3GPP TSG RAN Meeting #103 **RP-240495**
Maastricht, Netherlands, March 18-21, 2024

Source: Apple
Title: On intra-band non-collocated NR CA/EN-DC in R19
Agenda Item: 9.1.4.6
Document for: Discussion

NonCol_intraB | Background in R18

- R18 WI is targeted to enable support of non-co-located scenarios for both FR1 non-contiguous EN-DC and CA.
- In the end, only requirements (RF/RRM/Demod) for Type 2 UEs are specified, and requirements for Type 3a/3b and Type 4a/4b UEs are not completed.
  - Type 3a/3b UEs:
    - Type 3a/3b UE can support up to 4 MIMO layers per CC.
    - With shared LNA between CC1 and CC2 for type 3a/3b UE, it is essential that the receive timing difference (RTD) between 2 CCs is limited within CP. Otherwise, the gain change initiated by one CC will impact the performance of another CC in the middle of the symbol.
    - Due to network TAE requirement (3us) and propagation delay difference from the non-collocated TRPs, it is hard to ensure RTD <= CP for 30kHz SCS with 25dB power imbalance (3us + 1.6us propagation delay difference).
  - Type 4a/4b UE: was proposed for FWA and not prioritized in R18.

Type	CC#	Antenna/LNA		Mixer	Analog BB	#Rx	Frequency separation	NR CA/EN-DC	Power imbalance	comment
3a	1	4 shared		4	4	4Rx	No limitation or ≤ X MHz	ENDC	6<P≤25dB partial range	Reuse of baseline RFFE architecture adding RF split after 2 LNAs + 1BB/Rx => common AGC on LNA => 25dB only for some range
	2			2	2	2Rx				
3b	1	4 shared		4	4	4Rx	No limitation or ≤ X MHz	NRCA, ENDC	6<P≤25dB partial range	Reuse of baseline RFFE architecture adding RF split after 4 LNAs + 1BB/Rx => common AGC on LNA => 25dB only for some range
	2			4	4	4Rx				
4a	1	4	6 total	4	4	4Rx	No limitation or ≤ X MHz	ENDC	25dB full range	Requires 6 antennas and LNA => FWA only
	2	2		2	2	2Rx				
4b	1	4	8 total	4	4	4Rx	No limitation or ≤ X MHz	NRCA, ENDC	25dB full range	Requires 8 antennas and LNA => FWA only
	2	4		4	4	4Rx				

NonCol_intraB | Discussion on potential work in R19

- It is agreed in RAN#102 to consider the following two objectives with potential down-selection or prioritization:
  - Type3 requirements assuming MRTD<CP and power imbalance < X dB (Handheld UE)
  - Type4 requirements assuming MRTD>CP (FWA UE)
- For Type 3a/3b UE
  - From scenario perspective, power imbalance, inter-site distance and propagation time difference are all related and can be decided as below.

Power imbalance (dB)	Inter-site distance (m)	Propagation time difference (us)
6	65	0.22
10	99	0.33
15	168	0.56
20	283	0.94
25	479	1.6

  - Due to the limitation of MRTD < CP, which would limit the non-colocated deployment, it is preferable to keep power imbalance within 6dB, especially due to smaller CP for 30KHz SCS. This would also help avoid UE implementation fragmentation.
  - Network signaling to allow dynamic switching between 2MIMO layer (Type 2 UE) and 4MIMO layer (Type 3 UE) is preferred.
- **Proposal 1: It is proposed to take X = 6dB as the baseline for type 3a/3b UE.**
- **Proposal 2: Network signaling to allow dynamic switching between 2MIMO layer (Type 2 UE) and 4MIMO layer (Type 3 UE) is preferred.**

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