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CA and DC enhancements for Rel-18

RAN Rel-18 Workshop
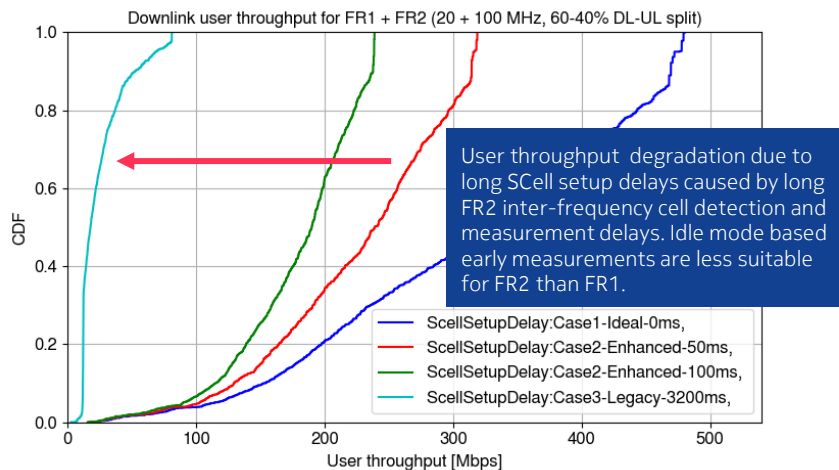28th June – 2nd July 2021
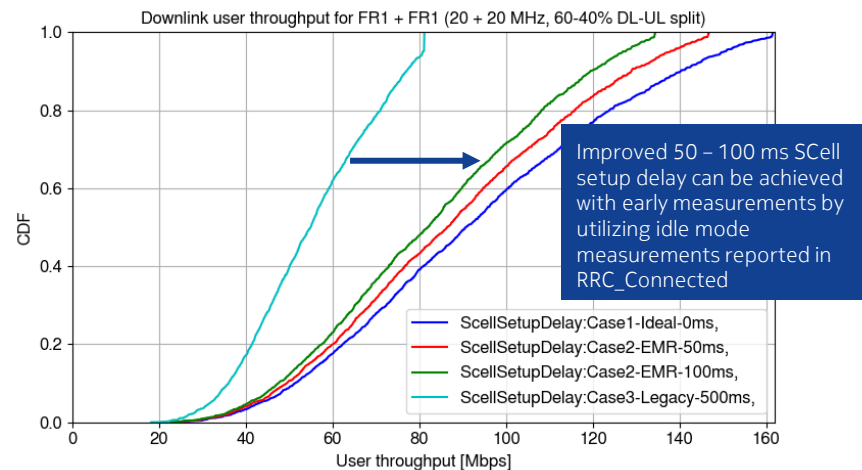RWS-210079

CA and DC enhancements: Motivation

The current FR2 CA and DC cell identification, measurement and measurement reporting delays are rather large causing significant degradations in user throughputs in FR2 related CA and DC deployments.

FR1 CA and DC performance is much better thanks to the early measurement enhancements where idle mode measurements can be reported RRC_Connected and thus, used for SCell activation

Practical Improvements for SCell setup delays would be needed for FR2 as well

Downlink user throughput for FR1 + FR2 (20 + 100 MHz, 60-40% DL-UL split)

User throughput degradation due to long SCell setup delays caused by long FR2 inter-frequency cell detection and measurement delays. Idle mode based early measurements are less suitable for FR2 than FR1.

ScellSetupDelay:Case1-Ideal-0ms,
ScellSetupDelay:Case2-Enhanced-50ms,
ScellSetupDelay:Case2-Enhanced-100ms,
ScellSetupDelay:Case3-Legacy-3200ms,

FR1 + FR2 (20 + 100 MHz)

Downlink user throughput for FR1 + FR1 (20 + 20 MHz, 60-40% DL-UL split)

Improved 50 – 100 ms SCell setup delay can be achieved with early measurements by utilizing idle mode measurements reported in RRC_Connected

ScellSetupDelay:Case1-Ideal-0ms,
ScellSetupDelay:Case2-EMR-50ms,
ScellSetupDelay:Case2-EMR-100ms,
ScellSetupDelay:Case3-Legacy-500ms,

FR1 + FR1 (20 + 20 MHz)

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CA and DC enhancements: Motivation

Our system simulation results show that idle mode measurements reported in connected mode work rather well for FR1.

However, since radio conditions may change rapidly in FR2 beam based deployments even with low and moderate UE speeds, FR2 idle mode measurements reported in connected mode may not work well considering the longer measurement delays

This means that for FR2 deployments idle mode measurements reported in connected mode may indicate wrong cell to be used for SCell activation.

Procedures and criteria achieving fast and accurate CA/DC activation for FR2 while balancing UE power consumption would result in more efficient FR2 utilization
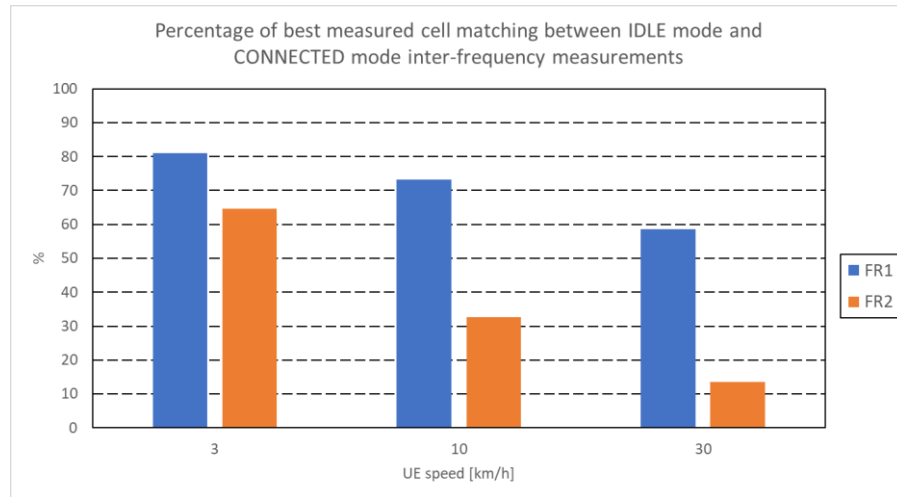
- Dense Urban deployment with 200 m ISD, 7 sites, 21 sectors
- SSB beams per sector: FR1: 8 wide beams, FR2: 14 wide beams
- FR1 frequency: 3.5 GHz
- FR2 frequency: 28 GHz
- Channel and propagation model: TR 38.901 UMa
- DRX: 640 ms
- Measurements according to TS 38.133: 4.2.2.4 and 9.3.9.2

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CA and DC enhancements: Objectives

Enhanced EMR procedures for FR2, including at least: [RAN2]

- Procedures and criteria balancing UE power consumption and CA/DC setup delay
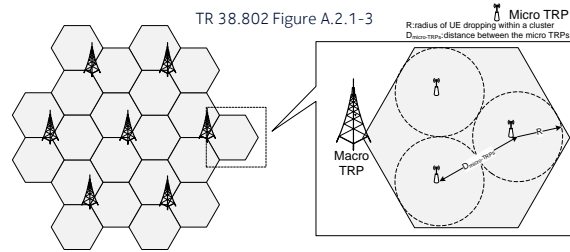
Improve UE requirements for cell setup time in FR2, including at least: [RAN4]

- UE Requirements for measurement procedures with FR2 (with decreased delays)

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Background

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CA and DC enhancements: Simulation assumptions

- User throughput analysis:

TR 38.802 Figure A.2.1-3

R:radius of UE dropping within a cluster
D$_{micro-TRPs}$:distance between the micro TRPs

Micro TRP

Macro TRP

Parameter	Setting
Scenario deployment	Dense Urban 21 NR macro cells with ISD 200 + 3 NR micro cells per macro cell area (TR 38.802)
Bandwidth	NR macro cells: 20 MHz@2.1GHz NR micro cells: FR1: 20 MHz@3.5GHz, FR2: 100 MHz@28GHz
Propagation and channel models	NR macro cells: TR 38.901 UMa NR micro cells: TR 38.901 UMi
Duplexing	TDD with 60-40% DL-UL split
Traffic	FTP model 1 in downlink with 5 MByte files and offered load 30 Mbps per macro area
UE speed	3 km/h
SCell setup delays	Ideal (0 ms), Enhanced (50-100 ms), Legacy (500-3200 ms)

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