mW e.i.r.p.		
16	Telemetry/Telecommand	235-300 MHz	1 mW e.i.r.p.		
17	Telemetry/Telecommand	300-322 MHz	10 mW e.i.r.p.		
18	Biomedical Telemetry	402-406 MHz	0.025 mW e.i.r.p.		The maximum permitted duty cycle is 0.1%
19	Telemetry/Telecommand	433.05-434.79 MHz	25 mW e.i.r.p.		
20	Biomedical Telemetry	444-444.925 MHz	25 mW e.i.r.p.		
21	Unrestricted	458.54-458.61 MHz	500 mW e.i.r.p.		
22	Unrestricted	466.80-466.85 MHz	500 mW e.i.r.p.		
23	Biomedical Telemetry	470-470.5 MHz	100 mW e.i.r.p.		
24	Unrestricted	471-471.5 MHz	100 mW e.i.r.p.		
25	Audio/Video senders	614-646 MHz	25 mW e.i.r.p.		
26	Unrestricted	819-824 MHz	100 mW e.i.r.p.		
27	Unrestricted	864-868 MHz	1 000 mW e.i.r.p.	May operate with gain antennas provided the peak power does not exceed 4 W e.i.r.p.	
28	Telemetry/Telecommand ⁽¹⁾	869.2-869.25 MHz	10 mW e.i.r.p.		
29	Telemetry/Telecommand	915-921 MHz	3 mW e.i.r.p.		

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks⁽⁴⁾
30	Unrestricted	921-929 MHz	1 000 mW e.i.r.p.	
31	Unrestricted	2.4-2.4835 GHz	1 000 mW e.i.r.p.	May operate with gain antennas provided the peak power does not exceed 4 W e.i.r.p.
32	Radiolocation	2.9-3.4 GHz	100 mW e.i.r.p.	
33	Wireless LAN	5.15-5.25 GHz	200 mW e.i.r.p.	Indoor use – The maximum permitted power density is 10 mW/MHz e.i.r.p. or equivalently 0.25 mW/25 kHz e.i.r.p.

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽⁴⁾
34	Wireless LAN	5.25-5.35 GHz	1 000 mW e.i.r.p.	<p>Indoor-only systems: In the band 5 250 to 5 350 MHz the maximum permitted mean power is 200 mW e.i.r.p. and the maximum permitted mean power density is 10 mW/MHz e.i.r.p., provided dynamic frequency selection and transmitter power control are implemented. If transmitter power control is not in use, then the e.i.r.p. values shall be reduced by 3 dB.</p> <p>Indoor and outdoor systems: In the band 5 250 to 5 350 MHz, the maximum permitted mean power is 1 watt e.i.r.p. and the maximum permitted mean power density is 50 mW/MHz, provided dynamic frequency selection and transmitter power control are implemented in conjunction with the following vertical radiation angle mask where θ is the angle above the local horizontal plane (of the Earth):</p> <p>Maximum permitted mean power density/quotient</p> <p>Elevation angle above horizontal:</p> <p>–13 dB(W/MHz) for $0^\circ \leq \theta < 8^\circ$</p> <p>–13 – 0.716($\theta$-8) dB(W/MHz) for $8^\circ \leq \theta < 40^\circ$</p> <p>–35.9 – 1.22($\theta$-40) dB(W/MHz) for $40^\circ \leq \theta \leq 45^\circ$</p> <p>–42 dB(W/MHz) for $45^\circ < \theta$</p>

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽⁴⁾
35	Wireless LAN	5.47-5.725 GHz	1 000 mW e.i.r.p.	The maximum transmitter power is 250 mW with a maximum permitted mean power of 1 W e.i.r.p. and a maximum permitted mean power density of 50 mW/MHz e.i.r.p., provided dynamic frequency selection and transmitter power control are implemented. If transmitter power control is not in use, then the maximum permitted mean power shall be reduced by 3 dB.
36	Radiolocation	5.47-5.725 GHz	100 mW e.i.r.p.	
37	Unrestricted (refer Note 2)	5.725-5.875 GHz	1 000 mW e.i.r.p.	
38	Road transport and traffic telematics	5.725-5.875 GHz	2 000 mW e.i.r.p.	
39	Radiolocation	8.5-10 GHz	100 mW e.i.r.p.	
40	Radiolocation – Radar systems only	10-10.6 GHz	25 mW e.i.r.p.	
41	Radiolocation	15.7-17.3 GHz	100 mW e.i.r.p.	
42	Unrestricted	24-24.25 GHz	1 000 mW e.i.r.p.	
43	Radiolocation	33.4-36 GHz	100 mW e.i.r.p.	
44	Field disturbance sensors	46.7-46.9 GHz	100 mW e.i.r.p.	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks ⁽⁴⁾
45	Fixed point-to-point links	57-64 GHz	20 000 mW e.i.r.p.	The average power density of any emission, measured during the transmit interval shall not exceed $9 \mu\text{W}/\text{cm}^2$ at a distance of 3 m and the peak power density of any emission shall not exceed $18 \mu\text{W}/\text{cm}^2$ at a distance of 3 m. In the band 57-64 GHz, the peak total transmitter power shall not exceed 500 mW. In the band 57-64 GHz, for emissions of bandwidths less than 100 MHz the transmitter peak power must be limited to $500 \text{ mW} \times (\text{bandwidth (MHz)} / 100 \text{ (MHz)})$.
46	Radiolocation	59-64 GHz	100 mW e.i.r.p.	
47	Field disturbance sensors	76-77 GHz	1 000 mW e.i.r.p.	
48	Unrestricted	122-123 GHz	1 000 mW e.i.r.p.	
49	Unrestricted	244-246 GHz	1 000 mW e.i.r.p.	

⁽⁴⁾ Administrations may indicate additional information on channel spacing, necessary bandwidth, interference mitigation requirement, unwanted emission limit and applicable radio standards.

Technical regulations in Philippines

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks
1	Ultra-low power active MICS	9-315 kHz	30 dB(μ A/m) @ 10 m	* Individual transmitters may combine adjacent channels for increased bandwidth up to 300 kHz.
		402-405 MHz*	25 μ W (e.r.p.)	
2	Biomedical devices	40.66-40.70 MHz	1 000 μ V/m @ 3 m	
3	Alarms	868.6-868.7 MHz	10 mW (e.r.p.)	
		869.2-869.25 MHz	10 mW (e.r.p.)	
		869.25-869.3 MHz	10 mW (e.r.p.)	
		869.65-869.7 MHz	25 mW (e.r.p.)	
4	Equipment for detecting movement and alert Alarms	2 400-2 483.5 MHz	25 mW (e.i.r.p.)	
		9 200-9 500 MHz	25 mW (e.i.r.p.)	
		9 500-9 975 MHz	25 mW (e.i.r.p.)	
		13.4-14.0 GHz	25 mW (e.i.r.p.)	
		24.05-24.25 GHz	100 mW (e.i.r.p.)	
5	Equipment for detecting movement and alert alarms	2 400-2 483.5 MHz	25 mW (e.i.r.p.)	
		9 200-9 500 MHz	25 mW (e.i.r.p.)	
		9 500-9 975 MHz	25 mW (e.i.r.p.)	
		13.4-14.0 GHz	25 mW (e.i.r.p.)	
		24.05-24.25 GHz	100 mW (e.i.r.p.)	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks
6	Inductive applications	9-59.750 kHz	72 dB(μ A/m) @ 10 m	
		59.750-60.250 kHz	42 dB(μ A/m) @ 10 m	
		60.250-70 kHz	69 dB(μ A/m) @ 10 m	
		70-119 kHz	42 dB(μ A/m) @ 10 m	
		119-135 kHz	66 dB(μ A/m) @ 10 m	
		135-140 kHz	42 dB(μ A/m) @ 10 m	
		140-148.5 kHz	37.7 dB(μ A/m) @ 10 m	
		3 155-3 400 kHz	13.5 dB(μ A/m) @ 10 m	
		6 765-6 795 kHz	42 dB(μ A/m) @ 10 m	
		7 400-8 800 kHz	9 dB(μ A/m) @ 10 m	
		13.553-13.567 MHz	42 dB(μ A/m) @ 10 m	
		26.957-27.283 MHz	42 dB(μ A/m) @ 10 m	
		10.2-11 MHz	9 dB(μ A/m) @ 10 m	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks
7	Non-specific short-range devices, telemetry, telecommand, alarms, data in general and other similar applications	6 765-6 795 kHz	42 dB(μ A/m) @ 10 m	
		13.553-13.567 MHz	42 dB(μ A/m) @ 10 m	
		26.957-27.283 MHz	10 mW e.r.p. / 42 dB(μ A/m) @ 10 m	
		40.660-40.700 MHz	10 mW (e.r.p.)	
		138.2-138.45 MHz	10 mW (e.r.p.)	
		315 MHz	10 mW (e.r.p.)	
		433.050-434.790 MHz	10 mW (e.r.p.)	
		868.000-868.600 MHz	25 mW (e.r.p.)	
		868.700-869.200 MHz	25 mW (e.r.p.)	
		869.3-869.4 MHz	25 mW (e.r.p.)	
		869.700-870.000 MHz	5 mW (e.r.p.)	
		2 400-2 483.5 MHz	10 mW (e.i.r.p.)	
		5 725-5 875 MHz	25 mW (e.i.r.p.)	
		24.00-24.25 GHz	100 mW (e.i.r.p.)	
		61.0-61.5 GHz	100 mW (e.i.r.p.)	
122-123 GHz	100 mW (e.i.r.p.)			
244-246 GHz	100 mW (e.i.r.p.)			
8	Road transport and traffic telematics	5 795-5 805 MHz*	2W (e.i.r.p.)	* Individual license required.
		63-64 GHz	8W (e.i.r.p.)	
		76-77 GHz	55 dBm peak	

Technical regulations for short-range radiocommunication devices				
No.	Typical application type	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Remarks
9	Wireless audio applications	72.0-73.0 MHz*	80 mV/m at 3 m (field strength)	* For auditory assistance device only. In case of analogue systems, the maximum occupied bandwidth should not exceed 300 kHz.
		75.4-76.0 MHz*	80 mV/m at 3 m (field strength)	
		863-865 MHz	10 mW (e.r.p.)	
		864.8-865.0 MHz	10 mW (e.r.p.)	
10	Wireless microphones	29.7-47.0 MHz	2 mW (e.r.p.)	50 mW restricted to for body worn microphones.
		173.965-174.015 MHz	10 mW (e.r.p.)	
		174-216 MHz	10 mW (e.r.p.)/ 50 mW (e.r.p.)	
		470-862 MHz	10 mW (e.r.p.)/ 50 mW (e.r.p.)	
		863-865 MHz	10 mW (e.r.p.)	
		1 785-1 800 MHz	10 mW (e.i.r.p.)/ 50 mW (e.i.r.p.)	
11	Wireless video transmitter	630-710 MHz	76 dB(μ V/m) at 3 m 5-8 MHz	
		2 400-2 483.5 MHz (Narrowband)	100 mW (e.i.r.p.)	

Technical regulations in Singapore

Technical regulations for short-range radiocommunication devices					
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Remarks
1	Induction loop system/ RFID	16-150 kHz	$\leq 66 \text{ dB}(\mu\text{A/m}) @ 3 \text{ m}$	$\geq 32 \text{ dB}$ below carrier at 3 m or EN 300 224-1	
		150-5 000 kHz	$\leq 13.5 \text{ dB}(\mu\text{A/m}) @ 10 \text{ m}$		
		6 765-6 795 kHz	$\leq 42 \text{ dB}(\mu\text{A/m}) @ 10 \text{ m}$		
		7 400-8 800 kHz	$\leq 9 \text{ dB}(\mu\text{A/m}) @ 10 \text{ m}$		
2	Radio detection, alarm system	0.016-0.150 MHz	$\leq 100 \text{ dB}(\mu\text{V/m}) @ 3 \text{ m}$	$\geq 32 \text{ dB}$ below carrier at 3 m or EN 300 330-1	
3		13.553-13.567 MHz	$\leq 94 \text{ dB}(\mu\text{V/m}) @ 10 \text{ m}$		
4		146.35-146.50 MHz	$\leq 100 \text{ mW (e.r.p.)}$	$\geq 32 \text{ dB}$ below carrier at 3 m or EN 300 220-1	
		240.15-240.30 MHz			
	300.00-300.30 MHz				
	312.00-316.00 MHz				
444.40-444.80 MHz					
5	Wireless microphone	0.51-1.60 MHz	$\leq 57 \text{ dB}(\mu\text{V/m}) @ 3 \text{ m}$		
6		40.66-40.70 MHz	$\leq 65 \text{ dB}(\mu\text{V/m}) @ 10 \text{ m}$		
7		88.00-108.00 MHz	$\leq 60 \text{ dB}(\mu\text{V/m}) @ 10 \text{ m}$		
8		470.00-806.00 MHz	$\leq 10 \text{ mW (e.r.p.)}$		
9	Wireless microphone, Hearing/Audio assistance aids	169.40-175.00 MHz	$\leq 500 \text{ mW (e.r.p.)}$	$\geq 32 \text{ dB}$ below carrier at 3 m or EN 300 220-1	
		180.00-200.00 MHz 487.00-507.00 MHz	$\leq 112 \text{ dB}(\mu\text{V/m}) @ 10 \text{ m}$		

Technical regulations for short-range radiocommunication devices					
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Remarks
10	Remote controls of garage door, cameras, toys and miscellaneous devices	26.96-27.28 MHz	≤ 100 mW (e.r.p.) ⁽⁵⁾	≥ 32 dB below carrier at 3 m or EN 300 220-1	
		34.995-35.225 MHz	≤ 100 mW (e.r.p.)		
		40.665-40.695 MHz	≤ 500 mW (e.r.p.)		
		40.77-40.83 MHz			
		72.13-72.21 MHz			
11	Remote controls of aircraft and glider models, telemetry, detection and alarm systems	26.96-27.28 MHz 29.70-30.00 MHz	≤ 500 mW (e.r.p.)		
12	Remote control of cranes and loading arms	170.275 MHz 170.375 MHz 173.575 MHz 173.675 MHz 451.750 MHz 452.000 MHz 452.050 MHz 452.325 MHz	$\leq 1\ 000$ mW (e.r.p.)		Operating under these provisions shall be approved on an exceptional basis.
13	On-site radio paging system	26.96-27.28 MHz 40.66-40.70 MHz	$\leq 3\ 000$ mW (e.r.p.) ⁽⁵⁾	≥ 32 dB below carrier at 3 m; EN 300 135-1; EN 300 433-1 or EN 300 224-1	Operating under these provisions shall be approved on an exceptional basis.
14		151.125 MHz 151.150 MHz	$\leq 3\ 000$ mW (e.r.p.)	≥ 60 dB below carrier over 100 kHz to 2 000 MHz or EN 300 224-1	

Technical regulations for short-range radiocommunication devices					
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Remarks
15	Medical and biological telemetry	40.50-41.00 MHz	≤ 0.01 mW (e.r.p.)	≥ 32 dB below carrier at 3 m or EN 300 220-1	
		216.00-217.00 MHz	> 25 μ W to ≤ 100 mW (e.r.p.)		
		454.00-454.50 MHz	≤ 2 mW (e.r.p.)		
		1 427.00-1 432.00 MHz	> 25 μ W to ≤ 100 mW (e.r.p.)	FCC Part 15 or EN 300 440-1	
		All frequencies	≤ 25 μ W (e.r.p.)	FCC Part 15; EN 300 220-1; EN 300 330-1; or EN 300 440-1	
16					
17					
18	Wireless modem, data communication system	72.080 MHz 72.200 MHz 72.400 MHz 72.600 MHz 158.275/162.875 MHz 158.325/162.925 MHz 453.7250/458.7250 MHz 453.7375/458.7375 MHz 453.7500/458.7500 MHz 453.7625/458.7625 MHz	$\leq 1\ 000$ mW (e.r.p.) ⁽⁵⁾	≥ 43 dB below carrier over 100 kHz to 2 000 MHz; EN 300 390-1 or EN 300 113-1	
19	Short-range radar systems such as automatic cruise control and collision warning systems for vehicle	76-77 GHz	≤ 37 dBm (e.r.p.) when vehicle is in motion ≤ 23.5 dBm (e.r.p.) when vehicle is stationary	FCC Part 15 § 15.253 (c) or EN 301 091	
20	Radio telemetry, telecommand system	433.05-434.79 MHz	≤ 10 mW (e.r.p.)	≥ 32 dB below carrier at 3 m or EN 300 220-1	

Technical regulations for short-range radiocommunication devices					
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Remarks
21	Radio Telemetry, Telecommand, RFID system	866-869 MHz 920-925 MHz	≤ 500 mW (e.r.p.) ⁽⁵⁾	≥ 32 dB below carrier at 3 m; EN 300 220-1 or EN 302 208	
22	Radio frequency identification (RFID) systems	920-925 MHz	> 500 mW (e.r.p.) $\leq 2\,000$ mW (e.r.p.)	≥ 32 dB below carrier at 3 m; EN 300 220-1 or EN 302 208	Only RFID systems operating in the 920-925 MHz frequency band shall be allowed to transmit between 500 mW and 2 000 mW (e.r.p.) and approved on an exceptional basis.
23	Wireless video transmitter and other SRD applications	2.4000-2.4835 GHz	≤ 100 mW (e.i.r.p.) ⁽⁶⁾	FCC Part 15 § 15.209; § 15.249 (d) or EN 300 440-1	Radar gun devices are not allowed to operate.
24		10.50-10.55 GHz	≤ 117 dB(μ V/m) @ 10 m		
25		24.00-24.25 GHz	≤ 100 mW (e.i.r.p.)		
26	Bluetooth	2.4000-2.4835 GHz	≤ 100 mW (e.i.r.p.) ⁽⁶⁾	FCC Part 15 § 15.209; or EN 300 328	
27	Wireless LAN only	2.4000-2.4835 GHz	≤ 200 mW (e.i.r.p.)		WLAN for non-localized operations shall be approved on an exceptional basis.
28	SRD applications	5.725-5.850 GHz	≤ 100 mW (e.i.r.p.)	FCC Part 15 § 15.209	

Technical regulations for short-range radiocommunication devices					
No.	Typical application types	Authorized frequency bands/frequencies	Maximum field strength/ RF output power	Transmitter spurious emissions	Remarks
29	Wireless LAN and broadband access (WBA) only	5.725-5.850 GHz	$\leq 1\ 000$ mW (e.i.r.p.)		Non-localized operations shall be approved on an exceptional basis.
30		5.725-5.850 GHz	$> 1\ 000$ mW (e.i.r.p.) $\leq 4\ 000$ mW (e.i.r.p.)		Operating under this provision shall be approved on an exceptional basis.
31	Wireless LAN	5.150-5.350 GHz	> 100 mW (e.i.r.p.) ⁽⁶⁾ ≤ 200 mW (e.i.r.p.)	FCC Part 15 § 15.407 (b) or EN 301 893	WLAN operating in 5.250-5.350 GHz under this provision shall employ dynamic frequency selection (DFS) mechanism and implement transmit power control (TPC). Non-localized operations shall be approved on an exceptional basis.
32	Wireless LAN	5.150-5.350 GHz	≤ 100 mW (e.i.r.p.)	FCC Part 15 § 15.407 (b) or EN 301 893	WLAN operating under this provision shall implement DFS function in the frequency range 5.250-5.350 GHz. Non-localized operations shall be approved on an exceptional basis.

⁽⁵⁾ Effective radiated power (e.r.p.) refers to radiation of a half wave tuned dipole, which is used for frequencies below 1 GHz.

⁽⁶⁾ Equivalent isotropic radiated power (e.i.r.p.) is a product of the power supplied to the antenna and the maximum antenna gain, relative to an isotropic antenna, and is used for frequencies above 1 GHz. There is a constant difference of 2.15 dB between e.i.r.p. and e.r.p. [e.i.r.p. (dBm) = e.r.p. (dBm) + 2.15].

Technical regulations in Viet Nam

The MIC's Decision 36/2009/TT-BTTTT of 03/12/2009 includes individual technical requirement for each type of SRDs. The common requirements are presented in the table below:

Technical requirements for short-range radiocommunication devices				
	Frequency band (MHz)	Emission (Max. power)	Spurious emission (Max. power or min deterioration)	Type of devices or applications
	A	B	C	D
1	0.115-0.150	≤ 4.5 mW e.r.p.	Details ⁽⁷⁾	Radio alarm and detection systems
				RFID
				Radio remote control
2	10.2-11	≤ 4.5 μ W e.r.p.		wireless audio system for hearing assistance aids
				Radio alarm and detection systems
3	13.553-13.567	≤ 4.5 mW e.r.p.		RFID
				Other applications
				Radio remote control
4	26.957-27.283	≤ 100 mW e.r.p.		≥ 40 dBc at output of the transmitter
				Other applications
				Radio remote control
5	29.70-30.00	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	Radio alarm and detection systems
				radio telemetry
				Radio remote control
6	34.995-35.225	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	Radio remote control
7	40.02-40.98	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	Remote controls of aircraft models (of radio remote control)
8	40.66-40.7	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	wireless audio system
				Radio remote control
				Other applications

Technical requirements for short-range radiocommunication devices				
	Frequency band (MHz)	Emission (Max. power)	Spurious emission (Max. power or min deterioration)	Type of devices or applications
	A	B	C	D
9	40.50-41.00	$\leq 10 \mu\text{W}$ e.r.p.	≥ 32 dBc at output of the transmitter	Medical and biological telemetry
10	43.71-44.00 46.60-46.98 48.75-49.51 49.66-50.00	$\leq 183 \mu\text{W}$ e.r.p.	≥ 32 dBc at 3 m	Cordless telephone
11	50.01-50.99	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	Remote controls of aircraft models (of radio remote control)
12	72.00-72.99	≤ 1 W e.r.p.	≥ 40 dBc at output of the transmitter	Radio remote control for aircraft model (of radio remote control)
13	88-108	$\leq 3 \mu\text{W}$ e.r.p.	≥ 32 dBc at 3 m	Wireless audio system (exception of FM transmitter)
		≤ 20 nW e.r.p.		FM transmitter (of wireless audio system)
14	146.35-146.50	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	Radio alarm and detection systems
15	182.025-182.975	≤ 30 mW e.r.p.	≥ 40 dBc at output of the transmitter	Wireless audio system
16	216-217	$\leq 10 \mu\text{W}$ e.r.p.	≥ 40 dBc at output of the transmitter	Medical and biological telemetry
17	217.025-217.975	≤ 30 mW e.r.p.	≥ 40 dBc at output of the transmitter	Wireless audio system
18	218.025-218.475	≤ 30 mW e.r.p.	≥ 40 dBc at output of the transmitter	Wireless audio system
19	240.15-240.30	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	Radio alarm and detection systems
20	300.00-300.33	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	Radio alarm and detection systems
21	312-316	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	Radio alarm and detection systems
				Radio remote control
22	401-406	$\leq 25 \mu\text{W}$ e.r.p.	Detail ⁽⁸⁾	MICS
23	402-405 403.5-403.8 405-406	≤ 100 nW e.r.p.		MITS

Technical requirements for short-range radiocommunication devices				
	Frequency band (MHz)	Emission (Max. power)	Spurious emission (Max. power or min deterioration)	Type of devices or applications
	A	B	C	D
24	433.05-434.79	≤ 10 mW e.r.p.	≥ 32 dBc at 3 m	RFID
			≥ 40 dBc at output of the transmitter	Radio remote control Radio telemetry
25	444.40-444.80	≤ 100 mW e.r.p.	≥ 40 dBc at output of the transmitter	Radio alarm and detection systems
26	470.075-470.725	≤ 10 mW e.r.p.	≥ 40 dBc at output of the transmitter	Wireless audio system
27	482.19-488.00	≤ 30 mW e.r.p.	≥ 40 dBc at output of the transmitter	Wireless audio system
28	821-822	≤ 183 μ W e.r.p.	≥ 32 dBc at 3 m	Cordless Telephone
29	866-868	≤ 500 mW e.r.p.	≥ 32 dBc at output of the transmitter	RFID
30	920-925	≤ 500 mW e.r.p.	≥ 32 dBc at output of the transmitter	RFID
31	924-925	≤ 183 μ W e.r.p.	≥ 32 dBc at 3 m	Cordless Telephone
32	2 400-2 483.5	≤ 100 mW e.i.r.p. and ≤ 100 mW/100 kHz e.i.r.p. for devices using FHSS modulation ≤ 10 mW/1 MHz e.i.r.p. for devices using other modulations	Detail ⁽⁹⁾	WLAN
				Other spread spectrum applications
		≤ 10 mW e.i.r.p.	Detail ⁽¹⁰⁾	Wireless video transmitter
			Detail ⁽¹¹⁾	Other applications
33	5 150-5 250	≤ 200 mW e.i.r.p. and ≤ 10 mW/MHz	Detail ⁽¹²⁾	WLAN
34	5 250-5 350	≤ 200 mW e.i.r.p. and ≤ 10 mW/MHz	Detail ⁽¹³⁾	WLAN

Technical requirements for short-range radiocommunication devices				
	Frequency band (MHz)	Emission (Max. power)	Spurious emission (Max. power or min deterioration)	Type of devices or applications
	A	B	C	D
35	5 470-5 725	≤ 1 mW e.i.r.p. and ≤ 50 mW/MHz	Detail ⁽¹⁴⁾	WLAN
36	5 725-5 850	≤ 1 mW e.i.r.p. and ≤ 50 mW/MHz	Detail ⁽¹⁵⁾	WLAN
		≤ 25 mW e.i.r.p.	Detail ⁽¹⁶⁾	Other applications
37	10.5-10.55	≤ 100 mW e.i.r.p.	Detail ⁽¹⁷⁾	Wireless video transmitter
38	24-24.25	≤ 100 mW e.i.r.p.	Detail ⁽¹⁸⁾	Wireless video transmitter
				Other applications

⁽⁷⁾ Spurious emissions:

Frequency ranges \ State	$9 \text{ kHz} \leq f \leq 10 \text{ MHz}$	$10 \text{ MHz} \leq f \leq 30 \text{ MHz}$	$47 \text{ MHz} \leq f \leq 74 \text{ MHz}$ $87.5 \text{ MHz} \leq f \leq 118 \text{ MHz}$ $174 \text{ MHz} \leq f \leq 230 \text{ MHz}$ $470 \text{ MHz} \leq f \leq 862 \text{ MHz}$	other frequencies $30 \text{ MHz} \leq f \leq 1\,000 \text{ MHz}$
Operating	27 dB(μ A/m) descending 3 dB/8 octave	-3.5 dB(μ A/m)	4 nW	250 nW
Standby	6 dB(μ A/m) descending 3 dB/8 octave	-24 dB(μ A/m)		2 nW

⁽⁸⁾ Spurious emissions:

Frequency ranges \ State	$47 \text{ MHz} \leq f \leq 74 \text{ MHz}$ $87.5 \text{ MHz} \leq f \leq 118 \text{ MHz}$ $174 \text{ MHz} \leq f \leq 230 \text{ MHz}$ $470 \text{ MHz} \leq f \leq 862 \text{ MHz}$	other frequencies $f \leq 1\,000 \text{ MHz}$	other frequencies $f > 1\,000 \text{ MHz}$
Operating	4 nW	250 nW	1 μ W
Standby		2 nW	20 nW

(9) Spurious emissions:

State \ Frequency ranges	$30 \text{ MHz} \leq f \leq 1 \text{ GHz}$		$1,8 \text{ MHz} \leq f \leq 1,9 \text{ GHz}$ $5,15 \text{ GHz} \leq f \leq 5,3 \text{ GHz}$		$1 \text{ GHz} \leq f \leq 12,75 \text{ GHz}$	
	narrow band	wide band	narrow band	wide band	narrow band	wide band
Operating	-36 dBm	-86 dBm/Hz	-47 dBm	-97 dBm/Hz	-30 dBm	-80 dBm/Hz
Standby	-57 dBm	-107 dBm/Hz			-47 dBm	-97 dBm/Hz

(10) Spurious emissions:

State \ Frequency ranges	$47 \text{ MHz} \leq f \leq 74 \text{ MHz}$ $87.5 \text{ MHz} \leq f \leq 118 \text{ MHz}$ $174 \text{ MHz} \leq f \leq 230 \text{ MHz}$ $470 \text{ MHz} \leq f \leq 862 \text{ MHz}$	other frequencies $f \leq 1\,000 \text{ MHz}$	other frequencies $f > 1\,000 \text{ MHz}$
Operating	4 nW	250 nW	1 μ W
Standby	2 nW	2 nW	20 nW

(11) Spurious emissions:

State \ Frequency ranges	$47 \text{ MHz} \leq f \leq 74 \text{ MHz}$ $87.5 \text{ MHz} \leq f \leq 118 \text{ MHz}$ $174 \text{ MHz} \leq f \leq 230 \text{ MHz}$ $470 \text{ MHz} \leq f \leq 862 \text{ MHz}$	other frequencies $f \leq 1\,000 \text{ MHz}$	other frequencies $f > 1\,000 \text{ MHz}$
Operating	4 nW	250 nW	1 μ W
Standby		2 nW	20 nW

⁽¹²⁾ Spurious emissions:

Frequency ranges	47 MHz $\leq f \leq$ 74 MHz 87.5 MHz $\leq f \leq$ 118 MHz 174 MHz $\leq f \leq$ 230 MHz 470 MHz $\leq f \leq$ 862 MHz	other frequencies $f \leq$ 1 000 MHz	other frequencies $f >$ 1 000 MHz
State			
Operating	-54 dBm e.r.p. (bandwidth: 100 kHz)	-36 dBm e.r.p. (bandwidth: 100 kHz)	-30 dBm e.r.p. (bandwidth: 1 MHz)

⁽¹³⁾ Spurious emissions is the same as detail in Note ⁽²⁾.

⁽¹⁴⁾ Spurious emissions is the same as detail in Note ⁽²⁾.

⁽¹⁵⁾ Spurious emissions is the same as detail in Note ⁽²⁾.

⁽¹⁶⁾ Spurious emissions is the same as detail in Note ⁽¹⁾.

⁽¹⁷⁾ Spurious emissions is the same as detail in Note ⁽¹⁾.

⁽¹⁸⁾ Spurious emissions is the same as detail in Note ⁽¹⁾.
