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| U.S. Radiocommunications SectorFact Sheet |
| **Working Party:** ITU-R WP1A | **Document No:** uswp1a-04\_FD\_Studies under Res.731 |
| **Ref:** Res. 731 (Rev. WRC-23) WRC-23 [Prov.Fin.Acts](https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.15-2023-PDF-E.pdf) p. 412[Chairs of Study Groups 1, 5 and 7](https://www.itu.int/dms_ties/itu-r/md/23/wp1a/c/R23-WP1A-C-0006%21%21MSW-E.docx),STUDIES UNDER RESOLUTION 731 (REV.WRC-23)Consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz. [Document 1A/6-E](https://www.itu.int/dms_ties/itu-r/md/23/wp1a/c/R23-WP1A-C-0006%21%21MSW-E.docx) | **Date:** 27 Mar 2024 |
| Document Title: Proposal on development of the working document towards a preliminary draft report on approaches to spectrum sharing and burden sharing in 71-275 GHz |
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| **Purpose/Objective:**  To develop a group of sharing approaches that can be evaluated for their potential to both provide new productive uses of spectrum as well as complying with the quantitative passive service protection goals of Res. 731 – originally proposed by USA at WRC-2000 as an integral part of the passive band allocations above 100 GHz |
| **Abstract:** In recent years a variety of technical approaches have been raised in the literature for possible implementation of interference-free sharing of passive bands in 71-275 GHz. In order to facilitate the future considerations of WP 5A, WP 5C, WP 7C and WP 7D this document will review these approaches and their characteristics. |

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| Reference  Resolution **731 (Rev.WRC-23)**Chairs of Study Groups 1, 5 and 7,STUDIES UNDER RESOLUTION 731 (REV.WRC-23)Consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz. [Document 1A/6-E](https://www.itu.int/dms_ties/itu-r/md/23/wp1a/c/R23-WP1A-C-0006%21%21MSW-E.docx) |  |
| Received:  | **Document 1A/** |
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| **English only** |
| **United States of America** |
| PROPOSAL TO INITIATE WORK UNDER RESOLUTION **731 (REV. WRC-23)** |
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**Introduction**

Resolution **731 (Rev. WRC-23)**, which is assigned to Working Party 1A among others, addresses issues of sharing and adjacent-band compatibility between passive and active services above 71 GHz.[[1]](#footnote-1)

The Resolution includes two references to “burden sharing” :

*Recognizing* states

 *b)* that, to the extent practicable, the burden of sharing among active and passive services

should be equitably distributed among the services to which allocations are made,

*invites* includes the following

1 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, 116-122.25 GHz, 174.8-182 GHz, 185-190 GHz and 235-238 GHz;

5 to take into account the principles of burden-sharing to the extent practicable in their

studies

Res. 731 was adopted at WRC-2000 in the same action that adopted most of the present allocations in 100-275 GHz. Drafts of Res. 731 were submitted to WRC-2000 as an integral part of allocation proposals from both the United States and the European countries.

**Discussion**

While Resolution 731 has been in force since 2000, no ITU-R studies have been conducted to determine either ‘if and under what conditions sharing is possible between active and passive services about 71 GHz’ or to study possible sharing mechanisms that might distribute “burden of sharing among active and passive services…equitably … among the services to which allocations are made.”

Resolution **731** explicitly includes in a non-exhaustive list in *invites ITU-R 1)* some bands that are addressed in RR No. **5.340**. Therefore, it can logically be concluded that the feasibility of sharing must recognize the need to protect these passive services. This would include both the EESS(passive) and the RAS services. Although, it is anticipated that the sharing issues, both from a technical and regulatory perspective, would involve primarily focus on protecting earth exploration-satellite service (EESS) (passive) use in bands listed in RR No. **5.340** as protecting RAS is at these frequencies is generally simpler.

EESS(p) sensors use downward or forward-facing antennas that generally cover the whole surface of the Earth from NGSO satellites and thus are potentially vulnerable to terrestrial emissions anywhere on Earth. RAS sensors use upward looking antennas at a small number of observatories that are generally located in high altitude arid areas to minimize the propagation impact of atmospheric molecules. Thus, RAS could potentially be protected from transmissions in 71-275 GHz by banning or restricting such transmissions in a small fraction of the surface area of the Earth that is near RAS facilities that cover the affected bands.

While RR No. **5.340** bands individually have bandwidths of a few GHz, the locations of the 11 such bands in 71-275 GHz limit the ability to create large contiguous blocks of spectrum for use by active services unless a sharing environment can be created to ensure the protection of the passive operations. Sharing above 71 GHz raises different technical issues than in the lower passive bands. Above 71 GHz atmospheric absorption is a key factor, and thus overall propagation loss, can vary greatly with respect to frequency and elevation angle. Thus, a method should be found to limit active emissions to levels that do not cause harmful interference to RAS and EESS (passive) systems.

Protection of RAS and EESS (passive) systems is especially critical for RR No. **5.340** bands where no emissions are allowed. Assembling defined terrestrial fixed and mobile service system characteristics and passive sensor characteristics and protection criteria is an important first step in beginning this work to determine the feasibility of interference-free sharing and the possibility of what specific conditions could be established to enable the sharing of these frequency bands by active and passive services, noting, as outlined in Resolution **731 (Rev. WRC-23)** the principles of burden-sharing to the extent practicable in the studies.

It is likely that taking the usual approach (i.e., asking the active services for characteristics and then doing sharing studies that show if sharing is feasible or not) will not be productive. There are two reasons to expect this: 1) because the active systems operating in those bands are either relatively old technologies without state-of-the-art filters, or 2) because there are no existing characteristics in the band.

In this framework, an alternative approach to this very difficult sharing scenario would be to start with the characteristics of the passive services and indicate to the active services that systems in these bands would need to be designed in such a way as to protect the passive services. This would allow the passive services to continue unimpeded operation, while offering the active services a mechanism by which sharing would be feasible in the future.

Fixed and mobile service communications should both be considered in this work. At this time, it may be that Fixed service coexistence and feasibility studies may be less complex due to the fixed geometry and the fact that the usually non-active antennas may present clearer sharing scenarios when compared to Mobile service applications. 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. Mobile service studies may have more challenges than fixed service; and studies by both active services may seek opportunities to collectively coordinate and collaborate on the studies, as practicable.

In order to address the burden sharing provisions of *Recognizing b)* and *Invites 5)* a dialogue between that >71 GHz active technology community and the EESS(p) community is needed to discuss the mutual impact of possible approaches. As an example of possible approaches involves dynamically changing transmissions as EESS(p) satellites pass in the sky above a transmitter. There are at least two options here. The first involves implementing a terrestrial Fixed Service network as a polygrid with alternative routing and changing the routing during the satellite pass in order to meet the protection goals of **Res. 731**. A second alternative involves integrating antenna nulling technology with MIMO technology in Fixed Service antennas and using known ephemeris information for the EESS(p) satellites to determine the altitude angle and azimuth for a null centered on the satellite. Both of these approaches burden both the terrestrial user as well as the EESS(p) user and could not be done with currently operating satellites. Thus any implementation will require a lengthy analysis and testing period and then the design and launch of new satellites. The impact for the terrestrial user in each example is clear, either building and operating a polygrid with dynamic routine or adding nulling capability to MIMO antennas which will likely require a large number of antenna elements. For the EESS(p) satellites the burden will be different for these options. The option are only feasible if the number of EESS(p) satellites, or closely spaced groups of satellites, in a given passive allocation visible from the ground in any area on Earth is limited and is known. At present there is no regulation of passive satellite orbits or even mandatory publication of sensor frequencies and ephemeris data. Thus both communities have “burdens” that enable the proper operation of the other users.

**Proposal**

The United States proposes initiating the studies called for in Resolution **731 (Rev.WRC-23)** to explore under what conditions sharing could be possible between active and passive services in the frequency bands above 71 GHz and on approaches to burden sharing between the active and passive services. In order to initiate this effort, the United States proposes liaising with relevant working parties to develop a framework for the studies called for in Resolution **731 (Rev.WRC-23**

A draft liaison statement is provided for the consideration of WP 1A.

Attachment: Draft liaison statement

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| **Working Party 1A** |
| DRAFT LIAISON STATEMENT TO Working PartIES 5A, 5C, 7B, 7C, AND 7D  |
| **Proposal to initiate work under Resolution 731 (Rev. WRC-23)** |

In accordance with *invites the ITU-R 1* of Resolution **731 (Rev. WRC-23)**, Working Party (WP) 1A is developing a framework for studies to determine if, and under what conditions, sharing is possible between active and passive services in bands above 71 GHz and policy options for burden sharing that is cited in the resolution.

Uncertainties about possible approaches to burden sharing discourage research into technical options. A few technical options that involve burden sharing have been proposed in the technical literature and these could be good examples to clarify how consideration of burden sharing could be handled.

As such, WP 1A would appreciate receiving from the WPs 5A, 5C, 7B, 7C and 7D regarding any feedback on the development of such a framework, including any technical information on emerging technologies that are being planned to operate in these frequency bands and any viewpoints on how burden sharing approaches should be considered..

In order to avoid any overlap with existing work, WP1A would also appreciate learning of any on-going studies within the working parties related to this topic.

The working parties are kindly invited to respond in a timely manner, preferably before the deadline of \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| **Status:** | For action. |  |
| **Deadline:** | \_\_\_\_\_\_\_\_\_\_ |  |
| **Contact:** |  | **E-mail**: |  |

1. WRC Resolution **731** was first adopted at WRC-2000 and included the *recognizing b* and *invites the ITU-R 1* and *5* cited. It was revised at WRC-19 and at WRC-23 but these parts have not been changed. [↑](#footnote-ref-1)