**3GPP TSG- Meeting #**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** |  | **rev** | 1 | **Current version:** |  |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:*** |  | | | | | | | | | |
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| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of CSI-RS based PMI reporting test for non-BL UEs. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduction of CSI-RS based PMI reporting test for non-BL UEs.  Introduction of new FRC R.108 for PMI reporting. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | CSI-RS based PMI reporting performance cannot be verified . | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 9.8.5 (new), A.3.1.1, A.3.3.3.2, A.3.4.3.5 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS36.521-1 ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

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

### 9.8.5 PMI reporting with PUCCH 1-1 (CSI Reference Symbol)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements are specified in terms of the ratio

In the definition of γ, tue is [70]% of the maximum throughput obtained at SNRfollow using the precoders configured according to the UE reports, and trnd is the throughput measured at SNRfollow with random precoding.

#### 9.8.5.1 FDD

For the parameters specified in Table 9.8.5.1-1 and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.8.5.1-2.

Table 9.8.5.1-1 PMI test for single-layer (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 9 |
| Propagation channel | |  | EPA5 |
| Precoding granularity | | PRB | 6 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| σ | dB | -3 |
| δ | dB | 0 |
|  | | dB[mW/15kHz] | -98 |
| Correlation and antenna configuration | |  | High XP 8 x 2 |
| Beamforming model | |  | Annex B.4.3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,22 |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/1 |
| CSI-RS reference signal configuration | |  | 0 |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 001F FFE0 0000 0000 FFFF |
| Reporting mode | |  | PUCCH 1-1 submode1 |
| Reporting interval | | ms | 5 |
| PMI delay (Note 2) | | ms | 10 |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note 3) |
| PUCCH Report Type for CQI/second PMI | |  | 2b |
| PUCCH Report Type for RI/ first PMI | |  | 2a |
| *cqi-pmi-ConfigurationIndex* | |  | 4 |
| Measurement channel | |  | R.108 FDD |
| OCNG Pattern | |  | OP.1 FDD |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| ce-csi-rs-feedback-config | |  | Configured |
| Frequency hopping | |  | Disabled |
| Frequency hopping inverval  (interval-FDD) | |  | N/A |
| Starting OFDM symbol (startSymbolBR) | |  | 3 |
| PDSCH repetition level | |  | 1 |
| MPDCCH repetition level | |  | 1 |
| Beamforming Precoder for MPDCCH | |  | No precoding |
| Precoder update granularity for MPDCCH | |  | N/A |
| BL/CE DL subframe comfiguration (fdd-DownlinkOrTddSubframeBitmapBR) | |  | 1111111111 |
| Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.  Note 4: PDSCH \_RA = 0dB, PDSCH\_RB = 0dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.  Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4 | | | |

Table 9.8.5.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
| *g* | [1.2] |
| UE Category | ≥1 |

#### 9.8.5.2 TDD

For the parameters specified in Table 9.8.5.2-1 and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.8.5.2-2.

Table 9.8.5.2-1 PMI test for single-layer (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 9 |
| Uplink downlink configuration | |  | 1 |
| Special subframe configuration | |  | 4 |
| Propagation channel | |  | EPA5 |
| Precoding granularity | | PRB | 6 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| Pc | dB | -3 |
| σ | dB | 0 |
|  | | dB[mW/15kHz] | -98 |
| Correlation and antenna configuration | |  | High XP 8 x 2 |
| Beamforming model | |  | Annex B.4.3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,22 |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/4 |
| CSI-RS reference signal configuration | |  | 6 |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 001F FFE0 0000 FFFF |
| Reporting mode | |  | PUCCH 1-1 submode1 |
| Reporting interval | | ms | 5 |
| PMI delay (Note 2) | | ms | 15 |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note 3) |
| PUCCH Report Type for CQI/second PMI | |  | 2b |
| PUCCH Report Type for RI/ first PMI | |  | 2a |
| *cqi-pmi-ConfigurationIndex* | |  | 4 |
| Measurement channel | |  | R.108 TDD |
| OCNG Pattern | |  | OP.1 TDD |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| ACK/NACK feedback mode | |  | Multiplexing |
| ce-csi-rs-feedback-config | |  | Configured |
| Frequency hopping | |  | Disabled |
| Frequency hopping inverval  (interval-TDD) | |  | N/A |
| Starting OFDM symbol (startSymbolBR) | |  | 3 |
| PDSCH repetition level | |  | 1 |
| MPDCCH repetition level | |  | 1 |
| Beamforming Precoder for MPDCCH | |  | No precoding |
| Precoder update granularity for MPDCCH | |  | N/A |
| BL/CE DL subframe comfiguration (fdd-DownlinkOrTddSubframeBitmapBR) | |  | 1011110111 |
| Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.  Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.  Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4. | | | |

Table 9.8.5.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
| *g* | [1.2] |
| UE Category | ≥1 |

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

### A.3.1.1 Overview of DL reference measurement channels

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

Table A.3.1.1-1G: Overview of DL reference measurement channels (FDD, PDSCH Performance (UE specific RS))

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Duplex | Table | Name | BW | Mod | TCR | RB | RB Offset | UE Categ | Notes |
| Without CSI-RS | | | | | | | | | |
| FDD | Table A.3.3.3.0-1 | R.70 FDD | 10 | QPSK | 0.65 | 50 |  | ≥ 1 |  |
| FDD | Table A.3.3.3.0-1 | R.71 FDD | 10 | 16QAM | 0.6 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.0-2 | R.80 FDD | 10 | QPSK | 1/3 | 6 |  | M1, ≥ 0 |  |
| Two antenna ports (CSI-RS) | | | | | | | | | |
| FDD | Table A.3.3.3.1-1 | R.51 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-1 | R.51-1 FDD | 10 | 16QAM | 0.54 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-1 | R.51-2 FDD | 5 | 16QAM | 0.54 | 25 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-1 | R.51-3 FDD | 15 | 16QAM | 0.54 | 75 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-1 | R.51-4 FDD | 20 | 16QAM | 0.54 | 100 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-1 | R.76 FDD | 10 | QPSK |  | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-3 | R.76-1 FDD | 5 | QPSK |  | 25 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-3 | R.76-2 FDD | 15 | QPSK |  | 75 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-3 | R.76-3 FDD | 20 | QPSK |  | 100 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-3 | R.76-4 FDD | 5 | QPSK |  | 25 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-3 | R.76-5 FDD | 10 | QPSK |  | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-3 | R.76-6 FDD | 15 | QPSK |  | 75 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-3 | R.76-7 FDD | 20 | QPSK |  | 100 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-1 | R.86 FDD | 10 | QPSK | 1/3 | 50 |  | ≥ 1 |  |
| FDD | Table A.3.3.3.1-1 | R.86A FDD | 10 | QPSK | 1/3 | 50 |  | ≥ 1 |  |
| FDD | Table A.3.3.3.1-1 | R.94 FDD | 10 | QPSK | 2/3 | 24 |  | ≥ 1 |  |
| Two antenna ports (CSI-RS, non Quasi Co-located) | | | | | | | | | |
| FDD | Table A.3.3.3.1-2 | R.52 FDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-2 | R.52-1 FDD | 10 | 16QAM | 0.54 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-2 | R.53 FDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-2 | R.54 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.1-2 | R.97 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| Four antenna ports (CSI-RS) | | | | | | | | | |
| FDD | Table A.3.3.3.2-1 | R.43 FDD | 10 | QPSK | 1/3 | 50 |  | ≥ 1 |  |
| FDD | Table A.3.3.3.2-1 | R.50 FDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2-2 | R.50A-1 FDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2-2 | R.44 FDD | 10 | QPSK | 1/3 | 50 |  | ≥ 1 |  |
| FDD | Table A.3.3.3.2-2 | R.45 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2-2 | R.45-1 FDD | 10 | 16QAM | 1/2 | 39 |  | ≥ 1 |  |
| FDD | Table A.3.3.3.2-1 | R.45A-1 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2-2 | R.45A-2 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2-1 | R.48 FDD | 10 | QPSK |  | 50 |  | ≥ 1 |  |
| FDD | Table A.3.3.3.2-2 | R.60 FDD | 10 | QPSK | 1/2 | 50 |  | ≥ 1 |  |
| FDD | Table A.3.3.3.2-3 | R.64 FDD | 10 | QPSK | 1/3 | 6 |  | 0 |  |
| FDD | Table A.3.3.3.2-1 | R.66 FDD | 10 | 256QAM | 0.77 | 50 |  | 11-15 |  |
| FDD | Table A.3.3.3.2-4 | R.69 FDD | 10 | QPSK | 0.74-0.8 | 50 |  | ≥ 1 |  |
| FDD | Table A.3.3.3.2-1 | R.75 FDD | 10 | 16QAM | 0.57 | 50 |  | ≥ 5 |  |
| FDD | Table A.3.3.3.2-1 | R.75A FDD | 10 | 16QAM | 0.51 | 50 |  | ≥5 |  |
| FDD | Table A.3.3.3.2-1 | R.cc FDD | 10 | 16QAM | 0.64 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2-1 | R.xx2 FDD | 10 | 1024QAM |  | 50 |  | 20, ≥ 22 | UE DL Category |
| Four antenna ports (CSI-RS, non Quasi Co-located) | | | | | | | | | |
| FDD | Table A.3.3.3.2-5 | R.98 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2-5 | R.99 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2-6 | R.100 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| Eight antenna ports (CSI-RS) | | | | | | | | | |
| FDD | Table A.3.3.3.2A-1 | R.50A-2 FDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2A-1 | R.50A-3 FDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.2A-2 | R.108 FDD | 10 | QPSK | 1/2 | 4 |  | ≥ 1 |  |
| **Twelve antenna ports (CSI-RS)** | | | | | | | | | |
| FDD | Table A.3.3.3.3-1 | R.77 FDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| **Sixteen antenna ports (CSI-RS)** | | | | | | | | | |
| FDD | Table A.3.3.3.4-1 | R.78 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| **Twenty-four antenna ports (CSI-RS)** | | | | | | | | | |
| FDD | Table A.3.3.3.5-1 | R.88 FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| FDD | Table A.3.3.3.5-1 | R.88A FDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| **Thirty-two antenna ports (CSI-RS)** | | | | | | | | | |
| FDD | Table A.3.3.3.6-1 | R.89 FDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |

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

Table A.3.1.1-1K: Overview of DL reference measurement channels (TDD, PDSCH Performance (UE specific RS))

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Duplex | Table | Name | BW | Mod | TCR | RB | RB Offset | UE Categ | Notes |
| Two antenna ports (CSI-RS) | | | | | | | | | |
| TDD | Table A.3.4.3.3-1 | R.51 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-1 | R.51-1 TDD | 10 | 16QAM | 0.57 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-1 | R.51-2 TDD | 5 | 16QAM | 0.57 | 25 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-1 | R.51-3 TDD | 15 | 16QAM | 0.57 | 75 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-1 | R.51-4 TDD | 20 | 16QAM | 0.57 | 100 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-1 | R.76 FDD | 10 | QPSK |  | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-3 | R.76-1 FDD | 5 | QPSK |  | 25 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-3 | R.76-2 FDD | 15 | QPSK |  | 75 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-3 | R.76-3 FDD | 20 | QPSK |  | 100 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-3 | R.76-4 FDD | 5 | QPSK |  | 25 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-3 | R.76-5 FDD | 10 | QPSK |  | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-3 | R.76-6 FDD | 15 | QPSK |  | 75 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-3 | R.76-7 FDD | 20 | QPSK |  | 100 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.1-2 | R.76A TDD | 10 | QPSK | 1/3 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.1-2 | R.94 TDD | 10 | QPSK | 2/3 | 24 |  | ≥ 1 |  |
| Two antenna ports (CSI-RS, non Quasi Co-located) | | | | | | | | | |
| TDD | Table A.3.4.3.3-2 | R.52 TDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-2 | R.52-1 TDD | 10 | 16QAM | 0.57 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-2 | R.53 TDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-2 | R.54 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.3-2 | R.97 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| Four antenna ports (CSI-RS) | | | | | | | | | |
| TDD | Table A.3.4.3.4-1 | R.44 TDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.4-5 | R.44A-1 TDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.4-1 | R.48 TDD | 10 | QPSK |  | 50 |  | ≥ 1 |  |
| TDD | Table A.3.4.3.4-2 | R.60 TDD | 10 | QPSK | 1/2 | 50 |  | ≥ 1 |  |
| TDD | Table A.3.4.3.4-2 | R.61 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.4-2 | R.61-1 TDD | 10 | 16QAM | 1/2 | 39 |  | ≥ 1 |  |
| TDD | Table A.3.4.3.4-1 | R.61A TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.4-3 | R.64 TDD | 10 | QPSK | 1/3 | 6 |  | 0 |  |
| TDD | Table A.3.4.3.4-1 | R.66 TDD | 20 | 256QAM |  | 100 |  | 11-15 |  |
| TDD | Table A.3.4.3.4-4 | R.69 TDD | 10 | QPSK | 0.61-0.8 | 50 |  | ≥ 1 |  |
| TDD | Table A.3.4.3.4-1 | R.75 TDD | 10 | 16QAM | 0.57 | 50 |  | ≥ 5 |  |
| TDD | Table A.3.4.3.4-1 | R.75A TDD | 10 | 16QAM | 0.51 | 50 |  | ≥ 5 |  |
| TDD | Table A.3.4.3.4-1 | R.cc TDD | 10 | 16QAM |  | 50 |  | ≥ 2 |  |
| Four antenna ports (CSI-RS, non Quasi Co-located)) | | | | | | | | | |
| TDD | Table A.3.4.3.4-6 | R.98 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.4-6 | R.99 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.4-7 | R.100 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| Eight antenna ports (CSI-RS) | | | | | | | | | |
| TDD | Table A.3.4.3.5-1 | R.50 TDD | 10 | QPSK | 1/3 | 50 |  | ≥ 1 |  |
| TDD | Table A.3.4.3.5-2 | R.45 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.5-2 | R.45-1 TDD | 10 | 16QAM | 1/2 | 39 |  | ≥ 1 |  |
| TDD | Table A.3.4.3.5-2 | R.45A TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.5-2 | R.45-2 TDD | 10 | 64QAM |  | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.5-3 | R.44A-2 TDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.5-3 | R.44A-3 TDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.5-1 | R.50-3 TDD | 5 | 16QAM | 1/2 | 25 |  | 8 |  |
| TDD | Table A.3.4.3.5-1 | R.50-4 TDD | 10 | 16QAM | 1/2 | 50 |  | 8 |  |
| TDD | Table A.3.4.3.5-1 | R.50-5 TDD | 15 | 16QAM | 1/2 | 75 |  | 8 |  |
| TDD | Table A.3.4.3.5-1 | R.50-6 TDD | 20 | 16QAM | 1/2 | 100 |  | 8 |  |
| TDD | Table A.3.4.3.5-4 | R.108 TDD | 10 | QPSK | 1/2 | 4 |  | ≥ 1 |  |
| **Twelve antenna ports (CSI-RS)** | | | | | | | | | |
| TDD | Table A.3.4.3.6-1 | R.77 TDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |
| **Sixteen antenna ports (CSI-RS)** | | | | | | | | | |
| TDD | Table A.3.4.3.7-1 | R.78 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| **Twenty-four antenna ports (CSI-RS)** | | | | | | | | | |
| TDD | Table A.3.4.3.8-1 | R.88 TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| TDD | Table A.3.4.3.8-1 | R.88A TDD | 10 | 16QAM | 1/2 | 50 |  | ≥ 2 |  |
| **Thirty-two antenna ports (CSI-RS)** | | | | | | | | | |
| TDD | Table A.3.4.3.9-1 | R.89 TDD | 10 | 64QAM | 1/2 | 50 |  | ≥ 2 |  |

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

#### A.3.3.3.2A Eight antenna ports (CSI-RS)

The reference measurement channels in Table A.3.3.3.2A-1 apply for verifying FDD CRI accuracy measurement with two CRS antenna ports and eight CSI-RS antenna ports.

Table A.3.3.3.2A-1: Fixed Reference Channel for eight antenna ports (CSI-RS)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | | |
| Reference channel |  | R.50A-2 FDD | R.50A-3 FDD |
| Channel bandwidth | MHz | 10 | 10 |
| Allocated resource blocks |  | 503 | 503 |
| Allocated subframes per Radio Frame |  | 7 | 5 |
| Modulation |  | 64QAM | 64QAM |
| Target Coding Rate |  | 1/2 | 1/2 |
| Information Bit Payload |  |  |  |
| For Sub-Frames (Non CSI-RS subframe) | Bits | 18336 | 18336 |
| For Sub-Frames (CSI-RS subframe) | Bits | N/A | N/A |
| For Sub-Frames (ZeroPowerCSI-RS subframe) | Bits | N/A | N/A |
| For Sub-Frame 5 | Bits | N/A | N/A |
|  |  |  |  |
| For Sub-Frame 0 | Bits | 14688 | 14688 |
| Number of Code Blocks per Sub-Frame (Note 4) |  |  |  |
| For Sub-Frames (Non CSI-RS subframe) |  | 3 | 3 |
| For Sub-Frames (CSI-RS subframe) |  | N/A | N/A |
| For Sub-Frames (ZeroPowerCSI-RS subframe) | Bits | N/A | N/A |
| For Sub-Frame 5 |  | N/A | N/A |
| For Sub-Frame 0 |  | 3 | 3 |
| Binary Channel Bits Per Sub-Frame |  |  |  |
| For Sub-Frames (Non CSI-RS subframe) | Bits | 36000 | 36000 |
| For Sub-Frames (CSI-RS subframe) | Bits | N/A | N/A |
| For Sub-Frames (ZeroPowerCSI-RS subframe) | Bits | N/A | N/A |
| For Sub-Frame 5 | Bits | N/A | N/A |
| For Sub-Frame 0 | Bits | 29520 | 29520 |
| Max. Throughput averaged over 1 frame | Mbps | 12.4704 | 8.8032 |
| UE Category |  | ≥ 2 | ≥ 2 |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz  Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]  Note 3: For R.50A-2, 50 resource blocks are allocated in sub-frames 2, 3, 4, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.50A-3, 50 resource blocks are allocated in sub-frames 3, 4, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.  Note 4: 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) | | | |

Table A.3.3.3.2A-2: Fixed Reference Channel for eight antenna ports (CSI-RS)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Reference channel |  | R.108 FDD |
| Channel bandwidth | MHz | 10 |
| Allocated resource blocks |  | 43 |
| Allocated subframes per Radio Frame |  | 8 |
| Modulation |  | QPSK |
| Target Coding Rate |  | 1/2 |
| Information Bit Payload |  |  |
| For Sub-Frames (Non CSI-RS subframe) | Bits | 472 |
| For Sub-Frames (CSI-RS subframe) | Bits | 472 |
| For Sub-Frame 5,7 | Bits | N/A |
| Number of Code Blocks per Sub-Frame (Note 4) |  |  |
| For Sub-Frames (Non CSI-RS subframe) |  | 1 |
| For Sub-Frames (CSI-RS subframe) |  | 1 |
| For Sub-Frame 5,7 |  | N/A |
| Binary Channel Bits Per Sub-Frame |  |  |
| For Sub-Frames (Non CSI-RS subframe) | Bits | 960 |
| For Sub-Frames (CSI-RS subframe) | Bits | 896 |
| For Sub-Frame 5,7 | Bits | N/A |
| Max. Throughput averaged over 1 frame | Mbps | 0.3776 |
| UE Category |  | ≥ 1 |
| Note 1: 2 symbols allocated to PDCCH.  Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]  Note 3: Allocated PRB positions for PDSCH are {2, 3, 4, 5} within the assigned narrowband. Allocated PRB positions for MPDCCH are {0, 1} within the assigned narrowband.  Note 4: 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) | | |

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

#### A.3.4.3.5 Eight antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.5-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and eight CSI-RS antenna ports.

Table A.3.4.3.5-1: Fixed Reference Channel for CDM-multiplexed DM RS with eight CSI-RS antenna ports

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Value | | | | | | |
| Reference channel |  | R.50 TDD | R.50-1 TDD | R.50-2 TDD | R.50-3 TDD | R.50-4 TDD | R.50-5 TDD | R.50-6 TDD |
| Channel bandwidth | MHz | 10 | 10 | 10 | 5 | 10 | 15 | 20 |
| Allocated resource blocks |  | 50 (Note 4) | 50 (Note 4) | 50 (Note 6) | 25 (Note 7) | 50 (Note 4) | 75 (Note 8) | 100 (Note 9) |
| Uplink-Downlink Configuration (Note 3) |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Allocated subframes per Radio Frame (D+S) |  | 3+2 | 3+2 | 3+2 | 3+2 | 3+2 | 3+2 | 3+2 |
| Modulation |  | QPSK | QPSK | QPSK | 16QAM | 16QAM | 16QAM | 16QAM |
| Target Coding Rate |  | 1/3 | 1/3 | 1/3 | 1/2 | 1/2 | 1/2 | 1/2 |
| Information Bit Payload |  |  |  |  |  |  |  |  |
| For Sub-Frames 4,9 (non CSI-RS subframe) | Bits | 3624 | 3624 | 3624 | N/A | N/A | N/A | N/A |
| For Sub-Frames 4,9 (CSI-RS subframe) | Bits | 3624 | 3624 | 3624 | 17568 | 39232 | 61664 | 78704 |
| For Sub-Frames 1,6 |  | 2664 | 2664 | 3112 | 12216 | 26416 | 42368 | 61664 |
| For Sub-Frame 5 | Bits | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| For Sub-Frame 0 | Bits | 2984 | 2984 | 3368 | 13536 | 37888 | 57336 | 78704 |
| Number of Code Blocks per Sub-Frame (Note 5) |  |  |  |  |  |  |  |  |
| For Sub-Frames 4,9 (non CSI-RS subframe) |  | 1 | 1 | 1 | N/A | N/A | N/A | N/A |
| For Sub-Frames 4,9 (CSI-RS subframe) |  | 1 | 1 | 1 | 3 | 7 | 11 | 13 |
| For Sub-Frames 1,6 |  | 1 | 1 | 1 | 2 | 5 | 7 | 11 |
| For Sub-Frame 5 |  | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| For Sub-Frame 0 |  | 1 | 1 | 1 | 3 | 7 | 10 | 13 |
| Binary Channel Bits Per Sub-Frame |  |  |  |  |  |  |  |  |
| For Sub-Frames 4,9 (non CSI-RS subframe) | Bits | 12000 | 13200 | 13200 | N/A | N/A | N/A | N/A |
| For Sub-Frames 4,9 (CSI-RS subframe) | Bits | 10400 | 11600 | 11600 | 33600 | 76800 | 115200 | 153600 |
| For Sub-Frames 1,6 |  | 7872 | 7872 | 8448 | 22848 | 55104 | 84672 | 118272 |
| For Sub-Frame 5 | Bits | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| For Sub-Frame 0 | Bits | 9840 | 9840 | 10560 | 26112 | 70848 | 108864 | 152064 |
| Max. Throughput averaged over 1 frame | Mbps | 1.556 | 1.556 | 1.684 | 7.3104 | 16.9184 | 26.54 | 35.944 |
| UE Category |  | ≥ 1 | ≥ 1 | ≥ 1 | 8 | 8 | 8 | 8 |
| UE DL Category |  |  |  |  | 14, 17,18,19,20,22,23,24,25,26 | 14, 17,18,19,20,22,23,24,25,26 | 14, 17,18,19,20,22,23,24,25,26 | 14, 17,18,19,20,22,23,24,25,26 |
| Note 1: 2 symbols allocated to PDCCH.  Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].  Note 3: as per Table 4.2-2 in TS 36.211 [4].  Note 4: 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.  Note 5: 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 6: 50 resource blocks are allocated in sub-frames 4,9 and 47 resource blocks (RB0–RB23 and RB27–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. In sub-frame 0 and the DwPTS portion of sub-frames 1, 6, PDSCH is rate matched around RB22, RB23 and RB27.  Note 7: 25 resource blocks are allocated in sub-frames 4,9 and 17 resource blocks (RB0–RB9 and RB18–RB24) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.  Note 8: 75 resource blocks are allocated in sub-frames 4,9 and 63 resource blocks (RB0–R31 and RB44–RB74) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.  Note 9: 100 resource blocks are allocated in sub-frames 4,9 and 88 resource blocks (RB0–RB43 and RB56–RB99) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.  Note 10: Given per component carrier per codeword. | | | | | | | | |

The reference measurement channels in Table A.3.4.3.5-2 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and eight CSI-RS antenna ports.

Table A.3.4.3.5-2: Fixed Reference Channel for eight antenna ports (CSI-RS)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Value | | | |
| Reference channel |  | R.45  TDD | R.45-1  TDD | R.45-2 TDD | R.45A  TDD |
| Channel bandwidth | MHz | 10 | 10 | 10 | 10 |
| Allocated resource blocks |  | 504 | 39 | 504 | 504 |
| Uplink-Downlink Configuration (Note 3) |  | 1 | 1 | 1 | 1 |
| Allocated subframes per Radio Frame (D+S) |  | 4+2 | 4+2 | 4+2 | 4+2 |
| Allocated subframes per Radio Frame |  | 5 | 5 | 10 | 5 |
| Modulation |  | 16QAM | 16QAM | 64QAM | 16QAM |
| Target Coding Rate |  | 1/2 | 1/2 |  | 1/2 |
| Information Bit Payload |  |  |  |  |  |
| For Sub-Frames 4 and 9  (Non CSI-RS subframe) | Bits | N/A | N/A | N/A | N/A |
| For Sub-Frames 4 and 9  (CSI-RS subframe) | Bits | 11448 | 8760 | [18336] | 11448 |
| For Sub-Frames 1,6 | Bits | 7736 | 7480 | [11832] | 7736 |
| For Sub-Frame 5 | Bits | N/A | N/A | N/A | N/A |
| For Sub-Frame 0 | Bits | 9528 | 8760 | [14688] | 9528 |
| Number of Code Blocks per Sub-Frame (Note 5) |  |  |  |  |  |
| For Sub-Frames 4 and 9  (Non CSI-RS subframe) |  | N/A | N/A | N/A | N/A |
| For Sub-Frames 4 and 9  (CSI-RS subframe) |  | 2 | 2 |  | 2 |
| For Sub-Frames 1,6 |  | 2 | 2 |  | 2 |
| For Sub-Frame 5 |  | N/A | N/A |  | N/A |
| For Sub-Frame 0 |  | 2 | 2 |  | 2 |
| Binary Channel Bits Per Sub-Frame |  |  |  |  |  |
| For Sub-Frames 4 and 9  (Non CSI-RS subframe) | Bits | N/A | N/A |  | N/A |
| For Sub-Frames 4 and 9  (CSI-RS subframe) | Bits | 22400 | 17472 | [33600] | 23200 |
| For Sub-Frames 1,6 | Bits | 15744 | 14976 | [23616] | 15744 |
| For Sub-Frame 5 | Bits | N/A | N/A | N/A | N/A |
| For Sub-Frame 0 | Bits | 19680 | 18720 | [29520] | 19680 |
| Max. Throughput averaged over 1 frame | Mbps | 4.7896 | 4.1240 | 7.3296 | 4.7896 |
| UE Category |  | ≥ 2 | ≥ 1 | ≥ 2 | ≥ 2 |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.  Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].  Note 3: As per Table 4.2-2 in TS 36.211 [4].  Note 4: For R.45 and R.45-2, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. For R.45-1, 39 resource blocks are allocated in sub-frames 0,4,9 and the DwPTS portion of sub-frames 1,6 (RB0–RB20 and RB30–RB47).  Note 5: 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 6: Localized allocation started from RB #0 is applied. | | | | | |

The reference measurement channels in Table A.3.4.3.5-3 apply for verifying CRI reporting accuracy with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.5-3: Fixed Reference Channel for eight antenna ports (CSI-RS)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | |
| Reference channel |  | R.44A-2 TDD | R.44A-3 TDD |
| Channel bandwidth | MHz | 10 | 10 |
| Uplink-Downlink Configuration (Note 3) |  | 2 | 2 |
| Allocated resource blocks |  | 504 | 504 |
| Allocated subframes per Radio Frame |  | 4+2 | 3+2 |
| Modulation |  | 64QAM | 64QAM |
| Target Coding Rate |  | 1/2 | 1/2 |
| Information Bit Payload |  |  |  |
| For Sub-Frames (Non CSI-RS subframe) | Bits | 18336 | 18336 |
| For Sub-Frames (CSI-RS subframe) | Bits | N/A | N/A |
| For Sub-Frame 5 | Bits | N/A | N/A |
| For Sub-Frames 1,6 |  | 11832 | 11832 |
| For Sub-Frame 0 | Bits | 14688 | 14688 |
| Number of Code Blocks per Sub-Frame (Note 5) |  |  |  |
| For Sub-Frames (Non CSI-RS subframe) |  | 3 | 3 |
| For Sub-Frames (CSI-RS subframe) |  | N/A | N/A |
| For Sub-Frame 5 |  | N/A | N/A |
| For Sub-Frames 1,6 |  | 2 | 2 |
| For Sub-Frame 0 |  | 3 | 3 |
| Binary Channel Bits Per Sub-Frame |  |  |  |
| For Sub-Frames (Non CSI-RS subframe) | Bits | 36000 | 36000 |
| For Sub-Frames (CSI-RS subframe) | Bits | N/A | N/A |
| For Sub-Frame 5 | Bits | N/A | N/A |
| For Sub-Frames 1,6 | Bits | 23616 | 23616 |
| For Sub-Frame 0 | Bits | 29520 | 29520 |
| Max. Throughput averaged over 1 frame | Mbps | 9.336 | 7.5024 |
| UE Category |  | ≥ 2 | ≥ 2 |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz  Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]  Note 3: As per Table 4.2-2 in TS 36.211 [4].  Note 4: For R.44A-2, 50 resource blocks are allocated in sub-frames 3, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and and the DwPTS portion of sub-frames 1,6. For R.44A-3, 50 resource blocks are allocated in sub-frames 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and and the DwPTS portion of sub-frames 1,6.  Note 5: 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) | | | |

Table A.3.4.3.5-4: Fixed Reference Channel for eight antenna ports (CSI-RS)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Reference channel |  | R.108 TDD |
| Channel bandwidth | MHz | 10 |
| Uplink-Downlink Configuration (Note 3) |  | 2 |
| Allocated resource blocks |  | 44 |
| Allocated subframes per Radio Frame |  | 4 |
| Modulation |  | QPSK |
| Target Coding Rate |  | 1/2 |
| Information Bit Payload |  |  |
| For Sub-Frames 0,5 (Non CSI-RS subframe) | Bits | 472 |
| For Sub-Frames 4,9 (CSI-RS subframe) | Bits | 472 |
| For Sub-Frames 1,6 |  | N/A |
| Number of Code Blocks per Sub-Frame (Note 5) |  |  |
| For Sub-Frames 0,5 (Non CSI-RS subframe) |  | 1 |
| For Sub-Frames 4,9 (CSI-RS subframe) |  | 1 |
| For Sub-Frames 1,6 |  | N/A |
| Binary Channel Bits Per Sub-Frame |  |  |
| For Sub-Frames 0,5 (Non CSI-RS subframe) | Bits | 960 |
| For Sub-Frames 4,9 (CSI-RS subframe) | Bits | 896 |
| For Sub-Frames 1,6 |  | N/A |
| Max. Throughput averaged over 1 frame | Mbps | 0.1888 |
| UE Category |  | ≥ 1 |
| Note 1: 2 symbols allocated to PDCCH.  Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]  Note 3: As per Table 4.2-2 in TS 36.211 [4].  Note 4: Allocated PRB positions for PDSCH are {2, 3, 4, 5} within the assigned narrowband. Allocated PRB positions for MPDCCH are {0, 1} within the assigned narrowband.  Note 5: 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) | | |

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