**3GPP TSG-RAN WG4 Meeting # 109 R4-231xxxx**

**Chicago, US, November 13 - 17, 2023**

**Agenda item:** 8.13.9

**Source:** Moderator (CMCC)

**Title:** Topic summary for [108bis][321] NR\_ATG\_Demod

**Document for:** Information

# Introduction

This summary focuses on demodulation requirements for Rel-18 NR ATG, including agenda 8.13.8. The agreed way forward in previous meetings are R4-2316991, R4-2313875, R4-2309796, R4-2302996 and R4-2305899. Companies are encouraged to be concise.

Recommendation of prioritized topics for online discussion

**Issue 1-5: Test scope for PDCCH**

**Issue 1-4: Whether to introduce 1024QAM for new incremental PUSCH requirements**

**Issue 1-2: Special Slot Configuration of 30D4S6U**

**Issue 1-1: Tx EVM for new incremental PUSCH requirements**

**Issue 2-1: How to introduce new TDD pattern configuration 30D4S6U in ATG PUSCH requirements**

# Topic #1: UE demodulation

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2320220 | Huawei, HiSilicon | Proposal 2: Do not do further down-selection based on the given test cases set. |
| R4-2318906 | CMCC | Proposal 1: For the Tx EVM, 3% for MCS Table 2 and 6% for MCS Table 1 needs to be considered in ideal results.  Proposal 2: For Special Slot Configuration of 30D4S6U, use 56G, which means all empty special slots.  Proposal 3: For the other parameters which not discussed before, for example, the SSB configuration, TRS configurations and so on, reuse the legacy common configuration, as in Table 5.2-1 in TS 38.101-4.  Observation 1: Following the PDCCH test cases listed in last meeting’s agreement, 2R FDD could cover all AL, 2R TDD could cover all AL, 4R FDD could cover all AL, 4R TDD could cover all AL.  Proposal 4: Consider following legacy PDCCH test cases for ATG PDCCH requirements  1T2R FDD: Test number 1, 3 and 5 in 5.3.2.1.1  2T2R FDD: Test number 3 in 5.3.2.1.2  1T2R TDD: All test cases in 5.3.2.2.1  2T2R TDD: All test cases in 5.3.2.2.2  1T4R FDD: Test number 1, 3 and 5 in 5.3.3.1.1  2T4R FDD: Test number 3 in 5.3.3.1.2  1T4R TDD: All test cases in 5.3.3.2.1  2T4R TDD: All test cases in 5.3.3.2.2 |
| R4-2318907 | CMCC | Simulation results for ATG PDSCH demodulation |
| R4-2319231 | Ericsson | draft CR on RMC for ATG PDSCH requirement |
| R4-2319232 | Ericsson | Observation 1: There is applicable scenarios for downlink 1024QAM according to the link budget analysis.  Observation 2: According to the simulation results, there is enough margin to consider 1024QAM with MCS23 for PDSCH demodulation requirement.  Proposal 1: Introduce 1024QAM requirements for ATG PDSCH demodulation, following test cases can be considered:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Test number | Duplex mode, SCS and CBW | Propagation condition | Antenna configuration | MCS | SNR @70% maxTput | | | 1 | FDD 15kHz/10MHz | AWGN+220Hz Doppler | 2T2R | 1024QAM Table  MCS23 |  | | 2 | 2T4R | 1024QAM Table  MCS23 |  | | 3 | TDD 30kHz/40MHz 7DS2U | AWGN+500Hz Doppler | 2T2R | 1024QAM Table  MCS23 |  | | 4 | 2T4R | 1024QAM Table  MCS23 |  | | 5 | TDD 30kHz/40MHz 30D4S6U | AWGN+500Hz Doppler | 2T2R | 1024QAM Table  MCS23 |  | | 6 | 2T4R | 1024QAM Table  MCS23 |  | |
| R4-2319233 | Ericsson | Updated simulation results for ATG PDSCH demodulation requirements |
| R4-2319547 | ZTE Corporation | Proposal 1. Not to down-select test cases reached in RAN4 # 108bis meeting for ATG PDCCH requirements. |
| R4-2319548 | ZTE Corporation | Simulation results for ATG UE demodulation |
| R4-2320218 | Huawei, HiSilicon | [NR\_ATG-Perf] Draft CR on ATG PDSCH demodulation performance requirements (TS38.101-4, Rel-18) |
| R4-2320791 | Qualcomm Incorporated | Simulation Results for UE PDSCH Demodulation for ATG  Observation 1: Alignment SNR considers Tx EVM 3% for MCS Table 2, Tx EVM = 6% for MCS Table 1; |
| R4-2320793 | Qualcomm Incorporated | draftCR for ATG UE Demodulation Requirements – Applicability Rules |

## Open issues summary

**Issue 1-1: Tx EVM for new incremental PUSCH requirements**

* Proposals
  + Option 1: For the Tx EVM, 3% for MCS Table 2 and 6% for MCS Table 1 needs to be considered in ideal results (CMCC, QC)
* Recommended WF
  + Option 1 can be agreed.

**Issue 1-2: Special Slot Configuration of 30D4S6U**

* Proposals
  + Option 1: S=14G (CMCC, ZTE)
* Recommended WF
  + Option 1 can be agreed.
  + New TDD UL-DL configurations in A.1.2 should be added, need a CR.

**Issue 1-3: Other parameters which not discussed before**

* Proposals
  + Option 1: For the other parameters which not discussed before, for example, the SSB configuration, TRS configurations and so on, reuse the legacy common configuration, as in Table 5.2-1 in TS 38.101-4. (CMCC)
* Recommended WF
  + Option 1 can be agreed.

**Issue 1-4: Whether to introduce 1024QAM for new incremental PDSCH requirements**

* Proposals
  + Option 1: Introduce 1024QAM requirements for ATG PDSCH demodulation, following test cases can be considered: (Ericsson)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | Duplex mode, SCS and CBW | Propagation condition | Antenna configuration | MCS | SNR @70% maxTput |
|
| 1 | FDD 15kHz/10MHz | AWGN+220Hz Doppler | 2T2R | 1024QAM Table  MCS23 |  |
| 2 | 2T4R | 1024QAM Table  MCS23 |  |
| 3 | TDD 30kHz/40MHz 7DS2U | AWGN+500Hz Doppler | 2T2R | 1024QAM Table  MCS23 |  |
| 4 | 2T4R | 1024QAM Table  MCS23 |  |
| 5 | TDD 30kHz/40MHz 30D4S6U | AWGN+500Hz Doppler | 2T2R | 1024QAM Table  MCS23 |  |
| 6 | 2T4R | 1024QAM Table  MCS23 |  |

* Recommended WF
  + Check whether Option 1 can be agreed or not.

**Issue 1-5: Test scope for PDCCH**

***Agreement in last meeting:***

* *To consider legacy PDCCH requirements for ATG PDCCH requirements to cover all AL.*
* *The following test cases are for down-selection: (if necessary)*
  + *1T2R FDD: Test number 1, 3 and 5 in 5.3.2.1.1*
  + *2T2R FDD: Test number 3 in 5.3.2.1.2*
  + *1T2R TDD: All test cases in 5.3.2.2.1*
  + *2T2R TDD: All test cases in 5.3.2.2.2*
  + *1T4R FDD: Test number 1, 3 and 5 in 5.3.3.1.1*
  + *2T4R FDD: Test number 3 in 5.3.3.1.2*
  + *1T4R TDD: All test cases in 5.3.3.2.1*
  + *2T4R TDD: All test cases in 5.3.3.2.2*
* Proposals
  + Option 1: Do not do further down-selection based on the given test cases set from last meeting’s agreement (CMCC, HW, ZTE)
* Recommended WF
  + Option 1 can be agreed. Consider following legacy PDCCH test cases for ATG
    - 1T2R FDD: Test number 1, 3 and 5 in 5.3.2.1.1
    - 2T2R FDD: Test number 3 in 5.3.2.1.2
    - 1T2R TDD: All test cases in 5.3.2.2.1
    - 2T2R TDD: All test cases in 5.3.2.2.2
    - 1T4R FDD: Test number 1, 3 and 5 in 5.3.3.1.1
    - 2T4R FDD: Test number 3 in 5.3.3.1.2
    - 1T4R TDD: All test cases in 5.3.3.2.1
    - 2T4R TDD: All test cases in 5.3.3.2.2

# Topic #2: BS Demodulation

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2319546 | ZTE Corporation | Proposal 1. For TDD pattern, propose to considering following practicable alternative to introduce new TDD pattern .   |  |  |  |  | | --- | --- | --- | --- | | **Parameter** | | **FDD** | **TDD** | | Transform precoding | | Disabled | | | Default TDD UL-DL pattern (Note 1) | |  | 30 KHz SCS:  7D1S2U, S=6D:4G:4U  30D4S6U,S= 14G | | 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 | 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, nSCID=0 | | | Time | PUSCH mapping type | A | | | domain | Start symbol | 0 | | | resource assignment | Allocation length | 14 | | | Frequency | RB assignment | Full applicable test bandwidth | | | domain resource assignment | Frequency hopping | Disabled | | | Code block group based PUSCH transmission | | Disabled | | | Note 1: The same requirements are applicable to TDD with different UL-DL pattern | | | |
| R4-2320220 | Huawei, HiSilicon | Proposal 1: Define an additional applicability rule that the ATG BS shall pass at least one PUSCH cases with the new TDD pattern in case ATG BS do not select the new TDD pattern for test. The case with legacy TDD pattern can be skipped if the test of the case with the new TDD pattern is passed, with same configuration except the TDD pattern. |
| R4-2319321 | Ericsson | Proposal 1 Capture new TDD pattern 30D4S6U as an example in the note of TDD pattern configuration.  Proposal 2 No need to define a new applicability rule for TDD pattern used in ATG BS demodulation. |
| R4-2319322 | Ericsson | Simulation results for ATG demodulation requirements |
| R4-2319323 | Ericsson | [NR\_ATG-Perf] Draft CR for 38.141-1 on ATG PUSCH demodulation requirements and FRC table |
| R4-2319549 | ZTE Corporation | Simulation results on NR BS ATG demodulation requirements |
| R4-2319550 | ZTE Corporation | Draft CR to TS38.141-2: Introduction applicability of PUSCH,PUCCH and PRACH for ATG performance requirements |
| R4-2319551 | ZTE Corporation | Draft CR to TS38.141-2: Introduction of PUSCH requirements and FRCs for ATG performance requirements |
| R4-2319835 | Samsung | Proposal 1: Update the note in the new section of ATG new incremental PUSCH requirements for configuring new TDD pattern 30D4S6U  NOTE 1: The same requirements are applicable to FDD and TDD with different UL-DL pattern, including the new TDD pattern 30D4S6U introduced in ATG scenario.  Proposal 2: The following applicability rule for PUSCH/PUCCH/PRACH requirement can be considered  8.1.2.x Applicability of PUSCH performance requirements for ATG scenario  Unless otherwise stated, PUSCH requirement tests in clause 8.2.1, 8.2.2 and 8.2.3 shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1).  Unless otherwise stated, PUSCH requirement tests in clause 8.2.x shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1).  8.1.2.x.x Applicability of requirements with different UL-DL patterns  Unless otherwise stated, for each subcarrier spacing declared to be supported, if BS supports multiple TDD UL-DL patterns including new TDD pattern (30D4S6U) for ATG scenario, only one of the supported TDD UL-DL patterns shall be used for all tests.  Note: For PUSCH Performance test cases, FRCs are not expected to be defined for the special slots, unless otherwise stated.  8.1.2.x.x Applicability of requirements for different MCSs  Unless otherwise stated, PUSCH requirement tests with 256QAM in clause 8.2.x shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1). A BS that declares to support 256QAM, and passes the test with 256QAM and the test with 64QAM in clause 8.2.1, the PUSCH requirement tests with 64QAM in clause 8.2.x can be skipped.  8.1.2.x Applicability of PUCCH performance requirements for ATG scenario  Unless otherwise stated, PUCCH requirement tests in clauses 8.3.1 to 8.3.6 shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1).  8.1.2.x Applicability of PRACH performance requirements for ATG scenario  Unless otherwise stated, PRACH requirement tests in clauses 8.4.1.5 shall apply only for shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1). |
| R4-2319836 | Samsung | Draft CR on manufacturer and applicability rule of BS demodulation requirements for Rel-18 ATG |
| R4-2320219 | Huawei, HiSilicon | [NR\_ATG-Perf] Draft CR on ATG PUSCH demodulation performance requirements and FRC definition (TS38.104, Rel-18) |
| R4-2320221 | Huawei, HiSilicon | Simulation results on NR BS ATG demodulation requirements |

## Open issues summary

**Issue 2-1: How to introduce new TDD pattern configuration 30D4S6U in ATG PUSCH requirements**

* Proposals
  + Option 1: considering following practicable alternative to introduce new TDD pattern. (ZTE)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **FDD** | **TDD** |
| Transform precoding | | Disabled | |
| Default TDD UL-DL pattern (Note 1) | |  | 30 KHz SCS:  7D1S2U, S=6D:4G:4U  30D4S6U,S= 14G |
| 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 | 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, nSCID=0 | |
| Time | PUSCH mapping type | A | |
| domain | Start symbol | 0 | |
| resource assignment | Allocation length | 14 | |
| Frequency | RB assignment | Full applicable test bandwidth | |
| domain resource assignment | Frequency hopping | Disabled | |
| Code block group based PUSCH transmission | | Disabled | |
| Note 1: The same requirements are applicable to TDD with different UL-DL pattern | | | |

* + Option 2: Define an additional applicability rule that the ATG BS shall pass at least one PUSCH cases with the new TDD pattern in case ATG BS do not select the new TDD pattern for test. The case with legacy TDD pattern can be skipped if the test of the case with the new TDD pattern is passed, with same configuration except the TDD pattern. (HW)
  + Option 3: Capture new TDD pattern 30D4S6U as an example in the note of TDD pattern configuration. No need to define a new applicability rule for TDD pattern used in ATG BS demodulation. (Ericsson)

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| Transform precoding | | Disabled |
| Default TDD UL-DL pattern (Note 1) | | 15 kHz SCS:  FDD  30 kHz SCS:  7D1S2U, S=6D:4G:4U |
| 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 | pos1 |
|  | Number of DM-RS CDM group(s) without data | 2 |
|  | Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
|  | DM-RS port | {0} |
|  | DM-RS sequence generation | NID0=0, nSCID =0 |
| Time domain | PUSCH mapping type | A |
| resource | Start symbol | 0 |
| assignment | Allocation length | 14 |
| Frequency domain resource | RB assignment | Full applicable test bandwidth |
| assignment | Frequency hopping | Disabled |
| TPMI index for 2Tx two-layer spatial multiplexing transmission | | 0 |
| Code block group based PUSCH transmission | | Disabled |
| NOTE 1: The same requirements are applicable to TDD with different UL-DL pattern, e.g., 30D4S6U, S=40G for 30kHz SCS. | | |

* + Option 4: Update the note in the new section of ATG new incremental PUSCH requirements for configuring new TDD pattern 30D4S6U (Samsung)

|  |
| --- |
| NOTE 1: The same requirements are applicable to FDD and TDD with different UL-DL pattern, including the new TDD pattern 30D4S6U introduced in ATG scenario. |

* Recommended WF
  + To be discussed.

**Issue 2-2: How to introduce new TDD pattern configuration 30D4S6U in ATG PUSCH requirements**

* Proposals
  + Option 1: The following applicability rule for PUSCH/PUCCH/PRACH requirement can be considered. (Samsung)

**8.1.2.x Applicability of PUSCH performance requirements for ATG scenario**

Unless otherwise stated, PUSCH requirement tests in clause 8.2.1, 8.2.2 and 8.2.3 shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1).

Unless otherwise stated, PUSCH requirement tests in clause 8.2.x shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1).

**8.1.2.x.x Applicability of requirements with different UL-DL patterns**

Unless otherwise stated, for each subcarrier spacing declared to be supported, if BS supports multiple TDD UL-DL patterns including new TDD pattern (30D4S6U) for ATG scenario, only one of the supported TDD UL-DL patterns shall be used for all tests.

Note: For PUSCH Performance test cases, FRCs are not expected to be defined for the special slots, unless otherwise stated.

**8.1.2.x.x Applicability of requirements for different MCSs**

Unless otherwise stated, PUSCH requirement tests with 256QAM in clause 8.2.x shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1). A BS that declares to support 256QAM, and passes the test with 256QAM and the test with 64QAM in clause 8.2.1, the PUSCH requirement tests with 64QAM in clause 8.2.x can be skipped.

**8.1.2.x Applicability of PUCCH performance requirements for ATG scenario**

Unless otherwise stated, PUCCH requirement tests in clauses 8.3.1 to 8.3.6 shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1).

**8.1.2.x Applicability of PRACH performance requirements for ATG scenario**

Unless otherwise stated, PRACH requirement tests in clauses 8.4.1.5 shall apply only for shall apply only for the BS declared to be supported (see D.1XX in table 4.6-1).

* Recommended WF
  + Check the CR R4-2319836, collect comments

# Topic #3: CR and TP

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2319231 | Ericsson | draft CR on RMC for ATG PDSCH requirement |
| R4-2320218 | Huawei, HiSilicon | [NR\_ATG-Perf] Draft CR on ATG PDSCH demodulation performance requirements (TS38.101-4, Rel-18) |
| R4-2320793 | Qualcomm Incorporated | draftCR for ATG UE Demodulation Requirements – Applicability Rules |
| R4-2319323 | Ericsson | [NR\_ATG-Perf] Draft CR for 38.141-1 on ATG PUSCH demodulation requirements and FRC table |
| R4-2319550 | ZTE Corporation | Draft CR to TS38.141-2: Introduction applicability of PUSCH,PUCCH and PRACH for ATG performance requirements |
| R4-2319551 | ZTE Corporation | Draft CR to TS38.141-2: Introduction of PUSCH requirements and FRCs for ATG performance requirements |
| R4-2319836 | Samsung | Draft CR on manufacturer and applicability rule of BS demodulation requirements for Rel-18 ATG |
| R4-2320219 | Huawei, HiSilicon | [NR\_ATG-Perf] Draft CR on ATG PUSCH demodulation performance requirements and FRC definition (TS38.104, Rel-18) |

## Open issues summary

38.101-4

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| --- | --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** | **Recommended WF** |
| R4-2320793 | Qualcomm Incorporated | draftCR for ATG UE Demodulation Requirements – Applicability Rules | Collect comments:  CMCC: The Table/Section number should keep aligned. The content in table should be aligned with R4-2320218  1699516233845 |
| R4-2319231 | Ericsson | draft CR on RMC for ATG PDSCH requirement | To be revised  Collect comments:  CMCC: Modulation in 256QAM table should be revised  Target coding rate of 64QAM should be 0.65 |
| R4-2320218 | Huawei, HiSilicon | [NR\_ATG-Perf] Draft CR on ATG PDSCH demodulation performance requirements (TS38.101-4, Rel-18) | Collect comments  CMCC: Some FRC could reuse legacy. For example, FDD 16QAM and 256QAM. |

38.104

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| **T-doc number** | **Company** | **Proposals / Observations** | **Recommended WF** |
| R4-2320219 | Huawei, HiSilicon | [NR\_ATG-Perf] Draft CR on ATG PUSCH demodulation performance requirements and FRC definition (TS38.104, Rel-18) | Pending on Issue 2-1  Collect comments: |

38.141-1

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| **T-doc number** | **Company** | **Proposals / Observations** | **Recommended WF** |
| R4-2319323 | Ericsson | [NR\_ATG-Perf] Draft CR for 38.141-1 on ATG PUSCH demodulation requirements and FRC table | Pending on Issue 2-1  Collect comments: |
| R4-2319836 | Samsung | Draft CR on manufacturer and applicability rule of BS demodulation requirements for Rel-18 ATG | Collect comments: |

38.141-2

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| **T-doc number** | **Company** | **Proposals / Observations** | **Recommended WF** |
| R4-2319550 | ZTE Corporation | Draft CR to TS38.141-2: Introduction applicability of PUSCH,PUCCH and PRACH for ATG performance requirements | Collect comments |
| R4-2319551 | ZTE Corporation | Draft CR to TS38.141-2: Introduction of PUSCH requirements and FRCs for ATG performance requirements | Pending on Issue 2-1  Collect comments |