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| U.S. Radiocommunication SectorFact Sheet |
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| **Document Title:** Finalization of the Draft New Report ITU-R RA.[RAS-IMT-COMPAT-43-GHZ]- Possible coordination and protection measures for stations of the radio astronomy service operating in the 42.5-43.5 GHz allocation and IMT systems operating in the 37-43.5 GHz mobile service allocation |
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| **Purpose/Objective:** To organize and move forward the in-progress report on compatibility between IMT systems and the radio astronomy service |
| **Abstract:** This input is intended to move the Working Document toward a Preliminary Draft New Report on compatibility between IMT systems and the radio astronomy service in the 43 GHz band toward completion. It incorporates additional feedback from Working Parties 3M and 5D, and proposes an upgrade to Draft New Report status. |

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| Finalization of the Draft New Report ITU-R RA.[RAS-IMT-COMPAT-43-GHZ]**Possible coordination and protection measures for stations of the Radio Astronomy Service operating in the 42.5-43.5 GHz allocation and IMT systems operating in the 37-43.5 GHz mobile service allocation** |
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**Introduction**

In 2019, Working Party (WP) 7D began work on a draft report addressing preliminary coordination and means to protect Radio Astronomy Service (RAS) systems operating in bands shared with and adjacent to bands used by International Mobile Telecommunications (IMT) systems. Based on the decision of WRC-19 to identify the frequency bands 37-43.5 GHz for IMT, Resolution **243 (WRC-19)** invited the ITU-R to provide information and assistance to concerned administrations on possible coordination and protection measures for RAS in the frequency band 42.5-43.5 GHz from IMT deployment.

**Proposal**

The United States has reviewed the latest version of the document, as received by WP 5D (7D/83) which incorporates feedback recently received by WP 3M (7D/77). Based on the collaborative effort between experts in WPs 7D and 5D, the U.S. considers the material is now mature and is ready to be finalized for submission to Study Group 7. As WP 7D concludes its consideration of this effort, the U.S. offers minor additional edits, shown in the Attachment following this page, for consideration.

ATTACHMENT

**ATTACHMENT**

*(Editorial Note: The proposed text below is based on 7D/83, with modifications accepted.)*

**Proposal 1**

### 5.2.1 Appropriate propagation conditions

Generally, atmospheric propagation in the subject frequency range is not a significant factor in reducing received aggregate signal power. However, using observed atmospheric characteristics for given RAS sites under realistic observing conditions, considering that such sites are typically located in remote locales selected for atmospheric conditions, may be warranted to assist with the coordination process.

Recommendation ITU-R P.452 or ITU-R P.2001 provides detailed calculation methodology for atmospheric loss employing empirical site-specific data.

It is well known that the topography around a RAS site has significant impact on the general interference situation. Diffraction at terrain is one of the most effective mitigation measures, especially at the high frequencies that are subject of this report. Unfortunately, existing RAS stations cannot be moved to different places and some sites, such as the WSRT in the Netherlands, are operated in a rather flat environment.

But, in general, the terrain can and should be incorporated in any coordination efforts, as it usually makes the required separation distances much smaller. The same is true for clutter, which can also provide additional path attenuation.

Recommendation ITU-R P.452 or ITU-R P.2001 provides information and procedures to account for multiple aspects of terrain loss, including knife-edge diffraction effects and spherical-Earth impacts. The most recent version of Recommendation ITU-R P.452, i.e. P.452-18, defines the use of both terrain heights and clutter categories along the radiowave path and notes that if “the method is used to calculate diffraction loss using the terrain profile without clutter, the diffraction loss will be under-estimated in cluttered environments, as opposed to combined representation of terrain and clutter”. However, the use of Recommendation ITU-R P.452-17 with only a terrain profile along with the statistical clutter model in Recommendation [ITU-R P.2108](https://www.itu.int/rec/R-REC-P.2108/en), section 3.2 will provide an alternative estimate of the desired basic transmission loss. Recommendation ITU-R P.2108-1, is of a statistical nature and can, for example, be used for IMT deployment in urban and suburban areas under the defined conditions with one or both of the radio transmitter and receiver terminals being embedded in local clutter (e.g., buildings).

Software solutions designed to incorporate terrain data may also be of use in facilitating compatibility between RAS observatories and IMT deployments.

**Proposal 2, Annex A**

### A.1.1 Introduction

Every BS can serve up to a given number of UE devices per frequency channel, which will use TDD, i.e., the up- and downlink communication occurs in time slots, which cannot be shared by different user devices. This also means that for a network simulation one needs to average the transmitted power from all devices over a sufficiently large period. To increase the link budget, the BS will dynamically steer its AAS beam towards each of the UE devices within the associated time slot. This also must be considered in a simulation by averaging over the effective antenna gains in time. Likewise, the UE may use AAS beamforming to improve the link budget. As the UE antenna frames can be arbitrarily rotated, the UE beams are also highly dynamic. It is usually assumed, however, that the angular distance between the UE antenna boresight and the actual direction to the host BS is, at most, 60° (otherwise, the UE antenna gain would be too low and the UE device would try to establish a connection to a different BS).

In the following, $\left(u, v, h\right)$ will represent a Cartesian coordinate frame around the RAS station, with $u$ measured to the East, $v$ measured to the North, and $h$ being the height above mean sea level (amsl). Thus, $\left(u, v, h\right)\_{BS}$ and $\left(u, v, h\right)\_{UE}$ are the positions of each individual IMT antenna. It is noted that Earth’s curvature must be considered for radio wave propagation. This will be accounted for in a subsequent step. The $\left(u, v, h\right)$ frame can be thought of as a local flat projection of the simulation area, akin to the [UTM](https://pubs.usgs.gov/fs/2001/0077/report.pdf) or [ETRS89](http://etrs89.ensg.ign.fr/) coordinate systems used in cartography. Each BS antenna sector will have a certain bearing (azimuthal direction), $α\_{BS}$.

**Proposal 3, Annex B**

### Table B1

IMT technical parameters for BSs and UEs

| Parameters | IMT BS | IMT UE |
| --- | --- | --- |
| Frequency |  41.5 GHz |  41.5 GHz |
| Antenna | 8 × 16 array elements,65° 3‑dB width, *Gelem*=5 dBi,30 dB f/b ratio, λ/2 spacing | 4 × 4 array elements,90° 3‑dB width, *Gelem*=5 dBi,25 dB f/b ratio, λ/2 spacing |
| Total integrated gain correction | +4.83 dB (single element)+0.28 dB (composite beam) | +2.44 dB (single element)+0.33 dB (composite beam) |
| Tilt | −15° (suburban open space),−10° (urban/suburban) | 0° |
| Ptx1 | 10 dBm per element | 10 dBm per element |
| Antenna height | 15 m (suburban open space),6 m (urban/suburban) | 1.5 m |
| Spectral mask | −56 dBc (spurious gain) | −49 dBc (spurious gain) |
| Ohmic losses | −3 dB | −3 dB |
| Other losses | n/a | 4 dB (body loss) |
| Total radiated spectral power density in RAS frequency band1,2 | −30 dB(m/MHz) (spurious)3 dB(m/MHz) (in‑band) | −30 dB(m/MHz) (spurious)−4 dB(m/MHz) (in‑band) |
| Total radiated power into RAS frequency band2,3 | 0 dBm (spurious)26 dBm (in‑band, one carrier) | 0 dBm (spurious)19 dBm (in‑band, one carrier) |
| Network loading factor | 20% | n/a |
| TDD activity factor | 80% | 20% |
| Rb (housing ratio) | 5% | 5% |
| Ra (ratio of hotspot area to housing area) | 7% (urban), 3% (suburban) | 7% (urban), 3% (suburban) |
| Deployment density in hotspot area | 30 km‑2 (urban),10 km‑2 (suburban),1 km‑2 (suburban open space) | 100 km‑2 (urban),30 km‑2 (suburban) |
| *Distribution of UE (relative to BS)* |
| Distance distribution | log‑normal(0.42, 3.9) (suburban open space)Rayleigh(0, 32) (urban/suburban) |
| Angular distribution | normal(0, 30) (clipped at ± 60°) |
| Note 1: The UE maximum transmit power will be lower in some simulation instances as it is subject to the power control algorithm. Note 2: (Spectral) TRP values in the table do not include UE body losses.Note 3: Within the RAS bandwidth of 1 GHz up to 5 carriers/channels of 200 MHz could be active. |