**3GPP TSG-RAN WG4 Meeting # 98-e R4-21xxxxx**

**Electronic Meeting, Jan. 25-Feb. 5, 2021**

**Agenda item: 11.6.3**

**Source:** Moderator (CMCC)

**Title:** Email discussion summary for [98e][328] NR\_HST\_Demod\_UE

**Document for:** Information

# Introduction

This email discussion focuses on UE demodulation for Rel-17 NR HST, including agenda 11.6.3.1~11.6.3.3. Two topics are included in total, including PDSCH requirements for CA scenarios and enhanced transmission schemes.

The targets of email discussion for 1st round and 2nd round are:

* 1st round: discuss the open issues and strive to minimize the open issues
* 2nd round: according to 1st round discussion, discuss left open issues for 2nd round, and strive to minimize the open issues, and strive to approve the WF.

# Topic #1: PDSCH requirements for CA scenarios

*Agenda 11.6.3.2*

## Companies’ contributions summary

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| **TDoc** | **Title** | **Source** | **Proposals/ Observations** |
| [R4-2100858](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100858.zip) | General discussion on NR HST UE demodulation for FR1 CA scenario | CMCC | Proposal 1: for HST-SFN conditions, both HST-SFN joint transmission and DPS transmission are considered to support CA.  Proposal 2: both 2RX and 4RX are considered to support CA for HST.  Proposal 3: the CA combinations specified in Rel-16 WI on NR performance requirement enhancement can be reused for NR FR1 HST CA, the detailed CA combinations are:  • FDD 15 kHz + TDD 30 kHz CA  • FDD 15 kHz + TDD 15 kHz CA  • TDD 15 kHz + TDD 30 kHz CA  • FDD 15 kHz + FDD 15 kHz CA  • TDD 30 kHz + TDD 30 kHz CA  Proposal 4: to support HST CA, PDSCH requirements on single carrier of following bandwidth need to be specified:  • for 15KHz SCS, specify PDSCH requirements on single carrier of BW of {5, 10, 15, 20, 25, 30, 40, 50} MHz  • for 30KHz SCS, specify PDSCH requirements on single carrier of BW of {5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 90, 100} MHz  Proposal 5: for CA scenario, reuse the modulation format and code rate adopted for PDSCH requirements specification in Rel-16 NR HST WI, the details are:  • for HST-SFN joint transmission, 16QAM, 0.48 is used  • for DPS, 64QAM, 0.43 is used |
| [R4-2101260](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101260.zip) | Views on NR HST CA PDSCH performance requirements | Intel Corporation | Proposal #1: For HST PDSCH CA tests use same framework for CA configuration selection as defined for normal PDSCH CA tests.  Proposal #2: Define HST PDSCH CA requirements only for the following CA duplex modes:  • FDD 15 kHz + FDD 15 kHz  • TDD 30 kHz + TDD 30 kHz  • FDD 15 kHz + TDD 30 kHz  Proposal #3: For HST PDSCH CA tests reuse CA CQI applicability rule on CA duplex modes for testing: If UE supports both FDD 15 kHz + TDD 30 kHz and FDD 15 kHz + FDD 15 kHz CA duplex modes, apply requirements only to the first one.  Proposal #4: Define HST PDSCH CA requirements for all supported in Rel-15 channel bandwidths.  Proposal #5: Make HST PDSCH CA requirements release independent from Rel-15.  Proposal #6: Define HST CA requirements only for HST-SFN JT and HST-SFN DPS with one active TCI state. Further discuss applicability rule to reduce the test efforts.  Proposal #7: Use same PDSCH, PDSCH DMRS, MCS, Rank, CSI-RS configurations, TDD pattern and channel model parameters for HST CA requirements as in corresponding single carrier requirements.  Proposal #8: Reuse HARQ process number and k1 values for HST CA requirements as in normal CA requirements.  Proposal #9: Use same applicability rule for Pcell configuration for HST CA requirements as in normal CA requirements. |
| [R4-2101308](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101308.zip) | Discussion on PDSCH CA scenarios for NR UE HST FR1 performance requirements | Huawei, HiSilicon | Proposal 1: Only define 500km/h performance requirements for CA.  − Reuse Maximum Doppler shift and corresponding configuration from Rel-16 HST-SFN requirements.  − Reuse SNR for FDD 10MHz/15kHz and TDD 40MHz/30kHz SCS and run simulation for other cases.  Proposal 2: Others parameters such as PUCCH format for HARQ-ACK feedback, number of HARQ process, K1 values for different CCs, and applicability rule for different CA configurations and bandwidth combination sets can be reused from NR Rel-16 normal CA.  Proposal 3: Define HST FR1 CA requirements based on the following simulation assumption.   |  |  | | --- | --- | | Parameter | Value | | Antenna configuration | 2x2; 2x4 | | DMRS type | type 1 | | Number of DMRS symbols | DMRS 1+1+1 | | TDD pattern | DDDSU, S: 10D+2G+2U for 15 kHz SCS;  7DS2U, S: 6D+4G+4U for 30 kHz SCS | | MCS | MCS 13 based on 64QAM table | | Propagation condition | HST-SFN | | TRS periodicity | 10 ms, 2 slot pattern | | PDSCH mapping | Type A, Start symbol 2, Duration 12 | | Ds and Dmin | Ds = 700m, Dmin = 150m | | Rank | Rank = 2 | | Bandwidth & SCS | 5, 10,15,20,30,40,50MHz for FDD and TDD 15 kHz SCS;  5, 10,15,20,30,40,50,60,70,80,90,100MHz for TDD 30 kHz SCS | | Maximum Doppler shift | 870 Hz for 15 kHz SCS; 1667 Hz for 30 kHz SCS | | Testing metric | SNR @ 70% of maximum throughput | |
| [R4-2101370](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101370.zip) | Views on HST CA tests for FR1 | NTT DOCOMO, INC. | Proposal 1: For FDD, consider at least FDD 15kHz  Proposal 2: For TDD, consider at least TDD 30kHz  Proposal 3: Target maximum Doppler frequency under HST-SFN scenario in the tests are as follows.  – For FDD 15kHz : 870Hz  – For TDD 30kHz : 1667Hz |
| [R4-2101439](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101439.zip) | PDSCH demodulation requirements for CA with HST-SFN scenario | Ericsson | Proposal 1: Define PDSCH CA demodulation requirements with HST-SFN scenario (joint transmission) with the combination of following component carriers:  • CBW=5, 10, 15, 20, 25, 30, 40, and 50MHz for FDD SCS=15kHz  • CBW=5, 10, 15, 20, 25, 30, 35, 40, 50, 60, 80, 90, and 100MHz for TDD SCS=30kHz  • RAN4 will discuss whether to define TDD SCS=15kHz or not.  Proposal 2: Apply the Rel-16 HST-SFN channel model parameters to PDSCH CA demodulation requirements with HST-SFN:   |  |  |  | | --- | --- | --- | | Parameters | SCS=15kHz | SCS=30kHz | | **Ds (inter-RRH distance)** | **700 m** | **700 m** | | **Dmin (distance between RRH and UE)** | **150 m** | **150 m** | | **v (UE velocity)** | **500 km/h** | **500 km/h** | | **fd (maximum Doppler shift)** | **870 Hz** | **1667 Hz** |   Proposal 3: Reuse the test setup of Rel-16 single carrier HST-SFN requirements for CA scenario.  • Antenna configuration: 2x2 and 2x4  • MCS: 13 (64QAM table)  • Rank 2  • DMRS Type 1 and 2 additional DM-RS symbols  • For TDD, use TDD pattern of 7D1S2U with S=6DL:4GP:4UL  o No PDSCH data transmission in the special slots  • TRS periodicity: 10ms  Proposal 4: Introduce new UE capability of demodulationEnhancement for SCell.  Proposal 5: Introduce new network-assisted signalling highSpeedDemodFlag to inform HST-SFN deployment for SCell. |

## Open issues summary

### Test parameters for CA scenario

**Issue 1-1-1: Target speed**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Huawei):* Only define 500km/h performance requirements for CA.
* ***Reuse Maximum Doppler shift and corresponding configuration from Rel-16 HST-SFN requirements.(*** ***870 Hz for 15 kHz SCS; 1667 Hz for 30 kHz SCS)***
* ***Reuse SNR for FDD 10MHz/15kHz and TDD 40MHz/30kHz SCS and run simulation for other cases.***
  + *Option 2 (DOCOMO, Ericsson, Intel):* Target maximum Doppler frequency under HST-SFN scenario in the tests are as follows.
* ***For FDD 15kHz : 870Hz***
* ***For TDD 30kHz : 1667Hz***
* Recommended WF
  + Can we agree with the following recommended WF?
    - Reuse Maximum Doppler shift and corresponding configuration from Rel-16 HST-SFN requirements.( 870 Hz for 15 kHz SCS; 1667 Hz for 30 kHz SCS)
    - Reuse SNR for FDD 10MHz/15kHz and TDD 40MHz/30kHz SCS and run simulation for other cases.

**Issue 1-1-2: Transmission schemes**

* Proposals in RAN4#98e meeting:
  + *Option 1 (CMCC): for HST-SFN conditions, both HST-SFN joint transmission and DPS transmission need to be considered to support CA*
  + *Option 2 (Intel):* *Define HST CA requirements only for HST-SFN JT and HST-SFN DPS with one active TCI state. Further discuss applicability rule to reduce the test efforts.*
  + *Option 3 (Ericsson): Define PDSCH CA demodulation requirements with HST-SFN scenario (joint transmission).*
* Recommended WF
  + Define HST CA requirements for HST-SFN joint transmission
  + Define HST CA requirements for HST-SFN DPS with one active TCI state.
  + Further discuss on how to define CA requirements for HST-SFN DPS with two active TCI states
  + Further discuss on the applicability rule.

**Issue 1-1-3: Antenna configurations**

* Proposals in RAN4#98e meeting:
  + *Option 1 (CMCC, Huawei, Ericsson): 2x2 and 2x4*
* Recommended WF
  + Can we agree with the following recommended WF?
    - Antenna configuration: 2x2 and 2x4

**Issue 1-1-4: SCS configurations**

* Proposals in RAN4#98e meeting:
  + *Option 1 (CMCC): Same as Rel-16 CA normal demodulation*
* ***FDD 15 kHz + TDD 30 kHz CA***
* ***FDD 15 kHz + TDD 15 kHz CA***
* ***TDD 15 kHz + TDD 30 kHz CA***
* ***FDD 15 kHz + FDD 15 kHz CA***
* ***TDD 30 kHz + TDD 30 kHz CA***
  + *Option 2 (Intel): Same as Rel-16 CA CQI*
* FDD 15 kHz + FDD 15 kHz
* TDD 30 kHz + TDD 30 kHz
* FDD 15 kHz + TDD 30 kHz
  + *Option 3 (Ericsson): RAN4 will discuss whether to define TDD SCS=15kHz or not.*
* Recommended WF
  + 3 companies discuss this issue. 1 company propose to keep the same configuration as Rel-16 CA normal demodulation (option 1), 1 company propose to keep the same configuration as Rel-16 CA CQI test (Option 2). More discussion is needed.

**Issue 1-1-5: Bandwidth combination configurations**

* Proposals in RAN4#98e meeting:
  + *Option 1 (CMCC, Huawei, Intel, Ericsson):*
* ***for 15KHz SCS, specify PDSCH requirements on single carrier of BW of {5, 10, 15, 20, 25, 30, 40, 50} MHz***
* ***for 30KHz SCS, specify PDSCH requirements on single carrier of BW of {5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 90, 100} MHz***
* Recommended WF
  + Can we agree with the following bandwidth combination configurations for CA HST-SFN?
    - for 15KHz SCS, specify PDSCH requirements on single carrier of BW of {5, 10, 15, 20, 25, 30, 40, 50} MHz
    - for 30KHz SCS, specify PDSCH requirements on single carrier of BW of {5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 90, 100} MHz

**Issue 1-1-6: HARQ process**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel, Huawei):*
* ***Reuse HARQ process number and k1 values for HST CA requirements as in normal CA requirements.***
* Recommended WF
  + Can we agree to reuse HARQ process number and k1 values for HST CA requirements as in normal CA requirements?

**Issue 1-1-7: MCS and Rank, and other test setup**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel, Huawei, Ericsson, CMCC):*
* ***Use same PDSCH, PDSCH DMRS, MCS, Rank, CSI-RS configurations, TDD pattern and channel model parameters for HST CA requirements as in corresponding single carrier requirements.***
* Recommended WF
  + Use the following test setup as the baseline for further discussion

|  |  |
| --- | --- |
| Parameter | Value |
| DMRS type | type 1 |
| Number of DMRS symbols | DMRS 1+1+1 |
| TDD pattern | DDDSU, S: 10D+2G+2U for 15 kHz SCS;  7DS2U, S: 6D+4G+4U for 30 kHz SCS |
| MCS | For JT: MCS 13 based on 64QAM table  For DPS:MCS 17 based on 64QAM table |
| TRS periodicity | 10 ms, 2 slot pattern |
| PDSCH mapping | Type A, Start symbol 2, Duration 12 |
| Ds and Dmin | Ds = 700m, Dmin = 150m |
| Rank | Rank = 2 |
| Testing metric | SNR @ 70% of maximum throughput |

### Applicabiliy rule

**Issue 1-2-1: Applicability rule for SCS configuration**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel): For HST PDSCH CA tests reuse CA CQI applicability rule on CA duplex modes for testing: If UE supports both FDD 15 kHz + TDD 30 kHz and FDD 15 kHz + FDD 15 kHz CA duplex modes, apply requirements only to the first one.*
* Recommended WF
  + This issue is related to the SCS configurations for CA. Suggest to discuss later when we reach agreements on the SCS configurations

**Issue 1-2-2: Applicability rule for PCell configuration**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel, Huawei): Use same applicability rule for Pcell configuration for HST CA requirements as in normal CA requirements.*
* Recommended WF
  + Can we agree with the following recommended WF?
    - Use same applicability rule for Pcell configuration for HST CA requirements as in normal CA requirements.

### Release independent

**Issue 1-3-1: release independent**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel): Make HST PDSCH CA requirements release independent from Rel-15.*
* Recommended WF
  + HST SFN single carrier requirements are release independent from Rel-15 as well as normal PDSCH CA requirements. Can we agree with HST PDSCH CA requirements are release independent from Rel-15?

### UE capability and network-assisted signalling

**Issue 1-4-1: UE capability and network-assisted signalling**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Ericsson): UE capability and network assisted signalling defined in Rel-16 are only applicable for NR Pcell or NR PScell. UE needs additional capability to support the advanced receiver for HST-SFN joint transmission in SCell .*
    - *Introduce new UE capability of demodulationEnhancement for SCell.*
    - *Introduce new network-assisted signalling highSpeedDemodFlag to inform HST-SFN deployment for SCell.*
* Recommended WF
  + More discussion is needed

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
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### CRs/TPs comments collection

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| --- | --- |
| **CR tdoc number** | **Comments collection** |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary** |
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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
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*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

## Discussion on 2nd round (if applicable)

### Open issues summary

### Open issues

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| **Company** | **Comments** |
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## Summary on 2nd round (if applicable)

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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
|  |  |

# Topic #2: Enhanced transmisison schemes

*Agenda 11.6.3.3*

## Companies’ contributions summary

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| --- | --- | --- | --- |
| **TDoc** | **Title** | **Source** | **Proposals/ Observations** |
| [**R4-2100859**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100859.zip) | Discussion on NR HST UE demodulation for enhanced transmission scheme | CMCC | Observation 1: transmission scheme 2 will improve the throughput, and it is possible deployment for the high speed train scenario.  Observation 2: The PDSCH demodulation requirements specified in Rel-16 eMIMO WI cannot be applied to high speed scenario.  Proposal 1: It is necessary to specify the PDSCH requirements for transmission scheme 2 in HST scenario to guarantee the performance. |
| [**R4-2101261**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101261.zip) | Views on NR HST PDSCH performance requirements for multi-DCI based Tx scheme | Intel Corporation | Proposal 1: Discuss simulation assumption and methodology to analyse performance benefits of multi-DCI based Tx scheme in application to HST multi-RRH deployment.  Proposal 2: Adopt HST-SFN propagation conditions (Doppler, delay, power profiles) as independent channel models to explicitly model multi-RRH Tx.  Proposal 3: Use same HST-SFN channel model parameters as used for Rel-16 HST requirements for multi-DCI Tx scheme analysis: Ds = 700m; Dmin=150m; max Doppler frequency 870 Hz and 1667 Hz for 15 kHz and 30 kHz SCS respectively.  Proposal 4: Single FFT operation should be assumed as baseline UE implementation  Observation 1: In Rel-16 multi-TRP performance requirements SSB is transmitted only from one TRP and ideal time synchronization between transmission points is assumed.  Proposal 5: Non-ideal synchronization between RRHs should be considered as a baseline assumption  Proposal 6: Consider JT and DPS Tx schemes as a reference performance for comparison  Proposal 7: Consider overlapped and non-overlapped PDSCHs allocations between different RRHs.  Proposal 8: Consider MCS 4, 13 and 17 as a baseline assumption for further evaluations.  Observation 2: In HST-SFN scenario with multi-DCI based Tx scheme large demodulation performance degradation is observed between codewords transmitted from different RRHs. For all considered MCS values performance gap is not less than 10 dB at 70% @ max throughput.  Observation 3: Performance analysis of multi-DCI based Tx scheme in HST deployments may not reflect real performance if fixed MCS Tx is assumed.  Proposal 9: Bring performance results collecting at different train positions:  1. Near the one RRH  2. In the middle region between RRHs  3. On the half of the track |
| [**R4-2101309**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101309.zip) | Discussion on enhanced transmission schemes for NR HST demodulation | Huawei, HiSilicon | Proposal 1: To determine whether to specify the PDSCH requirements for NC-JT, RAN4 evaluate performance difference between NC-JT and DPS with the following assumption.  Proposal 2: C-JT requirements, the following test setup can be considered.  − For UE support 2 active TCI, MAC-CE based TCI switching, interruption exists  − Two RRHs of RRH#(2k) and RRH#(2k+1) are assumed, and SSB#(k mod 2) is transmitted from TRP#(2k), where k=0,1, 2, …  − UE is configured with TCI#(2k mod 4) and TCI#((2k+1) mod 4) that are associated with TRS#(2k mod 4) and TRS#((2k+1) mod 4) transmitted from RRH#(2k) and RRH#(2k+1) respectively by RRC signalling tci-StatesToAddModList in the PDSCH-Config and tci-PresentInDCI is not configured;  − All the configured TCI states are known to UE. UE is configured with NZP-CSI-RS resource for L1-RSRP measurements by RRC signaling nzp-CSI-RS-ResourceSet within the CSI-ResourceConfig and periodic CSI reporting by setting reportConfigType to periodic and reportQuantity to cri-RSRP (Note: reported L1-RSRP mesurements are not tested)  − At slot#(k\*n), TE actives TCI#(k mod 4) and TCI#(k+1 mod 4) for PDCCH with coresetPoolIndex#(k mod 2) and coresetPoolIndex#(k+1 mod 2) transmitted from RRH#(k) and RRH#(k+1) by “TCI State Indication for UE-specific PDCCH MAC CE” command with the field of CORESET ID set to 0 and 1 respectively, where n is the number of slots between two RRH  − PDSCH associated with TCI #(k mod 4) is transmitted from RRH#(k mod 4) in slot from max((k-1)n + 1 + HARQ needed time + 3ms + first TRS + TRS processing time, 0) to (k+1)n + HARQ needed time + 3ms.  − For UE supports more than 2 active TCI, MAC-CE based TCI switching, no interruption exists  − Two RRHs of RRH#(2k) and RRH#(2k+1) are assumed, and SSB#(k mod 2) is transmitted from TRP#(2k), where k=0,1, 2, …  − UE is configured with TCI#(2k mod 4) and TCI#((2k+1) mod 4) that are associated with TRS#(2k mod 4) and TRS#((2k+1) mod 4) transmitted from RRH#(2k) and RRH#(2k+1) respectively by RRC signalling tci-StatesToAddModList in the PDSCH-Config and tci-PresentInDCI is not configured;  − All the configured TCI states are known to UE. UE is configured with NZP-CSI-RS resource for L1-RSRP measurements by RRC signaling nzp-CSI-RS-ResourceSet within the CSI-ResourceConfig and periodic CSI reporting by setting reportConfigType to periodic and reportQuantity to cri-RSRP (Note: reported L1-RSRP mesurements are not tested)  − At slot#(k\*n), TE activates TCI#(k mod 4), TCI#(k+1 mod 4) and TCI#(k+2 mod 4) for PDSCH at the same time by “TCI States Activation/Deactivation for UE-specific PDSCH MAC CE” and actives TCI#(k mod 4) and TCI#(k+1 mod 4) for PDCCH with coresetPoolIndex#(k mod 2) and coresetPoolIndex#(k+1 mod 2) transmitted from RRH#(k) and RRH#(k+1) by “TCI State Indication for UE-specific PDCCH MAC CE” command with the field of CORESET ID set to 0 and 1 respectively, where n is the number of slots between two RRH;  − PDSCH associated with TCI #(k mod 4) is transmitted from RRH#(k mod 4) in slot from max((k-1)n + 1 + HARQ needed time + 3ms + first TRS + TRS processing time, 0) to (k+1)n + HARQ needed time + 3ms. |
| [**R4-2101440**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101440.zip) | PDSCH demodulation requirements with enhanced transmission schemes in HST scenario | Ericsson | Proposal 1: Define multi-DCI PDSCH transmission requirement with HST-SFN deployment scenario. |

## Open issues summary

**Issue 2-1: Whether to specify PDSCH requirements for transmission scheme 2**

* Proposals in RAN4#98e meeting:
  + *Option 1 (CMCC, Ericsson): Specify the PDSCH requirements for transmission scheme 2 in HST scenario to guarantee the performance.*
  + *Option 3 (Huawei): To determine whether to specify the PDSCH requirements for NC-JT, RAN4 evaluate performance difference between NC-JT and DPS with the following assumption.*
* Recommended WF
  + It seems that more evaluation is needed before we make the decision. More discussion is needed

**Issue 2-2: Channel model**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel):* 
    - *Adopt HST-SFN propagation conditions (Doppler, delay, power profiles) as independent channel models to explicitly model multi-RRH Tx.*
    - *Use same HST-SFN channel model parameters as used for Rel-16 HST requirements for multi-DCI Tx scheme analysis: Ds = 700m; Dmin=150m; max Doppler frequency 870 Hz and 1667 Hz for 15 kHz and 30 kHz SCS respectively.*
  + *Option 2 (Ericsson, Huawei): reuse the HST-SFN channel model (TS38.101-4 B.3.2) and parameters for multi-DCI based PDSCH transmission requirements, where the number of visible RRHs are 2.*

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| --- | --- | --- |
| Parameters | SCS=15kHz | SCS=30kHz |
| Ds (inter-RRH distance) | 700 m | 700 m |
| Dmin (distance between RRH and UE) | 150 m | 150 m |
| v (UE velocity) | 500 km/h | 500 km/h |
| fd (maximum Doppler shift) | 870 Hz | 1667 Hz |

* Recommended WF
  + Ds=700m, Dmin=150m, max Doppler frequency: 870Hz for 15KHz, 1667Hz for 30KHz
  + More discussion is needed on the channel model

**Issue 2-3: Time/frequency errors and assumptions on UE synchronization**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel):* 
    - *Single FFT operation should be assumed as baseline UE implementation.*
    - *Non-ideal synchronization between RRHs should be considered as a baseline assumption.*
* Recommended WF
  + More discussion is needed

**Issue 2-4: Reference performance for comparison**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel): Consider JT and DPS Tx schemes as a reference performance for comparison.*
  + *Option 2 (Huawei): RAN4* evaluate performance difference between NC-JT and DPS.
* Recommended WF
  + More discussion is needed.

**Issue 2-5: PDSCHs allocations between different RRHs**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel): Consider overlapped and non-overlapped PDSCHs allocations between different RRHs*
  + *Option 2 (Ericsson, Huawei): reuse the same PRB allocation as Rel-16 eMIMO multi-DCI based transmission, i.e., overlapped in time domain but not overlapped in frequency domain.*
* Recommended WF
  + More discussion is needed

**Issue 2-6: MCS**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel): Consider MCS 4, 13 and 17 as a baseline assumption for further evaluations.*
  + *Option 2 (Ericsson, Huawei): MCS: 17 (64QAM table)*
* Recommended WF
  + More discussion is needed

**Issue 2-7: Other parameters**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel, Huawei):* 
    - *Antenna configuration: 2x2 and 2x4*
    - *Rank 2*
      * *DMRS ports 1000/1001 from TRP #(2i)*
      * *DMRS ports 1002/1003 from TRP #(2i+1)*
    - *DMRS Type 1 and 2 additional DM-RS symbols*
    - *For TDD, use TDD pattern of 7D1S2U with S=6DL:4GP:4UL*
      * *No PDSCH data transmission in the special slots*
    - *TRS periodicity: 10ms*
* Recommended WF
  + More discussion is needed

**Issue 2-8: Link adaptation and statistic calculation**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Intel): Bring performance results collecting at different train positions:*

*1. Near the one RRH*

*2. In the middle region between RRHs*

*3. On the half of the track*

* Recommended WF
  + More discussion is needed

**Issue 2-9: Test setup for transmission scheme 2**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Huawei): If RAN4 agree to define NC-JT requirements, the following test setup can be considered.*
    - *For UE support 2 active TCI, MAC-CE based TCI switching, interruption exists*
      * *Two RRHs of RRH#(2k) and RRH#(2k+1) are assumed, and SSB#(k mod 2) is transmitted from TRP#(2k), where k=0,1, 2, …*
      * *UE is configured with TCI#(2k mod 4) and TCI#((2k+1) mod 4) that are associated with TRS#(2k mod 4) and TRS#((2k+1) mod 4) transmitted from RRH#(2k) and RRH#(2k+1) respectively by RRC signalling tci-StatesToAddModList in the PDSCH-Config and tci-PresentInDCI is not configured;*
      * *All the configured TCI states are known to UE. UE is configured with NZP-CSI-RS resource for L1-RSRP measurements by RRC signaling nzp-CSI-RS-ResourceSet within the CSI-ResourceConfig and periodic CSI reporting by setting reportConfigType to periodic and reportQuantity to cri-RSRP (Note: reported L1-RSRP mesurements are not tested)*
      * *At slot#(k\*n), TE actives TCI#(k mod 4) and TCI#(k+1 mod 4) for PDCCH with coresetPoolIndex#(k mod 2) and coresetPoolIndex#(k+1 mod 2) transmitted from RRH#(k) and RRH#(k+1) by “TCI State Indication for UE-specific PDCCH MAC CE” command with the field of CORESET ID set to 0 and 1 respectively, where n is the number of slots between two RRH*
      * *PDSCH associated with TCI #(k mod 4) is transmitted from RRH#(k mod 4) in slot from max((k-1)n + 1 + HARQ needed time + 3ms + first TRS + TRS processing time, 0) to (k+1)n + HARQ needed time + 3ms.*
    - *For UE supports more than 2 active TCI, MAC-CE based TCI switching, no interruption exists*
      * *Two RRHs of RRH#(2k) and RRH#(2k+1) are assumed, and SSB#(k mod 2) is transmitted from TRP#(2k), where k=0,1, 2, …*
      * *UE is configured with TCI#(2k mod 4) and TCI#((2k+1) mod 4) that are associated with TRS#(2k mod 4) and TRS#((2k+1) mod 4) transmitted from RRH#(2k) and RRH#(2k+1) respectively by RRC signalling tci-StatesToAddModList in the PDSCH-Config and tci-PresentInDCI is not configured;*
      * *All the configured TCI states are known to UE. UE is configured with NZP-CSI-RS resource for L1-RSRP measurements by RRC signaling nzp-CSI-RS-ResourceSet within the CSI-ResourceConfig and periodic CSI reporting by setting reportConfigType to periodic and reportQuantity to cri-RSRP (Note: reported L1-RSRP mesurements are not tested)*
      * *At slot#(k\*n), TE activates TCI#(k mod 4), TCI#(k+1 mod 4) and TCI#(k+2 mod 4) for PDSCH at the same time by “TCI States Activation/Deactivation for UE-specific PDSCH MAC CE” and actives TCI#(k mod 4) and TCI#(k+1 mod 4) for PDCCH with coresetPoolIndex#(k mod 2) and coresetPoolIndex#(k+1 mod 2) transmitted from RRH#(k) and RRH#(k+1) by “TCI State Indication for UE-specific PDCCH MAC CE” command with the field of CORESET ID set to 0 and 1 respectively, where n is the number of slots between two RRH;*
      * *PDSCH associated with TCI #(k mod 4) is transmitted from RRH#(k mod 4) in slot from max((k-1)n + 1 + HARQ needed time + 3ms + first TRS + TRS processing time, 0) to (k+1)n + HARQ needed time + 3ms.*
* Recommended WF
  + Suggest discussing later after RAN4 reach agreements on whether to define transmission 2 requirements.

**Issue 2-10: Applicability and capability signalling**

* Proposals in RAN4#98e meeting:
  + *Option 1 (Ericsson): For the multi-DCI based transmission requirements in HST-SFN,* 
    - *UE does not require to be capable of demodulationEnhancement and gNB does not need to configure highSpeedDemodFlag.*
    - *UE should be capable of multiDCI-MultiTRP.*
    - *No new UE capability signaling and network assigned signaling are necessary.*
* Recommended WF
  + More discussion is needed.

## Companies views’ collection for 1st round

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |

### CRs/TPs comments collection

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
|  |  |
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*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

## Summary on 2nd round (if applicable)

### Open issues summary

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |

## Summary on 2nd round (if applicable)

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
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