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| **Radiocommunication Study Groups** |  |
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| Annex 11 to Working Party 4A Chairman’s Report |
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| Addressing the inefficiency associated with the asymmetry of existing unplanned FSS uplink/downlink spectrum in the 10-15 GHz band |

*Editor’s Note: It has been suggested that the term asymmetrical needs to be reviewed to address the shortfall of uplink spectrum in the 10-15 GHz frequency band.*

# 1 Introduction

The existing unplanned FSS bands in the 10-15 GHz range are extensively used for a myriad of applications. The very small aperture terminal (VSAT) services, video distribution, broadband networks, internet services, satellite news gathering, and backhaul links have triggered the rapid rise in the demand curve for this frequency range. Satellite traffic is typically symmetrical in a large variety of applications, i.e. similar amounts of Earth-to-space (uplink) and space-to-Earth (downlink) traffic are transmitted. Hence, in order to accommodate these services in the most efficient manner, there is a need for equal amounts of uplink and downlink spectrum in the frequency range of 10-15 GHz.

Working Party 4A has received contributions highlighting issues associated with asymmetrical uplink/downlink spectrum in the 10-15 GHz band in ITU Regions 2 and 3. This Report is expected to address difficulties related to the asymmetry in the total amount of allocated uplink and downlink spectrum for the unplanned FSS in the 10-15 GHz range. Within some ITU Regions, there is more downlink unplanned FSS spectrum available as compared to the uplink unplanned FSS spectrum. Background as to why this leads to difficulties in the use of the spectrum is given in this Report, and a work plan for studies is laid out to properly address the uplink/downlink spectrum asymmetry.

# 2 Issues related to asymmetry of unplanned FSS uplink/downlink spectrum in the10-15 GHz range

The shortage in the uplink spectrum in some ITU Regions can be illustrated with the following example: overall the 200 MHz spectrum asymmetry in Region 2 and 300 MHz in Region 3 translates to approximately 10 and 14 transponders for each respective Region, considering a transponder bandwidth of 36 MHz in both polarisations. The industry norm is for satellites to employ frequency re-use by means of beam and/or polarisation isolation, to optimally use the available spectrum.

Many satellites currently deployed have used up the available bands in their respective regions, both in the uplink and the downlink. However, due to the variety of services that satellites in the FSS offer, some administrations have expressed an urgent need for a symmetrical allocation of bandwidth in both directions in the 10-15 GHz frequency range. To date, satellite operators and manufacturers have dealt with this bandwidth limitation in the uplink by designing ever more complicated payload configurations. This consequentially adds to the weight and complexity of the satellites being built, and hence leads to overall higher costs for these satellite projects.

Another way to cope with the insufficiency of uplink spectrum in the 10-15 GHz band is to use allocated unplanned FSS bands outside of the 10-15 GHz band. There are examples of satellites that use unplanned FSS uplink bands in the 6 GHz band and in the 27-30 GHz band that are paired with the 10-15 GHz downlink bands. However, this leads to inefficient use of the orbital/spectrum resource for the following reasons:

1) By resorting to uplink bands outside the 10-15 GHz range, such as the 6 GHz or 27‑30 GHz bands, less spectrum becomes available for satellites operating in the 6/4 GHz or 30/20 GHz bands. Therefore, the problem of insufficient uplink spectrum in the 10‑15 GHz band propagates into other unplanned FSS bands that are also heavily used.

2) To enable the use of alternative and widely separated uplink bands as indicated above, this requires the utilisation of dual band antennas with transmission/reception capabilities both onboard the satellites and at the earth stations. Such antennas, which require more complex engineering and manufacturing designs, are also more expensive to end users.

3) Dual band antennas are usually less optimized in terms of gain and sidelobe performances compared to single band transmission/reception antennas. This also requires the use of dual band transmit amplifiers, which increases the cost of earth stations.

Faced with the current congestion and uplink spectrum insufficiency, it is difficult for satellite operators to effectively expand their communication services to meet the growing market demands. Consequently, the digital divide is further widened as essential communication services are not attainable in rural areas and developing countries.

# 3 Overview of unplanned FSS allocations

As mentioned in previous section, many satellites currently deployed have used up the available bands in their respective regions, both on the uplink and the downlink. It is noted that this spectrum asymmetry needs to be resolved to ensure that the uplink and downlink satellite traffic requirements can be fulfilled and managed efficiently.

For example, as indicated in Table 1 below, there is a difference of 200 MHz when comparing the amounts of spectrum allocated to the uplink and downlink unplanned FSS allocations in Region 2.

Table 1

The unplanned FSS bands in the 10-15 GHz range in ITU Region 2

|  |  |
| --- | --- |
| Frequency bands (GHz) | Bandwidth (MHz) |
| **Earth-to-space direction (uplink)** |
| 12.7-12.75 | 50 |
| 13.75-14.5 | 750 |
| **Total spectrum in the uplink** | **800** |
| **space-to-Earth direction (downlink)** |
| 10.95-11.2 | 250 |
| 11.45-11.7 | 250 |
| 11.7-12.2 | 500 |
| **Total spectrum in the downlink** | **1 000** |
| **Uplink and downlink spectrum difference** | **200** |

For Region 3, as indicated in Table 2 below, there is a difference of 300 MHz when comparing the amounts of spectrum allocated to the uplink and downlink unplanned FSS allocations.

Table 2

The unplanned FSS bands in the 10-15 GHz range in ITU Region 3

|  |  |
| --- | --- |
| Frequency bands (GHz) | Bandwidth (MHz) |
| **Earth-to-space direction (uplink)** |
| 13.75-14.5 | 750 |
| **Total spectrum in the uplink** | **750** |
| **space-to-Earth direction (downlink)** |
| 10.95-11.2 | 250 |
| 11.45-11.7 | 250 |
| 12.2-12.75 | 550 |
| **Total spectrum in the downlink** | **1 050** |
| **Uplink and downlink spectrum difference**  | **300** |

# 4 Work plan to address the asymmetry of unplanned FSS uplink/downlink spectrum in the 10-15 GHz range

To facilitate efficient spectrum utilisation and accessibility to satellite services, it is necessary to resolve the shortage in the uplink spectrum in the 10-15 GHz range. Therefore, this Report proposes a work plan that leads to sharing studies in order to identify suitable frequency bands which could address this issue, while ensuring compatibility with the existing services in identified bands and allocations.

## 4.1 Possible bands for consideration

Additional unplanned FSS spectrum in the Earth-to-space direction that is contiguous (or near contiguous) to the existing allocations is necessary to address this uplink spectrum insufficiency for the following reasons:

– it would help to ensure compatibility with the existing ground infrastructure;

– the necessity to invest in new user equipment would be minimised;

– the design of the satellite could be simplified and this reduces the cost of the satellite project.

These above measures effectively translate to a reduction in costs to the end users.

In view of the reasons above, and based on an initial review of the Table of Frequency Allocations in Article 5 of the Radio Regulations, it is suggested that a review could be conducted in the frequency bands listed in Table 4. However, a review of possible bands other than those listed in Table 4 is also welcomed.

Possible bands to be reviewed for study:

a) Potential bands with no FSS allocation

The possibility on the use of the bands of 13.25-13.4 GHz, 13.4-13.75 GHz, 14.8-15.35 GHz, 15.4-15.43 GHz, 15.63-15.7 GHz and 15.7-16.6 GHz could be examined.

b) Potential bands with FSS allocation beyond those mentioned above

The possibility of removing the current regulatory restrictions in the band of 15.43-15.63 GHz, to facilitate its use for unplanned FSS could be examined.

Table 4

Summary of possible bands for additional FSS uplink bands

|  |  |  |
| --- | --- | --- |
| Frequency bands (GHz) | Bandwidth (MHz) | Allocation to FSS  |
| 13.25-13.4 | 150 | No |
| 13.4-13.75 | 350 | No |
| 14.8-15.35 | 550 | No |
| 15.4-15.43 | 30 | No\* |
| 15.43-15.63 | 200 | Yes, but limited to feeder links of non‑geostationary systems in the mobile‑satellite service (RR No. 5.511A) |
| 15.63-15.7 | 70 | No\* |
| 15.7-16.6 | 900 | No |

 \* Allocated to FSS for which complete information for advance publication has been received by
the BR by 21 November 1997.

## 4.2 Steps for the work plan

It is noted that the review of the possible bands has to be done with careful consideration. It is also noted that the existing asymmetries in the unplanned FSS uplink/downlink spectrum for the range of 10-15 GHz, are results of clear decisions of past Conferences based on extensive discussions.

Many of the bands mentioned in Table 4 above are already used by other services and might be the subject of studies currently being carried out with respect to a number of agenda items for WRC-12. For these reasons the following steps should be taken:

1) Detailed study of the current allocations. Each band mentioned should be studied for its current allocation and use, to make sure that its use by other services is well understood.

2) A review of studies performed in previous study cycles on the mentioned bands has to be performed. This is important as it might contain relevant materials for study that would avoid duplication of study efforts.

3) Study of bands for review with respect to the current agenda items for WRC-12. It is understood that a number of the bands mentioned are included in the current study cycle for certain agenda items in WRC-12. This should be carefully examined in order to understand all the issues involved.

4) Upon complete inventory and study of the above points, send out liaison statements to concerned Working Parties in order to understand the usage and requirements of existing allocations in the bands being reviewed.

5) Based on comments received perform further studies in order to find suitable frequency bands which could address the issue of asymmetry in the unplanned FSS uplink/downlink spectrum for the range of 10-15 GHz, while ensuring compatibility with existing services and allocations.