

# The 3<sup>rd</sup> Workshop

## NSF Research Coordination Network on Millimeter-Wave Wireless

Panel 1: State of mmW Technology and Outlook:  
A View from Industry

Thursday, January 18, 2018

# Panel 1: State of mmW Technology and Outlook: A View from Industry

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- Theme: Updates and discussion on technology advances, use cases, business models, regulations, and standardization
- Moderator:
  - Ismail Guvenc (NC State University)
- Panelists:
  - Vasanthan Raghavan (Qualcomm)
  - Amitava Ghosh (Nokia Bells Labs)
  - Sarah Yost (National Instruments)
  - Andrew Thornburg (AT&T)
- Format: Moderator opening remarks (5 min); panelists opening remarks (3-5 minutes each), followed by panel discussion and audience questions.

# Summary of Key Discussion Points from July 2017 Panel (1)

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- Significant developments
  - The 5G NR (new radio) standard work
  - Studies on the impact of mobility on beamforming; new spectrum opening throughout the world
  - Including China and Japan; new prototypes and field trials from industry; 3GPP work on channel modeling
  - For standardization; investigation of higher frequencies 70-90GHz; relevant work in Europe (Horizon 2020, mmMagic).

# Summary of Key Discussion Points from July 2017 Panel (2)

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- Significant next steps
  - Over the air (OTA) testing with mobility, multiple users and base stations;
  - Mitigating blockage effects;
  - Integrated backhaul and access (a new 3GPP study item);
  - Thermal management at access points;
  - Cross-layer design issues

# Summary of Key Discussion Points from July 2017 Panel (3)

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- How the new NSF PAWR program could benefit mmWave research
  - Testing and experimentation on city/scale with high densification;
  - A/B testing;
  - Collaboration between industry and academia
- WiGig/802.11ay work:
  - Some similarities in terms of beamforming protocols, but...
    - 802.11ay is aimed at shorter WiFi links
    - 5G NR standard was aimed a larger scale cellular networks

# Summary of Key Discussion Points from July 2017 Panel (4)

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- Challenges and promising directions
  - Design of efficient power amplifiers identified as an important outstanding challenge;
  - Integrated communication and sensing, including mmWave radar, was identified as a promising area, especially in automotive industry;
  - The need for accurate channel models for different environments (urban, rural, indoor, outdoors, etc) and for different use cases (e.g., UAVs and V2X);
  - General consensus that fixed wireless access is the likely first use case that will take traction.

# Major Developments Since Last Workshop (1)

## First 5G NR Specs Approved

December 22, 2017

In his RAN report to the TSG SA Plenary – at the end of a week of meetings in Lisbon, Portugal – Balazs Bertenyi presented details of the group's approval of the Non-standalone 5G NR specifications and also outlined how RAN will now turn towards the completion of Release 15, by June 2018.

Balazs Bertenyi also spoke about the need to progress on some key study items for 5G Phase 2 work – to be specified in Release 16 - in the coming months, but he emphasised that the group will be maximising meeting time to complete Release 15 NR. The report stated: "Until March 2018, RAN Working Groups shall prioritize Option-3 stabilization and the Option-2 specification work...Migration to Option-4 and Option-7 starts as soon as Option-2 and Option-3 are stabilized."



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NSA 5G NR specs were approved today at RAN#78. Balazs Bertenyi, RAN Chair called it "an Impressive achievement in a remarkably short time, with credit due particularly to the Working Groups". News article to follow on the 3GPP site and from 3GPP Member announcements.



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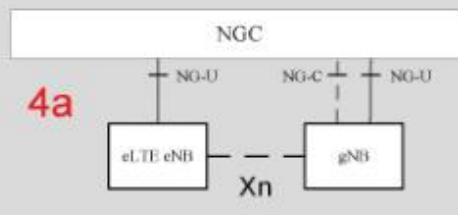
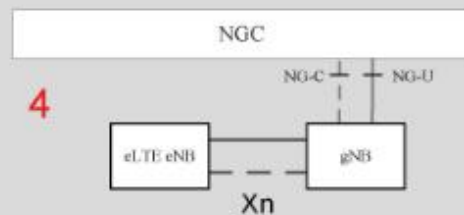
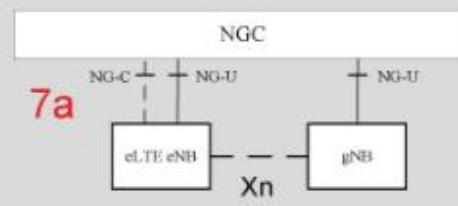
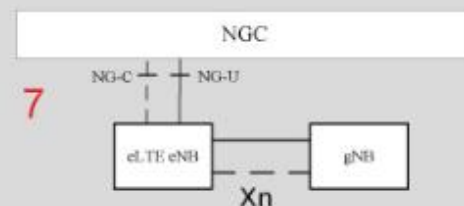
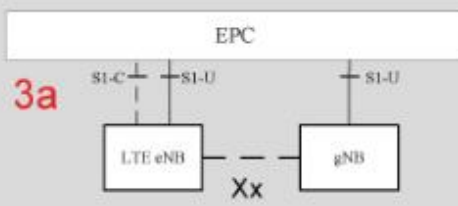
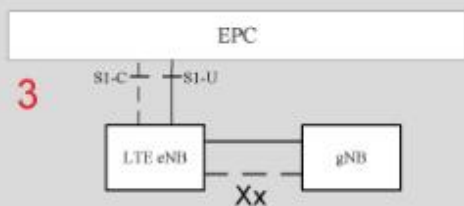


[http://www.3gpp.org/news-events/3gpp-news/1929-nsa\\_nr\\_5g](http://www.3gpp.org/news-events/3gpp-news/1929-nsa_nr_5g)

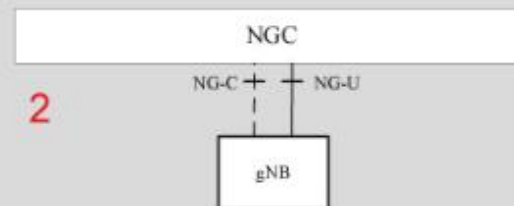
# Major Developments Since Last Workshop (2)

## New RAN Architecture Options

Dual Connectivity



Single Connectivity



[http://www.3gpp.org/news-events/3gpp-news/1929-nsa\\_nr\\_5g](http://www.3gpp.org/news-events/3gpp-news/1929-nsa_nr_5g)



# Questions to Seed Discussions

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- What are the new advancements and emerging challenges in the last 6-12 months?
- What are the implications of the first 5G NR specification?
  - When/how we will see deployments, equipment, SDRs?
  - What is the 3GPP agenda on mmWave for the upcoming releases?
- What are your views on mmWave verticals/usecases, e.g.:
  - URLLC (next in 3GPP agenda?)
  - Unmanned aerial vehicles (new 3GPP technical report in Dec. 2017 )
  - Vehicular-to-X and autonomous vehicles
  - Integrated communications/sensing/localization/radar
  - Integrated backhaul and access
  - Machine learning
- What are the key research challenges/problems that academia may contribute? Roles of modeling, analysis, experiments, simulations?