

Dynamic Spectrum Sharing



Driving 5G to scale

Meet the panelists

Sibel Tombaz, Head of 5G High-band and Active Antennas,
Product Area Networks, Ericsson



Andreas Roessler, Technology Manager, Rohde & Schwarz

What is DSS?

- Base station software that allows simultaneous operation of LTE and 5G New Radio in the same spectrum at the same time.
- MBSFN (multicast-broadcast single frequency network) method blocks LTE pilot signal and inserts 5G NR synchronization signals.
- Non-MBSFN method puts shortened 5G NR synchronization symbols in place of LTE.

Why does that matter?

- With software upgradable RAN infrastructure, operators can use DSS to avoid the multi-year process of re-farming spectrum for 5G NR.
- This saves time and money associated with truck rolls and other field services.
- The ability to quickly add a 5G NR coverage layer with NR facilitates a smoother transition from non-standalone to standalone.

What are the operators doing?

- Ericsson Spectrum Sharing is the only commercially available DSS solution as of Feb. 27, 2020.
- Ericsson: “More than 80 percent of service providers testing Ericsson Spectrum Sharing plan to deploy it in the coming 12 months.”
- AT&T and Verizon have both articulated plans to use DSS.
- Ooredoo (Qatar), Play (Poland), Swisscom (Switzerland) and Telstra (Australia) have all publicly commented on testing and/or plans to use DSS.

Spotlight on Verizon

--Current 5G deployment focused on millimeter wave in urban cores, stadiums and arenas.

--In November, Verizon worked with Ericsson and Qualcomm to test DSS on over-the-air data call conducted at an Ericsson lab in Texas.

--When will Verizon deploy DSS? “It is an implementation decision when we activate the capability for our customers—whether or not we activate all three vendors simultaneously... When we feel it will provide the best experience for all customers – 4G and 5G – we will look at deploying 5G on lower bands.” Karen Schultz, spokesperson, Verizon

Spotlight on Swisscom

- Swisscom partnered with Ericsson on end-to-end 5G network, launched in April 2019 using mid-band (3.6 GHz) spectrum.
- Swisscom achieved nationwide 5G coverage in December 2019.
- In November 2019, successfully made over-the-air 5G data call using DSS using Ericsson and Qualcomm equipment.
- In December 2019, Swisscom and Telstra used DSS on a live call between Switzerland and Australia.

The downside to DSS?

“It’s late. We are seeing some vendor delays there. There’s a lot of information coming through as we start to fully test software and capability in the future. ... We’re seeing as we learn more that, as you deploy DSS, it kind of eats away on the net capacity of the shared radio. And if you rush into that now, some of the early roll-outs and workarounds and pieces that we’ve seen are pretty corrosive and they would suck up capacity just by rolling out the feature.”

Neville Ray, President of Technology, T-Mobile

Ericsson Spectrum Sharing

Dr. Sibel Tombaz

Head of 5G High-band and Active Antenna Systems

Product Area Networks

Ericsson

GLOMO awards 2020

CTO Award & Best Mobile Technology Breakthrough Award for ESS

Ericsson Spectrum Sharing wins top honors at GSMA's GLOMO Awards

Ericsson's dynamic spectrum sharing solution won Overall Mobile Technology and Best Mobile Technology Breakthrough at the 2020 Global Mobile Awards.

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5G 4G #ESS #GLOMO2020 #RANCompute



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Winning the Overall Mobile Technology Award, also known as the CTO Award, means that Ericsson is recognized as a technology leader in 2020 for its innovative [Ericsson Spectrum Sharing solution](#).

The 25th annual awards were judged by a panel leading industry and subject matter experts, analysts, journalists, academics and mobile operator representatives. According to the judges, Ericsson Spectrum Sharing helps operators to migrate from 4G to 5G in a faster, simpler and more efficient manner and helps operators maximize usage of infrastructure and spectrum assets.

"What I love about it is that it will allow us to transition from one technology to another utilizing the same spectrum band. This has not been achievable until now," read the [GLOMO judge's motivation](#).

Ericsson Spectrum Sharing also won the [Best Mobile Technology Breakthrough Award](#). According to the award judges, "This is a powerful enabler that will help accelerate the rollout of 5G by maximizing the re-use of existing hardware, thus saving costs while avoiding disruption to customer service, and helping to speed time to revenue for both telcos and customers."

[Link to Ericsson Press release](#)



Dr. Sibel Tombaz

Head of 5G High-band and Active Antenna Systems

Ph.D Franz Heiser

Senior Expert L1-L2 Architecture

Key building blocks to realize 5G vision

“One network for multiple use cases & industries”

Capacity
& peak speeds

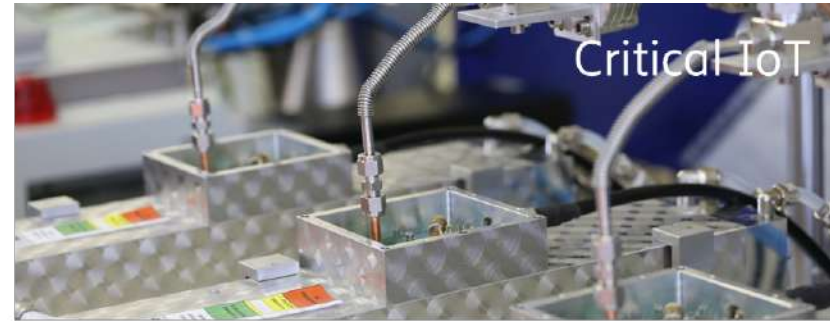
Latency
& network slicing

Coverage

Massive IoT



Critical IoT



Enhanced MBB



Fixed Wireless
Access



New bands



Standalone 5G



Low bands

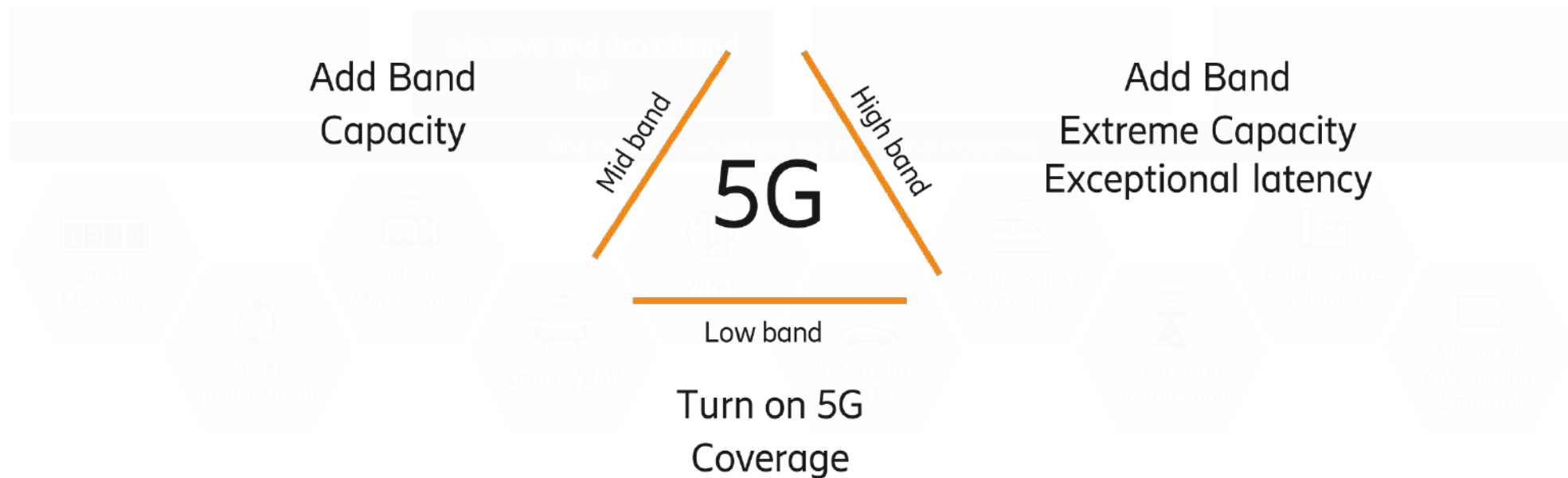
Key building blocks to realize 5G vision

“One network for multiple use cases & industries”

Capacity
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Coverage



New bands



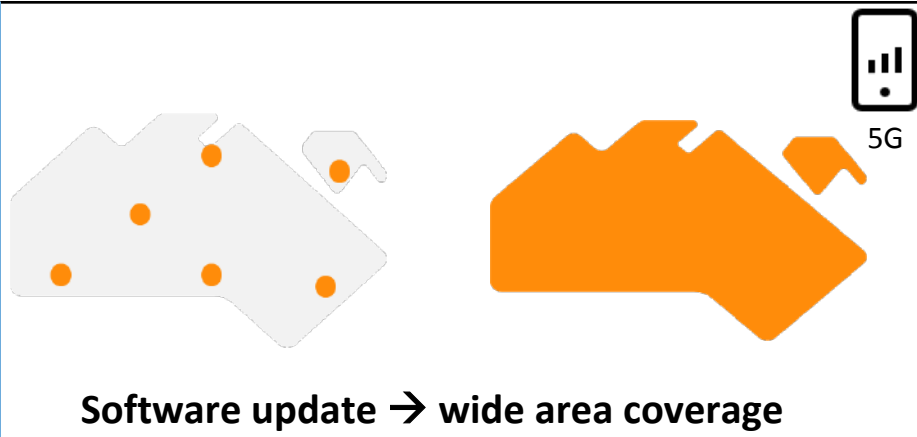
Standalone 5G



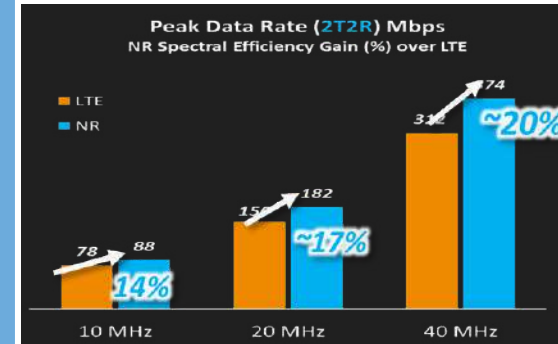
Low bands

NR low band provides more than “nation-wide 5G coverage”

Race to Nation-wide NR Coverage

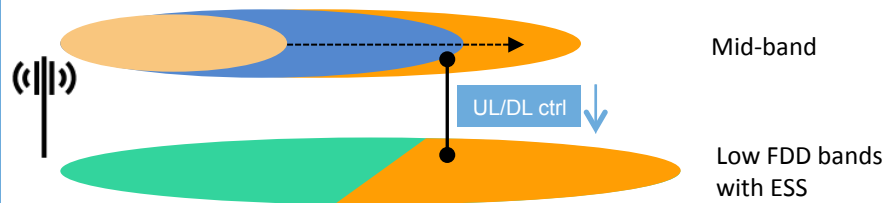


NR vs. LTE: Spectral Efficiency & RAN Latency

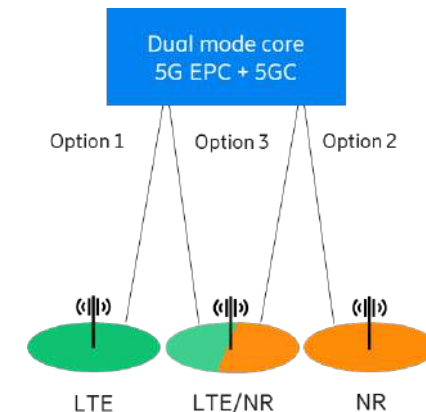


- Higher Spectrum Utilization
- More Flexible Overhead (CCH, RS)
- Lower Latency

Boost coverage with Carrier Aggregation



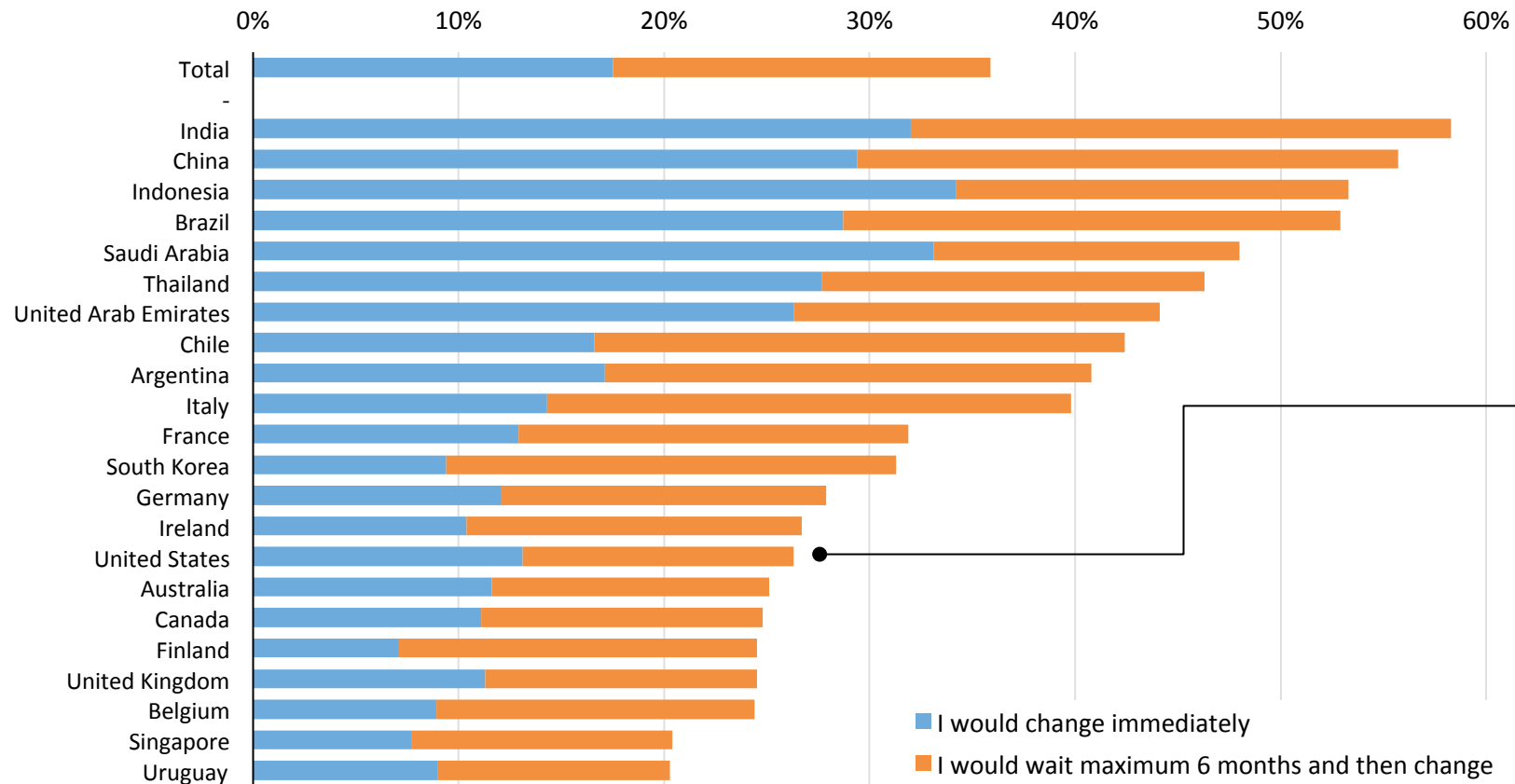
Stand-alone coverage secured with 5G FDD bands Reduced network complexity



- Low latency and network slicing
- Explore new use cases
- Voice over NR on FDD bands

1 in 4 people in United States will switch for 5G

Share who would switch operator if their own operator does not switch on 5G and somebody else does in the market



1 in 4

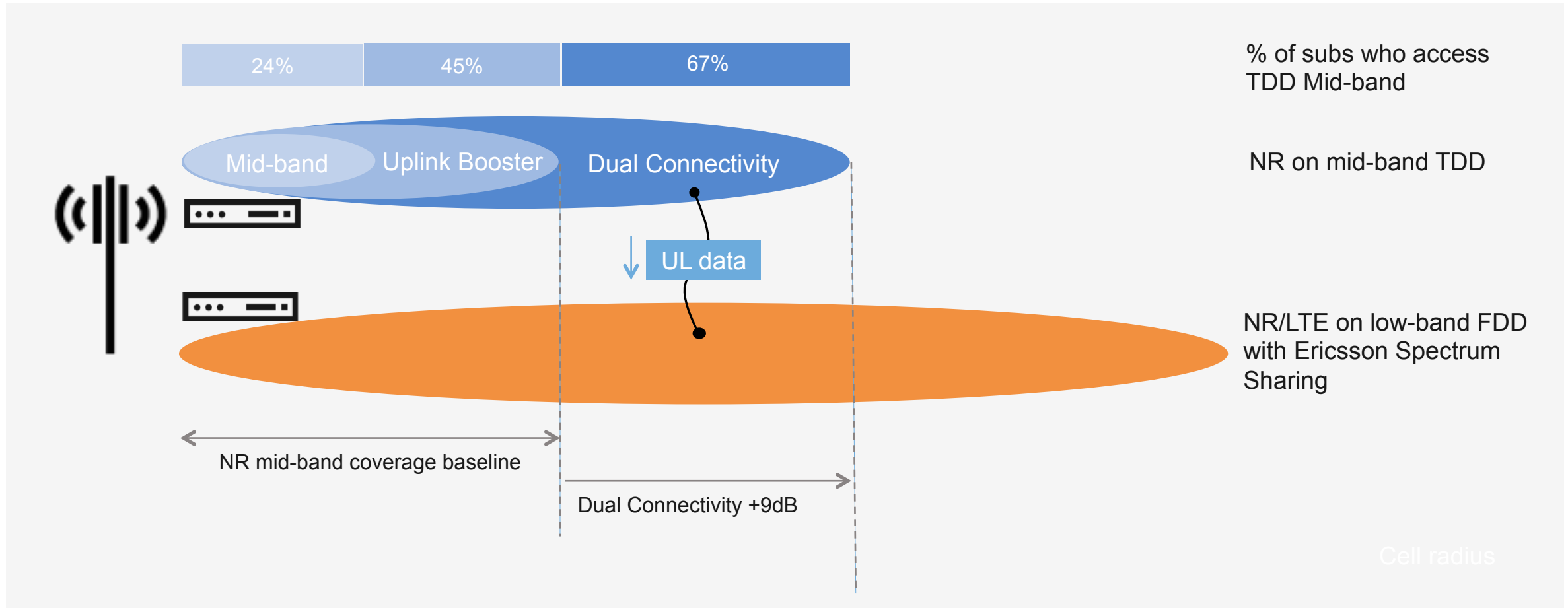
In United States would switch mobile broadband provider **within 6 months** if their own operator didn't offer 5G.

1 in 10

would change **immediately**

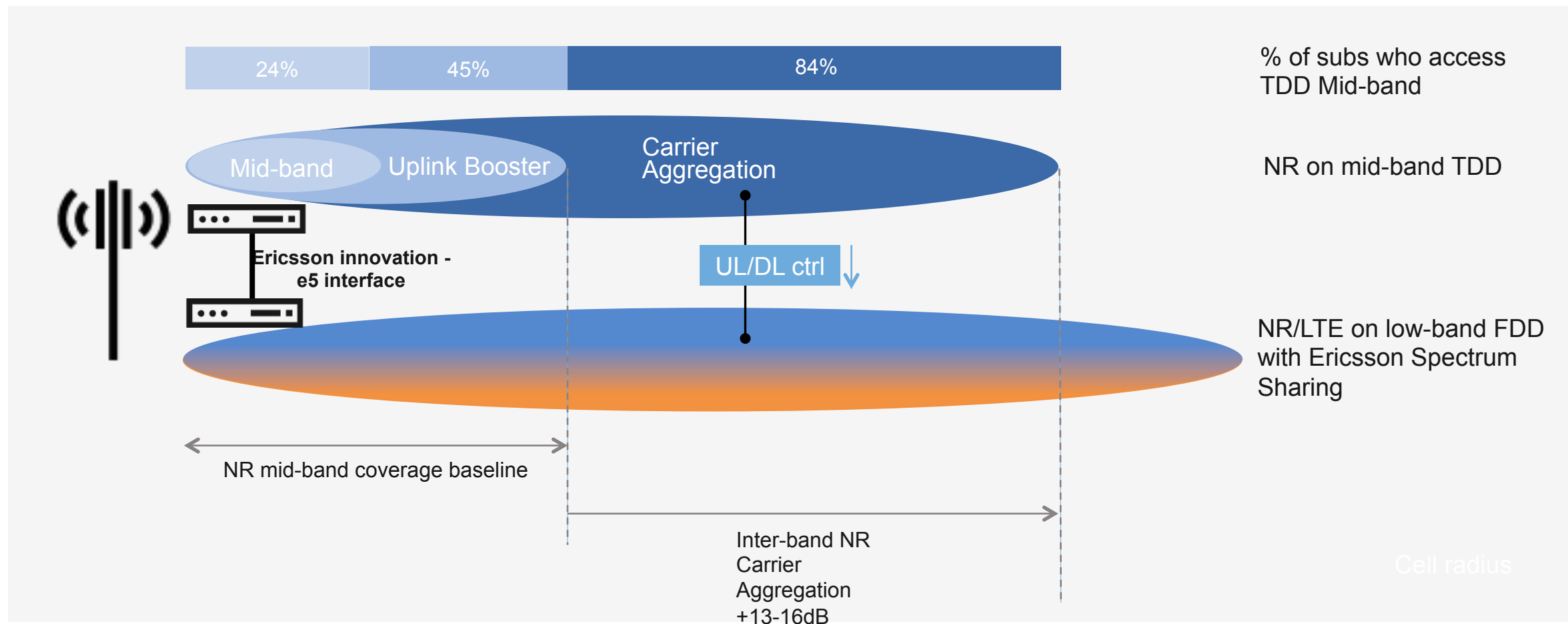
Migration to Stand-Alone

Maximize network spectrum efficiency with Ericsson Spectrum Sharing



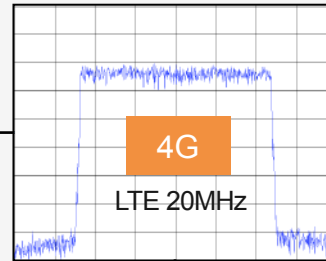
Migration to Stand-Alone

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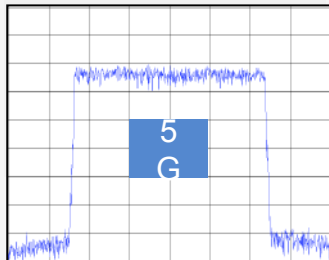
Ways to enable 5G on FDD

Baseline



Re-farming

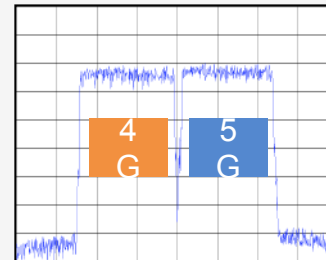
Expensive
when LTE
traffic
increasing is
still



Switch off 4G

Static sharing

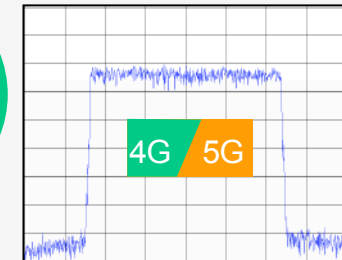
Capacity
limitation for
both 4G and
5G



4G 10MHz + 5G 10MHz

Ericsson Spectrum
Sharing

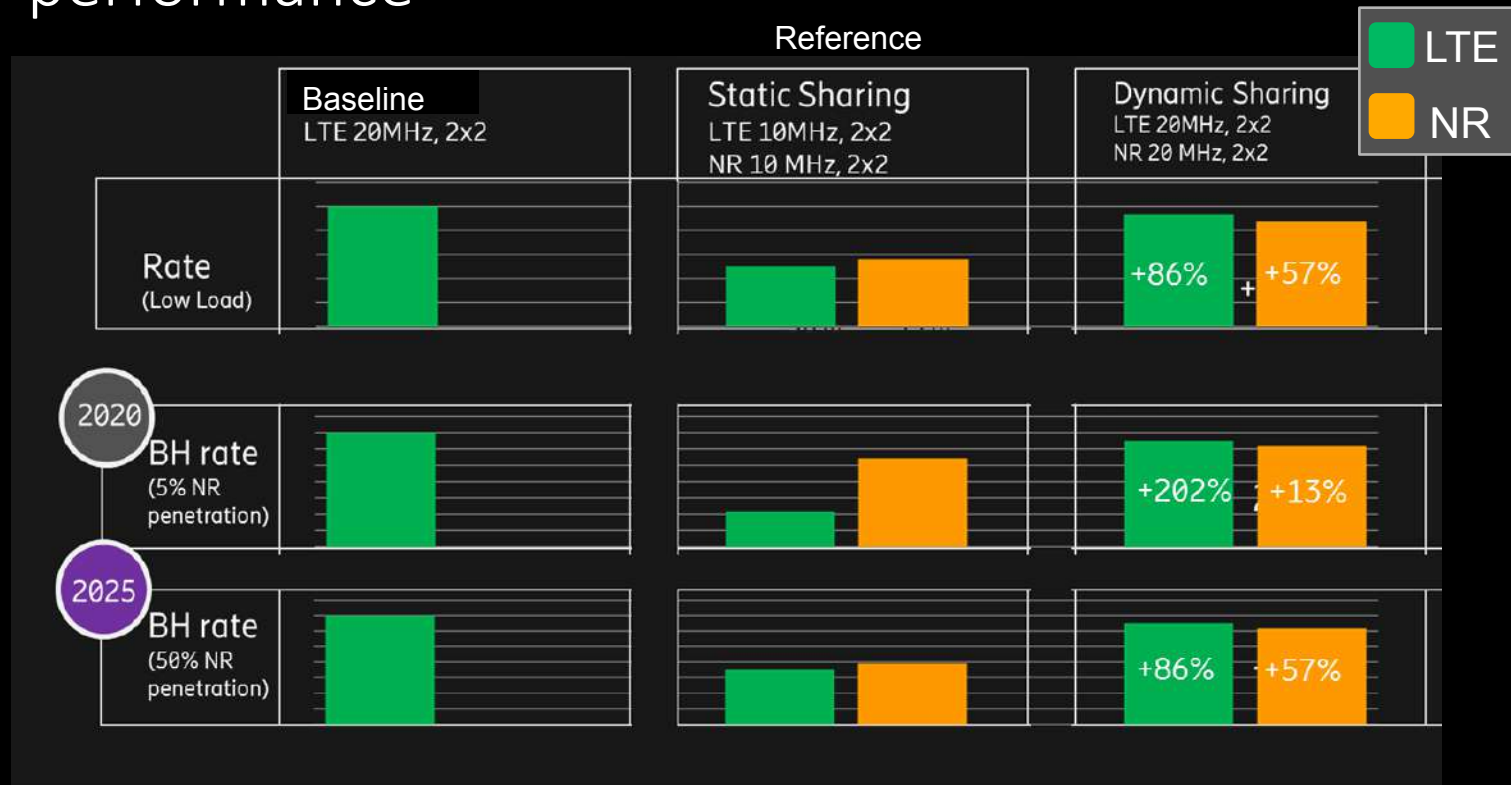
Flexible and
dynamic
introduction
of 5G



20MHz to LTE and NR

Ericsson Spectrum Sharing

Early & flexible low-band NR introduction with kept user performance



Dynamic Spectrum Sharing enables NR low-band introduction while ensuring LTE performance

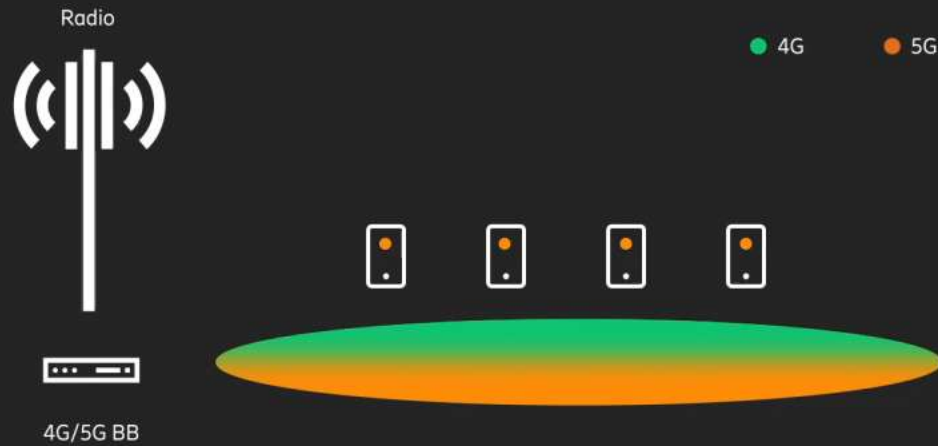
Dynamic Spectrum Sharing not only for initial NR roll-out - Significant improvement for LTE users: at low & high NR penetrations

Re-farm from LTE to NR without impacting LTE performance

Assumptions: For the BH analysis it is assumed that TTI utilization on a 20MHz 2x2 LTE carrier is 30%. For it is assumed that the same total traffic needs to be carried by the combined system post NR introduction. All NR devices are served by the NR carrier and the remaining devices are served by the LTE carrier. In the example the user experienced data rate R_{exp} is computed as $R_{exp} = R_{bit} (1-p)$ where R_{bit} is the data rate achievable when alone in the system and p is the TTI utilization (average load during BH).

Ericsson Spectrum Sharing

How does it work



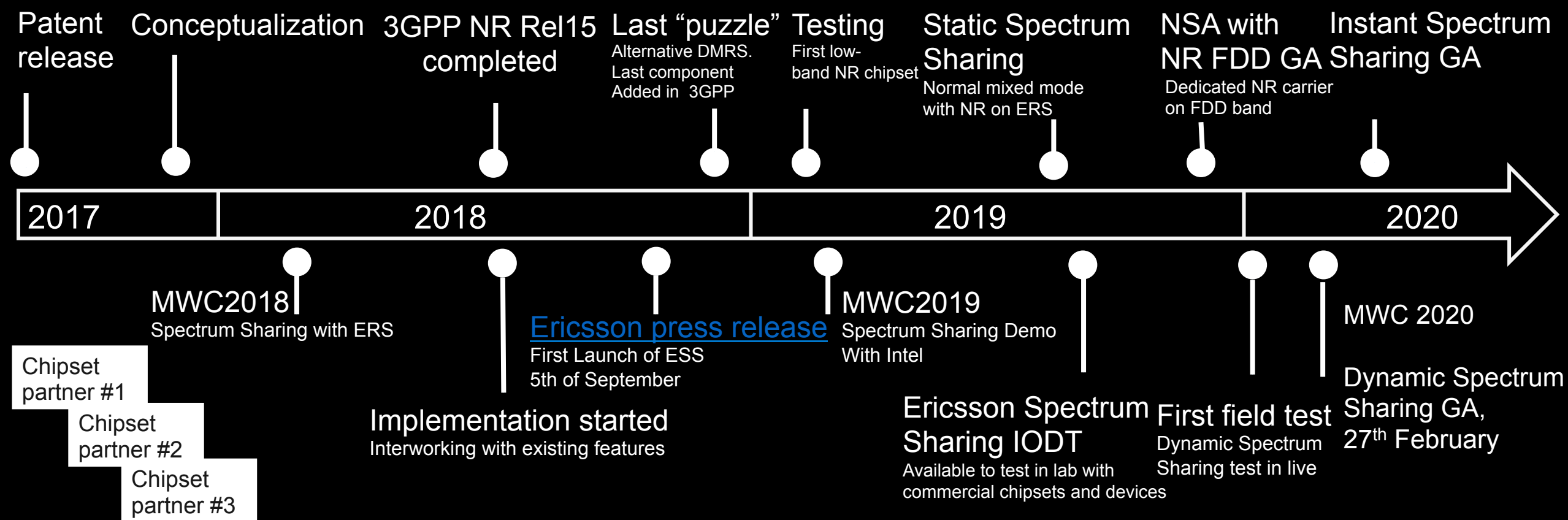
Ericsson Spectrum Sharing dynamically allocates spectrum allocation to 4G and 5G based on instantaneous traffic in the cell



ESS ☒

Ericsson Spectrum Sharing journey

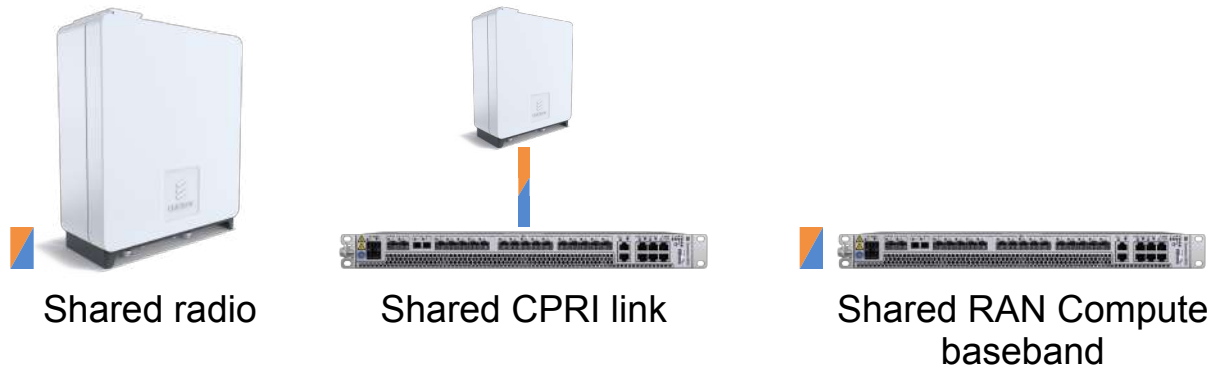
From idea to commercialization



Driving eco-system together with chipset partners

Ericsson Spectrum Sharing is unique

Cost optimized



Sustainable


Re-use of hardware




Fewer sites needed

Fast and efficient

1m
s



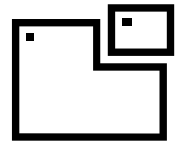
Split between 4G and 5G
evaluated every millisecond



Fully dynamic allocation between
4G and 5G without pre-set levels

Short time-to-market

Remote
software
installation

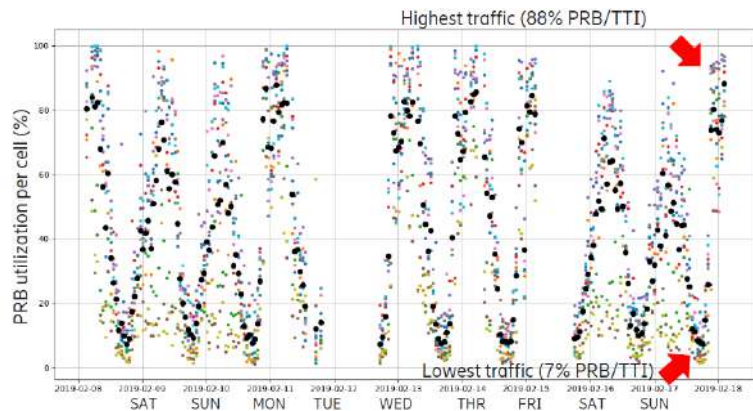


Eco-system
support across all
major
chipset vendors

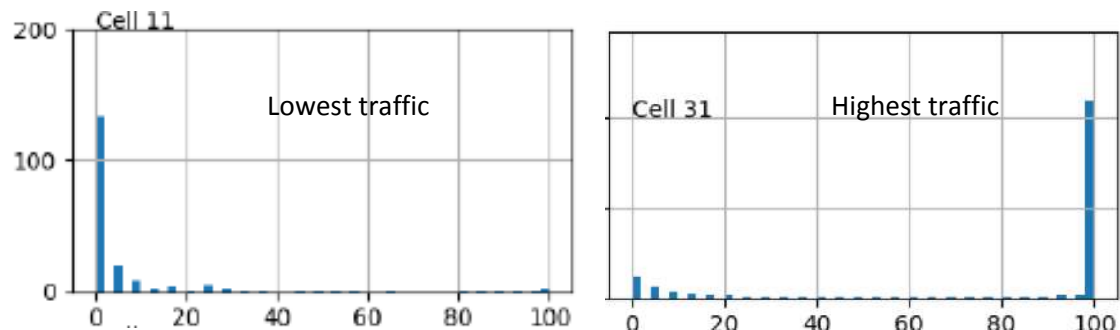
 = 4G  = 5G

ESS provides highest spectral efficiency

PRB utilization per cell | Real Traffic Analysis



PRB utilization zoom into 5min



>20%

Capacity gain
with PRB level sharing

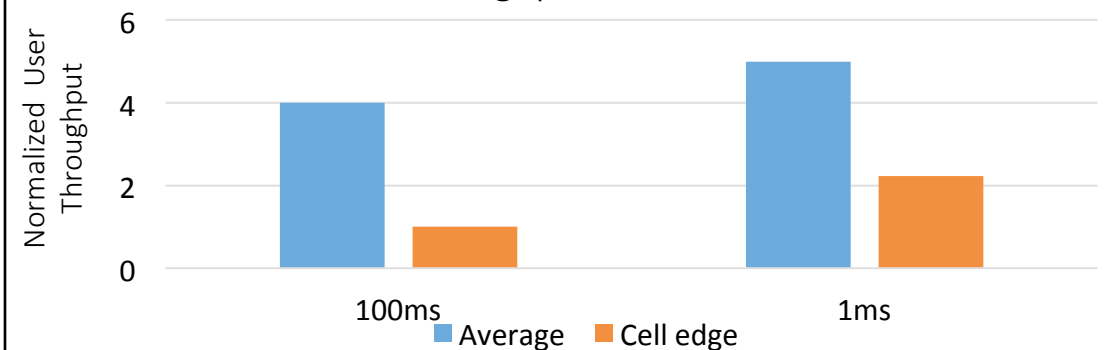
Allocation as small as 4 PRBs to
single RAT

+25%

Average object bitrate compared
to 100ms sharing

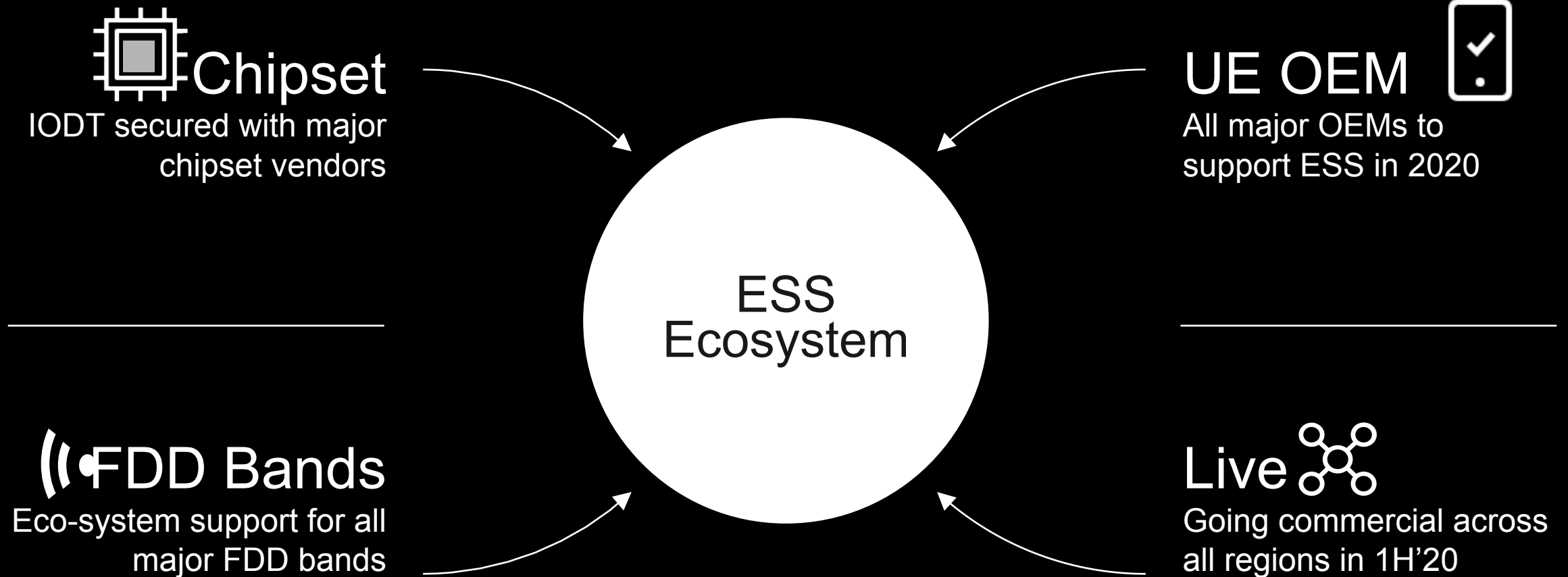
Improved download times for
smartphone users with 1ms
sharing

User throughput Gain with 1 ms



Global ESS ecosystem readiness

ESS will be part of every 5G smartphone in 2020



Sharing for the best performance

Ericsson Spectrum Sharing

Realize 5G vision

- 5G wide area coverage
- Smooth migration to standalone 5G
- Boost coverage and capacity with CA

A better way to build 5G

- Re-use of spectrum
- Re-use of installed base
- Re-use of sites

Unique solution

- Highest spectrum efficiency
- Fastest – 1ms 5G/4G spectrum sharing
- Full eco-system support





<https://www.ericsson.com/en/networks/offerings/5g/sharing-spectrum-with-ericsson-spectrum-sharing>

DYNAMIC SPECTRUM SHARING (DSS)

A Test and Measurement perspective

ROHDE & SCHWARZ

Make ideas real



WORKING WITH THE INDUSTRY ON DSS



Munich / 03-Mar-2020

Rohde & Schwarz and MediaTek verify dynamic spectrum sharing (DSS) for 5G NR

Today, frequencies below 6 GHz are heavily utilized due to the successful deployment of 4G LTE. This creates a challenge for network operators worldwide on how to deploy 5G NR at these low frequency bands. Dynamic spectrum sharing (DSS) is a technique that enables mobile network operators to use LTE and 5G NR in the same frequency band. The in-depth validation of the standardized coexistence methodology is key to the success of this technology. Rohde & Schwarz and MediaTek have leveraged their unique expertises through a collaboration, with the resulting verification that uses the R&S CMX500 5G NR radio communication tester platform by Rohde & Schwarz and a device under test (DUT) provided by MediaTek.

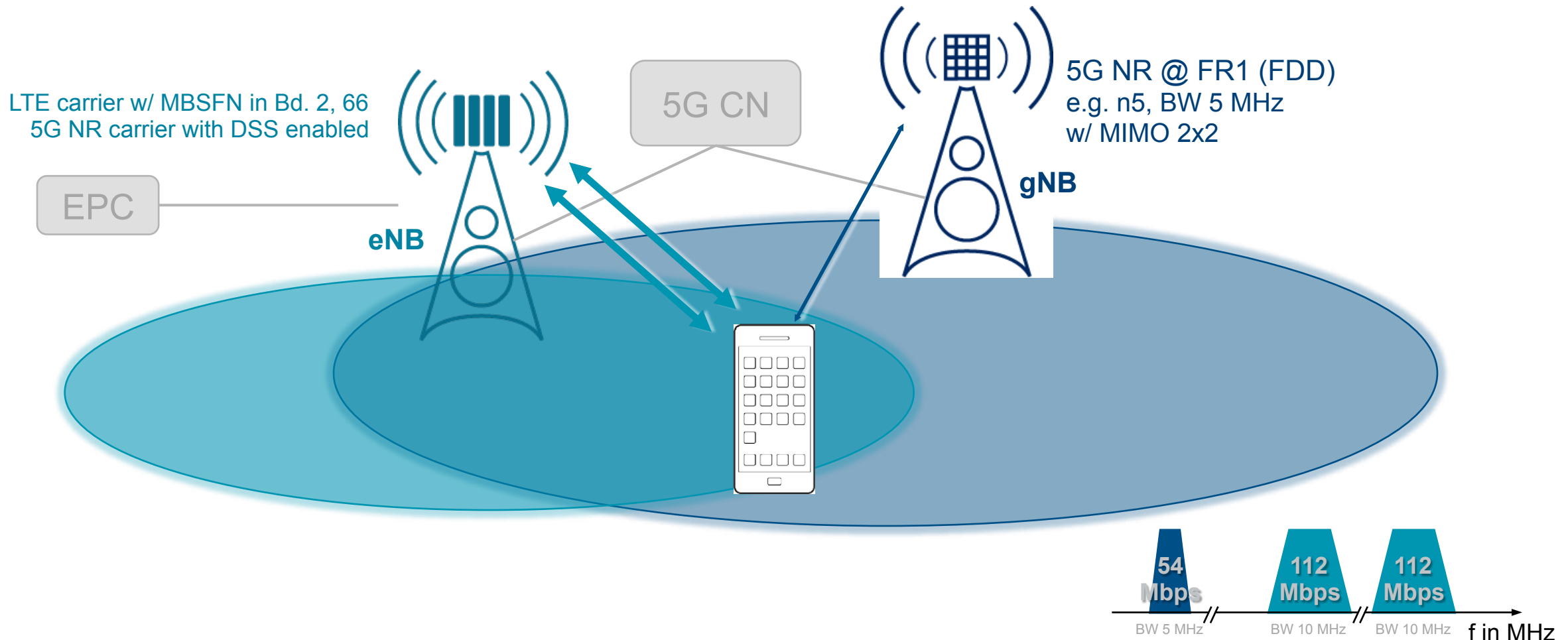
<https://www.youtube.com/watch?v=b53jkKUfaGE>

https://www.rohde-schwarz.com/us/about/news-press/all-news/rohde-schwarz-and-mediatek-verify-dynamic-spectrum-sharing-dss-for-5g-nr-press-release-detailpage_229356-787577.html



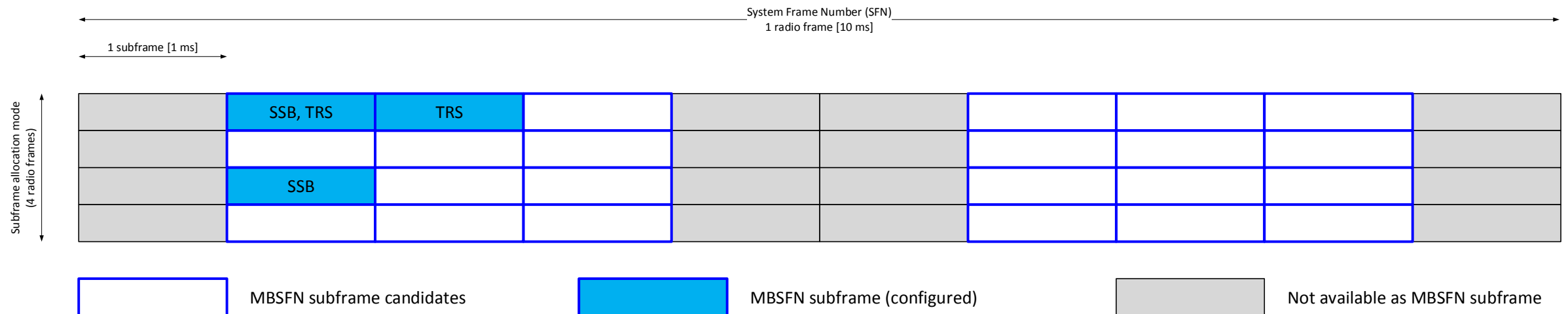
R&S®CMX500 5G NR Radio Communication Tester

DSS HELPS TO TRANSITION FROM NSA TO SA MODE



DOES DSS IMPACT OVERALL LTE CAPACITY?

Yes, but only in a single digit percentage!

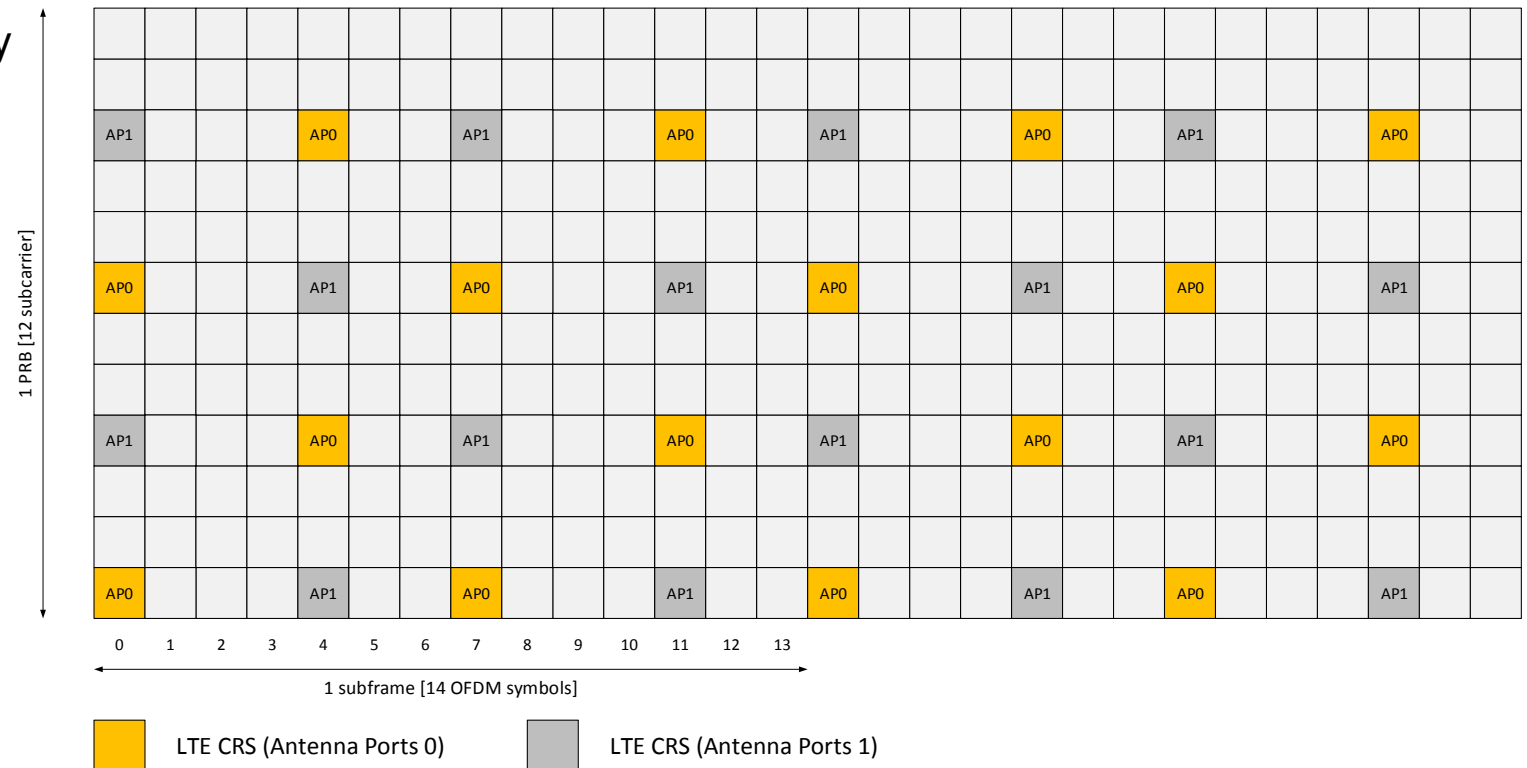


- The 'dynamic' in Dynamic Spectrum Sharing (DSS) comes from the fact that the smart scheduler in the base station balances the resource allocation between LTE and 5G NR based on several parameters including cell load, Quality of Service (QoS), etc.
 - Impact on LTE capacity depends on the actual situation and the behavior of the proprietary scheduling algorithm balancing resources among LTE and 5G New Radio (NR)

TESTING DYNAMIC SPECTRUM SHARING IN THE FIELD

- Scanners are sensitive, passive receivers (probes) to measure LTE, 5G network coverage based on synchronization and (cell-specific) reference signals (CRS) as RSRP, RSRQ, SINR

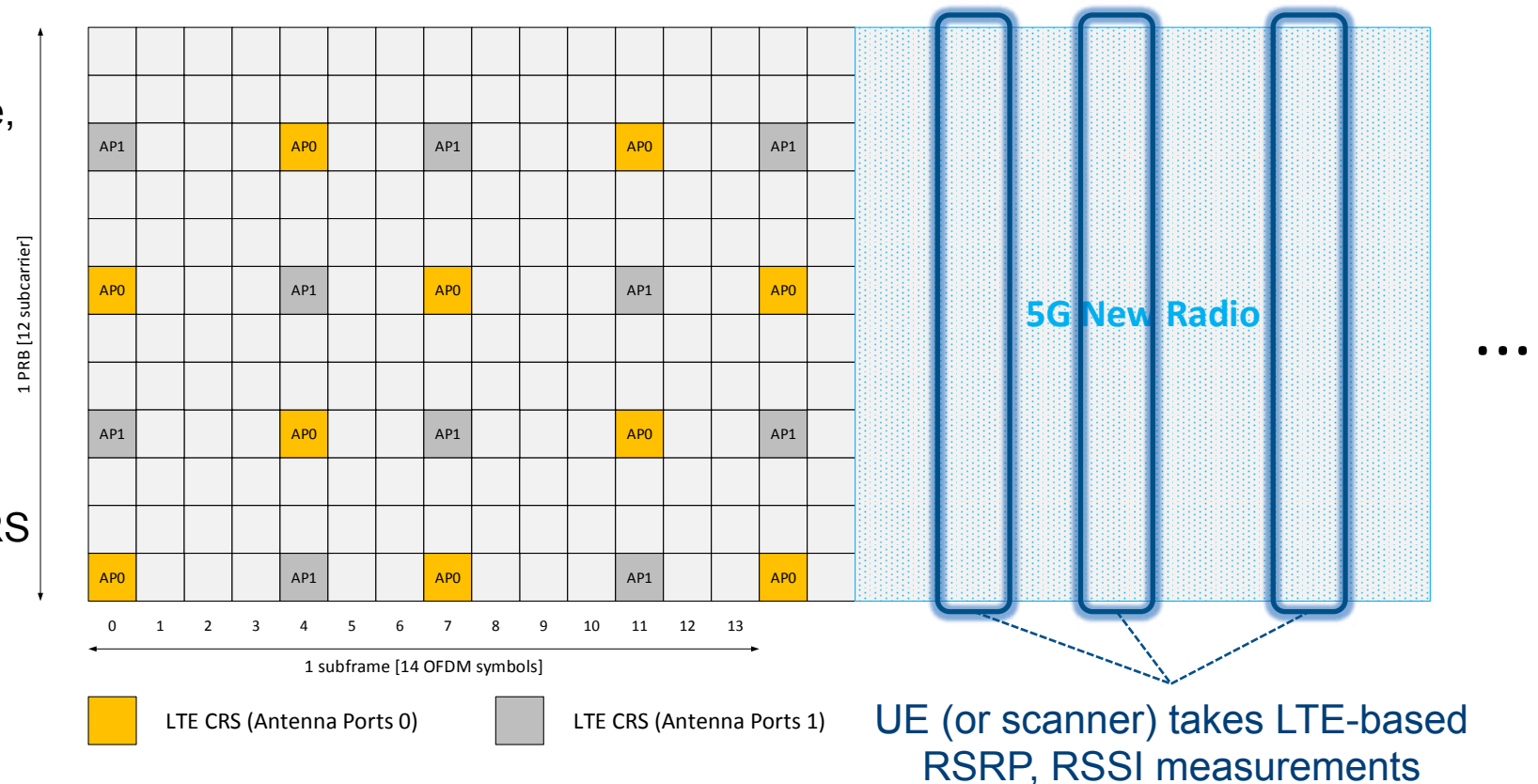
- RSRP measured as linear average only in resource elements that carry LTE CRS (i.e. for AP0)
- RSSI is only measured in symbols that contain LTE CRS (i.e. symbols #0, #4, #7, #11, ...)
- RSRQ is computed as RSRP over RSSI based on measurement bandwidth given in number of RBs



TESTING DYNAMIC SPECTRUM SHARING IN THE FIELD

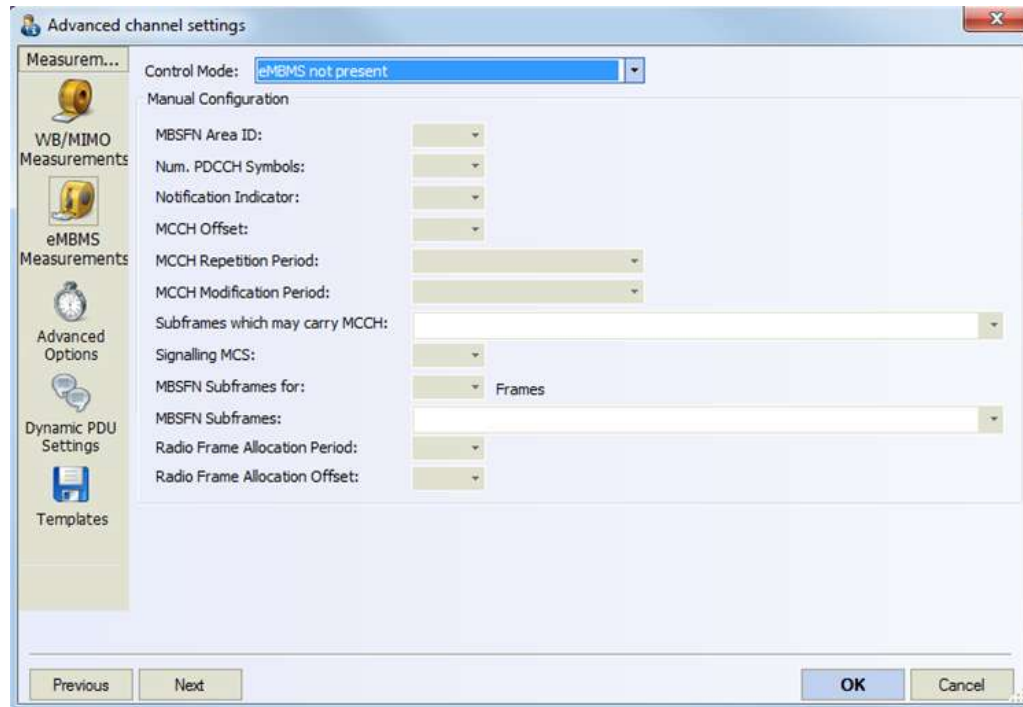
- Scanners are sensitive, passive receivers (probes) to measure LTE, 5G network coverage based on synchronization and (cell-specific) reference signals (CRS) as RSRP, RSRQ, SINR

- Without knowledge the UE (or scanner) would expect LTE CRS in the MBSFN-configured subframe, measure RSRP at the relevant resource elements and RSSI in the respective OFDM symbols that are now occupied by 5G NR signal components
- Exclude MBSFN configured subframes from measuring RSRP, RSRQ and SINR based on LTE CRS



TESTING DYNAMIC SPECTRUM SHARING IN THE FIELD

- Manual configuration of scanner or configure scanner automatically based on SIB2 broadcast to be aware of MBSFN subframes



Questions?

