

Motivation for Reduced Capability NR devices WID

3GPP TSG-RAN Meeting #90e
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Agenda item: 9.1.1

Motivation for Reduced Capability NR devices WID

Cost reduction recommendations from TR 38.875:

- Maximum UE bandwidth reduction => FR1: 20MHz, FR2: 100MHz
- Reduced Minimum Number of Rx branches in FR1 => 2Rx->1Rx and 4Rx->2Rx
- Reduced Maximum DL MIMO layers
- Reduced Maximum DL modulation order in FR1

Open issues WRT RedCap cost reduction techniques:

- Half-Duplex FDD operation (HD-FDD)
- Reduced Number of Minimum Rx branches in FR1 TDD: 4Rx->1Rx
- Relaxed UE Processing Time

Should RedCap to support HD-FDD?

From TR 38.875:

- 1RX 5.9% and 2RX 8.0% cost reduction for single band device
- Savings accumulate with each supported band
- No analysis on cost saving for multi-band device

FR1 FDD UE complexity Reduction techniques	Total reduction	Relative Reduction
20 MHz, 1 layer, 1 Rx	57.5%	Base
20 MHz, 1 layer, 1 Rx, HD-FDD type A	63.4%	5.9%
20 MHz, 2 layer, 2 Rx	31.9%	Base
20 MHz, 2 layer, 2 Rx, HD-FDD type A	39.9%	8.0%

Sierra Wireless analysis:

- A UE providing world-wide band support needs 12-15 FDD bands
 - For a 1Rx 15 FDD band UE => HD-FDD predicated cost saving is 39.1%
- A UE providing local band support (e.g. NA, EU, Asia) need 3-4 bands
 - For a 1Rx 2 FDD band UE => HD-FDD predicated cost saving is 8.6%

Observation: HD-FDD cost savings for world-wide UE is large ~40%

Should RedCap to support HD-FDD?

Need to fit into TU budget

- Complex mechanisms (e.g. ACK Bundling, Multi-TB grant) to increase speed (via improved slot utilization) will take signification specification and commercialization effort
- Potential solution:
 - Restrict specifying these complex mechanisms, at least for Rel 17 in the WID.
 - Setting a target slot utilization factor (e.g. 45%) in WID will help restrict specifying complex mechanisms

Need to avoid commercialization delays

- HD-FDD will have impacts on gNB's scheduler
- TR 38.875 did not find any impact on initial access for HD-FDD
- Potential solution: Making HD-FDD an optional UE feature will not require UE nor infra vendors to commercialize HD-FDD right away

Observation: Commercialization and TU concerns can be address

Proposal: Specify HD-FDD support for RedCap UEs as an optional UE feature

Should RedCap support Rx branches from 4Rx->1Rx?

From TR 38.875:

- Cost savings of 12% compared to 2Rx
- Impact on spectral efficiency
- Substantial coverage degradation
 - Will require new coverage recovery methods for several channels (Msg2,Msg4, PDCCH CSS, maybe PDSCH)

Concerns:

- CovEnh WI will not likely enhance those channels thus this will greatly expand TU requirement
- Spectral efficiency degradation may not be acceptable by operators

Observation: 4Rx->1Rx will not fit into a realistic TU budget

Proposal: Do not include an objective to specify Rx4->1Rx for RedCap UEs

Should RedCap support Relaxed UE Processing?

From TR 38.875:

- Cost savings of 1.8% for 1RX, 3.5% 2 Layer, 2 RX
- Savings do not accumulate with each supported band
- Impacts on initial access (may require Msg1 identification)

Concerns:

- Cost saving is limited
- Specification impact may be moderate

FR1 FDD UE complexity Reduction techniques	Total reduction	Relative Reduction
20 MHz, 1 layer, 1 Rx	57.5%	Base
20 MHz, 1 layer, 1 Rx, double N1 and N2	59.3%	1.8%
20 MHz, 2 layer, 2 Rx	31.9%	Base
20 MHz, 2 layer, 2 Rx, double N1 and N2	35.4%	3.5%

Proposal: If TU budget permits, include an objective to relax UE processing

RedCap Cost Reduction Summary

HD-FDD

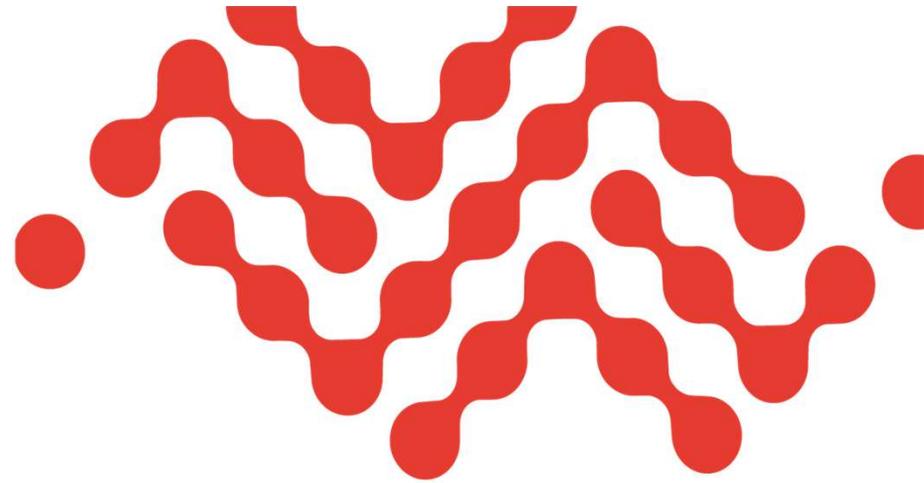
- Observation: HD-FDD cost savings for WW SKUs is large ~40%
- Observation: Commercialization and TU concerns can be address
- Proposal: Specify HD-FDD support for RedCap UEs as an optional UE feature in WID
 - Constrain TUs by specifying a target slot utilization factor

4 Rx->1 Rx Antennas

- Observation: 4Rx->1Rx antennas will not fit into a realistic TU budget
- Proposal: Do not include an objective to specify Rx4->1Rx for RedCap UEs

Relaxed Processing

- Proposal: If TU budget permits, include an objective to relax UE processing in WID



Thank you

13811 Wireless Way :: Richmond, British Columbia, Canada, V6V 3A4

sierrawireless.com

