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|  | ECC PT1(20)153 |
| ECC PT1 #66 |
| Web meeting, 1-3 and 9-11 September 2020 |
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| Date issued:  | 26 August 2020 |
| Source:  | CRAF |
| Subject:  | European Radio Astronomy at 43 GHz  |
| Group membership required to read? (Y/N)N |
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| Summary:  |
| In order to assist with its work on PT1\_34, the Committee on Radio Astronomy Frequencies (CRAF) submits the document attached here as Annex 1 to ECC PT1 for information and consideration.  |
| Proposal: |
| CRAF invites ECC PT1 toConsider the information contained in Annex 1 of this document in its work on PT1\_34 |
| Background: |
| ECC has tasked ECC PT1 to develop text for an ECC Decision on MFCN harmonisation for the band 40.5 – 43.5 GHz (work item PT1\_34) and has initiated a CG in order to respond to this. At its first meeting the CG considered current and planned use of the 40.5-43.5 GHz frequency band as listed in ERC Report 25 (ECA table) and the results of an ECO questionnaire of 2016 on use and future plans for frequency bands in relation to studies in CEPT on WRC-19 Agenda item 1.13. In the discussion on the ECO questionnaire it became clear that some additional information on RAS use of these frequencies would be desirable, particularly in terms of RAS sites currently operating (or capable of operating) at 42.5 – 43.5 GHz. Consequently, CRAF provides the information in Annex 1 of this document in order to assist in identifying relevant shared spectrum use between the current users and MFCN, and ensure co-existence. |

Annex 1

The RAS and MFCN at 43 GHz

# Introduction

Over the last 30 years millimetre-wave radio astronomy has grown to become one of the most dynamic fields of astronomy and an important tool for investigating the universe. Measurements on the millimetre radiation of molecules have enabled radio astronomers to make numerous discoveries and observe objects at the outer limits of the universe. In the 42.5 – 43.5 GHz band in particular the rotational lines of silicon monoxide in different vibrational states are the subject of extensive single dish and VLBI spectral line measurements. Additionally, continuum (broadband) measurements made in this band have contributed significantly to increasing our knowledge on a number of key astronomical questions. MFCN use of the 42.5 – 43.5 GHz band will involve sharing with the RAS on a co-primary basis and RAS operations may also be affected by the unwanted emissions from MFCN use of the adjacent band at 40.5 – 42.5 GHz.

The current regulatory status of these bands and applicable footnotes in the RR was provided in ECC PT1 source document [ECC PT1\_CG40 GHz (20)002\_rev2](https://www.cept.org/Documents/ecc-pt1/59749/ecc-pt1_cg40-ghz-20-002_rev2_1st-step-of-work_results-of-quesrionare-ecc-pt1-16-133-an31_r1_ai113).

# Protecting RAS Operations

RAS sharing with active services may be practical at mm-wavelengths. For active services at these frequencies useful transmit directivity can be achieved with modern antennas and for base stations various site engineering techniques may also be employed to reduce interference in the direction of an observatory. From the RAS perspective, there are relatively few mm-wave observatories to be protected and these are mostly located in areas of low population density, such as at high elevations and/or on sites with extremely dry atmospheric conditions.

Until recently there have been relatively few active systems operating above 40 GHz and therefore few reported cases of interference to the RAS; however, this situation is now changing. In the context of WRC-19 Agenda Item 1.13, sharing and compatibility studies were undertaken for terrestrial IMT with incumbent services at several mm-wave frequency bands including the band 40.5 - 43.5 GHz. A detailed discussion and analysis of the results of the pre-WRC-19 studies has been provided by the Chairman of TG5-1, in his final report located at [https:/www.itu.int/md/R15-TG5.1-C-0478/en](https://www.itu.int/md/R15-TG5.1-C-0478/en)). Studies covering RAS use of the frequency band 42.5 - 43.5 GHz and IMT systems operating in the range 37 - 43.5 GHz can be found in Annex 5, Part 5. In Annex 5, Part 5 of the TG5-1 Report, three stakeholders supplied studies; one considered the effects of IMT operation on the RAS for both adjacent and in-band conditions; the remaining two considered either in-band or adjacent band IMT operation and its effects on the RAS. Although the individual studies had a slightly different focus, there were elements of each that contained significant similarities in terms of deployment density, RAS operating mode, the use of non-specific site topographic characterisations, propagation model, etc. that allowed meaningful comparisons to be made. All studies, in all scenarios, concluded that to protect RAS operations, separation distances would be needed between RAS stations and deployed IMT transmitters (the differences were only in the magnitude of the separation distance).

Based on the studies discussed for terrestrial IMT use of the bands under consideration and given the likely dimensions of the separation distances required around stations, RAS protection should be able to be established at a national level. It is also worth noting that terrain profiles were not used in the studies. Use of detailed terrain profiles on a case by case basis around RAS stations would probably lead to reduced separation distances, especially for RAS stations in areas of high relief topography.

Other IMT use, such as to facilitate the connectivity to/from aerial UEs may have a significant impact on the RAS and the associated separation distances, and would require further studies to be undertaken.

# European RAS Stations at 43 GHz

The sites listed in the table below are currently operating (or capable of operating) at 42.5 – 43.5 GHz and should be appropriately protected from MFCN emissions.

Table 1: European RAS sites currently operating (or capable of operating) at 42.5 – 43.5 GHz

|  |  | Location |
| --- | --- | --- |
| Station Name | Responsible Administration | Lattiude | Longitude |
| Metsahovi | Finland | 60° 13′ 05″ N | 24° 23′ 36" E |
| Bure | France | 44° 38′ 02" N | 05° 54′ 28" E |
| Effelsberg | Germany | 50° 31′ 29″ N | 06° 53′ 01″ E |
| Wettzell | Germany | 49° 8′ 38″ N | 12° 52′ 40″ E |
| Noto | Italy | 36° 52′ 33″ N | 14° 59′ 20″ E |
| Sardinia | Italy | 39° 29′ 34″ N | 09° 14′ 42″ E |
| Medicina | Italy | 44° 31′ 15″ N | 11° 38′ 49″ E |
| Torun  | Poland | 53° 05′ 43″ N | 18° 33′ 46″ E |
| Pushchino | Russian Federation | 54° 49′ 20″ N | 37°37′ 53″ E |
| Yebes | Spain | 40° 31′ 29″ N | 03° 05′ 13″ W |
| Robledo | Spain | 40° 25′ 38″ N | 04° 14′ 57″ W |
| Pico Veleta | Spain | 37° 3' 58" N | 3° 23' 34" W |
| Onsala | Sweden | 57° 23′ 45″ N | 11° 55′ 35″ E |
| Cambridge | United Kingdom | 52° 09′ 59″ N | 00° 02′ 20″ E |