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| U.S. Radiocommunications SectorFact Sheet |
| **Working Party:** ITU-R WP 4C | **Document No:** USWP4C-xx |
| **Ref:** N/A | **Date:** 22 Mar 2024 |
| Document Title: Working Document [AI 1.13 sharing and compatibility studies] |
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| **Purpose/Objective:** Initiate the work under WRC-27 Agenda Item 1.13 |
| **Abstract:** The proposed U.S. contribution aims at getting the work started under WRC-27 Agenda Item 1.13. The document also includes a skeleton of various sections for the Working Document for the sharing and compatibility studies to be conducted under WRC-27 Agenda Item 1.13.  |

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| **Radiocommunication Study Groups** |  |
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| Source: -Subject: WRC-27 agenda item 1.13 | **Document 4A/TBD** |
| **TBD May 2024** |
| **English only** |
| United States of America |
| WORKING DOCUMENT [AI 1.13 SHARING AND COMPATIBILITY STUDIES] |
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Introduction

The proposed U.S. contribution aims at getting the work started under WRC-27 Agenda Item 1.13. The attached document includes a skeleton of the envisaged sections for conducting the sharing and compatibility studies under WRC-23 Agenda Item 1.13 in bands between 694 - 2 700 MHz identified for IMT in the Radio Regulations and reflected in Recommendation ITU-R M.1036.

**Attachment:** 1

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| Attachment 1 |
| WORKING DOCUMENT [AI 1.13 SHARING AND COMPATIBILITY STUDIES] |

1. **Introduction**

Resolution 253 (WRC-23) calls for 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.

Studies on sharing and compatibility between incumbent services, including in adjacent frequency bands are essential to ensure the protection of incumbent services in accordance with the Radio Regulations.

1. **Information on IMT frequency arrangements contained in ITU R.**

**Recommendation M.1036 and the corresponding incumbent and adjacent band services**

The following tables provide information on the IMT frequency arrangements contained in ITU R. Recommendation M.1036, in addition to the corresponding incumbent and adjacent band services for bands between 694 - 2 700 MHz identified for IMT in the Radio Regulations.

The tables for the Earth to Space direction have been included for information. Depending on further analysis, studies for this direction might not be necessary given that the characteristics of the IMT mobile stations (i.e. user equipment) are envisaged to remain unchanged.

**[Editor's note:** The table for the Earth to Space direction is included for information. Depending on further analysis, studies for this direction might not be necessary.**]**

|  |  |
| --- | --- |
| **FDD Frequency arrangements** | **Mobile station transmitter/ Uplink to Satellite (Earth to Space Direction) (MHz)** |
| A1 | 824-849 |
| A2 | 880-915 |
| A3 | 832-862 |
| A4 | 698-716 |
| 776-793 |
| A5 | 703-748 |
| A7 | 703-733 |
| A8 | 698-703 |
| A9 | 733-736 |
| A11 | 703-733 |

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| **FDD Frequency arrangements** | **Base station transmitter/Downlink from Satellite(MHz)** | **Incumbent** **Services** | **Adjacent band****Services** |
| A1 | 869-894 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| A2 | 925-960 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| A3 | 791-821 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| A4 | 728-746 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| 746-763 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| A5 | 758-803 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| A7 | 758-788 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| A8 | 753-758 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| A9 | 788-791 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| A10 | 738-758 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| A11 | 758-788 | FixedMobileBroadcasting | FixedMobileBroadcasting |
| 738-758 | FixedMobileBroadcasting | FixedMobileBroadcasting |

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| **TDD Frequency arrangements** | **Un-paired arrangement (MHz)** | **Incumbent** **Services** | **Adjacent band****Services** |
| A6 | 698-806 | FixedMobileBroadcasting | FixedMobileBroadcasting |

**[Editor's note:** The table for the Earth to Space direction is included for information. Depending on further analysis, studies for this direction might not be necessary.**]**

|  |  |
| --- | --- |
| **FDD Frequency arrangements** | **Mobile station transmitter/ Uplink to Satellite (Earth to Space Direction) (MHz)** |
| G2 | 1 427-1 470 |

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| --- | --- | --- | --- |
| **FDD Frequency arrangements** | **Base station transmitter/Downlink from Satellite (MHz)** | **Incumbent** **Services** | **Adjacent band****Services** |
| G1 | 1 427-1 517 | Space Operations (Earth-to-space)FixedMobile except aeronautical mobileMobileBroadcastingBroadcasting-Satellite | Earth Exploration-Satellite (passive)Radio AstronomySpace Research (passive)FixedMobileMobile-Satellite |
| G2 | 1 475-1 518 | Space Operations (Earth-to-space)FixedMobile except aeronautical mobileMobileBroadcastingBroadcasting-Satellite | Earth Exploration-Satellite (passive)Radio AstronomySpace Research (passive)FixedMobileMobile-Satellite |

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| --- | --- | --- | --- |
| **TDD Frequency arrangements** | **Un-paired arrangement (MHz)** | **Incumbent** **Services** | **Adjacent band****Services** |
| G3 | 1 427-1 517 | Space Operations (Earth-to-space)FixedMobile except aeronautical mobileMobileBroadcastingBroadcasting-Satellite | Earth Exploration-Satellite (passive)Radio AstronomySpace Research (passive)FixedMobileMobile-Satellite |

**[Editor's note:** The table for the Earth to Space direction is included for information. Depending on further analysis, studies for this direction might not be necessary.**]**

|  |  |
| --- | --- |
| **FDD Frequency arrangements** | **Mobile station transmitter/ Uplink to Satellite (Earth to Space Direction) (MHz)** |
| B1 | 1 920-1 980 |
| B2 | 1 710-1 785 |
| B3 | 1 850-1 920 |
| B4 | 1 710-1 785 |
| 1 920-1 980 |
| B5 | 1 850-1 920 |
| 1 710-1 780 |
| B6 | 1 980-2 010 |
| B7 | 2 000-2 020 |

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| --- | --- | --- | --- |
| **FDD Frequency arrangements** | **Base station transmitter/Downlink from Satellite(MHz)** | **Incumbent** **Services** | **Adjacent band****Services** |
| B1 | 2 110-2 170 | FixedMobileSpace Research (deep space) (Earth-to-space)Mobile-Satellite (space-to-Earth) | Space Operation (Earth-to-space) (space-to-space)Earth Exploration-Satellite (Earth-to-space) (space-to-space)FixedMobileSpace Research (Earth-to-space) (space-to-space)Mobile-Satellite (space-to-Earth) |
| B2 | 1 805-1 880 | FixedMobile | FixedMobile |
| B3 | 1 930-2 000 | FixedMobileMobile-Satellite (Earth-to-Space) | FixedMobileMobile-Satellite (Earth-to-Space) |
| B4 | 1 805-1 880 | FixedMobile | FixedMobile |
| 2 110-2 170 | FixedMobileSpace Research (deep space) (Earth-to-space)Mobile-Satellite (space-to-Earth) | Space Operation (Earth-to-space) (space-to-space)Earth Exploration-Satellite (Earth-to-space) (space-to-space)FixedMobileSpace Research (Earth-to-space) (space-to-space)Mobile-Satellite (space-to-Earth) |
| B5 | 1 930-2 000 | FixedMobileMobile-Satellite (Earth-to-Space) | FixedMobileMobile-Satellite (Earth-to-Space) |
| 2 110-2 180 | FixedMobileSpace Research (deep space) (Earth-to-space)Mobile-Satellite (space-to-Earth) | Space Operation (Earth-to-space) (space-to-space)Earth Exploration-Satellite (Earth-to-space) (space-to-space)FixedMobileSpace Research (Earth-to-space) (space-to-space)Mobile-Satellite (space-to-Earth) |
| B6 | 2 170-2 200 | FixedMobileMobile-Satellite (space-to-Earth) | Space Operations (space-to-Earth) (space-to-space)Earth-Exploration Satellite (space-to-Earth) (space-to-space)FixedMobileSpace Research (space-to-Earth) (space-to-space) |
| B7 | 2 180-2 200 | FixedMobileMobile-Satellite (space-to-Earth) | Space Operations (space-to-Earth) (space-to-space)Earth-Exploration Satellite (space-to-Earth) (space-to-space)FixedMobileSpace Research (space-to-Earth) (space-to-space) |

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| **TDD Frequency arrangements** | **Un-paired arrangement (MHz)** | **Incumbent** **Services** | **Adjacent band****Services** |
| B1 | 1 880-1 920 | FixedMobile | FixedMobile |
| 2 010-2 025 | FixedMobileMobile-Satellite (Earth-to-Space) | Space Operation (Earth-to-space) (space-to-space)Earth Exploration-Satellite (Earth-to-space) (space-to-space)FixedMobileSpace Research (Earth-to-space) (space-to-space) |
| B3 | 1 920-1 930 | FixedMobile | FixedMobile |
| B4 | 1 880-1 920 | FixedMobile | FixedMobile |
| 2 010-2 025 | FixedMobileMobile-Satellite (Earth-to-Space) | Space Operation (Earth-to-space) (space-to-space)Earth Exploration-Satellite (Earth-to-space) (space-to-space)FixedMobileSpace Research (Earth-to-space) (space-to-space) |
| B5 | 1 920-1 930 | FixedMobile | FixedMobile |

|  |  |  |  |
| --- | --- | --- | --- |
| **TDD Frequency arrangements** | **Un-paired arrangement (MHz)** | **Incumbent** **Services** | **Adjacent band****Services** |
| E1 | 2 300-2 400  | FixedMobileRadiolocation | FixedMobileRadiolocation |

**[Editor's note:** The table for the Earth to Space direction is included for information. Depending on further analysis, studies for this direction might not be necessary.**]**

|  |  |
| --- | --- |
| **FDD Frequency arrangements** | **Mobile station transmitter/ Uplink to Satellite (Earth to Space Direction) (MHz)** |
| C1 | 2 500-2 570 |
| C2 | 2 500-2 570 |

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| --- | --- | --- | --- |
| **FDD Frequency arrangements** | **Base station transmitter/Downlink from Satellite (MHz)** | **Incumbent** **Services** | **Adjacent band****Services** |
| C1 | 2 620-2 690 | FixedFixed Satellite (space-to-Earth) Mobile except aeronauticalMobile-Satellite (space-to-Earth)Broadcasting-Satellite  | Earth Exploration-Satellite (passive)Radio AstronomySpace Research (passive) |
| C2 | 2 620-2 690 | FixedFixed Satellite (space-to-Earth) Mobile except aeronauticalMobile-Satellite (space-to-Earth)Broadcasting-Satellite | Earth Exploration-Satellite (passive)Radio AstronomySpace Research (passive) |
| 2 570-2 620 | FixedFixed Satellite (space-to-Earth) Mobile except aeronauticalMobile-Satellite (space-to-Earth)Broadcasting-Satellite | FixedFixed Satellite (space-to-Earth) Mobile except aeronauticalBroadcasting-Satellite |

|  |  |  |  |
| --- | --- | --- | --- |
| **TDD Frequency arrangements** | **Un-paired arrangement (MHz)** | **Incumbent** **Services** | **Adjacent band****Services** |
| C3 | 2500-2690 | FixedFixed Satellite (Earth-to-space) (space-to-Earth)Mobile except aeronauticalMobile-Satellite (space-to-Earth)Broadcasting-Satellite | FixedMobileMobile-Satellite (space-to-Earth)RadiolocationRadiodetermination-satellite (space-to-Earth)Earth Exploration-Satellite (passive)Radio AstronomySpace Research (passive) |

1. **Detailed list of sharing studies to be conducted**

TBD

1. **Orbit and RF emission characteristics of systems and networks intended to provide direct connectivity between space stations and IMT user equipment**

The following tables summarize orbit configurations of systems and networks intended to provide direct connectivity between space stations and IMT user equipment.

Table X: TBD

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| --- | --- | --- | --- | --- | --- |
| Altitude (km) | Inclination (deg) | # Planes | Sats per plane | RAAN spacing (deg) | Total number of sats |
|  |  |  |  |  |  |

TBD

**4.1 Emissions in the space-to-Earth direction**

This section will contain relevant emission characteristics to conduct sharing studies. Relevant parameters should include, among others:

* Power Flux Density on the ground
* Satellite antenna pattern
* Cell edge definition (relative to cell center)
* TBD

TBD

**4.2 Out-of-band emissions to be used for out-of-band studies**

This section contains relevant information on out-of-band emissions.

TBD

**4.3 Emissions in the Earth-to-space direction**

The intended operations foresee communications to unmodified user equipment. Consequently, the receive/transmit characteristics of the user equipment will remain unchanged with respect to standard terrestrial operations.

**4.4 Modelling of operations and the concept of topology**

This section will contain important assumptions on how to accurately model operations of systems and networks implementing direct-to-device communications.

**4.4.1 Satellite selection mechanism**

TBD

**4.4.2 The “topology” function**

When implementing direct-to-device communications in real-world, operators make use of the “topology” function as a way of managing interference at borders.

This topology function enables direct-to-device operators to dynamically meet applicable cross-border limits without fixed keep-out zones away from borders.

A visual example is offered by the figure below, based on the territory of the United States. The simulated field strength shows how emissions are adapted in cells close to the border with neighboring countries.



Figure 1: Simulated field strength over the territory of the United States

Modelling topology is fundamental and should be duly taken into account in studies, as this is something satellite systems will implement continuously to manage interference into neighboring countries.

**4 Results of sharing studies**

TBD