28GHz 엑세스 솔루션 구현 및 구축 방안

권혁찬 5G RAN 아키텍트

Agenda

High band expectations

High band challenges

Solutions & Deployment

Summary

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High band challenges

Solutions & Deployment

Summary

Specifics for high band

High frequency mmWave spectrum > 20 GHz

- Different radio propagation characteristics
- AAS radios only

Large TDD spectrum allocations

- Allocations as high as 800 MHz per operator
- Very high capacity and peak rates p ossible

Wide carriers and Low latency

- Short TTI for short radio interface latency

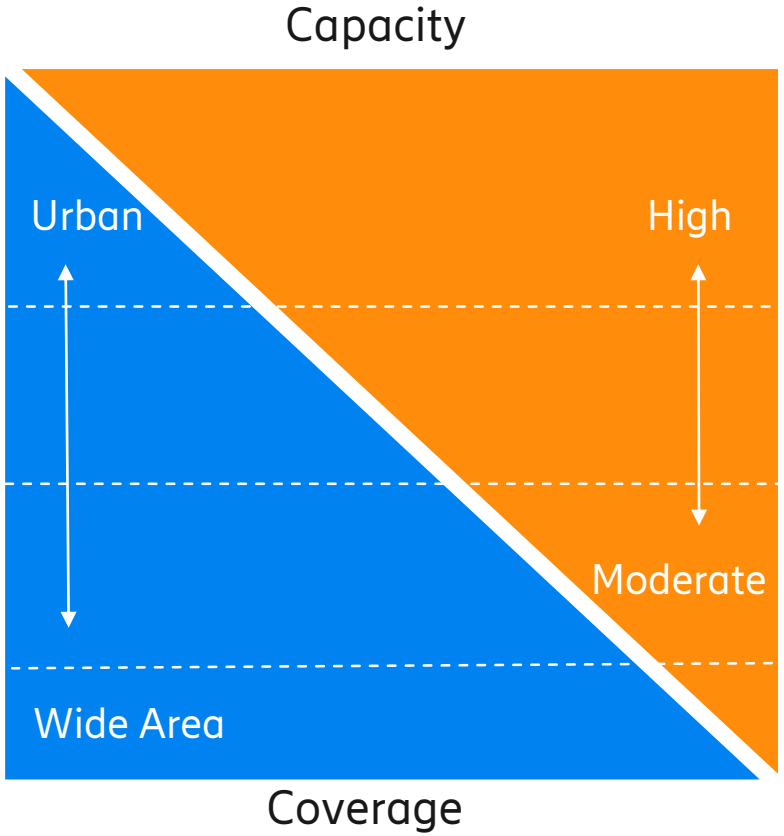
Spectrum trade-off between capacity and coverage

High bands
(24 GHz – 40 GHz)
New

Mid band TDD
(2.3 GHz – 6 GHz)
New

Low bands FDD
(1 GHz – 2.6 GHz)
Legacy

Low bands
(Sub – 1 GHz)
New/legacy



High capacity
dense urban / localized
deployments

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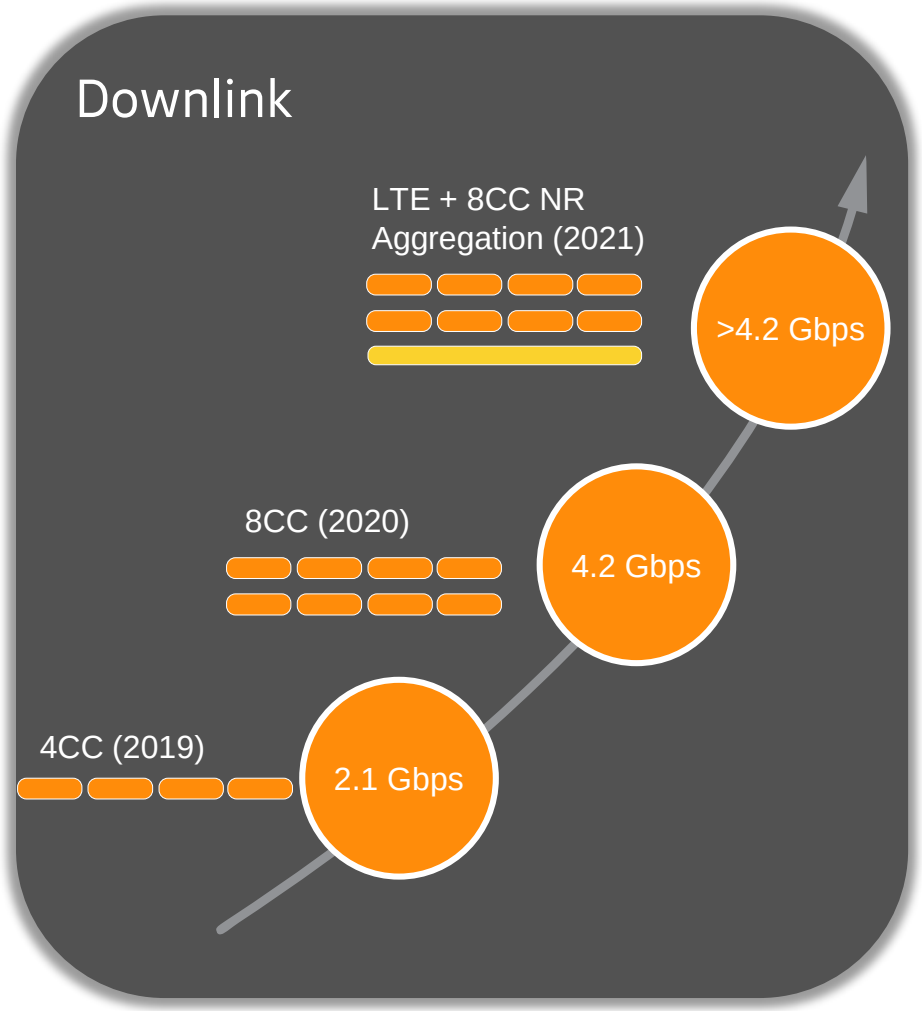
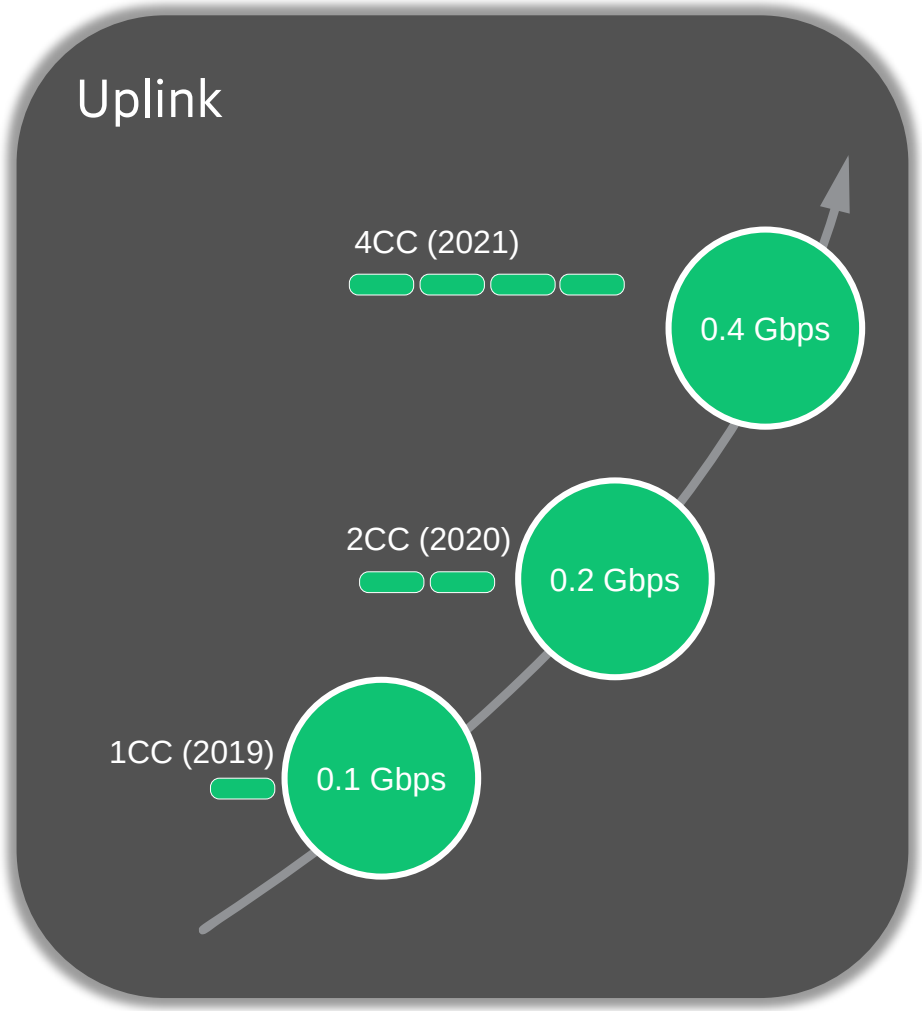
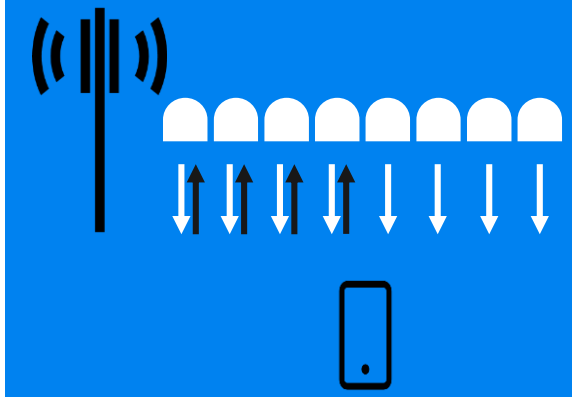
Moderate capacity
wide area/ outside-in
coverage

Peak rate evolution – high band







High band market interest & Ericsson leadership

North America

- Spectrum available from 2018
- High demand of eMBB and FWA
- Commercial traffic & Radio deployments increasing

EU

- Spectrum available 2020-2021
- eMBB and FWA
- Testing ongoing
- High interest in Smart Factory / Industry 4.0

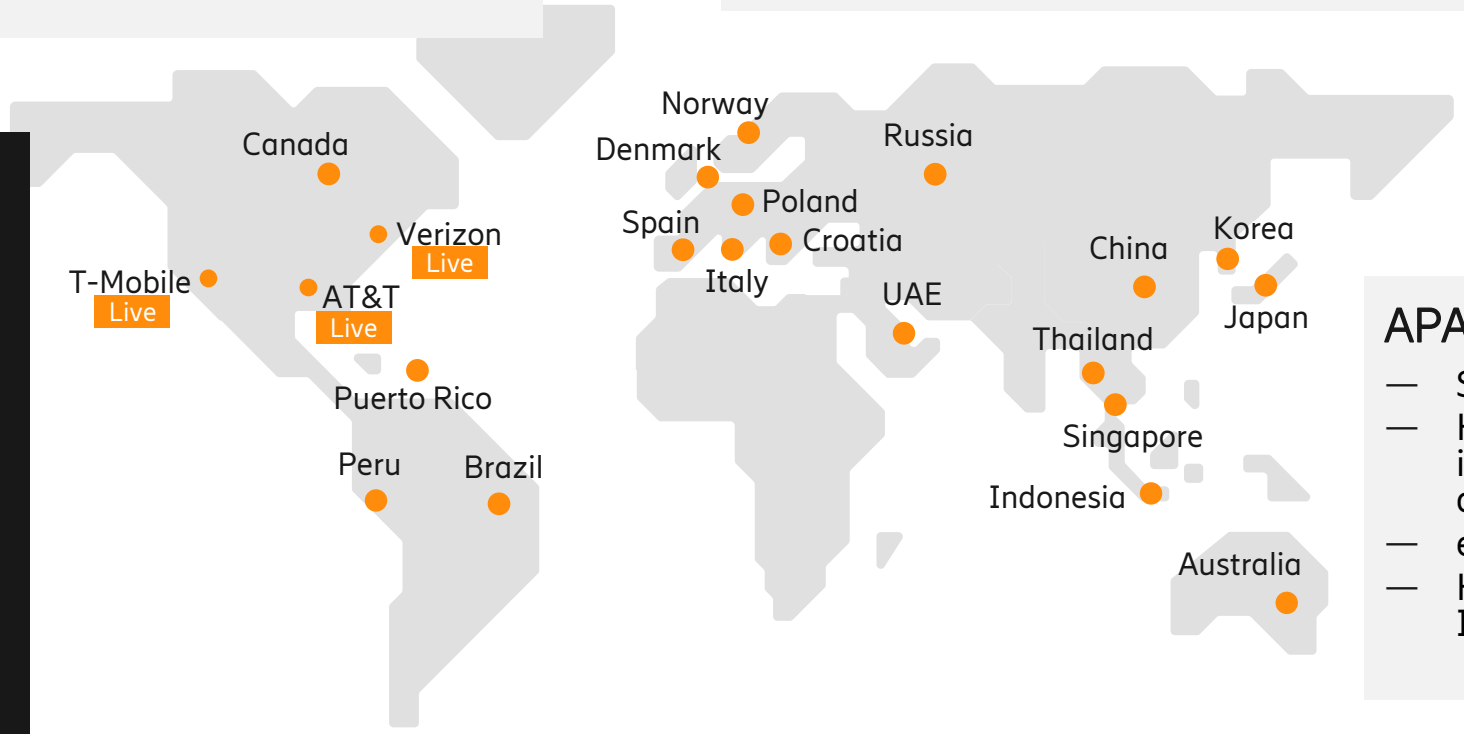
Ericsson mmWave Leadership

6

months ahead

>60 %

of live markets



APAC

- Spectrum available 2019-2020
- High interest from lead customers in China, South East Asia, Korea and Japan
- eMBB and FWA
- High interest in Smart Factory / Industry 4.0

*As of March 2020

5G Spectrums in USA

✓ Currently deployed
● Planned Deployment
● To be auctioned

Network Operator	5G Spectrum									
	Low band		Mid-band TDD		Mid-band FDD		mmWave TDD			
	600 MHz	850 MHz	2.5 GHz	3.7 GHz (C band)	AWS-3	PCS	24 GHz	28 GHz	39 GHz	47 GHz
AT&T		✓ *BW = 5-10 MHz		●	●	●	●		✓ *BW = 400 MHz	
verizon		●		●	●			✓ *BW = 400 MHz	✓ *BW = 400 MHz	
T Sprint	✓ *BW = 5-10 MHz		✓ *BW = 40-60 MHz			●		✓ *BW = 133 MHz (estimate average)	✓ *BW = 100 MHz (estimate average)	
U.S. Cellular	✓ *BW = 10 MHz	●		●	●					

*Estimation of spectrum BW

AWS-3 : 1755~1780/2155~2180MHz (3GPP B66A)
PCS : 1850~1910/1930~1990MHz (3GPP B2)

5G Milestones in Japan

	2019	20H1	20H2	21H1	21H2	28GHz use case
MIC & Japan Event	RUGBY WORLD CUP JAPAN 2019 #RWC2019		Summer low band NR regulation		TOKYO 2020 New 5G Spectrum allocation (4.9, 26GHz, 40GHz)	
docomo		March 25: 5G Commercial Start	Add high bands		SA launch: Target Not yet fixed	• Traffic offload in Hot Spot • B2B*
KDDI		March 26: 5G Commercial Start	Add high bands		SA launch: Target 2021	• Traffic offload in Hot Spot • B2B*
SoftBank		March 27: 5G Commercial Start			SA launch: Target 2021	• Traffic offload in Hot Spot • FWA* • B2B*
Rakuten		April 8: LTE commercial Start	June ->September 5G Commercial Start (Announcement on 3 months shift on May15)		SA launch: Target 2021	

** Under investigation*

High band expectations

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Solutions & Deployment

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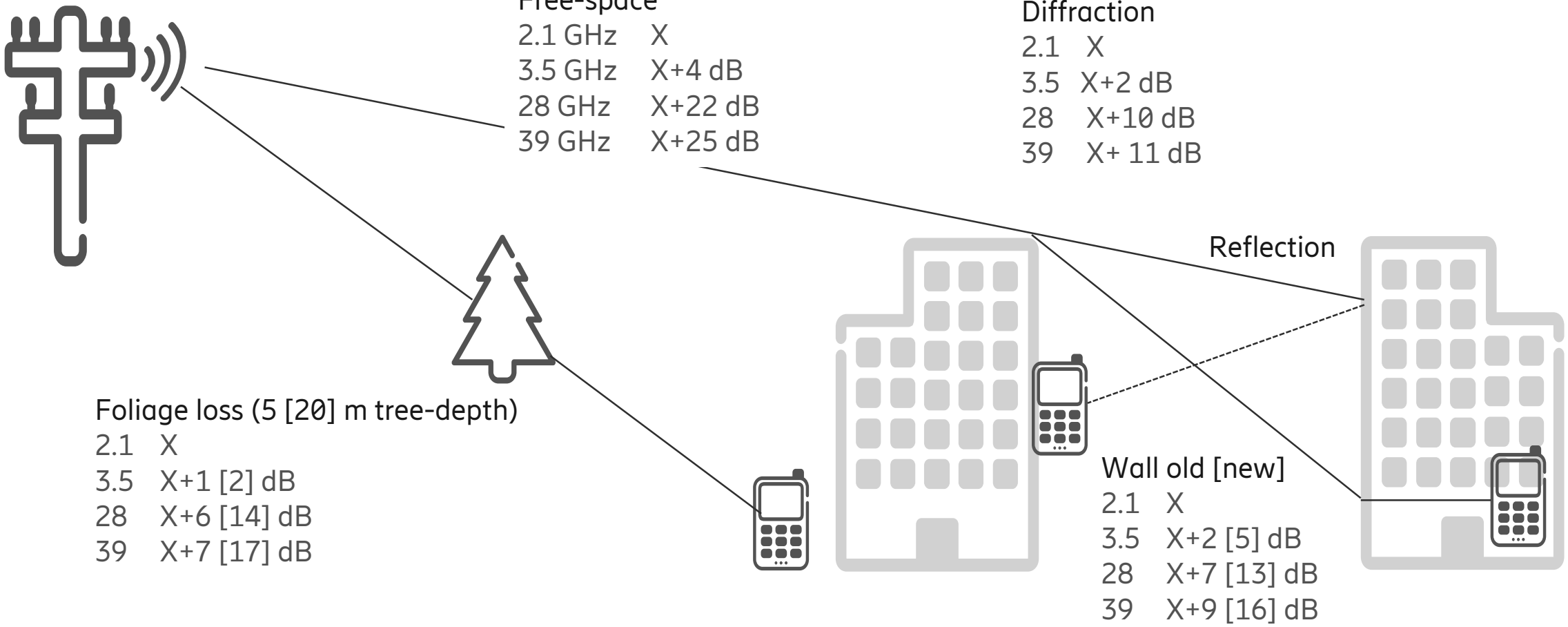
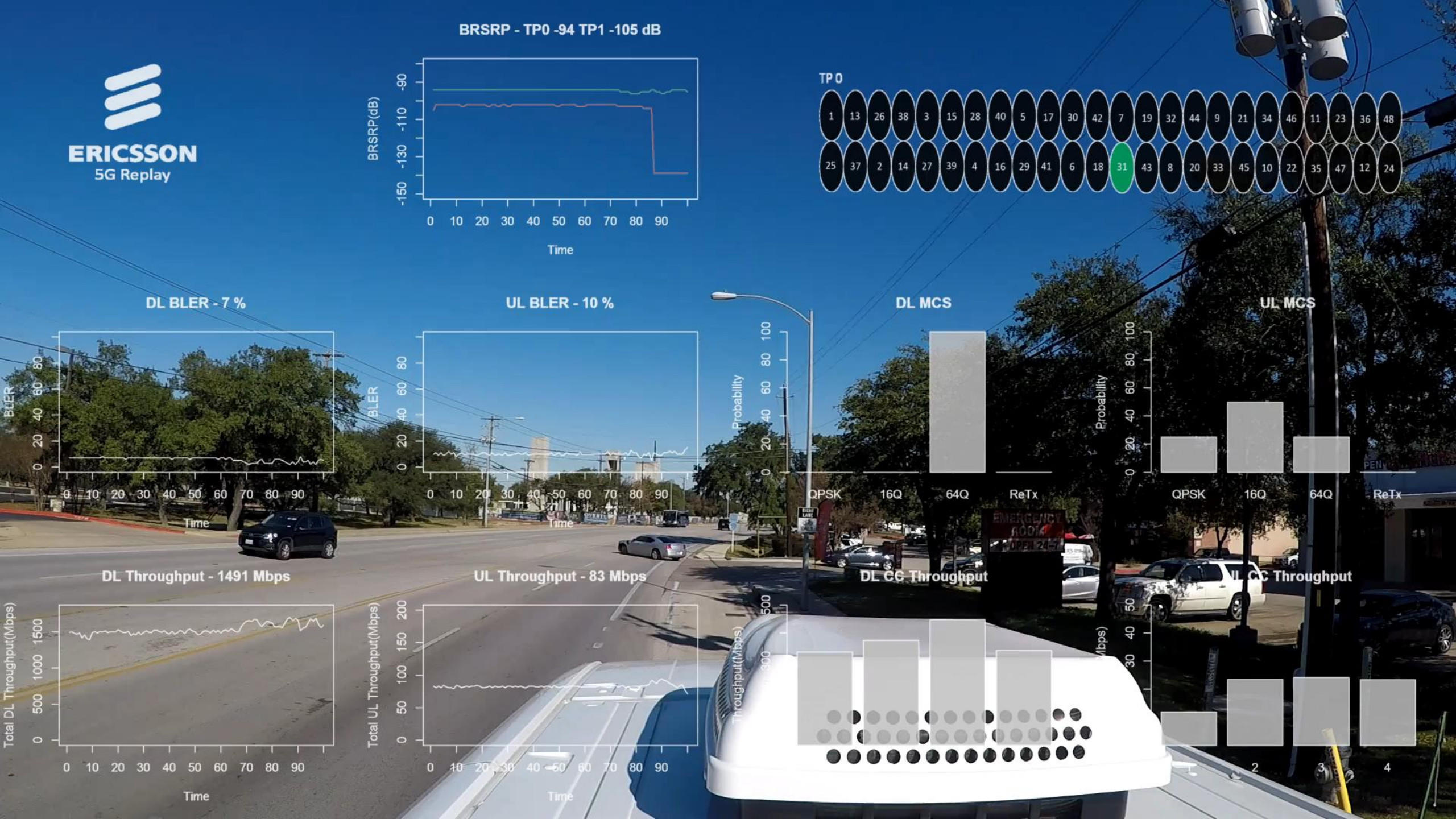
Propagation comparisons



28GHz channel shows >15dB more loss if compared with <2.6GHz FDD

Drive-testing the RF environment

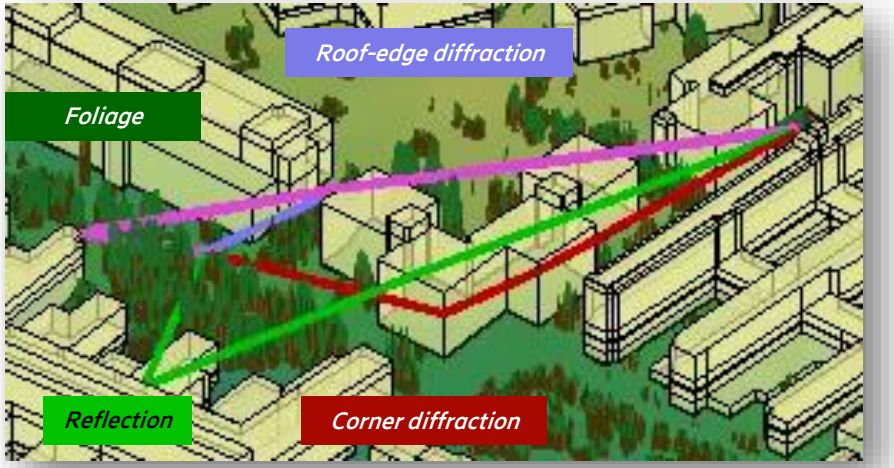

ERICSSON
5G Replay
BRSRP - TP0 -94 TP1 -105 dB
BRSRP(dB)
Time
TP 0
1 13 26 38 3 15 28 40 5 17 30 42 7 19 32 44 9 21 34 46 11 23 36 48
25 37 2 14 27 39 4 16 29 41 6 18 31 43 8 20 33 45 10 22 35 47 12 24
DL BLER - 7 %
BLER
Time
UL BLER - 10 %
BLER
Time
DL MCS
Probability
QPSK
16Q
64Q
ReTx
UL MCS
Probability
QPSK
16Q
64Q
ReTx
DL Throughput - 1491 Mbps
Total DL Throughput(Mbps)
Time
UL Throughput - 83 Mbps
Total UL Throughput(Mbps)
Time
DL CC Throughput
Throughput(Mbps)
UL CC Throughput
2
3
4

High-band deployment options

- Despite the challenging propagation conditions, there are several feasible deployment options for 28GHz where it brings very high data rate and capacity improvement.

- An important step to increase the usability of High-band band is optimized deployment, i.e. removing or largely reduce one of the three main propagation phenomena and guarantee LOS
  - Penetration loss
  - Diffraction loss
  - Foliage loss

- Key deployment scenarios where High-band is very useful:
  - Macro roof deployment with low band support
  - Fixed wireless use case with advanced CPE
  - Street level, Hot spot, cell deployment



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5G Street portfolio in US
- Deploy where it makes sense

High band portfolio

Segments	Products	Evolution
Capacity High EIRP, many beams Up to 62dBm EIRP	AIR 5322 62/59dBm EIRP	Higher output power Higher uplink performance
Compact Low weight & size with or without integrated baseband AIR 7 liter, 8 kg Street macro 13 liter, 13 kg	Street Macro 6701 Integrated baseband AIR 1281 Compact and energy efficient design	Smaller size and lower weight Lower transport requirements

General

Size/weight optimization

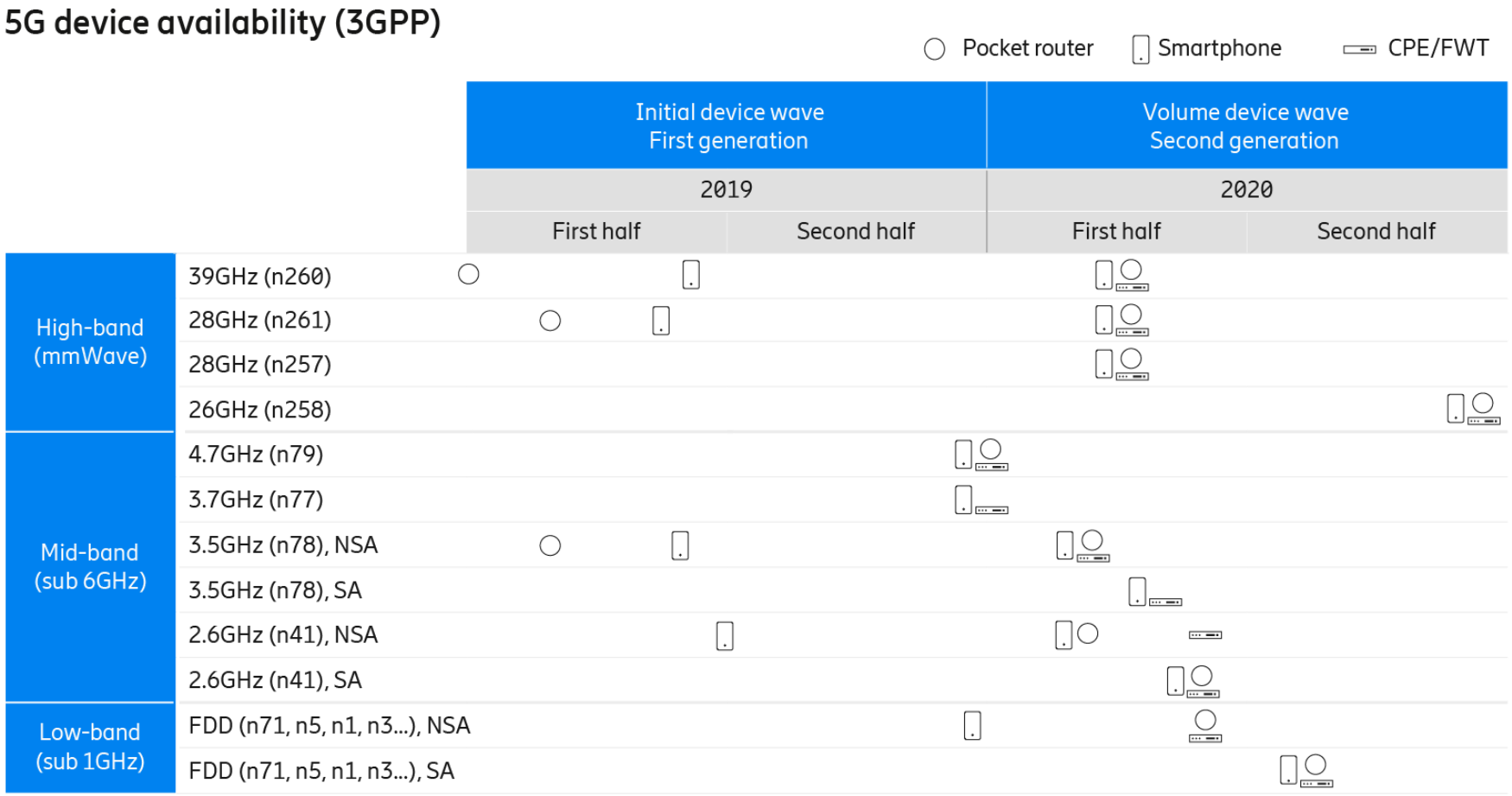
Energy efficiency

Fronthaul evolution

Support for all 3GPP bands

Performance optimization with third generation chipset

5G device availability (3GPP)



5G

Despite the uncertainity caused by the COVID-19 crises, the 5G device ecosystem continue to expand.

High band use cases

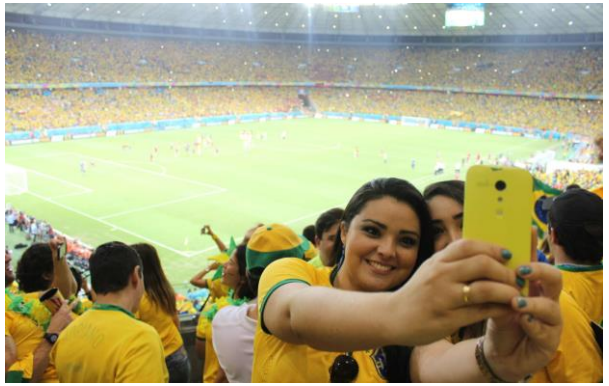
- high throughput and capacity at low latency and small form factor

Surveillance and video streaming / broadcast

Industry 4.0

Last-mile fiber/copper complement

Everywhere AR/VR



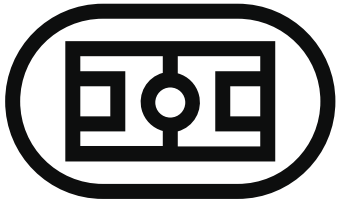
Crowded area capacity

Street Macro applications

Mobile broadband deployment cases

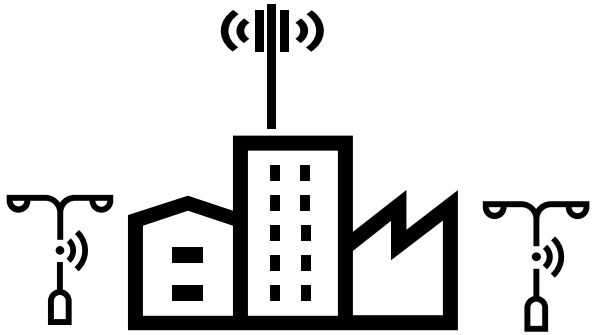
Hot spots

- Dedicated coverage for high traffic area as stadiums or event sites
- Provide very high capacity
- Deliver high peak rates



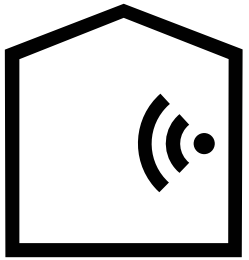
City deployment with street sites

- Outdoor and some indoor high band coverage in city
- Off-load capacity from lower bands
- Deliver high peak rates



Indoor

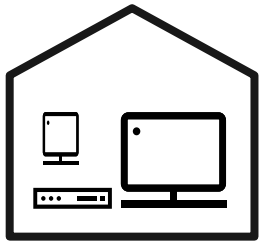
- Indoor high band coverage
- Deliver high peak rates
- Provide very high capacity



Special deployment cases

FWA

- High capacity high peak rate alternative to fiber
- Outdoor CPE and antennas to provide for LoS need

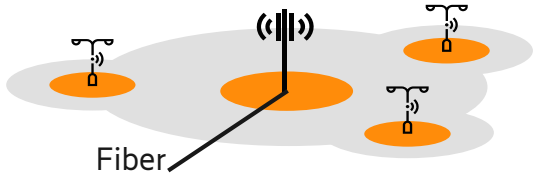


Industry

- High performance and low latency for industry applications
- Future potential to be developed in the industry connect segment

IAB

- High Band as backhaul for street sites with high band or mid band
- Future potential still being worked on in standardization

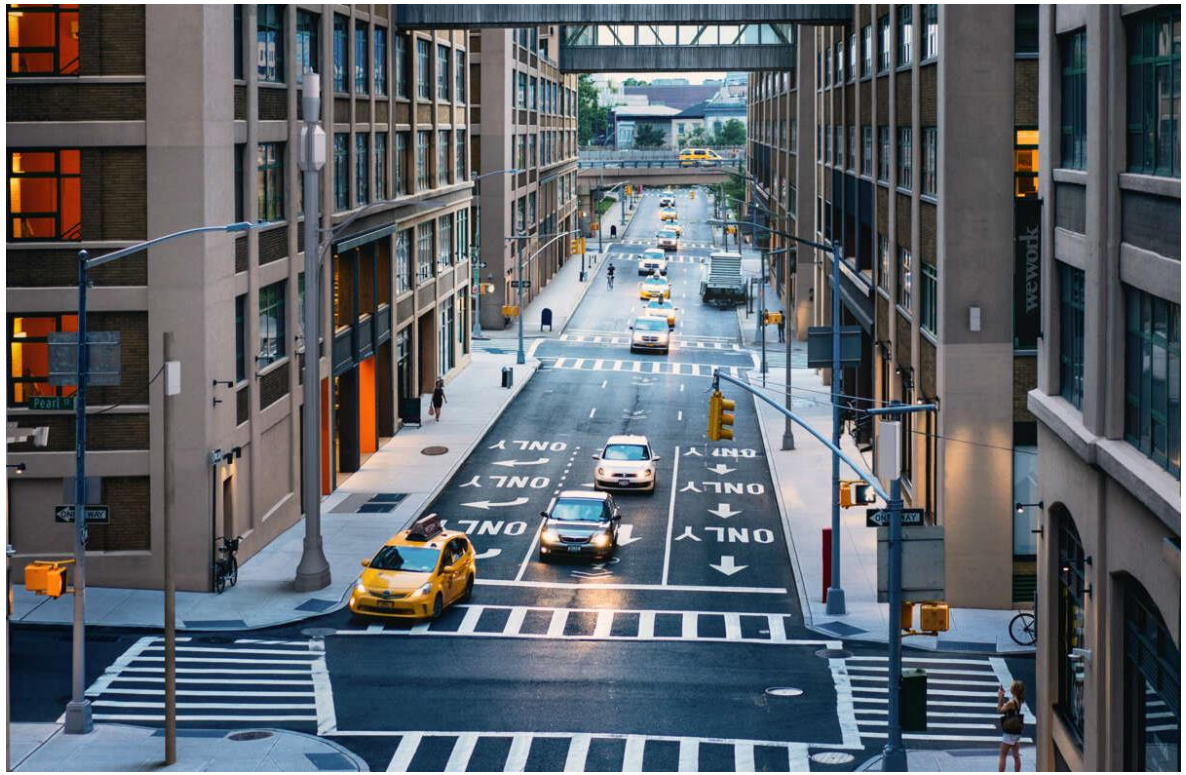


Industry applications

- Deliver high capacity low latency wireless connectivity for industry automation
- High band offers high speed, high capacity and can provide for low latency radio interface
- The limited radio propagation of high band can allow for radio coverage to be concealed to specific locations
- Wireless connectivity offers flexibility in industry applications

Integrated Access and Backhaul (IAB)

- Use high band spectrum and radio nodes for backhaul together with access
- The large spectrum allocations on high band allow for enough capacity for both backhaul and access
- High band can provide backhaul also for radios on lower bands
- Major savings removing backhaul cost and quicker installation of new site can be achieved using IAB
- IAB is still being standardized and is not ready for commercial offers yet.



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Key messages

Highband gives new opportunities

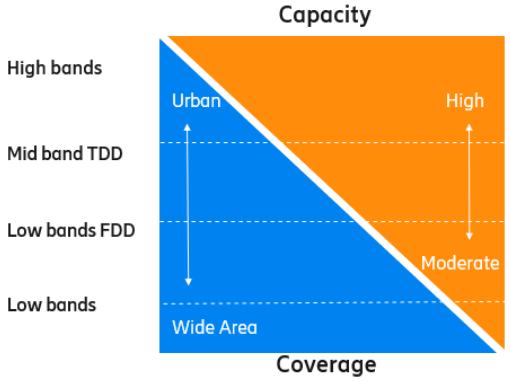
- New large spectrum assets
- High capacity, high peak rates

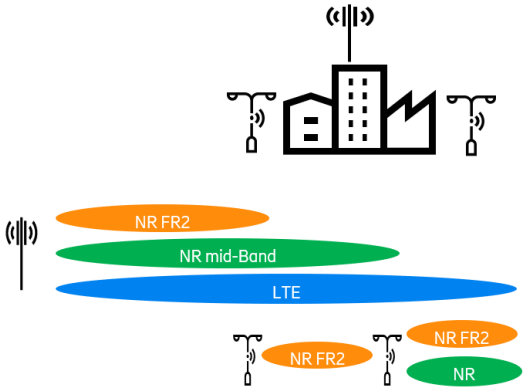
New deployment strategies needed

- Deploy where it makes sense
- Use with lower bands

Ericsson is leading highband industry

- Large experience on high band deployment
- Develop products that is needed for operato rs





AIR 1281

AAS for street
53-56 dBm
CPRI Fronthaul

Streetmacro 6701

RBS for street
53-56 dBm
Ethernet Backhaul

AIR 5322

AAS for roof top
59-62 dBm
CPRI Fronthaul

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