



Recommendation ITU-R SM.329-12
(09/2012)

Unwanted emissions in the spurious domain

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RECOMMENDATION ITU-R SM.329-12

Unwanted emissions in the spurious domain*

(1951-1953-1956-1959-1963-1966-1970-1978-1982-1986-1990-1997-2000-2001-2003-2011-2012)

Scope

This Recommendation provides limits for unwanted emissions in the spurious domain, as well as measurement methods of spurious domain emissions.

The ITU Radiocommunication Assembly,

considering

- a) that Recommendation ITU-R SM.328 gives definitions and explanatory notes which should be used when dealing with bandwidth, channel spacing and interference scenarios; when distinguishing between out-of-band emissions and spurious emissions; and when specifying limits for out-of-band domain emissions;
- b) that a difficulty faced in applying the limits for unwanted emissions in the spurious domain is knowing precisely the value of the necessary bandwidth and exactly where in the spectrum the limits for spurious domain should begin to apply, particularly for services using broadband or digitally-modulated emissions which may have both noise-like and discrete spurious components;
- c) that limitation of the maximum permitted level of spurious domain emissions¹ at the frequency, or frequencies, of each spurious domain emission is necessary to protect all radio services;
- d) that stringent limits may lead to an increase in size or in complexity of radio equipment, but will in general increase protection of other radio services from interference;
- e) that every effort should be made to keep limits for unwanted emissions in out-of-band and spurious domains, both for existing and new services, at the lowest possible values taking account of the type and nature of the radio services involved, economic factors, and technological limitations, and the difficulty of suppressing harmonic emissions from certain high power transmitters;
- f) that there is a need to define the methods, units of measurements and bandwidth, and the bandwidths to be used for measurement of power at frequencies other than the centre frequency. This will encourage the use of rational, simple, and effective means of reducing unwanted emissions;
- g) that the relation between the power of the spurious domain emission supplied to a transmitting antenna and the field strength of the corresponding signals, at locations remote from the transmitter, may differ greatly, due to such factors as antenna characteristics at the frequencies of the spurious domain emissions, propagation anomalies over various paths and radiation from parts of the transmitting apparatus other than the antenna itself;

* The limits in this Recommendation apply to any out-of-band or spurious emissions in the spurious domain. Spurious emissions are generally predominant in the spurious domain.

¹ Spurious domain emissions are unwanted emissions at frequencies within the spurious domain.

- h) that field-strength or pfd measurements of unwanted emissions, at locations distant from the transmitter, are recognized as the direct means of expressing the intensities of interfering signals due to such emissions;
- j) that in dealing with emissions on the centre frequencies, administrations customarily establish the power supplied to the antenna transmission line, and may alternatively or in addition measure the field strength or pfd at a distance, to aid in determining when a spurious domain emission is causing interference with another authorized emission, and a similar, consistent procedure would be helpful in dealing with spurious domain emissions (see Article 15, No. 15.11 of the RR);
- k) that for the most economical and efficient use of the frequency spectrum, it is necessary to establish general maximum limits of spurious domain emissions, while recognizing that specific services in certain frequency bands may need lower limits of spurious domain emissions from other services for technical and operational reasons as may be recommended in other ITU-R Recommendations (see Annex 4);
- l) that transmitters operating in space stations are increasingly employing spread-spectrum and other broadband modulation techniques that can produce out-of-band and spurious emissions at frequencies far removed from the carrier frequency, and that such emissions may cause interference to passive services, including the radio astronomy service, recognizing however, that spectrum shaping techniques, which are widely used to increase the efficiency of spectral usage, result in an attenuation of side band emissions;
- m) that spurious domain emission limits applicable to transmitters are a function of:
- the radiocommunication services involved and the minimum protection ratio determined in every frequency band;
 - the type of environment where transmitters could be found (urban, suburban, rural, etc.);
 - the type of transmitter;
 - the minimum distance between the transmitter in question and the potential victim radio receiver;
 - all possible decouplings between the antenna of the interfering transmitting antenna at the reception frequency and the receiving antenna of the radio receiver including the propagation model, polarization decoupling and other decoupling factors;
 - the probability of occurrence of the spurious radiation of the transmitter when the receiver is active;
 - the fact that a transmitter is active or idle, or that there are simultaneous active transmitters;
- n) that some space stations have active antennas and the measurement of power as supplied to the antenna transmission line cannot cover emissions created within the antenna. For such space stations, the determination of field strength or pfd at a distance should be established by administrations to aid in determining when an emission is likely to cause interference to other authorized services;
- o) that spurious domain emissions may exist in the whole radio spectrum, but practical difficulties may dictate a frequency limit above which they need not to be measured;
- p) that Recommendation ITU-R SM.1539 deals with variation of the boundary between the out-of-band and spurious domains,

noting

a) that the studies required by the new Question ITU-R 222/1, approved by the Radiocommunication Assembly 2000, could have formal and substantial impact to basic definitions used in this Recommendation. It may be necessary to revise this Recommendation in the future to reflect the results of these studies,

recommends

that the following should be used when spurious domain emission limits, and their methods of measurement, are applied:

1 Terminology and definitions

The following terms and definitions complement those already defined in the RR. (Definitions shown in *italics* are a direct quotation from the RR for completeness.)

1.1 Spurious emission (RR Article 1, No. 1.145)

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

1.1.1 Harmonic emissions

Spurious emissions at frequencies which are whole multiples of the centre frequency emissions.

1.1.2 Parasitic emissions

Spurious emissions, accidentally generated at frequencies which are independent both of the carrier or characteristic frequency of an emission and of frequencies of oscillations resulting from the generation of the carrier or characteristic frequency.

1.1.3 Intermodulation products

Spurious intermodulation products result from intermodulation between:

- the oscillations at the carrier, characteristic, or harmonic frequencies of an emission, or the oscillations resulting from the generation of the carrier or characteristic frequency; and
- oscillations of the same nature, of one or several other emissions, originating from the same transmitting system or from other transmitters or transmitting systems.

1.1.4 Frequency conversion products

Spurious emissions, not including harmonic emissions, at the frequencies, or whole multiples thereof, or sums and differences of multiples thereof, of any oscillations generated to produce the carrier or characteristic frequency of an emission.

1.1.5 Broadband and narrow-band emission with respect to the measurement apparatus

A broadband emission is an emission which has “a bandwidth greater than a particular measuring apparatus or receiver” (see the International Electrotechnical Vocabulary (IEV)/International Electrotechnical Commission (IEC) 161-06-11).

A narrow-band emission is an emission which has “a bandwidth less than a particular measuring apparatus or receiver” (see IEV/IEC, 161-06-13).

1.2 Out-of-band emission (RR Article 1, No. 1.144)

Emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

1.3 Unwanted emissions (RR Article 1, No. 1.146)

Consist of spurious emissions and out-of-band emissions.

1.3bis Out-of-band domain²

(of an emission): The frequency range, immediately outside the necessary bandwidth but excluding the *spurious domain*, in which *out-of-band emissions* generally predominate.

NOTE 1 – Out-of-band *emissions*, defined based on their source, occur in the out-of-band domain and, to a lesser extent, in the spurious domain. Spurious emissions likewise may occur in the out-of-band domain as well as in the spurious domain.

1.3ter Spurious domain²

(of an emission): The frequency range beyond the *out-of-band domain* in which *spurious emissions* generally predominate.

1.4 Necessary bandwidth (RR Article 1, No. 1.152)

For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

For application to multi-channel or multi-carrier transmitters/transponders, where several carriers may be transmitted simultaneously from a final output amplifier or an active antenna, the necessary bandwidth is taken to be the transmitter or transponder bandwidth, as its 3 dB bandwidth. This does not apply to base stations in the mobile service or to fixed wireless access base stations using mobile technology.

For fixed service, Recommendation ITU-R F.1191 is to be used to calculate the necessary bandwidth in the case of fixed digital radio multi-carrier systems.

For the radiodetermination service, the necessary bandwidth of frequency-agile radars is taken to be the part of the allocated band over which the carrier frequencies of those radars tune.

1.5 Active state of a transmitter

That state of a transmission station which produces the authorized emission.

1.6 Idle or standby state of a transmitter

That state of a transmission station where the transmitter is available for traffic but is not in active state.

² The terms “out-of-band domain” and “spurious domain” have been introduced in order to remove some inconsistency now existing between, on one hand, the definitions of the terms “out-of-band emission” and “spurious emission” in RR Article 1 and, on the other hand, the actual use of these terms in RR Appendix 3, as revised by the World Radiocommunication Conference (Istanbul, 2000) (WRC-2000). Out-of-band domain emission and spurious domain emission limits apply, respectively, to all unwanted emissions in the out-of-band and spurious domains.

Primary radars are not considered to operate in a standby state since the transmitter is in an active state during operation. Also, pulsed radar systems are not considered to be in the standby state during their interpulse intervals. Neither are time division communication systems to be considered to be in the idle or standby state in the interval between time slots.

2 Application of limits

2.1 The levels of spurious domain emissions could be expressed in terms of the peak envelope power or in terms of the mean power supplied by the transmitter to the antenna feeder line at the frequencies of the emission concerned, within a defined reference bandwidth, depending on the nature of the radio service of the transmitter.

2.2 Alternatively the levels of spurious domain emissions could be expressed in terms of the field strength or pfd on the surface of the Earth, at the frequencies of the spurious domain emission concerned.

2.3 According to the principles stated in Appendix 3 to the RR, the spurious domain generally consists of frequencies separated from the centre frequency of the emission by 250% or more of the necessary bandwidth of the emission. However, this frequency separation may be dependent on the type of modulation used, the maximum bit rate in the case of digital modulation, the type of transmitter, and frequency coordination factors. For example, in the case of some digital, broadband or pulse-modulated systems, the frequency separation may need to differ from the $\pm 250\%$ factor. As the RR forbid any radio service to cause harmful interference outside its allocated band, transmitter frequencies should be determined so that out-of-band emissions do not cause harmful interference outside the allocated band in accordance with RR No. 4.5.

Alternatively, the $\pm 250\%$ may apply to channel separation instead of the necessary bandwidth. As an example, for frequency coordination of the digital fixed service, Recommendation ITU-R F.1191 recommends the use of $\pm 250\%$ of the channel separation of the relevant radio-frequency channel arrangement as frequency boundaries between the out-of-band and spurious domains.

In case of very narrow or wide bandwidth, this method of determining the spurious domain might not be appropriate and Recommendation ITU-R SM.1539 provides further guidance.

Additional guidance concerning the necessary bandwidth required for determining the boundary between the out-of-band and spurious domains can be found in *recommends* 2.3 of Recommendation ITU-R SM.1541.

2.4 Where a transmitting system comprises more than one transmitter connected to the same antenna the limits specified in § 3 should apply, as far as practicable, to the intermodulation products related to the use of several transmitters.

2.5 Limits on spurious domain emissions for radio equipments are considered here to be applicable to the range 9 kHz to 300 GHz.

However, for practical measurement purposes only, the frequency range of the spurious domain may be restricted. As guidance for practical purposes, the following frequency ranges of measurement, as given in Table 1, are normally recommended.

TABLE 1

Frequency range for measurement of unwanted emissions

Fundamental frequency range	Frequency range for measurements	
	Lower limit	Upper limit (The test should include the entire harmonic band and not be truncated at the precise upper frequency limit stated)
9 kHz-100 MHz	9 kHz	1 GHz
100 MHz-300 MHz	9 kHz	10 th harmonic
300 MHz-600 MHz	30 MHz	3 GHz
600 MHz-5.2 GHz	30 MHz	5 th harmonic
5.2 GHz-13 GHz	30 MHz	26 GHz
13 GHz-150 GHz	30 MHz	2 nd harmonic
150 GHz-300 GHz	30 MHz	300 GHz

There will be cases where it is necessary, in order to protect specific services, to extend the range of test frequencies to the 3rd or higher harmonic for systems with fundamental frequency above 13 GHz. The parameters in Table 1 reflect the increasing practical difficulty of conducting tests by extending upwards in frequency the conventional microwave measurement techniques described in Annex 2 to frequencies above 110 GHz. At such frequencies and higher, it may be more practicable to adopt bolometric measurement techniques used at infra-red frequencies. For example, for vehicular radars at 76-77 GHz, it is appropriate that the 3rd harmonic be measured, around 220 GHz, and here, conventional microwave test methods are probably inappropriate.

In any case, systems having an integral antenna incorporating a waveguide section, or with an antenna connection in such form, and of unperturbed length equal to at least twice the cut-off wavelength, do not require spurious domain emission measurements below 0.7 times the waveguide cut-off frequency.

2.6 Spurious domain emission from any part of the installation, other than the antenna system (the antenna and its feeder) should not have an effect greater than would occur if this antenna system were supplied with the maximum permissible power at that spurious domain frequency.

2.7 Transient emissions caused by switching in time division multiple access (TDMA) systems should, where possible meet the spurious domain emission suppression requirement.

3 Limits of spurious domain emissions

3.1 The limits should improve the operation of radiocommunication services in all bands.

3.2 The different units for expressing spurious domain emission and the conversion Table given in Annex 1 should be used.

3.3 The definition of the categories of spurious domain emission limits are shown below, including RR Appendix 3 limits, examples of more stringent limits and limits applying to information technology equipment (ITE).

Category A	Category A limits are the attenuation values used to calculate maximum permitted spurious domain emission power levels. RR Appendix 3 is derived from Category A limits. These limits are given in § 4.2.
Category B	Category B limits are an example of more stringent spurious domain emission limits than Category A limits. They are based on limits defined and adopted in Europe and used by some other countries. These limits are given in § 4.3.
Category C	Category C limits are an example of more stringent spurious domain emission limits than Category A limits. They are based on limits defined and adopted in the United States of America and Canada and used by some other countries. These limits are given in § 4.4.
Category D	Category D limits are an example of more stringent spurious domain emission limits than Category A limits. They are based on limits defined and adopted in Japan and used by some other countries. These limits are given in § 4.5.
Category Z	Radiation limits for ITE specified by the International Special Committee on Radio Interference (CISPR). These limits are given in § 4.6.

NOTE 1 – Category B, C and D limits are more stringent than Category A limits and each represents a compromise between lower unwanted emissions and the cost of equipment. Currently, all are successfully used as national or regional regulations including in areas having a high radiocommunication density and using equipment representing a significant portion of the radiocommunications manufacturing base.

Tables of emission limits (see *recommends* 4) represent recommended limits for each of these categories by frequency band and type of transmitters for the protection of all radiocommunication services.

4 Tables of emission limits

4.1 Recommended reference bandwidths

A reference bandwidth is a bandwidth in which spurious domain emission levels are specified. The following reference bandwidths are recommended:

- 1 kHz between 9 and 150 kHz,
- 10 kHz between 150 kHz and 30 MHz,
- 100 kHz between 30 MHz and 1 GHz,
- 1 MHz above 1 GHz.

As a special case, the reference bandwidth of all space service spurious domain emissions should be 4 kHz.

For Category B limits, narrower reference bandwidth are specified close to the carrier for fixed and land mobile services.

The reference bandwidths required for proper measurement of radar spurious domain emissions must be calculated for each particular radar system, and the measurement methods should be guided by Recommendation ITU-R M.1177.

NOTE 1 – The reference bandwidth is a bandwidth in which the spurious domain emission limit is specified, but does not mean a bandwidth in which spurious domain emissions should be measured. Annex 2 describes the resolution bandwidth in which spurious domain emissions should be measured. As a general guideline, the resolution bandwidth should be equal to the reference bandwidth. However, to improve measurement

accuracy, sensitivity and efficiency, the resolution bandwidth can be different from the reference bandwidth as described in Annex 2.

4.2 Category A limits

Table 2 indicates the maximum permitted levels of spurious domain emissions, appearing in RR Appendix 3, in terms of power of any unwanted component supplied by a transmitter to the antenna transmission line, except for space services which are currently shown as design limits; for the implementation date for the radiodetermination service; for deep space stations and for amateur stations. Some notes to Appendix 3 give specific direction on the application of the limits.

Spurious domain emission from any part of the installation other than the antenna and its transmission line should not have an effect greater than would occur if this antenna system were supplied with the maximum permitted power at that spurious domain emission frequency.

For technical or operational reasons, more stringent levels than those specified in Table 2 may be applied to protect specific services in certain frequency bands. The levels applied to protect these services should be those agreed upon by the appropriate WRC. More stringent levels may also be fixed by specific agreements between the administrations concerned. Additionally, special consideration of transmitter spurious domain emissions is required for protection of radio astronomy and other passive services.

Sample calculations and Category A maximum absolute spurious domain power levels, derived from Table 2 values, can be found in Annex 5.

TABLE 2

Spurious domain emission limits – Category A

(Recommended attenuation values used to calculate maximum permitted spurious domain emission power levels intended for use with radio equipment by all countries)

Service category in accordance with RR Article 1, or equipment type ^{(1), (2)}	Attenuation (dB) below the power (W) supplied to the antenna transmission line
All services except those services quoted below	$43 + 10 \log P$, or 70 dBc, whichever is less stringent
Space services (mobile earth stations) ^{(3), (4)}	$43 + 10 \log P$, or 60 dBc, whichever is less stringent
Space services (fixed earth stations) ^{(3), (4)}	$43 + 10 \log P$, or 60 dBc, whichever is less stringent
Space services (space stations) ^{(3), (5), (6)}	$43 + 10 \log P$, or 60 dBc, whichever is less stringent
Radiodetermination ⁽⁷⁾	$43 + 10 \log PEP$, or 60 dB, whichever is less stringent
Broadcast television ⁽⁸⁾	$46 + 10 \log P$, or 60 dBc, whichever is less stringent, without exceeding the absolute mean power level of 1 mW for VHF stations or 12 mW for UHF stations. However greater attenuation may be necessary on a case-by-case basis
Broadcast FM	$46 + 10 \log P$, or 70 dBc, whichever is less stringent; the absolute mean power level of 1 mW should not be exceeded
Broadcasting at MF/HF	50 dBc and the absolute mean power level of 50 mW should not be exceeded

TABLE 2 (*end*)

Service category in accordance with RR Article 1, or equipment type ^{(1), (2)}	Attenuation (dB) below the power (W) supplied to the antenna transmission line
SSB from mobile stations ⁽⁹⁾	43 dB below PEP
Amateur services operating below 30 MHz (including with SSB) ⁽⁹⁾	43 + 10 log <i>PEP</i> , or 50 dB, whichever is less stringent
Services operating below 30 MHz, except space, radiodetermination, broadcast, those using SSB from mobile stations, and amateur ⁽⁹⁾	43 + 10 log <i>X</i> , or 60 dBc, whichever is less stringent where: <i>X</i> = <i>PEP</i> for SSB modulation, <i>X</i> = <i>P</i> for other modulation
Low power device radio equipment ⁽¹⁰⁾	56 + 10 log <i>P</i> , or 40 dBc, whichever is less stringent
Emergency position-indicating radio beacon (EPIRB), emergency locator transmitter (ELT), personal location beacon (PLB), search and rescue transponder (SART), ship emergency, lifeboat, and survival craft transmitters, land, aeronautical or maritime transmitters when used in emergency	No limit

Notes to Table 2:

P: mean power (W) at the antenna transmission line, in accordance with RR No. 1.158. When burst transmission is used, the mean power *P* and the mean power of any spurious domain emissions are measured using power averaging over the burst duration.

PEP: peak envelope power (W) at the antenna transmission line, in accordance with RR No. 1.157.

When the term *P* is used, both the power supplied to the antenna transmission line and spurious domain emissions should be evaluated in terms of mean power and mean power in the reference bandwidth respectively. When the term *PEP* is used, both the power supplied to the antenna transmission line and spurious domain emissions should be evaluated in terms of peak envelope power and peak envelope power in the reference bandwidth respectively. However, when measurement of spurious domain emission in terms of *PEP* is difficult due to the nature of spurious domain emission (e.g. Gaussian noise), it is allowed to evaluate both power supplied to the antenna transmission line and spurious domain emission power in terms of mean power (see Annex 2).

dBc: decibels relative to the unmodulated carrier power of the emission. In the cases which do not have a carrier, for example in some digital modulation schemes where the carrier is not accessible for measurement, the reference level equivalent to *dBc* is decibels relative to the mean power *P*.

- (1) In some cases of digital modulation and narrow-band high power transmitters for all categories of services, there may be difficulties in meeting limits close to $\pm 250\%$ of the necessary bandwidth.
- (2) Use the e.i.r.p. method shown in Annex 2, § 3.3, when it is not practical to access the transition between the transmitter and the antenna transmission line.
- (3) Spurious domain emission limits for all space services are stated in a 4 kHz reference bandwidth.
- (4) Earth stations in the amateur-satellite service operating below 30 MHz are in the service category "Amateur services operating below 30 MHz (including with SSB)".

Notes to Table 2 (continued):

- (5) For the case of a single satellite operating with more than one transponder in the same service area, and when considering the limits for spurious domain emissions as indicated in Table 2, spurious domain emissions from one transponder may fall on a frequency at which a second, companion transponder is transmitting. In these situations, the level of spurious domain emissions from the first transponder is well exceeded by the fundamental or out-of-band domain emissions of the second transponder. Therefore, the limits should not apply to those spurious domain emissions of a satellite that fall within either the necessary bandwidth or the out-of-band domain of another transponder on the same satellite, in the same service area (see RR Appendix 3).
- (6) Space stations in the space research service intended for operation in deep space as defined by RR No. 1.177 are exempt from spurious domain emission limits.
- (7) For radiodetermination systems (radar as defined by RR No. 1.100), spurious domain emission attenuation (dB) shall be determined for radiated emission levels, and not at the antenna transmission line. The measurement method for determining the radiated spurious domain emission levels from radar systems should be guided by Recommendation ITU-R M.1177.
- (8) For analogue television transmissions, the mean power level is defined with a specified video signal modulation. This video signal has to be chosen in such a way that the maximum mean power level (e.g. at the video signal blanking level for negatively modulated television signals) is provided to the antenna transmission line.
- (9) All classes of emission using SSB are included in the category "SSB".
- (10) Low power radio device having a maximum output power of less than 100 mW and intended for short range communication or control purposes. (Such equipment is in general exempt from individual licensing.)

4.3 Category B limits

Table 3 indicates the maximum permitted levels of spurious domain emissions, in terms of power level, of any unwanted component supplied by a transmitter to the antenna transmission line for Category B equipment. For all services/systems not quoted in this Table, Category A limits are applicable.

TABLE 3

Category B limits(See definitions in *recommends* 3.3)

Type of equipment	Limits
Fixed service ^{(1), (2)}	-50 dBm for $30 \text{ MHz} \leq f < 21.2 \text{ GHz}^{(3)}$ -30 dBm for $21.2 \text{ GHz} \leq f < (\text{see recommends } 2.5)^{(3)}$
Fixed service – Terminal station (out station with subscriber equipment interfaces) ⁽¹⁾	-40 dBm for $30 \text{ MHz} \leq f < 21.2 \text{ GHz}^{(3)}$ -30 dBm for $21.2 \text{ GHz} \leq f < (\text{see recommends } 2.5)^{(3)}$
Broadband wireless access (BWA) ⁽¹⁰⁾ systems operating between 1 GHz and 6 GHz (all transmitting stations)	-36 dBm for $9 \text{ kHz} \leq f < 1 \text{ GHz}^{(4)}$ -30 dBm for $1 \text{ GHz} \leq f < (\text{see recommends } 2.5)^{(4)}$
Land mobile service (mobiles and base stations)	-36 dBm for $9 \text{ kHz} \leq f < 30 \text{ MHz}$ -36 dBm for $30 \text{ MHz} \leq f < 1 \text{ GHz}^{(4)}$ -30 dBm for $1 \text{ GHz} \leq f < (\text{see recommends } 2.5)^{(4)}$
VSAT (very small aperture terminal)	See limits in Recommendation ITU-R S.726
FM broadcasting	$87.5 \text{ MHz} \leq f \leq 137 \text{ MHz}$: -36 dBm for $P < 9 \text{ dBW}$ 75 dBc for $9 \text{ dBW} \leq P < 29 \text{ dBW}$ -16 dBm for $29 \text{ dBW} \leq P < 39 \text{ dBW}$ 85 dBc for $39 \text{ dBW} \leq P < 50 \text{ dBW}$ -5 dBm for $50 \text{ dBW} \leq P$ $30 \text{ MHz} < f < 87.5 \text{ MHz}$ and $137 \text{ MHz} < f < (\text{see recommends } 2.5)$: -36 dBm for $P < 4 \text{ dBW}$ 70 dBc for $4 \text{ dBW} \leq P < 40 \text{ dBW}$ 0 dBm for $40 \text{ dBW} \leq P$
Radar systems in the radiodetermination service ^{(5), (6)} : Fixed radiodetermination stations ⁽⁷⁾ (except multifrequency, active array radars ⁽⁸⁾ and meteorological radars) Meteorological radars (except wind profiler radars)	Absolute levels (dBm in PEP in the reference bandwidth) or attenuation (dB) below the power (PEP) (whichever is less stringent): -30 dBm or 100 dB -30 dBm or 100 dB , for $\text{PEP} \leq 150 \text{ kW}$; -30 dBm or 90 dB , for $\text{PEP} > 150 \text{ kW}^{(9)}$
Short range devices operating below 30 MHz	$29 - 10 \log(f \text{ (kHz)}/9) \text{ dB}(\mu\text{A/m})$ at 10 m for $9 \text{ kHz} < f < 10 \text{ MHz}$ $-1 \text{ dB}(\mu\text{A/m})$ at 10 m for $10 \text{ MHz} < f < 30 \text{ MHz}$ -36 dBm for $30 \text{ MHz} \leq$ except frequencies below $< 1 \text{ GHz}$ -54 dBm for f within the bands $47\text{-}74 \text{ MHz}$, $87.5\text{-}118 \text{ MHz}$, $174\text{-}230 \text{ MHz}$, $470\text{-}862 \text{ MHz}$ -30 dBm for $1 \text{ GHz} \leq f < (\text{see recommends } 2.5)$