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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 inclusion of a new footnote to Article 5 of the Radio Regulations identifying the following frequency bands for fixed and mobile service applications in the range 275-450 GHz while maintaining the protection of the passive services identified in No 5.565:

275-296 GHz

306-313 GHz

318-333 GHz

356-450 GHz

With a total bandwidth of 137 GHz, CEPT stresses that this is exceeding the assessed spectrum requirements of the land mobile and fixed services. In addition to the 23 GHz already allocated to land mobile and fixed services in the lower adjacent band 252-275 GHz, this is hence providing a contiguous band of 44 GHz.

However, CEPT does not support land mobile and fixed services identification in the EESS (passive) bands 296-306 GHz, 313-318 GHz and 333-356 GHz (as identified in No 5.565) since study results show that they are not compatible.

Active services other than land mobile and fixed services are not subject to WRC-19 Agenda item 1.15. Consequently, CEPT is of the view that the corresponding regulatory provisions to other active services have to remain unchanged.

# Background

WP 5A and WP 5C have finalised the reference Reports providing the necessary parameters of land mobile service (LMS) and fixed service (FS) applications to be used for sharing and compatibility studies that have been adopted within Study Group 5 (November 2017):

* Report ITU-R M.2417 on “Technical and operational characteristics of land mobile service applications in the frequency range 275-450 GHz”
* Report ITU-R F.2416 on “Technical and operational characteristics and applications of the point-to-point fixed service applications operating in the frequency band 275-450 GHz”

Report ITU-R M.2417 considers LMS applications like "close proximity mobile systems (CPMS)", “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.

The main FS applications considered in Report ITU-R F.2416 are point-to-point fronthaul and backhaul links for mobile services. The fronthaul is the link connection between the base station’s baseband unit and the remote radio head, while the backhaul is the link between the base station and the higher level network elements. Both links 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 about 50 GHz. Due to the longer transmission distances, the atmospheric absorption narrows down the frequency range for candidate bands for fixed point-to-point systems.

In IEEE 802 a first standard for point-to-point links in the frequency range 252-325 GHz has been developed and published in the November of 2017. The applications and the technical characteristics of the IEEE standard are consistent with the FS and LMS parameters that are provided by WP 5A and WP 5C in the Reports ITU-R M.2417 and ITU-R F.2416 for consideration in the frequency compatibility studies.

## spectrum needs

Land mobile applications: Report ITU-R M.2417 concludes that a total bandwidth of 50 GHz would be sufficient to provide high-data rate transmissions between CPMS devices for KIOSK applications, as well as, intra device applications and wireless links for data centres. For CPMS applications, intra-device communications and wireless links for data centres, the candidate frequency bands considered are within the full range 275-450 GHz. The final selection of the bands identified for LMS will depend on the results of the technical studies. A segmentation of these 50 GHz in non-consecutive allocation blocks could provide the solution for this Agenda item. Due consideration should also be given to the MS allocations below 275 GHz (i.e. 252-275 GHz) to be used to satisfy parts of the spectrum requirements identified.

Fixed Service applications: Report ITU-R F.2416 concludes that a bandwidth of around 25 GHz would be sufficient for initial typical deployments of high-capacity links for fronthaul/backhaul of IMT systems. A total long-term spectrum bandwidth of about 50 GHz is considered sufficient to support the evolution of IMT traffic between baseband unit and remote radio head. The possible candidate frequency bands identified by WP 5C for fronthaul and backhaul applications are 275-325 GHz and 380-445 GHz whereas the frequency band 330-370 GHz may also be considered. The final selection of the bands identified for FS will depend on the results of the technical studies. A segmentation of these 50 GHz in non-consecutive allocation blocks could provide the solution for this Agenda item. Due consideration should also be given to the FS allocations below 275 GHz (i.e. 252-275 GHz) to be used to satisfy parts of the spectrum requirements identified.

## 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 (passive) and the space research service (passive). 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 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. However, the typical parameters (e.g. maximum e.i.r.p.) used for the illustrated examples vary from those in the Reports ITU-R F.2416 and ITU-R M 2417.

Sharing between radio astronomy service and land mobile and fixed services is considered in the working document towards a preliminary draft new Report ITU-R SM.[275-450GHZ\_SHARING] (Annex 3 to Document 1A/260).

Preliminary sharing studies between RAS and FS have shown that the sharing may be provided in the frequency bands 275-323 GHz, 327-371 GHz, 388-424 GHz, 426-442 GHz with separation distances and/or avoidance angles between RAS stations and FS stations.

### Earth Exploration-Satellite Service

The EESS (passive) sensing is described in Report ITU-R RS.2194 on a band by band basis. Furthermore, WP 7C has developed a preliminary draft new report ITU-R RS.[275-450 GHz CHARS] describing the technical and operational characteristics of EESS (passive) systems in the frequency range 275-450 GHz and provided this information to WP 1A. In carrying out the necessary sharing studies between the EESS (passive) sensing and the FS/LMS, 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, identified in No 5.565, need to be considered in the range 275-450 GHz in sharing and compatibility studies with both FS and LMS:

* 275-286 GHz
* 296-306 GHz
* 313-356 GHz
* 361-365 GHz
* 369-392 GHz
* 397-399 GHz
* 409-411 GHz
* 416-434 GHz
* 439-467 GHz

Before detailed information of the FS/LMS networks in the frequency range 275-450 GHz was made available initial sharing studies have been carried out and were based on assumed RF characteristics of FS and LMS systems. These preliminary studies provided 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. These 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/LMS systems, sharing could be critical with EESS (passive) nadir and conical instruments.

For the meeting in November 2017, WP 1Areceived an information from WP 7C (document 1A/225) that no sharing issues are expected between Limb sensors and FS and LMS systems and that hence the 275-286 GHz and 409-411 GHz bands could be identified for FS and LMS.WP 1A also considered a number of sharing and compatibility studies between FS and EESS (passive), in particular from ESA and EUMETSAT (document 1A/239), considering aggregate impact of FS deployments and all concluded that sharing would not be possible in some of the EESS (passive) frequency bands or portions thereof. Considering the various methodologies and parameters used, WP 1A agreed that the outcomes of the ESA/EUMETSAT studies (see Figure 1) were the most relevant and was hence used as the basis for draft CPM Text (Annex 1 to document 1A/260). For instances the bands 296-306 GHz, 313-320 GHz and 331-356 GHz cannot be made available to the FS whereas in the remaining parts of the 275-450 GHz range, FS identification can be envisaged, as illustrated in the following figure. It is further noted that sharing with LMS is not expected to change these conclusions. WP 1A updated the working document towards a preliminary draft new report ITU-R SM.[275-450GHZ\_SHARING] (Annex 3 to document 1A/260) to include the various studies presented at the meeting, expecting updates of these studies for the next meeting in June 2018.

It is to be noted that at this stage, the draft CPM text only includes a single method to satisfy the Agenda item, proposing a new footnote to identify FS and LMS frequency bands.

Based on further input to the PTA meeting in March 2018, the bands that are not suitable for sharing have been updated to 296-306 GHz, 313-318 GHz and 333-356 GHz.

In its June 2018 meeting, WP 1A finished the draft CPM text. Further studies have been presented and have to be further consider in May 2019 to finalize the Preliminary draft new Report ITU-R SM.[275-450GHZ\_SHARING).



Figure 1: Outcomes of the ESA/EUMETSAT studies

### 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/LMS 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]
* Report ITU-R M.2417
* Report ITU-R F.2416
* 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
* Draft CPM text on Agenda item 1.15 (Annex 1 to document 1A/340)
* Preliminary draft new Report ITU-R SM.[275-450GHZ\_SHARING] (Annex 3 to document 1A/340)

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 further consider and analyse 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 (March 2018)

APT Members support the ITU-R studies to consider identification of frequency bands for use by the land-mobile and fixed service applications operating in the frequency range 275-450 GHz, provided that the protection on passive services identified in No.5.565 is ensured. If such identification is made, APT Members support a method of adding a new footnote to the relevant part of the Radio Regulations.

ATU (September 2018)

APM19-3 Outcomes

Method C, which suggests modifying RR No 5.565 for use by fixed service land mobile service applications in portions of the 275-450 GHz band, while considering the evolving guidance of ITU-R Recommendations and Reports. Studies that evaluated the entire 275-450 GHz range show that sharing is feasible between applications in the land mobile/fixed service, and applications in the Earth exploration-satellite service (passive)/radio astronomy service in the particular frequency bands: 275-296 GHz, 306-313 GHz, 320-330 GHz and 356-450GHz.

Arab Group (April 2018)

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 and the possibility to support the only method proposed to satisfy this Agenda Item.

CITEL (June 2018)

Preliminary views from several countries supporting studies

1.15 – Land-mobile and fixed services identification in the 275-450 GHz range, some are 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

RCC (March 2018)

The RCC Administrations consider it reasonable that identification of frequency bands for land-mobile and fixed services applications in 275-450 GHz band in 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 of the Radio Regulations.

The RCC Administrations consider that to provide the balanced use of 275-450 GHz range, frequency bands could be identified for sharing between active and passive services, and also frequency bands for exclusive use by active and passive applications taking into account the frequency bands 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 (August 2018)

SFCG supports the concept that no actual allocations will be made to any service above 275 GHz at WRC-19. However, SFCG supports the conclusions of the technical studies performed in ITU-R showing that a large amount of spectrum within the 275-450 GHz range could be identified for FS and MS applications, with the exception of the bands 296-306 GHz, 313-318 GHz and 333-356 GHz that, as a result of ITU-R compatibility studies, were deemed incompatible with the existing Earth exploration-satellite service (passive). Thus, SFCG does not oppose either Method D1 or E from the draft CPM text, as both provide identification of the frequency ranges for land-mobile and fixed service use that will not cause harmful interference to the passive services while maintaining the requirement for active users to take all practicable steps to protect passive applications.

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 2018)

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

The bands 296-306 GHz, 313-320 GHz and 331-356 GHz should not be considered because fixed and land mobile services would not be compatible with the EESS (passive).

IEEE 802 (date of proposal)

## Regional organisations

ESA (October 2017)

Supports the SFCG position.

Eurocontrol (date of proposal)

EUMETSAT (October 2017)

EUMETSAT supports the SFCG and WMO position.

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 (175-192 GHz), 243 GHz (239-248 GHz), 325 GHz (314-337 GHz), 448 GHz (439-457 GHz) and 664 GHz (657-671 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 (November 2018)

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 and also spelling out the appropriate mitigation methods for the protection of RAS in the Radio Regulations for the frequency allocations above 275 GHz.