**3GPP TSG-RAN4 Meeting #111 *R4-2410198***

**Fukuoka, Japan, May 20 - 24, 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **4423**  | **rev** |  **1**  | **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:***  | Big CR for RRM performance requirements for NR sidelink evolution |
|  |  |
| ***Source to WG:*** | LG Electronics, OPPO |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_SL\_enh2-Perf |  | ***Date:*** | 2024-05-21 |
|  |  |  |  |  |
| ***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:*** | Endorsed draft Big CR (R4-2406517) for RRM performance requirements for NR sidelink evolution in RAN4#110bis was resubmitted. One draft CR in RAN4#111 was endorsed based on the endorsed draft Big CR. |
|  |  |
| ***Summary of change:*** | The formal Big CR has been resubmitted based on endorsed draft CR R4-2406517. R4-2406517 has been included the endorsed draft CRs below:- R4-2404731 Draft CR for measurement accuracy for SL-U- R4-2404923 Draft CR on new RMC for PSCCH and PSSCH for SLU- R4-2406323 Draft CR on new CCA model for SLU- R4-2406431 DraftCR on Initiation/Cease of SLSS transmission tests for SL-U operationThe endorsed draft CR for RMC table and clean up TC for for sidelink evolution RMM performance in RAN4#111 has been added in the Big CR.- R4-2410197 Draft CR on RMC table and clean up TC for NR SL-U |
|  |  |
| ***Consequences if not approved:*** | The RRM performance requirements for NR sidelink evolution are not completed. |
|  |  |
| ***Clauses affected:*** | A.3.26.1,New clauses : 10.4.2A, 10.4.3A, 10.4.4A, A.3.26.4, A.9.1.2.4, B.4.5, B.4.6, B.4.7  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS38.533  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Revision from R4-2407963 |

-------------- Start of Change <1> --------------

## 10.4 V2X measurements

### 10.4.1 Introduction

The requirements in this section are applicable for a UE capable of V2X sidelink communication.

The accuracy requirements in this clause are:

- applicable for AWGN radio propagation conditions,

- assume independent interference (noise) at each receiver antenna port.

----- Ommit unchanged part -----

### 10.4.2A Intra-frequency PSBCH-RSRP accuracy requirements for FR1 under CCA

#### 10.4.2A.1 PSBCH-RSRP Absolute Accuracy

The requirements for absolute accuracy of PSBCH-RSRP in this clause apply to a sidelink synchronization source on the same frequency as that of the own sidelink UE performing the measurement in FR1 under CCA.

The accuracy requirements in Table 10.4.2A.1-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.

- Conditions defined in Clause 7.3E of TS38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for PSBCH-RSRP measurements are fulfilled according to Annex B.4.2 for a corresponding Band for each relevant PSBCH-DMRS.

**Table 10.4.2A.1-1: Intra-frequency PSBCH-RSRP absolute accuracy in FR1**

|  |  |
| --- | --- |
| **Accuracy** | **Conditions** |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 3** | **Io Note 1 range** |
| **NR sidelink operating band groups Note 2** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm / SCSSL** | **dBm/BWChannel** | **dBm/BWChannel** |
| **SCSSL = 15 kHz** | **SCSSL = 30 kHz** |
| ±4.5 | ±9 | ≥-6 | NR\_CCA\_FR1\_I | -117 | -114 | N/A | -70 |
| NR\_CCA\_FR1\_J | -116.5 | -113.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 | NR\_CCA\_FR1\_I, NR\_CCA\_FR1\_J | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.NOTE 2: NR sidelink operating band groups in FR1 are as defined in clause 3.5.2.NOTE 3: Ês/Iot for a SyncRef UE is the Ês/Iot of PSBCH-DMRS. |

#### 10.4.2A.2 PSBCH-RSRP Relative Accuracy

The relative accuracy of PSBCH-RSRP is defined as the PSBCH-RSRP measured from one sidelink synchronization source compared to the PSBCH-RSRP measured from another sidelink synchronization source on the same frequency in FR1 under CCA.

The accuracy requirements in Table 10.4.2A.2-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.

- Conditions defined in Clause 7.3F of TS38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for PSBCH-RSRP accuracy measurements are fulfilled according to Annex B.4.2 for a corresponding Band for each relevant PSBCH-DMRS.

- The same number of S-SSB repetitions on frequency domain is configured between two sidelink synchronization sources.

**Table 10.4.2A.2-1: Intra-frequency PSBCH-RSRP relative accuracy in FR1**

|  |  |
| --- | --- |
| **Accuracy** | **Conditions** |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 3** | **Io Note 1 range** |
| **NR sidelink operating band groups Note 2** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm / SCSSL** | **dBm/BWChannel** | **dBm/BWChannel** |
| **SCSSL = 15 kHz** | **SCSSL = 30 kHz** |
| ±2 | ±3 | ≥-3 | NR\_CCA\_FR1\_I | -117 | -114 | N/A | -50 |
| NR\_CCA\_FR1\_J | -116.5 | -113.5 | N/A | -50 |
| ±3 | ±3 | ≥-6 | Note 4 | Note 4 | Note 4 | N/A | Note 4 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.NOTE 2: NR sidelink operating band groups in FR1 are as defined in clause 3.5.2.NOTE 3: Ês/Iot for a SyncRef UE is the Ês/Iot of PSBCH-DMRS.NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. |

### 10.4.3A Intra-Frequency SL-RSSI Measurement Accuracy Requirements for FR1 under CCA

#### 10.4.3A.1 Absolute SL-RSSI Accuracy

The intra-frequency SL-RSSI requirements are specified in Table 10.4.3A.1-1 under CCA. The requirements apply for measurement period of 1slot and for any configured measurement bandwidth larger than 10 RBs, provided that:

- All symbols during each RSSI measurement duration according to indication of first or second starting symbol within a slot are available for RSSI sampling within the same measurement interval.

Table 10.4.3A.1-1: Intra-frequency SL-RSSI absolute accuracy

|  |  |
| --- | --- |
| Accuracy | Conditions |
| Normal condition | Extreme condition | Io Note 1 range |
| NR sidelink operating band groups Note 2 | Minimum Io | Maximum Io |
| dB | dB |  | dBm/SCSSL | dBm/BWChannel |
| SCSSL = 15kHz | SCSSL = 30kHz |
| ±2.5 | ±5.5 | NR\_CCA\_FR1\_I | -117 | -114 | -50 |
| NR\_CCA\_FR1\_J | -116.5 | -113.5 | -50 |
| ±4.5 | ±7.5 | Note 3 | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.NOTE 2: NR sidelink operating band groups are as defined in Section 3.5 for the corresponding NR operating bands.NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. |

### 10.4.4A Intra-Frequency L1 SL-RSRP Measurement Accuracy Requirements for FR1 under CCA

#### 10.4.4A.1 Absolute L1 SL-RSRP Accuracy

The requirements for absolute accuracy of L1 SL-RSRP in this clause apply to a UE performing PSCCH-RSRP and/or PSSCH-RSRP measurements on the same frequency as used by operating sidelink communication under CCA.

The accuracy requirements in Table 10.4.4A.1-1 are valid under the following conditions:

- Demodulation reference signals for PSCCH and/or PSSCH are transmitted from one port.

- Conditions defined in clause 7.3F of TS38.101-1 [18] for reference sensitivity are fulfilled.

- PSCCH-RSRP|dBm and/or PSSCH-RSRP|dBm according to Annex B.4.4 for a corresponding Band are fulfilled.

Table 10.4.4A.1-1: Intra-frequency L1 SL-RSRP absolute accuracy for UE capable of sidelink communication

|  |  |
| --- | --- |
| Accuracy | Conditions |
| Normal condition | Extreme condition | Ês/Iot Note 3 | Io Note 1 range |
| NR sidelink operating band groups Note 2 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/SCS | dBm/BWChannel | dBm/BWChannel |
| SCS = 15kHz | SCS = 30kHz |
| ± 4.5 | ± 9 | ≥0 dB | NR\_CCA\_FR1\_I | -117 | -114 | N/A | -70 |
| NR\_CCA\_FR1\_J | -116.5 | -113.5 | N/A | -70 |
| ± 8 | ± 11 | ≥0 dB | NR\_CCA\_FR1\_I NR\_CCA\_FR1\_J | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.NOTE 2: NR sidelink operating band groups are as defined in Section 3.5 for the corresponding NR operating bands.NOTE 3: The parameter Ês/Iot is the Ês/Iot of PSCCH-DMRS and/or PSSCH-DMRS. |

-------------- End of Change <1> --------------

-------------- Start of Change <2> --------------

### A.3.26.1 Introduction

The CCA model is used in some RRM test cases with at least one cell on a carrier frequency with CCA. The intention with the CCA model is to emulate in the test equipment the behaviour of a gNB or UE which performs channel measurement to check that the channel is clear prior to performing one or more downlink, uplink or sidelink transmissions.

### A.3.26.4 CCA model for operation on a sidelink carrier frequency with CCA

#### A.3.26.4.1 CCA model for SyncRef UE

For the SyncRef UE transmitting S-SSB in sidelink carrier frequency with CCA, the modelling approach is based on probability PCCA\_SL\_SyncRefUE of successful CCA.

If the CCA attempt is successful for a S-SSB transmission, then the test equipment shall transmit S-SSB on S-SSB transmission occasion, according to the configuration.

If the CCA attempt is not successful for a S-SSB transmission, the test equipment shall determine whether the CCA attempt is successful for the next S-SSB occasion, based on probability PCCA\_SL\_SyncRefUE.

A counter, denoted by *l*CCA, tracks the number of unavailable S-SSB periods. In the SL CCA model, the counter *l*CCA is incremented when CCA failures led to an unavailable S-SSB period.

The probability can be different in different time intervals Ti during a test case. One probability value applies at any time point during a test; one or more probability values can be configured in the entire test, one value PCCA\_SL\_SyncRefUE per time interval Ti where i ≥ 1, and the multiple time intervals (when i > 1) do not overlap (e.g., PCCA\_SL\_SyncRefUE = 1.0 in T1 and PCCA\_SL\_ SyncRefUE = 0.75 in T2).

The parameters P CCA\_SL\_SyncRefUE\_1 and PCCA\_SL\_SyncRefUE\_2 are used to configure the probability of CCA success on the first and second S-SSB candidate occasions, respectively, in different time intervals Ti during a test realization. An additional limit LCCA\_SL determines the maximum number of unavailable S-SSB periods. If *l*CCA ≥LCCA\_SL, the CCA attempt is considered successful for S-SSB transmissions.

Two candidate SSB occasions are modelled within each S-SSB period. To decide whether the CCA attempt for the two S-SSB occasions within each of S-SSB period is successful, TE shall:

1 - Generate a uniform random variable *p1* from the range [0, 1] for the first candidate S-SSB occasion.

2 - Transmit the S-SSB based on *p1* in the first candidate occasion:

- if *p1* ≤ PCCA\_SL\_SyncRefUE\_1, the S-SSB is transmitted in first candidate SSB occasion and this S-SSB period is considered as available to the DUT,

- else TE shall generate a uniform random variable *p2* from the range [0, 1] for the second candidate SSB occasion

- If *p2* ≤ PCCA\_SL\_SyncRefUE\_2 or if *l*CCA ≥ LCCA\_SL, the S-SSB is transmitted in the second candidate SSB occasion;

- else this S-SSB period is muted.

The above steps are repeated for each S-SSB periods in each time interval Ti of the test. The limit LCCA\_SL is a configuration parameter for each test case.

In many test cases, the requirement under a test depends on the counter *l*CCA, so the test equipment shall track how many such S-SSB periods are not transmitted by TE during the test period.

-------------- End of Change <2> --------------

-------------- Start of Change <3> --------------

### A.9.1.2 Test for Initiation/Cease of S-SSB Transmission with V2X Sidelink Communication

----- Ommit unchanged part -----

#### A.9.1.2.4 Test for SyncRef UE as synchronization reference source with CCA

##### A.9.1.2.4.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to the evaluation time allowed to initiate and cease S-SSB transmissions defined in clause 12.3A.1.4, when the reference timing used for sidelink transmissions is a SyncRef UE.

The test parameters are given in Table A.9.1.2.4.1-1 and Table A.9.1.2.4.1-2 below. There are neither active cells nor GNSS signals in this test. There is one active SyncRef UE (SyncRef UE 1) in this test. The test system shall emulate SyncRef UE 1 to transmit S-SSB every synchronization period.

Prior to start of test, test system is required to ensure that the sidelink UE is synchronized to the SyncRef UE 1 and is transmitting S-SSB as derived from the S-SSB of SyncRef UE 1 as per clause 5.8.5.3 of TS 38.331[2]. For the test configuration, the SLSSID used by the sidelink UE shall be 30 with *inCoverage* IE in MIB-SL set as FALSE. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Two counters, *l*CCA\_2 and *l*CCA\_3, as defined in A.3.26.4.1 will be used with time duration of T2 and T3 respectively.

During T1, the PSBCH-RSRP of SyncRef UE 1 is above *syncTxThreshOOC* and the UE is not expected to be transmitting S-SSB.

During T2, the PSBCH-RSRP of SyncRef UE 1 is lowered below *syncTxThreshOOC* and the UE is expected to initiate S-SSB transmissions. The counter *l*CCA\_2 is initialized as 0 at the beginning of T2 and tracks the number of unavailable SSB periods as defined in A.3.26.4.1 until the end of T2.

During T3, the PSBCH-RSRP of SyncRef UE 1 is increased back to be above *syncTxThreshOOC* and the UE is expected to cease S-SSB transmissions. The counter *l*CCA\_3 is initialized as 0 at the beginning of T3 and tracks the number of unavailable SSB periods as defined in A.3.26.4.1 until the end of T3.

Table A.9.1.2.4.1-1: Test Parameters for Initiation/Cease of S-SSB Transmission Test for SyncRef UE as synchronization reference source with CCA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| SCS | kHz | 30 |  |
| Active cell |  | None |  |
| Active SyncRef UE |  | SyncRef UE 1 | Transmitting S-SSB on RF channel number 1 |
| Active sidelink UE |  | Sidelink UE | Transmitting S-SSB on RF channel number 1 |
| Sidelink communication preconfiguration |  | As specified in Table A.3.21.2-1 and Table A.3.21.2-2 | IE values unless specified otherwise in this test |
| networkControlledSyncTx |  | Not configured |  |
| syncTxThreshOoC | dBm/30kHz | -97 |  |
| T1 | s | 3 |  |
| T2 | s | 5.24 |  |
| T3 | s | 5.24 |  |

Table A.9.1.2.4.1-2: SyncRef UE Specific Test Parameters for Initiation/Cease of S-SSB Transmission Test for SyncRef UE as synchronization reference source with CCA

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | SyncRef UE 1 |
| T1 | T2 | T3 |
| NR RF Channel Number |  | 1 |
| SL CCA model |  | As specified in clause A.3.26.4.1 |
| PCCA\_SL\_SyncRefUE\_1 |  | 0.75 |
| PCCA\_SL\_SyncRefUE\_2 |  | 0.75 |
| LCCA\_SL |  | 4 |
| SL communication resource pool configuration |  | As specified in Table A.3.21.2-1 and Table A.3.21.2-2 |
| Channel Bandwidth (BWchannel) Note3 | MHz | 20(NRB,c = 50) or 40(NRB,c = 100) |
| SLSSID |  | 30 |
| inCoverage  |  | TRUE |
| networkControlledSyncTx |  | ON |
| Note1 | dBm/30 kHz | -98 |
|  | dB | 5.5 | -3.5 | 5.5 |
| PSBCH | dB | 5.5 | -3.5 | 5.5 |
| PSBCH-RSRPNote2 | dBm/30 kHz | -92.5 | -101.5 | -92.5 |
| IoNote2 | dBm/3.96MHz | -70.2 | -75.2 | -70.2 |
| Propagation condition |  | AWGN |
| Note 1: Interference from other UEs 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 2: PSBCH-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io level is based on the allocated RBs for S-PSS/S-SSS/PSBCH symbols.Note 3: The UE is only required to be tested in one of the supported test configurations.Note 4: S-PSS Es/Noc and S-SSS Es/Noc are set the same as PSBCH Es/Noc. |

##### A.9.1.2.4.2 Test Requirements

The S-SSB transmission initiation delay is defined as the time from the beginning of time period T2 up to the moment when the UE initiates the S-SSB transmission.

The S-SSB transmission initiation delay shall be less than Tevaluate,SLSS\_CCA + S-SSB period.

The S-SSB transmission cease delay is defined as the time from the beginning of time period T3 up to the moment when the UE ceases the S-SSB transmission.

The S-SSB transmission cease delay shall be less than Tevaluate,SLSS\_CCA + S-SSB period.

Where:

- Tevaluate,SLSS\_CCA = (4+LSLSS)×S-SSB periods [ms] (as specified in clause 12.3A.1.4) and LSLSS = *l*CCA\_2 or *l*CCA\_3, is the number of unavailable S-SSB period during time duration of T2 and T3 respectively;

- S-SSB period = 160ms.

The rate of correct initiation/cease delay of S-SSB transmissions observed during repeated tests shall be at least 90%.

-------------- End of Change <3> --------------

-------------- Start of Change <4> --------------

## B.4.5 Conditions for PSBCH-RSRP Accuracy Requirements under CCA

This clause defines the following conditions for PSBCH-RSRP measurement accuracy requirements applicable for a corresponding operating band under CCA.

The conditions are defined in Table B.4.5-1 for FR1.

Table B.4.5-1: Conditions for PSBCH-RSRP measurements in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | NR sidelink operating band groups Note1 | Minimum S-SSB\_RP | S-SSB Ês/Iot |
| dBm/SCSS-SSB | dB |
| SCSS-SSB = 15kHz | SCSS-SSB = 30kHz |
| NR\_CCA\_FR1\_I | -123 | -120 | ≥ -6 |
| NR\_CCA\_FR1\_J | -122.5 | -119.5 |
| NOTE 1: NR sidelink operating band groups are as defined in Section 3.5 for the corresponding NR operating bands. |

## B.4.6 Conditions for Selection/Reselection to Intra-frequency SyncRef UE under CCA

This clause defines the S-SSB\_RP and S-SSB Ês/Iot applicable for a corresponding operating band under CCA.

The conditions for selection/reselection to intra-frequency SyncRef UE are defined in Table B.4.6-1 for FR1.

Table B.4.3-1: Sidelink synchronization measurements in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | NR sidelink operating band groups Note1 | Minimum S-SSB\_RP | S-SSB Ês/Iot |
| dBm/SCSS-SSB | dB |
| SCSS-SSB = 15kHz | SCSS-SSB = 30kHz |
| NR\_CCA\_FR1\_I | -117 | -114 | ≥ 0 |
| NR\_CCA\_FR1\_J | -116.5 | -113.5 | ≥ 0 |
| NOTE 1: NR sidelink operating band groups are as defined in Section 3.5 for the corresponding NR operating bands.NOTE 2: The SyncRef UE transmission frequency shall be accurate to within ±5 PPM compared to the absolute frequency. |

## B.4.7 Conditions for L1 SL-RSRP Accuracy Requirements under CCA

This clause defines the following conditions for L1 SL-RSRP measurement accuracy requirements applicable for a corresponding operating band under CCA.

The conditions are defined in Table B.4.7-1 for FR1.

Table B.4.4-1: Conditions for L1 SL-RSRP measurements in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | NR sidelink operating band groups Note1 | Minimum L1 SL-RSRP | Ês/Iot |
| dBm/SCS | dB |
| SCS= 15kHz | SCS= 30kHz |
| NR\_CCA\_FR1\_I | -117 | -114 | ≥ 0 |
| NR\_CCA\_FR1\_J | -116.5 | -113.5 |
| NOTE 1: NR sidelink operating band groups are as defined in Section 3.5 for the corresponding NR operating bands.NOTE 2: The parameter Ês/Iot is the Ês/Iot of PSCCH-DMRS and/or PSSCH-DMRS.NOTE 3: The SCS is for PSCCH and/or PSSCH. |

-------------- End of Change <4> --------------