GSOA

Agenda Item 1.2

WRC-27 Agenda Item 1.2

Smaller FSS earth stations in the 13.75-14 GHz band

Overview

The Agenda Item invites consideration of possible revisions of sharing conditions in the frequency band 13.75-14 GHz to allow the use of uplink fixed-satellite service earth stations with smaller antenna sizes, in accordance with Resolution **129 (WRC-23)**. The aim of this Agenda Item is to enable efficient use of the band by uplink FSS earth stations, including FSS earth stations using small antenna sizes.

Background

In Ku-band, there is only 500 MHz of spectrum available for return links in 14-14.5 GHz for use by small satellite terminals. This is not sufficient to support rapidly growing demand for ubiquitous satellite services deploying small FSS antennas, such as very small aperture terminals (VSATs), which has placed tremendous strain on the available uplink spectrum for satellite services in Ku-band. There has been a rapid increase in number of operational satellite networks and use of orbit and spectrum resources over the last decades corresponding to increased development of a variety of applications and satellite user equipment. Meanwhile customers are requiring higher data transmission rates, smaller user terminals, and increasingly flexible products. From the operational point of view, the frequency band 13.75-14 GHz, being adjacent to the 14-14.5 GHz band currently used for return links, would be straightforward, cost efficient to implement in new amplifier models.

The ITU Radio Regulation Nos. 5.502 and 5.503 (introduced 1992, last reviewed 2003) impose limitations on the minimum size of the satellite earth station antennas operating in the 13.75-14 GHz band (1.2 m for GSO and 4.5 m for non-GSO) and on the maximum power flux density that a terminal can transmit towards the sea. The purpose of these limitations is to protect the radiolocation and space research services. In addition to the fact that satellite technology has changed tremendously since these conditions were developed 20 years ago, there may also be changes in the other services sharing this band, their applications and co-existence conditions.

Key Points

- Innovation both in GSO high throughput satellites (HTS), software defined satellites (SDS) and non-GSO satellites along with innovation in earth station terminals capable of providing large throughputs and broadband connections, have caused pressing need for additional Ku-band uplink spectrum to meet the increasing demand for connectivity, particularly for the use of small user terminals, such as ubiquitously deployed VSATs.
- There is a significant mismatch between available non-planned uplink and downlink spectrum in the 10-15 GHz range for small satellite user terminals, e.g., VSATs, satellite news gathering, in all three ITU-R Regions.
- Across multiple WRC-27 Agenda Items, where appropriate, GSOA is also considering how spectrum and associated orbits can be effectively shared among the wide range of NGSO systems.

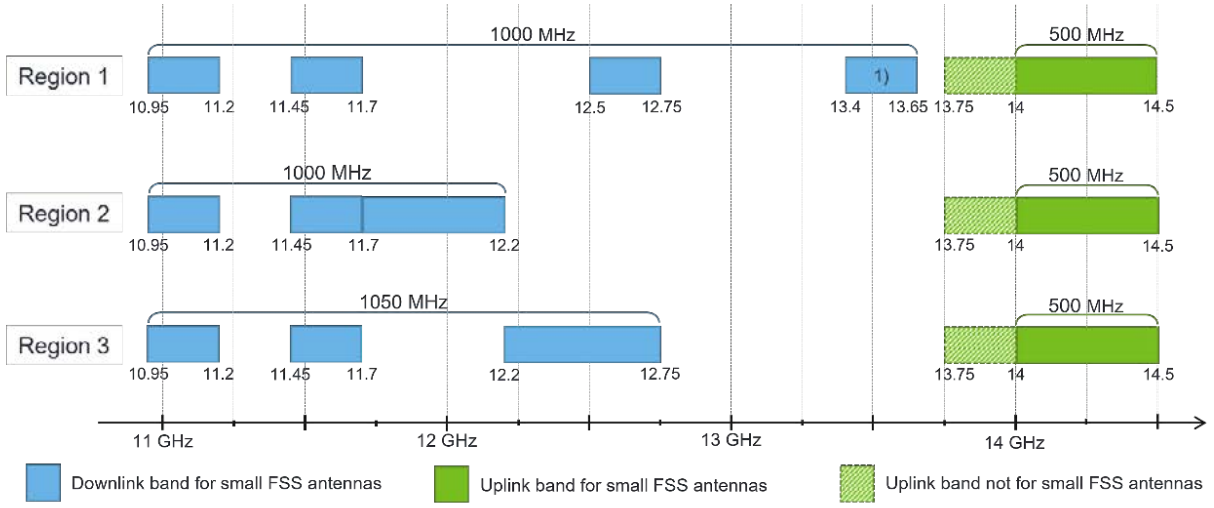

Figure 1: The amount of non-planned uplink and downlink spectrum in the 10-15 GHz range for small FSS antennas.

Status of Work

The last WP4A meeting on 21-31 October 2024 continued its work on studies under AI 1.2 and updated the Working Document (Annex 3 to WP4A/343 chair's report). As highlighted above the studies were carried out on the impact of small FSS ES antennas into two services: RLS and SRS. The following is a summary of the studies in the working document.

- **Studies on SRS presented in Annex 4 of the WD**
  - Study 1 (USA 4A/226): unfinished study with no results at this stage
  - Study 2 (Ghana 4A/223): aggregate study of NGSO deployment of small FSS ES antennas over Ghana into SRS. Protection criterion met with large margins
  - Study 3 (PNG/Indonesia/Thailand/India 4A/289): aggregate study of GSO deployment of small FSS ES antennas over the globe into SRS. Protection criterion met with large margins
- **These studies already seem to indicate good coexistence between small FSS ES antennas and SRS. Next WP4A meeting in May 2025 should see a refinement of the studies and conclusion.**
- **Studies on RLS presented in Annex 1 of the Working document**
  - Study 1 (China 4A/38 and 4A/194): single entry study comparing the interference probability into RLS of larger with smaller FSS ES antenna diameters. The study indicates that the density of ES is not a simply linked to the antenna diameter but the availability in capacity and the operation of the satellite system. The study shows that a 0.6m antenna (currently not allowed to operate as per No. 5.502) would not cause more interference into a shipborne radar compared to a 1.2m FSS ES antenna (currently allowed to operate under No. 5.502).

GSOA

Agenda Item 1.2

- Study 2 (Ghana 4A/222): single entry analysis of a NGSO LEO FSS ES antenna with diameter smaller than 1.2m into an RLS shipborne radar off the coast of Ghana. A statistical analysis is performed for three different scenarios with 10-30km separation considered depending on the scenario. The results show that the protection criteria of the RLS is met.
- Study 3 (USA 4A/226): unfinished study with no results at this stage.
- Study 4 (PNG/Indonesia/Thailand/India 4A/289): single entry analysis of a GSO and MEO FSS ES antenna with diameter smaller than 1.2m into an RLS shipborne and airborne radar.
  - For the shipborne case, the FSS ES small antenna (MEO and GSO) was assumed deployed on the coastline and the shipborne radar at a minimum distance based on the international water demarcation (12 nautical miles). The results show that the protection criteria of the RLS is met.
  - For the airborne radar case, the FSS ES small antenna (MEO and GSO) was assumed deployed in Belgium close to the border with France and the RLS airborne radar flying along the border. The results show that the protection criteria of the RLS is met.

- **The studies performed are for now only considering single entry (i.e. one interferer). The preliminary results show that the RLS protection criteria is met for all cases considered. Next WP4A meeting in May 2025 should focus on aggregate impact of small FSS ES antennas into RLS to further refine the studies and conclusion. Annexes 2 and 3 of the Working Document were created as placeholders for these aggregate studies.**

In addition to the studies, the meeting discussed the missing RLS radar parameters, namely missing airborne radar characteristics in Rec. ITU-R M.1644 and the lack of associated percentage of time linked to the RLS protection criteria I/N =-6dB. A liaison statement was sent to WP5B (5B/208) seeking such information.

WP5B in 11-28 November 2024, received multiple contributions (5B/199 from Mexico and South Africa, 5B/204&205 from France) on the questions raised by WP4A. While there was a lot of discussion on the time percentage associated to the I/N = -6dB protection criteria for RLS, agreement was not reached at WP5B. A working document for the update of Rec. ITU-R M.144 was created but none of the proposed changes were discussed nor agreed.

- **It is expected that further discussions will be had at the upcoming WP5B on 29 April to 8 May. Without further information sent by WP5B, WP4A will have to work with available information in M.1644 as well as assumptions from the WRC03 cycle which also considered this topic. GSOA notes that the current footnote No. 5.502 which came as an outcome of WRC03 proposes a time percentage of 1% associated with the pfd limits to protect the RLS. GSOA believes that this percentage can therefore be used.**

GSOA Position

- The use of smaller antennas in 13.75-14 GHz band would enable more efficient use of the radio frequency spectrum, alleviate congestion in the existing uplink Ku-band and balance the amount of available uplink and downlink spectrum resources for FSS in the Ku band
- Participate and contribute support refined aggregate studies at WP4A level to show means of coexistence with RLS and SRS.
- Participate and contribute to WP5B to seek clarification on missing parameters for RLS.
- Based on preliminary results of studies and regional usage, GSOA supports the update of the sharing conditions 13.75-14 GHz as set out in 5.502 and 5.503 to enable operation of small antennas.

GSOA

Agenda Item 1.2