**3GPP TSG-WG2 Meeting #120 R2-221xxxx**

**Toulouse, France, 14th Nov – 18th Nov, 2022**

**Source: CATT**

**Title:****Summary of agenda item 8.2.2 on sidelink positioning (CATT)**

**Agenda Item:** **8.2.2**

**Document for:** **Discussion and Decision**

# 1 Introduction

This contribution provides summary of contributions under 8.2.2 on sidelink positioning, excluding proposals related to the SA2 LS. The summary aims to consolidate common issues non-related to LS from SA2 across all the submitted contributions.

# 2 Discussion

### 2.1 Name of the new protocol for sidelink positioning

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| R2-2211226 | CATT | Proposal 2: Abbreviation of SLPP is used as the name of new protocol for sidelink positioning between UEs and inform other WGs, i.e. SA2 and RAN1:  - SLPP: Sidelink Positioning Protocol |
| R2-2211230 | vivo | Proposal 1: Use the SLPP (Sidelink Positioning Protocol) as the name of the new protocol for sidelink positioning procedures between UEs. |
| R2-2212359 | Ericsson | Proposal 5 The protocol is termed RPP (Ranging Positioning Protocol). |

**Rapp Summary:**

2 companies preferred to use SLPP (Sidelink Positioning Protocol) as the name of the new protocol for sidelink positioning procedures between UEs. 1 company preferred to use RPP (Ranging Positioning Protocol). Based on majority view, the following is the proposal:

1. **Abbreviation of SLPP is used as the name of new protocol for sidelink positioning between UEs and inform other WGs, i.e. SA2 and RAN1:**

**- SLPP: Sidelink Positioning Protocol**

### 2.2 Coverage scenarios

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| [R2-2211230](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211230%20Discussion%20on%20sidelink%20positioning.docx) | vivo | Proposal 10: Instead of U2N relay, message forwarding via control signaling can be considered for positioning in partial coverage scenario. |
| [R2-2211252](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211252%20Discussion%20on%20sidelink%20positioning_final.docx) | Huawei, HiSilicon | Proposal3: For the partial coverage of UE, RAN2 should discuss the following case:  • Anchor UE is in coverage while Target UE is out of coverage for Uu interface. |
| [R2-2211917](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211917_SL_Pos.docx) | Sony | Proposal 2: Discuss further different scenarios related to in-coverage, partly in-coverage, and out of coverage scenarios. |
| [R2-2212470](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212470%20Study%20of%20signalling%20procedures%20and%20design%20considerations%20for%20sidelink%20positioning.docx) | LG Electronics | Proposal 1. RAN2 to study two scenarios with priority, PC5-only-based positioning in OOC and hybrid (i.e. PC5- and Uu-based) positioning in IC. |
| [R2-2212506](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212506%20(R18%20NR%20POS%20SI%20A822_SLPos).docx) | InterDigital Inc. | Proposal 1: Study the procedures/signaling for supporting partial coverage scenarios after studying the procedures/signaling for supporting IC and OOC scenarios  Proposal 2: When considering partial coverage scenarios, study procedures/signaling for the following  - Scenario 1: Target UE is in OOC, and one or multiple anchor UEs are in IC  - Scenario 2: Target UE is in IC, and one or multiple anchor UEs are OOC  Proposal 3: When considering partial coverage scenarios, study whether/how the procedures/signaling for supporting SL positioning in IC and OOC methods can be reused/extended. |
| [R2-2212710](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212710%20Considerations%20on%20Sidelink%20positioning.docx) | CMCC | Proposal 1: RAN2 to confirm that LMF may be involved for SL positioning with network coverage (i.e., in-coverage or partial coverage).  Proposal 2: In the partial coverage scenario, the out-of-coverage UE could be the target UE or the anchor UE. |

**Summary:**

6 companies discussed this issue. 2 companies proposed to priority study IC and OOC scenarios. Study the procedures/signaling for supporting partial coverage scenarios after IC and OOC scenarios. For partial coverage scenarios, 2 companies considered that both target UE and one or multiple anchor UEs may be OOC. 1 company suggested only studying anchor UE is in coverage while Target UE is out of coverage. 1 company suggested studying the message forwarding via control signaling for positioning in partial coverage scenario (U2N relay). 1 company suggested studying the procedures/signaling for supporting SL positioning in IC and OOC whether and how to be reused or extended to partial coverage scenarios.

1. **RAN2 to confirm either of UEs, except not all UEs, including target UE and one or multiple anchor UEs may be OOC in partial coverage scenarios. How to enable the procedures/signaling for supporting SL positioning in partial coverage will be further discussed in normative work.**

### 2.3 Architecture

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| [R2-2211462](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211462.docx) | Intel Corporation | Proposal 10: In order to support sidelink based positioning for in coverage and out of coverage case, RAN2 to confirm the SL positioning architecture (including the concept of an anchor node/UE) shown in figure 1 and capture it in the TR. |
| [R2-2211839](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211839%20Further%20discussion%20on%20sidelink%20positioning.docx) | OPPO | Proposal 1: RAN2 to agree to take the two types of SL positioning architectures as the baseline  - Type A: a UE as location server (with or without assistant UE)  - Type B: the LMF as location server (with or without assistant UE) |
| [R2-2212096](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212096_SLPos_Solutions.docx) | Lenovo | Proposal 5: RAN2 to support both LMF-dependent (e.g., UEs supporting both LPP and SLPP/RSPP) for in-coverage scenarios and LMF-independent (e.g., UEs only supporting SLPP/RSPP) SL positioning architectures for all coverage scenarios including in-coverage, partial coverage and out-of-coverage. |
| [R2-2212811](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212811%20Discussion%20on%20SL%20positioning.docx) | Xiaomi | Proposal 1 RAN2 to capture the fig 1 to the TR.  Proposal 2 RAN2 to agree that the use of LTE PC5 link is not excluded. |
| [R2-2212857](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212857_(Sidelink%20Positioning).docx) | Qualcomm Incorporated | Proposal 2: The UE Positioning Architecture applicable to NG-RAN should not pr additional entities/nodes (e.g., “anchor UE”, “server UE”, “target UE”, etc.) and should be applicable to all coverage scenarios (e.g., no separate architecture for in-coverage or out-of-coverage scenarios is needed).  Proposal 3: Extend the UE Positioning Architecture applicable to NG-RAN as shown in Figure 7. |

**Summary:**

5 companies provided their view on architecture. The different are whether UE roles should be involved in architecture and whether LTE PC5 is excluded.

1. **RAN2 to discuss SL positioning architecture, including whether UE roles(target UE/ Anchor UE/ Server UE) are specified in SL positioning architecture, whether LTE PC5 is excluded for SL positioning.**

### 2.4 Session-based and Session-less operation

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| [R2-2211226](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211226%20Discussion%20on%20SL%20Positioning.docx) | CATT | Proposal 11: SLPP/RSPP session modification (add and remove) procedures are not supported. |
| [R2-2211230](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211230%20Discussion%20on%20sidelink%20positioning.docx) | vivo | Proposal 9: RAN2 does not consider the term “Session-based” or “Sessionless”, and just focuses on the cast type of SL positioning, i.e., unicast/broadcast/groupcast. |
| [R2-2211688](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211688-SL-POS-v0.docx) | Apple | Proposal 1: not to introduce any explicit “session management” SLPP/RSPP procedures.  Proposal 2: session support in SLPP/RSPP is realized through an optional sequence number IE, as in LPP.  Proposal 3: SLPP/RSPP supports session-less operation at least for some positioning methods (e.g. single-sided RTT). |
| [R2-2212082](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212082_Sidelink-Fraunhofer.docx) | Fraunhofer IIS, Fraunhofer HHI | Proposal 1: For the fixed infrastructure anchors, at least sessionless operation shall be supported. |
| [R2-2212109](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212109.docx) | Nokia, Nokia Shanghai Bell | Proposal 1: RAN2 to agree on the definition of session-based and session-less positioning.  Proposal 2: RAN2 to confirm that a positioning session is characterized by a time-limited two-way link enabling interactive expression and information exchange between two or more communication devices, typically in presence of state (ie, information about session history). FFS other characteristics.  Proposal 3: Session-less positioning is based on independent unidirectional broadcast transmissions. FFS other characteristics of session-less positioning including other cast types.  Proposal 4: Study the scenarios where session-based and session-less SL positioning are applicable.  Proposal 5: Study methods for reducing signaling overhead in reliable session-based positioning, including at least group/broadcast, pre-configuration including self-configuration, pre-activation including self-activation.  Proposal 6: Study method for minimizing impact on channel congestion in session-less positioning.  Proposal 7: Study co-existence between session-based & session-less sidelink positioning. |
| [R2-2212470](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212470%20Study%20of%20signalling%20procedures%20and%20design%20considerations%20for%20sidelink%20positioning.docx) | LG Electronics | Proposal 8. Multiple SLPP/RSPP sessions are supported for a single location request in sidelink positioning. |
| [R2-2212506](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212506%20(R18%20NR%20POS%20SI%20A822_SLPos).docx) | InterDigital Inc. | Proposal 5: If security is required, only session-based should be supported. Othrewise, session-less is applicable. |
| [R2-2212554](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212554.docx) | Sharp | Proposal 2 For positioning, the session-less operation should be supported.  Proposal 3 For ranging, the session-less operation is not necessary. |
| [R2-2212857](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212857_(Sidelink%20Positioning).docx) | Qualcomm Incorporated | Proposal 5: SLPP should support sidelink positioning session establishment, session termination and session modification (adding or removing UEs to a session.  Proposal 6: SLPP should support session-less operation to enable sidelink positioning with no discovery, no UE associations and no SLPP session. |
| [R2-2212883](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212883%20(8.2.2)%20Discussion%20on%20SL-POS%20protocol%20architecture%20design.docx) | Samsung | Proposal 3. RAN2 agree the scenario of using groupcast/broadcast among multiple involved UEs for sidelink positioning is session-based RSPP operation. |

**Summary:**

10 companied provided their view on this issue. 6 companies supported session-less operation. In which 1 company supported session-less operation for positioning but not for ranging. 1 company proposed RAN2 does not consider the term “Session-based” or “Sessionless”, and just focuses on the cast type of SL positioning, i.e., unicast/broadcast/groupcast. For session-based operation, 1 company did not support SLPP/RSPP session modification (add and remove) procedures. 1 company supported sidelink positioning session establishment, session termination and session modification (adding or removing UEs to a session). 1 company discussed session-based operation for the scenario of using groupcast/broadcast among multiple involved UEs for sidelink positioning. 1 company supported multiple SLPP/RSPP sessions for a single location request in sidelink positioning. 1 company proposed not to introduce any explicit “session management” SLPP/RSPP procedures. 1 company proposed to study details of session-based and session-less sidelink positioning. The proposal is as follows:

Understanding on a positioning session:

1. **RAN2 to confirm that a positioning session is characterized by a time-limited two-way link enabling interactive expression and information exchange between two or more communication devices, typically in presence of state (ie, information about session history).**
2. **RAN2 to discuss if the session modification (adding or removing UEs to a session) is supported or not in session-based.**

Session-less:

1. **RAN2 to discuss if session-less positioning is anything else than session-based positioning as per Proposal 5 (if agreed).”, or session-less positioning is best-effort positioning without QoS guarantees, FFS other necessary and satisfactory characteristics for its definition, including security and integrity.**
2. **RAN2 to discuss the candidate scenarios where the session-less SL positioning are applicable, including:**

* **at least for some positioning methods (e.g. single-sided RTT)**
* **If security is not required, session-less is applicable.**
* **SLPP should support session-less operation to enable sidelink positioning with no discovery, no UE associations and no SLPP session.**

### 2.5 Centralized/distributed operation

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| [R2-2212554](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212554.docx) | Sharp | Proposal 4 The discussion of the centralized/distributed operation is limited for positioning, and no need to consider for ranging. |
| [R2-2212857](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212857_(Sidelink%20Positioning).docx) | Qualcomm Incorporated | Proposal 7: SLPP should support distributed sidelink positioning enabling UEs to determine position and range based on exchanged location information. |

**Summary:**

Only 2 companies provided their view on this issue. Only 1 company supported distributed sidelink positioning. And 1 company proposed to limit the centralized/distributed operation for positioning and not for ranging. For “distributed operation” each UE distributes its measurements to the other UEs in the group (session or session-less), and each UE calculates the range/position itself. One company support to discuss the distributed operation online.

Since there isn’t majority view, no proposal on this issue.

1. **RAN2 to discuss whether SLPP should support distributed (or decentralized) mode of operation, where each of the participating UEs perform the range and/or position computations on their own (based on the exchanged location information), and FFS the need of session-based/session-less in normative work.**

### 2.6 SL-PRS configuration

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| [R2-2212082](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212082_Sidelink-Fraunhofer.docx) | Fraunhofer IIS, Fraunhofer HHI | Proposal 3: Provision of providing sidelink reference signal configuration through preconfigured assistance data shall be supported, at least for in-coverage and partial coverage scenarios. |
| [R2-2212096](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212096_SLPos_Solutions.docx) | Lenovo | Proposal 10: RAN2 to further study the SLPP/RSPP transmission of the SL positioning configuration depending on the type of configuration node and SL positioning mode (e.g., UE-based or UE-assisted), e.g., gNB, LMF, RSU/Anchor-UE, Target-UE by considering at least:  • UE-specific (via dedicated signalling) or common (via broadcast/groupcast signalling, e.g., SIB) SL positioning configurations.  • UE assistance information to assist the configuration node, e.g., gNB, LMF, UE in supporting SL positioning procedures.  Proposal 11: RAN2 to further study the impacts of Mode 1 coordination & signalling of SL PRS resources for one or more UEs participating in a SL positioning session (e.g., one or more anchor UEs and a target-UE) in line with RAN1’s agreement.  Proposal 12: RAN2 to further study Mode 2 coordination of SL PRS resources in line with RAN1’s agreement for one or more UEs participating in a SL positioning session e.g., one or more anchor UEs and a target-UE) including at least:  • The use of pre-configured resources in out-of-coverage scenarios.  • Initiator UE (e.g., target UE) indicates the SL-PRS resource to other UEs involved in SL Positioning (e.g., one or more anchor UEs) over sidelink. |
| [R2-2212169](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212169%20Discussion%20on%20potential%20solutions%20for%20SL%20positioning.docx) | Spreadtrum Communications | Proposal 8: Consider following SL-PRS configuration schemes:  - Alt1: SL-PRS is configured by gNB/LMF via high layer signalling;  - Alt2: SL-PRS semi-static parameters are configured by gNB/LMF and dynamic parameters are determined by UE;  - Alt3: SL-PRS is determined by UE. |
| [R2-2212470](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212470%20Study%20of%20signalling%20procedures%20and%20design%20considerations%20for%20sidelink%20positioning.docx) | LG Electronics | Proposal 6. Anchor UE configuration over LPP protocol (from LMF) is supported if SL-PRS is configured by higher layer.  Proposal 9. Anchor UE SL-PRS configuration over LPP should be introduced for broadcasting of SL-PRS configuration and transmission. |
| [R2-2212506](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212506%20(R18%20NR%20POS%20SI%20A822_SLPos).docx) | InterDigital Inc. | Proposal 17: Support combination of higher-layer and lower-layer signalling (e.g. MAC CE, DCI, SCI) for configuring and triggering of SL-PRS transmissions in both in-coverage and out-of-coverage scenarios. use of higher layer signaling to control periodic SL-PRS, use of MAC-CE to activate/deactivate semi-persistent PRS |
| [R2-2212647](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212647%20Discussion%20on%20SL-PRS%20resource%20allocation.docx) | Samsung | Proposal 1. RAN2 is kindly asked to discuss the feasibility of the option 1 (i.e., SL-PRS resource allocation by the LMF) from RAN2 perspective and consider to send LS to RAN1 if RAN2 can make some consensus on it. |
| [R2-2212685](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212685%20Discussion%20on%20sidelink%20positioning.docx) | ZTE Corporation | Proposal 6: Support to treat SL-PRS configuration transfer separately with other assistance data when RAN2 discusses ‘SL positioning assistance data exchange’ procedure. |

**Summary:**

7 companies discussed this issue. 5 companies mentioned that SL-PRS is configured by higher layer. 1 company considered the SL-PRS configuration node can be gNB, LMF, RSU/anchor-UE, target-UE. Since this issue depends on the conclusion from RAN1. Therefore, RAN2 can discuss this issue after the input from RAN1.

1. **RAN2 to enable the support of SL-PRS configuration in normative work based on the progress in RAN1.**

### 2.7 Anchor UE (re)selection

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| R2-2212096 | Lenovo | Proposal 9: RAN2 is suggested to investigate the procedures related to anchor UE(s) including triggering, (re)selection, and configuration when performing sidelink positioning procedures. The same procedures may be applicable to an Assistant UE (if need for such a UE is determined). |
| R2-2212112 | Nokia, Nokia Shanghai Bell | Proposal 4: Study procedures for UE anchor (re)selection, considering the impact on signalling overhead, and latency.  Proposal 5: RAN2 to study identification and activation of anchors to ensure that sufficient number of candidate anchors is available to the target UE and its positioning requirements can be met. |
| R2-2212169 | Spreadtrum Communications | Proposal 5: In order to select suitable anchor UEs, AS layer criteria should be considered besides the high layer criteria of discovery procedure. |
| [R2-2212359](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212359%20SL.docx) | Ericsson | Proposal 6 The assistance data about a candidate anchor UE includes: Sidelink positioning capabilities, state information, stationary UE indicator, UE type, Battery status, Serving cell ID and travelling path. |
| [R2-2212470](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212470%20Study%20of%20signalling%20procedures%20and%20design%20considerations%20for%20sidelink%20positioning.docx) | LG Electronics | Proposal 3. Anchor UE can be selected based on the type of UE (e.g. normal UE or RSU), location accuracy, velocity and direction, especially for V2X use case. |
| [R2-2212506](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212506%20(R18%20NR%20POS%20SI%20A822_SLPos).docx) | InterDigital Inc. | Proposal 11: Study mechanism and signalling for anchor UE providing its location info to target UE (e.g. for UE based positioning) or network (e.g. for UE-assisted positioning)  Proposal 12: Support anchor UE reporting the uncertainty associated with its location info to the network (e.g. when anchor UE location info is not determined/available at network)  Proposal 13: Study target UE receiving uncertainty associated with the location info of anchor UE from the network (e.g. for in-coverage) or anchor UE (e.g. for out-of-coverage)  Proposal 14: Study procedure for network to assist in the selection of anchor UEs in in-coverage scenarios  Proposal 15: Study procedure for target UE to discover and select anchor UEs at least in out-of-coverage scenarios  Proposal 16: Study the selection of stationary/fixed (e.g. RSU/PRU) and/or mobile (e.g. vehicle) anchor UEs, and their impacts on signalling in IC and OOC scenarios |
| [R2-2212811](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212811%20Discussion%20on%20SL%20positioning.docx) | Xiaomi | Proposal 15 RAN2 to discuss which of the following conditions can be used for anchor UE selection：  - the UE is capable of being anchor UE;  - the SL RSRP of the UE is above the threshold;  - the intended positioning methods are supported by the UE;  - the UE is location known.  - the UE is in coverage.  Proposal 16 RAN2 to discuss whether LMF/a third UE can participate in the decision of anchor UE selection.  Proposal 17 Anchor UE reselection is supported. |
| R2-2212941 | Philips International B.V. | Proposal 9: The criteria/conditions for a Ranging UE to determine if it can act as an Anchor UE or Located UE should be configurable by the network (e.g. by LMF or PCF).  Proposal 10: Criteria/conditions to be considered for a Ranging UE to determine if it can act or by which the LMF can decide it can act as an Anchor UE or Located UE include:  - Whether or not the UE has a position fix (e.g. through GNSS),  - Whether or not the UE’s position is stable (e.g. UE is stationary or moves at very slow speed or position fluctuates within a small limited area, the limits/thresholds of which may be determined by a set of criteria).  - Whether or not the UE is in coverage of a base station,  - Whether or not the UE is connected to an LMF.  - Whether it receives enough positioning/ranging reference signals. |

**Summary:**

8 companies preferred to study anchor UE (re)selection. In addition, there are 3 issues on anchor UE (re)selection:

* Issue 1: who performs anchor UE (re)selection?
* Issue 2: criteria of anchor UE (re)selection.
* Issue 3: signalling exchange of assistance data for candidate anchor UE.

For issue 1, 2 companies mentioned target UE performs anchor UE (re)selection. 1 company thinked LMF/a third UE can participate in the decision of anchor UE selection. Rapp thinks this issue is related to the functionalities of server UE and LMF. Therefore, this issue will be discussed during the discussion on LS from SA2.

For issue 2, it is preferred that AS layer criteria should be considered besides the high layer criteria. In addition, for both issue 2 and issue 3, the following assistance data can be discussed:

- the UE is capable of being anchor UE;

- the SL RSRP of the UE is above the threshold;

- the intended positioning methods are supported by the UE;

- the UE is location known.

- the UE is in coverage.

- the UE is stationary/fixed (e.g. RSU/PRU) and/or mobile (e.g. vehicle).

- UE type.

- Battery status.

- Serving cell ID.

- travelling path.

- location accuracy.

- velocity and direction.

1. **For anchor UE(s) (re)selection, AS layer criteria should be considered besides the high layer criteria.**
2. **For anchor UE(s) (re)selection** **criteria, the following assistance data can be discussed:**

* **the intended positioning methods are supported by the UE;**
* **the UE is capable of being anchor UE;**
* **Serving cell ID.**
* **the UE is stationary/fixed (e.g. RSU/PRU) and/or mobile (e.g. vehicle).**
* **the UE is location known**

**More assistance data can be further discussed in normative work based on the progress including RAN1:**

* **travelling path.**
* **Battery status**
* **location accuracy.**
* **velocity and direction.**
* **dynamic measurements including signal strength measurements. FFS further details.**

### 2.8 Functionalities of LMF for supporting SL positioning

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| R2-2212506 | InterDigital Inc. | Proposal 6: Study functionalities of LMF for supporting SL positioning (e.g. determining SL positioning method, interaction between LMF and gNB for scheduling resources for SL positioning) for in-coverage scenario |
| R2-2212685 | ZTE Corporation | Proposal 5: Support LMF to determine whether in/partial coverage target UE should adopt hybrid positioning or PC5-only positioning. |

**Summary:**

Both companies suggested studying functionalities of LMF for supporting SL positioning. This issue depends on the protocol options for sidelink positioning procedures between UE and LMF. It is proposed to be studied during normative work.

1. **RAN2 to discuss the details of functionalities of LMF for supporting SL positioning** **in normative work.**

### 2.9 UE-based/ UE-assisted and network-based/ network-assisted SL positioning

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| [R2-2212169](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212169%20Discussion%20on%20potential%20solutions%20for%20SL%20positioning.docx) | Spreadtrum Communications | Proposal 3: UE-based and network-based SL positioning methods should be considered. |
| [R2-2212359](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212359%20SL.docx) | Ericsson | Proposal 1 NW assisted ranging calculation based upon absolute position between two UEs is supported. |
| [R2-2212506](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212506%20(R18%20NR%20POS%20SI%20A822_SLPos).docx) | InterDigital Inc. | Proposal 10: Study procedures for supporting both UE-assisted and UE-based SL positioning for in-coverage and out-of-coverage scenarios |

**Summary:**

Only 3 companies proposed to discuss UE-based/ UE-assisted and network-based/ network-assisted SL positioning. And no majority view on this issue. Therefore, no proposal provided.

### 2.10 MO-LR, MT-LR and deferred MT-LR

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| [R2-2212506](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212506%20(R18%20NR%20POS%20SI%20A822_SLPos).docx) | InterDigital Inc. | Proposal 8: Study procedures for supporting MO-LR, MT-LR and deferred MT-LR for SL positioning in in-coverage scenarios  Proposal 9: Study procedures for supporting MO-LR and deferred MT-LR for SL positioning in out-of-coverage scenarios |
| [R2-2212811](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212811%20Discussion%20on%20SL%20positioning.docx) | Xiaomi | Proposal 11 For MT-LR, the positioning method determination is located in LMF.  Proposal 12 For MO-LR, if the UE is in coverage, RAN2 to discuss whether the selection of Uu positioning or SL positioning is done at SLPP/RSPP layer, or consult with SA2 is needed. |
| [R2-2212857](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212857_(Sidelink%20Positioning).docx) | Qualcomm Incorporated | Proposal 8: Support a MO-LR or a new supplementary services operation for UE initiated SLPP transactions towards an LMF.  Proposal 9: Support a MT-LR or a new supplementary services operation for LMF-initiated SLPP transactions towards a UE. |

**Summary:**

Only 3 companies proposed to study procedures for supporting MO-LR, MT-LR and deferred MT-LR for SL positioning which is in SA2 scope. And no majority view on this issue. Therefore, no proposal provided.

### 2.11 Positioning signaling for groupcast/broadcast

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| R2-2211226 | CATT | RAN2 to send an LS to SA3 to evaluate security of groupcast/broadcast-based SL positioning signaling.  Proposal 10: Groupcast/broadcast-based SL-PRS configuration is supported. |
| R2-2211230 | vivo | Proposal 8: To improve the efficiency of sidelink positioning, the broadcast/groupcast for SL positioning assistance data and UE sidelink positioning capability shall be supported.  Proposal 9: RAN2 does not consider the term “Session-based” or “Sessionless”, and just focuses on the cast type of SL positioning, i.e., unicast/broadcast/groupcast. |
| [R2-2211252](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2211252%20Discussion%20on%20sidelink%20positioning_final.docx) | Huawei, HiSilicon | Proposal1: SLPP capability can be sent by broadcast in the following scenarios:   Target UE can broadcast SLPP capability when searching for Anchor UE to perform SL positioning.   Anchor UE, which is responsible for SL positioning, e.g., RSU, can broadcast SLPP capability.  Proposal2: SLPP assistance data can be transferred in broadcast/groupcast in the following scenarios:   In the one-to-many scenario for SL positioning, Target UE can transmit its SLPP assistance data to multiple Anchor UEs at least for without LMF involved scenarios.   Anchor UEs can transmit its SLPP assistance data to multiple Target UEs at least for without LMF involved scenarios. |
| [R2-2211462](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2211462.docx) | Intel Corporation | Proposal 1b: RAN2’s preference, alongside the potential use cases for support of groupcast/broadcast and security considerations should be highlighted to SA2 and SA3. |
| [R2-2211839](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2211839%20Further%20discussion%20on%20sidelink%20positioning.docx) | OPPO | Proposal 6: RAN 2 to agree the positioning capability should be always broadcast/groupcast, similar with the SL positioning discovery msg.  Proposal 7: RAN2 to agree two use cases for applying the assistance data transfer:   The anchor UE and/or target UE broadcasts its configured SL-PRS   The SL positioning server UE distributes the SL-PRS configuration towards the anchor UE and/or the target UE for performing monitoring or transmission. |
| [R2-2212082](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2212082_Sidelink-Fraunhofer.docx) | Fraunhofer IIS, Fraunhofer HHI | Proposal 2: Anchor UEs shall not broadcast the measurements to other UEs. The measurement shall only be transmitted in unicast or report free ranging shall be supported. |
| [R2-2212096](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2212096_SLPos_Solutions.docx) | Lenovo | Proposal 2: RAN2 to further study the support for groupcast and broadcast in order to assess the merits between PC5-S and PC5-U in terms of the transport of SLPP/RSPP messages. |
| [R2-2212470](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2212470%20Study%20of%20signalling%20procedures%20and%20design%20considerations%20for%20sidelink%20positioning.docx) | LG Electronics | Proposal 4. Unicast/one-to-one operation is used between two UEs, i.e., between a target UE and an anchor UE, for capacity exchange and location information procedures. Broadcast/groupcast operations can be used between multiple UEs for assistant data transfer procedure. |
| [R2-2212506](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2212506%20(R18%20NR%20POS%20SI%20A822_SLPos).docx) | InterDigital Inc. | Proposal 4: Study whether security clearance is needed to transfer location information via broadcast or groupcast |
| [R2-2212685](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2212685%20Discussion%20on%20sidelink%20positioning.docx) | ZTE Corporation | Proposal 1: Broadcasting/groupcasting the SL UE capability and SL assistance data (including SL-PRS configuration) has applicability and should be supported. |
| [R2-2212811](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2212811%20Discussion%20on%20SL%20positioning.docx) | Xiaomi | Proposal 3 Anchor UE can broadcast SL positioning assistant information by SL SIB. The supported SL positioning methods at least include SL-TDOA and SL-AOA.  Proposal 4 Support ciphering of the SL SIB broadcast SL positioning assistant information.  Proposal 5 Groupcast of SLPP/RSPP message without group positioning is not supported. |
| [R2-2212883](file:///Z:\\临时中转\\文稿分析\\RAN2\\120\\doc\\8.2.2\\R2-2212883%20(8.2.2)%20Discussion%20on%20SL-POS%20protocol%20architecture%20design.docx) | Samsung | Proposal 2, RAN2 discuss and choose one of two ways, to use PC5-S for unicast and PC5-D for groupcast/broadcast RSPP transport OR to use PC5-S for unicast type RSPP, and to use PC5-U for groupcast/broadcast type RSPP, and send reply on this to SA2.  Proposal 3. RAN2 agree the scenario of using groupcast/broadcast among multiple involved UEs for sidelink positioning is session-based RSPP operation. |

**Summary:**

12 companies discussed cast type of sidelink positioning signalling exchange. Some companies associated cast type with protocol stack. It will be discussed in protocol stack discussion. 3 companies emphasized security aspects for groupcast/broadcast and propsed to send LS to SA2 and SA3. 1 company proposed to support ciphering of broadcasted SL positioning information. The following sidelink positioning signalling were mentioned to be exchanged via groupcast/broadcast:

• SL positioning capability (5)

• SL positioning assistance data (6)

For SL measurement/location information, 1 company thinked measurement shall only be transmitted in unicast. 1 company suggested to study whether security clearance is needed to transfer location information via broadcast/groupcast. 1 company supported to transfer location information via broadcast/groupcast.

The following use cases were discussed for applying groupcast/broadcast:

* SLPP capability:
* The positioning capability should be always broadcast/groupcast;
* Target UE can broadcast SLPP capability when searching for Anchor UE to perform SL positioning;
* Anchor UE, which is responsible for SL positioning, e.g., RSU, can broadcast SLPP capability.
* SLPP assistance data:
* In the one-to-many scenario for SL positioning, Target UE can transmit its SLPP assistance data to multiple Anchor UEs at least for without LMF involved scenarios;
* Anchor UEs can transmit its SLPP assistance data to multiple Target UEs at least for without LMF involved scenarios;
* The anchor UE and/or target UE broadcasts its configured SL-PRS;
* The SL positioning server UE distributes the SL-PRS configuration towards the anchor UE and/or the target UE for performing monitoring or transmission;
* SLPP assistance data exchange among multiple UEs;
* SLPP assistance data exchange for SL positioning methods at least include SL-TDOA and SL-AOA.

1. **RAN2 to confirm the applicability of at least the following positioning signaling for groupcast/broadcast (in addition to unicast):**

**• SL positioning capability (5)**

**• SL positioning assistance data (6)**

1. **RAN2 to further discuss in normative work:**

**- the security issues on specific information of SL positioning capability and assistance data in groupcast/broadcast and consult to SA2 and SA3.**

**- the use cases for applying groupcast/broadcast.**

# 3 Conclusion

Easy agreed

**Proposal 1 Abbreviation of SLPP is used as the name of new protocol for sidelink positioning between UEs and inform other WGs, i.e. SA2 and RAN1:**

**- SLPP: Sidelink Positioning Protocol**

**Proposal 2 RAN2 to confirm either of UEs, except not all UEs, including target UE and one or multiple anchor UEs may be OOC in partial coverage scenarios. How to enable the procedures/signaling for supporting SL positioning in partial coverage will be further discussed in normative work.**

**Proposal9 RAN2 to enable the support of SL-PRS configuration in normative work based on the progress in RAN1.**

**Proposal12 RAN2 to discuss the details of functionalities of LMF for supporting SL positioning in normative work.**

To be discussed

*Architecture aspect:*

**Proposal 3 RAN2 to discuss SL positioning architecture, including whether UE roles(target UE/ Anchor UE/ Server UE) are specified in SL positioning architecture, whether LTE PC5 is excluded for SL positioning.**

*Session-based and session-less aspect:*

**Proposal 4 RAN2 to confirm that a positioning session is characterized by a time-limited two-way link enabling interactive expression and information exchange between two or more communication devices, typically in presence of state (ie, information about session history).**

**Proposal 5 RAN2 to discuss if the session modification (adding or removing UEs to a session) is supported or not in session-based.**

**Proposal 6 RAN2 to discuss if session-less positioning is anything else than session-based positioning as per Proposal 5 (if agreed)”, or session-less positioning is best-effort positioning without QoS guarantees, FFS other necessary and satisfactory characteristics for its definition, including security and integrity.**

**Proposal 7 RAN2 to discuss the scenarios where the session-less SL positioning are applicable, including:**

* **at least for some positioning methods (e.g. single-sided RTT)**
* **If security is not required, session-less is applicable.**
* **SLPP should support session-less operation to enable sidelink positioning with no discovery, no UE associations and no SLPP session.**

*Distributed mode of operation aspect:*

**Proposal 8 RAN2 to discuss whether SLPP should support distributed (or decentralized) mode of operation, where each of the participating UEs perform the range and/or position computations on their own (based on the exchanged location information) and FFS the need of session-based/session-less in normative work.**

*Anchor UE (re)selection aspect:*

**Proposal 10 For anchor UE(s) (re)selection, AS layer criteria should be considered besides the high layer criteria.**

**Proposal 11 For anchor UE(s) (re)selection** **criteria, the following assistance data can be discussed online:**

* **the intended positioning methods are supported by the UE;**
* **the UE is capable of being anchor UE;**
* **Serving cell ID.**
* **the UE is stationary/fixed (e.g. RSU/PRU) and/or mobile (e.g. vehicle).**
* **the UE is location known**

**More assistance data can be further discussed in normative work based on the progress including RAN1:**

* **travelling path.**
* **Battery status**
* **location accuracy.**
* **velocity and direction.**
* **dynamic measurements including signal strength measurements. FFS further details.**

*groupcast/broadcast aspect:*

**Proposal 13 RAN2 to confirm the applicability of at least the following positioning signaling for groupcast/broadcast (in addition to unicast):**

**• SL positioning capability (5)**

**• SL positioning assistance data (6)**

**Proposal 14 RAN2 to further discuss in normative work:**

**- the security issues on specific information of SL positioning capability and assistance data in groupcast/broadcast and consult to SA2 and SA3.**

**- the use cases for applying groupcast/broadcast.**

# 4 Proposals not included

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| [R2-2211252](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211252%20Discussion%20on%20sidelink%20positioning_final.docx) | Huawei, HiSilicon | Proposal4: The local coordinate system is needed for the scenario in KI#5 for network-assisted absolute positioning for partial/in coverage UEs.  Proposal5: RAN2 to discuss the support of local co-ordinates in SL positioning for network-assisted absolute positioning for partial/in coverage UEs in normative work phase. |
| [R2-2211917](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2211917_SL_Pos.docx) | Sony | Proposal 1: Further discuss and align terminology with RAN1 and SA2, where e.g. the anchor UE could both have the function of providing resource configuration as well as acting as a Reference UE transmitting SL-PRS signals Proposal 3: Discuss further aspects whether the involved UEs have an PC5 connection established or UE autonomous SL-PRS resource allocation is to be used. Proposal 4: Consider supporting multiplexing of sidelink positioning reference signal from several UEs within a given set of resources. Proposal 7: Consider to support UE-types classification for V2X positioning (e.g., RSU, VRU, Car). Proposal 8: Consider to adapt positioning procedure based on the region/zone of the UE. Proposal 9: Consider supporting positioning procedure with the assistance of another UE for the estimation of relative positioning and relative angle. |
| [R2-2212082](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212082_Sidelink-Fraunhofer.docx) | Fraunhofer IIS, Fraunhofer HHI | Proposal 4: Determination of ranging between two UEs in sidelink without having to report the RxTxTimeDiff shall be supported. |
| [R2-2212096](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212096_SLPos_Solutions.docx) | Lenovo | Proposal 4: RAN2 to further study whether existing/new SL ID management needs to be supported for SL positioning.  Proposal 8: RAN2 to support the signalling design for at least SL-RTT type methods, SL-TDoA, SL-AoA.  Proposal 13: RAN2 to consider the supported signalling and procedures depending on which node/entity:  1) Performs the SL positioning measurements and associated reporting (e.g., if needed for UE-based positioning), e.g., RSU/Anchor-UE, Target-UE.  2) Performs the SL positioning calculation e.g., gNB, LMF, RSU/Anchor-UE, Target-UE.  NOTE: This has a dependency on the SL Positioning architecture as well as positioning modes (e.g., UE-assisted, UE-based).  Proposal 14: Support different SL Positioning reporting types including one-shot, triggered and periodic reports.  Proposal 15: From RAN2 perspective, measurement quality metric reporting should also be supported to assess the quality of SL positioning measurements. |
| [R2-2212112](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212112.docx) | Nokia, Nokia Shanghai Bell | Proposal 1: Sidelink UEs indicate capability to support SL positioning. FFS if support for SLPP and / or eLPP is indicated. |
| [R2-2212359](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212359%20SL.docx) | Ericsson | Proposal 2 Hybrid ranging involving gNBs and UEs exploiting timing advance procedures is supported. |
| [R2-2212470](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212470%20Study%20of%20signalling%20procedures%20and%20design%20considerations%20for%20sidelink%20positioning.docx) | LG Electronics | Proposal 2. Whether to trigger a sidelink positioning request is determined by the target UE or LMF.  Proposal 13. RAN2 to wait for RAN1 decision for SL-PRS activation/deactivation. |
| [R2-2212554](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212554.docx) | Sharp | Proposal 1 For the signaling procedure design, the positioning and ranging should be considered separately. |
| [R2-2212710](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212710%20Considerations%20on%20Sidelink%20positioning.docx) | CMCC | Proposal 4: RAN2 is kindly asked to support different granularity of the pre-configuration, e.g., SL-PRS resource pool, SL-PRS, SL PRS set. |
| [R2-2212811](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212811%20Discussion%20on%20SL%20positioning.docx) | Xiaomi | Proposal 5 Groupcast of SLPP/RSPP message without group positioning is not supported.  Proposal 6 For group positioning, if supported by SA2, group management is done at upper layer(e.g. application layer) instead of SLPP/RSPP layer.  Proposal 7 For group positioning, if supported by SA2, request for capability/asistant data/location information can be sent in groupcast mode.  Proposal 8 For group positioning, if supported by SA2, provide capability/asistant data can be sent in groupcast and unicast mode.  Proposal 9 For group positioning, if supported by SA2, provide location information can be sent in unicast mode.  Proposal 10 For group positioning, if supported by SA2, session based mechanism is used. |
| [R2-2212857](file:///Z:\临时中转\文稿分析\RAN2\120\doc\8.2.2\R2-2212857_(Sidelink%20Positioning).docx) | Qualcomm Incorporated | Proposal 4: SLPP supports mechanism for robustness and/or tolerance to transport failure, including redundancy, acknowledgement and retransmission. |
| R2-2212941 | Philips International B.V. | Proposal 1: Define a SL positioning server UE role for Anchor UEs (not for a separate UE that is neither a Target UE or Anchor UE).  Proposal 2: If multiple SL positioning server UEs are available, a single SL position server UE should be selected/negotiated.  Proposal 3: the out-of-coverage operational model using a SL positioning server UE should also be available for partial coverage situations.  Proposal 4: Use a combination of PC5-S and PC5-D for ranging protocol procedures over SR5 when using session-based ranging/SL positioning, and make a selection between PC5-D and PC5-U for session-less ranging/SL positioning.  Proposal 5: A Target UE shall be able to receive dynamic configuration information from an Anchor UE over SR5. To this end, the Anchor UE shall be able to provide the selected values for the dynamic configuration parameters to a Target UE for ranging over SR5.  Proposal 6: Dynamic configuration parameters to be considered include:  o ranging/positioning method to use (e.g. RTT, TDOA, …),  o frequency bands and which bandwidth to use,  o sampling frequency of ranging and positioning measurements,  o timing/period/duration of ranging and position signals and measurements,  o minimum/maximum transmit power to use,  o role of a device (e.g. Anchor UE, Target UE),  o ranging “constellation”/ranging session related information (e.g. identities of Anchor UEs working together to provide ranging/sidelink position service),  o coordinate system to be used,  o which device or service will collect the measurements and calculate a distance, angle or position.  Proposal 7: A Target UE or Anchor UE shall be able to negotiate the dynamic configuration information with one another over SR5 by indicating a preferred value or a list of possible values (based on its capabilities) for one or more configuration parameters during initial connection setup.  Proposal 8: The desired or possible role(s) of a Ranging UE should be provided during ranging discovery procedure.  Proposal 11: A mechanism should be provided by which a Ranging UE can inform the other UE(s) involved in a ranging session/procedure and also the LMF if the role of the Ranging UE changes.  Proposal 12: It should be possible to involve multiple Anchor UEs in a ranging session/procedure using ranging “constellation” information. |

# 5 Reference

1. R2-2211226 Discussion on SL Positioning CATT discussion Rel-18 FS\_NR\_pos\_enh2
2. R2-2211230 Discussion on sidelink positioning vivo discussion Rel-18 FS\_NR\_pos\_enh2
3. R2-2211252 Discussion on Sidelink Positioning Huawei, HiSilicon discussion Rel-18 FS\_NR\_pos\_enh2
4. R2-2211462 Support of sidelink positioning Intel Corporation discussion Rel-18 FS\_NR\_pos\_enh2
5. R2-2211688 SLPP/RSPP protocol design Apple discussion FS\_NR\_pos\_enh2
6. R2-2211839 Further discussion on sidelink positioning OPPO discussion Rel-18 FS\_NR\_pos\_enh2
7. R2-2211917 Considerations on sidelink positioning Sony discussion Rel-18 FS\_NR\_pos\_enh2
8. R2-2212082 Considerations for UE Positioning using Sidelink Fraunhofer IIS, Fraunhofer HHI discussion
9. R2-2212096 On SL Positioning Protocol and Architecture Lenovo discussion Rel-18
10. R2-2212109 Discussion of session-based and session-less sidelink positioning Nokia Germany discussion Rel-18
11. R2-2212112 Protocol and coverage aspects of sidelink positioning Nokia Germany discussion
12. R2-2212169 Discussion on potential solutions for SL positioning Spreadtrum Communications discussion Rel-18
13. R2-2212359 NW Assisted Ranging and Protocol Name and terminologies Ericsson discussion Rel-18
14. R2-2212470 Study of signalling procedures and design considerations for sidelink positioning LG Electronics Deutschland discussion Rel-18
15. R2-2212506 Discussion on Sidelink Positioning InterDigital Communications discussion Rel-18
16. R2-2212554 Signaling procedures to enable sidelink positioning Sharp discussion Rel-18 FS\_NR\_pos\_enh2
17. R2-2212647 Discussion on SL-PRS resource allocation schemes Samsung discussion Rel-18 FS\_NR\_pos\_enh2
18. R2-2212685 Discussion on sidelink positioning ZTE Corporation discussion Rel-18 FS\_NR\_pos\_enh2
19. R2-2212710 Considerations on Sidelink positioning CMCC discussion Rel-18 FS\_NR\_pos\_enh2
20. R2-2212811 Discussion on SL positioning Xiaomi discussion Rel-18
21. R2-2212857 Study of Sidelink Positioning Architecture, Signaling and Procedures Qualcomm Incorporated discussion
22. R2-2212883 Discussion on SL-POS protocol architecture design Samsung Electronics Romania discussion
23. R2-2212941 Protocol considerations for sidelink positioning Philips International B.V. discussion Rel-18 38.859 FS\_NR\_pos\_enh2