RECOMMENDATION ITU-R F.302-3*

Limitation of interference from trans-horizon radio-relay systems

(1959-1982-1990-1997)

Scope

This Recommendation provides technical adn operational requirements of trans-horizon radio-relay systems in the fixed service to avoid interference to line-of-sight fixed wireless systems or systems in other services operating in nearby countries.

The ITU Radiocommunication Assembly,

considering

a) that trans-horizon radio-relay systems can cause interference over long distances which in many cases may extend across national boundaries;

b) that trans-horizon radio-relay systems can cause interference to all the systems sharing the same frequency bands and particularly to space communication systems;

c) that trans-horizon systems need some form of diversity to circumvent fading;

d) that multiple-diversity can be provided without using additional frequencies, e.g. by employing spaced antennas, with or without cross-polarization,

recommends

in planning trans-horizon radio-relay systems:

1 that account be taken of the high degree of international coordination and planning which will be involved if trans-horizon radio-relay systems of this type are to occupy the same frequency bands in nearby countries without mutual interference, and that the problem would become much more complex if, in addition, they were to occupy the same frequency bands as conventional line-of-sight systems or other services;

2 that the utmost economy in frequency should be observed;

3 that frequency-diversity should be avoided as far as possible, particularly in those parts of the world where the frequency spectrum is likely to become congested;

4 that special efforts should be made to operate such radio-relay systems at the lowest practicable level of radiated power, and in particular:

4.1 in the case of a frequency band shared with space radiocommunication services (space-to-Earth), due consideration should be given to interference from the trans-horizon radio-relay system to earth stations on the basis of the coordination area for receiving earth stations determined in accordance with Recommendation ITU-R SM.847 (Geneva, 1993);

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* Radiocommunication Study Group 9 made editorial amendments to this Recommendation in 2007 in accordance with Resolution ITU-R 44.

4.2 for the range of angles for which the e.i.r.p. of the trans-horizon radio-relay systems is less than +40 dBW in a 4 kHz bandwith (see Note 1), careful consideration should be exercised, comparable to that required for coordination between line-of-sight radio-relay systems and earth stations. For the range of angles for which the directional e.i.r.p. of the trans-horizon system exceeds +40 dBW in a 4 kHz bandwith, more careful consideration is required;

5 that special efforts should be made to reduce radiation in, and reception from, undesired directions;

6 that special efforts should be made to reduce spurious emissions to the lowest practicable level.

NOTE 1 – This value is the maximum allowable e.i.r.p. transmitted towards the horizon by an earth station sharing the same frequency band with the fixed service (see Article 21, No. 21.8 of the Radio Regulations (RR) revised by the World Radiocommunication Conference (Geneva, 1995) (WRC-95)).

Annex 1

Trans-horizon radio-relay systems have interference-producing capabilities and susceptibilities not unlike those encountered in line-of-sight radio-relay systems. Differences are primarily due to the usually higher transmitting powers, narrower antenna beamwidths and more sensitive receivers encountered in trans-horizon systems. This means that siting considerations are very important with trans-horizon systems.

To minimize interference from a trans-horizon radio-relay system line-of-sight situations are usually avoided, as are areas where the diffracted signal will be strong. Under some circumstances, it may be impossible to avoid occasional interference from signals due to diffraction, strong layer reflection, and especially ducting.

To estimate expected co-channel interference, it is necessary to calculate transmission loss by subtracting the path antenna gain G_p given in Fig. 1 of Recommendation ITU-R F.1106 from the estimated basic transmission loss. The interfering field depends on the mean long-term loss and any additional fluctuations. At UHF and higher frequencies, the lowest observed values of extra-diffraction transmission loss are the result of atmospheric focusing and ducting, either over sea or over land.

Field strength may be combined with antenna gain to yield azimuthal distance-interference patterns for various systems and combinations. In considering non-co-channel interference, account must also be taken of transmitter spectrum distribution and receiver passband characteristics. For antenna pattern considerations see Recommendation ITU-R F.699.

Although it is not possible to recommend final channel arrangements, there is a need to select frequencies in an orderly manner on a regional basis. In arriving at such agreements between administrations, the guidelines in Report 286 (Geneva, 1982) should be observed.

Polarization discrimination is also suggested to aid the use of space-diversity and the rejection of interference.

It has been general practice to engineer tropospheric-scatter systems on the high propagation attenuations exceeded only during small percentages of the time. It should be realized that under more favourable conditions, prevailing for the rest of the time, transmitter powers and antenna gains so justified can cause increased interference fields. It may be advisable under such conditions to reduce the transmitter power temporarily.

Typical power output statistics

While automatic power control (APC) is not currently operated on analogue systems, successful trials of APC functionality have been carried out.

More recent trans-horizon systems employ digital modulation techniques and APC. Maximum power amplifier output is 1.6 kW but actual transmitter power monitored over a period of 12 consecutive months resulted in the following statistics:

– power exceeded for 10% time: 1 kW,

– power exceeded for 50% time: 175 W,

– power exceeded for 90% time: 6.5 W.

It is worth noting the median transmitter power level is approximately 10 dB below the maximum power level of 1 kW. The mitigating effect of automatic power control, when evaluating interference from trans-horizon radio into other services, is therefore significant.