

# Trans-Atlantic Symposium on Technology and Policy for a Smart Society

Minneapolis, Minnesota, U.S.A.

June 19-20, 2017



# 5G Networks: 5G Ultra-large Cell Technologies



**Berge Ayvazian**  
**Senior Industry Analyst and Consultant**

---

Wireless 20|20





# Ultra-large Cell Technologies



**Berge Ayvazian, Senior Consultant, Wireless 20|20**

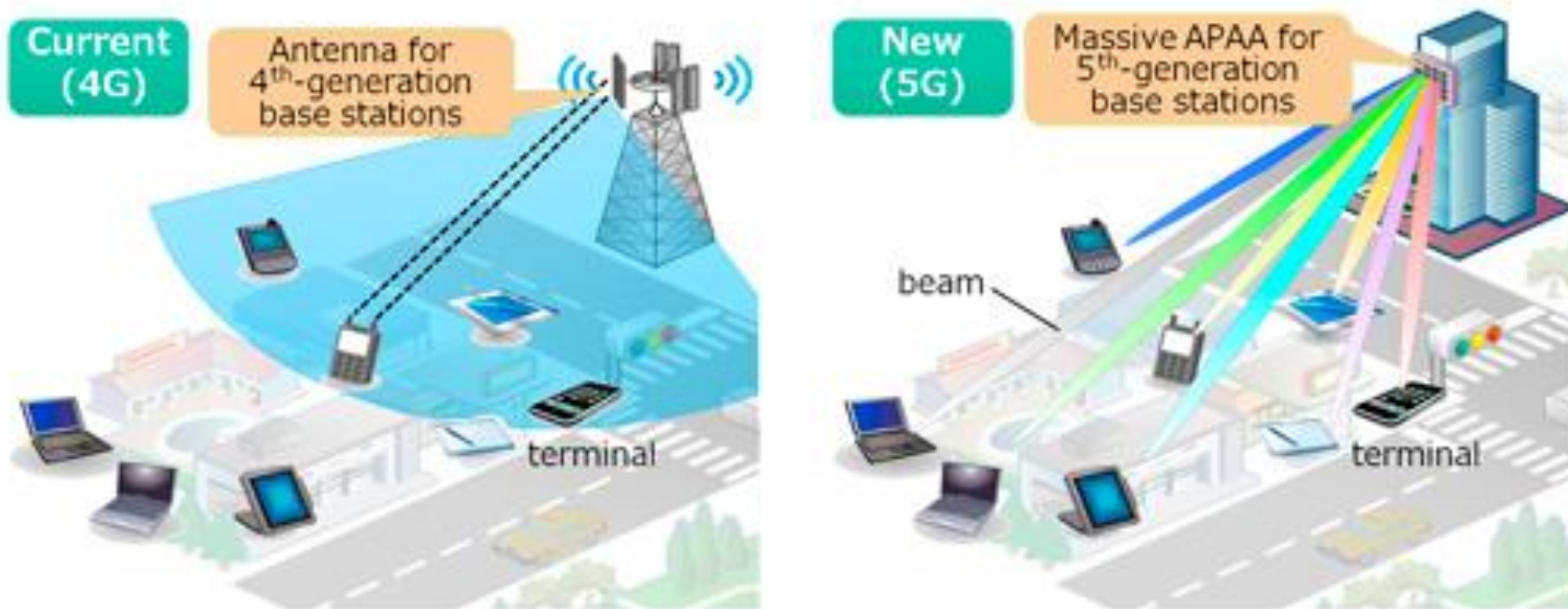
- 5G New Radios with Beamforming and Massive MIMO Large-scale Antenna Systems
- 5G NR standards are a 'work in progress'
- 5G NR needs global harmonization and alignment to achieve economies of scale
- Emerging 5G NR standards and technologies offer opportunities for EU-US cooperation
- Large scale 5G NR pilots worth highlighting



# Ultra-large Cell Technologies



## 5G New Radios with Beamforming and Massive MIMO Large-scale Antenna Systems



**Opportunity for 5G Technology innovation  
and Cooperation for EU and US**





# Ultra-large Cell Technologies



## 5G New Radios with Beamforming and Massive MIMO Large-scale Antenna Systems

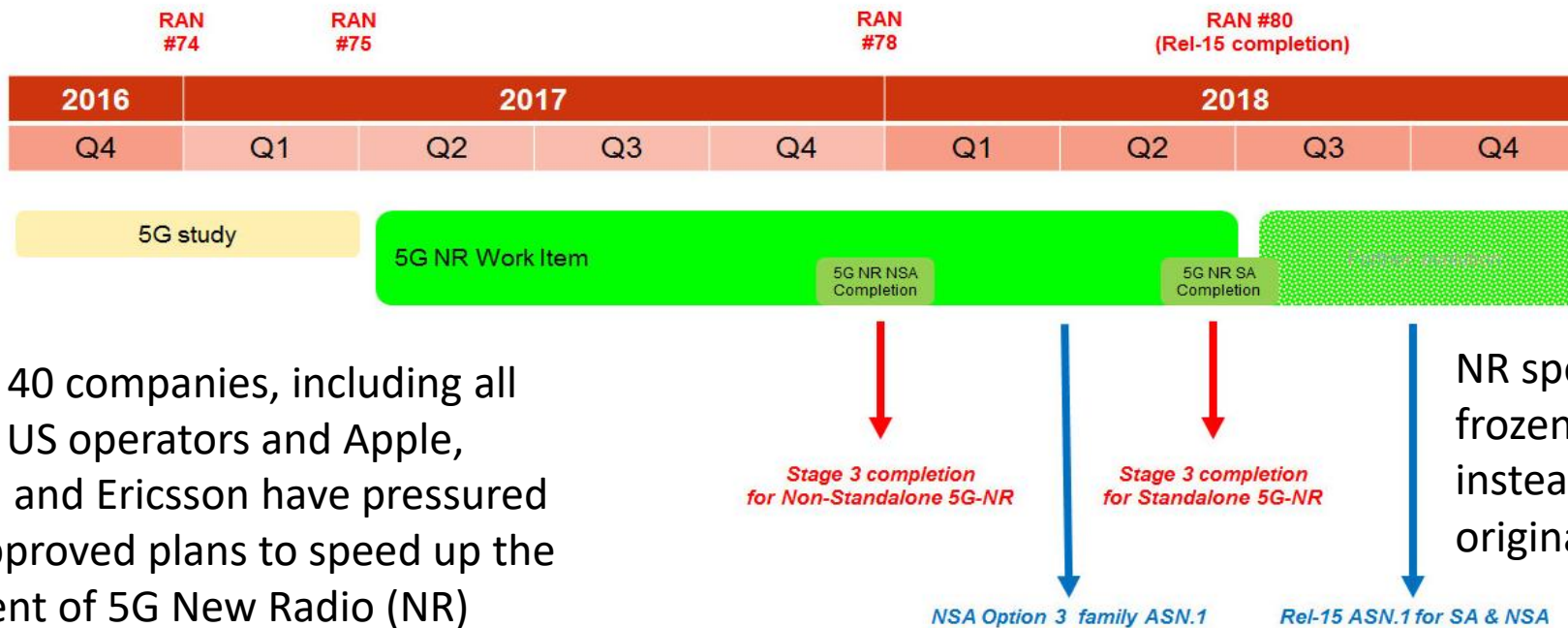
- **Two phase approach** to standardizing 5G New Radio specifications
- **Phase One** incorporates a mode known as **Non StandAlone (NSA)** – where the control of the 5G radio service is “anchored” in the LTE Evolved Packet Core to be completed in late 2017
- **Phase Two** would standardize **StandAlone Mode**, with 5G radio networks anchored by new 5G cores coming in 2018
- **Splitting the standards into two stages** means that operators can deploy “5G” services earlier than if vendors and device manufacturers had to wait for the full specs to be frozen.



Recent 3GPP decision will speed development of 5G New Radio (NR) specifications by six months to fast track 5G FWA with no delay in 5G NR



5G-NR eMBB workplan



More than 40 companies, including all four Tier-1 US operators and Apple, Qualcomm and Ericsson have pressured 3GPP to approved plans to speed up the development of 5G New Radio (NR) specifications by six months.

NR specifications will be frozen at the end of 2017 instead of in mid-2018, as originally planned

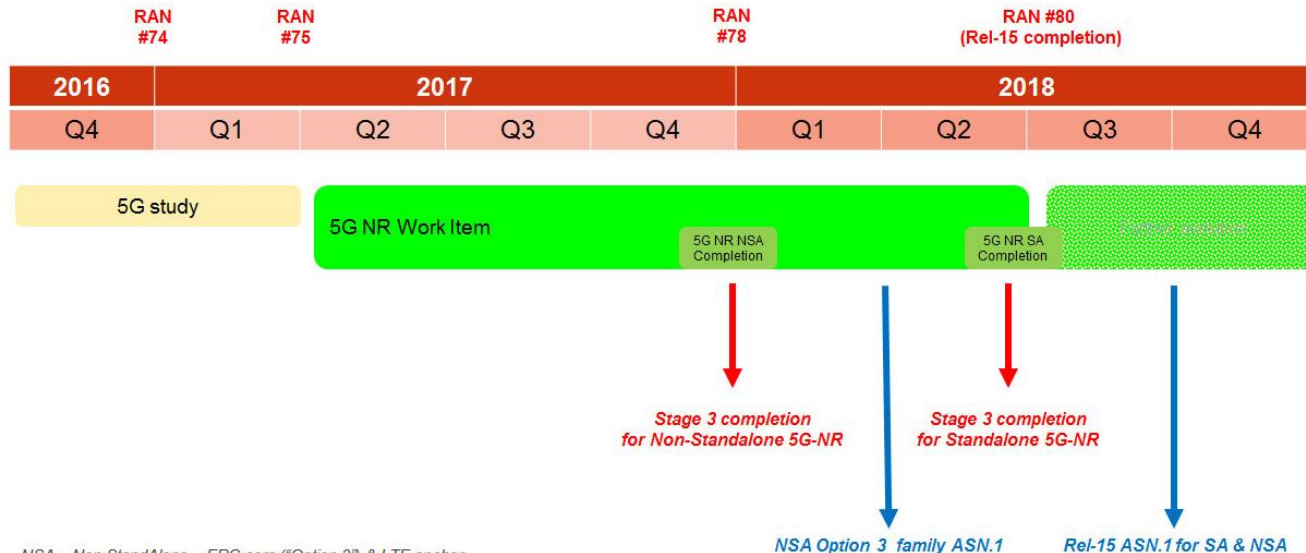
“Non-standalone“ version of 5G technology using 5G NR in conjunction with an existing 4G network could appear in 2019

# 5G NR standards are a 'Work in Progress'

## Need global harmonization and alignment to achieve economies of scale



### 5G-NR eMBB workplan



NSA = Non StandAlone = EPC core ("Option 3") & LTE anchor  
SA = StandAlone

**Accelerating**

# 5G NR

**for 2019 Commercial Deployments**

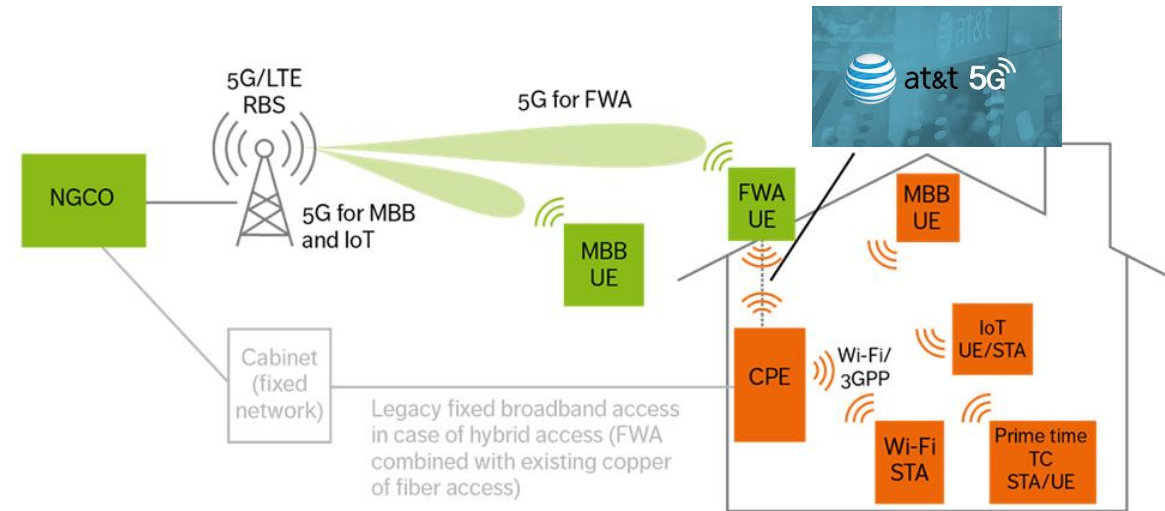
Emerging 5G NR standards and technologies offer opportunities for EU-US cooperation



# Large Scale 5G NR Pilots in US



## Verizon & AT&T 5G FWA Wireless Fiber Trial in 2017 Test 5G and mMwave for Gigabit BB to the Home



UE= 3GPP user entity  
STA= Wi-Fi station

# Trans-Atlantic Symposium on Technology and Policy for a Smart Society

Minneapolis, Minnesota, U.S.A.

June 19-20, 2017



## Smart Transportation and ICT: Topics For Collaboration



**Berge Ayvazian**  
Senior Industry Analyst and Consultant

---

Wireless 20|20





# Smart Transportation and ICT: Topics For Collaboration

**Berge Ayvazian, Senior Consultant, Wireless 20|20**

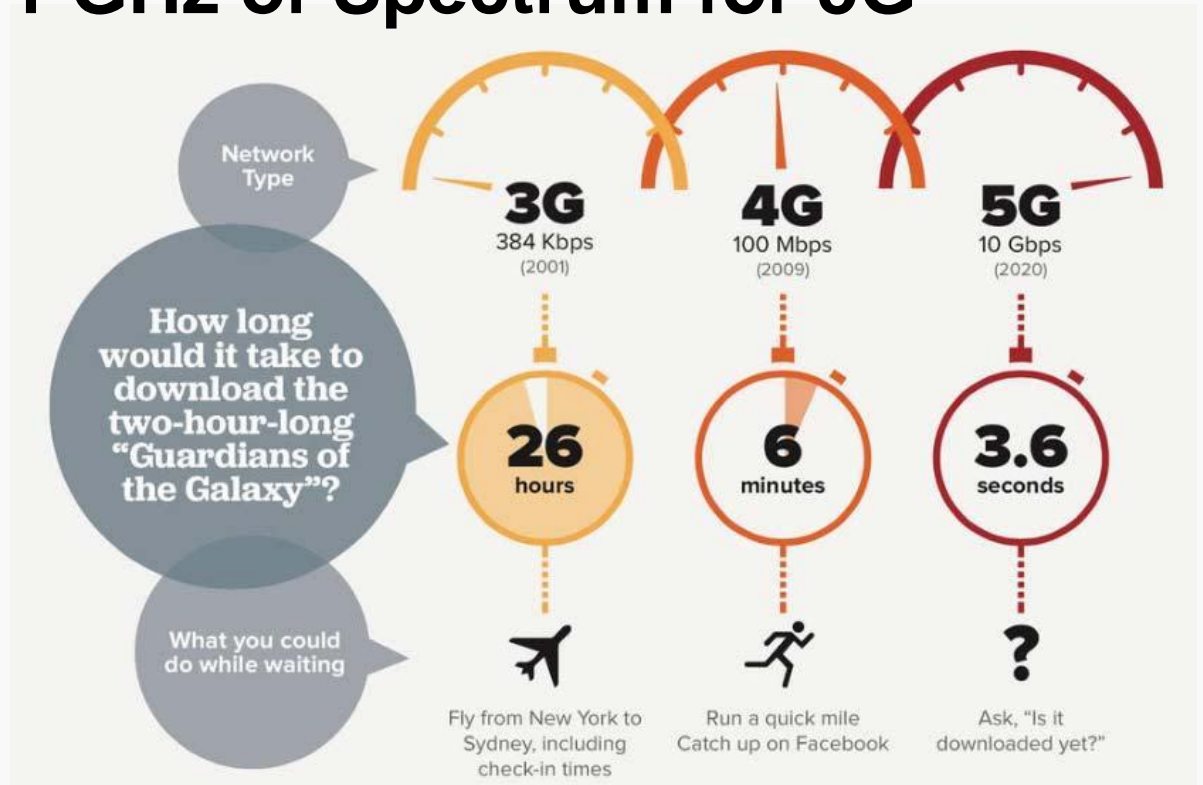
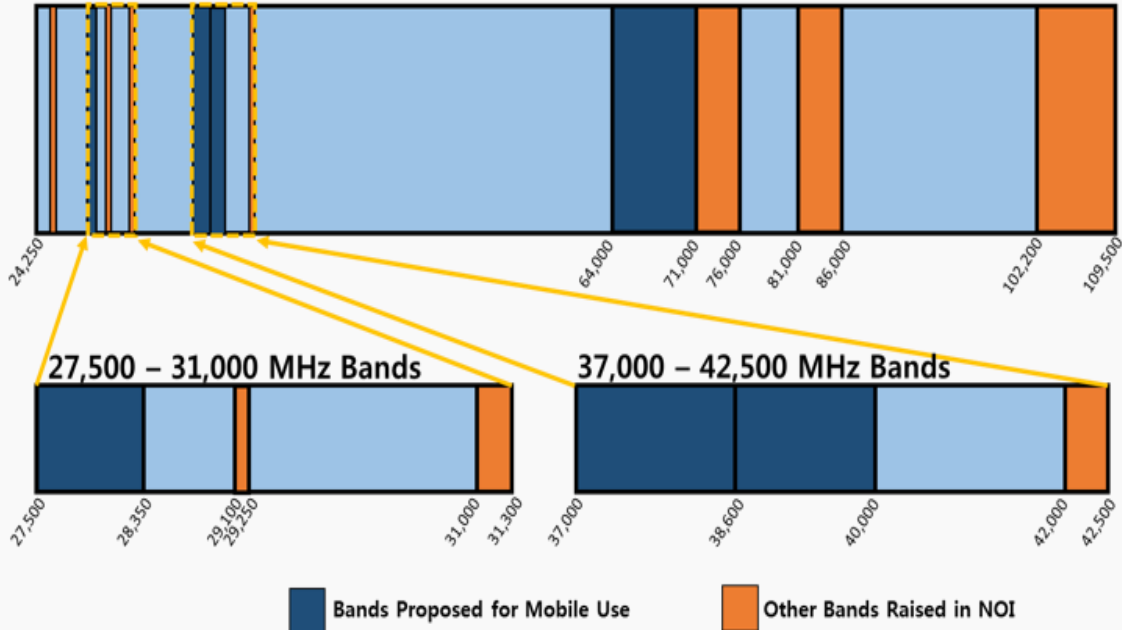
- Crucial role that 5G could play as an emerging technology for smart transportation  
Opportunities for 5G innovation in smart transportation/urban mobility for the EU and US
- What kinds of 5G standards are a ‘work in progress’ related to smart transportation, in need of global harmonization and alignment to achieve economies of scale?
- Emerging 5G smart transportation technologies that offer opportunities for EU-US cooperation
- Large scale pilots in 5G smart transportation worth highlighting
- Main barriers for developing EU-US RDI cooperation related to the emerging 5G technologies
- What should be taken into consideration in order to successfully establish EU-US RDI cooperation related to the emerging 5G technologies?

# Spectrum Policy Drives 5G Innovation

## How has the FCC done to date in allocating spectrum for 5G?



### FCC Unanimously Opens Nearly 11 GHz of Spectrum for 5G

Bands Above 24 GHz for Possible Mobile Use



# Spectrum Policy Drives 5G Innovation



Europe 	EU Council	FCC	USA 
		600 MHz band	Auction completed 39 months for repacking
By June 2020 for EU 5G	694-790 MHz	700 MHz band	Already licensed for LTE
C-Band for 5G pre-2020	3.4 – 3.8 GHz	3.5 – 3.65 GHz	CBRS shared
WRC-15 EU 5G	24.5 – 27.5 GHz		
		27.5 – 28.35 GHz	28GHz 5G
WRC-15 EU 5G	31.8 – 33.4 GHz		
		37.0 -38.6 GHz	37GHz 5G
		38.6 – 40 GHz	39GHz 5G
WRC-15 EU 5G	40.5 – 43.5 GHz		
		64 – 71 GHz	Unlicensed 5G

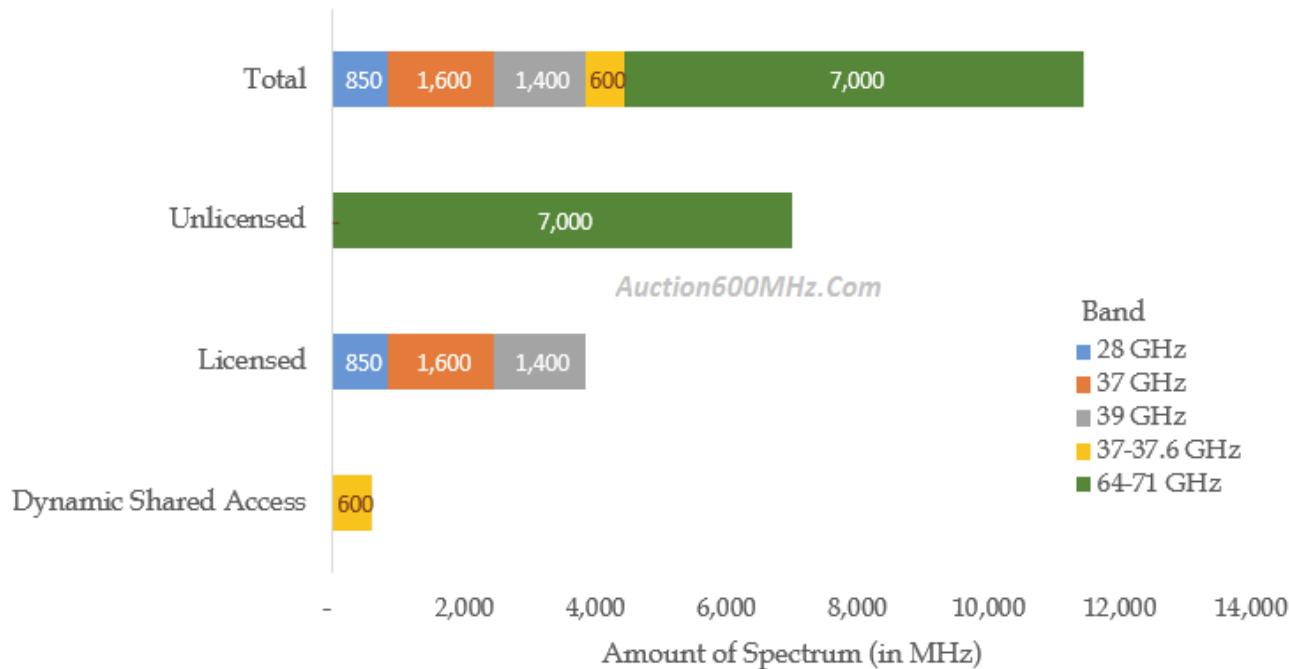
# Spectrum Policy Drives 5G Innovation



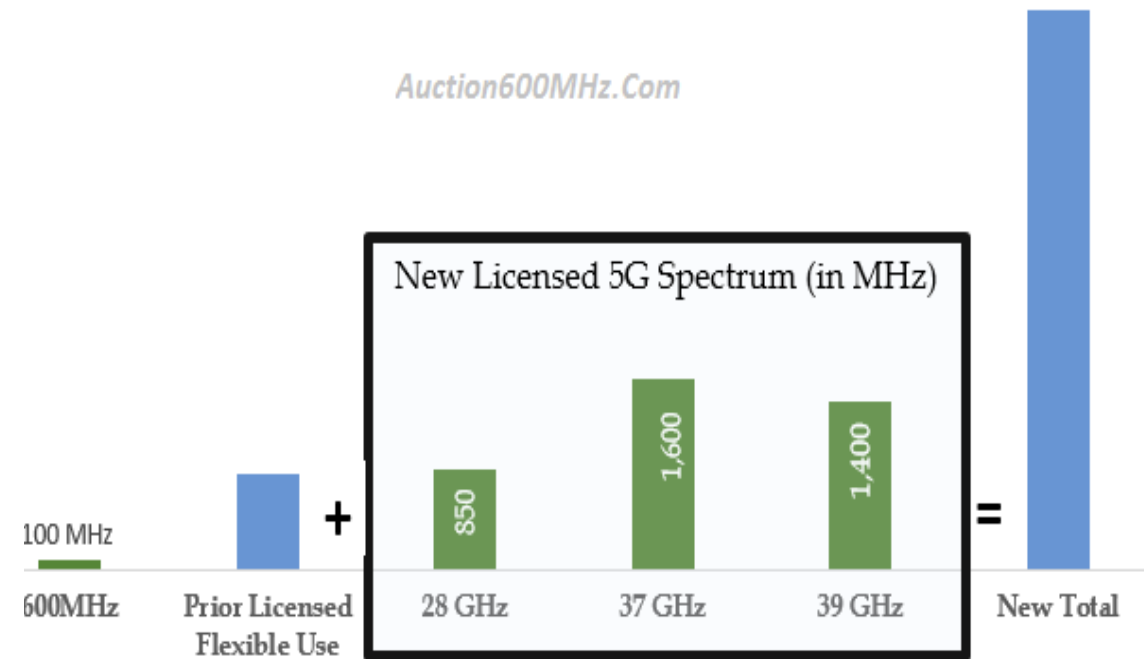
## US 5G Spectrum Policy will differ from 4G

Rely less on auctions and more on unlicensed and shared spectrum

NEW HIGH-BAND SPECTRUM FOR NEXT GENERATION (5G) WIRELESS BROADBAND (in MHz)

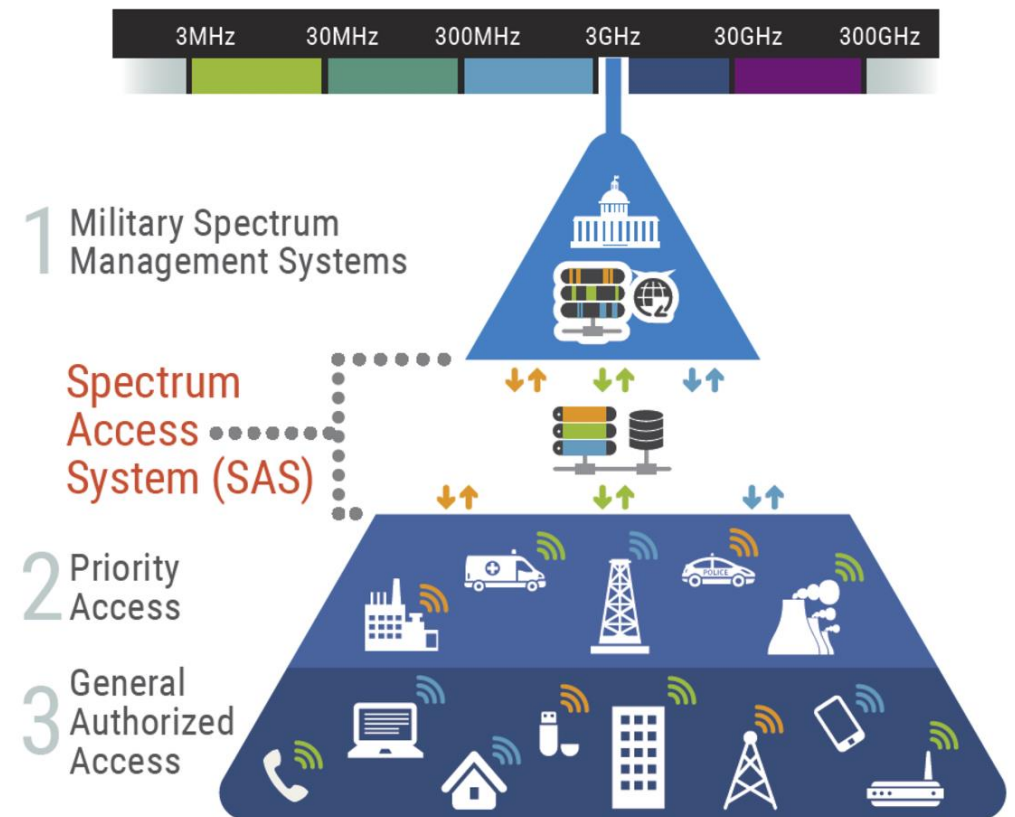


Licensed Flexible Use Spectrum Landscape



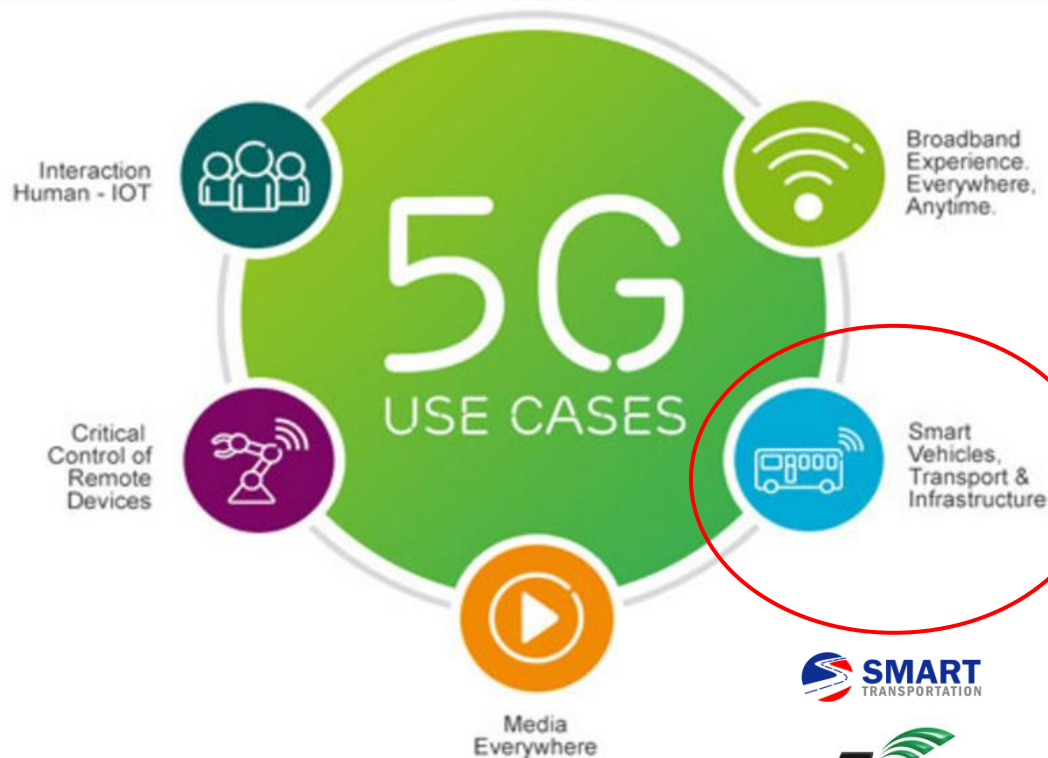
# Spectrum Policy Drives 5G Innovation

FCC's policy for CBRS spectrum sharing and SAS will serve as the foundation for 5G spectrum sharing



# Large Scale 5G Smart Transport Pilots Ericsson, Orange and PSA Group Conduct a 5G Automotive Technology Pilot

New 'Towards 5G' connected car partnership to use 4G - 5G technology to address connected vehicle intelligent transport systems (ITS) to improve road safety and new automotive services.



# How to Successfully Establish EU-US RDI Cooperation Related to Emerging 5G technologies

5G Automotive Association  
European Automotive - Telecom Alliance



Sign a Partnership MoU

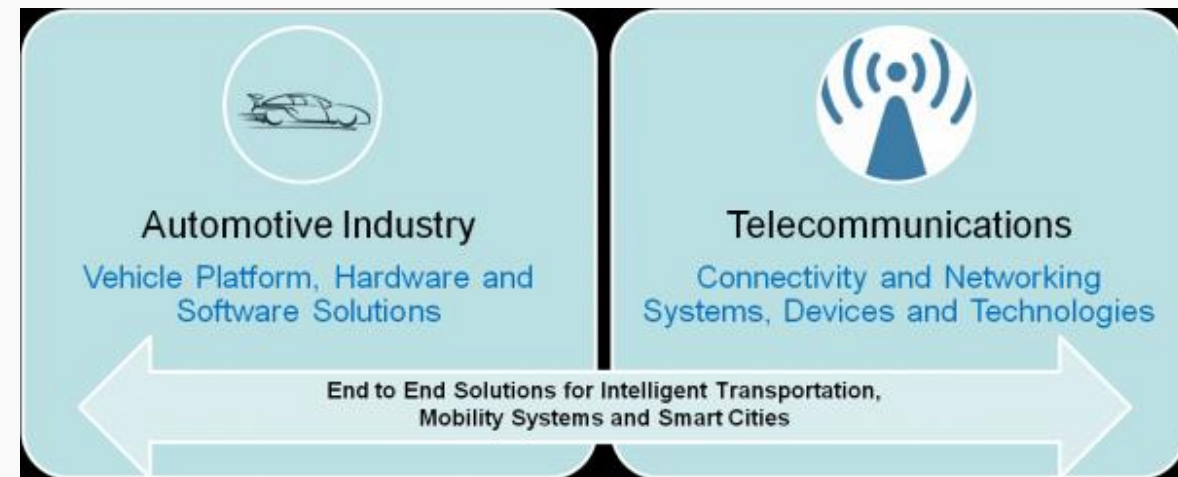
Audi, BMW, Daimler, Intel, Qualcomm, Ericsson & Huawei

And 37 telecom operators, vendors, automobile manufacturers and suppliers

Goal is to Address Society's Connected Mobility and Road Safety Needs with

Applications such as:

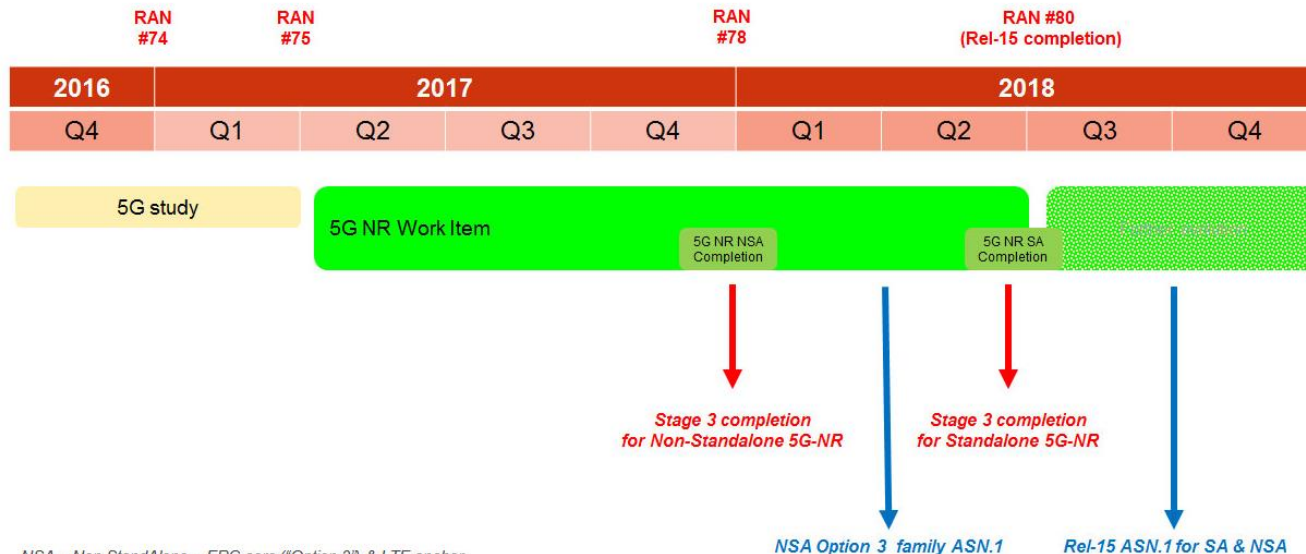
- Connected Automated Driving
- Road safety and traffic efficiency
- Intelligent Transportation Systems
- Ubiquitous Access To Services
- Integration Into Smart Cities
- Digitalisation of transport and logistics



# Main Barriers for Developing EU-US RDI Cooperation Related to 5G Technologies



## 5G-NR eMBB workplan



NSA = Non StandAlone = EPC core ("Option 3") & LTE anchor  
SA = StandAlone

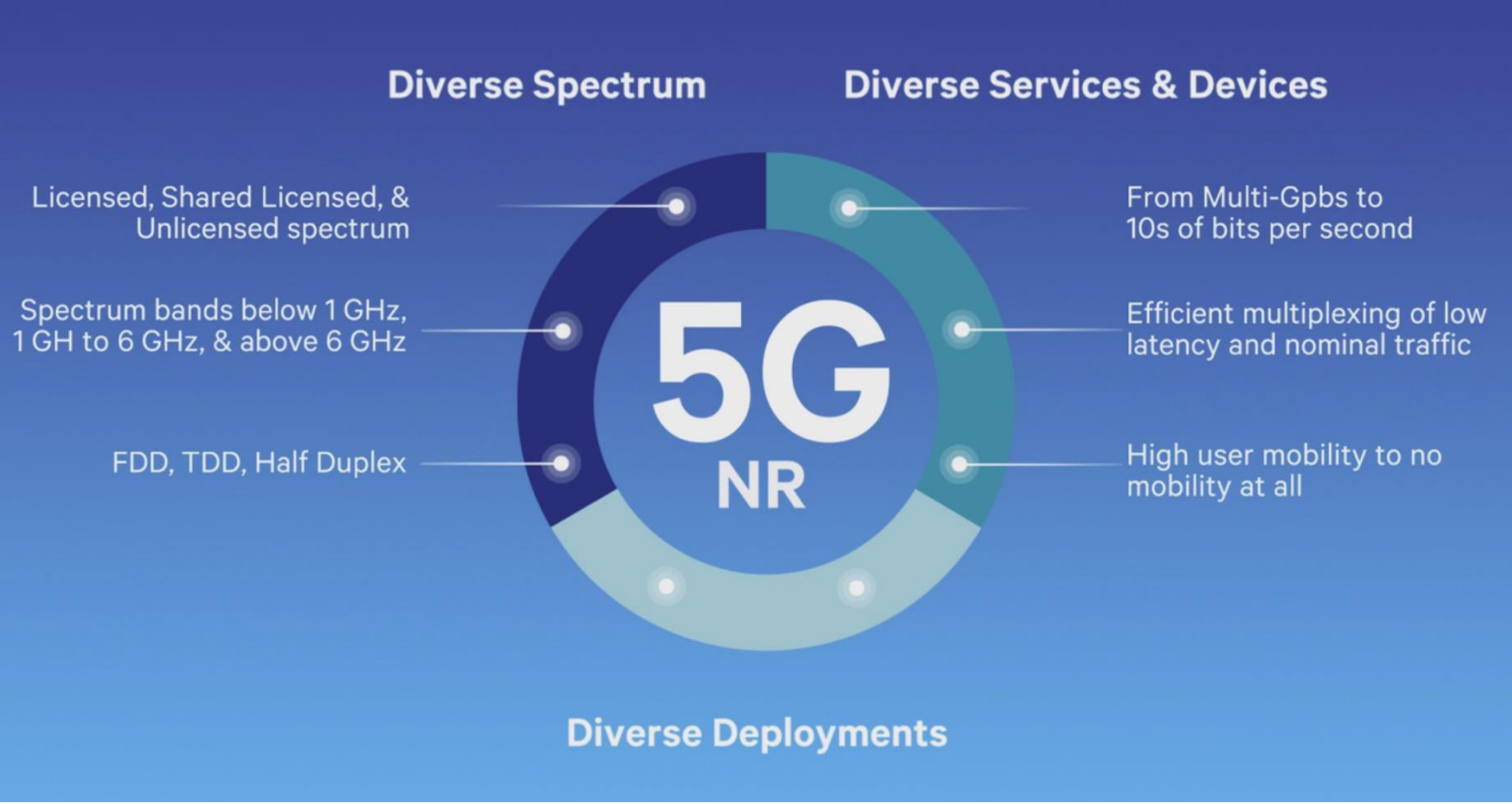
**Accelerating**

# 5G NR

**for 2019 Commercial Deployments**



# Opportunities for 5G Innovation in Smart Transportation & Urban Mobility for the EU and US





# Thank You!

Berge Ayvazian, Boston +1-617 803-6643

[berge@wireless2020.com](mailto:berge@wireless2020.com)

Randall Schwartz , San Francisco +1 650 490-3090

[randall@wireless2020.com](mailto:randall@wireless2020.com)

Haig Sarkissian New York +1 408 884-1561

[haig@wireless2020.com](mailto:haig@wireless2020.com)

