3GPP TSG-RAN WG4 Meeting #112 R4-241xxxx

Maastricht, NL, 19th - 23th Aug 2024

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| --- |
| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | 36.133 | **CR** | 7328 | **rev** | 1 | **Current version:** | 18.6.0 |  |
|  |
| *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 |  | Radio Access Network | **X** | Core Network |  |

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| --- |
|  |
| ***Title:***  | CR on RLM test cases for NB-IoT over NTN |
|  |  |
| ***Source to WG:*** | MediaTek inc. |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | LTE\_NBIOT\_eMTC\_NTN\_req-Perf |  | ***Date:*** | 19 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** |  |
|  | *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:*** | Starting at point B, the SNR is decreased in small steps from SNR2 to SNR3 within dT. Howevery, starting from B+dT/2, the the SNR is getting lower than the Qout and a good UE may start to send OOS. |
|  |  |
| ***Summary of change:*** | Allow UE to detect OOS and declare RLF starting from (B+dT/2). |
|  |  |
| ***Consequences if not approved:*** | Wrong UE behavior description and it may fail a good UE in RAN5 test. |
|  |  |
| ***Clauses affected:*** | A.13.4.3.1, A.13.4.3.2, A.13.4.3.7, A.13.4.3.8 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | 36.521-3 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

## <<< START OF CHANGES 1>>>

### A.13.4.3 Radio Link Monitoring for satellite access

#### A.13.4.3.1 HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in normal coverage

##### A.13.4.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the HD-FDD category NB1 UE properly detects the out of sync for the purpose of monitoring downlink radio link quality of the NB-IoT SAN PCell. This test will partly verify the NB-IoT HD-FDD radio link monitoring requirements in clause 7.23A.

The test parameters are given in Tables A.13.4.3.1.1-1, A.13.4.3.1.1-2, A.13.4.3.1.1-3, A.13.4.3.1.1-4 and A.13.4.3.1.1-5. nCell 1 is the active NB-IoT SAN PCell in the test. The test consists of four successive time periods with time duration of T1, T2, T3 and T4 respectively, excluding the transition time duration dT, where the SNR increases or decreases gradually in small steps. Figure A.13.4.3.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync state with the following testing procedure:

- Prior to the start of the time duration T1, the UE shall be fully synchronized to nCell1

- Starting at point A, the SNR is decreased in small steps from SNR1 to SNR2 within dT

- At the start of the time duration T2, the UE is provided with a UL grant with NPDCCH

Note: The UE is expected to decode the NPDCCH and complete the UL transmission during T2 according to the UL grant. The UE shall not be provisioned with any more UL grants until the start of time period T4.

- Starting at point B, the SNR is decreased in small steps from SNR2 to SNR3 within dT

- During T3, the SNR is kept as SNR3

Note: The UE is expected to detect OOS and declare RLF during the period from (B+dT/2) to the end of T3.

- Starting at point C, the SNR is increased in small steps from SNR3 to SNR1 with dT

- At the start of the time period T4, the UE will be provided with another UL grant with NPDCCH

Note: The UE is not expected to decode the UL grant and conduct any UL transmission during T4, since the UE is expected to declare RLF before the end of T3.

In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode the NPDCCH and complete the UL transmission when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

The UE shall be provided with the valid information about the SAN serving cells before the test.

Table A.13.4.3.1.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | GSO, HD-FDD duplex mode |
| 2 | NGSO, HD-FDD duplex mode |
| Note: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. |

Table A.13.4.3.1.1-2: General test parameters for HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in normal coverage

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| Active cell |  | nCell 1 |  |
| CP length |  | Normal |  |
| Deployment Mode |  | Standalone |  |
| Satellite information | Config 1 |  | SSC.1 | GSO |
| Config 2 |  | SSC.2 | NGSO |
| NPDCCH transmission parameters Rmax  |  | 8 | Other NPDCCH parameters are defined in “ out-of-sync” column in Table 7.23A.2-1  |
| DRX cycle  | ms | 256 | See Table A.13.4.3.1.1-4 |
| Layer 3 filtering Note 2,3 |  | Enabled | Counters:N310 = 1N311 = 1 |
| T310 timer Note 2,3 | ms | 0 | T310 is disabled |
| T311 timer Note 2,3 | ms | 1000 | T311 is enabled |
| T1 | s | 5.12 |  |
| dT | S | 0.8 |  |
| T2 | s | 10.24 |  |
| dT | S | 0.7 |  |
| T3 | s | 5.12 |  |
| dT | S | 1.4 |  |
| T4 | s | 5.12 |  |
| Note 1: NPDCCH corresponding to the out of sync transmission parameters need not be included in the Reference Measurement Channel.Note 2: N310, N311, T310 and T311 are defined in TS 36.331.Note 3: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. |

Table A.13.4.3.1.1-3: nCell specific test parameters for HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in normal coverage

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **nCell 1** |
| **T1** | **dT** | **T2** | **dT** | **T3** | **dT** | **T4** |
| BWchannel | kHz | 200 |
| OCNG Pattern as defined in A.3.2.3.3 Note 1  |  | NOP.3 FDD |
| NPDCCH parameters as defined in A.3.1.6.3 |  | R.30 HD-FDD |
| NPBCH\_RA | dB | 0 |
| NPBCH\_RB | dB |
| NPSS\_RA | dB |
| NSSS\_RA | dB |
| NPDCCH\_RA | dB |
| NPDCCH\_RB | dB |
| NPDSCH\_RA | dB |
| NPDSCH\_RB | dB |
| OCNG\_RANote 1 | dB |
| OCNG\_RBNote 1 | dB |
|  | dBm/15 kHz | -98 |
| SNR Note 4, 5 | dB | -3.1 | Note 6 | -9.1 | Note 7 | -14.1 | Note 8 | -3.1 |
| Propagation condition |  | AWGN |
| Antenna Configuration |  | 1x1 |
| 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: VoidNote 3: VoidNote 4: SNR levels correspond to the signal to noise ratio over the cell-specific reference signal REs.Note 5: The SNRs in time periods T1, T2, T3 and T4 are denoted as SNR1, SNR2, SNR3 and SNR1 respectively in figure A.13.4.3.1.1-1.Note 6: The Test system shall reduce its transmit power in steps of ((SNR2-SNR1) / (10\*dT)) dB every 100ms until SNR2 is achieved at the end of dT.Note 7: The Test system shall reduce its transmit power in steps of ((SNR3-SNR2) / (10\*dT)) dB every 100ms until SNR3 is achieved at the end of dT.Note 8: The Test system shall increase its transmit power in steps of ((SNR1-SNR3) / (10\*dT)) dB every 100ms until SNR1 is achieved at the end of dT. |

Table A.13.4.3.1.1-4: DRX-Configuration for HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in normal coverage

|  |  |  |
| --- | --- | --- |
| **Field** | **Value** | **Comment** |
| onDurationTimer | pp1 | As specified in clause 6.7.3 in TS 36.331 |
| drx-InactivityTimer | pp0 |
| drx-RetransmissionTimer | pp0 |
| drx-StartOffset | 0 |

Table A.13.4.3.1.1-5: *TimeAlignmentTimer* -Configuration for NB-IoT HD-FDD out-of-sync testing for UE category NB1 Standalone mode in normal coverage

|  |  |  |
| --- | --- | --- |
| **Field** | **Value** | **Comment** |
| TimeAlignmentTimer | infinity | As specified in clause 6.3.2 in TS 36.331 |



Figure A.13.4.3.1.1-1: SNR variation for out-of-sync testing in DRX for NB-IoT HD-FDD out-of-sync testing for UE category NB1 Standalone mode in normal coverage

##### A.13.4.3.1.2 Test Requirements

The UE behaviors in each test shall be as follows:

- The UE shall complete the NPUSCH transmission during T2 according to the received UL grant;

- The UE shall not conduct any NPUSCH transmission during T4

A correct event is defined as UE behaves correctly in all above steps. The correct events observed during repeated tests shall be at least 90%.

#### A.13.4.3.2 HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in enhanced coverage

##### A.13.4.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the HD-FDD category NB1 UE properly detects the out of sync for the purpose of monitoring downlink radio link quality of the NB-IoT SAN PCell. This test will partly verify the NB-IoT HD-FDD radio link monitoring requirements in clause 7.23A.

The test parameters are given in Tables A.13.4.3.2.1-1, A.13.4.3.2.1-2, A.13.4.3.2.1-3, A.13.4.3.2.1-4 and A.13.4.3.2.1-5. nCell 1 is the active NB-IoT SAN PCell in the test. The test consists of four successive time periods with time duration of T1, T2, T3 and T4 respectively, excluding the transition time duration dT, where the SNR increases or decreases gradually in small steps. Figure A.13.4.3.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync state with the following testing procedure:

- Prior to the start of the time duration T1, the UE shall be fully synchronized to nCell1

- Starting at point A, the SNR is decreased in small steps from SNR1 to SNR2 within dT

- At the start of the time duration T2, the UE is provided with a UL grant with NPDCCH

Note: The UE is expected to decode the NPDCCH and complete the UL transmission during T2 according to the UL grant. The UE shall not be provisioned with any more UL grants until the start of time period T4.

- Starting at point B, the SNR is decreased in small steps from SNR2 to SNR3 within dT

- During T3, the SNR is kept as SNR3

Note: The UE is expected to detect OOS and declare RLF during the period from (B+dT/2) to the end of T3.

- Starting at point C, the SNR is increased in small steps from SNR3 to SNR1 with dT

- At the start of the time period T4, the UE will be provided with another UL grant with NPDCCH

Note: The UE is not expected to decode the UL grant and conduct any UL transmission during T4, since the UE is expected to declare RLF before the end of T3.

In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode the NPDCCH and complete the UL transmission when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

The UE shall be provided with the valid information about the SAN serving cells before the test.

Table A.13.4.3.2.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | GSO, HD-FDD duplex mode |
| 2 | NGSO, HD-FDD duplex mode |
| Note: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. |

Table A.13.4.3.2.1-2: General test parameters for HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in enhanced coverage

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| Active cell |  | nCell 1 |  |
| CP length |  | Normal |  |
| Satellite information | Config 1 |  | SSC.1 | GSO |
| Config 2 |  | SSC.2 | NGSO |
| Deployment Mode |  | Standalone |  |
| NPDCCH transmission parameters Rmax  |  | 16 | Other NPDCCH parameters are defined in “ out-of-sync” column in Table 7.23A.2-1  |
| DRX cycle  | ms | 256 | See Table A.13.4.3.2.1-4 |
| Layer 3 filtering Note 2,3 |  | Enabled | Counters:N310 = 1N311 = 1 |
| T310 timer Note 2,3 | ms | 0 | T310 is disabled |
| T311 timer Note 2,3 | ms | 1000 | T311 is enabled |
| T1 | s | 5.12 |  |
| dT | s | 0.7 |  |
| T2 | s | 10.24 |  |
| dT | s | 0.8 |  |
| T3 | s | 5.12 |  |
| dT | s | 1.4 |  |
| T4 | s | 5.12 |  |
| Note 1: NPDCCH corresponding to the out of sync transmission parameters need not be included in the Reference Measurement Channel.Note 2: N310, N311, T310 and T311 are defined in TS 36.331.Note 3: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. |

Table A.13.4.3.2.1-3: nCell specific test parameters for HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in enhanced coverage

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **nCell 1** |
| **T1** | **dT** | **T2** | **dT** | **T3** | **dT** | **T4** |
| BWchannel | kHz | 200 |
| OCNG Pattern as defined in A.3.2.3.3 Note 1  |  | NOP.3 FDD |
| NPDCCH parameters as defined in A.3.1.6.3 |  | R.30 HD-FDD |
| NPBCH\_RA | dB | 0 |
| NPBCH\_RB | dB |
| NPSS\_RA | dB |
| NSSS\_RA | dB |
| NPDCCH\_RA | dB |
| NPDCCH\_RB | dB |
| NPDSCH\_RA | dB |
| NPDSCH\_RB | dB |
| OCNG\_RANote 1 | dB |
| OCNG\_RBNote 1 | dB |
|  | dBm/15 kHz | -98 |
| SNR Note 4, 5 | dB | -6.3 | Note 6 | -11.4 | Note 7 | -17.4 | Note 8 | -6.3 |
| Propagation condition |  | AWGN |
| Antenna Configuration |  | 1x1 |
| 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: VoidNote 3: VoidNote 4: SNR levels correspond to the signal to noise ratio over the cell-specific reference signal REs.Note 5: The SNRs in time periods T1, T2, T3 and T4 are denoted as SNR1, SNR2, SNR3 and SNR1 respectively in figure A.13.4.3.2.1-1.Note 6: The Test system shall reduce its transmit power in steps of ((SNR2-SNR1) / (10\*dT)) dB every 100ms until SNR2 is achieved at the end of dT.Note 7: The Test system shall reduce its transmit power in steps of ((SNR3-SNR2) / (10\*dT)) dB every 100ms until SNR3 is achieved at the end of dT.Note 8: The Test system shall increase its transmit power in steps of ((SNR1-SNR3) / (10\*dT)) dB every 100ms until SNR1 is achieved at the end of dT. |

Table A.13.4.3.2.1-4: DRX-Configuration for HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in enhanced coverage

|  |  |  |
| --- | --- | --- |
| **Field** | **Value** | **Comment** |
| onDurationTimer | pp1 | As specified in clause 6.7.3 in TS 36.331 |
| drx-InactivityTimer | pp0 |
| drx-RetransmissionTimer | pp0 |
| drx-StartOffset | 0 |

Table A.13.4.3.2.1-5: *TimeAlignmentTimer* -Configuration for HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in enhanced coverage

|  |  |  |
| --- | --- | --- |
| **Field** | **Value** | **Comment** |
| TimeAlignmentTimer | infinity | As specified in clause 6.3.2 in TS 36.331 |



Figure A.13.4.3.2.1-1: SNR variation for HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 Standalone mode in enhanced coverage

##### A.13.4.3.2.2 Test Requirements

The UE behaviors in each test shall be as follows:

- The UE shall complete the NPUSCH transmission during T2 according to the received UL grant;

- The UE shall not conduct any NPUSCH transmission during T4.

A correct event is defined as UE behaves correctly in all above steps. The correct events observed during repeated tests shall be at least 90%.

## <<< END OF CHANGES 1>>>

## <<< START OF CHANGES 2>>>

#### A.13.4.3.7 HD-FDD Radio Link Monitoring Test for Out-of-sync without DRX for UE Category NB1 Standalone mode in Normal Coverage

##### A.13.4.3.7.1 Test Purpose and Environment

The purpose of this test is to verify that the HD-FDD category NB1 UE properly detects the out of sync for the purpose of monitoring downlink radio link quality of the NB-IoT SAN PCell. This test will partly verify the NB-IoT HD-FDD radio link monitoring requirements in clause 7.23A.

The test parameters are given in Tables A.13.4.3.7.1-1, Tables A.13.4.3.7.1-2 and A.13.4.3.7.1-3. nCell1 is the active NB-IoT SAN PCell in the test. The test consists of four successive time periods with time duration of T1, T2, T3 and T4 respectively, excluding the transition time duration dT, where the SNR increases or decreases gradually in small steps. Figure A.13.4.3.7.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync state with the following testing procedure:

- Prior to the start of the time duration T1, the UE shall be fully synchronized to nCell1

- Starting at point A, the SNR is decreased in small steps from SNR1 to SNR2 within dT

- At the start of the time duration T2, the UE is provided with a UL grant with NPDCCH

Note: The UE is expected to decode the NPDCCH and complete the UL transmission during T2 according to the UL grant. The UE shall not be provisioned with any more UL grants until the start of time period T4.

- Starting at point B, the SNR is decreased in small steps from SNR2 to SNR3 within dT

- During T3, the SNR is kept as SNR3

Note: The UE is expected to detect OOS and declare RLF during the period from (B+dT/2) to the end of T3.

- Starting at point C, the SNR is increased in small steps from SNR3 to SNR1 with dT

- At the start of the time period T4, the UE will be provided with another UL grant with NPDCCH

Note: The UE is not expected to decode the UL grant and conduct any UL transmission during T4, since the UE is expected to declare RLF before the end of T3.

The UE shall be provided with the valid information about the SAN serving cells before the test.

Table A.13.4.3.7.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | GSO, HD-FDD duplex mode |
| 2 | NGSO, HD-FDD duplex mode |
| Note: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. |

Table A.13.4.3.7.1-2: General test parameters for HD-FDD Radio Link Monitoring Test for out-of-sync tests without DRX for UE Category NB1 Standalone mode in normal coverage

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| NB-IoT operational mode |  | Standalone |  |
| Active cell |  | nCell 1 |  |
| CP length  |  | Normal |  |
| Satellite information | Config 1 |  | SSC.1 | GSO |
| Config 2 |  | SSC.2 | NGSO |
| NPDCCH repetition level Rmax  |  | 8 | Other NPDCCH parameters are defined in “ out-of-sync” column in Table 7.23A.2-1  |
| DRX |  | OFF |  |
| Layer 3 filtering Note 2,3 |  | Enabled | Counters:N310 = 1N311 = 1 |
| T310 timer Note 2,3 | ms | 0 | T310 is disabled |
| T311 timer Note 2,3 | ms | 3000 | T311 is enabled |
| T1 | s | 2 |  |
| dT | s | 0.8 |  |
| T2 | s | 0.4 |  |
| dT | s | 0.7 |  |
| T3 | s | 0.5 |  |
| dT | s | 1.4 |  |
| T4 | s | 0.4 |  |
| Note 1: NPDCCH corresponding to the out of sync transmission parameters need not be included in the Reference Measurement Channel.Note 2: N310, N311, T310 and T311 are defined in TS 36.331.Note 3: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. |

Table A.13.4.3.7.1-3: nCell1 specific test parameters for HD-FDD Radio Link Monitoring Test for out-of-sync without DRX for UE Category NB1 Standalone mode in normal coverage

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **nCell 1** |
| **T1** | **dT** | **T2** | **dT** | **T3** | **dT** | **T4** |
| NB-IoT Channel Bandwidth (BWchannel) | kHz | 200 |
| OCNG Pattern as defined in A.3.2.3.3 Note 1  |  | NOP.3 FDD |
| NPDCCH parameters as defined in A.3.1.6.3 |  | R.30 HD-FDD |
| NPBCH\_RA | dB | 0 |
| NPBCH\_RB | dB |
| NPSS\_RA | dB |
| NSSS\_RA | dB |
| NPDCCH\_RA | dB |
| NPDCCH\_RB | dB |
| NPDSCH\_RA | dB |
| NPDSCH\_RB | dB |
| OCNG\_RA Note 1 | dB |
| OCNG\_RB Note 1  | dB |
|  | dBm/15 KHz | -98 |
| SNR Note 4,5 | - | -3.1 | Note 6 | -9.1 | Note 7 | -14.1 | Note 6 | -3.1 |
| Propagation Condition  | - | AWGN |
| Antenna Configuration | - | 1x1 |
| 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: VoidNote 3: VoidNote 4: SNR levels correspond to the signal to noise ratio over the cell-specific reference signal REs.Note 5: The SNRs in time periods T1, T2, T3 and T4 are denoted as SNR1, SNR2, SNR3 and SNR1 respectively in figure A.13.4.3.7.1-1.Note 6: The Test system shall reduce its transmit power in steps of ((SNR2-SNR1) / (10\*dT)) dB every 100ms until SNR2 is achieved at the end of dT.Note 7: The Test system shall reduce its transmit power in steps of ((SNR3-SNR2) / (10\*dT)) dB every 100ms until SNR3 is achieved at the end of dT.Note 8: The Test system shall increase its transmit power in steps of ((SNR1-SNR3) / (10\*dT)) dB every 100ms until SNR1 is achieved at the end of dT. |



Figure A.13.4.3.7.1-1: SNR variation for out-of-sync testing

##### A.13.4.3.7.2 Test Requirements

The UE behaviors in each test shall be as follows:

- The UE shall complete the NPUSCH transmission during T2 according to the received UL grant;

- The UE shall not conduct any NPUSCH transmission during T4

A correct event is defined as UE behaves correctly in all above steps. The correct events observed during repeated tests shall be at least 90%.

#### A.13.4.3.8 HD-FDD Radio Link Monitoring Test for Out-of-sync without DRX for UE Category NB1 Standalone mode in Enhanced Coverage

##### A.13.4.3.8.1 Test Purpose and Environment

The purpose of this test is to verify that the HD-FDD category NB1 UE properly detects the out of sync for the purpose of monitoring downlink radio link quality of the NB-IoT SAN PCell. This test will partly verify the NB-IoT HD-FDD radio link monitoring requirements in clause 7.23A.

The test parameters are given in Tables A.13.4.3.8.1-1, A.13.4.3.8.1-2 and A.13.4.3.8.1-3 below. nCell1 is the active NB-IoT SAN PCell, in the test. The test consists of four successive time periods with time duration of T1, T2, T3 and T4 respectively, excluding the transition time duration dT, where the SNR increases or decreases gradually in small steps. Figure A.13.4.3.8.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync state with the following testing procedure.

- Before the start of the time duration T1, the UE shall be fully synchronized to nCell1

- Starting at point A, the SNR is decreased in small steps from SNR1 to SNR2 with duration dT

- At the start of the time duration T2, the UE is provided with a UL grant with NPDCCH.

Note: The UE is expected to decode NPDCCH and complete the UL transmission during T2 according to the UL grant. The UE shall not be provisioned with any more UL grants until the start of time period T4.

- Starting at point B, the SNR is decreased in small steps from SNR2 to SNR3 with duration dT

- During T3, the SNR is kept at SNR3.

Note: The UE is expected to detect OOS and declare RLF during the period from (B+dT/2) to the end of T3.

- Starting at point C, the SNR is increased in small steps from SNR3 to SNR1 with duration dT

- At the start of the time period T4, the UE will be provided with another UL grant with NPDCCH

Note: The UE is not expected to decode the UL grant and conduct the UL transmission during T4 since the UE is expected to declare RLF before the end of T3.

The UE shall be provided with the valid information about the SAN serving cells before the test.

Table A.13.4.3.8.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | GSO, HD-FDD duplex mode |
| 2 | NGSO, HD-FDD duplex mode |
| Note: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. |

Table A.13.4.3.8.1-2: General test parameters for HD-FDD Radio Link Monitoring Test for out-of-sync tests without DRX for UE Category NB1 Standalone mode in enhanced coverage

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| NB-IoT operational mode |  | Standalone |  |
| Active cell |  | nCell 1 |  |
| CP length |  | Normal |  |
| Satellite information | Config 1 |  | SSC.1 | GSO |
| Config 2 |  | SSC.2 | NGSO |
| NB-IoT RF Channel Number |  | 1 | One NB-IoT carrier frequency  |
| NPDCCH repetition level Rmax  |  | 16 | Other NPDCCH parameters are defined in “ out-of-sync” column in Table 7.23A.2-1 |
| DRX |  | OFF |  |
| Layer 3 filtering Note 2 |  | Enabled | Counters:N310 = 1N311 = 1 |
| T310 timer Note 2 | ms | 0 | T310 is disabled |
| T311 timer Note 2 | ms | 3000 | T311 is enabled |
| T1 | s | 2 |  |
| dT | s | 0.7 |  |
| T2 | s | 0.4 |  |
| dT | s | 0.8 |  |
| T3 | s | 0.5 |  |
| dT | s | 1.4 |  |
| T4 | s | 0.4 |  |
| Note 1: NPDCCH corresponding to the out of sync transmission parameters need not be included in the Reference Measurement Channel.Note 2: N310, N311, T310 and T311 are defined in TS 36.331.Note 3: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. |

Table A.13.4.3.8.1-3: nCell1 specific test parameters for HD-FDD Radio Link Monitoring Test for out-of-sync without DRX for UE Category NB1 Standalone mode in enhanced coverage

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **nCell 1** |
| **T1** | **dT** | **T2** | **dT** | **T3** | **dT** | **T4** |
| BWchannel | kHz | 200 |
| OCNG Pattern as defined in A.3.2.3.3 Note 1  |  | NOP.3 FDD |
| NPDCCH parameters as defined in A.3.1.6.3 |  | R.30 HD-FDD |
| NPBCH\_RA | dB | 0 |
| NPBCH\_RB | dB |
| NPSS\_RA | dB |
| NSSS\_RA | dB |
| NPDCCH\_RA | dB |
| NPDCCH\_RB | dB |
| NPDSCH\_RA | dB |
| NPDSCH\_RB | dB |
| OCNG\_RA Note 1 | dB |
| OCNG\_RB Note 1  | dB |
|  | dBm/15 KHz | -98 |
| SNR Note 4,5 | - | -6.3 | Note 6 | -11.4 | Note 7 | -17.4 | Note 8 | -6.3 |
| Propagation Condition  | - | AWGN |
| Antenna Configuration | - | 1x1 |
| 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: VoidNote 3: VoidNote 4: SNR levels correspond to the signal to noise ratio over the cell-specific reference signal REs.Note 5: The SNR in time periods T1, T2, T3 and T4 is denoted as SNR1, SNR2, SNR3 and SNR1 respectively in figure A.13.4.3.8.1-1.Note 6: The Test system shall reduce its transmit power in steps of ((SNR2-SNR1) / (10\*dT)) dB every 100ms until SNR2 is achieved at the end of dT.Note 7: The Test system shall reduce its transmit power in steps of ((SNR3-SNR2) / (10\*dT)) dB every 100ms until SNR3 is achieved at the end of dT.Note 8: The Test system shall increase its transmit power in steps of ((SNR1-SNR3) / (10\*dT)) dB every 100ms until SNR1 is achieved at the end of dT. |



Figure A.13.4.3.8.1-1: SNR variation for out-of-sync testing

##### A.13.4.3.8.2 Test Requirements

The UE behaviors in each test shall be as follows:

- The UE shall complete the NPUSCH transmission during T2 according to the received UL grant;

- The UE shall not conduct any NPUSCH transmission during T4

A correct event is defined as UE behave correctly in all above steps. The correct events observed during repeated tests shall be at least 90%.

In the following section, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

## <<< END OF CHANGES 2>>>