**IEEE 802.15**

**Wireless Specialty Networks**

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| Project | IEEE P802.15 Working Group for Wireless Specialty Networks (WSNs) | |
| Title | Proposal to send information to APG23-6 meeting | |
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| Re: |  | |
| Abstract | This document proposes to send information on IEEE802.15.3d standard to APG23-6 meeting to be held on August 2023. | |
| Purpose | To provide information on IEEE802.15.3d standard to APT member countries and encourage them to develop APT Common Proposal on a WRC-27 agenda item which considers new allocations to fixed, mobile, radio astronomy services and Earth exploration-satellite service (passive) in the frequency range 275-325 GHz on a co-primary basis in the Table of Frequency Allocations. | |
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**Proposal to send information to APG23-6 meeting**

# Background

APG23, “The APT Conference Preparatory Group for the 2023 World Radiocommunication Conference (WRC-23)” is now developing APT Preliminary Views and APT Common Proposals (APCs) which express APT’s position for each WRC-23 agenda item. The final APG23 meeting, i.e. APG23-6 will be held on August 2023 and Preliminary ACP (PACP) on each agenda item will be developed and adopted for circulation between APT member countries for final approval as ACP. WRC-27 agenda items are discussed under WRC-23 agenda item 10 (see <https://www.itu.int/en/ITU-R/study-groups/rcpm/Pages/wrc-23-studies.aspx>).

At APG23-5 meeting held on February 2023, one possible WRC-27 agenda item which considers new allocations to fixed service (FS), mobile service (MS), radio astronomy service (RAS) and Earth exploration-satellite service (EESS) (passive) in the frequency range 275-325 GHz on a co-primary basis in the Table of Frequency Allocations was proposed and carried forward to APG23-6 for further study. The purpose of this agenda item is shown as follows:

1. To extend the frequency range of the Table of Frequency Allocations of the Radio Regulations (RR) up to 325 GHz and add a new allocation table for four radiocommunication services in the frequency range 275-325 GHz.
2. To coexist between active services (FS and MS) and passive services (RAS and EESS (passive)) in the frequency range 275-325 GHz.
3. To update RR Nos. **5.138, 5.149, 5.340, 5.564A** and **5.565** consequently.
4. To support future worldwide utilization of IEEE802.15.3d devices.

Since this possible WRC-27 agenda item will be discussed at APG23-6, it would be better to input information on IEEE802.15.3d standard to APG23-6 and get APT member countries to recognize that commercial market awaits worldwide regulated frequency bands above 275 GHz so that a huge number of IEEE802.15.3d devices could be distributed in the world.

# 2 Summary of the possible WRC-27 agenda item

The APG23-5 output documents on possible WRC-27 agenda items can be downloaded from the website <https://www.apt.int/2023-APG23-5-docs-tmp> if you are a member of APT. But this section briefly summarizes the proposal on new applications to FS, MS, RAS and EESS (passive) in the frequency range 275-325 GHz.

Table 1 shows the Table of Frequency Allocations in the frequency range 248-3 000 GHz which is extracted from the Radio Regulations. No radiocommunication services are not allocated in the frequency range 275-3 000 GHz, but some frequency bands, in accordance with RR Nos. **5.564A** and **5.565,** are identified for use by administrations for FS, MS, RAS and EESS (passive) applications. The use in footnote of expression “identified” only expresses the interest of some administrations on the future use of those bands for the specific applications and this expression is not sufficient to protect passive service applications form harmful interferences caused by other service applications. The additional provisions which are already included in the Table of Frequency Allocations in the frequency below 275 GHz should be added to protect passive services. The provision of RR No. **5.149** specified the frequency bands which administrations are urged to take all practicable steps to protect the RAS from harmful interference and that of RR No. **5.340** the frequency bands where emission is prohibited. In order to include those provisions in the Table of Frequency Allocations of RR, the radiocommunication services must be first allocated in the specific frequency bands and then the specific provisions are added in the frequency bands depending on whether passive services are protected or not.

The frequency ranges above 2.4 GHz for SRD applications are the same as those regulated to ISM applications by RR Nos. **5.138** and **5.150** in accordance with Recommendation ITU-R SM.1896. The provision of RR No. **5.138** is also considered whether it should be amended or not if the frequency bands are required by SRD applications.

Table 1 **Table of Frequency Allocations in the frequency range 252-3 000 GHz**

|  |  |  |
| --- | --- | --- |
| Region 1 | Region 2 | Region 3 |
| **248-250** AMATEUR  AMATEUR-SATELLITE  Radio astronomy  5.149 | | |
| **250-252** EARTH EXPLORATION-SATELLITE (passive)  RADIO ASTRONOMY  SPACE RESEARCH (passive) 5.340 5.563A | | |
| **252-265** FIXED  MOBILE  MOBILE-SATELLITE (Earth-to-space)  RADIO ASTRONOMY  RADIONAVIGATION  RADIONAVIGATION-SATELLITE 5.149 5.554 | | |
| **265-275** FIXED  FIXED-SATELLITE (Earth-to-space)  MOBILE  RADIO ASTRONOMY 5.149 5.563A | | |
| **275-3 000** (Not allocated) 5.564A 5.565 | | |

In the specific frequency range 275-325 GHz, as shown in Figure 1, the band 275-323 GHz has been identified for use by RAS applications, and three bands are identified for EESS (passive) and FS/LMS applications in the frequency range 275-325 GHz. In order to commercialize worldwide IEEE802.15.3d devices whose PHY is defined in the frequency range 252-325 GHz, provided protection of RAS and EESS (passive) in the frequency range 275-325 GHz, in particular, it would be appropriate to establish the Table of Frequency Allocations in the frequency range 275-325 GHz which allocate FS, MS, RAS and EESS (passive) on a co-primary basis.



Figure 1 **Identified frequency bands in the frequency range 275-325 GHz**

# 3 Proposal

NICT would like to propose that IEEE802 send information on IEEE802.15.3d standard to APG23-6 meeting to encourage APT member countries to develop PACP which considers new frequency allocations to FS, MS, RAS and EESS (passive) in the frequency range 275-325 GHz and assist to make APT member countries understand necessity to include the study of new allocations in the frequency range 275-325 GHz as WRC-27 agenda item. If the Table of Frequency Allocations in the frequency range 275-325 GHz will be added in the RR at WRC-27, the new regulation will benefit IEEE802 with respect to deployment of IEEE802.15.3d devices worldwide without constraint of regulations. The proposed information document is attached for consideration.

# 4 Date and venue of APG23-6 meeting

APG23-6 will be held on August 14 to 19, 2023 in Brisbane, Australia. The meeting will be held hybrid mode. Further information is available at <https://www.apt.int/2023-APG23-6>.

**Attachment**

|  |  |  |
| --- | --- | --- |
|  | ASIA-PACIFIC TELECOMMUNITY | **Document No:** |
| **The 6th Meeting of the APT Conference Preparatory**  **Group for WRC-23 (APG23-6)** | **APG23-6/INF-xx** |
| 14 – 19 August 2023, Brisbane, Australia | 12 August 2023 |

IEEE802

**First inernational standard operating in the frequency range 252-325 Ghz**

1. **Overview of THz work in IEEE 802 LMSC**

IEEE 802 LMSC has been working on THz Communications since 2008, when an Interest Group (IG) THz was formed in the IEEE 802.15 Working Group for Wireless Specialty Network, followed by transiting the Interest Group to the current IEEE 802.15 Standing Committee THZ (SC THz). As a spin-off of the activities of the IEEE 802.15 IG THz group, IEEE 802 LMSC published IEEE Std 802.15.3dTM-2017 in 2017 - an amendment to IEEE Std 802.15.3TM-2016, which defines physical layer (PHY) at the frequency range between 252 GHz and 325 GHz for switched point-to-point links and defines two PHY modes that enables data rates of up to 100 Gb/s using eight different bandwidths between 2.16 GHz and 69.12 GHz. Applications targeted with this standard comprise wireless backhaul/fronthaul links, wireless links in data centers as well as short-range applications such as kiosk downloading, intra-device and close-proximity communication. In 2022, IEEE 802 LMSC initiated a project to revise IEEE Std 802.15.3TM-2016, which also includes the integration of amendment IEEE Std 802.15.3dTM-2017 into the main standard IEEE Std 802.15.3TM-2016.

1. **Use cases supported by** **IEEE Std 802.15.3dTM-2017**

The standard defines a wireless switched point-to-point physical layer operating at PHY data rates of 100 Gbps with fallback solutions at lower data rates. The standard provides low complexity, low cost, low power consumption, and high data rate wireless connectivity among devices. Data rates will be high enough to satisfy a set of consumer multimedia industry needs, and to support emerging wireless switched point-to-point applications. Five use cases supported by this standard are shown below and the detailed information is provided in Application Requirement Document[[1]](#footnote-1).

- Intra-device communication

- Close proximity P2P applications (e.g. kiosk downloading and file exchange)

- Wireless backhaul/fronthaul

- Data centers

- Touchless gate systems[[2]](#footnote-2)

1. **Technical requirement for IEEE Std 802.15.3dTM-2017**

This document describes the technical requirements to define a wireless switched point-to-point physical layer operating at a nominal PHY data rate of 100 Gbps with fallbacks to lower data rates as needed. Operation is considered in bands from 252 GHz to 325 GHz. Additionally, the technical requirements for modifications to the Medium Access Control (MAC) layer, needed to support this new physical layer, are defined. The requirements in terms of minimum data rates, required BER and required transmission distances depending on the specific use cases are shown in Table 1.

Table 1 **Required performance for different use cases**

|  |  |  |  |
| --- | --- | --- | --- |
| **Use case** | **Minimum Data Rate in Gb/s** | **Required BER after error correction** | **Required Transmission Distance (m)** |
| Intra-Device Communication | 1 | 10-12 | 0.03 |
| Close Proximity Communication | 1 | 10-6 | 0.1 |
| Wireless Fronthauling | 10[[3]](#footnote-3) | 10-12 | 200 |
| Wireless Backhauling | 10 | 10-12 | 500 |
| Wireless Data Center | 1 | 10-12 | 100 |

The standard shall also comply with the regulatory requirements taking into account the specific situation for carrier frequencies beyond 275 GHz, however, it would be preferable for IEEE802.15.3d devices to use the whole range of the operational frequency 252-325 GHz. The channel arrangement of IEEE Std 802.15.3dTM-2017 is shown in Figure 1. The maximum channel whose bandwidth is 69.12 GHz could be in worldwide operation if the regulations allow IEEE802.15.3d devices to radiate transmission power in the whole range of the frequency in Regions 1, 2 and 3. The further information on technical requirements is provided in Technical Requirement Document[[4]](#footnote-4).



Figure 1 **Channel arrangement in the frequency range 252-325 GHz**

1. **Channel modeling for IEEE Std 802.15.3dTM-2017**

The propagation characteristics and channel models in Line-of-Sight (LoS) and Non-Line-of-Sight (NLoS) operational environments relevant for each use case are provided in Channel Model Document[[5]](#footnote-5). Antenna characteristics are also provided for the system simulation and evaluation by the proponents.

1. **Summary and Proposal**

Three important documents for IEEE Std 802.15.3dTM-2017 are briefly introduced including five use cases and some technical requirements. IEEE Std 802.15.3dTM-2017 can be downloaded from IEEE Xplore[[6]](#footnote-6). Since this standard utilizes a vast amount of spectrum resources and extremely wide range of channel bandwidths, data rates up to 100 Gbit/s are feasible using simple modulation schemes which can make it possible to develop compact and cost-effective transceivers. Further increase of data rates could be expected if multi-level modulation scheme and MIMO technologies are introduced[[7]](#footnote-7).

This standard has a great potential to increase not only data rates but also number of applications of use cases. A number of IEEE802.15.3d devices is expected to be used in worldwide under proper regulations. Therefore, the study for new allocations to FS and MS including RAS and EESS (passive) in the frequency range 275-325 GHz in the RR by WRC-27 is important to support the development and deployment of IEEE802.15.3d devices to meet worldwide demand for short-range devices. APG is invited to take into account the current international standard operating in the frequency range 252-325 GHz to address a WRC-27 agenda item under WRC-23 agenda item 10.

1. See <https://mentor.ieee.org/802.15/dcn/14/15-14-0304-16-003d-applications-requirement-document-ard.docx> [↑](#footnote-ref-1)
2. This use case was standardized using 60-GHz band and published as IEEE Std 802.15.3eTM-2017. See IEEE Xplore <https://ieeexplore.ieee.org/document/7856917> [↑](#footnote-ref-2)
3. 10 Gbit/s is the maximum data rate available today in CPRI. Hence, this shall be the minimum data rate targeted in the amendment. [↑](#footnote-ref-3)
4. See <https://mentor.ieee.org/802.15/dcn/14/15-14-0309-20-003d-technical-requirements-document.docx> [↑](#footnote-ref-4)
5. See <https://mentor.ieee.org/802.15/dcn/14/15-14-0310-19-003d-channel-modeling-document.docx> [↑](#footnote-ref-5)
6. See IEEE Xplore <https://ieeexplore.ieee.org/document/8066476> [↑](#footnote-ref-6)
7. See <https://mentor.ieee.org/802.15/dcn/15/15-15-0109-07-003e-technical-guidance-documnet-3e.docx> [↑](#footnote-ref-7)