**3GPP TSG-RAN4 Meeting #97-e *R4-2017260***

**Electronic Meeting, 2nd Nov 2020 – 13th Nov 2020**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **draftCR** | **rev** | 1 | **Current version:** | **16.5.0** |  |
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| *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: Introduction of 2-step RACH CFRA tests | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_2step\_RACH-Perf | | | | |  | ***Date:*** | | | 2020-11-11 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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 can be 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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of non-contention based random access test for 2-step RA type | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * Addtion of Non-contention based random access test for 2-step RA type in FR1 for PSCell in EN-DC * Additoin of Non-contention based random access test for 2-step RA type in FR2 for NR Standalone | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | 2-step RACH features are not verified. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | A.4.3.2.2.4 (new), A.7.3.2.2.4 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS38.533 ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | Revision of R4-1015811 | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Removed CSI-RS configuration  Replace ‘Random Access Preamble’ with ‘MsgA’ | | | | | | | | |

----------------------------------------------------- Beginning of Change ------------------------------------------------------------

##### A.4.3.2.2.4 Non-contention based random access test for 2-step RA type in FR1 for PSCell in EN-DC

A.4.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in Table A.4.3.2.2.4.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in Table A.4.3.2.2.4.1-2.

Table A.4.3.2.2.4.1-1: Supported test configurations for non-contention based random access test for 2-step RA type in FR1 for PSCell in EN-DC

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 3 | LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 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 depending on UE capability | |

Table A.4.3.2.2.4.1-2: General test parameters for non-contention based random access test for 2-step RA type in FR1 for PSCell in EN-DC

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test-1 | Comments |
| SSB Configuration | | Config 1,2 |  | SSB pattern 3 in FR1 | As defined in A.3.10 |
|  | | Config 3,4 |  | SSB pattern 4 in FR1 |  |
| Duplex Mode for Cell | | Config 1,2 |  | FDD |  |
| 2 | | Config 3,4 |  | TDD |  |
| TDD Configuration | | Config 3,4 |  | TDDConf.2.1 |  |
| OCNG Pattern Note 1 | | |  | OCNG pattern 1 | As defined in A.3.2.1. |
| PDSCH parameters | | Config 1,2 |  | SR.1.1 FDD | As defined in |
| Note 3 | | Config 3,4 |  | SR.2.1 TDD | A.3.1.1. |
| NR RF Channel Number | | |  | 1 |  |
| EPRE ratio of PSS to SSS | | | dB |  |  |
| EPRE ratio of PBCH\_DMRS to SSS | | | dB |  |  |
| EPRE ratio of PBCH to PBCH\_DMRS | | | dB |  |  |
| EPRE ratio of PDCCH\_DMRS to SSS | | | dB | 0 |  |
| EPRE ratio of PDCCH to PDCCH\_DMRS | | | dB |  |  |
| EPRE ratio of PDSCH\_DMRS to SSS | | | dB |  |  |
| EPRE ratio of PDSCH to PDSCH\_DMRS | | | dB |  |  |
| SSB with index 0 |  | | dB | 3 | Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB* |
|  |  | Config 1,2 | dBm/15kHz | -98 |  |
|  |  | Config 3,4 |  | -101 |  |
|  |  | | dB | 3 |  |
|  | SS-RSRP | | dBm/ SCS | -95 |  |
| SSB with index 1 |  | | dB | -17 | Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB* |
|  |  | Config 1,2 | dBm/15kHz | -98 |  |
|  |  | Config 3,4 |  | -101 |  |
|  |  | | dB | -17 |  |
|  | SS-RSRP | | dBm/ SCS | -115 |  |
| Io Note 2 | | Config 1,2 | dBm | -65.3/9.36MHz | For symbols |
|  | | Config 3,4 |  | -62.2/38.16MHz | without SSB index 1 |
| ss-PBCH-BlockPower | | | dBm/ SCS | -5 | As defined in clause 6.3.2 in TS 38.331 [2]. |
| Configured UE transmitted power (PCMAX,f,c) | | | dBm | 23 | As defined in clause 6.2.4 in TS 38.101-1. |
| MsgA Configuration | | |  | FR1 MsgA configuration 2 | As defined in [A.3.19.2]. |
| Propagation Condition | | | - | AWGN |  |
| Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.  Note 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.  Note 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required. | | | | | |

A.4.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.4.3.2.2.4.2.1 MsgA Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.3.2.1 for MsgA transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 0.6+3(μ+2) dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] , where μ indicates the MsgA PUSCH numerology, e.g. μ=0 for SCS=15 kHz and μ=1 for SCS=30 kHz. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble after 5 MsgA transmissions have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB if the MsgB contains a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA transmission power if Random Access Responses Reception has not been considered as successful.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 0.6+3(μ+2) dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] , where μ indicates the MsgA PUSCH numerology, e.g. μ=0 for SCS=15 kHz and μ=1 for SCS=30 kHz. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA*.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 0.6+3(μ+2) dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] , where μ indicates the MsgA PUSCH numerology, e.g. μ=0 for SCS=15 kHz and μ=1 for SCS=30 kHz. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

------------------------------------------------- Unchanged sections omitted --------------------------------------------------------

##### A.7.3.2.2.4 Non-contention based random access test for 2-step RA type in FR2 for NR Standalone

A.7.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.3 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in Table A.7.3.2.2.4.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in Table A.7.3.2.2.4.1-2 and Table A.7.3.2.2.4.1-3.

Table A.7.3.2.2.4.1-1: Supported test configurations for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

|  |  |
| --- | --- |
| Config | Description |
| 1 | NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

Table A.7.3.2.2.4.1-2: General test parameters for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test-1 | Comments |
| SSB Configuration | Config 1 |  | SSB.1 FR2 | As defined in A.3.10 |
| Duplex Mode for Cell 2 | Config 1 |  | TDD |  |
| TDD Configuration | Config 1 |  | TDDConf.3.1 |  |
| BWchannel | Config 1 | MHz | 100: NRB,c = 24 |  |
| OCNG Pattern Note 1 | |  | OP.3 | As defined in A.3.2.1. |
| PDSCH Reference Channel Note 2 | Config 1 |  | SR3.1 TDD | As defined in A.3.1.1. |
| NR RF Channel Number | |  | 1 |  |
| EPRE ratio of PSS to SSS | | dB | 0 |  |
| EPRE ratio of PBCH\_DMRS to SSS | | dB |  |
| EPRE ratio of PBCH to PBCH\_DMRS | | dB |  |
| EPRE ratio of PDCCH\_DMRS to SSS | | dB |  |
| EPRE ratio of PDCCH to PDCCH\_DMRS | | dB |  |
| EPRE ratio of PDSCH\_DMRS to SSS | | dB |  |
| EPRE ratio of PDSCH to PDSCH\_DMRS | | dB |  |
| ss-PBCH-BlockPower | | dBm/ SCS | +20 +ΔUL | As defined in TS 38.331 [2].  ΔUL is derived from the uplink calibration process Note 3 |
| Configured UE transmitted power (PCMAX,f,c) | | dBm | maximum value configurable for certain power class | As defined in clause 6.2.4 in TS 38.101-2 [19] |
| MsgA Configuration | |  | FR2 MsgA configuration 1 | As defined in [A.3.19.3], with exceptions as defined below. |
| msgA-RSRP-ThresholdSSB | | dBm | RSRP\_69 +ΔDL | RSRP\_69 corresponds to -88dBm. ΔDL is derived from the downlink calibration process Note 4 |
| msgA-PreambleReceivedTargetPower | | dBm | -100 | As defined in TS 38.331 [2] |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.  Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.  Note 3: The ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.  Note 4: The ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP\_x, x is treated as a positive integer value. | | | | |

**Table A.7.3.2.2.4.1-3: OTA-related test parameters for non-contention based random access test for 2-step RA type in FR2 for NR Standalone**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test-1** | **Comments** |
| AoA setup | |  | Setup 1 | As defined in A.3.15.1 |
| Assumption for UE beams Note 2 | |  | Rough |  |
| SSB with index 0 | Es Note1 | dBm/SCS | -80.6 | Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -80.6 |
| Es/IotBB | dB | 21.09 |  |
| Io | dBm/95.04 MHz | -56.01 | Io in symbols containing SSB index 0 |
| SSB with index 1 | Es Note1 | dBm/SCS | -95.0 | Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -95.0 |
| Es/IotBB | dB | 6.69 |  |
| Io | dBm/95.04 MHz | -70.41 | Io in symbols containing SSB index 1 |
| Propagation Condition | | - | AWGN |  |
| Note 1: No artificial noise is applied in this test.  Note 2: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

A.7.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.7.3.2.2.4.2.1 MsgA Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.3.2.1 for MsgA transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be 0.6+3(μ+2) dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology, e.g. μ=2 for SCS=60 kHz and μ=3 for SCS=120 kHz. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble after 3 MsgA transmissions have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB if the MsgB contains a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power if all received Random Access Response Reception has not been considered as successful.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be 0.6+3(μ+2) dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology, e.g. μ=2 for SCS=60 kHz and μ=3 for SCS=120 kHz. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA*.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be 0.6+3(μ+2) dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology, e.g. μ=2 for SCS=60 kHz and μ=3 for SCS=120 kHz. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

------------------------------------------------------------- End of change ------------------------------------------------------------