3GPP TSG-RAN WG2 #109-e Draft r2-2001946

Electronic meeting, 24 February – 6 March 2020

Agenda Item: 6.8.1

Source: Ericsson

**Title: Summary of [AT109e][620][POS] Text proposal for merge into 37.355 CR – additional path reporting (Ericsson)**

Document for: Discussion, Decision

# 1 Introduction

This document is for the following email discussion:

* [AT109e][620][POS] Text proposal for merge into 37.355 CR (Ericsson)

 **Status:** Started

**Scope:** Develop a text proposal reflecting the agreements on additional path reporting.

 **Intended outcome:** Agreeable TP in R2-2001946, to be merged into 37.355, including number of additional paths.

 **Deadline:** Wednesday 2020-03-04 1300 CET

At the first online discussion at Ran2#109e, the following was agreed:

**Agreements:**

Add support for additional path reporting to LPP for timing-based measurements, similar to LTE.

Recommend RAN3 to support timing-based additional path reporting in NRPPa.

The focus of this email discussion is the first agreement – an agreeable TP to be merged into 37.355 to support additional path reporting

# 2 Discussion

## 2.1 Max number of supported additional paths reported

In LTE, there is support for up to two additional paths to be reported. With the increased PRS bandwidth of up to 100 MHz in FR1 and up to 400MHz in FR2, NR timing measurements based on DL-PRS have significantly better time resolution compared to LTE. There are also considered central use cases such as in indoor scenarios, where several informative paths can be observed thanks to the supported large bandwidths. Therefore, it seems natural that LPP supports reporting of a much larger number of additional paths compared to LTE.

We would like to ask companies to express their view about the max number of supported additional paths that can be reported

1. the max number is fixed and from the email discussion in one company mentioned a fixed number 4 as reasonable, and
2. the max number supported by the protocol is higher than 4, maybe 8 or 16, and the supported number of reported additional paths is instead provided as a capability, possibly separate capabilities for additional paths per TRP and per resource.

**Question** 1**: Companies are requested to express their view on supported max number of additional paths that can be reported from the UE**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| **Qualcomm** | The number of additional paths should be 2 as in LTE. Any additional number of paths >2 needs input from RAN1 before representations can be discussed in RAN2. Therefore, this seems to be a suitable topic for discussion and evaluation in Rel. 17. |
| **Huawei** | As far as we know, RAN1 has not discussed about this in R16. We prefer the maximum number of 8. 16 is too many for us.  |
| **CATT** | RAN2 would better get evaluation from RAN1 so the larger number than 4 could be postponed to discuss by RAN1 in R-17. |
| **Nokia** | Since the number of paths to report for additional measurements is dependent on UE capability and there may be associated measurement performance impacts that RAN4 needs to take in to account, we prefer that the input on number of paths come from RAN1/RAN4. We can leave it FFS for now. |
| **Apple** | Prefer postpone the discussion to R17 |

Furthermore, the additional path reporting is associated to a capability in LTE. We would like to ask companies to express their view about the needed device capabilities associated to additional paths reporting

1. the capability is to support additional path reporting or not
2. the capability is the supported max number of additional paths the device can report, possibly separate capabilities for additional paths per TRP and per resource.

**Question** 2**: Companies are requested to express their view about the needed UE capabilities associated to additional paths reporting**

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| --- | --- |
| **Company** | **Comments** |
| **Qualcomm** | The same capability as we have for LTE is also needed for NR. |
| **Huawei** | Needed, same as LTE |
| **CATT** | The same capability as LTE |
| **Nokia** | This is subject to input from RAN1 and RAN4 but I expect the final decision to be a single max value for the number of paths to report. So, a high level capability to indicate whether UE supports reporting for additional detected paths is sufficient. |
| **Apple** | Needed, as same as LTE |

The appendix provides test proposals for the introduction of additional path reporting. Companies are asked to both provide comments to the text proposal below, as well as providing comments to the TP directly.

**Question** 3**: Companies are requested to provide general comments to the text proposals for additional path support introduction to 37.355.**

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| --- | --- |
| **Company** | **Comments** |
| **Qualcomm** | It is unclear how the IE *NR-AdditionalPath* should be applied for the RSTD measurement. For LTE, the *AdditionalPathList* is provided for the reference and for each neighbour measurement. In the TP in the Annex, it seems the IE *NR-AdditionalPathList* is provided for the RSTD, but it is unclear what an additional path is for a time-difference.Similar for the additional RSTD measurements, which are provided as delta-measurements. It is unclear if the *AdditionalPathList* is also provided as delta to the first RSTD, or as delta-path for each individual RSTD (similar for the *nr-UE-RxTxTimeDiffAdditional-r16*).*nrMaxAddPaths-r16* should be 2, same as in LTE.*nr-maxAddPathsReport-r16* is not needed as capability; same as in LTE. |
| **Nokia** | The field name nr-additionalPaths-r16 and the type definition name NR-AdditionalPath-r16 are very close. Prefer to clearly distinguish the two. Use nr-additionalPathList-r16 for the field name also. NR-AdditionalPath-r16 could be renamed NR-AdditionalPathMeas-r16. Also, ensure there is no confusion in 37.355 about additional detected paths measurements and additional measurements (the case where more than one measurement is reported using differential sigaling). |
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# 3 Conclusion

From the provided input, we have the following summary of the comments:

Based on the discussion in section 2, the following is proposed:

**Proposal 1 Agree to the text proposals in Appendix for additional path reporting support in 37.355.**

# 4 References

1. R2-2001659 Summary of [108#87][NR/Rel-16] Additional path reporting, Ericsson

# Appendix A Text Proposal for 37.355 based on [108#85]

 *[…]*

**The TP below would naturally be placed in the common part in section 6.4.3**

– *NR-AdditionalPath*

The IE *NR-AdditionalPath* is used by the target device to provide information about additional paths in association to the TOA measurements associated to NR positioning in the form of a relative time difference and a quality value. The additional path *nr-relativeTimeDifference* is the detected path timing relative to the detected path timing used for the TOA value, and each additional path can be associated with a quality value *nr-path-Quality.*

-- ASN1START

NR-AdditionalPath-r16 ::= SEQUENCE {

 nr-relativeTimeDifference-r16 FFS, OPTIONAL,

 nr-path-Quality-r16 NR-TOAMeasQuality-r16 OPTIONAL,

 ...

}

-- ASN1STOP

| ***NR-AdditionalPath* field descriptions** |
| --- |
| ***nr-relativeTimeDifference***This field specifies the additional detected path timing relative to the detected path timing of the reference resource. A positive value indicates that the particular path is later in time than the detected path of the reference; a negative value indicates that the particular path is earlier in time than the detected path of the reference |
| ***nr-path-Quality***This field specifies the target device′s best estimate of the quality of the detected timing of the additional path. |

*[…]*

#### 6.x.1.4 NR-DL-TDOA Location Information Elements

#### – *NR-DL-TDOA-SignalMeasurementInformation*

The IE *NR-DL-TDOA-SignalMeasurementInformation* is used by the target device to provide NR-DL TDOA measurements to the location server. The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP in case RSTD measurements are reported. The first TRP in the list may or may not be the reference TRP indicated in the *NR-DL-PRS-AssistanceData*. Furthermore, the target device selects a reference resource per TRP, and compiles the measurements per TRP based on the selected reference resource.

-- ASN1START

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

 dl-PRS-ReferenceInfo-r16 DL-PRS-IdInfo-r16,

 nr-DL-TDOA-MeasList-r16 NR-DL-TDOA-MeasList-r16,

 ...

}

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

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

 trp-ID-r16 TRP-ID-r16 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 INTEGER (0..ffs), -- FFS on the value range

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

 nr-MeasQuality-r16 NR-MeasQuality-r16,

 nr-PRS-RSRP-Result-r16 INTEGER (FFS) OPTIONAL, -- FFS, value range to be decided in RAN4.

 nr-DL-TDOA-AdditionalMeasurements-r16 NR-DL-TDOA-AdditionalMeasurements-r16,

 ...

}

NR-AdditionalPathList-r16 ::= SEQUENCE (SIZE(1..nrMaxAddPaths-r16)) OF NR-AdditionalPath-r16

NR-DL-TDOA-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) 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 INTEGER (0..ffs), -- FFS on the value range

 dl-PRS-RSPR-ResultDiff-r16 INTEGER (FFS) OPTIONAL, -- FFS on the value range

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

...

}

nrMaxTRPs INTEGER ::= 256 -- Max TRPs per UE

nrMaxAddPaths-r16 INTEGER ::== [4/8/16]

-- ASN1STOP

| *NR-DL-TDOA-SignalMeasurementInformation* field descriptions |
| --- |
|  |
| ***nr-PRS-RSRP-Result***This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |
| ***nr-additionalPaths***This field specifies one or more additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *rstd* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. |
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*[…]*

#### 6.x.1.5 NR-DL-TDOA Location Information Request

#### – *NR-DL-TDOA-RequestLocationInformation*

The IE *NR-DL-TDOA-RequestLocationInformation* is used by the location server to request NR DL-TDOA location measurements from a target device.

-- ASN1START

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

 nr-DL-PRS-RstdMeasurementInfoRequest-r16 ENUMERATED { true } OPTIONAL, -- Need ON

 nr-RequestedMeasurements-r16 BIT STRING { prsrsrpReq (0)

 } (SIZE(1..8)),

 nr-AssistanceAvailability-r16 BOOLEAN,

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

 additionalPaths-r16 ENUMERATED { requested } OPTIONAL, -- Need ON

 ...

}

-- ASN1STOP

*[…]*

#### 6.x.1.6 NR-DL-TDOA Capability Information

#### – *NR-DL-TDOA-ProvideCapabilities*

The IE *NR-DL-TDOA-ProvideCapabilities* is used by the target device to indicate its capability to support NR DL-TDOA and to provide its NR DL-TDOA positioning capabilities to the location server.

-- ASN1START

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

 nr-DL-TDOA-Mode-r16 PositioningModes,

 nr-DL-TDOA-MeasCapability-r16 NR-DL-PRS-MeasCapability-r16 OPTIONAL,

 nr-DL-TDOA-MeasSupported-r16 BIT STRING { prsrsrpSup (0)} (SIZE(1..8)),

 additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

 nr-maxAddPathsReport-r16 ENUMERATED {n2, n4, n8, n16, ...} OPTIONAL

 periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

*[…]*

#### 6.z.1.4 NR-Multi-RTT Location Information Elements

#### – *NR-Multi-RTT-SignalMeasurementInformation*

The IE *NR-Multi-RTT-SignalMeasurementInformation* is used by the target device to provide NR Multi-RTT measurements to the location server. The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP.

-- ASN1START

NR-Multi-RTT-SignalMeasurementInformation-r16 ::= SEQUENCE {

 nr-Multi-RTT-MeasList-r16 NR-Multi-RTT-MeasList-r16,

 ...

}

NR-Multi-RTT-MeasList-r16 ::= SEQUENCE (SIZE(1.. nrMaxTRPs)) OF NR-Multi-RTT-MeasElement-r16

NR-Multi-RTT-MeasElement-r16 ::= SEQUENCE {

 trp-ID-r16 TRP-ID-r16 OPTIONAL,

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

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

nr-UE-RxTxTimeDiff-r16 INTEGER (0..ffs) OPTIONAL, -- FFS on the value range

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-MeasQuality-r16 NR-MeasQuality-r16,

 nr-PRS-RSRP-Result-r16 INTEGER (FFS) OPTIONAL, -- FFS, value range to be decided in RAN4.

 nr-Multi-RTT-AdditionalMeasurements-r16 NR-Multi-RTT-AdditionalMeasurements-r16,

 ...

}

NR-AdditionalPathList-r16 ::= SEQUENCE (SIZE(1..nrMaxAddPaths-r16)) OF NR-AdditionalPath-r16

NR-Multi-RTT-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF NR-Multi-RTT-AdditionalMeasurementElement-r16

NR-Multi-RTT-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-PRS-RSRP-ResultDiff-r16 INTEGER (FFS) OPTIONAL, -- FFS, value range to be decided in RAN4.

nr-UE-RxTxTimeDiffAdditional-r16 INTEGER (0..ffs) OPTIONAL, -- FFS on the value range

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

 ...

}

nrMaxTRPs INTEGER ::= 256 -- Max TRPs

nrMaxAddPaths-r16 INTEGER ::== [4/8/16]

-- ASN1STOP

| *NR-Multi-RTT-SignalMeasurementInformation* field descriptions |
| --- |
| ***nr-PRS-RSRP-Result***This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |
| ***nr-UE-RxTxTimeDiff***This field specifies the UE Rx–Tx time difference measurement, as defined in FFS.  |
| ***nr-additionalPaths***This field specifies one or more additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *UE-RxTx* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. |

*[…]*

#### 6.z.1.5 NR-Multi-RTT Location Information Request

#### – *NR-Multi-RTT-RequestLocationInformation*

The IE *NR-Multi-RTT-RequestLocationInformation* is used by the location server to request NR Multi-RTT location measurements from a target device.

-- ASN1START

NR-Multi-RTT-RequestLocationInformation-r16 ::= SEQUENCE {

 nr-RequestedMeasurements-r16 BIT STRING { prsrsrpReq (0)} (SIZE(1..8)),

 nr-AssistanceAvailability-r16 BOOLEAN,

 nr-DL-PRS-ReportConfig-r16 NR-DL-PRS-ReportConfig-r16,

 additionalPaths-r16 ENUMERATED { requested } OPTIONAL, -- Need ON

 ...

}

-- ASN1STOP

*[…]*

#### 6.z.1.6 NR-Multi-RTT Capability Information

#### – *NR-Multi-RTT-ProvideCapabilities*

The IE *NR-Multi-RTT-ProvideCapabilities* is used by the target device to indicate its capability to support NR Multi-RTT and to provide its Multi-RTT positioning capabilities to the location server.

-- ASN1START

NR-Multi-RTT-ProvideCapabilities-r16 ::= SEQUENCE {

 nr-DL-PRS-MeasCapability-r16 NR-DL-PRS-MeasCapability-r16,

 nr-UL-SRS-MeasCapability-r16 NR-UL-SRS-MeasCapability-r16,

 nr-Multi-RTT-MeasSupported-r16 BIT STRING { prsrsrpSup (0)} (SIZE(1..8)),

 additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

 nr-maxAddPathsReport-r16 ENUMERATED {n2, n4, n8, n16, ...} OPTIONAL

 periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

 ...

}

-- ASN1STOP

*[…]*