Radiocommunication Study Groups

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SPECTRUM ASPECTS & WRC-23 PREPARATIONS

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COMPARISON OF SHARING/ COMPATIBILITY STUDIES OF IMT SYSTEMS WITH FSS SATELLITES IN THE FREQUENCY BANDS 6 425-7 025 MHz and 7 025-7 125 MHz

WRC-23 agenda item 1.2

1 1 Introduction

The IAFI had submitted the input Document 5D/1013 to the last meeting of the WP 5D. Some other administrations and sector members also provided their studies. These were compiled during the meeting but significant differences existed in the results of our study and other studies. We have analysed the reasons for these differences and summarised them in the present document.

Working Party 5D Document 5D/734 contains the interference criteria provided by WP 4A to assess interference from IMT to FSS space stations. During our analysis of different studies, we observed significant variation in the following areas, resulting in a cumulative difference of more than 20 dB in conclusions of different studies regarding interference levels (it is a well-known fact that differences in various assumptions can lead to significantly different results):

a) Satellite beam coverage versus visible earth area and elevation angles from 0 to 90 degrees;

b) Rural area coverage and IMT deployment;

c) Values of Ra1 and Rb1;

d) Clutter & propagation models;

e) Inclusion of impact due to fixed services;

f) Further adjustment for satellite antenna efficiency.

We have also provided our views on appropriate methods for sharing and compatibility studies in the 6 GHz band to be considered while evolving the CPM Text.

2 Analysis of the Methodology and parameter assumptions

2.1 Visibility of the surface area of earth from Satellite

We need to consider the total visible area on the surface of the earth from the satellite, like the global beam, and include all Base Stations (BSs) within this area visible from the satellite, having elevation angles from 0-degree to 90-degree from the earth surface to the satellite antenna/ receiver.

Some studies have considered BSs with elevation angles for satellite above 5 degrees. Some other studies have considered a much smaller area of earth's surface and only those BSs having elevation angles above 30 degrees (excluding all BSs below 30-degree). This can result in a variation of more than 6 dB.

2.2 Inclusion/ coverage of rural areas

India has a large population in rural areas (more than 900 Million). It is realistic to assume that 5G services would serve a significant part of the rural population. Therefore, this needs to be included suitably in the studies. However, some other studies do NOT consider any IMT deployment in rural areas, leading to a significant difference

Further, some studies have taken the Rb values as 0% for unpopulated areas and maintained a much lower density of BSs for suburban and urban areas. This approach is not consistent with existing agreed WP5D assumptions and leads to underestimation of the level of interference to the satellite receiver.

The above factors can result in a difference of around 3 dB.

2.3 Interference criteria

WP 4A has provided the interference criteria from IMT to FSS space stations in Document 5D/734.

In this frequency band, many fixed systems are also in operation. The impact of such fixed stations should also be considered. In some studies, IMT systems have been assumed as 0.15% of the total land area. Even with 2% land area coverage by IMT in some other studies, the remaining 98% of the land area may have the operation of fixed systems, and impact of the same needs to be considered. This can result in a difference of more than 3 dB.

2.4 Propagations and Clutter Model

Recommendation ITU-R P.2108 provides the clutter loss model for such sharing and compatibility studies. Even though the current version of this Recommendation does not include the 6 GHz band, the SG-3 has recommended extrapolation of the frequency. For the time being, the P.2018 model has not been applied, but a simplified approach is implemented for all BSs. For BSs above the height of surrounding rooftops, no clutter loss is used, while BSs below the rooftop are discounted. This is an optimistic assumption and likely to underestimate interference.

Some studies have used the clutter model, which has only been proposed (not currently agreed upon). These can significantly underestimate the interference to the satellite receiver.

This aspect can lead to a difference of about 3 dB.

2.5 Use of the most favourable FSS characteristics:

WP 4A provided eight carrier types for use in the studies (document 5D/734) due to various FSS system designs operating in the upper 6 GHz band. Some studies have focused their analysis only on one "Carrier 1" with a global beam, probably the least sensitive to interference. Satellites using "hemispherical beam" or "spot beam" are more susceptible to interference. This can lead to a difference up to 4.5 dB in interference assessment.

2.6 Satellite Antenna Efficiency

The Satellite antenna efficiency is built into the values recommended by WP 4A. However, some studies have taken into account further factors to adjust Satellite Antenna Efficiency. This can lead to a difference of more than 4 dB in interference assessment.

3 Conclusion

The above analysis reflects the impact to the satellite receiver due to variations in assumptions by the differences in various studies. The cumulative difference can be more than 20 dB.

The results of some studies with assumptions, which are not realistic/ appropriate, try to significantly reduce the level of interference at the satellite receiver and predict co-existence between IMT and FSS in the uplink 6 GHz band.

This has a detrimental impact on FSS systems providing critical safety-related services and those planning to use their national allotment per AP**30B**.

Hence, further studies should be carried out with realistic/ appropriate/ standard parameters and assumptions to determine whether co-existence is possible or not. The results can be presented to the future meeting of WP 5D.