

# mmW Standards: 5G NR and WiGig/802.11ay

Discussion of the strengths and weaknesses of emerging mmW standards, including synergy between WiGig/802.11ay (WiFi) standards, and 5G NR (including cellular) standards.

# Discussion Structure

## **Agenda**

- Introduction (15 mins)
- Open Discussion (70 mins)
- Wrap-Up (5 mins)

## **Discussion leaders**

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# General Discussion Points

- What are the key differences between 5G NR standards and 802.11ad/ay standards? What can we do in 5G NR standards that we cannot in 802.11ad/ay and vice versa?
- What is the killer application in mmW WiFi/cellular networks? Impact on standards?
- What are pros and cons of high and low mmW frequencies from a standards viewpoint?
- Why are there only few 11ad devices available?
- What can we learn from launching 802.11ad to make 802.11ay and 5G NR a success?
- Should future WiFi standards adopt/mandate a more centralized approach for better spectrum management/spatial reuse, given the provisions for scheduled access in 11ad/ay.
- 802.11ay supports MU-MIMO. What will be the use cases and key challenges in multi-user operation?
- How will 5G and 802.11ad/ay devices coexist? What are the key challenges?
- How will the asymmetry between uplink and downlink due to BS-UE array size (similar for 11ad/ay, downlink MU-MIMO) affect network performance?

# Beam Training

- Do the standards support precise yet effective device localization for beam training?
- Should beam-training be standardized or left open for customized scenarios?
- How to incorporate side-band/sensor information to assist beam training in 11ay/5G NR standards.
- The current phased array platforms (commercial/testbeds) show wide, non-uniform beam patterns with side lobes, contrary to the earlier "pencil beams" assumption. Is it still a question of finding "the best beam"? What are operational implications?
- 802.11ay supports MU-MIMO. How to make beam training scalable for multi-user transmissions? Will it be a limiting factor for implementing MU-MIMO?

# mmW Channel Modeling and System Design

- MmW supports multiple bands. What are the key elements of a channel model for comparing different approaches within the constraints of the 5G NR/802.11ay standards?
- What traffic models should be used to capture key requirements for 5G/11ay?

# D2D and Ad-hoc Cmmunications

- Do the 5G NR/802.11ay/ad standards support decentralized channel access in highly directional networks?
- Is centralized control a better approach for spatial reuse even in ad-hoc networks (11ad/ay model)?
- Does frequent beam sweeping pollute the channel in D2D communications or dense networks?

# Hardware, Prototypes, Testbeds, and Simulators

- What are key requirements on prototypes and testbeds from the viewpoint of evaluating and developing standards?
- How can industry help facilitate academic research and related collaborations?
- What are important considerations for research at the hardware-signal processing (HW-CSP) interface from the viewpoint of supporting the functionality of standards?
- What aspects of the standards are critical from the viewpoint of PHY and channel abstraction in network simulators?
- How can large-scale testbed be best utilized for future refinements/development in the standards? (The NSF PAWR program is facilitating the development of such platforms)