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| U.S. Radiocommunications SectorFact Sheet |
| **Working Party:** ITU-R WP 4C | **Document No:** US4C-02 |
| **Ref:** Resolution 253(WRC-23), Resolution 212(Rev. WRC-19) Administrative Circular CA/270 | **Date:** February 23rd, 2024 |
| **Document Title:** Review of Resolution 212 (Rev. WRC-19) with regards to WRC-27 Agenda item 1.13 |
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| **Purpose/Objective:** According to Administrative Circular CA/270, WP 4C has the role as the responsible group for WRC-27 Agenda item 1.13 with regards to undertaking sharing/compatibility studies and developing draft text for the CPM Report to WRC-27. Agenda item 1.13 is to investigate potential regulatory measures, including possible new allocations to the MSS, for direct connectivity between space stations and IMT user equipment to complement terrestrial IMT network coverage. As Resolution 212 (Rev. WRC-19), “Implementation of International Mobile Telecommunications in the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz”, regards the co-existence of the satellite and terrestrial components of IMT in the 2 GHz range, some of its provisions, in particular its Annex, may be able to provide insight into possible sharing or co-existence techniques for direct-to-user satellite connectivity in frequency bands with terrestrial service allocations.Specifically the Annex to Resolution 212 (Rev. WRC-19), “Guidance on the implementation of technical and operational measures to facilitate coexistence between terrestrial and satellite components of International Mobile Telecommunications in the frequency bands 1 980- 2010 MHz and 2 170-2 200 MHz”, may be of relevance. |
| **Abstract:** Contribution refers to Resolution 212 (Rev. WRC-19) and discusses potential applicability or relevance of its provisions and Annex to studies that should be undertaken by WP 4C in response to Resolution COM6/9(WRC-23). |

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Introduction

As determined by the CPM27-1 meeting (18-19 December 2023, Dubai) and according to Administrative Circular [CA/270](https://www.itu.int/md/R00-CA-CIR-0270/en), WP 4C has the role as the responsible group for WRC-27 Agenda item 1.13 with regards to undertaking sharing/compatibility studies and developing draft text for the CPM Report to WRC-27. Agenda item 1.13 is to investigate potential regulatory measures, including possible new allocations to the MSS, for direct connectivity between space stations and IMT user equipment to enhance the coverage area of terrestrial IMT networks:

to consider studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage, in accordance with Resolution ​253 (WRC-23);

In a review of prior WRC agenda items which may bear some similarity to WRC-27 Agenda item 1.13, it is noted that Agenda item 9.1.1 of WRC-19 was tasked with addressing the invites ITU-R of [Resolution 212 (Rev.WRC-15)](https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000C0019PDFE.pdf), Implementation of International Mobile Telecommunications in the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz:

to study possible technical and operational measures to ensure coexistence and compatibility between the terrestrial component of IMT (in the mobile service) and the satellite component of IMT (in the mobile service and the mobile-satellite service) in the frequency bands 1 980- 2 010 MHz and 2 170-2 200 MHz where those frequency bands are shared by the mobile service and the mobile-satellite service in different countries, in particular for the deployment of independent satellite and terrestrial components of IMT and to facilitate development of both the satellite and terrestrial components of IMT,

The development of the CPM text for this WRC-19 agenda item involved a joint, coordinated effort between WPs 4C and 5D, with each WP assigned the studies with regards to the satellite component and terrestrial component, respectively.

The results of these studies undertaken in response to Resolution 212(WRC-15) were incorporated into the Annex of [Resolution 212 (WRC-19)](https://www.itu.int/dms_pub/itu-r/oth/0C/0A/R0C0A00000F0068PDFE.pdf). To assist WP 4C in its role as responsible group for this Agenda item and as WP 4C starts to organize the work needed to comply with this responsibility, this contribution introduces this Annex and discusses its portions which may have some applicability to studies that should be undertaken with regards to WRC-23 Agenda item 1.13.

Discussion

The *considering b)* of [Resolution 253 (WRC-23)](https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.15-2023-PDF-E.pdf) indicates the benefits of enhancing the coverage of terrestrial IMT networks, and the principal objective of WRC-27 Agenda item 1.13 is to investigate the means to satisfy this objective via regulatory measures, including allocations to the mobile-satellite service, to provide direct connectivity between space stations and IMT user equipment which can complement the coverage of a terrestrial IMT network.

Taking into account *recognizing d)*:

that there is a need to concentrate the studies on the frequency bands allocated to the mobile service on a primary basis and used for IMT or identified for IMT by country footnotes or on a regional or multi-regional basis;

and likewise *further resolves* 2):

to study possible technical and operational measures to ensure that the stations in the MSS do not cause harmful interference to, or claim protection from, stations operating in the mobile service,

a starting point from which to organize sharing and compatibility studies for this agenda item would be to determine if any studies previously carried out by the ITU-R would have any potential relevance and applicability to WRC-27 Agenda item 1.13, in terms of providing guidance as to means or techniques which may achieve the objectives of Resolution 253 (WRC-23) while complying with *further resolves* 2) in terms of ensuring that any new allocation to the MSS does not adversely impact the operation of mobile service stations from a harmful interference perspective.

With regards to *recognizing d)* of Res. 253 (WRC-23) and for reference, the frequency bands identified via Article 5 Radio Regulation footnote for IMT in the range 694/98 MHz – 2 700 MHz is listed in a table in Attachment 1 at the end of this contribution.

[Resolution 212 (Rev. WRC-19)](https://www.itu.int/dms_pub/itu-r/oth/0C/0A/R0C0A00000F0068PDFE.pdf), which was revised from its WRC-15 version to incorporate the results of studies carried out in response to WRC-19 Agenda item 9.1.1, may provide some insight which may be useful in organizing studies in response to Resolution 253 (WRC-23).

The *noting further* provisions of this Resolution recognized the challenge of co-coverage, co-frequency operation of independent satellite and terrestrial networks in IMT frequency bands in the scope of this Resolution, which both *the invites administrations* provisions and Annex to Resolution 212(Rev. WRC-19) address.

The *invites administrations* 3.a) provides guidance as to preferred direction of transmission, for an MSS allocation in a band co-allocated to the mobile service, to limit the impact of harmful interference to mobile stations.

The Annex to Resolution 212(Rev. WRC-19), “Guidance on the implementation of technical and operational measures to facilitate coexistence between terrestrial and satellite components of International Mobile Telecommunications in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz“, notes the potential interference scenarios between the IMT satellite and terrestrial components in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz, along with measures which may reduce the potential of harmful interference between the terrestrial and satellite components of IMT in these bands.

In particular, the measures for the satellite component of IMT in the Annex of Resolution 212 (Rev. WRC-19) may provide guidance as to mitigation techniques that can be implemented to reduce harmful interference to terrestrial stations operating in MS bands from space stations operating in the MSS, which may warrant further consideration in studies developed in response to Resolution 253 (WRC-23). These measures are reprinted in Attachment 2 on the last page of this contribution.

Conclusion

The purpose of this contribution was to provide a brief introduction and discussion of some of the provisions of Res. 212(Rev. WRC-19) to take into account as studies for WRC-27 Agenda item 1.13 are considered and organized. This discussion is not intended preclude consideration of other methods to resolve WRC-27 Agenda item 1.13, nor to imply that the measures indicated in the Annex to Resolution 212 (WRC-19) are all necessarily applicable to this Agenda item. Nonetheless, along with the table of IMT frequency bands in 694/98 MHz – 2 700 MHz in Attachment 1, the consideration of potentially relevant sections of Resolution 212(Rev. WRC-19), such as those in Attachment 2, may provide guidance to WP 4C as studies for this agenda item are structured and organized.

Attachment 1

Frequency Bands Identified for IMT in Between 694/98 MHz and 2 700 MHz

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| **Frequency bands and Regions identified for IMT use by FN** |
| RR FN | Freq Band | Region |
| **5.296A** | 470-698 MHz | In Micronesia, the Solomon Islands, Tuvalu and Vanuatu |
| 610-698 MHz | Bangladesh, Maldives and New Zealand |
| **MOD 5.296A** | 470-698 MHz | Micronesia, the Solomon Islands, Tuvalu and Vanuatu |
| 610-698 MHz | Bangladesh, Lao P.D.R., Maldives, New Zealand and Viet Nam |
| **5.308A** | 614-698 MHz | Bahamas, Barbados, Belize, Canada, Colombia, the United States, Guatemala and Mexico |
| **MOD 5.308A** | 614-698 MHz | Bahamas, Barbados, Belize, Canada, Colombia, El Salvador, the United States, Guatemala, Jamaica and Mexico |
| **5.313A** | 698-790 MHz | Australia, Bangladesh, Brunei Darussalam, Cambodia, China, Korea (Rep. of), Fiji, India, Indonesia, Japan, Kiribati, Lao P.D.R., Malaysia, Myanmar (Union of), New Zealand, Pakistan, Papua New Guinea, the Philippines, the Dem. People’s Rep. of Korea, Solomon Islands, Samoa, Singapore, Thailand, Tonga, Tuvalu, Vanuatu and Viet Nam |
| **5.317A** | 698-960 MHz | Region 2 where MS allocated on primary basis |
| 694-790 MHz | Region 1 where MS allocated on primary basis |
| 790-960 MHz | Regions 1 and 3 where MS allocated on primary basis |
| 1 427-1 452 MHz | Region 1 |
| 1 492-1 518 MHz | Region 1 |
| **MOD 5.317A** | 698-960 MHz | Region 2 where MS allocated on primary basis |
| 694-790 MHz | Region 1 where MS allocated on primary basis |
| 790-960 MHz | Regions 1 and 3 where MS allocated on primary basis |
| **5.341B** | 1 427-1 518 MHz | Region 2 |
| **5.341C** | 1 427-1 452 MHz | Region 3 |
| 1 492-1 518 MHz | Region 3 |
| **5.346** | 1 452-1 492 MHz | Algeria, Angola, Saudi Arabia, Bahrain, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo (Rep. of the), Côte d'Ivoire, Djibouti, Egypt, United Arab Emirates, Eswatini, Gabon, Gambia, Ghana, Guinea, Iraq, Jordan, Kenya, Kuwait, Lesotho, Lebanon, Liberia, Madagascar, Malawi, Mali, Morocco, Mauritius, Mauritania, Mozambique, Namibia, Niger, Nigeria, Oman, Uganda, Palestine\*\*, Qatar, Dem. Rep. of the Congo, Rwanda,Senegal, Seychelles, Sudan, South Sudan, South Africa, Tanzania, Chad, Togo, Tunisia, Zambia, and Zimbabwe |
| **MOD 5.346** | 1 452-1 492 MHz | Algeria, Angola, Saudi Arabia, Bahrain, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo (Rep. of the), Côte d'Ivoire, Djibouti, Egypt, United Arab Emirates, Eswatini, Gabon, Gambia, Ghana, Guinea, Iraq, Jordan, Kenya, Kuwait, Lesotho, Lebanon, Liberia, Madagascar, Malawi, Mali, Morocco, Mauritius, Mauritania, Mozambique, Namibia, Niger, Nigeria, Oman, Uganda, Palestine\*\*, Qatar, Dem. Rep. of the Congo, Rwanda, Senegal, Seychelles, Somalia, Sudan, South Sudan, South Africa, Tanzania, Chad, Togo, Tunisia, Zambia, and Zimbabwe, |
| **5.346A** | 1 452-1 492 MHz | Region 3 |
| **5.384A** | 1 710-1 885 MHz | Global |
| 2 300-2 400 MHz | Global |
| 2 500-2 690 MHz | Global |
| **5.388** | 1 885-2 025 MHz | Global |
| 2 110-2 200 MHz | Global |
| **MOD** **5.388** | 1 885-2 025 MHz | Global |
| 2 110-2 200 MHz | Global |

Attachment 2

Excerpt from Annex to Resolution 212 (REV.WRC-19)

2) Measures for the satellite component of IMT:

a) Use narrower spot beams and steeper roll-off from the boresight of the satellite antenna (i.e. not only reducing the interference level from the antenna sidelobe but also increasing frequency reuse and resilience to interference).

b) Antenna steering, where such capability exists in the satellite design.

c) Beamforming and/or beam nulling of the satellite antenna (e.g. digital processing of multi-element beamforming technique, which has the capability to suppress received interference from regions on the Earth).

d) Dynamic frequency management paired with geographical separation (e.g. monitoring interference in real time and dynamically assigning channels and/or beams).

e) Consider reducing the power flux-density to a level sufficient for coexistence, for example to nominally 122 dBW/m2 for 1 MHz2 for the protection of some base stations or nominally 108.8 dBW/m2 for 1 MHz for the protection of some user equipment on the Earth’s surface on the territories of other administrations using this frequency band for the terrestrial IMT component.

f) Consider an appropriate elevation angle model of an earth station and handover method by a satellite control system in the coexistence analysis.

g) Consider actual activity factor values, which may result in a reduction of interference.

h) Apply a polarization of the satellite antenna different from that of the terrestrial station receiver (for example, use of linear polarization by the terrestrial station receivers and circular polarization by the satellite may provide some benefit).

i) Implement other applicable interference mitigation techniques.