

RECOMMENDATION ITU-R RS.1259*

FEASIBILITY OF SHARING BETWEEN SPACEBORNE PASSIVE SENSORS
AND THE FIXED SERVICE FROM 50 TO 60 GHz**

(Question ITU-R 216/7)

(1997)

The ITU Radiocommunication Assembly,

considering

- a) that unique atmospheric oxygen bands are located around 50 to 65 GHz allowing “all weather” monitoring of the Earth’s atmosphere on a worldwide scale;
- b) that measurements of temperature at different heights in the atmosphere using spaceborne passive sensors are vital for weather forecasts and climate studies (such as “global change”);
- c) that a small number of undetected interference events can have an extremely detrimental effect on numerical weather prediction;
- d) that measurements of sufficient accuracy can only be obtained in precise frequency sub-bands from around 50 to 60 GHz dictated by the physical processes of oxygen spectroscopy;
- e) that the World Radiocommunication Conference (Geneva, 1997) (WRC-97) Agenda item 1.9.4.3 concerns existing frequency allocations near 60 GHz and, if necessary, their re-allocation to protect Earth exploration-satellite service (EESS) (passive) systems;
- f) that around 55 GHz, temperature “sounding” is highly sensitive to interference from terrestrial sources;
- g) that the frequency bands 50.2-50.4 GHz and 54.25-58.2 GHz are shared on a co-primary basis between spaceborne passive sensors and the fixed service;
- h) that the preferred frequencies and necessary bandwidths for satellite passive sensing are contained in Recommendation ITU-R RS.515;
- j) that extensive sharing studies have been carried out as summarized in Annex 1;
- k) that restrictions would be required on the operation of fixed links in the band 55.2-55.78 GHz, as detailed in Annex 1;
- l) that due to the high vulnerability of passive temperature soundings to interference, the strict compliance of the restrictions in the band 55.2-55.78 GHz on a worldwide basis would be vital for adequate protection of passive sensors;
- m) that the enforcement on a worldwide basis of a strict compliance with the required restrictions would not be practicable,

recommends

- 1** that sharing between spaceborne passive sensors and the fixed service is feasible between 55.78 GHz and 60 GHz;
- 2** that sharing between spaceborne passive sensors and the fixed service is not practicable between 50 GHz and 55.78 GHz and that spaceborne passive sensors and the fixed service not operate in the same frequency band within this range.

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

** Throughout this Recommendation, “spaceborne passive sensors” includes sensors on board satellites operating in the Earth exploration-satellite (passive) and space research (passive) services, since the characteristics of these two services are essentially identical throughout the frequency bands under consideration.

ANNEX 1

Sharing between the fixed service and passive remote sensors in the range 50.2-58.2 GHz

1 Introduction

The fixed service and the Earth exploration-satellite (EES) passive and space research (passive) services have co-primary allocations in the bands 50.2-50.4 GHz and 54.25-58.2 GHz. The purpose of this Annex is to review the suitability of these allocations and, where necessary, to develop limitations to be applied to the fixed service to ensure adequate protection of passive remote sensors.

The oxygen absorption in the frequency ranges of interest varies considerably, with a large number of absorption lines, around 60 GHz. The level of absorption used in the sharing studies has been calculated from Recommendation ITU-R P.676. It will be shown that the level of absorption has an important effect on the feasibility of sharing. Figure 1 shows the total absorption on a vertical path from Earth-to-space. The absorption on the ground-space path is reduced as the height of ground above sea level is increased. Fixed link transmitters could operate from locations at a range of altitudes. Throughout this Annex, as a conservative estimate, it is assumed that fixed service transmitters are at 1 000 m above sea level.

At the relatively high frequencies of interest here, indirect propagation effects can be a significant propagation mechanism. As a worst case representative of indirect propagation mechanisms, the studies have considered reflection from building roof tops.

2 Fixed links

In some countries, fixed links have been operated in the bands 50.2-50.4 GHz and 57.2-58.2 GHz. The maximum transmitter power currently achievable is around -17 dBW. The sharing parameters of the fixed service have been derived from details of those systems in current use. To allow for future advances in microwave technology, a transmitter power higher than that currently achievable has been assumed. In the initial sharing analysis, the following parameters in Table 1 of fixed links have been used.

TABLE 1
Fixed service sharing parameters

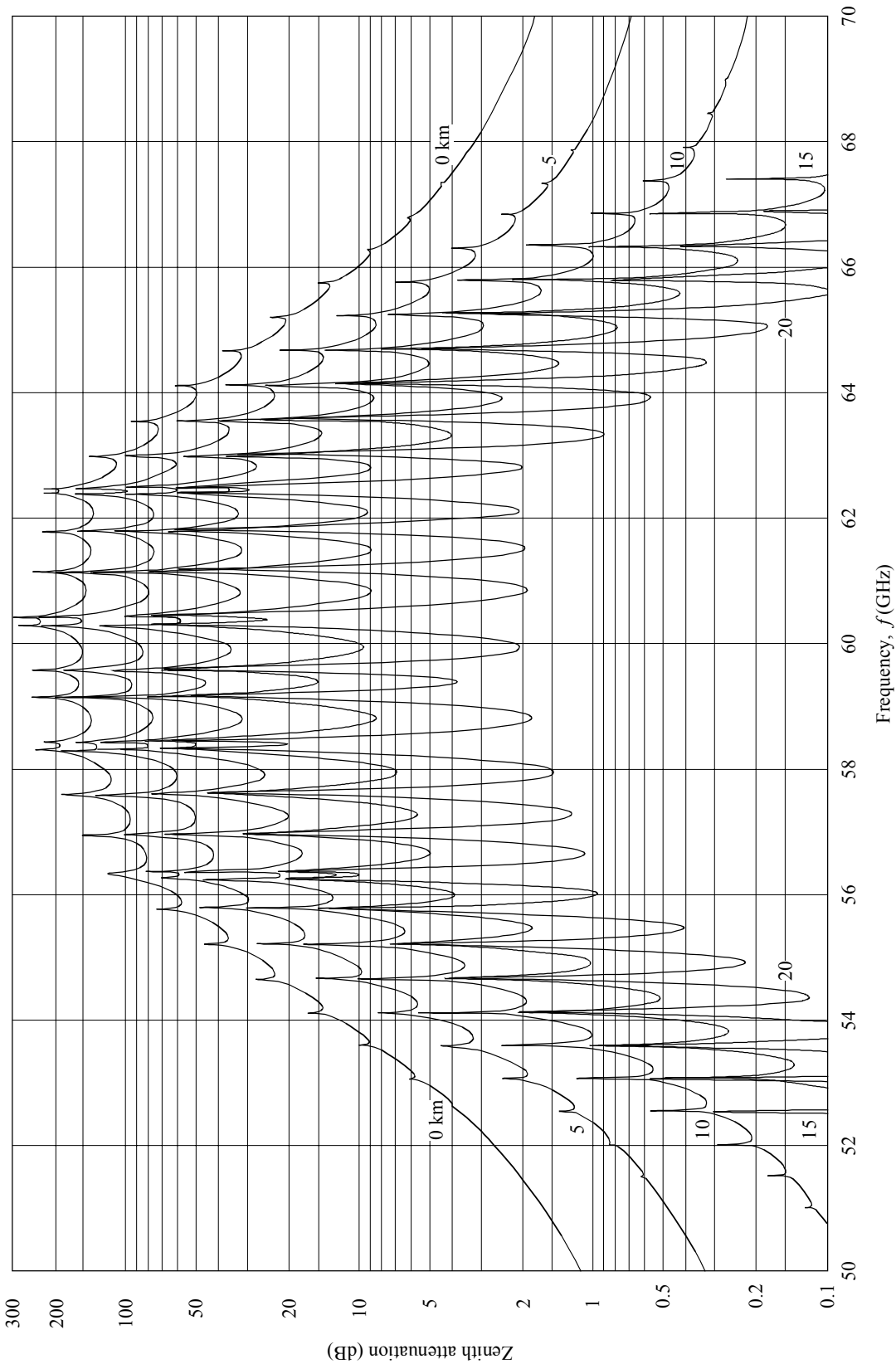
Transmitter power (dBW)	-10
Minimum bandwidth (MHz)	14
Feeder loss (dB)	0
Antenna gain (dBi) : - boresight	41
- 90° off boresight	-10
Antenna elevation angle (degrees)	0
Antenna height above sea level (m)	1 000

3 Passive sensors

3.1 Current and future systems

Several organizations are currently operating or developing passive sensors which operate in the bands around 55 GHz. These sensors use a mechanically scanning design. The next generation of passive sensor are likely to utilize a pushbroom scanning concept which allows improved radiometric and spatial resolution. The pushbroom type sensor is not expected to be used before 2005.

FIGURE 1
Zenith oxygen absorption for some initial heights



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