**3GPP TSG-RAN WG4 Meeting #104-bis-e *R4-22xxxx***

**Electronic, , 10th - 19th October 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.104** | **CR** | **DRAFT** | **rev** | **-** | **Current version:** | **17.7.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| --- |
|  |
| ***Title:***  | Draft CR 38.104: PUSCH requirements for FR2-2 |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell, Intel Corporation |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_ext\_to\_71GHz-Perf |  | ***Date:*** | 2022-10-14 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | Introduction of the structure of the PUSCH requirements for FR2-2 |
|  |  |
| ***Summary of change:*** | Proposal for scheleton of PUSCH requirements |
|  |  |
| ***Consequences if not approved:*** | No PUSCH requirements for FR2-2 |
|  |  |
| ***Clauses affected:*** | 11.2.2.1, 11.2.2.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.141-2  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

***<Start of change 1>***

#### 11.2.2.1 Requirements for PUSCH with transform precoding disabled

##### 11.2.2.1.1 General

The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ retransmissions.

Table 11.2.2.1.1-1: Test parameters for testing PUSCH

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Disabled |
| Default TDD UL-DL pattern (Note 1) | 60 kHz and 120kHz SCS:3D1S1U, S=10D:2G:2U480kHz SCS:14D2S4U, S1=12D:2G0U, S2=0D:6G:8U |
| HARQ | Maximum number of HARQ transmissions | 4 |
|  | RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
|  | DM-RS duration | single-symbol DM-RS |
|  | Additional DM-RS symbols | pos0, pos1 |
|  | Number of DM-RS CDM group(s) without data | 2 |
|  | Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
|  | DM-RS port(s) | {0}, {0, 1} |
|  | DM-RS sequence generation | NID=0, nSCID =0 |
| Time domain | PUSCH mapping type | B |
| resource | Start symbol index | 0  |
|  | Allocation length | 10  |
| Frequency domain | RB assignment | Full applicable test bandwidth |
| resource | Frequency hopping | Disabled |
| TPMI index for 2Tx two-layer spatial multiplexing transmission  | 0 |
| Code block group based PUSCH transmission | Disabled |
| PT-RS | Frequency density (*KPT-RS*) | 2, Disabled |
| configuration | Time density (*LPT-RS*) | 1, Disabled |
| NOTE 1: The same requirements are applicable to TDD with different UL-DL patterns |

##### 11.2.2.1.2 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput stated in the tables 11.2.2.1.2-1 to 11.2.2.1.2-10 at the given SNR for 1Tx and for 2Tx two-layer spatial multiplexing transmission.

Table 11.2.2.1.2-1: Minimum requirements for PUSCH with 70% of maximum throughput, 50 MHz channel bandwidth, 60 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | PT-RS | SNR(dB) |
| 1 | 2 | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-1 | pos0 | No | -2.0 |
|  |  |  |  |  | G-FR2-A3-13 | pos1 | No | -2.2 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-1 |  pos0 | Yes | 12.0 |
|  |  |  |  |  |  |  | No | 11.5 |
|  |  |  |  |  | G-FR2-A4-11 |  pos1 | Yes | 10.7 |
|  |  |  |  |  |  |  | No | 10.7 |
|  |  | Normal | TDLA30-75 Low | 70 % | G-FR2-A5-1 |  pos0 | Yes | 13.7 |
|  |  |  |  |  |  |  | No | 13.1 |
|  |  |  |  |  | G-FR2-A5-6 |  pos1 | Yes | 13.4 |
|  |  |  |  |  |  |  | No | 12.9 |
| 2 |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-6 |  pos0 | No | 1.5 |
|  |  |  |  |  | G-FR2-A3-18 |  pos1 | No | 1.2 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A7-1 | pos0 | Yes | 15.2 |
|  |  |  |  |  |  |  | No | 14.3 |
|  |  |  |  |  | G-FR2-A7-6 |  pos1 | Yes | 13.8 |
|  |  |  |  |  |  |  | No | 13.0 |

Table 11.2.2.1.2-2: Minimum requirements for PUSCH with 70% of maximum throughput, 100 MHz channel bandwidth, 60 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position  | PT-RS | SNR(dB) |
| 1 | 2 | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-2 | pos0 | No | -2.1 |
|  |  |  |  |  | G-FR2-A3-14 | pos1 | No | -2.4 |
|  |  |  | TDLA30-300 Low | 70 % | G-FR2-A4-2 | pos0 | Yes | 12.2 |
|  |  |  |  |  |  |  | No | 11.2 |
|  |  |  |  |  | G-FR2-A4-12 | pos1 | Yes | 11.2 |
|  |  |  |  |  |  |  | No | 10.6 |
|  |  |  | TDLA30-75 Low | 70 % | G-FR2-A5-2 | pos0 | Yes | 14.2 |
|  |  |  |  |  |  |  | No | 13.3 |
|  |  |  |  |  | G-FR2-A5-7 | pos1 | Yes | 13.7 |
|  |  |  |  |  |  |  | No | 13.1 |
| 2 |  |  | TDLA30-300 Low | 70 % | G-FR2-A3-7 | pos0 | No | 1.5 |
|  |  |  |  |  | G-FR2-A3-19 | pos1 | No | 1.2 |
|  |  |  | TDLA30-300 Low | 70 % | G-FR2-A7-2 | pos0 | Yes | 16.0 |
|  |  |  |  |  |  |  | No | 14.9 |
|  |  |  |  |  | G-FR2-A7-7 | pos1 | Yes | 13.8 |
|  |  |  |  |  |  |  | No | 13.1 |

Table 11.2.2.1.2-3: Minimum requirements for PUSCH with 70% of maximum throughput, 50 MHz channel bandwidth, 120 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position  | PT-RS | SNR(dB) |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-3 |  pos0 | No | -1.8 |
|  |  |  |  |  | G-FR2-A3-15 |  pos1 | No | -2.1 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-3 |  pos0 | Yes | 11.6 |
|  |  |  |  |  |  |  | No | 10.9 |
| 1 |  |  |  |  | G-FR2-A4-13 |  pos1 | Yes | 10.9 |
|  |  |  |  |  |  |  | No | 10.5 |
|  | 2 | Normal | TDLA30-75 Low | 70 % | G-FR2-A5-3 |  pos0 | Yes | 13.7 |
|  |  |  |  |  |  |  | No | 13.1 |
|  |  |  |  |  | G-FR2-A5-8 |  pos1 | Yes | 13.2 |
|  |  |  |  |  |  |  | No | 13.0 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-8 |  pos0 | No | 1.4 |
|  |  |  |  |  | G-FR2-A3-20 |  pos1 | No | 1.3 |
| 2 |  | Normal | TDLA30-300 Low | 70 % |  G-FR2-A7-3 |  pos0 | Yes | 14.2 |
|  |  |  |  |  |  |  | No | 13.6 |
|  |  |  |  |  | G-FR2-A7-8 |  pos1 | Yes | 13.9 |
|  |  |  |  |  |  |  |  |  |

Table 11.2.2.1.2-4: Minimum requirements for PUSCH with 70% of maximum throughput, 100 MHz channel bandwidth, 120 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position  | PT-RS | SNR(dB) |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-4 |  pos0 | No | -2.4 |
|  |  |  |  |  | G-FR2-A3-16 |  pos1 | No | -2.5 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-4 |  pos0 | Yes | 11.9 |
|  |  |  |  |  |  |  | No | 10.5 |
| 1 |  |  |  |  | G-FR2-A4-14 |  pos1 | Yes | 11.1 |
|  |  |  |  |  |  |  | No | 10.5 |
|  | 2 | Normal | TDLA30-75 Low | 70 % | G-FR2-A5-4 |  pos0 | Yes | 13.5 |
|  |  |  |  |  |  |  | No | 12.9 |
|  |  |  |  |  | G-FR2-A5-9 |  pos1 | Yes | 13.4 |
|  |  |  |  |  |  |  | No | 12.8 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-9 |  pos0 | No | 1.4 |
|  |  |  |  |  | G-FR21-A3-21 |  pos1 | No | 1.2 |
| 2 |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A7-4 | pos0 | Yes | 13.9 |
|  |  |  |  |  |  |  | No | 13.2 |
|  |  |  |  |  | G-FR2-A7-9 | pos1 | Yes | 13.5 |
|  |  |  |  |  |  |  | No | 12.9 |

Table 11.2.2.1.2-5: Minimum requirements for PUSCH with 70% of maximum throughput, 200 MHz channel bandwidth, 120 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | PT-RS | SNR(dB) |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-5 |  pos0 | No | -2.1 |
|  |  |  |  |  | G-FR2-A3-17 |  pos1 | No | -2.4 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-5 |  pos0 | Yes | 11.3 |
|  |  |  |  |  |  |  | No | 10.9 |
| 1 |  |  |  |  | G-FR2-A4-15 |  pos1 | Yes | 11.2 |
|  |  |  |  |  |  |  | No | 10.7 |
|  | 2 | Normal | TDLA30-75 Low | 70 % | G-FR2-A5-5 |  pos0 | Yes | 14.1 |
|  |  |  |  |  |  |  | No | 13.4 |
|  |  |  |  |  | G-FR2-A5-10 |  pos1 | Yes | 13.7 |
|  |  |  |  |  |  |  | No | 13.3 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-10 |  pos0 | No | 1.4 |
|  |  |  |  |  | G-FR2-A3-22 |  pos1 | No | 1.1 |
| 2 |  | Normal | TDLA30-300 Low | 70 % |  G-FR2-A7-5 |  pos0 | Yes | 14.0 |
|  |  |  |  |  |  |  | No | 13.3 |
|  |  |  |  |  |  G-FR2-A7-10 |  pos1 | Yes | 13.6 |
|  |  |  |  |  |  |  | No | 13.0 |

Table 11.2.2.1.2-6: Minimum requirements for PUSCH with 30% of maximum throughput, 50 MHz channel bandwidth, 60 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | PT-RS | SNR(dB) |
|  |  |  |  |  | G-FR2-A4-1 | pos0 | Yes | 4.0 |
| 1 | 2 | Normal | TDLA30-300 Low | 30 % |  |  | No | 3.5 |
|  |  |  |  |  | G-FR2-A4-11 | pos1 | Yes | 3.7 |
|  |  |  |  |  |  |  | No | 3.1 |

Table 11.2.2.1.2-7: Minimum requirements for PUSCH with 30% of maximum throughput, 50 MHz channel bandwidth, 120 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | PT-RS | SNR(dB) |
|  |  |  |  |  | G-FR2-A4-3 | pos0 | Yes | 4.0 |
| 1 | 2 | Normal | TDLA30-300 Low | 30 % |  |  | No | 3.6 |
|  |  |  |  |  | G-FR2-A4-13 | pos1 | Yes | 3.7 |
|  |  |  |  |  |  |  | No | 3.2 |

Table 11.2.2.1.2-8: Test requirements for PUSCH with 70% of maximum throughput, 100 MHz Channel Bandwidth, 120 kHz SCS in FR2-2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | PT-RS | SNR(dB) |
| 1 | 2 | Normal | TDLA30-650 | 70 % | TBD | pos1 | [No] | TBD |
|  |  | Normal | TDLA30-650 | 70 % | TBD | pos1 | Yes | TBD |
|  |  | Normal | TDLD30-200 | 70 % | TBD | pos1 | Yes | TBD |
| 2 |  | Normal | TDLA30-650 | 70 % | TBD | pos1 | [No] | TBD |
|  |  | Normal | [TDLA30-650] | 70 % | TBD | pos1 | Yes | TBD |
|  |  | Normal | TDLD30-200 | 70 % | TBD | pos1 | Yes | TBD |

Table 11.2.2.1.2-9: Test requirements for PUSCH with 70% of maximum throughput, 400 MHz Channel Bandwidth, 120 kHz SCS in FR2-2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | PT-RS | SNR(dB) |
| 1 | 2 | Normal | TDLA10-650 | 70 % | TBD | pos1 | [No] | TBD |
|  |  | Normal | TDLA10-650 | 70 % | TBD | pos1 | Yes | TBD |
|  |  | Normal | TDLD10-200 | 70 % | TBD | pos1 | Yes | TBD |
| 2 |  | Normal | TDLA10-650 | 70 % | TBD | pos1 | [No] | TBD |
|  |  | Normal | [TDLA10-650] | 70 % | TBD | pos1 | Yes | TBD |
|  |  | Normal | TDLD10-200 | 70 % | TBD | pos1 | Yes | TBD |

Table 11.2.2.1.2-10: Test requirements for PUSCH with 70% of maximum throughput, 400 MHz Channel Bandwidth, 480 kHz SCS in FR2-2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | PT-RS | SNR(dB) |
| 1 | 2 | Normal | TDLA10-650 | 70 % | TBD | pos1 | [No] | TBD |
|  |  | Normal | TDLA10-650 | 70 % | TBD | pos1 | Yes | TBD |
|  |  | Normal | TDLD10-200 | 70 % | TBD | pos1 | Yes | TBD |
| 2 |  | Normal | TDLA10-650 | 70 % | TBD | pos1 | [No] | TBD |
|  |  | Normal | [TDLA10-650] | 70 % | TBD | pos1 | Yes | TBD |
|  |  | Normal | TDLD10-200 | 70 % | TBD | pos1 | Yes | TBD |

***<End of change 1>***

***<Start of change 2>***

#### 11.2.2.2 Requirements for PUSCH with transform precoding enabled

##### 11.2.2.2.1 General

The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in Annex A. The performance requirements assume HARQ retransmissions.

Table 11.2.2.2.1-1: Test parameters for testing PUSCH

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Enabled |
| Default TDD UL-DL pattern (Note 1) | 60 kHz and 120kHz SCS:3D1S1U, S=10D:2G:2U480kHz SCS:14D2S4U, S1=12D:2G0U, S2=0D:6G:8U |
| HARQ | Maximum number of HARQ transmissions | 4 |
|  | RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
|  | DM-RS duration | single-symbol DM-RS |
|  | Additional DM-RS position | pos0, pos1 |
|  | Number of DM-RS CDM group(s) without data | 2 |
|  | Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
|  | DM-RS port(s) | 0 |
|  | DM-RS sequence generation | NID0=0, group hopping and sequence hopping are disabled |
| Time domain | PUSCH mapping type | B |
| resource | Start symbol | 0  |
| assignment | Allocation length | 10  |
| Frequency domain resource | RB assignment | FR2-1: 30 PRBs in the middle of the test bandwidthFR2-2: Full applicable test bandwidth |
| assignment | Frequency hopping | Disabled |
| Code block group based PUSCH transmission | Disabled |
| PT-RS | Not configured |
| NOTE 1: The same requirements are applicable to TDD with different UL-DL patterns. |

##### 11.2.2.2.2 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput stated in the tables 11.2.2.2.2-1 to 11.2.2.2.2-4 at the given SNR.

Table 11.2.2.2.2-1: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 50 MHz Channel Bandwidth, 60 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 2 | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-11 | pos0 | -1.8 |
|  |  |  |  |  | G-FR2-A3-23 | pos1 | -1.9 |

Table 11.2.2.2.2-2: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 50 MHz Channel Bandwidth, 120 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 2 | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-12 | pos0 | -1.8  |
|  |  |  |  |  | G-FR2-A3-24 | pos1 | -1.9 |

Table 11.2.2.2.2-3: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 100 MHz Channel Bandwidth, 120 kHz SCS in FR2-2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 2 | Normal | TDLA30-650 | 70 % | TBD | pos1 | TBD  |

Table 11.2.2.2.2-4: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 400 MHz Channel Bandwidth, 480 kHz SCS in FR2-2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 2 | Normal | TDLA10-650 | 70 % | TBD | pos1 | TBD  |

***<End of change 2>***