3GPP TSG-RAN WG2 Meeting #118-e ***R2-22xxxxx***

Electronic Meeting, May 9 – 20, 2022

**Agenda item:** 6.11.2.8

**Source:** Qualcomm Incorporated

**Title:** [AT118-e][631][POS] Remaining PropDisc LPP RIL items (Qualcomm)

**Document for:**  Discussion

# 1. Introduction

This document summarizes the following email discussion:

* [AT118-e][631][POS] Remaining PropDisc LPP RIL items (Qualcomm)

      Scope: Check company views and discuss the RIL items marked for discussion and not covered by contributions:

* H004: Expected AoA/AoD per TRP or per resource
* N013: Uncertainty mandatory or optional for expected AoA/AoD
* H059: DL-PRS ID in the TEG timestamp
* H024, H032, H033, H046: BIT STRING for UE-based assistance data per method

      Intended outcome: Report to Monday (week 2) session

      Deadline:  Friday 2022-05-13 1800 UTC

##### References:

[1] R2-2206326, "Rel-17 LPP RIL".

[2] R2-2206327, "Rel-17 LPP ASN1 Review File".

[3] R2-2206328, "LPP Updates and ASN.1 Review".

[4] R2-2203737, "LS on updated Rel-17 LTE and NR higher-layers parameter list", RAN1.

# 2. Discussion

## 2.1 Expected AoA/AoD

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| **[RIL]**: H004 **[Delegate]**: Huawei, HiSilicon (GuoYinghao) **[WI]**: **[Class]**: 2 **[Status]**: ToDo **[TDoc]**: None **[Proposed Conclusion]**: propDisc**[Description]**: We think this indication should be per resource not per TRP**[Proposed Change]**: Change the field to the resource level configuration of DL-PRS. We can send an LS to R1 for clarification, if needed**[Comments]**: [Rap] Can't see this is in the RAN1 parameter List. |

The current LPP implementation [3] is as follows:

-- ASN1START

NR-DL-PRS-AssistanceData-r16 ::= SEQUENCE {

 nr-DL-PRS-ReferenceInfo-r16 DL-PRS-ID-Info-r16,

 nr-DL-PRS-AssistanceDataList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

 NR-DL-PRS-AssistanceDataPerFreq-r16,

 nr-SSB-Config-r16 SEQUENCE (SIZE (1..nrMaxTRPs-r16)) OF

 NR-SSB-Config-r16 OPTIONAL, -- Need ON

 ...

}

NR-DL-PRS-AssistanceDataPerFreq-r16 ::= SEQUENCE {

 nr-DL-PRS-PositioningFrequencyLayer-r16

 NR-DL-PRS-PositioningFrequencyLayer-r16,

 nr-DL-PRS-AssistanceDataPerFreq-r16 SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

 NR-DL-PRS-AssistanceDataPerTRP-r16,

 ...

}

NR-DL-PRS-AssistanceDataPerTRP-r16 ::= SEQUENCE {

 dl-PRS-ID-r16 INTEGER (0..255),

 nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL, -- Need ON

 nr-CellGlobalID-r16 NCGI-r15 OPTIONAL, -- Need ON

 nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON

 nr-DL-PRS-SFN0-Offset-r16 NR-DL-PRS-SFN0-Offset-r16,

 nr-DL-PRS-ExpectedRSTD-r16 INTEGER (-3841..3841),

 nr-DL-PRS-ExpectedRSTD-Uncertainty-r16

 INTEGER (0..246),

 nr-DL-PRS-Info-r16 NR-DL-PRS-Info-r16,

 ...,

 [[

 prs-OnlyTP-r16 ENUMERATED { true } OPTIONAL -- Need ON

 ]],

 [[

 nr-DL-PRS-ExpectedAoD-or-AoA-r17

 NR-DL-PRS-ExpectedAoD-or-AoA-r17 OPTIONAL -- Need ON

 ]]

}

[parts omitted]

The RAN1 parameter list [4] includes the following:

|  |
| --- |
| Agreement For the purpose of both UE-B and UE-A DL-AoD, and with regards to the support of AOD measurements with an expected uncertainty window, the following is supported  • Indication of expected angle value and uncertainty (of the expected azimuth and zenith angle value) range(s) is signaled by the LMF to the UE • The type of expected angle and uncertainty can be requested by the UE, between the following options Option 1: Indication of expected DL-AoD/ZoD value and uncertainty (of the expected DL-AoD/ZoD value) range(s) is signaled by the LMF to the UE Option 2: Indication of expected DL-AoA/ZoA value and uncertainty (of the expected DL-AoA/ZoA value) range(s) is signaled by the LMF to the UE |

At RAN2#117, the following was agreed:

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| Proposal 20: RAN2 to agree that the angle assistance information (expected angel value and uncertainty) should be per TRP (12/12). |

**Question 1:** Which of the following options is preferred to resolve H004:

 (a) Angle assistance information (expected angle value and uncertainty (*NR-DL-PRS-ExpectedAoD-or- AoA-r17*)) should be per TRP (as agreed at RAN2#117) and as implemented in current LPP [3].

 (b) Agree the proposed change in H004: "Change the field to the resource level configuration of DL- PRS".

 (c) Ask RAN1 for clarification (via LS).

 (d) Other (please specify).

|  |  |  |
| --- | --- | --- |
| Company | Option (a), (b), (c), or (d) | Comments |
| Intel | A | Would be good to follow original agreements for now, and check internally instead of LS (unless RAN1 can reply our LS in this meeting) since officially we need to freeze the spec in this meeting. A general question is can we still change ASN.1 after this meeting with NBC? |
| Huawei, HiSilicon | (b) | First, we cannot change ASN.1 after this meetingBut the issue is that the L1 parameter is not clear whether it should be per TRP or per resource. Considering the time, maybe it is better to talk to R1 by internal communications and ask R1 to make clarification this meeting |
| ZTE | (b) or (c) | It is reasonable to configure expected angle value and uncertainty per resource than per TRP, so suggest to change it or ask R1 |
| Apple | A | Unless there is a clear information from RAN1 stating otherwise  |
| CATT | A and C | Prefer not to change unless clear reply from RAN1. |
| OPPO | A |  |
| vivo | A |  |
| Samsung | A |  |
| Xiaomi | A and C | Keep the current description and ask RAN1 to clarify it. |
| Ericsson | A | If expected RSTD per TRP can work then why not Expected AoD.Otherwise RAN1 should also define expected RSTD per beam.Per resource will result in additional data. |

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| **[RIL]**: N013 **[Delegate]**: Nokia (Mani) **[WI]**: **[Class]**: 2 **[Status]**: ToDo **[TDoc]**: None **[Proposed Conclusion]**: propDisc**[Description]**: Is the uncertainty fields mandatory?**[Proposed Change]**: Clarify if it is possible to provide expected AoD and expected AoA without the uncertainty info.**[Comments]**: [Rap] Is not clear from the RAN1 parameter list, but I assume Yes (seems not very useful otherwise (similar to expected RSTD)). |

The current LPP implementation [3] is as follows:

NR-DL-PRS-ExpectedAoD-or-AoA-r17 ::= CHOICE {

 expectedAoD-r17 SEQUENCE {

 expectedDL-AzimuthAoD-r17 INTEGER (0..359),

 expectedDL-AzimuthAoD-Unc-r17 INTEGER (0..60),

 expectedDL-ZenithAoD-r17 INTEGER (0..180),

 expectedDL-ZenithAoD-Unc-r17 INTEGER (0..30)

 },

 expectedAoA-r17 SEQUENCE {

 expectedDL-AzimuthAoA-r17 INTEGER (0..359),

 expectedDL-AzimuthAoA-Unc-r17 INTEGER (0..60),

 expectedDL-ZenithAoA-r17 INTEGER (0..180),

 expectedDL-ZenithAoA-Unc-r17 INTEGER (0..30)

 }

}

The RAN1 parameter list [4] includes the following:

|  |
| --- |
| Agreement For the purpose of both UE-B and UE-A DL-AoD, and with regards to the support of AOD measurements with an expected uncertainty window, the following is supported  • Indication of expected angle value and uncertainty (of the expected azimuth and zenith angle value) range(s) is signaled by the LMF to the UE • The type of expected angle and uncertainty can be requested by the UE, between the following options Option 1: Indication of expected DL-AoD/ZoD value and uncertainty (of the expected DL-AoD/ZoD value) range(s) is signaled by the LMF to the UE Option 2: Indication of expected DL-AoA/ZoA value and uncertainty (of the expected DL-AoA/ZoA value) range(s) is signaled by the LMF to the UEAgreementOnly GCS is supported for reference angle for expected angle and uncertainty of DL-AoD positioningAgreementFor the configuration of the AoA/AoD uncertainty window:The granularity is set as: Option 1: the granularity of the uncertainty range and expected AOD/AOA for AoD/AoA is 1 degree The uncertainty range is Option 1: Expected Azimuth DL-AoD/DL-AoA uncertainty range is configurable within [-60 0,60] with an step size of 1 degrees. Expected Zenith DL-AoD/DL-AoA uncertainty range is configurable within [-30 0,30] with an step size of 1 degrees. Option 2: the angles are configurable interpreted as follow  Range of Expected azimuth angle of arrival as (φAOA – ΔφAOA/2, φAOA + ΔφAOA/2) φAOA – expected azimuth angle of arrival, ΔφAOA – uncertainty range for expected azimuth angle of arrival. Range of Expected zenith angle of arrival as (θAOA – ΔθAOA/2, θAOA + ΔθAOA/2) θAOA – expected zenith angle of arrival, ΔθAOA – uncertainty range for expected zenith angle of arrival. Range of Expected azimuth angle of departure as (φAOD – ΔφAOD/2, φAOD + ΔφAOD/2) φAOD – expected azimuth angle of departure, ΔφAOD – uncertainty range for expected azimuth angle of departure. Range of Expected zenith angle of departure as (θAOD- ΔθAOD/2, θAOA + ΔθAOA/2) θAOD – expected zenith angle of departure, ΔθAOD – uncertainty range for expected zenith angle of departure. |

Rapporteur's Comments:

- The RAN1 agreements above do not indicate that the uncertainty of the expected AoA/AoD should be optional present.

**Question 2:** Which of the following options is preferred to resolve N013:

 (a) Uncertainty of expected AoA/AoD is mandatory present as implemented in current LPP [3].

 (b) Uncertainty of expected AoA/AoD is changed to OPTIONAL present.

 (c) Ask RAN1 for clarification (via LS).

 (d) Other (please specify).

|  |  |  |
| --- | --- | --- |
| Company | Option (a), (b), (c), or (d) | Comments |
| Intel | A | Would be good to follow original agreements for now, and check internally instead of LS (unless RAN1 can reply our LS in this meeting) since officially we need to freeze the spec in this meeting.  |
| Huawei, HiSilicon |  |  |
| ZTE | (c) | Suggest to ask R1 |
| Apple | A | Keep the current text unless there is a clear information from RAN1 stating it should be changed |
| CATT | A and C | Prefer not to change unless clear reply from RAN1. |
| OPPO | A  |  |
| vivo | A | Should be mandatory, similar with the expected RSTD: nr-DL-PRS-ExpectedRSTD-r16 INTEGER (-3841..3841), nr-DL-PRS-ExpectedRSTD-Uncertainty-r16 INTEGER (0..246), |
| Samsung | A and C | Keep the current text unless there is a new input from RAN1. |
| Xiaomi | A and C | Keep the current description and ask RAN1 to clarify it. |
| Ericsson | B and C | New featuire/functionality is by default OPTIONAL. |

## 2.2 TEG timestamp

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| **[RIL]**: H059 **[Delegate]**: Huawei, HiSilicon (GuoYinghao) **[Class]**: 3 **[Status]**: ToDo **[TDoc]**: Nones **[Proposed Conclusion]**: propDisc**[Description]**: Within the IE NR-TImeStamp, there is PRS-ID defined, which is mandatory present. but it is unnecessary for TEG reporting. **[Proposed Change]:** Define a new IE for time stamp with SFN, slot and symbol**[Comments]:** [Rap:] A reference for a time stamp seems always needed. This must not necessarily be the same TRP as for the measurement time stamp. |

The current LPP implementation [3] is as follows:

NR-SRS-TxTEG-Element-r17 ::= SEQUENCE {

 nr-TimeStamp-r17 NR-TimeStamp-r16 OPTIONAL, -- Need OP

 nr-UE-Tx-TEG-ID-r17 INTEGER (0..maxNumOfTxTEGs-1-r17),

 carrierFreq-r17 ARFCN-ValueNR-r15,

 srs-PosResourceList-r17 SEQUENCE (SIZE (1..maxNumOfSRS-PosResources-r17)) OF

 INTEGER (0..maxNumOfSRS-PosResources-1-r17),

 ...

}

-- ASN1START

NR-TimeStamp-r16 ::= SEQUENCE {

 dl-PRS-ID-r16 INTEGER (0..255),

 nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL, -- Need ON

 nr-CellGlobalID-r16 NCGI-r15 OPTIONAL, -- Need ON

 nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON

 nr-SFN-r16 INTEGER (0..1023),

 nr-Slot-r16 CHOICE {

 scs15-r16 INTEGER (0..9),

 scs30-r16 INTEGER (0..19),

 scs60-r16 INTEGER (0..39),

 scs120-r16 INTEGER (0..79)

 },

 ...

}

-- ASN1STOP

Rapporteur's comments:

- A time stamp based on NR time (SFN/slot) appears useless/ambiguous if no TRP ID is included. The time stamp for the TxTEG may not be the same as the measurement time stamp (e.g., a UE may be moving).

- Not clear why symbol level time stamp is needed. In current RRC, the time stamp is also not on symbol level.

**Question 3:** Do you agree with the proposed change in H059:
 "Define a new IE for time stamp with SFN, slot and symbol"
 and use this time stamp definition within the *NR-SRS-TxTEG-Element-r17* instead of *NR-TimeStamp-r16.*

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| --- | --- | --- |
| Company | Yes/No | Comments |
| Intel | No | Would like to understand if there is problem for a UE always contain PRS ID in TimeStamp for TEG.  |
| Huawei, HiSilicon | Yes | It is not clear what is the use of the PRS id is used for. PRS id is an index for PRS configuration, not for TRP and we need to be clear about this.  |
| ZTE | No | Suggest to remain as current version |
| Apple | No | Agree with the rapporteur  |
| CATT | No | To Huawei, dl-PRS-ID-r16 is considered as TRP-ID somehow which was discussed in Rel-16.  |
| OPPO | No | Agree with CATT |
| vivo | No |  |
| Samsung | No | Same view with CATT. Also no need for symbol level time. |
| Xiaomi | No | For the TEG association with SRS, we think the symbol level is not needed.  |
| Ericsson | No | A reference TRP w.r.t which timing is derived is needed? |

## 2.3 Request Assistance Data BIT STRING

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| **[RIL]**: H024 **[Delegate]**: Huawei, HiSilicon (GuoYinghao) **[WI]**: **[Class]**: 2 **[Status]**: ToDo **[TDoc]**: **[Proposed Conclusion]**: propDisc**[Description]**: R16 fields. not sure why they are introduced in R17**[Proposed Change]**: Remove them. if really needed, can be added with a R16 Cat F CR plus R17 shadow**[Comments]**: [Rap:] Because otherwise it is not clear anymore what the bit posCalc in nr-AdType-r16 would mean/refer to. For example, if the UE requests beamAntennaInfo only how should the posCalc bit be set?  |

The current LPP implementation [3] for the *method-RequestAssistanceData* (where method can be DL-TDOA, DL-AoD, or Multi-RTT) is using a BIT STRING with a bit for each assistance data element defined in IE *NR-PositionCalculationAssistance*:

-- ASN1START

NR-DL-TDOA-RequestAssistanceData-r16 ::= SEQUENCE {

 nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL,

 nr-AdType-r16 BIT STRING { dl-prs (0),

 posCalc (1) } (SIZE (1..8)),

 ...,

 [[

 nr-PosCalcAssistanceRequest-r17 BIT STRING { trpLoc (0),

 beamInfo (1),

 rtdInfo (2),

 beamAntInfo (3),

 losNlosInfo (4),

 trpTEG-Info (5)

 } (SIZE (1..8)) OPTIONAL,

[parts omitted]

| *NR-DL-TDOA-RequestAssistanceData* field descriptions |
| --- |
| ***nr-AdType***This field indicates the requested assistance data. *dl-prs* means requested assistance data is *nr-DL-PRS-AssistanceData*, *posCalc* means requested assistance data is *nr-PositionCalculationAssistance* for UE based positioning. |
| ***nr-PosCalcAssistanceRequest***This field indicates the Position Calculation Assistance Data requested. This is represented by a bit string, with a one‑value at the bit position means the particular assistance data is requested; a zero‑value means not requested.- bit 0 indicates whether the field *nr-TRP-LocationInfo* in IE *NR-PositionCalculationAssistance* is requested or not;- bit 1 indicates whether the field *nr-DL-PRS-BeamInfo* in IE *NR-PositionCalculationAssistance* is requested or not;- bit 2 indicates whether the field *nr-RTD-Info* in IE *NR-PositionCalculationAssistance* is requested or not;- bit 3 indicates whether the field *nr-TRP-BeamAntennaInfo* in IE *NR-PositionCalculationAssistance* is requested or not;- bit 4 indicates whether the field *nr-DL-PRS-Expected-LOS-NLOS-Assistance* in IE *NR-PositionCalculationAssistance* is requested or not;- bit 5 indicates whether the field *nr-DL-PRS-TRP-TEG-Info* in IE *NR-PositionCalculationAssistance* is requested or not.This field may only be present if the '*posCalc*' bit in *nr-AdType* is set to value '1'. |

#### *– NR-PositionCalculationAssistance*

The IE *NR-PositionCalculationAssistance* is used by the location server to provide assistance data to enable UE‑based downlink positioning.

-- ASN1START

NR-PositionCalculationAssistance-r16 ::= SEQUENCE {

 nr-TRP-LocationInfo-r16 NR-TRP-LocationInfo-r16 OPTIONAL, -- Need ON

 nr-DL-PRS-BeamInfo-r16 NR-DL-PRS-BeamInfo-r16 OPTIONAL, -- Need ON

 nr-RTD-Info-r16 NR-RTD-Info-r16 OPTIONAL, -- Need ON

 ...,

 [[

 nr-TRP-BeamAntennaInfo-r17 NR-TRP-BeamAntennaInfo-r17 OPTIONAL, -- Need ON

 nr-DL-PRS-Expected-LOS-NLOS-Assistance-r17

 NR-DL-PRS-ExpectedLOS-NLOS-Assistance-r17

 OPTIONAL, -- Need ON

 nr-DL-PRS-TRP-TEG-Info-r17 NR-DL-PRS-TRP-TEG-Info-r17 OPTIONAL -- Need ON

 ]]

}

-- ASN1STOP

Rapporteur's comments:

- The *nr-AdType* in Rel-16 essentially distinguishes between UE-assisted mode ('*dl-prs*') and UE-based mode ('*posCalc*'), where for UE-based, the '*dl-prs*' may or may not be set to '1' (dependent on what is available/needed at the target device).

- Therefore, if the '*posCalc*' bit in Rel-16 is set to value '1', it means the target device requests:

-  *NR-TRP-LocationInfo-r16*

- *NR-DL-PRS-BeamInfo-r16*

- *NR-RTD-Info-r16*

- For Rel-17, the following additional position calculation assistance data are introduced:

-  *NR-TRP-BeamAntennaInfo-r17*

- *NR-DL-PRS-Expected-LOS-NLOS-Assistance-r17*

- *NR-DL-PRS-TRP-TEG-Info-r17*

- Therefore, with the Rel-16 specification that "*posCalc* means requested assistance data is *nr-PositionCalculationAssistance"*, the UE requests all 6 six assistance data types if the '*posCalc*' bit is set to value '1'.

- To allow a UE to request any of the (Rel-17) assistance data individually, there seems to be two general implementation options for Rel-17:

(a) Extend the Rel-16 framework where the *nr-AdType-r16* distinguishes between *nr-DL-PRS-AssistanceData*, and *nr-PositionCalculationAssistance* (which is the current LPP implementation [3]).

The target device would set the *nr-AdType-r16* to '*posCalc*' (as in Rel-16) and includes the *nr-PosCalcAssistanceRequest* BIT STRING in addition with the individual bits set according to the need/request. A legacy server not supporting Rel-17 would provide the Rel-16 assistance data (*NR-TRP-LocationInfo-r16*, *NR-DL-PRS-BeamInfo-r16*, *NR-RTD-Info-r16)*; a Rel-17 server would take the received BIT STRING into account.

(b) Add the Rel-17 positioning calculation assistance data separately (which seems to be the suggestion in H024). This could be achieved by removing the Rel-16 assistance data from the BIT STRING; i.e.:

 nr-PosCalcAssistanceRequest-r17 BIT STRING { beamAntInfo (1),

 losNlosInfo (2),

 trpTEG-Info (3)

 } (SIZE (1..8)) OPTIONAL,

 or simply by using an ENUMERATED list:

 beamAntInfoRequest-r17 ENUMERATED { true } OPTIONAL,

 losNlosInfoRequest-r17 ENUMERTAED { true } OPTIONAL,

 trpTEG-InfoRequest-r17 ENUMERATED { true } OPTIONAL,

 For backwards compatibility, the field description must then clarify that the Rel-16 '*posCalc*' bit in *nr-AdType-r16* applies to Rel-16 assistance data only; e.g.:

| *NR-DL-TDOA-RequestAssistanceData* field descriptions |
| --- |
| ***nr-AdType***This field indicates the requested assistance data. *dl-prs* means requested assistance data is *nr-DL-PRS-AssistanceData*, *posCalc* means requested assistance data are the IEs *NR-TRP-LocationInfo,* *NR-DL-PRS-BeamInfo* and *NR-RTD-Info* for UE based positioning. |

 This would allow a UE to request the Rel-16 assistance data via the Rel-16 mechanism by setting the '*posCalc*' bit in *nr-AdType-r16* to '1' (which means *NR-TRP-LocationInfo*, *NR-DL-PRS-BeamInfo* and *NR-RTD-Info*), and any of the Rel-17 assistance data separately by setting the '*posCalc'* bit in *nr-AdType-r16* to '0'.
A Rel-16 server may then receive a request assistance data with all bits in the *nr-AdType-r16* set to '0' when only Rel-17 assistance data are requested, which may be treated as an error/exception at the server.

- Both options seem functioning and can be implemented backwards compatible. However, it is Rapporteur's understanding that the current LPP implementation [3] is more clear, flexible and future proof.

- Regarding the comment "*can be added with a R16 Cat F CR plus R17 shadow*", it is Rapporteur's understanding that this is a Rel-17 issue on how the additional position calculation assistance data are introduced by re-using (or not re-using) the *nr-AdType-r16* BIT STRING for the Rel-17 assistance data as described above. Whether this is desired for Rel-16 as well should be a separate discussion.

**Question 4:** Do you agree with the proposed change in H024:
 "Remove the Rel-16 assistance data elements from the *nr-PosCalcAssistanceRequest-r17* BIT STRING".
 NOTE: This may require clarification on the definition/applicability of the '*posCalc*' bit in *nr-AdType- r16* as well.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Intel | No | Ok to go for Rapporteur’s approach considering there is no different from function perspective.  |
| Huawei, HiSilicon (proponent) | Yes |  |
| ZTE | No | Agree with Intel |
| Apple | No | Agree with the rapporteur |
| CATT | No | Agree with the rapporteur |
| OPPO | No | Agree with Intel |
| vivo | Yes | In R16, the single 1 bit 'posCalc' can be used to request 3 ADs, why the UE shall request them separately in R17?Besides, in our view, the new way is not future proof as it wastes 3 bits, that is, less spare bits for the potential new AD in the future release. |
| Samsung | No | Agree with the rapporteur |
| Xiaomi | No | Agree with the rapporteur |
|  |  |  |

## 2.4 Assistance Data Support Indication

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| --- |
| **[RIL]**: H032 **[Delegate]**: Huawei, HiSilicon (GuoYinghao) **[WI]**: **[Class]**: 3 **[Status]**: ToDo **[TDoc]**: **[Proposed Conclusion]**: propDisc**[Description]**: Beam antenna information request is not needed for DL-TDOA**[Proposed Change]**: Remove beam antenna information capabiltiy reporting for DL-TDOA**[Comments]**: [Rap:] Request and Capabilities are proposed to be unified (and being future proof). What is needed/supported/desired or not should depend on implementation. |

The current LPP implementation [3] for the *method-ProvideCapabilities* (where method can be DL-TDOA, DL-AoD, or Multi-RTT) is using a BIT STRING indicating the UE supported position calculation assistance data analogous to the assistance data request discussed in section 2.3 above:

NR-DL-TDOA-ProvideCapabilities-r16 ::= SEQUENCE {

 nr-DL-TDOA-Mode-r16 PositioningModes,

 nr-DL-TDOA-PRS-Capability-r16 NR-DL-PRS-ResourcesCapability-r16,

 nr-DL-TDOA-MeasurementCapability-r16 NR-DL-TDOA-MeasurementCapability-r16,

 nr-DL-PRS-QCL-ProcessingCapability-r16 NR-DL-PRS-QCL-ProcessingCapability-r16,

 nr-DL-PRS-ProcessingCapability-r16 NR-DL-PRS-ProcessingCapability-r16,

 additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

 periodicalReporting-r16 PositioningModes OPTIONAL,

 ...,

 [[

 ten-ms-unit-ResponseTime-r17 PositioningModes OPTIONAL,

 nr-PosCalcAssistanceSupport-r17 BIT STRING { trpLocSup (0),

 beamInfoSup (1),

 rtdInfoSup (2),

 beamAntInfoSup (3),

 losNlosInfoSup (4),

 trpTEG-InfoSup (5)

 } (SIZE (1..8)) OPTIONAL,

[parts omitted]

Rapporteur's comments:

- This issue is similar to H024 discussed in section 2.3 above. The assistance data support BIT STRING resembles the assistance data request BIT STRING.

- If the Rel-16 assistance data will be removed from the request BIT STRING discussed in section 2.3 above, they must also be removed from the support BIT STRING.

- The reason for the proposal provided in H032 is:

 "Beam antenna information request is not needed for DL-TDOA"

Although, it may depend on implementation, it seems likely the case that "Beam antenna information request is not needed for DL-TDOA". However, the same argumentation may already apply to Rel-16:

"*NR-RTD-Info-r16* request is not needed for DL-AoD".

 I.e., for all NR positioning methods the same assistance data request mechanism is used as discussed in section 2.3 above (*nr-AdType-r16* BIT STRING). Also for DL-AoD, "*posCalc* means requested assistance data is *nr-PositionCalculationAssistance* for UE based positioning".

- It is Rapporteur's understanding that the Rel-16 implementation has been chosen to support hybrid positioning e.g., DL-TDOA and DL-AoD more efficiently (i.e., with a single request instead of two). Otherwise, if assistance data for hybrid DL-TDOA and DL-AoD are needed, the UE would have to send *NR-DL-TDOA-RequestAssistanceData-r16* and *NR-DL-AoD-RequestAssistanceData-r16*, both with '*posCalc*' bit in *nr-AdType-r16* set to value '1', which is (a) suboptimal and (b) ambiguous (duplicated request) at the server.

- Further, it should generally be up to implementation on which assistance data are needed in a given situation (i.e., similar to A-GNSS).

- Although, the issue is about capabilities, the description mentions the assistance data request as reason. In any case, the specification needs to be consistent at the end with respect to Request/Provide and capability messages.

**Question 5:** Do you agree with the proposed change in H032:
 "Remove beam antenna information capability reporting for DL-TDOA".

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| --- | --- | --- |
| Company | Yes/No | Comments |
| Intel | Yes/but | We tend to agree with Rapporteur that the unique design is desirable. However Rapporteur did not define a common IE for it. Considering anyway it is method specific IE, we do not see the need to keep it unless nr-PosCalcAssistanceSupport-r17 is defined outside as a common IE.  |
| Huawei, HiSIlicon | Yes | Antenna Information capability is only for DL-AOD. if it is needed in the future, add it in the future. The concept of “future-proof” or forward-compatibility is wrong to be justified here.  |
| ZTE | Yes | If UE can only set the beamAntInfoSup bit to 0 when DL-TDOA, it is a signalling overhead waste. So suggest to delete it |
| Apple | Yes |  |
| CATT |  | Tend to agree with Intel. A compromised way would be better. |
| OPPO | Yes | OK to delete it |
| vivo | Yes | Similar with Q4, it’s not future proof, it wastes some bits and less spare bits for the potential new capability in the future release. |
| Samsung | Yes |  |
| Xiaomi | Yes |  |
|  |  |  |

|  |
| --- |
| **[RIL]**: H033 **[Delegate]**: Huawei, HiSilicon (GuoYinghao) **[WI]**: **[Class]**: 3 **[Status]**: ToDo **[TDoc]**: **[Proposed Conclusion]**: propDisc**[Description]**: If this is present, the losNlosInfoSup in nr-PosCalcAsssitanceSupport is duplicated. **[Proposed Change]**: remove the field nr-posCalcAsssitanceSupport. **[Comments]**: [Rap:] See H032. Mechanism is similar to GNSS: General support bit, and support granularity, if needed/sensible. |

The current LPP implementation [3] for the LOS/NLOS assistance data granularity is as follows (e.g., for DL-TDOA):

-- ASN1START

NR-DL-TDOA-ProvideCapabilities-r16 ::= SEQUENCE {

 [parts omitted]

 ten-ms-unit-ResponseTime-r17 PositioningModes OPTIONAL,

 nr-PosCalcAssistanceSupport-r17 BIT STRING { trpLocSup (0),

 beamInfoSup (1),

 rtdInfoSup (2),

 beamAntInfoSup (3),

 losNlosInfoSup (4),

 trpTEG-InfoSup (5)

 } (SIZE (1..8)) OPTIONAL,

 nr-los-nlos-AssistanceDataSupport-r17 SEQUENCE {

 type-r17 LOS-NLOS-IndicatorType2,

 granularity-r17 LOS-NLOS-IndicatorGranularity2,

 ...

 } OPTIONAL, -- Cond losNlosInfoSup

 [parts omitted]

| Conditional presence | Explanation |
| --- | --- |
| *losNlosInfoSup* | The field is mandatory present if the *losNlosInfoSup* bit-4 in *nr-PosCalcAssistanceSupport* is set to value '1'; otherwise it is not present. |

Rapporteur's comments:

- As discussed under H032 above, the assistance data support BIT STRING resembles the assistance data request BIT STRING. In the case of finer granularity for support indication is needed (e.g., for *nr-los-nlos-AssistanceDataSupport*) additional fields are proposed, which are conditional present (this is essentially the same mechanism as used for A-GNSS). Note, if this should also be needed for assistance data requests in the future, the same mechanism/implementation would apply.

- Resolution of this issue depends also on the resolution of H024/32. I.e., depends on whether we have a common indication across all NR methods (as currently implemented) or not.

**Question 6:** Do you agree with the proposed change in H033:
 "remove the *losNlosInfoSup* field in *nr-posCalcAsssitanceSupport*".

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Intel | Yes/but | We tend to agree with Rapporteur that the unique design is desirable. However Rapporteur did not define a common IE for it. Considering anyway it is method specific IE, we do not see the need to keep it unless nr-PosCalcAssistanceSupport-r17 is defined outside as a common IE.  |
| Huawei, HiSiicon | Yes | If LOS/NLOS is supported, UE has to report type and ganularity, right? Then what is the use to have another bit to indicate whether NLOS/LOS is supported |
| ZTE | Yes |  |
| Apple | Yes |  |
| CATT |  | Tend to agree with Intel. A compromised way would be better. |
| vivo | Yes | Duplicated info |
| Samsung | Yes |  |
| Xiaomi | Yes |  |
|  |  |  |
|  |  |  |

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| --- |
| **[RIL]**: H046 **[Delegate]**: Huawei, HiSilicon (GuoYinghao) **[WI]**: **[Class]**: 3 **[Status]**: ToDo **[TDoc]**: **[Proposed Conclusion]**: propDisc**[Description]**: This bit not needed for DL-AoD**[Proposed Change]**: remove trpTEG-InfoSup from the capability reporting of DL-AOD**[Comments]**: [Rap:] Discuss whether we should have this (and capabilities) common, or whether method specific restrictions should apply. |

The current LPP implementation [3] for the assistance data support indication is as follows:

NR-DL-AoD-ProvideCapabilities-r16 ::= SEQUENCE {

 [parts omitted]

 nr-PosCalcAssistanceSupport-r17 BIT STRING { trpLocSup (0),

 beamInfoSup (1),

 rtdInfoSup (2),

 beamAntInfoSup (3),

 losNlosInfoSup (4),

 trpTEG-InfoSup (5)

 } (SIZE (1..8)) OPTIONAL,

 [parts omitted]

Rapporteur's comments:

- This is essentially the same issue as H033 discussed above.

- The same argument may apply to *rtdInfoSup* and *losNlosInfoSup* as well.

- As mentioned above, the current implementation has a common assistance data request BIT STRING and a common assistance data support BIT STRING. If this is not desired, care needs to be taken on what is "allowed" to indicate for each method, also because in practice a position calculation is often using multiple methods (aka "hybrid positioning" as discussed under H032).

- If individual/"non-applicable" assistance data support indicator should be removed, then the corresponding assistance data request indicator should be removed as well to have a consistent specification. I.e., implementation of the proposed change has impacts on other parts of the specification as well.

**Question 7:** Do you agree with the proposed change in H046:
 "Remove *trpTEG-InfoSup* from the capability reporting of DL-AOD".

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Intel | Yes/but | We tend to agree with Rapporteur that the unique design is desirable. However Rapporteur did not define a common IE for it. Considering anyway it is method specific IE, we do not see the need to keep it unless nr-PosCalcAssistanceSupport-r17 is defined outside as a common IE.  |
| Huawei, HiSIlicon (proponent) | Yes |  |
| ZTE | Yes | Same reason with Q5 |
| Apple | Yes |  |
| CATT |  | Tend to agree with Intel. A compromised way would be better. |
| vivo | Yes |  |
| Samsung | Yes |  |
| Xiaomi | Yes |  |
|  |  |  |
|  |  |  |

## 2.5 Measurement report with multiple TEGs

|  |
| --- |
| **[RIL]**: H028 **[Delegate]**: Huawei, HiSilicon (GuoYinghao) **[WI]**: **[Class]**:2 **[Status]**: ToDo **[TDoc]**: R2-2205003 **[Proposed Conclusion]**: propDisc**[Description]**:It is better to extend under a single measElement for measurements under different TEGIn this way, the assosiction is clearer and the signaling can be further optimized.**[Proposed Change]**:Add per TEG measurment in each measurement. We will provide a tdoc for this**[Comments]**: **[Rap**:] Not clear why "it is better". It looks like unnecessary ASN.1 and "double differential" reporting (i.e., additional measurements in the additional measurements). |

The current LPP implementation for DL-TDOA extends the Rel-16 *NR-DL-TDOA-AdditionalMeasurementElement*:

[parts omitted]

NR-DL-TDOA-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-DL-TDOA-MeasElement-r16

NR-DL-TDOA-MeasElement-r16 ::= SEQUENCE {

 dl-PRS-ID-r16 INTEGER (0..255),

 nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL,

 nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

 nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL,

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

 nr-DL-PRS-ResourceSetID-r16 NR-DL-PRS-ResourceSetID-r16 OPTIONAL,

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-RSTD-r16 CHOICE {

 k0-r16 INTEGER (0..1970049),

 k1-r16 INTEGER (0..985025),

 k2-r16 INTEGER (0..492513),

 k3-r16 INTEGER (0..246257),

 k4-r16 INTEGER (0..123129),

 k5-r16 INTEGER (0..61565),

 ...

 },

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,

 nr-DL-TDOA-AdditionalMeasurements-r16

 NR-DL-TDOA-AdditionalMeasurements-r16 OPTIONAL,

 ...,

 [[

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-Result-r17 INTEGER (0..126) OPTIONAL,

 nr-los-nlos-Indicator-r17 CHOICE {

 perTRP LOS-NLOS-Indicator-r17,

 perResource LOS-NLOS-Indicator-r17

 } OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

 nr-DL-TDOA-AdditionalMeasurementsExt-r17

 NR-DL-TDOA-AdditionalMeasurementsExt-r17 OPTIONAL

 ]]

}

NR-DL-TDOA-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF

 NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-DL-TDOA-AdditionalMeasurementsExt-r17 ::= SEQUENCE (SIZE (1..maxAddMeasTDOA-r17)) OF

 NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-DL-TDOA-AdditionalMeasurementElement-r16 ::= SEQUENCE {

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

 nr-DL-PRS-ResourceSetID-r16 NR-DL-PRS-ResourceSetID-r16 OPTIONAL,

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-RSTD-ResultDiff-r16 CHOICE {

 k0-r16 INTEGER (0..8191),

 k1-r16 INTEGER (0..4095),

 k2-r16 INTEGER (0..2047),

 k3-r16 INTEGER (0..1023),

 k4-r16 INTEGER (0..511),

 k5-r16 INTEGER (0..255),

 ...

 },

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 ...,

 [[

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-ResultDiff-r17

 INTEGER (0..61) OPTIONAL,

 nr-los-nlos-IndicatorPerResource-r17

 LOS-NLOS-Indicator-r17 OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL

 ]]

}

H028 suggests adding a Rel-17 version for the additional measurements in both, *NR-DL-TDOA-MeasElement-r16* and *NR-DL-TDOA-AdditionalMeasurementElement-r16*.

[parts omitted]

NR-DL-TDOA-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-DL-TDOA-MeasElement-r16

NR-DL-TDOA-MeasElement-r16 ::= SEQUENCE {

 dl-PRS-ID-r16 INTEGER (0..255),

 nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL,

 nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

 nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL,

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

 nr-DL-PRS-ResourceSetID-r16 NR-DL-PRS-ResourceSetID-r16 OPTIONAL,

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-RSTD-r16 CHOICE {

 k0-r16 INTEGER (0..1970049),

 k1-r16 INTEGER (0..985025),

 k2-r16 INTEGER (0..492513),

 k3-r16 INTEGER (0..246257),

 k4-r16 INTEGER (0..123129),

 k5-r16 INTEGER (0..61565),

 ...

 },

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,

 nr-DL-TDOA-AdditionalMeasurements-r16

 NR-DL-TDOA-AdditionalMeasurements-r16 OPTIONAL,

 ...,

 [[

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-Result-r17 INTEGER (0..126) OPTIONAL,

 nr-los-nlos-Indicator-r17 LOS-NLOS-Indicator-r17 OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

 nr-DL-TDOA-AdditionalTEG-Measurements-r17

 NR-DL-TDOA-AdditionalTEG-Measurements-r17 OPTIONAL

 ]]

}

NR-DL-TDOA-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF

 NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-DL-TDOA-AdditionalTEG-Measurements-r17 ::= SEQUENCE (SIZE (1..maxAddTEG-MeasTDOA-1-r17)) OF

 NR-DL-TDOA-AdditionalTEG-MeasurementElement-r17

NR-DL-TDOA-AdditionalMeasurementElement-r16 ::= SEQUENCE {

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

 nr-DL-PRS-ResourceSetID-r16 NR-DL-PRS-ResourceSetID-r16 OPTIONAL,

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-RSTD-ResultDiff-r16 CHOICE {

 k0-r16 INTEGER (0..8191),

 k1-r16 INTEGER (0..4095),

 k2-r16 INTEGER (0..2047),

 k3-r16 INTEGER (0..1023),

 k4-r16 INTEGER (0..511),

 k5-r16 INTEGER (0..255),

 ...

 },

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 ...,

 [[

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-ResultDiff-r17

 INTEGER (0..61) OPTIONAL,

 nr-los-nlos-Indicator-r17 LOS-NLOS-Indicator-r17 OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

 nr-DL-TDOA-AdditionalTEG-Measurements-r17

 NR-DL-TDOA-AdditionalTEG-Measurements-r17 OPTIONAL

 ]]

}

NR-DL-TDOA-AdditionalTEG-MeasurementElement-r17 ::=SEQUENCE {

 nr-TimeStamp-r17 NR-TimeStamp-r16,

 nr-RSTD-ResultDiff-r17 CHOICE {

 k0-r17 INTEGER (0..8191),

 k1-r17 INTEGER (0..4095),

 k2-r17 INTEGER (0..2047),

 k3-r17 INTEGER (0..1023),

 k4-r17 INTEGER (0..511),

 k5-r17 INTEGER (0..255),

 ...

 },

 nr-TimingQuality-r17 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-ResultDiff-r17 INTEGER (0..61) OPTIONAL,

 nr-AdditionalPathList-r17 NR-AdditionalPathList-r16 OPTIONAL,

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-ResultDiff-r17

 INTEGER (0..61) OPTIONAL,

 nr-los-nlos-Indicator-r17 LOS-NLOS-Indicator-r17 OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

 ...

}

**Question 8:** Do you agree with the proposed change in H028:
 "Add per TEG measurement in each measurement." as proposed in R2-2205003.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Huawei, HiSilicon (Poponent) | Yes | But as long as the association between the measurements for different TEGs of a single resource is clear, it is fine with us. The advantage of the TP above is that it saves the signaling overhead for indicating resource id/resoruceset id/trp and also, which resource is measured with different TEG is clear |
| ZTE | Yes | The change in H028 is more clear for a Rel-17 new feature |
| Apple |  | We are not entirely convinced this is much better |
| CATT | No | The proposed change doesn’t save signalling because the number of reported RxTEG always won't be changed.Similar data structure has been proposed by CATT in R2-2200300, but the measurement structure of asn.1 has been compromised in R2-2202410 [Pre117-e][611][POS] after the email discussion.No need to discuss it again. |
| OPPO | No | Prefer to using current ASN.1. Not a critical issue. |
| vivo | Yes | For the current structure, the number of DL PRS resources in the report can be 32 and the change is in line with the following RAN1 agreement:The number of DL PRS resources per target TRP in a measurement report is still limited to 4 as in Rel-16. |
| Samsung | Yes | The TP from HW seems more clear and can reduce the signalling overhead by not having the redundant field of PRS resource/resource set ID. |
|  |  |  |
|  |  |  |

# 3. Summary

TBD