

Enhancement for Device Requirement (RAN4-led)



Areas of further enhancement for device requirement

- **Further enhancement for FR1 RF**

- Simultaneous Rx/Tx for Intra-band non-contiguous CA/DC in TDD band
 - RAN4 need to study the feasibility for the Simultaneous Rx/Tx for Intra-band non-contiguous CA/DC.
- New power class for 14dBm device in NR-U 6GHz if not finalized in Rel-17
 - Comply with the regulatory requirements of VLP(Very Low Power) mode with 14dBm maximum EIRP power in some countries.

- **Further enhancement for FR2 RF**

- Vehicular UE requirement for Power Class in 39GHz
- Inter-band DL/UL CA
 - Vehicular UE requirements for inter-band DL/UL CA, e.g., 28+39GHz
 - Inter-band UL CA based on CBM
- Intra-band Non-contiguous CA
 - Simultaneous Rx/Tx for Intra-band non-contiguous CA

- **Further enhancement for RRM**

- Different RX beam sets in FR2

Further enhancement for FR1 RF

(Simultaneous Rx/Tx in FR1 RF)

- **Motivation**

- In the current specification, a simultaneous Rx/Tx capability is defined to enhance spectrum efficiency only for inter-band CA/DC band combinations.
- In Rel-17 SL enhancement WI, RAN4 agreed that SL V2X operation will consider simultaneous Rx/Tx capability after RAN4 study the feasibility of simultaneous Rx/Tx capability for intra-band NC CA UE of NR Uu.
- The general use case is the intra-band non-contiguous CA/DC.
- It needs to define the simultaneous Rx/Tx capability to enhance the spectrum efficiency in the intra-band non-contiguous CA/DC.

- **Objective**

- Study the feasibility on how much frequency gap is needed to achieve the acceptable interference in intra-band non-contiguous CA/DC UE.
- Depending on the feasibility study, define a simultaneous Rx/Tx capability and related RF requirements for intra-band non-contiguous CA/DC.
 - Specify the MPR and MSD requirements.

Further enhancement for FR1 RF (New power class for NR-U UE)

• Motivation

- In the current specification, RAN4 only allowed the PC5(20dBm) UE in NR-U WI (NR_unlic in Rel-16, NR_6GHz_unlic_full and NR_6GHz_unlic_EU in Rel-17).
- In NR_6GHz_unlic_full WI, some companies proposed to define low power class (PC6, 14dBm) to comply with the UK, Canada, Brazil and Korea regulatory requirements as follow.

| Region | Country | Permissible operation (Note 1) | Frequency range | Maximum mean EIRP for in-band emissions | Maximum mean EIRP density for in-band emissions | Maximum mean EIRP density for out-of-band emissions |
|----------|-------------|--------------------------------|-----------------|---|---|---|
| Region 1 | UK | LPI | 5925 – 6425MHz | 24dBm | 11dBm/MHz | In accordance with directive 2014/53/EC |
| | | VLP | | 14dBm | | |
| Region 2 | Canada | SP | 5925-6875 MHz | 36dBm | 23dBm/MHz | |
| | | LPI | 5925-7125 MHz | 30dBm | 5 dBm/MHz | |
| | | VLP | | 14dBm | -8dBm/MHz | |
| | Brazil | LPI | 5925 – 7125MHz | 30dBm (AP) 24dBm (Client) | 5dBm/MHz (AP) -1dBm/MHz (Client) | -27 dBm/MHz (outside operational range) |
| VLP | 17 dBm | -5 dBm/MHz | | | | |
| Region 3 | South Korea | LPI | 5925 – 7125MHz | 24dBm | 2dBm/MHz | -27 dBm/MHz (outside operational range) |
| | | VLP | 5925 – 6425MHz | 14dBm | 1dBm/MHz | -34 dBm/MHz (f ≤ 5925MHz, f ≥ 6445MHz) |

Note1: SP(Standard Power), LPI(Low Power Indoor), VLP(Very Low Power)

• Objective

- Define new low power class (PC6, 14dBm) to comply with some countries' regulatory requirements if RAN4 cannot define the low power class in Rel-17
- Specify A-MPR requirements to meet the out-of-emission requirements from each country.

Further enhancement for FR2 RF (Vehicular UE requirement in FR2)

• Motivation

- FR2 RF requirements for PC2 (Vehicular UE) need to be introduced on 39GHz like other PCs.

| | Operating Frequency | PC1 | PC2 | PC3 | PC4 | PC5 |
|------|---------------------|-----|-----|-----|-----|-----|
| n257 | 26500MHz~29500MHz | O | O | O | O | O |
| n258 | 24250MHz~27500MHz | O | O | O | O | O |
| n259 | 39500MHz~43500MHz | | | O | | O |
| n260 | 37000MHz~40000MHz | O | | O | O | |
| n261 | 27500MHz~28350MHz | O | O | O | O | |
| n262 | 47200MHz~48200MHz | O | O | O | O | |

- FR2 inter-band DL/UL CA for PC2 needs to be introduced as done in Rel-17 FR2 inter-band CA of PC3(e.g., 28GHz + 39GHz)

• Objective

- Specify RF requirement for PC2 (Vehicular UE) in FR2 on 39GHz
- Specify RF requirement for PC2 inter-band DL/UL CA in FR2

Further enhancement for FR2 RF (Inter-band UL CA based on CBM)

- **Motivation**

- FR2 inter-band UL CA based on only IBM is under discussion in Rel-17
- FR2 inter-band DL CA based on CBM is under discussion in Rel-17, however, FR2 inter-band UL CA based on CBM is not under scope of Rel-17.
- FR2 inter-band UL CA based on CBM needs to be specified in Rel-18.

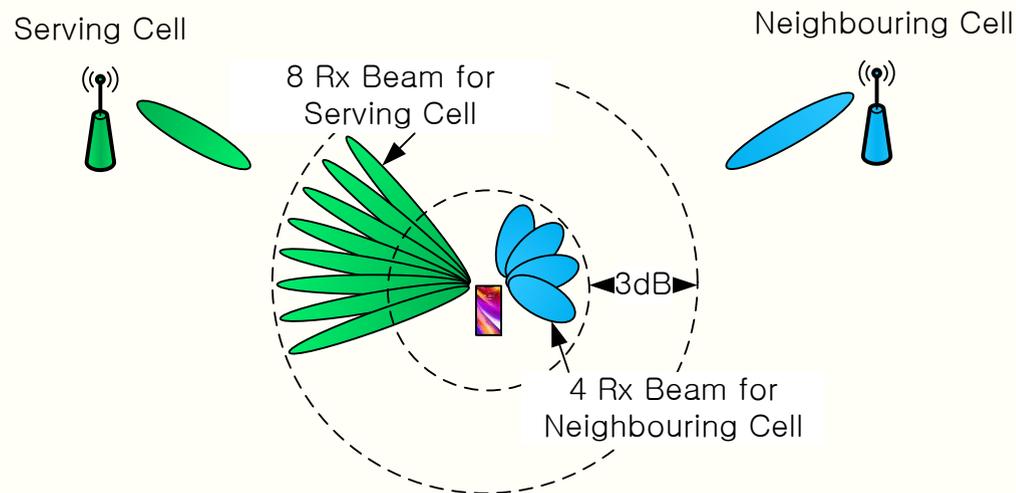
- **Objective**

- Specify RF requirements for FR2 inter-band UL CA based on CBM
- Specify RRM requirements for FR2 inter-band UL CA based on CBM

Further enhancement for RRM (Different RX beam sets in FR2)

• Motivation

- For a UE capable of FR2 NR
 - Different sets of RX beams can be used in measurements based on different measurement objects(MOs)
 - The measured RSRP of a neighboring cell can be different from serving cell even though the received signal levels are same for the different sets
 - a set of fine RX beams for the serving cell
 - a set of rough RX beams for neighbors
 - It is problematic for mobility management and as a result, RLF can occur abnormally.



• Objective

- Study mobility for different sets of RX beams between different MOs in FR2
- Specify RRM requirements related to different sets of RX beams