3GPP TSG-RAN WG2 #110e *DRAFT* R2-2005907

Online, June 01 – 12, 2020

Agenda Item: 6.8.2.3

Source: Ericsson

Title: [AT110-e][617][POS] Report on email discussion about structure of UE-based assistance data (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This document provides discussion templates and reports the following email discussion:

* [AT110-e][617][POS] UE-based assistance data continuation (Ericsson)

Scope: Continue the beam and location info aspects of the email discussion on the structure of UE-based assistance data (proposals from R2-2004705).

Intended outcome: Agreeable TP in R2-2005907

Deadline: Wednesday 2020-06-10 1000 UTC

It concerns the structure of UE-based assistance data, which currently cannot prevent that identical location and antenna beam information is unnecessarily represented several times. By adding an optional reference to a TRP with the same location and antenna (azimuth and tilt can be different), this can be avoided, and message size can be significantly reduced.

In studied example 3GPP indoor open office with two frequency layers, the location information is reduced by 67% and the beam information by 92%, and in the city example with two frequency layers, the location information is reduced by 40% and the beam information by 80%. Without this optional reference, the size of IEs may prevent them from being broadcasted due to their size, and the scalability with unicast distribution will be reduced.

# 2 Background

In order to analyze encoded ASN.1 of information element size, we consider two examples, a city scenario with automotive navigation and the 3GPP indoor open office scenario. The city scenario is based on a deployment of

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| --- |
| Figure 1. A city deployment with a panel antenna with DL-PRS in two sets of different beam widths and over two frequency layers |

identical antenna panels but with different positions, azimuth and tilt, each with two DL PRS resource sets, one with three wide beams, and one with eight narrow beams over two frequency layers. As part of the UE-based assistance data, the UE is provided with information about 32 TRPs per frequency layers at the time to allow smooth navigation. The scenario of 3GPP indoor open office, FR2 with two frequency layers is analyzed [1],[4].

For these two example scenarios, the *UEB NR-TRP-LocationInfo* and the *NR-TRP-BeamInfo* have been ASN.1 encoded based on baseline and the baseline with reference option, ASN.1 in bytes becomes:

Table 1. Encoded ASN.1 in bytes of the combination of two IEs for two relevant scenarios.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Example 1, City scenario | | Example 2, 3GPP IOO FR2 | |
|  | Baseline | Baseline with reference option | Baseline | Baseline with reference option |
| NR-TRP-LocationInfo | 1063 | 642 | 1189 | 393 |
| NR-TRP-BeamInfo | 2072 | 419 | 2919 | 204 |
| In total | 3135 | 1061 | 4108 | 597 |
| Number of SI-messages (DCI format 1A, 277 bytes) | 12 | 4 | 15 | 3 |

From the email discussion [3], companies asked for more details and assessments about the benefits of an associated TRP parameter. Therefore, more beam information analysis was provided in [4], and the city scenario was evaluated above.

# 3 Discussion

The discussion from [2] and [3] continues below, where previous comments from companies are provided in 2.x.1 and companies can provide new comments in the discussion templates in 2.x.2, highlighted in yellow for clarity, as well as comment on the text proposals in Annex 1 (NR-TRP-LocationInfo) and 2 (*NR-TRP-BeamInfo*).

## 3.1 NR-TRP-LocationInfo IE

The *NR-TRP-LocationInfo* IE provides the location of TRPs. The typical case of the overhead with the baseline signalling arises when a site is operational across two or more frequency layers, and/or when TRPs in the same frequency layer are located at the same location, such a different co-located sectors.

### 3.1.1 Input from [1]

Companies are asked to provide comments to the suggested addition of a TRP reference to avoid duplication of location information when several TRPs are co-located, typically the case with more than one frequency layer.

|  |  |
| --- | --- |
| Table 3.1 Optional TRP reference in TRP location information IE to avoid data duplication | |
| Company | Comments |
| Huawei/HiSilicon | In our understanding, TRP ID (PRS ID) will be used to associate the same TRP in different frequency layers. In case the ARP of PRS resources are the same across frequency layers, can it be fixed by setting some fields optiional with need OP and add procedure text in the field description? |
| Qualcomm | Only a single "reference point" can be provided in IE *NR-TRP-LocationInfo* and all antenna reference points can be provided as delta relative to this "reference point". If the deltas are absent, the locations coincide (meaning delta=0; i.e., colocated). Since the TRP-ID is provided in each *TRP-LocationInfoElement* (and assuming the TRP-ID can include a global ID as currently defined), the *NR-TRP-LocationInfo* can be sorted as appropriate (i.e., does not need to have the same order as the DL-PRS assistance data). This should give an LMF enough freedom to avoid providing the same coordinates twice. Hence, we cannot see this "duplication issue". |
| Ericsson | In response to HW:  TRP/PRS ID is to identify a TRP among the ones configured to allow matching in what is reported. The agreed RAN1 hierarchy is PFL(1..4) – TRP (1..64), which means that there are up to 256 TRPs that can be configured, each with a unique TRP ID 0..255 within the configuration scope between a UE and LMF.  In response to QC  It is a bit difficult to follow without an explicit example. Please provide fine details about how the IE NR-TRP-LocationInfo would be represented in the FR2 IOO scenario, I also understand that you are now open to use a structure that is not matching the DL-PRS structure, at least to reorder the TRP-entries in the list? |
| Vivo | No need to change. It is necessary to support the case that each ARP location is different per each frequency layer. Therefore, we do not need optimize the UEB AD structure and the current way. |
| CATT | It seems the discussion is also related to TRP ID definition which is under another email discussion.  If the TRP ID is not defined as (0..255), the optimization to use associated TRP ID may not save much signalling. Whether to optimize the signaling can be decided after we have the clear conclusion on the TRP ID definition.  Considering this is the last meeting for ASN.1 frozen, it is better not to change the structure too much. |
| Ericsson | Good point, CATT – we agree  A comment to vivo – yes, the case with different ARP locations per frequency layer is already supported. Here we want to avoid an inefficient representation in case they are the same, which seems to be a quite typical case.  A comment to Qualcomm  This is still broken – without the proposed TRP-ID-reference you still cannot encode the repetition of information properly. Note also that IOO FR2 is based on 3 sectors, so each TRP has three sectors at the same location per frequency layer, and with four frequency layers, that means 12 sectors per TRP that all have the same location. |
| Intel | It could save signaling overhead if many TRPs are in the same location. But would like to understand whether it is normal case or not. |
| Apple | From the table above, for FR2 example, the “Matching hierarchies with reference option” will cost most overhead for location representation (1189 bytes), then it is not clear to me what is the benefit to support such a change. |
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Rapporteurs note in relation to Apples comment – in [3], it was clarified that the columns for FR2 were swapped.

### 3.1.2 Discussion template

Companies are asked to provide their view regarding an associated TRP reference in the *NR-TRP-LocationInfo* IE to avoid repeating identical location information, partly in consideration of the evaluation summary in Table 1 of IE sizes for the baseline and baseline with reference cases. From the previous email discussion companies asked for more evaluations to better understand the relevance. Therefore, the city scenario was added in the background section.

|  |  |
| --- | --- |
| Associated TRP reference in TRP-LocationInfo to avoid multiple instances of the same information | |
| Company | Comment |
| Ericsson | We consider this modification necessary in order to limit the size of key information element for TRP location information, and thereby to enable broadcast or scalable unicast distribution of UEB AD |
| Deutsche Telekom | We support this modification and share Ericsson’s view. |
| OPPO | With existing delta-based coding for the location information, it is not clear to us what is the motivation to do this change. |
| Qualcomm | Not needed.  See our comment above. The delta-location is absent if the location is the same as the previous entry (e.g., for co-located TRPs). |
| Apple | No strong view. On top of the relative positioning signaling design, not sure about adding another layer for further size optimization. There is nothing broken in baseline design. I think the benefits really depends on the deployment of TRPs, we are not very sure the above savings shown in the table is for a typical case or just for a corner case. |
| Ericsson | We do not have the same understanding as Qualcomm. From the field descriptions:   * ***referencePoint*** *[...]* If this field is absent, the reference point is the same as in the previous entry of the *NR-TRP-LocationInfoPerFreqLayer* list. * ***trp-Location***: This field provides the location of the TRP relative to the *referencePoint* location. If this field is absent the TRP location coincides with the *referencePoint* location.   This means that in baseline you can avoid repeating the reference point per frequency layer, and you can avoid TRP locations that coincide with the reference point, but nothing more. Therefore, the proposed change is indeed needed. The proposed change with an optional reference was actually suggested by QC in email discussion #602, R2-2003983, quote from the QC comment:  However, if a duplication is possible/likely in practice, an index could be used within each type of assistance data. As an example:  NR-TRP-LocationInfo-r16 ::= SEQUENCE (SIZE (1..4)) OF NR-TRP-LocationInfoPerFreqLayer-r16  NR-TRP-LocationInfoPerFreqLayer-r16 ::= SEQUENCE {      referencePoint-r16          ReferencePoint-r16              OPTIONAL,   -- Cond NotSameAsPrev      trp-LocationInfoList-r16    SEQUENCE (SIZE (1..64)) OF TRP-LocationInfoElement-r16,      ...  }  TRP-LocationInfoElement-r16 ::= SEQUENCE {      trp-id-r16                     TRP-ID-r16,      trp-Index                   INTEGER (1..maxTRPs)                   OPTIONAL,      trp-Location-r16               RelativeLocation-r16                    OPTIONAL,   -- Need OP      trp-DL-PRS-ResourceSets-r16     SEQUENCE (SIZE(1..2)) OF                                        DL-PRS-ResourceSets-TRP-Element-r16 OPTIONAL,   -- Need OP      ...  }  The *trp-Index* would be included and the *trp-Location* and the *trp-DL-PRS-ResourceSets* would be excluded when location info for another TRP is referenced.  The current baseline cannot avoid repetition of information and therefore large message sizes, while the optional reference can. |
| CATT | We also think delta signaling could avoid the duplications. So no need to introduce new TRP ID/index. |
|  |  |

**Summary**: It is difficult to assess comments such as there is no overhead, when there is no motivation or explanation why. Especially when other companies concludes that there is an overhead after analysing the situation. The full high accuracy position with uncertainty used for the reference point uses 130 bits, the delta position with uncertainty 110 bits and an optional reference 9 bits. Therefore, the delta signalling does not solve the problem with duplications. The main improvement is due to the optional reference.

Two companies (Ericsson, Deutsche Telecom) are in favour of this change

Three companies think the delta signalling could avoid the overhead (OPPO, Apple, CATT) *(Rapporteurs note – as seen above, the delta signalling (110 bits/TRP) is better than using full representation (130 bits/TRP) but far from the optional reference (9 bits/TRP) )*

One company thinks that the delta-location is absent if the location is the same as the previous entry (Qualcomm) *(Rapporteurs note – as commented by Ericsson, this does not seem to be the case. If absent, the reference point location will be used according to the field description which is not flexible enough. )*

Therefore, based on the presented information and analysis, there is no technical motivation why the proposed change with an optional reference in the TRP-LocationInfo IE cannot be agreed.

1. RAN2 to discuss the whether there are technical motivations against agreeing the proposed change with an optional reference in the TRP-LocationInfo IE.

Companies are also asked to provide comments to the text proposal for introducing the optional TRP reference with the NR-LocationInfo IE.

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| --- | --- |
| Associated TRP reference in TRP-LocationInfo, text proposal in Annex 1 | |
| Company | Comment |
| Ericsson | We are fine with the text proposal – a very limited change to the spec text. |
| Deutsche Telekom | We are fine with the text proposal. |
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Depending on the outcome of discussion associated to proposal 1, the following proposal could be seen as agreeable:

1. RAN2 to agree to the text proposal in Annex 1.

## 3.2 NR-TRP-BeamInfo IE

The *NR-TRP-BeamInfo* IE provides the beam information of a TRPs. The typical case of the overhead with the baseline signalling is that the beam information of each TRP has to be specified in detail. However, typically, the same antenna type and beam configuration is used at several sites, except for individual azimuth and tilt. This means that it is enough to only define the full beam information for one TRP in the set of TRPs, and make an association from the other TRPs, while providing a TRP specific azimuth and tilt via the rotation angles.

### 3.2.1 Input from [1]

Companies are asked to provide comments to the suggested addition of a TRP reference to avoid duplication of beam information.

|  |  |
| --- | --- |
| Table 3.2 Optional TRP reference in TRP beam information IE to avoid data duplication | |
| Company | Comments |
| Huawei/HiSilicon | In our understanding, TRP ID (PRS ID) will be used to associate the same TRP in different frequency layers. In case the beam information of PRS resources are the same across frequency layers, can it be fixed by setting some fields optiional with need OP and add procedure text in the field description? |
| Qualcomm | Is the "*for example two TRPs at the same location but at different frequency layers*" the only case, or are there additional cases? I think the "same location" does not matter, since the Beam Info is provided for a TRP-ID (whose location is provided separately).  If the *DL-PRS-BeamInfoSet* can be applicable to multiple TRPs, the *trp-id* in *NR-DL-PRS-BeamInfoPerTRP* could include a list of TRP-IDs (up to 4) for which the *DL-PRS-BeamInfoSet* is applicable. |
| Ericsson | In response to Qualcomm:  It is a bit difficult to follow. There is no *NR-DL-PRS-BeamInfoPerTRP* in the ASN.1, but I guess you mean *NR-DL-PRS-BeamInfo-r16.*  The trp-id field of that IE is currently a simple attribute, but you mean a SEQUENCE would be better, that could take up to 4 (as meany as the supported frequency layers) TRP-IDs?  Yes – would be interesting to see what is more efficient. In RAN2#109bis, you suggested using a TRP ID reference to reduce overhead, and that is what we have provided encoding details for (for locationInfo). Why a new proposal again? The reference you suggested at the previous meeting and that we currently have in the text proposal in the Annex seems to address the overhead satisfactory. |
| CATT | Perhaps we needn’t spend much effort on multiple frequencies case, since at most, it is repeated 3 more times. At this stage, we’d better make the mechanism workable. |
| Ericsson | To repeat information 3 times can be critical, for example if the information is broadcasted it may prevent broadcasting due to its size. We believe that workable and efficient goes hand in hand here. |
| Intel | Would like to understand how much gain we can get in normal configuration, and also qualcomm’s way. |
| Apple | Need to understand how much gain is achieved in the typical scenario. From the numbers in Table-1, it seems there is no much difference for different options in regards of overhead in “NR-DL-PRS-AssistanceDataList” structure. |
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### 3.2.2 Discussion template

Companies are asked to provide their view regarding an associated TRP reference in the *NR-TRP-BeamInfo* IE to avoid repeating identical beam information, partly in consideration of the evaluation summary in Table 1 of IE sizes for the baseline and baseline with reference cases. From the previous email discussion companies asked for more evaluations, which has been provided in [4] and in the background section.

|  |  |
| --- | --- |
| Associated TRP reference in TRP-BeamInfo to avoid multiple instances of the same information | |
| Company | Comment |
| Ericsson | We consider this modification necessary in order to limit the size of key information element for TRP beam information, and thereby to enable broadcast or scalable unicast distribution of UEB AD |
| Deutsche Telekom | We support this modification and share Ericsson’s view. |
| OPPO | For beam info, the benefit of this change seems to be justified. |
| Qualcomm | Don’t think any change is needed. We consider it unlikely that base station antennas/beams point exactly in the same direction (incl. azimuth and elevation). |
| Apple | No strong view. If the beam config for different frequency layers are usually identical, then we are OK with this optimization. |
| Ericsson | In response to Qualcomms comment.  It is enough with the beam information of one antenna if the other antennas have the same beam configuration. The other antennas have their own LCS-GCS-translation parameters, so that they can be subject to any azimuth and tilt angle. As in the city example, only one antenna/TRP is provided with full beam information, while all the other antennas/TRPs has a reference to the first, and antenna/TRP-specific azimuth and tilt. To have the same antenna but with site-specific azimuth and elevation is the typical case |
| CATT | We don’t think the beam information is completely the same for different frequencies at the same place. But it is also difficult to say it is absolutely not the same in the real configuration. So it is acceptable for us to have the optimization. |
|  |  |

**Summary**: Five companies are fine with the optional reference, one company don’t think this is needed since it is unlikely that base station antennas/beams point exactly in the same direction. (Rapporteurs note – the change is said to address both the case with multiple frequency layers with the same beam config across layers, but also that one antenna/set of beams is used at several sites in the same frequency layer but with individual azimuth and elevation)

Therefore, based on a majority view, the following proposal is seen as agreeable:

1. RAN2 to the proposed change with an optional reference in the DL-PRS-BeamInfo IE.

Companies are also asked to provide comments to the text proposal for introducing the optional TRP reference with the NR-BeamInfo IE.

|  |  |
| --- | --- |
| Associated TRP reference in TRP-BeamInfo, text proposal in Annex 1 | |
| Company | Comment |
| Ericsson | We are fine with the text proposal – a very limited change to the spec text. It means that the beam information of TRPs can be made once for one TRP, and then only with reference and the existing rotation angles for azimuth and tilt for other TRPs with the same beam setup – very efficient. |
| Deutsche Telekom | We are fine with the text proposal. |
| OPPO | We are fine with the TP. |
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Depending on the outcome of discussion associated to proposal 3, the following proposal is seen as agreeable:

1. RAN2 to agree to the text proposal in Annex 3.

# 4 Conclusion

Based on the email discussion summary in the previous sections we propose the following:

[Proposal 1 RAN2 to discuss the whether there are technical motivations against agreeing the proposed change with an optional reference in the TRP-LocationInfo IE.](#_Toc42687763)

[Proposal 2 RAN2 to agree to the text proposal in Annex 1.](#_Toc42687764)

[Proposal 3 RAN2 to the proposed change with an optional reference in the DL-PRS-BeamInfo IE.](#_Toc42687765)

[Proposal 4 RAN2 to agree to the text proposal in Annex 3.](#_Toc42687766)

# 5 References

[1] R2-2003144 Important LPP structural aspects, Ericsson

[2] R2-2004700 Report on Structure of UE-based assistance data (Email discussion 949), Ericsson

[3] R2-2004705 Summary and Text Proposal on Structure of UE-based assistance data (Email discussion 949), Ericsson

[4] R2-2006013 Structure of UE-based beam information assistance data (Extension to email discussion 949), Ericsson

# Annex 1, Text proposal to 3GPP TS 37.355 for NR-TRP-LocationInfo

6.4.3 Common NR Positioning Information Elements

6.4.3.1 Common NR assistance data Information Elements

*[…]*

*–* *NR-TRP-LocationInfo*

The IE *NR-TRP-LocationInfo* is used by the location server to provide the coordinates of the antenna reference points for a set of TRPs. For each TRP, the ARP location can be provided for each associated PRS Resource ID per PRS Resource Set.

-- ASN1START

NR-TRP-LocationInfo-r16 ::= SEQUENCE (SIZE (1..4)) OF NR-TRP-LocationInfoPerFreqLayer-r16

NR-TRP-LocationInfoPerFreqLayer-r16 ::= SEQUENCE {

referencePoint-r16 ReferencePoint-r16 OPTIONAL, -- Cond NotSameAsPrev

trp-LocationInfoList-r16 SEQUENCE (SIZE (1..64)) OF TRP-LocationInfoElement-r16,

...

}

TRP-LocationInfoElement-r16 ::= SEQUENCE {

trp-id-r16 TRP-ID-r16

associatedTRP-ID-r16 INTEGER (0..255), OPTIONAL,

trp-Location-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

trp-DL-PRS-ResourceSets-r16 SEQUENCE (SIZE(1..2)) OF

DL-PRS-ResourceSets-TRP-Element-r16 OPTIONAL, -- Need OP

...

}

DL-PRS-ResourceSets-TRP-Element-r16 ::= SEQUENCE {

dl-PRS-ResourceSetARP-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

dl-PRS-Resource-ARP-List-r16 SEQUENCE (SIZE(1..64)) OF

DL-PRS-Resource-ARP-Element-r16 OPTIONAL, -- Need OP

...

}

DL-PRS-Resource-ARP-Element-r16 ::= SEQUENCE {

dl-PRS-Resource-ARP-location-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

...

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *NotSameAsPrev* | The field is mandatory present in the first entry of the *NR-TRP-LocationInfoPerFreqLayer* list; otherwise it is optionally present, need OP. |

| ***NR-TRP-LocationInfo* field descriptions** |
| --- |
| ***referencePoint***  This field specifies the reference point used to define the TRP location in the *trp-LocationInfoList*. If this field is absent, the reference point is the same as in the previous entry of the *NR-TRP-LocationInfoPerFreqLayer* list. |
| ***trp-LocationInfoList***  This field provides the antenna reference point locations of the DL-PRS Resources for the TRPs and comprises the following sub-fields:  - ***trp-id***: This field provides an identity of the TRP.  - ***associatedTRP-ID***: This field provides a dl-PRS-ID associated to another TRP with the same location information.  - ***trp-Location***: This field provides the location of the TRP relative to the *referencePoint* location. If this field is absent the TRP location coincides with the *referencePoint* location.  - ***trp-DL-PRS-ResourceSets***: This field provides the antenna reference point location(s) of the DL-PRS Resource Set(s) associated with this TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resource Set(s) coincides with the *trp-Location* location. This field comprises the following sub-fields:  - ***dl-PRS-ResourceSetARP***: This field provides the antenna reference point location of the DL-PRS Resource Set relative to the *trp-Location* location. If this field is absent, the antenna reference point location of this DL-PRS Resource Set coincides with the *trp-Location* location.  - ***dl-PRS-Resource-ARP-List***: This field provides the antenna reference point location(s) of the DL-PRS Resource(s) associated with this resource set of the TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resources coincides with the *dl-PRS-ResourceSetARP* location. This field comprises the following sub-fields:  - ***dl-PRS-Resource-ARP-location***: This field provides the antenna reference point location of the DL-PRS Resource associated with the DL-PRS Resource Set of the TRP relative to the *dl-PRS-ResourceSetARP* location. If this field is absent, the antenna reference point location of this DL-PRS Resource coincides with the *dl-PRS-ResourceSetARP* location. |

– *ReferencePoint*

The IE *ReferencePoint* provides a well defined location relative to which other locations may be defined.

-- ASN1START

ReferencePoint-r16 ::= SEQUENCE {

referencePointGeographicLocation-r16 CHOICE {

location3D-r16 EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,

ha-location3D-r16 HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15,

...

},

...

}

-- ASN1STOP

| ***ReferencePoint* field descriptions** |
| --- |
| ***referencePointGeographicLocation***  This field provides the geodetic location of the reference point. |

– *RelativeLocation*

The IE *RelativeLocation* provides a location relative to some known reference location.

-- ASN1START

RelativeLocation-r16 ::= SEQUENCE {

milli-arc-second-units-r16 ENUMERATED { mas0-03, mas0-3, mas3, mas30, ...},

height-units-r16 ENUMERATED {mm, cm, m, ...},

delta-latitude-r16 Delta-Latitude-r16,

delta-longitude-r16 Delta-Longitude-r16,

delta-height-r16 Delta-Height-r16,

locationUNC-r16 LocationUncertainty-r16 OPTIONAL, -- Need OP

...

}

Delta-Latitude-r16 ::= SEQUENCE {

delta-Latitude-r16 INTEGER (-1024..1023),

coarse-delta-Latitude-r16 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

Delta-Longitude-r16 ::= SEQUENCE {

delta-Longitude-r16 INTEGER (-1024..1023),

coarse-delta-Longitude-r16 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

Delta-Height-r16 ::= SEQUENCE {

delta-Height-r16 INTEGER (-1024..1023),

coarse-delta-Height-r16 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

LocationUncertainty-r16 ::= SEQUENCE {

horizontalUncertainty-r15 INTEGER (0..255),

horizontalConfidence-r15 INTEGER (0..100),

verticalUncertainty-r15 INTEGER (0..255),

verticalConfidence-r15 INTEGER (0..100)

}

-- ASN1STOP

| ***RelativeLocation* field descriptions** |
| --- |
| ***milli-arc-second-units***  This field provides the units and scale factor for the *delta-latitude* and *delta-longitude* fields. Enumerated values *mas0-03*, *mas0-3*, *mas3*, and *mas30*, correspond to 0.03, 0.3, 3, and 30 milliarcseconds, respectively. |
| ***height-units***  This field provides the units and scale factor for the *delta-height* field. Enumerated values *mm*, *cm*, and *m* correspond to 10-3 metre, 10-2 meter, and 1 meters, respectively. |
| ***delta-latitude***  This field specifies the delta value in latitude of the desired location, defined as "desired location" minus "reference point location" and comprises the following sub-fields:  - ***delta-Latitude*** specifies the delta value in latitude in the unit provided in *milli-arc-second-units* field.  - ***coarse-delta-Latitude*** specifies the delta value in latitude in 1024 times the size of the unit provided in *milli-arc‑second‑units* field and with the same sign as in the *delta-Latitude* field. If this field is absent, the value for *coarse-delta-Latitude*is zero.  I.e., the full *delta-latitude* is given by:  (*delta-Latitude* × *milli-arc-second-units*)±(*coarse-delta-Latitude* × 1024 × *milli-arc-second-units*) [milli-arc-seconds] |
| ***delta-longitude***  This field specifies the delta value in longitude of the desired location, defined as "desired location" minus "reference point location" and comprises the following sub-fields:  - ***delta-Longitude*** specifies the delta value in longitude in the unit provided in *milli-arc-second-units* field.  - ***coarse-delta-Longitude*** specifies the delta value in longitude in 1024 times the size of the unit provided in *milli-arc‑second‑units* field and with the same sign as in the *delta-Longitude* field. If this field is absent, the value for *coarse-delta-Longitude*is zero.  I.e., the full *delta-longitude* is given by:  (*delta-Longitude* × *milli-arc-second-units*)±(*coarse-delta-Latitude* × 1024 × *milli-arc-second-units*) [milli-arc-seconds] |
| ***delta-height***  This field specifies the delta value in ellipsoidal height of the desired location, defined as "desired location" minus "reference point location" and comprises the following sub-fields:  - ***delta-Height*** specifies the delta value in ellipsoidal height in the unit provided in *height-units* field.  - ***coarse-delta-Height*** specifies the delta value in ellipsoidal height in 1024 times the size of the unit provided in *height-units* field and with the same sign as in the *delta-Height* field. If this field is absent, the value for *coarse-delta-Height*is zero.  I.e., the full *delta-height* is given by:  (*delta-Height* × *height-units*) *±* (*coarse-delta-Height* × 1024 × *height-units*) [meters] |
| ***locationUNC***  This field specifies the uncertainty of the location coordinates and comprises the following sub-fields:  - ***horizontalUncertainty*** indicates the horizontal uncertainty of the ARP latitude/longitude. The ′*horizontalUncertainty*′ corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and ′*horizontalConfidence*′ corresponds to confidence as defined in TS 23.032 [15].  - ***verticalUncertainty*** indicates the vertical uncertainty of the ARP altitude. The '*verticalUncertainty*' corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and '*verticalConfidence*' corresponds to confidence as defined in TS 23.032 [15].  If this field is absent, the uncertainty is the same as for the associated reference point location. |

# Annex 2, Text proposal to 3GPP TS 37.355 for for efficient representation of UEB AD for beam information

### 6.4.3 Common NR Positioning Information Elements

#### 6.4.3.1 Common NR assistance data Information Elements

*[…]*

– *NR-DL-PRS-BeamInfo*

The IE *NR-DL-PRS-BeamInfo* is used by the location server to provide spatial direction information of the DL-PRS Resources.

-- ASN1START

NR-DL-PRS-BeamInfo-r16 ::= SEQUENCE (SIZE (1..4)) OF NR-DL-PRS-BeamInfoPerFreqLayer-r16

NR-DL-PRS-BeamInfoPerFreqLayer-r16 ::= SEQUENCE (SIZE (1..64)) OF NR-DL-PRS-BeamInfo-r16

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

trp-id-r16 TRP-ID-r16,

associatedTRP-ID-r16 INTEGER (0..255) OPTIONAL,

lcs-gcs-translation-parameter-r16 LCS-GCS-Translation-Parameter-r16 OPTIONAL, -- Need OP

dl-prs-BeamInfoSet-r16 DL-PRS-BeamInfoSet-r16 OPTIONAL,

...

}

DL-PRS-BeamInfoSet-r16 ::= SEQUENCE (SIZE(1..2)) OF DL-PRS-BeamInfoResourceSet-r16

DL-PRS-BeamInfoResourceSet-r16 ::= SEQUENCE (SIZE(1..64)) OF DL-PRS-BeamInfoElement-r16

DL-PRS-BeamInfoElement-r16 ::= SEQUENCE {

dl-PRS-Azimuth-r16 INTEGER (0..359),

dl-PRS-Azimuth-fine-r16 INTEGER (0..9), OPTIONAL, -- Need ON

dl-PRS-Elevation-r16 INTEGER (0..180) OPTIONAL, -- Need ON

dl-PRS-Elevation-fine-r16 INTEGER (0..9) OPTIONAL, -- Need ON

...

}

LCS-GCS-Translation-Parameter-r16 ::= SEQUENCE {

alpha-r16 INTEGER (0..359),

alpha-fine-r16 INTEGER (0..9), OPTIONAL, -- Cond AzElFine

beta-r16 INTEGER (0..359),

beta-fine-r16 INTEGER (0..9) OPTIONAL, -- Cond AzElFine

gamma-r16 INTEGER (0..359),

gamma-fine-r16 INTEGER (0..9) OPTIONAL, -- Cond AzElFine

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *AzElFine* | The field is mandatory present if *dl-PRS-Azimuth-fine* or *dl-PRS-Elevation-fine* are present; otherwise it is not present. |

| ***NR-DL-PRS-Beam-Info* field descriptions** |
| --- |
| ***trp-id***  This field provides an identity of the TRP. |
| ***associatedTRP-ID***  This field specifies the dl-PRS-ID of the associated TRP from which the beam information is adopted. The beam information from the associated TRP is considered to be in GCS if the *lcs-gcs-translation-parameter* field is not provided, and to be in LCS if the *lcs-gcs-translation-parameter* field is provided. If the field is omitted, the beam information is provided via the *dl-prs-BeamInfoSet* field. |
| ***lcs-gcs-translation-parameter***  This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [44]. If this field is absent, the azimuth and elevation *angles, or the beam information of the associated TRP,* are provided in a GCS. |
| ***dl-prs-BeamInfoSet***  This field provides the DL-PRS beam information for each DL-PRS Resource of the DL-PRS Resource Set associated with this TRP. |
| ***dl-PRS-Azimuth***  This field specifies the azimuth angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the azimuth angle is measured counter-clockwise from geographical North.  For a Local Coordinate System (LCS), the azimuth angle is measured measured counter-clockwise from the x-axis of the LCS.  Scale factor 1 degrees; range 0 to 359 degrees. |
| ***dl-PRS-Azimuth-fine***  This field provides finer granularity for the *dl-PRS-Azimuth*.  The total azimuth angle of the boresight direction is given by *dl-PRS-Azimuth* + *dl-PRS-Azimuth-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |
| ***dl-PRS-Elevation***  This field specifies the elevation angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the elevation angle is measured relative to zenith and positive to the horizontal direction (elevation 0 deg. points to zenith, 90 deg to the horizon).  For a Local Coordinate System (LCS), the elevation angle is measured relative to the z-axis of the LCS (elevation 0 deg. points to the z-axis, 90 deg to the x-y plane).  Scale factor 1 degrees; range 0 to 180 degrees. |
| ***dl-PRS-Elevation-fine***  This field provides finer granularity for the *dl-PRS-Elevation*.  The total elevation angle of the boresight direction is given by *dl-PRS-Elevation* + *dl-PRS-Elevation-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |
| ***alpha***  This field specifies the bearing angle α for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 1 degrees; range 0 to 359 degrees. |
| ***alpha-fine***  This field provides finer granularity for the *alpha*.  The total bearing angle α is given by *alpha* + *alpha-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |
| ***beta***  This field specifies the downtilts angle β for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 1 degrees; range 0 to 359 degrees. |
| ***beta-fine***  This field provides finer granularity for the *beta*.  The total downtilt angle β is given by *beta* + *beta-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |
| ***gamma***  This field specifies the slant angle γ for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 1 degrees; range 0 to 359 degrees. |
| ***gamma-fine***  This field provides finer granularity for the *gamma*.  The total slant angle γ is given by *gamma* + *gamma-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |