**3GPP TSG-RAN WG4 Meeting #100-e *DRAFT\_R4-2115128***

**Electronic meeting, August 16-27, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-2** | **CR** | **<CR#>** | **rev** | **-** | **Current version:** | **15.14.0** |  |
|  | | | | | | | | |
| *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 |  | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Big CR to TS 38.101-2 Maintenance Part 1 (Rel-15) | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | MCC, Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Core  WI code #2  WI code #3 | | | | |  | ***Date:*** | | | 2021-08-29 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-15 |
|  | *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:*** | | This big CRs merge the mutile endorsed draf CRs. The reason for change in each endorsed draft CR is copied below.  Incl. R4-2112025, R4-2112140, R4-2112366, R4-2113103, R4-2114473, R4-2114891  …..  R4-2112025 CR to 38.101-2 on handling of fallbacks for FR2 CA  This specification is not aligned with other specifications (38.331 and 38.306) with regards to which fallback band combinations are supported for the class of band combinations which consist of mixed contiguous and non-contiguous intra-band CA within FR2. In an effort to reconcile this issue, it has been recognized that mandating additional in-gap requirements for all possible mixed contiguous and non-contiguous fallback band combinations results in a high number of requirements and is a burden on UE development. Together with per-UE capability signaling, this CR aligns the RAN4 specification with RAN2 specifications.  R4-2112140 Correction of FR2 UE configured transmitted power  In Clause 6.2.4, the term of PPowerclass is not clearly defined to refer to UE minimum peak EIRP, since FR2 definition of power class consists of four components: minimum peak EIRP, maximum TRP, maximum EIRP, and EIRP spherical coverage. Therefore, it is proposed to define PPowerclass as minimum peak EIRP.  R4-2112366 Draft CR to 38.101-2 on side conditions for beam correspondence based on SSB and CSI-RS for n257, n258, n260, n261  The minimum SSB\_RP is defined as:   * Minimum SSB\_RP = EIS spherical coverage PC3, n260, 50MHz +Z -10Log10(PRBRefsens x 12) – SNRRefsens + SSB Ês/Iot + ΣMBS   In Table 6.6.4.3.1-1 and Table 6.6.4.3.1-2 the SSB Es/Iot and CSI-RS Es/Iot are defined as ≥6 dB. The result for minimum SSB and minimum CSI-RS are not correct in the specification, and these values need to be corrected considering the Es/Iot parameter as defined in the specification.  R4-2113103 Draft CR for Rel-15 38.101-2 to replace ΣMBS with MBS,n in section 6.6.4.3.1 of side conditions for beam correspondence  Replace ΣMBS with MBS,n in section of side conditions for beam correspondence.  R4-2114473 Draft CR on Minor correction on UL additional reference channels parameters for TDD 60kHz SCS  Missing *nrofUplinkSymbols* for UL-DL configuration required for SCS=60kHz in table A.2.3-1 while Special Slot Configuration indicates S=4D+6G+4U.  R4-2114891 CR to 38.101-2: P\_min requirements update  Pmin relaxed for 2L UL cases. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | R4-2112025 CR to 38.101-2 on handling of fallbacks for FR2 CA  For FR2 intra-band CA combinations with multiple sub-blocks, where at least one of the sub-blocks consists of a contiguous CA combination, the following two changes are implemented:  1. Remove the requirement of direct fallback to single FR2 carrier  2. Based on UE signaling a capability bit, introduce an applicability rule for Rx requirements (impacting clauses 7.5A, 7.5D, 7.6A, 7.6D) for fallbacks with multiple sub-blocks, where at least one of the sub-blocks consists of a contiguous CA combination  Changes to RAN2 specifications on UE capabilities (38.306) and RRC (38.331) are needed to introduce per-UE capability.  **Impact analysis**  Impacted functionality:  Requirements for band combinations.  Inter-operability:  No inter-operability issues are foreseen.  R4-2112140 Correction of FR2 UE configured transmitted power  The definition of PPowerclass as minimum peak EIRP.  R4-2112366 Draft CR to 38.101-2 on side conditions for beam correspondence based on SSB and CSI-RS for n257, n258, n260, n261  The minimum SSB and minimum CSI-RS values in Table 6.6.4.3.1-1  R4-2113103 Draft CR for Rel-15 38.101-2 to replace ΣMBS with MBS,n in section 6.6.4.3.1 of side conditions for beam correspondence  The Minimum SSB\_RP values and Minimum CSI-RS\_RP values are defined per band in the section of side conditions for beam correspondence. Therefore, For UEs that support multiple FR2 bands, the Minimum SSB\_RP values and Minimum CSI-RS\_RP values should be increased by MBS,nnot ΣMBS.  In addition, to resolve the testability concerns for multi-band requirement (MBR) framework provided by RAN5 in R5-199424, in Rel-15, RAN4 has introduced a maximum cap on to the per-band relaxation factors MBP,n and MBS,n in Rel-15 (CR R4-2003652); in Rel-16, RAN4 has obsoleted the definition of MBP and MBS from Rel-16 and beyond (CR R4-2003655) and defined the fixed per-band relaxation factors MBP,n and MBS,n to replace MBP and MBS.  Correspondingly, ΣMBS should be replaced with MBS,n in section of side conditions for beam correspondence  R4-2114473 Draft CR on Minor correction on UL additional reference channels parameters for TDD 60kHz SCS  Considering the agreement in R4-1816610, *nrofUplinkSymbols* is set to 4.  R4-2114891 CR to 38.101-2: P\_min requirements update  Change Pmin   1. D-suffix requirements: Pmin scales by BW \* number of layers 2. Editorial changes to move phrases repeated for every power class to the general section.   Extend clarifications to UE configurations made in agreed R4-2011920 to Pmin requirement also. Referenced CR only addressed peak EIRP and MPR requirements, but neglected to address Pmin:   1. Agreed changes in R4-2011920 applied to Pmin section and Tx signal quality section. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | R4-2112025 CR to 38.101-2 on handling of fallbacks for FR2 CA  This specification is not aligned with other specifications (38.331 and 38.306) with regards to which fallback band combinations are supported.  R4-2112140 Correction of FR2 UE configured transmitted power  There is ambiguity in the specification.  R4-2112366 Draft CR to 38.101-2 on side conditions for beam correspondence based on SSB and CSI-RS for n257, n258, n260, n261  Wrong values for minimum SSB and CSI-RS remain in the specification.  R4-2113103 Draft CR for Rel-15 38.101-2 to replace ΣMBS with MBS,n in section 6.6.4.3.1 of side conditions for beam correspondence  The denotation has some mistake.  R4-2114473 Draft CR on Minor correction on UL additional reference channels parameters for TDD 60kHz SCS  Specification will be incomplete.  R4-2114891 CR to 38.101-2: P\_min requirements update  Inconsistent requirements remain. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | R4-2112025 CR to 38.101-2 on handling of fallbacks for FR2 CA  4.2  R4-2112140 Correction of FR2 UE configured transmitted power  6.2.4  R4-2112366 Draft CR to 38.101-2 on side conditions for beam correspondence based on SSB and CSI-RS for n257, n258, n260, n261  6.6.4.3.1  R4-2113103 Draft CR for Rel-15 38.101-2 to replace ΣMBS with MBS,n in section 6.6.4.3.1 of side conditions for beam correspondence  6.6.4.3.1  R4-2114473 Draft CR on Minor correction on UL additional reference channels parameters for TDD 60kHz SCS  A.2.3  R4-2114891 CR to 38.101-2: P\_min requirements update  6.3D.1, 6.4D | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS38.306 CR0480,  TS38.331 CR2296 | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS/TR 38.521-2 CR 0609 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | R4-2112025 CR to 38.101-2 on handling of fallbacks for FR2 CA  This CR implements the principles for handling the FR2 fallback issue as described in RP-202556. | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | R4-2112025 CR to 38.101-2 on handling of fallbacks for FR2 CA  RP-201872 was postponed during the RAN #89e meeting. This CR is a revision of RP-202575. During the RAN #90e meeting this CR was approved in RP-202915 but not implemented in the specification. | | | | | | | | |

***<Start of change1>***

***NOTE: please merge the endorsed draft CRs in the way that the clause number is arranged in the same order as in the specifications to facilitate the implementaion of MCC.***

## 4.2 Applicability of minimum requirements

a) In this specification the Minimum Requirements are specified as general requirements and additional requirements. Where the Requirement is specified as a general requirement, the requirement is mandated to be met in all scenarios

b) For specific scenarios for which an additional requirement is specified, in addition to meeting the general requirement, the UE is mandated to meet the additional requirements.

c) The spurious emissions power requirements are for the long-term average of the power. For the purpose of reducing measurement uncertainty it is acceptable to average the measured power over a period of time sufficient to reduce the uncertainty due to the statistical nature of the signal

d) All the requirements for intra-band contiguous and non-contiguous CA apply under the assumption of the same slot format indicated by TDD-UL-DL-ConfigurationCommon and TDD-UL-DL-ConfigurationDedicated in the PCell and SCells for NR SA.

For FR2 intra-band CA configurations with multiple FR2 subblocks, where at least one of the subblocks is a contiguous CA configuration:

- if the field *partialFR2-FallbackRX-Req* is not present, the UE shall meet all applicable UE RF requirements for the highest order CA configuration and all associated fallback CA configurations;

- if the field *partialFR2-FallbackRX-Req* is present, for each FR2 intra-band CA configuration with multiple sub-blocks that the UE indicates support for explicitly in UE capability signalling: the in-gap UE RF requirements in clauses 7.5A, 7.5D, 7.6A, 7.6D apply as the equivalent requirements for the associated fallback CA configurations with the same number of sub-blocks, where at least one of the sub-blocks consists of a contiguous CA configuration. The UE shall meet all applicable UE RF requirements for fallback CA configurations with a lesser number of sub-blocks;

- regardless of the field *partialFR2-FallbackRX-Req*, the UE shall meet all DL out-of-gap requirements for all lower order fallback CA configurations.

***<End of change1>***

***<Start of change2>***

### 6.2.4 Configured transmitted power

The UE can configure its maximum output power. The configured UE maximum output power PCMAX,f,c for carrier f of a serving cell c is defined as that available to the reference point of a given transmitter branch that corresponds to the reference point of the higher-layer filtered RSRP measurement as specified in TS 38.215 [11].

The configured UE maximum output power PCMAX,f,c for carrier *f* of a serving cell *c* shall be set such that the corresponding measured peak EIRP PUMAX,f,c is within the following bounds

PPowerclass – MAX(MAX(MPRf,c, A- MPRf,c,) + ΔMBP,n, P-MPRf,c) – MAX{T(MAX(MPRf,c, A- MPRf,c,)), T(P-MPRf,c)} ≤ PUMAX,f,c ≤ EIRPmax

while the corresponding measured total radiated power PTMAX,f,c is bounded by

PTMAX,f,c ≤ TRPmax

with PPowerclass the UE minimum peak EIRP as specified in clause 6.2.1, EIRPmax the applicable maximum EIRP as specified in clause 6.2.1, MPRf,c as specified in clause 6.2.2 , A-MPRf,c as specified in clause 6.2.3, ΔMBP,n the peak EIRP relaxation as specified in clause 6.2.1 and TRPmax the maximum TRP for the UE power class as specified in clause 6.2.1.

***<End of change2>***

***<Start of change3>***

## 6.3D Output power dynamics for UL MIMO

### 6.3D.0 General

The requirements in subclause 6.3D shall be met with configurations specified in sub-clause 6.2D.1.x, where ‘x’ depends on power class. Unless otherwise specified, the requirements shall be verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

### 6.3D.1 Minimum output power for UL MIMO

#### 6.3D.1.0 General

The minimum output power is defined as the mean power in at least one sub frame (1ms). The minimum controlled output power is defined as the EIRP, i.e. the sum of the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the UE power is set to a minimum value.

#### 6.3D.1.1 Minimum output power for UL MIMO for power class 1

For UE supporting UL MIMO, the minimum output power shall not exceed the sum of the value specified in Table 6.3.1.1-1 and the quantity 10\*log10(Number of Layers).

#### 6.3D.1.2 Minimum output power for UL MIMO for power class 2, 3 and 4

For UE supporting UL MIMO, the minimum output power shall not exceed the sum of the value specified in Table 6.3.1.2-1 and the quantity 10\*log10(Number of Layers).

### 6.3D.2 Transmit OFF power for UL MIMO

For UE supporting UL MIMO, the transmit OFF power is defined as the TRP in the channel bandwidth when the transmitter is OFF. The transmitter is considered OFF when the UE is not allowed to transmit on any of its ports. During DTX and measurements gaps, the transmitter is not considered OFF. The minimum output power shall not exceed the values specified in Table 6.3.2-1. The requirement is verified with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

### 6.3D.3 Transmit ON/OFF time mask for UL MIMO

For UE supporting UL MIMO, the ON/OFF time mask requirements in clause 6.3.3 apply.

***<End of change3>***

***<Start of change4>***

## 6.4D Transmit signal quality for UL MIMO

### 6.4D.0 General

For a UE supporting UL MIMO, the transmit modulation quality requirements in clause 6.4 apply but with all references to sub-clauses 6.3.1.x in clause 6.4 redirected to sub-clauses 6.3D.1.x, where ‘x’ depends on power class. The requirements apply when the UE is configured for 2-layer UL MIMO transmission as specified in Table 6.2D.1.3-3.

The requirement may alternatively be verified in each of the single layer UL MIMO configurations as specified in Table 6.4D.0-1. In this case, the transmit modulation quality requirements in clause 6.4 apply without modification.

Table 6.4D.0-1: Alternative UL MIMO configuration for transmit signal quality tests

|  |  |  |
| --- | --- | --- |
| **Transmission scheme** | **DCI format** | **TPMI Index** |
| Codebook based uplink | DCI format 0\_1 | 0 |
| Codebook based uplink | DCI format 0\_1 | 1 |

### 6.4D.1 Frequency error for UL MIMO

For a UE supporting UL MIMO, the UE basic measurement interval of modulated carrier frequency is 1 slot. The mean value of basic measurements of UE modulated carrier frequency at each layer shall be accurate to within ± 0.1 PPM observed over a period of 1ms of cumulated measurement intevals compared to the carrier frequency received from the NR Node B.

### 6.4D.2 Transmit modulation quality for UL MIMO

For UE supporting UL MIMO, the transmit modulation quality requirements are specified at each layer separately.

The transmit modulation quality requirements are specified in terms of:

Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)

EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process

Carrier leakage (caused by IQ offset)

In-band emissions for the non-allocated RB

In case the parameter 3300 or 3301 is reported from UE via the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrentList* IE (as defined in TS 38.331 [13]), carrier leakage measurement requirement in clause 6.4D.2.2 and 6.4D.2.3 shall be waived, and the RF correction with regard to the carrier leakage and IQ image shall be omitted during the calculation of transmit modulation quality.

### 6.4D.3 Time alignment error for UL MIMO

For a UE with multiple physical antenna ports supporting UL MIMO, this requirement applies to frame timing differences between transmissions on multiple physical antenna ports in the codebook transmission scheme.

The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different physical antenna ports.

For a UE with multiple physical antenna ports, the Time Alignment Error (TAE) shall not exceed 130 ns.

### 6.4D.4 Requirements for coherent UL MIMO

For coherent UL MIMO, Table 6.4D.4-1 lists the maximum allowable difference between the measured relative power and phase errors between different physical antenna ports in any slot within the specified time window from the last transmitted SRS on the same antenna ports, for the purpose of uplink transmission (codebook or non-codebook usage) and those measured at that last SRS. The requirements in Table 6.4D.4-1 apply when the UL transmission power at each physical antenna port is larger than 0 dBm for SRS transmission and for the duration of time window. The requirement is verified with the test metric of EIRP (Link=TX Beam peak direction, Meas=Link angle).

Table 6.4D.4-1: Maximum allowable difference of relative phase and power errors in a given slot compared to those measured at last SRS transmitted

|  |  |  |
| --- | --- | --- |
| Difference of relative phase error | Difference of relative power error | Time window |
| 40 degrees | 4 dB | 20 msec |

The above requirements apply when all of the following conditions are met within the specified time window:

- UE is not signaled with a change in number of SRS ports in *SRS-config*, or a change in *PUSCH-config*

- UE remains in DRX active time (UE does not enter DRX OFF time)

- No measurement gap occurs

- No instance of SRS transmission with the usage antenna switching occurs

- Active BWP remains the same

- EN-DC and CA configuration is not changed for the UE (UE is not configured or de-configured with PScell or SCell(s))

***<End of change4>***

***<Start of change5>***

#### 6.6.4.3 Side Conditions

#### 6.6.4.3.1 Side Condition for SSB and CSI-RS

The beam correspondence requirements are only applied under the following side conditions:

- The downlink reference signals including both SSB and CSI-RS are provided and Type D QCL shall be maintained between SSB and CSI-RS.

- The reference measurement channel for beam correspondence are fulfilled according to the CSI-RS configuration in Annex A.3.

- For beam correspondence, conditions for L1-RSRP measurements are fulfilled according to Table 6.6.4.3.1-1 and Table 6.6.4.3.1-2.

Table 6.6.4.3.1-1: Conditions for SSB based L1-RSRP measurements for beam correspondence

|  |  |  |  |
| --- | --- | --- | --- |
| Angle of arrival | NR operating bands | Minimum SSB\_RP Note 2 | SSB Ês/Iot |
|  |  | dBm / SCSSSB | dB |
|  |  | SCSSSB = 120 kHz |  |
| All angles **Note 1** | n257 | -96.2 | ≥6 |
| n258 | -96.2 |
|  | n260 | -91.9 |
| n261 | -96.2 |
| NOTE 1: For UEs that support multiple FR2 bands, the Minimum SSB\_RP values for all angles are increased by MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1.  NOTE 2: Values specified at the radiated requirements reference point to give minimum SSB Ês/Iot, with no applied noise. | | | |

Table 6.6.4.3.1-2: Conditions for CSI-RS based L1-RSRP measurements for beam correspondence

|  |  |  |  |
| --- | --- | --- | --- |
| Angle of arrival | NR operating bands | Minimum CSI-RS\_RP Note 2 | CSI-RS Ês/Iot |
|  |  | dBm / SCSCSI-RS | dB |
|  |  | SCSCSI-RS = 120 kHz |  |
| All angles **Note 1** | n257 | -96.2 | ≥6 |
|  | n258 | -96.2 |  |
|  | n260 | -91.9 |  |
|  | n261 | -96.2 |  |
| NOTE 1: For UEs that support multiple FR2 bands, the Minimum CSI-RS\_RP values for all angles are increased by MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1.  NOTE 2: Values specified at the radiated requirements reference point to give minimum CSI-RS Ês/Iot, with no applied noise. | | | |

***<End of change 5>***

***<Start of change6>***

## A.2.3 Reference measurement channels for TDD

For UL RMCs defined below, TDD slot pattern defined in Table A.2.3-1 will be used for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, TDD slot patterns defined for reference sensitivity tests in Table A.3.3.1-1 will be used.

Table A.2.3-1: Additional reference channels parameters for TDD

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Value | |
| SCS 60 kHz (µ=2) | SCS 120 kHz (µ=3) |
| TDD Slot Configuration pattern (Note 1) | | DDDSUUUU | 7DS8U |
| Special Slot Configuration (Note 2) | | S=4D+6G+4U | S=12D+2G |
| *referenceSubcarrierSpacing* | | 60 kHz | 120 kHz |
| UL-DL configuration | *dl-UL-TransmissionPeriodicity* | 2 ms | 2 ms |
| *nrofDownlinkSlots* | 3 | 7 |
| *nrofDownlinkSymbols* | 4 | 12 |
| *nrofUplinkSlot* | 4 | 8 |
| *nrofUplinkSymbols* | 4 | 0 |
| Indexes of active UL slots | | mod(slot index, 40) = {36,…,39} | mod(slot index, 80) = {72,…,79} |
| NOTE 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information.  NOTE 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information. | | | |

### A.2.3.1 DFT-s-OFDM Pi/2-BPSK

Table A.2.3.1-1: Reference Channels for DFT-s-OFDM pi/2-BPSK

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | pi/2 BPSK | 0 | 32 | 16 | 2 | 1 | 132 | 132 |
|  | 16 | 11 | pi/2 BPSK | 0 | 504 | 16 | 2 | 1 | 2112 | 2112 |
|  | 32 | 11 | pi/2 BPSK | 0 | 1032 | 16 | 2 | 1 | 4224 | 4224 |
|  | 64 | 11 | pi/2 BPSK | 0 | 2024 | 16 | 2 | 1 | 8448 | 8448 |
|  | 128 | 11 | pi/2 BPSK | 0 | 3976 | 24 | 2 | 2 | 16896 | 16896 |
|  | 256 | 11 | pi/2 BPSK | 0 | 7944 | 24 | 2 | 3 | 33792 | 33792 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.1-2: Void

### A.2.3.2 DFT-s-OFDM QPSK

Table A.2.3.2-1: Reference Channels for DFT-s-OFDM QPSK

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | QPSK | 2 | 48 | 16 | 2 | 1 | 264 | 132 |
|  | 16 | 11 | QPSK | 2 | 808 | 16 | 2 | 1 | 4224 | 2112 |
|  | 20 | 11 | QPSK | 2 | 1032 | 16 | 2 | 1 | 5280 | 2640 |
|  | 32 | 11 | QPSK | 2 | 1608 | 16 | 2 | 1 | 8448 | 4224 |
|  | 64 | 11 | QPSK | 2 | 3240 | 16 | 2 | 1 | 16896 | 8448 |
|  | 128 | 11 | QPSK | 2 | 6408 | 24 | 2 | 2 | 33792 | 16896 |
|  | 256 | 11 | QPSK | 2 | 12808 | 24 | 2 | 4 | 67584 | 33792 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.2-2: Void

### A.2.3.3 DFT-s-OFDM 16QAM

Table A.2.3.3-1: Reference Channels for DFT-s-OFDM 16QAM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | 16QAM | 10 | 176 | 16 | 2 | 1 | 528 | 132 |
|  | 16 | 11 | 16QAM | 10 | 2792 | 16 | 2 | 1 | 8448 | 2112 |
|  | 32 | 11 | 16QAM | 10 | 5632 | 24 | 1 | 1 | 16896 | 4224 |
|  | 64 | 11 | 16QAM | 10 | 11272 | 24 | 1 | 2 | 33792 | 8448 |
|  | 128 | 11 | 16QAM | 10 | 22536 | 24 | 1 | 3 | 67584 | 16896 |
|  | 256 | 11 | 16QAM | 10 | 45096 | 24 | 1 | 6 | 135168 | 33792 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.3-2: Void

### A.2.3.4 DFT-s-OFDM 64QAM

Table A.2.3.4-1: Reference Channels for DFT-s-OFDM 64QAM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | 64QAM | 18 | 408 | 16 | 2 | 1 | 792 | 132 |
|  | 16 | 11 | 64QAM | 18 | 6400 | 24 | 1 | 1 | 12672 | 2112 |
|  | 32 | 11 | 64QAM | 18 | 12808 | 24 | 1 | 2 | 25344 | 4224 |
|  | 64 | 11 | 64QAM | 18 | 25608 | 24 | 1 | 4 | 50688 | 8448 |
|  | 128 | 11 | 64QAM | 18 | 51216 | 24 | 1 | 7 | 101376 | 16896 |
|  | 256 | 11 | 64QAM | 18 | 102416 | 24 | 1 | 13 | 202752 | 33792 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.4-2: Void

### A.2.3.5 CP-OFDM QPSK

Table A.2.3.5-1: Reference Channels for CP-OFDM QPSK

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | QPSK | 2 | 48 | 16 | 2 | 1 | 264 | 132 |
|  | 16 | 11 | QPSK | 2 | 808 | 16 | 2 | 1 | 4224 | 2112 |
|  | 32 | 11 | QPSK | 2 | 1608 | 16 | 2 | 1 | 8448 | 4224 |
|  | 33 | 11 | QPSK | 2 | 1672 | 16 | 2 | 1 | 8712 | 4356 |
|  | 66 | 11 | QPSK | 2 | 3368 | 16 | 2 | 1 | 17424 | 8712 |
|  | 132 | 11 | QPSK | 2 | 6536 | 24 | 2 | 2 | 34848 | 17424 |
|  | 264 | 11 | QPSK | 2 | 13064 | 24 | 2 | 4 | 69696 | 34848 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 5.1.3.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.5-2: Void

### A.2.3.6 CP-OFDM 16QAM

Table A.2.3.6-1: Reference Channels for CP-OFDM 16QAM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | 16QAM | 10 | 176 | 16 | 2 | 1 | 528 | 132 |
|  | 16 | 11 | 16QAM | 10 | 2792 | 16 | 2 | 1 | 8448 | 2112 |
|  | 32 | 11 | 16QAM | 10 | 5632 | 24 | 1 | 1 | 16896 | 4224 |
|  | 33 | 11 | 16QAM | 10 | 5760 | 24 | 1 | 1 | 17424 | 4356 |
|  | 66 | 11 | 16QAM | 10 | 11528 | 24 | 1 | 2 | 34848 | 8712 |
|  | 132 | 11 | 16QAM | 10 | 23040 | 24 | 1 | 3 | 69696 | 17424 |
|  | 264 | 11 | 16QAM | 10 | 46104 | 24 | 1 | 6 | 139392 | 34848 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 5.1.3.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.6-2: Void

### A.2.3.7 CP-OFDM 64QAM

Table A.2.3.7-1: Reference Channels for CP-OFDM 64QAM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | 64QAM | 19 | 408 | 16 | 2 | 1 | 792 | 132 |
|  | 16 | 11 | 64QAM | 19 | 6400 | 24 | 1 | 1 | 12672 | 2112 |
|  | 32 | 11 | 64QAM | 19 | 12808 | 24 | 1 | 2 | 25344 | 4224 |
|  | 33 | 11 | 64QAM | 19 | 13064 | 24 | 1 | 2 | 26136 | 4356 |
|  | 66 | 11 | 64QAM | 19 | 26120 | 24 | 1 | 4 | 52272 | 8712 |
|  | 132 | 11 | 64QAM | 19 | 53288 | 24 | 1 | 7 | 104544 | 17424 |
|  | 264 | 11 | 64QAM | 19 | 106576 | 24 | 1 | 13 | 209088 | 34848 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 5.1.3.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.7-2: Void

***<End of change6>***