3GPP TSG-RAN WG2 #110e *DRAFT* R2-2005894

Online, June 01 – 12, 2020

Agenda Item: 6.8.2.3

Source: Ericsson

Title: [AT110-e][612][POS] TRP-ID continuation (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This document summarizes the following email discussion:

* [AT110-e][612][POS] TRP-ID continuation (Ericsson)

      Scope: Continue discussion of the open issues from R2-2004704 and converge where possible.  Open issues identified:

* Name of the integer identifier for a TRP
* Unique identification of a DL-PRS resource between the UE and the LMF
* Need for an additional identifier in the measurement information
* Need for a cell identifier in DL-PRS assistance data
* Need for a cell identifier in UE-based assistance data

      Intended outcome: Report of discussion, in R2-2005894

      Deadline:  Thursday 2020-06-04 1800 UTC

Section 2 continues the email discussion on TRP-ID based on the summary and text proposal of [1], where the discussion regarding some questions converged to some agreeable proposals, while the following open issues were identified:

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| **Issue #1: The name of the (0..255) INTEGER identifying the TRP among the TRPs the target device can handle**  Option 1.1 – Use the name TRP-ID  Option 1.2 – Use the name DL-PRS-ID  Option 1.3 – Discuss and determine a new name |
| **Issue #2, Unique identification of a DL-PRS resource**  Option 2.1 – It is sufficient if the DL-PRS resource is uniquely identified between a UE and an LMF within the LPP scope including both unicast and broadcast data exchange  Option 2.2 – The DL-PRS resource needs to be uniquely identified globally, implying that the TRP identifier has to be globally unique, at least optionally |
| The following cases have been identifed:   1. DL-PRS AD is provided via unicast, signal measurement information is provided via unicast. In this case, the TRPs are handled between LMF and UE as part of an LPP session, and the (0..255) identifier is sufficient for LMF to uniquely identify TRPs from the signal measurement information 2. DL-PRS AD and semi-static UEB AD via unicast, dynamic UEB AD via broadcast. In this case, the TRPs are associated to an NCGI of the serving cell via the request assistance data as well as from the system information broadcast, and the baseline of an INTEGER (0..255) is sufficient for LMF to uniquely identify TRPs from the signal measurement information. 3. All assistance data (DL-PRS, UEB-AD) provided via broadcast. In this case, LMF has not an association of the UE to a cell identifier such as a serving cell NCGI, unless the UE provides some more information to LMF. Companies has suggested that NCGI or some other global identifier should be provided, which could mean:    * NCGI of the serving cell    * NCGI associated to each TRP   **Issue #3 Additional identifiers in the signal measurement information (case C and maybe case B)**  Option 3.1 – The serving cell NCGI  Option 3.2 – An NCGI associated to each TRP (which means that this association has to be established via the DL-PRS AD) |
| **Issue #4 The need for a cell identifier within the DL-PRS assistance data**  Option 4.1 – No, the associated serving cell identifier is enough (but the case when no cell identifier is provided in the Request AD needs to be handled)  Option 4.2 – An NCGI associated to each TRP |
| **Issue #5 The need for a cell identifier within the UEB assistance data**  Option 5.1 – No, the associated serving cell identifier is enough (but the case when no cell identifier is provided in the Request AD needs to be handled)  Option 5.2 – An NCGI associated to each TRP |

This email discussion is focused on these open issues.

To enable a discussion that is easy for other companies to follow, please include also technical motivations, not only an indicated preferred option.

# 2 Discussion

## 2.1 Name of INTEGER (0..255) identifying a TRP

It was considered agreeable to identify any TRP among the TRPs the target device can handle by an INTEGER (0..255), and three different names of this identity has been considered:

**Issue #1: The name of the (0..255) INTEGER identifying the TRP among the TRPs the target device can handle**

Option 1.1 – Use the name TRP-ID

Option 1.2 – Use the name DL-PRS-ID

Option 1.3 – Discuss and determine a new name

In Annex 1, there is a text proposal which changed the definition of the TRP-ID, and this IE will then be named according to the outcome of this discussion.

Companies are asked to provide their view regarding the name of the (0..255) INTEGER identifying a TRP among the TRPs a target device can handle, and which option is preferred.

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| Issue #1: The name of the (0..255) INTEGER identifying the TRP among the TRPs the target device can handle | |
| Company | Comments |
| Qualcomm | Maybe I’m confused, but the document [1] (R2-2004704) seems not the email discussion summary. The comments provided by individual companies seem to be included in R2-2004701, and from reading the comments, I cannot see how one can come to the conclusion summarized in [1]).  This is the current definition in TS 38.214, as agreed in April RAN1#100b-e (R1-2003142):  “The UE expects that it will be configured with *dl-PRS-ID-r16* each of which is defined such that it is associated with multiple DL PRS resource sets from the same cell. The UE expects that one of these *dl-PRS-ID-r16* along with a *nr-DL-PRS-ResourceSetId-r16* and a *nr-DL-PRS-ResourceId-r16* can be used to uniquely identify a DL PRS resource.”  Therefore, as we already commented in R2-2004701, the *dl-PRS-ID-r16* identifies (together with the other IDs) a DL-PRS Resource, not the TRP.  A TRP-ID is currently defined in RAN3 (R3-203082) as INTEGER (1..16384,…).  Therefore, the DL-PRS ID should not be renamed to TRP-ID. |
| Huawei, HiSilicon | We have the same view as Qualcomm. The previous definition of TRP ID can be replaced with PRS id with a range INTEGER(0..255). |
| Intel | Same view as Huawei, Qualcomm. Do not need to change DL-PRS-ID. |
| Ericsson | No strong view apart from trying to avoid confusion. The TRP-ID is now also used to tie elements in different IEs together, such as DL-PRSs of a TRP and the measurements associated to that TRP, and DL-PRSs of a TRP and the location info/beam info/RTD info of the TRP.  Given the agreement in RAN1, it seems natural to use DL-PRS-ID  Also, given the majority from the previous email discussion in favor of splitting up the current complex IE TRP-ID into separate fields, and with the suggestion to move the DL-PRS-ID to the IE *NR-DL-PRS-Config* (which should be renamed NR-DL-PRS-Info for consistency with LTE), then it seems that it is sufficient to consider an optional NCGI per TRP where relevant, and PCI with the SSB-Config according to the analysis Intel did in R2-2003318 |
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Summary: All four companies are in favor of using *DL-PRS-ID* for the INTEGER (0..255) that together with a DL-PRS resource set ID and DL-PRS resource ID identifies a DL-PRS resource. A TRP is associated to one DL-PRS-ID. This is already represented in the current specification text. For clarity, there is a suggestion to move the DL-PRS-ID to the NR-DL-PRS-Config. The following proposal could be seen to be agreeable and discussed online:

1. The field DL-PRS-ID is moved from the IE TRP-ID to the IE NR-DL-PRS-Config.

## 2.2 Meaning of RAN1 TRP identifier agreement

There are some different interpretations of the RAN1 agreement and how ‘unique’ is to be interpreted. What is clear is that

* the UE can handle up to 256 TRPs accross all frequency layers
* there is one identifier per TRP
* the TRP identifier together with a DL PRS resource set ID and a DL PRS resource ID will uniquely identify a DL PRS resource

There can be different interpretations of ‘unique’ in the context above. The purpose of the DL PRS is to enable UE-assisted positioning and UE-based positioning, which means that

* **UEA:** the UE shall be able to associate DL PRS assistance data to measurements provided per positioning method to enable LMF to understand which TRP a measurement corresponds to
* **UEB:** the UE shall be able to associate DL assistance data with UEB assistance data such as TRP location, beam and relative time difference information

From the comments from companies, the opinions about ‘unique’ can be grouped into two groups:

**Issue #2, Unique identification of a DL-PRS resource**

Option 2.1 – It is sufficient if the DL-PRS resource is uniquely identified between a UE and an LMF within the LPP scope including both unicast and broadcast data exchange

Option 2.2 – The DL-PRS resource needs to be uniquely identified globally, implying that the TRP identifier has to be globally unique, at least optionally

It was pointed out that a TRP identifier that is locally unique between a UE and an LMF within the LPP scope is also associated to one globally unique cell identifier, either via LPP unicast exchange or via the cell system information broadcast. Therefore, a locally unique TRP identifier with the associated globally unique cell identifier is enough to identify a DL-PRS resource uniquely globally.

Companies are asked to provide their view regarding the meaning of the RAN1 agreement on the unique identification of a DL-PRS resource, in consideration of the options presented above.

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| Issue #2, Unique identification of a DL-PRS resource | |
| Company | Comments |
| Qualcomm | We cannot see why the positioning mode (UE-assisted, UE-based) is relevant in this context.  The meaning of the RAN1 agreement can be found in the RAN1 specifications, e.g., as cited in our answer to issue #1.  The DL-PRS ID range 0..255 is sufficient, as defined by RAN1.  A DL-PRS Resource can be uniquely identified, since the DL-PRS ID is associated with a single TRP (which can be identified via PCI/CGI, or even the RAN3 TRP-ID), |
| Huawei, HiSilicon | Option2.1 |
| Intel | Option 2.1 |
| Ericsson | Option 2.1 |
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**Summary**: All companies share the same view that the DL-PRS resource is uniquely identified between a UE and an LMF within the LPP scope including both unicast and broadcast data exchange. This is already represented in the specification text.

## 2.3 TRP identifiers in the DL-TDOA, Multi-RTT and AoD signal measurement information, MeasList

There is a need for a TRP identifier in the \*-MeasList of the signal measurement information that is based on DL-PRS – that is, DL-TDOA, Multi-RTT and AoD. In the email discussion, an integer (0..255) identifier per TRP (name FFS - TRP-ID/DL-PRS-ID/...) is used as baseline. There are different opinions about whether there is a need for additional information to be provided to LMF to identify the TRP:

1. It is sufficient with the (0..255) identifier
2. There is a need for a cell identifier such as PCI or NCGI or some other global identifier
3. There is a need for NRARFCN

Companies have commented that 3 is not needed since NRARFCN is provide in the assistance data per frequency layer. Companies have also argued that 2 is needed in order to handle the situation when some assistance data is provided via unicast and some via broadcast, which other companies have disclosed that the association to one globally unique cell identifier is sufficient to ensure that LMF can identify the TRPs in the measurements, and that the globally unique NCGI is provided in the request assistance data and via system information broadcast, so it is already present.

Trying to analyse the provided comments per different cases:

1. DL-PRS AD is provided via unicast, signal measurement information is provided via unicast. In this case, the TRPs are handled between LMF and UE as part of an LPP session, and the (0..255) identifier is sufficient for LMF to uniquely identify TRPs from the signal measurement information
2. DL-PRS AD and semi-static UEB AD via unicast, dynamic UEB AD via broadcast. In this case, the TRPs are associated to an NCGI of the serving cell via the request assistance data as well as from the system information broadcast, and the baseline of an INTEGER (0..255) is sufficient for LMF to uniquely identify TRPs from the signal measurement information.
3. All assistance data (DL-PRS, UEB-AD) provided via broadcast. In this case, LMF has not an association of the UE to a cell identifier such as a serving cell NCGI, unless the UE provides some more information to LMF. Companies has suggested that NCGI or some other global identifier should be provided, which could mean:
   1. NCGI of the serving cell
   2. NCGI associated to each TRP

Given that a (0..255) INTEGER per TRP and a serving cell NCGI is sufficient in case A and B, a minimalistic approach would be to let the UE provide the serving cell NCGI in the signal measurement information, at least in case assistance data has only been provided via broadcast. Alternatively, an NCGI is provided per TRP in case assistance data has only been provided via broadcast.

**Issue #3 Additional identifiers in the signal measurement information (case C and maybe case B)**

Option 3.1 – The serving cell NCGI

Option 3.2 – An NCGI associated to each TRP (which means that this association has to be established via the DL-PRS AD)

Companies are asked to provide their view regarding the need for additional identifiers in the signal measurement information, in consideration of the options above.

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| Issue #3 Additional identifiers in the signal measurement information (case C and maybe case B) | |
| Company | Comments |
| Qualcomm | We provided our view already in R2-2004701.  At the end, an LMF need to be able to associate the UE measurements (and location time stamp) to the correct TRP; and a UE need to be able to associate the different assistance data to the correct (same) TRP. If all data are provided from the same LMF in a single LPP session, a local index would be sufficient. But this is generally not the case, since assistance data may be obtained via broadcast (received by the UE in multiple cells in case of moving UE) or via NAS MO-LR. And there may be more than one LMF in a network.  In any case, the current LPP definition seems in agreement with RAN1, TS 38.214:  “The UE expects that one of these *dl-PRS-ID-r16* along with a *nr-DL-PRS-ResourceSetId-r16* and a *nr-DL-PRS-ResourceId-r16* can be used to uniquely identify a DL PRS resource.”  This is the case with the current LPP. We agree that the naming of the IE is a bit misleading.  As commented before, a possible solution may be to move the DL-PRS-ID into the IE *NR-DL-PRS-Config* at the top level. Then the IE (and probably even the name) TRP-ID could remain (containing the cell IDs). |
| Huawei, HiSilicon | We are not sure we understand option 3.1/3.2. Currently, the NCGI are defined per cell for all the TRPs under the cell. Then what does it mean by option 3.2 that each TRP has an NCGI?  We think PRS id can be provided in the AD, along with optional presence of PCI and NCGI in the measurement reports for the above positioning methods.   * When the PCI/NCGI is not provided, the network assumes that the UE performs the measurement based on the PRS provided in the AD with PRS id, PRS resource set id and PRS resource id * When PCI/NCGI is provided, the network assumes that the UE performs the measurement based on the PRS id, PRS resource set id and PRS resource id identified on the cell identified by the PCI or NCGI. |
| Intel | Additional Serving cell NCGI or serving cell PCI+ARFCN should be sufficient. |
| Ericsson | It seems more flexible with Option 3.2 and an optional NCGI, and to support the case of separate sources for AD such as broadcast and unicast |
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**Summary**: There are some different opinions about what information that is needed to identify the signal measurements. In addition to the DL-PRS-ID associated to a TRP, companies agree that NCGI should be optionally provided, while there are different opinions about whether PCI and/or NR ARFCN should be provided.

1. Add an optional field NCGI to identify the TRP as part of DL-TDOA, Multi-RTT and AoD signal measurement information, MeasList
2. RAN3 to discuss whether to add optional fields PCI and NR ARFCN to identify the TRP as part of DL-TDOA, Multi-RTT and AoD signal measurement information, MeasList

## 2.4 TRP identifiers within the DL-PRS assistance data

The DL-PRS-IdInfo IE is used by LMF to configure the assistance data reference, as well as by the target device to indicate the reference in the DL-TDOA Signal measurement information. The NR-DL-PRS-AssistanceDataPerTRP IE is used by LMF to provide DL-PRS assistance data per TRP. These cases are also under discussion in the email discussion #948 on LPP ASN.1 issues, whether the reference TRP can be provided as the first element of the DL-PRS assistance data list of TRPs, and whether the reference could be provided as the first measElement of the MeasList.

For LMF to target device signalling of the DL-PRS assistance data reference TRP, there are different views expressed by companies:

1. It is sufficient with the (0..255) identifier
2. There is a need for a cell identifier such as PCI or NCGI or some other global identifier

Given that there is an associated serving cell identifier either via the request assistance data or via the cell identifier of the cell the broadcast was retrieved from, the remaining issues can be expressed as

**Issue #4 The need for a cell identifier within the DL-PRS assistance data**

Option 4.1 – No, the associated serving cell identifier is enough (but the case when no cell identifier is provided in the Request AD needs to be handled)

Option 4.2 – An NCGI associated to each TRP

Companies are asked to provide their view regarding the. need for additional identifiers within the DL-PRS assistance data, in consideration of the options above.

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| Issue #4 The need for a cell identifier within the DL-PRS assistance data | |
| Company | Comments |
| Qualcomm | We provided our view already in R2-2004701, and the same as Issue#3. |
| Huawei, HiSilicon | Same as the issue above |
| Intel | 4.1 |
| Ericsson | 4.2 to handle the case of separate sources for AD such as broadcast and unicast |
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**Summary**: There are different opinions about what is needed to identify a TRP as part of the DL-PRS assistance data. Some companies thinks an optional NCGI associated to each TRP is sufficient, while some companies also thinks an optional PCI and NR ARFCN is needed also or as an alternative.

1. RAN3 to discuss whether to add optional fields NCGI and/or PCI and NR ARFCN to identify the TRP as part of DL-PRS Assistance data

## 2.5 Identifiers in UEB Assistance data

The UEB assistance data is provided using the IEs NR-TRP-LocationInfo, NR-DL-PRS-BeamInfo, ReferenceTRP-RTD-Info and RTD-InfoElement, which needs to be associated to the DL-PRS assistance data on a per TRP basis. Companies have different views and there are different opinions about whether there is a need for additional identifier(s) to be provided by LMF per TRP:

1. It is sufficient with the (0..255) identifier
2. There is a need for a cell identifier such as PCI or NCGI or some other global identifier

Given that there is an associated serving cell identifier either via the request assistance data or via the cell identifier of the cell the broadcast was retrieved from, the remaining issues is essentially the same as Issue #4

**Issue #5 The need for a cell identifier within the UEB assistance data**

Option 5.1 – No, the associated serving cell identifier is enough (but the case when no cell identifier is provided in the Request AD needs to be handled)

Option 5.2 – An NCGI associated to each TRP

Companies are asked to provide their view regarding the need for additional identifiers within the UEB assistance data, in consideration of the options above.

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| Issue #5 The need for a cell identifier within the UEB assistance data | |
| Company | Comments |
| Qualcomm | We provided our view already in R2-2004701, and the same as Issue#3. |
| Huawei, HiSilicon | Same as the issue above. |
| Intel | 5.1. |
| Ericsson | 5.2 to handle the case of separate sources for AD such as broadcast and unicast |
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**Summary**: There are different opinions about what is needed to identify a TRP as part of the UEB assistance data. Some companies thinks an optional NCGI associated to each TRP is sufficient, while some companies also thinks an optional PCI and NR ARFCN is needed also or as an alternative.

1. RAN3 to discuss whether to add optional fields NCGI and/or PCI and NR ARFCN to identify the TRP as part of UEB Assistance data

# Conclusion

From the email discussion, the following proposals are seen as agreeable

[Proposal 1 The field DL-PRS-ID is moved from the IE TRP-ID to the IE NR-DL-PRS-Config.](#_Toc42221343)

[Proposal 2 Add an optional field NCGI to identify the TRP as part of DL-TDOA, Multi-RTT and AoD signal measurement information, MeasList](#_Toc42221344)

[Proposal 3 RAN3 to discuss whether to add optional fields PCI and NR ARFCN to identify the TRP as part of DL-TDOA, Multi-RTT and AoD signal measurement information, MeasList](#_Toc42221345)

[Proposal 4 RAN3 to discuss whether to add optional fields NCGI and/or PCI and NR ARFCN to identify the TRP as part of DL-PRS Assistance data](#_Toc42221346)

[Proposal 5 RAN3 to discuss whether to add optional fields NCGI and/or PCI and NR ARFCN to identify the TRP as part of UEB Assistance data](#_Toc42221347)

# References

[1] R2-2004704, Summary and Text Proposal on TRP-ID structure (Email discussion 947) (Ericsson).