



European Radiocommunications Committee (ERC)
within the European Conference of Postal and Telecommunications Administrations (CEPT)

ERC RECOMMENDATION (00)06

RECEIVER PARAMETERS

Recommendation adopted by the Working Group "Spectrum Engineering" (WGSE)

"The European conference of Postal and Telecommunications Administrations,

considering

- a) that the radio frequency spectrum is a common and finite resource which makes it necessary to use it as efficiently as possible and that adequate receiving parameters specifications enhance the usability of the spectrum resources;
- b) that receiver parameters play an fundamental role in frequency planning and in radio compatibility and sharing analysis;
- c) that receiving parameter specifications should reflect a satisfactory balance between technology and economic feasibility;
- d) that in certain cases the receiver requirements can be justified e.g. for safety services, EMC and spectrum efficiency;
- e) that it is essential for the planners of the radio spectrum (administrations, manufacturers, operators) to publish the receiver specifications used as a condition for the planning exercise;
- f) that CEPT and ETSI have developed a Memorandum of Understanding describing the relative responsibilities of the two bodies; the MoU text is available from the ERO;

noting

- a) that the Radio Regulations define interference as « the effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunications system, manifested by any performance degradation ».
- b) that technical justification on the need for receiver parameters can be found in Annexes A and B;
- c) that within CEPT/ERC, a statistical simulation methodology based on the 'Monte Carlo' method has been developed and accepted as the basis for the future development of a software tool that, amongst others, would enable the assessment of the effect of receiver parameters when considering the probability of interference. The tool developed for ERC will be made available under the conditions of the MoU on development of the Monte Carlo simulation tool. The text of this MoU is available from the ERO;

recommends

- 1) that, where justified, administrations should seek to get receiver parameter limits included as essential parameters in harmonised standards or in national regulated interface specifications on a case by case basis and in accordance with the list in Annex A;
- 2) that, where it is not possible for *recommend 1* to be implemented, the receiver parameter limits used as the basis for planning of the radio spectrum and for radio compatibility and sharing analysis should be included as recommended parameters in standards;
- 3) that, where it is not possible for *recommend 2* to be implemented, the receiver parameter limits should be published by other means in the common understanding that they are of a voluntary nature.

Note:

Please check the ERO web site (<http://www.ero.dk>) for the up to date position on the implementation of this and other ERC Recommendations.

Annex A

**List of receiver parameters to be considered and their impact on spectrum efficiency
in the case of poor receiver performance**

Receiver parameters	Impact on spectrum utilisation and efficiency of radio equipment with poor receiver characteristics
Sensitivity	<ul style="list-style-type: none"> • increase of number of transmitters (base stations) • increase of transmitter power • increased spectrum demand if number of transmitter and transmitter power can not be changed • <u>increased difficulty</u> to elaborate channel plans <p>⇒ more interference to other services ⇒ capacity loss and therefore an inefficient spectrum use ⇒ influence to public health ("electrosmog")</p>
Blocking, desensitisation, spurious response, protection ratio, co-channel rejection, receiving mask, selectivity, adjacent band rejection,	<ul style="list-style-type: none"> • decrease of number of transmitters of the interfering service and • decrease of transmitter power of the interfering service <p>⇒ capacity loss for the interfering service and consequently more spectrum for the other service ⇒ increase of the interference probability to the wanted radio service</p>
Intermodulation rejection	<p>⇒ more spectrum is required to allow channel planning to avoid intermodulation products</p>
Cross-modulation rejection	<ul style="list-style-type: none"> • Applies to systems with an AM component only: requires increased received signal so impacts on transmit power

Note : each of these factors are interrelated and needs to be analysed and quantified in detail. The lack of recommended receiver parameter limits prevent optimised spectrum engineering, leading to the adoption of increased guard bands, greater transmitter powers, smaller cell sizes and less efficient spectrum utilisation. The administration has to use greater safety factors than are otherwise feasible, and the necessity to use these factors may well lead to greater ecological impacts from publicly required radio systems than would otherwise be the case.

Annex B

Examples of scenarios where receiver parameters are fundamental for frequency management

Inter-system scenarios :

- ***compatibility study on adequate guard bands to implement between systems operating in adjacent bands:*** these studies are based on MCL (Minimum Coupling Loss) or statistical (Monte Carlo) methods, which both are based on the knowledge of input parameters like receiver sensitivity, selectivity (C/I) and blocking, as defined by the standards available. If these parameters are not controlled, there is a risk that some radio receivers be (possibly harmfully) interfered, although appropriate dispositions have been taken to avoid this interference. For future systems, if receiver parameters are not known, pessimistic assumptions will be necessary that will increase the calculated guard bands and consequently lower the spectrum efficiency. In addition, it should be noted that not only guard bands are affected, but also geographical separation distances, in the case where the band is shared between two systems are equally affected by the values of receiver parameters.
- ***studies to produce channel plans for the fixed service in order to ease standardisation and circulation of equipment:*** these channel plans cannot be produced efficiently if the receiver selectivity is not well known.
- CEPT produced a recommendation on limits of spurious emissions from radio equipment, which puts constraints on the transmitter in order to increase the effectiveness of use of the spectrum. ITU-R has also produced Recommendation SM.329-7. These recommendations are based on the assumption that the receiver would be sufficiently selective to be more affected by unwanted emissions than by blocking phenomena. This needs to be ensured in order for all users to take benefits of the increased spectrum efficiency.

Intra-system scenarios :

- ***studies to produce channel plans for the mobile service in order to ease frequency co-ordination, standardisation and circulation of equipment:*** these channel plans cannot be produced effectively if the receiver performance is not well known.
- Some systems related to the safety of life need receiver parameters to work correctly in their mission.
- for radio systems using a "Listen Before Talk" protocol of any kind, the receiver performance is inextricably tied to a transmitter response. Where the system capacity is linked to a specific response e.g. power control in a CDMA type system a "rogue" receiver can act in a "predatory" manner, leading to a significant reduction in capacity, and thus spectrum utilisation.