3GPP TSG-RAN WG2 Meeting #109-e R2-2001947

Online, 24 February – 6 March 2020

**Agenda item: 6.8.2.3**

**Source: Huawei, HiSilicon**

**Title: [Offline-622][POS] Summary on uplink capability for positioning**

**Document for: Discussion and Decision**

# 1 Introduction

This document provide the collection of summary for the following offline discussion.

* [AT109e][622][POS] Uplink capability for positioning (Huawei)

 Intended outcome: Summary of agreements on whether/what UL capability is needed at LMF. Summary in R2-2001947.

 Deadline: Wednesday 2020-03-04 1300 CET

# 2 Discussion

## 2.1 Whether UL capability is needed at LMF

In [1], companies provided their views on capabilities to be transferred in LPP for the purpose of positioning. Based on the input, we suggest to discuss whether UL capability is needed at LMF for different positioning method that involves UL.

### Discussion#1: Whether UL capability is needed at LMF for multi-RTT positioning

Companies are encouraged to provide their view on the options or provide other options

|  |  |
| --- | --- |
| Company  | Comments |
| Ericsson | UL SRS related detailed UE capability such as number of positioning frequency layers, resourceSets etc should be provided to gNB. However generic capability such as multi-RTT measurement support can be provided to LMF. |
| Qualcomm | SRS-for-positioning capabilities are needed at the LMF in order to provide appropriate assistance data to the serving gNB in the Positioning Information Exchange procedure.  |
| Huawei/HiSilicon | Currently yes. Since Multi-RTT can only use SRS for positioning, without the capability, LMF cannot decide whether to trigger RTT positioning. |
| CATT | Assuming the UL capability here means the UE UL capability. The UE capability about frequency resources is not needed in LMF, such as:• UL-SRS-Config-Capabilities(from RAN1)* e.g. NumOfUL-PositioningResourcesPerSet
* TotalNumOfUL-PositioningResources[64]
* TotalNumOfUL-PositioningResourceSets

But generic and report capability should report to LMF, such as:• ul-SRS-Capabilities• periodicalReporting• RSRP-Capabilities• Rx-Tx time difference-Capabilities |
| Nokia | Generally speaking, LPP-ProvideCapabilities signaling is there to inform LMF about positioning capabilities but what specific capabilities related to a specific positioning method are needed can be discussed later. With respect to positioning methods involving UL SRS use, since different SRS resource types (periodic, semi-persistent, aperiod) are possible we need to think more about whether gNB/TRP measurement capability (when it is neighbor gNB/TRP) for using the different SRS resource types is needed or not. Again, these can be discussed later after finalizing a baseline set of specifications. |
| Intel | General UL capabilities are needed. The details are also related to what recommended SRS characteristic the LMF should provide to the gNB, and could be discussed later. But can keep the general structure in LPP. |
| OPPO | If the only intention is for LMF recommendation on SRS configuration, we tend to agree with CATT that at least not all UL capability is needed at LMF. |

It is our understanding that the “UL capability” in the context means SRS configuration/measurement capability, not including reporting capability, or RSRP capabilities.

To CATT, it is not clear what the following capabilities mean. Can you clarify?

* ul-SRS-Capabilities (as UL SRS Tx capabilities in Discussion #2 as well)

Summary: The following capabilities for multi-RTT are discussed based on input from companies

* SRS related capability: Qualcomm, Huawei, [CATT], Intel, [Oppo]
* Measurement capabilities: Ericsson, CATT

We suggest to go with majority view with the following proposal.

***Proposal 1: At least some SRS related capabilities are needed at LMF for multi-RTT positioning.***

* ***The SRS related capabilities include aspects on SRS configuration, SRS transmission, or SRS measurement.***

### Discussion#2: Whether UL capability is needed at LMF for UL-only positioning

Companies are encouraged to provide their view on the options or provide other options

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| Company  | Comments |
| Ericsson | UL SRS capability is not needed in LMF. Since, gNB configures the resource and depending upon the available resource gNB would always strive to provide the best configurations. This principle should work. It is ok if LMF wants to recommend on how many spatial relations it wants to be configured. This input gNB may take into consideration while configuring SRS. |
| Qualcomm | SRS-for-positioning capabilities are needed at the LMF in order to provide appropriate assistance data to the serving gNB in the Positioning Information Exchange procedure.  |
| Huawei/HiSilicon | We slightly prefer to have it, since Rel-16 SRS positioning can be configured with association between DL RS from neighbouring gNBs, while Rel-15 SRS cannot. Without this capability, LMF cannot know whether the assistance data to the serving gNB for SRS spatial relation and pathloss will be useful. |
| CATT | Assuming the UL capability here means the UE UL capability. The UE capability about frequency resources should report to gNB not to LMF, such as:• UL-SRS-Config-Capabilities(from RAN1)* e.g. NumOfUL-PositioningResourcesPerSet
* TotalNumOfUL-PositioningResources[64]
* TotalNumOfUL-PositioningResourceSets

UL SRS TX capability can be report to LMF, such as:• ul-SRS-Capabilities |
| Nokia | Generally speaking, LPP-ProvideCapabilities signaling is there to inform LMF about positioning capabilities but what specific capabilities related to a specific positioning method are needed can be discussed later. With respect to positioning methods involving UL SRS use, since different SRS resource types (periodic, semi-persistent, aperiod) are possible we need to think more about whether gNB/TRP measurement capability (when it is neighbor gNB/TRP) for using the different SRS resource types is needed or not. Again, these can be discussed later after finalizing a baseline set of specifications. |
| Intel | Same as discussion 1. |
| OPPO | Same as discussion 1. |

Summary: The following capability for UL-only positioning are discussed based on input from companies

* SRS related capability
	+ Supported by: Qualcomm, Huawei, [CATT], Intel, [Oppo]
	+ Objected by: Ericsson

We suggest to go with majority view with the following proposal.

* ***Proposal 2: At least some SRS related capabilities are needed at LMF for UL-only positioning. The SRS related capabilities include aspects on SRS configuration, or SRS transmission.***

## 2.2 Discussion#3: What UL capability is needed at LMF

Companies are encouraged to provide their views for multi-RTT and/or UL-only positioning, if the capability is needed.

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| --- | --- |
| Company  | Comments |
| Ericsson | Positioning measurement related capability whether UE supports multi-RTT UE RxTx, RTOA measurements or not. |
| Qualcomm | It may depend on the final RAN1 capabilities/feature list, but the following general capabilities seem needed at the LMF:1. Max # of SRS Resource Sets for positioning2. Max # of aperiodic SRS Resources for positioning 3. Max # of semi-persistent SRS Resources for positioning 4. Max # of periodic SRS Resources for positioning5. Support of SSB for neighbour cell DL pathloss estimation and SRS for positioning power control6. Support of DL PRS for neighbour cell DL pathloss estimation and SRS for positioning power control7. Spatial Relation of SRS Resources for positioning with DL PRS / SSB8. Spatial Relation of SRS Resources for positioning with SRS resources for positioning9. Number of additional pathloss estimates across all SRS resource sets for positioning that the UE is expected to simultaneously maintain |
| Huawei/HiSilicon | Whether UE supports SRS for positioning (basic FG of SRS for positioning if defined).Support of pathloss reference from the non-serving cell of SRS for positioning.Support of spatial relation from the non-serving cell of SRS for positioning.Details subject to RAN1 UE feature discussion. |
| CATT | Please see the comments of Q1 and Q2. The capabilities are list there in detail. |
| Nokia | Detailed UE/gNB capabilities (and in which protocol layer) can be discussed later after finalizing a baseline set of specifications. |
| Intel | It depends on the feature lists defined in RAN1 and the details on recommended SRS characteristic. Can be discussed later. But can keep the general structure in LPP.  |
| OPPO | Same as discussion 1. |
| Ericsson | It is enough for LMF to know that UE supports UE RxTx measurements and Boolean capability such as semi persistent or aperiodic; but no need to have detailed numbers such as:1. Max # of SRS Resource Sets for positioning2. Max # of aperiodic SRS Resources for positioning 3. Max # of semi-persistent SRS Resources for positioning 4. Max # of periodic SRS Resources for positioning These are radio resource capability. Generally, UE sends this only once and it is stored in AMF. gNB retrieves it from AMF instead of getting from UE to save signaling overhead over Uu interface. If each UE needs to send this every time to LMF it will increase signaling load. Further even if LMF asks with certain fixed numbers; gNB may not be able to fulfil that or in some cases (low load/interference) can provide more resources than what LMF asked. gNB anyway needs to know the exact specific UE capability, as gNB would configure the SRS and depending upon UE capability, traffic, interference etc. it would provide the best configuration. Thus, there is no need for yet another NW node to also have a detailed capability information. Anyhow, it is OK for LMF to recommend in general the resource requirement for UL SRS and this can be based for example on the number of spatial relations that it wants. Based upon this sort of info gNB would be able to identify the resource requirements and makes the final decision. |

Summary: The discussion here seems to be diversified. It is hard to converge what capabilities should be included until RAN1 has clearly defined the SRS capabilities.

***Proposal 3: Postpone the detailed capability discussion till RAN1 finish their UE feature discussion.***

# 3 Conclusions

We have the following proposal based on comments from companies.

***Proposal 1: At least some SRS related capabilities are needed at LMF for multi-RTT positioning.***

* ***The SRS related capabilities include aspects on SRS configuration, SRS transmission, or SRS measurement.***

***Proposal 2: At least some SRS related capabilities are needed at LMF for UL-only positioning.***

* ***The SRS related capabilities include aspects on SRS configuration, or SRS transmission.***

***Proposal 3: Postpone the detailed capability discussion till RAN1 finish their UE feature discussion.***

# 4 References

1. R2-2000475 UE capability on positioning ([108#85][NR Pos]) Intel Corporation discussion Rel-16 37.355 NR\_pos-Core