

January 2019

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Location

Qualcomm

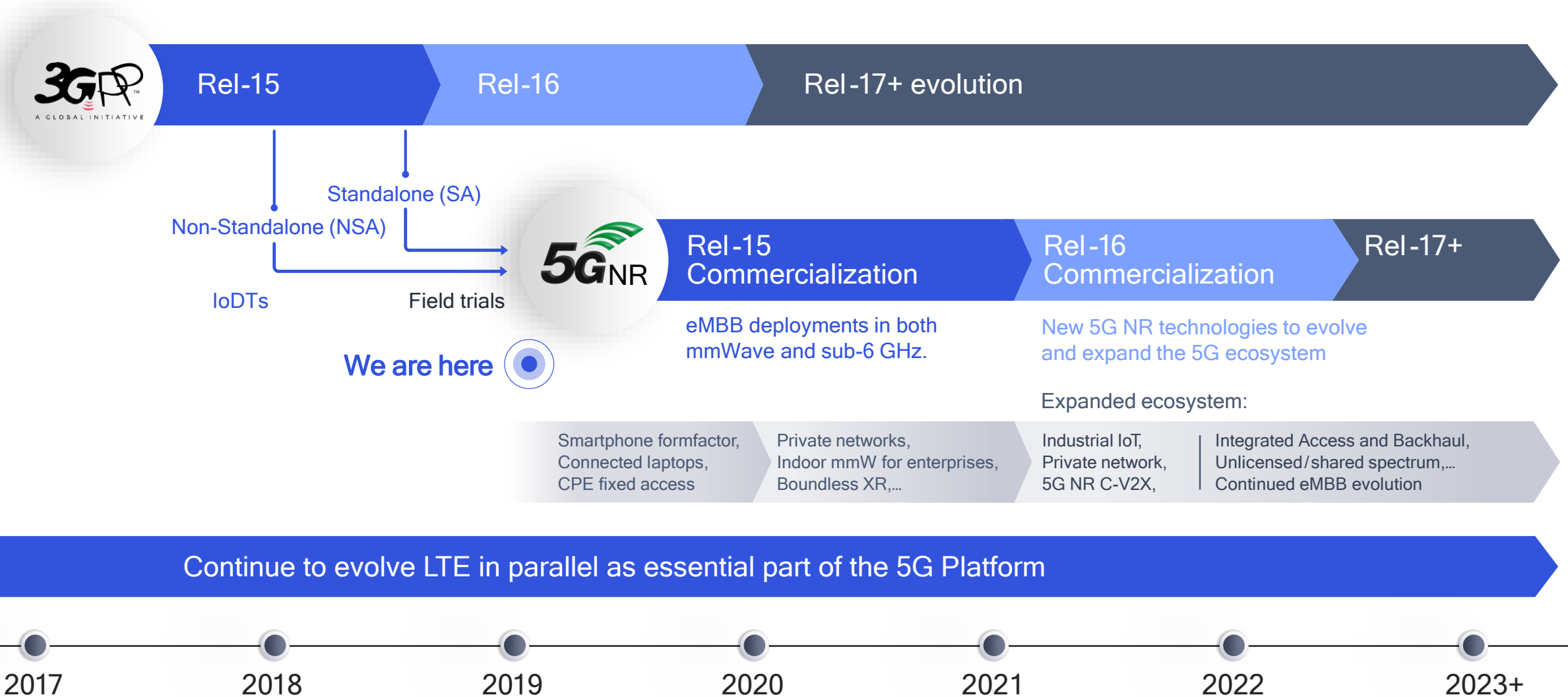
# State of mmW Technology and Outlook

Ozge Koymen

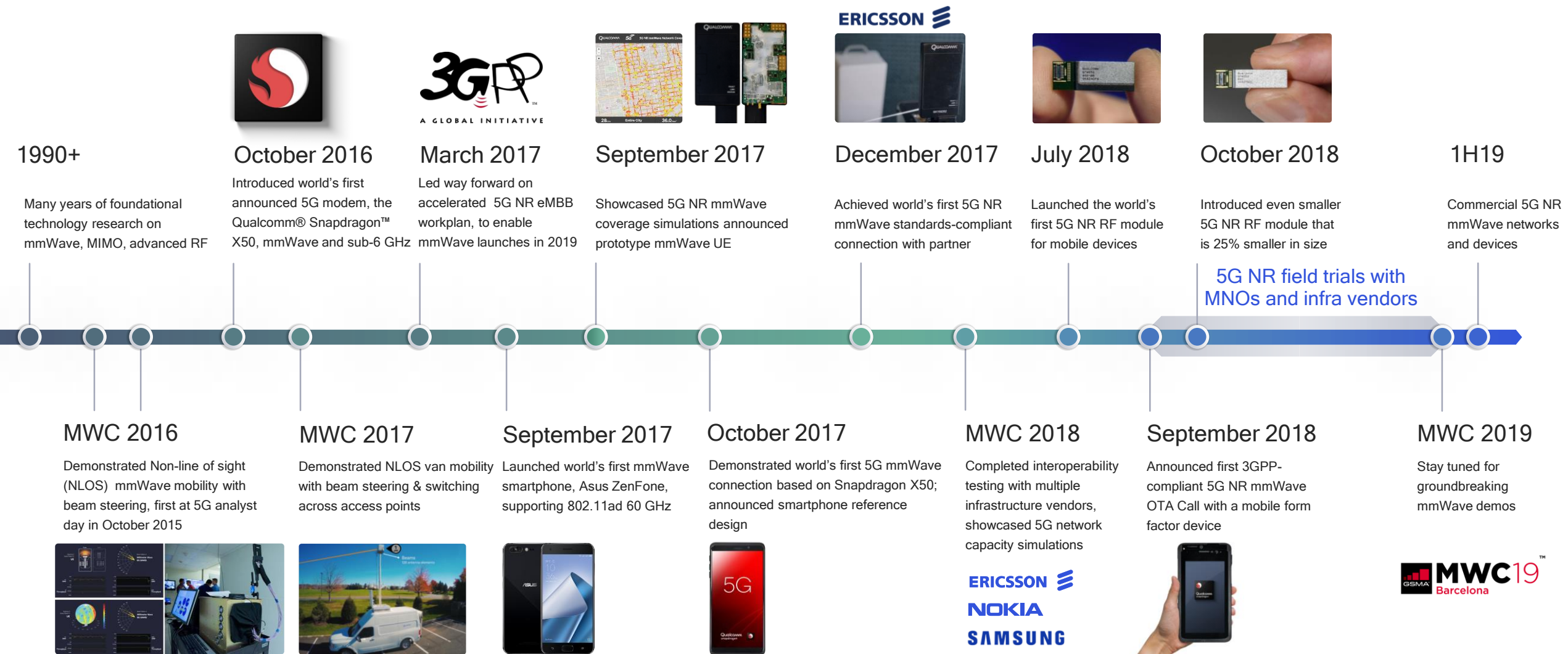
Senior Director of Technology



# Driving the 5G roadmap and ecosystem expansion



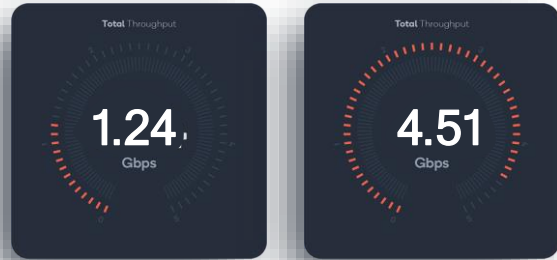
# Many milestones to mobilize 5G NR mmWave



Multi-Gigabit over mmWave on working Qualcomm® Snapdragon™ X50 5G modem silicon

5G NR Interoperability and field trials using form factor mobile test device

Providing Qualcomm® Reference Design to accelerate commercial devices



First 5G NR mmWave over-the-air data call, with Ericsson

First 5G NR Sub 6 GHz over-the-air data call, with Ericsson



Qualcomm  
snapdragon  
X50 5G modem



More than 30 commercial 5G mobile devices scheduled to launch in 2019

October 2017

February 2018

2H 2018

September 2018

October 2018

1H 2019

Qualcomm  
snapdragon  
X50 5G modem family



World's first announced 5G NR modems



5G NR standards compliant

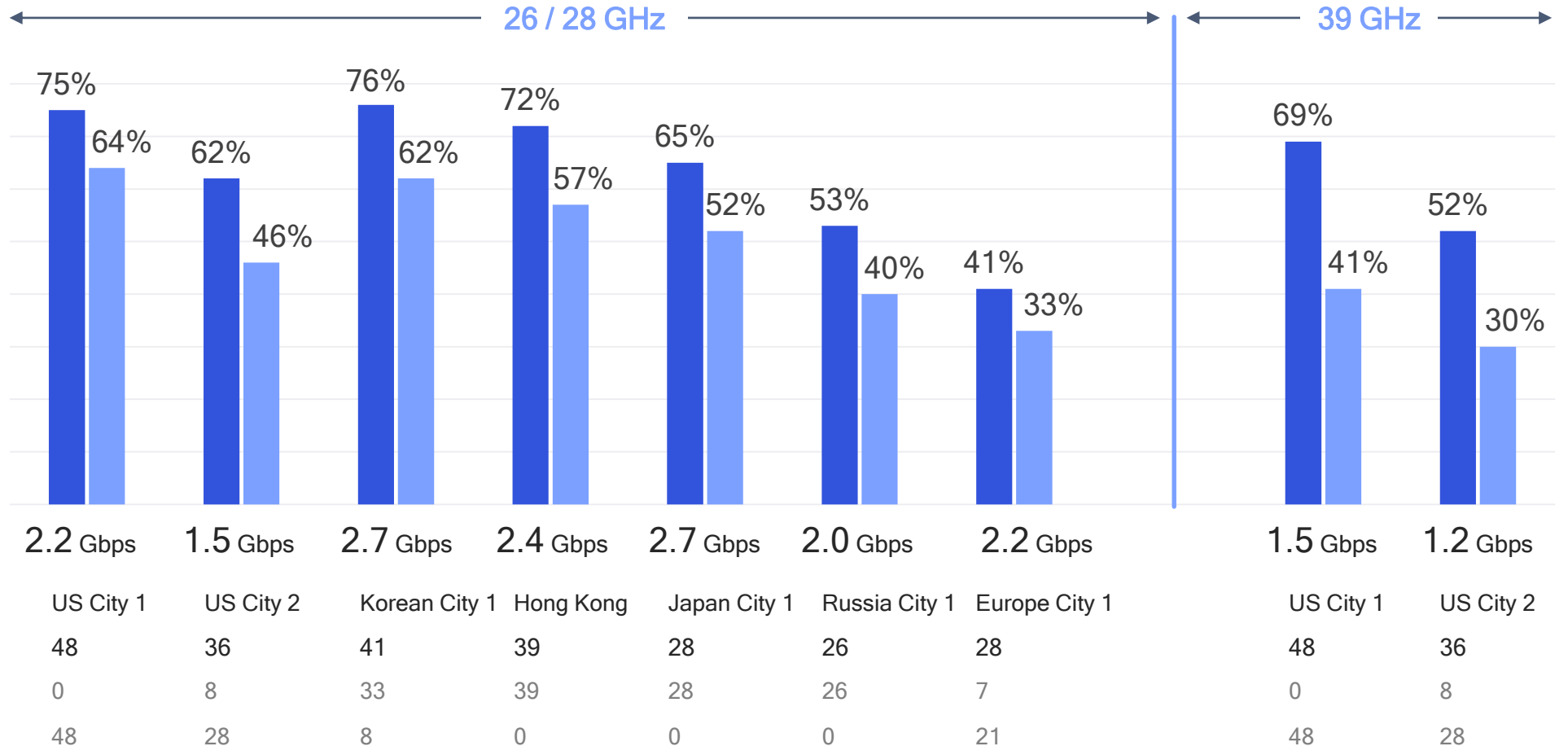


Sub-6 + mmWave



Premium-tier smartphones in 2019

Downlink  
Uplink  
Coverage %  
Co-siting with LTE



Median Downlink  
Burst Rate (Gbps)

Site density  
(per km<sup>2</sup>)












Total  
Macro  
Small

City	Burst Rate (Gbps)	Total	Macro	Small
US City 1	2.2	48	0	48
US City 2	1.5	36	8	28
Korean City 1	2.7	41	33	8
Hong Kong	2.4	39	39	0
Japan City 1	2.7	28	28	0
Russia City 1	2.0	26	26	0
Europe City 1	2.2	28	7	21
US City 1	1.5	48	0	48
US City 2	1.2	36	8	28

Simulations assumptions: Based on MAPL (maximum allowable path loss) analysis with ray tracer propagation model and city/area specific models; minimum 0.4 bps/Hz and 0.2 bps/Hz for downlink data and control, out-to-out coverage only; Using 800 MHz DL bandwidth and 100 MHz uplink bandwidth with 7:1 DL:UL TDD

Significant 5G NR mmWave outdoor coverage via co-siting  
Simulations based on over-the-air testing and channel measurements

# Global mmWave spectrum status

	24-28GHz	37-40GHz	64-71GHz
	24.25-24.45GHz 24.75-25.25GHz 27.5-28.35GHz	37-37.6GHz 37.6-40GHz 47.2-48.2GHz	64-71GHz
	26.5-27.5GHz 27.5-28.35GHz	37-37.6GHz 37.6-40GHz	64-71GHz
	24.5-27.5GHz		
	26GHz		
	26GHz		
	26GHz		
	26.5-27.5GHz		
	24.5-27.5GHz	37.5-42.5GHz	
	26.5-29.5GHz		
	27-29.5GHz		
	24.25-27.5GHz	39GHz	

## 5G NR mmWave spectrum highlights

### Regions targeting 2019 deployments



U.S.

Allocated 12.55 GHz of mmWave spectrum so far  
Auction started in Nov18 for 28 GHz with 24 GHz following; 37/39/47 GHz auction expected in 2H19



South Korea

28 GHz auction completed in Jun. 2018; each operator (SKT, KT, LG U+) secured 800 MHz  
Expected additional 3 GHz bandwidth in 2019+



Japan

Official 5G mmWave band in 28 GHz spectrum with maximum 2 GHz bandwidth  
Assignment expected by March 2019



Italy

5G spectrum auction completed in Sept. 2018 with right of use starting January 1st, 2019  
Initial commercial deployment expected in 2019



Russia

26 GHz auction completed in Q4 2018 to enable 2019 commercial deployments



Germany

Regulator published draft proposed allocation procedure and condition of use for 26 GHz



# Thank you!

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