

3GPP TSG RAN #97-e

E-meeting, September 12th - 16th, 2022

Agenda Item: 9.2.10
Document for: Decision

Discussion on WID for further NR RedCap UE complexity reduction

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■ Draft WID for Rel-18 eRedCap was approved at RAN#94-e meeting in RP-212705.

- Regarding the objectives for complexity/cost reduction, it is described as “TBD based on SI outcome” and needs to be discussed.

■ Conclusion and recommendation captured in TR38.865

Based on the analysis of the studied UE complexity reduction options, most companies in RAN1 recommend that a single option is down-selected from a list of options as the main Rel-18 RedCap UE complexity reduction option at RAN plenary. The list includes the following options.

- Option BW3:
 - 5 MHz BB bandwidth only for PDSCH (for both unicast and broadcast) and PUSCH with 20 MHz RF bandwidth for UL and DL.
 - The other physical channels and signals are still allowed to use a BWP up to the 20 MHz maximum UE RF+BB bandwidth.
- Option PR3:
 - Restriction of maximum number of PRBs for PDSCH and PUSCH.
 - For 15 kHz SCS, the maximum number of RBs is 25.
 - For 30 kHz SCS, the maximum number of RBs is 11 or 12.
 - The restricted number of PRBs in Option PR3 is a hardcoded limit.

Some of the companies who participated in the study also wanted to include one or both of the following options in the above list, for RAN plenary to assess the trade-off between degree of complexity reduction and specification impact.

- Option PR1:
 - Relaxation of the constraint $(v_{Layers}^{(j)} \cdot Q_m^{(j)} \cdot f^{(j)} \geq 4)$ for peak data rate reduction.
 - The relaxed constraint is, e.g., 1 (instead of 4).
 - The parameters $(v_{Layers}^{(1)}, Q_m^{(1)}, f^{(1)})$ can be as in Rel-17 RedCap [4]s.
- Option BW1:
 - Both RF and BB bandwidths are 5 MHz for UL and DL.

Furthermore, RAN1 recommends that Option PR1 is considered as a potential add-on. Whether to adopt this potential add-on can be decided during WI phase.

■ Main feature for further complexity reduction

- Rel-18 RedCap should ensure the complexity reduction compared to Rel-17 RedCap to enlarge the RedCap use cases.
 - » BW1 can provide largest complexity reduction gain compared to other options.
- Specification/coexistence impacts for BW1 can be minimized by configuration/UE implementation.
 - » Target scenario can be down-scoped to focus on 15 kHz SCS case.
 - Target peak data rate for Rel-18 eRedCap is much smaller than that for Rel-17 RedCap, and hence high frequency bands may not be required, i.e., refarming band from LTE can be the good candidate for Rel-18 eRedCap UE accommodation.
 - » Legacy channels can be reused by means of e.g., puncturing which does not degrade the coverage compared to the bottleneck channel of reference NR UE.
- **Proposal: BW1 should be considered as a main feature for Rel-18 eRedCap.**

■ Additional/complemental feature for further complexity reduction

- It is captured in TR38.865 that “required L2 buffer size at the UE scales linearly with the UE peak data rate”.
- Data rate can be approx. 20 Mbps for BW1/BW3/PR3 while the target peak data rate is 10 Mbps.
 - » There still exists a possibility for further peak data reduction which can be achieved by PR1.
- **Proposal: PR1 should be considered as a complementary feature for Rel-18 eRedCap.**

■ Coverage impacts captured in TR38.865

Deployment scenario and frequency (and UE bandwidth, and DL PSD)	3dB antenna efficiency loss?	Complexity reduction options in Clause 7			
		BW1	BW2	BW3	PR3
Urban at 2.6 GHZ with 11 PRBs	w/o 3dB ant. eff. loss	None	None	None	None
	with 3dB ant. eff. loss	PDCCH CSS w/ AL2 (<1dB) SIB1(<1dB)	PDCCH CSS w/ AL2 (<1dB) SIB1(<1dB)	SIB1(<1dB)	SIB1(<1dB)
Urban at 2.6 GHZ with 12 PRBs	w/o 3dB ant. eff. loss	None	None	None	None
	with 3dB ant. eff. loss	None	None	None	None
Rural at 0.7 GHz	w/o 3dB ant. eff. loss	None	None	None	None
	with 3dB ant. eff. loss	Msg3 (<0.1dB)	Msg3 (<0.1dB)	None	None
Urban at 4 GHz with 11 PRBs and DL PSD of 33dBm/MHz	w/o 3dB ant. eff. loss	None	None	None	None
	with 3dB ant. eff. loss	None	None	None	None
Urban at 4 GHz with 11 PRBs and DL PSD of 24dBm/MHz	w/o 3dB ant. eff. loss	<ul style="list-style-type: none"> • PDCCH CSS (w/ AL16, AL8 and AL2) • PDCCH USS with AL2 • SIB1 • Msg4 	<ul style="list-style-type: none"> • PDCCH CSS (w/ AL16, AL8 and AL2) • PDCCH USS with AL2 • SIB1 • Msg4 	<ul style="list-style-type: none"> • SIB1 • Msg4 	<ul style="list-style-type: none"> • SIB1 • Msg4
	with 3dB ant. eff. loss	<ul style="list-style-type: none"> • PBCH • PDCCH CSS • PDCCH USS • SIB1 • Msg2 • Msg4 	<ul style="list-style-type: none"> • PBCH • PDCCH CSS • PDCCH USS • SIB1 • Msg2 • Msg4 	<ul style="list-style-type: none"> • SIB1 • Msg2 • Msg4 	<ul style="list-style-type: none"> • SIB1 • Msg2 • Msg4

■ Coverage recovery for further complexity reduction

- For Urban at 2.6 GHz, coverage degradation for PDCCH/SIB1 can be compensated by PDCCH CORESET#0/AL configuration and SIB1 BW respectively.
- For Rural at 0.7 GHz, coverage degradation for Msg3 is small and also can be compensated by CE technique in Rel-17.
- We don't see the strong need for coverage recovery only for special scenario, i.e., Urban at 4GHz with 24dBm/MHz.
- **Proposal: Discussion for coverage recovery techniques should be deprioritized for Rel-18 5MHz eRedCap.**