**3GPP TSG-RAN WG4 Meeting #101-bis-e R4-22xxxx**

**Electronic Meeting, January 17th- 25th 2022**

**Agenda item: 6.19.4**

**Source: Intel Corporation**

**Title: WF on demodulation requirement for Enhancement on HST-SFN deployment**

**Document for: Approval**

# Background

This contribution is to capture the agreements and the directions for the further studies of performance requirements definition for Rel-17 HST-SFN enhancements.

The following sub-agenda items from e-mail thread [101-bis-e][320] NR\_FeMIMO\_Demod\_NWM are considered:

* Sub-topic 3-5: Test Scope on Enhancement on HST-SFN deployment
* Sub-topic 3-8: Test setup for demodulation requirement for HST-SFN enhancement

The detailed discussions can be found in the e-mail discussion summary [R4-22xxxx]

# WF on requirements definition for HST-SFN enhancements

## Scope of PDSCH requirements

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| *Tentative agreements:** Introduce PDSCH requirements for HST SFN scheme A
* FFS on HST SFN scheme B
	+ Further evaluate impact on UE receive processing for SFN scheme B
	+ FFS on test design and channel model definition

*Candidate options:** Option 1 (Samsung, Huawei, CMCC): Introduce PDSCH requirements for SFN scheme B.
* Option 2 (Ericsson, Intel, NTT DoCoMo, Qualcomm, Apple): Introduce only PDSCH requirements for SFN scheme A
* Option 3 (CMCC): Do not introduce PDSCH requirements for SFN scheme B and define the following test applicability rule to guarantee performance with this scheme:
	+ If UE passes the existing test cases (demodulation requirement for HST-SFN with high Doppler shift), the performance of SFN scheme B is guaranteed
* Option 5 (Huawei) Introduce PDSCH requirements for both SFN scheme A and SFN scheme B with introduction of the following test applicability rule:
	+ If UE passes the existing test cases (demodulation requirement for HST-SFN with high Doppler shift), the performance of SFN scheme B is guaranteed
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## Scope of PDCCH requirements

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| *Candidate options:** Option 1 (CMCC): Define PDCCH requirements for HST SFN scenario
* Option 2 (Ericsson): RAN4 discusses and decides whether to still have PDCCH demodulation requirement if intra-slot PDCCH repetition demodulation requirement is agreed to be introduced
* Option 3 (Huawei): Do not define any PDCCH requirements for HST scenario but define PDCCH requirements for Scheme A for non-HST scenario.
* Option 4 (Intel): Define test case when both channels (PDSCH/PDCCH) are transmitted using SFN scheme A and verify performance of PDSCH only
* Option 5 (Apple, Qualcomm): Do not define PDCCH requirements for HST SFN scenario
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## PDSCH CA requirements

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| *Candidate options:** Option 1 (Intel): Define PDSCH CA requirements for HST SFN scenario
* Option 2 (Huawei, Qualcomm): Do not define PDSCH CA requirements for HST SFN scenario
* Option 3 (Apple, CMCC, Samsung): Define single carrier requirement firstly
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## Test Case design for PDSCH requirement for SFN scheme A with Single Carrier

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| **Test setup*** Option 1:
	+ Reuse existing Rel-16 HST-SFN test set-up as a baseline
		- PDCCH/PDSCH/ SFN transmitted from two RRHs
		- TCI state 1 and TCI state 2 applied for TRP/RRH #2n, #2n+1 separately; TRS 1 and TRS 2 transmitted from TRP#2n, and #2n+1 separately

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| Parameter | Value |
| FDD 15 kHz SCS | TDD 30 kHz SCS |
| CBW | 10 MHz | 40 MHz |
| Antenna configuration | 2x2; 2x4 |
| DMRS type | Type 1 |
| Number of DMRS symbols | 1+1+1 |
| TDD pattern |  | 7D1S2U, S: 6D 4G 4U |
| TRS configuration | 10ms, 2 slot pattern |
| PDSCH mapping | Type A, Start symbol 2, Duration 12 |
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| Ds and Dmin | Ds =700m; Dmin=150m |
| Test metric | SNR @70% of maximum throughput |

* Other options are not precluded.

**Maximum Doppler shift*** 15 kHz SCS:
	+ Option 1: 972 Hz
	+ Option 2: 870 Hz
	+ Other options are not precluded
* 30 kHz SCS:
	+ Option 1: 1667 Hz
	+ Other options are not precluded

**MCS and Rank*** Option 1 (Huawei, Samsung): MCS 17 with Rank 2 from MCS Table 1 as a starting point
* Other options are not precluded

**Channel Model*** Option 1 (Samsung):
	+ HST SFN channel model specified in B.3.2 of TS 38.101-4 reused as a baseline
	+ MCS 13, MCS17 with Rank 2 from MCS Table 1
* Option 2 (Huawei):
	+ Reusing the existing Rel-16 HST-SFN channel model (Ds=700m, Dmin=150m) with removing the two furthest paths corresponding to the two furthest TRP
* Option 3 (Intel)
	+ HST-SFN for PDSCH, PDCCH, DMRS with 2 RRHs per cell deployment
	+ Single TRP Tx for TRS
* Other options are not precluded (Apple)
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## Test Case design for PDSCH requirement for SFN scheme B with Single Carrier

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| **MCS and Rank*** MCS 17 with rank 2 as a starting point

**Test setup and Channel Model definition*** Option 1 (Samsung): Reuse existing Rel-16 HST-SFN test set-up as a baseline
	+ Two TCI states with QCL A type information, and another one configured QCL type B information
		- PDCCH/PDSCH/PBCH SFN transmitted from two RRHs
		- TCI state 1 and TCI state 2 applied for for TRP/RRH #2n, #2n+1 separately; TRS 1 and TRS 2 transmitted from TRP#2n, and #2n+1 separately
		- HST SFN channel model specified in B.3.2 of TS 38.101-4 reused without modelling Doppler shift
* Option 2 (Huawei): Reuse existing Rel-16 HST-SFN test set-up as baseline. Reuse the existing Rel-16 HST-SFN channel model (Ds=700m, Dmin=150m) with removing the two furthest paths corresponding to the two furthest TRP

Select typical network implementation and consider the network implementation as a part of channel model (i.e., specify the function between the time and the pre-compensation value) to make sure TE implementation of pre-compensation has no impact on the UE performance during the test |