**3GPP TSG-RAN4 Meeting #112-bis *R4-241xxxx***

**Hefei, China, 14 – 18 October, 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | 1 | **Current version:** |  |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | draftCR on performance requirements for PRS BWA |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_pos\_enh2-Perf |  | ***Date:*** | 2024-10-05 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | There are TBDs and FFS in the RSTD accuracy requirements for BWA. |
|  |  |
| ***Summary of change:*** | Resolve TBDs and FFS in the RSTD accuracy requirements for BWA:1. Update accuracy numbers based on the updated simulation results summary in RAN4#112-bis.
2. Add the definition of margins and remove the editor note
3. Correct the table titles
 |
|  |  |
| ***Consequences if not approved:*** | The RSTD accuracy requirements for BWA are incomplete. |
|  |  |
| ***Clauses affected:*** | 10.1.23A.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | The draftCR is based on revised R4-2413983 shared on RAN4 reflector before RAN4#112-bis. |
|  |  |
| ***This CR's revision history:*** |  |

<Start of Change 1>

10.1.23A.2 Measurement Accuracy Requirements

When UE measures RSTD on PRS resources belonging to different PFLs or different PFL combinations, then the RSTD accuracy is defined as the accuracy corresponding to the largest accuracy value among different PFLs or different PFL combinations.

The requirements in this clause for 3-PFL and 2-PFL apply provided that:

- PRS resources linked for aggregation saftisfy all the conditions specified in TS 38.214 clause 5.1.6.5.3.

- The spacing between the center frequencies of adjacent PFLs containing PRS resources linked for aggregation does not exceed the nominal channel spacing for intra-band contiguous CA defined in TS 38.101-1, clause 5.4A.1 for FR1, and in 38.101-2, clause 5.4A.1 for FR2-1.

The accuracy requirements for RSTD measurement based on PRS Aggregation shall be within ±(X+Y+Z+Δ) Tc.

X is defined in Table 10.1.23A.2-1 for AWGN channel and Table 10.1.23A.2-3 for fading channel for FR1, provided that the following conditions are met:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for RSTD measurements are fulfilled according to Annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.

- UE does not perform positioning measurement with reduced number of samples.

X is defined in Table 10.1.23A.2-2 for AWGN channel and Table 10.1.23A.2-4 for fading channel for FR2, provided that the following conditions are met:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- Conditions for RSTD measurements are fulfilled according to Annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.

- UE does not perform positioning measurement with reduced number of samples.

X is defined in Table 10.1.23A.2-5 for AWGN channel in FR1, provided that the following conditions are met:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for RSTD measurements are fulfilled according to Annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.

- UE supports positioning measurement with reduced number of sample and is indicated by LMF to perform positioning measurement with reduced number of samples.

X is defined in Table 10.1.23A.2-6 for AWGN channel in FR2, provided that the following conditions are met:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for RSTD measurements are fulfilled according to Annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.

- UE supports positioning measurement with reduced number of sample and is indicated by LMF to perform positioning measurement with reduced number of samples.

NOTE: The requriements for fading channel in this clause are derived based on TDL-A (30 ns delay spread, 5Hz) and TDL-C (60 ns delay spread, 300 Hz) channel models for FR1 and FR2 respectively.

If the UE doesn’t support Rx TEG reporting for RSTD measurement or when the measurements of reference cell and neighbour cell belong to different Rx TEGs, Y, Z and Δ are defined as follows:

- When UE measures RSTD on PRS resources belonging to same PFL or same PFL combination, Y=32 Tc, provided that the time offset between the two PRS resource instances from the reference cell and the neighbor cell, which are used for a single RSTD estimate, is no greater than 160 ms.

- When UE measures RSTD on PRS resources belonging different PFLs or different PFL combinations, Y=256 Tc, provided that the time offset between the two PRS resource instances from the reference cell and the neighbor cell, which are used for a single RSTD estimate, is no greater than 1280 ms.

- Z is defined in Table 10.1.23A.2-7 for FR1 and Table 10.1.23A.2-9 for FR2, respectively, where the PRS BW refers to the sum of the PRS RB numbers across the aggregated PFLs.

- Δ is zero when UE measures RSTD on PRS resources belonging to same PFL or same PFL combination, and is defined in Table 10.1.23A.2-8 for FR1 and Table 10.1.23A.2-10 for FR2, respectively, when UE measures RSTD on PRS resources belonging different PFLs or different PFL combinations, where the PRS BW refers to the sum of the PRS RB numbers across the aggregated PFLs.

If the measurements of reference cell and neighbour cell belong to the same Rx TEG, i.e. associated and reported with a common Rx TEG ID, then the sum of Y+Z+Δ is equal to the timing error margin of the Rx TEG reported in *nr-UE-RxTEG-TimingErrorMargin*. The timing error margin reported via *nr-UE-RxTEG-TimingErrorMargin* cannot be larger than the value of (Y+Z+Δ) defined when the UE does not associate the measurements with the same Rx TEG.

**Table 10.1.23A.2-1: RSTD absolute accuracy in FR1 for AWGN channel**

|  |  |  |
| --- | --- | --- |
| **Accuracy for 3 PFLs** | **Accuracy for 2 PFLs** | **Conditions** |
| **PRS Ês/Iot** | **PRS SCS** | **PRS bandwidth per PFL****Note 1** | **PRS resource repetition (**$T\_{rep}^{PRS}\*L\_{PRS}/K\_{comb}^{PRS}$**)****Note 2** | **Io Note 3 range** |
| **NR operating band groups Note 4** | **Minimum Io**  | **Maximum Io** |
| **Tc Note 5** | **dB** | **kHz** | **RB** |  |  | **dBm/SCS** | **dBm/BWChannel** |
| [16] | [21] | (PRS Ês/Iot)ref ≥-6dB (PRS Ês/Iot)*i* ≥-13dB | 15 | ≥ 104 | ≥ 1 | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,NR\_SDL\_FR1\_A | -127 | -50 |
| NR\_FDD\_FR1\_B | -126.5 | -50 |
| NR\_TDD\_FR1\_C | -126 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -125.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -125 | -50 |
| NR\_FDD\_FR1\_F | -124.5 | -50 |
| NR\_FDD\_FR1\_G, NR\_TDD\_FR1\_G | -124 | -50 |
| NR\_FDD\_FR1\_H | -123.5 | -50 |
| NR\_FDD\_FR1\_N | -120.5 | -50 |
| [7] | [12] | 30  | ≥ 132 | ≥ 1 | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,NR\_SDL\_FR1\_A | -124 | -50 |
| NR\_FDD\_FR1\_B | -123.5 | -50 |
| NR\_TDD\_FR1\_C | -123 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -122.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -122 | -50 |
| NR\_FDD\_FR1\_F | -121.5 | -50 |
| NR\_FDD\_FR1\_G, NR\_TDD\_FR1\_G | -121 | -50 |
| NR\_FDD\_FR1\_H | -120.5 | -50 |
| NR\_FDD\_FR1\_N | -117.5 | -50 |
| [5] | [6] | 272 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| [7] | [12] | 60 | ≥ 64 | ≥ 1 | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,NR\_SDL\_FR1\_A | -121 | -50 |
| NR\_FDD\_FR1\_B | -120.5 | -50 |
| NR\_TDD\_FR1\_C | -120 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -119.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -119 | -50 |
| NR\_FDD\_FR1\_F | -118.5 | -50 |
| NR\_FDD\_FR1\_G, NR\_TDD\_FR1\_G | -118 | -50 |
| NR\_FDD\_FR1\_H | -117.5 | -50 |
| NR\_FDD\_FR1\_N | -114.5 | -50 |
| [5] | [6] | 132 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T\_{rep}^{PRS}, L\_{PRS} ,K\_{comb}^{PRS}$are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.NOTE 3: Io is assumed to have constant EPRE across the bandwidth.NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. |

**Table 10.1.23A.2-2: RSTD absolute accuracy in FR2 for AWGN channel**

|  |  |  |
| --- | --- | --- |
| **Accuracy for 3 PFLs** | **Accuracy for 2 PFLs** | **Conditions** |
| **PRS Ês/Iot** | **PRS SCS** | **PRS bandwidth per PFL****Note 1** | **PRS resource repetition** **(**$T\_{rep}^{PRS}\*L\_{PRS}/K\_{comb}^{PRS}$**) Note 2** | **Io Note 3 range** |
| **Minimum Io**  | **Maximum Io** |
| **Tc Note 4** | **dB** | **kHz** | **RB** |  | **dBm/SCS** | **dBm/BWChannel** |
| [7] | [12] | (PRS Ês/Iot)ref ≥-6dB (PRS Ês/Iot)*i* ≥-13dB | 60 | ≥ 64 | ≥ 1 | Same value as PRS\_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| [5] | [6] | ≥ 132 | ≥ 1 | Note 5 | Note 5 |
| [5] | [6] | 120 | ≥ 64 | ≥ 1 | Same value as PRS\_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| [2] | [3] | ≥ 128 | ≥ 1 | Note 5 | Note 5 |
| NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T\_{rep}^{PRS}, L\_{PRS} ,K\_{comb}^{PRS}$are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.NOTE 3: Io is assumed to have constant EPRE across the bandwidth.NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. |

**Table 10.1.23A.2-3: RSTD absolute accuracy in FR1 for fading channel**

|  |  |  |
| --- | --- | --- |
| **Accuracy for 3 PFLs** | **Accuracy for 2 PFLs** | **Conditions** |
| **PRS Ês/Iot** | **PRS SCS** | **PRS bandwidth per PFL****Note 1** | **PRS resource repetition (**$T\_{rep}^{PRS}\*L\_{PRS}/K\_{comb}^{PRS}$**)****Note 2** | **Io Note 3 range** |
| **NR operating band groups Note 4** | **Minimum Io**  | **Maximum Io** |
| **Tc Note 5** | **dB** | **kHz** | **RB** |  |  | **dBm/SCS** | **dBm/BWChannel** |
| [29] | [38] | (PRS Ês/Iot)ref ≥-6dB (PRS Ês/Iot)*i* ≥-13dB | 15 | ≥ 104 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| [29] | [29] | 30  | ≥ 132 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| [26] | [27] | 272 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| [34] | [29] | 60 | ≥ 64 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| [31] | [27] | 132 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T\_{rep}^{PRS}, L\_{PRS} ,K\_{comb}^{PRS}$are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.NOTE 3: Io is assumed to have constant EPRE across the bandwidth.NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS as defined in Table 10.1.23A.2-1. |

**Table 10.1.23A.2-4: RSTD absolute accuracy in FR2 for fading channel**

|  |  |  |
| --- | --- | --- |
| **Accuracy for 3 PFLs** | **Accuracy for 2 PFLs** | **Conditions** |
| **PRS Ês/Iot** | **PRS SCS** | **PRS bandwidth per PFL****Note 1** | **PRS resource repetition** **(**$T\_{rep}^{PRS}\*L\_{PRS}/K\_{comb}^{PRS}$**) Note 2** | **Io Note 3 range** |
| **Minimum Io**  | **Maximum Io** |
| **Tc Note 4** | **dB** | **kHz** | **RB** |  | **dBm/SCS** | **dBm/BWChannel** |
| [48] | [71] | (PRS Ês/Iot)ref ≥-6dB (PRS Ês/Iot)*i* ≥-13dB | 60 | ≥ 64 | ≥ 1 | Note 5 | Note 5 |
| [38] | [54] | ≥ 132 | ≥ 1 | Note 5 | Note 5 |
| [49] | [72] | 120 | ≥ 64 | ≥ 1 | Note 5 | Note 5 |
| [51] | [56] | ≥ 128 | ≥ 1 | Note 5 | Note 5 |
| NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T\_{rep}^{PRS}, L\_{PRS} ,K\_{comb}^{PRS}$are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.NOTE 3: Io is assumed to have constant EPRE across the bandwidth.NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS as defined in Table 10.1.23A.2-2. |

**Table 10.1.23A.2-5: RSTD absolute accuracy in FR1 for AWGN channel with reduced number of samples**

|  |  |  |
| --- | --- | --- |
| **Accuracy for 3 PFLs** | **Accuracy for 2 PFLs** | **Conditions** |
| **PRS Ês/Iot** | **PRS SCS** | **PRS bandwidth per PFL****Note 1** | **PRS resource repetition (**$T\_{rep}^{PRS}\*L\_{PRS}/K\_{comb}^{PRS}$**)****Note 2** | **Io Note 3 range** |
| **NR operating band groups Note 4** | **Minimum Io**  | **Maximum Io** |
| **Tc Note 5** | **dB** | **kHz** | **RB** |  |  | **dBm/SCS** | **dBm/BWChannel** |
| [17] | [22] | (PRS Ês/Iot)ref ≥-3dB (PRS Ês/Iot)*i* ≥-6dB | 15 | ≥ 104 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| [7] | [12] | 30  | ≥ 132 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| [5] | [6] | 272 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| [7] | [12] | 60 | ≥ 64 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| [5] | [6] | 132 | ≥ 1 | Note 6 | Note 6 | Note 6 |
| NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T\_{rep}^{PRS}, L\_{PRS} ,K\_{comb}^{PRS}$are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.NOTE 3: Io is assumed to have constant EPRE across the bandwidth.NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS as defined in Table 10.1.23A.2-1. |

**Table 10.1.23A.2-6: RSTD absolute accuracy in FR2 for AWGN channel with reduced number of samples**

|  |  |  |
| --- | --- | --- |
| **Accuracy for 3 PFLs** | **Accuracy for 2 PFLs** | **Conditions** |
| **PRS Ês/Iot** | **PRS SCS** | **PRS bandwidth per PFL****Note 1** | **PRS resource repetition** **(**$T\_{rep}^{PRS}\*L\_{PRS}/K\_{comb}^{PRS}$**) Note 2** | **Io Note 3 range** |
| **Minimum Io**  | **Maximum Io** |
| **Tc Note 4** | **dB** | **kHz** | **RB** |  | **dBm/SCS** | **dBm/BWChannel** |
| [7] | [12] | (PRS Ês/Iot)ref ≥-3dB (PRS Ês/Iot)*i* ≥-6dB | 60 | ≥ 64 | ≥ 1 | Note 5 | Note 5 |
| [5] | [6] | ≥ 132 | ≥ 1 | Note 5 | Note 5 |
| [5] | [6] | 120 | ≥ 64 | ≥ 1 | Note 5 | Note 5 |
| [2] | [3] | ≥ 128 | ≥ 1 | Note 5 | Note 5 |
| NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T\_{rep}^{PRS}, L\_{PRS} ,K\_{comb}^{PRS}$are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.NOTE 3: Io is assumed to have constant EPRE across the bandwidth.NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS as defined in Table 10.1.23A.2-2. |

Table 10.1.23A.2-7: Margin for RSTD measurement accuracy in FR1

|  |  |
| --- | --- |
| PRS BW (RB number) | Margin (Tc) |
| SCS=15kHz | SCS=30kHz | SCS=60kHz |
| ≥ 104 | N/A | N/A | 36 |
| N/A | ≥ 132 | ≥ 64 | 16 |
| N/A | N/A | ≥ 132 | 12 |

Table 10.1.23A.2-8: Margin Δ for RSTD measurement accuracy in FR1

|  |  |
| --- | --- |
| PRS BW (RB number) | Margin (Tc) |
| SCS=15kHz | SCS=30kHz | SCS=60kHz |
| ≥ 104 | N/A | N/A | 32 |
| N/A | ≥ 132 | ≥ 64 | 16 |
| N/A | N/A | ≥ 132 | 8 |

Table 10.1.23A.2-9: Margin for RSTD measurement accuracy in FR2

|  |  |
| --- | --- |
| PRS BW (RB number) | Margin (Tc) |
| SCS=60kHz | SCS=120kHz |
| ≥ 64 | N/A | 32 |
| ≥ 132 | ≥ 64 | 16 |
| N/A | ≥ 128 | 12 |

Table 10.1.23A.2-10: Margin Δ for RSTD measurement accuracy in FR2

|  |  |
| --- | --- |
| PRS BW (RB number) | Margin (Tc) |
| SCS=60kHz | SCS=120kHz |
| ≥ 64 | N/A | 16 |
| ≥ 132 | ≥ 64 | 8 |
| N/A | ≥ 128 | 4 |

<End of Change 1>