에릭슨 스펙트럼 쉐어링과 주파수 활용

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01

Ericsson Spectrum Sharing is unique

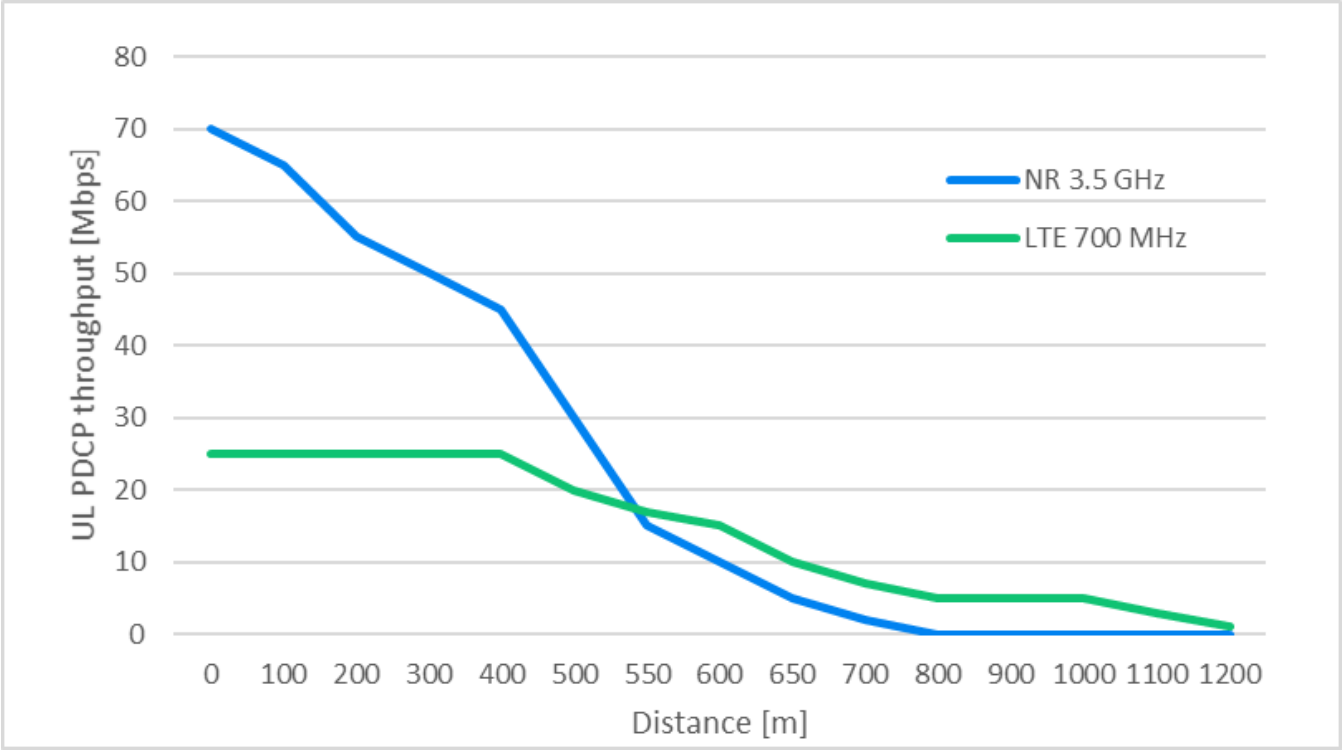
Inter-RAT solution including 1ms scheduling, frequency division multiplexing and coordinated signaling

Why NR on Low-band FDD band?

Better UL coverage with low-band FDD compared to mid-band TDD

To increase DL mid-band service area by making use of low-band FDD for NR

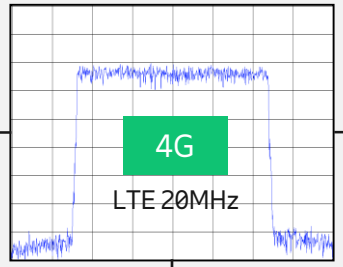
Critical piece in migration towards SA



Uplink : Low band vs. mid band field measurements

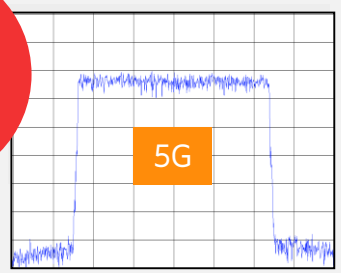
Ways to enable 5G on FDD

Baseline



Re-farming

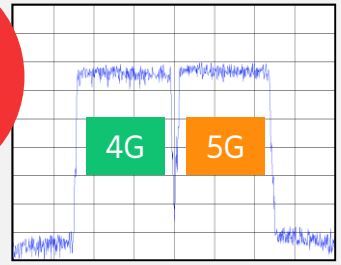
Expensive when LTE traffic increasing is still



Switch off 4G

Allocation

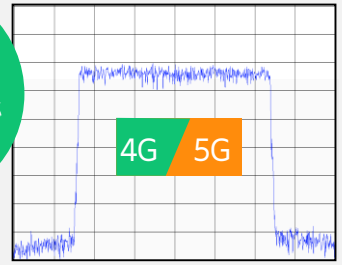
Capacity limitation for both 4G and 5G



4G 10MHz + 5G 10MHz

Ericsson Spectrum Sharing

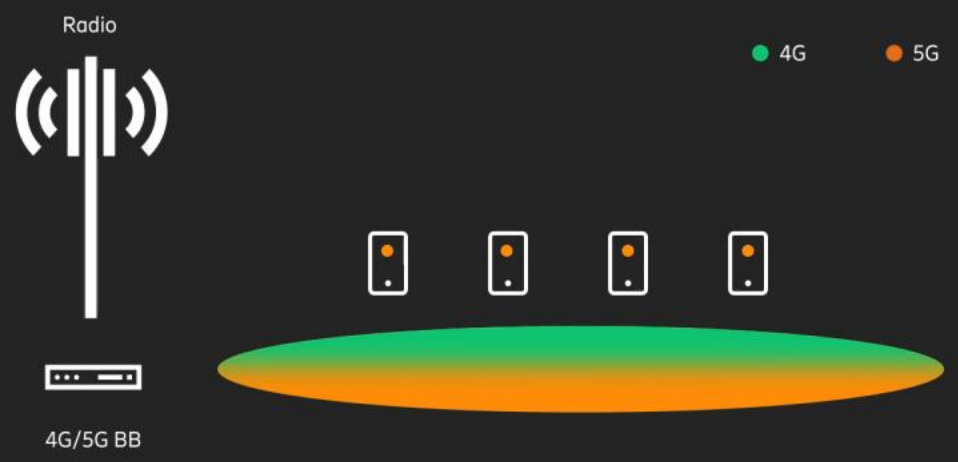
Flexible, cost effective and dynamic introduction of 5G

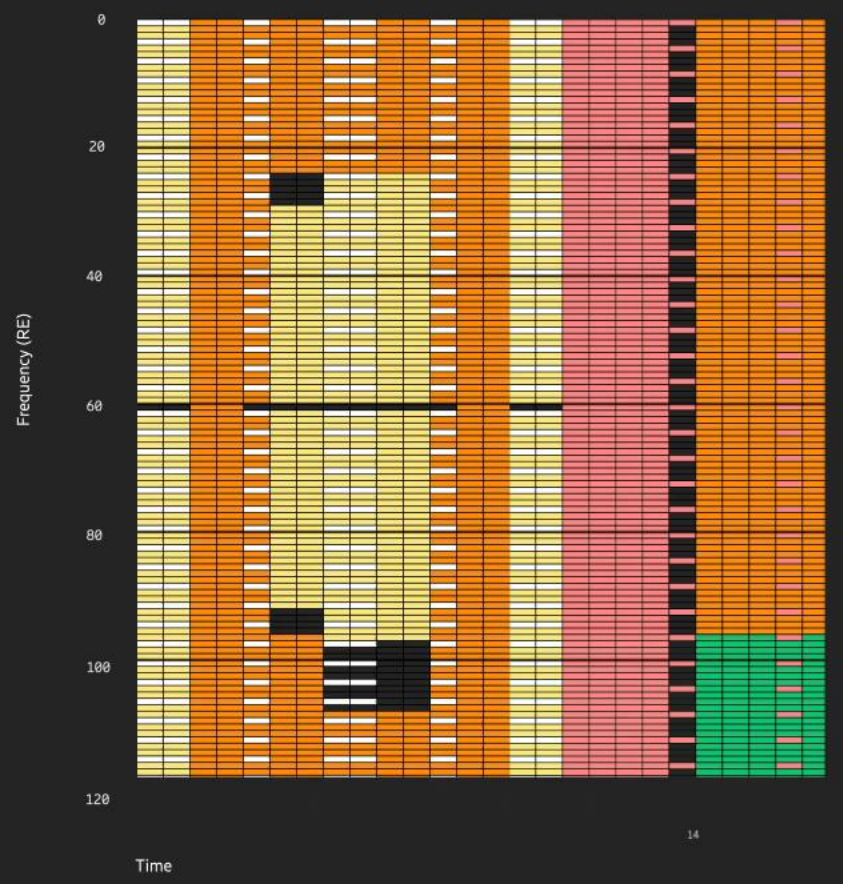


20MHz to LTE and NR

Ericsson spectrum sharing

How does it work?

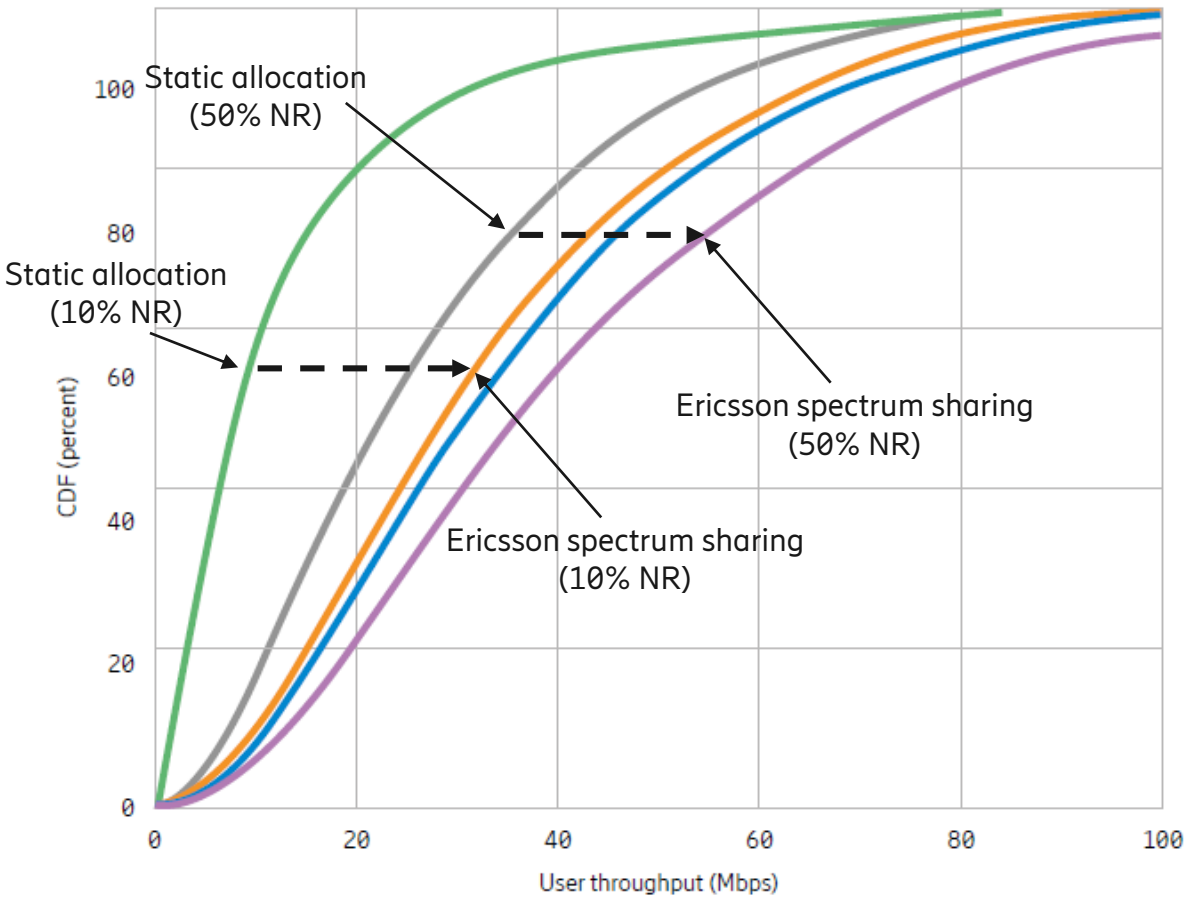




ESS

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

Ericsson Spectrum Sharing outperforms static spectrum allocation



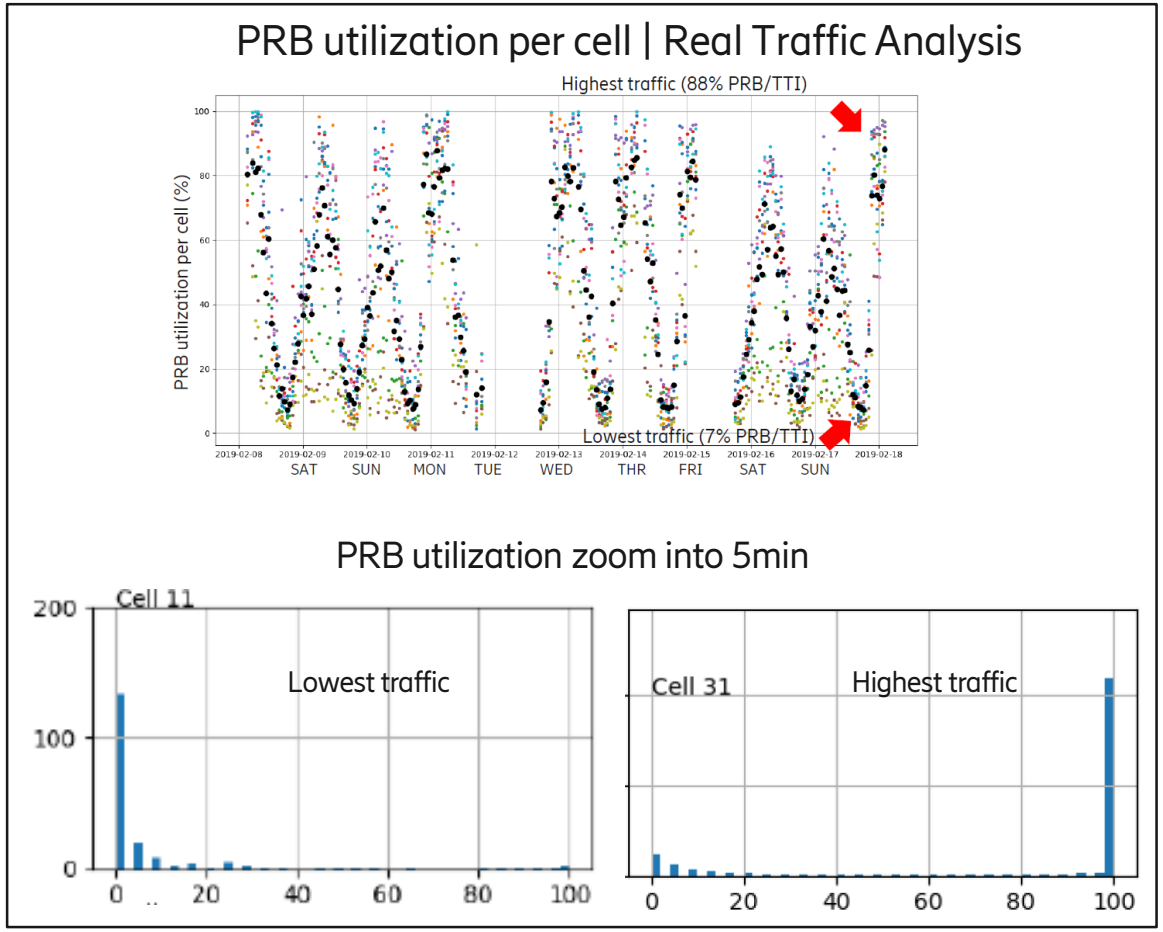
Game-changing

Ericsson Spectrum Sharing outperforms a static spectrum allocation at any system load

Static spectrum allocation prevents operators in handling the growing 5G data traffic

Cumulative distribution functions (CDF) of the end-to-end throughput observed by an LTE and NR device at a total system load of 6MBit/s, which can be considered medium in this scenario.

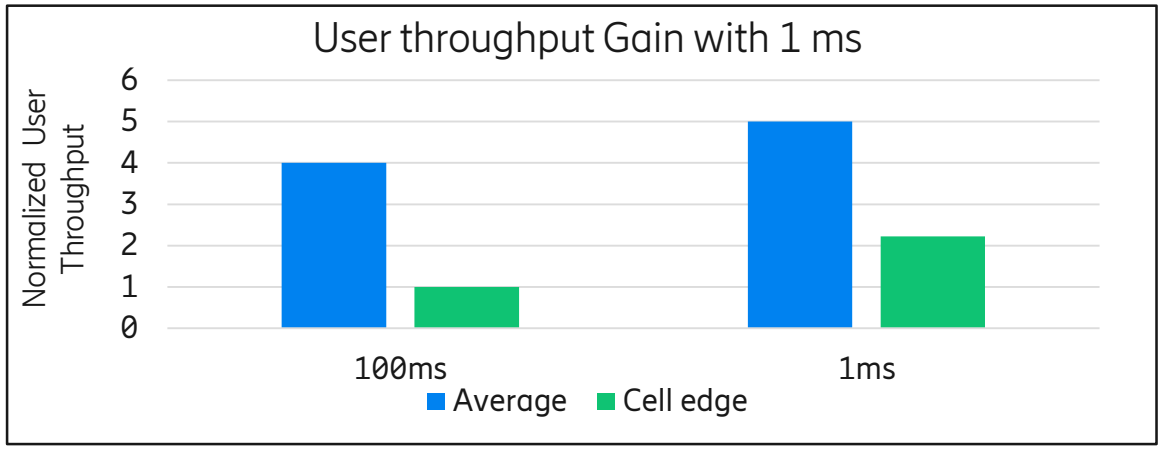
1ms PRB assessment critical to maximize capacity



>20%

Capacity gain
with PRB level sharing

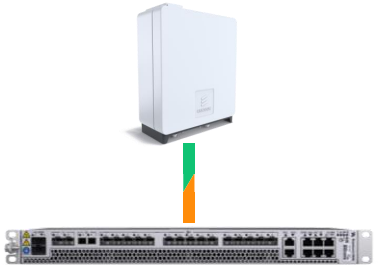
Allocation as small as 4 PRBs to single RAT



Ericsson Spectrum Sharing is unique

Cost optimized

Shared radio



Shared CPRI link

Shared RAN Compute baseband

Sustainable

Re-use of hardware

Fewer sites needed

Fast and efficient

1ms

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

Ericsson Spectrum Sharing Tools in 3GPP + Ericsson innovations

Technical deep dive

Ericsson Spectrum Sharing

Tools in 3GPP

- CRS rate matching of NR PDCCH
- NR 7.5kHz UL frequency shift

Ericsson innovation

- Coordination scheduling for 1ms spectrum sharing enabling FDM
- Transmit NR common signals in the presence of LTE CRS
- Avoid LTE synchronization signals, broadcast channels, and CSI-RS
- Constant improvement of NR PDCCH capacity

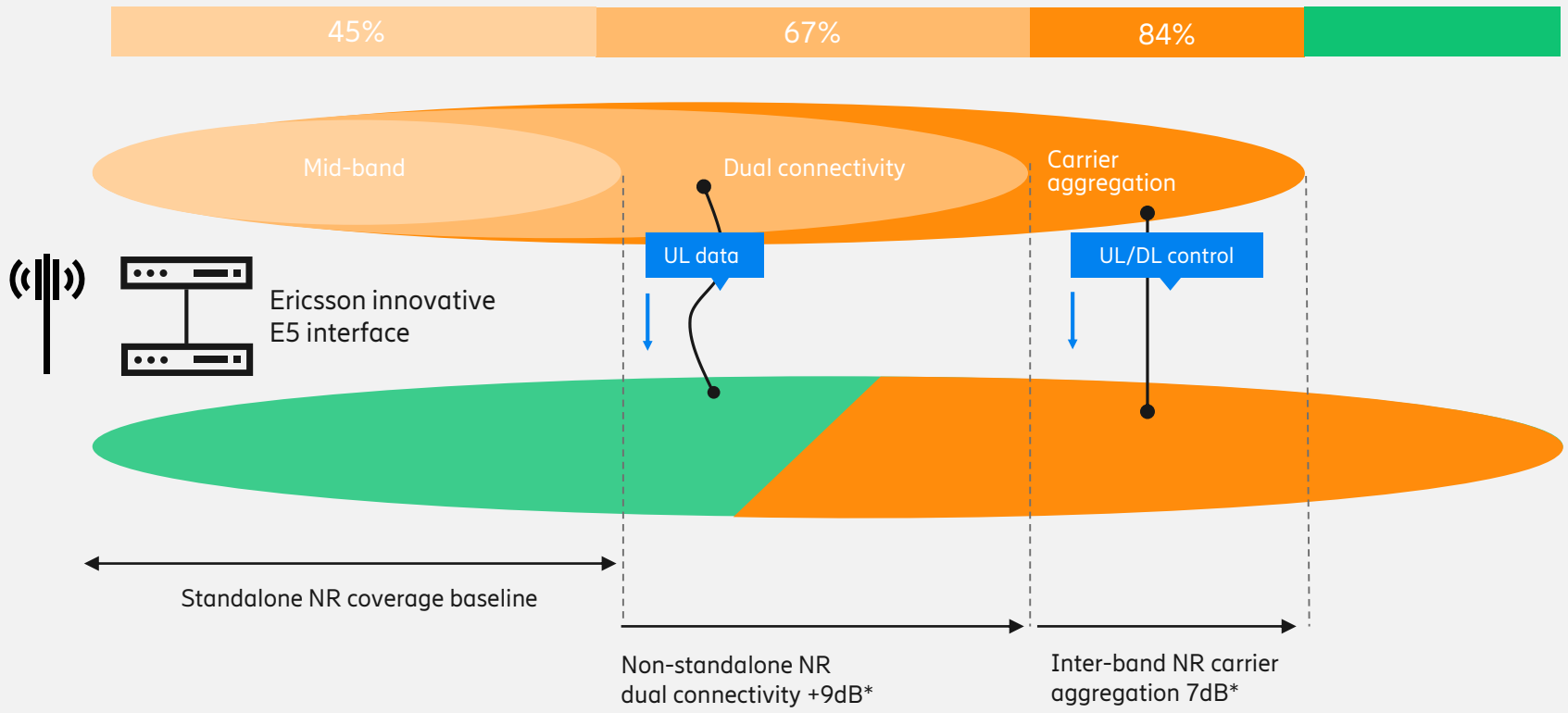
Ericsson Radio System – enabling software activation of Ericsson Spectrum Sharing in installed base

02

Expanding mid-band/ high-band cell coverage

Introduce 5G and its' benefits with Ericsson Spectrum Sharing, get wide area coverage and high capacity over the whole spectrum

Maximize mid-band coverage with low-band and carrier aggregation



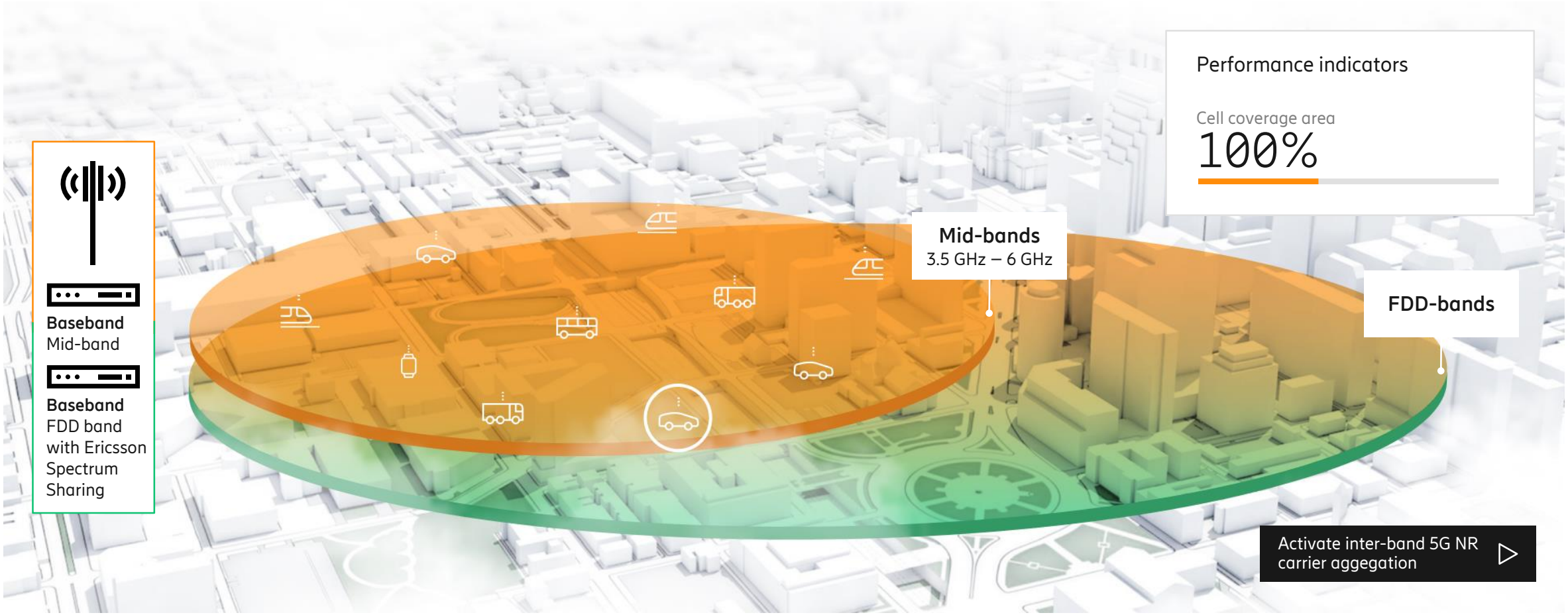
*upper bound. Gain depends on frequency band combinations and product assumptions.

% of subs who access mid-band TDD

NR on mid-band TDD

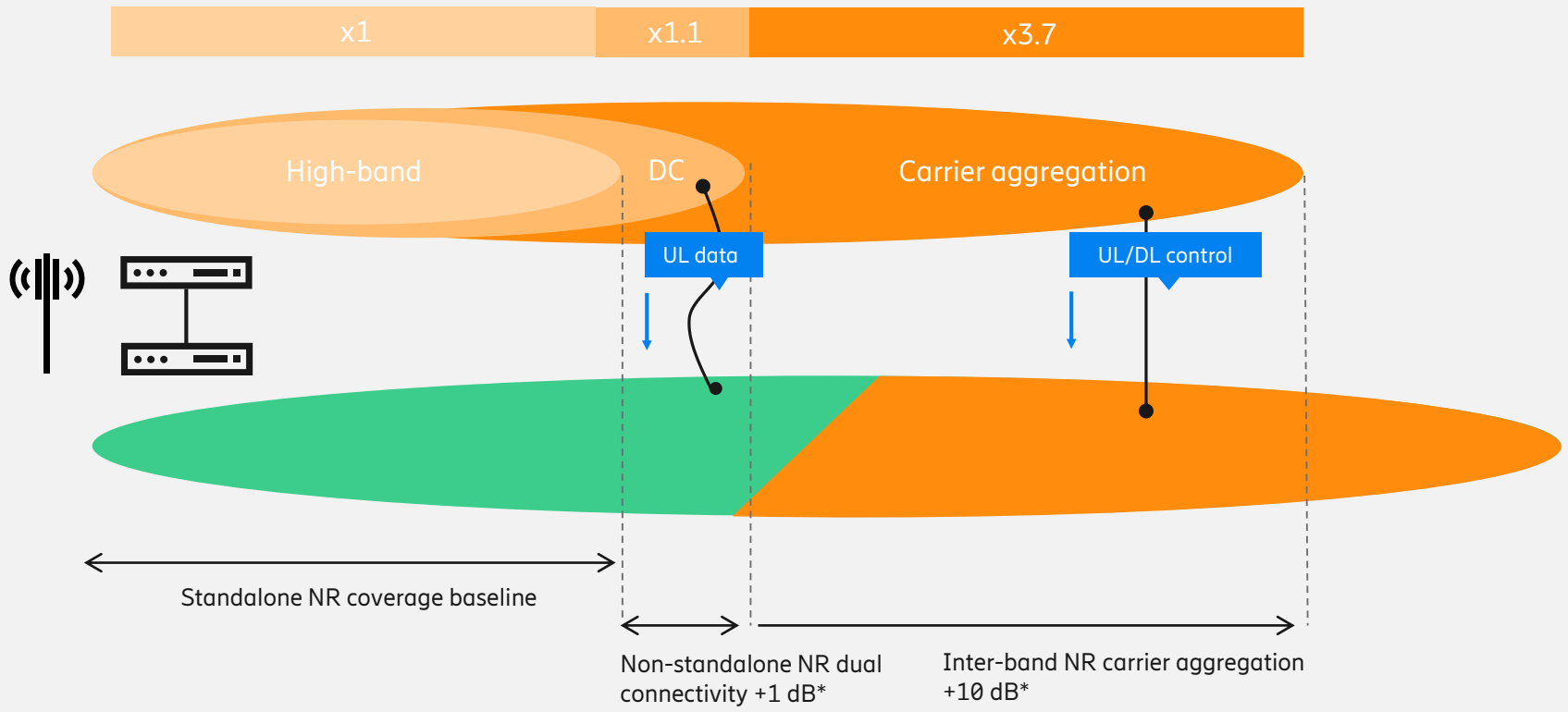
NR/LTE on low-band FDD with Ericsson Spectrum Sharing

Expand cell coverage area of mid-band TDD



Expand cell coverage area of mid-band TDD

Carrier aggregation: using low-band to maximize high-band coverage



*upper bound. Gain depends on frequency band combinations and product assumptions.

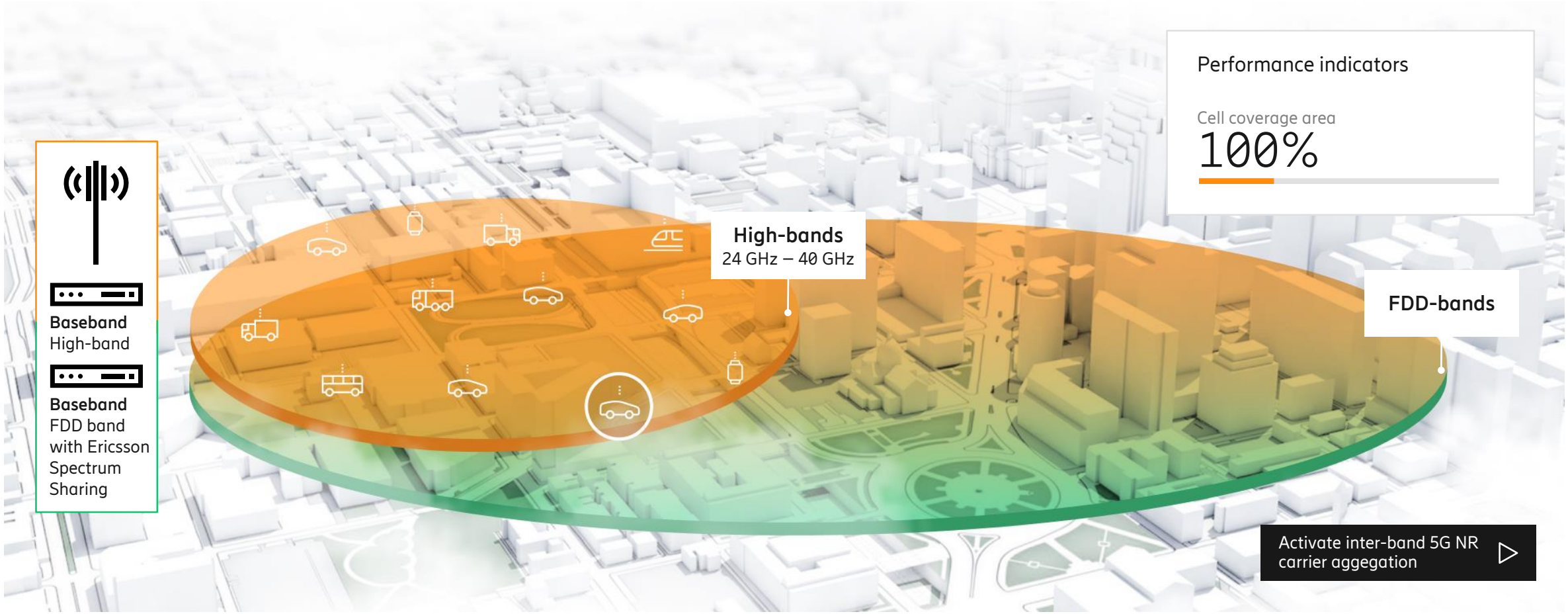
Relative high-band area coverage

NR on high-band TDD

x3.7 cell coverage area

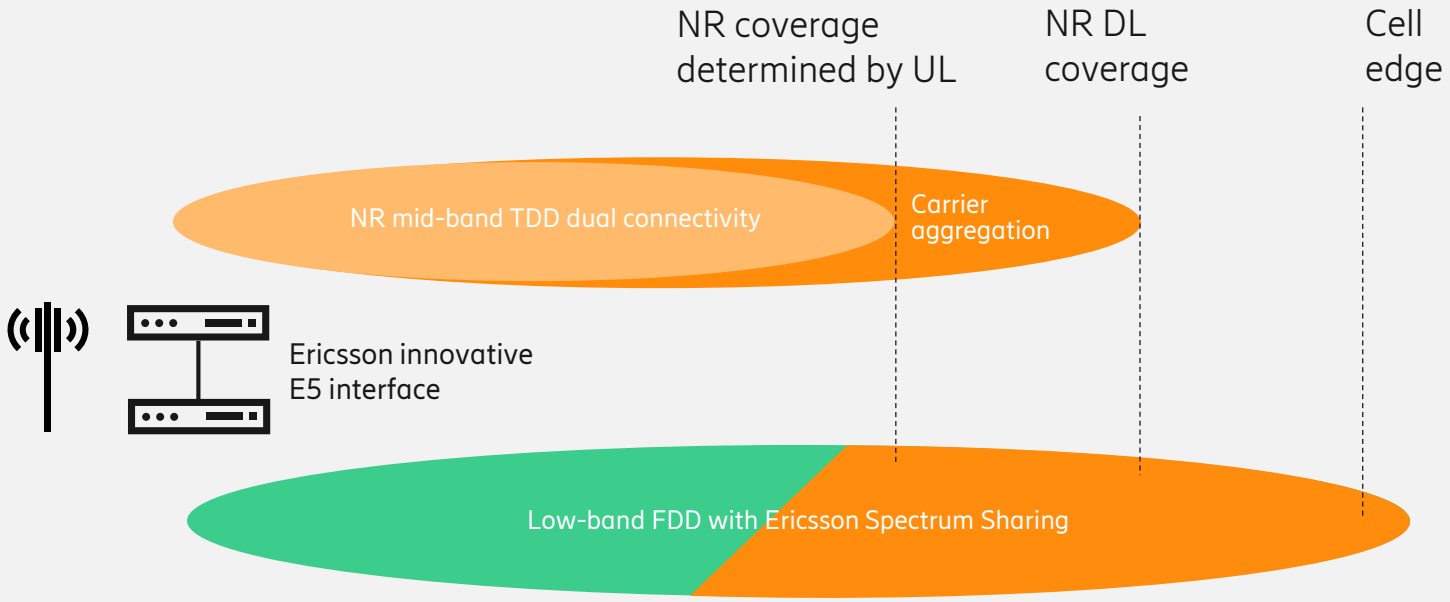
x2 cell radius

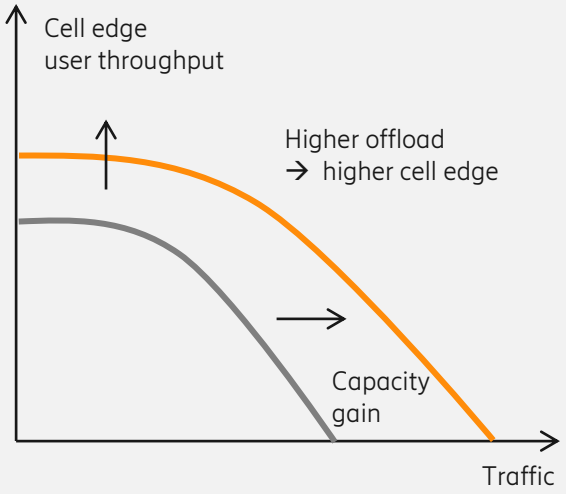
Expand cell coverage area of high-band



Expand cell coverage area of high-band

Coverage is prerequisite for high capacity





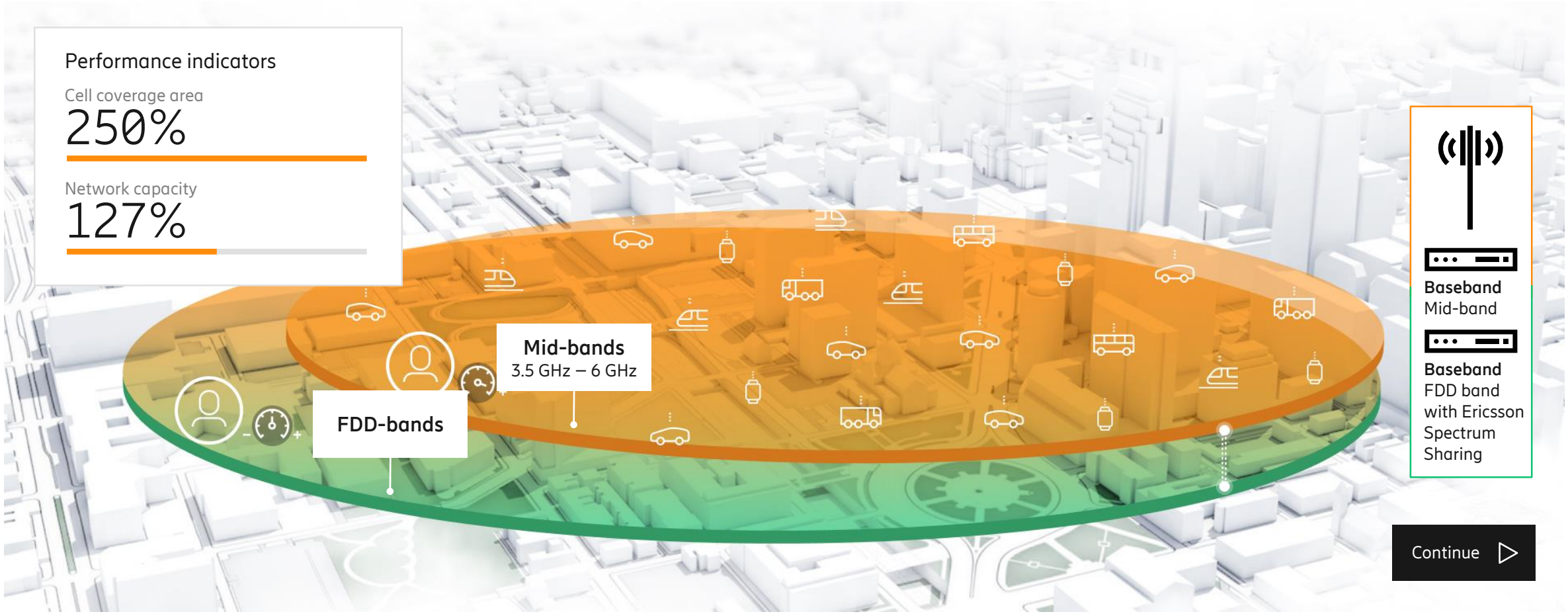
Cell capacity is the amount of traffic a cell can handle by satisfying the minimum data rate requirement of the cell edge users.

— More extended cell coverage means higher offload.

— A higher offload result in higher UE throughput for the cell edge; leads to a higher capacity.

Increase network capacity

Increase network capacity

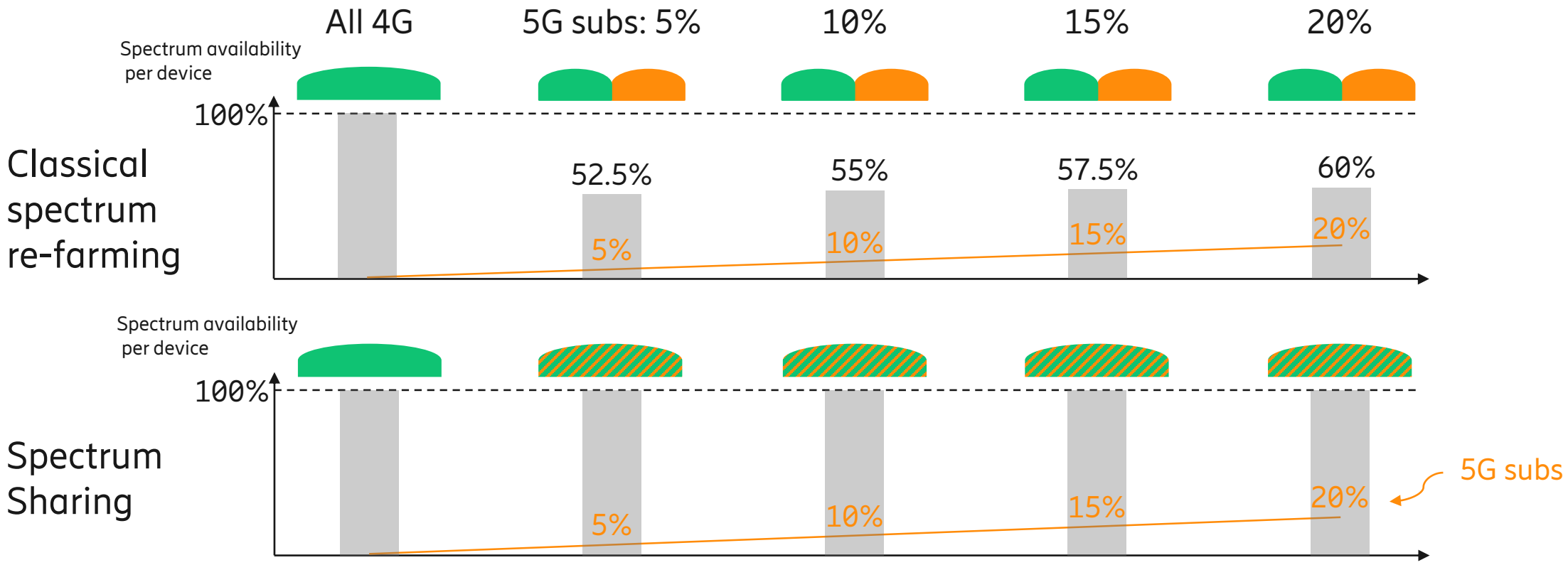


03

5G evolution strategy

Ericsson Spectrum Sharing is a unique solution allowing for a smarter way to roll-out and take the full advantage of 5G

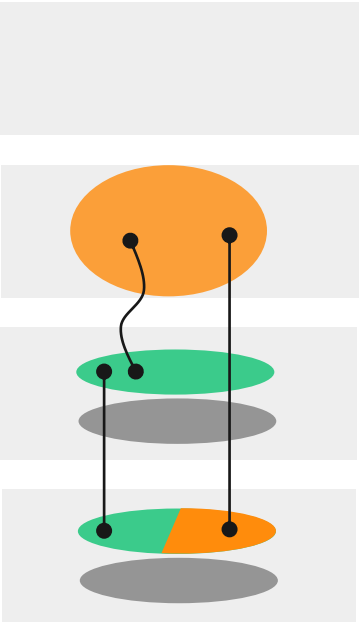
Maximize spectrum utilization



5G can be smoothly introduced without impacting on 4G subscribers and traffic

5G icon everywhere – quickly

5G introduction



Option 3

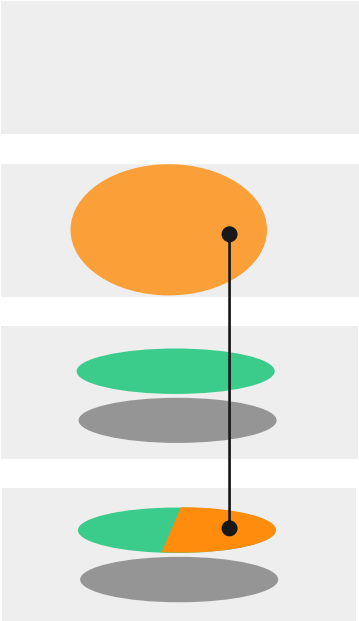
5G

5G introduction on mid/high-band → limited coverage

Ericsson Spectrum Sharing – Software update → wide area coverage

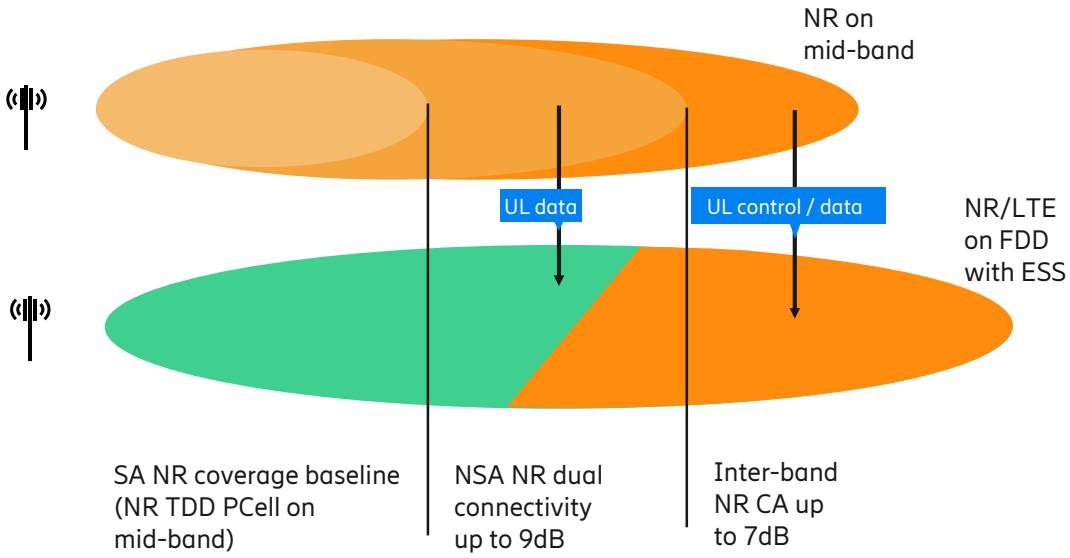
Boost coverage

+ 5G coverage



Option 3/2

Boost coverage and capacity with NR carrier aggregation



27% Increase in network capacity

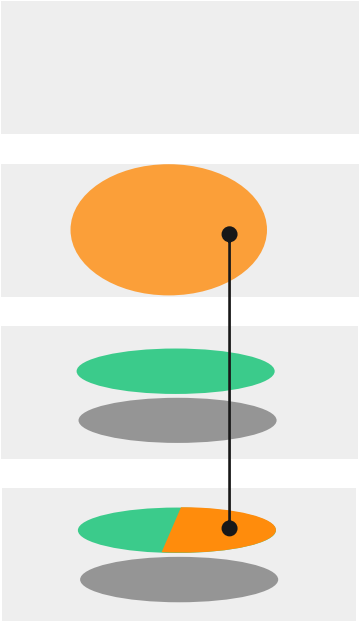
3–7dB

Using 5G NR Carrier Aggregation can provide up to 3–7dB gain in link budget on the downlink

Extended coverage on 3.5GHz spectrum with NR carrier aggregation of shared FDD bands

Minimize network complexity

+ 5G stand-alone

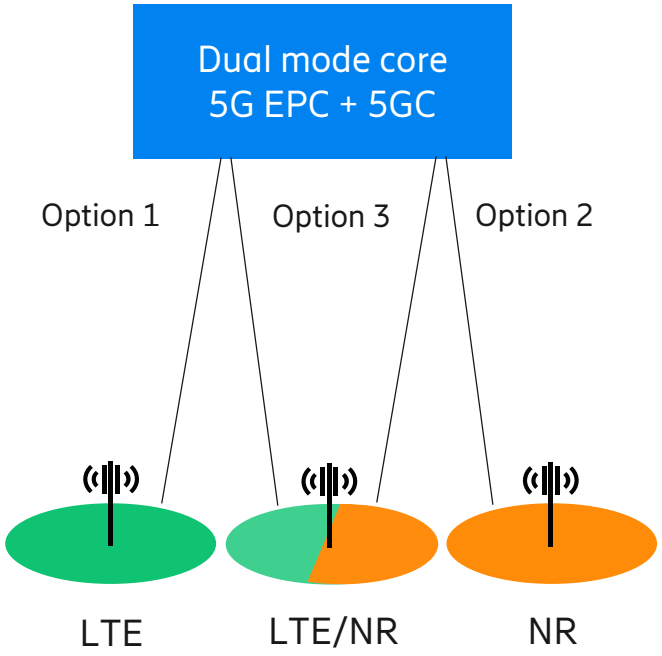


Option 3/2

No need for complicated options

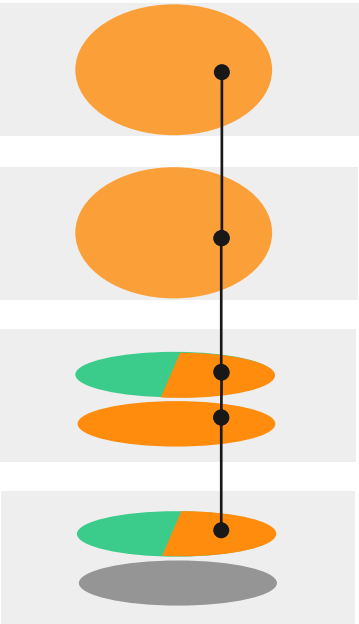
- 5G stand-alone coverage secured with 5G FDD bands
- Reduced network complexity

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



5G goes mainstream

+ Ultimate



Option 3/2

5G goes mainstream

Decrease of LTE traffic and devices

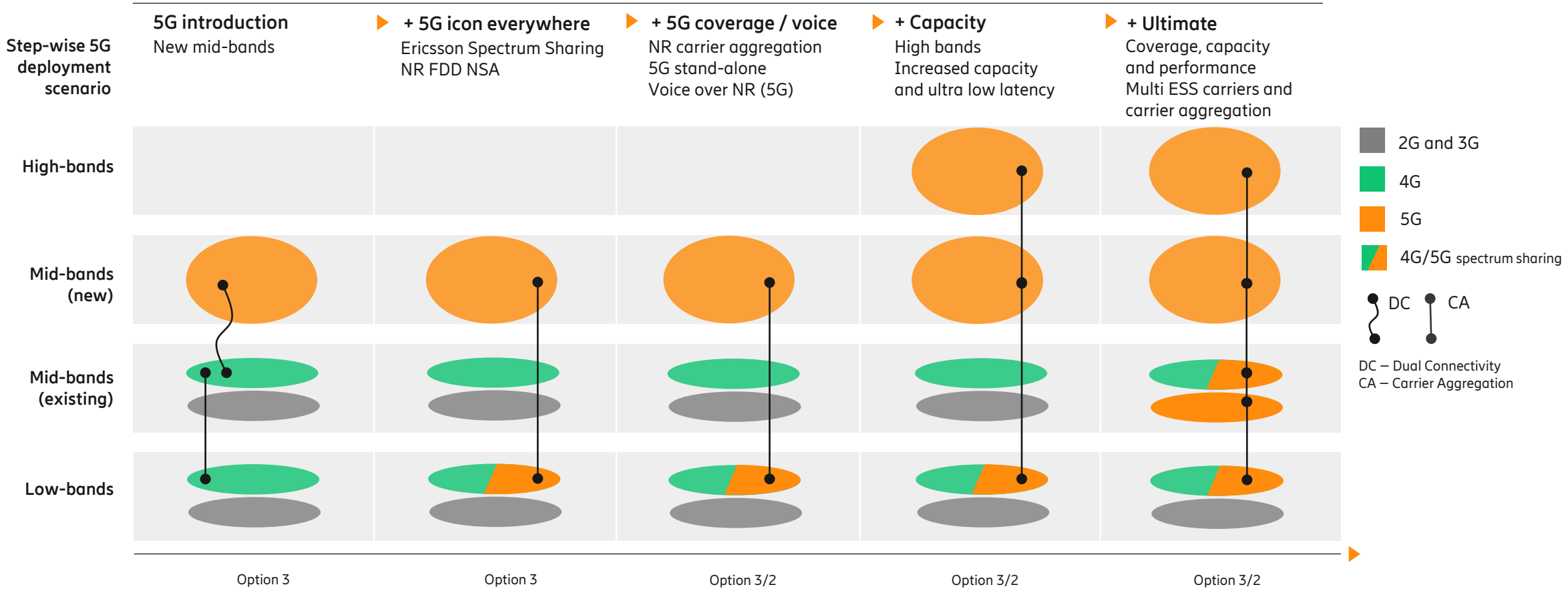
Increase throughput and peak speed with 5G Carrier Aggregation over many bands

5G on multiple bands with Ericsson Spectrum Sharing

Explore new use cases

Increased capacity and ultra low latency

Smooth 5G expansion



04

A smarter way to build 5G

Ericsson Spectrum Sharing is the tool to build 5G cost effective

Legacy technologies and spectrum bands

Traditionally new spectrum is added and/or re-farmed when a new a generation is introduced

2G 3G 4G

Traditional way to build 5G

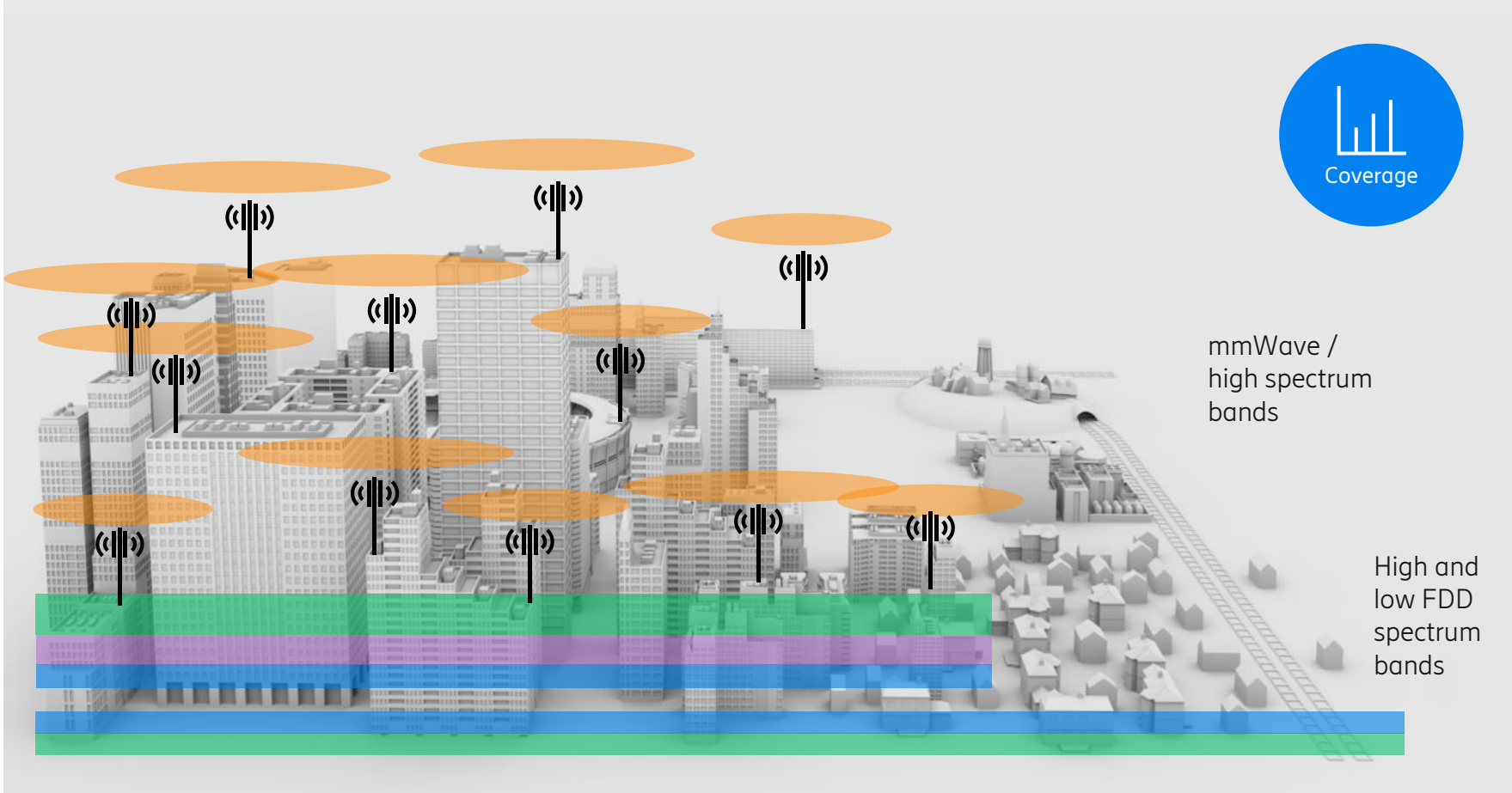
Overlay 5G network on new bands;

- Mid-bands – 3.5GHz
- mmWave >28GHz

1) Deploy 5G in urban areas on mid-band

2) Add high-band in selected locations

3) Extend coverage and add capacity



2G 3G 4G 5G

A better way to build 5G

1. Re-use sites and grid in initial roll-out of 5G

2. Increase value of spectrum
   - '5G icon' - wide area coverage with Ericsson Spectrum Sharing
   - Extend coverage and increase capacity with carrier aggregation between low and mid bands

3. Add mmWave with business sense

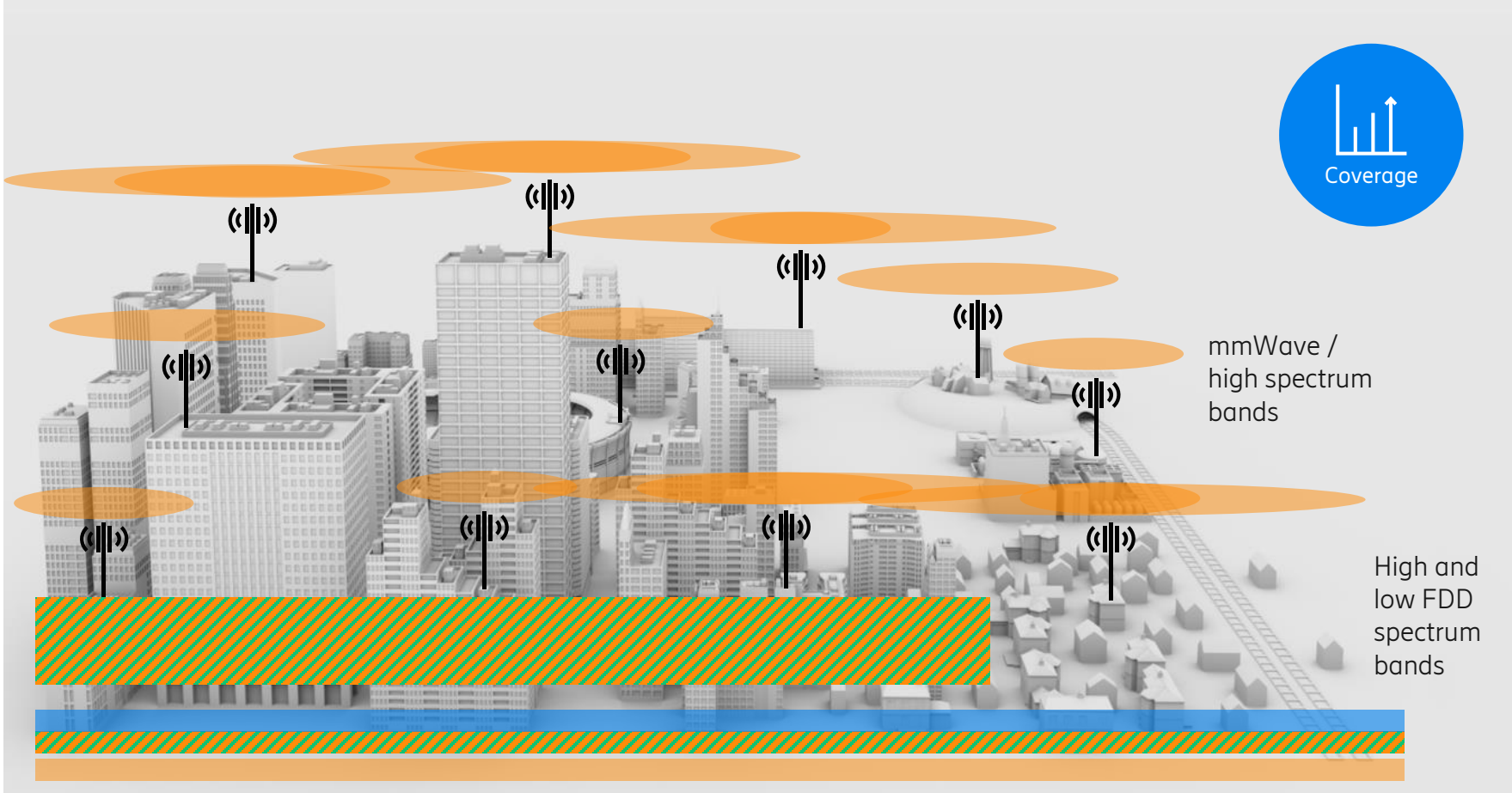
2G 3G 4G 5G 4G/5G spectrum sharing

A better way to build 5G

4. When business allows, gradually add 5G to more spectrum bands with Ericsson Spectrum Sharing

5. Business driven capacity and coverage extension with new sites on 3.5GHz / mmWave

6. Add 5G on new low bands when available



2G 3G 4G 5G 4G/5G spectrum sharing

Sharing for the best performance

Ericsson Spectrum Sharing

A better way to build 5G

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

Realize 5G vision

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

Take the full advantage

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

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