

SECTION 4E: FREQUENCY SHARING BETWEEN NETWORKS OF THE FIXED-SATELLITE SERVICE AND THOSE OF OTHER SPACE RADIOCOMMUNICATIONS SYSTEMS

RECOMMENDATION ITU-R S.1151*

SHARING BETWEEN THE INTER-SATELLITE SERVICE INVOLVING
GEOSTATIONARY SATELLITES IN THE FIXED-SATELLITE SERVICE
AND THE RADIONAVIGATION SERVICE AT 33 GHz

(Question ITU-R 213/4)

(1995)

The ITU Radiocommunication Assembly,

considering

- a) that the frequency band 32-33 GHz is allocated on an equal basis to the inter-satellite service (ISS) and to the radionavigation service;
- b) that the band may be used for links between satellites of the fixed-satellite service (FSS);
- c) such information as is available in existing ITU-R texts regarding the technical characteristics of the two services, supplemented by reasonable assumptions where information is lacking;
- d) that inter-satellite links of various path lengths should be taken into account;
- e) the content of Recommendation ITU-R M.496;
- f) that the space research service (deep space) (space-to-Earth) shares the band 32-32.3 GHz on a primary basis and that protection and sharing criteria exist for this service (Recommendation ITU-R SA.578);
- g) that analysis and conclusions concerning sharing in the band 32-32.3 GHz should take into account the allocation to the space research service;
- h) the analysis contained in Annex 1,

recommends

- 1 that to avoid the requirement of power limitations to emissions of the ISS and the radionavigation service, the maximum geocentric separation angle of the two ends of the inter-satellite link should not exceed 90°;
- 2 that, whenever it is not practicable to observe the angular limitation in § 1, sharing between these two services should be accomplished by means of the following criteria:
 - 2.1 for emissions of the ISS, the maximum power flux-density (pfd) at the Earth's surface from geostationary satellites should be limited to the values given by curve B of Fig. 2;
 - 2.2 for continuous wave emissions of the radionavigation service, the e.i.r.p. density of individual transmitters should be limited to:

$$A - 43 - 10 \log D \quad \text{dB(W/MHz), for separation angles of } \leq 140^\circ$$

where A is the aggregate e.i.r.p. spectral density given by Fig. 2 and D is the estimated geographical density of radionavigation transmitters per km² simultaneously active in any 1 MHz band, taking into account future needs and averaged over the territory of the administration concerned or over an area of 10⁶ km², whichever is less (see Annex 1 to Recommendation ITU-R M.496).

NOTE 1 – recommends 2.2 is restricted to continuous wave emissions. Further study is required for pulsed radionavigation systems. Information on pulsed systems is given in Annex 2.

* This Recommendation should be brought to the attention of Radiocommunication Study Group 8.

ANNEX 1

**Sharing criteria between inter-satellite links connecting
geostationary satellites in the fixed-satellite service
and the radionavigation service at 33 GHz**

1 Introduction

In the near term there may be a need for a limited form of inter-satellite link having a relatively short inter-satellite spacing and operating between about 15 and 33 GHz.

At the World Administrative Radio Conference (Geneva, 1979) (WARC-79) a band in this range was allocated to the ISS (32-33 GHz), shared with the radionavigation service.

The feasibility of sharing between inter-satellite links of geostationary satellites in the FSS and the radionavigation service is considered below.

2 Characteristics of inter-satellite links in the frequency range 32-33 GHz

It is assumed that the links would probably be few in number, would be used for relatively short inter-satellite distances to minimize transit-time delay, and, if required soon, would rely as much as possible on existing spacecraft technology. Parameters which might represent typical links are presented in Table 1. The links considered here are assumed to connect satellites at varying orbital separations, to employ tracking antennas of 2 m diameter and to operate at a carrier-to-noise ratio of 25 dB such that the inter-satellite link contributes a relatively small part of the allowable channel noise.

TABLE 1
Assumed characteristics of inter-satellite link (ISL)
and radionavigation service (RN)

	ISL	RN
Receiver system noise temperature T (K)		
$10 \log T$	31	30
Receive, transmit antenna diameter (m)	2	–
Receive, transmit antenna gain (dBi)	54	50
		35 (airborne)
Receive noise power per MHz (dB(W/MHz)) (referred to antenna port)	–138	–139
Carrier-to-noise ratio (dB)	25	–
Required carrier at receiver (dB(W/MHz))	–113	
Maximum permissible interference level, below noise (dB)	–10	–10
Maximum permissible unwanted signal level (dB(W/MHz))	–148	–149
Combined tracking loss (dB)	1	–
Path loss (Earth-to-space geostationary orbit) (dB)	215	–
Half power beamwidth (ISL) (degrees)	0.32	–

From the values derived, it is possible to assess the levels of interference caused to, and received from, the radionavigation services.