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Beyond 5G R&D Promotion Unit

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ITUWRC DUBAI2023
20 November - 15 December 2023
Dubai, United Arab Emirates

Beyond 5G International Conference 2024

MMW＆THz : What we can see from the results of the WRC-23

Contents 1: Activity report of the 6G working group of the Terahertz Consortium (positioned as part of the activities of the High Frequency WG of the B5G Consortium International Committee: Dr. Hosako is the WG leader)

- Activities in FY2022 after the last international conference (Qct. 2022)
- Activities for FY2023
  Discusses MMW dissemination methods and their expansion to THz waves.
  - As materials for discussion, interviews have so far been held with two operators and two vendors.
  - Discussions will be held after the hearings and recommendations will be made (in FY2024).

Content 2: Activities Plans for FY2024

- The things regarding MMW and THz-wave frequencies decided at WRC23 and the proposed actions to be taken are presented.

Beyond 5G Consortium, International Committee,
High Frequency Working Group, WG-Chair : **Iwao Hosako** (NICT)

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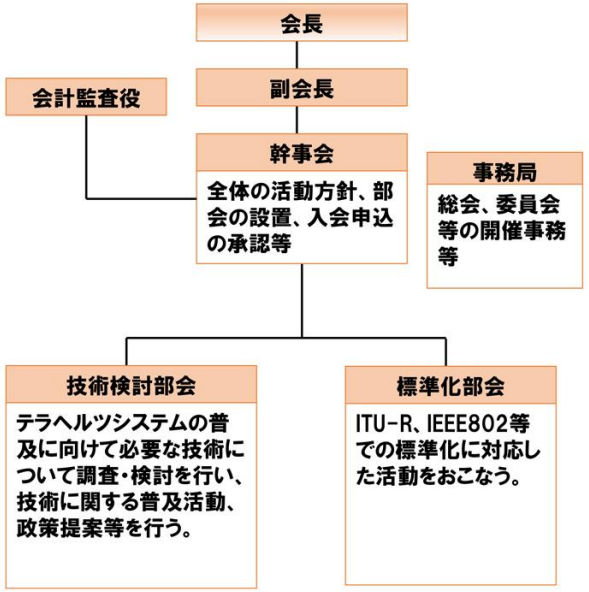


Terahertz Systems Consortium

6G Working Group Activity Report for FY2022 after Oct. 2022 and FY2023

- Examine system requirements for F/B-haul and Small Cell Access Link as a possible use case.
- Summarize the degree of device performance required for the above system.
- Discussion on MMW dissemination methods and their expansion to THz waves

(The above activities are positioned as part of the activities of the High Frequency WG of the B5G Consortium International Committee)

Backhaul / Fronthaul

- Required SNR for 16QAM ~ 13dB (Required SNR value for 5G NR [Ref])
- Required output power at amplifier end for transmit side ~ 11.5dBm
- When TWTA is used, 30 dBm output is expected at the output end
  → Maximum transmission distance ~ 2,500 m

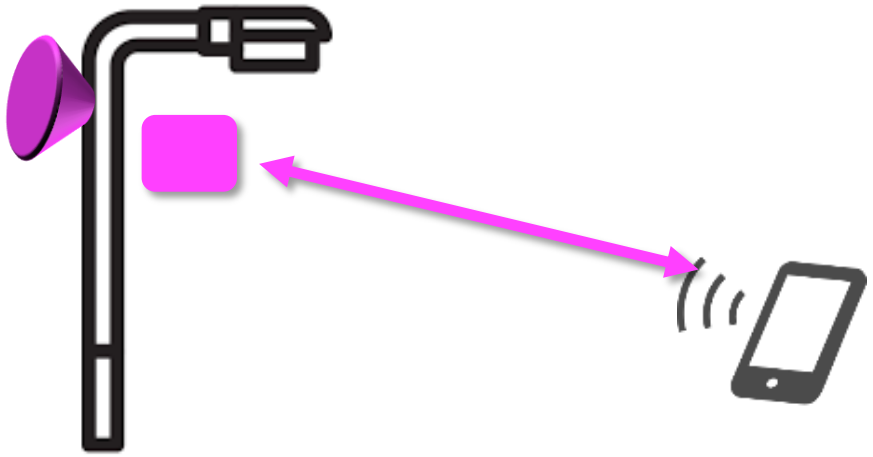
Item	Requirement
Max. Distance	300 m
Band Width/Channel	4 GHz
Modulation	16 QAM
Capacity/Channel	13.3 Gbps
Center Frequency	300 GHz
Antenna Gain (Tx,Rx)	45 dBi

Approx. 15 cm in diameter

Link Budget		
Tx AMP Output	11.5	dBm
Loss at Tx	10	dB
Antenna Gain at Tx	45	dBi
Pass Loss	131.5	dB
Fading Margin	20	dB
Antenna Gain at Rx	45	dBi
LNA Gain	20	dB
Loss at Rx	10	dB

[Ref] R. Kovalchukov, D. Moltchanov, Y. Gaidamaka, and E. Bobrikova, “An Accurate Approximation of Resource Request Distributions in Millimeter Wave 3GPP New Radio Systems,” [Online]. Available: arXiv:1908.08872 [cs.NI] https://arxiv.org/abs/1908.08872

Small Cell Access Link



- Required SNR for 16QAM ~ 13dB (Required SNR value for 5G NR [Ref])
- Amplifier output required on the transmit side ~ 16.5dBm* due to small antenna gain

Item	Requirement
Max. Distance	30 m
Band Width/Channel	4 GHz
Modulation	16 QAM
Capacity/Channel	13.3 Gbps
Center Frequency	300 GHz
Antenna Gain (Tx,Rx)	25 dBi

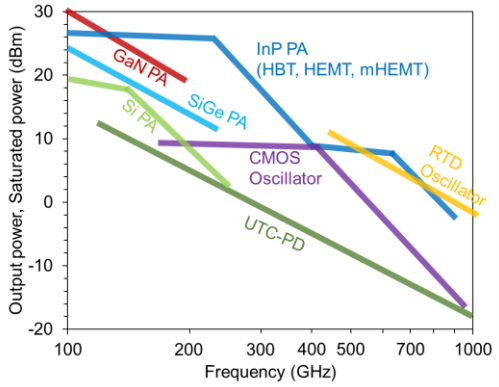
Approx. 1 cm in diameter

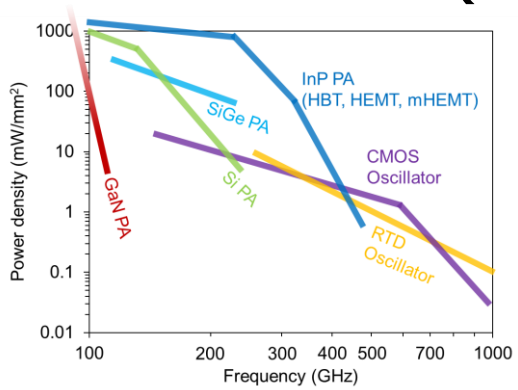
Link Budget		
Tx AMP Output	16.5	dBm
Loss at Tx	10	dB
Antenna Gain at Tx	25	dBi
Pass Loss	111.5	dB
Fading Margin	5	dB
Antenna Gain at Rx	25	dBi
LNA Gain	20	dB
Loss at Rx	10	dB

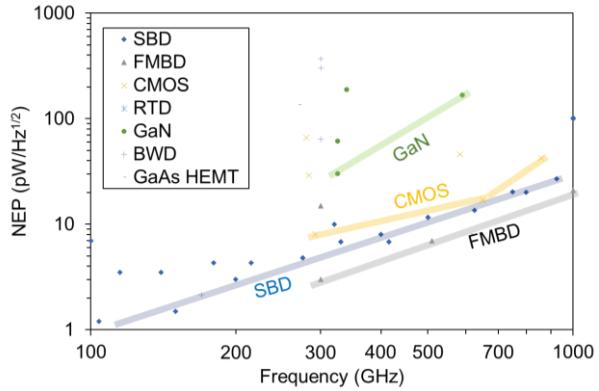
Base-band and Array Antenna Techs are not included.

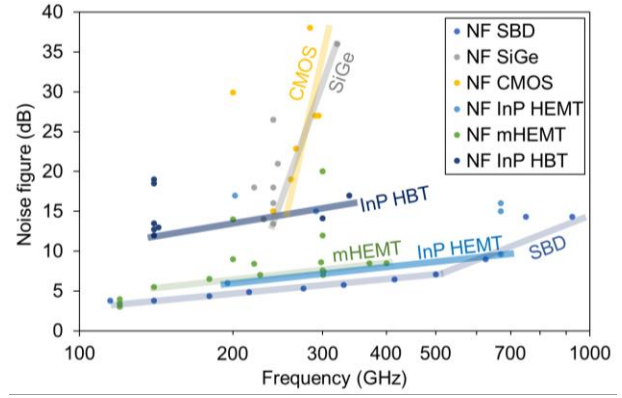
[Ref] R. Kovalchukov, D. Moltchanov, Y. Gaidamaka, and E. Bobrikova, “An Accurate Approximation of Resource Request Distributions in Millimeter Wave 3GPP New Radio Systems,” [Online]. Available: arXiv:1908.08872 [cs.NI] https://arxiv.org/abs/1908.08872

Terahertz Systems Consortium
6G Working Group Activity Report for FY2022
(Summary)









- Backhaul/Fronthaul
  - Uses InP-based PA or TWTA on the transmitter side and InP-based MMIC receiver on the receiver side
    → System requirements have already been met
- Mobile communication
  - InP-based MMIC receiver on the receiver side satisfies the requirements
  - Further improvement of PA output and signal source output is needed on the transmitter side
- Bands where physical limitations of Si-based devices are clearly observed
  - Device combinations will differ between the 200 GHz band and the 300 GHz band

- These results have already been published in the following ITU journals in June 2023.
- However, they are only available in Japanese.
- https://www.ituaj.jp/?itujournal=2023_06

一般財団法人 日本ITU協会

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← 2023年5月号　バックナンバー　2023年7月号 →

2023年6月号

直近の2号はどなたでもダウンロードが可能です

トピックス

「第55回世界情報社会・電気通信日のつどい」開催

一般財団法人日本ITU協会　企画部

特集　Beyond 5Gへの展望 —「Beyond 5G国際カンファレンス」より—

2030年代の社会基盤を支えるBeyond 5G実現に向けて
—「Beyond 5G国際カンファレンス2022」の開催 —

栗原　渉

Beyond 5Gに向けた時空間同期技術

原　基揚

次世代移動通信（6G）におけるテラヘルツ無線通信のシステムとデバイス
—テラヘルツシステム応用推進協議会6Gワーキンググループ活動報告—

齋迫　巌／鈴木　左文／矢吹　歩

東芝の量子暗号通信に関する研究開発と実証

米良　恵介

Beyond 5G時代のイノベーション高速化を支えるテストベッド

西角　直樹

Discussion on MMW dissemination methods and their expansion to THz waves.

- As materials for discussion, interviews have so far been held with two operators and two vendors.

- Discussion from the following perspectives
  - Physics
  - Human-centered principles
  - Wireless Technology
  - Energy Efficiency
  - Economical Aspects

- Discussions will be held after the hearings and reports will be made (in FY2024).

- WRC-23 has made a couple of decisions, which are relevant for MMW&THz bands
- In response to the results of WRC-23, it is necessary to consider what future responses will be required and to create a corresponding group for each response.

- Summary of WRC-23 Results for MMW & THz

1. RESOLUTION COM6/23 (WRC-23)
   Agenda for the 2027 world radiocommunication conference
   1.8 to consider possible additional spectrum allocations to the radiolocation service on a primary basis in the frequency range **231.5-275 GHz** and possible new identifications for radiolocation service applications in the frequency bands within the frequency range **275-700 GHz** for millimetric and sub-millimetric wave imaging systems, in accordance with Resolution 663 (Rev.WRC-23);
2. RESOLUTION COM6/25 (WRC-23)
   Preliminary agenda for the 2031 world radiocommunication conference
   2.1 to consider potential new allocations to the fixed, mobile, radiolocation, amateur, amateur-satellite, radio astronomy, Earth exploration-satellite (passive and active) and space research (passive) services in the frequency range **275-325 GHz** in the Table of Frequency Allocations of the Radio Regulations, with the consequential update of Nos. 5.149, 5.340, 5.564A and 5.565, in accordance with Resolution COM6/13 (WRC-23);
   2.6 to consider the identification of the frequency bands [**102-109.5 GHz, 151.5-164 GHz, 167-174.8 GHz, 209-226 GHz and 252-275 GHz**] for International Mobile Telecommunications, in accordance with Resolution COM6/17 (WRC-23);

Conclusion

- The technical foundation is in place for simple use cases (P2P) in THz. (FY2022)

- MMW dissemination is being discussed from THz perspective (FY2023)

- WRC-23 has made a couple of decisions, which are relevant for MMW&THz bands
  - An unprecedented interest has been shown in the use of high-frequency waves.
  - However, the general public has not been informed of this situation, so it is vital to first inform people about the status of the WRC-23 and get their attention

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