3GPP TSG-RAN WG1 Meeting #100bis-e***R1-2002713***

e-Meeting, April 20 – 30, 2020

**Agenda item:** 7.2.8.4

**Source:** Moderator **(**Qualcomm Incorporated)

**Title:** Summary of 7.2.8.4: Physical-layer procedures to support UE/gNB measurements

**Document for:**  Discussion and Decision

# 1. Introduction

This document summarizes the observed issues related to physical-layer procedures to support UE/gNB measurements for NR positioning as submitted in [1] – [11].

[1] R1-2001561, "Maintenance of physical layer procedures to support positioning measurements", Huawei, HiSilicon.

[2] R1-2001603, "Maintenance of physical-layer procedure for NR positioning", ZTE.

[3] R1-2001687, "Discussion on remaining issues on physical-layer procedures for NR positioning", vivo.

[4] R1-2001734, "Remaining Issues on Physical Layer Procedures for NR Positioning", OPPO.

[5] R1-2001955, "Remaining details of physical-layer procedure to support UE/gNB measurements", LG Electronics.

[6] R1-2002049, "Remaining details on Measurement Procedures", Futurewei.

[7] R1-2002098, "Remaining issues on NR Positioning Procedures", CATT.

[8] R1-2002147, "Physical-layer procedures to support UE/gNB measurements", Samsung.

[9] R1-2002217, "Remaining issues on physical layer procedure for UL SRS transmission", CMCC.

[10] R1-2002287, "Corrections to physical layer procedures for NR positioning", Intel Corporation.

[11] R1-2002623, "Maintenance of rel16 Physical-layer procedures to support UE - gNB measurements", Ericsson.

**April 13-17: preparation phase**

* April 13th – 14th: FLs to prepare summary
* April 15th – 17th: FLs to lead the discussion identifying the set of email threads
	+ Note: PLEASE KEEP THE EMAIL DISCUSSION SCOPE PER EMAIL THREAD REASONABLE!
	+ Too much scope will force Chairman/Vice Chairman to step in to do the necessary cut down using the best judgement
		- if so, no complain please.

**email thread budget:**

* Positioning: up to 4 in total

🡪 Given that there are 4 sub-agenda items for positioning, a single email thread for AI 7.2.8.4 is assumed.

# 2. UE procedures for receiving DL-PRS

## 2.1 SSB measurement for the purpose of positioning

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 1 | Huawei [1] | **Proposal 1:** UE is not required to perform additional measurement on the SSB for the sole purpose of positioning.**Proposal 2:** Adopt the following TP for Clause 5.1.6.5 of TS 38.214.NOTE: The corresponding proposal for UL SRS is listed in scetion 3.1. | TP for Clause 5.1.6.5 (PRS reception procedure) of TS 38.214:[…]The UE may be configured to measure and report up to 8 DL PRS RSRP measurements on different DL PRS resources from the same cell. When the UE reports DL PRS RSRP measurements from one DL PRS resource set, the UE may indicate which DL PRS RSRP measurements have been performed using the same spatial domain filter for reception.If the UE is configured with *DL-PRS-QCL-Info* thatindicates an SS/PBCH block from a non-serving cell- the UE is not required to make additional measurements on the SS/PBCH block for the sole purpose of positioning.- the UE may reuse the measurement on the corresponding SS/PBCH block during RRM.If the UE is configured with *DL-PRS-QCL-Info* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are from the same cell. If *DL-PRS-QCL-Info* is configured to the UE with ‘QCL-Type-D’ with a source DL-PRS-Resource then the *DL-PRS-ResourceSetId* and the *DL-PRS-ResrouceId* of the source DL-PRS-Resource are expected to be indicated to the UE.[…] |

## 2.2 SSB assistance data

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 2 | Samsung [8] | **Proposal 1**: The following working assumption should be confirmed.* For DL-PRS processing, the following SSB assistance data can be provided for an indicated SSB:
	+ PCI of the cell
	+ *ssbFrequency* with values: *ARFCN-ValueNR*
	+ *halfFrameIndex* with values: 0 or 1
	+ *SSB-periodicity* with the values: *ServingCellConfigCommon* IE.
	+ *SSB-positionInBurst* with values: of *ServingCellConfigCommon* IE.
	+ *ssbSubcarrierSpacing* with values: *SubcarrierSpacing* IE
	+ *SFN-SSBoffset* with values {0,1,2,…15}
	+ Working assumption: *Smtc* per SSB frequency layer with values: *SSB-MTC* IE
	+ SSB Index
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## 2.3 RX beam indication for DL-AoD positioning

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 3 | Huawei [1] | **Proposal 5:** Adopt the following TP for Clause 5.1.6.5 of TS 38.214. | TP for Clause 5.1.6.5 (PRS reception procedure) of TS 38.214:[…]The UE may be configured to measure and report up to 8 DL PRS RSRP measurements on different DL PRS resources from the same cell. When the UE reports DL PRS RSRP measurements from one DL PRS resource set, the UE may indicate ~~which~~that the DL PRS RSRP measurements associated with the same *nr-DL-PRS-RxBeamIndex* have been performed using the same spatial domain filter for reception.[…] |

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 4 | Futurewei [6] | **Proposal:** RAN1 should discuss and decide on the definition of *nr-DL-PRS-RxBeamIndex*. |  |

## 2.4 RSTD Reference Info

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 5 | ZTE [2] | **Proposal 1:** Adopt the following text changes to allow all the possible options for a UE to determine a reference time. | TP for clause 5.1.6.4 (PRS reception procedure) of TS 38.214:[…]The UE may be indicated by the network that a DL PRS resource can be used as the reference for the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements in a higher layer parameter *DL-PRS-RstdReferenceInfo*. The reference time indicated by the network to the UE can also be used by the UE to determine how to apply higher layer parameters DL-PRS-expectedRSTD and DL-PRS-expectedRSTD-uncertainty. The UE expects the reference time to be indicated whenever it is expected to receive the DL PRS. This reference time provided by *DL-PRS-RstdReferenceInfo* may include an [ID], a DL PRS resource set ID, and optionally a single DL PRS resource ID or a list of PRS resource IDs from a single DL PRS resource set. The UE may use different DL PRS resources within a single DL PRS resource set provided by *DL-PRS-RstdReferenceInfo* or a different DL PRS resource set which can be any DL PRS resource set associated with the [ID] provided by *DL-PRS-RstdReferenceInfo* ordifferent DL PRS resources associated with an [ID] other than the [ID] provided by *DL-PRS-RstdReferenceInfo* or different DL PRS resource sets associated with an [ID] other than the [ID] provided by *DL-PRS-RstdReferenceInfo* to determine the reference time for the RSTD measurement. If the UE chooses to use a different reference time than indicated by the network, then it is expected to report the [ID], the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference. […] |

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 6 | LG Electronics [5] | **Proposal 1:**Adopt the following text proposal on Section 5.1.6.5 of TS 38.214 | TP for Clause 5.1.6.5 (PRS reception procedure) of TS 38.214:[…]The UE may be indicated by the network that a DL PRS resources can be used as the reference for the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements in a higher layer parameter *DL-PRS-RstdReferenceInfo*. The reference time indicated by the network to the UE can also be used by the UE to determine how to apply higher layer parameters DL-PRS-expectedRSTD and DL-PRS-expectedRSTD-uncertainty. ~~The UE expects the reference time to be indicated whenever it is expected to receive the DL PRS.~~ This reference time provided by *DL-PRS-RstdReferenceInfo* may include an [ID], a PRS resource set ID, and optionally a single PRS resource ID or a list of PRS resource IDs. The UE may use different DL PRS resources or a different DL PRS resource set to determine the reference time for the RSTD measurement as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met. If the UE chooses to use a different reference time than indicated by the network, then it is expected to report the [ID], the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference. In case that the reference time is not indicated by the network, the UE can select a TRP or a TRP including a PRS resource set and/or PRS resource(s) to determine a reference time, and it is expected to report the TRP ID and it is expected to optionally report the PRS resource set ID and/or the PRS resource ID(s). […] |

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 7 | Ericsson [11] | **Proposal 1:** Endorse text proposal 1 in Section 5 for inclusion in 38.214. | TP for Clause 5.1.6.5 (PRS reception procedure) of TS 38.214:[…]The UE may be indicated by the network that a DL PRS resources can be used as the reference for the RSTD measurement in a higher layer parameter *DL-PRS-RstdReferenceInfo*. The reference time indicated by the network to the UE can also be used by the UE to determine how to apply higher layer parameters DL-PRS-expectedRSTD and DL-PRS-expectedRSTD-uncertainty. The UE expects the reference time to be indicated whenever it is expected to receive the DL PRS. This reference time provided by *DL-PRS-RstdReferenceInfo* may include an [ID], a PRS resource set ID, and optionally a single PRS resource ID or a list of PRS resource IDs. The UE may use different DL PRS resources within a single DL PRS resource set ~~or a different DL PRS resource set~~ to determine the reference time for the RSTD measurement where the DL PRS resource set can be any DL PRS resource set associated with the [ID] provided by *DL-PRS-RstdReferenceInfo* ~~as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met~~. If the UE chooses to use a different reference time than indicated by the network, then it is expected to report the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference. […] |

## 2.5 QCL Info

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 8 | Ericsson [11] | **Proposal 2:** Endorse text proposal 2 in Section 5 for inclusion in 38.214. | TP for Clause 5.1.6.5 (PRS reception procedure) of TS 38.214:[…]*- DL-PRS-QCL-Info* defines any quasi-colocation information of the DL PRS resource with other reference signals. The DL PRS may be configured to be ‘QCL-Type-C’ and 'QCL-Type-D' (when applicable) with a source DL PRS or SS/PBCH Block from a serving cell or a non-serving cell. ~~The DL PRS may be configured to be 'QCL-Type-C' with a SS/PBCH Block from a serving or non-serving cell.~~ If the DL PRS is configured as both 'QCL-Type-C' and 'QCL-Type-D' with a SS/PBCH Block then the SSB index indicated should be the same.[…]If the UE is configured with *DL-PRS-QCL-Info* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are from the same cell. If *DL-PRS-QCL-Info* is configured to the UE ~~with 'QCL-Type-D'~~ with a source DL-PRS-Resource then the *DL-PRS-ResourceSetId* and the *DL-PRS-ResrouceId* of the source DL-PRS-Resource are expected to be indicated to the UE.[…] |

## 2.6 Measurement Gaps

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 9 | vivo [3] | **Observation1:** For some specific configurations for NR positioning, the time span of continuous PRS resources within a PRS resource set can exceed the maximum length of measurement gap configuration. **Proposal1:** Extending measurement gap length for NR positioning measurement should be considered.**Proposal2:** Extending measurement gap periodicity for NR positioning measurement should be considered. **Proposal3:** RAN1 should send an LS to RAN2 and RAN4 if extending measurement gap length and repetition period for NR positioning is agreed.  |  |

## 2.7 LPP *CommonIEsRequestLocationInformation* / early fix report

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 10 | Huawei [1] | **Observation 1:** Whether the QCL-D source RS has already been detected has impact on the latency.**Proposal 4:** UE is not required to report the measurement based on PRS resources that are TypeD QCLed with the SSBs from the non-serving cells that are not detected in the early fix report. |  |

## 2.8 Sidelink

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 11 | Huawei [1] | **Proposal 6:** No need to consider PRS collision with SL for positioning. |  |

## 2.9 UE Rx-Tx Time Difference Measurements

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 12 | Ericsson [11] | **Proposal 3:** Endorse text proposal 3 in Section 5 for inclusion in 38.214. | TP for Clause 5.1.6.5 (PRS reception procedure) of TS 38.214:[…]The UE can be configured in higher layer parameter *UE Rx-Tx Time-MeasRequestInfo* to report, subject to UE capability, up to 4 ~~multiple~~ UE Rx-Tx time difference measurements corresponding to a single configured SRS resource or resource set for positioning. Each measurement corresponds to a single received DL PRS resource or resource set which can be in difference positioning frequency layers.[…] |

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 13 | Huawei [1] | **Proposal 8**: Adopt the following TP for Clause 5.1.6.5 of TS 38.214. | TP for Clause 5.1.6.5 (PRS reception procedure) of TS 38.214:[…]For DL UE positioning measurement reporting in higher layer parameters *DL-PRS-RstdMeasurementInfo or DL-PRS-UE-Rx-Tx-MeasurementInfo* the UE can be configured to report the DL PRS resource ID(s) or the DL PRS resource set ID(s) associated with the DL PRS resource(s) or the DL PRS resource set(s) which are used in determining the UE measurements DL RSTD, UE Tx-Rx time difference or the DL PRS-RSRP.~~The UE can be configured in higher layer parameter~~ *~~UE Rx-Tx Time-MeasRequestInfo~~* ~~to report multiple UE Rx-Tx time difference measurements corresponding to a single configured SRS resource or resource set for positioning. Each measurement corresponds to a single received DL PRS resource or resource set which can be in difference positioning frequency layers.~~ For the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements the UE can report an associated higher layer parameter *Timestamp*. The *Timestamp* can include the SFN and the slot number for a subcarrier spacing. These values correspond to the reference which is provided by *DL-PRS-RSTDReferenceInfo*. The UE is expected to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP if the measurement is made during a configured measurement gap. When not configured with a measurement gap, the UE is only required to measure DL PRS within the active DL BWP and with the same numerology as the active DL BWP. When the UE is expected to measure the DL PRS resource outside the active DL BWP it may request a measurement gap in higher layer parameter [XYZ]. The UE assumes that the DL PRS from the serving cell is not mapped to any symbol that contains SS/PBCH block from the serving cell. If the time frequency location of the SS/PBCH block transmissions from non-serving cells are provided to the UE then the UE also assumes that the DL PRS from a non-serving cell is not mapped to any symbol that contains the SS/PBCH block of the same non-serving cell. The UE may be configured to measure and report, subject to UE capability, up to 4 DL RSTD measurements per pair of cells with each measurement between a different pair of DL PRS resources or DL PRS resource sets within the DL PRS configured for those cells. The up to 4 measurements being performed on the same pair of cells and all DL RSTD measurements in the same report use a single reference timing. The UE may be configured to measure and report, subject to UE capability, up to 8 DL PRS RSRP measurements on different DL PRS resources from the same cell. When the UE reports DL PRS RSRP measurements from one DL PRS resource set, the UE may indicate which DL PRS RSRP measurements have been performed using the same spatial domain filter for reception.The UE can be configured to measure and report, subject to UE capability, up to 4 UE Rx-Tx time difference measurements corresponding to a single configured SRS resource or resource set for positioning. Each measurement corresponds to a single received DL PRS resource or resource set which can be in difference positioning frequency layers.If the UE is configured with *DL-PRS-QCL-Info* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are from the same cell. If *DL-PRS-QCL-Info* is configured to the UE with ‘QCL-Type-D’ with a source DL-PRS-Resource then the *DL-PRS-ResourceSetId* and the *DL-PRS-ResrouceId* of the source DL-PRS-Resource are expected to be indicated to the UE.The UE does not expect to process the DL PRS in the same symbol where other DL signals and channels are transmitted to the UE when there is no measurement gap configured to the UE.[…] |

## 2.10 Alignment of IE names with other specifications

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 14 | Intel [10] |  | TP for Clause 5.1.6.5 (PRS reception procedure) of TS 38.214:5.1.6.5 PRS reception procedureThe UE can be configured with one or more DL PRS resource set configuration(s) as indicated by the higher layer parameters *nr-DL-PRS-ResourceSet-r16* and *nr-DL-PRS-Resource-r16*. Each DL PRS resource set consists of K≥1 DL PRS resource(s) where each has an associated spatial transmission filter~~.~~ The UE can be configured with one or more DL PRS positioning frequency layer configuration(s) as indicated by the higher layer parameter *nr-DL-PRS-PositioningFrequencyLayer-r16.* A DL PRS positioning frequency layer is defined as a collection of DL PRS resource sets which have common parameters configured by *nr-DL-PRS-PositioningFrequencyLayer-r16*.The UE assumes that the following parameters for each DL PRS resource(s) are configured via higher layer parameters *nr-DL-PRS-PositioningFrequencyLayer-r16, nr-DL-PRS-ResourceSet-r16* and *nr-DL-PRS-Resource-r16* definedby Clause 6.4.2.1 [TS 37.355].A positioning frequency layer consists of one or more DL PRS resource sets and it is defined by Clause 6.4.2.1 [TS 37.355]:*- dl-PRS-SubcarrierSpacing-r16* defines the subcarrier spacing for the DL PRS resource. All DL PRS resources and DL PRS resource sets in the same DL PRSpositioning frequency layer have the same value of *dl-PRS-SubcarrierSpacing-r16*.*- dl-PRS-CyclicPrefix-r16* defines the cyclic prefix for the DL PRS resource. All DL PRS resources and DL PRS resource sets in the same DL PRS positioning frequency layer have the same value of *dl-PRS-CyclicPrefix-r16.* *- dl-PRS-PointA-r16* defines the absolute frequency of the reference resource block. Its lowest subcarrier is also known as Point A. All DL PRS resources belonging to the same DL PRS resource set have common Point A and all DL PRS resources sets belonging to the same DL PRS positioning frequency layer have a common Point A.The UE expects that it will be configured with *dl-PRS-ID-r16* each of which is defined such that it is associated with multiple DL PRS resource sets from the same cell. The UE expects that one of these *dl-PRS-ID-r16* along with a *nr-DL-PRS-ResourceSetId-r16* and a *nr-DL-PRS-ResourceId-r16* can be used to uniquely identify a DL PRS resource. A DL PRS resource set consists of one or more DL PRS resources and it is defined by Clause 6.4.2.1 [TS 37.355]:*- nr-DL-PRS-ResourceSetId-r16* defines the identity of the DL PRS resource set configuration.*- dl-PRS-Periodicity-and-ResourceSetSlotOffset-r16* defines the DL PRS resource periodicity and the slot offset for DL PRS resource set with respect to SFN0 slot 0. All the DL PRS resources within one DL PRS resource set are configured with the same DL PRS resource periodicity.*- dl-PRS-ResourceRepetitionFactor-r16* defines how many times each DL-PRS resource is repeated for a single instance of the DL-PRS resource set. All the DL PRS resources within one resource set have the same resource repetition factor.*- dl-PRS-ResourceTimeGap-r16* defines the offset in number of slots between two repeated instances of a DL PRS resource with the same *nr-DL-PRS-ResourceSetId-r16* within a single instance of the DL PRS resource set. The UE is expected to be configured with *dl-PRS-ResourceTimeGap-r16* if *dl-PRS-ResourceRepetitionFactor-r16* is configured with value greater than 1. The time duration spanned by one instance of a *nr-DL-PRS-ResourceSet-r16* is not expected to exceed the configured value of DL PRS periodicity. All the DL PRS resources within one resource set have the same value of *dl-PRS-ResourceTimeGap-r16.**- dl-PRS-MutingPatternList-r16* defines a bitmap of the time locations where the DL PRS resource is expected to not be transmitted for a DL PRS resource set. The bitmap has two options for applicability. In the first option, each bit in the bitmap corresponds to a configurable number provided by higher layer parameter *dl-PRS-MutingBitRepetitionFactor-r16* of consecutive instances of a DL PRS resource set where all the DL PRS resources within the set are muted for the instance that is indicated to be muted. In the second option, each bit in the bitmap corresponds to a single repetition index for each of the DL PRS resources within each instance of a *nr-DL-PRS-ResourceSet-r16* and the length of the bitmap is equal to the values of *dl-PRS-ResourceRepetitionFactor-r16*. Both options may be configured at the same time in which case the logical AND operation is applied to the bit maps as described in Clause 7.4.1.7.4 of [4, TS 38.211].*- nr-DL-PRS-SFN0-Offset-r16* defines the time offset of the SFN0 slot 0 for the transmitting cell with respect to SFN0 slot 0 of reference cell.*- dl-PRS-CombSizeN-r16* defines the comb size of a DL PRS resource where the allowable values are given in Clause 7.4.1.7.1 of [TS38.211]. All DL PRS resource sets belonging to the same positioning frequency layer have the same value of *dl-PRS-CombSizeN-r16*.*- dl-PRS-ResourceBandwidth-r16* defines the number of resource blocks configured for DL PRS transmission. The parameter has a granularity of 4 PRBs with a minimum of 24 PRBs and a maximum of 272 PRBs. All DL PRS resources sets within a positioning frequency layer have the same value of *dl-PRS-ResourceBandwidth-r16*.*- dl-PRS-StartPRB-r16* defines the starting PRB index of the DL PRS resource with respect to reference Point A, where reference Point A is given by the higher-layer parameter *dl-PRS-PointA-r16*. The starting PRB index has a granularity of one PRB with a minimum value of 0 and a maximum value of 2176 PRBs. All DL PRS resource sets belonging to the same positioning frequency layer have the same value of *dl-PRS-StartPRB-r16*.A DL PRS resource is defined by:*- dl-PRS-ResourceList-r16* determines the DL PRS resources that are contained within one DL PRS resource set. *- nr-DL-PRS-ResourceId-r16* determines the DL PRS resource configuration identity. All DL PRS resource IDs are locally defined within a DL PRS resource set.*- dl-PRS-SequenceId-r16* is used to initialize cinit value used in pseudo random generator [4, TS38.211, 7.4.1.7.2] for generation of DL PRS sequence for a given DL PRS resource.*- dl-PRS-ReOffset-r16* defines the starting RE offset of the first symbol within a DL PRS resource in frequency. The relative RE offsets of the remaining symbols within a DL PRS resource are defined based on the initial offset and the rule described in Clause 7.4.1.7.3 of [4, TS38.211]. *- dl-PRS-ResourceSlotOffset-r16* determines the starting slot of the DL PRS resource with respect to corresponding DL PRS resource set slot offset.*- dl-PRS-ResourceSymbolOffset-r16* determines the starting symbol of the DL PRS resource within the starting slot. *- dl-PRS-NumSymbols-r16* defines the number of symbols of the DL PRS resource within a slot where the allowable values are given in Clause 7.4.1.7.1 of [4, TS38.211]. *- dl-PRS-QCL-Info-r16* defines any quasi-colocation information of the DL PRS resource with other reference signals. The DL PRS may be configured to be 'QCL-Type-D' with a DL PRS or SS/PBCH Block from a serving cell or a non-serving cell. The DL PRS may be configured to be 'QCL-Type-C' with a SS/PBCH Block from a serving or non-serving cell. If the DL PRS is configured as both 'QCL-Type-C' and 'QCL-Type-D' with a SS/PBCH Block then the SSB index indicated should be the same.The UE assumes constant EPRE is used for all REs of a given DL PRS resource.The UE may be indicated by the network that a DL PRS resources can be used as the reference for the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements in a higher layer parameter *nr-DL-PRS-ReferenceInfo-r16*. The reference time indicated by the network to the UE can also be used by the UE to determine how to apply higher layer parameters *nr-DL-PRS-expectedRSTD-r16* and *nr-DL-PRS-expectedRSTD-uncerainty-r16*. The UE expects the reference time to be indicated whenever it is expected to receive the DL PRS. This reference time provided by *nr-DL-PRS-ReferenceInfo-r16* may include an *dl-PRS-ID-r16* , a DL PRS resource set ID, and optionally a single DL PRS resource ID or a list of DL PRS resource IDs. The UE may use different DL PRS resources or a different DL PRS resource set to determine the reference time for the RSTD measurement as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met. If the UE chooses to use a different reference time than indicated by the network, then it is expected to report the *dl-PRS-ID-r16* , the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference. The UE may be configured to report quality metrics corresponding to the DL RSTD and UE Rx-Tx time difference measurements which include the following fields:*- timingMeasQualityValue-r16* which provides the best estimate of the uncertainty of the measurement*- timingMeasQualityResolution-r16* which specifies the resolution levels used in the *timingMeasQualityValue-r16* fieldThe UE is expected to be configured with higher layer parameter *nr-DL-PRS-expectedRSTD-r16*, which defines the time difference with respect to the received DL subframe timing the UE is expected to receive DL PRS, and *DL-PRS-expectedRSTD-uncertainty*, which defines a search window around the *nr-DL-PRS-expectedRSTD-r16*.For DL UE positioning measurement reporting in higher layer parameters *nr-DL-PRS-RstdMeasurementInfoRequest-r16 or* [*DL-PRS-UE-Rx-Tx-MeasurementInfo*]the UE can be configured to report the DL PRS resource ID(s) or the DL PRS resource set ID(s) associated with the DL PRS resource(s) or the DL PRS resource set(s) which are used in determining the UE measurements DL RSTD, UE Tx-Rx time difference.The UE can be configured in higher layer parameter [*UE Rx-Tx Time-MeasRequestInfo*] to report multiple UE Rx-Tx time difference measurements corresponding to a single configured SRS resource or resource set for positioning. Each measurement corresponds to a single received DL PRS resource or resource set which can be in different positioning frequency layers. For the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements the UE can report an associated higher layer parameter *nr-TimeStamp-r16*. The *nr-TimeStamp-r16* can include the SFN and the slot number for a subcarrier spacing. These values correspond to the reference which is provided by *nr-DL-PRS-ReferenceInfo-r16*. The UE is expected to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP if the measurement is made during a configured measurement gap. When not configured with a measurement gap, the UE is only required to measure DL PRS within the active DL BWP and with the same numerology as the active DL BWP. When the UE is expected to measure the DL PRS resource outside the active DL BWP it may request a measurement gap in higher layer parameter [*measGapConfig*]. The UE assumes that the DL PRS from the serving cell is not mapped to any symbol that contains SS/PBCH block from the serving cell. If the time frequency location of the SS/PBCH block transmissions from non-serving cells are provided to the UE then the UE also assumes that the DL PRS from a non-serving cell is not mapped to any symbol that contains the SS/PBCH block of the same non-serving cell. The UE may be configured to report, subject to UE capability, up to 4 DL RSTD measurements per pair of cells with each measurement between a different pair of DL PRS resources or DL PRS resource sets within the DL PRS configured for those cells. The up to 4 measurements being performed on the same pair of cells and all DL RSTD measurements in the same report use a single reference timing. The UE may be configured to measure and report up to 8 DL PRS RSRP measurements on different DL PRS resources from the same cell. When the UE reports DL PRS RSRP measurements from one DL PRS resource set, the UE may indicate which DL PRS RSRP measurements have been performed using the same spatial domain filter for reception.If the UE is configured with *dl-PRS-QCL-Info-r16* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are from the same cell. If *dl-PRS-QCL-Info-r16* is configured to the UE with 'QCL-Type-D' with a source DL-PRS-Resource then the *nr-DL-PRS-ResourceSetId-r16* and the *nr-DL-PRS-ResourceId-r16* of the source DL-PRS resource are expected to be indicated to the UE.The UE is not expected to process the DL PRS in the same symbol where other DL signals and channels are transmitted to the UE when there is no measurement gap configured to the UE. |

## 2.11 UE procedure for determining slot format

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 15 | OPPO [4] |  | TP for Clause 11.1.1 (UE procedure for determining slot format) of TS 38.213:[…]For a set of symbols of a slot indicated to a UE as flexible by *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* if provided, or when *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* are not provided to the UE, and if the UE detects a DCI format 2\_0 providing a format for the slot using a slot format value other than 255[…]- if the UE is configured by higher layers to receive DL PRS in the set of symbols of the slot, the UE receives the DL PRS in the set of symbols of the slot ~~only~~ if an SFI-index field value in DCI format 2\_0 indicates the set of symbols of the slot as downlink or flexible.* if the UE is configured by higher layers to receive DL PRS in the set of symbols of the slot, the UE does not receives the DL PRS in the set of symbols of the slot if an SFI-index field value in DCI format 2\_0 indicates the set of symbols of the slot as uplink if not measurement gap is configured.

- if the UE is configured by higher layers to transmit PUCCH, or PUSCH, or PRACH in the set of symbols of the slot, the UE transmits the PUCCH, or the PUSCH, or the PRACH in the slot only if an SFI-index field value in DCI format 2\_0 indicates the set of symbols of the slot as uplink […] |

## 2.12 DL-PRS Resource Set/DL-PRS Resouce

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 16 | OPPO[4] |  | TP for Clause 5.1.6.5 (PRS reception procedure) of TS 38.214:[…]A DL PRS resource set consists of one or more DL PRS resources and it is defined by:*- DL-PRS-ResourceSetId* defines the identity of the DL PRS resource set configuration. All DL PRS resource set IDs are defined locally within a [ID] that is associated with multiple DL PRS resource sets from the same cell.[…]A DL PRS resource is defined by:*- DL-PRS-ResourceList* determines the DL PRS resources that are contained within one DL PRS resource set. *- DL-PRS-ResourceId* determines the DL PRS resource configuration identity. All DL PRS resource IDs are locally defined within a DL PRS resource set.[…]*- DL-PRS-ResourceSymbolOffset* determines the starting symbol of the DL PRS resource within ~~the starting~~ one slot. *- DL-PRS-NumSymbols* defines the number of symbols of the DL PRS resource within a slot where the allowable values are given in Clause 7.4.1.7.1 of [4, TS38.211]. *- DL-PRS-QCL-Info* defines any quasi-colocation ~~information of~~ relationship between the PRS port of the DL PRS resource ~~with~~ and other reference signals. The DL PRS may be configured to be ‘QCL-Type-D’ with a DL PRS or SS/PBCH Block from a serving cell or a non-serving cell. The DL PRS may be configured to be ‘QCL-Type-C’ with a SS/PBCH Block from a serving or non-serving cell. If the DL PRS is configured as both ‘QCL-Type-C’ and ‘QCL-Type-D’ with a SS/PBCH Block then the SSB index indicated should be the same.[…] |

## 2.13 Miscelaneous

|  |  |  |  |
| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 17 | Samsung [8] | **Proposal 3**: Following aspects should be supported for UE measurement and report* Signalling overhead reduction for DL PRS quality report;
* Configurable UE measurement window for low complexity and low power consumption.
 |  |

# 3. UE procedures for SRS-for-positioning

## 3.1 SSB measurement for the purpose of positioning

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 18 | Huawei [1] | **Proposal 3:** Adopt the following TP for Clause 6.2.1.4 TS 38.214.NOTE: The corresponding proposal for PRS is listed in section 2.1. | TP for Clause 6.2.1.4 (UE sounding procedure for positioning purposes) TS 38.214:[…]If the UE is configured with the higher layer parameter *spatialRelationInfoPos-r16*, and if the reference RS is SS/PBCH block configured on a non-serving cell- the UE is not required to make additional measurements on the SS/PBCH block for the sole purpose of positioning.- the UE may reuse the measurement on the corresponding SS/PBCH block during RRM.[…] |

## 3.2 Pathloss reference signal

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 19 | Huawei [1] | **Proposal 7:** Reuse the side conditions for SS-RSRP and potentially PRS-RSRP in RAN4 specification for determining whether UE is not able to accurately measure the PL. |  |

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 20 | CATT [7] | **Proposal 4:** A criterion which based on RSRP threshold or other solution is needed to clarify the meaning of “the UE is not able to accurately measure$ PL\_{b,f,c}\left(q\_{d}\right)$”.**Proposal 5:** Inform RAN4 on the need to clarify the meaning of “the UE is not able to accurately measure$ PL\_{b,f,c}\left(q\_{d}\right)$” for SRS-Pos power control. |  |

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 21 | OPPO [4] |  | TP for Clause 7.3.1 (Sounding reference signals - UE behaviour) TS 38.213:[…]If a UE transmits SRS based on a configuration by IE *SRS-Positioning-Config* on active UL BWP $b$ of carrier $f$ of serving cell $c$, the UE determines the SRS transmission power $P\_{SRS,b,f,c}\left(i,q\_{s}\right)$ in SRS transmission occasion $i$ as  [dBm]where, - $P\_{O,SRS,b,f,c}\left(q\_{s}\right)$ and $α\_{O,SRS,b,f,c}\left(q\_{s}\right)$ are provided by *p0* and *alpha* respectively, for active UL BWP $b$ of carrier $f$ of serving cell $c$, and SRS resource set $q\_{s}$ is indicated by *SRS-ResourceSetId* from *SRS-ResourceSet*, and- $PL\_{b,f,c}\left(q\_{d}\right)$ is a downlink pathloss estimate in dB calculated by the UE, as described in Clause 7.1.1 in case of an active DL BWP of a serving cell $c$, using RS resource indexed $q\_{d}$ in a serving or non-serving cell for SRS resource set $q\_{s}$ [6, TS 38.214]. A configuration for RS resource index $q\_{d}$ associated with SRS resource set $q\_{s}$ is provided by *pathlossReferenceRS* - if a *ssb-Index* is provided, *referenceSignalPower* is provided by *ss-PBCH-BlockPower*- if a *dl-PRS-ResourceId* is provided, *referenceSignalPower* is provided by *dl-PRS-ResourcePower* If the UE determines that the UE is not able to accurately measure $PL\_{b,f,c}\left(q\_{d}\right)$ or the UE is not provided with *pathlossReferenceRS-Pos-r16*, the UE calculates $PL\_{b,f,c}\left(q\_{d}\right)$ using a RS resource obtained from the SS/PBCH block of the serving cell that the UE uses to obtain *MIB* The UE indicates a capability for a number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource set configured through *SRS-PosResourceSet-r16* in all the serving cells.[…] |

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 22 | LG Electronics [5] | **Proposal 2:**Adopt the following text proposal on Section 7.3.1 of TS 38.213 | TP for Clause 7.3.1 (Sounding reference signals - UE behaviour) TS 38.213:[…]If a UE transmits SRS based on a configuration by IE *SRS-Positioning-Config* on active UL BWP $b$ of carrier $f$ of serving cell $c$, the UE determines the SRS transmission power $P\_{SRS,b,f,c}\left(i,q\_{s}\right)$ in SRS transmission occasion $i$ as  [dBm]where, - $P\_{O,SRS,b,f,c}\left(q\_{s}\right)$ and $α\_{O,SRS,b,f,c}\left(q\_{s}\right)$ are provided by *p0* and *alpha* respectively, for active UL BWP $b$ of carrier $f$ of serving cell $c$, and SRS resource set $q\_{s}$ is indicated by *SRS-ResourceSetId* from *SRS-ResourceSet*, and- $PL\_{b,f,c}\left(q\_{d}\right)$ is a downlink pathloss estimate in dB calculated by the UE, as described in Clause 7.1.1 in case of an active DL BWP of a serving cell $c$, using RS resource indexed $q\_{d}$ in a serving or non-serving cell for SRS resource set $q\_{s}$ [6, TS 38.214]. A configuration for RS resource index $q\_{d}$ associated with SRS resource set $q\_{s}$ is provided by *pathlossReferenceRS* - if a *ssb-Index* is provided, *referenceSignalPower* is provided by *ss-PBCH-BlockPower*- if a *dl-PRS-ResourceId* is provided, *referenceSignalPower* is provided by *dl-PRS-ResourcePower* If the UE determines that the UE is not able to accurately measure $PL\_{b,f,c}\left(q\_{d}\right)$, the UE calculates $PL\_{b,f,c}\left(q\_{d}\right)$ using a RS resource obtained from the SS/PBCH block of the serving cell that the UE uses to obtain *MIB* The UE indicates a capability for a number of pathloss estimates that the UE can simultaneously maintain.If the UE is not provided with *pathlossReferenceRS-Pos-r16*, the UE calculates $PL\_{b,f,c}(q\_{d})$ using a RS resource configured within *SRS-SpatialRelationInfoPos-r16.* If the RS resource configured within *SRS-SpatialRelationInfoPos-r16* is a SRS resource or the *SRS-SpatialRelationInfoPos-r16* is not configured, the UE calculates $PL\_{b,f,c}(q\_{d})$ using a RS resource obtained from SS/PBCH block of the serving cell that the UE uses to obtain MIB.[…] |

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 23 | Samsung [8] | **Proposal 2**: UE should identify the weakest link quality and transmit based on the weakest link quality as long as it is lower than the maximum allowed transmit power per carrier to ensure successful reception of SRS by the non-serving cells. The following TP should be captured in TS 38.213. | TP for Clause 7.3.1 (Sounding reference signals - UE behaviour) TS 38.213:[…]If a UE transmits SRS based on a configuration by IE *SRS-Positioning-Config* on active UL BWP $b$ of carrier $f$ of serving cell $c$, the UE determines the SRS transmission power $P\_{SRS,b,f,c}\left(i,q\_{s}\right)$ in SRS transmission occasion $i$ as  [dBm]where, - $P\_{O,SRS,b,f,c}\left(q\_{s}\right)$ and $α\_{O,SRS,b,f,c}\left(q\_{s}\right)$ are provided by *p0* and *alpha* respectively, for active UL BWP $b$ of carrier $f$ of serving cell $c$, and SRS resource set $q\_{s}$ is indicated by *SRS-ResourceSetId* from *SRS-ResourceSet*, and- $PL\_{b,f,c}\left(q\_{d}\right)$ is a downlink pathloss estimate in dB calculated by the UE, as described in Clause 7.1.1 in case of an active DL BWP of a serving cell $c$, using RS resource indexed $q\_{d}$ in a serving or non-serving cell for SRS resource set $q\_{s}$ [6, TS 38.214], where $PL\_{b,f,c}\left(q\_{s}\right)$ is the smallest value of all measured non-serving cells. A configuration for RS resource index $q\_{d}$ associated with SRS resource set $q\_{s}$ is provided by *pathlossReferenceRS* - if a *ssb-Index* is provided, *referenceSignalPower* is provided by *ss-PBCH-BlockPower*- if a *dl-PRS-ResourceId* is provided, *referenceSignalPower* is provided by *dl-PRS-ResourcePower*[…] |

## 3.3 Spatial Relation

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 24 | OPPO [4] |  | TP for Clause 6.2.1.4 (UE sounding procedure for positioning purposes) TS 38.214:[…]The UE is not expected to transmit multiple SRS resources with different spatial relations in the same OFDM symbol.~~If the UE is not configured with the higher layer parameter~~ *~~spatialRelationInfo~~* ~~the UE may use a fixed spatial domain transmission filter for transmissions of the SRS configured by the higher layer parameter [SRS-for-positioning] across multiple SRS resources or it may use a different spatial domain transmission filter across multiple SRS resources.~~ The UE is only expected to transmit an SRS configured the by the higher layer parameter [SRS-for-positioning] within the active UL BWP of the UE.[…] |

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 25 | CMCC [9] | **Proposal 1:** The spatial relation information fallback mechanism should be defined for the UL SRS for positioning.**Proposal 2:** For the UL SRS for positioning that transmitted towards the neighboring cell, the DL RS that can be detected with the highest RSRP from the same neighboring cell should be used as the fallback spatialRelationInfo RS.**Proposal 3:** For the UL SRS for positioning that transmitted towards the serving cell, the RS that obtaining MIB from the serving cell should be used as the fallback spatialRelationInfo RS. |  |

## 3.4 Prioritizations for transmission power reductions

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 26 | LG Electronics [5] | **Proposal 3:**Adopt the following text proposal on Section 7.5 of TS 38.213 | TP for Clause 7.5 (Prioritizations for transmission power reductions) of TS 38.213:7.5 Prioritizations for transmission power reductions[…] The total UE transmit power in a symbol of a slot is defined as the sum of the linear values of UE transmit powers for PUSCH, PUCCH, PRACH, and SRS in the symbol of the slot. - PRACH transmission on the PCell- PUCCH transmission with HARQ-ACK information, and/or SR, and/or LRR, or PUSCH transmission with HARQ-ACK information- PUCCH transmission with CSI or PUSCH transmission with CSI- PUSCH transmission without HARQ-ACK information or CSI and, for Type-2 random access procedure, PUSCH transmission on the PCell- SRS transmission, with aperiodic SRS having higher priority than semi-persistent and/or periodic SRS, or PRACH transmission on a serving cell other than the PCell - SRS transmission configured by *SRS-Resource* has high priority than SRS transmission configured by *SRS-PosResource-r16*In case of same priority order and for operation with carrier aggregation, the UE prioritizes power allocation for transmissions on the primary cell of the MCG or the SCG over transmissions on a secondary cell.[…] |

## 3.5 Alignment of IE names with other specifications

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 27 | CATT [7] | **Proposal 1:** Adopt the following text proposal for UE sounding procedure in 38.214: | TP for Clause 6.2.1 (UE sounding procedure) TS 38.214:6.2.1 UE sounding procedure[…]- if the UE is configured with the higher layer parameter *spatialRelationInfo* containing the ID of a reference 'ssb-Index', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter *spatialRelationInfo* contains the ID of a reference 'csi-RS-Index', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, or of the latest reference aperiodic CSI-RS. If the higher layer parameter *spatialRelationInfo* contains the ID of a reference 'srs', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS or of the reference semi-persistent SRS or of the reference aperiodic SRS. When the SRS is configured by the higher layer parameter [SRS-for-positioning] and if the higher layer parameter *spatialRelationInfoPos* contains the ID of a reference '*DL-PRS-ResourceId*', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS.[…] |

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 28 | CATT [7] | **Proposal 2:** Adopt the following text proposal for UE sounding procedure for positioning purposes in 38.214: | TP for Clause 6.2.1.4 (UE sounding procedure for positioning purpose) TS 38.214:6.2.1.4 UE sounding procedure for positioning purposesWhen the SRS is configured by the higher layer parameter [SRS-for-positioning] and if the higher layer parameter *spatialRelationInfoPos* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *SRS-Config* or [SRS-for-positioning], CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell. The UE is not expected to transmit multiple SRS resources with different spatial relations in the same OFDM symbol.If the UE is not configured with the higher layer parameter *spatialRelationInfoPos* the UE may use a fixed spatial domain transmission filter for transmissions of the SRS configured by the higher layer parameter [SRS-for-positioning] across multiple SRS resources or it may use a different spatial domain transmission filter across multiple SRS resources. The UE is only expected to transmit an SRS configured the by the higher layer parameter [SRS-for-positioning] within the active UL BWP of the UE.When the configuration of SRS is done by the higher layer parameter [SRS-for-positioning], the UE can only be provided with a single RS source in *spatialRelationInfoPos* per SRS resource.If an SRS configured by the higher parameter [SRS-for-positioning] collides with a scheduled PUSCH, the SRS is dropped in the symbols where the collision occurs.  |

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| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 29 | CATT [4] | **Proposal 3:** Adopt the following text proposal for SRS-Pos power control in 38.213: | TP for Clause 7.3.1 (Sounding reference signals - UE behaviour) TS 38.213:7.3.1 UE behaviour[…]If a UE transmits SRS based on a configuration by IE *SRS-Positioning-Config* on active UL BWP $b$ of carrier $f$ of serving cell $c$, the UE determines the SRS transmission power $P\_{SRS,b,f,c}\left(i,q\_{s}\right)$ in SRS transmission occasion $i$ as  [dBm]where, - $P\_{O,SRS,b,f,c}\left(q\_{s}\right)$ and $α\_{O,SRS,b,f,c}\left(q\_{s}\right)$ are provided by *p0* and *alpha* respectively, for active UL BWP $b$ of carrier $f$ of serving cell $c$, and SRS resource set $q\_{s}$ is indicated by *SRS-PosResourceSetId* from *SRS-PosResourceSet*, and- $PL\_{b,f,c}\left(q\_{d}\right)$ is a downlink pathloss estimate in dB calculated by the UE, as described in Clause 7.1.1 in case of an active DL BWP of a serving cell $c$, using RS resource indexed $q\_{d}$ in a serving or non-serving cell for SRS resource set $q\_{s}$ [6, TS 38.214]. A configuration for RS resource index $q\_{d}$ associated with SRS resource set $q\_{s}$ is provided by *pathlossReferenceRS-Pos* - if a *ssb-Index* is provided, *referenceSignalPower* is provided by *ss-PBCH-BlockPower*- if a *dl-PRS-ResourceId* is provided, *referenceSignalPower* is provided by *dl-PRS-ResourcePower* If the UE determines that the UE is not able to accurately measure $PL\_{b,f,c}\left(q\_{d}\right)$, the UE calculates $PL\_{b,f,c}\left(q\_{d}\right)$ using a RS resource obtained from the SS/PBCH block of the serving cell that the UE uses to obtain *MIB* The UE indicates a capability for a number of pathloss estimates that the UE can simultaneously maintain. |

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| --- | --- | --- | --- |
| Item # | Company | Observations/Proposals | Specification Text Proposal |
| 30 | Intel [10] |  | TP for Clause 6.2.1.4 (UE sounding procedure for positioning purpose) TS 38.214:6.2.1.4 UE sounding procedure for positioning purposesWhen the SRS is configured by the higher layer parameter *srs-PosResource-r16* and if the higher layer parameter *spatialRelationInfoPos-r16* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *srs-Resource* or *srs-PosResource-r16*, CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell. The UE is not expected to transmit multiple SRS resources with different spatial relations in the same OFDM symbol.If the UE is not configured with the higher layer parameter *spatialRelationInfoPos-r16* the UE may use a fixed spatial domain transmission filter for transmissions of the SRS configured by the higher layer parameter *srs-PosResource-r16* across multiple SRS resources or it may use a different spatial domain transmission filter across multiple SRS resources. The UE is only expected to transmit an SRS configured by the higher layer parameter *srs-PosResource-r16* within the active UL BWP of the UE.When the configuration of SRS is done by the higher layer parameter *srs-PosResource-r16*, the UE can only be provided with a single RS source in *spatialRelationInfoPos-r16* per SRS resource for positioning .If an SRS configured by the higher parameter *srs-PosResource-r16* collides with a scheduled PUSCH, the SRS is dropped in the symbols where the collision occurs.  |

# 4. Identifying items for email discussion

NOTE: A single email discussion thread for AI 7.2.8.4 is assumed.

##### Issue #1: SSB Measurements for the purpose of positioning

- Sections: 2.1, 3.1

- Items #: 1, 18

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | low | UE implementation, it does not need to be specified in RAN1. It would make more sense to be discussed in RAN4 |
| Huawei/HiSilicon | High | Spec should be clear of SSB measurement for the purpose of positioning, either DL or UL. The provision of SMTC also implies mandating UE to do SSB measurement, or even cause scheduling restriction on PUCCH/PUSCH/SRS or PDCCH/PDSCH/TRS/CSI-RS for CQI for the purpose of measuring SSB from neighbouring gNB, which should be avoided in the first place.[2nd round] In reponse to Qualcomm, companies agreeing with Qualcomm, and companies without providing clear reason why it is not needed, we do not think it is only UE implementation, rather it may also impact gNB implementation and even signaling exchange between gNBs/5GC.We will face scheduling restrictioins for measurement on SSB symbols in SMTC, which means that gNB should not schedule DL/UL RS/Channels on the SSB, because even if it does, UE will not do the reception/transmission as UE is measuring SSB. This SSB may be from neighbouring cells, which is why it is possible to be transmitted on UL symbols of the serving cell.That being said, we need to clarify whether such scheduling restriction is assumed by UE/gNB for the purpose of measuring SSB to facilitate PRS reception. |
| Samsung | low | Agree with QC |
| CMCC | low | We share similar views with QC |
| LG | Low | Similar view with Qualcomm. This seems UE implementation issue. |
| Intel | Low | TP should be left up to UE implementation. No need to capture in spec |
| CATT | low | Similar view with QC. |
| Nokia/NSB | Low | Not needed.  |
| Vivo | low | Not needed. UE implementation. |
| Futurewei | low |  |
| ZTE | low | Actually, It’s more like network implementation. |
| OPPO | High | It is good to clarify that |
| Ericsson | low | Similar to the view expressed by other companies, we also think this is an implementation issue. We do not see the need to capture this in 38.214. |

**Summary:**

- 2 companies consider this issues of high priority; 11 companies consider it of low priority.

**Proposed conclusion:** The issue is not pursued at RAN1#100bis-e.

##### Issue #2: SSB Assistance Data

- Sections: 2.2

- Items #: 2

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| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | Medium |  |
| Huawei/HiSilicon | Low | We do not see the impact on the outcome of the discussion, and SMTC is already a field in NR-SSB-Config of NR-DL-PRS-AssistanceData in TS 37.355. No need to be discussed in RAN1. |
| Samsung | Low | Not critical |
| CMCC | Low |  |
| LG | Low |  |
| Intel | Low | It is already part of spec. No need to confirm |
| CATT | Low |  |
| Nokia/NSB | Low | Already in RAN2 spec |
| vivo | Low | Not needed |
| Futurewei | Low |  |
| ZTE | Low |  |
| OPPO | Low | It is not cirtical issue but we need to make RAN2 sepc capture it correctly. |
| Ericsson | Low |  |

**Summary:**

- 1 company considers this issue of medium priority; 12 companies consider it of low priority.

**Proposed conclusion:** The issue is not pursued at RAN1#100bis-e.

##### Issue #3: UE RX beam indication for DL-AoD positioning

- Sections: 2.3

- Items #: 3, 4

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | 3: Medium, 4: low | Regarding 4, it is not clear what needs to be decided. Isnt it obvious if 3 is clarified? |
| Huawei/HiSilicon | High | RAN1 agreement was interpreted by RAN2 by one-step further, and therefore RAN1 spec should be updated accordingly. |
| Samsung | Low |  |
| LG | Medium | It seems not a critical issue in the current phase, but we are fine with a discussion to clarify the definiction of “nr-DL-PRS-RXBeamIndex”. |
| Intel | 3 Low, 4 Medium | We assume that RAN2 agreement is hold. Capturing it in spec can be done as a part of alignment e.g. added to R1-2002287. Whether additional definition is needed it can be discussed.  |
| CATT | Medium | It seems some clarification is needed. |
| Nokia/NSB | High | This issue should be discussed as RAN2 has made a mistake in their interpretation of RAN1 agreement which is now incorrectly captured.  |
| vivo | Medium | Okay to clarify. |
| Futurewei | High |  |
| ZTE | High |  |
| OPPO | Low | There is no need to define a “UE Rx beam ID” |
| Ericsson | medium | ok to clarify issue 3.  |

**Summary:**

- 4 companies consider this issues of high priority; 5 companies of medium priority, and 3 companies consider it of low priority.

**Proposed conclusion:** Discuss and conclude this issue at RAN1#100bis-e.

##### Issue #4: RSTD/timing reference info

- Sections: 2.4

- Items #: 5, 6, 7

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | low | We have some preference to wait until RAN2 specs are more stable, because our understading is that there will be additional IE names in RAN2 to try to clarify the difference between Reference of Assistance data and Reference for RSTD. Specifically, the TPs proposed here are mainly doing some reshuffling currently. |
| Huawei/HiSilicon | Medium | The clarification of use of reference seems less urgent, although we are OK to resolve it without taking much time. |
| Samsung | High | Clarification is needed since positioning could be wrong without knowing the correct reference. |
| CMCC | Medium | We think this issue can be further disscussed, due to the limited ED #, however, it seems not as urgent as some other issues. |
| LG | High | The reference for the timing difference measurement is so important, this issue needs to be clarified.  |
| Intel | Medium | There is no different views/misunderstanding. It can be added later. |
| CATT | Medium | It seems some clarification is needed. |
| Nokia/NSB | Medium | We are okay to discuss but do not support any of the TPs. We could send an LS to RAN2 informing them this is incorrect in their spec.  |
| vivo | Medium | Okay to clarify. |
| Futurewei | Medium |  |
| ZTE | High | Need to clarify. |
| OPPO | High | It is good to clarify |
| Ericsson | Medium | Ok to clarify. |

**Summary:**

- 4 companies consider this issue of high priority; 8 companies of medium priority, and 1 company consider it of low priority.

**Proposed conclusion:** Discuss and conclude this issue at RAN1#100bis-e

##### Issue #5: QCL Info

- Sections: 2.5

- Items #: 8

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | low | Our understanding is Type-C from DL PRS to DL PRS was discussed and is not supported in Rel-16. Even though we were supportive of this feature, we believe that it is not an essential correction for Rel-16.  |
| Huawei/HiSilicon | Medium | In our understanding, any QCL-D indication cannot be standalone and should be assumed along with at least QCL-C, so we are OK to discuss extension of PRS-PRS QCL indication to QCL-C, but it seems less urgent. |
| Samsung | Low | Not critical |
| LG | Medium | QCL type-C might be needed to configure QCL type-D, so we think this issue mighbt be easily addressed. |
| Intel | Low | QCL framework is not so critical. It seems intention is to support QCL type-C only in FR1 on which no concensus was reached in the past |
| CATT | Low | We don’t see the necessity to add QCL type-C on top of QCL type-D. |
| Nokia/NSB | Low | Not critical and not needed. |
| vivo | Medium | OK to discuss. |
| Futurewei | Low |  |
| ZTE | Medium | It’s a low hanging fruit. |
| OPPO | Low | Agree with QC that DL PRS can be configured as source for QCL-TypeC. |
| Ericsson | Medium | We think this is good to discuss further, but given the 1 email limit for this agenda, we can defer this to a future meeting. |

**Summary:**

- 5 companies consider this issue of medium priority, and 7 companies of low priority.

**Proposed conclusion:** The issue is not pursued at RAN1#100bis-e.

##### Issue #6: UE Rx-Tx Time Different measurements

- Sections: 2.9

- Items #: 12, 13

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | High | Agreement missing which has not been captured in RAN1 specifications. |
| Huawei/HiSilicon | Medium | We consider this type of change editorial (even one from us), less urgent, but we are OK to address them without taking much time. |
| Samsung | Medium | Can be easily addressed. |
| LG | Medium |  |
| Intel | Low | 12 – looks editorial. We can add parameter name later on13 – UE Rx-Tx Time-MeasRequestInfo is missing including RAN2 specs. Propose to make correction next time if it is necessary. |
| CATT | High | Need to capture the missing RAN1’s agreement |
| Nokia/NSB | Medium | Okay to discuss.  |
| vivo | Medium | Editorial. Okay to discuss. |
| Futurewei | Low |  |
| ZTE | Medium | Okay to address. |
| OPPO | High | It is editorial change to capture the missing part. |
| Ericsson | High | It would be good to address this. |

**Summary:**

- 4 companies consider this issue of high priority; 6 companies of medium priority, and 2 companies consider it of low priority.

**Proposed conclusion:** Discuss and conclude this issue at RAN1#100bis-e

##### Issue #7: Alignment of IE names with other specifications

- Sections: 2.10, 3.5

- Items #: 14, 27, 28, 29, 30

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | Medium | Note: We are also OK to wait until RAN2 specs are more stable |
| Huawei/HiSilicon | Medium | The required modifications pertaining to 27-30 seem to be more complicated than just changing *spatialRelationInfo to*  *spatialRelationInfoPos or pathlossReferenceRS to pathlossReferenceRS-Pos* and need to be discussed either in this meeting or in May meeting.  |
| Samsung | Low | Should wait for RAN2 |
| LG | Medium |  |
| Intel | High | We believe the progress in this area can reduce amount of TPs and therefore amount of work for the next meeting and therefore prefer to handle it during 100bis-E meeting. |
| CATT | High | Share the similar views with Intel. |
| Nokia/NSB | Medium | As commented in other AIs we are okay to discussed alignment issues as long as all AIs are treated the same.  |
| vivo | Medium | Editorial |
| Futurewei | Low | Editorial |
| ZTE | Medium | Editorial |
| OPPO | High | It is good to correct the names |
| Ericsson | Medium-to-low | Given the 1 email per agenda limit, it may be better to leave this to spec editors. |

**Summary:**

- 3 companies consider this issue of high priority; 3 companies of medium priority, and 6 companies consider it of low priority.

**Proposed conclusion:** The issue is not pursued at RAN1#100bis-e.

##### Issue #8: UE procedures determining slot format

- Sections: 2.11

- Items #: 15

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | low | This issue was discussed previous meeting, we don’t see an additional calrification needed.  |
| Huawei/HiSilicon | Low | The suggested change is covered by another section in 213.The proposed change:* if the UE is configured by higher layers to receive DL PRS in the set of symbols of the slot, the UE does not receives the DL PRS in the set of symbols of the slot if an SFI-index field value in DCI format 2\_0 indicates the set of symbols of the slot as uplink if not measurement gap is configured.

The existing specIf a UE is configured by higher layers to receive a DL PRS in a set of symbols of a slot and the UE detects a DCI format 2\_0 with a slot format value other than 255 that indicates a slot format with a subset of symbols from the set of symbols as uplink, or the UE detects a DCI format indicating to the UE to transmit PUSCH, PUCCH, SRS, or PRACH in at least one symbol in the set of the symbols, the UE cancels the DL PRS reception in the set of symbols of the slot. |
| Samsung | Low | Not critical |
| LG | Low | We do not see necessity of clarification in addition to the current specification. |
| Intel | Low | No need |
| CATT | Low | Seems not needed. |
| Noia/NSB | Low | Not needed. |
| vivo | Low | Not needed. |
| Futurewei | Low |  |
| ZTE | Low |  |
| OPPO | Low |  |
| Ericsson | Low | Not needed. |

**Summary:**

- All interested companies consider this issue of low priority.

**Proposed conclusion:** The issue is not pursued at RAN1#100bis-e.

##### Issue #9: DL-PRS Resource Set/Resource clarifications

- Sections: 2.12

- Items #: 16

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | low | This seems to be aligment and not essential corrections, and could potentially be merged with #7 if #7 is part of the scope of the final ED. |
| Huawei/HiSilicon | Low | This clarification seems less needed, as it is already common understanding. For example, in Rel-15, we do not need say the CSI-RS/SRS resource/resource set ID is defined globally or locally |
| Samsung | Low | Not critical |
| CMCC | Low | The current spec is clear at this point (see “ The UE expects that one of these [IDs] along with a *DL-PRS-ResourceSetId* and a *DL-PRS-ResourceId* can be used to uniquely identify a DL PRS Resource.”), and no need to additionally clarify that the resouce (set) ID is locally configured. |
| LG | Low |  |
| Intel | Low | Does’s not matter at this stage |
| CATT | Low |  |
| Nokia/NSB | Low | Not needed.  |
| vivo | Low | Not needed at all. |
| Futurewei | Low |  |
| ZTE | low | Not crytical. |
| OPPO | Low | Not critical issue |
| Ericsson | Low | Not critical. |

**Summary:**

- All interested companies consider this issue of low priority.

**Proposed conclusion:** The issue is not pursued at RAN1#100bis-e.

##### Issue #10: Pathloss reference

- Sections: 3.2

- Items #: 19, 20, 21, 22, 23

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | Low |  |
| Huawei/HiSilicon | Medium | From our perspective, if the criteria of not correctly measuring PL needs to be discussed, a conclusion from RAN1 is sufficient.On whether PL reference can be optional, and the UE behaviour in case it is absent, we are open to discuss it. |
| Samsung | High | Without clarification, UE actually does not know with PL reference to use to determine Tx power and thus UE behaviour is not clear. |
| CMCC | Low | Seems that this issue belongs to RAN4 scope. |
| LG | High | It needs to be discussed. First, in terms of RAN1 spec, it is not clear the case where ”the UE is not able to accurately measure PL”. Secondly, the path-loss configuration is optional, so the UE behavior needs to be addressed for that case. |
| Intel  | Low | Was discusses at 100-E meeting. It seem to be in RAN4 scope now. |
| CATT | High | There is a need to clarify UE’s behavior in RAN1’s specitcation when UE is not able to accurately measure PL. |
| Nokia/NSB | Medium | Okay to discss.  |
| vivo | Low | Not needed. This has already been discussed and concluded in RAN1#100-e, why keep repeating the same thing. |
| Futurewei | Low |  |
| ZTE | Medium | Item 19 is in RAN4 scope now and default UE behavior for not knowing PL reference can be discussed. |
| OPPO | High | The pathloss RS is optionals and we need to specify the UE behavior if the parameter is configured. Please note: for all the other SRS, the UE behavior for parameter is not configured is specified in 38.213 |
| Ericsson | Low |  |

**Summary:**

- 4 companies consider this issue of high priority; 3 companies of medium priority, and 6 companies consider it of low priority.

**Proposed conclusion:** Discuss and conclude this issue at RAN1#100bis-e

##### Issue #11: Spatial relation

- Sections: 3.3

- Items #: 24, 25

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | Low | New UE behavior for fallback of spatial relation is proposed. Even though, a similar discussion was made for pathloss reference, and it could be reasonable to do it for the spatial relation, we are OK to not introduce new features for Rel-16 and consider it for further enhancements in rel-17.  |
| Huawei/HiSilicon | Medium | It seems to be an enhancement, but we are open to discuss the fallback behaviour in case UE fails to detect the spatial relation source RS. |
| Samsung | Medium | Fallback behaviour is needed. |
| CMCC | High | We believe that the spatial relation info fallback mechanism is critial to positioning accuracy and latency, and it should be discussed. Note that this issue is also summarized in 7.2.8.2 and labelel as high priority in ED#C. We are ok to move this discussion under 7.2.8.2. |
| LG | High | Similar to path-loss reference RS, the UE needs fallback behaviour when the UE is not able to detect the DL RS which is configured as a source of spatial realtion information. |
| Intel | Low | Postpone to R17 discussion/analysis.  |
| CATT | High | There is a need to clarify UE’s fallback behavior in case UE is not able to detect the configured the spatialRelationInfo RS. |
| Nokia/NSB | Low | Same view as Intel/QC.  |
| vivo | Low | Not critical and no need to discuss. Whether UE fallback procedure for pathloss reference or spatial relation, optimization of fallback, which itself may not happen often in nature, is not important to the system operation. The arguments of positioning accuracy for fallback have been brought up and not agreed in RAN1 before. No need to repeat them in Rel-16.  |
| Futurewei | Low | Not essential but rather enhancements |
| ZTE | low | Not crytical. |
| OPPO | High for 24Low for 25 | On 24: That paragraph on UE behavior is totally up to UE implementation and shall not be stated in specification.On 25: if not configuring spatial relation info by the system, it means that the UE shall use one UL Tx beam based on the UE implementation. No need to specify UE behavior.  |
| Ericsson | Low | similar view as QC/Intel/Nokia |

**Summary:**

- 4 companies consider this issue of high priority; 2 companies of medium priority, and 7 companies consider it of low priority.

Although, some companies regard this of high priority, the issue is not considered being a correction at this stage.

**Proposed conclusion:** The issue is not pursued at RAN1#100bis-e.

##### Issue #12: Prioritizations for transmission power reductions

- Sections: 3.4

- Items #: 26

|  |  |  |
| --- | --- | --- |
| Company | Priority:High (essential correction) / medium / low | Comments |
| Qualcomm | Low | New Ue behavior / optimization with limited gain; not essential correction.  |
| Huawei/HiSilicon | Low | Suggest to cover this issue when we discuss whether MIMO SRS and positioning SRS can be transmitted on the same symbol on different CC. |
| Samsung | Low | Not critical |
| CMCC | Low | Not critical |
| LG | Medium | Needs to be discussed together with an issue on whether or not to support simultaneous transmission of SRS for positioning and SRS for MIMO. |
| Intel | Low | Depends on outcome of the discussion on SRS transmission in one symbol |
| CATT | Low | Can be discussed together with an issue on whether or not to support simultaneous transmission of SRS for positioning and SRS for MIMO |
| Nokia/NSB | Low | Share a similar view as Huawei and LG that this could be combined with other issue from DL AI.  |
| vivo | Low | Not essential. |
| Futurewei | Low | Not critical |
| ZTE | Low | Agree with Huawei,LG,Intel, and CATT. |
| OPPO | Low | That is not critical. Current spec seems good enough |
| Ericsson | Low | Not critical. |

**Summary:**

- 1 company considers this issues of medium priority; 12 companies consider it of low priority.

**Proposed conclusion:** The issue is not pursued at RAN1#100bis-e.

##### Items not considered in the above Issue List:

Item #9, section 2.6: RAN4 is currently discussing measurement gaps; issue appears a RAN4 only issue.

Item #10, section 2.7: The LPP "early fix" feature is a common (i.e., independent on positioning method) and "best-effort" reporting feature. There are no requirements defined.

Item #11, section 2.8: There appears to be no RAN1 action required at this time.

Item #17, section 2.13: There appears to be no RAN1 action possible/required at this time.

|  |  |
| --- | --- |
| Company | Comments |
| Qualcomm | low |
| Nokia/NSB | Low |
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|  |  |

# 5. Proposed email discussion scope

Based on the company feedback in section 4, and considering a manageable email discussion scope, the following items are proposed to be discussed and concluded in an email discussion at RAN1 #100bis-e:

- Issue #3: UE RX beam indication for DL-AoD positioning

- Issue #4: RSTD/timing reference info clarifications

- Issue #6: UE Rx-Tx Time Difference measurements configuration

- Issue #10: Pathloss reference configuration

|  |  |
| --- | --- |
| Company | Comments |
| Huawei/HiSilicon | Regarding issue#1, we expressed our concern, as it is not purely UE implementation and it may impact gNB implementation. The concern has not been responded by any proponents marking “low”. Even from those marking “low”, we observe contradictory arguments with some saying up to UE implementation, and some saying up to gNB implementation.Without any clear response to the concern, which is technical as we think, I am afraid we cannot accept the current scope. Although we do not know what the criterion is to do phase 1 down-scoping, any technical comments/concerns needs to be replied so that a consensus-driven principle is observed, regardless of e-meeting or F2F meeting. |
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