

RECOMMENDATION ITU-R RS.1279*, **

**SPECTRUM SHARING BETWEEN SPACEBORNE PASSIVE SENSORS
AND INTER-SATELLITE LINKS IN THE RANGE 50.2-59.3 GHz**

(Question ITU-R 216/7)

(1997)

The ITU Radiocommunication Assembly,

considering

- a) that weather forecasting is an increasingly important tool which is essential to all human economic activities, and is also playing a predominant role in early identification and warnings of potentially dangerous phenomena;
- b) that atmospheric temperature is essential data needed for weather forecasting on a global basis;
- c) that the oxygen absorption band consisting of several absorption lines between 50 and 65 GHz represents a unique natural resource for remote temperature profile sensing in the atmosphere, not available in any other frequency band;
- d) that all-weather atmospheric temperature profiles can only be obtained on a global basis with sufficient accuracy through three-dimensional microwave passive measurements from low-Earth orbiting (LEO) space platforms in the unique frequency band around 60 GHz where absorption by atmospheric oxygen is taking place;
- e) that these passive measurements are extremely vulnerable to interference because the natural variability of the atmosphere makes it impossible to recognize and to filter out measurements contaminated by interference;
- f) that contaminated passive sensor measurements can have a dramatic, adverse impact on climate studies and the quality of weather predictions;
- g) that non-geostationary-satellite orbit (non-GSO) networks providing fixed-satellite services (FSS) and mobile-satellite services are being developed which plan to employ large numbers of inter-satellite links (ISL) near 60 GHz;
- h) that geostationary-satellite orbit (GSO) networks providing FSS and mobile-satellite services are being developed which plan to employ ISLs near 60 GHz;
- j) that the 54.25-58.2 GHz frequency band is shared on a co-primary basis by the Earth exploration-satellite service (passive) (EESS), the Space Research (passive) service, and the inter-satellite service (ISS);
- k) that item 1.9.4.3 of Resolution 718 (WRC-95) (Agenda for the 1997 World Radiocommunication Conference) is to consider “the existing frequency allocations near 60 GHz and, if necessary, their re-allocation, with a view to protecting the Earth exploration-satellite (passive) service systems operating in the unique oxygen absorption frequency range from about 50 GHz to about 70 GHz”;
- l) that Recommendation ITU-R RS.1029 contains interference protection criteria for passive sensors in bands near 60 GHz;
- m) that studies conducted in the band 54.25-58.2 GHz have shown that the ISLs in a non-GSO network can cause interference to the passive sensors well in excess of these protection criteria (see Annex 1);
- n) that studies conducted in the band 54.25-58.2 GHz have shown that ISLs in GSO networks can share the band with passive sensors with suitable restrictions on the power flux density (pfd) produced by GSO satellites at the sensor orbital altitude (see Annex 2),

recognizing

- a) the need to protect existing and planned ISS systems in the band 56.9-57 GHz,

* This Recommendation should be brought to the attention of Radiocommunication Study Group 4.

** Radiocommunication Study Group 7 made editorial amendments to this Recommendation.

recommends

- 1 that, in view of *considering* c) and m), passive sensors and ISLs of non-GSO networks should operate in separate bands in the range 50.2-59.3 GHz;
- 2 that, in view of *considering* n), passive sensors and ISLs of GSO networks can share bands in the range 50.2-59.3 GHz provided that the pfd at all altitudes from zero to 1 000 km above the Earth's surface produced by emissions from a space station in the ISS does not exceed $-147 \text{ dB(W/(m}^2 \cdot 100 \text{ MHz))}$.

ANNEX 1

Results of the non-GSO interference study

1 Introduction

The EESS includes spaceborne passive sensors which measure temperatures of various atmospheric layers in several frequency bands within the oxygen absorption bands near 60 GHz. Depending on the frequency, measurements in the 60 GHz band can be substantially protected from interference from terrestrial emissions. Frequency bands near 60 GHz are also attractive for ISL of a non-GSO communications system. Unfortunately these ISLs introduce potential interference to spaceborne passive sensor measurements, which are not attenuated by oxygen absorption. Table 1 describes the non-GSO and sensor satellite orbits, and Table 2 describes the non-GSO transmission and sensor satellite reception characteristics used in the study. All antennas were modelled using Recommendation ITU-R S.672, with -10 dBi minimum gain.

TABLE 1

non-GSO and sensor satellite orbit characteristics

Orbital parameter	non-GSO satellite	Sensor
Altitude (km)	700	833
Inclination (degrees)	98.16	98.7
Period (min.)	98.8	101.5
Eccentricity	0.0	0.0
Number of orbital planes	21	2
Number of satellites per plane	40	1
Ascending nodes	Spaced 9.5° starting at 0°	N.A.

TABLE 2

non-GSO and sensor satellite characteristics

Parameter	non-GSO satellite	Advanced microwave sounding unit (AMSU) sensor	Pushbroom sensor
Carrier frequencies (GHz)	56 and 59	56	56
Bandwidth per channel (MHz)	1 000	400	100
Power in each band (dBW)	7.4	N.A.	N.A.
Peak antenna gain (dBi)	48	36	45

Copyright International Telecommunication Union/ITU Radiocommunication Sector