**3GPP TSG-RAN WG4 Meeting #102-e R4-22xxxxx**

**Electronic Meeting, 21st Feb – 3rd Mar, 2022**

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

**Source:** Intel Corporation

**Agenda item:** 10.19.4

**Document for:** Approval

# Introduction

This WF capture all agreements and open issues for the following topics in [102-e][330] NR\_FeMIMO\_Demod:

* Topic #2: Demodulation requirement for Enhancement on HST-SFN scenario
	+ Sub-topic 2-1: Test scope
	+ Sub-topic 2-2: Test setup for PDSCH requirement for SFN scheme A with Single Carrier
	+ Sub-topic 2-3: Test setup for PDSCH requirement for SFN scheme B with Single Carrier If introduced

The agreed WFs on demodulation performance requirements for enhancement on HST-SFN in the previous meetings:

* R4-2203091, “WF on demodulation requirement for Enhancement on HST-SFN deployment”, Intel, RAN4#101-bis-e

# Topic #2: Demodulation requirement for Enhancement on HST-SFN scenario

## Sub-topic 2-1: Test scope

**Issue 2-1-1: Whether to define PDCCH requirement for HST SFN scenario**

*Tentative agreement:*

* No PDCCH requirement for Enhancement on HST-SFN scenario.
* Define test case where both channels (PDSCH/PDCCH) are transmitted using SFN scheme and verify performance of PDSCH only

*Recommendations for 2nd round:*

Confirm tentative agreement

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

**Issue 2-1-2: Whether to define PDSCH requireemnt with HST-SFN scheme B**

*Candidate options:*

* Option 1: Yes
	+ Option 1a: scheme A and scheme B with test applicability rule: If UE pass HST-SFN scheme A test cases, UE can skip HST-SFN scheme B test cases
* Option 2: No
* Option 3: 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

*Recommendations for 2nd round:*

* Encourage comments if any
* Encourage companies to further discuss with following aspects
	+ UE feature list with HST SFN scheme A and scheme B
	+ Channel model with scheme A and scheme B
	+ QCL type with two TCI states for scheme A and scheme B
	+ UE receiver processing with scheme A and scheme B
	+ Channel model with scheme B compared with single tap HST or DPS
	+ UE receiver processing of scheme B compared with single tap HST or DPS

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

**Issue 2-1-3: Whether to define PDSCH CA requirement for Enhancement on HST SFN scnearion**

*Tentative agreements*

* No PDSCH CA requirement for Enhancement on HST SFN scenario in Rel-17 FeMIMO WI.

*Recommendations for 2nd round:*

Confirm tentative agreement

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

## Sub-topic 2-2: Test setup for PDSCH requirement for SFN scheme A with Single Carrier

**Issue 2-2-1: Common setup for PDSCH requirement**

*Tentative agreements*

* Reuse existing Rel-16 HST-SFN test set-up as a baseline
	+ PDCCH/PDSCH SFN transmitted from two RRHs

|  |  |
| --- | --- |
| 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 |
| Ds and Dmin | Ds =700m; Dmin=150m |
| Test metric | SNR @70% of maximum throughput |

*Recommendations for 2nd round:*

Confirm tentative agreement

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

**Issue 2-2-2: Number of TCI codepoint for Test**

*Candidate options:*

* Option 1: 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
* Option 2: Configure 4 TCI code point during test, transmit TRS#i from RRH#4k+i that i = 0, 1, 2, 3 and k = 0, 1, 2, … .
	+ Codepoint#0 active when UE receiving PDSCH from RRH#4k and RRH#4k+1 : TCI#0, TCI#1
	+ Codepoint#1 active when UE receiving PDSCH from RRH#4k+1 and RRH#4k+2: TCI#1, TCI#2
	+ Codepoint#2 active when UE receiving PDSCH from RRH#4k+2 and RRH#4k+3: TCI#2, TCI#3
	+ Codepoint#3 active when UE receiving PDSCH from RRH#4k+3 and RRH#4(k+1): TCI#3, TCI#0
* Option 3: Configure 3 TCI code point during test, transmit TRS#i from RRH#3k+i that i = 0, 1, 2 and k = 0, 1, 2, … based on two RRHs
	+ Codepoint#0 active when UE receiving PDSCH from RRH#3k and RRH#3k+1 : TCI#0, TCI#1
	+ Codepoint#1 active when UE receiving PDSCH from RRH#3k+2 and RRH#3k+2: TCI#1, TCI#2
	+ Codepoint#3 active when UE receiving PDSCH from RRH#3k+2 and RRH#3k+2: TCI#2, TCI#0

*Recommendations for 2nd round:*

Encourage comments if any

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

**Issue 2-2-3: Maximum Doppler shift**

*Tentative agreements:*

* Define PDSCH requirement with HST-SFN scheme A with Maximum Doppler shift
	+ 30KHz SCS: 1667Hz
	+ 15 kHz SCS:
		- Option 1: 972 Hz
		- Option 1: 840 Hz
		- Companies are encouraged to bring simulation results with both option 1 and option 2 to check whether there is performance degradation with option 1, down selection one of them in the next meeting

*Recommendations for 2nd round:*

Encourage comments if any

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

**Issue 2-2-4: MCS and Rank**

*Tentative agreements:*

* Define PDSCH requirement with HST-SFN scheme A with MCS 17 and Rank 2 from MCS Table 1

*Recommendations for 2nd round:*

* Confirm tentative agreement

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

**Issue 2-2-5: Channel Model**

*Tentative agreements:*

* 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 as baseline
* For PDCCH and PDSCH HST-SFN with 2 nearest RRH, including time varying path power and path delay
* For TRS, single tap from each RRH, including time varying path power and path delay, apply the same scaling as PDSCH for each TRP for path power, and apply the same delay as PDSCH for each TRP for path delay, and apply the same time-varying Doppler shift from each RRH as PDCCH/PDSCH for Doppler shift

*Recommendations for 2nd round:*

Confirm tentative agreement

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

**Issue 2-2-6: Baseline receiver for defining scheme A requirement**

*Candidate options:*

* Option 1: Confirm the assumption that the HST-SFN advanced receiver is the baseline receiver for defining scheme A requirement
* Option 2: Do not assume HST-SFN advanced receiver is the baseline receiver for defining scheme A requirement

*Recommendations for 2nd round:*

Encourage comments if any

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

**Issue 2-2-7: UE capabilty**

*Candidate options:*

* Option 1: The PDSCH demodulation requirements for HST-SFN Scheme A is applicable for UE capable of ‘SFN Scheme A’.

*Recommendations for 2nd round:*

Pending on conclusion of UE feature list of Rel-17 FeMMO

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

**Issue 2-2-8: Performance evalution**

*Candidate options:*

* Option 1: Evaluate performance improvement of HST SFN scheme A over Rel-16 HST SFN.

*Tentative agreements:*

* Interested companies can provide the performance evaluation result of HST SNF scheme A over Rel-16 HST SFN. No impact on the Rel-17 HST SFN scheme A performance requirement definition.

*Recommendations for 2nd round:*

Confirm tentative agreement

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

## Sub-topic 2-3: Test setup for PDSCH requirement for SFN scheme B with Single Carrier If introduced

**Issue 2-3-1: Common setup for PDSCH requirement**

*Candidate options:*

* Option 1: Reuse existing Rel-16 HST-SFN test set-up as a baseline
	+ two TCI states with one configured QCL type A information, and another one configured QCL Type B information’
	+ 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

|  |  |
| --- | --- |
| 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 |
| Ds and Dmin | Ds =700m; Dmin=150m |
| Test metric | SNR @70% of maximum throughput |

*Recommendations for 2nd round:*

* Pending on issue 2-1-2

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

**Issue 2-3-2: Modeling of TRP pre-compensation**

*Candidate options:*

* Option 1: For scheme B, BS behaviour can be Doppler Modeling into channel model so that TE implementation of pre-compensation has no impact on the UE performance during the test.

*Recommendations for 2nd round:*

* Pending on issue 2-1-2

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

**Issue 2-3-3: Number of TCI codepoint for Test**

*Candidate options:*

* Option 1: 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
* Option 2: Configure 4 TCI code point during test, transmit TRS#i from RRH#4k+i that i = 0, 1, 2, 3 and k = 0, 1, 2, … .
	+ Codepoint#0 active when UE receiving PDSCH from RRH#4k and RRH#4k+1 : TCI#0, TCI#1
	+ Codepoint#1 active when UE receiving PDSCH from RRH#4k+1 and RRH#4k+2: TCI#1, TCI#2
	+ Codepoint#2 active when UE receiving PDSCH from RRH#4k+2 and RRH#4k+3: TCI#2, TCI#3
	+ Codepoint#3 active when UE receiving PDSCH from RRH#4k+3 and RRH#4(k+1): TCI#3, TCI#0

*Recommendations for 2nd round:*

* Pending on issue 2-1-2

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

**Issue 2-3-4: MCS and Rank**

*Candidate options:*

* Option 1: MCS 17 with Rank 2

*Recommendations for 2nd round:*

* Pending on issue 2-1-2

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

**Issue 2-3-5: Channel Model**

*Candidate options:*

* Option 1:
	+ 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 as baseline
	+ HST SFN channel model specified in B.3.2 of TS 38.101-4 reused without modelling Doppler shift

*Recommendations for 2nd round:*

* Pending on issue 2-1-2
* 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 as baseline
* For PDCCH and PDSCH HST-SFN with 2 nearest RRH, including time varying path power and path delay, without modelling Doppler shift
* For TRS, single tap from each RRH, including time varying path power and path delay, apply the same scaling as PDSCH for each TRP for path power, and apply the same delay as PDSCH for each TRP for path delay, without modelling Doppler shift

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

# Reference

1. R4-2207177, Email discussion summary for [102-e][330] NR\_FeMIMO\_Demod, RAN4#102-e, Samsung