

**3<sup>rd</sup> mmW RCN Workshop**  
**Jan 18-19, 2018**  
**University of Arizona, Tucson**

## **Breakout Discussion Session: 5G NR and 802.11ad/ay Standards**

**Discussion leaders:** Daniel Steinmetzer (T. U. Darmstadt), Muhammad Kumail Haider (Rice U.), and Sarah Yost (National Instruments)

There is currently significant ongoing work on the development of standards for mmW technology: 5G NR standards for 5G cellular networks, and 802.11ad/ay standards for mmW WiFi networks. The goal of this breakout is to discuss the status of the two standards, their key elements, their similarities and differences, and their impact on research and development of mmW technology, especially in the context of the ongoing RCN activities.

### **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?
- 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?
- How to incorporate side-band/sensor information to assist beam training in 11ay/5G NR standards.
- 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?

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**D2D and Ad-hoc Communications**

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

**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)