

Document for: discussion and decision

Agenda Item: 9.7.4

# Scope of Rel-17 WI on NR coverage enhancements

Huawei, HiSilicon

# Background

- Rel-17 CovEnh SI has been completed with TR in R1-2009851 [1]
- Bottleneck channels
  - PUSCH for eMBB and VoIP are identified as real bottleneck channels for both FR1 and FR2
  - For FR1, some channels are identified as 2nd priority of potential bottleneck, which refers to coverage shortage experienced only by some simulated scenarios.
  - For Indoor 28GHz, no identified bottleneck channel with coverage shortage
  - For Urban 28GHz, with MIL of PUCCH F1 as baseline, additional potential bottleneck channels are
    - PUCCH F3 11bits/22bits; PRACH B4; PUSCH of Msg3
- Many enhancement techniques were studied but only the following are recommended,
  - Enhancements on PUSCH repetition type A for TDD
  - TB processing over multi-slot PUSCH
  - Joint channel estimation
- No recommendations achieved in RAN1 for PUCCH and other channels
- RAN plenary to decide whether to support power boosting for pi/2 BPSK for PUSCH for PC2 UEs.

# General view of scope of NR CovEnh WI

- Principle for setting the scope of NR CovEnh WI
  - Recommended techniques in TR [1] should be prioritized, i.e. the following should be prioritized for the WI scope
    - Enhancements on PUSCH repetition type A
    - TB processing over multi-slot PUSCH
    - Joint channel estimation
  - Additional enhancements can be considered if sufficient TU is available
- Handling of potential overlap with Redcap WI needs to be addressed at RAN#90e
  - Techniques specific for RedCap UE should be placed in “Redcap” WI if any
    - e.g. Faster hopping/switching, enhancement(s) caused by up to 3 dB antenna radiation loss or 1 Rx

**Proposal 1:** *For the scope of NR CovEnh WI, recommended techniques in SI TR should be included.*

- *Additional enhancements can be considered*

**Proposal 2:** *For the potential overlap with Redcap WI,*

- *Overlap if any should be addressed in RAN1#90-e*
- *Techniques common to RedCap UE and normal UE can be placed in CovEnh WI if any*
- *Techniques specific for RedCap UE should be placed in “Redcap” WI if any*

# DMRS-less PUCCH enhancement

- No recommendations achieved in RAN1 yet on PUCCH enhancements
  - DMRS-less PUCCH is one of the main candidates discussed in RAN1
- DMRS-less PUCCH should be included in NR CovEnh WI, since promising gain is expected by DMRS-less PUCCH
  - Around average 2.22 dB SNR gain (Table 6.2.1-1 of [1])
  - Around average 4.77 dB PAPR gain for QPSK and around average 2.57 dB PAPR gain for pi/2 BPSK (Table 6.2.1-2 of [1])
- Potential main Spec impacts for DMRS-less PUCCH based on RAN1 agreements
  - Specifying a new PUCCH format for DMRS-less transmission for PUCCH for  $UCI \leq 11$  bits

**Proposal 3:** *Specify a new PUCCH format for DMRS-less PUCCH with  $UCI \leq 11$  bits in NR CovEnh WI.*

# Proposal for RAN#90-e

**Proposal 1:** *For the scope of NR CovEnh WI, recommended techniques in SI TR should be included.*

- *additional enhancements can be considered*

**Proposal 2:** *For the potential overlap with Redcap WI,*

- *Overlap if any should be addressed in RAN1#90-e*
- *Techniques common to RedCap UE and normal UE can be placed in CovEnh WI if any*
- *Techniques specific for RedCap UE should be placed in “Redcap” WI if any*

**Proposal 3:** *Specify a new PUCCH format for DMRS-less PUCCH with UCI  $\leq$  11 bits in NR CovEnh WI.*

# References

[1] R1-2009851, 3GPP TR 38.830: Study on NR coverage enhancements, V0.2.0