8.1 HST agreements till RAN1#108-e

Clarification: The following includes all the agreements and conclusions made in Rel-17, including the texts which are crossed out. The crossed out texts are just not directly relevant to the change of specification.

**~~Agreement~~**

~~For the discussion purpose consider the following categorization of the enhanced DL transmission schemes~~

* **~~Scheme 1~~**~~:~~
	+ ~~TRS is transmitted in TRP-specific / non-SFN manner~~
	+ ~~DM-RS and PDCCH/PDSCH from TRPs are transmitted in SFN manner~~
* **~~Scheme 2~~**~~:~~
	+ ~~TRS and DM-RS are transmitted in TRP-specific / non-SFN manner~~
	+ ~~PDSCH from TRPs is transmitted in SFN manner~~

**~~Agreement~~**

~~Study the following aspects of the enhanced transmission schemes:~~

* **~~For scheme 1~~**~~:~~
	+ ~~Target DL physical channels, i.e., PDSCH only or PDSCH + PDCCH~~
	+ ~~Whether more than 2 QCL/TCI states are required and corresponding signaling details~~
	+ ~~Whether and how to indicate scheme 1 for differentiation with Rel-16 non-SFNed transmission schemes with multiple QCL/TCI states~~
	+ ~~QCL relationship between TRS and DMRS ports~~
	+ ~~Note: Other schemes/aspects are not precluded~~
* **~~For scheme 2~~**~~:~~
	+ ~~Association of each MIMO layer of PDSCH to DM-RS antenna ports~~
	+ ~~Whether more than 2 QCL/TCI states are required and corresponding signaling details~~
	+ ~~Whether and how to indicate scheme 2 for differentiation with Rel-16 non-SFNed transmission schemes with multiple QCL/TCI states~~

~~Note: Other schemes/aspects are not precluded~~

**~~Agreement~~**

~~Study TRP-based frequency offset pre-compensation including the following aspects:~~

* ~~Aspects related to indication of the carrier frequency determined based on the received TRS resource(s) in the 1~~~~st~~ ~~step~~
	+ **~~Option 1~~**~~: Implicit indication of the Doppler shift(s) using uplink signal(s) transmitted on the carrier frequency acquired in the 1~~~~st~~ ~~step~~
		- ~~Indication for QCL-like association of the resource(s) received in the 1~~~~st~~ ~~step with UL signal transmitted in the 2~~~~nd~~ ~~step~~
		- ~~Type of the uplink reference signals / physical channel used in the 2~~~~nd~~ ~~step, necessity of new configuration and corresponding signaling details~~
	+ **~~Option 2~~**~~: Explicit reporting of the Doppler shift(s) acquired in the 1~~~~st~~ ~~step using CSI framework~~
		- ~~FFS: Indication for QCL-like association of the resource(s) received in the 1~~~~st~~ ~~step with UL signal transmitted in the 2~~~~nd~~ ~~step~~
		- ~~CSI reporting aspects, configuration, quantization, signalling details, etc.~~
* ~~New QCL types/assumption for TRS with other RS (e.g., SS/PBCH), when TRS resource(s) is used as target RS in TCI state~~
* ~~New QCL types/assumptions for TRS with other RS (e.g., DM-RS), when TRS resource(s) is used as source RS in the TCI state~~
* ~~Target physical channels (e.g., PDSCH only or PDSCH/PDCCH) and reference signals that should be supported for pre-compensation~~
* ~~Signalling/procedural details on whether/how the pre-compensation is applied to target channels~~
* ~~Whether multiple sets of TRS and pre-compensation on TRS is needed in 3~~~~rd~~ ~~step.~~

~~Note: Other aspects/schemes are not precluded~~

**Agreement**

Support at least the following configuration for HST scenario in Rel-17

* The same DMRS port(s) can associate with multiple TCI states
	+ FFS other details

Note: DMRS and PDCCH/PDSCH from different TRPs are transmitted in SFN manner

**Agreement**

At most two TCI states are supported for HST scenario in Rel-17

* ~~FFS: Whether to support more than two TCI states for FR2~~
* ~~FFS configuration/signalling details of the TCI states~~

Note: DMRS and PDCCH/PDSCH from different TRPs are transmitted in SFN manner

**Agreement**

When the same DMRS port(s) are associated with two TCI states containing TRS as source reference signal, at least one variant is supported for Rel-17 HST-SFN scenario based on further evaluations

* **Variant A**: One of the TCI state can be associated with {*average delay*, *delay spread*} and another TCI states can be associated with {*average delay, delay spread, Doppler shift, Doppler spread*} (i.e., QCL-TypeA)
* **~~Variant B~~**~~: One of the TCI state can be associated with {~~*~~average delay, delay spread~~*~~} and another TCI state with {~~*~~Doppler shift, Doppler spread~~*~~} (i.e., QCL-TypeB)~~
* **~~Variant C~~**~~: One of the TCI state can be associated with {~~*~~delay spread~~*~~}  and another TCI states can be associated with {~~*~~average delay, delay spread, Doppler shift, Doppler spread~~*~~} (i.e., QCL-TypeA)~~
* **Variant E**: Both TCI states can be associated with {*average delay, delay spread, Doppler shift, Doppler spread*} (i.e., QCL-TypeA)
* ~~FFS: Indication method to apply QCL, e.g., via new QCL-type, or reuse existing QCL-type while UE to ignore certain QCL properties~~
* Note: Each TCI state in the above variants may be additionally associated with {Spatial Rx parameter} (i.e., QCL-TypeD)
* ~~Note: Companies are encouraged to provide evaluation results for the above variants based on agreed EVM from RAN1#102e meeting~~
* ~~Note: Above variants are applicable to scheme 1 and/or TRP based pre-compensation as a reference for evaluation.~~

~~This agreement is for the purpose of evaluation and does not imply the support or lack of support of scheme 1 and/or TRP based pre-compensation~~

**Agreement**

For PDCCH reliability enhancements, support SFN scheme + Alt 1-1.

* FFS: TCI state activation for CORESET, impact on default beam, BFD resource for BFR

Where the Alt 1-1 is agreed as:

Alt 1-1: One PDCCH candidate (in a given SS set) is associated with both TCI states of the CORESET

**Agreement**

Scheme 1 is supported in Rel-17

* TRS is transmitted in TRP-specific / non-SFN manner
* DM-RS and PDCCH/PDSCH from TRPs are transmitted in SFN manner
* ~~FFS other details~~

**Agreement**

For scheme 1 and SFN transmission of PDCCH support Variant E for QCL assumption in TCI state when TRS is used as source RS

**Agreement**

Two TCI states are supported for scheme 1 in FR2

**Agreement**

* Support MAC CE activation of two TCI states for PDCCH
* ~~FFS other details~~

**~~Conclusion~~**

~~The decision on support of specification based TRP pre-compensation scheme for HST-SFN scenario to be made in RAN1#104-e-bis meeting. To facilitate RAN1 decision, companies are encouraged to provide evaluation results according to the agreed evaluation assumptions. The evaluations not compliant with agreed assumptions will not be considered by RAN1 in the decision process.~~

**Agreement**

For HST-SFN scenario:

* Support semi-static (RRC based) switching of scheme 1 (PDSCH) with 2a, 2b, 3, 4

~~FFS all other details including RRC signaling, possible RAN4 impact (if any), etc.~~

**Agreement**

Introduce enhanced MAC CE signaling for PDCCH activating two TCI states for SFN-based PDCCH transmission

* The corresponding MAC CE includes at least the following fields
	+ Serving cell ID
	+ CORESET ID
	+ Two TCI state IDs
* ~~FFS whether for CA scenario additionally support RRC configured set of the serving cells which can be addressed by a single MAC CE~~
* ~~FFS whether or not enhanced MAC CE signaling is applicable to a CORESET configured with CORESETPoolindex~~

~~Send LS to RAN2 to inform about agreement on support of enhanced MAC CE for CORESET in Rel-17. LS is endorsed in R1-2104064~~

**Agreement**

Specification-based TRP Doppler pre-compensation scheme is supported in Rel-17 for FR1 with one or both:

* UL RS based Doppler estimation by gNB
	+ ~~FFS: Details including UL RS enhancement~~
* ~~DL RS based Doppler feedback by UE~~
	+ ~~FFS: Details~~
	+ ~~FFS: Whether UE capability needs to be introduced~~
* ~~Whether to support one or both will be decided later~~

**Agreement**

* Support dynamic (DCI-based) switching of scheme 1 (PDSCH) with single-TRP scheme by TCI state field in DCI format 1\_1/1\_2
	+ This feature is UE optional
* ~~FFS all other details including RRC signalling, possible RAN4 impact (if any), etc.~~

**Working Assumption**

All QCL source RS resource types as defined in TCI state for Rel-16 multi-TRP are supported for scheme 1

**Agreement**

Support semi-static (RRC-based) switching of scheme 1 (PDSCH) with Rel-16 scheme 1a

* ~~FFS: Whether dynamic switching is additionally supported~~

**~~For future meeting:~~**

~~Companies to consider Proposal #3-8a in FL summary (R1-2104020) for future meetings.~~

~~Companies to consider Proposal #3-10 in FL summary (R1-2104020) for future meetings.~~

**Agreement**

Scheme 1 for PDSCH is identified by

* New RRC parameter and the number of TCI states indicated by DCI
	+ ~~FFS RRC configuration details, e.g., per BWP or per CC~~

~~FFS whether or not restriction to a single CDM group for DM-RS is also supported~~

**Agreement**

Confirm the following working assumption from RAN1#104b-e:

All QCL source RS resource types as defined in TCI state for Rel-16 multi-TRP are supported for scheme 1.

**Agreement**

UE is not expected to be indicated by MAC CE with single TCI state per any of TCI codepoint , if UE is configured with scheme 1 PDSCH by RRC , but not capable to support dynamic switching between scheme 1 and single-TRP by TCI state field in DCI Format 1\_1/1\_2

**Agreement**

For specification based TRP-based frequency offset pre-compensation scheme

* Support dynamic (DCI -based) switching with single-TRP scheme by TCI state field in DCI format 1\_1/1\_2
	+ This feature is UE optional
	+ UE is not expected to be indicated by MAC CE with single TCI state per any of TCI codepoint , if UE is configured with TRP-based frequency PDSCH by RRC , but not capable to support dynamic switching between TRP-based frequency and single-TRP by TCI state field in DCI Format 1\_1/1\_2
* Support semi-static (RRC based) switching with Rel-16 schemes 1a, 2a, 2b, 3, 4
* Support semi-static (RRC based) switching with Rel-17 scheme 1 (PDSCH)

**Agreement**

Enhanced MAC CE signaling is not applicable to any of the configured CORESETs in a BWP if the CORESETs are configured with different *CORESETPoolindex* values in the BWP.

**Working Assumption**

For TRP-based pre-compensation, Variant A (based on RAN1#103-e meeting agreement) are supported as QCL types/assumption, when the same DMRS port(s) are associated with two TCI states.

* ~~FFS: Additional support of Variant B~~

**Agreement**

* For TRP-based pre-compensation QCL assumptions is provided to the UE by using the existing QCL type(s) with certain QCL parameters dropped from the indicted QCL type
	+ ~~FFS rule or signalling to determine which TCI state with dropped QCL parameters~~
* UE does not expect to be configured different SFN schemes (scheme 1 or TRP pre-compensation) for both PDCCH and PDSCH.
	+ ~~FFS whether this restriction is per UE or per CC~~
* UE does not expect to be configured different SFN schemes (scheme 1 or TRP pre-compensation) for different CORESETs.
	+ ~~FFS whether this restriction is per UE or per CC~~

**Agreement**

Enhanced SFN PDCCH transmission scheme (scheme 1 or TRP-based pre-compensation) is identified by the number of TCI states activated per CORESET and RRC parameter

* ~~FFS: Configuration detail of RRC parameter~~
	+ ~~Including whether the same RRC parameter is used for PDCCH and PDSCH~~

**~~Agreement~~**

~~If enhanced SFN PDCCH transmission scheme (scheme 1 or TRP -based pre-compensation) is configured and a CORESET is activated with two TCI states and UE is configured with enableTwoDefaultTCI-States and time offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold timeDurationForQCL, down-select rule to determine default beam(s) for Rel-17 SFN PDSCH reception in RAN1#106-e:~~

* **~~Alt 1~~**~~: Reuse rule to determine TCI states as defined for Rel-16 PDSCH scheme-1a~~
* **~~Alt 2~~**~~: Introduce new rules to determine TCI states based on two TCI state(s) of the CORESET~~

**~~Agreement~~**

~~If enhanced SFN PDCCH transmission scheme (scheme 1 or TRP-based pre-compensation) is configured and two TCI states are activated for at least one CORESET, support the following configuration of RS for BFD~~

* ~~Down-select one alternative for implicit configuration~~
	+ **~~Alt 1-2~~**~~: RS of CORESETs with both single and two TCI states are used~~
	+ **~~Alt 1-3~~**~~: RS of CORESETs with only two TCI states are used~~
* ~~Down-select one alternative for explicit configuration~~
	+ **~~Alt 2-1~~**~~: Support defining CSI-RS resource or SSB pairs as BFD RS~~
		- ~~FFS other details~~
	+ **~~Alt 2-2~~**~~: Reuse the existing Rel-15/Rel-16 approach for BFD RS configuration~~
* ~~Note: down-selection can be done separately for Rel-15/16 cell specific BFR and Rel-17 TRP-specific BFR, Rel-17 TRP-specific BFR to be discussed under AI 8.1.2.3~~

**Agreement**

Support the following combination of the transmission schemes

* Single-TRP PDCCH + Rel-17 Scheme 1 PDSCH
* Single-TRP PDCCH + Rel-17 TRP-based pre-compensation PDSCH
* ~~FFS: Other combinations of the transmission scheme~~

Note: The PDSCH corresponds to the PDSCH scheduled by DCI formats 1\_1 and 1\_2.

**Agreement**

For Rel-17 TRP-based pre-compensation scheme, indication of carrier frequency for uplink transmission (Doppler frequency reporting) in TRP-based pre-compensation scheme is supported using

* **Option 1** Implicit from RAN1#102-e agreement
	+ ~~FFS enhancements to SRS (e.g multiple SRS resource in a set) to improve the accuracy of frequency estimation~~

~~For Option1, some companies raised concerns that there is no consensus on the benefit and the applicability of this scheme in FDD.~~

~~For Option1, some companies raised concerns that there is no benefit in low SNR scenarios.~~

**Agreement**

For TRP -based pre-compensation

* Alt-1: QCL parameters are dropped from the second TCI state of the indicated TCI codepoint containing two TCI states

**~~Conclusion~~**

~~For Variant A and B (if supported)~~

* ~~For frequency offset pre-compensation QCL -like association of the resource(s) received in the 1st step with UL signal transmitted in the 2nd step is supported by implementation without specification impact~~

**Agreement**

Confirm working assumption from RAN1#105e meeting without modification:

For TRP -based pre-compensation, Variant A (based on RAN1#103-e meeting agreement) is supported as QCL types/assumption, when the same DMRS port(s) are associated with two TCI states.

* ~~FFS: Support of Variant B~~

**Agreement**

In CA scenario support RRC configured set of the serving cells which can be addressed by a single MAC CE for activation of two TCI states of CORESET with the same CORESET ID for all the BWPs in the indicated CCs set

* ~~FFS: Whether to reuse Rel-16 RRC parameters or introduce new RRC parameters.~~
* ~~FFS: UE capability~~
* ~~FFS: Whether/How to update the CORESET that is not configured to SFN scheme in the indicated CCs set~~

**Agreement**

If enableTwoDefaultTCI-States is configured and at least one TCI codepoint indicates two TCI states and time offset between the reception of the DL DCI and the PDSCH is less than the threshold timeDurationForQCL, default beam(s) for Rel-17 enhanced SFN PDSCH (scheme 1 or if supported TRP-based pre-compensation) reception:

* **Alt 1**: Reuse rule to determine TCI states as defined for Rel-16 PDSCH scheme-1a

This is a UE optional feature

**Agreement**

For PDSCH reception scheduled by DCI format 1\_0, [1\_1 and 1\_2], if 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 state(s) of the scheduling CORESET when receiving the PDSCH
		- if there are two active TCI states for the CORESET, UE applies the both QCL assumption of the CORESET that schedules the PDSCH when receiving the PDSCH
		- otherwise, UE applies the one active TCI state of the CORESET when receiving the PDSCH
* ~~FFS if the time offset between the reception of the DL DCI and the corresponding PDSCH is smaller than the threshold~~ *~~timeDurationForQCL~~*

This is a UE optional feature.

**Agreement**

If enhanced SFN PDCCH transmission scheme (scheme 1 or if TRP-based pre-compensation is supported in FR2) is configured and CORESET is indicated with two TCI states, and scheduling offset for AP CSI-RS is less than the threshold and *enableTwoDefaultTCIStates* is not configured

* If there is no other DL signal on the same symbol, use one of two TCI states as default beam for aperiodic CSI-RS reception, i.e.
	+ using one TCI state of the CORESET with the lowest CORESET ID in the latest slot as default beam for aperiodic CSI-RS reception. If there are two activated TCI states for the CORESET with the lowest CORESET ID, one of two TCI states will be selected, i.e. always selects the first TCI state if the CORESET has two TCI states
* If there is other DL signal on the same symbol, reuse Rel-15/16 mechanism

**Agreement**

If enhanced SFN PDCCH transmission scheme (scheme 1 or TRP-based pre-compensation) is configured and two TCI states are activated for at least one CORESET, support the following configuration of RS for BFD

* For implicit configuration
	+ **Alt 1-2**: RS of CORESETs with both single and two TCI states are used

~~FFS: The maximum number of BFD RS and details on RS determination~~

**Agreement**

If enhanced SFN PDCCH transmission scheme (scheme 1 or if TRP-based pre-compensation is supported in FR2) is configured, and if the CORESET with the lowest ID in the active DL BWP is indicated with two TCI states

* If PL-RS and spatial relation information are not configured for PUCCH and enableDefaultBeamPL-ForPUCCH is configuredin FR2
	+ For single-TRP PUCCH transmission, select the first TCI state of the CORESET as default beam and PL RS
* If PUSCH scheduled by DCI format 0\_0 and *enableDefaultBeamPL-ForPUSCH0-0* is configured in FR2, and if PUCCH resource is not configured on active UL BWP in the cell or if spatial relation is not configured in any PUCCH resource on active UL BWP in the cell,
	+ For single-TRP PUSCH transmission scheduled by DCI format 0\_0, select the first TCI state of the CORESET as default beam and PL RS
* If PL-RS and spatial relation information are not configured for SRS and *enableDefaultBeamPL-ForSRS* is configured in FR2
	+ For single-TRP SRS resource, select the first TCI state of the CORESET as default beam and PL RS
* ~~FFS other details, if any~~
* These are UE optional features

**Agreement**

When a CORESET is activated with two TCI states which overlaps with another CORESET, support extension of Rel-15 prioritization rule for PDCCH monitoring of PDCCH candidates in overlapping monitoring occasions with different QCL-TypeD

* ~~FFS: Prioritization rule considers CORESETs indicated with 1 and/or 2 TCI states~~
* Supports identifying two QCL-TypeD properties for multiple overlapping CORESETs
	+ UE capability is introduced
* ~~FFS other details~~
* ~~FFS: Strive to have same / similar solution as discussed under AI 8.1.2.1~~

**Conclusion**

No RAN1 specification impact on how to calculate hypothetical BLER for BFD

**~~Working Assumption~~**

~~Reuse legacy Rel-16 RRC parameters~~ *~~simultaneousTCI-UpdateList1, simultaneousTCI-UpdateList2~~* ~~to define set of the serving cells which can be addressed by a single MAC CE for activation of two TCI states of CORESET with the same CORESET ID for all the BWPs.~~

**Agreement**

If CSI-RS other than those configured with repetition set to 'on' is overlapping in the time domain with CORESET with two TCI states, support the first TCI state of the CORESET as the default TCI assumption for the CSI-RS.

**Agreement**

Support combination of Rel-17 SFN PDCCH scheme 1 and single-TRP PDSCH

* This is optional UE feature
* ~~Note: The support of such combination scheme is for URLLC use-case only.~~

**Agreement**

Enhanced SFN (scheme 1 or TRP-based pre-compensation scheme) for PDCCH and PDSCH is configured by using separate per-BWP RRC parameters

* In Rel-17, all downlink BWPs (except initial BWP and FFS: BWP-DownlinkCommon) within a CC should be the same configuration of SFN scheme

**~~Agreement~~**

~~When SFN PDSCH is not configured by RRC, for PDSCH reception scheduled by DCI format 1\_0, 1\_1, 1\_2, if the time offset between the reception of the DL DCI and the corresponding PDSCH is smaller than the threshold~~ *~~timeDurationForQCL,~~*

* ~~For DCI format 1\_1/1\_2, support both configurations with and without TCI state field.~~
* ~~[If~~ *~~enableTwoDefaultTCIStates~~* ~~is not configured,] for both cases with and without TCI state field,~~
	+ ~~If enhanced SFN PDCCH transmission scheme 1 is configured and the lowest CORESET ID in the latest slot is indicated with two TCI states, select the 1st TCI state of the two TCI states of the CORESET as default beam for the PDSCH reception~~
		- ~~FFS: Whether above applies for TRP-based pre-compensation if TRP-based pre-compensation is agreed to be support in FR2~~
	+ ~~Otherwise, UE applies the one active TCI state of the CORESET with the lowest~~ *~~controlResourceSetId~~* ~~in the latest slot when receiving the PDSCH~~

**~~Agreement~~**

~~For CSS associated with SFN CORESET, study the following alternatives and down-select in RAN1#107e:~~

* ~~Alt 2: UE doesn’t expect PDCCH candidates in CSS to be associated with CORESET activated with two TCI states, except for CSS type 3 associated with CORESET configured with scheme 1~~
* ~~Alt 3: If PDCCH candidates in CSS 0/0A/1/2/3 are associated with CORESET that activated with two TCI states, the first TCI state is applied for the CSS reception, except for CSS type 3 associated with CORESET configured with scheme 1.~~
	+ ~~For CSS type 3 associated with CORESET configured with scheme 1,  both TCI states can be applied for the CSS reception.~~

**Agreement**

When CORESET is indicated with two TCI states

* One BFD RS pair for SFN CORESET is counted as two BFD RSs
* ~~FFS: Increase the maximum number of monitored BFD RSs to X.~~
	+ ~~X is UE capability~~
	+ ~~X = 2, 3, 4, FFS other values of X~~

**Agreement**

When two TCI states are activated for a CORESET, NBI RS can be configured as follows

* **Alt 4-1**: Using the existing Rel-15 NBI configuration based on single SSB / CSI-RS resource
* **~~FFS addition support of~~****~~Alt 4-2~~**~~: two new beam identification CSI-RS resource sets / new beam identification CSI-RS resource pairs or SSB pairs~~

**Agreement**

Confirm the working assumption from RAN1 #106b-e meeting to reuse legacy Rel-16 RRC parameters *simultaneousTCI-UpdateList1*, *simultaneousTCI-UpdateList2* to define set of the serving cells which can be addressed by a single MAC CE for activation of two TCI states of CORESET with the same CORESET ID for all the BWPs.

**Agreement**

For intra-band CA, UE doesn’t expect configurations of different SFN schemes in different CCs

**Agreement**

TRP-based pre-compensation scheme for PDSCH / PDCCH is supported in both FR1 and FR2 with UE capability at least per FR

* Note: While majority of the companies support above, only one company has shown benefit on TRP-based pre-compensation scheme for PDSCH in FR2 with 200m ISD. Evaluation methodology and results can be found in R1-2101450.

**Agreement**

When a CORESET is activated with two TCI states which overlaps with another CORESET, support PDCCH monitoring of PDCCH candidates in overlapping monitoring occasions with QCL-TypeD properties identified according to prioritization rule

* Reuse Rel-15 prioritization to identify the first CORESET, i.e., SS type > serving cell index > SS set ID
	+ If the CORESET has two TCI states with QCL-typeD, both QCL-typeD are identified**.**
	+ If the CORESET has one TCI state with QCL-typeD, the second QCL-typeD is not identified

**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

**Agreement**

The agreement from RAN1#106b-e meeting is updated as follows

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), for PDSCH reception scheduled by DCI format 1\_0, 1\_1, 1\_2, if the time offset between the reception of the DL DCI and the corresponding PDSCH is smaller than the threshold timeDurationForQCL,

* For DCI format 1\_1/1\_2, support both configurations with and without TCI state field.
* ~~[If enableTwoDefaultTCIStates  is not configured,]~~ for both cases with and without TCI state field,
	+ If enhanced SFN PDCCH transmission scheme 1 is configured and the lowest CORESET ID in the latest slot is indicated with two TCI states, select the 1st TCI state of the two TCI states of the CORESET as default beam for the PDSCH reception
		- ~~FFS : Whether above applies for TRP -based pre-compensation if TRP -based pre-compensation is agreed to be support in FR2~~
	+ Otherwise, UE applies the one active TCI state of the CORESET  with the lowest controlResourceSetId  in the latest slot when receiving the PDSCH
* It is up to editor how to capture the above agreement

**Agreement**

If PDCCH candidates in CSS 3 are associated with CORESET that is activated with two TCI states and configured with enhanced SFN scheme 1 or TRP based pre-compensation, both TCI states can be applied for the CSS reception.

* FFS: Whether/How specification change is needed is up to the editor

**Agreement**

For a CORESET with two activated TCI states, for implicit BFD RS, how to calculate radio link quality for RLM /BFD is up to RAN4 discussion

* Send LS to let RAN4 to let them know about two possible options of radio link quality estimation for RLM /BFD using each RS or RS pair of CORESET activated with two TCI states. RAN1 has discussed both options, but was not able to reach a consensus. Inform that it is up to RAN4 to specify the most appropriate option. LS is endorsed in R1-2112829.

**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**

For the response to RAN2 LS (in R1-2200886), the following is agreed

|  |
| --- |
| Question: RAN2 would like to ask whether “Enhanced TCI state indication for UE specific PDCCH MAC CE” can be applied to CORESET zero or not. |

* RAN1 response: There is no restriction in RAN1 on whether enhanced TCI state indication for UE specific PDCCH MAC CE can be applied to CORESET zero.

**Agreement**

When SFN is configured for PDSCH and not configured for PDCCH, TCI field should be always present in DCI formats 1\_1 and 1\_2 for SFN PDSCH transmission with scheduling offset larger than threshold *timeDurationForQCL* if applicable

* FFS whether the above assumption is applicable for UE not capable of dynamic switching

**Agreement**

TPs #2-5 (for TS 38.213) in Section 2.3.5 and # 2-7 in Section 2.3.7 (for TS 38.214) of R1-2202755 are endorsed for editor’s CRs

**Agreement**

UE doesn’t expect to receive a MAC-CE activating two TCI states for a CORESET that is not configured with SFN scheme.

**Agreement**

When two TCI states are activated for a CORESET, BFR enhancements are applicable to

* CBRA/CFRA based BFR on SpCell in Rel.15.
* BFR MAC CE based BFR on Scell in Rel.16.
* CBRA BFR on SpCell (with BFR MAC CE on Msg.3/A) in Rel.16.
* Note: the “enhancement” means using RS from two TCI states for implicit BFD and counting one BFD RS pair for SFN CORESET as two BFD RSs

**Agreement**

The LS to RAN2 on Enhanced TCI state indication for UE-specific PDCCH MAC CE is endorsed in R1-220XXXX.

**Agreement**

The following text proposal is endorsed for the editor’s CR on TS38.214

|  |
| --- |
| **TS 38.214****<Unchanged parts are omitted>**5.1   UE procedure for receiving the physical downlink shared channel…When a UE is configured with *sfnSchemePdsch* and/or *sfnSchemePdcch*~~for a DL BWP~~, the UE shall expect that the *sfnSchemePdsch*and/or *sfnSchemePdcch* configuration are the same in~~the other~~ all DL BWPs within a CC other than initial BWP~~[and BWP-DownlinkCommon],~~ and the UE shall expect that the *sfnSchemePdsch* and/or *sfnSchemePdcch* configuration are the same in all CCs in a same frequency band if the UE is configured with CA.**< Unchanged parts are omitted >** |

R1-2202914, Agreed TPs to TS 38.213 and TS 38.214 for HST-SFN enhancements, Moderator (Intel Corporation)