

## RECOMMENDATION ITU-R SM.329-10

**Unwanted emissions in the spurious domain\***

(Question ITU-R 211/1)

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

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 emissions<sup>1</sup> 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

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\* 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.

<sup>1</sup> Spurious domain emissions are unwanted emissions at frequencies within the spurious domain.

of the spurious domain emissions, propagation anomalies over various paths and radiation from parts of the transmitting apparatus other than the antenna itself;

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.