# 0. For Chair’s Notes

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**For the LS R3-233722** LS on reporting granularity for timing related positioning measurements (RAN4(Huawei))

We discussed and agreed to work on the NRPPa and F1 TPs to support the additional reporting granularity corresponding to k=-1 and k=-2.

TP for NRPPa – HW

TP for F1AP – SS

**SL Positioning:**

No agreement could be achieved this meeting.

* On whether and how to include the UE types in the Ranging/Sidelink Positioning authorized information. 🡺Postpone to next meeting, internal check is needed.
* On SL-PRS configuration 🡺RAN3 impact on SL-PRS allocation need more progress from RAN1/RAN2.

**Carrier Phase Positioning:**

Work on the TPs for NRPPa and F1AP to capture UL RSCP and SRS time window(s) related things, ASN.1 could be provided later, FFS should be added for the IE details.

TP for NRPPa – Nokia

TP for F1AP – HW

**SRS Bandwidth Aggregation:**

Work on TPs for NRPPa and F1AP, make FFS to the new IEs.

NRPPa – Ericsson

F1AP - Xiaomi

Whether Positioning activation/deactivation procedure should be involved to be further discussed the next meeting.

**PRS bandwidth aggregation:**

More progress of RAN1/ RAN2 is expected for PRS band aggregation from RAN3 perspective.

**LPHAP**

On cross-cell SRS configuration, let’s try to converge on the WA as below, with some FFS.

WA: LMF provide a list of cells and SRS information to the serving gNB, the serving gNB replies with a single SRS configuration (as in legacy).

FFS on SRS information e.g. SRS configuration or requested SRS transmission characteristics (with additional information).

FFS on whether need to response a list of cells.

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# 1. LS in:

There’re 3 LS in [7][20][21]:

LS [7] is about LPHAP, to be discussed with LPHAP, it’s already considered during the last meeting.

LS [20] is on positioning integrity, where RAN1 answered the questions raised by RAN2, RAN3 is in CC. there’s no RAN3 impact is foreseen. Contribution [22] also provides the analysis and similar proposal.

LS [21] is on reporting granularity for timing related positioning measurements

RAN4 discussed the reporting granularity for DL RSTD, UE Rx-Tx Time Difference, UL-RTOA and gNB Rx-Tx Time Difference in the context of PRS/SRS BW aggregation, and reached the following agreements.

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| **Agreements:*** For FR1 the additional reporting granularity values are 0.5 Tc, 1 Tc and 2 Tc.
* For FR2 the additional reporting granularity values are 0.25 Tc and 0.5 Tc.
* The above reporting granularity values apply to both UE and gNB positioning measurements.
* Send LS to RAN2 and RAN3 (and CC to RAN1) to define signaling for UE and gNB positioning measurement reporting respectively.
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RAN4 respectfully asks RAN2 and RAN3 to take the above information into account and define signaling support for the additional reporting granularity corresponding to k=-1 and k=-2.

For this issue, contribution [1] provides the analysis:

*The reporting range of UL Relative Time of Arrival (UL-RTOA), as defined in Clause 5.2.2 of TS 38.215 [4], is defined from -985024Tc to +985024×Tc. The reporting resolution is uniform across the reporting range and is defined as T = Tc\*2k where k is selected by gNB from the set {0, 1, 2, 3, 4, 5}.*

*Tc is defined in TS 38.211 [6].*

As indicated by TS 38.133, k is used to determine the reporting resolution, and we assume the same equation still applies when k=-1 or -2.

As a result, the maximum of the INTEGER value for k-1 can be calculated and is equal to 3940097, while the value for k-2 is equal to 7880193, so the NRPPa spec can be updated as follows,

### 9.2.39 UL RTOA Measurement

This information element contains the uplink RTOA measurement.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description | Criticality | Assigned Criticality |
| CHOICE *UL RTOA Measurement* | M |  |  |  | - |  |
| >k0 | M |  | INTEGER (0.. 1970049) | TS 38.133 [16] | - |  |
| >k1 | M |  | INTEGER (0.. 985025) | TS 38.133 [16] | - |  |
| >k2 | M |  | INTEGER (0.. 492513) | TS 38.133 [16] | - |  |
| >k3 | M |  | INTEGER (0.. 246257) | TS 38.133 [16] | - |  |
| >k4 | M |  | INTEGER (0.. 123129) | TS 38.133 [16] | - |  |
| >k5 | M |  | INTEGER (0.. 61565) | TS 38.133 [16] | - |  |
| >kminus1 | M |  | INTEGER (0.. 3940097) | TS 38.133 [16] | - |  |
| >kminus2 | M |  | INTEGER (0.. 7880193) | TS 38.133 [16] | - |  |
| Additional Path List | O |  | 9.2.41 | This IE is ignored if the *Extended Additional Path List* IE is included | - |  |
| Extended Additional Path List | O |  | 9.2.74 |  | YES | ignore |
| TRP Rx TEG Information | O |  | 9.2.85 |  | YES | ignore |

**Proposal 3: The maximum INTEGER value for k=-1 is 3940097 and the maximum INTEGER value for k=-2 is 7880193. Update the NRPPa and F1AP spec accordingly.**

Rapporteur’s summary:

Check with companies, whether the proposal above is correct or not. As this is quite straightforward, we expect to capture the changes to the NRPPa and F1 BL CRs.

HW and SS provide TPs for NRPPa and F1, to be further checked. If agreeable, we can capture them to the BL CR this meeting.

# SL Positioning

**Open issues for SL Positioning:**

*Authorization information for UE Type/Role wait the progress in other group*

*SL-PRS configuration from LMF wait the progress in other group*

## 1.1 UE types in Authorization info

In the SA2 TS 23.586, UE types are included in the "Ranging/Sidelink Positioning authorised" information:

The "Ranging/Sidelink Positioning authorised" information and the RSPP transport QoS parameters shall be provided to the NG-RAN node for scheduled resource allocation mode resource management.

The "Ranging/Sidelink Positioning authorised" information includes one or more of the following:

- whether the UE is authorized to act as a Reference UE;

- whether the UE is authorized to act as a Target UE;

- whether the UE is authorized to act as a Located UE;

- whether the UE is authorized to act as a SL Positioning Server UE.

The definition of those types of UEs are shown below:

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| **SL Reference UE:** A UE, supporting positioning of target UE, e.g. by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc. using Sidelink.NOTE 1: SL Reference UE is understood as "Anchor UE" in RAN WGs.**Target UE:** A UE whose distance, direction and/or position is measured with the support from one or multiple SL Reference UEs using Sidelink in the Ranging based service and Sidelink positioning.**Located UE:** A SL Reference UE of which the location is known or is able to be known using Uu based positioning. A Located UE can be used to determine the location of a Target UE using Sidelink Positioning.**SL Positioning Server UE:** A UE offering method determination, assistant data distribution and/or location calculation functionalities for Sidelink Positioning and Ranging based service. It interacts with other UEs over PC5 as necessary in order to determine Ranging/SL Position method, distribute assistant data and calculate the location of the Target UE. Target UE or SL Reference UE can act as SL Positioning Server UE if any of the functionalities is supported. |

Some companies (refer to [1][2][3][4]) expect to align the definition with SA2, i.e. including the UE types in the authorization IE over NG, Xn and F1.

**Issue to discuss:**

Whether and how to include the UE types in the Ranging/Sidelink Positioning authorized information?

SA2 has finalized their work on SL positioning, it’s better to align with them.

🡺Postpone to next meeting, internal check is needed.

## 1.2 SL-PRS Configuration

**Some background info:**

Regarding SL-PRS resource allocation, both scheme 1 and scheme 2 should be introduced for supporting SL positioning/ranging:

* + Scheme 1: Network-centric operation SL-PRS resource allocation
	+ Scheme 2: UE autonomous SL-PRS resource allocation

Agreement
For Scheme 1 SL-PRS resource allocation, a transmitting UE can receive a SL-PRS resource allocation signaling from gNB through a
 • Dynamic grant
 o FFS Reuse DCI format 3\_0 for signalling SL-PRS resource allocation or Support a new DCI format (3\_X) and consider DCI format 3\_0 as a starting point
 • Configured grant type 1
 o the SL-PRS transmission(s) follows the higher layer configuration
 • Configured grant type 2
 o Support activating and releasing the configured grant using a new DCI format 3\_X or 3\_0 (to be downselected between the two DCI formats)
 • The above mechanisms use NR Rel-16 mode-1 signaling as a starting point
 • FFS: whether same/different DCI format(s) are applied for shared pool and dedicated pool.
 • FFS: Further details

AgreementFor SL-PRS transmission, either dedicated resource pool(s) or shared resource pool(s) or both can be (pre-)configured in the only SL BWP of a carrier.
•A UE can be (pre-)configured with one or more dedicated SL resource pools.
•A UE can be (pre-)configured with one or more shared SL resource pools.

**Rapporteur’s summary:**

On how to allocate the SL-PRS resource, and what’s the RAN3 impact, companies provide different views (see [2][3][4][5][6]) .

Some companies think the NRPPa and F1 impact is not clear on how to allocate SL-PRS resource according to RAN1/2 and SA2 progress.

As RAN1 has agreed that LMF is not involved in the SL PRS resource allocation, it’s configured by the gNB directly. So it’s assumed there’s no NRPPa impact on SL PRS resource allocation.

**🡺Potential way forward:**

RAN3 impact on SL-PRS allocation need more progress from RAN1/RAN2.

For the SL-PRS confliction issue mentioned by some companies, we could further discuss that after the SL-PRS resource allocation work is done.

# 3. Carrier Phase Positioning

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| **RAN1#112bis-e Agreement**Support enabling a TRP to report UL RSCP together with RTOA and/or gNB Rx-Tx time difference measurements to LMFNote 1: The report of UL carrier phase measurement with gNB Rx – Tx time difference does not necessarily require the report of DL carrier phase measurement with UE Rx – Tx time difference.Note 2: This doesn’t preclude standalone UL carrier phase measurements reporting.**RAN#113 Agreement**To enable simultaneous transmission of UL SRS for positioning by a target UE and a PRU, support the following enhancements:* Enabling LMF to request the serving gNB of a UE to configure the transmission of the UL SRS resources from the UE within indicated time window(s).
* FFS: the details of the time window, e.g., the start time, duration, periodicity for the time window(s), within the vicinity of a reference SRS configuration or use the existing message of Scheduled Location time
* Enabling LMF to request the serving gNB and neighboring gNBs of the UE to measure the UL SRS resources from the UE within indicated time window(s).
* Note: this may be a different indicated time window

To enable LMF to request the serving gNB and neighboring gNBs of a UE to measure the UL SRS resources from the UE within indicated time window(s), each time window is defined with the following parameters:* The start of the time window, which is indicated by a combination of subframe number, slot offset and symbol index with respect to the SFN initialization time
* The duration of the time window, which is given by a number of consecutive slots/symbols
	+ FFS: the number of consecutive slots/symbols
* (Optional) The periodicity of the time window, which is defined similar to IE Measurement Periodicity in MEASUREMENT REQUEST in TS 38.455.
* FFS: the maximum number of the windows
 |

**Rapporteur’s summary:**

Following the RAN1 agreements on CPP, there’re some NRPPa impact, some companies provide the analysis and proposals in [5][6][7][8], companies have the similar view on the RAN3 impact, to make the discussion easier, the related proposals from [6] are copied here:

**Proposal 3: The measurements of CPP (Carrier Phase Positioning) performed by TRP can be reported to LMF via NRPPa messages following the legacy procedure, including:**

* **UL RSCP** **together with RTOA and/or gNB Rx-Tx time difference measurements to LMF via NRPPa MEASUREMENT RESPONSE message.**

**Proposal 4: To enable simultaneous transmission of UL SRS and measurement of target UE and a PRU, there are some impacts to NRPPa, including:**

* **LMF requests the serving gNB of a UE to configure the transmission of the UL SRS resources from the UE within indicated time window(s).**
* **LMF requests the serving gNB and neighboring gNBs of the UE to measure the UL SRS resources from the UE within indicated time window(s).**

**Issue to discuss:**

One or more time windows will be provided from LMF to the gNB? How to encode the time window? It’s UE specific or SRS resource specific?

**Potential WF:**

🡺Try to work on the TP for NRPPa （Nokia）and F1AP（HW）, ASN.1 could be provided later, FFS should be added for the IE name and IE place.

# 4. Band Aggregation

RAN1 have made the following agreements related to Bandwidth aggregation for positioning measurements:

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| **Agreement**For PRS bandwidth aggregation between PRS in two or three different PFLs, the following are needed for the aggregated PRS resources for a TRP: • The same periodicity and slot offset • The same muting pattern • The same *NR-DL-PRS-SFN0-Offset* value • UE expects to be configured with PRS resources that maintain a per-symbol uniformly spaced PRS pattern across aggregated bandwidths in frequency domain (Note: It does not preclude dropping some REs in the guardband between two PFLs). • FFS same antenna port from RAN1 perspective**Agreement**For PRS bandwidth aggregation across PFLs, support • Option 2: Per TRP basis and per PRS resource set basis. o For each TRP, support new signaling to indicate which PRS resource sets across PFLs are linked. o It is assumed that the PRS resources across the linked PRS resource sets are linked if the conditions are satisfied.For the non-linked PRS resource sets, no aggregation is assumed even if the conditions are satisfied.**Agreement**For PRS bandwidth aggregation across PFLs, in a measurement report element, support • Single RSRP or single RSRPP o FFS: the single RSRP/RSRPP is based on aggregated PRS resources across aggregated PFLs • The aggregated reference RSTD • The used PRS resource set IDs for the aggregated measurement which are shared for RSRP/RSRPP and/or timing measurement results |

|  |
| --- |
| **Agreement**For SRS bandwidth aggregation across two or three carriers, support enhancement of SRS configuration to indicate the SRS resources from which two or three carriers are linked * SRS resources are per BWP per carrier configuration
* FFS whether the link is per SRS resource set basis or per SRS resource basis.

**Agreement*** Support LMF-initiated and UE-initiated on-demand PRS request for PRS bandwidth aggregation
	+ FFS details
* Support preconfigured on-demand PRS across PFLs for PRS bandwidth aggregations
	+ FFS details

**Agreement**From RAN1 perspective, support UE performs PRS measurement across multiple aggregated PFLs in RRC\_CONNECTED, RRC\_INACTIVE and RRC\_IDLE state.**Agreement**Support joint measurement and report for the SRS resources across the aggregated carriers for UL-TDOA and Multi-RTT positioning methods* Single UL RTOA or gNB Rx-Tx time difference is reported for the SRS resources across aggregated carriers
	+ FFS: RSRP or RSRPP
* FFS: SRS carrier aggregation indication is reported along with the measurement results to indicate whether/which carriers are aggregated for the joint SRS measurement
* Support LMF to request gNB for the UL positioning measurement from aggregated SRS resources across multiple CCs

**Agreement**For SRS bandwidth aggregation between SRS in two or three carriers, the following is needed for the aggregated SRS resources• The same *periodicityAndOffset,* and *slotOffset*• The configuration of pathloss RS, Po and alpha to ensure the same Tx PSD (power per subcarrier) o The same configuration of Po and alpha. o Note: UE may either perform pathloss RS measurement across CCs and form a single path loss value to apply across CCs or perform pathloss RS measurement in a single CC and apply across CCs**Agreement**For SRS bandwidth aggregation across two or three carriers, support • Option 2: Per SRS resource set basis. o Support new signaling to indicate which SRS resource sets across carriers are linked. o It is assumed that the SRS resources across the linked SRS resource sets are linked if the conditions are satisfied. For the non-linked SRS resource sets, no aggregation is assumed even if the conditions are satisfied. |

**Rapporteur’s summary:**

From RAN1 agreements, both PRS band aggregation and SRS band aggregation should be considered, and NRPPa is impacted. Some companies raised the contributions (see [5][9]) ,which analyzed the potential RAN3 impact.

For SRS band aggregation:

Just take the figure 2 in [5] for easy understanding:



**Signaling of SRS Bandwidth aggregation**

LMF to request the serving gNB to provide the SRS resource set(s) that can be aggregated, the serving gNB decides which SRS resource set(s) can be aggregated and provide associated aggregation id to LMF, the “aggregation id” is also provided in the following positioning measurement procedure.

It’s assumed NRPPa and F1AP Positioning Information Request/Response and NRPPa measurement procedures could be reused, with necessary enhancement.

We can try to agree at this meeting:

* LMF requests the serving gNB to provide the SRS resource set(s) that can be aggregated, and the serving gNB decides which SRS resource set(s) can be aggregated and provide associated aggregation id to LMF.
* The “SRS aggregation id” is provided in the NRPPa Measurement Request.
* The signalling details (NRPPa, F1) for SRS band aggregation to be further worked the next meeting.

🡺Work on TPs for NRPPa (E///) and F1AP (Xiaomi) this meeting base on above figure, make FFS to the new IEs.

Whether Positioning activation/deactivation procedure should be involved to be further discussed the next meeting.

For PRS band aggregation:

Maybe similar NRPPa and F1AP impact with SRS band aggregation, more progress of RAN1 (and RAN2) seems needed.

🡺More progress of RAN1 and or RAN2 is expected for PRS band aggregation from RAN3 perspective.

# 5. LPHAP

## 5.1 Cross-cell SRS configuration

LS [10] from RAN2 on their view on area specific SRS configuration:

For the SRS configuration with validity area, RAN2 has agreed on the following:

RAN2 consider that the LMF should determine the area-specific SRS configuration. Details are up to RAN3.

**Rapporteur’s summary:**

Contributions [11] ~ [19] provide the analysis on support of area specific SRS configuration.

Relationship between RNA and validity area:

Some companies mentioned the relationship between validity area and RNA, and it seems more aligned that the validity area shall not be larger than the RNA.

The straightforward way is to let the serving gNB make the decision on the validity area, some assistance info, e.g. recommended cell list from LMF may be needed.

Rapporteur would propose to have an agreement:

* The validity area shall not be larger than the RNA.
* The validity area is finally determined by the gNB, with necessary assistance info from LMF.

On area specific Resource allocation, simply summarized the potential solutions as below:

* Option 1: LMF determines the SRS configuration, provides SRS configuration and recommended validity area to the serving gNB, gNB further determines the validity area and provides it to LMF.
* Option 2: LMF provides available SRS configuration(s), and recommended validity area to the serving gNB. The gNB further determines the SRS configuration and validity area, and provide them to LMF.
* Option 3: The LMF provides SRS characteristics to serving gNB,serving gNB allocate the SRS according to that information, just as legacy procedure..
* Any other options?

For Option 1~2, how the SRS configuration(s) is available in the LMF should be considered, leave it to implementation? Or add some new procedures to collect/obtain the (available) SRS configurations from number of gNBs?

Option 3 is more like the legacy procedure on the SRS resource allocation.

Rapporteur would encourage to discuss and decide which option to go at this meeting, the detail signalling design could be continued the next meeting.

**🡺No consensus on how the cross-cell SRS configuration is allocated.**

**WA: LMF provide a list of cells and SRS information to the serving gNB, the serving gNB replies with a single SRS configuration (as in legacy).**

**FFS on SRS information e.g. SRS configuration or requested SRS transmission characteristics (with additional information).**

**FFS on whether need to response a list of cells.**

On SRS resource reservation:

It seems companies are more aligned on how to reserve the area-specific SRS sent to UE, we can try to have the agreement:

* The LMF should indicate to gNBs that certain SRS resources are “reserved” for multi-cell SRS for positioning configurations (i.e. gNB should avoid autonomously allocating reserved SRS resources).
* Introduce a new non-UE associated NRPPa message to indicate SRS resources that are “reserved” for SRS for positioning configurations across cells.

## 5.2 UE moves out of validity area

Let’s take the picture from [12] for example:



Figure 2 Area-specific SRS re-configuration

Some assumptions:

The LMF should be involved in this procedure, new area specific or legacy SRS configuration maybe decided, fully up to LMF.

Issue is when and how to notify LMF, just like 4a/4b/4c shown in the figure above.

## 5.3 LPHAP Indicator

Some company propose to introduce the LPHAP indication from LMF to the gNB, the gNB may consider to release the UE into RRC\_INACTIVE state for positioning for power saving.

The rapporteur understand that if the LPHAP related UE capability is defined by RAN2, gNB could get the UE capability and do proper actions, then the LPHAP indicator is not really needed.

**Proposal: further check with RAN2/SA2 whether the indicator is really needed.**

# 6. Reference:

1. R3-234032 Discussion on sidelink positioning and others (Samsung)
2. R3-234254 Discussion on sidelink positioning (Xiaomi)
3. R3-234409 (TP to 38.413, 38.423, 38.473,38.455) Discussion on Sidelink positioning (ZTE)
4. R3-234451 Discussion on NR SL Positioning (CMCC)
5. R3-234269 Discussion on RAN3 impacts to support SL Positioning, CPP and other topics with TP for CPP support (Ericsson)
6. R3-234364 Discussion on SL Positioning BW aggregation and CPP (CATT)
7. R3-234217 Discussion on Carrier Phase Positioning and Sidelink Positioning (Huawei)
8. R3-234327 (TP for TS 38.455 BL CR) Positioning accuracy enhancements (Nokia, Nokia Shanghai Bell)
9. R3-234256 (TP for BL CR to TS 38.455) Support of SRS bandwidth aggregation (Xiaomi, Samsung, ZTE)
10. R3-233714 LS on LPHAP (RAN2(Huawei))
11. R3-234218 Discussion on LPHAP (Huawei)
12. R3-234255 Discussion on LPHAP positioning enhancement. (Xiaomi)
13. R3-234270 Discussion on RAN3 impacts to support LPHAP with TP (Ericsson)
14. R3-234285 Enhancements for LPHAP (Qualcomm Incorporated)
15. R3-234326 Coordination of SRS resources within a validity area (Nokia, Nokia Shanghai Bell)
16. R3-234033 Discussion on LPHAP (Samsung)
17. R3-234467 (TP to 38.455, 38.473)Discussion on LPHAP impacts and SRS bandwith aggregation (ZTE)
18. R3-234365 (TP to BL CR for TS 38.305) Support of cross-cell SRS configuration (CATT)
19. R3-234468 Discussion on area-specific SRS configuration (vivo)
20. R3-233706 LS reply on the RAT-dependent positioning integrity (RAN1(Interdigital))
21. R3-233722 LS on reporting granularity for timing related positioning measurements (RAN4(Huawei))
22. R3-234286 Integrity of NR Positioning Technologies (Qualcomm Incorporated)