

RECOMMENDATION ITU-R SF.1486*

**SHARING METHODOLOGY BETWEEN FIXED WIRELESS ACCESS SYSTEMS
IN THE FIXED SERVICE AND VERY SMALL APERTURE TERMINALS
IN THE FIXED-SATELLITE SERVICE IN THE 3 400-3 700 MHz BAND**

(Questions ITU-R 255/4 and ITU-R 227/9)

(2000)

The ITU Radiocommunication Assembly,

considering

- a) that the frequency band 3 400-3 700 MHz is allocated worldwide on a primary basis to the fixed service (FS) and the fixed-satellite service (FSS);
- b) that this band is in use by the FSS, particularly by systems using very small aperture terminals (VSATs);
- c) that this band is used for terrestrial point-to-multipoint (P-MP) systems operating in the FS for providing fixed wireless access (FWA) and that this use is growing rapidly in many countries;
- d) that in ITU Regions 2 and 3 the band 3 400-3 600 MHz is also allocated to the radiolocation service on a primary basis by RR No. S5.433;
- e) that there is a need to protect co-primary services and to assess further the sharing conditions between FWA systems and these services,

noting

- a) that there is interest in harmonized use of FWA systems in this band;
- b) that co-frequency sharing between VSAT and P-MP systems may be difficult for VSATs operating at low elevation angles;
- c) that some FWA systems are capable of using a range of frequencies, but in some administrations only part of the 3 400-3 700 MHz band may be available;
- d) Recommendation ITU-R F.1488 on frequency block arrangements, for FWA systems in the range 3 400-3 800 MHz,

recommends

1 that to facilitate sharing between VSAT earth stations in the FSS and FWA stations in the FS in the band 3 400-3 700 MHz, the methodology as outlined in Annex 1 should be used;

2 that to facilitate substantial frequency sharing within the coordination distance, administrations are encouraged to adopt precautions during the planning and deployment of such systems, taking into account the interference mitigation methods described in Annex 2, and in particular those for the installation at the VSAT and P-MP central and terminal stations, including judicious location of antennas to exploit natural and man-made features or the use of diffraction screens close to the VSAT antennas (see Note 1).

NOTE 1 – Co-frequency sharing between such systems depends to a considerable extent on the usage of this band by the two services, especially on the density of deployment, on geographical and other factors.

* This Recommendation should be brought to the attention of Radiocommunication Study Group 3.

Methodology for calculating separation distances for sharing in the 3 400-3 700 MHz range between FSS VSATs and P-MP FWA systems

1 Introduction

Generally it is acknowledged that the 3.5 GHz range is suitable for P-MP FWA systems. For FSS systems the range 3 400-3 700 MHz is commonly referred to as extended C-band. The characteristics of typical VSAT and (TDMA based) P-MP FWA systems in this band are given in Tables 1 and 2.

The two modes of possible concern are:

- a) interference from P-MP central station (CS) and/or terminal station (TS) into the FSS earth station (VSAT) receiver;
- b) interference from the FSS spacecraft into the P-MP CS and/or TS receivers.

The methodology addressed in this Annex is for interference mode a), and makes certain general assumptions regarding system characteristics and propagation conditions. Other methodologies employing the actual system parameters and path loss specific to the case under study may provide a more precise separation distance.

Interference mode b) is currently addressed by the power flux-density (pfd) requirements of Article S21 of the RR, but may require future studies.

1.1 Interference criteria

It is considered that interference to the FSS terminal is significant when the victim receiver (VSAT) is subjected to an interference level equivalent to a degradation of the thermal noise floor by 0.4 dB, corresponding to an interference level 10 dB below the receiver thermal noise floor for more than 20% of any month (see Recommendation ITU-R SF.558).

2 Sharing methodology

2.1 System parameters

P-MP FWA system parameters used for calculations are shown in Table 1. The FWA example described here uses TDMA, but generally the calculations for other FWA technologies may be considered similar in this context (see also Recommendation ITU-R. IS.847).

The technology is designed for wireless access for the delivery of telephony and data services to businesses and residential users.

Typical VSAT parameters for this band are given in Table 2.

The antennas used in 3 400-3 700 MHz VSATs and those used in FWA CSs and TSs, are not sufficiently large to afford substantial off-beam rejection; side-lobe discrimination levels are modest due to the apertures involved. Nevertheless the type of VSAT antenna typically used for this band is of parabolic reflector type with good offset horn type feed. However, practical FWA TS and CS antennas are predominately of planar design, of relatively lower efficiency and side-lobe performance. Terrestrial P-MP FWA systems normally feature air-side traffic concentration, which from a RF viewpoint may be considered deployed in a manner similar to that of terrestrial mobile cellular, that is in a contiguous cellular arrangement using frequency reuse.

2.2 FWA TS interference into VSAT station

The example P-MP FWA system occupies the frequencies 3 475-3 492 MHz (CS to TS) and 3 425-3 442 MHz (TS to CS). Because the e.i.r.p. of the TSs is higher than that of the CS, as well as their greater number and distribution and hence the greater likelihood that the TS will be directed towards the VSAT station (downlink band), it is appropriate to calculate the interference from the TS. From Table 1, the e.i.r.p. from the FWA TS = $27 + 18 - 30 = 15$ dBW. The TS directional antenna typically has a nominal beamwidth of 20° (at -3 dB).

TABLE 1

P-MP FWA system parameters

Transmission frequency band (TS to CS) (MHz)	3 425-3 442
Reception frequency band (CS to TS) (MHz)	3 475-3 492
Channel spacing (kHz)	307.2
Access technique	TDMA
Duplex spacing (MHz)	50 or 100
Number of frequency channels	48
Modulation	$\pi/4$ DQPSK
Traffic channel bit rate/time slot (kbit/s)	32
CS ⁽¹⁾ transmit power (dBm)	29
CS antenna gain (dBi)	10 (omnidirectional), 12 (tri-sector)
Receiver sensitivity (dBm)	-102
TS ⁽²⁾ transmit power, maximum (dBm)	27
TS antenna gain (dBi)	18
TS feeder loss (dB)	0
TS height (m)	10

(1) CS: P-MP FWA central (base) station.

(2) TS: terminal (subscriber or remote) station.

TABLE 2

Typical VSAT system parameters

Frequency band (GHz)	3.4-3.7
Transmit rate (kbit/s)	64
Modulation	2-PSK
FEC rate	1/2
Channel bandwidth (kHz)	153.6
Antenna diameter (m)	1.8/2.4
Antenna gain (dBi)	35.7/38.2
Noise temperature (K)	114.8
Tx e.i.r.p. (maximum) (dBW)	38
Receiver sensitivity (dBm)	-126.1
Height of VSAT station (m)	10

The interference level depends upon the FWA TS transmit output power, antenna gain, antenna height and the direction of the antenna main beam. The FWA TS interference can be determined as a function of the separation distance, d , and the off-axis angles of the VSAT (φ) and FWA TS (α) for various assumptions regarding the digital modulation techniques for the VSAT and FWA systems, side-lobe envelope, power level of the FWA TS carrier, centre frequency offset between carriers, required protection ratio, and the amount of shielding of the VSAT stations.