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

SM Series

Sprectum 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*

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

(2009)

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.

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

** Unless otherwise specified by mutual agreement between given administrations, status given to SRDs in individual country does not engage any other countries.

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. electro-cardiograms 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

TABLE 2

Radiated power or magnetic field strength

Maximum radiated power or magnetic field-strength level	Frequency bands
−20 dB(μA/m) at 10 m	5-30 MHz
−15 dB(μA/m) at 10 m	148.5 kHz-5 MHz
−7 dB(μA/m) at 10 m	11.1-16 MHz 12.5-20 MHz
−8 dB(μA/m) at 10 m	400-600 kHz
−5 dB(μA/m) at 10 m	148.5-1 600 kHz 315-600 kHz
7 dB(μA/m) at 10 m	457 kHz 4 515 kHz 4 516 kHz (until 2010)
9 dB(μA/m) at 10 m	7 400-8 800 kHz 4 234 kHz 10.2-11.0 MHz
13.5 dB(μA/m) at 10 m	3 155-3 400 kHz
30 dB(μA/m) at 10 m	9-315 kHz (ULP-AMI only)
37.7 dB(μA/m) at 10 m	140-148.5 kHz
42 dB(μA/m) at 10 m	59.750-60.250 kHz 9070-119 kHz 135-140 kHz 6 765-6 795 kHz 13.553-13.567 MHz 26.957-27.283 MHz
60 dB(μA/m) at 10 m	13.553-13.567 MHz (RFID and electronic article surveillance (EAS) only)
72 dB(μA/m) at 10 m (at 30 kHz descending 3.5 dB/octave)	9.0-9059.75 kHz 60.25-70.0 kHz 119-135 kHz
50 nW[(1)]	87.5-108 MHz
25 μW[(1)]	401-402 MHz (MEDS only) 402-405 MHz (MICS only) 405-406 MHz (MEDS only)
0.1 mW	24.075-24.150 GHz
1 mW[(1)]	30-37.5 MHz 433.050-434.790 MHz
2 mW[(1)]	173.965-174.015 MHz
5 mW[(1)]	869.700-870.000 MHz

TABLE 2 (*end*)

Maximum radiated power or magnetic field-strength level	Frequency bands
10 mW[(1)]	26.957-27.283 MHz 29.7-47.0 MHz 40.660-40.700 MHz 138.2-138.45 MHz 169.400-169.475 MHz 169.4750-169.4875 MHz 169.4875-169.5875 MHz 169.5875-169.6000 MHz 169.4-174.0 MHz 433.050-434.790 MHz 434.040-434.790 MHz 863-865 MHz 868.600-868.700 MHz 869.200-869.300 MHz 869.300-869.400 MHz 2 400-2 483.5 MHz
20 mW[(1)]	1 7951 785-1 800 MHz
25 mW[(1)]	863-870 MHz 868.000-868.600 MHz 868.700-869.200 MHz 869.650-869.700 MHz 2 400-2 483.5 MHz 5 725-5 875 MHz 9 200-9 975 MHz 13.4-14 GHz
50 mW[(1)]	174-216 MHz 470-862 MHz 1 785-1 800 MHz

(1) Levels are either effective radiated power (e.r.p.) (below 1 000 MHz) or equivalent isotropically radiated power (e.i.r.p.) (above 1 000 MHz).

TABLE 3

Power level

Maximum power level	Frequency bands
100 mW[1]	26.990-27.000 MHz 27.040-27.050 MHz 27.090-27.100 MHz 27.140-27.150 MHz 27.190-27.200 MHz 34.995-35.225 MHz (for flying models only) 40.660-40.700 MHz 865.0-865.6 MHz[2] 2 400-2 483.5 MHz (for RLANs only) 17.1-17.3 GHz 24.050-24.250 GHz 61.0-61.5 GHz 122-123 GHz 244-246 GHz
200 mW[1]	5 150-5 350 MHz (indoor use only)
316 mW[1] (25 dBm)	57-66 GHz (Fixed outdoor installations are not allowed. The maximum mean e.i.r.p. density is limited to −2 dBm/MHz)
500 mW[1]	169.4-169.475 MHz 867.6-868.0 MHz[2] 869.400-869.650 MHz 2 446-2 454 MHz (railway applications and RFID outdoor use) 10.5-10.6 GHz
1 W[1]	5 470-5 725 MHz
2 W[1]	865.6-867.6 MHz[2] 5 795-5 815 MHz (for specific licensed applications only)
4 W[1]	2 446-2 454 MHz (for RFID indoor use only)
8 W[1])	5 795-5 815 MHz (for specific licensed applications only)
4 W[1]	2 446-2 454 MHz (for RFID indoor use only)
10 W[1] (40 dBm)	57-66 GHz (Restricted to indoor use. The maximum mean e.i.r.p. density is limited to 13 dBm/MHz)
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.	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 (All the bands above are designated for use by tank level probing radar)[3]

TABLE 3 (*end*)

Maximum power level	Frequency bands
55 dBm peak power[1] 50 dBm average power[1] 23.5 dBm average power[1] (pulsed radar only)	76-77 GHz

[1] Levels are either effective radiated power (e.r.p.) (below 1 000 MHz) or equivalent isotropically radiated power (e.i.r.p.) (above 1 000 MHz) or maximum mean e.i.r.p.

[2] After 2010 RFID may transmit in 4 designated high power channels of 200 kHz each at power levels up to 2 W e.r.p. The remainder of the band 865-868 MHz may be used for the low power response from the tag at power levels up to −20 dBm e.r.p.

[3] The power limit applies inside a closed tank and corresponds with a spectral density of −41.3 dBm/MHz e.i.r.p. outside a 500 litre test tank.

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

TABLE 4

General limits for any intentional transmitter

Frequency (MHz)	Electric field strength (μV/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 5

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

Frequency band	Electric field strength (μV/m)
$f \leq 322$ MHz	500
322 MHz $< f \leq$ 10 GHz	35
10 GHz $< f \leq$ 150 GHz	$3.5 \times f$ [1, 2]
150 GHz $< f$	500

[1] f (GHz).

[2] If $3.5 \times f > 500$ μV/m, the tolerable value is 500 μV/m.

6.4 The Republic of Korea

TABLE 6

The limit of electric field strength of the low power device

Frequency band	Electric field strength measured at the distance of 3 m (μV/m)
$f \leq 322$ MHz	500[(1)]
322 MHz < $f \leq 10$ GHz	35
$f \geq 10$ 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

In 1994, the European Radiocommunications Committee (ERC) adopted Recommendation ERC/REC 01-06 – Procedure for mutual recognition of type testing and type approval for radio equipment. This Recommendation is applicable to all kinds of radio equipment and all international standards adopted within the CEPT/ERC can be used as a basis for conformity assessment. This Recommendation aims at removing the requirement for testing the equipment in every country, but still includes the requirement to apply for conformity assessment in every CEPT country.

Further, ERC has adopted the Decision CEPT/ERC/DEC/(97)10 – Decision on the mutual recognition of conformity assessment procedures including marking of radio equipment and radio terminal equipment. This Decision (including the Decisions on the adoption of harmonized standards) will set the framework for CEPT wide collaboration in this field.

The purpose of marking equipment is to indicate its conformance to relevant European Commission (EC) Directives, ERC Decisions or Recommendations and national regulations.

In almost 100% of cases, requirements for marking and labelling 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.

Within European Union and European Free Trade Association (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.

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 7

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 control 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 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 μW/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 μW/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 8 to 10.

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 8.

TABLE 8

Characteristic	Value
Bandwidth	0.1 × 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

MCW systems are in Table 9.

TABLE 9

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 10

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

TABLE OF CONTENTS

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 Applications and frequency bands

Currently following applications and frequency bands are covered by annexes of Recommendation CEPT/ERC/REC 70-03. 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.

TABLE 11

Applications	Frequency bands	Notes
Non-specific short-range devices (primarily for telemetry, telecommand, alarms and data in general and other similar applications)		
	6 765-6 795 kHz	
	13.553-13.567 MHz	
	26.957-27.283 MHz	
	40.660-40.700 MHz	
	138.2-138.45 MHz	
	433.050-434.790 MHz	Power density limited to −13 (dBm/10 kHz) for wideband modulation with a bandwidth greater than 250 kHz
	434.040-434.790 MHz	
	863-870 MHz	FHSS, DSSS and other wideband modulation. Narrow/wideband modulation
	868.000-868.600 MHz	Narrow/wideband modulation. No channel spacing, however the whole stated frequency band may be used
	868.700-869.200 MHz	Narrow/wideband modulation. No channel spacing, however the whole stated frequency band may be used
	869.400-869.650 MHz	Narrow/wideband modulation. The whole stated frequency band may be used as one channel for high-speed data transmission
	869.700-870.000 MHz	Narrow/wideband modulation. No channel spacing, however the whole stated frequency band may be used

TABLE 11 (*continued*)

Applications	Frequency bands	Notes
Non-specific short-range devices (*cont.*)	2 400-2 483.5 MHz	
	5 725-5 875 MHz	
	24.00-24.25 GHz	
	61.0-61.5 GHz	
	122-123 GHz	
	244-246 GHz	
Tracking, tracing and data acquisition	456.9-457.1 kHz	Detection of avalanche victims
	169.4-169.475 MHz	Meter reading
	169.4-169.475 MHz	Asset tracking and tracing
Wideband data transmission systems (including WAS/RLANs)	2 400.0-2 483.5 MHz	For wideband modulations other then FHSS (e.g. DSSS, OFDM), the maximum e.i.r.p. density is limited to 10 mW/1 MHz
	5 150-5 250 MHz	Restricted to indoor use. The maximum mean e.i.r.p. density shall be limited to 0.25 mW/25 kHz in any 25 kHz band
	5 250-5 350 MHz	Restricted to indoor use. The maximum mean e.i.r.p. density shall be limited to 10 mW/MHz in any 1 MHz band
	5 470-5 725 MHz	Indoor as well as outdoor use allowed. The maximum mean e.i.r.p. density shall be restricted to 50 mW/MHz in any 1 MHz band
	17.1-17.3 GHz	
	57-66 GHz	Fixed outdoor installations are not allowed. The maximum mean e.i.r.p. density is limited to −2 dBm/MHz
	57-66 GHz	Restricted to indoor use. The maximum mean e.i.r.p. density is limited to 13 (dBm/MHz)
Railway applications	2 446-2 454 MHz	Transmitting only in presence of trains. 5 channels, each 1.5 MHz wide within the band 2 446-2 454 MHz
	27.090-27.100 MHz	Tele-powering and down-link signal for Balise/Eurobalise. May also be optionally used for the activation of the Loop/ Euroloop
	984-7 484 kHz	Transmitting only on receipt of a Balise / Eurobalise tele-powering signal from a train

TABLE 11 (*continued*)

Applications	Frequency bands	Notes
Railway applications (*cont.*)	516-8 516 kHz	Not intended for new applications, existing applications to be phased out by 2010
	7.3-23 MHz	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
Road transport and traffic telematics (RTTT)	5 795-5 805 MHz	
	5 805-5 815 MHz	Individual license required
	63-64 GHz	Vehicle to vehicle and road to vehicle systems
	76-77 GHz	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
	21.65-26.65 MHz	For automotive short-range radars (SRR).
	77-81 MHz	For automotive short-range radars (SRR)
	24.050-24.075 GHz	
	24.075-24.150 GHz	0.1 mW with no restriction. 100 mW ≤ 6 μs/40 kHz dwell time every 3 ms
	24.150-24.250 GHz	
Radiodetermination applications (including SRD radar systems, equipment for detecting movement and alert)	9 200-9 500 MHz	
	9 500-9 975 MHz	
	10.5-10.6 GHz	
	13.4-14.0 GHz	
	24.05-24.25 GHz	
	4.5-7.0 GHz	Tank level probing radar (TLPR)
	8.5-10.6 GHz	
	24.05-27.0 GHz	
	57-64 GHz	
	75-85 GHz	

TABLE 11 (*continued*)

Applications	Frequency bands	Notes
Radiodetermination applications (including SRD radar systems, equipment for detecting movement and alert) (*cont.*)	17.1-17.3 GHz	Ground-based synthetic aperture radar (GBSAR)
	30 MHz − 12.4 GHz	Ground and wall-probing radar
	2.2-8 GHz	Building material analysis
Alarms (including social alarms and alarms for security and safety)	868.6-868.7 MHz	The whole frequency band may also be used as one channel for high-speed data transmissions
	869.250-869.300 MHz	
	869.650-869.700 MHz	
	869.200-869.250 MHz	Social alarms
	869.300-869.400 MHz	
	169.4750-169.4875 MHz 169.5875-169.6000 MHz	Social alarms (exclusive use)
Model control	26.995, 27.045, 27.095, 27.145, 27.195 MHz	
	34.995-35.225 MHz 40.665, 40.675, 40.685, 40.695 MHz	Only for flying models
Inductive applications	9-90 kHz	In case of external antennas only loop coil antennas may be employed. Field-strength level descending 3 dB/octave at 30 kHz
	90-119 kHz	In case of external antennas only loop coil antennas may be employed
	119-135 kHz	In case of external antennas only loop coil antennas may be employed. Field-strength level descending 3 dB/octave at 30 kHz
Inductive applications (*cont.*)	135-140 kHz	In case of external antennas only loop coil antennas may be employed
	140-148.5 kHz	
	6 765-6 795 kHz	
	7 400-8 800 kHz	
	13.553-13.567 MHz	
	13.553-13.567 MHz	For RFID and EAS only
	26.957-27.283 MHz	
	10.200-11.000 MHz	
	3 155-3 400 kHz	In case of external antennas only loop coil antennas may be employed
	148.5 kHz − 5 MHz	
	5-30 MHz	
	400-600 kHz	For RFID only. In case of external antennas only loop coil antennas may be employed

TABLE 11 (*continued*)

Applications	Frequency bands	Notes
Radio microphones and assistive listening devices	29.7-47.0 MHz	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
	173.965-174.015 MHz	Aids for the hearing impaired
	863-865 MHz	
	174-216 MHz	On a tuning range basis. Individual license required
	470-862 MHz	
	1 785-1 795 MHz	Individual license required. 50 mW restricted to body worn microphones
	1 795-1 800 MHz	50 mW restricted to body worn equipment
	169.4000-169.4750 MHz	Aids for the hearing impaired
	169.4875-169.5875 MHz	
	169.4-174.0 MHz	Aids for the hearing impaired. On a tuning range basis
Radio frequency identification applications (RFID)	2 446-2 454 MHz	Power levels above 500 mW are restricted to use 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)
	865.0-865.6 MHz	
	865.6-867.6 MHz	
	867.6-868.0 MHz	
Active medical implants (AMIs) and their associated peripherals	402-405 MHz	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
	401-402 MHz	For ultra low power active medical implants and accessories covered by the applicable harmonized standard and not covered by band 402-405 MHz. Individual transmitters may combine adjacent 25 kHz channels for increased bandwidth up to 100 kHz

TABLE 11 (*end*)

Applications	Frequency bands	Notes
Active medical implants (AMIs) and their associated peripherals (*cont.*)	405-406 MHz	For ultra low power active medical implants and accessories covered by the applicable harmonized standard and not covered by band 402-405 MHz. Individual transmitters may combine adjacent 25 kHz channels for increased bandwidth up to 100 kHz
	9-315 kHz	The application is for ultra low power active medical implant systems using inductive loop techniques for telemetry
	315-600 kHz	The application is for animal implantable devices.
	30-37.5 MHz	The application is for ultra low power medical membrane implants for blood pressure measurements
	12.5-20 MHz	For ultra low power active medical implants and accessories covered by the applicable harmonized standard and not covered by band 402-405 MHz. Individual transmitters may combine adjacent 25 kHz channels for increased bandwidth up to 100 kHz
Wireless audio applications	863-865 MHz	
	864.8-865.0 MHz	Narrow-band analogue voice devices
	87.5-108.0 MHz	

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 to transpose European Standards for Telecommunications (ETSs or ENs) into national standards, and to withdraw any conflicting national standards.

With regard to SRDs, ETSI developed three generic standards (EN 300 220; EN 300 330 and EN 300 440) 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 European countries have EMC requirements, based on IEC and CISPR standards or in some cases on the ETSI EMC standards. In the EEA (EEA is EU and 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 may affix the CE marking to his radiocommunication products, based on a conformity certificate issued by a notified body for EMC (competent body). This body will base its certificates mainly on conformity with the relevant ETSI/CENELEC harmonized standards. most European harmonized standards in the EEA are based on IEC/CISPR standards.

The European countries outside the EEA mostly accept a test report from an accredited EEA laboratory 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 950 + 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 950.

The European countries outside the EEA, 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 950.

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

Currently all European countries which are members of CEPT, but that have not implemented the R&TTE Directive, have national specifications for radio equipment which are based on transposed ENs or ETSs 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 ERC and are dependent on the frequency range and the applications chosen. The average H-field strength/power level is 5 dB(μA/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

EN 300 220-1 V2.0.1 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 12.

TABLE 12

	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

Recommendation ERC/REC 01-06 covers the – Procedure for mutual recognition of type testing and type approval for radio equipment. This Recommendation is applicable to all kinds of radio equipment and all international standards adopted within the CEPT/ERC can be used as a basis for conformity assessment. This Recommendation aims at removing the requirement for testing the equipment in every country, but still includes the requirement to apply for conformity assessment in every CEPT country.

Further, ERC has adopted Decision CEPT/ERC/DEC/(97-10) – Decision on mutual recognition procedures including marking of conformity assessment of radio and radio terminal equipment. This Decision (including the decisions on the adoption of harmonized standards) will set the framework for CEPT wide collaboration in this field.

The purpose of marking an equipment is to indicate its conformance to relevant EC Directives, 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 EEA member countries the placing on the market and free movement of SRDs are 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).

8 Update of Recommendation CEPT/ERC/REC 70-03

Recommendation CEPT/ERC/REC 70-03 may be downloaded free of charge from the website of the European Communications Office: (http://www.ero.dk/).

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 meters 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 μV.

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 μV 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 13

General limits for any intentional transmitter

Frequency (MHz)	**Field strength (μV/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 14 contains exceptions or exclusions (indicated) to the general limits, otherwise the general limits can still be used.

TABLE 14

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 µV/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 µW input to final RF stage	
525-1 705 kHz	Any	100 µW input to final RF stage	
	Transmitters on grounds of educational institutions	24 000/f (kHz) µV/m at 30 m outside of campus boundary	Q
	Carrier current and leaky coax systems	15 µV/m at 47 715/f (kHz) m from cable	
1.705-10 MHz	Any, when 6 dB bandwidth ≥ 10% of centre frequency	100 µV/m at 30 m	A
	Any, when 6 dB bandwidth < 10% of centre frequency	15 µV/m at 30 m or bandwidth in (kHz)/f (MHz)	
13.553-13.567 MHz	Any 15.225	10 000 µV/m at 30 m	Q
26.96-27.28 MHz	Any 15.227	10 000 µV/m at 3 m	A
40.66-40.7 MHz	Intermittent control signals	2 250 µV/m at 3 m	A or Q
	Periodic transmissions	1 000 µV/m at 3 m	
	Any 15.229	1 000 µV/m at 3 m	Q
	Perimeter protection systems	500 µV/m at 3 m	A
43.71-44.49 MHz	Cordless telephones	10 000 µV/m at 3 m	
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	100 µV/m at 3 m	Q

TABLE 14 (*continued*)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
70-72 MHz	Exclusively either intermittent control signals	1 250 μV/m at 3 m	A or Q
	Or periodic transmissions	500 μV/m at 3 m	
	Or non-residential perimeter protection systems	100 μV/m at 3 m	Q
72-73 MHz	Auditory assistance devices	80 000 μV/m at 3 m	A
	Intermittent control signals	1 250 μV/m at 3 m	A or Q
	Periodic transmissions	500 μV/m at 3 m	
74.6-74.8 MHz	Auditory assistance devices	80 000 μV/m at 3 m	A
	Intermittent control signals	1 250 μV/m at 3 m	A or Q
	Periodic transmissions	500 μV/m at 3 m	
75.2-76 MHz	Auditory assistance devices	80 000 μV/m at 3 m	A
	Intermittent control signals	1 250 μV/m at 3 m	A or Q
	Periodic transmissions	500 μV/m at 3 m	
76-88 MHz	Exclusively either intermittent control signals	1 250 μV/m at 3 m	
	Or periodic transmissions	500 μV/m at 3 m	
76-88 MHz (*cont.*)	Or non-residential perimeter protection systems	100 μV/m at 3 m	Q
88-108 MHz	Intermittent control signals	1 250 μV/m at 3 m	A or Q
	Periodic transmissions	500 μV/m at 3 m	
	Any 15.239 (≤ 200 kHz bandwidth)	250 μV/m at 3 m	A
121.94-123 MHz	Intermittent control signals	1 250 μV/m at 3 m	A or Q
	Periodic transmissions	500 μV/m at 3 m	
138-149.9 MHz	Intermittent control signals	$(625/11) \times f$ (MHz) − (67 500/11) μV/m at 3 m	
	Periodic transmissions	$(250/11) \times f$ (MHz) − (27 000/11) μV/m at 3 m	
150.05-156.52475 MHz	Intermittent control signals	$(625/11) \times f$ (MHz) − (67 500/11) μV/m at 3 m	
	Periodic transmissions	$(250/11) \times f$ (MHz) − (27 000/11) μV/m at 3 m	
156.52525-156.7 MHz	Intermittent control signals	$(625/11) \times f$ (MHz) − (67 500/11) μV/m at 3 m	
	Periodic transmissions	$(250/11) \times f$ (MHz) − (27 000/11) μV/m at 3 m	

TABLE 14 (*continued*)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
156.9-162.0125 MHz	Intermittent control signals	$(625/11) \times f$ (MHz) − (67 500/11) μV/m at 3 m	A or Q
	Periodic transmissions	$(250/11) \times f$ (MHz) − (27 000/11) μV/m at 3 m	A or Q
167.17-167.72 MHz	Intermittent control signals	$(625/11) \times f$ (MHz) − (67 500/11) μV/m at 3 m	A or Q
	Periodic transmissions	$(250/11) \times f$ (MHz) − (27 000/11) μV/m at 3 m	A or Q
173.2-174 MHz	Intermittent control signals	$(625/11) \times f$ (MHz) − (67 500/11) μV/m at 3 m	A or Q
	Periodic transmissions	$(250/11) \times f$ (MHz) − (27 000/11) μV/m at 3 m	A or Q
174-216 MHz	Exclusively either intermittent control signals	3 750 μV/m at 3 m	A or Q
	Or periodic transmissions	1 500 μV/m at 3 m	A or Q
	Or biomedical telemetry devices	1 500 μV/m at 3 m	A
216-240 MHz	Intermittent control signals	3 750 μV/m at 3 m	A or Q
	Periodic transmissions	1 500 μV/m at 3 m	A or Q
285-322 MHz	Intermittent control signals	$(125/3) \times f$ (MHz) − (21 250/3) μV/m at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f$ (MHz) − (8 500/3) μV/m at 3 m	A or Q
335.4-399.9 MHz	Intermittent control signals	$(125/3) \times f$ (MHz) − (21 250/3) μV/m at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f$ (MHz) − (8 500/3) μV/m at 3 m	A or Q
410-470 MHz	Intermittent control signals	$(125/3) \times f$ (MHz) − (21 250/3) μV/m at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f$ (MHz) − (8 500/3) μV/m at 3 m	A or Q
470-512 MHz	Exclusively either intermittent control signals	12 500 μV/m at 3 m	A or Q
	Or periodic transmissions	5 000 μV/m at 3 m	A or Q
512-566 MHz	Exclusively either intermittent control signals	12 500 μV/m at 3 m	A or Q
	Or periodic transmissions	5 000 μV/m at 3 m	A or Q
	Or biomedical telemetry devices for hospitals	200 μV/m at 3 m	Q

TABLE 14 (*continued*)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
566-608 MHz	Exclusively either intermittent control signals	12 500 µV/m at 3 m	A or Q
	Or periodic transmissions	5 000 µV/m at 3 m	A or Q
614-806 MHz	Exclusively either intermittent control signals	12 500 µV/m at 3 m	A or Q
	Or periodic transmissions	5 000 µV/m at 3 m	A or Q
806-890 MHz	Intermittent control signals	12 500 µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
890-902 MHz	Intermittent control signals	12 500 µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
	Signals used to measure the characteristics of a material	500 µV/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 µV/m at 3 m	A
	Any 15.249	50 000 µV/m at 3 m	Q
	Signals used to measure the characteristics of a material	500 µV/m at 30 m	A
	Intermittent control signals	12 500 µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
928-940 MHz	Intermittent control signals	12 500 µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
	Signals used to measure the characteristics of a material	500 µV/m at 30 m	A
940-960 MHz	Intermittent control signals	12 500 µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
1.24-1.3 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
1.427-1.435 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
1.6265-1.6455 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
1.6465-1.66 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
1.71-1.7188 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A

TABLE 14 (*continued*)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
1.7222-2.2 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/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 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
2.39-2.4 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Asynchronous personal communications service devices	Varies	
	Periodic transmissions	5 000 µV/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 µV/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 µV/m at 3 m	A
	Any 15.249	50 000 µV/m at 3 m	A
2.465-2.4835 GHz	Spread spectrum transmitters	1 W output power	
	Digital modulation	1 W output power	A
	Any 15.249	50 000 µV/m at 3 m	A
2.5-2.655 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
2.9-3.26 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
	AVI systems	3 000 µV/m per MHz of bandwidth at 3 m	A
3.267-3.332 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
	AVI systems	3 000 µV/m per MHz of bandwidth at 3 m	A
3.339-3.3458 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
	AVI systems	3 000 µV/m per MHz of bandwidth at 3 m	A

TABLE 14 (*continued*)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
3.358-3.6 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
	AVI systems	3 000 µV/m per MHz of bandwidth at 3 m	A
4.4-4.5 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/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 µV/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 µV/m at 3 m	A
5.46-5.725 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/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
5.725-5.825 GHz	National information infrastructure devices	Output power: lesser of 1 W or 17 dBm + 10 log *B* (where *B* = 26 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 µV/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 µV/m at 3 m	A
	Any 15.249	50 000 µV/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 µV/m at 3 m	A
5.85-5.875 GHz	Any	50 000 µV/m at 3 m	A
5.875-7.25 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A

TABLE 14 (*continued*)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
7.75-8.025 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
8.5-9 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
9.2-9.3 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
9.5-10.5 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
10.5-10.55 GHz	Field disturbance sensors	2 500 000 µV/m at 3 m	A
	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic Transmissions	5 000 µV/m at 3 m	A
10.55-10.6 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
12.7-13.25 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
13.4-14.47 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
14.5-15.35 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
16.2-17.7 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
21.4-22.01 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
23.12-23.6 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
24-24.075 GHz	Any 15.249	250 000 µV/m at 3 m	A
24.075-24.175 GHz	Field disturbance sensors	2 500 000 µV/m at 3 m	A
	Any 15.249	250 000 µV/m at 3 m	A
24.175-24.25 GHz	Any 15.249	250 000 µV/m at 3 m	A
24.25-31.2 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
31.8-36.43 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
36.5-38.6 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A

TABLE 14 (*end*)

Frequency band	Type of use	Emission limit	Detector A-average Q-quasi-peak
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 15

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 16

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 μV/m and W?

Watts (W) are the units used to describe the amount of power generated by a transmitter. Microvolts per meter (μV/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 (μV/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(μA/m) at 10 m (in 9 to 50 kHz, quasi-peak detector)
		72 dB(μA/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(μA/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(μA/m) at 10 m (quasi-peak detector)
	Frequency tolerance:	100×10^{-6}
	Spurious emission limit:	9 dB(μA/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(μA/m) at 10 m (in 315 kHz to 1 MHz, quasi-peak detector)
	−15 dB(μA/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 17

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 18

Frequency range	Testing bandwidth	Emission limit	Detector
9-150 kHz	200 kHz (6 dB)	27 dB(μA/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(μA/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

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 19

Frequency range	Testing bandwidth	Emission limit	Detector
9-150 kHz	200 kHz (6 dB)	6 dB(μA/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(μA/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.

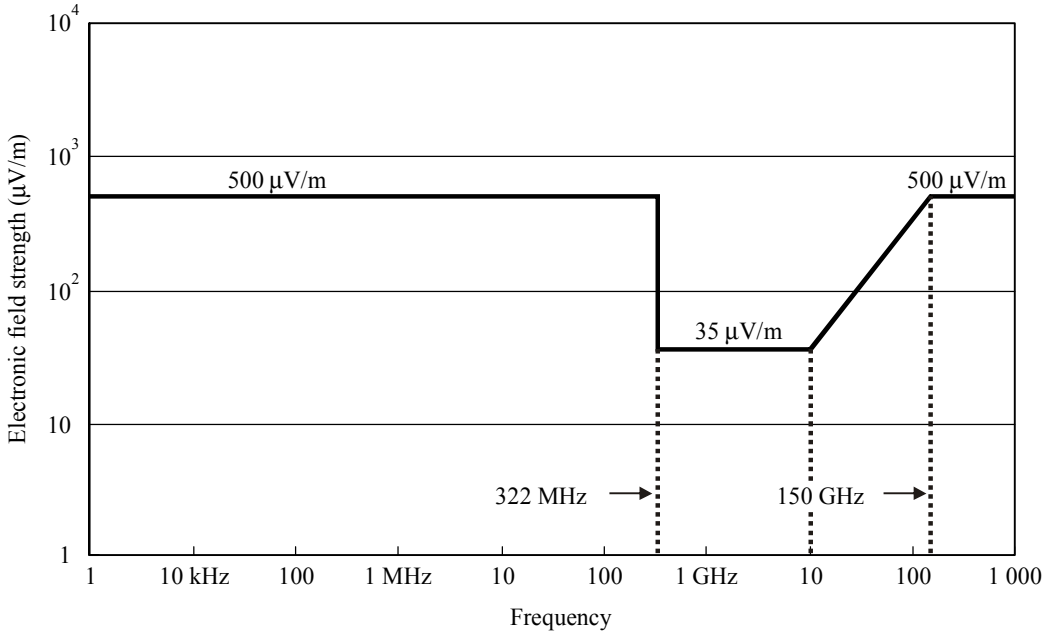
Radio stations listed in § 1) and 3) of Article 4 of the Radio Law:

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*



* If 10 GHz < (GHz) 150 GHz and 3.5 > 500 μV/m, the tolerable value is 500 μV/m.

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TABLE 20

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

Frequency band	Electric field strength (μV/m)
$f \leq 322$ MHz	500
322 MHz < $f \leq 10$ GHz	35
10 GHz < $f \leq 150$ GHz	$3.5 \times f$ (1), (2)
150 GHz < f	500

(1) f (GHz).

(2) If $3.5 \times f > 500$ μV/m, the tolerable value is 500 μV/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 21

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
Telemeter, telecontrol and data transmission					
–	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	≤ 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 21 (*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
Telemeter, telecontrol and data transmission					
	1 216.5375-1 216.9875 (25 kHz spacing) 1 252.5375-1 252.9875 (25 kHz spacing)	≤ 16			
Wireless telephone					
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) 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)	≤ 8.5	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	7 µV
F2D, F3E	413.7-414.14375 (6.25 kHz spacing) 454.05-454.19375 (6.25 kHz spacing)	≤ 8.5	1.6 mW (2.14 dBm)	≤ 1 mW ≤ (2.14 dBi)	Not required
Radio pager					
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
Radio microphone					
F1D, F1E, F2D, F3E, F7D, F7E, F7W, F8E, F8W, F9W, D1D, D1E, D7D, D7E, D7W, G1D, G1E, G7D, G7E, G7W or N0N	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 21 (*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
Radio microphone					
F3E, F8W, F2D or F9W	322.025-322.15 (25 kHz spacing) 322.25-322.4 (25 kHz spacing)	≤ 30	≤ 1.6 mW (2.14 dBm)	≤ 1 mW ≤ 2.14 dBi	Not required
F3E or F8W	74.58,74.64,74.70,74.76	≤ 60	≤ 16 mW (12.14 dBm)	≤ 10 mW ≤ 2.14 dBi	Not required
Medical telemeter					
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	≤ 1.6 mW (2.14 dBm)	≤ 1 mW ≤ 2.14 dBi	Not required
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			
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	
Hearing aid					
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 21 (*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
Hearing aid					
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			
PHS (land mobile station)					
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
Wireless LAN					
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 21 (*continued*)

<table>
<tr><th>Type of emission</th><th>Frequency band (MHz)</th><th>Occupied bandwidth (kHz)</th><th>Power level or spectral density (e.i.r.p.)</th><th>Antenna power and antenna gain</th><th>Carrier sense</th></tr>
<tr><td colspan="6">Wireless LAN</td></tr>
<tr><td rowspan="2">SS (DS), OFDM or others</td><td>5 150-5 250 (indoor use)</td><td rowspan="2">20 MHz system:
≤ 19 MHz
40 MHz system:
≤ 38 MHz</td><td>20 MHz system:
≤ 10 mW/MHz
40 MHz system:
≤ 5 mW/MHz</td><td rowspan="2">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.</td><td>100 mV/m
DFS/
TPC is not required.</td></tr>
<tr><td>5 250-5 350 (indoor use)</td><td>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</td><td>100 mV/m
DFS/
TPC is required for the key station.

DFS/
TPC is not required for the station controlled by the key station</td></tr>
<tr><td></td><td>5 470-5 725</td><td>≤ 19.7 MHz</td><td>≤ 50 mW/MHz
(17 dBm/MHz)</td><td></td><td></td></tr>
<tr><td colspan="6">Millimetre-wave radar</td></tr>
<tr><td>–</td><td>60.5 GHz
76.5 GHz</td><td>≤ 500 MHz</td><td>100 W
50 dBm</td><td>≤ 10 mW
≤ 40 dBi</td><td>Not required</td></tr>
<tr><td colspan="6">Radio stations for cordless phones</td></tr>
<tr><td>F1D, F2A, F2B, F2C, F2D, F2N, F2X or F3E</td><td>253.8625-254.9625
(12.5 kHz spacing)
380.2125-381.3125
(12.5 kHz spacing)</td><td>≤ 8.5</td><td>≤ 10 mW
(10 dBm)</td><td>–</td><td>2 μV</td></tr>
<tr><td colspan="6">Radio stations for low-power security systems</td></tr>
<tr><td rowspan="2">F1D, F2D or G1D</td><td>426.25-426.8375
(12.5 kHz spacing)</td><td>≤ 8.5</td><td rowspan="2">≤ 10 mW
(10 dBm)</td><td rowspan="2">–</td><td rowspan="2">Not required</td></tr>
<tr><td>426.2625-426.8375
(25 kHz spacing)</td><td>> 8.5
≤ 16</td></tr>
<tr><td colspan="6">Radio stations for digital cordless phones</td></tr>
<tr><td>G1C, G1D, G1E, G1F, G1X, G1W, G7C, G7D, G7E, G7F, G1X or G7W</td><td>1 893.65-1 905.95
(300 kHz spacing)</td><td>≤ 288</td><td>≤ 25 mW
(14 dBm)</td><td>≤ 10 mW
≤ 4 dBi</td><td>159 μV</td></tr>
</table>

TABLE 21 (*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
Mobile land stations for dedicated short-range communication (DSRC) system					
A1D G1D	5.815-5.845 GHz (5 MHz spacing)	≤ 4.4 MHz	≤ 100 mW (20 dBm)	≤ 10 mW ≤ 10 dBi	Not required
RF identification (RFID) systems					
–	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	
Medical implant communication systems					
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
Sensors for detecting or measuring mobile objects					
–	10.525 GHz (indoor use)	≤ 40 MHz	≤ 2.5 W (34 dBm)	≤ 10 mW ≤ 24 dBi	–
	24.15 GHz	≤ 76 MHz			
Quasi-millimetre-wave communication systems					
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 21 (*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
Monitoring systems of animal's position					
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
Ultra wide band systems for communication applications					
	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 22

No.	Application	Frequency bands/ frequencies	Maximum field strength/RF output power	Remarks
1	Low power devices	0-322 MHz*	500 μV/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 μV/m @ 3 m	
		10-150 GHz*	3.5f μV/m @ 3 m1)	
		Above 150 GHz*	500 μV/m @ 3 m	
2	Inductive applications	9-30 kHz	72 dB(μA/m) @ 10 m	Detector type is quasi-peak mode 2) *f*: frequency (kHz).
		30-90 kHz	72 − 10 log(*f*/30) dB(μA/m) @ 10 m2)	
		90-110 kHz	42 dB(μA/m) @ 10 m	
		110-135 kHz	72 − 10log(f/30) dB(μA/m) @ 10 m2)	
		135-140 kHz	42 dB(μA/m) @ 10 m	
		140-148 kHz	37.5 dB(μA/m) @ 10 m	
		148-150 kHz	14.8 dB(μA/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 22 (*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 22 (*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 MHz ≤ OBW ≤ 20 MHz Nominal antenna gain is 7 dBi
			5 mW/MHz	20 MHz ≤ OBW ≤ 40 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 22 (*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.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(μV/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 22 (*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 23

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 24

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 equipment[1] in Brazil

1 Introduction

In 2008, Anatel republished the Regulation on Restricted Radiation Radio Communications Equipment[2] 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.

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[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 tervice (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 25

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 26

General emission limits

Frequency (MHz)	Field strength (μV/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 (μV/m)/m at a distance of 3 m from the emitter for carrier frequency emissions;

– 500 (μV/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 (μV/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 27

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 (μV/m)	Field strength of harmonics (μV/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 28

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 μV/m at 3 m	A or Q
	Periodic transmissions	1 000 μV/m at 3 m	A or Q
	Any	1 000 μV/m at 3 m	Q
	Perimeter protection systems	500 μV/m at 3 m	A
54-70 MHz	Exclusively non-residential perimeter protection systems	100 μV/m at 3 m	Q
	Wireless microphone	50 mW	
	Telemetry devices	50 mW	
70-72 MHz	Intermittent control signals	1 250 μV/m at 3 m	A or Q
	Periodic transmissions	500 μV/m at 3 m	A or Q
	Non-residential perimeter protection systems	100 μV/m at 3 m	Q
	Wireless microphone	50 mW	
72-73 MHz	Intermittent control signals	1 250 μV/m at 3 m	A or Q
	Periodic transmissions	500 μV/m at 3 m	A or Q
74.6-74.8 MHz	Intermittent control signals	1 250 μV/m at 3 m	A or Q
	Periodic transmissions	500 μV/m at 3 m	A or Q

TABLE 28 (*continued*)

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

TABLE 28 (*continued*)

Frequency band	Type of use	Emission limit	Detector A-Average Q-Quasi-peak
216-225 MHz	Intermittent control signals	3 750 µV/m at 3 m	A or Q
	Periodic transmissions	1 500 µV/m at 3 m	A or Q
225-240 MHz	Intermittent control signals	3 750 µV/m at 3 m	A or Q
	Periodic transmissions	1 500 µV/m at 3 m	A or Q
	Indoor sound system	580 000 µV/m at 3 m	
240-242.95 MHz	Indoor sound system	580 000 µV/m at 3 m	
243-270 MHz	Indoor sound system	580 000 µV/m at 3 m	
285-322 MHz	Intermittent control signals	$(125/3) \times f$(MHz) − (21 250/3) µV/m at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f$(MHz) − (8 500/3) µV/m at 3 m	A or Q
335.4-399.9 MHz	Intermittent control signals	$(125/3) \times f$(MHz) − (21 250/3) µV/m at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f$(MHz) − (8 500/3) µV/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	$(125/3) \times f$(MHz) − (21 250/3) µV/m at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f$(MHz) − (8 500/3) µV/m at 3 m	A or Q
433-435 MHz	Intermittent control signals	$(125/3) \times f$(MHz) − (21 250/3) µV/m at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f$(MHz) − (8 500/3) µV/m at 3 m	A or Q
	Any	10 mW (e.i.r.p.)	
462.53-462.74 MHz	Intermittent control signals	$(125/3) \times f$(MHz) − (21 250/3) µV/m at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f$(MHz) − (8 500/3) µV/m at 3 m	A or Q
	General usage radio equipment	500 mW (e.r.p.)	
462.74-467.53 MHz	Intermittent control signals	$(125/3) \times f$(MHz) − (21 250/3) µV/m at 3 m	A or Q
	Periodic transmissions	$(50/3) \times f$(MHz) − (8 500/3) µV/m at 3 m	A or Q

TABLE 28 (*continued*)

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

TABLE 28 (*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 µV/m at 30 m	A
	Intermittent control signals	12 500 µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
928-940 MHz	Intermittent control signals	12 500 µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
	Signals used to measure the characteristics of a material	500 µV/m at 30 m	A
940-944 MHz	Intermittent control signals	12 500 µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
944-948 MHz	Intermittent control signals	12 500µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
	Wireless PABX system	250 mW	
948-960 MHz	Intermittent control signals	12 500 µV/m at 3 m	A or Q
	Periodic transmissions	5 000 µV/m at 3 m	A or Q
1.24-1.3 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
1.427-1.435 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
1.6265-1.6455 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
1.6465-1.66 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
1.71-1.7188 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
1.7222-2.2 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/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 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
2.39-2.4 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/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 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A

TABLE 28 (*continued*)

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

TABLE 28 (*end*)

Frequency band	Type of use	Emission limit	Detector A-Average Q-Quasi-peak
14.5-15.35 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
16.2-17.7 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/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 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
23.12-23.6 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
24.25-31.2 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
31.8-36.43 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/m at 3 m	A
36.5-38.6 GHz	Intermittent control signals	12 500 µV/m at 3 m	A
	Periodic transmissions	5 000 µV/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 29

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(μA/m) at 10 m	Non-specific
9.0-59.75 kHz	72 dB(μA/m) at 10 m	Non-specific
59.750-60.250 kHz	42 dB(μA/m) at 10 m	Non-specific
60.250-70.000 kHz	69 dB(μA/m) at 10 m	Non-specific
70-119 kHz	42 dB(μA/m) at 10 m	Non-specific
119-135 kHz	66 dB(μA/m) at 10 m	Non-specific
135-140 kHz	42 dB(μA/m) at 10 m	Non-specific
140-148.5 kHz	37.7 dB(μA/m) at 10 m	Non-specific
148.5 kHz − 5 MHz	−15 dB (μA/m) at 10 m	Non-specific
400-600 kHz	−8 dB(μA/m) at 10 m	Non-specific
315-600 kHz	−5 dB(μA/m) at 10 m	Non-specific
3 155-3 195 kHz	13.5 dB(μA/m) at 10 m	Wireless hearing aids
3 195-3 400 kHz	13.5 dB(μA/m) at 10 m	Non-specific
5-30 MHz	−20 dB(μA/m) at 10 m	Non-specific
6 765-6 795 kHz	42 dB(μA/m) at 10 m	Non-specific
7 400-8 800 kHz	9 dB(μA/m) at 10 m	Non-specific
10.2-11.0 MHz	9 dB(μA/m) at 10 m	Non-specific
11.1-20 MHz	−7 dB(μA/m) at 10 m	Non-specific
13.553-13.567 MHz	60 dB(μA/m) at 10 m	RFID and EAS only
26.957-27.283 MHz	42 dB(μA/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 29 (*end*)

Frequency range	Max radiated power or magnetic field strength	Application notes
401-402 MHz 405-406 MHz	25 µW	For microphones
402-405 MHz	25 µW	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 30

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