

3GPP TSG RAN Meeting #104
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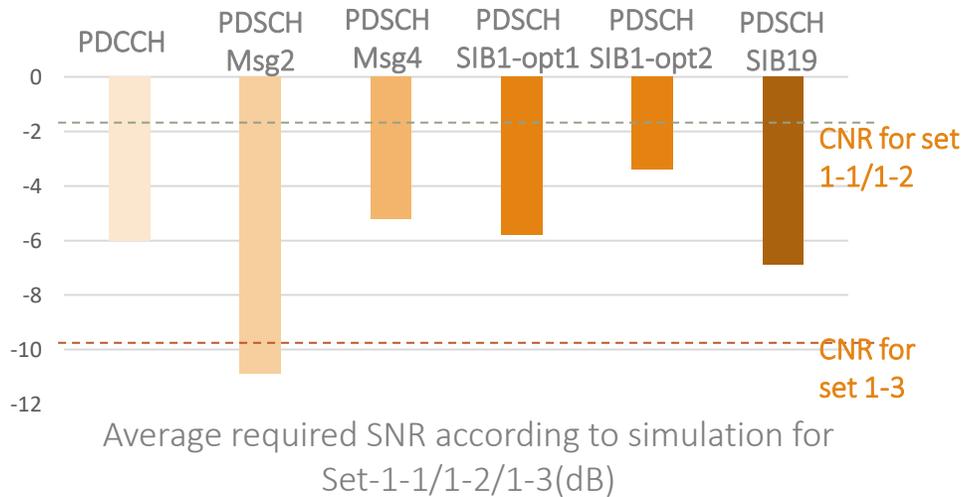
Agenda Item: 9.3.2.2
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Views on Rel-19 NR-NTN

Downlink coverage enhancement

DL coverage performance has been extensively evaluated in RAN1. The following observations can be obtained.

- For parameter set 1-1 FR1 and set 1-2 FR1, there is no performance gap for all evaluated channels.*
- For parameter set 1-3 FR1, performance gap is observed for PDCCH, PDSCH Msg4, PDSCH SIB1 and PDSCH SIB19. *



Proposal 1: Specify solutions of link level enhancements for FR1-NTN, including PDCCH and PDSCH.

DL coverage ratio evaluation at system level was also been extensively discussed in RAN1. The following observations can be obtained from the submitted results.

- With SSB periodicity extension, the coverage ratio can be significantly improved depending on applied periodicity.
- With implementing wide beam footprint, the coverage ratio can be significantly improved with penalty of possible EIRP reduction.
- Based on collected evaluation results, DL coverage ratio can be improved to 80%-100% depending on specific assumption.*

Proposal 2: Specify system level enhancements for FR1-NTN and/or FR2-NTN, allowing dynamic and flexible power sharing between satellite beams or different satellite beam patterns/size (i.e. wide or narrow) across the satellite footprint.

Note*: Detailed evaluation results and observations can be found in [1].

Support of RedCap/eRedCap

- The issues coming along with TA-mismatch for seven collision cases for RedCap UE were extensively discussed in RAN1.
- It was concluded that the existing priority rules can be reused for a HD-FDD (e)RedCap UE in NTN for collision cases 1,2,5 and 6. **No additional specification is needed.**
- For collision case 3&4, the following conclusion and observation were achieved in RAN1. **Normative work is beneficial.**

Conclusion

For collision cases 1, 2, 5 and 6, the existing priority rules can be reused for a HD-FDD (e)RedCap UE in NTN.

Conclusion

For Rel-19 HD-FDD RedCap/eRedCap UE in NTN, the issues caused by TA mismatch between actual TA used by the UE and assumed TA for the UE at the gNB should be mitigated for collision cases 3 and 4.

- Note: further discussion on other cases is not precluded

Observation

TA reporting is beneficial to mitigate the TA mismatch between actual TA used by the UE and assumed TA for the UE at the gNB for HD-FDD RedCap/eRedCap UE in NTN from RAN1 perspective.

- Note: complexity, power consumption and signaling overhead impact of TA reporting for (e)redcap UEs was not investigated in this work item

- Based on the aforementioned conclusion and observation, our understanding is that collision case 3 and collision case 4 deserve normative work in Rel-19.

■ **Proposal 3:**

- Start the normative work to specify the solutions to resolve the issues caused by TA mismatch between actual TA used by the UE and assumed TA for the UE at gNB side for collision case 3 and 4.
- Detailed solutions can be left to WG level discussion.

Uplink capacity/throughput enhancement

- Three potential solutions for PUSCH capacity and throughput enhancement were extensively studied in RAN1.
- The following agreement and conclusion were achieved in RAN1#117 meeting.

Agreement

For the normative phase, at least one of the OCC techniques will be specified:

- Inter-slot time-domain OCC with PUSCH repetition Type A with OCC length 2 or 4
- Inter-symbol(s) time domain OCC with OCC length 2 or 4
- Intra-symbol pre-DFT-s OCC (comb-like structure as in PUCCH format 4) with OCC length 2 or 4
- FFS Combination of OCC techniques including multiplexing of 8 UEs
- FFS Use of OCC techniques with TBoMS
- FFS Backward compatibility with non-Rel-19 UEs

Conclusion

OCC with PUSCH can support at least multiplexing of 2 or 4 UEs and achieve up to 2 or 4 times capacity gains respectively, when repetitions are used.

Note: the actual gain may be less due to e.g. intra/inter cell interference.

- Based on the aforementioned agreement and conclusion, our understanding is that PUSCH capacity enhancement deserves normative work in Rel-19.
- **Proposal 4:**
 - Specify DFT-s-OFDM PUSCH enhancements via Orthogonal Cover Codes (OCC).
 - Detailed solutions can be left to WG level discussion.



Reference

[1]RAN1 Chair's Notes, 3GPP TSG RAN WG1 #117, Fukuoka City, Fukuoka, Japan, May 20th – 24th, 2024



Thanks!