Low-power Radio-frequency Devices Technical Regulations

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Preface

This regulation is formulated based on Section 1 of Article 50 of the Telecommunications Act. It consists of five chapters: Chapter 1 defines related terminology; Chapter 2 stipulates general requirements for the operating bands, radiated field intensity, performances and manufacture, installation, possession, import and sales of equipment. Low-power radio-frequency devices in this chapter are unrestricted unless otherwise stipulated by other laws codes; Chapter 3 and Chapter 4 outline specifications for conformity. As such these two chapters place limitations on the frequency bands and radiated field intensity and correspond to the relevant frequency bands and types of device. Those not stipulated in these two Chapters shall comply with the provisions of Chapter 2; Chapter 5 covers test requirements of type approvals on low-power radio-frequency devices.

1 Terminology

1.1 Radio frequency (RF) energy: Electromagnetic energy at any frequency in the radio spectrum, located in the frequency range between 9 kHz and 300 GHz.

1.2 Carrier: Radio frequency energy generated by Low power radio frequency devices before modulation. In other words, the carrier wave without being modulated.

1.3 Spurious emissions: Emissions 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.

1.4 Out-of-band emissions: Due to modulation process, emissions on a frequency (or frequencies) which are outside the necessary bandwidth. The spurious emission is exclusive.

1.5 Unwanted emissions: Encompass spurious emissions and out-of-band emissions.

1.6 Necessary bandwidth: Under regulations, the bandwidth required to ensure necessary speed and quality of transmitted information.

1.7 Instantaneous frequency: The time rate of change in phase in radians divided by 2π; the unit is Hz.

1.8 Peak frequency deviation: Half of the range between the maximum and minimum values of the instantaneous frequency.

1.9 Harmful interference: Any emission, radiation or induction that endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radio communications service operation served by legal radio communication business enterprise.

1.10 Damped waves: The strength of the radio wave increases rapidly and then decreases gradually until nil.

1.11 Effective Radiated Power (ERP): The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

1.12 Equivalent isotropically radiated power (EIRP): The product of the power supplied to the antenna and the antenna gain.The antenna gain is expressed relative to an ideal (theoretical) isotropic antenna.

1.13 Maximum Conducted Output Power:The total transmitting power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible, the maximum conducted output power is the highest total transmit power occurring in any mode.

2 General requirements

2.1 The low-power radio-frequency devices shall be self-contained with no external or readily accessible controls which may be adjusted to permit operation in a manner inconsistent with the provisions.

2.2 Antenna requirement: Low-power radio frequency transmitter or transceiver(receiver) shall utilize a permanently, semi-permanently attached antenna or uses a unique coupling of the antenna and at any cable connector between the transmitter and the antenna. The antenna shall be an omni-directional type. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector or other than authorized is prohibited. Such standard connectors are for example: BNC, F type, N type, M type, UG type, RCA, SMA, SMB, and other standard type antenna connectors.

2.3 For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall be less than or equal the limits in the following table, as measured using a 50 [mu]H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 – 56(Note)	56 – 46(Note)
0.5-5	56	46
5-30	60	50

Note: Decreases with the logarithm of the frequency.

2.4 Low-power radio-frequency devices that produce damped waves are prohibited.

2.5 Low-power radio-frequency devices must not be altered by changing the frequency, enhancing emission power, adding an external antenna, and modification of original design characteristic or function.

2.6 The operation of the low-power radio-frequency devices shall be subject to the conditions that no harmful interference is caused. The user must cease operating the device immediately should harmful interference be caused and shall not resume until the condition causing the harmful interference has been corrected.
Moreover, the interference must be accepted that it may be caused by the operation of authorised communications, or ISM equipment.

2.7 Additional regulations shall apply except for this standard. The fundamental frequency of any low-power radio-frequency devices shall be restricted in any of the operation bands listed below; spurious emissions shall be permitted in any of frequency band listed below and shall meet the field strength requirement of 2.8:

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)
0.090 ～ 0.110	322.00 ～ 335.40	3500.0 ～ 4400.0
0.490 ～ 0.510	399.90 ～ 410.00	4500.0 ～ 5250.0
2.172 ～ 2.198	485.00 ～ 510.00	5350.0 ～ 5460.0
3.013 ～ 3.033	608.00 ～ 614.00	7250.0 ～ 7750.0
4.115 ～ 4.198	703.00 ～ 748.00	8025.0 ～ 8500.0
5.670 ～ 5.690	758.00 ～ 803.00	9000.0 ～ 9200.0
6.200 ～ 6.300	825.00 ～ 915.00	9300.0 ～ 9500.0
8.230 ～ 8.400	930.00 ～ 1240.0	10600 ～ 12700
12.265 ～ 12.600	1300.0 ～ 1427.0	13250 ～ 13400
13.340 ～ 13.430	1435.0 ～ 1626.5	14470 ～ 14500
14.965 ～ 15.020	1660.0 ～ 1785.0	15350 ～ 16200

16.700 ～ 16.755	1805.0 ～ 1880.0	17700 ～ 21400
19.965 ～ 20.020	1885.0 ～ 1900.0	22010 ～ 23120
25.500 ～ 25.700	1905.0 ～ 1985.0	23600 ～ 24000
37.475 ～ 38.275	2010.0 ～ 2025.0	31200 ～ 31800
73.500 ～ 75.400	2110.0 ～ 2170.0	36430 ～ 36500
108.00 ～ 138.00	2200.0 ～ 2300.0	38600 +
149.90 ～ 150.05	2310.0 ～ 2390.0	
156.70 ～ 156.90	2483.5 ～ 2900.0	
162.01 ～ 167.17	3260.0 ～ 3267.0	
167.72 ～ 173.20	3332.0 ～ 3339.0	
240.00 ～ 285.00	3345.8 ～ 3358.0	)

2.8 Additional regulations shall applyexcept for this standard, the emissions from the low-power radio-frequency devices shall be less than or equal the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges.

Frequency (MHz)	Field strength (micro-volts/meter)	Measurement distance (meters)
0.009 - 0.490 (included)	2,400/Freq.(kHz)	300
0.490 (excluded) - 1.705 (included)	24,000/Freq.(kHz)	30
1.705 (excluded) - 30 (excluded)	30	30
30 (included) - 88 (included)	100	3
88 (excluded) -216 (included)	150	3
216 (excluded) -960 (included)	200	3
above 960 (excluded)	500	3

2.9 The field strength radio frequency 9-90 kHz, 110-490 kHz and 1000 MHz above stipulated in the above table shall be measured according to an average detector and comply with Section 5.15.2, while others shall be measured using a CISPR quasi-peak detector. Those not specified above shall comply with Section 5.5 and the frequency bands measurement of radiated emission shall accord with Section 5.14.

2.10 The low-power radio-frequency devices on the market must be accompanied with operation manual or instructions. Sample copies for of both should be submitted for review together with the device approval application (manual in draft form shall be deemed acceptable temporarily but final copies must also be submitted thereafters.) The operation manual shall contain all the necessary information for proper installation and operation of the device by the users. The necessary contents are:

2.10.1 The control, adjust, and on/off operation of the device to does not violate Administrative Regulations on Low Power Radio Waves Radiated Devices.

2.10.2 Warnings against any adjustments being made to the device that may violate regulations. The manual shall suggest that all these adjustments be carried out or be monitored by a specialist who has expertise on radio frequency devices maintenance.

2.10.3 Warnings against any replacements of components (ICs, transistors, etc) that may lead to the violation to the regulations.

2.10.4 Articles 12 and 14 of Administrative Regulations on Low Power Radio Waves Radiated Devices.

2.10.5 Applications for use in aviation model or similar remote control shall conform to the regulations of the business authority and the aviation model.

2.11 If the transmitter and receiver of the low-power radio-frequency device are sold in one set, the corresponding type approval review documents shall be submitted; otherwise the transmitter and receiver should be applied for approval together. The receiver radiated field strength must not exceed the emission specified in Section 2.8 and the receiver shall not receive, demodulate frequency listed in Section 2.7.

2.12 The characteristic of low-power radio-frequency devices shall be test in accordance with this regulation; those not stipulated shall be tested per CNS standards. If in-country standards are not found, they shall be tested based on IEEE, ANSI,ETSI EN standards and FCC 47 CFR PART 2,KDB,ARIB STD-T67 associated test requirements.

3 Conformance specifications (by frequency ranges)

3.1 Frequency bands:1.705 MHz - 37 MHz.

3.1.1 Type of device: any radiated device.

3.1.1.1 Frequency bands: 1.705 MHz - 10 MHz

3.1.1.2 Fundamental emission:

(1) If the bandwidth of the emission is less than 10% of the center frequency, the field strength shall be less than or equal to 15 microvolts/meter or (the bandwidth of the device in kHz) divided by (the center frequency of the device in MHz) microvolts/meter at a distance of 30 meters, whichever is the higher level.

(2) If the bandwidth of the emission is equal or greater than 10% of the center frequency, the field strength of any emission within the band 1.705-10.0 MHz shall be less than or equal to 100 microvolts/meter at a distance of 30 meters.

(3) The bandwidth of the preceding two paragraphs indicates the width between two measurement signal points, which are the upper and lower sides of the central frequency of modulation carrier wave, relative to lower 6 dB at the maximum power of a modulated carrier.

(4) The central frequency must not be within the band listed in 2.7.

3.1.1.3 Unwanted emission: The field strength of unwanted emissions shall not exceed the general radiated emission limits in Section 2.8.

3.1.1.4 Field strength shall be based on measurement instrumentation employing an average detector and must meet the peak emissions of Section 5.15.2.

3.1.2 Type of device: Swept frequency field disturbance sensors

3.1.2.1 Frequency bands: 1.705 MHz - 37 MHz

3.1.2.2 The field strength of fundamental emission and unwanted emission shall complly with 2.8. Field strength shall be based on measurement instrumentation employing an average detector and must meet the peak emissions of Section 5.15.2.

3.2 Operation within the band 13.553 MHz～13.567 MHz

3.2.1 Type of device: any radiated device.

3.2.1.1 Fundamental emission: The field strength of any emissions within this band shall be less than or equal 15848 microvolts/meter at 30 meters.

3.2.1.2 Unwanted emission: The field strength of unwanted emissions shall not exceed the general radiated emission limits in Section 2.8.

3.2.1.3 The frequency tolerance: The frequency tolerance of the carrier shall be ±0.01%. This frequency tolerance shall be maintained for a temperature variation of -20 to +50°C at normal supply voltage, and for a variation in the primary supply voltage within ±15% of the rated supply voltage at a temperature of 20°C. For battery operated equipment, the equipment tests shall be performed using a new battery and shall conform to the requirements set forth in Section 5.18.

3.3 Operation within the band: 26.957 MHz～27.283 MHz

3.3.1 Type of device: any radiated device.

3.3.1.1 Fundamental emission: The field strength of any emissions within this band shall be less than or equal 10 mV/meter at 3 meters (measurement instrumentation employing an average detector). The provisions in section 5.15.2 for limiting peak emissions shall apply.

3.3.1.2 Unwanted emission: The field strength of unwanted emissions shall not exceed the general radiated emission limits in Section 2.8.

3.4 Operation within the band: 40.66 MHz～40.70 MHz and above 70 MHz

3.4.1 Type of device: perimeter protection systems

3.4.1.1 Note: A perimeter protection systems employs RF emissions to sense field disturbance, and to detect movement within the protected area.

3.4.1.2 Operation within the band: 40.66 MHz～40.70 MHz

3.4.1.3 Fundamental emission: (measurement instrumentation employing an average detector)

(1) Perimeter protection system: The field strength of any emissions within this band shall be less than or equal to 500 microvolts/meter at 3 meters.

(2) The provisions stipulated Section 5.15.2 for limiting peak emissions shall apply.

3.4.1.4 Unwanted emission: The field strength of unwanted emissions shall not exceed the general radiated emission limits in Section 2.8.

3.4.1.5 The frequency tolerance: The frequency tolerance of the carrier shall be ±0.01%. This frequency tolerance shall be maintained for a temperature variation of -20 to +50°C at normal supply voltage, and for a variation in the primary supply voltage within ±15% of the rated supply voltage at a temperature of 20°C. For battery operated equipment, the equipment tests shall be performed using a new battery and shall conform to the requirements set forth in Section 5.18.

3.4.2 Type of device: intermittent or periodic devices.

3.4.2.1 Operation within the bands 40.66 MHz～40.70MHz and use spectra in Section 2.7 and frequency greater than 70 MHz.

3.4.2.2 The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency.The bandwidth indicates the upper and lower sides of the central frequency of modulation carrier, relative to lower 20 dB at the maximum power of a modulated carrier.

3.4.2.3 For devices operating within the frequency band 40.66 MHz～40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be ±0.01%. This frequency tolerance shall be maintained for a temperature variation of -20 to +50 °C at normal supply voltage, and for a variation in the primary supply voltage within ±15% of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment tests shall be performed using a new battery and shall conform to the requirements set forth in Section 5.18.

3.4.2.4 The operation limits of the device.

(1) The device is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, such as Radio control of toys, video, or data are not permitted and shall conform to the following conditions:

(A) For operation in 314 MHz～316 MHz and 433 MHz～435MHz: A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds after being released.

(B) For operation in frequencies other than (A): A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being selected.

(C) The device can automatically transmit, and shall not transmit less than five seconds each time.

(D) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions used in security or safety applications shall be allowed if the total periodic rate of transmission is less than or equal to two seconds duration per hour for each transmitter.

(2) Except for (1), the device shall have an automatic control mechanism with each transmission time is shorter than 1 second, and stop duration of a transmission period is longer than 10 seconds and is not shorter than transmission time multiplied by 30.

3.4.2.5 Field strength of fundamental emissions:

(1) In addition to the provisions of Section 2.7, the field strength of emissions from intentional radiators at 3 meters operated under this section 3.4.2.4(1) shall not exceed limits in the table below (measurement instrumentation employing an average detector, CISPR quasi-peak detector is accepted as well): The tighter limit applies at the band edges.

Fundamental frequency (MHz)	Field strength of fundamental emissions (microvolts/meter)	Unwanted emissions (microvolts/meter)
40.66～40.70	2250	225
70～130 (included)	1250	125
130 (excluded)～174 (included)	1250～3750(Note 1, 2)	125～375(Note 1, 2)
174 (excluded)～260 (included)	3750	375
260 (excluded)～470 (included)	3750～12500(Note 1, 2)	375～1250(Note 1, 2)
above 470 (excluded)	12500	1250

Note: 1. With linear interpolations, the formulas for calculating the maximum permitted fundamental field strengths shall be as follows:

(1.1) 130 MHz～174MHz, μV/m at 3 meters = 56.81818 x (frequency bands, MHz) -6136.3636

(1.2) 260 MHz～470MHz, μV/m at 3 meters = 41.6667 x (frequency bands, MHz) -7083.3333

2. The maximum permitted unwanted emission level shall be 20dB below the maximum permitted fundamental level, or meets the requirement of Section 2.8, whichever is less. If the field strength is based on measurement instrumentation employing an average detector, it shall comply with the peak emissions set forth in Section 5.15.2

(2) In addition to the provisions of Section 2.7, the field strength of emissions from intentional radiators at 3 meters operated under this section 3.4.2.4(2) shall not exceed limits in the table below (measurement instrumentation employing an average detector, CISPR quasi-peak instrumentation is accepted as well): The tighter limit applies at the band edges.

Fundamental frequency (MHz)	Field strength of fundamental emissions (microvolts/meter)	Unwanted emissions (microvolts/meter)
40.66～40.70	1000	100
70～130 (included)	500	50
130 (excluded)～174 (included)	500～1500(Note 1, 2)	50～150(Note 1, 2)
174 (excluded)～260 (included)	1500	150
260 (excluded)～470 (included)	1500～5000(Note 1, 2)	150～500(Note 1, 2)
above 470 (excluded)	5000	500

Note: 1. With linear interpolations, the formulas for calculating the maximum permitted fundamental field strengths shall be as follows:
(1.1)130 MHz～174MHz, μV/m at 3 meters = 22.72727 x (frequency bands, MHz) -2454.545
(1.2)260 MHz～470MHz, μV/m at 3 meters = 16.6667 x (frequency bands, MHz) -2833.3333

2. The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level, or meets the requirement of Section 2.8, whichever is less. If the field strength is based on measurement instrumentation employing an average detector, it shall comply with the peak emissions set forth in Section 5.15.2

3.4.3 Type of device: any radiated devices except for those described in Section 3.4.1 and 3.4.2.

3.4.3.1 Operation within the band: 40.66 MHz～40.70 MHz

3.4.3.2 Fundamental emission: The field strength of any emissions within this band shall be less than or equal 1 millivolts/meter at 3 meters.

3.4.3.3 Unwanted emission: The field strength of unwanted emissions shall not exceed the general radiated emission limits in Section 2.8.

3.4.3.4 Frequency tolerance: The frequency tolerance of the carrier shall be ±0.01%. This frequency tolerance shall be maintained for a temperature variation of -20 to +50°C at normal supply voltage, and for a variation in the primary supply voltage within ±15% of the rated supply voltage at a temperature of 20°C. For battery operated equipment, the equipment tests shall be performed using a new battery and shall comply to the requirements set forth in Section 5.18.

3.5 Operation within the band: 49.82 MHz～49.90MHz

3.5.1 Type of device: any radiated devices except for the Wireless Phone.

3.5.1.1 Fundamental emission: The field strength of any emission within this band shall be less than or equal to 10 millivolts/meter at 3 meters (measurement instrumentation employing an average detector). The provisions in Section 5.15.2 for limiting peak emissions shall apply.

3.5.1.2 Unwanted emission:

(1) The field strength of any emissions appearing in the bands 49.81 MHz～49.82MHz and 49.90 MHz～49.91MHz shall be attenuated at least 26dB below the level of the unmodulated carrier or to the general limits in Section 2.8; whichever is lower shall be the adopted regulation.

(2) The field strength of any emissions below 49.81 MHz (exclusive) or above 49.91 MHz (exclusive) shall not exceed the general radiated emission limits in Section 2.8.

(3) Measure the field strength (employing an average detector function) at 3 meters from the device. The field strength greater than 20 μV/m shall be recorded in the test report.

3.5.1.3 For a home-built intentional radiator, the following standards may be employed:

(1) The RF carrier and modulation products shall be maintained within the band 49.82 MHz～49.90 MHz.

(2) The total input power to the device measured at the battery or the power line terminals shall be less than or equal to 100 mW under any condition of modulation.

(3) The antenna shall be a single element, 1 meter or less in length, permanently mounted on the enclosure containing the device.

(4) Emissions outside of this band shall be attenuated at least 20 dB below the level of the unmodulated carrier.

3.6 Operation within the band 72.0 MHz～73.0 MHz

3.6.1 Type of device: Auditory assistance device. An intentional radiator used to provide auditory assistance to a handicapped person or persons. Such a device may be used for auricular training in an education institution, for auditory assistance at places of public gatherings, such as a theater, auditorium or meeting.

3.6.1.1 Fundamental emission: The field strength of any emission within this band shall be less than or equal 80 millivolts/meter at 3 meters (measurement instrumentation employing an average detector). The provisions in Section 5.15.2 for limiting peak emissions shall apply.

3.6.1.2 Bandwidth: Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the frequency bands. The 200 kHz band shall lie wholly within the frequency range of 72.0 MHz～73.0MHz.

3.6.1.3 The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall conform to 2.8 (employing an average detector function), and must conform to the peak in Section 5.15.2.

3.7 Operation within the band: 88.0 MHz～108.0MHz

3.7.1 Type of device: any radiated device.

3.7.1.1 Fundamental emission: The field strength of fundamental emissions shall be less than or equal 250 microvolts/meter at 3 meters (measurement instrumentation employing an average detector). The provisions in Section 5.15.2. for limiting peak emissions shall apply.

3.7.1.2 Emissions from the intentional radiator shall be confined within a 200 kHz band, which shall lie wholly within the frequency range of 88.0 MHz～108.0MHz.

3.7.1.3 The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed the general radiated emission limits in Section 2.8.

3.8 Operation within the bands: 174.0 MHz～216.0 MHz, 584 MHz～608 MHz

3.8.1 Type of device: Operation under the provisions of this Section is restricted to biomedical telemetry devices which are the intentional radiators used to transmit measurements of either human or animal biomedical phenomena to a receiver.

3.8.1.1 Frequency bands: 174 MHz～216 MHz.

3.8.1.2 The field strength of any emissions radiated within the specified 200 kHz band shall be less than or equal to 1500 microvolts/meter at 3 meters.

3.8.1.3 Outside band emission: The field strength of any emissions within this band shall be less than or equal 150 millivolts/meter at 3 meters.

3.8.1.4 Bandwidth: Emissions from the intentional radiator shall be confined within a 200 kHz band, which shall lie wholly within the frequency range of 174 MHz～216 MHz.

3.8.1.5 Above measurements shall be taken employing an average detector. The provisions in Section 5.15.2 for limiting peak emissions shall apply.

3.8.2 Type of device: Operation under the provisions of this Section is restricted to biomedical telemetry devices which are the intentional radiators used to transmit measurements of either human or animal biomedical phenomena to a receiver. Such device is restricted to be operated only in hospitals and shall not extend to mobile vehicles, such as ambulances, even if those vehicles are associated with a health care facility.

3.8.2.1 Frequency bands: 174 MHz～216 MHz, 584 MHz～608 MHz.

3.8.2.2 Fundamental emission: The field strength of emissions radiated shall be less than or equal to 50 millivolts/meter at 3 meters (employing an average detector).

3.8.2.3 Outside band emission: The field strength of outside the specified band shall not exceed the general radiated emission limits set forth in Section 2.8.

3.8.2.4 Required to be at least 5.5 km away from the 64 dBuV/m field strength contour of broadcasting, TV broadcast station or an associated TV booster station and at least 3.1 km away from the 74 dBuV/m field strength contour of a low power TV or a TV translator station.

3.8.2.5 The device shall be installed by a qualified person. Prior to installation, evaluation of the radio environment and the user retained assessment records shall be taken. Biomedical telemetry devices must not cause harmful interference to licensed TV broadcast stations or to other authorized radio services. If harmful interference occurs, the interference must either be corrected or the device must immediately cease operation on the occupied frequency.

3.9 Operation within the bands 216 MHz～217 MHz

3.9.1 Type of device: The purpose is for voice or data transmission for auditory assistance communication (such as hearing aid devices, hearing assistant devices for handicapped individuals, language translation assistance equipments, assistant listening devices(except for assistant microphones), and assistant guiding devices or health care related communications for the patient;however, two-way communications is prohibited.

3.9.1.1 Transmitting channels: There are three types of transmission Channels.

(1) Standard Channel: channel number from n=1 to n=40, the center frequencies are 216.0125 + (n-1) x 0.025 MHz with a channel bandwidth of 25 kHz and the frequency tolerance is 0.005 %.

(2) Wide-band Channel: channel number from n=41 to n=60, the center frequencies are 216.025 + (n-41) x 0.05 MHz with a channel bandwidth of 50 kHz and the frequency stability is 0.005 %.

(3) Narrow-band Channel: channel number from n=61 to n=260, the center frequencies are 216.0025 + (n-61) x 0.005 MHz with a channel bandwidth of 5 kHz, an authorized bandwidth (the maximum permitted transmitted bandwidth) of 4 kHz, and the frequency stability is ±0.00015%.

3.9.1.2 Output power: No more than 100mW (ERP).

3.9.1.3 Unwanted emission: The unwanted emission shall be attenuated below to the fundamental power P (in unit of W) as following,

(1) Transmitters with standard-band channel:

(A) Emissions 12.5 kHz to 22.5 kHz away from the channel center frequency: Minimum 30 dB.

(B) Emissions more than 22.5 kHz away from the channel center frequency: Minimum 43 + 10 log(P) dB.

(2) Transmitters with wide-band channel:

(A) Emissions 25 kHz to 35 kHz away from the channel center frequency: Minimum 30 dB.

(B) Emissions more than 35 kHz away from the channel center frequency: Minimum 43 + 10 log(P) dB.

(3) Transmitters with narrow-band channel:

(A) On any frequency within the authorized bandwidth: 0 dB.

(B) On any frequency removed from the center of the authorized bandwidth by a displacement frequency f_d (in kHz) of more than 2 kHz up to and including 3.75 kHz: The lesser of 30 + 20 (f_d - 2) dB, or 55 + 10 log (P) dB, or 65 dB.

(C) On any frequency beyond 3.75 kHz removed from the center of the authorized bandwidth: At least 55 + 10 log(P) dB.

3.9.1.4 The operation of this device shall not interfere with legal communications.

3.9.1.5 The operational location of this device is limited to educational and training facilities, guided facilities, nursing facilities, families, or indoor usage.

3.9.1.6 If the device is not entirely within a building, the tip of the antenna shall not exceed 30.5m above the ground.

3.10 Operation within the bands 2400 MHz~2483.5 MHz, 5725 MHz~5875 MHz, 24.00 GHz~24.25 GHz

3.10.1 Type of device: Intentional radiators employing frequency hopping spread spectrum or digital modulation techniques, and meeting Section 3.10.1.6.

3.10.1.1 Frequency bands:

(1) 2400 MHz~2483.5 MHz (Intentional radiators employing frequency hopping spread spectrum or digital modulation technique)

(2) 5725 MHz~5850 MHz (Intentional radiators employing frequency hopping spread spectrum)

3.10.1.2 The maximum peak output power:

(1) Operation within 2400 MHz~2483.5 MHz

(A) For frequency hopping systems employing at least 75 hopping channels: below 1 Watt (inclusive).

(B) Frequency hopping systems according to Section 3.10.1.6 (1) (A) (a) excluded by (A): below 0.125 W (inclusive).

(C) For systems using digital modulation: below 1 Watt (inclusive).

(2) For frequency hopping systems in 5725 MHz~5850 MHz: below 1 Watt (inclusive).
In addition to the peak output power described in Appendix 2 for measurement, the maximum conducted output power may also be used.

3.10.1.3 Limits of antenna gains:

(1) For systems operated in the 2400 MHz~2483.5 MHz:

(A) For fixed, point-to-point operations, the peak conducted output power of the intentional radiator shall be reduced by 1dB for every 3dBi when the directional gain of the antenna exceeds 6dBi.

(B) Transmitters that emit multiple directional beams (including simultaneously or sequentially) for the purpose of directing signals to individual receivers or to groups of receivers shall comply with the following requirements:

(a) If the transmitter employs an antenna system that emits multiple directional beams but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device shall not exceed the limit specified in paragraph 3.10.1.2 of this section. However, the total conducted output power shall be reduced by 1dB below the specified limits for each 3dBi that the directional gain of the antenna/antenna array exceeds 6dBi. The directional antenna gain shall be computed as follows:

(i) Directional gain = 10log (number of array elements or staves) + the directional gain of the element or stave having the highest gain.

(ii) A lower value for the directional gain than that calculated in paragraph (i) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beam forming.

(b) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channel(s), the power supplied to each emission beam shall be subject to the power limit specified in (a). If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in (a). In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in (a) by more than 8dB. The directional gain is calculated the same as (a).

(c) Transmitters that emit a single directional beam shall operate under the provisions of (1) (A) and (3) of this section.

(2) When operating in 5725 MHz~5850 MHz and by fixed point-to-point operation, the directional gain of the transmitting antenna shall exceed 6 dBi without reducing the maximum conducted output power.

(3) When using the transmitting antennas with the directional gain over 6 dBi except for (1) and (2), the maximum conducted output power shall be reduced in equal quantity according to the total dBi of the antenna directional gain over 6 dBi.

3.10.1.4 The antenna specification shall not be subject to the requirement of Section 2.2.

3.10.1.5 Limits on emissions outside the frequency band:

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, the attenuation shall be as below:

(1) The attenuation shall be at least 20dB when the conducted power is measured according to Appendix II of this section, based on either an RF conducted or a radiated measurement.

(2) The attenuation shall be at least 30dB when the conducted power is measured according to the paragraph (1) (C) of this section 3.10.1.2.

In addition, radiated emissions that fall under Section 2.7 the restricted bands must also comply with the radiated emission limit specified in Section 2.8.

3.10.1.6 Other limits:

(1) Frequency hopping systems:

(A) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. However, frequency hopping systems operated in 2400 MHz~2483.5 MHz with output power less than or equal to 125 mW, the intervals of hopping channel carrier

frequencies shall not be less than 25 kHz or two thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

(a) Frequency hopping systems in the 2400 MHz~2483.5 MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall be less than or equal to 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. The intelligent hopping techniques shall be used to avoid the occupancy on specific frequency hopping channel.

(b) Frequency hopping systems operating in the 5725 MHz~5850 MHz band shall use at least 75 hopping channels. The maximum 20 dB bandwidth of the hopping channel shall be less than or equal to 1 MHz. The average time of occupancy on any frequency shall be less than or equal to 0.4 seconds within a 30-second period.

(2) Digital modulation techniques system:

(A) For digitally modulated systems, the minimum 6dB bandwidth shall be at least 500 kHz.

(B) For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall be less than or equal to 8 dBm in any 3kHz band during any time interval of continuous transmission, and shall reduce the power spectral density requirement according to the Section 3.10.1.3.

(3) Hybrid systems:

(A) The frequency hopping operation of the hybrid system, with the direct sequence operation or digital modulation turned off, shall have an average time of occupancy on any frequency less than or equal to 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

(B) The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power spectral density requirements of those specified in paragraph 3.10.1.6(2)(B).

(4) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is prohibited.

(5) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is prohibited.

3.10.2 Type of device: any radiated device.

3.10.2.1 Frequency bands:

(1) 2400 MHz~2483.5 MHz

(2) 5725 MHz~5875 MHz

(3) 24.00 GHz~24.25 GHz

3.10.2.2 Fundamental and harmonics emissions: The field strength of the emission shall be less than or equal to the limit in the table below except for 3.10.2.3.

Fundamental frequency (MHz)	Field Strength of Fundamental Emissions (millivolts/meter)	Field Strength of Harmonics Emissions (microvolts/meter)
2400-2483.5	50	500
5725-5875	50	500
24000-24250	250	2500

3.10.2.3 The fixed, point-to-point operation devices operating in the 24.05 GHz~24.25 GHz band shall comply with the following restrictions:

(1) Fundamental emission: The fundamental field strength at a distance of 3 meters from the device shall be less than or equal to 2500 mV/m.

(2) Frequency tolerance: Keep within ±0.001% of fundamental frequency. This frequency tolerance shall be maintained for a temperature variation of -20℃~50℃ at normal supply voltage, and for a variation in the primary supply voltage within ±15% of the rated supply voltage at a temperature of 20°C. For battery operated equipment, the equipment tests shall be performed using a new battery and shall conform to the requirements of Section 5.18.

(3) Antenna gain and main lobe beam width: The antenna gain shall be over 33 dBi, or the main lobe beam width shall be less than or equal to 3.5 degrees. The orientation angle and the elevation plane of the main lobe beam width shall comply with the restrictions.

Note: The fixed, point-to-point operation indicates a fixed transmitter transmits the information to a fixed receiver at the remote place. The fixed, point-to-point operation shall not include the point-to-multipoint system, omnidirectional applications and multiple co-located transmitter to transmit the same information.

3.10.2.4 Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Sec. 2.8, whichever is lower.

3.10.2.5 The field strength indicates the measurement value at a distance of 3 meters from the device, and is measured by measurement instrumentation employing an average detector, adhering to the peak requirements of Section 5.15.2. The peak field strength of the point-to-point operation device along the antenna orientation angle shall be less than or equal to 2500 mV/m.

3.11 Operation within the bands 2435 MHz~2465 MHz, 5785 MHz~5815 MHz, 10500 MHz~10550 MHz, 24075 MHz~24175 MHz, 24250 MHz~26650 MHz

3.11.1 Type of device: Field disturbance sensors, but excluding perimeter protection systems.

3.11.1.1 Frequency bands:

(1) 2435.0 MHz~2465.0 MHz

(2) 5785 MHz~5815 MHz

(3) 10500 MHz~10550 MHz

(4) 24075 MHz~24175 MHz

3.11.1.2 Fundamental and harmonics emissions: Measured at a distance of 3 meters, the field strength shall be less than or equal to the limits in the table below.

Fundamental frequency (MHz)	Field Strength of Fundamental Emissions (millivolts/meter)	Field Strength of of Harmonics Emissions (microvolts/meter)
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25.0
24075-24175	2500	25.0

3.11.1.3 Emission outside the band: shall be lower 50 dB at least than fundamental emission or meet the requirements of Section 2.8, whichever is less.

3.11.1.4 The emission limits are based on measurement instrumentation employing an average detector, and must meet the peak requirement of Section 5.15.2.

3.11.2 Type of device: The automotive Short Range Radar (SRS) Devices shall operate only when the vehicle is operating, e.g., the engine is running or in the specific start. Operation shall occur only upon specific activation, such as upon starting the vehicle, changing gears, or engaging a turn signal. The operation of these devices shall be related to the proper functioning of the transportation vehicle (e.g., collision prevention, obstacle detection, blind point detection, parking assistance, collision prevention).

3.11.2.1 Frequency bands: 24250 MHz~26650 MHz

3.11.2.2 -10 dB bandwidth:

(1) The step frequency, frequency hopping or other modulation and the device shall be maintained for a temperature variation of -20℃~50℃, and for a variation within ±15% of the rated supply voltage at a temperature of 20°C. The -10 dB bandwidth shall be in the range of 24.25 GHz~26.65 GHz.

(2) The -10 dB bandwidth shall be greater than or equal to 10 MHz.

3.11.2.3 Emission limit:

(1) The radiated emission below 960 MHz shall comply with the requirements set forth in Section 2.8.

(2) The EIRP power density up to the radiated emission of 960 MHz shall be less than or equal to the RMS average limits in the table below, and measure with RBW=1 MHz:

Frequency (MHz)	EIRP (dBm)
960~1610	-75.3
1610~24250	-61.3
24250~26650	-41.3
Above 26650	-61.3
Note: The tighter limit applies at the band overlap.	

(3) Radiated emission of GPS band: In addition to the radiated emission limits specified in the tables in paragraphs (1) and (2) of this section, the EIRP power density for transmitters operating under the Section 3.11.2 shall be less than or equal to the RMS average limit I in the table below. When measuring, RBW must be greater than or equal to 1 kHz:

Frequency (MHz)	EIRP (dBm)
1164~1240	-85.3
1559~1610	-85.3

3.11.2.4 The limiting peak emissions of fundamental emissions (1 MHz≦RBW≦50 MHz):

(1) The peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission must be contained within the 24.25 GHz~26.65 GHz band.

(2) The peak EIRP limit is 20 log (RBW/50) dBm, and RBW shall not be greater than the −10 dB bandwidth of the device under test.

3.11.2.5 Measurement procedures:

(1) All emissions at and below 960 MHz are based on measurements employing a CISPR quasi-peak detector. Unless otherwise specified, all RMS average emission levels specified in Section 3.11.2.5 are to be measured utilizing a 1 MHz resolution bandwidth with 1 ms/MHz. The frequency span of the analyzer should equal the number of sampling bins times 1 MHz and the sweep rate of the analyzer should equal the number of sampling bins times one millisecond. The provision in Section 3.11.2.5 that allows emissions to be averaged over a 100 millisecond period shall not apply to devices operating under Section 5.15.3. The video bandwidth of the measurement instrument shall not be less than the resolution bandwidth and trace averaging shall not be employed.

(2) The RMS average emission measurement shall be repeated over multiple sweeps with the analyzer set for maximum hold until the amplitude stabilizes.

(3) For transmitters that employ frequency hopping, stepped frequency or similar modulation types, the peak emission level measurement, the measurement of the RMS average emission levels, the measurement to determine the center frequency, and the measurement to determine

the frequency at which the highest level emission occurs shall be made with the frequency hop or step function active. Gated signals may be measured with the gating active.

(4) The -10 dB bandwidth is based on measurement using a peak detector, a 1 MHz resolution bandwidth, and a video bandwidth greater than or equal to the resolution bandwidth.

(5) For transmitters that employ frequency hopping, stepped frequency or similar modulation types, the modulation functions of frequency hopping or stepped frequency shall be switched off when measuring the -10 dB bandwidth in Section 3.11.2, and shall be measured by continuously operating with fundamental frequency according to the requirement of Section 5.12.

(6) Emissions from digital circuitry used to enable the operation of the transmitter may comply with the limits in Section 2.8 provided it can be clearly demonstrated that those emissions are due solely to emissions from digital circuitry contained within the transmitter and the emissions are not intended to be radiated from the transmitter's antenna.

(7) Emissions from associated digital devices, e.g., emissions from digital circuitry used to control additional functions or capabilities other than the operation of the transmitter, shall comply with the requirements of Section 2.8.

(8) Emissions from these digital circuits in (6) and (7) above shall not be employed in determining the -10 dB bandwidth of the fundamental emission or the frequency at which the highest emission level occurs.

3.12 Operation within the bands 2.9 GHz~3.26 GHz, 3.267 GHz~3.332 GHz, 3.339 GHz~3.3458 GHz, 3.358 GHz~3.6 GHz

3.12.1 Type of device: Automatic vehicle identification systems (AVIS), which use swept frequency techniques for the purpose of automatically identifying transportation vehicles.

3.12.1.1 Frequency bands:

(1) 2.90 GHz~3.26 GHz

(2) 3.267 GHz~3.332 GHz

(3) 3.3390 GHz~3.3458 GHz

(4) 3.358 GHz~3.600 GHz

3.12.1.2 Radiated emission limits:

(1) The field strength anywhere within the frequency range swept by the signal shall be less than or equal to 3000 microvolts/meter/MHz at 3 meters in any direction

(2) The field strength of an AVIS shall be less than or equal to 400 microvolts/meter/MHz in any direction within ±10 degrees of the horizontal plane when in its operating position.

(3) The field strength of radiated emissions outside the frequency range swept by the signal shall be less than or equal to 100 microvolts/meter/MHz at 3 meters, measured from 30MHz to 20GHz for the complete system.

(4) The emission limits are based on measurement instrumentation employing an average detector. The provisions in Section 5.15.2 for limiting peak emissions shall apply.

(5) The signal emission from the AVIS shall occur only when the vehicle to be identified is within the radiated field of the system.

(6) Statements included in the operation instructions: “during use the antenna may not be pointed within ±XX degrees of the horizontal plane.”(Note)

Note: The double asterisks in condition three (XX) shall be replaced by the responsible party with the angular pointing restriction necessary to meet the horizontal emission limit specified in Section 2.2.

3.12.1.3 Type of Antenna: A horn antenna or other comparable directional antenna for signal emission.

3.12.1.4 The sweep repetition rate: From 4,000 sweeps per second to 50,000 sweeps per second.

3.12.1.5 Measuring methods and notices:

(1) The field strength denoted by microvolts/meter/MHz along with the intermediate frequency of the spectrum analyzer or equivalent measuring receiver shall be measured.

(2) When measuring the frequency search for spurious and sideband emissions from 30 MHz to 20 GHz exclusive of the swept frequency band, the measuring instrument shall be as close as possible to the unit under test.

(3) The angular separation between the direction at which maximum field strength occurs and the direction at which the field strength is reduced to 400 microvolts/meter/MHz at 3 meters.

(4) The test report shall contain photographs or drawings of the spectrum analyzer display showing the entire swept frequency signal and a calibrated scale for the vertical and horizontal axes; the spectrum analyzer settings that were used shall be labeled on the photographs or drawings.

3.13 Operation within the band 57 GHz~66 GHz

3.13.1 Type of device: Any type of the emission device, but excluding field disturbance sensors not fixed to operate and equipment used on aircrafts or satellites.

3.13.1.1 Within the 57 GHz~66 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power (EIRP):

(1) For fixed field disturbance sensors that occupy 500 MHz or less of bandwidth and that are contained wholly within the frequency band 61.0 GHz~61.5 GHz:

(A) The average power of any emission, measured during the transmit interval, shall be less than or equal to 40 dBm, and the peak power of any emission shall be less than or equal to 43 dBm.

(B) The average power of any emission in the 57 GHz~61.0 GHz and 61.5 GHz~66.0 GHz bands shall be less than or equal to 10 dBm, and the peak power of any emission shall be less than or equal to 13 dBm.

(2) For fixed field disturbance sensors other than those operating under the provisions of paragraph (1) of this section, the peak transmitter conducted output power shall be less than or equal to -10 dBm and the peak EIRP level shall be less than or equal to 10 dBm

(3) For products other than fixed field disturbance sensors, the EIRP shall meet the regulations below during the transmit interval:

(A) For transmitters located outdoors, the average power of any emission shall be less than or equal to 82 dBm, and the peak power shall be less than or equal to 85 dBm when the antenna gain is greater than 51 dBi; the average power of any emission shall be less than or equal to 82-2×(51-G) dBm, and the peak power shall be less than or equal to 85-2×(51-G) dBm when the antenna gain is greater than 51 dBi.

(B) Except for the provisions of (A) of this part, the average power of any emission shall be less than or equal to 40 dBm, and the peak power of any emission shall be less than or equal to 43 dBm

3.13.1.2 Limits on spurious emissions:

(1) The power density of any emissions outside the 57 GHz~66 GHz band shall consist solely of spurious emissions.
(2) Radiated emissions below 40 GHz shall meet the regulations in Section 2.8 of this part.
(3) Between 40 GHz and 200 GHz, the level of these emissions shall be less than or equal to 90 pW/cm^2 at a distance of 3 meters.

3.13.1.3 Limits on the total peak transmitter output power.

(1) For transmitters with an emission bandwidth of greater than or equal to 100 MHz, the total peak transmitter output power shall be less than or equal to 500mW.
(2) Transmitters with an emission bandwidth less than 100 MHz must limit their total peak transmitter output power less than or equal to 500 mW times their emission bandwidth (MHz) divided by 100 MHz.
(3) For the purposes of this paragraph, the 6 dB emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density shall be less than the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g. for frequency hopping devices).
(4) Peak transmitter output power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57 GHz~66 GHz band and that has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

3.13.1.4 Frequency stability: This frequency stability shall be maintained for a temperature variation of -20℃~50℃ at normal supply voltage, and for a variation in the primary supply voltage within ±15% of the rated supply voltage at a temperature of 20°C. The emission frequency shall be contained within the 57 GHz~66 GHz band. For battery operated equipment, the equipment tests shall be performed using a new battery, and the requirements of Section 5.18 must be met.

3.14 Operation within the band 76 GHz~77 GHz

3.14.1 Type of device: restricted to vehicle-mounted field disturbance sensors used as vehicle radar systems. The transmission of additional information, such as data, is permitted provided the primary mode of operation is as a vehicle-mounted field disturbance sensor. Operation under the provisions of this section is not permitted on aircraft or satellites.

3.14.1.1 Frequency bands 76 GHz~77 GHz.

3.14.1.2 Radiated emission limits: The power density of any emission within the bands specified in this section shall be less than or equal to 88 uW/cm^2 (EIRP 50 dBm) at a distance of 3 meters from the exterior surface of the radiating structure; the peak power density shall be less than or equal to 279 uW/cm^2 (EIRP 55 dBm).

3.14.1.3 The power density of any emissions outside the operating band shall consist solely of spurious emissions and shall not exceed the following:

(1) Radiated emissions below 40 GHz shall meet the regulations in Section 2.8 of this rule.
(2) Radiated emissions between 40 GHz and 200 GHz shall be less than or equal to 600 pW/cm^2 at a distance of 3 meters from the exterior surface of the radiating structure:
(3) Radiated emissions above 200GHz shall be less than or equal to 1000pW/cm^2 at a distance of 3 meters from the exterior surface of the radiating structure.
(4) The spectrum shall be analyzed up to 231 GHz.

3.14.1.4 Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20℃~50℃ for a variation in the primary supply voltage within ±15% of the rated supply voltage.

3.15 Operation within the band 77 GHz~81 GHz

3.15.1 Type of device: The automotive Short Range Radar (SRS) Devices shall operate only when the vehicle is operating, e.g., the engine is running or in the specific start. Operation shall occur only upon specific activation, such as upon starting the vehicle, changing gears, or engaging a turn signal. The operation of these devices shall be related to the proper functioning of the transportation vehicle (e.g., collision prevention, obstacle detection, blind point detection, parking assistance, collision prevention).

3.15.1.1 Frequency bands: 77 GHz~81 GHz

3.15.1.2 Radiated emission limits:

(1) Maximum radiated average power spectral density:

(A) The maximum radiated average power spectral density (including the antenna gain) measured in the 1 MHz RBW shall be less than or equal to -3 dBm/MHz (EIRP).

(B) The spectrum analyzer shall be set with the 1 MHz~10 MHz RBW and 3 MHz video bandwidth at minimum. The detector uses the root mean square (RMS) mode. The spectral curves measured by the spectrum analyzer shall be recorded in the amplitude range of 35 dB. If the power spectral density is less than -40 dBm/MHz (EIRP), it shall not be recorded.

(C) When the measuring level is less than the background noise, the related measurements shall be conducted in a fully anechoic test chamber.

(2) Maximum radiated peak power:

(A) The spectrum analyzer shall use the 50 MHz RBW. The maximum peak power (including antenna gain) measured when the peak detector is set in the maximum hold mode shall be less than 55 dBm (EIRP).

(B) The spectrum analyzer uses 1 MHz$\leqq$RBW<50 MHz. The peak power measured by the detector using the peak power in the maximum hold mode shall plus a correct factor of 20log(RBW/50) dBm [where the RBW represents the resolution bandwidth (a unit of MHz)].

(3) Maximum radiated spurious and out-of-band emissions:

(A) The quasi-peak detector with 100 kHz~120 kHz RBW shall be used when the spectrum analyzer is set less than 1 GHz, and the peak detector with 1 MHz RBW shall be used when the spectrum analyzer is set greater than or equal to 1 GHz.

(B) The ERP limits are listed in the table below:

Frequency range	Spurious/out-of-band limit
47 MHz~74 MHz	-54 dBm
87.5 MHz~118 MHz	-54 dBm
174 MHz~230 MHz	-54 dBm
470 MHz~862 MHz	-54 dBm
30 MHz~1 GHz, and excluding the bands above	-36 dBm
1 GHz~100 GHz	-30 dBm
Note: 1. The 77 GHz ~81 GHz band is excluded. 2. The tighter limit applies at the band overlap.	

(4) Receiver spurious emissions:

(A) The spectrum analyzer is set the same as (3) (A) above.

(B) The maximum EIRP limits are in the table below:

Frequency range	Limit
25 MHz~1 GHz	-57 dBm
1 GHz~100 GHz	-47 dBm
Note: The tighter limit applies at the band overlap.	

(C) This item must not be measured if transmitters are equipped with receivers.

3.15.1.3 The following conditions shall be additionally measured when measuring in 3.15.1.2(1) and (2): Temperature variation of -20℃~50℃ at normal supply voltage, and for a variation in the primary supply voltage within ±15% of the rated supply voltage at a temperature of 20°C.

3.15.2 Type of device: Only used for Tank Level Probing Radar (TLPR).

3.15.2.1 Frequency bands: 77 GHz~81 GHz.

3.15.2.2 TLPR devices operating under the provisions of this section shall utilize a dedicated or integrated transmit antenna, and the system shall be installed and maintained to ensure a vertically downward orientation of the transmit antenna's main beam.

3.15.2.3 TLPR devices operating under the provisions of this section shall be installed only at fixed locations. The TLPR device shall not operate while being moved, or while inside a moving container.

3.15.2.4 Hand-held or resident applications are prohibited.

3.15.2.5 Fundamental emission bandwidth limits:

(1) Fundamental emission bandwidth ≧50 MHz.

(2) The fundamental emission bandwidth must be in the 77 GHz~81 GHz band.

(3) The fundamental bandwidth of an LPR emission is defined as the width of the signal between two points, one below and one above the center frequency, outside of which all emissions are attenuated by at least 10 dB relative to the maximum transmitter output power when measured in an equivalent resolution bandwidth.

3.15.2.6 Fundamental emissions limits:

(1) The fundamental emissions limits are as follows:

(A) The EIRP of average emission power measured by the average detector in 1 MHz shall be less than or equal to -3 dBm within a specified bandwidth.

(B) Based on the frequency point of the maximum average power as the center, the EIRP of the peak emission power measured by the peak detector in 50 MHz shall be less than or equal to 34 dBm.

(2) For a RBW less than 50 MHz when measuring by the peak detector, the peak EIRP limit shall plus a correct factor of 20 log (RBW/50) dB where RBW is the resolution bandwidth in MHz.

(3) The RBW is in 1 MHz~50 MHz, and the VBW must be greater than or equal to RBW.

3.15.2.7 Antenna beam width limits: The -3 dB antenna beam width shall be less than or equal to 8 degrees.

3.15.2.8 Antenna side lobe gain limit: The antenna side lobe gain limit relative to main beam gain for off-axis angles from the main beam of greater than 60 degrees shall be attenuated over 38 dB.

3.15.2.9 Emissions from digital circuitry used to enable the operation of the transmitter may comply with the limits in Section 2.8 provided it can be clearly demonstrated that those emissions are due solely to emissions from digital circuitry contained within the transmitter and the emissions are not intended to be radiated from the transmitter's antenna. Emissions from associated digital devices, shall be the same. Emissions from these digital circuits shall not be employed in determining the -10 dB bandwidth of the fundamental emission or the frequency at which the highest emission level occurs.

3.15.2.10 Measurement procedures

(1) Radiated measurements of the fundamental emission bandwidth and power shall be made with maximum main-beam coupling between the LPR and test antennas (boresight).

(2) Measurements of the unwanted emissions radiating from an LPR shall be made utilizing elevation and azimuth scans to determine the location at which the emissions are maximized.

(3) All emissions at and below 1,000 MHz (except for 9 kHz~90 kHz and 110 kHz~490 kHz bands) are based on measurements employing a CISPR quasi-peak detector.

(4) The fundamental emission bandwidth measurement shall be made using a peak detector with a resolution bandwidth of 1 MHz and a video bandwidth of greater than or equal to 3 MHz.

(5) The measurement procedures in Section 5.15.2 and Section 5.15.3 shall not be applied to Section 3.15.2.

(6) The fundamental emission bandwidth shall be greater than or equal to 50 MHz when operating in sweep, step or frequency hopping.

4 Conformance specification of special devices

4.1 Tunnel radio systems: An intentional radiator utilized as a communication transceiver by the people work in the tunnel.

4.1.1 Frequency bands: use spectra in Section 2.7 and frequency

4.1.2 Installation regulation: Operation of a tunnel radio system including intentional radiator and all connecting wires shall be contained solely within a tunnel.

4.1.3 Radiated emission limits: The total electromagnetic field from a tunnel radio system on any frequency or frequencies appearing outside of the tunnel shall be less than or equal the limits shown in Section 2.8. and shall comply with Section 2.3 should voltage be applied on the public utility power lines.

4.1.4 The antenna specification is not subject to the requirement of Section 2.2

4.2 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 radio frequency signal onto the cable, pipe, etc. and using a receiver to detect the location of that structure or element.

4.2.1 Frequency bands: 9 kHz~490 kHz.

4.2.2 The peak output power: Under any type of modulation technique shall be less than or equal to the following limits.

4.2.2.1 9 kHz~45 (exclusive) kHz: 10 watt.

4.2.2.2 45 kHz~490kHz: 1 watt.

4.2.3 Modulation technique: any kind of non-voice modulation technique.

4.2.4 It shall follows Section 2.3 if apply voltage on the public utility power lines.

4.2.5 The antenna specification is not subject to the requirement of Section 2.2.

4.3 Radio control devices: including the remote controlled devices for model toys, industrial purposes and also the radio data transceivers.

4.3.1 The remote controlled devices for model toys: including a model aircraft device or a model

surface craft device on the ground or water.

4.3.1.1 Frequency bands:

(1) The frequencies listed below are for any type of remote device operation: 26.995 MHz, 27.045 MHz, 27.095 MHz, 27.120 MHz, 27.136 MHz, 27.145 MHz, 27.195 MHz and 27.245 MHz.

(2) The frequencies listed below are for any type of model aircraft device operation only: 72.00 MHz~72.99 MHz, a channel interval: 20 kHz.

(3) The frequencies listed below are for any type of model surface craft device operation: 75.41MHz~75.99 MHz, a channel interval: 20 kHz.

4.3.1.2 Effective radiated power (ERP): Under any modulation technique, the carrier power of the radio controlled device shall be less than or equal to the following limits.

(1) 26.995 MHz~27.245 MHz band: model surface craft device: 4 W, model aircraft device: 0.75 W.

(2) 72.00 MHz~72.99 MHz band: 0.75 W.

(3) 75.41 MHz~75.99 MHz band: 0.75 W.

4.3.1.3 Modulation technique: any kind of non-voice modulation technique.

4.3.1.4 Bandwidth: within 8 kHz.

4.3.1.5 The frequency tolerance:

(1) 26.995 MHz~27.245 MHz band: The frequency tolerance of the carrier shall be ±0.005 %. This frequency tolerance shall be maintained for a temperature variation of -20 ℃~50 ℃ at normal supply voltage, and for a variation in the primary supply voltage within ±15 % of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment tests shall be performed using a new battery. In the meantime, it shall meet the requirement of Section 5.18.

(2) 72.00 MHz~72.99 MHz and 75.41 MHz~75.99 MHz bands: The frequency tolerance of the carrier shall be ±0.002 %. This frequency tolerance shall be maintained for a temperature variation of -20 ℃~50 ℃ at normal supply voltage, and for a variation in the primary supply voltage within ±15 % of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment tests shall be performed using a new battery. In the meantime, it shall meet the requirement of Section 5.18.

4.3.1.6 Unwanted emission:

(1) 26.995 MHz~27.245 MHz band:

(A) Emissions ±4 kHz (exclusive) to ±8 kHz (exclusive) from the channel center frequency: At least 25 dB.

(B) Emissions ±8 kHz (exclusive) to ±20 kHz (exclusive) from the channel center frequency: at least 35 dB.

(C) Emissions more than ± 20 kHz (exclusive) from the channel center frequency: at least 43 + 10 log (max. output power) dB.

(2) 72.00 MHz~72.99 MHz and 75.41 MHz~75.99 MHz bands:

(A) Emissions ±4 kHz (exclusive) to ±8 kHz (inclusive) from the channel center frequency: at least 25 dB.

(B) Emissions ±8 kHz (exclusive) to ±10 kHz (inclusive) from the channel center frequency: at least 45 dB.

(C) Emissions ±10 kHz (exclusive) to ±20 kHz (inclusive) from the channel center frequency: at least 55 dB.

(D) Emissions more than ± 20 kHz (exclusive) from the channel center frequency: at least 56 + 10 log (max. output power) dB.

4.3.1.7 Limits:

(1) One-way control only.

(2) Compliance with the regulations in Section 2.10.5.

4.3.2 Radio controlled devices for industry: Radio frequency transceiver used only in the factory building for transmitting digital control signal.

4.3.2.1 Frequency bands: Limited to the following frequency.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	480.050	7	480.200
2	480.075	8	480.225
3	480.100	9	480.250
4	480.125	10	480.275
5	480.150	11	480.350
6	480.175	12	480.400

4.3.2.2 Effective radiated power (ERP): shall not exceed 10 mW.

4.3.2.3 Modulation technique：F1D and F2D.

4.3.2.4 Bandwidth: within 8.5 kHz.

4.3.2.5 Frequency tolerance: within 4ppm. This frequency tolerance shall be maintained for a temperature variation of -20 ℃~50 ℃ at normal supply voltage, and for a variation in the primary supply voltage within ±15 % of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment tests shall be performed using a new battery. In the mean time, it shall comply with the requirements set forth in Section 5.18.

4.3.2.6 Spurious emissions: less than 2.5 uW (ERP) measured by the average detector.

4.3.3 Radio data transceiver: Radio transceiver used restricted inside the building for voice, images and data communication.

4.3.3.1 Frequency bands:

(1) Restricted to the 6 channels below only,

Channel	Frequency (MHz)
1	429.1750
2	429.1875
3	429.2000
4	429.2125
5	429.2250
6	429.2375

(2) Restricted to the 10 channels below only,

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	429.8125 / 449.7125	6	429.8750 / 449.7750
2	429.8250 / 449.7250	7	429.8875 / 449.7875
3	429.8375 / 449.7375	8	429.9000 / 449.8000
4	429.8500 / 449.7500	9	429.9125 / 449.8125
5	429.8625 / 449.7625	10	429.9250 / 449.8250

Note: The 10th channel is for control purpose.

4.3.3.2 Effective radiated power (ERP): shall not exceed 10 mW.

4.3.3.3 Modulation technique:F1D, F2D,F1E,F2E,F1F,及 F2F.

4.3.3.4 Bandwidth: within 8.5 kHz.

4.3.3.5 Adjacent Channel Leakage Ratio: The emission power in the central frequency ±4.25 kHz for adjacent channel shall be lower over 40 dB than the carrier power.

4.3.3.6 For control channel, the duration of each transmission shall be less than 0.2 seconds and the silent period shall be greater than 2 seconds. For other channel, the duration of each transmission shall be less than 40 seconds and the silent period shall be greater than 2 seconds.

4.3.3.7 Frequency tolerance: within 4 ppm. This frequency tolerance shall be maintained for a temperature variation of -20 ℃~50 ℃ at normal supply voltage, and for a variation in the primary supply voltage within ±15 % of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment tests shall be performed using a new battery. In the meantime, it shall comply with the requirements set forth in Section 5.18.

4.3.3.8 Spurious emissions: less than 2.5 uW (ERP) measured by the average detector.

4.3.4. Special note for compliance approval.

4.3.4.1 The module compliance approval shall be conducted if the end user can gain access to replace plug-in type detector module. Each module should contain the whole frequency detection circuit including the oscillator. Plug-in type oscillation crystal is not part of the frequency detector module and cannot be altered by the user.

4.3.4.2 The antenna must be integral attached onto the Low-power radio-frequency devices. External antenna shall be prohibited. It shall be vertical polarization and zero gain compared to half-wave dipole antenna.

4.3.4.3 The frequency of the Low-power radio-frequency devices should be generated by crystal.

4.4 Citizens Band Radio Service (CBRS)

4.4.1 Transmitter:

4.4.1.1 Frequency bands: from 26.965 MHz~27.405 MHz in total 40 channels (as table below). The channel 9 shall be specially marked for emergency call only.

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	26.965	11	27.085	21	27.215	31	27.315
2	26.975	12	27.105	22	27.225	32	27.325
3	26.985	13	27.115	23	27.235	33	27.335
4	27.005	14	27.125	24	27.245	34	27.345
5	27.015	15	27.135	25	27.255	35	27.355
6	27.025	16	27.155	26	27.265	36	27.365
7	27.035	17	27.165	27	27.275	37	27.375
8	27.055	18	27.175	28	27.285	38	27.385
9	27.065	19	27.185	29	27.295	39	27.395
10	27.075	20	27.205	30	27.305	40	27.405

4.4.1.2 Modulation technique:

(1) AM (A3E): amplitude modulation below ±100 %.
(2) FM (F3E): peak frequency deviation within ±2.5 kHz.

4.4.1.3 Bandwidth:

AM (A3E): 8 kHz.

FM (F3E): 10 kHz.

4.4.1.4 The frequency tolerance: within 0.005 %. This frequency tolerance shall be maintained for a

temperature variation of -20 ℃~50 ℃ at normal supply voltage, and for a variation in the primary supply voltage within ±15% of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment tests shall be performed using a new battery. In the meantime, it shall comply with the requirements set forth in Section 5.18.

4.4.1.5 Effective radiated power (ERP):

AM (A3E): within 4 W.

FM (F3E): within 5 W.

4.4.1.6 Power in the adjacent channels:

(1) AM (A3E): the same as 4.4.1.7(1).
(2) FM (F3E): less than or equal to 20 nW under normal testing conditions.

4.4.1.7 Unwanted emission:

(1) AM (A3E):

(A) Emissions ±4 kHz~±8 kHz from the channel center frequency : minimum 25 dB.

(B) Emissions ±8 kHz~±20 kHz from the channel center frequency : minimum 35 dB.

(C) Emissions more than ±20 kHz from the channel center frequency: at l minimum 53 + 10 log (maximum output power) dB.

(2) FM (F3E):

(A) When the transmitter is operating, the spurious power in the following frequency bands shall be less than or equal to 4 nW (ERP): 41 MHz~68 MHz, 87.5 MHz~118 MHz, 162 MHz~230 MHz and 470 MHz~862 MHz.

(B) In addition to those specified in (A) above, the ERP of spurious power in the frequencies from 25 MHz~1 GHz shall be less than or equal to 0.25 μW (ERP).

(C) In addition to those specified in (A) and (B) above, the ERP of spurious power in the frequencies from 1 GHz~2 GHz shall be less than or equal to 1 uW (ERP).

(D) When the transmitter is in standby, the ERP of spurious power in the frequencies from 25 MHz~1 GHz shall be less than or equal to 2 nW (ERP), and in the frequencies from 1 GHz~2 GHz shall be less than or equal to 20 nW (ERP).

4.4.2 The receiver:

4.4.2.1 Unwanted emission: The field strength of unwanted emissions shall not exceed the general radiated emission limits in Section 2.8.

4.5 Family Radio Service (FRS)

4.5.1 Frequency bands: It is limited to the following 14 channels (the total channel number displayed shall l be less than or equal to 14).

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	467.5125	8	467.60
2	467.525	9	467.6125
3	467.5375	10	467.625
4	467.550	11	467.6375
5	467.5625	12	467.650
6	467.575	13	467.6625
7	467.5875	14	467.675

4.5.2 Modulation technique:F3E/F2D.

4.5.3 Effective radiated power (ERP): below 1 Watt.

4.5.4 Bandwidth: within 12.5 kHz.

4.5.5 The frequency tolerance: within ±2.5 ppm. This frequency tolerance shall be maintained for a temperature variation of -20 ℃~50 ℃ at normal supply voltage, and for a variation in the primary

supply voltage within ±15 % of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment tests shall be performed using a new battery. In the mean time, it shall meet the requirement of Section 5.18.

4.5.6 Peak frequency deviation of F3E: within ±2.5 kHz.

4.5.7 Audio frequency response of F3E: within 3.125 kHz.

4.5.8 Unwanted emission:

4.5.8.1 F3E:

(1) Emissions ±6.25 kHz (exclusive) to ±12.5 kHz (inclusive) from the channel center frequency attenuated over 25 dB.

(2) Emissions ±12.25 kHz (exclusive) to ±31.5 kHz (inclusive) from the channel center frequency attenuated over 35 dB.

(3) Emissions more than ±31.25 kHz from the channel center frequency shall be attenuated over 43+10log (maximum output power) dB.

4.5.8.2 F2D: within 50 uW (ERP).

4.5.9 Receiver: Effective radiated power (ERP) within 20 nW.

4.5.10 Any antenna and power amplifier connected to FRS transmitter can be used with FRS in this section after approved by he committee.

4.5.11 The connecting to the external power is allowed, but the effective radiated power (ERP) shall be less than or equal to 1 Watt.

4.5.12 FRS shall be permitted for one-way or two-way voice or no-voice communications.

4.5.13 One-way voice or non-voice communications shall be limited to establish voice communications, send text messages, emergency messages, or location information.

4.5.14 Non-voice communications:

4.5.14.1 A non-voice emission is limited to squelch tones, such as CTCSS (Continuous Tone Controlled Squelch System) and CDCSS (Continuous Digital Controlled Squelch System) to establish or continue communications. If the audible tones are more than 300 Hertz, it shall not last longer than 15 seconds at one time; if the audible tones are less than or equal to 300 Hertz, the restriction shall not apply.

4.5.14.2 The FRS unit may transmit digital data containing text messages, emergency messages, GPS information, or requesting location information from one or more other FRS units. Digital data transmissions must be initiated manually or by command of a user, except in the case of an FRS unit receiving an interrogation request to automatically respond with its location. Digital data transmissions shall be less than or equal to one second, and shall be limited to less than or equal to one digital transmission within a thirty-second period, except in the case an FRS unit automatically respond to one interrogation request, which shall not be limited. FRS units are prohibited from transmitting data in store-and-forward packet operation mode.

4.5.15 Connecting to public telecommunications system is prohibited.

4.6 Low-Power Wireless Microphone and Wireless Earphone: A low power wireless microphone is used for transmission of voice or music by radio waves to remote receiving equipments.

4.6.1 Frequency bands: 227.1 MHz~227.4 MHz, 229.4 MHz~230.0 MHz, 231.0 MHz~231.9 MHz, 510 MHz~530 MHz, 748 MHz~758 MHz, 803 MHz~806 MHz, 1790 MHz~1805 MHz

4.6.2 Necessary bandwidth:

4.6.2.1 The necessary bandwidth for the system with the operating frequency (fc) less than 1 GHz shall be less than or equal to 200 kHz, and shall comply with the mask standards in the following two tables.

Frequency deviation Δf	Analog system					
	Limit (dBc)	RBW	VBW	Detector	Trace	Span
± (0 ≤ Δf ≤ 0.35B)	0 ~ -20 (Note 1)	1 kHz	1 kHz	RMS	Max Hold	fc ± 1 MHz
± (0.35B ≤ Δf ≤ 0.5B)	-20 ~ -60 (Note 1)	1 kHz	1 kHz	RMS	Max Hold	fc ± 1 MHz
± (0.5B ≤ Δf ≤ B)	-60 ~ -80 (Note 1)	1 kHz	1 kHz	RMS	Max Hold	fc ± 1 MHz
± (B ≤ Δf ≤ 1MHz)	-80 ~ -90 (Note1)	1 kHz	1 kHz	RMS	Average	fc ± 1 MHz
Note: 1. For the limits calculated by linear interpolations, please see Figure 1. 2. The tighter limit applies at the band overlap. 3. B indicates the bandwidth stated by the supplier.						

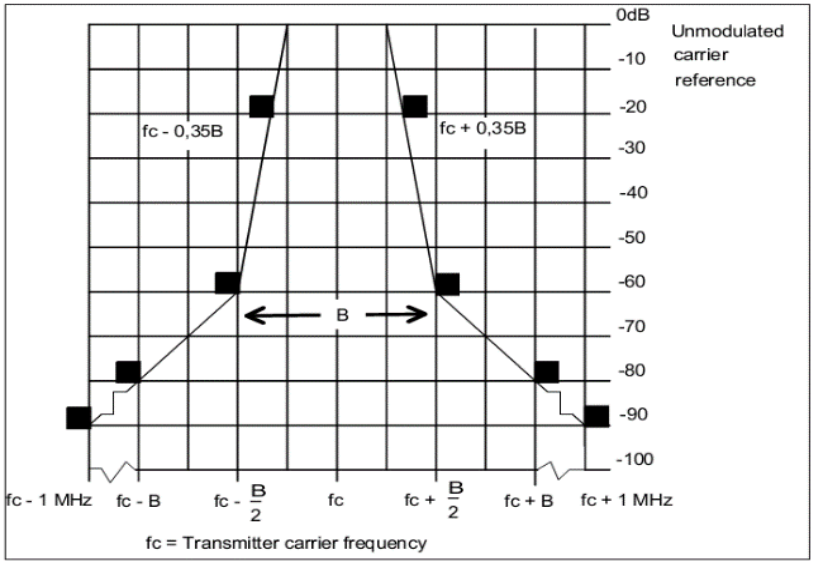

Figure 1

Frequency deviation Δf	Digital system (<1 GHz)						
	Limit (dBc)	RBW	VBW	Detector	Trace	Span	Sweep Time
± (0 ≤ Δf < 0.5B)	0	1 kHz	1 kHz	RMS	Max Hold	≥ 5 x B	≥ 2 seconds
± (0.5B ≤ Δf ≤ 1.75B)	-30 ~ -80 (Note 1)	1 kHz	1 kHz	RMS	Max Hold	≥ 5 x B	≥ 2 seconds
± (1.75B ≤ Δf ≤ 5B)	-80 ~ -90 (Note 1)	1 kHz	1 kHz	RMS	Average	± (1.75B ≤ Δf ≤ 5B)	2 seconds Per 200 kHz
Note: 1. For the limits calculated by linear interpolations, please see Figure 2. 2. The tighter limit applies at the band overlap. 3. B indicates the bandwidth stated by the supplier.							

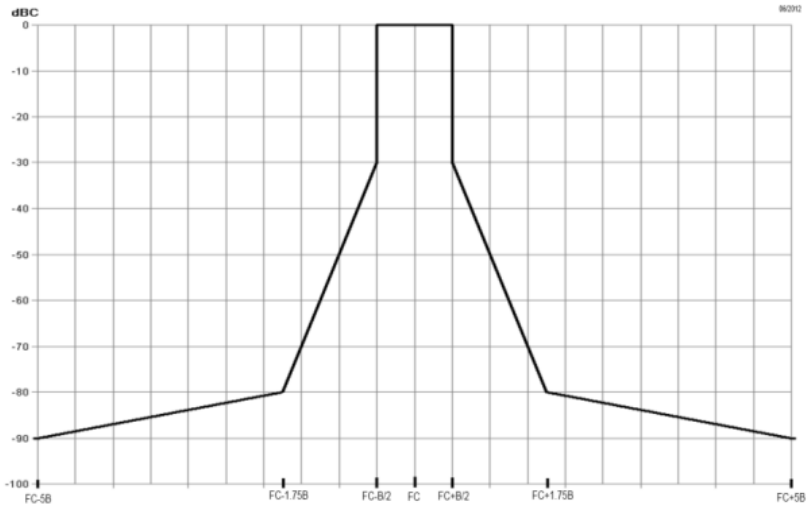

Figure 2

4.6.2.2 The necessary bandwidth for the system with the operating frequency (fc) greater than 1 GHz shall be less than or equal to 600 kHz, and comply with the mask standard in the table below.

Frequency deviation Δf	Digital system (>1 GHz)						
	Limit (dBc)	RBW	VBW	Detector	Trace	Span	Sweep Time
± (0 ≤ Δf < 0.5B)	0	1 kHz	1 kHz	RMS	Max Hold	≥ 5 x B	≥ 2 seconds
± (0.5B ≤ Δf ≤ B)	-40 ~ -60 (Note 1)	1 kHz	1 kHz	RMS	Max Hold	≥ 5 x B	≥ 2 seconds
± (B ≤ Δf ≤ 1MHz)	-60	1 kHz	1 kHz	RMS	Average	± (B ≤ Δf ≤ 1MHz)	2 seconds per 200 kHz
Note: 1. For the limits calculated by linear interpolations, please see Figure 3. 2. The tighter limit applies at the band overlap. 3. B indicates the bandwidth stated by the supplier.							

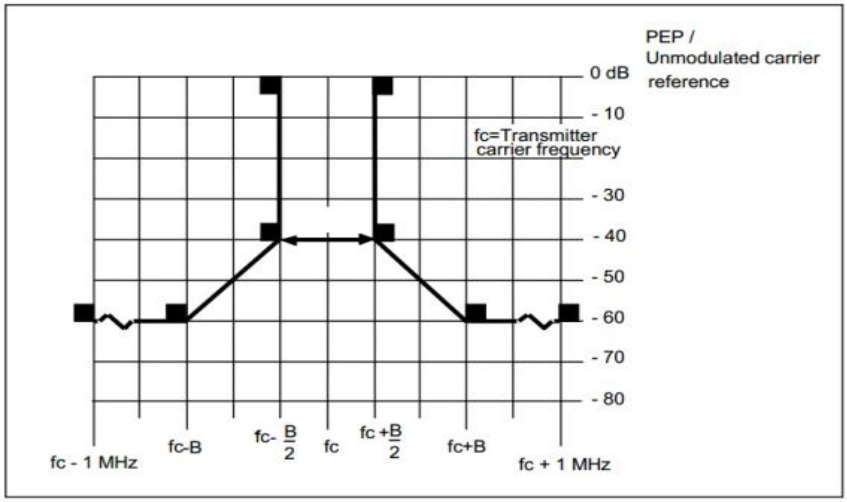

Figure 3

4.6.2.3 For the measurement method, please see ETSI EN300 422-1.

4.6.3 Fundamental emission (ERP):

4.6.3.1 Operation within the bands 227.1 MHz~227.4 MHz, 229.4 MHz~230.0 MHz, 231.0 MHz~231.9 MHz:

Channel Bandwidth	ERP limit
No more than 50kHz	No more than 10mW.
Below 200kHz, above 50kHz (exclusive)	No more than 5mW

4.6.3.2 Operation within the 510.0 MHz~530.0 MHz band: below 50 mW.

4.6.3.3 Operation within the 748.0 MHz~758.0 MHz band: below 10 mW.

4.6.3.4 Operation within the 803.0 MHz~806.0 MHz band: below 10 mW.

4.6.3.5 Operation within the 1790.0 MHz~1805.0 MHz band: below 10 mW.

4.6.3.6 The carrier power must be operated according to the table below when measuring the channel width.

Carrier power measurement						
Central emission frequency	RBW	VBW	Detector	Trace	Span	Sweep Time
f_c	5 x B	5 x B	RMS	Average	Zero Span	≥ 2 seconds
Remark: B represents the emission bandwidth.						

4.6.4 Frequency deviation: less than or equal to ±75 kHz, solely applied to analog system.

4.6.5 Frequency stability:

4.6.5.1 Operating frequency less than 1 GHz: 20 ppm

4.6.5.2 Operating frequency greater than 1 GHz: 15 ppm

4.6.6 Spurious emission (ERP):

	Frequency		
	47 MHz~74 MHz, 87.5 MHz~137 MHz, 174 MHz~230 MHz, 470 MHz~862 MHz	< 1 GHz	＞1 GHz
Operating state	Below 4 nW	Below 250 nW	Below 1 uW
Standby state	Below 2 nW	Below 2 nW	Below 20 nW

4.6.7 Spurious emission of receiver (ERP): below 2 nW (inclusive).

4.6.8 The antenna attached to transmitter shall be an integral structure.

4.6.9 The frequency stability shall be maintained over a temperature variation of -10 ℃~45 ℃ at normal supply voltage, and for a variation in the primary supply voltage within ±15 % of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment tests shall be performed using a new battery. In the meantime, it shall conform to the requirement of Section 5.18.

4.7 Unlicensed National Information Infrastructure: Use wideband digital modulation techniques and provide a wide array of high data rate mobile and fixed communications for individuals, businesses, and organizations.

4.7.1 Operating frequencies: 5.15 GHz~5.25 GHz, 5.25 GHz~5.35 GHz, 5.470 GHz~5.725 GHz and 5.725 GHz~5.85 GHz.

4.7.2 Terminology:

4.7.2.1 Average symbol envelope power: The average symbol envelope power is the average, taken over all symbols in the signaling alphabet, of the envelope power for each symbol.

4.7.2.2 Digital modulation: The process by which the characteristics of a carrier wave are varied among a set of predetermined discrete values in accordance with a digital modulating function as specified in document ANSI C63.17-1998.

4.7.2.3 Emission bandwidth: For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points (one below and one above the carrier center frequency) that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1 % of the emission bandwidth of the device being measured.

4.7.2.4 Access Point (AP): A U-NII transceiver that operates either as a bridge in a peer-to-peer connection or as a connector between the wired and wireless segments of the network.

4.7.2.5 Available Channel: A radio channel on which a Channel Availability Check has not identified the presence of radar.

4.7.2.6 Power spectral density: The power spectral density is the total energy output per unit bandwidth from a pulse or sequence of pulses for which the transmit power is at its maximum level, divided by the total duration of the pulses. This total time does not include the time between pulses during which the transmit power is off or below its maximum level.

4.7.2.7 Pulse: A pulse is a continuous transmission of a sequence of modulation symbols, during which the average symbol envelope power is constant.

4.7.2.8 Operating Channel: Once a U-NII device starts to operate on an Available Channel then that channel becomes the Operating Channel.

4.7.2.9 Transmit Power Control (TPC): A feature that enables a U-NII device to dynamically switch between several transmission power levels in the data transmission process.

4.7.2.10 Channel Availability Check: A check during which the U-NII device listens on a particular radio channel to identify whether there is a radar operating on that radio channel.

4.7.2.11 Dynamic Frequency Selection (DFS): A mechanism that dynamically detects signals from other systems and avoids co-channel operation with these systems (notably radar systems).

4.7.2.12 DFS Detection Threshold: The required detection level defined by detecting a received signal strength that is greater than a threshold specified, within the U-NII device channel bandwidth.

4.7.2.13 Channel Move Time: The time needed by a U-NII device to cease all transmissions on the current channel upon detection of a radar signal above the DFS detection threshold.

4.7.2.14 In-Service Monitoring: A mechanism to check a channel in use by the U-NII device for the presence of a radar.

4.7.2.15 Non-Occupancy Period: The required period in which, once a channel has been recognized as containing a radar signal by a U-NII device, the channel will not be selected as an available channel.

4.7.2.16 Maximum Power Spectral Density: The maximum power spectral density within the specified measurement bandwidth, within the U-NII device operating band.

4.7.3 Power limits

4.7.3.1 For the band 5.15 GHz~5.25 GHz

(1) For outdoor access:

(A) The maximum conducted output power shall be less than or equal to 1 Watt.

(B) The maximum power spectral density shall be less than or equal to 17 dBm in any 1 MHz band.

(C) If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dBi that the directional gain of the antenna exceeds 6 dBi.

(D) The maximum EIRP at any elevation angle above 30 degrees as measured from the horizon shall be less than or equal to 21 dBm.

(2) For indoor access:

(A) The maximum conducted output power over the frequency band of operation shall be less than or equal to 1 Watt.

(B) The maximum power spectral density shall be less than or equal to 17 dBm in any 1 MHz band.

(C) If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dBi that the directional gain of the antenna exceeds 6 dBi.

(3) For fixed point-to-point access:

(A) The maximum conducted output power shall be less than or equal to 1 Watt.

(B) The maximum power spectral density shall be less than or equal to 17 dBm in any 1 MHz band.

(C) If transmitting antennas of directional gain greater than 23 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dBi that the directional gain of the antenna exceeds 23 dBi.

(D) Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

(4) For client devices:

(A) The maximum conducted output power shall be less than or equal to 250 mW.

(B) The maximum power spectral density shall be less than or equal to 11 dBm in any 1 MHz band.

(C) If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dBi that the directional gain of the antenna exceeds 6 dBi.

4.7.3.2 For the 5.25 GHz~5.35 GHz and 5.470 GHz~5.725 GHz bands

(1) The maximum conducted output power shall be less than or equal to 250 mW or 11dBm+10log B (B is the 26 dB emission bandwidth with a unit of MHz) whichever is less.

(2) The maximum power spectral density shall be less than or equal to 11 dBm in any 1 MHz band.

(3) If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dBi that the directional gain of the antenna exceeds 6 dBi.

4.7.3.3 For the 5.725 GHz~5.850 GHz band

(1) The maximum conducted output power shall be less than or equal to 1 Watt.

(2) The maximum power spectral density shall be less than or equal to 30 dBm in any 500 kHz band.

(3) Fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

(4) In addition to (3), if transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dBi that the directional gain of the antenna exceeds 6 dBi.

4.7.3.4 Measurement regulations

(1) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of a rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations (such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc.,) so as to obtain a true peak measurement conforming to the above definitions for the emission in question.

(2) The measurement regulations for the peak power spectral density:

(A) A calibrated test instrument shall be directly connected to the equipment under test, measured as a conducted emission.

(B) In the 5.15 GHz~5.25 GHz, 5.25 GHz~5.35 GHz and 5.47 GHz~5.725 GHz bands, the bandwidth of a calibrated test instrument shall be set as 1 MHz bandwidth or 26 dB emission bandwidth for the equipment under test, whichever is less.

(C) In the 5.725 GHz~5.850 GHz band, the bandwidth of a calibrated test instrument shall be set as 500 kHz or 26 dB emission bandwidth for the equipment under test, whichever is less.

(D) When the resolution bandwidth is less than that in (B) or (C), the total power spectral density shall be calculated by the compensation.

4.7.4 Undesirable emission limits: The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

4.7.4.1 For transmitters operating in the 5.15 GHz~5.35 GHz and 5.470 GHz~5.725 GHz bands: out-of-band EIRP $\leq$-27 dBm/MHz.

4.7.4.2 For transmitters operating in the 5.725 GHz~5.850 GHz band: All emissions within the

frequency range from the band edge to 5 MHz above or below the band edge shall be less than or equal to an EIRP of 27 dBm/MHz~15.6 dBm/MHz (limits corresponding to linear method); all emissions within the frequency range from the band edge to 5 MHz~25 MHz above or below the band edge shall be less than or equal to an EIRP of 15.6 dBm/MHz~10 dBm/MHz (limits corresponding to linear method); all emissions within the frequency range from the band edge to 25 MHz~75 MHz above or below the band edge shall be less than or equal to an EIRP of 10 dBm/MHz~ -27 dBm/MHz (limits corresponding to linear method); for frequencies 75 MHz or greater above or below the band edge, emissions shall be less than or equal to an EIRP of -27 dBm/MHz; for the mask limit, please see Figure 1.

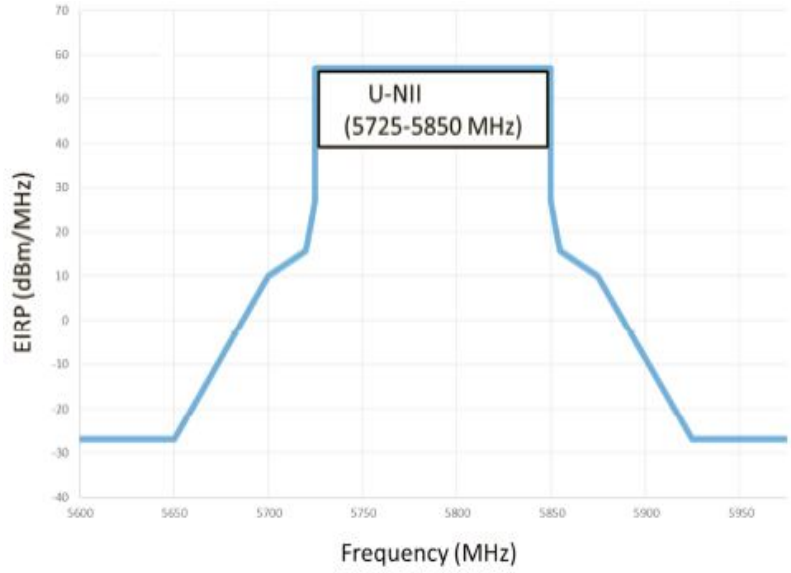

Figure 1

4.7.4.3 When measuring unwanted emissions, the emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A resolution bandwidth less than 1 MHz may be employed near the band edge, when necessary, and the total value is calculated by compensation.

4.7.4.4 When measuring the unwanted emission limits, the carrier frequency for the equipment under test shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

4.7.4.5 The unwanted emissions below 1 GHz shall meet the requirement of Section 2.8. Any devices supplied by the commercial power must adhere to the power line conducted limit of Section 2.3.

4.7.4.6 The unwanted emissions operating in the band of Section 2.7 shall conform to the requirement of Section 2.8.

4.7.4.7 The devices operating in the 5.725 GHz~5.850 GHz band and the antenna gain greater than 10dBi must apply to the out-of-band radiated emission limits of Section 3.10.1.5 before March 2, 2017；those operating in the 5.725 GHz~5.850 GHz and the antenna gain less than or equal to 10dBi must apply for the out-of-band radiated emission limits of Section 3.10.1.5 before March 2, 2018.

4.7.5 Within the 5.725 GHz~5.850 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

4.7.6 The device shall automatically discontinue transmission in case of “either absence of information to transmit” or “operational failure”. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

4.7.7 Other limits:

4.7.7.1 Transmit power control (TPC): U-NII devices operating in the 5.25 GHz~5.35 GHz and 5.470 GHz~5.725 GHz bands shall employ a TPC mechanism. The U-NII device is required to have the

capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an EIRP of less than 500 mW.

4.7.7.2 U-NII devices operating in the 5.25 GHz~5.35 GHz and 5.470 GHz~5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. The related regulations are as follows:

(1) Minimum DFS detection threshold

(A) For devices with a maximum EIRP of 200 mW~1 W, the minimum DFS detection threshold is -64 dBm.

(B) For devices that operate with less than a maximum EIRP of 200 mW and a power spectral density of less than 10 dBm in a 1 MHz band, the minimum DFS detection threshold shall be -62 dBm.

(C) For devices that operate with less than a maximum EIRP of 200 mW and a power spectral density of greater than or equal to 10 dBm in a 1 MHz band, the minimum DFS detection threshold shall be -64 dBm.

(D) The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. For the initial channel setting, the manufacturers shall be permitted to provide for either random channel selection or manual channel selection.

(2) Operational modes. The DFS requirement applies to the following operational modes:

(A) The requirement for channel availability check time applies in the master operational mode.

(B) The requirement for channel move time applies in both the master and slave operational modes.

(3) Channel availability check time: A U-NII device shall check if there is a radar system already operating on the channel before it can initiate a transmission on a channel and when it has to move to a new channel. The U-NII device may start using the channel if no radar signal with power level greater than the interference threshold values listed above is detected within 60 seconds.

(4) Channel move time: After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

(5) Non-occupancy period: A channel that has been flagged as containing a radar system, either by a channel availability check or in-service monitoring, is subject to a nonoccupancy period of at least 30 minutes. The non-occupancy period starts at the time when the radar system is detected.

4.7.7.3 A radio information transmission device must own the safety function to protect the software change from the party without authorization. The manufacturers shall propose the certificates or compliance statement that meets the regulations in this section.

4.7.7.4 The manufacturers operate the digital modulation system on the U-NII bands to provide the safety function, so that the third party is unable to overwrite program and set without approval. The software must avoid transmitters operating in the frequency, output power, modulation technique or other RF without approval. The manufacturers can operate the private network to download software only authorized by users and update the electronic signature by software or firmware by hardware. New software is permitted to be legally installed in the equipment. In the meantime, the items above can be met, and the authorization methods are described in the application.

4.7.7.5 The Manufacturers shall ensure DFS cannot be cancelled by a user who operates a radio information transmission device.

4.7.8 The antenna specifications shall not be subject to the requirement of Section 2.2.

4.7.9 The operation manuals or the specifications shall not only specify the items, except for the requirement of Section 2.10, but also the following items:

4.7.9.1 The operations near the radar system shall not be influenced.

4.7.9.2 The directed antenna with high gain must apply to the fixed point-to-point system only.

4.8 Radio Frequency Identification (RFID), radio beacon in seaside, and other IoT devices.

4.8.1 Adopted frequency hopping system or digital modulation technique devices, excluding passive tag devices.

4.8.1.1 Use Frequency:

(1) Radio frequency identification (RFID) devices: 920 MHz to 928 MHz。

(2) Radio beacon in seaside: 926 MHz to 928 MHz。

(3) Other IoT devices: 920 MHz to 925 MHz。

4.8.1.2 Restrictions to power efficiency::

(1) Installed areas and the maximum peak output power limit except the radio beacon in seaside.

(A) For devices installed indoors or at a specific area: the maximum peak output power limit shall be up to 1 W (inclusive).

(B) For devices installed outdoors: the maximum peak output power limit shall be up to 0.5 W (inclusive).

(C) As aforementioned in paragraph (A), “specific area” is specified to particular, closed and restricted fields with management (both indoors and outdoors).

(2) The maximum peak output power of radio beacon in seaside shall be limited up to 0.5 W (inclusive).

(3) If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power from the intentional radiator shall be reduced by the amount in dB that exceeds 6 dBi.

4.8.1.3 The antenna specification shall not be subject to the requirement of Section 2.2.

4.8.1.4 Radiated emission limits:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power shall be attenuated at least 20 dB and the measured RMS shall be 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, for radiated emissions that fall under Section 2.7 the restricted bands must also comply with the radiated emission limit specified in Section 2.8.

4.8.1.5 Other limits:

(1) Frequency hopping systems:

(A) Frequency hopping systems shall include hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter.

(B) Hopping channels and 20 dB bandwidth limits: If the 20 dB bandwidth of the hopping channel is less than or equal to 250 kHz, the system shall use at least X hopping frequencies. If the 20 dB bandwidth of the hopping channel is greater than 250 kHz, the system shall use at least X/2 hopping frequencies. The maximum allowed 20 dB bandwidth of the hopping channel shall be 500 kHz.

X＝used frequency band（MHz）/26*50,

and adopted unconditional carry law to integer; besides, X≧10

(C) Frequency hopping systems, the average time of occupancy on any frequency each time shall be less than or equal to 0.4 seconds within a time period in seconds equal to the number of hopping channels limit employed multiplied by 0.4.

(2) Digital modulation techniques system:

(A) For digitally modulated systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

(B) The power spectral density from the transmitter to the antenna in any 3 kHz bandwidth of the frequency band shall be less than or equal to 8 dBm.

(3) The hybrid system: The hybrid systems employ a combination of both frequency hopping and digital modulation techniques.

(A) The frequency hopping operation of the hybrid system, with the direct sequence operation turned off, shall include an average time of occupancy on any frequency each time less than or equal 0.4 seconds within a time period in seconds equal to the number of hopping channels employed multiplied by 0.4.

(B) The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power spectrum density requirements of those specified in (B) of Digital modulation techniques system of Section 2 Other limits in this section 4.8.1.4.

(4) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in section 4.8.1 should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in section 4.8.1. .

(5) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels shall be permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

4.8.2 Any transmission device.

4.8.2.1 Use frequency: same as 4.8.1.1.

4.8.2.2 Radiated emissions limits: All field strength limits are specified at a distance of 3 meters. The field strength of fundamental and harmonic emissions shall comply with the limits shown in the table below. Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in Section 2.8, whichever is the lesser attenuation.

Field Strength of Fundamental (mv/m)	Field Strength of Harmonics Emission (μv/m)
50	500

4.8.2.3 The emission limits are based on measurement instrumentation employing an average detector. The provisions in Section 5.15.2 for limiting peak emissions shall apply.

4.9 Auto, motorcycle theft-proof remote control

4.9.1 Frequency bands: 467.4625 MHz~467.4875 MHz

4.9.2 Output power: No more than 0.5 W (ERP)

4.9.3 Unwanted emission: The field strength of unwanted emissions shall not exceed the general radiated emission limits in Section 2.8.

4.9.4 Only for transmitting control signals.

4.9.5 The frequency tolerance:
Shall be maintained within ±3 ppm of the operating bands. This frequency tolerance shall be maintained for a temperature variation of -5 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage within ±15 % of the rated supply voltage at 20 °C. For battery-powered equipment, the equipment tests shall be performed using a new battery.

4.9.6 Types of operation:

4.9.6.1 Devices with manual operation must be fitted with a switch. Emissions shall be stopped within 5 seconds after you push and release the switch.

4.9.6.2 For devices with automatic control mechanism: The duration of each emission shall be less than 5 seconds. The off time between emission cycles shall be greater than 5 seconds. Emissions are prohibited after 2 minutes of each trigger or state change.

4.10 Assistive vision disabled communication devices

4.10.1 Frequency bands: 475.5 MHz~476.5 MHz

4.10.2 Output power: No more than 0.5 W (ERP)

4.10.3 Unwanted emission: The field strength of unwanted emissions shall not exceed the general radiated emission limits in Section 2.8

4.10.4 Frequency tolerance:
The frequency tolerance of the carrier shall be ±0.01 %. This frequency tolerance shall be maintained for a temperature variation of -5 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage within ±15 % of the rated supply voltage at 20 °C. For battery-powered equipment, the equipment tests shall be performed using a new battery.

4.11 Medical Device Radio communication Service (MedRadio): is a medical service system specifically for transmitting data in support of diagnostic or therapeutic functions between an external programmer/control transceiver and an active medical implant or body-worn transceiver placed in the human body.

4.11.1 Operating frequencies: 401 MHz~406 MHz,

4.11.2 Terminology:

4.11.2.1 Emission bandwidth: The emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 20 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1 % of the emission bandwidth of the device under measurement.

4.11.2.2 MedRadio communications session: is a collection of transmissions that may or may not be continuous, between co-operating MedRadio devices and accessories.

4.11.2.3 MedRadio channel: is any continuous segment of spectrum that is equal to the emission bandwidth of the device with the largest bandwidth that is to participate in a MedRadio communications session.

4.11.3 Requirement of MedRadio programmer/control transmitter:

4.11.3.1 For frequency monitoring: Before the medical programmer/control transmitter begins the MedRadio communication session, the following conditions must be adhered to:

(1) The 20 dB bandwidth of the monitoring system must be greater than or equal to the wanted emission bandwidth.

(2) Within 5 seconds prior to initiating a communications session, the MedRadio must monitor the channel or channels the MedRadio system devices intend to occupy for a minimum of 10

milliseconds per channel.

(3) Based on use of an isotropic monitoring system antenna, the monitoring threshold power level (P_{Th}) must be less than or equal to 10 logB (Hz) - 150 (dBm/Hz) + G (dBi) where B is the emission bandwidth of the MedRadio communication session transmitter having the widest emission and G is the programmer/control transmitter monitoring system antenna gain relative to an isotropic antenna. If using a non-isotropic monitoring system antenna, the monitoring threshold power level shall be modified.

(4) If no signal in a MedRadio channel above the monitoring threshold power level is detected, the MedRadio programmer/control transmitter may initiate a MedRadio-communications session. The MedRadio communications session may continue as long as any silent period between consecutive data transmission bursts does not exceed 5 seconds. If a channel confirmed with the signals is higher than the monitoring threshold level, MedRadio transmitters shall cease the emission. The MedRadio transmitters that are capable of operating on multiple channels shall be applied as well. The device with the lowest monitored ambient power level must be changed to continue the communication sessions.

(5) When a channel is selected prior to a MedRadio communications session, it is permissible to select an alternate channel for use if communications are interrupted, provided that the alternate channel selected is the next best choice using the above criteria. The alternate channel may be accessed in the event a communications session is interrupted by interference. The following criteria must be met:

(A) Before transmitting on the alternate channel, the channel must be monitored for a period of at least 10 milliseconds.

(B) The detected power level during this 10 milliseconds or greater monitoring period must be no higher than 6 dB above the power level detected when the channel has been selected as the alternate channel.

(C) In the event that this alternate channel provision is not used by the MedRadio system or if the criteria in paragraphs (A) and (B) are not met, a channel must be selected using the access criteria specified in 4.11.3.1(1)~(4).

4.11.3.2 MedRadio programmer/control transmitter shall be a mechanism to monitor frequency, and the communication session is started by the implant medical device operating under monitoring (including the monitoring channel or channel used by MedRadio), but the device or the communication session that meets one of the following conditions will not be limited here:

(1) MedRadio devices operating in either the 401 MHz~401.85 MHz or 405 MHz~406 MHz bands, provided that the transmit power shall be less than or equal to 250 nW EIRP and the duty cycle for such transmissions need to be less than or equal to 0.1 %, based on the total transmission time during a one-hour interval, and a maximum of 100 transmissions per hour.

(2) MedRadio devices operating in the 401.85 MHz~402 MHz band, provided that the transmit power shall be less than or equal to 25 uW EIRP and the duty cycle for such transmissions need to be less than or equal to 0.1 %, based on the total transmission time during a one hour interval, and a maximum of 100 transmissions per hour.

(3) MedRadio devices operating with a total emission bandwidth not exceeding 300 kHz centered at 403.5 MHz~403.8 MHz, provided that the duty cycle for such transmissions need to be less than or equal to 0.01 %, based on the total transmission time during a one-hour interval, and a maximum of 10 transmissions per hour.

4.11.3.3 The measurement procedures to monitor MedRadio frequency shall refer to the requirement of ETSI EN 301 839-1, ETSI EN 302 537-1 or FCC 47CFR Part 95.627.

4.11.4 Operation band for MedRadio Station:

4.11.4.1 MedRadio Station is an associated device to connect to the medical radio transmitter.

4.11.4.2 MedRadio Station associated with medical implant devices and meeting 4.11.3.1 must use any frequencies in the 401 MHz~406 MHz band.

4.11.4.3 MedRadio Station associated with medical implant devices but not meeting 4.11.3.1 must only use any frequencies in the 401 MHz~402 MHz and 405 MHz~406 MHz bands or 403.65 MHz in the 402 MHz~405 MHz band.

4.11.4.4 MedRadio Station associated with body-worn medical devices and using frequency monitoring in 4.11.3.1 can operate any frequencies in the 401 MHz~402 MHz or 405 MHz~406 MHz band.

4.11.4.5 MedRadio Station associated with multiple permanent implant medical devices and using frequency monitoring in 4.11.3.1 can operate any frequencies in the 402 MHz~405 MHz band:

(1) The maximum output power of the temporary body-worn device needs to be less than 200 nW EIRP; and

(2) The temporary body-worn device must comply fully with all other MedRadio rules applicable with medical implant device operation in the 402 MHz~405 MHz band.

4.11.5 Emission bandwidth:

4.11.5.1 For MedRadio operating in the 402 MHz~405 MHz band, the maximum emission bandwidth is 300 kHz. The total bandwidth used in communication session shall be less than or equal to 300 kHz.

4.11.5.2 For MedRadio operating in the 401 MHz~401.85 MHz or 405 MHz~406 MHz band, the maximum emission bandwidth is 100 kHz. The total bandwidth used in communication session shall be less than or equal to 100 kHz.

4.11.5.3 For MedRadio operating in the 401.85 MHz~402 MHz band, the maximum emission bandwidth is 150 kHz. The total bandwidth used in communication session shall be less than or equal to 150 kHz.

4.11.5.4 For MedRadio operating in the 402 MHz~405 MHz band, the total amount of bandwidth utilized by a channel shall be less than or equal to 300 kHz. For MedRadio operating in the 401 MHz~402 MHz and 405 MHz~406 MHz bands, the total amount of bandwidth utilized by a channel shall be less than or equal to 100 kHz. Full duplex or half duplex communications shall be adopted.

4.11.6 For the EIRP, limits are summarized in Table 1:

4.11.6.1 The maximum emission power by a MedRadio transmitter operating in the 402 MHz~405 MHz band in any 300 kHz bandwidth or the 401 MHz~402 MHz or 405 MHz~406 MHz band in any 100 kHz bandwidth in compliance with 4.11.3.1 shall be less than or equal to 25 uW EIRP.

4.11.6.2 The maximum emission power by a MedRadio transmitter operating in the 403.5 MHz~403.8 MHz band in compliance with 4.11.3.2(3) shall be less than or equal to 100 nW EIRP.

4.11.6.3 The power radiated by a MedRadio transmitter operating in the 401 MHz~401.85 MHz or 405 MHz~406 MHz band in compliance with 4.11.3.2(1) shall be less than or equal to 250 nW EIRP in any 100 kHz bandwidth.

4.11.6.4 The power radiated by a MedRadio transmitter operating in the 401.85 MHz~402 MHz band in compliance with 4.11.3.2(2) shall be less than or equal to 25 uW EIRP in any 150 kHz bandwidth.

4.11.6.5 The EIRP measurements may be determined by connecting the MedRadio transmitter to the antenna and measuring the radiated field from the equipment under test at 3 meters and calculating the EIRP. The equivalent radiated field strength at 3 meters for 25 uW, 250 nW, 100 nW EIRP is 18.2 mV/m, 1.8 mV/m, 1.2 mV/m, respectively, when measured on an open area test site; or 9.1 mV/m, 0.9 mV/m, 0.6 mV/m, respectively, when measured on a test site equivalent to free space such as a fully anechoic test chamber.

4.11.6.6 Compliance with the maximum transmitter power requirements set forth shall be based on measurements using a peak detector function and measured over an interval of time when transmission is continuous and at its maximum power level.

Table 1

Operating frequency band	Monitoring		No monitoring			
	BW	EIRP	BW	EIRP	Operating condition	
					Duty cycle	Times Per hour
401~401.85	100 kHz	25 uW	100 kHz	250 nW	0.1 %	100

					(3.6 s/hr)	
401.85~402	100 kHz	25 uW	150 kHz	25 uW	0.1 % (3.6 s/hr)	100
402~403.5	300 kHz	25 uW	----	----	----------	-----
403.5~403.8	300 kHz	25 uW	300 kHz	100 nW	0.01 % (360 ms/hr)	10
403.8~405	300 kHz	25 uW	----	----	----------	-----
405~406	100 kHz	25 uW	100 kHz	250 nW	0.1 % (3.6 s/hr)	100

4.11.7 Unwanted emission:

4.11.7.1 The unwanted emission power must be less than the fundamental emission power.

4.11.7.2 The field strength in the following circumstance shall conform to the requirements in Section 2.8.

(1) MedRadio operating in the band 402 MHz~405 MHz that is more than 250 kHz away from the 402 MHz~405 MHz band.

(2) MedRadio operating in the band 401 MHz~402 MHz or 405 MHz~406 MHz that is more than 100 kHz in the 406 MHz~406.1 MHz band and away from the bands 401 MHz~402 MHz and 405 MHz~406 MHz.

4.11.7.3 For MedRadio operating in the band 402 MHz~405 MHz that is more than 150 kHz away from the center frequency of the transmission, the emission power shall be attenuated below the maximum permitted output power over 20 dB.

4.11.7.4 MedRadio operating in the band 401 MHz~402 MHz or 405 MHz~406 MHz that is more than 50 kHz away from the center frequency of the transmission; for MedRadio operating in the band 401.85 MHz~402 MHz that is more than 75 kHz away from the center frequency of the transmission, the emission power shall be attenuated below the maximum permitted output power over 20 dB.

4.11.7.5 The emission powers in Section 4.11.7.3 and Section 4.11.7.4 are based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1 % of the emission bandwidth of the device under measurement.

4.11.8 Frequency tolerance: Each transmitter in the MICS service must maintain a frequency stability of ±100 ppm of the operating frequency over the range: 25 ℃~45 ℃ in the case of medical implant transmitters; and 0 ℃~55 ℃ in the case of medical implant programmer/control and body-worn transmitters.

4.11.9 Measurement requirements on implant transmitters:

4.11.9.1 For a transmitter intended to be implanted in a human body, the following test fixture must be used to simulate operation of the implant under actual operating conditions.

4.11.9.2 For measurement purposes to determine compliance with emission limits, the radiating characteristics of an implant transmitter placed in a test fixture should approximate those of an implant transmitter placed in a human body. An appropriate human torso simulator for testing medical implant transmitters consists of a cylindrical Plexiglas container with a size of 30±0.5 cm by 76±0.5 cm with a sidewall thickness of 0.6±0.21 cm. It must be completely filled with a material that is sufficiently fluidic that it will flow around the implant without any voids, but not including the saline. The dielectric and conductivity properties of this material must match the dielectric and conductivity properties of human muscle tissue at 403.5 MHz. All emissions measurements will be made using the above specification at a nominal temperature of 22 ℃~38 ℃. A stand for the implant inside the container must be provided that permits the radiating element or elements of the implant to be positioned vertically and horizontally. The implant transmitter shall be vertically placed in the container, and the antenna shall be mounted 6±0.5 cm from the sidewall. If it is horizontally set up, the antenna shall be readjusted to keep 6±0.5 cm from the sidewall. The above fixture shall be placed on a turntable such that the implant transmitter will be located at a nominal 1.5-meter height above ground and at a 3-meter distance from the measurement antenna. The above fixture shall be placed on a turntable such that the implant transmitter will be located at a nominal 1.5-meter height

above ground and at a 3-meter distance from the measurement antenna.

4.11.9.3 A formula for a suitable tissue substitute material refers to FCC 95.627 or ETSI EN 301839-1, ETSI EN 302537-1.

4.11.10 Programmer/control receiver: shall conform to the regulations in Section 2.8.

4.11.11 Programmer/control devices using AC power line shall conform to the limits of power-line conducted emissions in Section 2.3.

4.11.12 The MedRadio Station can send any emission type that applies to non-voice communication service.

4.12 Ultra-wideband Devices:

4.12.1 Frequency bands: 4.224 GHz~4.752 GHz, 6.336 GHz~7.920 GHz, 7.392 GHz~8.976 GHz.

4.12.2 Terminology:

4.12.2.1 UWB bandwidth: For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system (including the antenna). The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M.

4.12.2.2 Center frequency: Central frequency f_C is equal to $(f_H+f_L)/2$.

4.12.2.3 Fractional bandwidth: Fractional bandwidth is equal to 2 (f_H-f_L) / (f_H+f_L).

4.12.2.4 Ultra-wideband transmitter): An intentional radiator that, at any point in time, has a fractional bandwidth greater than 0.20 or has a UWB bandwidth greater than 500 MHz, regardless of the fractional bandwidth.

4.12.2.5 Medical imaging system: A field disturbance sensor that is designed to detect the location or movement of objects within the body of a person or animal.

4.12.2.6 Hand held device: A hand held device is a portable device, such as a lap top computer or a PDA

4.12.3 Device type:

4.12.3.1 Medical imaging systems

(1) Radiated emissions:

(A) The radiated emissions below 960 MHz from a device operating under the provisions of this section shall conform to the emission levels in Section 2.8.

(B) Radiated emissions above 960 MHz from a device operating under the provisions of this section shall be less than or equal to the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)
960~1610	-65.3
1610~1990	-53.3
1990~4224	-51.3
4224~4752	-41.3
4752~6336	-51.3
6336~8976	-41.3
Over 8976	-51.3
Note: The tighter limit applies at the band overlap.	

(C) Radiated emission from GPS band: In addition to the radiated emission limits specified in the table in paragraph (A) and (B) of this section, UWB transmitters operating under the provisions of this section shall be less than or equal to the following average limits when measured using a resolution bandwidth over 1 kHz:

frequency (MHz)	EIRP (dBm)
1164～1240	-75.3
1559～1610	-75.3

(2) Peak radiated emission limit: Within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M, the peak emission limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures stipulated in 4.12.4.6.

(3) A medical imaging system shall contain a manually operated switch or a remote emergency switch that causes the transmitter to cease operation within 10 seconds of being released by the operator.

4.12.3.2 Indoor UWB systems:

(1) Radiated emissions:

(A) The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall conform to the emission levels in Section 2.8.

(B) The radiated emissions above 960 MHz from a device operating under the provisions of this section shall be less than or equal to the following average limits when measured using a resolution bandwidth of 1 MHz:

frequency (MHz)	EIRP (dBm)
960～1610	-75.3
1610～1990	-53.3
1990～4224	-51.3
4224～4752	-41.3
4752～6336	-51.3
6336～8976	-41.3
8976 以上	-51.3
Note: The tighter limit applies at the band overlap.	

(C) Radiated emission from GPS band: In addition to the radiated emission limits specified in the table in paragraph (A) and (B) of this section, UWB transmitters operating under the provisions of this section shall be less than or equal to the following average limits when measured using a resolution bandwidth over 1 kHz:

frequency (MHz)	EIRP (dBm)
1164～1240	-85.3
1559～1610	-85.3

(2) Peak radiated emission limit: Within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M, the peak emission limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in 4.12.4.6.

(3) Others:

(A) For indoor access.

(B) The emissions from equipment operated under this section shall not be intentionally

directed outside of the building in which the equipment is located (such as through a window or a doorway, to perform an outside function, such as the detection of persons about to enter a building).

(C) The use of outdoor mounted antennas, e.g., antennas mounted on the outside of a building or on a telephone pole, or any other outdoors infrastructure is prohibited.

(D) Field disturbance sensors installed inside of metal or underground storage tanks are considered to operate indoors provided the emissions are directed towards the ground.

(E) A communications system shall transmit only when the intentional radiator is sending information to an associated receiver.

(F) The UWB systems shall label the following or similar descriptions: “this device used for indoor only” at the obvious place where the device is installed or in the attached operation manual.

4.12.3.3 Hand held UWB systems

(1) Radiated emission:

(A) The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall meet the emission levels in Section 2.8.

(B) The radiated emissions above 960 MHz from a device operating under the provisions of this section shall be less than or equal to the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)
960～1610	-75.3
1610～1990	-63.3
1990～4224	-61.3
4224～4752	-41.3
4752～6336	-61.3
6336～8976	-41.3
8976 以上	-61.3
Note: The tighter limit applies at the band overlap.	

(C) Radiated emission from the GPS band: In addition to the radiated emission limits specified in the table in paragraph (A) and (B) of this section, UWB transmitters operating under the provisions of this section shall be less than or equal to the following average limits when measured using a resolution bandwidth over 1 kHz:

frequency (MHz)	EIRP (dBm)
1164～1240	-85.3
1559～1610	-85.3

(2) Peak radiated emission limit: Within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M, the peak emission limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in 4.12.4.6.

(3) Others:

(A) UWB devices operating under the provisions of this section must be hand held, i.e., they are relatively small devices that are primarily hand held while being operated and do not employ a fixed infrastructure.

(B) A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received.

4.12.4 Other rules:

4.12.4.1 UWB devices must not be employed for the operation of toys. Operation onboard an aircraft, a ship or a satellite is prohibited.

4.12.4.2 The operation of the antenna shall conform to the regulations in Section 2.2.

4.12.4.3 If emissions from digital circuitry of UWB transmitter can be specified other than the emission from the antenna, the emissions shall conform to the regulations in Section 2.8. Emissions from associated digital devices shall be the same.

4.12.4.4 Within the tables in 4.12.3.1, 4.12.3.2, and 4.12.3.3, the tighter emission limit applies at the band edges. Radiated emission levels at and below 960 MHz are based on measurements employing a CISPR quasi-peak detector. Radiated emission levels above 960 MHz are based on RMS average measurements over a 1 MHz resolution bandwidth. The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less (inclusive) averaging time.

4.12.4.5 The frequency at which the highest radiated emission occurs, f_M, must be contained within the UWB bandwidth.

4.12.4.6 The measurement shall be centered on the frequency at which the highest radiated emission occurs, f_M. If a resolution bandwidth among 1 MHz~50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm. This may be converted to a peak field strength level at 3 meters using (dBuV/m) = P(dBm EIRP) + 95.2.

4.12.4.7 The highest frequency employed in Section 5.14 to determine the measurement range of the unnecessary emission e shall be based on the center frequency, f_C.

4.12.4.8 The UWB devices shall not be applied to the requirement of Section 2.4.

4.12.4.9 Unless specified in 4.12, the UWB devices shall not be applied to the requirement of Section 5.1.5.3.

5 Inspection rules

5.1 For swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

5.2 Measurements of radio frequency emissions conducted on public utility power lines shall be undertaken using a 50 ohm/50 uH line impedance stabilization network (LISN).

5.3 Field strength measurements shall be made, to the extent possible, on an open field site. Test sites other than open field sites may be employed if they are properly calibrated so that the measurement results correspond to what would be obtained from an open field site. In the case of equipment for which measurements can be undertaken only at the installation site, such as perimeter protection systems, carrier current systems, and systems employing a "leaky" coaxial cable as an antenna, measurements for verification or for obtaining a grant of equipment authorization shall be performed at a minimum of three installations that can be demonstrated to be representative of typical installation sites.

5.4 For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be undertaken with the supply voltage varied ±15% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be undertaken using a new battery. A preliminary measurement shall be undertaken to determine the configuration and condition that produces the highest emission for the final measurement as follows:

5.4.1 EUT powered from both AC and DC (battery) power, if the device has this capability.

5.4.2 EUT supplied with the appropriate modulation and without modulation, if the modulation of carrier can be controlled.

5.4.3 For hand-held or body-worn devices, the EUT shall be rotated through three orthogonal axes.

5.5 To the extent possible, the device under test shall be measured at the distance specified in the appropriate rule section. The distance specified corresponds to the horizontal distance between the measurement antenna and the closest point of the equipment under test, support equipment or interconnecting cables as determined by the boundary defined by an imaginary straight line periphery describing a simple geometric configuration enclosing the system containing the equipment under test. The equipment under test, support equipment and any interconnecting cables shall be included within this boundary.

5.5.1 At frequencies at or above 30 MHz, measurements may be undertaken at a distance other than what is specified provided measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be undertaken at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When undertaking measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

5.5.2 At frequencies below 30 MHz, measurements may be undertaken at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. When performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

5.5.3 When the measurement distance is other than the distance specified, the measurement report shall indicate the extrapolation method used during the measurement.

5.5.4 Measurements shall be undertaken at a sufficient number of radials around the equipment under test to determine the radial at which the field strength values of the radiated emissions are maximized. The maximum field strength at the frequency being measured shall be recorded and

reported.

5.6 Equipment under test shall be adjusted, using those controls that are readily accessible to or are intended to be accessible to the consumer, in such a manner as to maximize the level of the emissions. For those devices to which cable may be attached by the consumer, tests shall be performed with cable attached. The cable shall be of the length to be used with the equipment if that length is known. Otherwise, cable one meter in length shall be attached to the equipment. Longer cable may be employed if necessary to interconnect to associated peripherals.

5.6.1 For tabletop EUT, the requirements for configuration of power-line conducted emission test is as follows:

5.6.1.1 If interconnecting cables between devices hang less than 40cm to the ground plane, the rest should be folded forming a bundle 30 to 40 cm long and tied in the middle, so that the lowest point of the cable is in the middle between the test table and the ground plane.

5.6.1.2 I/O cable not connected to a peripheral shall be bundled in center to keep the cable away from the grounding surface by 40 cm approximately. The end of the cable shall be terminated with correct terminating impedance.

5.6.1.3 LISN at least 80 cm from nearest part of EUT chassis. The excess power cord of EUT shall be bundled close to the center of the cord. Non-EUT equipment needs not to be bundled.

5.6.1.4 Rear of EUT, including peripherals, shall be all aligned and flush with rear of tabletop. Rear of tabletop shall be 40 cm removed from the vertical conducting plane.

5.6.2 For floor-standing EUT, the requirements for configuration of power-line conducted emission test is as follows:

5.6.2.1 Excess interconnecting cable shall be bundled in center and the bundling shall not exceed 40 cm.

5.6.2.2 LISN is 80 cm from nearest part of EUT chassis. The excess power cord of EUT and peripherals shall be bundled in center to appropriate length.

5.6.2.3 I/O cable that are not connected to a peripheral shall be bundled in center. The end of the cable shall be terminated with correct terminating impedance.

5.6.2.4 EUT and all cables shall be insulated from ground plane by 3 mm~12 mm of insulating material.

5.6.3 For tabletop EUT, the requirements for configuration of radiated emission test is as follows:

5.6.3.1 If interconnecting cables between devices hang less than 40cm to the ground plane, the rest should be folded forming a bundle 30 cm to 40 cm long and tied in the middle, so that the lowest point of the cable is in the middle between the test table and the ground plane.

5.6.3.2 I/O cable not connected to a peripheral shall be bundled in center to keep the cable away from the grounding surface by 40 cm approximately. The end of the cable may be terminated if required using correct terminating impedance.

5.6.3.3 Rear of EUT, including peripherals, shall be all aligned and flush with rear of tabletop.

5.6.3.4 The power cords of EUT and peripheral drape to the floor and are not required to be bundled.

5.6.4 For floor-standing EUT, the requirements for configuration of radiated emission test is as follows:

5.6.4.1 Excess interconnecting cable shall be bundled in center and the bundling shall not exceed 40 cm.

5.6.4.2 The excess power cord of EUT and peripherals shall be bundled in center to appropriate length.

5.6.4.3 I/O cables that are not connected to a peripheral shall be bundled in center. The end of the cable shall be terminated with correct terminating impedance.

5.6.4.4 EUT and all cables shall be insulated from ground plane by 3 mm~12 mm of insulating material.

5.7 For a composite system that incorporates devices contained either in a single enclosure or in separate enclosures connected by wire or cable, testing for compliance with the standards shall be undertaken

with all of the devices in the system functioning. If an intentional radiator incorporates more than one antenna or other radiating source and these radiating sources are designed to emit at the same time, measurements of conducted and radiated emissions shall be undertaken with all radiating sources that are to be employed emitting. A device which incorporates a carrier current system shall be tested for compliance with whatever rules would apply to the device.

5.8 If the device under test provides for the connection of external accessories, including external electrical input signals, the device shall be tested with the accessories attached. The device under test shall be fully exercised with these external accessories. The emission tests shall be undertaken with the device and accessories configured in a manner that tends to produce maximized emissions within the range of variations that can be expected under normal operating conditions. Only one test using peripherals or external accessories that are representative of the devices that will be employed with the equipment under test is required. All possible equipment combinations do not need to be tested. The accessories or peripherals connected to the device being tested shall be unmodified, commercially available equipment.

5.9 If the equipment under test consists of a central control unit and an external or internal accessory(ies) (peripheral) and the party verifying the equipment or applying for a grant of equipment authorization manufactures or assembles the central control unit and at least one of the accessory devices that can be used with that control unit, testing of the control unit and/or the accessory(ies) must be undertaken using the devices manufactured or assembled by that party, excluding any other needed devices which the party does not manufacture or assemble. If the party verifying the equipment or applying for a grant of equipment authorization does not manufacture or assemble the central control unit and at least one of the accessory devices that can be used with that control unit or the party can demonstrate that the central control unit or accessory(ies) normally would be marketed or used with equipment from a different entity, testing of the central control unit and/or the accessory(ies) must be performed using the specific combination of equipment which is intended to be marketed or used together. Only one test using peripherals or external accessories that are representative of the devices that will be employed with the equipment under test is required. All possible equipment combinations do not need to be tested. The accessories or peripherals connected to the device being tested shall be unmodified, commercially available equipment.

5.10 If the individual devices in a composite system are subject to different technical standards, each such device must comply with its specific standards. In no event may the measured emissions of the composite system exceed the highest level permitted for an individual component.

5.11 Modular transmitter: In order to be considered a modular transmitter, the device must be a complete RF transmitter, and can be installed on different platforms.
The modular transmitter shall conform to the following requirements:

5.11.1 The modular transmitter must have its own RF shielding.

5.11.2 The modular transmitter must have buffer for modulation/data inputs, if such inputs are provided.

5.11.3 The modular transmitter must have its own power supply regulation.

5.11.4 The modular transmitter must comply with the antenna requirements of Section 2.2. Any antenna used with the module, with specifications presented, must be tested under maximum output power and maximum gain of the transmitter.

5.11.5 The modular transmitter must not be inside another device during testing. It can be installed on an extending fixture.

5.11.5.1 DC or AC power lines and data input/output lines connected to the module must not contain ferrites, unless they will be marketed with the module and instructions.

5.11.5.2 Length of these lines shall be length typical of actual use or, if that length is unknown, at least 10cm.

5.11.5.3 Any accessories, testing fixture, peripherals, or support equipment connected to the module during testing shall not be modified.

5.12 Measurements on intentional radiators or receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1Mhz or less	1	Middle
1-10 MHz	2	One near the top and the other near the bottom
More than 10 MHz	3	One near the top, one near the bottom and another near the center

5.13 The amplitude of spurious emissions that are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this standard.

5.14 Frequency measurement range:

5.14.1 The spectrum shall be measured from the lowest radio frequency signal generated in the device (without going below 9 kHz), and the upper limit of the measurement range shall be decided according to the maximum operating frequency.

5.14.1.1 Maximum operating frequency less than 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

5.14.1.2 Maximum operating frequency between 10 GHz~30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

5.14.1.3 Maximum operating frequency over 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.

5.14.2 Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

5.15 Specifications of measuring equipment: The conducted and radiated emission limits shown in this rule are based on the following, unless otherwise specified elsewhere in this rule.

5.15.1 On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electro technical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.

Note: For pulse modulated devices with a pulse-repetition frequency less than or equal of 20 Hz and for which CISPR quasi-peak measurements are specified, compliance with the regulations shall be demonstrated using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, using the same measurement bandwidths that are indicated for CISPR quasi-peak measurements.

5.15.2 On any frequency of frequencies above 1000 MHz, the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in the regulations (including emission measurements below 1000 MHz), there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules. Unless otherwise specified, measurements above 1000 MHz shall be undertaken using a minimum resolution bandwidth of 1MHz.

5.15.3 Unless otherwise specified, when the radiated emission limits are expressed in terms of the

average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with the test report.

5.16 Modulation applied: Unless specified in the individual test instructions or when modulation is needed to produce a transmitted signal (e.g. single-sideband suppressed carrier transmitters), modulation does not need to be applied during testing. When modulation is specified in individual tests, the following provisions can be applied:

5.16.1 For voice-only modulated devices (200 Hz~3000 Hz) except cordless telephones, a 1000 Hz sine wave at 100 dB SPL (0 dB SPL is 20 μPa) shall be applied 10 cm from the microphone.

5.16.2 If the EUT is modulated from internal sources, then the internal sources shall be applied.

5.16.3 If the EUT is equipped with input terminals for external modulation, modulating signals of sine wave shall be applied at the maximum rated level and appropriate frequency.

5.17 Unless the operation of EUT requires different range, the ambient temperature and humidity shall be within the range of 10 °C to 40 °C and 10 % to 90 % respectively.

5.18 Battery Operating End Point Voltage: For battery operated only device, the frequency stability shall be measured supplying the EUT primary voltage at the battery operating end point that is specified by the manufacturer and record the frequency.

5.19 Frequency response: if measurement of frequency response is specified in individual provision, the test data should cover a range of 100 Hz~5000 Hz.

5.20 RF exposure assessment: If RF Exposure Assessment is required in the regulation, the requirements are as following:

5.20.1 For purposes of RF exposure assessment requirements, Specific Absorption Rate (SAR) shall be measured as transmitters whose radiating structures are designed to be used within 20 centimeters of the body of the user. Limits are as follows:

Position	Occupational/Controlled Exposure (W/kg)	General Population/Uncontrolled Exposure (W/kg)
Whole-Body	0.4	0.08
Partial-Body	8.0	1.6
Hands, Wrists, Feet and Ankles	20.0	4.0

Note 1: Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Note 2: At frequencies above 6.0 GHz, SAR limits are not applicable and MPE limits for power density should be applied at 5 cm or more from the transmitting device.

5.20.2 For purposes of RF exposure assessment requirements, Maximum Permissible Exposure (MPE) shall be measured, if separation distance of at least 20 centimeters is normally maintained between radiating structures and the body of the user or nearby persons. Limits are as follows:

5.20.2.1 Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
0.3-3.0	614	1.63	*100	6

3-30	1842/f	4.89/f	*900/f^2	6
30-300	61.4	0.163	1.0	6
300-1,500	-----	-----	f/300	6
1,500-100,000	-----	-----	5.0	6

Note 1: asterisk (*) is plane-wave equivalent power density.
Note 2: f is the testing frequency in MHz.

5.20.2.2 Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f^2	30
30-300	27.5	0.073	0.2	30
300-1,500	-----	-----	f/1500	30
1,500-100,000	-----	-----	1.0	30

Note 1: asterisk (*) is plane-wave equivalent power density.

Note 2: f is the testing frequency in MHz.

Appendix Measurement of low power radio frequency devices

Appendix I Measurement of international radiators

I. Note:
The following procedure may be used as a guide for determining compliance of international radiators operation on frequencies above 30 MHz that can be tested on an open site with certain regulatory requirements.

II. Test items:

(I) AC power line conducted emission measurements setup: applies only to EUTs that operate from public utility powerlines.

1. The AC power line conducted emission test site shall conform to the requirements of CNS13306-1; The measuring instruments, containing the LISN, shall conform to the requirements of CNS13306-1.
2. The EUT shall be configured in accordance with CNS13438. If the EUT uses a detachable antenna, these measurements shall be made with a suitable dummy load connected to the antenna output terminals; otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended.
3. Use the type and length of interface cables specified in 5.6 and connect them to the interface ports on the EUT. In accordance with 5.6.1, the bundle shall be secured with masking tape or any other nonconducting material that will not affect the measurements.
4. Connect the EUT power cord to one LISN and connect the peripheral or support equipment power cords to a separate LISN. AC power for all LISNs is to be obtained from the same one power source. If the EUT power cord is long enough to be bundled, the bundle should be secured with masking tape or any other nonconducting material that will not affect the measurements. Power cords of non-EUT equipment do not require bundling. Drape AC power cords of non-EUT equipment over the rear edge of the table, and route them down onto the floor of the AC powerline conducted emission test site to the second LISN. Power cords of floor-standing accessory equipment may be routed in any convenient fashion atop the reference groundplane or insulating material specified in 5.6.2. Power cords of peripheral equipment should not be draped over the top of an LISN.
5. The EUT shall be supplied with the appropriate modulation. If the EUT transmit only pulse modulation and has coding switches, these shall be set to the position that produces the maximum duty cycle during measurements.

(II) AC power line conducted emission measurements:

1. Check the calibration of measuring instrument using either an internal calibrator or a known signal level from an external signal generator.
2. A spectrum analyzer or other instrument providing spectral display is recommended for exploratory AC powerline conducted emission measurements. Connect the measuring instrument to the RF port of a section of the LISN supplying current to the EUT using a suitable length of coaxial cable. Terminate all other RF ports of the LISN in 50-ohm resistive. Set the 6dB bandwidth of the measuring instrument to not less than 10 kHz and the detector function to the peak mode. Set the controls on the measuring instrument to enable viewing the entire frequency range for which limits are specified.
3. Activate the EUT and the measuring instrument. The EUT should be set to transmit on any one convenient frequency in its rated range.
4. Exercise the EUT in all modes of operation as specified in 5.4. Accessory equipment connected to the EUT shall be exercised individually.
5. Use the procedure in 5.8 to determine the arrangement of the EUT system that produces the emission with the highest amplitude relative to the limit. The EUT may be turned off and on to determine which emissions emanate from it.

6. Repeat step 5 with the measuring instrument connected to the RF port of the other LISN section supplying the EUT with AC power.

   Note: Measurement are to be made only on emanations at the RF ports of the LISNs connected to the EUT.

7. Select the EUT arrangement and mode of operation that produced the highest emission relative to the limit for final AC powerline conducted emission measurements. If the EUT is moved to a final AC powerline conducted emission test site from an exploratory conducted emission test site, be sure to re-maximize the highest emission according to 5.8. Set the bandwidth and the detector function of the instrument to measure the final AC powerline conducted emission from the EUT.
8. Repeat step 7 with the measuring equipment connected to the RF port of the other LISN section supplying the EUT with AC power.
9. Record the EUT arrangement, mode of operation, and interconnect cable or wire positions used for final AC powerline conducted emission measurements. This can be done with either diagrams or photographs.

(III) Radiated emission measurements setup:

1. The measuring instruments shall conform to the requirements in CNS13306-1.
2. The EUT shall be positioned on a turntable as specified in 5.6 and configured as “AC power line conducted emission measurements setup”.
3. If operated from AC power, connect the power cord of the EUT and any accessory equipment to the AC power source receptacle located on the turntable. If the battery operated, begin the tests with a new or a fully charged battery installed in the EUT. The AC power cords of the EUT and accessories do not require bundling. Drape all AC power cords of equipment tested on a tabletop over the rear edge of the table and route them down onto the turntable surface to the AC receptacle. AC power cords of floor-standing equipment may be routed in any convenient fashion.
4. If the EUT is provided only with an adjustable permanently attached antenna, it shall be tested with this antenna extended to its maximum length. If the EUT is provided with terminals for connection of an external antenna, connect the antenna normally used with the EUT to these terminals, and position it in a typical location or orientation.
5. The EUT shall be supplied with modulation as specified in Section 5.16. If the EUT transmits only pulsed modulation and has coding switches, these shall be set to the position that produces the maximum duty cycle during measurements.

(IV) Radiated emission measurement:

1. Check the calibration of measuring instrument using either an internal calibrator or a known signal level from an external signal generator.
2. A spectrum analyzer or other instrument providing a spectral display is recommended for exploratory radiated measurements. The frequency range may be scanned in segments or in its entirely depending on the rated frequency range of the measurement antenna [see NOTE under step 5], and the resolution and noise floor of the measuring instrument. Set the 3 dB bandwidth of the measuring instrument to 100 kHz or greater and the detector function to the peak mode. Set the display on the measuring instrument to enable viewing of emissions. Adjust the sweep speed control so the analyzer display is calibrated. Video filter is not used for measurement.

   Note: I. If ambient radio or TV signals are of such magnitude or spacing that emission from the EUT may be hidden, the scan width control may be set to 10 MHz per division or less to identify EUT emission. Use of a bandwidth less than 100 kHz might be helpful.

   II. The bandwidth of the measuring instrument shall be wider than the pulse repetition frequency of the transmitted signal to measure its maximum peak level.

3. Activate the EUT and the measuring instrument. If the EUT operates over a range of frequencies, set it to one of the number of frequencies specified in 5.12.

Note: These exploratory tests shall be run with the EUT powered in turn from both AC and DC (battery) power, if the device has these capabilities, to determine which power source produces the highest emission relative to the limit.

4. Exercise the EUT as specified in 5.4. Accessories connected to the EUT shall be exercised independently.

5. Use the procedure stipulated in 5.8 to maximize emission from the EUT and note the EUT latitude, arrangement, operating mode, and interconnect cable or wire positions that produce the highest emission relative to the limit. In addition, exploratory radiated emission testing of hand-held or body-worn devices shall include rotation of the EUT through three orthogonal axes to determine the latitude that produces the highest emission relative to the limit.

   Note: Exploratory scanning of radiated emission. A broadband antenna is recommended for exploratory scanning of radiated emission. It shall be necessary to change to other measurement antennas during this process to cover the complete frequency range of the test.

6. Tune the spectrum analyzer to the next segment of the frequency spectrum to be scanned, and repeat step 3 through 5 until the frequency range of interest has been investigated. When radiation measurements are required on an EUT on more than one operating frequency, repeat setp 3 through 5 for each additional frequency.

7. Select the EUT arrangement, operating mode, and interconnecting cable or wire positions from step 5 that produced the highest emission relative to the limit to use for final radiated measurements. Set the bandwidth and the detector function as specified in appropriated section.

8. It is recommended that highest emission relative to the limit be remaximized per Section 5.8 before performing final measurements, even if the EUT is not moved from a exploratory to a final radiated emission test site, as slight variations in cable or wire positions can cause large variations in signal amplitude. Only slight variation in cable movements should be needed to remaximize the highest emission again.
   Note: The same measurement antenna and distance should be used for remaximizing the highest emission relative to the limit at the final radiated emission test site.

9. Place the measurement antenna the distance from the EUT specified in the appropriate regulations.

10. Follow the procedure to measure final radiated emission from the EUT on the number of frequencies specified. When average detector function limits are specified for a pulse-modulated transmitter, the average level of emission shall be determined by measuring the peak level of the emissions and correcting them with the duty cycle detailed as follows:

    Note: It may be necessary to use multiple measurement antennas during this process to cover the complete frequency range of the test.

    10.1 Turn on the transmitter, and set it to transmit the pulse train continuously.

    10.2 Tune a spectrum analyzer to the transmitter, carrier frequency, and set the spectrum analyzer resolution bandwidth wide enough to encompass all significant spectral components. The video bandwidth should be at least as wide as the resolution bandwidth.

    10.3 Set the spectrum analyzer vertical scale (amplitude) to the linear mode and the analyzer frequency scan to 0 Hz. If necessary, move the receiving antenna closer to the device to obtain a signal level.

    10.4 Connect a storage oscilloscope to the video output of the spectrum analyzer that is used to demodulate and detect the pulse train.

    10.5 Adjust the oscilloscope settings(or use a spectrum analyzer set to zero span) to observe the pulse train, and determine the number and width of the pulses, as well as the period of the train.

    10.6 Measure the pulsewidth by determining the time difference between the two half-voltage points on the pulse.

    10.7 When the pulse train is less than 100 ms (including blanking intervals), calculate the duty cycle by averaging the sum of the pulswidths over one complete pulse train. Alternatively, when the pulse train is not periodic or the period exceeds 100 ms, calculate the duty cycle by averaging the sum of the pulsewidths over the 100 ms width with highest average value, which the work period is the total pulse width is divided by 100 ms.

10.8 Multiply the peak-detector field strength (expressed in uV/m) of an emission from a transmitter using pulsed modulation by the duty cycle just measured to determine the average detector field strength of that emission for comparison to the average detector limit.

10.9 If regulations do not require radiated measurements above 1 GHz, proceed to step 13. If radiated measurements above 1 GHz are required, an instrument capable of measuring both peak and average detector function signals shall be used. Set the bandwidth of this instrument to 1 MHz and the detector function to the peak mode.

11. Should all of the emission levels above 1 GHz as measured with the peak detector function comply with the average limit specified by the appropriate regulations, proceed to step 13. Should any of thess emission levels exceed the average lkimit but comply with the peak limit, proceed to step 12.

12. Set the detector function of the measuring instrument to the average mode and according to step 11 remeasure only those emissions form step 11 that complied with the peak limits but exceed the average limits.

13. Record the EUT arrangement, operating mode, and cable or wire positions used for final radiated emission measurements. This can be done with either diagrams or photographs.

14. Where radiated measurements are required on an EUT on more than one operating frequency, the report shall list the field strength measured at the fundamental frequency, the field strength of the three highest harmonic or spurious emissions relative to the limit, and the field strength of the three highest restricted band emissions relative to the limit and the frequencies on which these were observed, for each operating frequency measured.

    Note: For the purposes of this standard, spurious emissions shall include out-of-band emissions typically associated with or generated by the modulating signal.

(V) Operating frequency measurement

1. Operating frequency measurements may be made at ambient room temperature if it is within the range of +15 °C~+25 °C; otherwise, an environmental temperature test chamber set for a temperature of +20 °C shall be used. If possible, an antenna should be connected to the EUT, as the use of dummy load could affect the output frequency of the EUT. If the EUT is equipped with or uses an adjustable length antenna, it should be fully extended.

2. Supply the EUT with nominal AC voltage, or install a new or fully charged battery in the EUT. Turn the EUT on, and couple its output to the frequency counter or precision frequency measurement instrument which is capable of measuring the required frequency tolerance of the EUT.

    Note: For purposes of measurement, place the measurement antenna at a distance (15 cm, for example) close to the EUT by connecting to the measurement instrument with a suitable length of coaxial cable.

3. Tune it to one of the number of frequencies required in Section 5.12. Adjust the location of the measurement antenna and the controls on the measuring instrument to obtain a suitable signal level, a level will not overload the measuring instrument, but is strong enough to allow the measurement or the fundamental frequency of the EUT.Turn the EUT on and record the operating frequency at startup and two, five, and ten minutes after the EUT is energized. Four measurements in total are made.Turn the EUT off, and place it inside an environmental chamber if appropriate. Allow about 30 minutes for the chamber to stabilize at +20 °C before proceeding.

4. If there is more than one frequency for measurement, turn the EUT off to allow enough time to stablize to environmental temperature. Set the EUT to a new operating frequency, and repeat step 3 until the number of frequencies specified in 5.12 are measured.

(VI)Frequency stability with respect to temperature

1. Place the EUT in an environmental temperature test chamber, and supply the EUT with nominal AC voltage, or install a new fully charged battery in the EUT. If possible, an antenna should be connected to the EUT, because use of dummy load could affect the output frequency of the EUT. If the EUT is equipped with or uses an adjustable length antenna, it should be fully extended.

2. Supply the EUT with nominal AC voltage, or install a new or fully charged battery in the EUT. Turn the EUT on, and couple its output to the frequency counter or precision frequency measurement instrument which is capable of measuring the required frequency tolerance of the EUT.

   Note: For purposes of measurement, place the measurement antenna at a distance (15 cm, for example) close to the EUT by connecting to the measurement instrument with a suitable length of coaxial cable.

3. Tune it to one of the number of frequencies required in Section 5.12. Adjust the location of the measurement antenna and the controls on the measuring instrument to obtain a suitable signal level, a level that will not overload the measuring instrument, but is strong enough to allow the measurement or the fundamental frequency of the EUT.Turn the EUT off, and place it inside an environmental temperature chamber at the highest specified temperature. For devices that are normally operated continuously, the EUT may be energized while inside the test chamber. For devices that have oscillator heaters, energize only the heater circuit while the EUT is inside the chamber.

4. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup and two, five, and ten minutes after the EUT is energized. Four measurements in total are made.

5. If there is just one frequency for measurement, skip to step 6; otherwise, turn the EUT off to allow enough time to stablize to environmental temperature. Set the EUT to a new operating frequency, and repeat step 4 until the number of frequencies specified in 5.12 are measured.

6. Repeat step 4 and 5 for the EUT with the test chamber set at the lowest temperature. Before proceeding measurement, make sure the test chamber is stablized.

(VII) Frequency stability with respect to input voltage

1. Operating frequency measurements may be made at ambient room temperature if it is within the range of +15°C~+25 °C; otherwise, an environmental temperature test chamber set for a temperature of +20 °C shall be used. If possible, an antenna should be connected to the EUT, as use of the dummy load could affect the output frequency of the EUT. If the EUT is equipped with or uses an adjustable length antenna, it should be fully extended.

2. Supply the EUT with nominal AC voltage, or install a new or fully charged battery in the EUT. Turn the EUT on, and couple its output to the frequency counter or precision frequency measurement instrument which is capable of measuring the required frequency tolerance of the EUT.

   Note: For purposes of measurement, place the measurement antenna at a distance (15 cm, for example) close to the EUT by connecting to the measurement instrument with a suitable length of coaxial cable.

3. Tune it to one of the number of frequencies required in Section 5.12. Adjust the location of the measurement antenna and the controls on the measuring instrument to obtain a suitable signal level. A level will not overload the measuring instrument, but is strong enough to allow the measurement or the fundamental frequency of the EUT.Turn the EUT off, and place it in an environmental chamber. Allow about 30 minutes for the chamber to stabilize at +20 °C before proceeding, a level that will not overload the measuring instrument, but is strong enough to allow measurement of the fundamental frequency of the EUT. Turn the EUT on and record the operating frequency at startup and two, five, and ten minutes after the EUT is energized. Four measurements in total are made.

4. If there is just one frequency for measurement, skip to step 5; otherwise, turn the EUT off to allow enough time to stablize to environmental temperature. Set the EUT to a new operating frequency, and repeat step 3 until the number of frequencies specified in 5.12 are measured.
5. If the EUT is powered from the AC power line, supply it with 85% of the nominal AC voltage and repeat step 3 and step 4. If the EUT is battery-operated supply it with the lowest working voltage.
6. If the EUT is powered from the AC power line, supply it with 115% of the nominal AC voltage and repeat step 3 and step 4.

(VIII) Occupied bandwidth measurements

1. Check the calibration of measuring instrument using either an internal calibrator or a known signal level from an external signal generator.
2. A spectrum analyzer or other instrument providing spectral display is recommended for. Video filter is not used for measurement.

   Note: In order to measure the modulated signal properly, a resolution bandwidth that is small compared with the bandwidth required. Under some circumstance, the improper measurement will be made due to too small bandwidth. Thus, the resolution bandwidth of the measuring instrument shall be set to a value greater than 5 % of the bandwidth requirements. When no bandwidth requirements are specified, the resolution bandwidth of the measuring instrument is given in the following table:

Fundamental frequency (MHz)	Minimum resolution bandwidth (kHz)
0.009 to 30	1
30 to 1000	10
1000 to 4000	100

3. Supply the EUT with nominal AC voltage, or install a new or fully charged battery in the EUT. Turn the EUT on, and set it to any convenient frequency within its operating range. Set a reference level on the measuring instrument at –26 dB below the unmodulated carrier. Take modulated frequency into consideration, adjust resolution bandwidth, sweep speed, and sweep range and display calibrated.
4. Apply modulation signal(s) as specified in 5.16 and measure the frequencies of the modulated signal from the EUT where it is the specified number of dB below the reference level set in step 3. This is the occupied bandwidth. The measured result may be undertaken with plotted graphs or photographs of the measuring instrument display.

(IX) Input power measurements

1. If possible, an antenna should be connected to the EUT, as use of a dummy load could affect the output frequency of the EUT. If the EUT is equipped with or uses an adjustable length antenna, it should be fully extended.
2. Supply the EUT with nominal AC voltage, or install a new or fully charged battery in the EUT. Typical modulation shall be applied to the EUT during these tests.
3. Turn the EUT on and tune it to any one convenient frequency specified in Section 5.12. For measurement of the input power to the final RF stage, while varying the input modulation sources, measure the voltage at the supply to the final RF stage of the EUT, and the current in to that stage, using a DC voltmeter and ammeter of appropriate ranges respectively. The input power to the final RF stage is the product of these values. For input power measurements on an intentional radiator, use a voltmeter and ammeter and measure, as appropriate, either the AC or DC voltage and current at the AC power cord or battery input terminals of the intentional radiator. Again, the input power is the product of these values.Turn the EUT on and tune it to any one convenient frequency specified in Section 5.12. For measurement of the input power to the final RF stage, while varying the input modulation sources,

measure the voltage at the supply to the final RF stage of the EUT, and the current in to that stage, using a DC voltmeter and ammeter of appropriate ranges respectively. The input power to the final RF stage is the product of these values. For input power measurements on an intentional radiator, use a voltmeter and ammeter and measure, as appropriate, either the AC or DC voltage and current at the AC power cord or battery input terminals of the intentional radiator. Again, the input power is the product of these values.

(X) Effective radiated power measurements

1. Test arrangement is as field strength radiation measurement
2. Set the resolution bandwidth of measuring instrument per 5.15.2. The video bandwidth is not less than resolution bandwidth. In order to enable viewing of emissions, set the sweep speed, and sweep range on the measuring instrument enough to cover all tested frequencies.
3. The receiving horizontal polarization antenna shall be raised or lowered through 1 meter~ 4 meter height range until a maximum reading is obtained on the measuring instrument, the EUT shall be rotated through 360° around a horizontal axis until a higher maximum signal is received. This level shall be recorded as reference level.
4. Repeat step 3 until all frequencies that need to be measured are complete.
5. Repeat step 4 with search antenna in vertical polarized orientations.
6. Replace the EUT with a transmitting antenna (tuned dipole antenna for frequency no more than 1 GHz and horn antenna for frequency above 1 GHz) in horizontally polarized orientation and as the same polarized orientation with search antenna. Connect the tuned dipole antenna to a standard signal generator (SG). Tune SG to the frequency obtained from above steps as well as set SG at an appropriate output level. Rise and lower the search antenna to get the highest value on the measurement instrument, and then hold this position. Adjust the SG output to get an identical value derived from step 3 on measurement instrument. Record this value for result calculated.
7. Repeat step 6 until all frequencies that need to be measured are complete.
8. Repeat step 7 with both transmitting antenna and search antenna in vertical polarized orientations.
9. If the antenna gain of EUT relative to dipole antenna (or isotropic antenna) is known, then the ERP (or EIRP) can be derived from the product of conducted output power at antenna terminal and the antenna gain.

Appendix II Measurement Guidelines for Direct Sequence Spread Spectrum

I. Bandwidth:
Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) =100 kHz and video bandwidth >= RBW. In order to make an accurate measurement, set the span > RBW.

II. The peak output power:
This is a RF conducted test. Use a direct connection between the antenna port of the transmitter and measurement instrument, through suitable attenuation. Set the RBW > 6 dB bandwidth of the emission or use a peak power meter.

III. Spurious emissions:

1. RF antenna conducted test:

   1.1 Set RBW=100 kHz, Video bandwidth (VBW) > RBW, scan up through 10th harmonic.

   1.2 All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

2. Radiated emission test:

   2.1 Applies to harmonics/spurs that fall in the restricted bands listed in Section 2.7. The maximum permitted average field strength is listed in Section 2.8.

   2.2 A pre-amp (and possibly a high-pass filter) is necessary for this measurement. For measurements above 1 GHz, set RBW=1 MHz, VBW=10 Hz, Sweep=auto.

   2.3 If the emission is pulsed, modify the unit for continuous operation. Use the settings shown above, and then correct the readings by a corrector factor.

IV. Power spectral density

1. Use a direct connection between the antenna port of the transmitter and measurement instrument, through suitable attenuation. Locate and zoom in on emission peak(s) within the pass band. Set RBW=3 kHz, VBW>RBW, sweep = (SPAN/3 kHz). The peak level measured shall be less than or equal +8 dBm.

2. If devices with spectrum line spacing is equal to or less than 3 kHz, the resolution bandwidth must be reduced below 3 kHz until the individual lines in the spectrum are greater than 3 kHz. The measurement data must then be normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band to determine compliance.

V. Alternative method:
If antenna conducted tests cannot be performed on this device, radiated tests to show compliance with the various conducted requirements of Section 3.10.1 are acceptable. As stated previously, a pre-amp must be used in making the following measurements.

1. Calculate the transmitter's peak power using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

E is the measured maximum fundamental field strength in V/m.
G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.
d is the distance in meters from which the field strength was measured.
P is the power in W.

$$P = \frac{(Ed)^2}{30G}$$

2. Measure the power spectral density as follows:

   2.1 Tune the analyzer to the highest point of the maximized fundamental emission. Reset the analyzer to a RBW = 3 kHz, VBW > RBW, span = 300 kHz, sweep = 100 seconds.

   2.2 From the peak level obtained, derive the field strength, E. Using the aforementioned equations, calculate a power level for comparison to the +8 dBm limit.

Appendix III Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

I. Carrier frequency separation:
   (I) The EUT must have its hopping function enabled.
   (II) Use the following spectrum analyzer settings:
      1. Span = wide enough to capture the peaks of two adjacent channels.
      2. Resolution (or IF) Bandwidth (RBW) >= 1 % of the span; Video (or Average) Bandwidth (VBW) >= RBW.
      3. Sweep = auto; Detector function = peak; Trace = max hold
      4. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

II. Number of hopping frequencies:
   (I) The EUT must have its hopping function enabled.
   (II) Use the following spectrum analyzer settings:
      1. Span = the frequency band of operation.
      2. Resolution (or IF) Bandwidth (RBW) >= 1 % of the span; Video (or Average) Bandwidth (VBW) >= RBW.
      3. Sweep = auto; Detector function = peak; Trace = max hold

III. Time of occupancy (Dwell Time):
   (I) The EUT must have its hopping function enabled.
   (II) Use the following spectrum analyzer settings:
      1. Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW >= RBW
      2. Sweep = as necessary to capture the entire dwell time per hopping channel.
      3. Detector function = peak; Trace = max hold
      4. If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

IV. 20 dB bandwidth:
   (I) Use the following spectrum analyzer settings:
      1. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel.
      2. RBW >= 1% of the 20 dB bandwidth; VBW >= RBW
      3. Sweep = auto; Detector function = peak; Trace = max hold
      4. The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission.
      5. Use the marker-delta function to measure 20 dB down bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

V. The peak output power:

(I) Use the following spectrum analyzer settings:

1. Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel.
2. RBW > 1 % of the 20 dB bandwidth of the emission being measured; VBW >= RBW
3. Sweep = auto; Detector function = peak; Trace = max hold
4. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.
5. Please note above regarding external attenuation and cable loss.

VI. Band-edge compliance of RF conducted emissions:

(I) Use the following spectrum analyzer settings:

1. Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation signal which fall outside of the authorized band of operation
2. RBW = 1 % of the span; VBW >= RBW.
3. Sweep = auto; Detector function = peak; Trace = max hold
4. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge.
5. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section.
6. Using the same instrument settings, enable the hopping function of the EUT.
7. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

VII. Spurious RF conducted emissions

(I) Use the following spectrum analyzer settings:

1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
2. RBW = 100 kHz; VBW >= RBW.
3. Sweep = auto; Detector function = peak; Trace = max hold
4. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the specified limit.

VIII. Spurious radiated emissions

(I) This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 2.7.

(II) It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

1. Span = wide enough to fully capture the emission being measured
2. RBW = 1 MHz for f >= 1 GHz, 100 kHz for f < 1 GHz; VBW >= RBW.
3. Sweep = auto; Detector function = peak; Trace = max hold
4. Follow the guidelines in Appendix 1 with respect to maximizing the emission. A pre-amp and a high pass filter may be required for this test, in order to provide the measuring system with sufficient sensitivity. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 5.15.2.
5. Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 2.8.
6. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor” in an effort to demonstrate compliance with the Section 2.8 limit.

IX. Alternative test procedures:
If antenna conducted tests cannot be performed on this device, radiated tests to show compliance with the peak output power limit specified in Section 3.10.1.2 and the spurious RF conducted emission limit specified in Section 3.10.1.5 are acceptable. As stated previously, a pre-amp, and, probably, a high pass filter, are required for the following measurements.

(I) Calculate the transmitter's peak power using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

E is the measured maximum fundamental field strength in V/m.
G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.
d is the distance in meters from which the field strength was measured.
P is the power in W.

$$P = \frac{(Ed)^2}{30G}$$

(II) The spurious RF conducted emission
Use the following spectrum analyzer settings:

1. Span = wide enough to fully capture the emission being measured
2. RBW = 100 kHz; VBW >= RBW.
3. Sweep = auto; Detector function = peak; Trace = max hold
4. Measure the field strength of both the fundamental emission and all spurious emissions with these settings. The measured field strength of all spurious emissions must be below the measured field strength of the fundamental emission by the amount specified in 3.10.1.5. This is only applied on spurious emissions that do not fall in restricted band.

(III) Marker-delta method:

While undertaking radiated band-edge measurements according to Chapter 5, the following techniques are for determining band-edge compliance.

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function required by Section 5.15.2 for the frequency being measured. For transmitters operating above 1 GHz, use a 1 MHz RBW, a 1 MHz VBW, and a peak detector. Repeat the measurement with an average detector (i.e., 1 MHz RBW with 10 Hz VBW).
   Note: For pulsed emissions, corrector factors must be included. Also, please note that radiated measurements of the fundamental emission of a transmitter operating under 3.10.1 are not normally required, but they are necessary in connection with this procedure.
2. Choose a spectrum analyzer span that encompasses both the peaks of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1 % of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission. Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step 1. The resultant field strengths are then used to determine band-edge compliance as required by Section 2.7.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by Section 5.15.2 for the frequency being measured.