**3GPP TSG-RAN WG2 Meeting #125R2-240xxxx**

**Athens, Greece, 26th Feb – 1st March 2024**

Agenda Item: 7.2.3

Source: Ericsson

Title: RIL E103 Missing RedCap capability for RRC Connected mode

Document for: Discussion, Decision

# 1 Introduction

This paper discusses RIL E103 and suggest the corresponding corrections as provided in Text Proposal.

RAN1 has agreed below capability, however it is missing in LPP specification.

*PRS measurement with Rx frequency hopping within a MG and measurement reporting RRC\_CONNECTED for RedCap UEs*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 41. NR\_pos\_enh2 | 41-5-1 | PRS measurement with Rx frequency hopping within a MG and measurement reporting RRC\_CONNECTED for RedCap UEs | 1. Maximum DL PRS bandwidth across all hops3. Maximum number of hops4. Duration of DL PRS symbols N3 in units of ms a UE can process every T3 ms5. RF Rx retune times between consecutive hops6. Overlapping PRB(s) between adjacent hops | 13-1, [28-1] | PRS measurement with Rx frequency hopping within a MG and measurement report in RRC\_CONNECTED for RedCap UEs is not supported | Component 1 candidate values:FR1: {40, 50, 80, 100}FR2: {100, 200, 400}Component 3 candidate values: {2,3,4,5,6}Component 4 candidate values:T3: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} msN3: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} msComponent 5 candidate values:FR1: {70us, 140us, 210us}FR2: {35us, 70us, 140us}Component 6 candidate values: {0, 1, 2, 4}Note 1: The maximum DL PRS bandwidth per hop follows component 1 of FG 13-1Note 2: DL PRS buffering capability follows component 2 of FG 13-1[FFS: whether this FG is applicable to non-Redcap UE]Need for location server to know if the feature is supported. | Optional with capability signalling |

# 2 Discussion

## 2.1 nr-DL-PRS-MeasurementTimeWindowsConfig

For RedCap positioning,

* In *NR-DL-PRS-ProcessingCapability*: It is expected to add FG 41-5-1 for “PRS measurement with Rx frequency hopping within a MG and measurement reporting RRC\_CONNECTED for RedCap UEs” inside, and this FG includes maximal DL PRS bandwidth across all hops, maximum number of hops, duration of DL PRS symbols N3 in units of ms a UE can process every T3 ms, RF Rx retune times between consecutive hops and overlapping PRB(s) between adjacent hops.
1. Agree to add the capability 41-5-1.

# Conclusion

Based on the discussion in the previous sections we propose the following:

[Proposal 1 Agree to add the capability 41-5-1.](#_Toc158495649)

# 4 Text Proposal/Draft CR

*Beginning of Changes*

#### *– NR-DL-PRS-ProcessingCapability*

The IE *NR-DL-PRS-ProcessingCapability* defines the common DL-PRS Processing capability. In the case of capabilities for multiple NR positioning methods are provided, the IE *NR-DL-PRS-ProcessingCapability* applies across the NR positioning methods and the target device shall indicate the same values for the capabilities in IEs *NR-DL-TDOA-ProvideCapabilities*, *NR-DL-AoD-ProvideCapabilities*, and *NR-Multi-RTT-ProvideCapabilities*.

The *PRS-ProcessingCapabilityPerBand* is defined for a single positioning frequency layer on a certain band (i.e., a target device supporting multiple positioning frequency layers is expected to process one frequency layer at a time).

-- ASN1START

NR-DL-PRS-ProcessingCapability-r16 ::= SEQUENCE {

 prs-ProcessingCapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

 PRS-ProcessingCapabilityPerBand-r16,

 maxSupportedFreqLayers-r16 INTEGER (1..4),

 simulLTE-NR-PRS-r16 ENUMERATED { supported } OPTIONAL,

 ...,

 [[

 dummy ENUMERATED { m1, m2, ... } OPTIONAL

 ]]

}

PRS-ProcessingCapabilityPerBand-r16 ::= SEQUENCE {

 freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

 supportedBandwidthPRS-r16 CHOICE {

 fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

 mhz50, mhz80, mhz100},

 fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400},

 ...

 },

 dl-PRS-BufferType-r16 ENUMERATED {type1, type2, ...},

 durationOfPRS-Processing-r16 SEQUENCE {

 durationOfPRS-ProcessingSymbols-r16 ENUMERATED {nDot125, nDot25, nDot5, n1,

 n2, n4, n6, n8, n12, n16, n20, n25,

 n30, n32, n35, n40, n45, n50},

 durationOfPRS-ProcessingSymbolsInEveryTms-r16

 ENUMERATED {n8, n16, n20, n30, n40, n80,

 n160,n320, n640, n1280},

 ...

 },

 maxNumOfDL-PRS-ResProcessedPerSlot-r16 SEQUENCE {

 scs15-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

 n48, n64} OPTIONAL,

 scs30-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

 n48, n64} OPTIONAL,

 scs60-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

 n48, n64} OPTIONAL,

 scs120-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

 n48, n64} OPTIONAL,

 ...,

 [[

 scs15-v1690 ENUMERATED {n6, n12} OPTIONAL,

 scs30-v1690 ENUMERATED {n6, n12} OPTIONAL,

 scs60-v1690 ENUMERATED {n6, n12} OPTIONAL,

 scs120-v1690 ENUMERATED {n6, n12} OPTIONAL

 ]]

 },

 ...,

 [[

 supportedDL-PRS-ProcessingSamples-RRC-CONNECTED-r17 ENUMERATED { supported } OPTIONAL,

 prs-ProcessingWindowType1A-r17 ENUMERATED { option1, option2, option3} OPTIONAL,

 prs-ProcessingWindowType1B-r17 ENUMERATED { option1, option2, option3} OPTIONAL,

 prs-ProcessingWindowType2-r17 ENUMERATED { option1, option2, option3} OPTIONAL,

 prs-ProcessingCapabilityOutsideMGinPPW-r17

 SEQUENCE (SIZE(1..3)) OF

 PRS-ProcessingCapabilityOutsideMGinPPWperType-r17

 OPTIONAL,

 dl-PRS-BufferType-RRC-Inactive-r17 ENUMERATED { type1, type2, ... } OPTIONAL,

 durationOfPRS-Processing-RRC-Inactive-r17 SEQUENCE {

 durationOfPRS-ProcessingSymbols-r17 ENUMERATED {nDot125, nDot25, nDot5, n1,

 n2, n4, n6, n8, n12, n16, n20, n25,

 n30, n32, n35, n40, n45, n50},

 durationOfPRS-ProcessingSymbolsInEveryTms-r17

 ENUMERATED {n8, n16, n20, n30, n40, n80,

 n160,n320, n640, n1280},

 ...

 } OPTIONAL,

 maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17 SEQUENCE {

 scs15-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs30-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs60-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs120-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 ...

 } OPTIONAL,

 supportedLowerRxBeamSweepingFactor-FR2-r17 ENUMERATED { n1, n2, n4, n6 } OPTIONAL

 ]],

 [[

 supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17 ENUMERATED { supported } OPTIONAL

 ]],

 [[

 prs-MeasurementWithoutMG-r17 ENUMERATED {cp, symbolDot25, symbolDot5,

 slotDot5} OPTIONAL

 ]],

 [[

 maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Inactive-r18 SEQUENCE {

 scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 ...

 } OPTIONAL,

 maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Connected-r18 SEQUENCE {

 scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 ...

 } OPTIONAL,

 ppw-maxNumOfOneSymbolPRS-ResProcessedPerSlot-r18 SEQUENCE {

 scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

 n32, n48, n64} OPTIONAL,

 ...

 } OPTIONAL,

 prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected-r18

 PRS-BWA-TwoContiguousIntrabandInMG-r18 OPTIONAL,

 prs-BWA-ThreeContiguousIntrabandInMG-RRC-Connected-r18

 PRS-BWA-ThreeContiguousIntrabandInMG-r18 OPTIONAL,

 prs-BWA-TwoContiguousIntrabandInMG-RRC-IdleAndInactive-r18

 PRS-BWA-TwoContiguousIntrabandInMG-r18 OPTIONAL,

 prs-BWA-ThreeContiguousIntrabandInMG-RRC-IdleAndInactive-r18

 PRS-BWA-ThreeContiguousIntrabandInMG-r18 OPTIONAL,

 reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-Connected-r18 BOOLEAN OPTIONAL,

 reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive-r18 BOOLEAN OPTIONAL,

 dL-PRS-MeasurementWithRxFH-RRC-Inactive-r18 ENUMERATED { supported } OPTIONAL,

 dL-PRS-MeasurementWithRxFH-RRC-Idle-r18 ENUMERATED { supported } OPTIONAL,

 dl-PRS-MeasWithRxFH-RRC-Connected-r18  DL-PRS-MeasWithRxFH-RRC-Connected-r18 OPTIONAL,

 reducedNumOfSampleForMeasurementWithFH-RRC-Connected-r18 BOOLEAN OPTIONAL,

 reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive-r18 BOOLEAN OPTIONAL

 ]]

}

PRS-ProcessingCapabilityOutsideMGinPPWperType-r17 ::= SEQUENCE {

 prsProcessingType-r17 ENUMERATED { type1A, type1B, type2 },

 ppw-dl-PRS-BufferType-r17 ENUMERATED { type1, type2, ... },

 ppw-durationOfPRS-Processing1-r17 SEQUENCE {

 ppw-durationOfPRS-ProcessingSymbolsN-r17

 ENUMERATED { msDot125, msDot25, msDot5, ms1, ms2, ms4,

 ms6, ms8, ms12, ms16, ms20, ms25, ms30, ms32, ms35,

 ms40, ms45, ms50 },

 ppw-durationOfPRS-ProcessingSymbolsT-r17

 ENUMERATED { ms1, ms2, ms4, ms8, ms16, ms20, ms30, ms40, ms80,

 ms160, ms320, ms640, ms1280 }

 } OPTIONAL,

 ppw-durationOfPRS-Processing2-r17 SEQUENCE {

 ppw-durationOfPRS-ProcessingSymbolsN2-r17

 ENUMERATED { msDot125, msDot25, msDot5, ms1, ms2, ms3, ms4, ms5,

 ms6, ms8, ms12 },

 ppw-durationOfPRS-ProcessingSymbolsT2-r17

 ENUMERATED { ms4, ms5, ms6, ms8 }

 } OPTIONAL,

 ppw-maxNumOfDL-PRS-ResProcessedPerSlot-r17 SEQUENCE {

 scs15-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 }

 OPTIONAL,

 scs30-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 }

 OPTIONAL,

 scs60-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 }

 OPTIONAL,

 scs120-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 }

 OPTIONAL,

 ...

 },

 ...,

 [[

 ppw-maxNumOfDL-Bandwidth-r17 CHOICE {

 fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

 mhz50, mhz80, mhz100},

 fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

 } OPTIONAL

 ]]

}

PRS-BWA-TwoContiguousIntrabandInMG-r18 ::= SEQUENCE {

 maximumOfTwoAggregatedDL-PRS-Bandwidth-FR1-r18 ENUMERATED {mhz10, mhz20, mhz40, mhz50,

 mhz80, mhz100, mhz160, mhz200}

 OPTIONAL,

 maximumOfTwoAggregatedDL-PRS-Bandwidth-FR2-r18 ENUMERATED {mhz100, mhz200, mhz400, mhz800}

 OPTIONAL,

 maximumOfDL-PRS-BandwidthPerPFL-FR1-r18 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

 mhz50, mhz80, mhz100} OPTIONAL,

 maximumOfDL-PRS-BandwidthPerPFL-FR2-r18 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

 OPTIONAL,

 dl-PRS-BufferTypeOfBWA-r18 ENUMERATED {type1, type2},

 prs-durationOfTwoPRS-BWA-Processing-r18 SEQUENCE {

 prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18

 ENUMERATED {msDot125, msDot25, msDot5, ms1, ms2, ms4, ms6, ms8, ms12,

 ms16, ms20, ms25, ms30, ms32, ms35, ms40, ms45, ms50},

 prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18

 ENUMERATED {ms8, ms16, ms20, ms30, ms40, ms80, ms160, ms320, ms640, ms1280}

 } OPTIONAL,

 maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18 SEQUENCE {

 scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL,

 scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL,

 scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL

 },

 maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18 SEQUENCE {

 scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL,

 scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL

 }

}

PRS-BWA-ThreeContiguousIntrabandInMG-r18 ::= SEQUENCE {

 maximumOfThreeAggregatedDL-PRS-Bandwidth-FR1-r18

 ENUMERATED {mhz15, mhz20, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100, mhz120,

 mhz140, mhz150, mhz180, mhz200, mhz240, mhz300} OPTIONAL,

 maximumOfThreeAggregatedDL-PRS-Bandwidth-FR2-r18

 ENUMERATED {mhz150, mhz200, mhz300, mhz400, mhz600, mhz800, mhz1000,

 mhz1200} OPTIONAL,

 maximumOfDL-PRS-BandwidthPerPFL-FR1-r18

 ENUMERATED {mhz5, mhz10, mhz20, mhz40, mhz50, mhz80, mhz100} OPTIONAL,

 maximumOfDL-PRS-BandwidthPerPFL-FR2-r18

 ENUMERATED {mhz50, mhz100, mhz200, mhz400} OPTIONAL,

 dl-PRS-BufferTypeOfBWA-r18 ENUMERATED {type1, type2},

 prs-durationOfThreePRS-BWA-Processing-r18 SEQUENCE {

 prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18

 ENUMERATED {msDot125, msDot25, msDot5, ms1, ms2, ms4, ms6, ms8, ms12,

 ms16, ms20, ms25, ms30, ms32, ms35, ms40, ms45, ms50},

 prs-durationOfThreePRS-BWA-ProcessingSymbolsT-r18

 ENUMERATED {ms8, ms16, ms20, ms30, ms40, ms80, ms160,

 ms320, ms640, ms1280}

 } OPTIONAL,

 maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18 SEQUENCE {

 scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL,

 scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL,

 scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL

 },

 maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18 SEQUENCE {

 scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL,

 scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

 n16, n24, n32, n48, n64 } OPTIONAL

 }

}

DL-PRS-MeasWithRxFH-RRC-Connected-r18  ::=   SEQUENCE {

 supportedTotalBW-r18  CHOICE {

 fr1                                          ENUMERATED {prb40, prb50, prb80, prb100},

        fr2                                           ENUMERATED {prb100, prb200, prb400},

        ...

        },

 maxNumOfHop-r18                 ENUMERATED {n2, n3, n4, n5, n6},

    processingDuration-r18     SEQUENCE {

 processingSymbolsDuration-r18  ENUMERATED {nDot125, nDot25, nDot5, n1, n2, n4, n6, n8, n12, n16, n20, n25, n30, n32, n35, n40,

 n45, n50},

     processingSymbolsInEveryTms-r18    ENUMERATED {n8, n16, n20, n30, n40, n80, n160,n320, n640, n1280}

       },

       rf-RetuneTus-r18      CHOICE {

           fr1                                        ENUMERATED {n70, n140, n210},

           fr2                                        ENUMERATED {n35, n70, n140},

           ...

        },

      numOfOverlappingPRB-r18          ENUMERATED {n0, n1, n2, n4},

       ...

    }

-- ASN1STOP

| *NR-DL-PRS-ProcessingCapability* field descriptions |
| --- |
| ***maxSupportedFreqLayers***Indicates the maximum number of positioning frequency layers supported by UE. |
| ***simulLTE-NR-PRS***Indicates whether the UE supports parallel processing of LTE PRS and NR PRS. |
| ***dummy***This field is not used in the specification. If received it shall be ignored by the receiver. |
| ***supportedBandwidthPRS***Indicates the maximum number of DL-PRS bandwidth in MHz, which is supported and reported by UE. |
| ***dl-PRS-BufferType***IndicatesDL-PRS buffering capability. Value *type1* indicates sub-slot/symbol level buffering and value *type2* indicates slot level buffering. |
| ***durationOfPRS-Processing***Indicates the duration *N* of DL-PRS symbols in units of ms a UE can process every T ms assuming maximum DL-PRS bandwidth provided in *supportedBandwidthPRS* and comprises the following subfields:- ***durationOfPRS-ProcessingSymbols***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.- ***durationOfPRS-ProcessingSymbolsInEveryTms***: This field specifies the values for *T*. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.See NOTE 9. |
| ***maxNumOfDL-PRS-ResProcessedPerSlot***Indicates the maximum number of DL-PRS resources that UE can process in a slot. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands.  |
| ***supportedDL-PRS-ProcessingSamples-RRC-CONNECTED***Indicates the UE capability for support of measurements based on measuring M=1 or M=2 (instances) of a DL-PRS Resource Set. The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.NOTE 1: This feature is supported for both UE-assisted and UE based positioning. |
| ***prs-ProcessingWindowType1A***Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.Type 1A refers to the determination of prioritization between DL-PRS and other DL signals/channels in all OFDM symbols within the PRS Processing Window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR. Enumerated value indicates supported priority handing options of DL-PRS:- *option1*: Support of "st1" and "st3" defined in clause 5.1.6.5 of TS 38.214 [45].- *option2*: Support of "st1", "st2", and "st3" defined in clause 5.1.6.5 of TS 38.214 [45].- *option3*: Support of "st1" only defined in clause 5.1.6.5 of TS 38.214 [45].The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.NOTE 2: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP.NOTE 2a: When the UE determines higher priority for other DL signals/channels over the DL-PRS measurement/processing, the UE is not expected to measure/process DL-PRS. |
| ***prs-ProcessingWindowType1B***Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.Type 1B refers to the determination of prioritization between DL-PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected. Enumerated value indicates supported priority handing options of DL-PRS (see *prs-ProcessingWindowType1A*).The UE can include this field only if the UE supports prs-ProcessingCapabilityBandList. Otherwise, the UE does not include this field.NOTE 3: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP.NOTE 3a: When the UE determines higher priority for other DL signals/channels over the DL-PRS measurement/processing, the UE is not expected to measure/process DL-PRS. |
| ***prs-ProcessingWindowType2***Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.Type 2 refers to the determination of prioritization between DL-PRS and other DL signals/channels only in DL-PRS symbols within the PRS processing window. Enumerated value indicates supported priority handing options of DL-PRS (see *prs-ProcessingWindowType1A*).The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.NOTE 4: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP.NOTE 4a: When the UE determines higher priority for other DL signals/channels over the DL-PRS measurement/processing, the UE is not expected to measure/process DL-PRS. |
| ***prs-ProcessingCapabilityOutsideMGinPPW***Indicates the DL-PRS Processing Capability outside MG of each of the supported PPW Type in the case the UE supports multiple PPW Types in a band and comprises the following subfields:- ***prsProcessingType***: Indicates the DL-PRS Processing Window Type for which the *prs-ProcessingCapabilityOutsideMGinPPW* are provided.- ***ppw-dl-PRS-BufferType***: Indicates DL-PRS buffering capability. Value '*type1'* indicates sub-slot/symbol level buffering and value '*type2'* indicates slot level buffering.- ***ppw-durationOfPRS-Processing1***: Indicates the duration of DL-PRS symbols N in units of ms a UE can process every T ms assuming maximum DL-PRS bandwidth provided in *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:- ***ppw-durationOfPRS-ProcessingSymbolsN***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.- ***ppw-durationOfPRS-ProcessingSymbolsT***: This field specifies the values for *T*. Enumerated values indicate 1, 2, 4, 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.- ***ppw-durationOfPRS-Processing2***: Indicates the duration of DL-PRS symbols N2 in units of ms a UE can process inT2 ms assuming maximum DL-PRS bandwidth provided in *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:- ***ppw-durationOfPRS-ProcessingSymbolsN2***: This field specifies the values for *N2*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12 ms.- ***ppw-durationOfPRS-ProcessingSymbolsT2***: This field specifies the values for *T2*. Enumerated values indicate 4, 5, 6, 8 ms.- ***ppw-maxNumOfDL-PRS-ResProcessedPerSlot:*** Indicates the maximum number of DL-PRS resources that UE can process in a slot. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands.- ***ppw-maxNumOfDL-Bandwidth:*** Indicates the maximum number of DL PRS bandwidth in MHz, which is supported and reported by UE for PRS measurement outside MG within the PPW.The UE can include this field only if the UE supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* and *prs-ProcessingWindowType2*. Otherwise, the UE does not include this field.NOTE 5: A UE that supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* or *prs-ProcessingWindowType2* shall always include the *prs-ProcessingCapabilityOutsideMGinPPW*.NOTE 6: The (N, T) UE capability in *ppw-durationOfPRS-Processing1* is interpreted as in NOTE 9, and the UE is expected to receive the DL-PRS within the PRS processing window but the processing of the received DL-PRS may be outside a DL-PRS processing window.NOTE 7: The (N2, T2) UE capability in *ppw-durationOfPRS-Processing2* is interpreted such that the UE is capable of measuring up to N2 ms DL-PRS within a PPW and is capable of completing the DL-PRS processing within the PPW, e.g., if the time duration from the last symbol of the measured DL-PRS resource(s) inside the PPW to the end of PPW is not smaller than T2 ms.NOTE 8: A UE which supports *prs-ProcessingCapabilityOutsideMGinPPW* shall support either *ppw-durationOfPRS-Processing1* or *ppw-durationOfPRS-Processing2*, but not both for each supported type in a band. |
| ***dl-PRS-BufferType-RRC-Inactive***IndicatesDL-PRS buffering capability in RRC\_INACTIVE state. Value '*type1'* indicates sub-slot/symbol level buffering and value '*type2'* indicates slot level buffering. |
| ***durationOfPRS-Processing-RRC-Inactive***Indicates the duration *N* of DL-PRS symbols in units of ms a UE can process every *T* ms in RRC\_INACTIVE state assuming maximum DL-PRS bandwidth provided in *supportedBandwidthPRS* and comprises the following subfields:- ***durationOfPRS-ProcessingSymbols***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.- ***durationOfPRS-ProcessingSymbolsInEveryTms***: This field specifies the values for *T*. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.See NOTE 9. |
| ***maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive***Indicates the maximum number of DL-PRS resources a UE can process in a slot in RRC\_INACTIVE state. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. |
| ***supportedLowerRxBeamSweepingFactor-FR2***Indicates support of the lower Rx beam sweeping factor than 8 for FR2. Enumerated value indicates the number of Rx beam sweeping factors supported. |
| ***supportedDL-PRS-ProcessingSamples-RRC-Inactive***Indicates the UE capability for support of reduced number of samples for PRS measurement in RRC\_INACTIVE state. The UE can include this field only if the UE supports *prs-ProcessingRRC-Inactive* defined in TS 38.331 [35]. Otherwise, the UE does not include this field. |
| ***maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Inactive***Indicates the maximum number of single-symbol DL-PRS resources that UE can process in a slot in RRC\_INACTIVE. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. A UE which supports *maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Inactive-r18* shall support single-symbol DL-PRS with the comb sizes from {2,4,6,12}.The UE can include this field only if the UE supports one of *dl-PRS-BufferType-RRC-Inactive*, *durationOfPRS-Processing-RRC-Inactive*, and *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive*. Otherwise, the UE does not include this field. |
| ***maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Connected***Indicates the maximum number of single-symbol DL-PRS resources that UE can process in a slot inside a measurement gap in RRC\_CONNECTED. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. A UE which supports *maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Connected-r18* shall support single-symbol DL-PRS with the comb sizes from {2,4,6,12}.The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field. |
| ***ppw-maxNumOfOneSymbolPRS-ResProcessedPerSlot***Indicates the maximum number of single-symbol DL-PRS resources that UE can process in a slot outside a measurement gap in RRC\_CONNECTED. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. A UE which supports *ppw-maxNumOfOneSymbolPRS-ResProcessedPerSlot-r18* shall support single-symbol DL-PRS with the comb sizes from {2,4,6,12}.The UE can include this field only if the UE supports *prs-ProcessingCapabilityOutsideMGinPPW*. Otherwise, the UE does not include this field. |
| ***prs-MeasurementWithoutMG***Indicates the UE capability for support of Rx timing difference between the serving cell and non-serving cell for PRS measurement within a PPW. Value '*cp*' indicates one CP length, value '*symbolDot25*' indicates 0.25 symbol length, value '*symbolDot5*' indicates 0.5 symbol length and value '*slotDot5*' indicates 0.5 slot length. The UE can include this field only if the UE supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* and *prs-ProcessingWindowType2*. Otherwise, the UE does not include this field. |
| ***prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected***Indicates the UE capability for support of DL PRS processing capabilities for aggregated PRS processing of 2 PFLs in intra-band contiguous within a MG for RRC\_CONNECTED state and and comprises the following subfields:- ***maximumOfTwoAggregatedDL-PRS-Bandwidth-FR1***: Indicates the maximum aggregated DL PRS bandwidth in MHz for FR1, which is supported and reported by UE.- ***maximumOfTwoAggregatedDL-PRS-Bandwidth-FR2***: Indicates the maximum aggregated DL PRS bandwidth in MHz for FR2, which is supported and reported by UE.- ***maximumOfDL-PRS-BandwidthPerPFL-FR1***: Indicates the maximum DL PRS bandwidth in MHz for FR1, per PFL.- ***maximumOfDL-PRS-BandwidthPerPFL-FR2***: Indicates the maximum DL PRS bandwidth in MHz for FR2, per PFL.- ***dl-PRS-BufferTypeOfBWA***: Indicates the DL PRS buffering capability.- ***prs-durationOfTwoPRS-BWA-Processing***: Indicates the duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum aggregated DL PRS bandwidth in MHz, which is supported and reported by UE.- ***prs-durationOfTwoPRS-BWA-ProcessingSymbolsN***: This field specifies the values for N. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.- ***prs-durationOfTwoPRS-BWA-ProcessingSymbolsT***: This field specifies the values for T. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280, 2560 ms.- ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1***: Indicates the Maximum number of aggregated DL PRS resources across aggregated PFLs that UE can process in a slot for FR1.- ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2***: Indicates the Maximum number of aggregated DL PRS resources across aggregated PFLs that UE can process in a slot for FR2.The UE can include this field only if the UE supports *ProcessingCapabilityPerBand*. Otherwise, the UE does not include this field.NOTE10: *dl-PRS-BufferTypeOfBWA* follows buffering capability type reported in *ProcessingCapabilityPerBand.*NOTE11: The value N should be equal or smaller than the value N reported by *ProcessingCapabilityPerBand*, or this value T should be equal or larger than the value T reported by *ProcessingCapabilityPerBand.*NOTE12: Each two linked PRS resources are counted as 1 resourceNOTE13: *maxNumOfAggregatedDL-PRS-ResourcePerSlot* should be equal or smaller than the value reported by *ProcessingCapabilityPerBand.*NOTE14: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL)/measurement gap repetition period (MGRP) of no more than 30%. |
| ***prs-BWA-ThreeContiguousIntrabandInMG-RRC-Connected***Indicates the UE capability for support of DL PRS processing capabilities for aggregated PRS processing of 3 PFLs in intra-band contiguous within a MG for RRC\_CONNECTED state and and comprises the following subfields:**- *maximumOfThreeAggregatedDL-PRS-Bandwidth-FR1***: Indicates the maximum aggregated DL PRS bandwidth in MHz of for FR1, which is supported and reported by UE.**- *maximumOfThreeAggregatedDL-PRS-Bandwidth-FR2***: Indicates the maximum aggregated DL PRS bandwidth in MHz for FR2, which is supported and reported by UE.**- *maximumOfDL-PRS-BandwidthPerPFL-FR1***: Indicates the maximum DL PRS bandwidth in MHz for FR1, per PFL**- *maximumOfDL-PRS-BandwidthPerPFL-FR2***: Indicates the maximum DL PRS bandwidth in MHz for FR2, per PFL**- *dl-PRS-BufferTypeOfBWA***: Indicates the DL PRS buffering capability.**- *prs-durationOfThreePRS-BWA-Processing***: Indicates the duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum aggregated DL PRS bandwidth in MHz, which is supported and reported by UE.**- *prs-durationOfThreePRS-BWA-ProcessingSymbolsN***: This field specifies the values for N. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.**- *prs-durationOfThreePRS-BWA-ProcessingSymbolsT***: This field specifies the values for T. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280, 3840 ms.**- *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1***: Indicates the Maximum number of aggregated DL PRS resources across aggregated PFLs that UE can process in a slot for FR1.**- *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2***: Indicates the Maximum number of aggregated DL PRS resources across aggregated PFLs that UE can process in a slot for FR2.The UE can include this field only if the UE supports *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected****.*** Otherwise, the UE does not include this field.NOTE15: *dl-PRS-BufferTypeOfBWA* follows buffering capability type reported in *ProcessingCapabilityPerBand.*NOTE16: The value N should be equal or smaller than the value N reported by *ProcessingCapabilityPerBand*, or this value T should be equal or larger than the value T reported by *ProcessingCapabilityPerBand.*NOTE17: Each three linked PRS resources are counted as 1 resourceNOTE18: *maxNumOfAggregatedDL-PRS-ResourcePerSlot* should be equal or smaller than the value reported by *ProcessingCapabilityPerBand*.NOTE19: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL)/measurement gap repetition period (MGRP) of no more than 30%. |
| ***prs-BWA-TwoContiguousIntrabandInMG-RRC-IdleAndInactive***Indicates the UE capability for support of DL PRS processing capabilities for aggregated PRS processing of 2 PFLs in intra-band contiguous within a MG for RRC\_INACTIVE and RRC\_IDLE state.The UE can include this field only if the UE supports DL PRS processing capabilities in RRC inactive state. Otherwise, the UE does not include this field. |
| ***prs-BWA-ThreeContiguousIntrabandInMG-RRC-IdleAndInactive***Indicates the UE capability for support of DL PRS processing capabilities for aggregated PRS processing of 3 PFLs in intra-band contiguous within a MG for RRC\_INACTIVE and RRC\_IDLE state. The UE can include this field only if the UE supports *prs-BWA-TwoContiguousIntrabandInMG-RRC-IdleAndInactive*. Otherwise, the UE does not include this field. |
| ***reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-Connected***Indicates whether UE supports reduced number of samples in positioning measurements with PRS bandwidth aggregation for RRC\_CONNECTED. TRUE means supported and FALSE means not supported. The UE can indicate TRUE only if the UE supports *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected****.*** Otherwise, the UE indicates FALSE. |
| ***reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive***Indicates whether UE supports reduced number of samples in positioning measurements with PRS bandwidth aggregation for RRC\_IDLE and RRC\_INACTIVE. TRUE means supported and FALSE means not supported. The UE can indicate TRUE only if the UE supports *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected****.*** Otherwise, the UE indicates FALSE. |
| ***dl-PRS-MeasurementWithRxFH-RRC-Inactive***Indicates the UE capability for support of PRS measurement with Rx frequency hopping in RRC\_INACTIVE for RedCap UEs. The UE can include this field only if the UE supports PRS measurement with Rx frequency hopping within a MG and measurement reporting in RRC\_CONNECTED for RedCap UEs and *prs-ProcessingRRC-Inactive* defined in TS 38.331 [35]. Otherwise, the UE does not include this field. |
| ***dl-PRS-MeasurementWithRxFH-RRC-Idle***Indicates the UE capability for support of PRS measurement with Rx frequency hopping in RRC\_IDLE for RedCap UEs. The UE can include this field only if the UE supports PRS measurement with Rx frequency hopping within a MG and measurement reporting in RRC\_CONNECTED for RedCap UEs. Otherwise, the UE does not include this field. |
| ***dl-PRS-MeasurementWithRxFH-RRC-Connected***Indicates the UE capability for support of PRS measurement with Rx frequency hopping in RRC\_IDLE for RedCap UEs.**- *supportedTotalBW***: Indicates the Maximum DL PRS bandwidth across all hops.**- *maxNoOfHpos***: Indicates the Maximum Maximum number of hops**- *processingDuration***: Indicates the Duration of DL PRS symbols N3 in units of ms a UE can process every T3 ms.**- *rf-RetuneTus***: Indicates the RF Rx retune times between consecutive hops.**- *numOfOverlappingPRB***: Indicates the Overlapping PRB(s) between adjacent hops. |
| ***reducedNumOfSampleForMeasurementWithFH-RRC-Connected***Indicates whether UE supports reduced number of samples for PRS based positioning measurements frequency hopping for RRC\_CONNECTED. TRUE means supported and FALSE means not supported. The UE can indicate TRUE only if the UE supports *supportOfRedCap-r17* defined in TS 38.331 [35]*,* and *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED-r17*. Otherwise, the UE indicates FALSE. |
| ***reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive***Indicates whether UE supports reduced number of samples for PRS based positioning measurements frequency hopping for RRC\_IDLE and RRC\_INACTIVE. TRUE means supported and FALSE means not supported. The UE can indicate TRUE only if the UE supports *supportOfRedCap-r17* defined in TS 38.331 [35], and *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED-r17*. Otherwise, the UE indicates FALSE. |
| NOTE 9: When the target device provides the *durationOfPRS-Processing* capability (*N*, *T*) for any $P(\geq T)$ time window defined in TS 38.214 [45] clause 5.1.6.5, the target device should be capable of processing all DL-PRS resources within $P$, if- $N\geq K$ where K is defined in the TS 38.214 [45] clause 5.1.6.5, and- the number of DL-PRS Resources in each slot does not exceed the *maxNumOfDL-PRS-ResProcessedPerSlot*, and- the configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) is as specified in TS 38.133 [46]. |

*End of changes*