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RP-240312

R19 UE RF enhancement

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Background

RAN4 Rel-19 package has been discussed in RAN#102 and summary can be found in RP-233918. In the latest guidance from RAN chair (RP-240019), all the UE RF proposals are merged to one big WI including both FR1 and FR2.

For the detailed contents our views are shown in the following pages.

UE RF enhancements for FR1 and FR2 (3-4 topics?)

- High power UE (HPUE) for CA in TN (combined with 3Tx?)
- High power UE for NTN → **consider merging into a single project?**
- Power boosting and/or MPR reduction (is there a real commercial need?)
- 6 Rx

CA HPUE@TN + 3Tx (1)

General view:

- 3Tx has been introduced in Rel-18 with limited power configurations and UE types. To fully enable this useful feature, it should be extended and specified in a full scope.

Objectives:

3Tx with PC2 or PC1.5 for inter-band UL CA/EN-DC

- For inter band UL CA or EN-DC, only two bands in uplink are considered:
  - ✓ In each band up to 2 contiguous UL CCs
  - ✓ The Tx capability considered is 1Tx in one band, and 2Tx in the other band
- The following power combinations and UE types are considered
  - ✓ **Introduce handheld UE** to Rel-18 power combinations.
  - ✓ No limitation of UE types in Rel-19
  - ✓ Study how to **accommodate different power combinations with a general approach**
    - ◆ Total power class PC2 or PC1.5 with any power combinations requested by operators in each band that is not covered by Rel-18 power combinations, examples in right tables.
- Specify necessary generic requirements for 3Tx inter-band UL CA or EN-DC, e.g. MSD requirements

PC2 in total		band A 1Tx			
		FDD PC3	FDD PC2	TDD PC3	TDD PC2
band B 2Tx	FDD PC3				
	FDD PC2	R19	R19	R19	R19
	TDD PC3	R18			
	TDD PC2	R18	R19	R18	

PC1.5 in total		band A 1Tx			
		FDD PC3	FDD PC2	TDD PC3	TDD PC2
band B 2Tx	FDD PC2	N/A		N/A	
	TDD PC2	N/A		N/A	
	TDD PC1.5	R18	R19	R19	R19

CA HPUE@TN + 3Tx (2)

General view:

- HPUE is versatile in many releases. However, to control workload, only the highly interested HPUEs should be considered instead of introducing all HPUEs by theoretical analysis.

Objectives:

2Tx with PC1.5 for intra-band contiguous or inter-band UL CA

- PC1.5 for TDD intra-band contiguous UL CA
  - ✓ Take uplink CA_n41C, CA_n78C, CA_n77C as example
  - ✓ Specify necessary requirements for PC1.5 intra-band contiguous UL CA with or without UL MIMO
  - ✓ Identify UE architectures, and define requirements including MPR/AMPR
  - ✓ Specify the mechanism to meet SAR requirements if necessary, and PMPR is used as baseline
- PC1.5 for inter-band UL CA
  - ✓ Take CA_n41A-n77A, and CA_n1A-n78A as example
  - ✓ Specify necessary requirements for PC1.5 inter-band UL CA without UL MIMO, e.g. MSD requirements
  - ✓ Specify the mechanism to meet SAR requirements if necessary, and PMPR is used as baseline
- Both handheld UE and FWA are considered

CA HPUE@TN + 3Tx (3)

General view:

- Increasing high power limit has been discussed also in several releases, and it was considered useful to fully utilize UE PA capabilities. In Rel-19, this feature can be extended to all possible power configurations and band combinations

Objectives:

Generic framework of supporting increase UE power high limit for inter-band UL CA/ENDC

- Study and specify generic framework of supporting increase power high limit feature for inter-band UL CA/ENDC.
  - ✓ Note: only TN is considered
- The power combinations of each band in a band combination to be considered including at least:
  - ✓ PC3 in band A + PC1.5 in band B with 3Tx in total
  - ✓ PC2 in band A + PC1.5 in band B with 3Tx in total
- Example band combinations: CA_n41A-n77A, DC_3A_n78A

6Rx

General view:

- 6Rx is useful in improving DL sensitivity also throughputs for large size handheld UE.

Objectives:

6Rx

- Example bands: TDD bands with n41, n77/ n78, n79
- Consider both single carrier and CA/DC with 6Rx capabilities
- Specify requirements to support SRS antenna switching
- Introduce necessary capabilities in TS38.306 and TS38.331 to support 6Layer reception and also SRS antenna switching considering the Tx antenans could be up to 3Tx and 4Tx
- Release independent will be considered for 6Rx

Power boosting and MPR reduction

General view:

- Power boosting and MPR reduction have been discussed in previous releases, if continue should careful about the scope to avoid exploding in discussion.

Objectives:

Power boosting and MPR reduction

- Study on whether and how much the requirement can be relaxed and how often the power boosting can be done.
- QPSK/BPSK are prioritized, and modulation order higher than QPSK is 2nd priority
- After benefits are confirmed, introduce power boosting or MPR reduction for PC2/PC3 with ACLR relaxation with BS indication for FR1 and FR2

Thank you

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