**3GPP TSG-RAN WG4 Meeting #111 draft R4-2408941**

**Fukuoka City, Fukuoka, Japan, 20th – 24th May, 2023**

**Agenda item: 10.9.4**

**Source:** Moderator (OPPO)

**Title:** Topic summary for [111][130] NR\_SL\_ intraB\_CA\_ITS\_part1

**Document for:** Information

# Introduction

This summary includes system parameters, TX requirements and RX requirements for intra-band non-contiguous CA in ITS band.

# Topic #1: System Parameter

## Companies’ contributions summary

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| **TDoc** | **Company** | **Summary** |
| R4-2408834 | OPPO | **Proposal 1: To capture the intra-band contiguous and non-contiguous SL CA bands under the same sub-clause.**  **Proposal 2: For PC2 intra-band contiguous CA, reuse the same channel bandwidth of PC3 intra-band contiguous CA.**  **Proposal 3: No update for sidelink CA subclause is needed for intra-band non-contiguous CA.** |
| R4-2408952 | Xiaomi | **Proposal 1:** **All the requirements defined for PC2/PC3 sidelink intra-band non-contiguous CA shall apply under the assumption of the same subcarrier spacing for SL CA.** |

## Open issues summary

### Sub-topic 2-1 General

#### Issue 2-1-1: How to capture the operating band

* Proposals
  + Proposal: To capture the intra-band contiguous and non-contiguous SL CA bands under the same sub-clause.
* Moderator Recommendation:
  + Agree on the proposal

#### Issue 2-1-2: Update on sub-clause 5 of TS 38.101-1

* Proposals
  + Proposal: No update for sidelink CA subclause is needed for intra-band non-contiguous CA

(Moderator note: This proposal limit to sub-clause 5 of TS 38.101-1 for intra-band non-contiguous CA besides the operating band).

* Moderator Recommendation:
  + Agree on the proposal

#### Issue 2-1-3: SCS

* Proposals
  + Proposal: All the requirements defined for PC2/PC3 sidelink intra-band non-contiguous CA shall apply under the assumption of the same subcarrier spacing for SL CA.
* Moderator Recommendation:
  + Further discuss

# Topic #2: UE TX RF requirement

## Companies’ contributions summary

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| **TDoc** | **Company** | **Summary** |
| R4-2407613 | Huawei, HiSilicon | ***Proposal 1: The work in Rel-19 NR sidelink intra-band non-contiguous CA with power class 3 and power class 2 would include at least***   * ***Maximum output power*** * ***MPR for PC2 and PC3*** * ***Configured output power*** * ***Update output power dynamic, transmit signal quality, out of band emission, spurious emissions***   ***Proposal 2: Arch#1-1 and Arch#1-2 are both with 1LO and shall be considered to specify requirements for intra-band sidelink non-contiguous CA with PC3/PC2.***  ***Proposal 3: If there is any conclusion to update the definition PCmax for intra-band non-contiguous CA with 1LO in NR\_ENDC\_RF\_Ph4, we should update accordingly in NR\_SL\_ intraB\_CA\_ITS.***  ***Proposal 4:*** ***Arch#2-2 with dualPA-Architecture (2x23dBm PA+ 2LO) shall be considered to specify requirements for intra-band sidelink non-contiguous CA with PC3/PC2 instead of Arch#2-1(2x26dBm PA+ 2LO).***  ***Proposal 5: For the MPR evaluation of intra-band non-contiguous CA with PC2/PC3 1LO, the simulation assumptions as follows should be agreed***   |  |  | | --- | --- | | Center frequency | 5.9GHz | | Bandwidth | per CC: 10/20/30/40MHz  Aggregated CBW: Table 5.2.3-1 (up to 70MHz CBW) | | Maximum output power for aggregated CBW | 23dBm and 26dBm | | Numerology | 15 kHz/30kHz/60kHz | | Modulation per CC | QPSK/16QAM/64QAM/256QAM | | Waveform | CP-OFDM | | Carrier leakage | 35dBc | | IQ image | 40dBc | | CIM3 | 60dBc | | PA calibration | PA calibrated to deliver 30dBc ACLR for a fully allocated RBs in 20MHz QPSK DFT- S-OFDM waveform at 1 dB MPR.  This is based to share PA between LTE V2X and NR V2X at 5.9GHz as worst case. | |
| R4-2407817 | Xiaomi | **Proposal 1：The MPR for PC2/PC3 intra-band non-contiguous SL CA should be specified for PSSCH/PSCCH, PSFCH and S-SSB.**  **Proposal 2: The MPR/A-MPR for PC2/PC3 intra-band non-contiguous SL CA can be defined based on the architectures of 1PA+1LO and 2PA+2LO, and doesn’t need to consider the architecture of 2PA+1LO.**  **Proposal 3: Using -34dBc carrier leakage as the starting point in MPR simulation.**  **Proposal 4: For the intra-band non-contiguous SL CA, using the frequency gap equal or smaller than the aggregated BW+5MHz as the baseline in the MPR simulation.**  **Proposal 5: PCMAX should be specified for PC2/PC3 intra-band non-contiguous SL CA.**  **Proposal 6: Other Tx requirements except MOR, MPR/A-MPR and configured transmitted power can reuse the requirements specified for PC2/PC3 single carrier V2X UE in 47.** |
| R4-2407983 | LG Electronics | **Proposal 1: Consider 3 architectures, 1x26dBm+1LO, 2x23dBm+2LO, and 2x23dBm+1LO for PC2 SL intra-band non-contiguous CA MPR evaluation.**  **Proposal 2: Consider all possible BW Gap size for PC2 SL intra-band non-contiguous CA MPR evaluation.**  **Proposal 3: Reuse the applicability of NR intra-band NC CA 2PA+1LO, i.e., BW Gap size＜CC1 +CC2 CBW.**  **Proposal 4:** **Indicate ‘dualPA-architecture’ like NR intra-band non-contiguous CA.** |
| R4-2408045 | Facebook Japan G.K. | **Proposal 1: *On top of above MPR simulation assumptions in Table in issue 2-2-2, RAN4 should consider the frequency gap between sub-block1 and sub-block2 to derive MPR/A-MPR requirements for NR SL intra-band non-contiguous CA UE in ITS spectrum*.**  **Proposal 2: *The above MPR simulation assumptions in Table in issue 2-2-2 1, frequency gap with 20MHz in Euro regions and additional spectrum emission mask in Table 6.5E.2.3.1-1 in TS38.101-1 and additional spurious emission requirements in Table 6.5E.3.4.2-1 and Table 6.5E.3.4.2-2 in TS38.101-1 will be considered to derive A-MPR requirements to comply European regulation for NR SL intra-band non-contiguous CA for both power class 3 and power class 2 in ITS spectrum*.**  **Proposal 3: *For US regulation requirements*, *RAN4 will study and specify the related A-MPR requirements with NS\_52 for NR SL intra-band non-contiguous CA UE after final FCC announcement for the additional emission limits in US.***  **Proposal 4: *The above UE Tx/Rx requirements for NR SL intra-band non-contiguous CA shall be considered to specify the UE RF requirements in TS38.101-1.*** |
| R4-2408833 | OPPO | **Proposal 1: To consider both 1 PA and 2 PA architecture for intra-band non-contiguous sidelink CA MPR simulation for both PC3 and PC2.**  **Proposal 2: The 2PA+1LO architecture can be precluded for intra-band non-contiguous CA A-MPR simulation for both PC2 and PC3..**  **Proposal 3: To add new sub-clause to introduce UE TX requirement of intra-band non-contiguous CA.** |

## Open issues summary

### Sub-topic 2-1 MPR/A-MPR simulation

#### Issue 2-1-1: Architecture

* Proposals
  + Proposal 1 (Huawei):
    - Arch#1-1 and Arch#1-2 are both with 1LO and shall be considered to specify requirements for intra-band sidelink non-contiguous CA with PC3/PC2.
    - Arch#2-2 with dualPA-Architecture (2x23dBm PA+ 2LO) shall be considered to specify requirements for intra-band sidelink non-contiguous CA with PC3/PC2 instead of Arch#2-1(2x26dBm PA+ 2LO)
  + Proposal 2 (Xiaomi, OPPO)
    - The MPR/A-MPR for PC2/PC3 intra-band non-contiguous SL CA can be defined based on the architectures of 1PA+1LO and 2PA+2LO, and doesn’t need to consider the architecture of 2PA+1LO.
  + Proposal 3 (LG Electronics)
    - Consider 3 architectures, 1x26dBm+1LO, 2x23dBm+2LO, and 2x23dBm+1LO for PC2 SL intra-band non-contiguous CA MPR evaluation
* Recommendation:
  + First to decide whether the 1LO architecture should be included
  + Second to decide the PA power class for two PA architecture

#### Issue 2-1-2: Frequency gap

* Proposals
  + Proposal 1: The MPR for PC2/PC3 intra-band non-contiguous SL CA should be specified for PSSCH/PSCCH, PSFCH and S-SSB. (Huawei)
    - Observation 1: The Frequency Separation, Gap between the CCs ≤ the overall channel bandwidth summed between two CC, may not be met for some of configuration for intra-band sidelink CA in Arch#1 without dualPA-architecture.
    - Observation 2: The RB allocation imbalance on the two CC of intra-band sidelink CA should be considered for PCmax in dualPA-Architecture according to the conclusion (if there to be) in NR\_ENDC\_RF\_Ph4.
  + Proposal 2: For the intra-band non-contiguous SL CA, using the frequency gap equal or smaller than the aggregated BW+5MHz as the baseline in the MPR simulation. (Xiaomi)
  + Proposal 3: (LG Electronics)
    - Consider all possible BW Gap size for PC2 SL intra-band non-contiguous CA MPR evaluation.
    - Reuse the applicability of NR intra-band NC CA 2PA+1LO, i.e., BW Gap size＜CC1 +CC2 CBW
  + Proposal 4: (Facebook)
    - On top of above MPR simulation assumptions in Table in issue 2-2-2, RAN4 should consider the frequency gap between sub-block1 and sub-block2 to derive MPR/A-MPR requirements for NR SL intra-band non-contiguous CA UE in ITS spectrum.
    - The above MPR simulation assumptions in Table in issue 2-2-2 1, frequency gap with 20MHz in Euro regions and additional spectrum emission mask in Table 6.5E.2.3.1-1 in TS38.101-1 and additional spurious emission requirements in Table 6.5E.3.4.2-1 and Table 6.5E.3.4.2-2 in TS38.101-1 will be considered to derive A-MPR requirements to comply European regulation for NR SL intra-band non-contiguous CA for both power class 3 and power class 2 in ITS spectrum.
* Moderator Recommendation:
  + Depend on the architecture discussion, whether 1 LO needs to be considered.
  + Further to discuss
    - BW Gap Size
      * the BW Gap size<CC1+CC2 CBW rule of NR intra-band non-contiguous CA apply to SL.
      * frequency gap equal or smaller than the aggregated BW+5MHz.
      * Consider all possible BW Gap size for PC2 SL intra-band non-contiguous CA MPR evaluation.
    - The RB allocation imbalance

#### Issue 2-1-3: MPR/A-MPR evaluation parameters

* Proposals
  + Proposal 1 (Huawei):
    - Proposal: For the MPR evaluation of intra-band non-contiguous CA with PC2/PC3 1LO, the simulation assumptions as follows should be agreed

|  |  |
| --- | --- |
| Center frequency | 5.9GHz |
| Bandwidth | per CC: 10/20/30/40MHz  Aggregated CBW: Table 5.2.3-1 (up to 70MHz CBW) |
| Maximum output power for aggregated CBW | 23dBm and 26dBm |
| Numerology | 15 kHz/30kHz/60kHz |
| Modulation per CC | QPSK/16QAM/64QAM/256QAM |
| Waveform | CP-OFDM |
| Carrier leakage | 35dBc |
| IQ image | 40dBc |
| CIM3 | 60dBc |
| PA calibration | PA calibrated to deliver 30dBc ACLR for a fully allocated RBs in 20MHz QPSK DFT- S-OFDM waveform at 1 dB MPR.  This is based to share PA between LTE V2X and NR V2X at 5.9GHz as worst case. |

* + Proposal 2 (Xiaomi)
    - Using -34dBc carrier leakage as the starting point in MPR simulation.
* Recommendation:
  + Proposal 1 is for 1LO architecture, need further discuss after issue 2-1-1 has been agreed
  + Proposal 2 in-line with agreement in the last meeting

#### Issue 2-1-4: Requirement for simulation

* Proposal 1: The above MPR simulation assumptions in Table in issue 2-2-2 1, frequency gap with 20MHz in Euro regions and additional spectrum emission mask in Table 6.5E.2.3.1-1 in TS38.101-1 and additional spurious emission requirements in Table 6.5E.3.4.2-1 and Table 6.5E.3.4.2-2 in TS38.101-1 will be considered to derive A-MPR requirements to comply European regulation for NR SL intra-band non-contiguous CA for both power class 3 and power class 2 in ITS spectrum.
* Proposal 2: For US regulation requirements, RAN4 will study and specify the related A-MPR requirements with NS\_52 for NR SL intra-band non-contiguous CA UE after final FCC announcement for the additional emission limits in US.
* Recommendation:
  + The EU regulation is more stable and can be agreed
  + For FCC regulation, can work based on current NS\_52 first and wait for FCC update.

### Sub-topic 2-2 TX Requirements

#### Issue 2-2-1: TX Requirement

* Proposals
  + Proposal 1: The work in Rel-19 NR sidelink intra-band non-contiguous CA with power class 3 and power class 2 would include at least
    - Maximum output power
    - MPR for PC2 and PC3
    - Configured output power
    - Update output power dynamic, transmit signal quality, out of band emission, spurious emissions
  + Proposal 2: (Xiaomi)
    - PCMAX should be specified for PC2/PC3 intra-band non-contiguous SL CA.
    - Other Tx requirements except MOR, MPR/A-MPR and configured transmitted power can reuse the requirements specified for PC2/PC3 single carrier V2X UE in 47
  + Proposal 3: (Facebook)
    - The above UE Tx/Rx requirements for NR SL intra-band non-contiguous CA shall be considered to specify the UE RF requirements in TS38.101-1.Moderator Recommendation:
  + Proposal 4: (OPPO)
    - To add new sub-clause to introduce UE TX requirement of intra-band non-contiguous CA.
* Recommendation:
  + Further discuss

#### Issue 2-2-2: Signalling

* Proposal: Indicate ‘dualPA-architecture’ like NR intra-band non-contiguous CA
* Recommendation:
  + Further discuss after the simulation frame work is agreed.

# Topic #3: UE RX RF requirement

## Companies’ contributions summary

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| **TDoc** | **Company** | **Summary** |
| R4-2407614 | Huawei, HiSilicon | *Proposal 1: The description of the following Rx requirements in the specification should be updated from that only for contiguous intra-band SL CA to also accommodate the requirements for non-contiguous intra-band SL CA*   * ***REFSENS*** * ***Maximum input level,*** * ***ACS locking*** * ***In-band/ out-of-band blocking*** * ***Spurious response*** * ***Wide band Intermodulation*** |
| R4-2407818 | Xiaomi | **Proposal 1: The REFSENS specified for single carrier operation in n47 shall apply to each component carrier of intra-band non-contiguous SL CA.**  **Proposal 2: For intra-band non-contiguous SL CA, the Rx requirements including maximum input power, ACS and blocking should be specified based on the sub-block. The requirements for single carrier shall apply to the sub-block including one component carrier only and the requirements for intra-band contiguous SL CA shall apply to the sub-block including multiple component carriers.** |
| R4-2408832 | OPPO | **Proposal 1: For intra-band non-contiguous SL CA, for all the RX requirements, the requirement for general and intra-band contiguous CA apply for one component carrier and two component carriers per sub-block, respectively.** |

### Sub-topic 3-1

#### Issue 3-1-1: RX requriements

* Proposals
  + Proposal 1 (Huawei):
    - The description of the following Rx requirements in the specification should be updated from that only for contiguous intra-band SL CA to also accommodate the requirements for non-contiguous intra-band SL CA
      * REFSENS
      * Maximum input level,
      * ACS locking
      * In-band/ out-of-band blocking
      * Spurious response
      * Wide band IntermodulationProposal 2
  + Proposal 2 (Xiaomi, OPPO)
    - The REFSENS specified for single carrier operation in n47 shall apply to each component carrier of intra-band non-contiguous SL CA.
    - For intra-band non-contiguous SL CA, the Rx requirements including maximum input power, ACS and blocking should be specified based on the sub-block. The requirements for single carrier shall apply to the sub-block including one component carrier only and the requirements for intra-band contiguous SL CA shall apply to the sub-block including multiple component carriers.
* Recommendation:
  + Further discuss