

SECTION 1B: PRINCIPLES AND TECHNIQUES FOR SPECTRUM PLANNING, AND SHARING AND UTILIZATION

RECOMMENDATION ITU-R SM.1049-1

A METHOD OF SPECTRUM MANAGEMENT TO BE USED FOR AIDING FREQUENCY ASSIGNMENT FOR TERRESTRIAL SERVICES IN BORDER AREAS

(Question ITU-R 47/1)

(1994-1995)

The ITU Radiocommunication Assembly,

considering

- a) that frequency coordination is necessary in border areas;
- b) that there is a need to establish guidelines for frequency sharing in border areas;
- c) that if administrations develop effective bilateral or multilateral agreements on frequency use in border areas this will aid long-term strategic planning, promote efficient spectrum utilisation and help avoid interference;
- d) that the establishment of a mechanism for updating and exchanging appropriate information is required to enable an efficient accomplishment of the coordination process;
- e) that coordination methods may vary depending on the services and frequency bands involved,

recommends

- 1 that neighbouring administrations establish coordination agreements which should include:
 - 1.1 the exchange of appropriate spectrum management data from a national database;
 - 1.2 a means of resolving instances of unexpected harmful interference;
 - 1.3 procedural mechanisms such as the establishment of a *Coordination zone*, within which the coordination agreement applies;
 - 1.3.1 the following definitions apply:
 - *Coordination zone*: the area along the border in which a coordination agreement applies;
 - *Coordination perimeter*: a line establishing the agreed limit of the *Coordination zone*,
 - 1.3.2 the methods of determining the *Coordination perimeter* are based on typical technical and operational requirements for the concerned radio service;
 - 1.3.3 in reaching any bilateral or multilateral agreements on the creation of a *Coordination zone* administrations should consider the options listed in Annex 1 and examples shown in Annex 2.

ANNEX 1

The following steps provide a guideline for administrations considering entering into a bilateral or multilateral agreement for the establishment of a *Coordination zone*. In developing any agreement administrations should determine the appropriate method of implementation.

NOTE 1 – The terms “database” and “model” used in this Annex do not necessarily refer to computer based systems.



1 Agreements for establishing the *Coordination zone*

1.1 The depth of detail and the items included in bilateral or multilateral agreements for establishing a *Coordination zone* will depend upon the requirements of the individual administrations. Agreements should however cover both the administrative and the technical arrangements and may include standardisation of technical and operational parameters. Agreements may include components such as:

- frequency range(s) to be covered in the agreement,
- authorized bandwidth of service,
- modulation system,
- effective antenna height,
- limiting the service area of transmitters to the area required to be covered,
- the pertinent information to be exchanged e.g. service area, etc.,
- a method for collating, standardising and exchanging information,
- a method for identifying stations requiring coordination,
- the point in the process at which coordination is effected.

1.2 Administrations should also consider the requirements of any existing systems that are within the frequency range covered by the agreement but whose technical and operational parameters do not conform to the parameters in the agreement. Resolution of any difficulties caused by existing systems should be considered by the administrations and an appropriate mechanism incorporated into the agreement, this could include settlement on an evolutionary or case by case basis.

1.3 Within the *Coordination zone* administrations should consider the following frequency sharing options:

- *Allotted frequencies* (see Note 1): frequencies designated to an individual administration on an exclusive or preferential basis which can be assigned by that administration without prior coordination, provided technical characteristics fixed by prior agreement are followed.
- *Shared frequencies* (see Note 1): frequencies which may be shared by administrations without prior coordination provided the characteristics fixed by prior agreement are followed.
- *Coordinated frequencies* (see Note 2): frequencies that can be assigned only after successful coordination.
- *Allotted frequencies used on the basis of geographical network plans*: (e.g. cellular or broadcast allotment plans) frequencies used, in the countries concerned on the basis of a geographical network plan prepared and adopted in advance, taking into account the technical characteristics set out in the plan.

NOTE 1 – Most applicable to area coverage Systems such as VHF/UHF land mobile services.

NOTE 2 – Most applicable to fixed services.

2 The *Coordination zone*

2.1 For a service a smaller *Coordination zone* may permit an administration to coordinate fewer assignments in the operational planning of the service, whilst keeping the risk of interference to an acceptable level. Refining the *Coordination perimeter* map would require administrations to have more complex arrangements for regulating the operation of the agreement and achieve greater precision in determining interference levels. To refine the *Coordination perimeter* map and minimise the *Coordination zone* the *Coordination perimeter* may be estimated by propagation prediction methods. These methods may vary in complexity and precise applicability to the actual terrain and climatic conditions. In essence the aim is to improve on the “simple line” approach by using prediction methods to estimate the excess losses introduced by intervening hills and similar features and to assess the degree of risk that anomalous propagation conditions will mitigate against these excess losses. It may also be necessary to agree measurement strategies by which the accuracy and applicability of the prediction methods or models may be verified.

2.2 To determine the *Coordination perimeter*, mutual agreement on a number of factors is required:

- the maximum permitted interference field strength for each service/frequency band;
- the maximum values of transmitter power, effective antenna height and gain allowed or a method of including these in the calculations;
- an agreed method of prediction calculation;
- methods for allowing each administration to verify the correct or accepted use of the model(s) on a case-by-case basis.

For a more detailed model a terrain database covering relevant parts of each administrations territories may be required.

In addition it may be necessary to agree on a strategy for performing actual measurements to verify the applicability of the model and give confidence in the chosen procedures. This measurement strategy will need to consider a number of factors:

- the selection of test points at which transmitters and measurement receivers will be located;
- the conditions, such as climate and signal-to-noise ratios, over which results will be considered valid;
- the mechanism for witnessing measurement programmes and resolving any difficulties;
- the duration of measurements, in which context two issues need to be addressed:
 - the duration of measurements needed to validate terrain loss predictions under “normal” climatic conditions;
 - the extended duration required to assess the time probability that anomalous propagation will significantly enhance propagation and received signal levels;
- the method of relating measured results to the prediction models and the conditions under which the applicability and accuracy of the model can be considered proven.

ANNEX 2

EXAMPLE 1

Agreement between country X and country Y concerning the use of the bands 932 to 932.5 MHz and 941 to 941.5 MHz along the X-Y border for point to multipoint

1 This agreement between country X on the one hand, and country Y on the other hand, covers the coordination and use of the bands 932-932.5 and 941-941.5 MHz for point-to-multipoint communications systems in the vicinity of the X-Y border.

2 Agreement for point-to-multipoint systems in the band segments 932.0-932.5 MHz and 941.0-941.5 MHz.

2.1 Notwithstanding any other provisions of this agreement, beyond the Coordination zone each country shall have full use of the entire 932.0-932.5 and 941.0-941.5 MHz bands.

2.2 The Coordination zone is defined as the area adjacent to the X-Y border extending a distance of 50 km within either country.

2.3 In the Coordination zone, the frequencies shall be used as follows, consistent with the technical criteria of Appendix 1:

2.3.1 932.0-932.25 MHz and 941.0-941.25 MHz

Country Y has full use of frequencies within these bands. Country X may also use these frequencies on an unprotected basis, provided its stations are limited to a power flux-density (pfd) of $-100 \text{ dB(W/m}^2\text{)}$ at or beyond the Country Y border for the frequency band 932-932.25 MHz and $-94 \text{ dB(W/m}^2\text{)}$ at or beyond the Country Y border for the band 941.0-941.25 MHz.

2.3.2 932.25-932.50 MHz and 941.25-941.50 MHz

Country X has full use of frequencies within these bands. Country Y may also use these frequencies on an unprotected basis, provided its stations are limited to a pfd of $-100\text{ dB(W/m}^2\text{)}$ at or beyond the Country X border for the frequency band 932.25-932.5 MHz and $-94\text{ dB(W/m}^2\text{)}$ at or beyond the Country X border for the band 941.25-941.50 MHz.

2.4 Wherever this agreement provides that a power flux-density may be met in lieu of a distance separation, free space propagation may initially be assumed to determine whether the required power flux-density has been met. If the new applicant fails to meet a required pfd limit using free space propagation, the administration seeking use of the frequency may apply other methods, as appropriate, to demonstrate that the required pfd limit has, in fact, been met. On frequencies primarily assigned for use by the other country, the pfd limit must be met at and anywhere beyond the border.

APPENDIX 1**TO ANNEX 2**

**Technical criteria applicable to point-to-multipoint stations
operating in accordance with this agreement**

1 Example values**1.1 Maximum radiated power:****TABLE 1**

Class of station	Band (MHz)	Maximum e.i.r.p.		Maximum e.r.p.	
		(W)	(dBW)	(W)	(dBW)
Master	941.0-941.5	1 000	30	600	27.8
Fixed remote and master	932.0-932.5	50	17	30	14.8

1.2 The maximum antenna height above average terrain for master stations operating at maximum power shall not exceed 150 m. Above 150 m, the power of master stations shall be in accordance with Table 2.

TABLE 2

Antenna height above average terrain (m)	e.i.r.p.		e.r.p.	
	(W)	(dBW)	(W)	(dBW)
Above 305	200	23	120	20.8
275-305	250	24	150	21.8
245-275	315	25	190	22.8
215-245	400	26	240	23.8
180-215	500	27	300	24.8
150-180	630	28	380	25.8

1.3 Terms and definitions

- e.i.r.p. equivalent isotropically radiated power (dBW)
- e.r.p. effective radiated power (reference dipole antenna) (dBW)

$$e.r.p. = e.i.r.p. - 2.2$$

1.4 Formula used for calculating free space propagation losses

$$pfd \text{ (dB(W/m}^2\text{))} = 10 \log \left(\frac{e.i.r.p.}{4\pi D^2} \right)$$

pfd is the power flux-density where e.i.r.p. (W), *D* in (M) and power is relative to an isotropic radiator.

EXAMPLE 2

Arrangement between country X and country Y concerning
the use of the bands 821-824 MHz and 866-869 MHz
along the X-Y border for land-mobile service

1 Scope

- 1.1 This arrangement between country X and country Y covers the establishment and operation of land mobile radio services operating in the bands 821-824 MHz and 866-869 MHz along the X-Y border.
- 1.2 This arrangement is subject to review at any time at the request of either country.
- 1.3 Special coordination arrangements may be initiated under this arrangement by either country and implemented subject to the approval of both countries.

2 Sharing arrangements

The frequency bands covered by this arrangement are to be shared along the border as indicated below.

2.1 a) Country X

Country X has the unrestricted use of the frequency bands 821.000-822.500 MHz and 866.000-867.500 MHz in the Coordination zone within country X.

b) Country Y

Country Y has the unrestricted use of the frequency bands 822.500-824.000 MHz and 867.500-869.000 MHz in the Coordination zone within country Y.

c) Shared channels

Both countries agree that the following paired channels are to be available as public safety mutual aid channels (Mutual aid channels are to be used only for coordination of tactical communications between different public safety organizations, or for other similar emergency communications.):

821.0125 MHz	866.0125 MHz
821.5125 MHz	866.5125 MHz
822.0125 MHz	867.0125 MHz
822.5125 MHz	867.5125 MHz