

PCC.III-REC. 65 (XIX-01)¹

**GUIDELINES FOR THE HIGH-DENSITY IMPLEMENTATION OF GSO FSS
EARTH STATIONS WITHOUT INDIVIDUAL SITE COORDINATION IN
BANDS SHARED WITH THE FIXED SERVICE**

The XIX Meeting of the Permanent Consultative Committee III: Radiocommunications,

CONSIDERING:

- a) That an increasing number of GSO Fixed-Satellite Service (FSS) networks applications incorporate large numbers of the same type of transmit/receive earth stations (i.e., "typical" earth stations) operating in certain FSS bands in the 11/14 GHz and 20/30 GHz part of the spectrum;
- b) That these GSO FSS networks are subject to coordination under various provisions of the ITU Radio Regulations and under each CITEL Member's jurisdiction;
- c) That PCC. III/REC. 62 (XVIII-01) recommends that in portions of the frequency bands 17.7-20.2 GHz (space-to-Earth) and 27.5-30.0 GHz (Earth-to-space), CITEL administrations consider implementing national provisions and procedures to facilitate the implementation of Ka-Band FSS systems intending to provide broadband services to high density employed terminals;
- d) That in order to ensure the widest availability of FSS services, there is a global need to facilitate the implementation of a high density of GSO FSS terminals which do not have the need for individual site coordination of such stations with the fixed service;
- e) That under a high density deployment, such earth stations will conform to a set of common technical characteristics (i.e., "typical" earth stations);
- f) That the deployment of a high density of earth stations is most suitable in frequency bands not shared with terrestrial services;
- g) That a growing number of CITEL Administrations already identify in their respective allocation plans the 19.7-20.2 GHz and 29.5-30.0 GHz bands, as bands not shared with FS, for ubiquitous deployment of GSO FSS earth stations;
- h) That as the 19.7-20.2 GHz and 29.5-30.0 GHz bands are not shared on a co-primary basis with the FS, no issues arise with respect to individual site coordination with fixed service stations;
- i) That a number of FSS systems with other types of earth stations and characteristics than those used by high-density systems have already been brought into use or are planned to be brought into use, including some that use the band 17.8-20.2 GHz (space-to-Earth), and

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- j) That methods exist to ensure that the deployment of a high density of earth stations can make efficient use of the radio spectrum and not cause unacceptable interference.

RECOMMENDS:

1. That CITEL Members, on a national basis or in discussions between administrations, use the guidelines in the Annex when regulating the deployment of large groups of GSO FSS earth stations with similar characteristics without individual site coordination with the fixed service.
2. That in using these guidelines, administrations take into account existing and planned FSS systems with types of earth stations and characteristics other than those used by high-density systems and characteristics.

ANNEX PCC.III-REC. 65 (XIX-01)

Guidelines for the High-Density Implementation of GSO FSS Earth Stations Without Individual Site Coordination with the Fixed Service

1.0 Introduction

The requirement for guidance regarding implementation of groups of GSO FSS earth stations derives from the need to allow operation of hundreds or even thousands of terminals operating in the same service area. The objective of this approach is to ease the implementation of all these terminals if the terminals conform to a certain set of conditions. While these conditions may vary from administration to administration, and region to region, the objective of this Recommendation is to develop a set of conditions that would be considered sufficient in any region. These GSO FSS networks are subject to coordination under various provisions of the Radio Regulations. The conditions that are addressed in this Annex include:

- frequency bands
- earth station technical parameters
- coordination with satellite networks using other types of earth stations
- sharing with other co-primary services.

2.0 Frequency Bands

The concept of group station GSO FSS implementation in FSS spectrum allocations can best be carried out in bands that are not shared with terrestrial services. However, the principles presented here are intended to apply to bands shared with the FS. This group station GSO FSS deployment is currently, or is proposed to be done, in various FSS allocations in the 11/14 GHz and in the 20/30 GHz spectrum range.

Some of the FSS allocations to which these type of guidelines may apply are in Tables 1.1 (space-to-Earth) and 1.2 (Earth-to-space).

Table 1.1

ITU Primary Service Frequency Allocations, 17.7–20.2 GHz (s-E)

Region 1	Region 2	Region 3
17.7–18.1 FIXED FIXED-SATELLITE (space-earth) S5.484A (Earth-space) S5.516 MOBILE	17.7–17.8 FIXED FIXED-SATELLITE S5.516 BROADCASTING SATELLITE S5.518, S5.515, S5.517 17.8–18.1 FIXED FIXED-SATELLITE S5.516 MOBILE S5.484A	17.7–18.1 FIXED FIXED-SATELLITE (space-Earth) S5.484A (Earth –space) S5.516 MOBILE
18.1–18.6 FIXED FIXED-SATELLITE (space-Earth) S5.484A (Earth-space) S5.520 MOBILE S5.519, S5.521		
18.6–18.8 FIXED FIXED-SATELLITE (space-Earth) S5.522B EARTH EXPLORATION SATELLITE(passive) MOBILE S5.522A S5.522C	18.6–18.8 EARTH EXPLORATION SATELLITE(passive) FIXED FIXED-SATELLITE (Space-Earth) S5.522B MOBILE SPACE RESEARCH (passive) S5.522A	18.6–18.8 FIXED FIXED-SATELLITE (space-Earth) S5.522B EARTH EXPLORATION SATELLITE(passive) MOBILE S5.522A S5.522
18.8–19.7 FIXED FIXED-SATELLITE S5.523A MOBILE S5.523B, S5.523C, S5.523D, S5.523E		
19.7–20.1 FIXED-SATELLITE S5.484A S5.524	19.7–20.1 FIXED SATELLITE S5.484A MOBILE-SATELLITE , S5.524, S5.525, S5.526, S5.527, S5.528, S5.529	FIXED-SATELLITE (space-Earth) S5.484A S5.524

20.1-20.2	FIXED SATELLITE (space-Earth) S 5.484A MOBILE SATELLITE S5.524, S5.525, S5.526, S5.527, S5.528
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Table 1.2

ITU Primary Service Frequency Allocations, 27.5–30.0 GHz (E-s)

Region 1	Region 2	Region 3
27.5–29.5 FIXED FIXED-SATELLITE (Earth-Space) S5.484A S5.539 MOBILE S5.538, S5.540, S5.523A, S5.539		
29.5–29.9 FIXED SATELLITE (Earth-space) S 5.484A S5.539	29.5–29.9 FIXED-SATELLITE (Earth-space) S 5.484A S5.539 MOBILE-SATELLITE	29.5–29.9 FIXED-SATELLITE (Earth-space) S5.484A, S5.539
29.9–30.0 FIXED-SATELLITE (Earth-space) S5.484A, S5.539 MOBILE-SATELLITE S5.525, S5.526, S5.527, S5.538, S5.540, S5.542		

An examination of these allocations indicates that some are shared with other radio services, in particular the Fixed Service, and some allocations are not. The conditions which apply in each of these categories differ.

When implementing group GSO FSS terminals, the complexities of operating such systems on the same frequencies in the same geographical areas as terrestrial services need to be taken into account.

2.1 Bands not Shared with FS

In the case where GSO FSS group-implemented terminals operate in bands not shared with the Fixed Service but are shared with other FSS systems, FSS terminals with other types of technical characteristics or that have been individually site coordinated must continue to be accommodated. As these bands are not shared on a co-primary basis with the FS, no issues arise with respect to individual site coordination with fixed service stations.

2.2 Bands Shared with FS

It is expected that a major deployment of groups of GSO FSS earth stations will take place in the 20/30 GHz FSS allocations. There are a variety of geostationary satellite systems in the FSS that are expected to begin operation in these FSS allocations in the near future.

To operate this type of group implemented GSO FSS stations in bands allocated on a co-primary basis with the fixed service requires some special techniques and methods that ensure that unacceptable interference is avoided.

In areas where there is already heavy deployment of FS links, it may become very difficult to site FSS earth stations. In any case, some special methods that are further described in Section 4 of this Annex address the situation where the band is shared with FS.

3.0 Earth Station Technical Parameters

The technical characteristics of high density FSS earth stations operating with geostationary satellite networks in the 20/30 GHz FSS bands are found in Draft New Recommendation ITU-R S.Doc. 4/70 – “Technical Characteristics of High Density FSS Earth Stations Transmitting towards Geostationary FSS Space Stations in the 30 GHz Band”.

Some similar characteristics for 14 GHz terminals can be found in Recommendation ITU-R S.580-5 which reads as follows :

"with regard to antennas having a D/λ exceeding 150:

- that new antennas of an earth station operating with a geostationary satellite should have a design objective such that the gain (G) of at least 90% of the side-lobe peaks does not exceed:

$$G = 29 - 25 \log (\text{theta}) \quad \text{dBi}$$

(G being the gain relative to an isotropic antenna and theta being the off-axis angle in the direction of the geostationary-satellite orbit referred to the main-lobe axis).

This requirement should be met for any off-axis direction which is within 3° of the GSO and for which $1^\circ \leq \text{theta} \leq 20^\circ$;

with regard to antennas having a D/λ between 50 and 150:

- that antennas should have a design objective such that the gain (G) of at least 90% of the side-lobe peaks does not exceed:

$$G = 32 - 25 \log (\text{theta}) \quad \text{dBi}$$

- that antennas installed after 1995 (this date takes into account the needs of developing countries and every effort should be made to achieve the design objective at an earlier date) should have a design objective such that the gain (G) of at least 90% of the side-lobe peaks does not exceed:

$$G = 29 - 25 \log (\text{theta}) \quad \text{dBi}$$

These requirements should be met for theta between 1° or $(100 \lambda/D)$ whichever is the greater and 20° for any off-axis direction which is within 3° of the GSO and for an off-axis angle, theta, greater than the limits specified above, Recommendation ITU-R S.465 should be used."

The type of parameters referenced in this Section are of the type which when agreed for use in a particular service area, would permit the large-scale deployment of these terminals for use throughout that service area.

The principal goal for this approach is to avoid the need for individual terminal coordination while ensuring the protection of individual GSO FSS terminals.

These terminals operate in the FSS, for example at 20/30 GHz, which have primary or co-primary allocation status in the frequency bands in which this approach is being developed.

The technical parameters associated with such an approach are particularly useful when the terminals are working through closely spaced FSS satellites, (i.e., 2° separation).

4.0 Coordination With Other Networks and With Co-Primary Services

GSO FSS 20/30 GHz band satellite systems use pairs of frequency bands within FSS allocations for their terminals. Coordination between GSO FSS networks within an orbital arc of ± 8 degrees is addressed by No. S9.7 in all of the bands shown in Tables 1.1 and 1.2. In the band 18.8-19.7 GHz, coordination is required between GSO FSS and non-GSO FSS systems. In other frequency bands, compatibility is ensured between GSO FSS and non-GSO FSS systems through equivalent power flux density limits on NGSO FSS systems in Article S22.

4.1 Bands not Shared with FS

Assignments are within the following bands:

29.5-30.0 GHz Earth-to-space and
19.7-20.2 GHz space-to-Earth; and

In this pair, the 29.5-30.0 GHz/19.7-20.0 GHz the bands are not shared terrestrially, and are therefore inherently suitable for group authorization of terminals deployed without individual site coordination.

4.2 Bands Shared with FS

Assignments of GSO FSS use vary on a Regional basis within the following bands:

27.5 – 28.6 GHz Earth-to-space and
17.7 – 18.8 GHz space-to-Earth; and

In most cases, as the Earth-to-space band is not shared, there is no threat of FSS terminal interference into other co-primary FS users.

In the space-to-Earth band, when shared with terrestrial services, there is a requirement to protect Earth Stations from unacceptable interference caused by co-primary FS users of the band. This protection may be achieved by means of a user terminal registration process.

One approach to achieve this is as follows:

1. User obtains satellite terminal from a vendor outlet (e.g. mass market or service provider).
2. The vendor provides an order to a professional installer to install the terminal at the user location.
3. The installer reviews national database of authorized FS links:
 - a) If an FS link exists that would cause unacceptable interference to a satellite terminal, the terminal cannot be used at that location without an interference protection solution. In this case the user's terminal may be set to operate in the FS-free band.
 - b) If no unacceptable interference is anticipated (by nearby FS links), the terminal is installed at the user premises and the location of this terminal is added to the database.
 - c) The installer may register the terminal for terrestrial station interference protection. "Coordination" is not required because the terminal does not transmit in a shared band.
 - d) The success of this approach will be dependent on the maintenance and availability of FS and FSS terminal databases.
4. The FS entity desiring to install a new FS link would search the frequency use database in the band shared with the FSS and would deploy around registered satellite user terminals. The FS user is not required to protect non-registered satellite terminals in shared spectrum.
5. A similar method can be used with respect to individual earth stations which have been individually coordinated.