

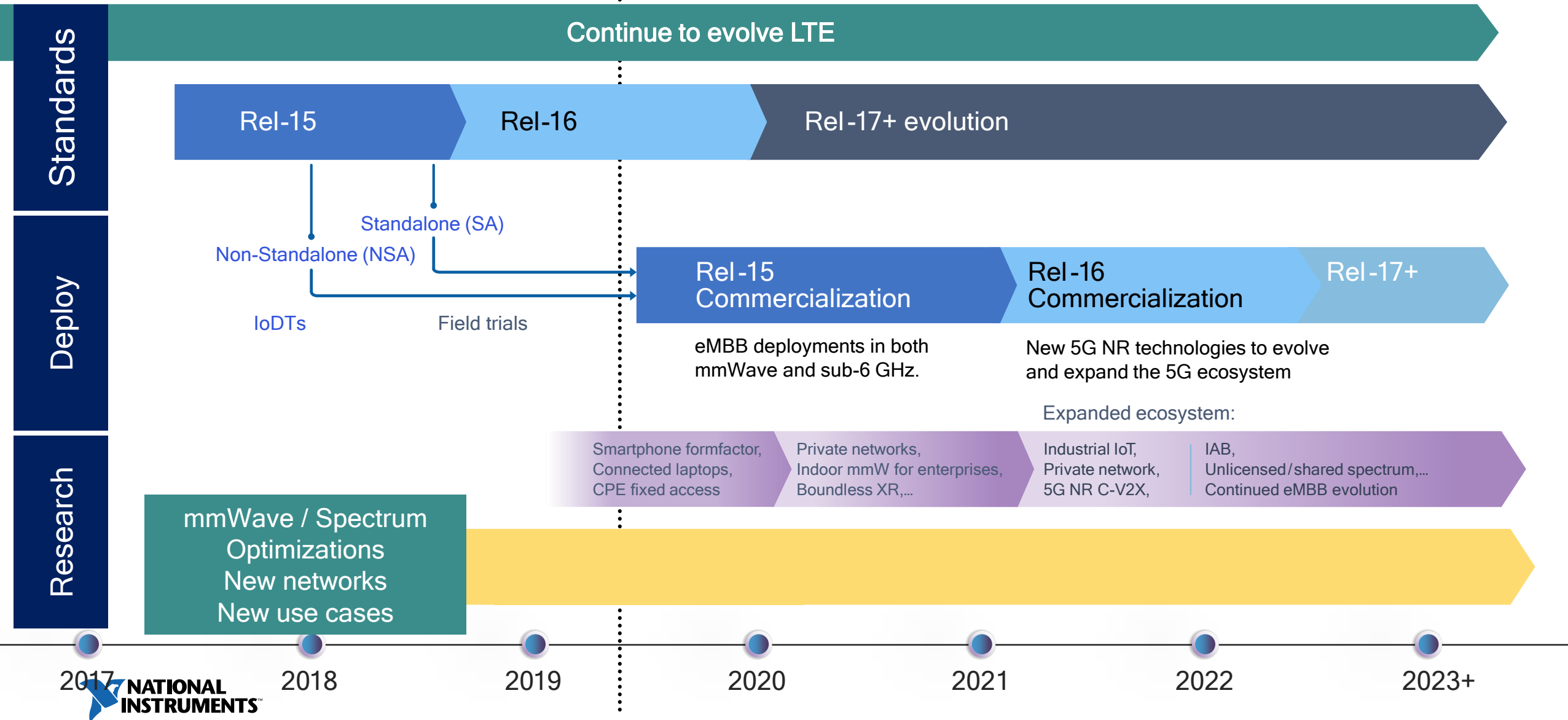
State of mmW Technology and Outlook: A View from Industry

National Instruments

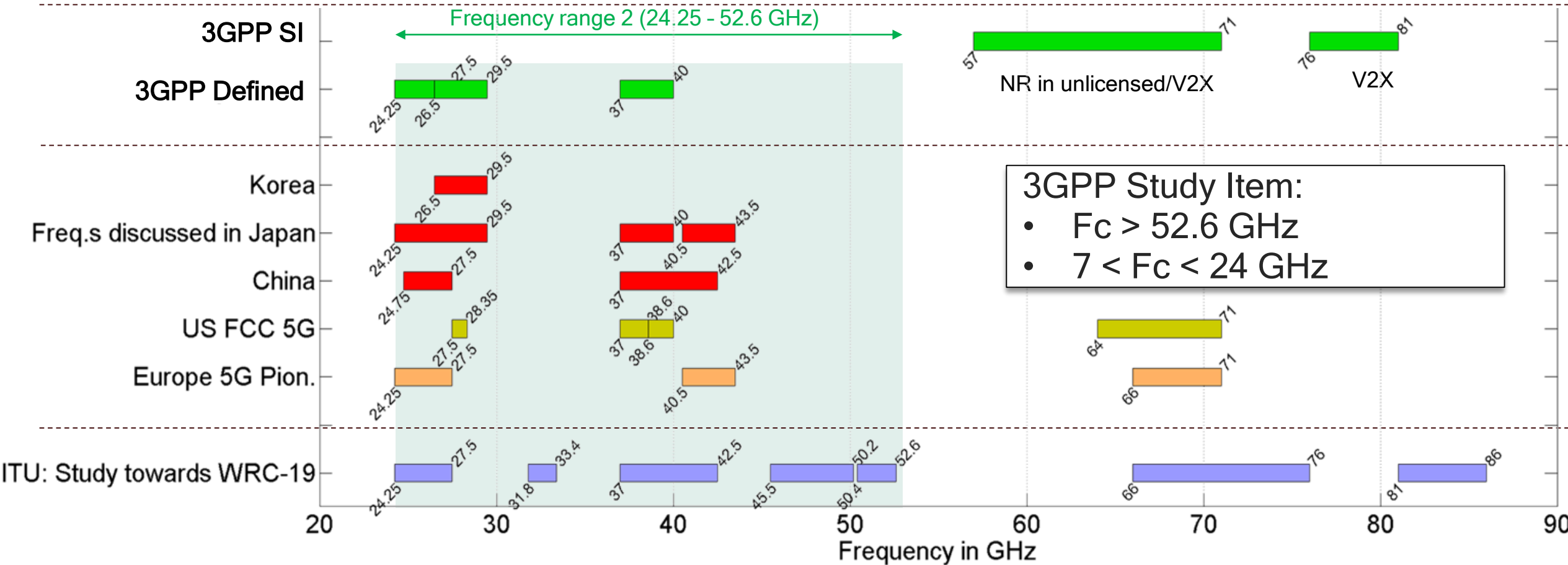
Sarah Yost

Senior Product Marketing Manager

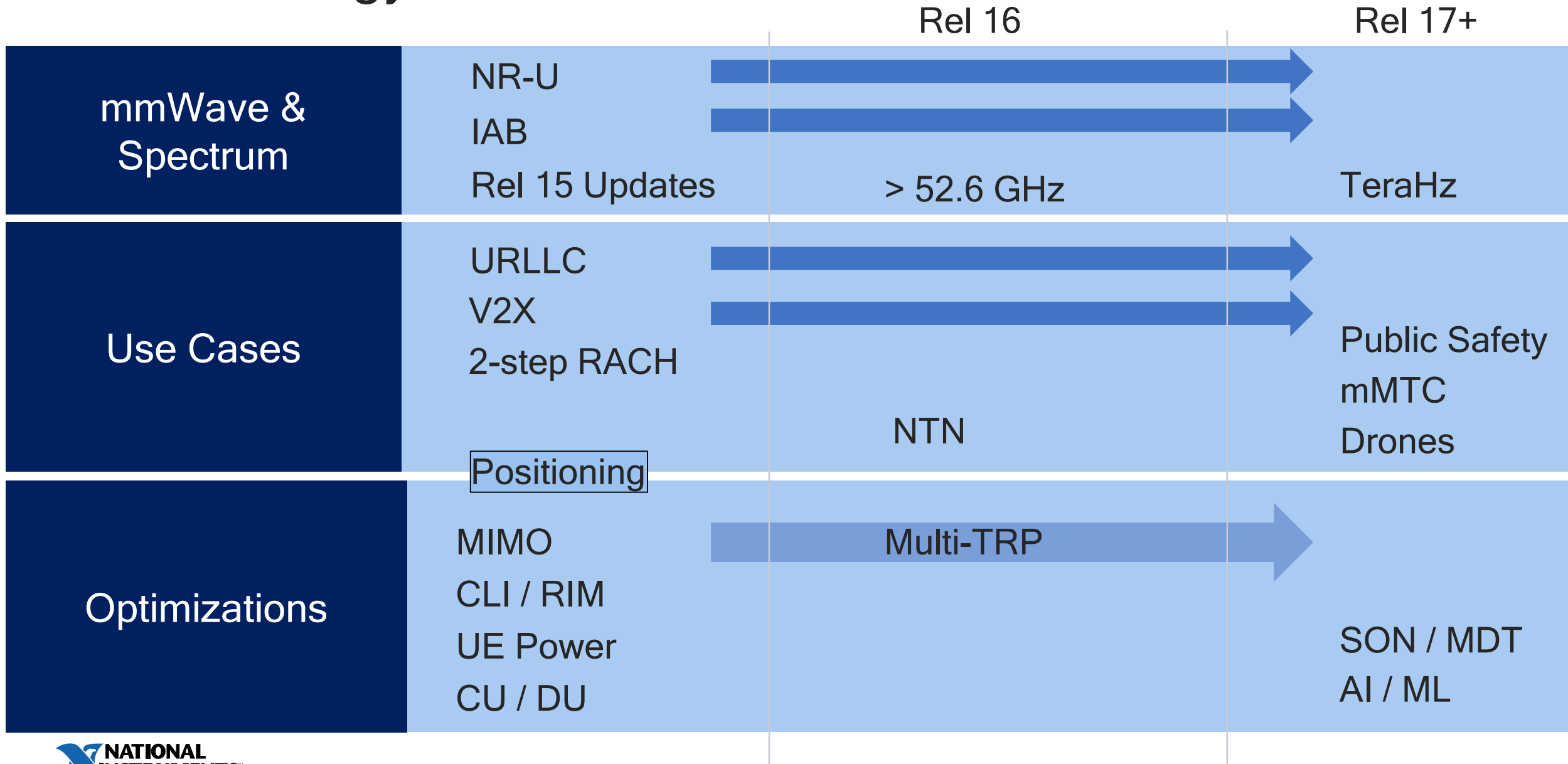
3GPP 5G Timeline



FR2: Spectrum Allocations



5G Technology Evolutions



mmWave and Higher Frequencies

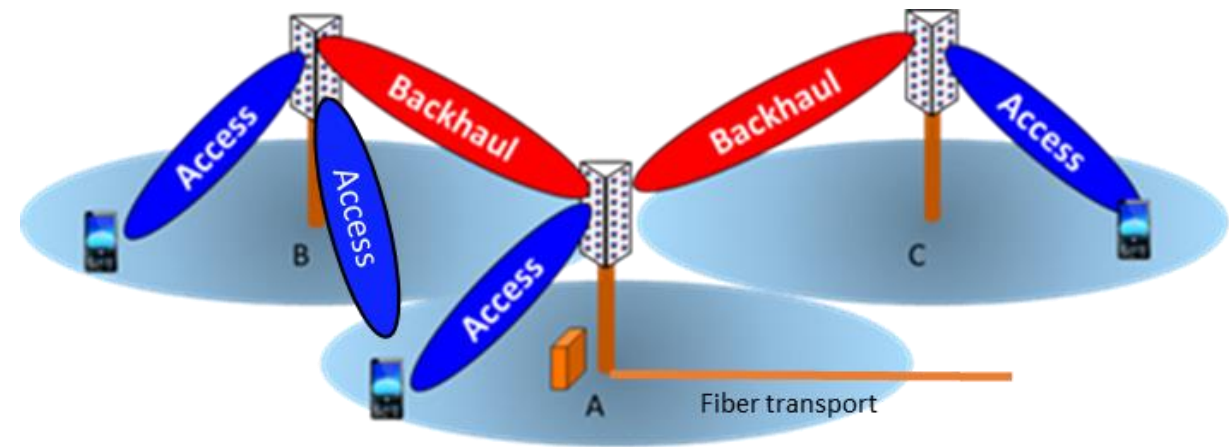
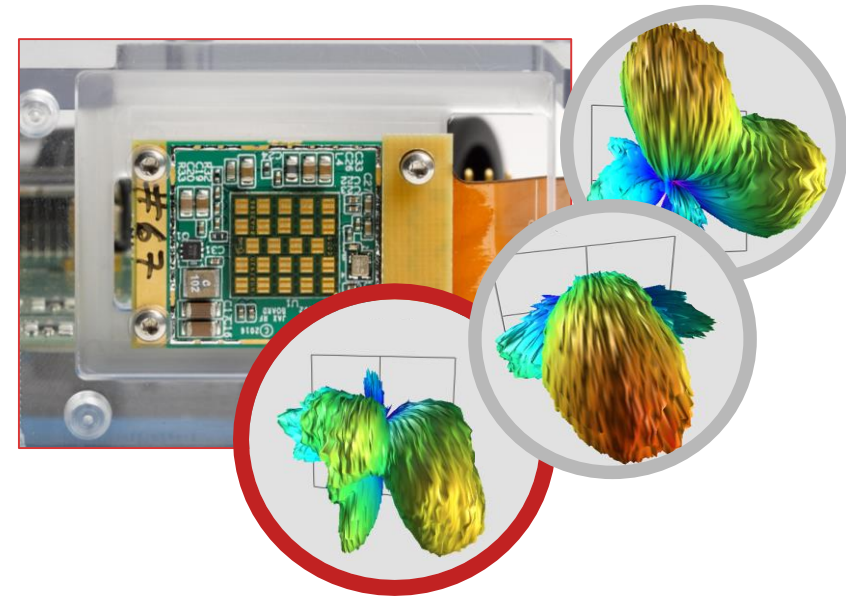
- *Short-term Focus:*
Fixed Wireless Access and Indoor Hotspots

Technical

- mmWave for Mobile Access is challenging
 - New CR's to be adopted in Rel 16
 - Reliable control
 - Power in the uplink
- Antennas and beam management

Business

- Commercial cost of running fiber to each gNodeB is very high
- Technology is expensive
- IAB is needed
 - IAB may undergo several updates



NR-U: The Need for More Spectrum

- FCC and ETSI investigating the band **5.925 - 7.125 GHz** for 5G NR
 - WiFi and 5G coexistence - LAA and LBT
 - Opportunities for optimization
- [Drivers in the US](#): Apple, AT&T, BCOM, Cisco, Facebook, Google, HPE, Intel, Microsoft, QCT, Verizon
- Headwind from satellite companies (e.g. INTELSAT & SES): interference might reduce performance
- mmWave spectrum also identified and under investigation

Band	Freq Range	Max Power
U-NII Low / U-NII-1 / U-NII Indoor	5.150–5.250	50 mW
U-NII Mid / U-NII-2A	5.250–5.350	250 mW
U-NII-2B	5.350–5.470	—
U-NII Worldwide / U-NII-2C / U-NII-2-Extended / U-NII-2e	5.470–5.725	250 mW
U-NII Upper / U-NII-3	5.725–5.850	1 W
DSRC/ITS / U-NII-4	5.850–5.925	—
U-NII-5	5.925 – 6.425	1 W
U-NII-6	6.425 – 6.525	250 mW
U-NII-7	6.525 – 6.875	1 W
U-NII-8	6.875 – 7.125	250 mW

- *FCC: Unlicensed use of the 6 GHz band; notice of proposed rulemaking*

NR-U Use Cases

- **LAA NR-U**
 - Boost existing deployments
 - Better user experience with higher speeds
 - Ex: AR, VR, AGV

- **Stand-alone NR-U**
 - Private 5G Networks
 - IIoT
 - Enterprise broadband
 - Open mobile broadband
 - Neutral host
 - Neighborhood network

Future

