**3GPP TSG- Meeting #**

**Bengaluru, India, 25th August 2025 - 29th August 2025**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** |  | **rev** |  | **Current version:** | **18.10.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | (NR\_NTN\_solutions-Core) CR to update RMCs for FR1-NTN TRx testing with 15kHz and 30kHz SCSs | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_NTN\_solutions-Core, NR\_NTN\_enh-Core | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***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 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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | RMCs for FR1-NTN TRx testing with 30kHz SCS are not defined in TS 38.101-5, as well as the maximum throughput values for the fixed reference channels for receiver requirements for 15kHz SCS. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | - Adding the section A.3.4.1.1A Fixed reference channels for SCS 30kHz FR1-NTN and its associated tables.  - Adding the FR1-NTN FDD active uplink slots for 30kHz SCS for both NGSO (in Table A.2.1-1) and GSO (in Table A.2.1-2).  DL  - Adding the max throughput values for the fixed reference channels for receiver requirements (SCS 15kHz, FDD)) for NGSO QPSK (Table A.3.4.1.1-1), NGSO 64QAM (Table A.3.4.1.1-2), GSO QPSK (Table A.3.4.1.1-3), NGSO 64QAM (Table A.3.4.1.1-4).  - Replacing “radio frame” by just “frame”.  - Adding a placeholder for the section A.3.4.1.1B Fixed reference channels for SCS 60kHz FR1-NTN. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | RMCs for FR1-NTN TRx testing with 30kHz SCS remain missing. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | A.2.1, A.3.4.1.1, A.3.4.1.1A (new), A.3.4.1.1B (new, placeholder) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS 38.521-5 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Typos were reported in Tables A.3.4.1A-1, A.3.4.1A-2, A.3.4.1A-3, and A.3.4.1A-4, the “Allocated slots per Frame” have been changed from 11 to 16. | | | | | | | | |

<<Unchanged sections skipped>>

<<Start of change>>

# A.2 UL reference measurement channels

## A.2.1 General

The measurement channels in the subclause A2.2 are defined to derive the requirements in clause 6 (Transmitter Characteristics) and clause 7 (Receiver Characteristics). And the measurement channels in the subclause A2.3 are defined to derive the requirements in clause 9 (Radiated Transmitter Characteristics) and clause 10 (Radiated Receiver Characteristics). The measurement channels represent example configurations of physical channels for different data rates.

The measurement channels in the following clauses are applicable only to FDD.

The active uplink slots for FR1-NTN FDD configurations for NGSO are specified in Table A.2.1-1. FR1-NTN FDD slot patterns defined for reference sensitivity tests will be used for FR1-NTN FDD UL RMCs, unless otherwise stated.

Table A.2.1-1: FR1-NTN FDD active uplink slots for NGSO

|  |  |
| --- | --- |
| **SCS** | **Active Uplink slots** |
| 15 kHz | 0,1,2,3,4,5,8,9 in every frame |
| 30 kHz | 0,1,2,3,4,5,6,7,8,9,34,35,36,37,38,39 in every 2 frames |
| 60 kHz |  |
| NOTE 1: Due to lack of HARQ processes for PUSCH and considering CellSpecificKoffset, all Uplink slots cannot be activated for NTN.  NOTE 2: Assuming K2 is 2, CellSpecificKoffset is 14 | |

The active uplink slots for FR1-NTN FDD configurations for GSO are specified in Table A.2.1-2. FR1-NTN FDD slot patterns defined for reference sensitivity tests will be used for FR1-NTN FDD UL RMCs, unless otherwise stated.

Table A.2.1-2: FR1-NTN FDD active uplink slots for GSO

|  |  |
| --- | --- |
| SCS | Active Uplink slots |
| 15 kHz | 262,263,264,265,266,267,268,269, 272,273,274, 275, 276, 277, 278, 279 in every 32 frames |
| 30 kHz | 522,523,524,525,526,527,528,529,530,531,532,533,534,535,536,537 in every 32 frames |
| 60 kHz |  |
| NOTE 1: The active slots are counted from the 0th slot in the 1st frame of the periodicity.  NOTE 2: Due to lack of HARQ processes for PUSCH and considering CellSpecificKoffset, all Uplink slots cannot be activated for NTN.  NOTE 3: Assuming K2 is 2, CellSpecificKoffset is 258 | |

## A.2.2 Reference measurement channels for FR1-NTN FDD

### A.2.2.1 DFT-s-OFDM Pi/2-BPSK

Table A.2.2.1-1: 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 | 24 | 16 | 2 | 1 | 132 | 132 |
|  | 5 | 11 | pi/2 BPSK | 0 | 160 | 16 | 2 | 1 | 660 | 660 |
|  | 9 | 11 | pi/2 BPSK | 0 | 288 | 16 | 2 | 1 | 1188 | 1188 |
|  | 10 | 11 | pi/2 BPSK | 0 | 320 | 16 | 2 | 1 | 1320 | 1320 |
|  | 12 | 11 | pi/2 BPSK | 0 | 384 | 16 | 2 | 1 | 1584 | 1584 |
|  | 15 | 11 | pi/2 BPSK | 0 | 480 | 16 | 2 | 1 | 1980 | 1980 |
|  | 18 | 11 | pi/2 BPSK | 0 | 576 | 16 | 2 | 1 | 2376 | 2376 |
|  | 24 | 11 | pi/2 BPSK | 0 | 768 | 16 | 2 | 1 | 3168 | 3168 |
|  | 25 | 11 | pi/2 BPSK | 0 | 808 | 16 | 2 | 1 | 3300 | 3300 |
|  | 30 | 11 | pi/2 BPSK | 0 | 984 | 16 | 2 | 1 | 3960 | 3960 |
|  | 32 | 11 | pi/2 BPSK | 0 | 1032 | 16 | 2 | 1 | 4224 | 4224 |
|  | 36 | 11 | pi/2 BPSK | 0 | 1128 | 16 | 2 | 1 | 4752 | 4752 |
|  | 45 | 11 | pi/2 BPSK | 0 | 1416 | 16 | 2 | 1 | 5940 | 5940 |
|  | 50 | 11 | pi/2 BPSK | 0 | 1544 | 16 | 2 | 1 | 6600 | 6600 |
|  | 60 | 11 | pi/2 BPSK | 0 | 1864 | 16 | 2 | 1 | 7920 | 7920 |
|  | 64 | 11 | pi/2 BPSK | 0 | 2024 | 16 | 2 | 1 | 8448 | 8448 |
|  | 75 | 11 | pi/2 BPSK | 0 | 2408 | 16 | 2 | 1 | 9900 | 9900 |
|  | 80 | 11 | pi/2 BPSK | 0 | 2472 | 16 | 2 | 1 | 10560 | 10560 |
|  | 81 | 11 | pi/2 BPSK | 0 | 2536 | 16 | 2 | 1 | 10692 | 10692 |
|  | 90 | 11 | pi/2 BPSK | 0 | 2792 | 16 | 2 | 1 | 11880 | 11880 |
|  | 100 | 11 | pi/2 BPSK | 0 | 3104 | 16 | 2 | 1 | 13200 | 13200 |
| 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 TS 38.214 [14].  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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### A.2.2.2 DFT-s-OFDM QPSK

Table A.2.2.2-1: 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 |
|  | 5 | 11 | QPSK | 2 | 256 | 16 | 2 | 1 | 1320 | 660 |
|  | 9 | 11 | QPSK | 2 | 456 | 16 | 2 | 1 | 2376 | 1188 |
|  | 10 | 11 | QPSK | 2 | 504 | 16 | 2 | 1 | 2640 | 1320 |
|  | 12 | 11 | QPSK | 2 | 608 | 16 | 2 | 1 | 3168 | 1584 |
|  | 15 | 11 | QPSK | 2 | 768 | 16 | 2 | 1 | 3960 | 1980 |
|  | 18 | 11 | QPSK | 2 | 928 | 16 | 2 | 1 | 4752 | 2376 |
|  | 20 | 11 | QPSK | 2 | 1032 | 16 | 2 | 1 | 5280 | 2640 |
|  | 24 | 11 | QPSK | 2 | 1192 | 16 | 2 | 1 | 6336 | 3168 |
|  | 25 | 11 | QPSK | 2 | 1256 | 16 | 2 | 1 | 6600 | 3300 |
|  | 30 | 11 | QPSK | 2 | 1544 | 16 | 2 | 1 | 7920 | 3960 |
|  | 32 | 11 | QPSK | 2 | 1608 | 16 | 2 | 1 | 8448 | 4224 |
|  | 36 | 11 | QPSK | 2 | 1800 | 16 | 2 | 1 | 9504 | 4752 |
|  | 45 | 11 | QPKS | 2 | 2208 | 16 | 2 | 1 | 11880 | 5940 |
|  | 50 | 11 | QPSK | 2 | 2472 | 16 | 2 | 1 | 13200 | 6600 |
|  | 60 | 11 | QPSK | 2 | 3104 | 16 | 2 | 1 | 15840 | 7920 |
|  | 64 | 11 | QPSK | 2 | 3240 | 16 | 2 | 1 | 16896 | 8448 |
|  | 75 | 11 | QPSK | 2 | 3752 | 16 | 2 | 1 | 19800 | 9900 |
|  | 80 | 11 | QPSK | 2 | 3976 | 24 | 2 | 2 | 21120 | 10560 |
|  | 81 | 11 | QPSK | 2 | 4040 | 24 | 2 | 2 | 21384 | 10692 |
|  | 90 | 11 | QPSK | 2 | 4488 | 24 | 2 | 2 | 23760 | 11880 |
|  | 100 | 11 | QPSK | 2 | 5000 | 24 | 2 | 2 | 26400 | 13200 |
| 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 TS 38.214 [14].  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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### A.2.2.3 DFT-s-OFDM 16QAM

Table A.2.2.3-1: 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 |
|  | 5 | 11 | 16QAM | 10 | 888 | 16 | 2 | 1 | 2640 | 660 |
|  | 9 | 11 | 16QAM | 10 | 1608 | 16 | 2 | 1 | 4752 | 1188 |
|  | 10 | 11 | 16QAM | 10 | 1800 | 16 | 2 | 1 | 5280 | 1320 |
|  | 12 | 11 | 16QAM | 10 | 2088 | 16 | 2 | 1 | 6336 | 1584 |
|  | 15 | 11 | 16QAM | 10 | 2664 | 16 | 2 | 1 | 7920 | 1980 |
|  | 18 | 11 | 16QAM | 10 | 3240 | 16 | 2 | 1 | 9504 | 2376 |
|  | 24 | 11 | 16QAM | 10 | 4224 | 24 | 1 | 1 | 12672 | 3168 |
|  | 25 | 11 | 16QAM | 10 | 4352 | 24 | 1 | 1 | 13200 | 3300 |
|  | 30 | 11 | 16QAM | 10 | 5248 | 24 | 1 | 1 | 15840 | 3960 |
|  | 32 | 11 | 16QAM | 10 | 5632 | 24 | 1 | 1 | 16896 | 4224 |
|  | 36 | 11 | 16QAM | 10 | 6272 | 24 | 1 | 1 | 19008 | 4752 |
|  | 45 | 11 | 16QAM | 10 | 7808 | 24 | 1 | 1 | 23760 | 5940 |
|  | 50 | 11 | 16QAM | 10 | 8712 | 24 | 1 | 2 | 26400 | 6600 |
|  | 60 | 11 | 16QAM | 10 | 10504 | 24 | 1 | 2 | 31680 | 7920 |
|  | 64 | 11 | 16QAM | 10 | 11272 | 24 | 1 | 2 | 33792 | 8448 |
|  | 75 | 11 | 16QAM | 10 | 13064 | 24 | 1 | 2 | 39600 | 9900 |
|  | 80 | 11 | 16QAM | 10 | 14088 | 24 | 1 | 2 | 42240 | 10560 |
|  | 81 | 11 | 16QAM | 10 | 14088 | 24 | 1 | 2 | 42768 | 10692 |
|  | 90 | 11 | 16QAM | 10 | 15880 | 24 | 1 | 2 | 47520 | 11880 |
|  | 100 | 11 | 16QAM | 10 | 17424 | 24 | 1 | 3 | 52800 | 13200 |
| 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 TS 38.214 [14].  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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### A.2.2.4 DFT-s-OFDM 64QAM

Table A.2.2.4-1: 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 |
|  | 5 | 11 | 64QAM | 18 | 2024 | 16 | 2 | 1 | 3960 | 660 |
|  | 9 | 11 | 64QAM | 18 | 3624 | 16 | 2 | 1 | 7128 | 1188 |
|  | 10 | 11 | 64QAM | 18 | 3968 | 24 | 1 | 1 | 7920 | 1320 |
|  | 12 | 11 | 64QAM | 18 | 4736 | 24 | 1 | 1 | 9504 | 1584 |
|  | 15 | 11 | 64QAM | 18 | 6016 | 24 | 1 | 1 | 11880 | 1980 |
|  | 18 | 11 | 64QAM | 18 | 7168 | 24 | 1 | 1 | 14256 | 2376 |
|  | 24 | 11 | 64QAM | 18 | 9480 | 24 | 1 | 2 | 19008 | 3168 |
|  | 25 | 11 | 64QAM | 18 | 9992 | 24 | 1 | 2 | 19800 | 3300 |
|  | 30 | 11 | 64QAM | 18 | 12040 | 24 | 1 | 2 | 23760 | 3960 |
|  | 32 | 11 | 64QAM | 18 | 12808 | 24 | 1 | 2 | 25344 | 4224 |
|  | 36 | 11 | 64QAM | 18 | 14344 | 24 | 1 | 2 | 28512 | 4752 |
|  | 45 | 11 | 64QAM | 18 | 17928 | 24 | 1 | 3 | 35640 | 5940 |
|  | 50 | 11 | 64QAM | 18 | 19968 | 24 | 1 | 3 | 39600 | 6600 |
|  | 60 | 11 | 64QAM | 18 | 24072 | 24 | 1 | 3 | 47520 | 7920 |
|  | 64 | 11 | 64QAM | 18 | 25608 | 24 | 1 | 4 | 50688 | 8448 |
|  | 75 | 11 | 64QAM | 18 | 30216 | 24 | 1 | 4 | 59400 | 9900 |
|  | 80 | 11 | 64QAM | 18 | 31752 | 24 | 1 | 4 | 63360 | 10560 |
|  | 81 | 11 | 64QAM | 18 | 32264 | 24 | 1 | 4 | 64152 | 10692 |
|  | 90 | 11 | 64QAM | 18 | 35856 | 24 | 1 | 5 | 71280 | 11880 |
|  | 100 | 11 | 16QAM | 10 | 17424 | 24 | 1 | 3 | 52800 | 13200 |
| 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 TS 38.214 [14].  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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### A.2.2.5 Void

### A.2.2.6 CP-OFDM QPSK

Table A.2.2.6-1: Reference Channels for CP-OFDM QPSK

| Parameter | Allocated resource blocks (LCRB) | CP-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 |
|  | 5 | 11 | QPSK | 2 | 256 | 16 | 2 | 1 | 1320 | 660 |
|  | 6 | 11 | QPSK | 2 | 304 | 16 | 2 | 1 | 1584 | 792 |
|  | 9 | 11 | QPSK | 2 | 456 | 16 | 2 | 1 | 2376 | 1188 |
|  | 10 | 11 | QPSK | 2 | 504 | 16 | 2 | 1 | 2640 | 1320 |
|  | 11 | 11 | QPSK | 2 | 552 | 16 | 2 | 1 | 2904 | 1452 |
|  | 12 | 11 | QPSK | 2 | 608 | 16 | 2 | 1 | 3168 | 1584 |
|  | 13 | 11 | QPSK | 2 | 672 | 16 | 2 | 1 | 3432 | 1716 |
|  | 15 | 11 | QPSK | 2 | 768 | 16 | 2 | 1 | 3960 | 1980 |
|  | 16 | 11 | QPSK | 2 | 808 | 16 | 2 | 1 | 4224 | 2112 |
|  | 18 | 11 | QPSK | 2 | 928 | 16 | 2 | 1 | 4752 | 2376 |
|  | 19 | 11 | QPSK | 2 | 984 | 16 | 2 | 1 | 5016 | 2508 |
|  | 24 | 11 | QPSK | 2 | 1192 | 16 | 2 | 1 | 6336 | 3168 |
|  | 25 | 11 | QPSK | 2 | 1256 | 16 | 2 | 1 | 6600 | 3300 |
|  | 26 | 11 | QPSK | 2 | 1288 | 16 | 2 | 1 | 6864 | 3432 |
|  | 31 | 11 | QPSK | 2 | 1544 | 16 | 2 | 1 | 8184 | 4092 |
|  | 33 | 11 | QPSK | 2 | 1672 | 16 | 2 | 1 | 8712 | 4356 |
|  | 38 | 11 | QPSK | 2 | 1928 | 16 | 2 | 1 | 10032 | 5016 |
|  | 39 | 11 | QPSK | 2 | 2024 | 16 | 2 | 1 | 10296 | 5148 |
|  | 40 | 11 | QPSK | 2 | 2024 | 16 | 2 | 1 | 10560 | 5280 |
|  | 47 | 11 | QPSK | 2 | 2408 | 16 | 2 | 1 | 12408 | 6204 |
|  | 51 | 11 | QPSK | 2 | 2536 | 16 | 2 | 1 | 13464 | 6732 |
|  | 52 | 11 | QPSK | 2 | 2600 | 16 | 2 | 1 | 13728 | 6864 |
|  | 53 | 11 | QPSK | 2 | 2664 | 16 | 2 | 1 | 13992 | 6996 |
|  | 54 | 11 | QPSK | 2 | 2664 | 16 | 2 | 1 | 14256 | 7128 |
|  | 61 | 11 | QPSK | 2 | 3104 | 16 | 2 | 1 | 16104 | 8052 |
|  | 65 | 11 | QPSK | 2 | 3240 | 16 | 2 | 1 | 17160 | 8580 |
|  | 67 | 11 | QPSK | 2 | 3368 | 16 | 2 | 1 | 17688 | 8844 |
|  | 68 | 11 | QPSK | 2 | 3368 | 16 | 2 | 1 | 17952 | 8976 |
|  | 78 | 11 | QPSK | 2 | 3848 | 24 | 2 | 2 | 20592 | 10296 |
|  | 79 | 11 | QPSK | 2 | 3912 | 24 | 2 | 2 | 20856 | 10428 |
|  | 80 | 11 | QPSK | 2 | 3976 | 24 | 2 | 2 | 21120 | 10560 |
|  | 81 | 11 | QPSK | 2 | 4040 | 24 | 2 | 2 | 21384 | 10692 |
|  | 93 | 11 | QPSK | 2 | 4616 | 24 | 2 | 2 | 24552 | 12276 |
|  | 95 | 11 | QPSK | 2 | 4744 | 24 | 2 | 2 | 25080 | 12540 |
|  | 106 | 11 | QPSK | 2 | 5256 | 24 | 2 | 2 | 27984 | 13992 |
| 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 TS 38.214 [14].  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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### A.2.2.7 CP-OFDM 16QAM

Table A.2.2.7-1: Reference Channels for CP-OFDM 16QAM

| Parameter | Allocated resource blocks (LCRB) | CP-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 |
|  | 5 | 11 | 16QAM | 10 | 888 | 16 | 2 | 1 | 2640 | 660 |
|  | 6 | 11 | 16QAM | 10 | 1064 | 16 | 2 | 1 | 3168 | 792 |
|  | 9 | 11 | 16QAM | 10 | 1608 | 16 | 2 | 1 | 4752 | 1188 |
|  | 10 | 11 | 16QAM | 10 | 1800 | 16 | 2 | 1 | 5280 | 1320 |
|  | 11 | 11 | 16QAM | 10 | 1928 | 16 | 2 | 1 | 5808 | 1452 |
|  | 12 | 11 | 16QAM | 10 | 2088 | 16 | 2 | 1 | 6336 | 1584 |
|  | 13 | 11 | 16QAM | 10 | 2280 | 16 | 2 | 1 | 6864 | 1716 |
|  | 15 | 11 | 16QAM | 10 | 2664 | 16 | 2 | 1 | 7920 | 1980 |
|  | 16 | 11 | 16QAM | 10 | 2792 | 16 | 2 | 1 | 8448 | 2112 |
|  | 18 | 11 | 16QAM | 10 | 3240 | 16 | 2 | 1 | 9504 | 2376 |
|  | 19 | 11 | 16QAM | 10 | 3368 | 16 | 2 | 1 | 10032 | 2508 |
|  | 24 | 11 | 16QAM | 10 | 4224 | 24 | 1 | 1 | 12672 | 3168 |
|  | 25 | 11 | 16QAM | 10 | 4352 | 24 | 1 | 1 | 13200 | 3300 |
|  | 26 | 11 | 16QAM | 10 | 4480 | 24 | 1 | 1 | 13728 | 3432 |
|  | 31 | 11 | 16QAM | 10 | 5376 | 24 | 1 | 1 | 16368 | 4092 |
|  | 33 | 11 | 16QAM | 10 | 5760 | 24 | 1 | 1 | 17424 | 4356 |
|  | 38 | 11 | 16QAM | 10 | 6656 | 24 | 1 | 1 | 20064 | 5016 |
|  | 39 | 11 | 16QAM | 10 | 6784 | 24 | 1 | 1 | 20592 | 5148 |
|  | 40 | 11 | 16QAM | 10 | 7040 | 24 | 1 | 1 | 21120 | 5280 |
|  | 47 | 11 | 16QAM | 10 | 8192 | 24 | 1 | 1 | 24816 | 6204 |
|  | 51 | 11 | 16QAM | 10 | 8968 | 24 | 1 | 2 | 26928 | 6732 |
|  | 52 | 11 | 16QAM | 10 | 9224 | 24 | 1 | 2 | 27456 | 6864 |
|  | 53 | 11 | 16QAM | 10 | 9224 | 24 | 1 | 2 | 27984 | 6996 |
|  | 54 | 11 | 16QAM | 10 | 9480 | 24 | 1 | 2 | 28512 | 7128 |
|  | 61 | 11 | 16QAM | 10 | 10760 | 24 | 1 | 2 | 32208 | 8052 |
|  | 65 | 11 | 16QAM | 10 | 11272 | 24 | 1 | 2 | 34320 | 8580 |
|  | 67 | 11 | 16QAM | 10 | 11784 | 24 | 1 | 2 | 35376 | 8844 |
|  | 68 | 11 | 16QAM | 10 | 11784 | 24 | 1 | 2 | 35904 | 8976 |
|  | 78 | 11 | 16QAM | 10 | 13576 | 24 | 1 | 2 | 41184 | 10296 |
|  | 79 | 11 | 16QAM | 10 | 13832 | 24 | 1 | 2 | 41712 | 10428 |
|  | 80 | 11 | 16QAM | 10 | 14088 | 24 | 1 | 2 | 42240 | 10560 |
|  | 81 | 11 | 16QAM | 10 | 14088 | 24 | 1 | 2 | 42768 | 10692 |
|  | 93 | 11 | 16QAM | 10 | 16392 | 24 | 1 | 2 | 49404 | 12276 |
|  | 95 | 11 | 16QMA | 10 | 16392 | 24 | 1 | 2 | 50160 | 12540 |
|  | 106 | 11 | 16QAM | 10 | 18432 | 24 | 1 | 3 | 55968 | 13992 |
| 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 TS 38.214 [14].  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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### A.2.2.8 CP-OFDM 64QAM

Table A.2.2.8-1: Reference Channels for CP-OFDM 64QAM

| Parameter | Allocated resource blocks (LCRB) | CP-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 |
|  | 5 | 11 | 64QAM | 19 | 2024 | 16 | 2 | 1 | 3960 | 660 |
|  | 9 | 11 | 64QAM | 19 | 3624 | 16 | 2 | 1 | 7128 | 1188 |
|  | 10 | 11 | 64QAM | 19 | 3968 | 24 | 1 | 1 | 7920 | 1320 |
|  | 11 | 11 | 64QAM | 19 | 4352 | 24 | 1 | 1 | 8712 | 1452 |
|  | 12 | 11 | 64QAM | 19 | 4736 | 24 | 1 | 1 | 9504 | 1584 |
|  | 13 | 11 | 64QAM | 19 | 5120 | 24 | 1 | 1 | 10296 | 1716 |
|  | 15 | 11 | 64QAM | 19 | 6016 | 24 | 1 | 1 | 11880 | 1980 |
|  | 18 | 11 | 64QAM | 19 | 7168 | 24 | 1 | 1 | 14256 | 2376 |
|  | 19 | 11 | 64QAM | 19 | 7552 | 24 | 1 |  | 15048 | 2508 |
|  | 24 | 11 | 64QAM | 19 | 9480 | 24 | 1 | 2 | 19008 | 3168 |
|  | 25 | 11 | 64QAM | 19 | 9992 | 24 | 1 | 2 | 19800 | 3300 |
|  | 26 | 11 | 64QAM | 19 | 10504 | 24 | 1 | 2 | 20592 | 3432 |
|  | 31 | 11 | 64QAM | 19 | 12296 | 24 | 1 | 2 | 24552 | 4092 |
|  | 33 | 11 | 64QAM | 19 | 13064 | 24 | 1 | 2 | 26136 | 4356 |
|  | 38 | 11 | 64QAM | 19 | 15112 | 24 | 1 | 2 | 30096 | 5016 |
|  | 39 | 11 | 64QAM | 19 | 15624 | 24 | 1 | 2 | 30888 | 5148 |
|  | 47 | 11 | 64QAM | 19 | 18960 | 24 | 1 | 3 | 37224 | 6204 |
|  | 51 | 11 | 64QAM | 19 | 20496 | 24 | 1 | 3 | 40392 | 6732 |
|  | 52 | 11 | 64QAM | 19 | 21000 | 24 | 1 | 3 | 41184 | 6864 |
|  | 53 | 11 | 64QAM | 19 | 21000 | 24 | 1 | 3 | 41976 | 6996 |
|  | 61 | 11 | 64QAM | 19 | 24567 | 24 | 1 | 3 | 48312 | 8052 |
|  | 65 | 11 | 64QAM | 19 | 26120 | 24 | 1 | 4 | 51480 | 8580 |
|  | 67 | 11 | 64QAM | 19 | 26632 | 24 | 1 | 4 | 53064 | 8844 |
|  | 78 | 11 | 64QAM | 19 | 31240 | 24 | 1 | 4 | 61776 | 10296 |
|  | 79 | 11 | 64QAM | 19 | 31752 | 24 | 1 | 4 | 62568 | 10428 |
|  | 80 | 11 | 64QAM | 19 | 31752 | 24 | 1 | 4 | 63360 | 10560 |
|  | 81 | 11 | 64QAM | 19 | 32264 | 24 | 1 | 4 | 64152 | 10692 |
|  | 93 | 11 | 64QAM | 19 | 36896 | 24 | 1 | 5 | 73656 | 12276 |
|  | 95 | 11 | 64QAM | 19 | 37896 | 24 | 1 | 5 | 75240 | 12540 |
|  | 106 | 11 | 64QAM | 19 | 42016 | 24 | 1 | 5 | 83952 | 13992 |
| 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 TS 38.214 [14].  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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### A.2.2.9 Void

## A.2.3 Reference measurement channels for FR2-NTN FDD

### 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 |  |  | Bits9 |  |
|  | 1 | 11 | pi/2 BPSK | 0 | 24 | 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 |
|  | 60 | 11 | pi/2 BPSK | 0 | 1864 | 16 | 2 | 1 | 7920 | 7920 |
|  | 64 | 11 | pi/2 BPSK | 0 | 2024 | 16 | 2 | 1 | 8448 | 8448 |
|  | 120 | 11 | pi/2 BPSK | 0 | 3752 | 16 | 2 | 1 | 15840 | 15840 |
|  | 128 | 11 | pi/2 BPSK | 0 | 3976 | 24 | 2 | 2 | 16896 | 16896 |
|  | 144 | 11 | pi/2 BPSK | 0 | 4488 | 24 | 2 | 2 | 19008 | 19008 |
|  | 243 | 11 | pi/2 BPSK | 0 | 7560 | 24 | 2 | 2 | 32076 | 32076 |
|  | 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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### 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 |
|  | 60 | 11 | QPSK | 2 | 2976 | 16 | 2 | 1 | 15840 | 7920 |
|  | 64 | 11 | QPSK | 2 | 3240 | 16 | 2 | 1 | 16896 | 8448 |
|  | 120 | 11 | QPSK | 2 | 5896 | 24 | 2 | 2 | 31680 | 15840 |
|  | 128 | 11 | QPSK | 2 | 6408 | 24 | 2 | 2 | 33792 | 16896 |
|  | 144 | 11 | QPSK | 2 | 7176 | 24 | 2 | 2 | 38016 | 19008 |
|  | 243 | 11 | QPSK | 2 | 12040 | 24 | 2 | 4 | 64152 | 32076 |
|  | 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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### 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 |
|  | 60 | 11 | 16QAM | 10 | 10504 | 24 | 1 | 2 | 31680 | 7920 |
|  | 64 | 11 | 16QAM | 10 | 11272 | 24 | 1 | 2 | 33792 | 8448 |
|  | 120 | 11 | 16QAM | 10 | 21000 | 24 | 1 | 3 | 63360 | 15840 |
|  | 128 | 11 | 16QAM | 10 | 22536 | 24 | 1 | 3 | 67584 | 16896 |
|  | 144 | 11 | 16QAM | 10 | 25104 | 24 | 1 | 3 | 76032 | 19008 |
|  | 243 | 11 | 16QAM | 10 | 43032 | 24 | 1 | 6 | 128304 | 32076 |
|  | 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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### 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 |
|  | 60 | 11 | 64QAM | 18 | 24072 | 24 | 1 | 3 | 47520 | 7920 |
|  | 64 | 11 | 64QAM | 18 | 25608 | 24 | 1 | 4 | 50688 | 8448 |
|  | 120 | 11 | 64QAM | 18 | 48168 | 24 | 1 | 6 | 95040 | 15840 |
|  | 128 | 11 | 64QAM | 18 | 51216 | 24 | 1 | 7 | 101376 | 16896 |
|  | 144 | 11 | 64QAM | 18 | 57376 | 24 | 1 | 7 | 114048 | 19008 |
|  | 243 | 11 | 64QAM | 18 | 96264 | 24 | 1 | 12 | 192456 | 32076 |
|  | 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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### 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 |
|  | 62 | 11 | QPSK | 2 | 3104 | 16 | 2 | 1 | 16368 | 8184 |
|  | 66 | 11 | QPSK | 2 | 3368 | 16 | 2 | 1 | 17424 | 8712 |
|  | 124 | 11 | QPSK | 2 | 6152 | 24 | 2 | 2 | 32736 | 16368 |
|  | 132 | 11 | QPSK | 2 | 6536 | 24 | 2 | 2 | 34848 | 17424 |
|  | 148 | 11 | QPSK | 2 | 7304 | 24 | 2 | 2 | 39072 | 19536 |
|  | 248 | 11 | QPSK | 2 | 12296 | 24 | 2 | 4 | 65472 | 32736 |
|  | 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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### 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 |
|  | 62 | 11 | 16QAM | 10 | 10760 | 24 | 1 | 2 | 32736 | 8184 |
|  | 66 | 11 | 16QAM | 10 | 11528 | 24 | 1 | 2 | 34848 | 8712 |
|  | 124 | 11 | 16QAM | 10 | 21504 | 24 | 1 | 3 | 65472 | 16368 |
|  | 132 | 11 | 16QAM | 10 | 23040 | 24 | 1 | 3 | 69696 | 17424 |
|  | 148 | 11 | 16QAM | 10 | 26120 | 24 | 1 | 4 | 78144 | 19536 |
|  | 248 | 11 | 16QAM | 10 | 43032 | 24 | 1 | 6 | 130944 | 32736 |
|  | 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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

### 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 |
|  | 62 | 11 | 64QAM | 19 | 24576 | 24 | 1 | 3 | 49104 | 8184 |
|  | 66 | 11 | 64QAM | 19 | 26120 | 24 | 1 | 4 | 52272 | 8712 |
|  | 124 | 11 | 64QAM | 19 | 49176 | 24 | 1 | 6 | 98208 | 16368 |
|  | 132 | 11 | 64QAM | 19 | 53288 | 24 | 1 | 7 | 104544 | 17424 |
|  | 148 | 11 | 64QAM | 19 | 59432 | 24 | 1 | 8 | 117216 | 19536 |
|  | 248 | 11 | 64QAM | 19 | 98376 | 24 | 1 | 12 | 196416 | 32736 |
|  | 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: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

# A.3 DL reference measurement channels

## A.3.1 General

The transport block size (TBS) determination procedure is described in sub-clause 5.1.3.2 of TS 38.214 [12].

Unless otherwise stated, no user data is scheduled on slot #0 within 20 ms in order to avoid SSB and PDSCH transmissions in one slot and simplify test configuration.

## A.3.2 Reference measurement channels for PDSCH performance requirements

For PDSCH reference channels 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).

### A.3.2.1 FDD

#### A.3.2.1.1 Reference measurement channels for SCS 15 kHz FR1

Table A.3.2.1.1-1: PDSCH Reference Channel for FDD (QPSK)

| Parameter | Unit | Value | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| Reference channel |  | R.PDSCH.1-1.1 FDD |  |  |  |  |
| Channel bandwidth | MHz | 10 |  |  |  |  |
| Subcarrier spacing | kHz | 15 |  |  |  |  |
| Number of allocated resource blocks | PRBs | 52 |  |  |  |  |
| Number of consecutive PDSCH symbols |  | 12 |  |  |  |  |
| Allocated slots per 2 frames | Slots | 19 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.30 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |
| For Slots i = 1,…, 19 | Bits | 4096 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |
| For Slots i = 1,…, 19 | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
| For Slot i = 0 | CBs | N/A |  |  |  |  |
| For Slots i = 1,…, 19 | CBs | 1 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |
| For Slots i = 10, 11 | Bits | 13104 |  |  |  |  |
| For Slots i =1,…, 9, 12, …, 19 | Bits | 13728 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 3.891 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms  Note 2: Slot i is slot index per 2 frames | | | | | | |

Table A.3.2.1.1-2: PDSCH Reference Channel for FDD (16QAM)

| Parameter | Unit | Value | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel |  | R.PDSCH.1-2.1 FDD |  |  |  |  |  |
| Channel bandwidth | MHz | 10 |  |  |  |  |  |
| Subcarrier spacing | kHz | 15 |  |  |  |  |  |
| Number of allocated resource blocks | PRBs | 52 |  |  |  |  |  |
| Number of consecutive PDSCH symbols |  | 12 |  |  |  |  |  |
| Allocated slots per 2 frames | Slots | 19 |  |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |  |
| MCS index |  | 13 |  |  |  |  |  |
| Modulation |  | 16QAM |  |  |  |  |  |
| Target Coding Rate |  | 0.48 |  |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |  |
| Number of DMRS REs |  | 12 |  |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |  |
| For Slots i = 1,…, 19 | Bits | 13064 |  |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |  |
| For Slots i = 1,…, 19 | Bits | 24 |  |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |
| For Slot i = 0 | CBs | N/A |  |  |  |  |  |
| For Slots i = 1,…, 19 | CBs | 2 |  |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |  |
| For Slots i = 10, 11 | Bits | 26208 |  |  |  |  |  |
| For Slots i = 1,…, 9, 12, …, 19 | Bits | 27456 |  |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 12.411 |  |  |  |  |  |
| NOTE 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms  NOTE 2: Slot i is slot index per 2 frames | | | | | | | |

#### A.3.2.1.2 Reference measurement channels for SCS 60 kHz FR2-NTN

Editor’s note: RMC for performance requirements is not defined yet.

Table A.3.2.1.2-1: Void

Table A.3.2.1.2-2: Void

Table A.3.2.1.2-3: Void

#### A.3.2.1.3 Reference measurement channels for SCS 120 kHz FR2-NTN

Table A.3.2.1.3-1: Void

Table A.3.2.1.3-2: Void

Table A.3.2.1.3-3: PDSCH Reference Channel for FDD (QPSK)

| Parameter | Unit | Value | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| Reference channel |  | R.PDSCH.3-3.1 FDD |  |  |  |  |
| Channel bandwidth | MHz | 200 |  |  |  |  |
| Subcarrier spacing | kHz | 120 |  |  |  |  |
| Number of allocated resource blocks | PRBs | 132 |  |  |  |  |
| Number of consecutive PDSCH symbols |  | 13 |  |  |  |  |
| Allocated slots per 2 frames | Slots | 159 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.30 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |
| For Slots i = 1,…, 159 | Bits | 11528 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |
| For Slots i = 1,…, 159 | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
| For Slot i = 0 | CBs | N/A |  |  |  |  |
| For Slots i = 1,…, 159 | CBs | 2 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |
| For Slots i = 80, 81 | Bits | 36432 |  |  |  |  |
| For Slots i =1,…, 79, 82, …, 159 | Bits | 38016 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 91.648 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms  Note 2: Slot i is slot index per 2 frames | | | | | | |

Table A.3.2.1.3-4: PDSCH Reference Channel for FDD (16QAM)

| Parameter | Unit | Value | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| Reference channel |  | R.PDSCH.3-4.1 FDD |  |  |  |  |
| Channel bandwidth | MHz | 200 |  |  |  |  |
| Subcarrier spacing | kHz | 120 |  |  |  |  |
| Number of allocated resource blocks | PRBs | 132 |  |  |  |  |
| Number of consecutive PDSCH symbols |  | 13 |  |  |  |  |
| Allocated slots per 2 frames | Slots | 159 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 13 |  |  |  |  |
| Modulation |  | 16QAM |  |  |  |  |
| Target Coding Rate |  | 0.48 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |
| For Slots i = 1,…, 159 | Bits | 36896 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |
| For Slots i = 1,…, 159 | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
| For Slot i = 0 | CBs | N/A |  |  |  |  |
| For Slots i = 1,…, 159 | CBs | 5 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A |  |  |  |  |
| For Slots i = 80, 81 | Bits | 72864 |  |  |  |  |
| For Slots i =1,…, 79, 82, …, 159 | Bits | 76032 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 293.323 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms  Note 2: Slot i is slot index per 2 frames | | | | | | |

Table A.3.2.1.3-5: Void

## A.3.3 Reference measurement channels for PDCCH performance requirements

### A.3.3.1 FDD

#### A.3.3.1.1 Reference measurement channels for SCS 120 kHz FR2-NTN

Table A.3.3.1.1-1: PDCCH Reference Channels

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | |
| Reference channel |  | R.PDCCH.1-1.1 FDD | R.PDCCH.1-1.2 FDD |
| Subcarrier spacing | kHz | 120 | 120 |
| CORESET frequency domain allocation |  | 132 | 132 |
| CORESET time domain allocation |  | 1 | 2 |
| Aggregation level |  | 8 | 16 |
| DCI Format |  | 1\_0 | 1\_1 |
| Payload (without CRC) | Bits | 42 | 56 |

## A.3.4 Reference measurement channels for receiver requirements

### A.3.4.1 FDD

#### A.3.4.1.1 Fixed reference channels for SCS 15kHz FR1-NTN

In addition to general description, no user data is scheduled on slot #1 within 20 ms in order to avoid SIB and PDSCH transmissions in one slot and simplify test configuration.

Table A.3.4.1.1-1: Fixed reference channel for receiver requirements (SCS 15kHz, FDD, QPSK 1/3, NGSO)

| Parameter | Unit | Value | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel bandwidth | MHz | 5 | 10 | 15 | 20 |  |  |  |  |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 |  |  |  |  |
| Subcarrier spacing configuration |  | 0 | 0 | 0 | 0 |  |  |  |  |
| Allocated resource blocks |  | 25 | 52 | 79 | 106 |  |  |  |  |
| Subcarriers per resource block |  | 12 | 12 | 12 | 12 |  |  |  |  |
| Allocated slots per 2 frames |  | 16 | 16 | 16 | 16 |  |  |  |  |
| MCS Index |  | 4 | 4 | 4 | 4 |  |  |  |  |
| MCS Table for TBS determination |  | 64QAM | | | |  |  |  |  |
| Modulation |  | QPSK | QPSK | QPSK | QPSK |  |  |  |  |
| Target Coding Rate |  | 1/3 | 1/3 | 1/3 | 1/3 |  |  |  |  |
| Maximum number of HARQ transmissions |  | 1 | 1 | 1 | 1 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11 | Bits | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | Bits | 1672 | 3368 | 5120 | 6912 |  |  |  |  |
| Transport block CRC | Bits | 16 | 16 | 24 | 24 |  |  |  |  |
| LDPC base graph |  | 2 | 2 | 1 | 1 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11 | CBs | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | CBs | 1 | 1 | 1 | 1 |  |  |  |  |
| Binary Channel Bits per Slot |  |  |  |  |  |  |  |  |  |
| For Slots0, 1, 10, 11 | Bits | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | Bits | 5400 | 11232 | 17064 | 22896 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 1.338 | 2.694 | 4.096 | 5.530 |  |  |  |  |
| Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].  Note 2: 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 3: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms.  Note 4: Slot i is slot index per 2 frames.  Note 5: PDSCHs are scheduled from 1st frame of the periodicity. | | | | | | | | | |

Table A.3.4.1.1-2: Fixed reference channel for receiver requirements (SCS 15kHz, FDD, 64QAM, NGSO)

| Parameter | Unit | Value | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel bandwidth | MHz | 5 | 10 | 15 | 20 |  |  |  |  |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 |  |  |  |  |
| Subcarrier spacing configuration |  | 0 | 0 | 0 | 0 |  |  |  |  |
| Allocated resource blocks |  | 25 | 52 | 79 | 106 |  |  |  |  |
| Subcarriers per resource block |  | 12 | 12 | 12 | 12 |  |  |  |  |
| Allocated slots per 2 frames |  | 16 | 16 | 16 | 16 |  |  |  |  |
| MCS Index |  | 24 | 24 | 24 | 24 |  |  |  |  |
| MCS Table for TBS determination |  | 64QAM | | | |  |  |  |  |
| Modulation |  | 64 QAM | 64 QAM | 64 QAM | 64 QAM |  |  |  |  |
| Target Coding Rate |  | 3/4 | 3/4 | 3/4 | 3/4 |  |  |  |  |
| Maximum number of HARQ transmissions |  | 1 | 1 | 1 | 1 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11 | Bits | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | Bits | 12296 | 25608 | 38936 | 52224 |  |  |  |  |
| Transport block CRC | Bits | 24 | 24 | 24 | 24 |  |  |  |  |
| LDPC base graph |  | 1 | 1 | 1 | 1 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11 | CBs | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | CBs | 2 | 4 | 5 | 7 |  |  |  |  |
| Binary Channel Bits per Slot |  |  |  |  |  |  |  |  |  |
| For Slots0, 1, 10, 11 | Bits | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | Bits | 16200 | 33696 | 51192 | 68688 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 9.837 | 20.486 | 31.149 | 41.779 |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].  NOTE 2: 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 3: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms.  NOTE 4: Slot i is slot index per 2 frames.  NOTE 5: PDSCHs are scheduled from 1st frame of the periodicity. | | | | | | | | | |

Table A.3.4.1.1-3: Fixed reference channel for receiver requirements (SCS 15kHz, FDD, QPSK 1/3, GSO)

| Parameter | Unit | Value | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel bandwidth | MHz | 5 | 10 | 15 | 20 |  |  |  |  |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 |  |  |  |  |
| Subcarrier spacing configuration |  | 0 | 0 | 0 | 0 |  |  |  |  |
| Allocated resource blocks |  | 25 | 52 | 79 | 106 |  |  |  |  |
| Subcarriers per resource block |  | 12 | 12 | 12 | 12 |  |  |  |  |
| Allocated slots per 32 frames |  | 16 | 16 | 16 | 16 |  |  |  |  |
| MCS Index |  | 4 | 4 | 4 | 4 |  |  |  |  |
| MCS Table for TBS determination |  | 64QAM | | | |  |  |  |  |
| Modulation |  | QPSK | QPSK | QPSK | QPSK |  |  |  |  |
| Target Coding Rate |  | 1/3 | 1/3 | 1/3 | 1/3 |  |  |  |  |
| Maximum number of HARQ transmissions |  | 1 | 1 | 1 | 1 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, …, 319 | Bits | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | Bits | 1672 | 3368 | 5120 | 6912 |  |  |  |  |
| Transport block CRC | Bits | 16 | 16 | 24 | 24 |  |  |  |  |
| LDPC base graph |  | 2 | 2 | 1 | 1 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, …, 319 | CBs | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | CBs | 1 | 1 | 1 | 1 |  |  |  |  |
| Binary Channel Bits per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, …, 319 | Bits | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | Bits | 5400 | 11232 | 17064 | 22896 |  |  |  |  |
| Max. Throughput averaged over 32 frames | Mbps | 0.084 | 0.168 | 0.256 | 0.346 |  |  |  |  |
| Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].  Note 2: 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 3: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms.  Note 4: Slot i is slot index per 32 frames.  Note 5: PDSCHs are scheduled from 1st frame of the periodicity. | | | | | | | | | |

Table A.3.4.1.1-4: Fixed reference channel for receiver requirements (SCS 15kHz, FDD, 64QAM, GSO)

| Parameter | Unit | Value | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel bandwidth | MHz | 5 | 10 | 15 | 20 |  |  |  |  |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 |  |  |  |  |
| Subcarrier spacing configuration |  | 0 | 0 | 0 | 0 |  |  |  |  |
| Allocated resource blocks |  | 25 | 52 | 79 | 106 |  |  |  |  |
| Subcarriers per resource block |  | 12 | 12 | 12 | 12 |  |  |  |  |
| Allocated slots per 32 frames |  | 16 | 16 | 16 | 16 |  |  |  |  |
| MCS Index |  | 24 | 24 | 24 | 24 |  |  |  |  |
| MCS Table for TBS determination |  | 64QAM | | | |  |  |  |  |
| Modulation |  | 64 QAM | 64 QAM | 64 QAM | 64 QAM |  |  |  |  |
| Target Coding Rate |  | 3/4 | 3/4 | 3/4 | 3/4 |  |  |  |  |
| Maximum number of HARQ transmissions |  | 1 | 1 | 1 | 1 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, …, 319 | Bits | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | Bits | 12296 | 25608 | 38936 | 52224 |  |  |  |  |
| Transport block CRC | Bits | 24 | 24 | 24 | 24 |  |  |  |  |
| LDPC base graph |  | 1 | 1 | 1 | 1 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, …, 319 | CBs | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | CBs | 2 | 4 | 5 | 7 |  |  |  |  |
| Binary Channel Bits per Slot |  |  |  |  |  |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, …, 319 | Bits | N/A | N/A | N/A | N/A |  |  |  |  |
| For Slots 2, …, 9, 12, …, 19 | Bits | 16200 | 33696 | 51192 | 68688 |  |  |  |  |
| Max. Throughput averaged over 32 frames | Mbps | 0.615 | 1.280 | 1.947 | 2.611 |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].  NOTE 2: 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 3: SS/PBCH block is transmitted in slot #0 with 20ms periodicity.  NOTE 4: Slot i is slot index per 32 frames.  NOTE 5: PDSCHs are scheduled from 1st frame of the periodicity. | | | | | | | | | |

#### A.3.4.1.1A Fixed reference channels for SCS 30kHz FR1-NTN

In addition to general description, no user data is scheduled on slot #1 within 20 ms in order to avoid SIB and PDSCH transmissions in one slot and simplify test configuration.

**Table A.3.4.1.1A-1: Fixed reference channel for receiver requirements (SCS 30kHz, FDD, QPSK 1/3, NGSO)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Value | | | | | | |
| Channel bandwidth | MHz | 10 | 15 | 20 |  |  |  |  |
| Subcarrier spacing configuration |  | 1 | 1 | 1 |  |  |  |  |
| Allocated resource blocks |  | 24 | 38 | 51 |  |  |  |  |
| Subcarriers per resource block |  | 12 | 12 | 12 |  |  |  |  |
| Allocated slots per Frame |  | 16 | 16 | 16 |  |  |  |  |
| MCS Index |  | 4 | 4 | 4 |  |  |  |  |
| MCS Table for TBS determination |  | 64QAM | | |  |  |  |  |
| Modulation |  | QPSK | QPSK | QPSK |  |  |  |  |
| Target Coding Rate |  | 1/3 | 1/3 | 1/3 |  |  |  |  |
| Maximum number of HARQ transmissions |  | 1 | 1 | 1 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,39 | Bits | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | Bits | 1608 | 2472 | 3368 |  |  |  |  |
| Transport block CRC | Bits | 16 | 16 | 16 |  |  |  |  |
| LDPC base graph |  | 2 | 2 | 2 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,39 | CBs | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | CBs | 1 | 1 | 1 |  |  |  |  |
| Binary Channel Bits per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,39 | Bits | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | Bits | 5184 | 8208 | 11016 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 1.286 | 1.978 | 2.694 |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].  NOTE 2: 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 3: SS/PBCH block is transmitted in slot #0 of each frame  NOTE 4: Slot i is slot index per 2 frames | | | | | | | | |

**Table A.3.4.1.1A-2: Fixed reference channel for receiver requirements (SCS 30kHz, FDD, 64QAM, NGSO)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | | | | | | |
| Channel bandwidth | MHz | 10 | 15 | 20 |  |  |  |  |
| Subcarrier spacing configuration |  | 1 | 1 | 1 |  |  |  |  |
| Allocated resource blocks |  | 24 | 38 | 51 |  |  |  |  |
| Subcarriers per resource block |  | 12 | 12 | 12 |  |  |  |  |
| Allocated slots per Frame |  | 16 | 16 | 16 |  |  |  |  |
| MCS Index |  | 24 | 24 | 24 |  |  |  |  |
| MCS Table for TBS determination |  | 64QAM | | |  |  |  |  |
| Modulation |  | 64 QAM | 64 QAM | 64 QAM |  |  |  |  |
| Target Coding Rate |  | 3/4 | 3/4 | 3/4 |  |  |  |  |
| Maximum number of HARQ transmissions |  | 1 | 1 | 1 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,39 | Bits | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | Bits | 11784 | 18432 | 25104 |  |  |  |  |
| Transport block CRC | Bits | 24 | 24 | 24 |  |  |  |  |
| LDPC base graph |  | 1 | 1 | 1 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,39 | CBs | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | CBs | 2 | 3 | 3 |  |  |  |  |
| Binary Channel Bits per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,39 | Bits | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | Bits | 15552 | 24624 | 33048 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 9.427 | 14.746 | 20.083 |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].  NOTE 2: 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 3: SS/PBCH block is transmitted in slot #0 of each frame  NOTE 4: Slot i is slot index per 2 frames | | | | | | | | |

**Table A.3.4.1.1A-3: Fixed reference channel for receiver requirements (SCS 30kHz, FDD, QPSK 1/3, GSO)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Value | | | | | | |
| Channel bandwidth | MHz | 10 | 15 | 20 |  |  |  |  |
| Subcarrier spacing configuration |  | 1 | 1 | 1 |  |  |  |  |
| Allocated resource blocks |  | 24 | 38 | 51 |  |  |  |  |
| Subcarriers per resource block |  | 12 | 12 | 12 |  |  |  |  |
| Allocated slots per Frame |  | 16 | 16 | 16 |  |  |  |  |
| MCS Index |  | 4 | 4 | 4 |  |  |  |  |
| MCS Table for TBS determination |  | 64QAM | | |  |  |  |  |
| Modulation |  | QPSK | QPSK | QPSK |  |  |  |  |
| Target Coding Rate |  | 1/3 | 1/3 | 1/3 |  |  |  |  |
| Maximum number of HARQ transmissions |  | 1 | 1 | 1 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,639 | Bits | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | Bits | 1608 | 2472 | 3368 |  |  |  |  |
| Transport block CRC | Bits | 16 | 16 | 16 |  |  |  |  |
| LDPC base graph |  | 2 | 2 | 2 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,639 | CBs | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | CBs | 1 | 1 | 1 |  |  |  |  |
| Binary Channel Bits per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,639 | Bits | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | Bits | 5184 | 8208 | 11016 |  |  |  |  |
| Max. Throughput averaged over 32 frames | Mbps | 0.080 | 0.124 | 0.168 |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].  NOTE 2: 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 3: SS/PBCH block is transmitted in slot #0 of each frame  NOTE 4: Slot i is slot index per 32 frames | | | | | | | | |

**Table A.3.4.1.1A-4: Fixed reference channel for receiver requirements (SCS 30kHz, FDD, 64QAM, GSO)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | | | | | | |
| Channel bandwidth | MHz | 10 | 15 | 20 |  |  |  |  |
| Subcarrier spacing configuration |  | 1 | 1 | 1 |  |  |  |  |
| Allocated resource blocks |  | 24 | 38 | 51 |  |  |  |  |
| Subcarriers per resource block |  | 12 | 12 | 12 |  |  |  |  |
| Allocated slots per Frame |  | 16 | 16 | 16 |  |  |  |  |
| MCS Index |  | 24 | 24 | 24 |  |  |  |  |
| MCS Table for TBS determination |  | 64QAM | | |  |  |  |  |
| Modulation |  | 64 QAM | 64 QAM | 64 QAM |  |  |  |  |
| Target Coding Rate |  | 3/4 | 3/4 | 3/4 |  |  |  |  |
| Maximum number of HARQ transmissions |  | 1 | 1 | 1 |  |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,639 | Bits | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | Bits | 11784 | 18432 | 25104 |  |  |  |  |
| Transport block CRC | Bits | 24 | 24 | 24 |  |  |  |  |
| LDPC base graph |  | 1 | 1 | 1 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,639 | CBs | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | CBs | 2 | 3 | 3 |  |  |  |  |
| Binary Channel Bits per Slot |  |  |  |  |  |  |  |  |
| For Slots 0,1,2,3, 20,…,639 | Bits | N/A | N/A | N/A |  |  |  |  |
| For Slots 4,…,19 | Bits | 15552 | 24624 | 33048 |  |  |  |  |
| Max. Throughput averaged over 32 frames | Mbps | 0.589 | 0.922 | 1.255 |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].  NOTE 2: 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 3: SS/PBCH block is transmitted in slot #0 of each frame  NOTE 4: Slot i is slot index per 32 frames | | | | | | | | |

#### A.3.4.1.1B Fixed reference channels for SCS 60kHz FR1-NTN

<<End of change >>