3GPP TSG-RAN WG2 #110e R2-20xxxxx

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 provides discussion templates and reports 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 – updated report in R2-2005904

Deadline: Thursday 2020-06-04 1800 UTC – extended to Wednesday 2020-06-10 1000 UTC

The online discussion during RAN2#110-e led to the following agreements:

Agreements:

The TRP-ID IE is replaced by separate IEs signalled in the separate cases where previously the TRP-ID was used.

The existing dl-PRS-Id field retains its range as INTEGER (0..255) and is broken out as a separate IE.

The included identifiers of the NR E-CID Signal Measurement Information per cell are the NR physical cell identity, NR cell global identity (shall be provided if the device was able to determine the NCGI of the measured cell at the time of measurement) and NRARFCN.

The NR-SSB-Config IE includes NR physical cell identity and NR ARFCN but no (0..255) TRP ID.

Some issues are however still open:

1. Any optional cell identifiers per TRP associated to TRPs in the DL-PRS and UEB AD, as well as UEA measurements
2. Any optional cell identifiers of the NR-DL-PRS-AssistanceDataPerTRP IE
3. Any optional cell identifiers associated to each TRP of the \*-measResult IEs
4. Any optional cell identifiers associated to each TRP of the NR-TRP-LocationInfo, NR-DL-PRS-BeamInfo, ReferenceTRP-RTD-Info, RTD-InfoElement IEs
5. The optional cell identifiers of the NR-TimeStamp IE

# 2 Discussion

The following subsections addresses the open issues, first with the input provided from companies in [1] in section 2.x.1, and then the discussion template in 2.x.2, where applicable.

## 2.1 Any optional cell identifiers per TRP associated to TRPs in the DL-PRS and UEB AD, as well as UEA measurements

The DL-PRS-ID IE enables the device to associate the NR DL-PRS assistance data with measurements and UEB assistance data within an LPP session. However, there are also scenarios where NR DL-PRS AD and/or parts or all UEB AD are provided via a mix of unicast and broadcast and/or the UEA measurements per TRP are provided via unicast, which means that there is a need to cross-identify the information per TRP via these different resources. Therefore, there is a need for additional cell identifiers.

Since the optional cell identifiers associated with a TRP as part of the DL-PRS AD, UEB AD and UEA measurements are inter-related, we gather all these aspects in a common discussion about optional cell identifiers per TRP in these contexts. Hopefully, it is enough to address this issue in common and there is no need for the discussion under sections 2.2, 2.3 and 2.4.

Companies are asked to provide their view regarding any optional cell identifier information in the IE per TRP by an ‘x’ in the corresponding column together with motivations and comments.

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| Issue 1 The optional cell identifiers of the IE associated to TRPs in the DL-PRS and UEB AD, as well as UEA measurements | | | |
| Company | PCI+NR-ARFCN | NCGI | Motivation/comment |
| Qualcomm | x | x | See our comments to the previous 3 (?) email discussions on the same topic. |
| Nokia | x | x | Given that LMF signals DL PRS config for UEB AD and UEA measurements for a pool of 256 TRPs, which is a subset of the total deployed in the network, indicating the associated cell and frequency layer information is useful for UE to store and use TRP information. |
| OPPO | X | X | We also agree that broadcast-based AD provisioning cause the main reason for globally unique ID, e.g., PCI+ARFCN / NCGI. |
| CATT | x | x | PCI+NR-ARFCN/NCGI is required in DL-PRS AD because UE needs to get the sfn of reference TRP.  PCI+NR-ARFCN/NCGI is required in UEA measurements so the LMF can identify the measurement. Because the TRP which is relative to this report may not belong to the TRP list which were sent in this LPP session. |
| Spreadtrum |  |  | DL-PRS-ID is enough for DL-PRS AD and UEA measurement which is under a session. PCI+NR-ARFCN or NCGI is OK for DL-PRS AD and UEB AD for UEB positioning.  A little confusion on the mix mode of unicast and broadcast. Does this mean that DL-PRS-ID is referenced in UEB AD for the scenario DL-PRS AD are provided by unicast while UEB AD such as NR-UEB-TRP-LocationData-r16 are provided via broadcast? If the answer is yes, I guess there will be problems because the DL-PRS-ID is per session per UE while NR-UEB-TRP-LocationData-r16 is for all UEs. |
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## 2.2 Any optional cell identifiers of the NR-DL-PRS-AssistanceDataPerTRP IE

The *NR-DL-PRS-AssistanceDataPerTRP* IE is part of the IE *NR-DL-PRS-AssistanceData*.

### 2.2.1 Input from [1]

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| Table 2.7 Need for additional TRP identifiers in *NR-DL-PRS-AssistanceDataPerTRP-r16* | |
| Company | Comments |
| Huawei/HiSilicon | *dl-PRS-ID*, *nr-PhysCellId*, *nr-CellGlobalId*  Considering broadcast and positioning SIB may be different for different cell, Cell ID should be included, and optional.  No need for ARFCN, as *dl-PRS-PointA* is already provided in *NR-DL–PRS-PositioningFrequencyLayer* |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  I understand the *nr-ARFCN* can disambiguate the *nr-PhysCellId* in some cases. I.e., this is the same as in Rel-15 LPP where PCI/ARFCN can be provided as pair. If this is not applicable to NR (and we made a mistake in Rel-15), then I agree with Huawei and *nr-ARFCN* is not needed (note, I understand this *nr-ARFCN* is not supposed to be the *dl-PRS-PointA*).  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurement. E.g., when the assistance data are not provided from the same source or the same LPP session.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in the IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in DL PRS info here. |
| Ericsson | As explained above, there is a *nr-CellGlobalId* presented together with the DL-PRS in the broadcast, and a *nr-CellGlobalId* in the AD request in case of unicast, so an additional cell ID is not needed. |
| CATT | As explained above, slightly prefer dl-PRS-ID + Either nr-PhysCellId/nr-ARFCN Or nr-CellGlobalId. But wonder nr-ARFCN needs to be configured for each TRP as TRPs within a frequency layer sharing the same nr-ARFCN. |
| Intel | For the AD from LMF via LPP, and corresponding measurement reports, ID 0-255 is sufficient.  The only question is whether it is allowed to provide more than 255 TRPs in broadcast AD? If yes, ID defined in RAN1 is not sufficient. Additional ID, e.g. PCI/ARFCN or CGI is needed. |
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### 2.2.2 Discussion template

Companies are asked to provide their view regarding any optional cell identifier information in the *NR-DL-PRS-AssistanceDataPerTRP* IE by an ‘x’ in the corresponding column together with motivations and comments.

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| Issue 2 Any optional cell identifiers of the NR-DL-PRS-AssistanceDataPerTRP IE | | | |
| Company | PCI+NR-ARFCN | NCGI | Motivation/comment |
| Qualcomm | x | x | See our comments to the previous 3 (?) email discussions on the same topic. |
| Nokia | x | x | Given that LMF signals DL PRS config for UEB AD and UEA measurements for a pool of 256 TRPs, which is a subset of the total deployed in the network, indicating the associated cell and frequency layer information is useful for UE to store and use TRP information. |
| OPPO | X | X | We also agree that broadcast-based AD provisioning cause the main reason for globally unique ID, e.g., PCI+ARFCN / NCGI. |
| CATT | x | x | PCI+NR-ARFCN/NCGI is required in *NR-DL-PRS-AssistanceDataPerTRP* because UE needs to get the sfn of reference TRP. |
| Spreadtrum | x | x | PCI+NR-AFRCN or NCGI. In some cases, ARFCN can be omitted if it can be deferred as described by companies above. |
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## 2.3 Any optional cell identifiers associated to each TRP of the \*-measResult IEs

The *NR-Multi-RTT-MeasElement* IE is part of the IE *NR-Multi-RTT-SignalMeasurementInformation*, the *NR-DL-AoD-MeasElement* IE is part of the IE *NR-DL-AoD-SignalMeasurementInformation*, and the *NR-DL-TDOA-MeasElement* IE is part of the IE *NR-DL-TDOA-SignalMeasurementInformation*

### 2.3.1 Input from [1]

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| Table 2.1 Need for additional TRP identifiers in *NR-Multi-RTT-MeasElement-r16* | |
| Company | Comments |
| Huawei/HiSilicon | *dl-PRS-ID*, *nr-PhysCellId*, *nr-CellGlobalId*  Considering broadcast and positioning SIB may be different for different cell, Cell ID should be included, and optional.  No need for ARFCN, as *dl-PRS-PointA* is already provided in *NR-DL–PRS-PositioningFrequencyLayer* |
| Qulcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  I understand the *nr-ARFCN* can disambiguate the *nr-PhysCellId* in some cases. I.e., this is the same as in Rel-15 LPP where PCI/ARFCN can be provided as pair. If this is not applicable to NR (and we made a mistake in Rel-15), then I agree with Huawei and *nr-ARFCN* is not needed (note, I understand this *nr-ARFCN* is not supposed to be the *dl-PRS-PointA*).  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurements. E.g., when the assistance data are not provided from the same source or the same LPP session.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in this IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in UL report here for multi-RTT. |
| Ericsson | We read the RAN1 agreement differently. The TRP ID is like the country code of a telephone number that together with an area code and a local number identifies the number identity. Same here, where the DL PRS resource is identified by a TRP-ID, a DL-PRS resource set ID and a DL PRS resource ID.  Therefore, to name the “country code” a “local number identifier” would be strange, and to name the identify of the TRP a DL-PRS ID would also be confusing.  It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. When the UE provides measurements to the LMF, the corresponding measurement is tied to a TRP with a TRP ID, and since the UE can be configured with up to 4\*64=256 TRPs, the TRP ID 0..255 is enough to identify the measurement as part of UEA.  With a globally unique cell identifier in the unicast AD request and in the broadcast SIB1, and a list of TRPs, each with a TRP ID, how can there be a need for something in addition to that? We do not see any technical motivation for additional identifiers. |
| CATT | *dl-PRS-ID +* either *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId.*  From a UE perspective, we agree with Ericsson it is enough to identify a TRP with 256 value. But LMF serves a large area. LMF needs *dl-PRS-ID +* either *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* to identify a TRP when receiving measurement info from a UE. In order to avoid the LMF storing the mapping for a UE between *dl-PRS-ID +* either *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* and a TRP id for the UE, we slighly prefer to introduce *dl-PRS-ID +* either *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId.* |
| Intel | For the AD from LMF via LPP, and corresponding measurement reports, ID 0-255 is sufficient.  The only question is whether it is allowed to provide more than 255 TRPs in broadcast AD? If yes, ID defined in RAN1 is not sufficient. Additional ID, e.g. PCI/ARFCN or CGI is needed. |
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| Table 2.2 Need for additional TRP identifiers in *NR-DL-AoD-MeasElement-r16* | |
| Company | Comments |
| Huawei/HiSilicon | *dl-PRS-ID*, *nr-PhysCellId*, *nr-CellGlobalId*  Considering broadcast and positioning SIB may be different for different cell, Cell ID should be included, and optional.  No need for ARFCN, as *dl-PRS-PointA* is already provided in *NR-DL–PRS-PositioningFrequencyLayer* |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  I understand the *nr-ARFCN* can disambiguate the *nr-PhysCellId* in some cases. I.e., this is the same as in Rel-15 LPP where PCI/ARFCN can be provided as pair. If this is not applicable to NR (and we made a mistake in Rel-15), then I agree with Huawei and *nr-ARFCN* is not needed (note, I understand this *nr-ARFCN* is not supposed to be the *dl-PRS-PointA*).  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurements. E.g., when the assistance data are not provided from the same source or the same LPP session.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in this IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in UL report here for DL-AoD. |
| Ericsson | We read the RAN1 agreement differently. The TRP ID is like the country code of a telephone number that together with an area code and a local number identifies the number identity. Same here, where the DL PRS resource is identified by a TRP-ID, a DL-PRS resource set ID and a DL PRS resource ID.  Therefore, to name the “country code” a “local number identifier” would be strange, and to name the identify of the TRP a DL-PRS ID would also be confusing.  It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. When the UE provides measurements to the LMF, the corresponding measurement is tied to a TRP with a TRP ID, and since the UE can be configured with up to 4\*64=256 TRPs, the TRP ID 0..255 is enough to identify the measurement as part of UEA.  With a globally unique cell identifier in the unicast AD request and in the broadcast SIB1, and a list of TRPs, each with a TRP ID, how can there be a need for something in addition to that? We do not see any technical motivation for additional identifiers. |
| CATT | As explained above, slightly prefer dl-PRS-ID + Either nr-PhysCellId/nr-ARFCN Or nr-CellGlobalId. |
| Intel | Same as above. |
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| Table 2.3 Need for additional TRP identifiers in *NR-DL-TDOA-MeasElement-r16* | |
| Company | Comments |
| Huawei/HiSilicon | *dl-PRS-ID*, *nr-PhysCellId*, *nr-CellGlobalId*  Considering broadcast and positioning SIB may be different for different cell, Cell ID should be included, and optional.  No need for ARFCN, as *dl-PRS-PointA* is already provided in *NR-DL–PRS-PositioningFrequencyLayer* |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  I understand the *nr-ARFCN* can disambiguate the *nr-PhysCellId* in some cases. I.e., this is the same as in Rel-15 LPP where PCI/ARFCN can be provided as pair. If this is not applicable to NR (and we made a mistake in Rel-15), then I agree with Huawei and *nr-ARFCN* is not needed (note, I understand this *nr-ARFCN* is not supposed to be the *dl-PRS-PointA*).  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurements. E.g., when the assistance data are not provided from the same source or the same LPP session.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in this IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in UL report here for DL-TDOA. |
| Ericsson | We read the RAN1 agreement differently. The TRP ID is like the country code of a telephone number that together with an area code and a local number identifies the number identity. Same here, where the DL PRS resource is identified by a TRP-ID, a DL-PRS resource set ID and a DL PRS resource ID.  Therefore, to name the “country code” a “local number identifier” would be strange, and to name the identify of the TRP a DL-PRS ID would also be confusing.  It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. When the UE provides measurements to the LMF, the corresponding measurement is tied to a TRP with a TRP ID, and since the UE can be configured with up to 4\*64=256 TRPs, the TRP ID 0..255 is enough to identify the measurement as part of UEA.  With a globally unique cell identifier in the unicast AD request and in the broadcast SIB1, and a list of TRPs, each with a TRP ID, how can there be a need for something in addition to that? We do not see any technical motivation for additional identifiers. |
| CATT | As explained above, slightly prefer dl-PRS-ID + Either nr-PhysCellId/nr-ARFCN Or nr-CellGlobalId. |
| Intel | Same as above. |
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### 2.3.2 Discussion template

Companies are asked to provide their view regarding any optional cell identifier information in the \*-measResult IE by an ‘x’ in the corresponding column together with motivations and comments.

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| Issue 3 3. Any optional cell identifiers associated to each TRP of the \*-measResult IEs | | | |
| Company | PCI+NR-ARFCN | NCGI | Motivation/comment |
| Qualcomm | x | x | See our comments to the previous 3 (?) email discussions on the same topic. |
| Nokia | x | x | Same reasoning as for signaling in downlink. Helps LMF to know which cells the TRP are associated with for any look up operation or associative operation. |
| OPPO | X | X | We also agree that broadcast-based AD provisioning cause the main reason for globally unique ID, e.g., PCI+ARFCN / NCGI. |
| Spreadtrum |  |  | No one is needed for a unique TRP can be addressed by the LMF with a DL-PRS-ID in the session for the UE. |
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## 2.4 Any optional cell identifiers associated to each TRP of the NR-TRP-LocationInfo, NR-DL-PRS-BeamInfo, ReferenceTRP-RTD-Info, RTD-InfoElement IEs

The IEs The IEs *NR-TRP-LocationInfo, NR-DL-PRS-BeamInfo,* *ReferenceTRP-RTD-Info* and *RTD-InfoElement* are part of the UEB AD.

### 2.4.1 Input from [1]

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| Table 2.9 Need for additional TRP identifiers in *ReferenceTRP-RTD-Info-r16* and *RTD-InfoElement-r16* | |
| Company | Comments |
| Huawei/HiSilicon | We think only *dl-PRS-ID* is needed. |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurement. E.g., when the assistance data are not provided from the same source or the same LPP session.  Also, e.g. RTD and TRP location info can be provided in different posSIBs, and a UE may get the posSIBs from different cells. A UE need to be able to uniquely associate the assistance data to the correct TRP, even when provided from different sources (e.g., different cells/posSIBs, different LPP messages of the same or different LPP session, MO-LR, etc.).  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in the *TRP-ID* IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in RTD info here. |
| Ericsson | It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. |
| CATT | As explained above, slightly prefer dl-PRS-ID + Either nr-PhysCellId/nr-ARFCN Or nr-CellGlobalId. But wonder nr-ARFCN needs to be configured for each TRP as TRPs within a frequency layer share the same nr-ARFCN. |
| Intel | For the AD from LMF via LPP, and corresponding measurement reports, ID 0-255 is sufficient.  The only question is whether it is allowed to provide more than 255 TRPs in broadcast AD? If yes, ID defined in RAN1 is not sufficient. Additional ID, e.g. PCI/ARFCN or CGI is needed. |
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| Table 2.10 Need for additional TRP identifiers in *NR-TRP-LocationInfo-r16 and NR-DL-PRS-BeamInfo-r16* | |
| Company | Comments |
| Huawei/HiSilicon | We think only *dl-PRS-ID* is needed. |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurement. E.g., when the assistance data are not provided from the same source or the same LPP session.  Also, e.g. RTD and TRP location info can be provided in different posSIBs, and a UE may get the posSIBs from different cells. A UE need to be able to uniquely associate the assistance data to the correct TRP, even when provided from different sources (e.g., different cells/posSIBs, different LPP messages of the same or different LPP session, MO-LR, etc.).  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in the *TRP-ID* IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in TRP location and beam info here. |
| Ericsson | It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. |
| CATT | As explained above, slightly prefer dl-PRS-ID + Either nr-PhysCellId/nr-ARFCN Or nr-CellGlobalId. But wonder nr-ARFCN needs to be configured for each TRP as TRPs within a frequency layer share the same nr-ARFCN. |
| Intel | For the AD from LMF via LPP, and corresponding measurement reports, ID 0-255 is sufficient.  The only question is whether it is allowed to provide more than 255 TRPs in broadcast AD? If yes, ID defined in RAN1 is not sufficient. Additional ID, e.g. PCI/ARFCN or CGI is needed. |
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### 2.4.2 Discussion template

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| Issue 4 4. Any optional cell identifiers associated to each TRP of the NR-TRP-LocationInfo, NR-DL-PRS-BeamInfo, ReferenceTRP-RTD-Info, RTD-InfoElement IEs | | | |
| Company | PCI+NR-ARFCN | NCGI | Motivation/comment |
| Qualcomm | x | x | See our comments to the previous 3 (?) email discussions on the same topic. |
| Nokia | x | x | See comments in 2.2.2 and 2.3.2 |
| OPPO | X | X | We also agree that broadcast-based AD provisioning cause the main reason for globally unique ID, e.g., PCI+ARFCN / NCGI. |
| Spreadtrum | X | x | PCI+NR-ARFCN or NCGI. |
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## 2.5 The optional cell identifiers of the NR-TimeStamp IE

The NR time stamp is provided as SFN and slot number, which needs to be associated to a cell identifier of the cell the SFN has been retrieved from. Companies have commented that there is a RAN1 agreement stating that the assistance data reference is used to identify the time stamp timing. However, companies have also commented that the assistance data reference is not always present. In the case when the target device is configured with UE-based positioning and to provide a location estimate to the location server, no assistance data reference is present.

Therefore, an optional cell identifier (PCI+NR-ARFCN and/or NCGI) needs to be conditionally present in the NR-TimeStamp IE.

### 2.5.1 Input from [1]

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

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| Table 2.5 Need for additional TRP identifiers in *NR-TimeStamp-r16* | |
| Company | Comments |
| Huawei/HiSilicon | No need to include TRP ID or PCI, as it was agreed in RAN1 and captured in RAN1 specification, that the assistance data reference is used to identify the time stamp timing.  Agreement (RAN1#99):  Modify the previous agreement on the definition of the time stamp as follows:  A UE measurement can be associated with a time stamp. For UE RSTD, DL PRS RSRP and UE Rx-Tx time difference measurement report, the time stamp can include the SFN, as well as the slot number for a subcarrier spacing. These values correspond to the reference provided by the DL-PRS-RstdReferenceInfo.  TS 38.214  For the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements the UE can report an associated higher layer parameter *Timestamp*. The *Timestamp* can include the SFN and the slot number for a subcarrier spacing. These values correspond to the reference which is provided by *DL-PRS-RSTDReferenceInfo*. |
| Qualcomm | The proposed *NR-PhysCellId-r16* in the ASN.1 above is included in IE *TRP-ID-r16*, so no change is needed.  The *NR-TimeStamp-r16* can also provide the time stamp for the location estimate (UE-based); e.g., IE *NR-DL-TDOA-LocationInformation,* for which the RAN1 agreement cited by Huawei above seems not applicable (i.e., the *TRP-ID* is optional present). |
| OPPO | We are not sure about the necessity of PCI/Arfcn/CGI information here in timestamp.  If take DL TDOA as an example:   1. For the time stamp included in *NR-DL-AoD-MeasElement-r16,* we assume the agreement cited by Huawei is applicable, so no need for additional information at all (not even PCI); 2. For the time stamp included in *NR-DL-TDOA-LocationInformation*, if Qualcomm comment is correct, and thus cell information is needed, we wonder if PCI is enough, considering the possible PCI confusion issue. As commented above, So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL. |
| Ericsson | In response to the QC comment about this already being present in a complex IE:  The clear majority of companies from the RAN2#109bis email discussion were in favor of splitting the TRP ID of the baseline into separate fields, so TRP ID (or another name) in this context is 0..255 and not including PCI.  We agree with QC on the necessity to ensure that SFN is well-defined in all cases. |
| CATT | Agree with Qualcomm. |
| Intel | Agree with Huawei view, i.e. TRP-ID, PCI are not needed since it is based on reference cell. |
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### 2.5.2 Discussion template

Companies are asked to provide their view regarding any optional cell identifier information in the *NR-TimeStamp* IE by an ‘x’ in the corresponding column together with motivations and comments.

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| Issue 5 The optional cell identifiers of the NR-TimeStamp IE | | | |
| Company | PCI+NR-ARFCN | NCGI | Motivation/comment |
| Qualcomm | x | x | See our comments to the previous 3 (?) email discussions on the same topic. |
| Nokia | x | x | The NR-TimeStamp is seen per measurement element inside the xxx-SignalMeasurementInformation IE but also at a higher level in the xxx-LocationInformation IE. For the per-measurementElement time stamp, there is already a TRP ID. We need to add cell identifiers along with TRP ID in this case but the TRP ID inside NR-TimeStamp IE is not needed. For the time stamp in LocationInformation (included in ProvideLocationInformation) the time stamp is associated with the signal measurement information as a whole. Not sure if this time stamp in xxx-LocationInformation IE (i.e. measurementReferenceTime-r16) is needed. Need to take to close look at the level at time information is added and then decide where to add the cell identifiers. |
| OPPO | X | X | We also agree that broadcast-based AD provisioning cause the main reason for globally unique ID, e.g., PCI+ARFCN / NCGI. |
| Spreadtrum |  |  | We think DL-PRS-ID is enough for UEA. For UEB cases, would QC like to provide examples? |
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## 2.6 Any remaining open issues concerning cell identifiers associated to TRPs

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# Conclusion

# References

[1] R2-2004701, Report on TRP-ID structure (Email discussion 947) (Ericsson).

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

[3] R2-2005894, Report on TRP-ID continuation, Ericsson