3GPP TSG RAN WG2 #131 R2-250

**Bengaluru, India Aug 25th – 29th, 2025**

Title: Draft LS on per band and per BC capability

Response to: -

Release: Release 19

Work Item: NR\_MIMO\_Ph5, NR\_AIML\_air

Source: Samsung, Xiaomi [to be RAN WG2]

To: RAN WG1

Cc: RAN WG4

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Attachments: -

**1. Overall Description:**

RAN2 observed that many feature groups are defined as “per band and per BC” in Rel-19 feature list and identified that there are some unclear aspects in specifying “per band and per BC capability”.

Based on running CR on Rel-19 UE capability, the following is example of how per band and per BC capability is defined. The same codebookParametersType1SP-SchemeA-r19 is defined MIMO-ParametersPerBand and CA-ParametersNR-v1900.

MIMO-ParametersPerBand ::= SEQUENCE {

…omitted

codebookParametersType1SP-SchemeA-r19 CodebookParametersType1SP-SchemeA-r19 OPTIONAL,

…omitted

}

CA-ParametersNR-v1900 ::= SEQUENCE {

codebookParametersType1SP-SchemeA-PerBC-r19 CodebookParametersType1SP-SchemeA-r19 OPTIONAL,

…omitted

}

CodebookParametersType1SP-SchemeA-r19 ::= SEQUENCE {

-- R1 59-2-1-1: Enhanced Type-I SP codebook for 64 ports – Scheme-A

enhType1SP64PortSchemeA-r19 SEQUENCE {

supportedCSI-RS-ResourceList-r19 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER

(0..maxNrofCSI-RS-ResourcesAlt-1-r16),

maxRank-r19 INTEGER (4..8),

maxNumberResource-r19 INTEGER (1..8),

processingCapability-r19 ENUMERATED {cap1, cap2}

},

-- R1 59-2-1-1a: Enhanced Type-I SP codebook for 48 ports – Scheme-A

enhType1SP48PortsSchemeA-r19 SEQUENCE {

supportedCSI-RS-ResourceList-r19 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER

(0..maxNrofCSI-RS-ResourcesAlt-1-r16),

maxRank-r19 INTEGER (4..8),

maxNumberResource-r19 INTEGER (1..8),

processingCapability-r19 ENUMERATED {cap1, cap2}

}

…omitted

}

**Question 1:** what is the relationship between per band and per BC capabilities i.e. what is the final capability in the following cases?

* Case 1: when UE indicates both per band and per BC capability
* Case 2: when per BC capability is indicated but one of bands in the BC doesn’t indicate per band capability
* Case 3: when the UE reports the per band capability but does not include the per BC capability for a certain BC..

Regarding Case 1, we included two example for easy explanation. In 59-2-1-1, component 4 is Max # of CSI-RS resource in a resource set (candidate value is {1..8}). Assuming the following capability indicated, what is Maximum # of CSI-RS resource in a resource set in band 1 and band 2 in CA-n1\_n2?

* Band 1: Max # of CSI-RS resource in a resource set = 4
* Band 2: Max # of CSI-RS resource in a resource set = 8
* CA-n1\_n2: Max # of CSI-RS resource in a resource set = 6

In 59-2-1-1, component 5 is Supported processing capability (candidate value {Capability 1, Capability 2}). Assuming the following capability indicated, what is actual supported processing capability in band 1 and band 2 in CA-n1\_n2?

* Band 1: Capability 1
* Band 2: Capability 2
* CA-n1\_n2: Capability 1

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (Sidelink WI only)”. | Consequence if the feature is not supported by the UE | Type  (the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC) |
| 59. NR\_MIMO\_Ph5 | 59-2-1-1 | Enhanced Type-I SP codebook for 64 ports – Scheme-A | 1. Support of enhanced Type-I SP codebook for Scheme-A with 64 Tx ports by aggregating multiple NZP CSI-RS resources  within one slot  2. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 2-35 | Yes | n/a | Enhanced Type-I SP codebook is not supported for 64 ports – Scheme-A, aggregated CSI-RS resources within one slot | Per band and per BC |
| 59. NR\_MIMO\_Ph5 | 59-2-1-1a | Enhanced Type-I SP codebook for 48 ports – Scheme-A | 1. Support of enhanced Type-I SP codebook for Scheme-A with 48 Tx ports by aggregating multiple NZP CSI-RS resources within one slot  2. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 59-2-1-1 | Yes | n/a | Enhanced Type-I SP codebook is not supported for Scheme-A for 48 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC |

Regarding Case 2, there could be potential different understanding as follows. Please indicate which understanding is correct or new assumption if none of them is correct.

1. If the perBC capability is indicated in a BC, the per band capability of the bands in the BC shall be included for each band within the BC.

2. If the per BC capability is indicated, the per band capability may be absent for a subset bands in the BC. In this case, the feature is not supported in the band without per band capability, the feature is supported only in the band with per band capability.

3. If the per BC capability is indicated, the per band capaility may be absent for a subset or all the bands in the BC. In this case, the perBC capability can be applied for the band(s) without per band capability. For example, the 59-2-1-1.

Regarding Case 3, there could be potential different understanding as follows. Please indicate which understanding is correct or new assumption if none of them is correct.

1. the UE supports the feature as indicated in the per band capability without further per BC limitations.
2. the UE doesn’t support this feature for this BC. For example, if band A support capability 1, Band A+B: doesn’t support Capability 1 if per BC capability is absent in Band A+B, If per BC capability is indicated in Band A+C, UE supports Capability 1.

**Question 2:** how do we define pre-requisite if pre-requisite is also per band and per BC capabilities?

In case of 59-2-1-1a, the pre-requisite is 59-2-1-1 which is also per band and per BC.

In order to indicate 59-2-1-1a in CA-n1\_n2 (per BC capability), should UE also indicate 59-2-1-1 in CA-n1\_n2 (per BC capability)? Or is it also considered to be met for pre-requisite if UE indicates 59-2-1-1 in band 1 or band 2 (per band capability)?

In order to indicate 59-2-1-1a in band 1 (per band capability), could UE just indicate 59-2-1-1 in band 1 or should UE indicate 59-2-1-1a CA-n1\_n2 (per BC capability) as well?

**2. Actions:**

**To RAN1:**

**ACTION:** RAN2 respectfully asks RAN1 to provide answer for the questions above.

**3. Dates of Next RAN2 Meetings:**

RAN2#131bis 13th to 17th October 2025 Prague, CZ

RAN2#132 17th to 21st November 2025 Dallas, US