**3GPP TSG RAN WG1 #118bis R1-240XXXX**

**Hefei, China, October 14th – 18th, 2024**

Source: Moderator (vivo)

Title: Summary on discussion on default TCI state for PDSCH without TCI field in DCI in HST-SFN scheme

Agenda Item: 7

Document for: Discussion and Decision

# Discussion

In [1], a draft CR is provided to add a phrase “without TCI field” after DCI format 1\_1/1\_2, to remove the condition “for DCI scheduling without TCI field” after *sfn-DefaultDL-BeamSetup-r17* and to modify “1\_1, 1\_2” to “1\_1/1\_2”. The reason for change is provided as below:

In Rel-17 HST-SFN discussion, default TCI state determination rules have been agreed, accordingly if PDSCH is scheduled by DCI without TCI field if the time offset between the reception of the DL DCI and the corresponding PDSCH is equal or larger than the threshold timeDurationForQCL as follows.

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| **Agreement**When SFN PDSCH and SFN PDCCH are configured by RRC, for PDSCH reception scheduled by DCI formats 1\_1 and 1\_2, and, if applicable the time offset between the reception of the DL DCI and the corresponding PDSCH is equal or larger than the threshold timeDurationForQCL * Support configuration when there is no TCI field in the DCI scheduling PDSCH
	+ UE applies the TCI state(s) of the scheduling CORESET when receiving the PDSCH
		- If there are two active TCI states for the CORESET, UE applies both QCL assumptions of the CORESET that schedules the PDSCH when receiving the PDSCH
		- otherwise, if there is one active TCI state for the CORESET, UE applies the one active TCI state of the CORESET when receiving the PDSCH

This feature is UE optional capability* If UE doesn’t support this capability, UE is expected to be configured with TCI state field
* UEs supporting this feature and are not capable of dynamic switching between single TRP and SFN, the CORESET that schedules PDSCH by DCI formats 1\_1 and 1\_2 (FFS DCI format 1\_0) should be activated with two TCI states.

FFS for maintenance: if SFN PDCCH is not configured**Agreement**When SFN PDSCH is not configured by RRC and there is no TCI codepoint which indicates two TCI states activated for the PDSCH (i.e. Rel-16 MTRP PDSCH is not configured) and SFN transmission scheme 1 is configured for PDCCH, for PDSCH reception scheduled by DCI format 1\_0, 1\_1, 1\_2 without TCI field, if the time offset between the reception of the DL DCI and the corresponding PDSCH is equal or larger than the threshold timeDurationForQCL if applicable and the CORESET which schedules the PDSCH is indicated with two TCI states, the default TCI state is defined as the first TCI state of the CORESET. |

However, in Rel-17 specification TS 38.214, “without TCI field” is missing after DCI format 1\_0/1\_1/1\_2 for HST-SFN scheme, which would lead to the wrong behavior when determining the TCI state for PDSCH reception.

Besides, *sfn-DefaultDL-BeamSetup-r17* is defined to indicate whether the UE supports the following features in TS 38.306.

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| - For FR2 only, PDSCH reception using default beam for enhanced SFN scheme when PDSCH is scheduled with offset less than threshold- For FR1 and FR2, PDSCH reception using default beam for enhanced SFN scheme when TCI field is not present in DCI format 1 0/1 1/1 2 when PDSCH is scheduled with offset equal or larger than the threshold, if applicable.- For FR2 only, aperiodic CSI-RS reception using default beam for enhanced SFN scheme when scheduling offset is less than threshold. |

It can be noticed that *sfn-DefaultDL-BeamSetup-r17* is not only for the case of TCI field not present in DCI format 1 0/1 1/1 2 when PDSCH is scheduled with offset equal or larger than the threshold. To remove the potential confusion, the unnecesary condition, i.e., for DCI scheduling without TCI field after *sfn-DefaultDL-BeamSetup-r17* in TS 38.214 should be removed.

And, following change is proposed for 38.214 section 5.1.5

When a UE is configured with both *sfnSchemePDCCH* and *sfnSchemePDSCH* scheduled by DCI format 1\_0 or by DCI format 1\_1/1\_2 without TCI field, if the time offset between the reception of the DL DCI and the corresponding PDSCH of a serving cell is equal to or greater than a threshold *timeDurationForQCL* if applicable:

- if the UE supports *sfn-DefaultDL-BeamSetup-r17*, the UE assumes that the TCI state(s) or the QCL assumption(s) for the PDSCH is identical to the TCI state(s) or QCL assumption(s) whichever is applied for the CORESET used for the reception of the DL DCI within the active BWP of the serving cell regardless of the number of active TCI states of the CORESET. If the UE does not support *sfn-SchemeA-DynamicSwitching-r17* or *sfn-SchemeB-DynamicSwitching-r17*, the UE should be activated with the CORESET with two TCI states.

- else if the UE does not support *sfn-DefaultDL-BeamSetup-r17*, the UE shall expect TCI field present when scheduled by DCI format 1\_1/1\_2.

When a UE is configured with *sfnSchemePDSCH* and *sfnSchemePDCCH* is not configured, when scheduled by DCI format 1\_1/1\_2, if the time offset between the reception of the DL DCI and the corresponding PDSCH of a serving cell is equal to or greater than a threshold *timeDurationForQCL* if applicable, the UE shall expect TCI field present.

For PDSCH scheduled by DCI format 1\_0 or by DCI format 1\_1/1\_2 without TCI field, when a UE is configured with *sfnSchemePDCCH* set to 'sfnSchemeA' and *sfnSchemePDSCH* is not configured, and there is no TCI codepoint with two TCI states in the activation command, and if the time offset between the reception of the DL DCI and the corresponding PDSCH is equal or larger than the threshold *timeDurationForQCL* if applicable and the CORESET which schedules the PDSCH is indicated with two TCI states, the UE assumes that the TCI state or the QCL assumption for the PDSCH is identical to the first TCI state or QCL assumption which is applied for the CORESET used for the PDCCH transmission within the active BWP of the serving cell.

Please provide your views whether you agree with the change or need further revision.

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# Conclusion

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# References

[1] R1-2407838 Draft CR on default TCI state for PDSCH without TCI field in DCI in HST-SFN scheme vivo

[2] R1-2407839 Draft CR on default TCI state for PDSCH without TCI field in DCI in HST-SFN scheme (Rel-18 mirror) vivo