3GPP TSG RAN Meeting #93-e
Electronic Meeting, September 13 - 17, 2021

RP-212226

Views on CRS-IM requirements in scenarios with overlapping spectrum for LTE and NR

Agenda Item: 9.3.4.3
Source: Intel Corporation
Document for: Discussion/Decision

intel®

Summary of RAN4 conclusions (1)

- In RAN #91-e meeting "Further enhancement on NR demodulation performance" WID [1] was revised and objectives to evaluate techniques to cope with CRS interference in scenarios with overlapping spectrum for LTE and NR were added
- In RAN4 #99e and #100e meetings RAN4 evaluated the performance of Rel-15/16 CRS rate matching (CRS-RM) and CRS interference mitigation (CRS-IM) schemes in different typical scenarios and made a comparison with the reference scheme without CRS interference handling
- The summary of RAN4 evaluation is captured in Section 5 of the TR 38.833 [2].
- LS R4-2115741 to RAN with RAN4 recommendation to define NR PDSCH demodulation requirements for neighboring cell LTE CRS-IM in was approved in RAN4 #100e [3]

RAN4 recommends to define NR PDSCH demodulation requirements for neighbouring cell LTE CRS-IM in scenarios with overlapping spectrum for LTE and NR in Rel-17:

- *Use LLR weighting as baseline reference receiver, and further discuss the feasibility of CRS-IC receiver taking into account the UE complexity and PDSCH processing time.*
- *Synchronous network scenario is prioritized. The asynchronous network scenario will be discussed after RAN #93e meeting.*
- *15 kHz SCS for NR is prioritized. The 30 kHz SCS scenario will be discussed after RAN #93e meeting.*
- *RAN4 will further discuss the necessity of network assistance signaling and UE capability signaling during requirements definition phase.*

Summary of RAN4 conclusions (2)

- Observations on NR UE PDSCH performance
  - CRS-IC with NW assistance signaling (Scheme #4) can achieve better performance compared to RM scheme 1 (Scheme #1) . CRS-IC without NW assistance signaling (Scheme #5) achieves similar or lower performance compared to CRS-IC schemes with the assumption of NW signalling (Scheme #4) .
  - CRS-IM with LLR weighting with the assumption of NW signaling (Scheme #6) can achieve better or similar performance compared to RM scheme 1 (Scheme #1). LLR weighting without NW assistant signaling (Scheme #7) achieve similar or lower performance compared to LLR weighting with the assumption of NW signalling (Scheme #6) .
- Conclusion on LTE UE performance impact of CRS-RM schemes
  - Due to RM applied in interference cells, the CRS REs and data REs under LTE cells will observe different interference level with SINR offset.
  - The interference mismatch among CRS REs and data REs may bring impact on LTE cells considering the LTE CQI/RI/PMI reporting, PDSCH demodulation and RSSI/RSRQ measurement.
  - NW implementation solutions were provided by one company to address LTE cell impact and the feasibility of such solutions from network implementation perspective needs further discussion.

Summary of RAN4 link level analysis

- Intel's observations on NR UE PDSCH performance based on average link level results
  - CRS-IM schemes (#4-7) provide significant performance improvement over reference scheme without interference mitigation for both considered scenarios
  - CRS-IM schemes (#4-7) provide performance improvement over CRS-RM schemes (#1-3) for Scenario 1

SNR performance difference in comparison to reference scheme for Scenario 1 (LTE/NR DSS)

MIMO	MCS index	Scheme #1	Scheme #2	Scheme #3	Scheme #4	Scheme #5	Scheme #6	Scheme #7
4Tx 2Rx Low	QPSK MCS4	1.7	0.0	1.6	3.3	3.1	2.7	3.7
	16QAM MCS13	1.3	-0.5	0.0	3.4	3.4	2.3	2.9
4Tx 4Rx Low	QPSK MCS4	1.8	0.2	1.9	3.2	3.2	2.2	3.7
	16QAM MCS13	1.5	-0.2	0.5	3.6	3.7	2.1	3.0

Note: Schemes #1-3 are CRS-RM schemes. **Schemes #4-7 are CRS-IM schemes**

SNR performance difference in comparison to reference scheme for Scenario 2 (no DSS)

MIMO	MCS index	Scheme #4	Scheme #5	Scheme #6	Scheme #7
4Tx 2Rx Low	QPSK MCS4	2.6	2.5	2.2	2.9
	16QAM MCS13	2.5	2.3	1.8	2.1
4Tx 4Rx Low	QPSK MCS4	2.3	2.4	1.6	1.9
	16QAM MCS13	2.5	2.6	1.4	1.3

Note: Results are not provided for Schemes #1-3 (CRS-RM schemes), because maximum achievable throughput values are lower for Schemes #1-3 in comparison to reference scheme and Schemes #4-7.

Proposed WID revision

- **Proposal:** Add the following objectives to the Rel-17 WI on "Further enhancement on NR demodulation performance"

Define NR PDSCH demodulation requirements for neighbouring cell LTE CRS-IM in scenarios with overlapping spectrum for LTE and NR

- Use LLR weighting as baseline CRS-IM reference receiver, and further discuss the feasibility of CRS-IC receiver taking into account the UE complexity and PDSCH processing time.
- Synchronous network scenario is prioritized. The asynchronous network scenario will be discussed further.
- 15 kHz SCS for NR is prioritized. 30 kHz SCS scenario will be discussed further.
- Study and if necessary, define network assistance signaling and UE capability signaling.

References

1. RP-210920 “Revised WID: Further enhancement on NR demodulation performance”, China Telecom, RAN #91-e, March 2021.
2. R4-2112224 “Draft TR 38.833 v0.1.0: Further enhancement on NR demodulation performance”, China Telecom, RAN4 #100-e, August 2021.
3. R4-2115741 “LS on RAN4 evaluation for LTE CRS interference handling for NR UE”, China Telecom, RAN4 #100-e, August 2021.

intel®