

3GPP TSG RAN Meeting #91-e  
e-meeting, March 22-26, 2021

RP-210266

Agenda Item: 9.7.27

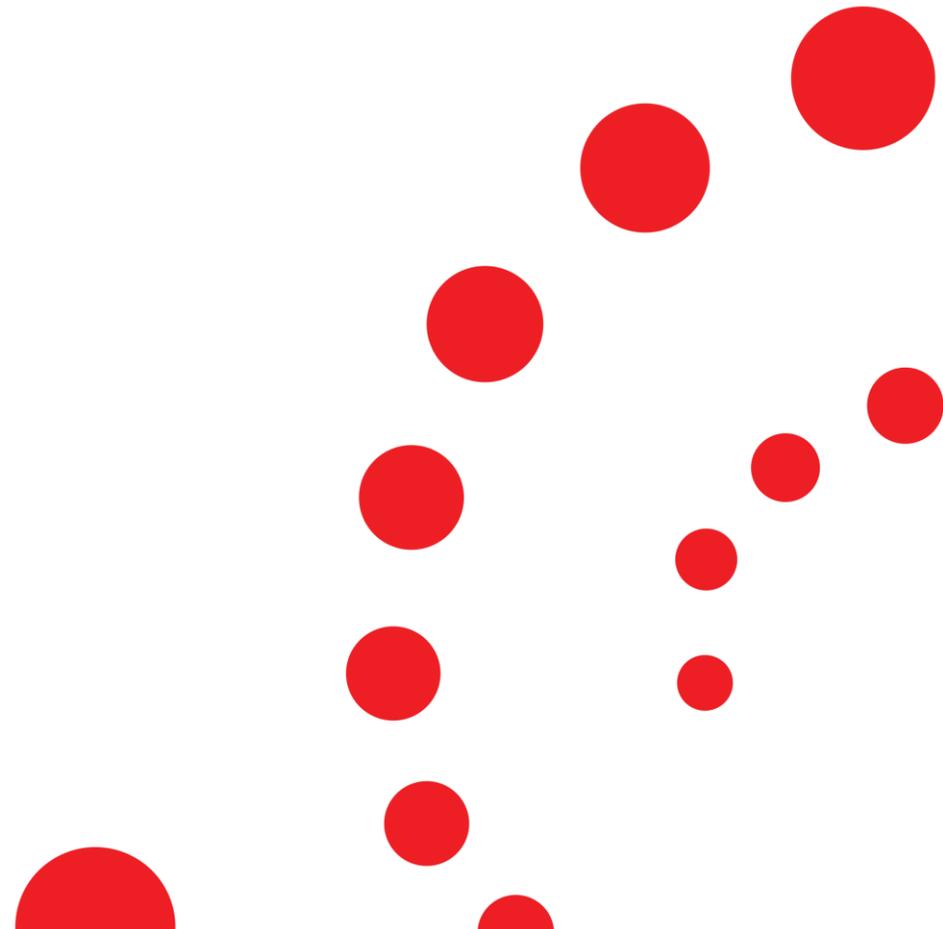
Source: FUTUREWEI

Document for: Discussion and decision



# Scoping update for R17 RedCap WI

FUTUREWEI



# Discussion points for RedCap in RAN#91

- Updates after RAN2 SI completion
- Discussions deferred from RAN#90 due to operator and others' concerns on the impact to the **network** and the **ecosystem**
  - Support of 1RX in addition to 2RX in bands that currently require 4RX
  - Support of 40MHz after initial access in FR1
- Troubling observations from the RedCap work last quarter
  - Some companies continue to argue for differentiating high and low end wearables despite multiple RAN discussions and RAN2 agreement not to fragment the market
  - Some companies did not want the gNB to be informed of the #RX branches
- **It is imperative that we “get on the same page” at RAN#91 !**

# RedCap UE Type(s) and UE categories

- RAN2 has agreed that
  - The existing UE capabilities framework is used as baseline to indicate the capabilities of a RedCap UE (i.e., LTE-style UE categories are NOT the baseline for RedCap)
  - The number of device types should be minimised, to reduce market fragmentation, and introduced only where essential to control UE accesses and differentiate them from legacy R15/R16 and non-Redcap R17 UEs
  - A single RedCap UE type has benefits of no market fragmentation, simpler specification, and avoiding non-technical discussions outside of 3GPP's scope
- Many companies do not support introducing UE categories or RedCap types for “high” and “low-end” wearables
- It will be difficult to consider the proposals to expand the scope of RedCap (1RX in 4RX bands, 40MHz after initial access) when the motivation from some companies is to unnecessarily fragment the market into multiple RedCap UE types and/or UE categories
- **Recommendation**
  - Specify the definition of either: one RedCap UE type (s) per FR
  - The introduction of UE categories into NR for RedCap is not supported

# gNB knowledge of the reduced number of RX branches

- The majority of companies desire that the gNB to be informed (either explicitly or implicitly) the #RX capability of the RedCap UEs
  - At least through the normal UE capabilities reporting, potentially through early identification (if supported)
- It will be difficult to discuss the handling of the bands that currently require 4RX if the gNB is kept unaware of the #RX or has to “guess” the #RX by observing rank reports
- **Recommendation**
  - For all bands, the number of antenna branches is assumed to be known at the gNB (either explicitly or implicitly)

# Should RedCap UEs in FR1 TDD bands that currently support 4RX support only 2RX, or also be allowed to support 1RX?

- Very large performance impacts from 4RX to 1RX
  - 75% reductions in peak data rate
  - ~10dB PDSCH degradation (see TR38.875 Table C.1-1 and C.1-3, results include a 3dB loss for small form factor)
- The performance degradation is always present even if the UE is “in coverage”
  - MCS selection is impacted and scheduling more difficult unless the UE supports the (*optional*) Rel-15 low-spectral efficiency MCS table and DL repetition for PDSCH
- Both 2RX and 1RX may have a benefit for size reduction over 4RX, however the key issue is whether (and how) to accommodate 1RX devices that can work in all FR1 bands
- We are fine to only support 2RX for these bands. However, if 1RX is to be supported:
  - No additional RedCap UE types or UE categories (see previous slide)
  - #RX branches is known at the gNB (see previous slide)
  - At least the 1RX RedCap UEs should have *mandatory* support for the Rel-15 features of the low-SE MCS table and DL repetition

# 40MHz after initial access in FR1?

- In RAN#90 some argued that the entire RedCap WI doesn't make sense unless 40MHz is supported. However, this seems to be more of a marketing consideration since ~(50-80)Mbps peak data rates seem sufficient for wearables.
  - The target data rates for coverage in the study were 1-2Mbps
  - RAN has previously concluded that all wearables did not need to offer the same data rate by including “up to” in the use case requirements
- The NR ecosystem will be split into 20MHz and 40MHz and 100MHz NR development paths in FR1
- Some operators expressed concerns that 40MHz would be used in low-tier smartphones
- **Recommendation**
  - Do not support 40MHz bandwidth
  - This could possibly be revisited in a later release when concerns are less strong

# What coverage compensation to include in the WID?

- PUSCH & Msg 3 are in the CE WI
- PDSCH can use e.g. DL repetition
- PDCCH can use compact DCI & power boosting
  - RAN1 will discuss whether the existing compact DCI is optional or mandatory
  - RAN1 has FFS related to possible DCI modifications for reduced MIMO layers/#RX
- Msg 2 can use existing TBS scaling (though may not be the best solution)
- Msg 4 can use retransmission (though may not be the best solution)
- RAN1 has FFS to consider whether to use the low-SE MCS table during initial access
- **Recommendation**
  - Msg 2 & 4 compensation could be considered to be added into the WID
  - However, given the various FFS, it may be sufficient to Note that coverage compensations from the SI are considered in the WI
  - Whether and how RedCap UEs use CE features is discussed later in the WI along with RedCap UE capabilities

Ch. / Msg	FR1 (dB)	FR2 (dB)
PUSCH & Msg3	~3	
PDSCH		~2.5-3
PDCCH	~1	
Msg2	~6*	~1
Msg4	~2-3	~1

The limiting scenarios are:  
FR1 4GHz 24dBm/MHz 1RX  
FR2 23dBm 1RX  
\* Msg 2 for 2RX is ~1dB

# RAN2 related complexity reductions

- RAN2 listed a few possible complexity reductions in the TR, with the caveat that there was no study objective on these and that they “would require further evaluation during the normative phase if they are to be considered”
- RAN1 did, however, study or consider techniques related to processing time relaxations and buffer reductions. Such techniques were either not recommended or included in the TR or WID.
  - The benefits were considered to be too small when in combination or on top of other “major” techniques such as BW reduction and RX/MIMO layer reduction
  - L2 buffer requirements for RedCap are anyways reduced with the peak data rate reductions from the other techniques
- **Recommendation**
  - Study/Work objectives are NOT included in the WID for either reduction of L2 buffer size (beyond the existing calculations in 38.306) OR for relaxing RRC processing delay requirements

# Thank You.

**Copyright © 2019 Futurewei Technologies, Inc.  
All Rights Reserved.**

The information in this document may contain predictive statements including, without limitation, statements regarding the future financial and operating results, future product portfolio, new technology, etc. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied in the predictive statements. Therefore, such information is provided for reference purpose only and constitutes neither an offer nor an acceptance. Futurewei may change the information at any time without notice.

