RECOMMENDATION ITU-R M.1186-1

Technical considerations for the coordination between mobile-satellite service networks utilizing code division multiple access and other spread spectrum techniques in the 1-3 GHz band

(Questions ITU-R 83/8 and ITU-R 201/8)

(1995-2006)

Scope

This Recommendation provides the technical parameters to be considered for the coordination of code division multiple access (CDMA) mobile-satellite service (MSS) systems, and recommends the administrations implementing such systems to coordinate based on agreed values for the pfd or e.i.r.p. density, in space-to-Earth or Earth-to-space direction, respectively.

The ITU Radiocommunication Assembly,

considering

a) that non-geostationary satellite systems in the MSS using code division multiple access (CDMA) or other spread spectrum techniques have been proposed for operation in the 1-3 GHz band;

b) that MSS systems using other modulation methods frequency division multiple access (FDMA)/time division multiple access (TDMA) have also been proposed for operation in the 1-3 GHz band;

c) that multiple MSS systems using CDMA or other spread spectrum transmission techniques can in some cases operate on a co-channel and co-coverage basis;

d) that the most recent technical information developed by the Radiocommunication Study Groups should be made available to administrations for their use in the coordination of these systems,

recommends

1 that administrations implementing MSS networks using CDMA or other spread spectrum transmission techniques exchange detailed information on the following system parameters, to facilitate the coordination process (see Note 1):

– downlink spectral power flux-density (pfd),
– aggregate uplink e.i.r.p. spectral density over a specified geographical area,
– polarization,
– frequency use approaches,
– code structures and associated cross-correlation properties,
– antenna beam patterns,
– signal burst structures (if applicable);

2 that administrations implementing MSS networks using CDMA or other spread spectrum transmission techniques should undertake coordination in the space-to-Earth direction based on agreed values for the spectral pfd on Earth resulting from those MSS space stations (see Note 2);

3 that administrations implementing MSS networks using CDMA or other spread spectrum transmission techniques may undertake coordination in the Earth-to-space direction based on agreed values of e.i.r.p. density from the mobile earth stations within a given geographical area (see Note 3).

NOTE 1 – Additional parameters can be utilized to facilitate the coordination process among MSS spread spectrum networks. Administrations should exchange information on and may wish to coordinate additional technical parameters. These additional technical parameters are:

Polarization: The sense of polarization used should be specified, although only circular polarization is assumed for the user terminal antennas. While the amount of intersystem isolation due to use of different sense of circular polarization in the service link that can be assumed in coordination may be small, any amount of isolation can provide a usable increase in system capacity under interference sharing conditions.

Frequency use approaches: System operators would be required to specify their satellite frequency use in terms of the individual radio-frequency channels (centre frequency and bandwidth) in their systems. Frequency use approaches may indicate a degree of isolation between systems, and constraints on frequency use approaches may be needed to achieve compatibility (i.e. avoidance of co-channel operation).

Code structures and associated cross-correlation properties: There are numerous pseudo-random noise codes of adequate length and acceptable properties that can be selected by a CDMA system operator to ensure satisfactory system operation. However, there is a small probability that system operators can independently select codes that have cross-correlation artifacts that produce more interference than would be in the case of the white gaussian noise usually assumed in the intersystem interference calculations. For this reason, coordination between system operators would include identification of their code structures to ensure that the codes selected have sufficiently good cross-correlation properties that the effects of intersystem interference are no worse than white gaussian noise.

Antenna beam patterns: Antenna beam patterns (number of beams, pointing angle of maximum gain, side-lobe gain patterns and beam array layout) together with frequency plans, can be used to represent the distribution of spectral pfd/e.i.r.p. spectral density across a specified geographic area and the assigned frequency band. Satellite beam patterns are especially important in cases where geographic operating constraints are needed (e.g. where co-channel sharing is not possible between global-coverage systems and regional-coverage systems).

Signal burst structures: If a system uses a form of transmission that does not radiate a continuous signal, the time dependent characteristics of the transmission should be described in such terms as peak/average power levels, duty cycle, framing and guard time structure, burst synchronization characteristics, etc.

NOTE 2 – In the downlink direction, the key interference parameter is the total amount of interfering power presented to the receiving mobile earth station, and this interference level can most readily be defined in terms of a spectral pfd value. Because of the constantly changing geometry of non-geostationary systems and the number of satellites visible at any particular moment at a point in the service area being coordinated, the value of maximum spectral pfd should be specified as the maximum spectral pfd that is permitted at any point in the service area from the aggregate of all satellites in the interfering network. It may be desirable to average the maximum permissible spectral pfd limit over an appropriate and agreed-upon period of time to account for short-term peak situations due to power control transients, differing number of satellites in view, and other time-varying system characteristics. Polarization effects shall also be considered during coordination. This agreed-to maximum spectral pfd per network is determined on the basis of achieving coordination between multiple spread spectrum satellite networks subject to other spectral pfd constraints on a per satellite basis that are established during coordination of MSS downlinks with terrestrial services under Article 9 of the Radio Regulations (RR) and in some bands if the pfd values of RR No. 21.16 are exceeded.

NOTE 3 – In the uplink direction, the key interference parameter is the total interference power presented at the satellite receiver input, and this parameter can be most conveniently addressed in the coordination process for spread spectrum networks by agreeing on a limit on the aggregate e.i.r.p. spectral density simultaneously radiated by all mobile earth stations for a single interfering system that are located within an appropriately sized reference area within the service area being coordinated. Because of different beam sizes used in spread spectrum systems such aggregate e.i.r.p. spectral density levels may have to be specified for a set of reference averaging areas that approximate the range of beam sizes being coordinated. Some time averaging also may be desirable to account for short-term peak situations due to random access channels, power control system transients, and other time-varying system characteristics. It should be noted that these agreed-to aggregate e.i.r.p. spectral density limits must be within applicable e.i.r.p. spectral density limits imposed on mobile earth stations as a result of sharing with other services in the band and in some bands if the e.i.r.p. spectral density limits are exceeded.