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| **Radiocommunication Study Groups** | Logo  Description automatically generated |
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| Reference WRC-19 Res. 731 |  |
| Received:  | **Document 1A/** |
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| **English only** |
| United States of America |
| PROPOSAL TO INITIATE WORK UNDER WRC RESOLUTION 731 |
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**Introduction**

WRC Resolution 731 addresses issues of sharing and adjacent-band compatibility between passive and active services above 71 GHz.[[1]](#footnote-1)

The Resolution invites the ITU-R:

1 to continue its studies to determine if and under what conditions sharing is possible between active and passive services in the frequency bands above 71 GHz, such as, but not limited to, 100‑102 GHz, 116‑122.25 GHz, 148.5‑151.5 GHz, 174.8‑191.8 GHz, 226‑231.5 GHz and 235‑238 GHz;

**Discussion**

This work will begin to determine if and under what conditions sharing is possible between the fixed service and passive services in the frequency bands above 71 GHz as invited in Resolution 731. The most difficult sharing issues, both from a technical and regulatory perspective, involve protecting EESS (passive) use in bands listed in RR No. **5.340**. While RAS use must also be protected, RAS receiver sites at frequencies above 71 GHz tend to be in high altitude arid sites in order to reduce the impact of terrestrial-based interference and atmospheric absorption at these frequencies. Thus the coordination approach of ITU-R RA.1031-2 may be adequate to protect RAS receivers in bands where sharing may be authorized

EESS (passive) protection is complex because these passive satellites operate globally, have antennas pointing either tangential to the orbit or pointed towards the Earth’s surface taking measurements over the entire Earth’s surface and regularly performing critical meteorological and environmental measurements, usually from low altitude orbits. FIXED service communications is the primary focus for consideration for this work at this time as its fixed geometry and usually non-active antennas may present a less complex sharing scenario when compared to any MOBILE service application. FIXED systems above 71 GHz have the potential for quick deployment (compared to wired/fiber links) for paths with a distance of a few km as well as lower costs in places with difficult terrain for wired installations, requirements for temporary high-bandwidth restoration links and other short term connectivity needs. If resources permit the study may include the use of active FIXED antennas which are specifically designed to simultaneously place a null on known satellite positions will also directing power to a desired receiver. While such antennas would include multiple radiating elements similar to MIMO antennas, the amplitude and phase control algorithms to achieve both a null in the satellite direction and good power transfer to the intended receiver would be different.

While RR No. 5.340 bands individually have bandwidth of a few GHz, the locations of the numerous such bands above 71 GHz limit the ability to create large contiguous bands. At present, there are no studies yet on the spectrum needs for Fixed service applications in the proposed range above 71 GHz, and it is technically possible to achieve wide bandwidth throughput using bands that are not contiguous. Once spectrum requirements and operating characteristics are known, if an acceptable sharing procedure could be found that ensures the EESS (passive) protection criteria, as defined in Rec. ITU-R RS.2017, is satisfied, wider contiguous bands could be available.

Protection of the EESS (passive) sensors in bands allocated to EESS (passive) services has to be a key issue in the design of any fixed service system operating in or nearby to passive allocations. This is especially critical for RR No. 5.340 bands where no emissions are allowed. It is not possible to discuss communications requirements in the abstract sense for such spectrum and then see if sharing is possible. Assembling well defined fixed service system characteristics and passive sensor characteristics and protection criteria are an important first step in beginning this work to determine the feasibility of interference-free sharing. However, since WRC Resolution 731 makes clear that passive service protection is the most important goal of this study, if the nominal fixed service characteristics derived from experiences at lower bands is not conducive to interference free sharing with passive services, it may be necessary to focus on what FIXED parameters are necessary to make such sharing feasible.

Sharing above 71 GHz raises different technical issues than in the lower bands. Atmospheric absorption, and thus overall propagation loss, can vary greatly with respect to frequency and elevation angle, and the passive sensing bands in many cases are in spectrum ranges with lower propagation losses due to absorption. A preliminary approach to address the sharing issue may be to develop EIRP limits for emissions at various elevation angles for FIXED service transmitters operating in non-RR 5.340 passive bands and near selected RR 5.340 bands. It should also be noted that, due to the spacecraft altitude, passive sensors operating in these bands have a large field-of-view and are highly sensitive to the aggregation effects from multiple interferers. Therefore, it is critically important that any use of EIRP limits would have to take these aggregate interference effects into account or should include possible numerical limits on FIXED transmitter geographic density for consideration as part of a sharing mechanism subject to strict regulation.

As noted above, FIXED service systems generally have low elevation angles, so main beam illumination of EESS receivers by the direct signal path can be reduced to a smaller percentage of time. However there is a possibility that fixed service system antenna main-beam paths could interfere with passive sensors when the passive satellite is orbiting and rising from Earth horizon. Other factors, such as sidelobe illumination and multipath propagation/reflections are possible interference sources. Consequently, advice from WP 3J and WP 3M is needed on these issues. Also, while all finite size non-active antennas must have sidelobes for practical reasons, it may be possible to decrease sidelobes at high elevation angles below the typical values generally encountered in today’s FIXED service applications, which were designed in a terrestrial-to-terrestrial sharing environment where such sidelobes were not of concern. Information could be sought from antenna researchers on the feasibility of such antenna designs.

**Proposal**

The United States proposes developing methods for computing the unwanted illumination of EESS (passive) systems by direct-path and/or multipath propagation effects from terrestrial Fixed Service systems with a range of elevation angle paths, based on propagation information and system characteristics that are available or being developed. If studies show that interference-free sharing will be achieved, then this method could then be used to develop EIRP limits based on Fixed system elevation angle as a possible method to ensure that the aggregate interference from all fixed service usage meets the EESS (passive) protection criteria defined in Rec. ITU-R RS.2017. In case there is difficulty meeting the protection requirements using FIXED systems characteristics received from SG5, the study may consider what system characteristics are compatible with band sharing and whether geographic density limits for transmitters might be considered as a regulatory tool to enable interference-free sharing between active and passive services in some of the bands under consideration in Resolution 731.As Working Party 7C is the expert group on EESS (passive) protection, WP 1A endeavors to seek its advice on this proposal and its cooperation in beginning relevant work.

At this time, the US proposes to evaluate the suitability of this approach considering only systems operating under the Fixed Service. Additionally, at this time, the US proposes that this work only consider the feasibility of sharing with EESS (passive) systems in the 116-122.25 GHz band, the 148.5-151.5 GHz band and the 226-231.5 GHz bands. The evaluation should include consideration of adjacent band compatibility with RR No. 5.340 bands.

In order to initiate this work, the US proposes requesting characteristics and propagation information from the relevant working parties. Draft liaison statements are provided for the consideration of WP 1A.

Attachments: Draft liaison statements

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| Working Party 1A |
| DRAFT LIAISON STATEMENT TO Working Parties 3j AND 3M (copy for information TO WORKING PARTIES 7C and 7D) |
| Propagation Information related to proposed studies under WRC Resolution 731  |

In accordance with invites the ITU-R 1 of WRC Resolution. 731 Working Party (WP) 1A is considering if and under what conditions sharing is possible between active and passive services in passive bands between 86 and 252 GHz. As such, WP 1A requests WPs 3J and 3M to provide guidance on which ITU-R Recommendations should be used to appropriately model the propagation effects (e.g., free-space attenuation, atmospheric absorption, hydrometeor scatter, multipath, etc.) that exist for this frequency range between terrestrial-based fixed service interferers and satellite-based passive sensors. The characteristics of the satellite-based systems are contained in Recommendation RS.1861. In the proposed studies only Fixed terrestrial systems with main beam elevation angles less than 5o and beamwidths in the 1o - 5o  range in the 116-122.25 GHz, 148.5-151.5 GHz and 226-231.5 GHz bands will be considered. Working Parties 3J and 3M are kindly invited to respond in a timely manner before the deadline of 15 May, 2021, at the latest, and in advance if possible.

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| DRAFT LIAISON STATEMENT TO Working Party 5C (COPY FOR INFORMATION TO WORKING PARTY 5A) |
| Information related to proposed studies under WRC Resolution 731  |

In accordance with invites the ITU-R 1 of WRC Resolution 731, Working Party (WP) 1A is considering if and under what technical conditions sharing is possible between active and passive services in the frequency bands above 71 GHz.

For timely conducting studies on Res. 731 to protect EESS (passive) sensors above 71 GHz, WP 1A requests the viewpoint of WP 5C on WP 1A’s planned approach to addressing this complex sharing issue. In studies for Report ITU-R F.2239 and for WRC-19 AI 1.15 the basic approach taken was to start with assumptions for Fixed transmitter uses in a band range and to predict the impact on EESS (passive) systems compared to the protection level given in Recommendation ITU-R RS.2017. However, the framework of Res. 731 is different from AI 1.15 and requests ITU-R “to continue its studies to determine if and under what conditions sharing is possible between active and passive services.” To this end we are considering a different approach for a new proposed technical evaluation of mitigation methods and seek your inputs.

The approach being considered by WP 1A is to focus on the technical feasibility of sharing between the fixed service and EESS (passive) in the 116-122.25 GHz, 148.5-151.5 GHz and the 226-231.5 GHz frequency bands. The approach is based on two elements:

1. Are fixed service system characteristics, including antenna and deployment information, available in the relevant frequency range, and can they be designed in such a way as to minimize radiation in the direction toward space?

While there are some passive bands above 71 GHz that are already shared with other services, certain bands are protected by RR 5.340 from any emissions and any shared use is presently prohibited. With that in mind, more information is needed on antenna characteristics, particularly sidelobe behaviour, in order to determine if it is possible to permit sharing without any interference to EESS (passive) sensors.

2. What are the system characteristics and deployment models for fixed service applications in these frequency ranges?

 FIXED systems generally have low elevation angles and atmospheric absorption is a key propagation issue above 71 GHz. As a result, for low elevation angle fixed links, the interference path (ground-to-satellite) can have significant losses. However this path loss decreases as the path elevation angle increases and zenith propagation is comparable to much lower bands.

WP 1A is considering developing a method of calculating an EIRP mask as a function of elevation angle to limit the impact the impact between the Fixed service and EESS (passive) services in the previously mentioned bands, taking into account the effects of aggregate interference and as invited in WRC Resolution 731.

WRC Resolution clearly states that the primary goal of any study must be to prevent interference to EESS (passive) systems. Therefore if it is impossible to develop parameters for a noninterfering potential FIXED system that is consistent with the system characteristics and deployment models and antenna and deployment information requested here, the study may deviate from the information you provide to see what combination of system parameters is consistent with interference-free service. This may include consideration of geographic density limits for FIXED transmitters in these band to prevent potential aggregate interference from many emitters in the field of view of an EESS (passive) satellite antenna.

WP 5C is invited to provide information on these topics and to provide available characteristics for fixed systems (including antenna and deployment characteristics) operating in the ranges around the 116-122.25 GHz, 148.5-151.5 GHz and the 226-231.5 GHz passive bands.

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| DRAFT LIAISON STATEMENT TO Working PartY7C(COPY FOR INFORMATION TO WP 7D) |
| Information related to proposed studies under WRC-19 Resolution 731  |

In accordance with invites the ITU-R 1 of WRC Resolution 731, Working Party (WP) 1A is considering if and under what technical conditions sharing is possible between active and passive services in the frequency bands above 71 GHz.

The proposed studies are focusing only on EESS (passive) protection and not RAS protection since RAS facilities at these frequencies are typically located in high altitude arid sites such as in Northern Chile in order to avoid degradation by the atmosphere. These facilities are best protected by restrictive zones surrounding them which will have little impact on communications networks due to the nature of the siting of these RAS receivers. Thus the coordination approach of Recommendation ITU-R RA.1031-2 used at lower bands may be adequate here. Thus, while protection issues with Radio Astronomy need to be considered, it is not a focus of the proposed work at this time but will have to be addressed before any sharing is allowed.

For timely conducting studies on Res. 731 to protect EESS (passive) sensors above 71 GHz, WP 1A requests the viewpoint of WP 7C on its planned approach to addressing this complex sharing issue. In studies for Report ITU-R F.2239 and for WRC-19 AI 1.15 the basic approach taken was to start with assumptions for Fixed transmitter characteristics and specific deployments in band ranges around 300 GHz and to study the impact on EESS (passive) systems using the protection level given in Recommendation ITU-R RS.2017. In a parallel liaison statement WP5C is being asked for system characteristics including antenna parameters and deployment models. If interference free sharing with EESS (passive) is possible with these parameters, sharing proposals will be based on them .

However, the framework of Res. 731 is different from AI 1.15 and requests ITU-R “to continue its studies to determine if and under what conditions sharing is possible between active and passive services.” Thus if reasonable sharing is not possible with the FIXED parameters received from WP5C, the study may consider combination of technical and deployment parameters might permit interference-free sharing along with constructive FIXED use of such bands

To this end we are considering a different approach for a new proposed technical evaluation of mitigation methods and seek your inputs.

WP 1A is considering developing a method of calculating an EIRP mask as a function of elevation angle to determine the impact between the fixed service and passive services in the 116-122.25 GHz, 148.5-151.5 GHz and the 226-231.5 GHz EESS (passive) bands. Aggregate interference potential is a key issue so the study will review the maximum geographic density of FIXED transmitters in these bands that is consistent with interference-free sharing taking into account the effects of aggregate interference and as invited in WRC Resolution 731. WP 1A would be pleased to cooperate with WP 7C and WP 7D in this effort.

WP 7C is invited to provide information on these topics for EESS (passive) sensors operating in the ranges around the 116-122.25 GHz, 148.5-151.5 GHz and the 226-231.5 GHz passive bands.

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1. WRC Resolution 731 was first developed at WRC-2000 and includes the invites ITU-R 1 referenced. It was revised at WRC-19 but the invites to 1 was not changed. [↑](#footnote-ref-1)