3GPP TSG-RAN WG4 Meeting #111 R4-2410190

Fukuoka City, Fukuoka, Japan, 20th – 24th May, 2024

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **DraftCR** | **Rev** | **-** | **Current version:** | **18.5.0** |  |
|  |
| *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:***  | Draft CR on SL positioning RRM performance |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_pos\_enh2-Perf |  | ***Date:*** | 2024-05-13 |
|  |  |  |  |  |
| ***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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | Accuracy requirements and test cases for SL positioning are missing |
|  |  |
| ***Summary of change:*** | The CR is based on the endorsed CR R4-2406523 from RAN4#110-bis.Change #1: draft CR set 2-11 (according to the worksplit)Change #2: draft CR set 2-12 (according to the worksplit)Change #3: draft CR set 10-1 (according to the worksplit)Change #4: Side conditions for SL-PRS based measurements are corrected |
|  |  |
| ***Consequences if not approved:*** | Accuracy requirements and test cases for SL positioning are missing |
|  |  |
| ***Clauses affected:*** | 10.4A.2.2;10.4A.3.2;B.4A.1.New clauses: 10.4A.3.2.1;A.9A.1.1.X, A.9A.1.1.X.1, A.9A.1.1.X.2. |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.533 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | R4-2409372 |

## **--- Start of Change #1 [draft CR set 2-11] ---**

### 10.4A.2 SL RSTD measurements

--- unchanged clauses ---

#### 10.4A.2.2 Measurement Accuracy Requirements

The accuracy requirements for SL RSTD measurement shall be within ±(X+Y+Z) Tc, where X, Y, and Z are defined as follows.

X is defined in Table 10.4A.2.2-1 for AWGN channel and Table 10.4A.2.2-2 for fading channel for FR1, provided that the following conditions are met.

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

- Conditions for SL RSTD measurements are fulfilled according to Annex B.4A.1 for a corresponding Band for each relevant SL-PRS resource configured for measurement.

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

Y=[32] Tc, provided that the time offset between the two SL-PRS resource instances from the reference UE and the second anchor UE, which are used for a single SL RSTD estimate, is no greater than 160 ms.

Z is defined in Table 10.4A.2.2-3 for FR1.

Table 10.4A.2.2-1: SL RSTD absolute accuracy in FR1 for AWGN channel

|  |  |
| --- | --- |
| Accuracy | Conditions |
| SL-PRS Ês/Iot | SL-PRS SCS | SL-PRS bandwidthNote 1 | Number of samples, S | Io Note 2 range |
| NR operating band groups Note 3 | Minimum Io  | Maximum Io |
| Tc Note 4 | dB | kHz | RB |  |  | dBm/SCS | dBm/BWChannel |
| TBD | (SL-PRS Ês/Iot)ref ≥0 dB(SL-PRS Ês/Iot)*i* ≥-3 dB | 15 | 48 | ≥ 4 | NR\_TDD\_FR1\_B | -126.5 | -50 |
| NR\_TDD\_FR1\_J | -122.5 | -50 |
| TBD | >48 | ≥ 1 | Note 5 | Note 5 | Note 5 |
| TBD | ≥ 96 | ≥ 1 | Note 5 | Note 5 | Note 5 |
| TBDTBD | 30  | ≥ 24 | ≥ 4 | NR\_TDD\_FR1\_B | -123.5 | -50 |
| NR\_TDD\_FR1\_J | -119.5 | -50 |
| TBD | >48 | ≥ 1 | Note 5 | Note 5 | Note 5 |
| TBD | 60 | ≥ 24 | ≥ 4 | NR\_TDD\_FR1\_B | -120.5 | -50 |
| NR\_TDD\_FR1\_J | -116.5 | -50 |
| NOTE 1: Minimum SL-PRS bandwidth, which is the minimum of the SL-PRS bandwidths of the reference resource and the measured neighbour resource i.NOTE 2: Io is assumed to have constant EPRE across the bandwidth.NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.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 SL-PRS bandwidth of the smallest PRB number for the corresponding SCS. |

Table 10.4A.2.2-2: SL RSTD absolute accuracy in FR1 for fading channel

|  |  |
| --- | --- |
| Accuracy | Conditions |
| SL-PRS Ês/Iot | SL-PRS SCS | SL-PRS bandwidthNote 1 | Number of samples, S | Io Note 2 range |
| NR operating band groups Note 3 | Minimum Io  | Maximum Io |
| Tc Note 4 | dB | kHz | RB |  |  | dBm/SCS | dBm/BWChannel |
| TBD | (SL-PRS Ês/Iot)ref ≥0 dB(SL-PRS Ês/Iot)*i* ≥-3 dB | 15 | 48 | ≥ 4 | NR\_TDD\_FR1\_B | -126.5 | -50 |
| NR\_TDD\_FR1\_J | -122.5 | -50 |
| TBD | >48 | ≥ 1 | Note 5 | Note 5 | Note 5 |
| TBD | ≥ 96 | ≥ 1 | Note 5 | Note 5 | Note 5 |
| TBDTBD | 30  | ≥ 24 | ≥ 4 | NR\_TDD\_FR1\_B | -123.5 | -50 |
| NR\_TDD\_FR1\_J | -119.5 | -50 |
| TBD | >48 | ≥ 1 | Note 5 | Note 5 | Note 5 |
| TBD | 60 | ≥ 24 | ≥ 4 | NR\_TDD\_FR1\_B | -120.5 | -50 |
| NR\_TDD\_FR1\_J | -116.5 | -50 |
| NOTE 1: Minimum SL-PRS bandwidth, which is the minimum of the SL-PRS bandwidths of the reference resource and the measured neighbour resource i.NOTE 2: Io is assumed to have constant EPRE across the bandwidth.NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.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 SL-PRS bandwidth of the smallest PRB number for the corresponding SCS. |

Table 10.4A.2.2-3: Margin for SL RSTD measurement accuracy in FR1

|  |  |
| --- | --- |
| PRS BW (RB number) | Margin (Tc) |
| SCS=15kHz | SCS=30kHz | SCS=60kHz |
| ≥ 48 | ≥ 24 | N/A | [72] |
| ≥ 96 | ≥ 48 | ≥ 24 | [36] |

## **--- End of Change #1 ---**

## **--- Start of Change #2 [draft CR set 2-12] ---**

### 10.4A.3 SL PRS-RSRP measurements

--- unchanged clauses ---

#### 10.4A.3.2 Measurement Accuracy Requirements

##### 10.4A.3.2.1 Absolute SL PRS-RSRP accuracy

The absolute accuracy requirements for SL PRS-RSRP measurement for FR1 defined in Table 10.4A.3.2.1-1 are valid under the following conditions:

- Conditions defined in 38.101-1 Clause 7.3E for reference sensitivity are fulfilled.

- PRP 1,2|dBm according to Annex B.4A.1 for a corresponding Band.

Table 10.4A.3.2.1-1: SL PRS-RSRP absolute accuracy for FR1

|  |  |
| --- | --- |
| Accuracy | Conditions |
| Normal condition | Extreme condition | SL-PRS Ês/Iot | SL-PRS BW Note 2 | Number of samples, S | Io Note 4 range |
| NR operating band groups Note 5 | MinimumIo Note 1dBm / SCSPRS | MaximumIo |
| dB | dB | dB | PRB |  |  | dBm / SCSPRS | dBm/BWChannel |
| dBm/15kHz | dBm/30kHz | dBm/60kHz |
| TBD | TBD | ≥ -3 dB | 48 | ≥ 4 | NR\_TDD\_FR1\_B | -126.5 | -123.5 | -120.5 | -50 |
| NR\_TDD\_FR1\_J | -122.5 | -119.5 | -116.5 | -50 |
| TBD | TBD | > 48 | ≥ 1 | Note 3 |
| TBD | TBD | ≥ 96 | ≥ 1 | Note 3 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.NOTE 2: SL-PRS bandwidth is as indicated in *sl-PRS-BW* in T 38.355 [37].NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the SL-PRS bandwidth of the smallest PRB number for the corresponding SCS.NOTE 4: The Io is defined in SL-PRS positioning slots. The same Io range applies to SL-PRS and non-SL-PRS symbols. Io levels are different in SL-PRS and non-SL-PRS symbols within the same slot.NOTE 5: NR operating band groups are as defined in Section 3.5.2. |

## **--- End of Change #2 ---**

## **--- Start of Change #3 [draft CR set 10-1] ---**

# A.9A Tests for NR SL Measurements for Positioning

## A.9A.1 Tests for NR SL Measurements for Positioning in FR1

#### A.9A.1.1 Measurement delay tests

#### A.9A.1.1.X NR SL RSTD measurement reporting delay test case in FR1 SA

##### A.9A.1.1.X.1 Test Purpose and Environment

The purpose of the test is to verify that the SL RSTD measurement meets the requirements specified in clause 12A.2 in an environment with AWGN propagation conditions in FR1 in standalone NR scenario, with additionally configured single frequency layer for SL positioning.

This test is applicable for UEs supporting NR Uu and V2X or 5G ProSe operation, which are capable of performing SL RSTD measurements.

The supported NR Uu test configurations are specified in Table A.9A.1.1.X.1-1.

The supported NR SL test configurations are specified in Table A.9A.1.1.X.1-2.

Table A.9A.1.1.X.1-1: Supported test configurations for FR1 NR Cell 1

|  |  |
| --- | --- |
| NR Uu configuration | Description |
| Uu\_conf1 | NR Uu: 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode |
| Uu\_conf2 | NR Uu: 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode |
| Uu\_conf3 | NR Uu: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to be tested in one of the supported test configurations. |

Table A.9A.1.1.X.1-2: Supported test configurations for NR SL UEs

|  |  |
| --- | --- |
| NR SL configuration | Description |
| SL\_conf1 | NR SL: 15 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode |
| SL\_conf2 | NR SL: 30 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode |
| SL\_conf3 | NR SL: 30 kHz SSB SCS, 20 MHz bandwidth, HD duplex mode |
| NOTE: The UE is only required to be tested in one of the supported test configurations. |

In the test, there is one target UE receiving SL-PRS and performing SL RSTD measurements and three anchor UEs (anchor UE 1, anchor UE 2, and anchor UE 3) transmitting SL-PRS for the SL RSTD measurements on NR SL RF channel 2. Anchor UE 1 is the reference anchor UE for the measurements. The target UE and all the anchor UEs are in RRC\_CONNECTED state, with Cell 1 as their PCell in FR1 on NR Uu RF channel 1. Cell 1 is also the synchronization source of the target UE and all anchor UEs in the test.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the target UE shall not have any timing information of anchor UE 2 and anchor UE 3. All three anchor UEs transmit SL-PRS during T2.

The *SL-TDOA-ProvideAssistanceData* and *SL-TDOA-RequestLocationInformation* as defined in TS 38.355 [37, clause 6.9], shall be provided to the target UE via Cell 1 during T1. The last TTI containing the two messages shall be provided to the target UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *SL-TDOA assistance* data and location information request.

The general test parameters are listed in Table A.9A.1.1.X.1-3. NR Uu specific test parameters for Cell 1 and NR Uu UE-specific test parameters for all UEs in the test are listed in Table A.9A.1.1.X.1-4 and A.9A.1.1.X.1-5, respectively. Anchor UE specific test parameters for SL RSTD measurement reporting delay during T1 and T2 are listed in Table A.9A.1.1.X.1-6.

Table A.9A.1.1.X.1-3: General test parameters for SL RSTD measurement reporting delay

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| Serving cell |  | Cell 1 | NR PCell of the target UE and all anchor UEs (anchor UE 1, anchor UE 2, anchor UE 3), in FR1 on NR Uu RF channel 1. This cell is also the synchronization source for SL operation for all UEs in the test. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| Measurement gap |  | OFF |  |
| Target UE |  | UE 0 | The performing SL RSTD measurements based on SL-PRS transmissions from anchor UEs |
| Reference anchor UE |  | UE 1 | Reference anchor UE is the UE in the SL-TDOA assistance data with respect to which the SL RSTD measurement is defined, as specified in TS 38.215 [4] and TS 38.355 [37]. The reference anchor UE is UE 1 in this test case. |
| Other anchor UEs |  | UE 2 and UE 3 | Anchor UE 2 and Anchor UE 3 appear at the first and second places in the anchor UE list SL-RTD-Info in the SL-TDOA assistance data. |
| Number of anchor UEs provided in SL-TDOA assistance data |  | 4 | Including the reference anchor UE |
| Sidelink communication configuration |  | As specified in Table A.3.21.2-2 |  |
| Target UE antenna configuration |  | 1 x 2 |  |
| Timing offset between the anchor UEs at the target UE antenna connector | μs | UE 2 to UE 1: 0UE 3 to UE 1: 3 | Synchronous transmissions |
| T1 | s | 3 | The length of the time interval from the beginning of each test |
| T2 | s | 1.28 | The length of the time interval that follows immediately after time interval T1 |

|  |  |  |  |
| --- | --- | --- | --- |
| Table A.9A.1.1.X.1-4: NR Uu specific test parameters for Cell 1Parameter | Unit | Value | Comment |
| NR Uu RF channel number |  | 1 | RF channel of Cell 1. |
| SSB configuration | Uu\_conf1 |  | SSB.1 FR1 | SSB configuration of Cell 1. |
| Uu\_conf2 |  | SSB.1 FR1 |
| Uu\_conf3 |  | SSB.2 FR1 |
| SMTC configuration | Uu\_conf1 |  | SMTC.2 | SMTC configuration of Cell 1. |
| Uu\_conf2 |  | SMTC.1 |
| Uu\_conf3 |  | SMTC.1 |
| PDSCH RMC configuration | Uu\_conf1 |  | SR.1.1 FDD |  |
| Uu\_conf2 |  | SR.1.1 TDD |  |
| Uu\_conf3 |  | SR.2.1 TDD |  |
| RMSI CORESET RMC configuration | Uu\_conf1 |  | CR.1.1 FDD | As specified in clause A.3.1.2.1 |
| Uu\_conf2 |  | CR.1.1 TDD |  |
| Uu\_conf3 |  | CR.2.1 TDD |  |
| Dedicated CORESET RMC configuration | Uu\_conf1 |  | CCR.1.1 FDD |  |
| Uu\_conf2 |  | CCR.1.1 TDD |  |
| Uu\_conf3 |  | CCR.2.1 TDD |  |
| Initial BWP configuration | Uu\_conf1,2,3 |  | DLBWP.0.1 ULBWP.0.1 |  |
| Active DL BWP configuration | Uu\_conf1,2,3 |  | DLBWP.1.1 |  |
| Active UL BWP configuration | Uu\_conf1,2,3 |  | ULBWP.1.1 |  |

Table A.9A.1.1.X.1-5: NR Uu UE-specific test parameters for UE 0, UE 1, UE 2, and UE 3

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR Uu RF channel number |  | 1 | RF channel of Cell 1. |
| DRX |  | OFF |  |
| OCNG Patterns |  | OP.1 |  |
| EPRE ratio of PSS to SSS | dB | 0 |  |
| EPRE ratio of PBCH DMRS to SSS |  |
| EPRE ratio of PBCH to PBCH DMRS |  |
| EPRE ratio of PDCCH DMRS to SSS |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |
| EPRE ratio of PDSCH DMRS to SSS  |  |
| EPRE ratio of PDSCH to PDSCH  |  |
| EPRE ratio of OCNG DMRS to SSS Note 1 |  |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |
| Note2 | Config 1,2,3 | dBm/15 kHz | -110 |  |
| Config 1, 2 | dBm /SCS | -110 |  |
| Config 3 | -107 |  |
|  | dB |  | 4.5 |  |
|  | dB |  | 4.5 |  |
| SS-RSRPNote3 | Config 1,2 | dBm /SCS | -105.5 |  |
|  | Config 3 | -102.5 |  |
| IoNote3 | Config 1,2 | dBm /9.36MHz | -76.2 |  |
| Config 3 | dBm/ 38.16MHz | -70.1 |  |
| Propagation condition |  | AWGN |  |
| NOTE 1: OCNG shall be used such that cell 1 is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |

Table A.9A.1.1.X.1-6: Anchor UE specific test parameters on the SL carrier

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Anchor UE 1 | Anchor UE 2 | Anchor UE 3 |
| T1 | T2 | T1 | T2 | T1 | T2 |
| SL RF Channel number |  | 2 | 2 | 2 |
| SL DRX |  | OFF | OFF | OFF |
| networkControlledSyncTx |  | ON | ON | ON |
| inCoverage (in MIB-SL) |  | TRUE | TRUE | TRUE |
| SL pool configuration | SL\_conf1 |  | N/A | TBD | N/A | TBD | N/A | TBD |
| SL\_conf2 |
| SL\_conf3 |
| SL-PRS configuration | SL\_conf1 |  | N/A | TBD | N/A | TBD | N/A | TBD |
| SL\_conf2 |
| SL\_conf3 |
| PSCCH RMC (defined in TBD) |  | TBD | TBD | TBD | TBD | TBD | TBD |
| PSSCH RMC (defined in A.3.21.3) |  | TBD | TBD | TBD | TBD | TBD | TBD |
|  Note 2 | dBm/SCS | -98 |
| SL-PRS  | dB | -Infinity | TBD | -Infinity | TBD | -Infinity | TBD |
| PSCCH  | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Io Note 3 | SL\_conf1 | dBm/BW | TBD | TBD | TBD | TBD | TBD | TBD |
| SL\_conf2 |
| SL\_conf3 |
| SL PRS-RSRP Note3 | dBm/SCS | -Infinity | TBD | -Infinity | TBD | -Infinity | TBD |
| Propagation Condition  |  | AWGN |
| NOTE 1: The resources for NR Uu uplink transmission are assigned to the UE prior to the start of time period T2.NOTE 2: Interference from other UEs and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.NOTE 3: SL PRS-RSRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. |

##### A.6.6.12.1.2 Test Requirements

The SL RSTD measurement time fulfils the requirements specified in clause 12A.2.5.

The UE shall perform and report to LMF the SL RSTD measurements for anchor UE 2 and anchor UE 3 with respect to the reference anchor UE 1, within the time duration specified in clause 12A.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each anchor UE observed during repeated tests shall be at least 90%, where the reported SL RSTD measurement for each correct event shall be within the SL RSTD reporting range specified in clause 10.4A.2.1.1, i.e., between SL\_RSTD\_000000 and SL\_RSTD\_492513.

## **--- End of Change #3 ---**

## **--- Start of Change #4 ---**

# B.4A Conditions for NR Sidelink Positioning Measurement Procedures and Performance Requirements

## B.4A.1 Conditions for NR SL-PRS based measurements

This clause defines the following condtions for NR SL-PRS based measurement procedures and accuracy requirements: SL-PRP and SL-PRS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.4A.1-1 for FR1.

Table B.4A.1-1: Conditions for NR SL-PRS based measurements in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **NR operating band groups Note1** | **Minimum SL-PRP1,2** | **SL-PRS Ês/Iot** |
| **dBm / SCSSL-PRS** | **dB** |
| **SCSSL-PRS = 15 kHz** | **SCSSL-PRS = 30 kHz** | **SCSSL-PRS = 60 kHz** |
| **Conditions** | NR\_TDD\_FR1\_B | -126.5 | -123.5 | -120.5 | ≥ 0 Note2≥ -3 Note3 |
| NR\_TDD\_FR1\_J | -122.5 | -119.5 | -116.5 |
| NOTE 1: NR operating band groups are defined in clause 3.5.2.NOTE 2: SL-PRS Ês/Iot for SL-PRS resource of the reference UE for SL RSTD measurement. NOTE 3: SL-PRS Ês/Iot for SL-PRS resource of the anchor UE, which is not the reference UE, for SL RSTD measurement, SL PRS-RSRP measurement, SL PRS-RSRPP measurement, SL Rx-Tx time difference measurement, SL AoA measurement, and SL RTOA measurement. |

## **--- End of Change #4 ---**