**3GPP TSG-RAN WG3 #109 *R3-205644(rev of 5219)***

**Online, 17th - 28th August 2020**

Agenda Item: 19.4

Source: Ericsson

**Title: TP to NRPPa: correction of TRP geo-coordinates**

Document for: Others

# Discussion

In last meeting, RAN3 discussed the topic of TRP geographical coordinates in the TRP INFORMATION procedure [1]. The current description in the tabulars is however not aligned with the LPP representation and some important inconsistencies remain. Specifically:

1. The relative location per PRS resource/resource set can only be in relative geodetic, not cartesian
2. Only either the resource coordinates or the TRP coordinates can be provided in 9.2.z9 Geographical Coordinates.
3. The Coordinate Reference System for the relative location (X,Y,Z) relative the global reference system (WGS84) needs to be defined (mainly direction of  (X,Y,Z)).
4. The value range of the relative coordinates (-2^31 - 2^31-1) is too large!!! It corresponds to 214 748 364.7 m, i.e. more than the distance between the poles: 6356.752 km according to NASA <https://nssdc.gsfc.nasa.gov/planetary/factsheet/earthfact.html> (on an average, the distance from Earth to the moon is about 384,400 km…) A local reference system needs to be limited such that earth can be approximated to be flat. This as distances in the local system is not on earth but in the local tangential plane <https://en.wikipedia.org/wiki/Geographic_coordinate_conversion>). It should thus be about plus/minus 2^9, which in case of cm is a range of plus/minus 2000 kilometers.
5. In LPP there is an optional reference point (location, high-accuracy-location, or a reference ID) that should be aligned in the 9.1.1.f TRP INFORMATION RESPONSE. If that is present, it is possible to provide relative coordinates, if not, absolute coordinates are the only possible option.
6. For each TRP, there is a geographical coordinate which can take four different types – i) absolute location, ii) absolute high accuracy (ha)-location, iii) relative geodetic location, iv) relative cartesian location. This needs to be aligned in NRPPa.
7. Furthermore, there is an optional DL-PRS resource coordinate per TRP, which provides the relative location (geodetic or cartesian) of DL-PRS resources in relation to the TRP location.
8. the scale can be **mm**, cm, dm to be aligned with the level of detail of the geodetic ones.

We propose to correct NRPPa by considering the points raised above.

**Proposal 1: Agree to the TP below to correct the TRP geographical coordinates**

# References

**[1]**  R3-203602, (TP for BL CR for TS 38.455/TS 38.473): TRP Geographical Coordinates, Huawei, Deutsche Telekom, LGU+, BT, Orange.

# TP to NRPPa: correction of TRP Geo-coordinates

**START OF CHANGES**

9.2.z9 Geographical Coordinates

This information element contains the geographical coordinates for the TRP.

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| **IE/Group Name** | **Presence** | **Range** | **IE Type and Reference** | **Semantics Description** |
| CHOICE *TRP Position Definition Type* | M |  |  |  |
| >*Direct* |  |  |  |  |
| >>CHOICE *Accuracy* | M |  |  |  |
| >>>TRP Position | O |  | NG-RAN Access Point Position9.2.10 | The configured estimated geographical position of the antenna of the cell/TRP. |
| >>>TRP High Accuracy Access Position | O |  | NG-RAN High Accuracy Access Point Position9.2.bb1 | The configured estimated geographical high accuracy position of the antenna of the cell/TRP. |
| >*Referenced* |  |  |  |  |
| >>Reference Point | M |  | 9.2.z9d | The reference point is used to derive the TRP position |
| >>CHOICE *Type* | M |  |  |  |
| >>>TRP Position Relative Geodetic | O |  | Relative Geodetic Location9.2.z9b | The configured estimated relative geodetic coordinate of the antenna of the cell/TRP |
| >>>TRP Position Relative Cartesian | O |  | Relative Cartesian Location9.2.z9c | The configured estimated relative Cartesian coordinate of the antenna of the cell/TRP |
| DL-PRS Resource Coordinates | O |  | 9.2.z9a | DL-PRS Resource Coordinates relative to the TRP coordinate |

9.2.z9a DL-PRS Resource Coordinates

This information element contains the geographical coordinates of the antenna reference points (ARP) for the DL-PRS Resources of a TRP.

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| **IE/Group Name** | **Presence** | **Range** | **IE Type and Reference** | **Semantics Description** |
| **DL-PRS Resource Set ARP List** | M | *1..<maxPRS-ResourceSets>* |  |  |
| >DL-PRS Resource Set ID | M |  | INTEGER (0..7) |  |
| >CHOICE *DL-PRS Resource Set ARP Location* | M |  |  | Relative to the geographical coordinates for the TRP.If this IE is absent, the Relative Location is zero for the indicated DL-PRS Resource Set ID. |
| >>Relative Geodetic Location | O |  | Relative Geodetic Location 9.2.z9b |  |
| >>Relative Cartesian Location | O |  | Relative Cartesian Location 9.2.z9c |  |
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| >**DL-PRS Resource ARP List** | M | *1..<maxPRS-ResourcesPerSet>* |  |  |
| >>DL-PRS Resource ID | M |  | INTEGER (0..63) |  |
| >>CHOICE *DL-PRS Resource ARP Location* | M |  |  | Relative to the DL-PRS Resource Set ARP Location.If this IE is absent, the Relative Location is zero for the indicated DL-PRS Resource ID. |
| >>>Relative Geodetic Location | O |  | Relative Geodetic Location 9.2.z9b |  |
| >>>Relative Cartesian Location | O |  | Relative Cartesian Location 9.2.z9c |  |

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| **Range bound** | **Explanation** |
| maxPRS-ResourceSets | Maximum no of DL-PRS resource sets per TRP. Value is 2. |
| maxPRS-ResourcesPerSet | Maximum no of DL-PRS resources of the DL-PRS resource set of the TRP. Value is 64. |

9.2.z9b Relative Geodetic Location

This information element provides a location relative to some known reference location in a relative geodetic coordinate system.

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| **IE/Group Name** | **Presence** | **Range** | **IE Type and Reference** | **Semantics Description** |
| Milli-Arc-Second Units | M |  | ENUMERATED (0.03, 0.3, 3, ...) | Units and scale factor for the delta-latitude and delta-longitude fields. 0.03, 0.3, 3, milliarcseconds. TS 37.355 [y]. |
| Height Units | M |  | ENUMERATED (mm, cm, m, ...) | Units and scale factor for the delta-height field. 10-3 metre, 10-2 metre, TS 37.355 [y]. |
| Delta Latitude | M |  | INTEGER (-1024..1023) | Delta value in latitude in the unit provided in Milli-Arc-Second Units. TS 37.355 [y]. |
| Delta Longitude | M |  | INTEGER (-1024..1023) | Delta value in longitude in the unit provided in Milli-Arc-Second Units. TS 37.355 [y]. |
| Delta Height | M |  | INTEGER (-1024..1023) | Delta value in ellipsoidal height in the unit provided in Height Units. TS 37.355 [y]. |
| Location uncertainty | M |  | 9.2.z9e |  |
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**NEXT CHANGE**

9.2.z9c Relative Cartesian Location

This information element provides a location relative to some known reference location in a relative Cartesian coordinate system

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| **IE/Group Name** | **Presence** | **Range** | **IE Type and Reference** | **Semantics Description** |
| XYZ unit | M |  | ENUMERATED (mm, cm, dm,..) |  |
| X value | M |  | INTEGER(-216.. 216-1) | Positive value represents northing from reference point, in units of *XYZ Unit* IE. |
| Y value | M |  | INTEGER(-216.. 216-1) | Positive value represents easting from reference point in units of *XYZ Unit* IE. |
| Z value | M |  | INTEGER(-26.. 26-1) | Positive value represents height above reference point in units of *XYZ Unit* IE. |
| Location uncertainty | M |  | 9.2.z9e |  |

9.2.z9d Reference Point

This information element provides a reference point information.

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| **IE/Group Name** | **Presence** | **Range** | **IE Type and Reference** | **Semantics Description** |
| CHOICE *ReferencePoint* | M |  |  | Reference point to which relative location information is related to  |
| >Coordinate ID |  |  |  |  |
| >>Coordinate ID | M |  | INTEGER(0.. 29-1,..) | Referential ID mapped to  WGS84 coordinates via OAM |
| >Reference Point Coordinates |   |   |   |   |
| >>Reference Point Position | M |   | NG-RAN Access Point Position9.2.10 |   |
| >Reference Point Coordinates High Accuracy |   |   |  |   |
| >>Reference Point High Accuracy Access Position  | M |   | NG-RAN High Accuracy Access Point Position9.2.bb1 |   |

9.2.z9e Location Uncertainty

This information element provides the location uncertainty information.

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| **IE/Group Name** | **Presence** | **Range** | **IE Type and Reference** | **Semantics Description** |
| >Horizontal Uncertainty | M |  | INTEGER (0..255) | Horizontal uncertainty of the ARP latitude/longitude. Corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [8] |
| >Horizontal Confidence | M |  | INTEGER (0..100) | Corresponds to confidence as defined in TS 23.032 [8]. |
| >Vertical Uncertainty | M |  | INTEGER (0..255) | Vertical uncertainty of the ARP altitude. Corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [8] |
| >Vertical Confidence | M |  | INTEGER (0..100) | Corresponds to confidence as defined in TS 23.032 [8]. |

**NEXT CHANGE**

***ASN.1 to be added after the meeting.***

**END OF CHANGES**