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| Summary:  |
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| Proposal: |
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DRAFT CEPT BRIEF ON AGENDA ITEM 1.15

1.15 to consider identification of frequency bands for use by administrations for the land-mobile and fixed services applications operating in the frequency range 275-450 GHz, in accordance with Resolution 767 (WRC-15);

# ISSUE

Taking into account the results of ITU-R studies according to Resolution 767 (WRC-15) on sharing and compatibility between passive and active services as well as spectrum needs for those services, to consider identification for use by administrations for the land-mobile and fixed service applications operating in the frequency range 275-450 GHz, while maintaining protection of the passive services identified in No 5.565 and take appropriate action.

# Preliminary CEPT position

CEPT supports the identification of frequency bands for land-mobile and fixed services in the frequency range 275-450 GHz under the condition that the protection of passive services identified in No 5.565 is ensured.

# Background

In close proximity radio communication systems huge amount of data is transferred from a stationary terminal to some mobile equipment in less than a few seconds. Wireless links for data centres, which are deployed in addition to fibres, allow for reconfigurable links within a data center. These links allow for flexibility in routing to cope with peak traffic. In intra-device communications, a wireless link between e.g. microchips within one device is realized.

ITU-R initiated studies based on the technical and operational characteristics of applications like "close proximity radio communication", “wireless links for data centres” and “intra-device communications”. All these applications are point-to-point wireless links which will provide high data rates, in the order of 100 Gbit/s, with simple modulation schemes using wide bandwidths of up to 103.68 GHz in the range of 275 to 450 GHz.

For fronthaul and backhaul links which share identical parameters since the difference between both is only the transmitted data. High data rates in the order of 100 Gbit/s are provided by simple modulation schemes using wide bandwidths of more than 50 GHz. Due to the longer transmission distances the atmospheric absorption narrows down the frequency range for candidate bands to 275-321.84 GHz and 380-445 GHz.

In IEEE 802 a first standard for point-to-point links in the frequency range 252-325 GHz is currently under development. IEEE 802 also issued a call for proposals for the applications close proximity, intra-device, wireless data centres and front-/backhaul links in March 2016 (IEEE Doc. 802.15-15-0936-04-003d, <https://mentor.ieee.org/802.15/dcn/15/15-15-0936-04-003d-tg3d-100g-call-for-proposals.docx>).

Initial proposals have been presented in the July 2016 meeting of IEEE 802 and were combined to a joined proposal in the September 2016 meeting. The key parameters are summarized in IEEE Doc. 802.15-16-0595-00-003d (<https://mentor.ieee.org/802.15/dcn/16/15-16-0595-00-003d-proposal-for-ieee802-15-3d-thz-phy.docx>). A first draft of the standard will be available in the beginning of 2017. After several review cycles the new standard is expected to be finished by the beginning of 2018.

## Sharing with passive services

The frequency range 275-450 GHz is identified by No 5.565 for the use for the radio astronomy service, the Earth exploration-satellite service and the space research service. An additional identification of this frequency range for land-mobile and fixed services needs to maintain the protection of the passive service as identified in RR No. 5.565 in the frequency range 275-1 000 GHz.

### Radio Astronomy Service

Sharing between the radio astronomy service and active services has been addressed in Report ITU-R RA.2189. The Report takes account of terrestrial, aeronautical and satellite based active transmitters and concludes that sharing with all types of transmitters is, under certain conditions, feasible.

1. to be confirmed at the next PTA meeting

### Earth Exploration-Satellite Service

The EESS (passive) sensing is described in Report ITU-R RS.2194 on a band by band basis. In carrying out the necessary sharing studies between the EESS (passive) sensing and the FS/MS, account needs to be taken of the different types of sensing modes: Limb Scan Mode, Conical Scan Mode and Nadir scan mode as well as the relevant spectral lines and measurements performed in the various bands. Studies should also take into account existing and planned instruments in the EESS (passive) sensing.

As far as EESS (passive) is concerned, the following bands will need to be considered in the range 275-450 GHz range (taking into account the last outcomes of WP 5C stating that the band 322-380 GHz is not assumed relevant for FS applications the recent):

275-286 GHz (sharing with both FS and MS)

296-306 GHz (sharing with both FS and MS)

313-356 GHz (sharing with FS and MS in the 313-322 GHz, with MS only above 322 GHz)

361-365 GHz (sharing with MS only)

369-392 GHz (sharing with MS only in the 369-380 GHz, with FS and MS above 380 GHz)

397-399 GHz (sharing with both FS and MS)

409-411 GHz (sharing with both FS and MS)

416-434 GHz (sharing with both FS and MS)

439-467 GHz (sharing with both FS and MS)

In absence of detailed information of the FS/MS networks in the frequency range 275-450 GHz yet it may be sufficient. for the time being, to calculate the maximum emission levels at the ground in a reference area that would be necessary to ensure protection of EESS (passive) sensors in bands above 275 GHz.

Initial studies in the 296-306 GHz presented at the PTA meeting of February 2017 band have shown that the maximum emission levels at the ground would be -12.9 dBW/200 MHz (ref. area of 10/20 km²) for Nadir instruments, -8.9 dBW/200 MHz (ref. area of 10/20 km²) for Conical instruments and 33 to 53 dBW/3 MHz (ref. area of around 30 M km²) Limb instruments.

Under all combinations of the FS characteristics known to date, the FS e.i.r.p. density in 200 MHz is between 7.5 to 22.6 dB (for 24 dBi antenna) and 33.5 to 48.6 dB (for 50 dBi antenna) above the maximum emission level at the ground for Conical instruments (-8.9 dBW/200 MHz) and 11.5 to 26.6 dB (for 24 dBi antenna) and 37.5 to 52.6 dB (for 50 dBi antenna) above the maximum emission level at the ground for Nadir instruments (-12.9 dBW/200 MHz).

Since the description of the FS antenna pattern is currently missing but essential it seems that considering the large exceedance up to around 50 dB, interference could also occur for a single FS transmitter in its antenna sidelobe, i.e. pointing at quite large angle from the satellite position. Taking as an example the FS antenna pattern in Recommendation ITU-R F.699 (recognising that it does apply in this frequency range) would show that an FS link could interfere the EESS sensors at an angle up to 24° from its main beam for a 50 dBi antenna and at all angles for a 24 dBi antenna.

The initial studies in the 296-306 GHz band have shown that even not having taken into account any aggregate effects or the case of compatibility in adjacent bands, relevant in particular when considering broadband FS/MS systems, sharing could be critical.

However, the assessment of potential interference from FS/MS to EESS (passive) sensors will require the consideration of the aggregate effect of a full deployment of FS/MS networks/stations in the corresponding frequency bands, in particular for the Limb instrument case.

This will require further studies taking into account relevant information from FS/MS industry about deployment scenarios (density of equipment per km², frequency reuse pattern, pointing elevation distributions, …) as soon as this information is available.

### Space Research Service

Taking into account the specificities of SRS (passive) missions that are not dedicated to measurements on Earth, sharing and compatibility studies with FS/MS in bands above 275 GHz are not required.

# List of relevant documents

ITU-Documentation (Recommendations, Reports, other)

* Recommendation ITU-R RS.2017
* Preliminary draft new Report ITU-R RS.[275-450 GHz CHARS]
* Preliminary draft new Report ITU-R M.[300GHZ\_MS\_CHAR]
* Preliminary draft new Report ITU-R F.[300GHZ\_FS\_CHAR]
* Report ITU-R [SM.2352](http://www.itu.int/pub/R-REP-SM/publications.aspx?lang=en&parent=R-REP-SM.2352) on Technology trends of active services in the frequency range 275 - 3000 GHz
* Report ITU-R RS.2194 on Passive bands of scientific interest to EESS/SRS from 275 - 3000 GHz
* Report ITU-R RA.2189 on Sharing between the radio astronomy service and active services in the frequency range 275-3 000 GHz

CEPT and/or ECC Documentation (Decisions, Recommendations, Reports)

EU Documentation (Directives, Decisions, Recommendations, other), if applicable

IEEE Documentation

* IEEE Doc. 802.15-14-0304-16-003d Application Requirements Document
(<https://mentor.ieee.org/802.15/dcn/14/15-14-0304-16-003d-applications-requirement-document-ard.docx>)
* IEEE Doc. 802.15-13-0309-20-003d Technical Requirements Document (<https://mentor.ieee.org/802.15/dcn/14/15-14-0309-20-003d-technical-requirements-document.docx>)
* IEEE Doc. 802.15-16-0610-00-003d Final Draft Proposal Explanation (<https://mentor.ieee.org/802.15/dcn/16/15-16-0610-00-003d-proposal-for-ieee802-15-3d-thz-phy-explanations.pptx>)
* IEEE Doc. 802.15-16-0592-00-003d Final Draft Proposal Explanation Channelization (<https://mentor.ieee.org/802.15/dcn/16/15-16-0592-00-003d-proposal-for-ieee802-15-3d-channel-assignment-plans.pdf>)

# Actions to be taken

The following actions need to be taken into account before identifying frequency bands for land-mobile and fixed services applications operating in the frequency range 275-450 GHz:

to identify technical and operational characteristics of systems in the land-mobile and fixed services operating at frequencies above 275 GHz, including the description of:

link elevation distribution expected in the band above 275 GHz

antenna pattern(s)

deployment scenarios (densities of equipment per km²) in various environments (Rural, suburban and urban)

emission masks including out of band emission and spurious emissions

to study spectrum needs of systems in the land-mobile and fixed services, taking into account the results of the above studies;

to develop propagation models within the frequency range 275-450 GHz so as to enable sharing and compatibility studies between the land-mobile, fixed and passive services in this frequency range;

to conduct sharing and compatibility studies between the land-mobile, fixed and passive services operating in the frequency range 275-450 GHz, including single entry and aggregate scenarios.

# Relevant information from outside CEPT (examples of these are below)

## European Union (date of proposal)

## Regional telecommunication organisations

APT (date of proposal)

ATU (date of proposal)

Arab Group (20 April 2017)

* Follow up and support the current studies to consider identification of frequency bands for use by administrations for the land-mobile and fixed services applications operating in the frequency range 275-450 GHz, while ensuring the protection of passive services identified in No 5.565, and not adding any additional constraints on these services.

CITEL (July 2017)

USA:

The United States is of the view that it may be possible to develop a similar footnote to that in No. 5.565 for land-mobile and fixed services, identifying bands for terrestrial active service use. To this end, the United States supports studies in the ITU-R on sharing and compatibility between passive and active services as well as spectrum needs for the land-mobile and fixed services for WRC-19 agenda item 1.15 under the terms of Resolution 767 (WRC-15).

RCC (16 September 2016)

The RCC Administrations consider it reasonable that identification of frequency bands for land-mobile and fixed services applications in 275-450 GHz bandin the RR No. 5.565 will facilitate global harmonization of radio frequencies for development and introduction of land mobile and fixed service applications above 275 GHz.

The RCC Administrations consider that when identifying frequency bands for active services in 275-450 GHz range, a balance of interests has to be observed in the use of this frequency range by both active and passive services, ensuring possibility for future development of new active service applications while excluding interferences to the passive services in the frequency bands already identified in No 5.565 for passive services and effect of active applications in the main and adjacent frequency bands.

## International organisations

IARU (April 2017)

Resolution 767 (WRC-15) recognizes that the amateur service is developing and demonstrating applications above 275 GHz. As studies proceed to identify candidate frequency bands for the land-mobile and fixed services in the frequency range 275-450 GHz, the IARU supports maintaining access for non-commercial experimentation by stations in the amateur service to as much of the frequency range as possible, consistent with the protection of the passive and other active services.

IATA (date of proposal)

ICAO (date of proposal)

IMO (date of proposal)

SFCG (June 2016)

SFCG supports the identification of frequency bands for use by systems operating in the land-mobile and fixed service by considering technology innovation, as long as these applications do not preclude the passive use of the bands identified in No 5.565. SFCG supports the concept that no allocations will be made to any service above 275 GHz at WRC-19.

EUMETNET (21 November 2016)

No opposition to FS/MS identification in the 275-450 GHz band provided that protection of EESS (passive) is ensured

WMO (February 2017)

WMO does not oppose the identification of land-mobile and fixed services in the 275-450 GHz band provided that protection of EESS (passive) is ensured and the identification is consistent with footnote No 5.565.

If allocations for active service are envisaged, the same approach would have to be applied to passive service.

IEEE802 (date of proposal)

## Regional organisations

ESA (October 2016)

Supports the SFCG position.

Eurocontrol (date of proposal)

EUMETSAT (February 2017)

Since 2006, the European contribution to operational meteorological observations from polar orbit has been provided by the first generation of the EUMETSAT Polar System (EPS) with its 3 Metop satellites. The second generation of this system with 6 Metop satellites (3x Metop-SG-A and 3x Metop-SG-B) will provide continuity and enhancement of these observations in the timeframe of 2020 to 2040. On the three Metop-SG-B satellites, the conical scanning Ice Cloud Imager (ICI) instrument is planned to provide ice cloud and snowfall imaging in 11 channels in the frequency range from 183 to 664 GHz at a spatial resolution of 15 km. These 11 channels are centered at 183 GHz, 243 GHz, 325 GHz, 448 GHz and 664 GHz.

Given the importance of the bands above 275 GHz for passive sensing instruments like the ICI on Metop-SG-B satellites, adequate protection of the frequency bands identified in No 5.565 has to be ensured when proposing identifications for use by administrations for the land-mobile and fixed service applications.

## OTHER INTERNATIONAL AND REGIONAL ORGANISATIONS

EBU (date of proposal)

GSMA (date of proposal)

CRAF (29 September 2016)

CRAF supports the protection of existing RAS, SRS, and EESS (passive) frequency allocations. CRAF also supports the development of propagation models for this frequency range. No changes should be made to the Radio Regulations unless acceptable sharing and compatibility criteria are developed to ensure the protection of RAS, SRS, and EESS (passive) from future services and applications above 275 GHz.