3GPP TSG RAN WG4 #100-e
e-Meeting, August 16th – 27th, 2021

R4-2115629

Systems Level Evaluations on CRS Interference in Scenarios with Overlapping Spectrum for LTE and NR

Source: AT&T

Agenda: 9.12.2.3

Document for: Discussion/Decision

This contribution is an update of R4-2112316

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Background

RAN4 #99e discussed CRS interference handling in Rel. 17 [1]

According to the agreed Way Forward [2], simulation results will be collected before RAN4 #100e

Link level simulation assumptions were agreed in [2]

This contribution presents additional systems level simulation results

[1] R4-2108696, Email discussion summary for [99-e][330] NR_perf_enh2_Demod_Part1, Moderator (China Telecom)

[2] R4-2108662, WF on CRS interference handling in scenarios with overlapping spectrum for LTE and NR, China Telecom

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Simulation Parameters

Parameter	Assumption
Carrier Frequency	1955 MHz
Carrier Channel Bandwidth	20 MHz
Number of carriers	1
Number of users per cell	5 UEs
SCS	15 kHz
Channel Model	NR UMa
Base station height	25m
UE height	1.5m
UE location	80% indoor
Layout	21 sectors with full wrap-around
ISD	1000m
BS Tx Power	52 dBm
BS Antenna gain	14 dBi
BS Noise Figure	5dB
UE receiver	MMSE-IRC
Reference receivers	Rel. 15 CRS rate matching, Rel. 16 CRS rate matching, Rel. 15 symbol level rate matching, CRS-IC
BS antenna Array configuration	(M, N, P, Mg, Ng) = (1, 2, 2, 1, 1), dH = dV = 0.5 λ
UE antenna Array configuration	(M, N, P, Mg, Ng) = (1, 1, 2, 1, 1), dH = dV = 0.5 λ
Traffic model	Bursty data - FTP Model 3
Traffic distribution (NR/LTE)	25%/75%, 50%/50%, 75%/25%
CSI feedback	Wideband
Scheduler	PF
Architecture	SA
MBSFN subframes	4 MBSFN subframes per 40ms for NR SSB, CSI-RS, TRS, RMSI, OSI
DSS mode	Dynamic DSS at TTI level
CRS	Interference and overhead is modeled
CRS power boost	0 dB

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Evaluation Assumptions

For the CRS-IC receiver, perfect channel estimation of CRS interference is assumed

Following [3], CRS-IC is only turned on when the interfering cell's RSRP is within 6dB of the UE's serving cell RSRP

A UE cancels the CRS of the cells with the *N* strongest RSRPs whose CRS is not colliding with the serving cell's CRS (*N* = 1 or 2)

For the CRS-RM receiver, both Rel. 15 symbol level rate matching and Rel. 16 CRS rate matching (second pattern) are evaluated

- For Rel. 16 rate matching the UE is configured with a second pattern to rate match the CRS of the cell with the strongest RSRP whose CRS is not colliding with the serving cell's CRS

[3] RP-210350, Discussion of LTE CRS-IC for DSS, Qualcomm

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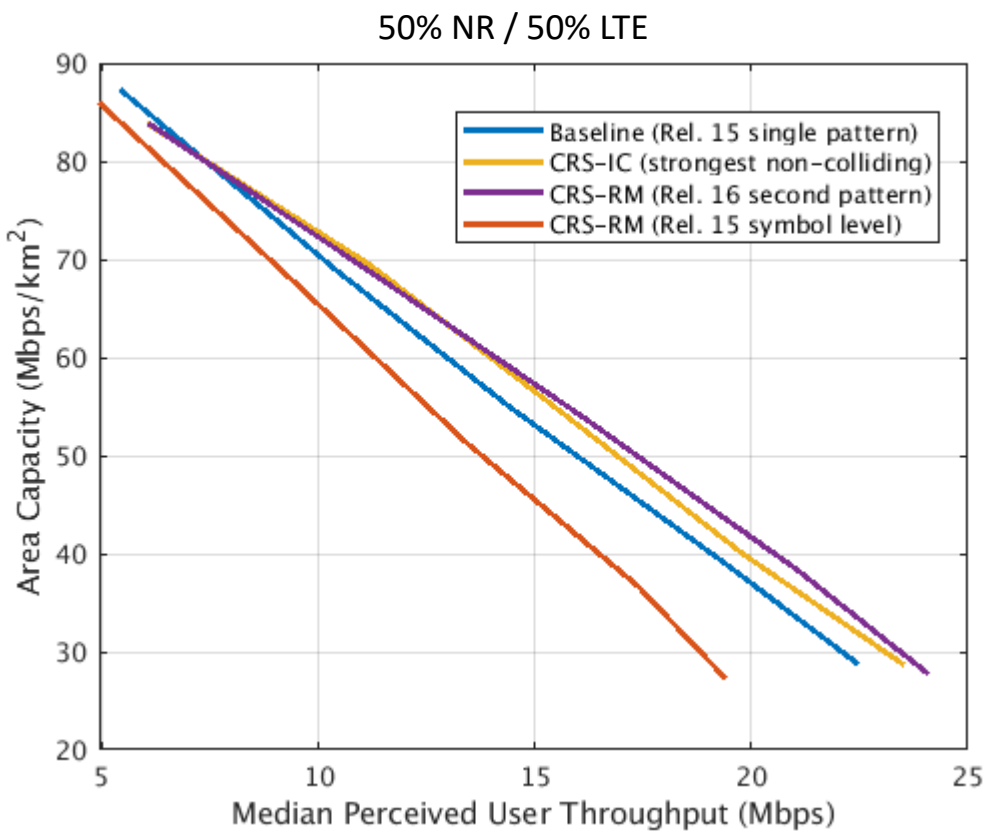
Simulation Results and Observations



1. CRS-IC and Rel. 16 rate matching (second pattern) perform similarly when LTE traffic dominates

2. Rel. 16 rate matching (second pattern) performs better than CRS-IC when NR traffic dominates (see next slide)

3. Rel. 15 symbol level rate matching results in a significant performance loss

4. Canceling the cell with the second strongest RSRP whose CRS is not colliding with the serving cell's CRS in addition does not yield a measurable improvement (not shown)

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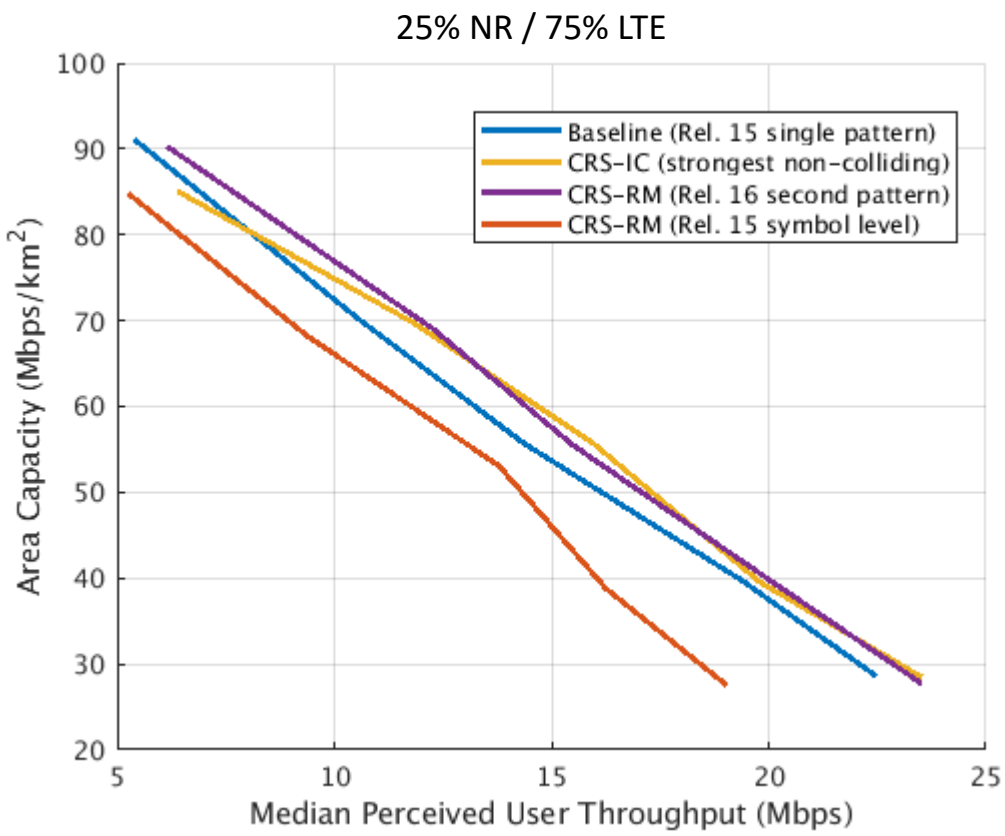
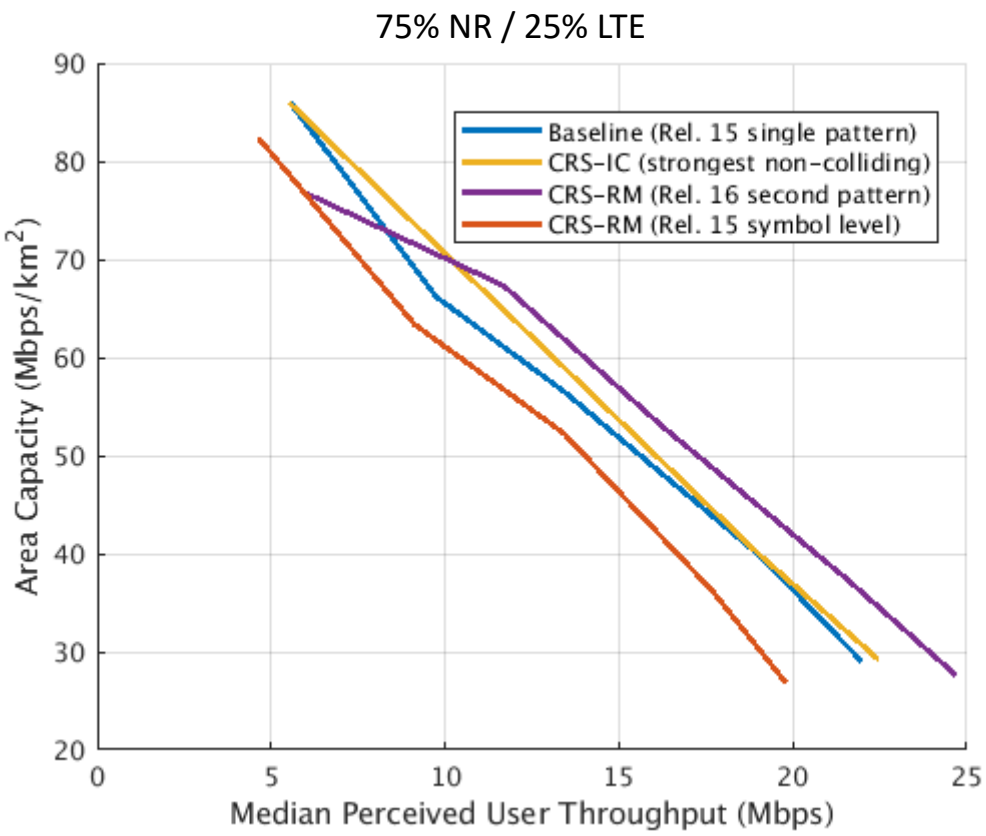
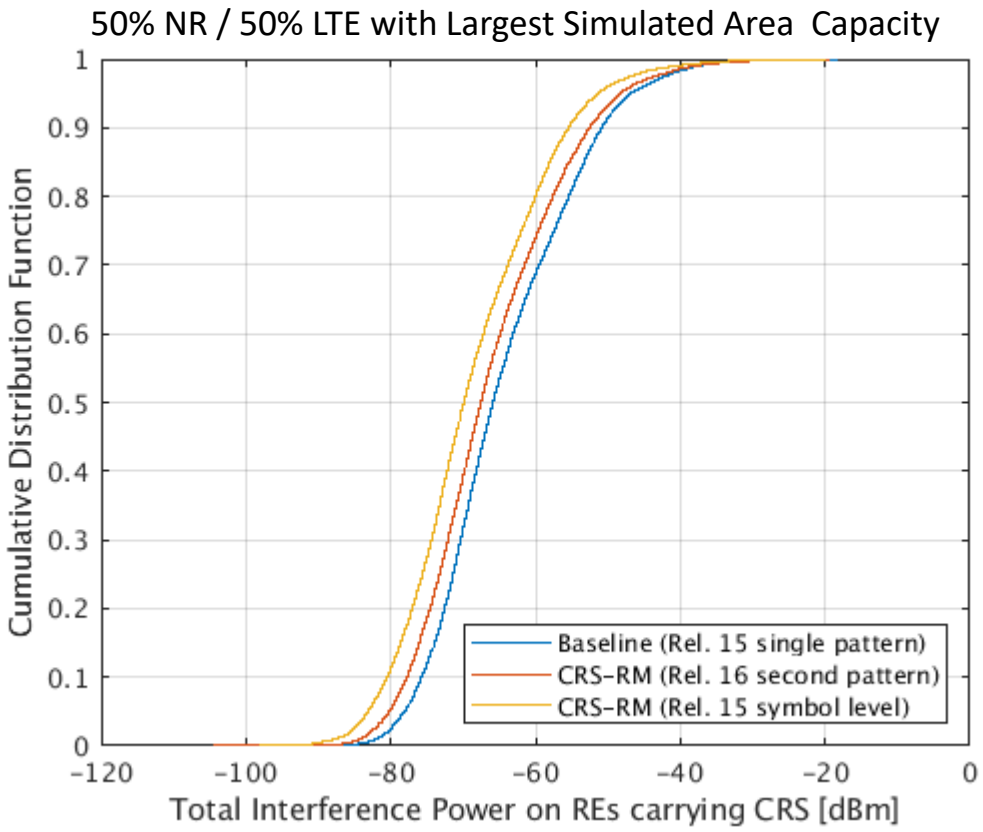
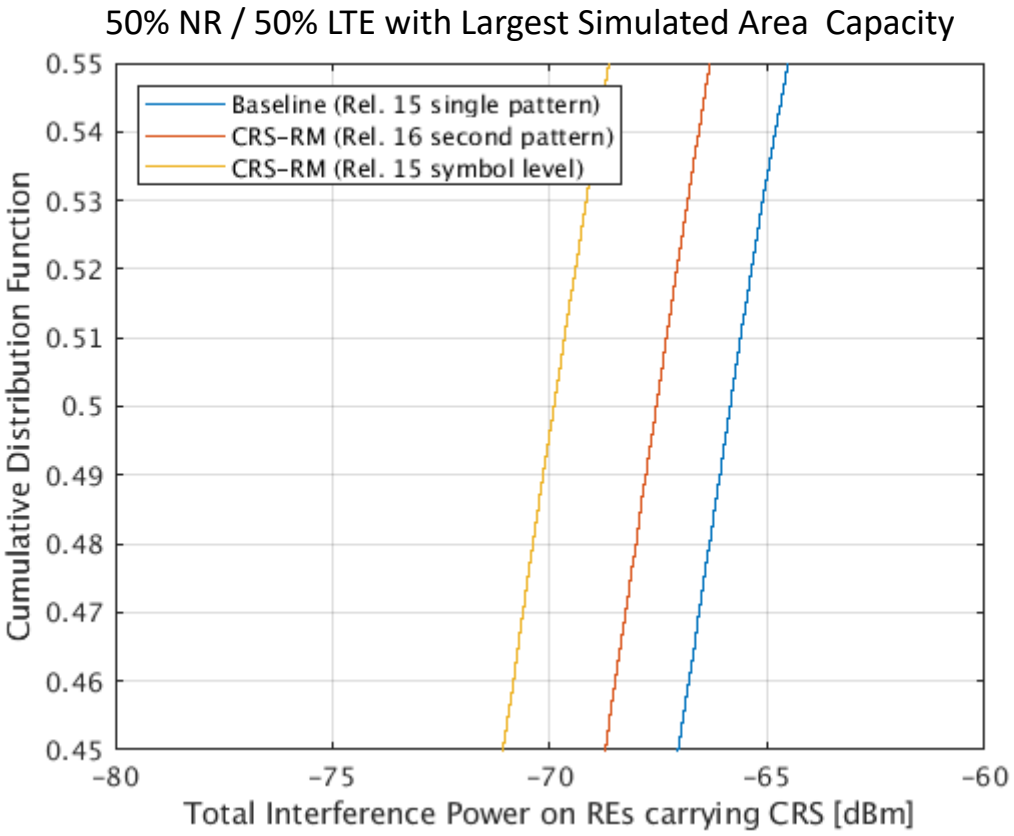
Simulation Results for Different Traffic Splits





Performance Impact on LTE Cells due to Rel. 16 Rate Matching





According to the agreed Way Forward [2], companies are encouraged to analyze the performance impact on LTE cells due to Rel. 16 RM

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Conclusions and Proposals

Rel. 16 rate matching with a second CRS pattern can be used to mitigate the impact of CRS interference on NR UEs in networks with overlapping spectrum for LTE and NR

The impact on LTE UEs needs further investigation before concluding on a solution for CRS interference handling in networks with overlapping spectrum for LTE and NR

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