**3GPP TSG-RAN WG4 Meeting # 98-bis-e *R4-2106161***

**Electronic Meeting, 12 - 20 April, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-4** | **CR** | **-** | **rev** | **-** | **Current version:** | **16.3.0** |  |
|  |
| *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 Big CR: Introduction of Rel-16 NR V2X demodulation performance requirements |
|  |  |
| ***Source to WG:*** | LG Electronics |
| ***Source to TSG:*** | RAN4 |
|  |  |
| ***Work item code:*** | 5G\_V2X\_NRSL-Perf |  | ***Date:*** | 2021-04-21 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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 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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Updated draft CRs for NR V2X demodulation performance requirements for each test cases based on R4-2103976 were endorsed. It is a draft Big CR to merge the endorsed draft CRs in RAN4#98-bis-e. |
|  |  |
| ***Summary of change:*** | Performance requirements with square bracket and table of test parameters, minimum performance, RMC, and resource pool configuration have been updated.Following endorsed draft CRs have been merged.* R4-2106030 (General)
* R4-2106031 (PSSCH demodulation)
* R4-2106032 (PSCCH demodulation)
* R4-2106029 (PSBCH demodulation)
* R4-2106033 (PSFCH demodulation)
* R4-2106036 (Power imbalance performance)
* R4-2104903 (HARQ buffer soft combining)
* R4-2106039 (PSCCH decoding capabiliyt)
* R4-2106038 (PSFCH decoding capability)
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| ***Consequences if not approved:*** | The performance requirements will be incompleted. |
|  |  |
| ***Clauses affected:*** | 11, A.6, A.7 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS38.521-4  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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

11 V2X requirements

This clause contains the performance requirements for the sidelink physical channels specified for V2X Sidelink Communication.

## 11.1 Demodulation performance requirements (Conducted requirements)

11.1.1 General

#### 11.1.1.1 Applicability of requirements

##### 11.1.1.1.1 General

The minimum performance requirements are applicable to all V2X operating bands defined in TS 38.101-1[6] Clause 5.2E.

The minimum performance requirements in Clause 11.1 are mandatory for UE supporting NR SL operation (*sl-Reception-r16*), except test cases listed in Clauses 11.1.1.1.2.

##### 11.1.1.1.2 Applicability of requirements for mandatory UE V2X features with capability signalling

The performance requirements in Table 11.1.1.1.2-1 shall apply for V2X UEs which support mandatory UE features with capability signalling only.

Table 11.1.1.1.2-1: Requirements applicability for mandatory features with UE capability signalling

|  |  |  |  |
| --- | --- | --- | --- |
| UE feature/capability [14] | Test type | Test list | Applicability notes |
| Support of synchronization sources for NR sidelink (*sync-Sidelink-r16*) | FR1 | PSBCH | Clause 11.1.4.1.1 |  |
| Supports of PSFCH format 0 (*psfch-FormatZeroSidelink-r16)* | FR1 | PSSCH | Clause 11.1.2.1.1Clause 11.1.6.1.1Clause 11.1.7.1.1 |  |
| PSCCH | Clause 11.1.3.1.1 |
| PSFCH | Clause 11.1.5.1.1Clause 11.1.9.1.1 |

#### 11.1.1.2 Common test parameters

Parameters specified in Table 11.1.1.2-1 are applied for all test cases in this clause unless otherwise stated.

Table 11.1.1.2-1: Common test parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) | RBs | 0 |
| Subcarrier spacing | kHz | 30 |
| SL BWP configuration #1 | Cyclic prefix |  | Normal |
| RB offset | RBs | 0 |
| Number of contiguous PRB | PRBs | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing |
| PT-RS configuration |  | PT-RS is not configured |
|  |  |  |
| Resource pool configuration | PSCCH Time resource | Symbols | 2 |
| PSCCH Frequency resource | PRBs | 10 |
| PSFCH number of cyclic shift pairs |  | n1 |
| PSFCH hopping ID |  | 0 |
| PSFCH candidate resource type |  | allocSubCH |
| Set of PRBs for PSFCH transmission |  | ones(1,100) for 40 MHz and ones(1,50) for 20 MHz |
| PSSCH RSRP threshold |  | 66 (infinity dBm) |
| Synchronization reference |  | GNSS |
| Subchannel size | PRBs | 10 |
| Number of sub-channels |  | 5 for 20 MHz and 10 for 40 MHz |
| Start PRB for first sub-channel |  | 0 |
| Time resource bitmap |  | ones(1, 160) |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing. |

### 11.1.2 PSSCH demodulation requirements

#### 11.1.2.1 2Rx requirements

##### 11.1.2.1.1 Minimum requirements

The purpose of the requirements in this subclause is to verify the PSSCH for V2X demodulation performance with a single active PSSCH link.

The minimum requirements are specified in Table 11.1.2.1.1-2 with the test parameters specified in Table 11.1.2.1.1-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and sidelink UE 1 transmits PSCCH and PSSCH.

Table 11.1.2.1.1-1: Test parameters

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|  |
| **Parameter** | **Unit** | **Value** |
| **Test 1** | **Test 2** | **Test 3** |
| Active cell(s) |  | None |
| Sidelink UE 1 | Sidelink transmissions |  | PSCCH + PSSCH  |
| PSSCH DMRS pattern (Note 1) |  | {3,4} | {2,3} | {2,2} |
| Index of sub-channel allocation |  | [0,1] | [0,1] | [0] |
| Timing offset (Note 2) |  | CP/2-12\*64\*Tc |
| Frequency offset (Note 3) | Hz | +600 |
| Synchronization |  | GNSS or GNSS-equivalent |
| Antenna configuration |  | 1x2 |
| PSFCH resource period | Slot | 4 | 4 | 4 |
| MinTimeGapPSFCH | Slot | 3 | 3 | 3 |
| Note 1: {x, y}: x and y means the number of DMRS symbols for slot with PSFCH transmission and without PSFCH transmission, respectively.Note 2: Time offset of sidelink UE receive signal with respect to GNSS referring timing.Note 3: Frequency offset of sidelink UE with respect to GNSS reference frequency. |

Table 11.1.2.1.1‑2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz)/Subcarrier spacing(kHz)** | **Modulation format and code rate** | **Propagation condition** | **Reference value** |
| **PSSCH BLER (%)** | **SNR(dB) of PSSCH** |
| 1 | R.PSSCH.2-1.1 | 20 / 30 | QPSK, 0.30 | TDLA30-2700 | 10% | [3.4] |
| 2 | R.PSSCH.2-1.2 | 20 / 30 | 16QAM, 0.37 | TDLA30-1400 | [8.8] |
| 3 | R.PSSCH.2-1.3 | 20 / 30 | 64QAM, 0.43 | TDLA30-180 | [14.8] |

11.1.3 PSCCH demodulation requirements

#### 11.1.3.1 2Rx requirements

##### 11.1.3.1.1 Minimum requirements

The purpose of the requirements in this subclause is to verify the PSCCH for V2X demodulation performance with a single active PSSCH link.

The minimum requirements are specified in Table 11.1.3.1.1-2 with the test parameters specified in Table 11.1.3.1.1-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and Sidelink UE 1 transmits PSCCH and PSSCH.

Table 11.1.3.1.1-1: Test Parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
|  |  |  |
| Active cell(s) |  | None |
| Sidelink UE 1 | Sidelink Transmissions |  | PSCCH+PSSCH |
| Timing offset (Note 1) |  | CP/2-12\*64\*Tc |
| Frequency offset (Note 2) | Hz | +600 |
| Synchronization |  | GNSS or GNSS-equivalent |
| Antenna configuration |  | 1x2 Low |
| PSSCH RMC |  | R.PSSCH.2-1.1 |
| NOTE 1: Time offset of Sidelink UE receive signal with respect to GNSS reference timing.NOTE 2: Frequency offset of Sidelink UE with respect to GNSS reference frequency.NOTE 3: OCC index i for PSCCH DMRS is randomly selected from {0, 1, 2} for each PSCCH transmission. |

Table 11.1.3.1.1-2: Minimum performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test number | PSCCH Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Propagation condition | Reference value |
| Probability of missed PSCCH (%) | SNR (dB) of PSCCH |
| 1 | R.PSCCH.2-1.1 | 20 / 30 | TDLA30-1400 | 1 | [4.6] |

11.1.4 PSBCH demodulation requirements

#### 11.1.4.1 2Rx requirements

##### 11.1.4.1.1 Minimum requirements

The purpose of the requirements in this subclause is to verify the PSBCH demodulation performance with a single active link.

The minimum requirements are specified in Table 11.1.4.1.1-2 with the test parameters specified in Table 11.1.4.1.1-1. The Sidelink UE 1 is synchronized to SLSS as synchronization reference.

Table 11.1.4.1.1-1: Test Parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
|  |  |  |
| Active cell(s) |  | 0 |
| Sidelink UE 1 | Sidelink Transmissions |  | SLSS+PSBCH (Note 3) |
| slssid |  | 0 |
| Time offset (Note 1) | μs | 0 |
| Frequency offset (Note 2) | Hz | 0 |
| Synchronization source |  | SLSS |
| Antenna configuration |  | 1x2 Low |
| Note 1: Time offset of Sidelink UE receive signal with respect to GNSS reference timing.Note 2: Frequency offset of Sidelink UE with respect to GNSS reference frequency.Note 3: PSBCH transmits together with corresponding SLSS in the same slot. |

Table 11.1.4.1.1-2: Minimum performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) / Subcarrier spacing (kHz) | PSBCH Reference channel | Propagation condition | Reference value |
| Probability of missed PSBCH (%) | SNR (dB)  |
| 1 | 20 / 30 | R.PSBCH.2-1 | TDLA30-180 | 1 | [-0.5] |

11.1.5 PSFCH demodulation requirements

#### 11.1.5.1 2Rx requirements

##### 11.1.5.1.1 Minimum requirements

11.1.5.1.1.1 NACK missed detection requirements

The NACK missed detection probability is the probability of not detecting an NACK when an NACK was sent. The test parameters are configured in table 11.1.5.1.1.1-1.

Table 11.1.5.1.1.1-1: Test Parameters

|  |  |  |
| --- | --- | --- |
| Parameter | unit | Test 1 |
|  |  |  |
| Allocated resource blocks | RB | 1 |
| The number of PSFCH symbols (Note 1) | symbol | 2 |
| Number of information bits | bit | 1 |
| Synchronization source |  | GNSS |
| Timing offset | Ts | CP/2-12\*64\*Tc |
| Frequency offset | Hz | 600 |
| PSFCH resource period | Slots | 1 |
| Antenna configuration |  | 1x2 Low |
| Note 1: First symbol is included. First symbol is used for AGC and not used for demodulation |

The NACK missed detection probability shall not exceed 1% at the SNR given in table 11.1.5.1.1.1-2.

Table 11.1.5.1.1.1-2: Minimum requirements

|  |  |  |  |
| --- | --- | --- | --- |
| **Test num.** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Propagation condition** | **Reference value** |
| **NACK missed detection probability (%)** | **SNR (dB)**  |
| 1 | 20 / 30 | TDLA30-180 | 1 | [9.4] |

11.1.5.1.1.2 DTX to NACK requirements

The DTX to NACK probability, i.e. the probability that NACK is detected when nothing was sent:

where:

- #(false NACK bits) denotes the number of detected NACK bits.

- #(NACK bits) denotes the number of encoded bits per slot

- #(PSFCH DTX) denotes the number of DTX occasions

The test parameters are configured in table 11.5.1.1.1-1.

The DTX to NACK probability shall not exceed 1%.

### 11.1.6 Power imbalance performance with two links

#### 11.1.6.1 2RX requirements

##### 11.1.6.1.1 Minimum requirements

The purpose of this test is to check the demodulation performance when receiving PSSCH transmissions from two Sidelink UEs with power imbalance in one slot.

The minimum requirements are specified in Table 11.1.6.1.1-2 with the test parameters specified in Table 11.1.6.1.1-1. The Sidelink UE 1 and 2 are synchronized to GNSS or GNSS-equivalent synchronization reference.

**Table 11.1.6.1.1-1: Test Parameters**

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| Parameter | Unit | Test 1 |
| Active cell(s) |  | None |
| Active Sidelink UE(s) |  | Sidelink UE 1, Sidelink UE 2 |
| Sidelink UE 1 | Sidelink Transmissions |  | PSCCH + PSSCH |
| PSSCH DMRS pattern(Note 1) |  | {2,3} |
| Sub-channel allocation  |  | Sub-channel 0 |
| Time offset (Note 2) | μs | 0 |
| Frequency offset (Note 3) | Hz | 0 |
| Antenna configuration |  | 1x2 Low |
| PSFCH periodicity | Slots | 4 |
| MinTimeGapPSFCH | Slots  | 3 |
| Sidelink UE 2 | Sidelink Transmissions |  | PSCCH + PSSCH |
| PSSCH DMRS pattern(Note 1) |  | {2,3} |
| Sub-channel allocation  |  | Sub-channnel 3 |
| Time offset (Note 2) | μs | 0 |
| Frequency offset (Note 3) | Hz | 0 |
| Antenna configuration |  | 1x2 Low |
| PSFCH periodicity | Slots | 4 |
| MinTimeGapPSFCH | Slots  | 3 |
| Note 1: {x, y}: x and y means the number of DMRS symbols for slot with PSFCH transmission and without PSFCH transmission, respectively.Note 2: Time offset of received signal by Sidelink UE with respect to GNSS reference timing.Note 3: Frequency offset of Sidelink UE with respect to GNSS reference frequency. |

Table 11.1.6.1.1-2: Minimum performance

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz)/Subcarrier spacing(kHz) | Sidelink UE | PSSCH Reference channel | Modulation format andcode rate | Propagation condition | Reference value |
| PSSCH BLER (%) | SNR (dB) of PSSCH |
| 1 | 20 / 30 | 1 | R.PSSCH.2-1.4 | QPSK, 0.30 | AWGN | (Note 1)  | 30.35 |
| 2 | R.PSSCH.2-1.4 | QPSK, 0.30 | AWGN | 10 | [4.7] |
| Note 1: There is no BLER requirement for Sidelink UE 1. |

### 11.1.7 HARQ buffer soft combining test

#### 11.1.7.1 2Rx requirement

##### 11.1.7.1.1 Minimum requirement

The purpose of this test is to verify the maximum number of HARQ processes per TTI supported by the V2X UE.

The minimum requirement is specified in Table 11.1.7.1.1-2 with the test parameters specified in Table 11.1.7.1.1-1.

Table 11.1.7.1.1-1: Test Parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
|  |  |  |
| Active cell(s) |  | None |
| Active Sidelink UE(s) |  | Sidelink UE i, 0 ≤ i ≤ *n* (Note 1,2) |
| Sidelink UE i,0 ≤ i ≤ *n* | Sidelink Transmissions |  | PSCCH + PSSCH |
| PSSCH DMRS pattern  |  | {2} |
| Time gap between initial transmission and retransmission | Slots | [*n* (Note 3)] |
| Timing offset (Note 4) | μs | [0] |
| Frequency offset (Note 5) | Hz | [0] |
| Synchronization source |  | GNSS or GNSS-equivalent |
| Antenna configuration |  | 1x2 |
| PSFCH resource period | Slots | 1 |
| Note 1: *n* is the number of HARQ process UE can support (based on IE harq-RxProcessSidelink)Note 2: When *n* = 16 or 24, sidelink UEs transmit one by one circularly for every slot; When *n*=32, the first 31 UEs transmit signal one by one circularly for every slot and in the first subchannel, and the 32nd UE transmits signal in the first slot but in the second subchannel; When *n*=48, the first 31 UEs transmit signal one by one circularly for every slot and in the first subchannel, the next 17 UEs transmit signal in the same slot as the first 17 UEs but in the second subchannel; When *n*=64, first 31 UEs transmit signal one by one circularly for every slot and in the first subchannel, the next 31 UEs transmit signal one by one circularly for every slot and in the second subchannel, the last 2 UEs transmit signal in the same slot as the first 2 UEs in the third subchannel Note 3: *k* = *n* if *n* < 32, otherwise *k* = 31Note 4: Time offset of Sidelink UE receive signal is with respect to GNSS reference timing.Note 5: Frequency offset of Sidelink UE is with respect to GNSS reference frequency. |

Table 11.1.7.1.1-2: Minimum performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test num. | Bandwidth (MHz) /Subcarrier spacing(kHz) | PSSCH Reference channel | Propagation condition | Reference value |
| PSSCH BLER (%) | SNR (dB) of PSSCH |
| 1 | 20 / 30 | R.PSSCH.2-1.5 | AWGN | 5 | [TBD] |

### 11.1.8 PSCCH decoding capability test

#### 11.1.8.1 2RX requirements

##### 11.1.8.1.1 Minimum requirements

The purpose of this test is to verify the maximum number of Sidelink processes per TTI supported by the V2X UE.

The minimum requirements are specified in Table 11.1.8.1.1-2 with the test parameters specified in Table 11.1.8.1.1-1

Table 11.1.8.1.1-1: Test Parameters

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| **Parameter** | **Unit** | **value** |
| Sidelink UE i,0 ≤ i ≤ 9 (Note 4) | Sidelink Transmissions |  | PSCCH + PSSCH |
| Timing offset (Note 1) | μs | 0 |
| Frequency offset (Note 2) | Hz | 0 |
| Synchronization source |  | GNSS  |
| Propagation Channel |  | Static propagation condition without external noise |
| Antenna configuration |  | 1x2 Low |
| PSSCH RMC |  | R.PSSCH.2-1.1 |
| PSCCH RMC (Note 3) |  | R.PSCCH.2-1.1 |
| Note 1: Time offset of received signal by Sidelink UE with respect to GNSS reference timing.Note 2: Frequency offset of Sidelink UE with respect to GNSS reference frequency.Note 3: OCC index for PSCCH DMRS is randomly selected between {0, 1, 2} for each PSCCH transmission as per in Clause 8.4.1.3.2 of TS 38.211[9].Note 4: Each UE occupies one sub-channel so that all sub-channels are filled.Note 5: The mapping procedure of PSSCH resource and PSFCH resource is specified in Clause 16.3 of TS 38.213 [11]. |

Table 11.1.8.1.1-2: Minimum performance

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| --- | --- | --- |
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| Test Number | Bandwidth (MHz) /Subcarrier spacing(kHz) | PSCCH Reference channel | Propagation Channel | Reference value |
| Probability of missed PSCCH (%) |
| 1 | 40 / 30 | R.PSCCH.2-1.1 | Static propagation condition without external noise | 1 |

### 11.1.9 PSFCH decoding capability test

#### 11.1.9.1 2RX requirements

##### 11.1.9.1.1 Minimum requirements

The purpose of this test is to verify the maximum number of PSFCHs received by UE per slot in group cast scenario by using ACK/NACK feedback mode. In each slot, the tested UE transmits one PSSCH that occupies all the sub channels to a group of receiving UEs. Receiving UEs transmit ACKs or nothing randomly with equal probability to tested UE on the respective PSFCH resources.

The minimum requirements are specified in Table 11.1.9.1.1-2 with the test parameters specified in Table 11.1.9.1.1-1

**Table 11.1.9.1.1-1: Test parameters**

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| Parameter | Unit | Test 1 |
| HARQ-ACK information |  | ACK or NACK |
| Source ID of tested UE |  | 0 |
| Sidelink UE i,0 ≤ i ≤ N-1(Note 3) | Sidelink transmissions for  |  | PSFCH |
| Timing offset (Note 1) | μs | 0 |
| Frequency offset (Note 2) | Hz | 0 |
| Synchronization source |  | GNSS or GNSS-equivalent |
| Propagation Channel |  | Static propagation conditionNo external noise sources are applied |
| Antenna configuration |  | 1x2 Low |
| Member ID(Note 4) |  | i |
| PSFCH resource allocation(Note 5)  |  | N UEs transmit PSFCHs one by one on each RB with CS pair index 0. i.e. UE 0 transmits PSFCH on RB 0, UE 1 transmits PSFCH on RB 1,…, UE (N-1) transmits PSFCH on RB N-1 |
| PSFCH periodicity | Slots | 1 |
| Note 1: Time offset of received signal by Sidelink UE with respect to GNSS reference timing.Note 2: Frequency offset of Sidelink UE with respect to GNSS reference frequency.Note 3: N equals to the number of PSFCH(s) resources that UE can receive in a slot as specified in Clause 4.2.16.1.6 of TS 38.306[14]( IE *psfch-RxNumber*)) .Note 4: Member ID is an identifier uniquely identifying a memberNote 5: All PSFCHs in a slot are corresponding to one PSSCH that occupies all sub channels. |

**Table 11.1.9.1.1-2: Minimum requirement**

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| --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) /Subcarrier spacing(kHz) | Propagation Channel | Reference value |
| Probability of ACK miss (%) (Note 1) | Probability of DTX to ACK (%) (Note 2) |
| 1 | 40 / 30 | Static propagation condition without external noise | 1 | 1 |
| Note 1: The ACK missed detection probability is the probability of not detecting an ACK when an ACK was sent.Note 2: The DTX to ACK probability is the probability that ACK is detected when nothing was sent: |

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

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

# A.6 SL reference measurement channels

## A.6.1 General

The transport block size (TBS) determination procedure is described in clause 8.1.3 of TS 38.214 [12].

## A.6.2 Reference measurement channels for PSSCH performance requirements

A.6.2.1 Reference measurement channels for SCS 15 kHz FR1

A.6.2.2 Reference measurement channels for SCS 30 kHz FR1

Table A.6.2.2-1: PSSCH Reference Channel

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| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PSSCH.2-1.1 | R.PSSCH.2-1.2 | R.PSSCH.2-1.3 | R.PSSCH.2-1.4 | R.PSSCH.2-1.5 |
| Channel bandwidth | MHz | 20 | 20 | 20 | 20 | 20 |
| Subcarrier spacing | kHz | 30 | 30 | 30 | 30 | 30 |
| Allocated resource blocks | RB | 20 | 20 | 10 | 10 | 10 |
| CP-OFDM symbols for slot with PSFCH(Note 1) |  | 9 | 9 | 9 | 9 | 9 |
| CP-OFDM symbols for slot without PSFCH  |  | 12 | 12 | 12 | 12 | - |
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|  |  |  |  |  |  |  |
| Modulation order |  | QPSK | 16QAM | 64QAM | QPSK | 64QAM |
| MCS index |  | 4 | 11 | 17 | 4 | 27 |
| Number of MIMO layers |  | 1 | 1 | 1 | 1 | 1 |
| Number of DMRS REs |  | 21 | 15 | 12 | 15 | 12 |
| Number of REs for SCI format 1-A |  | 240 | 240 | 240 | 240 | 240 |
| 2nd stage SCI format 2-A configuraion | Payloads | Bits | 35 | 35 | 35 | 35 | 35 |
| *α* |  | 1 | 1 | 1 | 1 | 1 |
| *βoffset* |  | 3.5 | 5 | 5 | 3.5 | 2.5 |
| Overhaed for TBS determination |  | 0 | 0 | 0 | 0 | 0 |
| Transport Block Size for slot with PSFCH | Bits | 704 | 1800 | 984 | 208 | 3496 |
| Transport Block Size for slot without PSFCH | Bits | 1128 | 2856 | 1928 | 432 | - |
| Transport block CRC | Bits | 24 | 24 | 24 | 24 | 16 |
| Maximum number of HARQ transmissions |  | 1 | 1 | 1 | 1 | 2 |
| Binary Channel Bits for slots with PSFCH |  | 2304 | 4848 | 2232 | 744 | 3816 |
| Binary Channel Bits for slots without PSFCH | Bits | 3744 | 7728 | 4392 | 1464 | - |
| Note 1: OFDM symbols is for PSCCH/PSSCH transmission not including first symbol (AGC), PSFCH symbols, and guard symbols. |

## A.6.3 Reference measurement channels for PSCCH performance requirements

A.6.3.1 Reference measurement channels for SCS 15 kHz FR1

A.6.3.2 Reference measurement channels for SCS 30 kHz FR1

Table A.6.3.2-1: PSCCH Reference Channel

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Reference channel  |  | R.PSCCH.2-1.1 |
| Allocated resource blocks |  | 10 |
| OFDM Symbols per slot (Note 2) |  | 2 |
| Modulation |  | QPSK |
| Payload (without CRC) | Bits | 26 |
| CRC | Bits | 24 |
| SCI Format  |  | 1-A |
| Binary Channel Bits | Bits | 180 |
| NOTE 1: The first OFDM symbol of a PSSCH and its associated PSCCH is duplicated as described in clauses 8.3.1.5 and 8.3.2.3 of TS 38.211. This symbol is used for AGC and not used for demodulation.NOTE 2: First OFDM symbol is not included. |

## A.6.4 Reference measurement for PSBCH performance requirements

A.6.4.1 Reference measurement channels for SCS 15 kHz FR1

A.6.4.2 Reference measurement channels for SCS 30 kHz FR1

Table A.6.4.2-1: PSBCH Reference Channel

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Reference channel  |  | R.PSBCH.2-1 |
| Channel bandwidth | MHz | 20 |
| Allocated resource blocks |  | 11 |
| CP-OFDM Symbols per slot (see Note 1) |  | 8 |
| Modulation |  | QPSK |
| Transport Block Size (without CRC) | Bits | 32 |
| Transport block CRC  | Bits | 24 |
| Binary Channel Bits | Bits | 1782 |
| Note 1: PSBCH transmissions are rate-matched for 9 CP-OFDM symbols per slot. The first symbol is used for AGC and the last symbol shall be punctured as per TS 38.211. |

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

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

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