**3GPP TSG RAN WG1 #109-e R1-220xxxx**

**e-Meeting, May 9th – 20th, 2022**

**Agenda item:** **9.5.1.3**

**Source: Moderator (Qualcomm)**

**Title: Moderator Summary #2 for [109-e-R18-Pos-04] Email discussion on potential solutions for SL positioning**

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

# Introduction

The study on expanded and improved NR positioning introduces sidelink positioning as an objective [1]:

|  |
| --- |
| * Study solutions for sidelink positioning considering the following: [RAN1, RAN2] * Scenario/requirements   + Coverage scenarios to cover: in-coverage, partial-coverage and out-of-coverage   + Requirements: Based on requirements identified in TR38.845 and TS22.261 and TS22.104   + Use cases: V2X (TR38.845), public safety (TR38.845), commercial (TS22.261), IIOT (TS22.104)   + Spectrum: ITS, licensed * Identify specific target performance requirements to be considered for the evaluation based on existing 3GPP work and inputs from industry forums [RAN1] * Define evaluation methodology with which to evaluate SL positioning for the uses cases and coverage scenarios, reusing existing methodologies from sidelink communication and from positioning as much as possible [RAN1]. * Study and evaluate performance and feasibility of potential solutions for SL positioning, considering relative positioning, ranging and absolute positioning: [RAN1, RAN2]   + Evaluate bandwidth requirement needed to meet the identified accuracy requirements [RAN1]   + Study of positioning methods (e.g. TDOA, RTT, AOA/D, etc) including combination of SL positioning measurements with other RAT dependent positioning measurements (e.g. Uu based measurements) [RAN1]   + Study of sidelink reference signals for positioning purposes from physical layer perspective, including signal design, resource allocation, measurements, associated procedures, etc, reusing existing reference signals, procedures, etc from sidelink communication and from positioning as much as possible [RAN1]   + Study of positioning architecture and signalling procedures (e.g. configuration, measurement reporting, etc) to enable sidelink positioning covering both UE based and network based positioning [RAN2, including coordination and alignment with RAN3 and SA2 as required]   Note: When the bandwidth requirements have been determined and the study of sidelink communication in unlicensed spectrum has progressed, it can be reviewed whether unlicensed spectrum can be considered in further work. Checkpoint at RAN#97 to see if sufficient information is available for this review. |

The focus on the 9.5.1.3 SubAgenda is the following objective:

* Study of positioning methods (e.g. TDOA, RTT, AOA/D, etc) including combination of SL positioning measurements with other RAT dependent positioning measurements (e.g. Uu based measurements) [RAN1]
* Study of sidelink reference signals for positioning purposes from physical layer perspective, including signal design, resource allocation, measurements, associated procedures, etc, reusing existing reference signals, procedures, etc from sidelink communication and from positioning as much as possible [RAN1]

In this paper, we summarize some common elements in the contributions and identify some areas and positions where contributing companies are aligned from which some agreements could be derived at this meeting.

# Email Discussion Information

This contribution provides the moderator’s summary of SL positioning evaluation, subject to the following email discussion.

[109-e-R18-Pos-04] Email discussion on evaluation of SL positioning by May 20 - Alex (Qualcomm)

* Check points: May 16, May 20

**ROUND 1**

All companies, please provide your initial inputs before Thursday May 12th 23:59 UTC, so that there is enough time to stabilize some of the proposals before the 1st checkpoint.

**ROUND 2**

**Thursday May 12th 23:59 UTC - Friday, May 13th, 11:59 UTC**

Based on received feedback, a new set of proposals are provided as follos:

* The previous Feature Lead proposals have been denote as “CLOSED
* A new set of Feature lead proposals is included with the categorization of “HIGH”, “MEDIUM”, “LOW”
* Considering the first check-point next Monday, it would be most appreciated if you could provide your feedback at least to the proposals tagged with “HIGH” (note that 4 proposals out of the 16 are denoted as “HIGH”), by **Friday, May 13th, 11:59 UTC**, if possible.

**ROUND 3**

**Monday May 16th 00:00 UTC - Tuesday, May 17th, ~~05~~10:00 UTC**

Based on received feedback, a new set of proposals are provided as follos:

* The previous Feature Lead proposals have been denote as “CLOSED
* A revised set of Feature lead proposals is included with the categorization of “HIGH”, “MEDIUM”, “LOW”
* Two proposals are going for Email Endorsment denoted as “CHECKPOINT 1”

[CHECKPOINT 1] Feature Lead Proposal 4.2.7-v0

With regards to the numerologies of the SL-PRS, limit the study, to those supported for NR Sidelink.

[CHECKPOINT 1] Feature Lead Proposal 6.1-v1

Study power control mechanisms for SL-PRS transmission, including whether it is necessary.

* Considering the first online GTW is Tuesday at 12:00 UTC, it would be most appreciated if you could provide your feedback by **Tuesday, May 17th, ~~05~~10:00 UTC**, if possible.

# Delegate Contact Information

As requested by the Chair, please provide the main Person of contact (PoC) for each company interested/contributing/providing comments for this subagenda in the table below:

|  |  |
| --- | --- |
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| InterDigital | Fumihiro Hasegawa, Fumihiro.hasegawa@interdigital.com |
| BOSCH | Maximilian Stark, Maximilian.stark2@de.bosch.com |
| Huawei, HiSilicon | Jinhuan Xia, Jinhua.xia@huawei.com |

# Sidelink Positioning Methods & Measurements, including combination with other RAT dependent positioning measurements

## SL Positioning Methods & Measurements

Based on the submitted contributions, the following statements/proposals are identified to be related to the sub-topc of SL Positioning Methods & Measurements:

|  |  |
| --- | --- |
| Futurewei | RAN1 should discuss the SL UE support of the positioning methods and measurements defined in Rel-16, and Rel 17.  The SL positioning study should investigate the BW size, non-ideal synchronization, and NLOS propagation impact on the SL positioning accuracy. |
| Nokia, NSB | Different positioning techniques based on time and angle-based measurements such as TDOA, Multi-RTT, AoA, AoD, etc. should be studied for sidelink positioning, to better evaluate their advantages and drawbacks. |
| Huawei, HiSilicon | SL positioning should support:   * RTT-based method for absolute and relative positioning * AoA-based method for absolute and relative positioning * TDOA-based method for absolute positioning   Note: For absolute positioning, the position of the transmitters, such as RSU, is known.  To support the above SL positioning methods, the following measurements should be reported:   * RSTD and/or RTOA measurements for TDOA-based method * Rx-Tx timing difference for RTT-based method * AoA for AoA-based method   Support to fix UE locations based on measurements at different time instances considering UE’s mobility characteristics.  UE timing drift should be considered in SL positioning or ranging. |
| NTT DOCOMO | * For SL-positioning, at least RTT mechanism is supported. * For SL-positioning, study whether TDOA mechanism can be supported or not, in consideration of time-misalignment among synchronizing UEs. |
| Samsung | Study the feasibility of TDOA for absolute and relative SL positioning considering synchronization error between UEs.  For instance, carrier phase measurements can be studied not only for Uu but also for SL. |
| CEWiT, Reliance Jio, Saankhya Labs, IITM, IITK | For Rel 18 study, both time-based (TDOA, M-RTT) and angle-based (AOD, AOA) positioning methods should be considered.  Time difference of arrival (TDOA) method should be defined for sidelink to measure RSTD for positioning over sidelink: For angle-based methods for sidelink positioning, antenna configuration consideration should be studied using practical UE capabilities and sidelink positioning architecture |
| CATT, GOHIGH | The potential positioning methods of TDOA, AOD/AOA, RTT for sidelink positioning should be further studied.  Support at least the following measurements for sidelink positioning:   * SL Rx-Tx time difference * SL AOA * SL RSRP/RSRPP |
| vivo | Prioritize RTT and AoA for sidelink positioning considering to achieve relative positioning and ranging (e.g., ranging for distance and ranging for angle).  Double-side RTT should be considered for SL positioning.  Two antenna panels as the distributed antenna system can be considered for V2X positioning.  The unified SL Positioning method can be introduced to support reporting one or more measurement results, similar to the TRP measurement result in TS 38.455.  Suggest UE Rx – Tx time difference for SL positioning can be defined as T, which is the timing gap between transmission of SL-PRS and receiving SL-PRS to/from other UE.  SL-PRS RSRP is needed to be introduced for SL-PRS measurement and reporting.  SL-AoA is needed to be introduced for SL-PRS measurement and reporting. |
| CMCC | RAN1 should further study which or which combination of positioning methods (e.g. TDOA, RTT, AOA/D, etc) should be selected for NR SL positioning, based on the evaluation results of:   * Positioning accuracy performance by using each method; * Feasibility of resolving the respective method’s bottleneck in Rel-18 of each method.   Initial views from our company on which methods to be supported in Rel-18 SL positioning are:   * RTT can be supported in Rel-18 SL positioning for both absolute positioning and relative positioning /ranging; * TDOA can be supported only in the case where the anchor devices are RSUs in Rel-18 SL positioning, both absolute positioning; * Whether AoA/AoD can be supported should be subject to UE capability, for both absolute positioning and relative positioning/ranging. |
| ZTE | From standard perspective, support all in-coverage, partial-coverage and out-of-coverage scenarios. The legacy positioning methods should be reused.   * For in-coverage and partial-coverage, support both absolute positioning and relative positioning.   For out-of-coverage, support relative positioning which TDOA may not be applicable  Time synchronization between anchor UEs need to be considered for SL TDOA positioning |
| China Telecom | Study the angle measurement based solution for sidelink positioning  Consider the RTT measurement based solution for sidelink positioning  Consider the TDOA measurement based solution for sidelink positioning |
| Qualcomm | Support a SL-RTT positioning method, wherein at least 2 devices transmit and receive SL-PRS waveform(s) and perform SL Rx-Tx measurements  Study both single-sided and double-sided SL-RTT methods  Support SL-AoA positioning method  For devices with a limited number of Tx antennas, SL-RTT and SL-AoA are more suitable and effective methods than the RSRP-based SL-AoD approach  From RAN1 perspective, SL-only positioning corresponds to a positioning mode wherein all the UEs performs SL positioning/ranging measurements and location/range is computed using measurements derived on SL without network involvement  Support UE Rx-Tx time difference measurements derived on SL-PRS to enable SL-RTT ranging  Support angle of arrival (both azimuth and zenith angles) measurements to enable SL-AoA positioning  If SL-TDoA and SL-AoD are supported, introduce RSTD, RSRP, and RSRPP measurements |
| ROBERT BOSCH GmbH | For studying sidelink positioning method (e.g., TDO, RTT, AOA/D, …) consider the relevant positioning technique (e.g., relative, ranging, or absolute) and the deployment scenario  Study sidelink positioning techniques considering both LOS and NLOS conditions  Study carrier phase based positioning for sidelink positioning techniques |
| Apple | As a first step, RAN1 should decide which of the existing Uu RAN-based positioning techniques are suitable to be re-designed for SL positioning. Candidate SL-positioning schemes are:   |  |  |  |  | | --- | --- | --- | --- | |  | DL based positioning | UL based positioning | DL and UL based positioning | | Techniques | SL-TDOA-1 (DL-like),  SL-AoD | SL-TDOA-2 (UL-like),  SL-AoA | SL-multi-cell RTT,  SL-E-CID Type positioning |   Issues to be addressed include:  Establishment of a common synchronization reference and the positioning reference UE (for TDOA based schemes) |
| Xiaomi | Round trip time measurement and measurement report exchange are supported in NR sidelink ranging. |
| Sharp | As the potential positioning methods for sidelink, whether/which of the Rel-16/17 positioning technologies are reused for sidelink positioning should be discussed |
| OPPO | OTDOA, RTT, and AoA/AoD based positioning methods should be studied for UE-based or UE-assisted absolute positioning, and RTT based and AoA/AoD based positioning methods should be studied for ranging  Measurements including RSTD, Rx-Tx time difference, SL-PRS RSRP, SL AoA/AoD, etc., could be supported depending on the positioning methods to be used in sidelink positioning. |
| Sony | Relative positioning is estimated based on received power measurement (e.g., RSRP) and/or timing measurement (e.g., TDOA). |
| Localia | Study use case, solution and impact to sidelink positioning when applying the phase-based AoA measurement method  Consider using the carrier phase method for V2V synchronization and the necessary impact on gNodeB structure. |
| Lenovo | Support SL-TDoA for satisfying the absolute positioning use cases in SL  Support the following two types of RTT methods for SL positioning:   * One-way SL-RTT * Two-way SL-RTT   Support angular-based SL positioning methods for antenna calibrated entities and fixed anchor nodes, e.g., gNBs or RSUs  RAN1 to support the SL fingerprinting method to satisfy coarse positioning techniques and to be used in conjunction with other SL positioning methods to enhance UE position estimation |
| Spreadtrum | RAN1 should consider the following positioning techniques for SL positioning: RTT based positioning, TDOA based positioning, AOA/D based positioning |
| LGE | RTT-based positioning is supported for relative SL positioning.  SL Multi-RTT positioning is supported for absolute SL positioning, regardless of the synchronization error between UEs  TDOA positioning with T-UE’s SL PRS transmission is supported for absolute SL positioning  SL TDOA positioning with S-UE’s SL PRS transmission is supported for absolute SL positioning  RSSI-based relative positioning based on the layer-1 or layer-2 service/destination ID associated to UE transmission is supported  Azimuth of arrival (AoA) and zenith of arrival (ZoA) based SL positioning is supported  Azimuth of departure (AoD) and zenith of departure (ZoD) based SL positioning is supported  SL positioning supports per-panel location estimation if UE uses multiple panels  SL synchronization procedure is performed by the UE that performs SL positioning |
| Mediatek | Slightly prefer to use the terminology of SL RTOA measurements for RTT technique under sidelink  Define the measurement types of SL RSTD, SL PRS-RSRP, SL PRS-RSRPP, SL RTOA and SL AOA |
| Intel | * + - One or more of TDoA, AoA/AoD, and RTT based positioning methods may be adapted for positioning utilizing combinations of Uu and PC5 links involving:       * multiple UEs and one or more TRPs,       * one or more UEs, and one or more RSUs, and one or more TRPs, or       * one or more UEs and one or more RSUs.     - For different positioning methods, consider support of the currently defined measurements that may include RSTD, SL-PRS-RSRP, AoD, and Rx-Tx measurements.     - AoA/ZoA measurements may also be considered for optional support, e.g., by RSUs. |
| NEC | The movement of reference points should be taken into account for the study of sidelink positioning methods including OTDOA, RTT, AOA/D, etc, especially for DL positioning.  Timing/power/AoA/AoD based positioning methods can be combined with carrier phase based positioning method to firstly used to reduce the searching space of the integer ambiguity and corresponding measurement should be conducted |
| Interdigital | Study pros and cons of RTT-based and TDOA-based positioning methods  For TDOA based positioning, study methods where the target UE transmit PRSs to anchor UEs or receive PRSs from anchor UEs  Evaluate pros and cons of angle-based positioning methods and discuss prioritization of angle based positioning methods with respect to timing based positioning methods |

Based on the submitted tdocs, and proposals summarized above, in the table below we provide a list of methods that were proposed, along with a first categorization of what is companies’ preferences:

|  |  |  |
| --- | --- | --- |
| Method | Study | Prioritize or Support |
| RTT | Nokia, FW, CEWiT, OPPO, Apple, Spreadtrum, IDC | QC, HW, DCM, CATT, vivo, CMCC, Xiaomi, Lenovo, LGE, MTK |
| AoA | Nokia, FW, CEWiT, OPPO, Apple, Spreadtrum, IDC | QC, HW, CATT, vivo, LGE, MTK |
| TDOA | QC, Nokia, FW, DCM, DCM, CEWiT, CATT, OPPO, Apple, Spreadtrum, IDC | HW, CMCC, Localia, Lenovo, LGE, MTK |
| AoD | QC, Nokia, FW, CEWiT, OPPO, Apple, Spreadtrum, IDC | LGE, MTK(?) |
| “E-CID-like for SL ” | Apple | Lenovo, LGE |
| Carrier phase Positioning | Localia, NEC, Bosch, Samsung |  |

Based on the above, the following proposal is made:

##### [CLOSED] Feature Lead Proposal 3.1-v0

With regards to the Positioning methods supported using SL measurements study further the following methods:

* + SL-RTT
    - Study both single-sided (also known as one-way) and double-sided (also known as two-way) RTT
  + SL-AoA
    - Include both Azimuth of arrival (AoA) and zenith of arrival (ZoA) in the study
  + SL-TDOA
    - Consider synchronization error(s) between UEs and any mechanisms/procedures to address this
  + SL-AoD
    - Corresponds to a method where RSRP and/or RSPPP measurements similar to the DL-AoD method in Uu.
    - Include both Azimuth of departure (AoD) and zenith of departure (ZoD) in the study
  + A positioning method that uses existing SL measurements (e.g. RSSI, RSRP), destination/source IDs information, zone-ID information, etc, may be used.
  + Carrier phase positioning for Sidelink Positioning
* Consider in the study at least the following aspects:
  + Definition(s) of the corresponding SL measurements for each method
  + Which method is applicable to absolute or relative positioning or ranging, including whether such categorization is needed to be discussed.
  + For angle-based methods, antenna configuration consideration(s) using practical UE capabilities
  + Per-panel location estimation if UE uses multiple panels
* Note: The above categorization does not necessarily mean that there will be separate SL positioning methods specified, or whether there will be a unified SL Positioning method.

##### Companies views

|  |  |
| --- | --- |
| vivo | On the study of carrier phase for sidelink, it’s not clear to us how we can proceed on this for sidelink given carrier phase for NR positioning is studied in another agenda. We prefer not to consider it for sidelink before the details of it is clear based on the study of another agenda. |
| CATT | Support including the carrier phase positioning in the proposal.  Since the carrier phase positioning had been studied in Rel-18, we prefer to study the solution the evaluation the performance of carrier phase positioning in sidelink positioning, in order to improve the accuracy of sidelink positioning. |
| MTK | Similar view as vivo, not to consider carrier phase measurement for sidelink now |
| Fraunhofer | The phase measurements can provide information to achieve the SL relative velocity requirements, hence we support the bullet independent from the discussions in 9.5.2 |
| ZTE | For the specification of carrier phase based positioning, UE’s initial located is obtained through TOA/TDOA/AOA/AOD. We think whether carrier phase measurement is an independent positioning method or is configured under each legacy positioning method as an enhancement should be firstly discussed. |
| Huawei, HiSilicon | Share the view that CPP should be firstly discussed in AI9.5.2.2 in general so should be deleted from this proposal.  Not sure how destination/source IDs information is relevant to positioning methods.  Study positioning methods considering the UE’s mobility in V2X scenario, as the UE’s displacement (e.g. compared to the distance to an RSU) may be non-negligible in SL positioning compared to Uu positioning. |
| Spreadtrum | Considering carrier phase for NR positioning is studied in another agenda, we also think that it's a little premature to discuss carrier phase positioning for sidelink positioning now. |
| InterDigital | We agree with vivo and others and phase error measurement should be at least down prioritized for SL positioning.  We also suggest to study what roles a SL node, e.g., a UE or RSU will perform in each method in terms of configuring, coordinating, performing and reporting the related measurement. Thus, we propose to add an aspect to the study, as proposed below.  ….   * Consider in the study at least the following aspects:   + Definition(s) of the corresponding SL measurements for each method   + Which method is applicable to absolute or relative positioning or ranging, including whether such categorization is needed to be discussed.   + For angle-based methods, antenna configuration consideration(s) using practical UE capabilities   + Per-panel location estimation if UE uses multiple panels   + Identification of the role of SL nodes participating in each method (e.g., target UE, anchor UE, RSU, etc.,) and interaction/coordination between the nodes to perform the related measurements.   …. |
| Futurewei | Carrier phase is the subject of another AI, and we prefer not to consider it here now. We are OK considering E-CID-like for SL, for instance based on S-SSB measurements. |
| CMCC | We are open for studying all of the methods except the carrier phase positioning, at least this should be suspended until more outcomes have been achieved in the parallel sub-adgenda for Uu carrier phase positioning. |
| NEC | **Comment 1**: Considering the limited band of ITS for V2X, carrier phase based positioning should be considered to achieve improved accuracy.  Comment 2: Suggest removing sub-bullet for SL-TDOA since it is not a method but factors to consider when designing the method. |
| Sony | We are OK with the proposed scope above. Carrier phase positioning should be discussed in another AI. It may be discussed in the context of sidelink positioning at later stage (subject to RANP approval). |
| OPPO | We share the view as others that carrier phase positioning is being studies in another agenda, the concrete solution for this method is far from clear now. If considered in this agenda, we need to consider the possibilities that may happen in carrerier phase positioning when design the solutions for SL-positioning, it would slow down the progress dramatically.  And, we also do not understand how to use “SL measurements (e.g. RSSI, RSRP), destination/source IDs information, zone-ID information” as independent positioning method to meet the accuracy requirements considered in this item. Furthermore, it seems desirable if we can keep the methods list a bit shorter from working load perspective.  So, maybe we can only keep SL-RTT, SL-AoA, SL-TDOA, and SL-AoD in the list, and up to companies to study other methods. |
| Lenovo | Support the FL’s proposal as a starting point of discussions. Share the view with companies, that the carrier phase technique needs to be first studied in the parallel agenda. |
| Apple | Okay with above scope. Agree that carrier phase positioning should be postponed. |
| Locaila | In order to meet the positioning accuracy requirements in limited bandwidth, a study on Carrier Phase Positioning is required. |
| Samsung | OK for the direction of proposal 3-1 in general.  We suggest the following modification as  Note: ~~A~~ positioning methods ~~that uses~~ may reuse existing SL measurements (e.g. RSSI, RSRP), destination/source IDs information, zone-ID information~~, etc, may be used~~  Per-panel location estimation or (pre-)configuration if UE uses multiple panels |
| Qualcomm | We’re ok with the proposal. We share the view to study carrier phase in the other AI first before sidelink. |
| DCM | OK with the proposal. We also are not sure carrier phase positioning should be included. |
| LGE | We share the view with other companies that carrier phase measurement for SL positioning can be considered after study in UU link based positioning. Other parts of the proposal is ok for us. |
| Sharp | We prefer to focus on existing Rel-16/17 positioning mehods for the enhancement on sidelink and it may be premature to study carrier phase positioning now. |
| Xiaomi | We share the view that carrier phase shall be studied in other agenda first. We are open to study other positioning methods. |
| Philips | Would prefer to keep carrier phase positioning for improved accuracy in a narrow bandwidth. |
| Nokia, NSB | Carrier phase methods for NR positioning are being studied as part of A.I. 9.5.2.2, it may be premature to include them here already. |
| Ericsson | We agree with other companies on not including carrier phase at this stage.  For positioning methods in-coverage scenario, TRPs should be involved as point of references. The SL measurements should be combined with TRP based measurements for absolute positioning of UEs. |
| Intel | Mostly fine with the FL proposal, except, as others have pointed out, CPP should be removed for now.  Also, we support changes suggested by Samsung to make the bullet above CPP as a note. |

##### FL Observations

Seems overall there is good convergence on most of the methods to be studied, except the carrier phase for Sidelink. In short, with regards to this topic, we observe the following:

|  |
| --- |
| In favor of keeping in the study related to this subagenda the carrier phase for Sidelink:   * CATT, Fraunhofer, NEC, Localia, Samsung, Philips (6)   Against/concerns/low-priority keeping in the study related to this subagenda the carrier phase for Sidelink:   * Vivo, MTK, ZTE, Huawei, HiSilicon, Spreadtrum, Interdigital, Futurewei, CMCC, Sony, OPPO, Lenovo, Apple, Qualcomm, NTT DOCOMO, LGE, Sharp, Xiaomi, Nokia, NSB, Ericsson, Intel (19) |

There is majority support to not consider the carrier phase in this study, for several reasons described in the companies responses. In an attempt to find a way forward, my suggestion is the following:

* Note: When the study of carrier phase positioning and the evaluations of sidelink positioning have progressed, it can be reviewed whether carrier phase for sidelink can be considered in further work. Checkpoint at RAN1#110-e-Bis to see if sufficient information is available for this review.

With regards to additional modifications suggested by individual companies, the FL makes the following observation:

* Huawei, HiSilicon suggested to remove “destination/source IDs information”.
  + Since this method has “e.g.”, if a company thinks that this information could be useful, they could provide their analysis in net meeting. So my suggestion is to remove it.
* Huawei, HiSilicon suggested to add to consider UE’s mobility.
  + It is a reasonable consideration to be included.
* Interdigital suggested to include the following: Identification of the role of SL nodes participating in each method (e.g., target UE, anchor UE, RSU, etc.,) and interaction/coordination between the nodes to perform the related measurements.
  + It may indeed be useful for companies to provide a description of what they envision from each method with regards to how the SL devices interact.
* NEC “Suggest removing sub-bullet for SL-TDOA since it is not a method but factors to consider when designing the method.”
  + As as FL i am adding it in the bullet of what to consider, since many companies, in their Tdoc, pointed out that this may be a main issue that needs to be discussed.
* OPPO and Samsung commented on the 4th method:
  + OPPO: “And, we also do not understand how to use “SL measurements (e.g. RSSI, RSRP), destination/source IDs information, zone-ID information” as independent positioning method to meet the accuracy requirements considered in this item. Furthermore, it seems desirable if we can keep the methods list a bit shorter from working load perspective. So, maybe we can only keep SL-RTT, SL-AoA, SL-TDOA, and SL-AoD in the list, and up to companies to study other methods.
  + Samsung: “Note: ~~A~~ positioning methods ~~that uses~~ may reuse existing SL measurements (e.g. RSSI, RSRP), destination/source IDs information, zone-ID information~~, etc, may be used~~“
    - This may be a focus topic that we could take up in the 2nd round of discussion. For now i keep it since most companies showed interest in this method.
* Samsung also suggested the following change: “Per-panel location estimation or (pre-)configuration if UE uses multiple panels”
  + However, it is unclear to me what was Samsung’s intention.

##### [CLOSED] Feature Lead Proposal 3.1-v1

With regards to the Positioning methods supported using SL measurements study further the following methods:

* + SL-RTT
    - Study both single-sided (also known as one-way) and double-sided (also known as two-way) RTT
  + SL-AoA
    - Include both Azimuth of arrival (AoA) and zenith of arrival (ZoA) in the study
  + SL-TDOA
  + SL-AoD
    - Corresponds to a method where RSRP and/or RSPPP measurements similar to the DL-AoD method in Uu.
    - Include both Azimuth of departure (AoD) and zenith of departure (ZoD) in the study
  + ~~Carrier phase positioning for Sidelink Positioning~~
  + A positioning method that uses existing SL measurements (e.g. RSSI, RSRP), ~~destination/source IDs information~~, zone-ID information, etc, may be used.
* Consider in the study at least the following aspects:
  + Definition(s) of the corresponding SL measurements for each method
  + Which method is applicable to absolute or relative positioning or ranging, including whether such categorization is needed to be discussed.
  + For angle-based methods, antenna configuration consideration(s) using practical UE capabilities
  + Per-panel location estimation if UE uses multiple panels
  + UE’s mobility, especially for V2X scenarios
  + For SL-TDOA, synchronization error(s) between UEs and any mechanisms/procedures to address it
* Note: The above categorization does not necessarily mean that there will be separate SL positioning methods specified, or whether there will be a unified SL Positioning method.
* Note: When the study of carrier phase positioning and the evaluations of sidelink positioning have progressed, it can be reviewed whether carrier phase for sidelink can be considered in further work. Checkpoint at RAN1#110-e-Bis to see if sufficient information is available for this review.
* Note: Companies are encouraged to describe the role of SL nodes and their interaction/coordination participating in each method.

Companies are encouraged to reply if they support the above proposal, and specifically, provide arguments in favor or against keeping the following subbulet together with the SL-RTT, SL-AoA, SL-TDOA, SL-AoD bullets:

* + A positioning method that uses existing SL measurements (e.g. RSSI, RSRP), ~~destination/source IDs information~~, zone-ID information, etc, may be used.

##### Companies views

|  |  |
| --- | --- |
| vivo | We support this proposal in principle.  On the sub-bullet “A positioning method that uses existing SL measurements (e.g. RSSI, RSRP), ~~destination/source IDs information~~, zone-ID information, etc, may be used.”, we prefer not to have it. We don’t think zone-ID information with RSRP can providing positioning accaury to meet the performance target. |
| Futurewei | OK in principle. For SL-RTT we prefer not exclude “multi-RTT” at this stage. It should be added to first sub-bullet. For “SL-TDOA, synchronization error(s) between UEs and any mechanisms/procedures to address it” is not clear if the goal is to improve synchronization or to mitigate the synchronization error impact on positioning errors. Suggest changing to:  “SL-TDOA, synchronization error(s) between UEs impact on positioning accuracy, and any mechanisms/procedures to address it” |
| InterDigital | We support the proposal.  We are in favor of keeping the sub-bullet listed above, as in our view it is beneficial to at least assess the accuracy of a SL location information derived from Zone ID and determine if it can be a R18 candidate SL positioning method. |
| Samsung | If controversial, we think that the following bullet can be removed. According to the part marked in red, it is not important to capture.   * + A positioning method that uses existing SL measurements (e.g. RSSI, RSRP), ~~destination/source IDs information~~, zone-ID information, etc, may be used.   In addition, for our previous comment, the location of each panel can be provided (pre-)configured in case of multiple panels |
| LGE | We prefer to keep source/destination ID to be used for SL positioning. Based on the source/destination ID, UE can decide whether or not to participate in SL positioning that is initated by other UE. If source/destination ID is related to the positioning service of interest, UE can join the SL positioning for example.   * + A positioning method that uses existing SL measurements (e.g. RSSI, RSRP), destination/source IDs information, zone-ID information, etc, may be used.   In addition, We prefer to add UE-ID based SL positioning, as something similar to E-CID in NR positioning. For example, ranging can be performed with reference to UE-type RSU in SL positioning. The source/destination ID can also be used for UE-ID based SL positioning.   * + UE-ID |
| LGE(2) | Add the following comments.  Considering the synchronization impact on the SL TDOA, we suggest to add multi-RTT for absolute SL positioning, which is at least free from the timing offset between UEs.   * + SL-RTT/SL multi-RTT |
| Xiaomi | We are generally fine with the proposal.  On the subbullet “For SL-TDOA, synchronization error(s) between UEs and any mechanisms/procedures to address it”, we think the impact of synchronization error among UEs shall be considered not only for SL-TDOA, but also for SL RTT solutions.  We are open on whethe to keep the sub-bullet on reusing SL measurement. |
| DCM | OK with the proposal.  OK to keep the bullet asked by FL; may be used, may not. It can be studied. |
| NEC | Generally OK  For carrier phase based positioning, maybe we can put it as FFS and with the note I guess it is clear what to do in the next meetings.  For the sub-bullet listed above, we think it needs further discussion so maybe FFS as well. |
| Sharp | Support the FL proposal. |
| CMCC | We support this proposal.  For the sub-bullet “A positioning method that uses existing SL measurements (e.g. RSSI, RSRP), ~~destination/source IDs information~~, zone-ID information, etc, may be used.” We think at least this cannot be used as a standalone method to achieve the positioning accuracy requirement because only roughly position information can be provided by it, but we are open to study it as a complementary method to others. |
| CATT | We support to keep destination/source IDs information in the proposal.  In Rel-16 V2X, 16-bits destination ID and 8-bits source ID are carried by SCI format 2-A to identify the destination UE and source UE and they are widely used in sidelink communications. Regarding sidelink positioning, we see the benefits of positioning node selection and SL-PRS resource allocation from the introduction of destination ID and source ID. For example, if we use RSU to transmit the SL-PRS, the RSU\_ID will be the source ID for the SL-PRS from the RSU. |
| OPPO | We are basically fine with the proposal.  As to the sub-bullet asked by FL, we think at least “zone-ID information” should be removed, based on the current specification, Zone-ID is determined based on UE’s geographical coordinates, the UE with known geo-location is not a target of SL positioning. |
| Lenovo | Support the FL’s revised proposal, we prefer to keep the zone-ID informationa at this stage for further study. From our side, the overall intentaion of using SL RSS measurements is to support the main pos. techniques in the proposal and to meet the coarse accuracy requirements. No strong view on the inclusion of destination/source ID information, but since it’s a study open to keep it. |
| Nokia, NSB | OK; regarding subbullet on “A positioning method that uses existing SL measurements … ”, fine to study it. |
| Huawei, HiSilicon | OK. |
| Ericsson | To manage scope of the SI, we think SL-RTT and SL-AoA should be prioritized. These are the most promising and least complex methods. As pointed out by companies in their contributions, SL-TDOA will require synchronization among anchor UEs.  We suggest to remove the following bullet:  o ~~For SL-TDOA, synchronization error(s) between UEs and any mechanisms/procedures to address it~~  TDOA based positioning can be achieved in many ways even including the SL nodes. Improving time sync among UEs is out of scope of the study in our view. So we have concern including this bullet. Such isssues can be addressed in a future release.  For ‘zone-ID information’, we sympathize with the comment from OPPO. |
| ZTE | We support Proposal 3.1-v1 in principle.  (1) In our understanding, we should prioritize the study for SL-RTT, SL-AoA, SL-TDOA, SL-AoD and the zone-ID information etc can be used as assistance measurement information. Therefore, we propose to put the following bullets to FFS or change it as a subbullet under “Consider in the study at least the following aspects:”   * + A positioning method that uses existing SL measurements (e.g. RSSI, RSRP), ~~destination/source IDs information~~, zone-ID information, etc, may be used.   (2) Study of UE’s mobility can be quite difficult and time-consuming, we prefer to come back to this issue after general design of SL positioning is completed. But anyway we can accept it as one potential study point. |
| Philips | Agree with the proposal. |
| Intel | OK |
| Qualcomm | Ok with the proposal |

##### FL Observations

Remove the Subbulet / Put as FFS

* Vivo, Samsung, NEC

Keep the subbulet OR agree with the proposal overall

* Interdigital, DCM, Nokia, NSB, Huawei, HiSilicon, Lenovo, Philips, Intel, Qualcomm

Study the method described in the subbulet as complementary to other methods

* CMCC

@Futurewei: Added mRTT. Removed

@Samsung: Added in brackets the suggested change. Other companies haven’t commented on it.

@Futurewei: With regards to the subbulet, making it as one of the “considerations” may be a compromised proposal, please see below

@Ericsson: With regards to the bullet on synchronization, what if we just say “consider the impact of synchronization error between UEs”, without explicitly including mechanism/procedures to address it? With regards to explicitly saying that we “prioritize” SL-RTT and SL-AoA over TDOA/AoD, i don’t think it will help with stabilizing the proposal for the first checkpoint. As seen in the papers, there were a lot o companies that wanted to study TDOA and AoD.

Based on the above we make the following updated proposal:

##### [CLOSED] Feature Lead Proposal 3.1-v2

With regards to the Positioning methods supported using SL measurements study further the following methods:

* + SL-RTT / SL multi-RTT
    - Study both single-sided (also known as one-way) and double-sided (also known as two-way) RTT
  + SL-AoA
    - Include both Azimuth of arrival (AoA) and zenith of arrival (ZoA) in the study
  + SL-TDOA
  + SL-AoD
    - Corresponds to a method where RSRP and/or RSPPP measurements similar to the DL-AoD method in Uu.
    - Include both Azimuth of departure (AoD) and zenith of departure (ZoD) in the study
  + ~~A positioning method that uses existing SL measurements (e.g. RSSI, RSRP), zone-ID information, etc, may be used.~~
* Consider in the study at least the following aspects:
  + Definition(s) of the corresponding SL measurements for each method
  + Which method is applicable to absolute or relative positioning or ranging, including whether such categorization is needed to be discussed.
  + For angle-based methods, antenna configuration consideration(s) using practical UE capabilities
  + Per-panel location estimation, [or (pre-)configuration] if UE uses multiple panels
  + UE’s mobility, especially for V2X scenarios
  + ~~For SL-TDOA,~~ Impact ofsynchronization error(s) between UEs ~~and any mechanisms/procedures to address it~~
  + ~~A positioning method that~~ Use of existing SL measurements (e.g. RSSI, RSRP), [destination/source IDs information], [zone-ID information], UE-ID(s), etc, ~~may be used~~.
* Note: The above categorization does not necessarily mean that there will be separate SL positioning methods specified, or whether there will be a unified SL Positioning method.
* Note: When the study of carrier phase positioning and the evaluations of sidelink positioning have progressed, it can be reviewed whether carrier phase for sidelink can be considered in further work. Checkpoint at RAN1#110-e-Bis to see if sufficient information is available for this review.
* Note: Companies are encouraged to describe the role of SL nodes and their interaction/coordination participating in each method.

Please comment if you have strong views in removing the elements in the brackets in the above proposal, and if yes why.

##### Companies views

|  |  |
| --- | --- |
| MTK | 1, We are general okay for the above proposal by FL |
| CMCC | Comments.  Firstly, what does “[or (pre-)configuration]” mean in the forth sub-bullet under the second bullet should be further clarified.  Secondly, we prefer to keep the [zone-ID information] since zone-ID is only a roughly position information from our understanding. A UE may only have zone\_ID information but no more precise location information, so it may still need to do further positioning by the scheme designed in Rel-18. |
| CATT | We support to keep the [destination/source IDs information] and [zone-ID information] in the proposal.  In Rel-16 V2X, 16-bits destination ID and 8-bits source ID are carried by SCI format 2-A to identify the destination UE and source UE and they are widely used in sidelink communications. Regarding sidelink positioning, we see the benefits of positioning node selection and SL-PRS resource allocation from the introduction of destination ID and source ID. For example, if we use RSU to transmit the SL-PRS, the RSU\_ID will be the source ID for the SL-PRS from the RSU.  Regarding [or (pre-)configuration], we are fine to remove it. |
| ZTE | Support in general.  1. We also don’t get why “[or (pre-)configuration]” is needed.  2. For the sentence “[destination/source IDs information], [zone-ID information]”, we are fine with or without brackets as long as they are included in “Consider in the study at least the following aspects”. |
| OPPO | We also do not understand why “[or (pre-)configuration]” was added the its meaning.  “[zone-ID information]” should be removed, as zone-ID calculation defined in 38.331 is based on distance in longitude/latitude between UE's **current location** and geographical coordinates (0, 0), or the zone-ID being discussed here is not the same as what specified in current 38.331?  “[destination/source IDs information]” should be removed, as it has aleady been covered by “UE-ID(s)”. |
| Fraunhofer | Support in principle.  Comments:   * Isnt “SL-RTT” part of “SL multi-RTT” ? * Agree that “pre-configuration” needs clarification |
| LGE | we support to keep the following sub-bullet.   * + ~~A positioning method that~~ Use of existing SL measurements (e.g. RSSI, RSRP), [destination/source IDs information], [zone-ID information], UE-ID(s), etc, ~~may be used~~.   Similar to E-CID in Uu link positioning, ID-based ranging can also be used for SL positioning. Which ID can be used for this purpose is for further study, including source/destination ID, zone-ID and any unique UE-ID. Source/destination ID or any unique UE-ID can be used as an anchor UE, or used for determining whether or not to participate in the SL positioning service of interest.  We agree that zone-ID cannot meet the high positioning accuracy requirement, but it certainly provide a rough information at least, which can be used for initial acquisition of position or for eliminating any ambiguity of other SL positioning, for example. |
| Xiaomi | We are fine with the proposal. We also think “[or (pre-)configuration]” part shall be clarified or deleted. |
| vivo | We prepfer to keep “SL RTT/SL M-RTT”.  On the sentence, our suggestion is below.   * + ~~A positioning method that~~ Use of existing SL measurements (e.g. RSSI, RSRP), and UE ID information (e.g. ~~[~~destination/source IDs information~~]~~, ~~[~~zone-ID information~~]~~, UE-ID(s)), etc, ~~may be used~~. |
| NEC | Support |
| Lenovo | Support FL’s proposal, we have a strong preference to keep zone-ID information and open to keep source/destination ID information. |
| InterDigital | We support the proposal in principle with comments below:  1. We would like a further clarification for the reasoning to adding “[or (pre-)configuration]”.  2. We consider on SL the information [destination/source IDs information] and UE-ID(s) are identical for a UE and former we understand covers also RSU. So we suggest to modify the wording to [destination/source IDs information of SL node(s) partipcating the SL positioning].  3. We agree with including [zone-ID information]. As suggested by OPPO, a UE derives a Zone ID based on GNSS information, but in our view, as Zone ID information is an exising location information at lower layer signaling (i.e. SCI), it is beneficial to study such a low-latency indication of a UE’s position to other UE(s) in certain applications. |
| Futurewei | Support in principle |
| Intel | Support in general. Prefer to remove as also suggested by others.  For the bullet on “miscellaneous considerations”, we also think that destination/source ID information and zone-ID information should be considered. |
| Qualcomm | We would be OK with the proposal after clarifying the (pre-)configuration issue identified by others. |
| Samsung | We support keeping “[or (pre-)configuration]”.  The relative position between the panels can be pre-configured rather than measured. This can assist in SL positioning |
| Spraeadtrum | We also think that “[or (pre-)configuration]” should be removed. |
| Apple | Fine with the proposal. |
| Sharp | Support the FL proposal. |
| Huawei, HiSilicon | OK |
| DCM | Same view with QC/Spreadtrum/others. |
| SONY | In general support and need to keep this sub-bullet point:   * ~~A positioning method that~~ Use of existing SL measurements (e.g. RSSI, RSRP), [destination/source IDs information], [zone-ID information], UE-ID(s), etc, ~~may be used~~. |
| Nokia, NSB | OK, but propose to remove “[or (pre-configuration)”. Regarding “or (pre-)configuration”, Samsung explained the intention, but it seems to us that this is not relevant, since “per-panel location estimation”, in our understanding does not imply that SL positioning is used to measure the position of the panels on the same vehicle relative to each other. |
| Ericsson | Compared to the previous round, we think the scope has expanded. Now, SL multi-RTT has also been added to the scope. To manage the scope, we suggest to remove SL multi-RTT and focus on unicast solutions. |

##### FL Observations

Keep zone-ID, destination/source ID:

* CMCC, CATT, ZTE, LGE, Lenovo, Intel

Remove these terms

* OPPO

Vivo suggested the following as a middle ground:

* Use of existing SL measurements (e.g. RSSI, RSRP), and UE ID information (e.g. [destination/source IDs information], [zone-ID information], UE-ID(s)), etc, may be used.

Questions the meaning/need of Per-panel location estimation, [or (pre-)configuration] if UE uses multiple panels

* MCC, CATT, ZTE, OPPO, Xiaomi, Intedigital, Qualcomm, Nokia, NTT DOCOMO

Based on the reply from Samsung the intention is to say that the relative positioning between panels may be known and could assist in SL Positioning. This is something that can be discussed as we move forward. At this stage, we should try to stabilize this specific proposal, and I prefer to not include it.

Ericsson considers that multi-RTT is an expanded scope compared to only including SL-RTT, but from Feature lead perspective, even SL-RTT was not excluding multi-RTT. There was no description that was pointing that there is difference between those 2 at this point. All remaining companies seemed OK to keep this for further discussion.

Based on the above, the latest proposal is the following:

##### [CLOSED] Feature Lead Proposal 3.1-v3

With regards to the Positioning methods supported using SL measurements study further the following methods:

* + SL-RTT / SL multi-RTT
    - Study both single-sided (also known as one-way) and double-sided (also known as two-way) RTT
  + SL-AoA
    - Include both Azimuth of arrival (AoA) and zenith of arrival (ZoA) in the study
  + SL-TDOA
  + SL-AoD
    - Corresponds to a method where RSRP and/or RSPPP measurements similar to the DL-AoD method in Uu.
    - Include both Azimuth of departure (AoD) and zenith of departure (ZoD) in the study
* Consider in the study at least the following aspects:
  + Definition(s) of the corresponding SL measurements for each method
  + Which method is applicable to absolute or relative positioning or ranging, including whether such categorization is needed to be discussed.
  + For angle-based methods, antenna configuration consideration(s) using practical UE capabilities
  + Per-panel location estimation, if UE uses multiple panels.
  + UE’s mobility, especially for V2X scenarios
  + Impact of synchronization error(s) between UEs
  + Use of existing SL measurements (e.g. RSSI, RSRP), and UE ID information (e.g. destination/source IDs information, zone-ID information, other UE-ID(s)), etc, may be used.
* Note: The above categorization does not necessarily mean that there will be separate SL positioning methods specified, or whether there will be a unified SL Positioning method.
* Note: When the study of carrier phase positioning and the evaluations of sidelink positioning have progressed, it can be reviewed whether carrier phase for sidelink can be considered in further work. Checkpoint at RAN1#110-e-Bis to see if sufficient information is available for this review.
* Note: Companies are encouraged to describe the role of SL nodes and their interaction/coordination participating in each method.

There was a wrong copy/paste from my side and 2 Notes that were stable in the Proposal 3.1-v3 that we just discussed online, were not copied over since they were appearing on a different page in the summary. These Notes were considered stable during the last Round of Email Discussion and should have been captured in the Proposal and correspondingly in the agreement.

##### [EMAIL ENDORSEMENT] Feature Lead Proposal 3.1-v4

Include the following 2 Notes in the agreement that was made in the 9.5.1.3 subagenda during the GTW session of 05/17/2022:

* Note: When the study of carrier phase positioning and the evaluations of sidelink positioning have progressed, it can be reviewed whether carrier phase for sidelink can be considered in further work. Checkpoint at RAN1#110-e-Bis to see if sufficient information is available for this review.
* Note: Companies are encouraged to describe the role of SL nodes and their interaction/coordination participating in each method.

## Joint SL and Uu Positioning

Based on the submitted contributions, the following statements/proposals are identified to be related to the sub-topc of Joint SL & Uu Positioning:

|  |  |
| --- | --- |
| Futurewei | For position determination SL UE should support the aggregation of DL PRS resources with SL positioning resources |
| Nokia, NSB | Besides offering a standalone positioning solution, SL can be also utilized to enhance or offload Uu-based positioning, or simply offload Uu control signaling for positioning purposes via SL communications. |
| NTT DOCOMO | * Study whether SL-positioning can use Uu measurement or not.   + If supported, some UE in SL-positioning method can be replaced to gNB. * Study availability of Uu positioning instead of SL-positioning in use cases assumed for SL-positioning.   + If available, study priority order between Uu positioning and SL positioning and detailed procedure. |
| Fraunhofer IIS, Fraunhofer HHI | Integrate the reporting of sidelink measurements into the reporting framework for DL-TDOA, UL-TDOA and multi-RTT based positioning |
| vivo | Prioritize sidelink-based positioning. The combination of SL positioning with Uu positioning is of low priority. |
| CMCC | Joint scheme b/w NR Uu and SL positioning can be considered to facilitate the positioning accuracy performance. |
| Qualcomm | From RAN1 perspective, joint SL/Uu positioning corresponds to a positioning mode wherein at least one of the UEs performs SL positioning/ranging measurements and location/range is computed using measurements derived on both SL and Uu. |
| ROBERT BOSCH GmbH | Study possible mechanisms combing sidelink and Uu positioning and study whether this combination requires any RAN impacts. |
| Apple | Hybrid SL positioning with a mix of gNBs and SL-UEs in the positioning candidate set should also be considered. |
| Sony | Support hybrid positioning where the UE receives reference signal for positioning from both direct-link (Uu) and sidelink (PC5) and jointly utilize for positioning estimation purpose. |
| Lenovo | RAN1 to support hybrid positioning under the following models:   * Hybrid Positioning Model A - Hybrid positioning using hybrid interfaces including the support of Uu and SL measurements for SL position calculation. * Hybrid Positioning Model B - Hybrid positioning using hybrid technologies including the support of RAT-dependent and RAT-independent methods for SL position calculation. |
| Ericsson | Hybrid ranging involving gNBs and UEs should be studied |

Based on the submitted tdocs, and proposals summarized above, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 3.2-v0

For in-coverage and partial-coverage scenarios, study hybrid positioning methods wherein one or more of UE(s) perform SL measurements and position/ranging is estimated using measurements derived on both SL and Uu positioning. Include in the study at least the following aspects:

* What incremental change(s) on top of SL-only Positioning/ranging, if any, are needed
* Whether Uu positioning includes both RAT dependent and RAT-independent methods

##### Companies views

|  |  |
| --- | --- |
| vivo | We’re okay to study hybrid positioning.  However, a couple of points we’d like to make/emphasize  1. priority of study on SL-only positioning/ranging is still needed given we need to cover out of coverage case which hybrid positioning cannot address. Furthermore, it’s not possible to identify incremental change(s) if we don’t know the details of SL-only positioning.  2. different design aspects on top of SL-only positioning/ranging should be avoided as much as possible. Otherwise, we have concerns on the design complexity of SL-PRS and other aspects on protocol/procedure etc. |
| CATT | In Rel-18, we prefer to prioritize the sidelink positioning only and low priority for hybrid positioning, since we should first specify the sidelink positioning, then consider to support the hybrid methods.  In addition, we prefer to focus on in-coverage scenario for the hybrid positioning methods, if we want to support the hybrid methods. |
| ZTE | We agree with studying hybrid positioning methods but the solutions for SL positioning should firstly be specified. Since all or part of the UEs are inside the network coverage for in-coverage and partial coverage scenarios, we can consider hybrid positioning method combining SL positioning with other RAT dependent positioning (e.g. Uu based positioning) to improve positioning accuracy and study its potential specification impacts. |
| Huawei, HiSilicon | Fine to study in general. However, we also view that positioning based on sidelink purely should be looked into firstly. Only after having a design for SL positioning, can it be evaluated whether incremental changes are needed on top.  One question for clarification is why should RAT-independent methods be considered as Uu positioning and we think it should be out of scope from SID. |
| Spreadtrum | We are fine to study hybrid positioning methods. |
| InterDigital | The study for hybrid positioning should be down-prioritized. When Uu positioning measurements is available, it is conceivable that additional SL measurement provides certain level of improvement of positioning accuracy. But in our view, this is a secondary use case for SL-based positioning. It is more important to study and develop SL-only positioning solutions when Uu positioning is not available or severely impaired. It can be evaluated later on (if time allows) if the developed SL-only positiong solutions when used together with Uu positiong measurements will improvie positioning performance. |
| Futurewei | We support the study of hybrid positioning methods. We prefer to focus on the RAT-dependent solutions. |
| CMCC | “Sidelink positioning only” case should be studied first, otherwise, it is not clear how to support hybrid positioning methods. For the hybrid positioning methods, we also prefer to study in-coverage scenario first then move on to partial coverage case if there is remaining time budget, then main intention is to focus on the fundamental coverage scenarios and simplify the design workload. |
| NEC | We think hybrid and SL positioning are with equal importance. In addition, we suggest removing sub-bullet 2 since RAT-independent methods have no RAN1 impacts. |
| Sony | We support to study hybrid positioning and we prefer to only consider RAT-dependent (at least from RAN1 point of view). |
| OPPO | We support to further study the hybrid positioning methods, we believe it is an important feature to improve the accuracy of 3GPP based positioning, and SL-positioning and Uu-based positioning complement each other should be a more popular scenario than SL only or Uu only positioning in practice. Furthermore, we also think only RAT-dependent solution should be considered in this item. |
| Lenovo | Generally supportive of the overall proposal regarding Hybrid positioning. At this stage, it may not be clear if there will be any incremental/major changes on top of the SL-only pos. solution. On bullet 2, not sure if there is a typo, instead of Uu, should it rather be SL? Since Uu already supports RAT-dependent and RAT-independent methods. |
| Apple | Supportive of the proposal |
| Locaila | Support the study of hybrid positioning. |
| Samsung | OK for the direction of proposal 3-2 in general |
| Qualcomm | We support the proposal. Hybrid methods are an important feature to futher improve positioning accuracy. We also share the view to focus on RAT-depedent solutions at this stage. |
| DCM | We support the proposal in general. In addition, how to decide which mechanism from SL-only positioning / hybrid positioning / Uu-only positioning is selected should be added as another sub-bullet. |
| LGE | We also share the view with other companies that stand-alone SL positioning should be prioritized to hybrid positioning. In addition, stand-alone SL positioning should be available regardless of the network coverage. |
| Sharp | Although we are generally OK to study hybrid positioning, we would like to prioritize to study sidelink-based positioning first. |
| xiaomi | We are supportive to study hybrid solutions, but think the study on SL stand-alone positioning shall be prioritized at this stage. |
| Philips | Similar to others, we are ok to study hybrid positioning, but think that SL stand-alone positioning should be prioritized in this initial phase. |
| Nokia, NSB | OK, but we prefer to focus on SL standalone |
| Ericsson | We do not agree that SL stand-along positioning should be prioritized over hybrid positioning.  In our view, Hybrid positioning should have the same priority as SL stand-alone positioning.  Furthermore, we do not agree with the bullet on ‘incremental changes’. Rather the objective should be to study SL+UU based hybrid positioning. So we suggest to remove the sub-bullet on incremental changes.  For in-coverage scenario, UE assisted network based SL+Uu hybrid positioning should be studied. The objective should include hybrid ranging and hybrid positioning. |
| Intel | We are supportive of studying hybrid UU+PC5 schemes. Further, we prefer to limit to RAT-dependent solutions – this is also consistent with the views from companies in AI 9.5.1.1. |

##### FL Observations

Seems all companies are OK to study hybrid positioning, but 10 out 23 companies explicitly say that it should be lower priority than SL-only Positioning. Specifically, the split is as follows:

* OK to study Hybrid Positioning, but SL positioning should be first looked into / prioritized over hybrid
  + Vivo, CATT, ZTE, Huawei, HiSilicon, Interdigital, CMCC, LGE, Sharp, Xiaomi, Philips, Nokia, NSB (10)
* OK with the proposal as is OR OK to study Hybrid Positioning OR equal importance between hybrid and SL Positioning
  + Spreadtrum, Futurewei, NEC, Sony, OPPO, Lenovo, Apple, Localia, Samsung, Qualcomm, NTT DOCOMO, Ericsson, Intel (14)

It was also pointed out by several companies that “”Uu Positioning” should correspond to “RAT dependent methods” as shown in the SID:

* + Study of positioning methods (e.g. TDOA, RTT, AOA/D, etc) including combination of SL positioning measurements with other RAT dependent positioning measurements (e.g. Uu based measurements) [RAN1]

Finally, at least one company pointed out that we could focus this proposal on the in-coverage cases.

Based on the above, the revised proposal is the following:

##### [CLOSED] Feature Lead Proposal 3.2-v1

At least for in-coverage ~~and partial-coverage~~ scenarios, study hybrid positioning methods wherein one or more of UE(s) perform SL measurements and position/ranging is estimated using measurements derived on both SL and Uu positioning. ~~Include in the study at least the following aspects:~~

* Note: Companies are encouraged to focus their study on the solutions for standalone SL positioning, while providing information on any change(s) needed in their solutions for enabling hybrid positioning.
* Note: Uu positioning corresponds to RAT dependent methods

##### Companies views

|  |  |
| --- | --- |
| vivo | OK |
| Futurewei | Support. The main text is a little unclear. Suggest a comma before “and” in the main text, and replacing “derived on both SL and Uu positioning” with “on both SL and Uu interfaces” |
| Samsung | OK |
| LGE | Counting of supporting/not supporting companies seems incorrect. If we count based on FL observations, the first option of prioritization on SL positioning-only counts as 14, and the second option of hybrid positioning counts as 12 (equal priority(NEC) was counted to both optoins). Thus, the main bullet and the sub-bullet needs to be changed. We propose the following.  Regardless of the network coverage, study first the stand-alone SL positioning, wherein positioning/randing is estimated using the measurements derived on SL positioning only   * At least for in-coverage ~~and partial-coverage~~ scenarios, study hybrid positioning methods wherein one or more of UE(s) perform SL measurements and position/ranging is estimated using measurements derived on both SL and Uu positioning. ~~Include in the study at least the following aspects:~~ * Note: Companies are encouraged to focus their study on the solutions for standalone SL positioning, while providing information on any change(s) needed in their solutions for enabling hybrid positioning. * Note: Uu positioning corresponds to RAT dependent methods |
| Xiaomi | Support. |
| NEC | OK but we think this issue should also be marked as HIGH. Minor editorial comment as follows,  ‘At least for in-coverage ~~and partial-coverage~~ scenarios’ 🡪 ‘At least for in-coverage ~~and partial-coverage~~ scenario~~s~~’ |
| Sharp | Support |
| CMCC | OK |
| CATT | We prefer to first focus on the standalone SL positioning, including the postioning methods and measurements for standalone SL positioning. hybrid positioning methods should be low priority, since it only work in in-coverage scenario.  We are fine with LGE’s revision above. |
| OPPO | Support. |
| Nokia, NSB | OK |
| Huawei, HiSilicon | OK. |
| ZTE | Support. |
| Philips | OK |
| Intel | Support. |
| InterDigital | We support the proposal |
| Qualcomm | Support |

##### FL Observations

Support current proposal as is or with minor modifications

* Vivo, Futurewei, Samsung, Xiaomi, NEC, Support, CMCC, OPPO, Nokia, NSB, Huawei, HiSilicon, ZTE, Philips, Intel, Interdigital, Qualcomm

Add the sentence: Regardless of the network coverage, study first the stand-alone SL positioning, wherein positioning/randing is estimated using the measurements derived on SL positioning only

* LGE, CATT

##### [CLOSED] Feature Lead Proposal 3.2-v2

[Regardless of the network coverage, study first the stand-alone SL positioning, wherein positioning/ranging is estimated using the measurements derived on SL positioning only]

* At least for in-coverage ~~and partial-coverage~~ scenarios, study hybrid positioning methods wherein one or more of UE(s) perform SL measurements and position/ranging is estimated using measurements derived on both SL and Uu positioning. ~~Include in the study at least the following aspects:~~
  + Note: Companies are encouraged to focus their study on the solutions for standalone SL positioning, while providing information on any change(s) needed in their solutions for enabling hybrid positioning.
  + Note: Uu positioning corresponds to RAT dependent methods

Please comment if you have strong views to keep or remove the sentence in the brackets and why.

##### Companies views

|  |  |
| --- | --- |
| MTK | okay |
| CATT | Support to keep the sentence in the brackets.  We prefer to first focus on the standalone SL positioning, including the postioning methods and measurements for standalone SL positioning. hybrid positioning methods should be low priority, since it only work in in-coverage scenario. |
| ZTE | The sentence in brackets is not necessarily needed. The first note in Proposal 3.2-v2 already makes it clear that companies should focus on the standalone first. |
| OPPO | If the sentence in brackets kept, how to determine when to start the hybrid positiong? |
| Fraunhofer | The sentence in bracets is a dublication of the first Note. Prefer no to remove it from the proposal |
| LGE | We support to keep the main sentence. As commented in the previous round, the stand-alone SL positioning should be able to be used in all the coverage senarios. As a common part for all coveage scenarios, it’s a natural consequence to prioritize the stand-alone SL positioning to other method. On the contrary, hybrid positioning is only available in the in-coverage area. We’re fine to study it, but do not support it as highest priority. |
| BOSCH | To our understanding the sentence in brackets emphazies what is captured in the Note marked in green. In our understanding standalone SL positioning should have the highest priority and serve as a starting point. The sentence in brackets is not necessarily needed. |
| Xiaomi | OK. We are open to keep or remove the sentence in the blanket. |
| vivo | We support to keep the sentence. Our suggestion of wording to not duplicate with the note.   * Regardless of the network coverage, study first the stand-alone SL positioning, wherein positioning/ranging is estimated using the measurements derived on SL positioning only * At least for in-coverage ~~and partial-coverage~~ scenarios, study hybrid positioning methods wherein one or more of UE(s) perform SL measurements and position/ranging is estimated using measurements derived on both SL and Uu positioning. ~~Include in the study at least the following aspects:~~   + Note: Companies are encouraged to ~~focus their study on the solutions for standalone SL positioning, while~~ provide~~ing~~ information on any change(s) needed on top of stand-along SL positioning in their solutions for enabling hybrid positioning.   + Note: Uu positioning corresponds to RAT dependent methods |
| NEC | OK |
| Lenovo | Generally support FL proposal 3.2-v2. Also agree that the note may overlap with the first sentence of the proposal. The note may be sufficient for further guidance. |
| InterDigital | We support the proposal without the texts in the bracket. We agree with ZTE that the texts in square barckets seem redudant and unnecessary. |
| Futurewei | In our understanding, the text in the bracket seems to be redundant with the green note. Either one should be removed. |
| Intel | A couple of observations:   * + For the new top-level bullet, how to interpret “*study first* the stand-along SL positioning” part? Are we expecting a timeline for this and how do we determine that sufficient time has been given to standalone SL positioning? If this is only meant as a prioritization, we should word it accordingly, e.g., “Regardless of the network coverage, study first the stand-alone SL positioning, wherein positioning/ranging is estimated using the measurements derived on SL positioning only”   + If we add the new top-level bullet, then the Note (in green) should be removed. For the suggestion from vivo for the Note, there is no need to provide further guidance on how exactly hybrid solutions are approached or presented – whether the changes are strictly additive or not can be up to proponents to determine. |
| Qualcomm | Support except for the sentence in brackets and the first note, which we think should be removed. |
| Samsung | OK to have newly added sentence before the main bullet. |
| Spreadtrum | We also think that the sentence in brackets is not needed. |
| Apple | There seems to be something missing from the proposal.  Option 1:  At least for in-coverage ~~and partial-coverage~~ scenarios, study hybrid positioning methods wherein one or more of the UE(s) performing SL measurements and positioning/ranging ~~is estimated~~ using measurements derived on both SL and Uu positioning  Option 2:  At least for in-coverage ~~and partial-coverage~~ scenarios, study hybrid positioning methods wherein one or more of the UE(s) perform(s) SL measurements and its position/range ~~ing~~ is estimated using measurements derived on both SL and Uu positioning |
| Sharp | We are OK with the FL proposal in principle. Regarding the main bullet, we are OK with either keeping it or removing it. |
| Huawei, HiSilicon | OK with vivo’s version. The structure of the original proposal, especially the leading paragraph, is confusing. |
| DCM | Basically fine, but we think the following FFS should be added.  - FFS: how to decide a positioning method from standalone SL positioning and hybrid positioning when both are supported. |
| SONY | The text in the bracket shall be removed |
| Nokia, NSB | OK |
| Ericsson | We suggest ro remove the purple text under brackets as it seems redundant (i.e., the note in green captures what is written in the purple text).  We should not be discouraged to study hybrid positioning from the beginning. |

##### FL Observations

Keep the sentence in brackets

* CATT, LGE, vivo, Samsung

Sentence in brackets is not necessarily needed / duplication of the note

* ZTE, Fraunhofer, Bosch, Futurewei, Intel, Spreadtrum, Ericsson

Remove the sentence in brackets and the Note

* Qualcomm

OK either way

* Xiaomi, OK, Sharp

Unfortunately, the suggestion of adding the first sentence, made the proposal significantly more unstable than before (E.g. in v1, there was a majority of companies of supporting the previous version). Therefore, I propose to not include the sentence.

* LGE suggested to add the sentence under the reasoning that: “the stand-alone SL positioning should be able to be used in all the coverage senarios”. This is true and well-known fact, but this is not the point of this proposal. The point is to say that hybrid positioning is inside the study, at least for one of the cases that make sense (at this point consensus seem to exist for the in-coverage). The “Note” is the one that is trying to softly point out to the companies that, as they are studying stand-alone positioning (for the reason that it is applicable to all coverage scenarios), they could also discuss how they would enable hybrid positioning with their suggested solutions.

To @Apple: My understanding is that the “position/ranging” is a generic term, and not associated to a specific UE or set of UEs. Maybe, instead of “its”, we could add a generic “UE” as shown below.

##### [CLOSED] Feature Lead Proposal 3.2-v3

At least for in-coverage scenarios, study hybrid positioning methods wherein one or more of the UE(s) perform SL measurements and UE position/ranging is estimated using measurements derived on both SL and Uu positioning.

* Note: Companies are encouraged to focus their study on the solutions for standalone SL positioning, while providing information on how their solutions would enable hybrid positioning.
* Note: Uu positioning corresponds to RAT dependent methods

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We support the proposal. |
| Futurewei | We are confused by the Proposal. In the main text is emphasized that the in coverage solution should be based on SL and Uu positioning. In the note we are encouraged to focus on standalone SL positioning. Is standalone SL positioning based only on SL PRS signals? It seems contradictory. We suggest to remove or rephrase this note to clarify that the standalone SL positioning does not contradict with Uu measurements based hybrid method. |
| CMCC | We support this proposal. |
| vivo | We still prefer to clearly indicate the priority of stand alone SL positioning over hybrid positioning. As commented by other company, given there’s no separate proposal on the priority of stand alone SL positioning itself, we think it’s confusing to mention it inside a note as enrougement for companies to focus when the main bullet is calling for study on hybrid positioning. We also see companies have question on the meaning of stand alone positioning. So we think a separate bullet is clear to explain what is stand alone SL positioning.   * Regardless of the network coverage, study first the standalone SL positioning, wherein positioning/ranging is estimated using the measurements derived on SL positioning only * At least for in-coverage scenarios, study hybrid positioning methods wherein one or more of the UE(s) perform SL measurements and UE position/ranging is estimated using measurements derived on both SL and Uu positioning.   + Note: Companies are encouraged to ~~focus their study on the solutions for standalone SL positioning, while~~ provide~~ing~~ information on how their solutions for standalone SL positioning would enable hybrid positioning.   + Note: Uu positioning corresponds to RAT dependent methods |
| Intel | Support and we suggest to remove the first Note as it does not seem essential and instead likely to cause more confusion than clarity and require additional new discussions to converge.  In our view, the consideration of stand-alone SL positioning is obvious and also already agreed explicitly.  If it helps, we could probably consider the following version that indicates that hybrid positioning methods are studied “in addition to” standalone SL positioning methods:  At least for in-coverage scenarios, in addition to standalone SL positioning methods, study hybrid positioning methods wherein one or more of the UE(s) perform SL measurements and UE position/ranging is estimated using measurements derived on both SL and Uu positioning.   * ~~Note: Companies are encouraged to focus their study on the solutions for standalone SL positioning, while providing information on how their solutions would enable hybrid positioning.~~ * Note: Uu positioning corresponds to RAT dependent methods |
| ZTE | Support in general. |
| Spreadtrum | Support. |
| CATT | Support the revision from vivo above.  We prefer to first focus on the standalone SL positioning, including the postioning methods and measurements for standalone SL positioning. hybrid positioning methods should be low priority, since it only work in in-coverage scenario and it is the combination of SL positioning and UU positioning. |
| DCM | As commented in the last round, we think the following FFS should be added. Or the newly added sentence with blue color intends this aspect?  - FFS: how to decide a positioning method from standalone SL positioning and hybrid positioning when both are supported. |
| LGE | Thank FL for reply to our comment. We understand FL’s comment and support the proposal. |
| Lenovo | Supportive of proposal |
| NEC | The first note reads like the standalone SL positioning schems can be extended hybrid positioning in a straitforward way, which is not the case in our understanding. We prefer the original wording ‘information on any change(s) needed in their solutions for enabling hybrid positioning’ |
| Sharp | We are OK with the FL proposal. |
| OPPO | Support the proposal. |
| Samsung | OK |
| Bosch | In our understanding, stand-alone SL positioning should be prioritized. If companies prefer to state this explicitly, we are fine with Vivo’s proposal to drop the note and add an extra bullet, i.e.,:   * Regardless of the network coverage, study first the standalone SL positioning, wherein positioning/ranging is estimated using the measurements derived on SL positioning only * At least for in-coverage scenarios, study hybrid positioning methods wherein one or more of the UE(s) perform SL measurements and UE position/ranging is estimated using measurements derived on both SL and Uu positioning.   + ~~Note: Companies are encouraged to focus their study on the solutions for standalone SL positioning, while provideing information on how their solutions for standalone SL positioning would enable hybrid positioning.~~   + Note: Uu positioning corresponds to RAT dependent methods |
| Xiaomi | To avoid misunderstanding, we also suggest to use separate bullet to capture the stuudy on both standalone SL positioning and hybrid positioning. We prefer to vivo proposed revision. |
| SONY | We think this proposal indicates standalone SL positioning is still the main focus.  We support this proposal. |
| Huawei, HiSilicon | General OK. |
| Qualcomm | We still prefer to remove the first note. |
| Nokia, NSB | OK |

##### FL Observations

**4th round**

Support the proposal

* Interdigital, CMCC, ZTE, Spreadtrum, LGE, Sharp, OPPO, Samsung, Huawei, HiSilicon, Nokia

Prefer to clearly indicate priority of standalone SL over hybrid

* Vivo, CATT, Bosch

Remove the note / Issues with the note

* Intel, NEC, Futurewei, Qualcomm

Add an additional FFS

* NTT DOCOMO

It seems we are going back and forth on this discussion.

From the first round, it became evident there is no consensus to explicitly prioritize standalone positioning (from **1st round**):

* The first option of prioritization on SL positioning-only counts as 14, and the second option of hybrid positioning counts as 12

For me the above means that we are split in half, and there is no chance we ll agree through email to an explicit prioritization of standalone-only positioning.

In the **2nd round** we tried the following:

At least for in-coverage ~~and partial-coverage~~ scenarios, study hybrid positioning methods wherein one or more of UE(s) perform SL measurements and position/ranging is estimated using measurements derived on both SL and Uu positioning. ~~Include in the study at least the following aspects:~~

* Note: Companies are encouraged to focus their study on the solutions for standalone SL positioning, while providing information on any change(s) needed in their solutions for enabling hybrid positioning.
* Note: Uu positioning corresponds to RAT dependent methods

And the outcome was:

Support current proposal as is or with minor modifications

* Vivo, Futurewei, Samsung, Xiaomi, NEC, Support, CMCC, OPPO, Nokia, NSB, Huawei, HiSilicon, ZTE, Philips, Intel, Interdigital, Qualcomm

Add the sentence: Regardless of the network coverage, study first the stand-alone SL positioning, wherein positioning/randing is estimated using the measurements derived on SL positioning only

* LGE, CATT

So, i tried to see if there is consensus on the additional sentence proposed by LGE, CATT, and the result of the **3rd round** was:

Keep the sentence in brackets

* CATT, LGE, vivo, Samsung

Sentence in brackets is not necessarily needed / duplication of the note

* ZTE, Fraunhofer, Bosch, Futurewei, Intel, Spreadtrum, Ericsson

Remove the sentence in brackets and the Note

* Qualcomm

OK either way

* Xiaomi, OK, Sharp

So in the **4th round** i suggested to remove the newly added bullet and keep the note (closer to round 2) but again there is no convergence. Seems actually its even worse than Round 2!

So, in this 5th round, by reading the comments above, maybe the proposal from Intel is trying to find a middle ground:

* Keep the bullet that we study standalone SL in all cases
* Then, for in-coverage, in addition to standalone SL, hybrid is studied.
* It avoids an explicit prioritization between standalone-SL & hybrid, but at the same time, it emphasizes that standalone-SL is studied all cases, and hybrid is studied “in addition” for a specific network coverage case.
* I know that some companies want to explicitly deprioritize hybrid. But this cannot converge.
* Some companies might not like the “in addition” that is suggested, since they are really more interested in hybrid. Please see the situation and lets find a middle ground here.

I would like to ask the companies to acknowledge that there is no way we ll converge if we try to agree on an “explicit” prioritization of standalone SL positioning. At least the above states the fact:

* Standalone SL positioning is studied regardless of network coverage
* Hybrid positioning is studied at least for in-coverage cases.

To @NTT DOCOMO: Adding more FFS will just make the proposal unstable; its likely at least one company will suggest a rewording, or adding a new FFS, etc, etc. There will be a lot of FFS added going forward. We are only getting starting here, and all the questions will have to be addressed. I would appreciate to try to converge the discussion at this point, and only point out big disagreements of what this proposal is trying to say.

So, the 5th round’s proposal is the following:

##### [HIGH][OPEN] Feature Lead Proposal 3.2-v4

* Regardless of the network coverage, study first the standalone SL positioning, wherein positioning/ranging is estimated using the measurements derived on SL positioning only
* At least for in-coverage scenarios, in addition to standalone SL positioning methods, study hybrid positioning methods wherein one or more of the UE(s) perform SL measurements and UE position/ranging is estimated using measurements derived on both SL and Uu positioning.
  + ~~Note: Companies are encouraged to focus their study on the solutions for standalone SL positioning, while providing information on how their solutions would enable hybrid positioning.~~
  + Note: Uu positioning corresponds to RAT dependent methods

##### Companies views

|  |  |
| --- | --- |
|  |  |

# Sidelink Reference Signals for Positioning Purposes (SL-PRS)

## 4.1 Reuse of existing SL reference Signals for Sidelink positioning

Based on the submitted contributions, there were a few companies that suggest to study (and/or support) using one or more of the existing SL reference signals.

|  |  |
| --- | --- |
| Futurewei | Consider supporting the S-SSB based SL position determination |
| Nokia, NSB | Currently defined reference signals over the NR SL are not suitable for positioning purposes. |
| NTT DOCOMO | * Study the following alternatives for SL-PRS.   + Alt 1: Define SL-PRS as a new reference signal.     - Configuration/Indication/Cast-type/Mapping resource/Mapping procedure (rate-matching vs puncturing)/Sequence   + Alt 2: Define SL-PRS as an existing reference signal.     - Configuration/Indication/Cast-type/Mapping resource modification * Supporting SL-PRS as independent signal would lead to significant modification of SL structure. * Support SL-positioning RS multiplexed on PSSCH. |
| Ericsson | A sidelink ranging solution should reuse existing signals |
| Samsung | Study and evaluate performance of SL positioning reference signals considering the following   * Reusing SL synchronization signal in Rel-16 * Reusing DL PRS or positioning SRS design in Rel-16 |

Based on the submitted tdocs, and proposals summarized above, the following proposal is made:

##### [CLOSED][MERGED WITH 4.2.1]Feature Lead Proposal 4.1-v0

Study whether existing SL reference Signals can be reused for sidelink Positioning.

* Limit the study to the existing S-SSB and SL-CSIRS reference signals.

##### Companies views

|  |  |  |
| --- | --- | --- |
| vivo | The wording of this proposal “whether … can be reused” sounded like feasibility study only and not clear about the scope of the study. At least performance evaluation/comparision should be mentioned to see whether such signal can meet the positioning accuracy requirements. | |
| CATT | Low priority.  We prefer to define new SL-PRS based on DL-PRS. The existing SL reference signals cannot meet the accuracy requirements of SL positioning. | |
| MTK | We prefer to have new SL-PRS, but also to slightly prefer to base on SRS | |
| Fraunhofer | It reads from the contributions and proposals that few companies are keen on studying the SL RSs. In our view the UL/DL positioning reference signals are the better starting point especially when targeting high accuracy, multi SL users and extended coverage scenarios. | |
| ZTE | We prefer to not reuse the existing SL reference signals (e.g. SL-CSIRS). Large bandwidth is required for high-accuracy positioning if timing based positioning methods are used. Current sidelink RS in Rel-15/16 is always configured and limited within the bandwidth of PSSCH/SL-data resource pool. If current sidelink RS is reused for SL positioning, it is difficult to satisfy the positioning requirement. | |
| Huawei, HiSilicon | When we study using the existing SL reference Signals for sidelink Positioning, we also wonder what target we are talking about. | |
| Spreadtrum | We prefer to introduce new sidelink positioning reference signal for sidelink positioning. | |
| InterDigital | We agree with the proposal in principle. However, considering SL PTRS is introduced in R16 V2X, we prefer to also include SL-PTRS in the study in addition to SSB and CSI-RS. | |
| Futurewei | We understand and support new SL positioning RS. However, we do not see how this would exclude the use of other existing signals for positioning solutions. Not all applications may require high accuracy, which implies very wide band for SL PRS, therefore simple solutions based on S-SSB or SL-CSIRS should be considered as well. These type of solutions will come with minimal spec changes and overhead. | |
| CMCC | Not preferred.  In NR sidelink, S-SSB only occupies 11 PRBs and the BW is too limited to meet the requirement. In addition, SL-CSIRS are multiplexed on PSSCH, which may not be suitable for SL positioning purpose, because this may not only bring back the issue of processing data and positioning RS simultaneously, but also cannot fulfill the requirement for positioning due to the bandwidth may not be large enough. | |
| NEC | Although we agree existing RS can be re-used as a starting point, we do not agree to limit the study since we do not know if the existing design can fulfill the target requirements at current stage. | |
| Sony | Low Priority. We should focus on the reference signal that is optimized for positioning purpose (i.e, in providing good accuracy). |
| OPPO | We do not think S-SSB and SL-CSIRS can be used as SL-PRS, S-SSB is transmitted from multiple UEs in SFN manner, it is impossible to use it for either absolute positioning or ranging, and the density of SL-CSIRS is only 1, it cannot ensure the accuracy if use for positioning. We prefer to deprioritize existing SL siganls and leave it up to companies to study. |
| Lenovo | Prefer to use existing PRS/SRS design, which has been designed specifically to meet the positioning requirements. | |
| Apple | Although the S-SSB and SL-CSI-RS may be re-used in a CID-like manner, we think that positioning signals based on the PRS/SRS design are optimized for positioning and should be the starting point of the design. | |
| Locaila | We prefer to define new SL-PRS. | |
| Samsung | OK for the main bullet of proposal 4-1.  For the sub-bullet, no need to limit to S-SSB and SL-CSI-RS, infact SL PSSCH DMRS might be a better option. | |
| Qualcomm | In our view, neither S-SSB nor SL CSI-RS is suitable for use as a positioning reference signal and there is no need to study further. S-SSB has very limited bandwidth (11 PRBs) and is SFNed from multiple UEs. Meanwhile, SL CSI-RS is limited to a single symbol, can only be transmitted together with PSSCH, is limited to the allocated PSSCH bandwidth and shares resources with other sidelink signals. | |
| DCM | Same view with Samsung. | |
| LGE | We think S-SSB and SL CSI-RS are not appropriate for SL positioning. The frequency of S-SSB transmission is too low, and its transmission is scheduled so dynamic transmission is not possible. As for CSI-RS, it too sparse in time and frequency domain, so it’s hardly expected to meet the SL positioning requirements. | |
| Sharp | We prefer to introduce new positioning reference signals, but we are ok to study to reuse existing SL reference signals. | |
| xiaomi | We share the view of othe companies that existing SL signals are not suitable for positioinig purpose. We prefer to define new SL positioning signals other than reusing existing SL signals. | |
| Philips | We prefer to introduce new positioning reference signal for sidelink positioning | |
| Nokia, NSB | Deprioritize study of existing SL reference signals for sidelink positioning. We prefer to define new reference signal for SL positioning. | |
| Ericsson | We support the proposal. As mentioned by Futurewei, the existing SL reference signals may still be considered for applications relying on simple solutions that reuse existing SL reference signals. | |
| Intel | Do not support.  We do not think S-SSB and SL-CSI-RS are suitable candidates for accurate positioning due to restricted BW and sparsity respectively. | |

##### FL Observations

Most companies consider reusing existing SL reference signals as low priority, or explicitly say that these will not meet requirements:

* Low priority to study existing SL reference signals / prefer to have a new SL-PRS
  + CATT, MTK, vivo, Fraunhofer, ZTE, Speadtrum, CMCC, NEC, Sony, OPPO, Lenovo, Apple, Localia, Qualcomm, LGE, Sharp, Xiaomi, Philips, Nokia, NSB, Intel (21)
* OK to study the existing SL reference signals
  + Futurewei, Samsung, NTT DOCOMO, Ericsson (4)

Maybe, one way to progress on this is to close the 4.1 section and try to merge it with Section 4.2, as shown later.

## 4.2 Design of a new SL reference Signal (SL-PRS)

#### 4.2.1 General proposals on a new SL-PRS reference signal

Based on the submitted contributions, there appears to be a lot of companies that suggested to study (or directly support) designing a new reference signal for SL Positioning, as shown in the statements below:

|  |  |
| --- | --- |
| Futurewei | RAN1 should consider the UL PRS design as the starting point of the S-PRS design |
| Nokia, NSB | A new reference signal should be defined over SL interface for positioning purposes. For this, the structure of the UL SRS can be re-used, with any necessary modifications to be studied.  Study mechanisms to support multiplexing of SL PRS belonging to different users in time, frequency or code domain, such as in coordination with the target UEs.  Allocation of frequency bands for SL positioning purposes, and any required modifications to the configuration and use of SL resource pools should consider the bandwidth requirements of SL positioning based on the performance evaluations to be conducted.  Study mechanisms to support co-existence of SL PRS transmissions with other SL transmissions. |
| Samsung | Study and evaluate performance of SL positioning reference signals considering the following   * Reusing SL synchronization signal in Rel-16 * Reusing DL PRS or positioning SRS design in Rel-16 |
| CEWiT, Reliance Jio, Saankhya Labs, IITM, IITK | New positioning reference signal should be designed for sidelink positioning. CSI-RS can be used as the baseline. |
| Fraunhofer IIS, Fraunhofer HHI | The sidelink reference signals for positioning should be based on SRS-Pos. |
| vivo | Introduce a new SL reference signal (i.e., SL PRS) for SL positioning.  SL PRS can be transmitted without PSSCH transmission in the resource pool.  SCI should be transmitted with the associated SL PRS.  Slot level SL PRS transmission should be supported. |
| CMCC | RAN1 should further study which signal should be used as design baseline for sidelink positioning RS, b/w PRS and SRS-Pos  Parameters of SL positioning RS, e.g., number of symbols, RS comb size, and RS BW, should be (pre)configured on resource pool level.  Configuration of SL positioning RS should be tied to BWP  Multiplexing rule b/w PSCCH and positioning RS resources may need to be re-designed for NR SL positioning. |
| ZTE | SL-PRS design, consider DL-PRS like signals to reduce the specification complexity |
| China Telecom | Consider the angle estimation based on the waveform measurement. Consider the possibility of introducing SRS-Pos or PRS as the reference signal  For the angle estimation based on the RSRP measurement, consider the possibility of the CSI-RS or PRS as the reference signal used here for positioning, and some modifications of physical procedures especially beam management related are required  Introduce PRS or SRS-Pos into sidelink as the reference signal for time of flight measurement.  Introduce PRS or SRS-Pos into sidelink as the reference signal for TDOA measurement |
| Qualcomm | Sidelink PRS to use DL-PRS as a starting point and enhance the design if necessary |
| ROBERT BOSCH GmbH | Study SPRS design, allocation and signalling considering the following aspects:   * Reusing NR Uu SPRS design as much as possible * Impact of sidelink synchronization method and sidelink broadcast channel * Impact on sidelink control channel design including coexistence to old releases * SPRS scheduling impact on SL resource (re-)selection / reservation, * SPRS allocation with interference avoidance mechanism * SPRS allocation with periodic reservation and/or dynamic (on demand) allocation * SPRS request and response should consider the different casting types, i.e., unicast, groupcast, and broadcast   Study whether SPRS design should consider both full sensing UEs and partial sensing/DRX capabilities introduced with Rel-17  Study enhancing Sidelink positioning accuracy using S-PRS bandwidth aggregation (will be introduced in Rel-18). |
| Xiaomi | PRS is considered as the baseline for sidelink positioning signal design if coverage performance requirement of sidelink positioning can be satisfied, otherwise SRS is considered as the baseline |
| Sharp | For reference signals for sidelink positioning, the starting point for the discussion of the structure is PRS and SRS for positioning in Rel-16/17.   * The difference of the SL environment from DL/UL should be considered * The trade-off between the performance of sidelink positioning and the overhead of the reference signals should be considered |
| Sony | Consider supporting multiplexing of sidelink positioning reference signal from several UEs within a given set of resources |
| Localia | Study new sidelink positioning reference signal efficient for supporting phase-based measurement method |
| Lenovo | RAN1 to consider at least the following design criteria for SL PRS:   * Configurable transmission bandwidth and allocation in time frequency resources * Configurable periodicity and transmission duration (number of symbols) * Good auto and cross correlation properties in the presence of time and frequency offsets and /or Doppler effects * Sufficient degree of randomization and orthogonalization for PRS transmission from multiple Initiator UEs * PAPR   RAN1 to consider at least the following configurability options for SL PRS:   * Unambiguous identification of initiator UEs and responder UEs |
| Spreadtrum | Sidelink positioning reference signals should be introduced for sidelink positioning |
| LGE | A method to make SL PRS transmission and reception reliable between the distant UEs needs to be studied.  If RX UE fails to receive SL PRS or the quality of the received SL PRS does not meet a condition, UE sends SL PRS retransmission request to TX UE |
| Intel | For SL-PRS design, both NR-PRS and SRS-for-positioning should be studied for potential support.   * + - Specification support of up to 100 MHz/400 MHz BW for FR1/FR2 (licensed bands) should be considered for SL positioning.     - In addition, RAN1 should study the performance for SL positioning in limited bandwidth scenarios, e.g., up to 20 MHz. |
| NEC | Sidelink positioning reference signal (S-PRS) should be designed with NR DL PRS and UL SRS-Pos as a baseline and the design should be adapted to sidelink slot formats  S-PRS transmission pattern should be determined based on S-PRS design and related evaluation.  − including number of OFDM symbols, number of repetitions, gap between two repetitions, etc. |
| Interdigital | Study PRS configuration structure, using the Uu positioning PRS hierarchical structure |

Based on the above, the FL proposal is to study a new SL positioning reference signal for SL positioning ranging:

##### [CLOSED]Feature Lead Proposal 4.2.1-v0

Study a new SL positioning reference signal (SL-PRS) for sidelink positioning/ranging.

* The study could at least include: Sequence design, frequency domain pattern, time domain pattern (e.g. number of symbols, repetitions, etc), time domain behavior, configuration/triggering/activation of the SL-PRS, AGC time, Tx-Rx Turanround time, supportable bandwidth(s), multiplexing options with other SL channels, randomization/orthogonalization options.

##### Companies views

|  |  |
| --- | --- |
| CATT | Support |
| MTK | okay |
| Fraunhofer | We miss a proposal similar to 4.1-v0 on the study for reusing of UL or DL positioning reference signals as a baseline for SL-PRS. We assume the study/evaluation of solution on the SL specific ehnacements for the issues treated in the following proposals become easier. |
| ZTE | Support to study a new SL positioning reference signal. |
| Huawei, HiSilicon | We appreciate the effort. However, this proposal can mean everything or is saying nothing.  Can we try to make some points more concrete? For example, what sequces can be the starting point? What options we can focus on the frame structure for SL-RS transmission? If there are other concrete proposals later, then we don’t need to agree on this proposal. |
| Spreadtrum | Support |
| InterDigital | We agree with the proposal |
| Futurewei | We support proposal in principle, but we notice that most of companies consider as starting point either DL PRS or UL PRS (SRS Pos) therefore we think that the proposal should be focus only on these two type of sequences, and emphasize the reuse (and extension) of the existing design. |
| CMCC | Support.  Both PRS and SRS-Pos in NR Uu positioning can be baseline. |
| NEC | Agree |
| Sony | Support and consider the legacy positioning signals as the baseline. |
| OPPO | Support. |
| Lenovo | Support proposal, However, it would be better to add a clarification to assist in the selection of SL PRS. Suggestion the following modification for the 1st line of the proposal:  “Study new SL positioning reference signal for SL positioning/ranging based on the existing PRS/SRS design, the study of other existing SL RS is also not precluded” |
| vivo | Support the intention.  However, as stated in the SID “reusing existing reference signals, procedures, etc from sidelink communication and from positioning as much as possible”, we suggest a rewording to the main bullet.  “Study new SL positioning reference signal for SL positioning/ranging based on existing PRS/SRS and SL design aspects”. |
| Apple | Support overall idea. Lenovo’s languate seems to be fine for a high level agreement at this time. |
| vivo2 | Also,the sub-bullet seems not needed given FL’s proposals in the following sub-sections of 4.2. |
| Locaila | Support. |
| Samsung | OK for the direction of proposal 4.2.1 in general.  We suggest to add the following note as  “Note: RAN1 strives to reuse design aspects from DL PRS and/or Positioning SRS” |
| Qualcomm | We support the proposal. |
| DCM | OK |
| LGE | We support the proposal in general. But we prefer to reuse the existing positioning reference siganls as much as possible. NR PRS and SRS for positioning should be a starting point for a new SL PRS. |
| Sharp | Agree with the FL proposal. |
| Xiaomi | We are fine with the proposal. We are also supportive if the candidate SL\_PRS signaling design baseline can be listed to narrow the discussion scope: DL PRS or UL SRS for positioning. |
| Nokia, NSB | OK |
| Ericsson | DL-PRS and UL-SRS for positioning should be the starting point for studying signals used for sidelink positioning measurements.  The sub-bullet is to detailed and includes a broad list. This items can be considered later. So suggest to remove the sub-bullet. |
| Intel | OK. |

##### FL Observations

As was noted in Section 4.1 and 4.2.1, there is strong support looking more closely at a new SL reference signal. It was pointed out by a few companies that it may be useful to clarify that the existing PRS/SRS design should be used as a baseline. Based on this input, the revised proposal is:

##### [CLOSED]Feature Lead Proposal 4.2.1-v1

Study new SL positioning reference signal for SL positioning/ranging based on the existing PRS/SRS design and SL design aspects

* The study could at least include: Sequence design, frequency domain pattern, time domain pattern (e.g. number of symbols, repetitions, etc), time domain behavior, configuration/triggering/activation of the SL-PRS, AGC time, Tx-Rx Turanround time, supportable bandwidth(s), multiplexing options with other SL channels, randomization/orthogonalization options.
* Note: The study of existing SL reference signal for SL positioning/ranging is not precluded. Companies are encouraged to perform performance evaluation/comparision to investigate whether such reference signals can meet the positioning accuracy requirements.

Companies are encourage to comment whether they consider the first subbulet useful, or they prefer to remove it.

##### Companies views

|  |  |
| --- | --- |
| vivo | We support this proposal. |
| Futurewei | Support. |
| InterDigital | We support the proposal. However, we are not fully clear regarding which SL design aspects are referred to. Note the aspect of re-using SL reference signals is included in the Note, so we presume the SL design aspects are more related to SL physical layer design framework in which SL reference signal-related procedure are performed. Thus, we suggest to change the proposal to the following :  Study new SL positioning reference signal for SL positioning/ranging based on the existing PRS/SRS design and R17 SL design framework ~~SL design aspects~~  …. |
| Samsung | OK |
| LGE | Our first preference is to reuse the existing PRS/SRS for SL positioning as much as possible. In this sense, the FL proposal of a new SL PRS based on existing PRS/SRS is fine for us. |
| Xiaomi | support |
| DCM | OK |
| NEC | Generally agree. The current wording to design based on existing RS is a bit confusing. We are OK to InterDigital’s revision or alternatively we suggest to change it as ‘Study new SL positioning reference signal for SL positioning/ranging ~~based on~~ using the existing PRS/SRS design and SL design ~~aspects~~ as a starting point’ |
| Sharp | Support |
| CMCC | Support |
| CATT | Support |
| OPPO | We are supportive of the proposal. A minor comments, seems “SL positioning” should be removed as below, as there is no SL positioning reference signal so far.  Study new ~~SL positioning~~ reference signal for SL positioning/ranging based on the existing PRS/SRS design and SL design aspects |
| Lenovo | Support, fine with Oppo’s revision as a clarification. |
| Nokia, NSB | Generally OK, but “SL design aspects” in the first sentence is a bit unclear – my reading was that the proposal is to study SL design aspects of this new SL PRS, but InterDigital seems to have read it differently. |
| Huawei, HiSilicon | On question for the note, which agenda should handle the evaluation? 9.5.1.2 or 9.5.1.3? |
| Ericsson | Suggest to reword the note. The note should reflect that we start the study with existing SL signals, and then study new SL signals after this. |
| ZTE | Support. |
| Philips | Agree with LGE |
| Intel | OK. |
| Qualcomm | Support |

##### FL Observations

Support current proposal as is, or with minor modifications

* Vivo, Futurewei, Interdigital, Samsun, LGE, Xiaomi, DCM, NEC, Sharp, CMCC, CATT, OPPO, Lenovo, Nokia, NSB, ZTE, Philips, Intel, Qualcomm

Reword the Note:

* Ericsson

##### [CLOSED]Feature Lead Proposal 4.2.1-v2

Study new ~~SL positioning~~ reference signal for SL positioning/ranging ~~based on~~ using the existing PRS/SRS design and SL design framework ~~aspects~~ as a starting point.

* The study could at least include: Sequence design, frequency domain pattern, time domain pattern (e.g. number of symbols, repetitions, etc), time domain behavior, configuration/triggering/activation of the SL-PRS, AGC time, Tx-Rx Turanround time, supportable bandwidth(s), multiplexing options with other SL channels, randomization/orthogonalization options.
* Note:
  + Alt. 1: The study of existing SL reference signal for SL positioning/ranging is not precluded. Companies are encouraged to perform performance evaluation/comparison to investigate whether such reference signals can meet the positioning accuracy requirements.
  + Alt. 2: Companies are encouraged to start their study using existing SL signals, and then study new reference signals. Companies are encouraged to perform performance evaluation/comparison to investigate whether existing SL signals can meet the positioning accuracy requirements.

Please comment if you prefer Alt. 1 or Alt. 2 or whether either one is fine.

##### Companies views

|  |  |
| --- | --- |
| MTK | We slightly prefer Alt. 1 |
| CMCC | Prefer Alt.1.  In our views, Alt.2 is against the direction of the main bullet, because in the main bullet, studying new SL positioning reference signal for SL positioning/ranging is anyway there, so studying the existing SL signal can only be a parallel action. |
| CATT | We prefer Alt.1, or to remove the note. |
| ZTE | We prefer Alt.1. |
| OPPO | Share similar view as CMCC. |
| Fraunhofer | Okay with the proposal and prefer removing the Note.  The requriements of the SL-PRS needs to be first identified: to achieve these requriements we can check if SRS and PRS works as a baseline and focus on enhancements, if not we need a new SL-PRS design. Hence we believe Alt.2 is more reasonable. |
| LGE | We support the main sentence and the first bullet. Regarding the note, we prefer Alt.1 as the existing PRS/SRS is the baseline in the main sentence. |
| BOSCH | We prefer Alt.1. - although we are also fine removing the entire note now as “as a starting point” was introduced in the proposal. |
| Xiaomi | Alt 1. |
| vivo | We cannot accept Alt.2 as the note.  We are OK to have no note or take Alt. 1 as the note. |
| NEC | Alt. 1 |
| Lenovo | Supportive of the main proposal 4.2.1-v2, and prefer that the Note be removed |
| InterDigital | We prefer Alt. 1. |
| Futurewei | We think that the note is not necessary, however if the companies want it we could live with Alt 1. |
| Intel | OK with Alt. 1; cannot accept Alt. 2. |
| Qualcomm | Same view as CATT, we prefer Alt 1 or to remove the note completely. |
| Samsung | Suggest to add de-activation   * The study could at least include: Sequence design, frequency domain pattern, time domain pattern (e.g. number of symbols, repetitions, etc), time domain behavior, configuration/triggering/activation/de-activation of the SL-PRS, AGC time, Tx-Rx Turanround time, supportable bandwidth(s), multiplexing options with other SL channels, randomization/orthogonalization options.   For the note, we can consiser following modification as  Alt. 3: Companies are encouraged to perform performance evaluation/comparison to investigate whether the existing SL reference signal for SL positioning/ranging ~~such reference signals~~ can meet the positioning accuracy requirements. |
| Spreadtrum | We prefer Alt. 1. |
| Apple | We are fine with Alt-1, or Samsung’s update. |
| Sharp | We prefer Alt. 1. |
| Huawei, HiSilicon | When we saying SRS, do we mean both MIMO SRS and positioning SRS?  On the Note selection, Alt.1 is better. |
| DCM | Our preference is Alt 2. Firstly evaluation reusing existing RS should be done. If sufficient performance can be achieved, introducing new RS is quite strange. After confirming that the existing SL-RS is not enough, then new RS should be considered.  But considering the above companies’ comments, we can accept Alt 1. But removing note is unacceptable. |
| SONY | ALT.1 |
| Nokia, NSB | Alt 1 is preferred |
| Ericsson | We assume the intention is to downselect between Alt 1 and Alt 2 this meeting. We think the selected Alt should be used as the main bullet of the proposal.  Our preference is Alt 2. |

##### FL Observations

Alt. 1:

* Support: MTK, CMCC, CATT, ZTE, OPPO, LGE, Bosch, Xiaomi, vivo, NEC, Intedigital, Futurewei (2nd), Intel, Qualcomm, Spreadtrum, Apple, Sharp, Huawei, HiSilicon, Sony, Nokia, NSB
* Would accept as a compromise: NTT DOCOMO

Alt. 2

* Support: Fraunhofer, NTT DOCOMO, Ericsson
* Cannot accept: Intel, vivo

No Note

* Support: Lenovo, Futurewei, Bosch, vivo, Qualcomm
* Cannot accept: NTT DOCOMO

I think it is clear that there is strong majority for Alt. 1. As a FL, the note is added to try to find a compromise between Section 4.2.1 and 4.1. Alt. 1 seems to be considered as a compromise of this, even if a few of the supports of Alt. 1 still prefer “No Note” at all.

To @Huawei: “SRS” at this point includes all SRS. No need to start debating this at this point, since there will be more opportunities to discuss these soon.

To @Samsung: Changing “such reference signals” to “the existing SL reference signal for SL positioning/ranging” is not necessary. This bullet has 2 sentences; it is clear that the “such reference signals” corresponds to the existing SL reference signals.

##### [CLOSED]Feature Lead Proposal 4.2.1-v3

Study new reference signal for SL positioning/ranging using the existing PRS/SRS design and SL design framework as a starting point.

* The study could at least include: Sequence design, frequency domain pattern, time domain pattern (e.g. number of symbols, repetitions, etc), time domain behavior, configuration/triggering/activation/de-activation of the SL-PRS, AGC time, Tx-Rx Turanround time, supportable bandwidth(s), multiplexing options with other SL channels, randomization/orthogonalization options.
* Note: The study of existing SL reference signal for SL positioning/ranging is not precluded. Companies are encouraged to perform performance evaluation/comparison to investigate whether such reference signals can meet the positioning accuracy requirements.

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We support the proposal. |
| Futurewei | Fine with the Proposal 4.2.1-v3. We note that in our proposal of using existing S-SSB for positioning we did not suggested to use only S-SSBs. For instance, a combination of 2 SL PRS (wideband) and one S-SSB could actually provide good performance. |
| CMCC | We support the proposal. |
| vivo | OK |
| Intel | OK |
| ZTE | Support. |
| Spreadtrum | Support. |
| CATT | Support |
| DCM | OK with this proposal if the note is kept. |
| LGE | Support |
| Lenovo | Support |
| NEC | Support |
| Sharp | Support |
| OPPO | Support the proposal. |
| Samsung | OK |
| Bosch | OK |
| Xiaomi | Support |
| SONY | Support |
| Qualcomm | We are ok with the proposal |
| Nokia, NSB | OK |

##### FL Observations

Seems a convergence is reached here. Thanks all for the great discussion.

##### [EMAIL ENDORSEMENT]Feature Lead Proposal 4.2.1-v3

Study new reference signal for SL positioning/ranging using the existing PRS/SRS design and SL design framework as a starting point.

* The study could at least include: Sequence design, frequency domain pattern, time domain pattern (e.g. number of symbols, repetitions, etc), time domain behavior, configuration/triggering/activation/de-activation of the SL-PRS, AGC time, Tx-Rx Turanround time, supportable bandwidth(s), multiplexing options with other SL channels, randomization/orthogonalization options.
* Note: The study of existing SL reference signal for SL positioning/ranging is not precluded. Companies are encouraged to perform performance evaluation/comparison to investigate whether such reference signals can meet the positioning accuracy requirements.

#### 4.2.2 SL-PRS Sequence design Proposals

Based on the submitted contributions, there appears to be a good set of companies that have proposals on what should be the sequence of SL-PRS. In the table below, we summarize the corresponding proposals.

|  |  |
| --- | --- |
| Futurewei | RAN1 should consider the UL PRS design as the starting point of the S-PRS design |
| Huawei, HiSilicon | The candidate SL-PRS sequences should support the pseudo-random sequences.  Companies should report the used sequences for SL-PRS transmission in the evaluations. |
| CATT, GOHIGH | Gold sequence should be adopted as the sequence of S-PRS. |
| vivo | The of SL PRS can be associated with some UE information (e.g., pre-configured sequence ID, source ID). |
| ZTE | * Sequence: gold sequence or ZC (Zadoff-Chu) sequence   + Gold sequence is preferable to align with sidelink CSI-RS design. |
| Apple | DL-PRS and positioning SRS both considered as candidates for the SL-PRS.   * + UE may be configured with one or both of these variants.   + UE may indicate its capability to support one or both of these variants. |
| OPPO | DMRS sequence of sidelink PSCCH/PSSCH should be used as SL-PRS, and low-PAPR sequence can be considered if larger coverage needs to be supported in sidelink positioning |
| Sony | Consider UL-SRS as the sidelink reference signal for positioning, as the baseline during the evaluation. |
| Lenovo | RAN1 to further study the feasibility of SL PRS Gold sequence signals for UEs without power limitations such as vehicular UEs or RSUs  RAN1 to further consider the feasibility of SL PRS ZC signals for UEs with power limitations such as commercial handheld devices, IIoT and pedestrian UEs |
| LGE | Either NR DL PRS sequence or SRS sequence for positioning is the starting point for SL PRS sequence design |
| Mediatek | ZC is slightly preferred over the Gold as the sequence for SL-PRS, due to the low PAPR property |
| Qualcomm | Sidelink PRS to use DL-PRS as a starting point and enhance the design if necessary. |

Based the submitted contributions, we observe there is a need for more discussion on whether a ZC-based or a Pseudo-rando sequence should be used as baseline for SL-PRS, as summarized below (please feel to correct/remove/add in the comment section):

|  |  |  |
| --- | --- | --- |
| Option 1: Use as baseline Pseudo-random sequence (e.g. Gold sequence signals, similar to DL-PRS/SL-CSIRS) | Option 2: Use as baseline ZC-based design, (e.g. similar to UL SRS) | Option 3: Study/consider both options |
| Huawei, HiSilicon, CATT, GOHIGH, OPPO, Qualcomm | Futurewei, ZTE, Sony, Mediatek | Apple, Lenovo, LGE |

Therefore, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 4.2.2-v0

Study further both the following options with regards to the sequence design for the new SL Positioning Reference Signal:

* Option 1: ZC-based design, (e.g. similar to the sequences used for NR SRS)
* Option 2: Pseudorandom sequence (e.g. Gold sequence signals, similar to DL-PRS, or SL-CSI-RS).

##### Companies views

|  |  |
| --- | --- |
| CATT | Support Option 2.  We prefer to reuse the Gold sequence, similar to DL-PRS. |
| MTK | We are okay to study both before making decision |
| ZTE | Thanks for FL’s summary table but we want to clarify that Gold sequence is preferred for us to align with sidelink CSI-RS design. |
| Huawei,  HiSilicon | If it would be helpful to guide the further study, we suggest adding a note to consider high Doppler shift especially for V2X scenario. |
| Spreadtrum | We are open to discuss both Option 1 and Option 2. |
| InterDigital | We favor Gold sequence, as it is used for SL RS. In addition, we consider the SL PRS transmission coverage requirement is not as stringent as the UL transmission and thus the PAPR requirement is of less concern. |
| Futurewei | We are open to discuss both options, but we have a slight preference for Option 1. |
| CMCC | Open.  Both the sequences of PRS and SRS-Pos can be used as baseline. |
| Sony | It is a bit confusing when we see the table and the proposal (i.e, Option 1 in table 1 is about pseudo random sequence while, Option 1 in the FL proposal is about ZC-based design).  Our preference is ZC-based design (Option 1 as in the FL proposal). |
| OPPO | Support the proposal to further study the 2 sequences. But in our view only one sequence is use as SL-PRS at the end, maybe we can add this restriction at this stage. |
| Lenovo | We are currently open to both options regarding the new SL PRS. For clarification, is the eventual outcome to downselect the two options for eventual support? |
| vivo | As pointed out by Sony, the numbering of options in table and proposal is not matched which cause confusion.  Before we jump into discussion on sequence design for SL-PRS, maybe a high level principle should be discussed first: whether we follow PRS or SRS to begin with.  Furthermore, for study of sequence, we’d like to know what aspect(s) to look into for further study. |
| Apple | We are fine with studying both options. |
| Locaila | We support the study of both ZC and PN sequence design for the new SL-PRS. |
| Samsung | OK for the direction of proposal 4.2.2 in general |
| Qualcomm | We are ok with the proposal. In terms of the options, we support Option 2 since it is a better fit with the existing NR sidelink signals. |
| DCM | OK with this proposal to study further. |
| LGE | We’re open to both options but slightly prefer option 2 due to the performance degradation of ZC sequence under UE mobility. |
| Sharp | We are OK to study both options. |
| Xiaomi | We are supportive to study both options, but think finally only 1 SN shall be supported. |
| Nokia, NSB | OK |
| Ericsson | During study phase, both options could be considered. We feel it is a bit too early to be discussing down selection to specific sequence designs. |
| Intel | Support to study both options. |

##### FL Observations

Most of the companies seem OK to study both options. A few of the companies explicitly provided a preference for either one or the other. It doesn’t seem possible clearly to downselect now. To improve the proposal, a few suggestions were made:

* Could we agree that eventually a single option will be supported?
* Could we add which aspects should be studied with regards to these 2 sequences?

##### [CLOSED]Feature Lead Proposal 4.2.2-v1

Study further both the following options with regards to the sequence design for the new SL Positioning Reference Signal:

* Option 1: ZC-based design, (e.g. similar to the sequences used for NR SRS)
* Option 2: Pseudorandom sequence (e.g. Gold sequence signals, similar to DL-PRS, or SL-CSI-RS).
* Note 1: Companies are encouraged to consider at least the following aspects in their study: PAPR aspects, high mobility, commonality with other SL-RS, performance evaluation(s)
* Note 2: RAN1 should downselect one of the options

Companies are encouraged to provide views specifically on the 2 Notes:

* Question 1: What additional elements are you interested in including in Note 1?
* Question 2: Do you support Note 2?

##### Companies views

|  |  |
| --- | --- |
| vivo | For Q2, we support note 2 as we don’t think SL-PRS need two types of sequence design. |
| Futurewei | Support FL proposal including Note 2. |
| InterDigital | We agree with starting with a study both options. For Note 1 we support the FL’s version. For Note 2 we think the study should consider at least UE and RSU as types of SL node to support SL positioning and down-selection for sequence design can be done for eacy type of SL node with different considerations. |
| Samsung | We do not prefer to have note 2. We think two options are good direction for the study but we do not need to limit other possibilities at this early stage. |
| LGE | We’re ok with studying both note 1 and 2. We support Note 2 otherwise two SL PRS sequences need to be implemented at UE side, which causes uncessarily the UE complexity. |
| Xiaomi | Support. We are open for option 1 and option 2 now.  Also support note 2. |
| DCM | Support. Strongly prefer to have note 2. Doubled definitions of SL-PRS should be avoided. |
| NEC | Support down selection. |
| Sharp | For Note 2, we have similar view with InterDigital. |
| CMCC | No additional elements for Q1;  Support Note 2, single type of sequence should be defined for SL-PRS. |
| CATT | Support.  Note2 is fine for us. Only one kind of sequence is needed for SL-PRS. |
| OPPO | We are fine with the proposal in principle.  In Note 1, in our view, it is common understanding that PAPR of ZC sequence is lower than Gold sequence, but what’s important here is wheter the low PAPR can bring additional benefit in terms of performance under targeted scenarios, thus maybe we can start from the study of “benefit of PAPR aspects”.  We support Note 2, we believe the performance of sequence has nothing to do with UE type, if one is better than the other, it shall be used for all UE types. |
| Lenovo | Support of revised proposal including Notes 1 and 2. On Option 1, we also think it would be also beneficial to keep the study open (since it’s the first meeting) to consider other ZC-based designs aside from SRS, such as the PRACH ZC-based design. Any PAPR gains/losses (if any) between ZC-based SRS and PRACH designs could be further studied. |
| Nokia, NSB | OK for main proposal; regarding Note 2, prefer to make it FFS for now and decide later. It is conceivable, though unlikely, that we might want to specify both options, e.g. to optimally support both use cases with high range/power saving requirements and use cases with high Doppler. |
| Huawei, HiSilicon | OK |
| ZTE | We support Note 2 to downselect one of the sequence design for SL-PRS. |
| Intel | OK in principle, but few observations and suggestions:   * For Note1, we prefer to say “mobility” as a general consideration than “high mobility” – sufficient to mention the characterstic/aspect to consider than requirement possibly on for a subset of use-cases. * For Note1, the motivation for and how to objectively evaluate “commonality” in “commonality with other SL-RS” are not clear. Instead, we suggest to generalize as “compatibility with other SL channels and signals”. * For Note2, f we say “RAN1 ***should*** downselect …”, then it should not be a note, but in the main bullet. However, reading through some of the responses, looks like we are not ready to committing to such at this point in time. In such a case, downselection aspects can be considered in later discussions. |
| Qualcomm | We support in general, including Note 2. We also agree with OPPO’s update to Note 1. |

##### FL Observations

Support Note 2

* Vivo, Futurewei, LGE, Xiaomi, NTT DOCOMO, NEC, CMCC, CATT, OPPO, Lenovo, Huawei, HiSilicon, ZTE, Qualcomm

Not support Note 2

* Samsung, Nokia, NSB

Downselection of sequence based on the type

* Interdigital, NEC

Change Note 1 to: “benefit of PAPR aspects”

* OPPO, Qualcomm

##### [CLOSED]Feature Lead Proposal 4.2.2-v2

Study further both the following options with regards to the sequence design for the new SL Positioning Reference Signal:

* Option 1: ZC-based design, (e.g. similar to the sequences used for NR SRS)
* Option 2: Pseudorandom sequence (e.g. Gold sequence signals, similar to DL-PRS, or SL-CSI-RS).
* Note 1: Companies are encouraged to consider at least the following aspects in their study: [Benefit of] PAPR aspects, high mobility, commonality with other SL-RS, performance evaluation(s)
* Note 2:
  + Alt. 1: RAN1 should downselect one of the options
  + Alt. 2: RAN1 shall strive to downselect one of the options
  + Alt. 3: FFS: RAN1 should downselect one of the options

Please comment which alternative(s) of Note 2 you could accept, and whether you are OK with the text inside the bracket

##### Companies views

|  |  |
| --- | --- |
| MTK | We prefer Alt. 1 within Note 2 |
| CMCC | We are OK about the “[Benefit of]”’  We do not see so much difference b/w Alt.1 and Alt. 2 under Note 2. Both of them are OK for us. Alt.3 is not preferred since majority companies support to make down selection in future for the sequence design. |
| CATT | We prefer Alt.1.  We can live with the text of [Benefit of]. |
| ZTE | We are fine with [Benefit of] PAPR aspects;  Among the three alternatives for Note 2, we support Alt.1 but Alt.2 is also OK. |
| OPPO | Support the text inside the brackets.  Support Alt.1 of Note 2, both options should be studied at study phase but only one of them should be selected based on overall performance for SL positioning. |
| Fraunhofer | Interefence resulting from multi-user[/port] SL positioning is an important aspect for the performance analysis to downselect between Options1 and options2 |
| LGE | We are fine either with or without [benefit of], which seems not having a significant difference. As for note 2, based on the comments from other companies, we need to change it as a main text from the note. We suggest the following modification. [HIGH]Feature Lead Proposal 4.2.2-v2 Study further both the following options with regards to the sequence design for the new SL Positioning Reference Signal:   * Option 1: ZC-based design, (e.g. similar to the sequences used for NR SRS) * Option 2: Pseudorandom sequence (e.g. Gold sequence signals, similar to DL-PRS, or SL-CSI-RS). * Note 1: Companies are encouraged to consider at least the following aspects in their study: [Benefit of] PAPR aspects, high mobility, commonality with other SL-RS, performance evaluation(s) * RAN1 should downselect one of the options |
| Bosch | The text inside the brackets is fine. We prefer Alt. 1. |
| Xiaomi | Alt 1 is preferred. We can accept Alt 2 as 2nd priority. |
| vivo | We’re OK to have “Benefit of” before PAPR.  On the proposed “Note2”, we actually think this is part of proposal for agreement, not just a note for explanation. We suggest an even stronger wording as the 3rd bullet before note 1.   * RAN1 shall downselect to one of the options |
| NEC | We support Alt. 2. |
| Lenovo | Ok with the text in brackets, Alt. 1 or Alt. 2 seems fine |
| InterDigital | We support the proposal. Regarding Note 2, as indicated earlier, we prefer to study both types of PRS for different SL nodes (UE/RSU) and make a decision depending on the outcome. Thus, we don’t prefer to commit to a down-selection at such an early stage as indicated in Alt .1. We are fine with Alt. 2 or Alt. 3. |
| Intel | Alt 2 seems most reasonable at this stage. Again, Alt 1 is not consistent with it being a Note.  For Note 1, we still request for clarification on interpretation of “commonality with SL-RS” – specifically, how is this to be ascertained including which characteristics are under consideration here. For instance, is compatibility the main aim, or Tx or Rx requirements/characteristics, or resource mapping characteristics, etc.? |
| Qualcomm | Alt 1 with update to “RAN1 ~~should~~ to downselect one of the options”  We think RAN1 needs to downselect to one option. Having both is unnecessarily burdensome to the UE and would lead to two sets of UE which cannot perform positioning/ranging operations with each other. |
| Samsung | OK for Alt3 and fine with Alt 2. |
| Spreadtrum | For the proposed “Note2”, we prefer Alt.1. |
| Apple | We are fine with Alt-2 |
| Sharp | We are OK with Alt. 3 and also Alt. 2. Similar view with InterDigital. |
| Huawei, HiSilicon | Alt.1 on the Note. |
| DCM | Alt 1 or QC’s recommendation. |
| SONY | We think Note 2 is not needed, at least at this stage. We can do the downselection after the pros and cons are on the table. However, we prefer Alt.1 |
| Nokia, NSB | OK; We prefer Alt 3. |
| Ericsson | Suggest some wording change:  Study further both the following options with regards to the sequence design for ~~the~~ a potential new SL Positioning Reference Signal: |

##### FL Observations

With regards to Note 2:

* Alt. 0 (RAN1 shall / to downselect to one of the options)
  + Vivo, Qualcomm, NTT DOCOMO
* Alt. 1:
  + MTK, CMCC, ZTE (1st) , OPPO, LGE, Bosch, Xiaomi, Lenovo, Spreadtrum, Huawei, HiSilicon, NTT DOCOMO, Sony
* Alt. 2:
  + CMCC, ZTE(2nd) , Xiaomi (2nd) , NEC, Lenovo, Interdigital, Intel, Samsung, Apple, Sharp
* Alt. 3:
  + Interdigital, Samsung, Sharp, Nokia, NSB

There is clear majority on either making clear that we ll have to pick one of the options, or at least strive to do so (Alt 0, 1, 2). Even between the 4 companies that support Alt. 3, 3 of those also support Alt. 2. I think a compromised solution, through email discussion might be more possible going with Alt. 2.

To @Intel: “commonality with other RS” shall be up to each company to provide. This will be contribution driven in the next meeting. Trying to narrow down the definition of “commonality” would make this proposal unstable at this point. My suggestion is to trust that companies will describe what they consider as factors that are within this aspect.

##### [CLOSED]Feature Lead Proposal 4.2.2-v3

Study further both the following options with regards to the sequence design for a potential SL Positioning Reference Signal:

* Option 1: ZC-based design, (e.g. similar to the sequences used for NR SRS)
* Option 2: Pseudorandom sequence (e.g. Gold sequence signals, similar to DL-PRS, or SL-CSI-RS).
* Note 1: Companies are encouraged to consider at least the following aspects in their study: Benefit of PAPR aspects, high mobility, commonality with other SL-RS, performance evaluation(s)
* Note 2: RAN1 shall strive to downselect one of the options

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We are okay with the proposal. |
| Futurewei | Support |
| CMCC | OK |
| vivo | OK |
| Intel | Thanks to the Moderator for clarifying our question on “commonality with other SL-RS”. Although not ideal, we can accept it for progress. |
| ZTE | In our understanding, RAN1 need to downselect one of the options. But we are fine with this compromised proposal. |
| Spreadtrum | Support. |
| CATT | Support. |
| DCM | Although my feeling of this note 2 is to give up down-selection without certain reason to adopt both options – I saw this situation in previous SL discussions many times – and thus will consume more time to make spec for both options, we can accept if this is really majority’s preference. |
| LGE | Support with one comment. Smal editorial suggesttion to add ‘impact of’ before high mobility to make the meaning clearer.  Note 1: Companies are encouraged to consider at least the following aspects in their study: Benefit of PAPR aspects, impact of high mobility, commonality with other SL-RS, performance evaluation(s) |
| Lenovo | Support and fine with LGE’s editorial correction |
| NEC | Support |
| Sharp | Support |
| OPPO | Support the proposal. |
| Samsung | OK |
| Xiaomi | OK |
| SONY | Support |
| Huawei, HiSilicon | Support. |
| Qualcomm | We are still of the view that only one PRS design should be supported in specifications.  Supporting two designs leads to system fragmentation, where some UEs support one type but other UEs support another type. The alternative is for the UE to implement both, increasing both transmitter and receiver complexity. Additional RAN1 discussions would be needed regarding prioritization, simultaneous reception and measurements, …  Our first preference for Note 2 remains Alt 1 but we can compromise to Alt 2. |
| Nokia, NSB | OK |

##### FL Observations

It seems the proposal is agreeable from all companies except 1. It was also noted by 2 companies that seem to accept the current version as compromise but they appear “uncorfortable” doing so. I am planning to propose this for GTW.

##### [GTW]Feature Lead Proposal 4.2.2-v3

Study further both the following options with regards to the sequence design for a potential SL Positioning Reference Signal:

* Option 1: ZC-based design, (e.g. similar to the sequences used for NR SRS)
* Option 2: Pseudorandom sequence (e.g. Gold sequence signals, similar to DL-PRS, or SL-CSI-RS).
* Note 1: Companies are encouraged to consider at least the following aspects in their study: Benefit of PAPR aspects, high mobility, commonality with other SL-RS, performance evaluation(s)
* Note 2: RAN1 shall strive to downselect one of the options
  + Support/Accept Note as is
    - Interdigital, Futurewei, CMCC, vivo, Intel, ZTE, Spreadtrum, CATT, DCM, LGE, Lenovo, NEC, Sharp, OPPO, Samsung, Xiaomi, Sony, Huawei, HiSilicon, Nokia, NSB
  + Change the Note to “RAN1 should downselect one of the options”
    - Qualcomm

#### 4.2.3 SL-PRS Frequency domain Pattern

Based on the submitted contributions, several proposals were made with regards to the SL-PRS frequency domain pattern:

|  |  |
| --- | --- |
| Huawei, HiSilicon | The comb structure of PRS should be supported for SL-PRS design. |
| Futurewei | RAN1 should consider the UL PRS design as the starting point of the S-PRS design |
| Nokia, NSB | A new reference signal should be defined over SL interface for positioning purposes. For this, the structure of the UL SRS can be re-used, with any necessary modifications to be studied. |
| Samsung | Study frequency domain behaviour for SL positioning reference signal as   * The number of supported sub-channels for SL positioning reference signal |
| Fraunhofer IIS, Fraunhofer HHI | Support the sidelink transmission in the whole carrier bandwidths up to 40 MHz which are defined in TS 38.101-1  RAN1 to study the impact of the following options to improve the sidelink accuracy in Rel-18:   * Option 1: for sidelink positioning in inter and intra-band operation: allow a maximum transmission and reception for UE capable devices according to the bandwidth allowed for Uu: {50, 60, [70], 80, 90, 100} MHz. * Option 2: allow bandwidth extension by applying CA for SL   Support staggered SRS for the sidelink positioning reference signal.  Study the use of low power positioning reference signals with a bandwidth higher than the bandwidth allocated for sidelink (communication) signals |
| vivo | Support reuse of one or more comb sizes of DL-PRS for the SL-PRS pattern.  Partial staggered pattern can be considered for SL-PRS pattern considering SL structure (e.g, excluding the PSCCH symbol, AGC, or GP symbol for SL-PRS transmission) |
| ZTE | SL-PRS Pattern   * Comb size |
| OPPO | Both full RE mapping pattern and comb-like pattern should be further studied for SL-PRS design. |
| Qualcomm | RAN1 to further study contiguous or comb structure ZC sequence design for SL PRS |
| Mediatek | Consider partial staggering or non-staggering structure for SL-PRS |
| Interdigital | Study PRS patterns for SL positioning, using the Uu PRS patterns as the starting point |

Based on the above, it seems that companies consider a comb-based design for SL-PRS, and therefore the following proposal is made:

##### [CLOSED] Feature Lead Proposal 4.2.3-v0

With regards to the frequency domain pattern, study further a Comb-N SL-PRS design. Study at least the following aspects:

* N>=1 (where N=1 corresponds to full RE mapping pattern)
* Fully staggered SL-PRS pattern (i.e., N symbols of SL-PRS with comb-N and, at each symbol a different RE offset is used), Partially staggered SL-PRS pattern, Unstaggered SL-PRS patterns
* The number of symbols of SL-PRS within a slot, and any relation to the comb-N options

##### Companies views

|  |  |
| --- | --- |
| CATT | Support |
| MTK | okay |
| ZTE | Agree to further discuss comb pattern of SL-PRS. |
| Spreadtrum | Support |
| InterDigital | We think it will be beneficial to have one or more target PRS bandwith requirements based on the supported positioning method and use case and apply such requirements to the frequency domain pattern design. In addition, this may be related to PRS slot structure, e.g. whether or not PRS is multiplexed with other SL channels within a slot either in time or frequency domain. Thus we propose to make the following change to the proposal:  With regards to the frequency domain pattern, study further a Comb-N SL-PRS design. Study at least the following aspects:   * N>=1 (where N=1 corresponds to full RE mapping pattern) * Fully staggered SL-PRS pattern (i.e., N symbols of SL-PRS with comb-N and, at each symbol a different RE offset is used), Partially staggered SL-PRS pattern, Unstaggered SL-PRS patterns * The number of symbols of SL-PRS within a slot, and any relation to the comb-N options * Consideration for PRS multiplexing with other channels |
| Futurewei | Support |
| CMCC | Support |
| NEC | OK |
| Sony | Okay |
| OPPO | Support |
| Lenovo | Support FL’s proposal. |
| vivo | OK in principle.  On the suggested modification from InterDigital, we don’t think multiplexing with other channels is the only aspect need to be considered for comb design. Either we add all aspects worth consideration together or not at all. |
| Apple | We are fine with the proposal. |
| Locaila | Doppler-resistant block-type pattern such as PTRS is required. |
| Samsung | OK for the direction of proposal 4.2.3 in general |
| Qualcomm | Support |
| DCM | OK with this proposal to study further. |
| LGE | Support with one comment. Staircase pattern should also be included for study, which is beneficial for multiplexing different comb patterns in a slot. |
| Sharp | Support |
| Xiaomi | Agree |
| Nokia, NSB | OK |
| Ericsson | This is a further detail. These aspects can be studied of course. |
| Intel | OK. |

##### FL Observations

Most of the companies seem OK with the proposal in the current form. Two additional comments:

* LGE: “Staircase pattern should also be included for study”
  + FL: A staircase pattern is an example of pattern that can be fully/partially staggered, so it is within the study clearly.
* Localia: “Doppler-resistant block-type pattern such as PTRS”
  + Maybe we could add the expression “RE offset repetitions”, which I think is what you are referring as “block-type pattern”.

##### [CLOSED] Feature Lead Proposal 4.2.3-v1

With regards to the frequency domain pattern, study further a Comb-N SL-PRS design. Study at least the following aspects:

* N>=1 (where N=1 corresponds to full RE mapping pattern)
* Fully staggered SL-PRS pattern (i.e., N symbols of SL-PRS with comb-N and, at each symbol a different RE offset is used), Partially staggered SL-PRS pattern, Unstaggered SL-PRS patterns
* The number of symbols of SL-PRS within a slot, any relation to the comb-N option, RE offset repetitions within a slot

##### Companies views

|  |  |
| --- | --- |
| vivo | OK |
| Futurewei | Support |
| InterDigital | We support the proposal. |
| Samsung | OK |
| LGE | If it’s common understanding that ‘staggered’ includes ‘staircase’, we’re ok with the proposal. We’re also fine with adding ‘RE offset repetitions within a slot.’ |
| Xiaomi | agree |
| DCM | OK |
| NEC | OK |
| Sharp | Support |
| CMCC | Support |
| CATT | Support |
| OPPO | OK |
| Lenovo | Ok, just for clarification would agreeing on the comb design already preclude the study of other designs as noted in the previous response in P 4.4.2 -v1? |
| Nokia, NSB | OK |
| Huawei, HiSilicon | OK |
| ZTE | We support this proposal. To avoid the inconsistency of understanding among companies, can we also add some explanations for Partially staggered SL-PRS pattern and Unstaggered SL-PRS patterns? |
| Intel | Support in general, but would like to second ZTE’s suggestion to add some examples/explanations (similar to fully staggered case) for “partially staggered”, “unstaggered SL-PRS”, and “RE offset repetitions”. |
| Qualcomm | Support |

##### FL Observations

Support the proposal

* Vivo, Futurewei, Interdiital, Samsung, Xiaomi, DCM, NEC, Sharp, CMCC, CATT, OPPO, Nokia, NSB, Huawei, HiSilicon,

@ZTE, @Intel: Added a description for partial staggered and unstaggered.

@Lenovo: Yes this proposal limits the study to comb-based designs.

@LGE: Yes staircase is one example. Any time comb-N pattern is open with this proposal. The only limitation is that it has to be a SL-PRS that uniformly samples the frequency in a symbol.

##### [CLOSED] Feature Lead Proposal 4.2.3-v2

With regards to the frequency domain pattern, study further a Comb-N SL-PRS design. Study at least the following aspects:

* N>=1 (where N=1 corresponds to full RE mapping pattern)
* Fully staggered SL-PRS pattern (i.e., N symbols of SL-PRS with comb-N and, at each symbol a different RE offset is used), Partially staggered SL-PRS pattern (i.e., N symbols of SL-PRS with comb-M, with M>N, at each symbol a different RE offset is used), Unstaggered SL-PRS patterns (i.e., single symbol SL-PRS with comb-M, M>1)
* The number of symbols of SL-PRS within a slot, any relation to the comb-N option, RE offset repetitions within a slot

This proposal is close to be considered stable. Added some short description for the partial/unstaggered which i hope is acceptable. Please comment if you strongly think that these descriptions have flaws.

##### Companies views

|  |  |
| --- | --- |
| MTK | 1, We suggest to change the example for unstaggered SL-PRS patterns   * ~~(i.e., single symbol SL-PRS with comb-M, M>1)~~ 🡪 (i.e, N symbols of SL-PRS with comb-M, at each symbol a same RE offset is used, M> 1 and N >=1) |
|  |  |
| CATT | We are fine with MTK’s revision. |
| ZTE | We agree with MTK’s change. |
| OPPO | Fine with the proposal, the wording of MTK for unstaggered is clearer for us. |
| Fraunhofer | Ok with FL or MTK revision |
| LGE | Support |
| BOSCH | Ok with proposal and MTKs refinement. |
| Xiaomi | Agree. Also fine with MTK revision. |
| vivo | OK in general.  Regarding MTK’s suggestion, the last “N >=1” is not needed since it is already covered by the 1st bullet. |
| NEC | We suggest not to include details but agree on design principles at this stage. The details in the parentheses can be removed. |
| Lenovo | Fine with FL’s proposal and MTK’s revision for the unstaggered pattern definition. |
| InterDigital | We agree with the proposal with the wording suggested by MTK |
| Futurewei | OK in general. MTK suggestion makes sense for the symmetry of the first bullet text, but we also are OK if the staggered and unstaggered definitions in paranthesis are removed. |
| Intel | We can accept the proposal and support MTK’s example. To address NEC’s comment, we suggest replacing “i.e.” by “e.g.”, that is, these are to serve only as examples. |
| Qualcomm | OK with the proposal |
| Samsung | OK |
| Spreadtrum | Support. |
| Apple | Okay |
| Sharp | Support. Also OK with MTK’s modification. |
| Huawei, HiSilicon | It seems we are on the common ground of be open to study. We think it is too early to exclude other patterns than the comb structure. For example the RE spacing can be non-uniform. We suggest to add one subbullet:  FFS: Non-uniform RE pattern in the frequency domain. |
| DCM | OK |
| SONY | OKAY |
| Nokia, NSB | OK |

##### FL Observations

All companies support the proposal or MTK’s modification. Huawei, Hisilicon suggests to keep non-uniform RE pattern in frequency domain still open.

From FL perspective, this proposal clearly says that we are going to study uniform patterns in frequency, so the intention of the proposal was indeed to not keep the Non-uniform RE pattern open. Seems all companies except 1 wanted to keep the non-uniform in frequency pattern still open, the proposal doesn’t change.

NEC prefers to remove the parenthesis, even though to me, it just helps to provide a description. Intel suggested to change “i.e.” to “e.g.”. Wondering if that would be a way forward.

Vivo, pointed out that N>=1 is already included in the first bullet, so there is no need to include it again. This is fine. We also say. Especially if we make these examples, rather than definitions, i assume it should be fine to remove the repetition of N>=1.

Therefore, the updated proposal is:

##### [CLOSED] Feature Lead Proposal 4.2.3-v3

With regards to the frequency domain pattern, study further a Comb-N SL-PRS design. Study at least the following aspects:

* N>=1 (where N=1 corresponds to full RE mapping pattern)
* Fully staggered SL-PRS pattern (e.g., N symbols of SL-PRS with comb-N and, at each symbol a different RE offset is used), Partially staggered SL-PRS pattern (e.g., N symbol(s) of SL-PRS with comb-M, with M>N, at each symbol a different RE offset is used), Unstaggered SL-PRS patterns (e.g., N symbol(s) of SL-PRS with comb-M, at each symbol a same RE offset is used, M> 1)
* The number of symbols of SL-PRS within a slot, any relation to the comb-N option, RE offset repetitions within a slot

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We support the proposal. |
| Futurewei | Support |
| CMCC | Support |
| vivo | OK |
| Intel | Support |
| ZTE | Support. |
| Spreadtrum | Support. |
| CATT | We support this proposal in principle.  In the main bullet, N refers to number of Comb. But in the second bullet, N refers to the number of symbols of SL-PRS and M refers to the number of Comb. So we prefer to revise the proposal to align the meanings of N and M.  Regarding the third sub-bullet, we prefer to divide it into three ones to make the thing clearer.  Our preferred proposal as follows (The changes are marked as BLUE color), Updated [HIGH] Feature Lead Proposal 4.2.3-v3 With regards to the frequency domain pattern, study further a Comb-N SL-PRS design. Study at least the following aspects:   * N>=1 (where N=1 corresponds to full RE mapping pattern) * Fully staggered SL-PRS pattern (e.g., M~~N~~ symbols of SL-PRS with comb-N with M=N and, at each symbol a different RE offset is used), Partially staggered SL-PRS pattern (e.g., M~~N~~ symbol(s) of SL-PRS with comb-N~~M~~, with M<~~>~~N, at each symbol a different RE offset is used), Unstaggered SL-PRS patterns (e.g., M~~N~~ symbol(s) of SL-PRS with comb- N~~M~~, at each symbol a same RE offset is used, N~~M~~ > 1) * The number of symbols of SL-PRS within a slot~~, any relation to the comb-N option, RE offset repetitions within a slot~~ * Any relation to the comb-N option * RE offset repetitions within a slot |
| DCM | OK |
| Feature Lead | Thanks to CATT for noticying this notation discrepancy. Since time is limited, please **continue commenting using the updated proposal from CATT.** |
| LGE | We need clarification on “RE offset repeitions within a slot.”  Does ‘repetition’ mean the unstaggered SL-PRS (same RE offsets)? If so, it’s redundant and can be removed.  Or, does it mean that the RE offset pattern is repeated? Equivalently, it can be meant that a whole or a part of SL PRS is repeated within a slot (N>M). If so, a clarification is needed in wording. We suggest “RE offset pattern is repeated.’  As a subsequenct question from above, we need to define such a repetition is treated as a part of SL-PRS or as a repetition of SL-PRS. If it means the former, we need to study the possibility of the latter. We suggest to add to study the repetition of SL-PRS in general.  As a conclusion, we suggest the following modification.   * The number of symbols of SL-PRS within a slot * Any relation to the comb-N option * RE offset pattern repetitions within a slot * SL-PRS repetition |
| Lenovo | Support CATT’s revision |
| NEC | Support the LGE’s modification. |
| Sharp | Support |
| OPPO | Support the updated proposal from CATT. |
| Samsung | OK |
| Bosch | OK |
| Xiaomi | OK |
| Huawei, HiSilicon | We believe that non-uniform comb structure can overcome the sidelobes introduced in the comb structure with e.g. 1 symbol PRS, and also provide sufficient randomization of interference if two UE autonomously selects the same symbol to transmit the SL-PRS without pre-coordination. It should not be precluded to discourage companies to study it.  The following FFS should be added.  FFS: Non-uniform RE pattern in the frequency domain. |
| Qualcomm | We are ok with the proposal |
| Nokia, NSB | OK with CATT’s update |

##### FL Observations

It seems the proposal is agreeable by all companies except 1.

* The updates from CATT are editorial and correct the initial intention.
* Also, the LGE’s modification looks very minor. Therefore, I ll attempt this one, with the LGE’s modifications for an Email Endorsement.
* Huawei, HiSilicon still wants to add the following:
  + FFS: Non-uniform RE pattern in the frequency domain.

We may need to go for 1 more round to try to settle whether we ll study the non-uniform RE pattern further.

##### [HIGH][OPEN] Feature Lead Proposal 4.2.3-v4

With regards to the frequency domain pattern, study further a Comb-N SL-PRS design. Study at least the following aspects:

* N>=1 (where N=1 corresponds to full RE mapping pattern)
* Fully staggered SL-PRS pattern (e.g., M~~N~~ symbols of SL-PRS with comb-N with M=N and, at each symbol a different RE offset is used), Partially staggered SL-PRS pattern (e.g., M~~N~~ symbol(s) of SL-PRS with comb-N~~M~~, with M<~~>~~N, at each symbol a different RE offset is used), Unstaggered SL-PRS patterns (e.g., M~~N~~ symbol(s) of SL-PRS with comb- N~~M~~, at each symbol a same RE offset is used, N~~M~~ > 1)
* The number of symbols of SL-PRS within a slot~~, any relation to the comb-N option, RE offset repetitions within a slot~~
* Any relation to the comb-N option
* RE offset pattern repetitions within a slot
* SL-PRS repetition
* **[FFS: Non-uniform RE pattern in the frequency domain.]**

Do you support adding the “FFS” on Non-uniform RE pattern?

##### Companies views

|  |  |
| --- | --- |
|  |  |

#### 4.2.4 SL-PRS Time domain Behavior

Based on the submitted contributions, several proposals were made with regards to the SL-PRS time domain pattern:

|  |  |
| --- | --- |
| Samsung | Study time domain behaviour for SL positioning reference signal as   * The number of supported symbols for SL positioning reference signal * Aperiodic (one shot or N shots), semi-persistent or periodic |
| Fraunhofer IIS, Fraunhofer HHI | Support the allocation of “double burst” (e.g. pairs of SRS-pos) for relative speed measurements |
| CATT, GOHIGH | Periodic, semi-persistent and aperiodic S-PRS should be supported in Rel-18.  The semi-persistent S-PRS and aperiodic S-PRS transmission procedure should be triggered explicitly by the related signaling procedure. |
| CMCC | RAN1 should further study which type of RS in time domain should be supported in Rel-18, including periodic, semi-persistent, and aperiodic |
| ZTE | * SL-PRS Pattern   + Number of OFDM symbols within a slot * Periodicity: specify the periodicity of SL-PRS and the modification based on the DL-PRS’s periodicity. * Repetition |
| OPPO | Both periodic SL-PRS transmission and on-demand SL-PRS transmission should be considered in sidelink positioning. |
| Lenovo | RAN1 to consider at least the following configurability options for SL PRS:   * Support of periodic/semi-persistent/aperiodic transmission of SL PRS |
| LGE | The following types of SL PRS transmission are supported.   * Semi-persistent SL PRS transmission * Aperiodic SL PRS transmission * On-demand SL PRS transmission   When LMF/gNB schedules the SL PRS resources, the following operations are supported.   * Semi-persistent SL PRS resources can be allocated to UE based on a single UE request. * Aperiodic SL PRS resources can be allocated to UE based on the UE request per SL PRS transmission. |
| NEC | Periodic, aperiodic and semi-persistent resource configuration for S-PRS and related reporting should be supported. |
| Huawei, HiSilicon | Support at least aperiodic PRS triggered by SCI for sidelink positioning. |

Based on the above proposals, and also Section 4.2.5, it may be beneficial at this point to clarify the following two aspects:

* A 1st aspect is whether the SL-PRS is an “always-On” or “On-demand” signal (see for example, the NR Rel-16 DL-PRS and the new feature added in NR Rel-17 on on-demand DL-PRS)
* A 2nd aspect is whether the SL-PRS is configured through high-layer (RRC/LPP/SLPP/PC5-RRC), activated through MAC-CE, or triggered through SCI, or any combination of those. This aspect might be referred to, in some of the above papers, as “periodic” (e.g. high-layer configured), “semi-persistent” (high-layer configured with MAC-CE used for activation), “aperiodic” (high-layer configured with SCI used for triggering).

I think it will be useful to start with the 1st aspect in this proposal, and ask the companies whether they find it useful to clarify this aspect, whether we need to study both options for SL positioning, or not:

##### [CLOSED]Feature Lead Proposal 4.2.4-v0

With regards to the time-domain behavior of the SL-PRS, companies are encouraged to provide their views, whether they support one or both of the following options to be studied:

* Option 1: Always-on SL-PRS
  + SL-PRS is pre-configured and is always transmitted in a given deployment (i.e., similar to the NR Rel-16 DL-PRS defined in the Uu interface)
* Option 2: On-demand SL-PRS
  + Request/configuration/activation/triggering message(s), or a combination of such messages, is needed for one or more instances of a SL-PRS to be transmitted
* Note: How SL-PRS is configured, e.g, through high layers, and/or activated/deactivated through MAC-CE, and/or triggered by SCI, or any combination of signaling, is a separate topic.

##### Companies views

|  |  |
| --- | --- |
| CATT | Support to study both Option 1 and Option 2.  We prefer that periodic, semi-persistent and aperiodic S-PRS should be supported in Rel-18. |
| MTK | 1, We have some concern on Option 1 for the pre-configured SL-PRS. The main reason is, the RTT measurement is quite important for relative positioning. So it requires UE A🡪 UE B 🡪 UE A as one sided or A🡪B🡪A🡪B as two sided, the transmission A🡪 B and B🡪 is expected to be as close as possible especially under mobility. So we prefer option 2  2, We also assume that option 2 may contain “coordination” between UEs for SL-PRS transmission. So we suggest to add a note that “Option 2 may contain coordination between UEs for SL-PRS configuration |
| ZTE | Open to discuss. In our understanding we can firstly choose and prioritize Option 1 as a starting point. |
| Huawei, HiSilicn | Our first preference is option 2.  Keeping both options open for further study is fine since for now everything is open for more study/discussion because we are thinking it is somehow related with RS resource allocation schemes.  One question for clarification on the categorization into “Always-on SL-PRS” and “On-demand SL-PRS” is that even DL-PRS may not be always ON, and periodic Uu RS may not be always ON. On the other hand, does “On-demand SL-PRS” also includes some sort of periodic signal that is transmission is configured, instead of pre-configured. |
| Spreadtrum | Open to discuss both Option 1 and Option 2. We prefer Option 2. |
| **Feature Lead Clarification** | Clarification to avoid ambiguity: “On-demand PRS” includes periodic PRS that is configured but NOT pre-configured. If it helps with the discussion, consider the “i.e.” as deleted in option 1:   * SL-PRS is pre-configured and is always transmitted in a given deployment ~~(i.e., similar to the NR Rel-16 DL-PRS defined in the Uu interface)~~ |
| InterDigital | We are ok to study both options. Option 1 may be more suitable for positioning involving RSU. |
| Futurewei | We are open to discuss both options, however we prefer Option 2, we also notice that the positioning signaling and procedure may be triggered by upper layers and therefore we are not sure if would be compatible with Option 1. |
| CMCC | Support to study both options.  We believe at this initial stage, either type of PRS should not be precluded and can be further studied. |
| NEC | Both options should be studied. |
| Sony | Let’s keep it open at this stage. We support to study both options. |
| OPPO | We support to further study both options, always-on is more suitable for TDOA based absolute positioning, and on-demand is preferable for RTT based method. |
| Lenovo | We have a preference towards Option 2. In the case of out-of-coverage , Option 1 may challenging to always transmit PRS given the resource selection mechanisms in Mode 2, and therefore has dependency on the type of coverage scenario. |
| vivo | Not against the study, but we don’t feel this “always on” or “on demand” is part of physical layer SL-PRS design.  We prefer to discuss this after we know more about PHY SL-PRS design itself. For instance, after we know the number of symbols of SL-PRS within a slot, whether to support symbol level SL-PRS, etc. |
| Apple | We are okay to study both options |
| Locaila | Support to study Option 1. |
| Samsung | Study two options.  For option 2, we sugget adding “deactivation” as   * Option 2: On-demand SL-PRS   Request/configuration/activation/deactivation/triggering message(s), or a combination of such messages, is needed for one or more instances of a SL-PRS to be transmitted |
| Qualcomm | The terminology used is a bit confusing in the context of sidelink. Is the intention to separate pre-configuration from network-based configuration? Or is the intention to have (pre-)configuration in Option 1 and include PC5-RRC configuration also in Option 2?  We support studying both options and propose the following update to the proposal, addressing the terminology comment above:  With regards to the time-domain behavior of the SL-PRS, companies are encouraged to provide their views, whether they support one or both of the following options to be studied:   * Option 1: Always-on SL-PRS   + SL-PRS is (pre-)configured and is always transmitted in a given deployment (i.e., similar to the NR Rel-16 DL-PRS defined in the Uu interface) * Option 2: On-demand SL-PRS   + Request/PC5-RRC/configuration/activation/triggering message(s), or a combination of such messages, is needed for one or more instances of a SL-PRS to be transmitted * Note: How SL-PRS is configured, e.g, through high layers, and/or activated/deactivated through MAC-CE, and/or triggered by SCI, or any combination of signaling, is a separate topic. |
| DCM | We think Option 2 is much better, but we are OK to study both. |
| LGE | We prefer option 2. Always-on SL PRS transmission is not feasible because there is no scheduler such as gNB/LMF in Uu link based positioning. In this sense, on-demand approach is more aligned with SL transmission property. If a periodic SL PRS is configured in option 2, isn’t is same as semi-persistent? That is, a periodic SL PRS transmission can be activated or deactivated based on the needs. |
| Sharp | We are OK to study both options. |
| Xiaomi | We are fine to study both but more prefer to option 2. Burst TXs of PRS are needed for RTT measurement.  We also think there is no need to differentiate pre-configuration and NW configuration. (Pre-)configuration has been widely used in sidelink discussion, that is, preconfiguration is used when OOC and NW configuration is used when IC. |
| Huawei, HiSilicon | Thanks for the clarification from FL.  We are confused by adding “PC5-RRC” prior to “/configuration”, is it correct interpretation that “configuration” means “Uu-RRC” (not for the preconfiguration)?  In addition, we think it should be helpful to add the following Note to make it clear.   * Option 2: On-demand SL-PRS   + Request/PC5-RRC/Uu-RRC configuration/activation/triggering message(s), or a combination of such messages, is needed for one or more instances of a SL-PRS to be transmitted   + Note: This may include periodic, semi-persistent, and/or aperiodic SL-PRS. |
| Nokia, NSB | OK to study both, but prefer Option 2. Regarding terminology, prefer to stick to existing SL conventions, hence “(pre-)configured” as proposed by Qualcomm. |
| Ericsson | Ok to study both options for now. |
| Intel | OK in principle for the version updated by QC, but some of the terminologies are still confusing.  First of all, we are not sure if we should identify these as “always ON” vs. “on-demand”, especially when “always ON” options may still be triggered/released by (NW) configuration (with (pre-)configuration in the first bullet), or when “On-demand” includes periodic transmissions based on, again, (NW) configuration. So, it may be better to avoid these terms altogether and just keep the Option #s.  Also if we add (pre-) configuration (with “configuration” implying NW configuration via Uu) to Option 1, then perhaps “(Uu-RRC) configuration” should be removed from Option 2. |

##### FL Observations

Good support to study both options, even though there seems to be clear majority to support only Option 2. There may be some further clarification needed with regards to the terms pre-configuration, PC5-RRC configuration, Uu-RRC configuration. At least in within SL context, the term pre-configuration and NW configuration, has been widely used with the term (pre-)configuration. It may be more appropriate to continue with this approach for SL positioning.

1 company suggests to remove the terminology “Always-on SL-PRS” and “On-demand SL-PRS” and keep only the subbulet. From FL perspective, the NW configuration in the first Option, would be to similar to a SIB-based broadcast of the SL-PRS configuration. In that case, it is not expected to have a request for SL-PRS specific parameters, no expectation of UE-specific SL-PRS configuration as in Uu-RRC configuration of Option 2. However, it may be fine from FL side, to remove these terminologies, if it is considered a better way forward for the majority of the companies.

* *companies are encouraged to comment whether they consider the “Always-On” and “On-demand” useful to be kept or not.*

For now, we make the following updated proposal, and please feel free to provide any additional comment with respect to the v1 below:

##### [CLOSED]Feature Lead Proposal 4.2.4-v1

With regards to the time-domain behavior of the SL-PRS, study the following options:

* Option 1: Always-on SL-PRS
  + SL-PRS is (pre-)configured and is always transmitted in a given deployment
* Option 2: On-demand SL-PRS
  + Request/PC5-RRC-configuration/Uu-RRC-configuration /activation/deactivation/triggering message(s), or a combination of such messages, is needed for one or more instances of a SL-PRS to be transmitted
* Note: This may include periodic, semi-persistent, and/or aperiodic SL-PRS.
* Note: How SL-PRS is configured, e.g, through high layers, and/or activated/deactivated through MAC-CE, and/or triggered by SCI, or any combination of signaling, is a separate topic.

##### Companies views

|  |  |
| --- | --- |
| vivo | As we previously indicated, we prefer to defer the discussion and leave this open until more progress on PHY SL-PRS design. |
| Futurewei | We are OK in principle to study both, but prefer Option 2. It is not clear that Option 1 may cover all scenarios. |
| Samsung | We suggest to add DCI in the below note as  Note: How SL-PRS is configured, e.g, through high layers, and/or activated/deactivated through MAC-CE, and/or triggered by SCI, DCI or any combination of signaling, is a separate topic |
| LGE | The proposal is still confusing in that if we say (pre-)configured in SL context, it includes UU-RRC-configuration. But we don’t think this kind of configuration method is important at this stage. That could be a separate topic as the final Note says. So we propose to remove all the sub-bullets.  The point of different between two options, in our opinion, is whether or not to allow a permanent always-on SL PRS transmission for SL positioning. If it’s not needed, the option 2 seems fully enough. And we don’t think this kind of permanent SL PRS transmission is necessary. It degrades the SL resource utilization. Without it, those SL resources can be dynamically use for other SL tranmsision purpose. But we’re open to both option as a study purpose at this stage.  Final comment is about the first note. We think the note belongs to option 2? We suggest the following simplification.  With regards to the time-domain behavior of the SL-PRS, study the following options:   * Option 1: Always-on SL-PRS * Option 2: On-demand SL-PRS   + Note: This may include periodic, semi-persistent, and/or aperiodic SL-PRS. * Note: How SL-PRS is configured, e.g, through high layers, Uu/PC-5 RRC configuration, and/or activated/deactivated through MAC-CE, and/or triggered by SCI, or any combination of signaling, is a separate topic. |
| Xiaomi | Agree |
| NEC | OK to study both options. However, we prefer the original version since ‘PC5-RRC-configuration/Uu-RRC-configuration’ are part of configuration and there is no need to specify further details at the moment. |
| Sharp | OK |
| CMCC | OK |
| CATT | Support to study both Option 1 and Option 2.  For the terms of “Always-On” and “On-demand”, we are fine to keep them here. |
| Nokia, NSB | OK |
| Huawei, HiSilicon | OK |
| OPPO | We support to study both, but seems the boundary between the 2 is not so clear as both can be configured and having multiple transmissions, and we also think the first Note is for non-demand SL-PRS only. How about the following:  With regards to the time-domain behavior of the SL-PRS, study the following options:   * Option 1: Always-on SL-PRS   + If (pre-)configured, SL-PRS ~~is (pre-)configured and~~ is always transmitted in a given deployment until the (pre-)configuration is disabled. * Option 2: On-demand SL-PRS   + Request~~/PC5-RRC-configuration/Uu-RRC-configuration /activation/deactivation~~/triggering (except for the (pre-)configuration for Always-on SL-PRS) ~~message(s), or a combination of such messages,~~ is needed for one or more instances of a SL-PRS to be transmitted   + Note: This may include periodic, semi-persistent, and/or aperiodic SL-PRS. * Note: How SL-PRS is configured, e.g, through high layers, and/or activated/deactivated through MAC-CE, and/or triggered by SCI, or any combination of signaling, is a separate topic. |
| ZTE | Support in principle but defer the down selection and further detailed discussion |
| Intel | We still think the descriptors “always ON” vs. “on-demand” are ambiguous and not necessary for the intent of the proposal.  Further, in our understanding, SIB-provided configuration falls under Uu-RRC, and thus, as some responses have noted above, the demarcation between the two options is blurred as was noted before. |
| InterDigital | We support the proposal |
| Qualcomm | Support |

##### FL Observations

Support the proposal or support in principle

* Xiaomi, Sharp, CMCC, CATT, Nokia, NSB, Huawei, HiSilicon, ZTE, Interdigital, Qualcomm

Still too early to look into these details, or the description between the always-on/on-demand to the subbulets is not clear / boundary between the options is unclear

* Vivo, LGE, Intel, OPPO

Based, on the above, one way forward is to only include the general direction of studying always-on/on-demand, or add a description following the suggestions from LGE

##### [CLOSED]Feature Lead Proposal 4.2.4-v2

With regards to the time-domain behavior of the SL-PRS, study the following options:

* Option 1: Always-on SL-PRS
  + [If (pre-)configured, SL-PRS ~~is (pre-)configured and~~ is always transmitted in a given deployment until the (pre-)configuration is disabled.]
* Option 2: On-demand SL-PRS
  + [Request~~/PC5-RRC-configuration/Uu-RRC-configuration /activation/deactivation~~/triggering (except for the (pre-)configuration for Always-on SL-PRS) ~~message(s), or a combination of such messages,~~ is needed for one or more instances of a SL-PRS to be transmitted]
  + Note: This may include periodic, semi-persistent, and/or aperiodic SL-PRS.
* Note: How SL-PRS is configured, e.g, through high layers, Uu/PC-5 RRC configuration, and/or activated/deactivated through MAC-CE, and/or triggered by SCI or DCI, or any combination of signaling, is a separate topic.

Companies are encouraged to comment whether the above is acceptable with or without the subbulets in brackets. If you have preference to keep the subbulets in brackets, please comment if the description is acceptable. If the description in the subbulets is still controversial, we could potentially remove the subbulets, and let the companies to provide their views on always-on/on-demand SL-PRS in their contributions for next meeting.

##### Companies views

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| --- | --- |
| CATT | We support the proposal in principle, and we prefer to keep the **configuration /activation/deactivation** for the Option 2 as follows, Updated [MEDIUM]Feature Lead Proposal 4.2.4-v2 With regards to the time-domain behavior of the SL-PRS, study the following options:   * Option 1: Always-on SL-PRS   + [If (pre-)configured, SL-PRS ~~is (pre-)configured and~~ is always transmitted in a given deployment until the (pre-)configuration is disabled.] * Option 2: On-demand SL-PRS   + [Request~~/PC5-RRC-configuration/Uu-RRC-~~**configuration /activation/deactivation/**triggering (except for the (pre-)configuration for Always-on SL-PRS) ~~message(s), or a combination of such messages,~~ is needed for one or more instances of a SL-PRS to be transmitted]   + Note: This may include periodic, semi-persistent, and/or aperiodic SL-PRS. * Note: How SL-PRS is configured, e.g, through high layers, Uu/PC-5 RRC configuration, and/or activated/deactivated through MAC-CE, and/or triggered by SCI or DCI, or any combination of signaling, is a separate topic. |
| ZTE | We prefer to remove the subbullets. |
| LGE | We support the proposal with removing the texts in the bracket.  For the first sub-bullet, pre-configuration cannot be disabled. For the second sub-bullet, on-demand SL PRS was originally meant to activate or deactivate the SL-PRS, which is not clear with the modified text. Our understanding on the always-on SL-PRS is the SL-PRS that is always transmitted as (pre-)configured, and the on-demand SL-PRS is the SL-PRS that is not transmitted always. If this definition cannot be accepted as a common understanding, we prefere to remove the sub-bullets. |
| Xiaomi | We are fine with the subbullet description. |
| vivo | Now companies are suggesting to remove sub-bullets, which to us means that we don’t even have a common understanding on the defitions of “always on” and “on-demand”. We don’t see the point of listing options which we have no clear common understanding.  We still prefer to defer the discussion and leave this open until more progress on PHY SL-PRS design. |
| Lenovo | We can live with Option 1 and 2 for study, although we still prefer Option 2. Our preference to also remove sub-bullets for this meeting pending further progress on the details of each option. |
| InterDigital | We support the proposal with bracket in principle, but we think the wording can be further clarified to establish a high level distinction between the options. In our view, Option 1 only requires a presence of a pre-configuration or a reception of a configuration by the LMF/gNB and Option 2 requires an additional signaling in addition to the (pre)- or configuration used in Option 1. Thus, we suggest the following modified proposal Updated [MEDIUM]Feature Lead Proposal 4.2.4-v2 With regards to the time-domain behavior of the SL-PRS, study the following options:   * Option 1: Always-on SL-PRS   + [If (pre-)configured, SL-PRS ~~is (pre-)configured and~~ is always transmitted in a given deployment ~~until the (pre-)configuration is disabled.~~] * Option 2: On-demand SL-PRS   + [Request~~/PC5-RRC-configuration/Uu-RRC-configuration /activation/deactivation~~/triggering ~~(except for the (pre-)configuration for Always-on SL-PRS)~~ ~~message(s), or a combination of such messages,~~ is needed for one or more instances of a (pre)configured SL-PRS to be transmitted]   + Note: This may include periodic, semi-persistent, and/or aperiodic SL-PRS. |
| Futurewei | We agree with vivo, that it seems thre is no common understating yet on the always-on, and on-demand. We suggest to defer the discussion for later. We also think that we may end up supporting both solutions for different scenarios. |
| Intel | Do not agree.  We share same view as vivo. With the sub-bullets removed, and generic terms like “always ON” or “on demand”, we think it would onlyl get chaotic with varied interpretations of these terms. Also, we are not sure why we need to classify the schemes in these two categories to begin with.  In summary, we think the details in the sub-bullets are more helpful for the proposal than the classification “always ON” vs. “on-demand”. |
| Qualcomm | We are ok with the proposal in general and suggest to keep the text but remove the brackets around it. |
| Apple | It does seem as if there needs to be some more discussion, for example, why is option 1 conditional on if it is pre-configured ? is there a scenario where we could have a SL-PRS not pre-configured ? could we decide on a default configuration ?  Support LGE’s proposal that side-steps the issue of definitions etc i.e.  With regards to the time-domain behavior of the SL-PRS, study the following options:   * Option 1: Always-on SL-PRS * Option 2: On-demand SL-PRS   + Note: This may include periodic, semi-persistent, and/or aperiodic SL-PRS. * Note: How SL-PRS is configured, e.g, through high layers, Uu/PC-5 RRC configuration, and/or activated/deactivated through MAC-CE, and/or triggered by SCI, or any combination of signaling, is a separate topic. |
| OPPO | We support the sub-bullet which makes the 2 definitoins much clearer, we are open with other clarification on the 2 definitions. To address some companies’ concern on pre-configuration we can make following modification (Note that the use of pre-configuration can be enabled/disabled when UE is OOC/IC):  the use of (pre-)configuration is disabled |
| Sharp | We support the FL proposal in principle. We are OK to list possible signalling types if those improve clarity. However, we don’t have to list all of them at this stage. |
| DCM | Prefer to keep sub-bullets to make more progress. |
| Nokia, NSB | OK |
| Ericsson | Do not agree.  According to the description below   * + “[If (pre-)configured, SL-PRS ~~is (pre-)configured and~~ is always transmitted in a given deployment until the (pre-)configuration is disabled.]”   this sounds more like a semi-persistent SL-PRS. It is not really an always-on signal. We suggest to remove the world ‘always-on’ and use ‘semi-persistent’ instead. |

##### FL Observations

Looking at the situation above, the views seem to be diverging. Given that we have a lot of proposals and limited time, my suggestion **is to close this Email Discussion**. We may need to revisit depending on SL-PRS progress.

#### 4.2.5 SL-PRS Configuration/Triggering/Activation

Based on the submitted contributions, several proposals were made with regards to the SL-PRS Configuration/Triggering/Activation:

|  |  |
| --- | --- |
| NTT DOCOMO | * For SL-positioning,   + Study details on configuration/indication/report |
| Huawei, Hisilicon | Support at least aperiodic PRS triggered by SCI for sidelink positioning  Consider the following SL-PRS configuration schemes:   * Alt1: SL-PRS is (pre-)configured by higher layers, and SCI is used for time/frequency reservation. * Alt2: SL-PRS is configured by SCI. |
| CATT, GOHIGH | For all types of S-PRS (periodic, semi-persistent and aperiodic S-PRS), the required measurements are configured through SLPP (the definition is up to RAN2). And corresponding SL measurements are also reported through SLPP. |
| CMCC | SL positioning RS should also be transmitted along with PSCCH to reserve further resources and mitigate the resource collision possibility  Procedure for CSI-RS measurement in Rel-16 NR sidelink could be a reference for SL positioning RS resource configuration/indication.  The usage of 2nd SCI for reception can be precluded by defining a similar procedure to CSI-RS measurement for SL positioning RS. |
| ZTE | Support using SCI to trigger SL-PRS and consider the following 2 cases:   * SCI can schedule both SL-PRS and SL-data; * SCI can either schedule SL-PRS or SL-data.   If mode 1 resource allocation for SL positioning is supported   * Support using DCI to dynamically or semi-persistently schedule SL-PRS and consider whether a new DCI format other than DCI format 3\_0 is needed |
| China Telecom | The detail of the resource configuration and trigger signaling design should be as compatible as possible with existing sidelink capabilities |
| Lenovo | RAN1 to consider the triggering mechanism of SL PRS transmission(s), e.g., from UE/gNB/LMF and higher layers |
| LGE | It is supported that LMF/gNB initiates the SL PRS procedure, including SL positioning group configuration  It is supported that LMF/gNB schedules the SL PRS resources  To shorten the SL positioning latency, the SL PRS related parameters such as SL positioning method, SL PRS resource or resource set configuration, etc. allowed in a resource pool can be (pre-)configured.  When LMF/gNB schedules the SL PRS resources, the following operations are supported.   * Semi-persistent SL PRS resources can be allocated to UE based on a single UE request. * Aperiodic SL PRS resources can be allocated to UE based on the UE request per SL PRS transmission. |
| Mediatek | RAN1 to discuss the configured parameters for SL-PRS transmission. Once agreed, RAN2 may further handle the corresponding signalling  RAN1 to discuss the required assistance information for SL-PRS measurement. Once agreed, RAN2 may further handle the corresponding signalling  RAN1 to discuss whether there are pre-defined time/frequency physical resources for SL-PRS allocation. SCI could be used to indicate the occupation within the pre-defined physical resources |
| Intel | RAN1 to investigate potential solutions for conveying SL-PRS configuration and scheduling information from a transmitting UE over SL.   * + - * For different requirements and use-cases (in-coverage, inter-cell, partial coverage), different options that enable trade-off between flexibility, overhead, and reliability should be studied carefully.   If the currently defined formats for first and second stages of SCI are to be re-used for SL-PRS-related scheduling information, solutions to distinguish such SCI as against those for SL communications (PSSCH scheduling) should be explored.  As a baseline mechanism, Mode 2 resource allocation for PSSCH, using resource reservation indication via PSCCH, should be considered for transmission of SL-PRS.   * + - * FFS: Detailed options for indication of SL-PRS configuration and scheduling information, including potential availability of assistance information from serving gNB for in-coverage scenarios.   RAN1 to study suitable options for efficient signalling of SL-PRS configurations and scheduling information based on potential enhancements to resource reservation mechanism currently specified for PSSCH transmissions.  RAN1 to study potential ways to realize coordination and muting patterns across a number of transmitting UEs in a distributed manner. |
| Qualcomm | The network indicates resources for SL-PRS and trigger or configure SL-PRS transmission for in-coverage UEs.  Higher layers indicate resources for SL-PRS and trigger or configure SL-PRS transmission for out-of-coverage UEs. |
| Futurewei | Consider whether the S-PRS configuration should be controlled by gNB when SL UEs are in coverage or partial coverage. |
| Apple | Issues to be addressed include:  Configuration, transmission and measurement of SL positioning reference signals to or from the target UE |
| ROBERT BOSCH GmbH | For studying sidelink positioning method (e.g., TDO, RTT, AOA/D, …) keep L1/L2 layer impact being minimum and independent of sidelink positioning signal design. |

Based on the submitted contributions, and proposals summarized above, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 4.2.5-v0

With regards to the configuration/activation/triggering of SL-PRS, study the following options:

* Option 1: High-layer-only signaling involvement in the SL-PRS configuration
  + No Lower layer involvement, e.g., SL-MAC-CE or SCI or DCI, for the activation or the triggering of a SL-PRS.
  + Based on the study, this option may correspond to
    - A SL-PRS configuration that is a single-shot or multiple shots
    - A high-layer configuration that may be received from an LMF, a gNB, or a UE
* Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration
  + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
* Based on the study, different options may be more appropriate for different scenarios (e.g., in-coverage, partial coverage, out of coverage), for different resource allocation selections procedures, resource reservation mechanisms, etc. Include aspects in the study related to flexibility, overhead, and reliability as/if needed.

##### Companies views

|  |  |
| --- | --- |
| CATT | We support Option 2.  Both the high-layer and lower-layer signaling can be introduced in the SL-PRS configuration. |
| MTK | Support option 2 |
| ZTE | We think at least option 2 should be supported for scheduling flexibility and latency. If sidelink resource collision happens for sidelink resource selection mode 2 (or in out of coverage scenario), UEs need to be aware of other UE’s SL-PRS configuration and lower-layer signaling like SCI can be used to avoid resource waste. |
| Huawei, HiSilicon | Support the revised Option 2 to be clearer,   * Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration   + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI   + High layer signaling can be used for SL-PRS configuration and lower layer signaling can be used for triggering/activating transmission of SL-PRS.   We believe that under OOC scenario, the sensing based resource allocation is anyway needed. SCI would be needed for resource indication/reservation of SL-PRS. It is unclear how Option1 works under OOC scenario. |
| Spreadtrum | We prefer Option 2. |
| InterDigital | Examples for high-layer can be provided in the proposal for clarification, e.g., RRC, LPP.  For out-of-coverage, when UEs don’t have PC5-RRC connection (i.e., no unicast connection), lower layer signaling may be used for SL PRS configuration/activation/triggering purpose. Thus we propose to add the following option.  Option 3 : Lower-layer signaling |
| Futurewei | We prefer Option 2. In our opinion, in OOC scenarios both lower and higher layers will be involved. |
| CMCC | Option 2.  This is related to the resource allocation of SL-PRS, without SCI reservation in NR sidelink, resource collision may happen more frequently which will have bad impacts on system performance. |
| NEC | Option 2 since for SL positioning, it might be more dynamic than Uu interface positioning and thus hybrid signalling is needed. |
| Sony | Option 2. A good interaction between high and lower layer signalling is needed to support SL-Pos |
| OPPO | In our view this issue should be deffered, it is highly related to the concrete design of other aspects, including resource allocation and SL-PRS transmission procedure,etc.. |
| Lenovo | Support Option 2 |
| vivo | We also feel this could be discussed at a later stage after we know more about PHY SL-PRS design. |
| Apple | Decision on this can be deferred. |
| Samsung | This proposal is a bit confusing for us.  In our understanding, activation and triggering should involve lower layers (MAC CE and/or L1 control). So, we suggest to modify the main bullet as  With regards to the configuration~~/activation/triggering~~ of SL-PRS, study the following options:  Also, the third bullet seems not necessary. |
| Qualcomm | We support Option 1 as it provides a unified approach for both in-coverage and out-of-coverage scenarios and avoids duplicating work in WGs and multiple layers.  In out-of-coverage scenarios, the signaling would come from the protocol or application layer. |
| DCM | Option 2. |
| LGE | Support option 2. Lower layer approach has a benefit of requiring less latency for SL positioning, which is crucial to meet the latency requirement. |
| Sharp | We prefer Option 2. |
| Xiaomi | We are not sure what SL PRS configuration includes here, for example, whether SL PRS time-freq. resource scheduling information is included in the configuration here. Hope it can be clarified. |
| Nokia, NSB | OK to study both, prefer Option 2. |
| Ericsson | Similar view as vivo and Apple. As this is a signaling detail aspect, this can be discussed later. |
| Intel | As already mentioned in the third bullet, both options can be studied at equal priority and each option could be beneficial in different scenarios and use-cases. Thus, do not see a need to pick an option at this point.  For the addition from HW for Option 2, this may be a bit premature to agree on – in general, MAC-CE or L1 signaling can not only activate but provide part of the configuration (on parameters necessary for Tx/Rx) as well. So, prefer not to add further details at this point. |

##### FL Observations

Based on the above replies, we make the following observations:

Support/Prefer of Option 1:

* Qualcomm

Support/Prefer of Option 2:

* CATT, MTK, ZTE, Huawei, Hisilicon, Spreadtrum, Futurewei, CMCC, NEC, Sony, Lenovo, NTT DOCOMO, LGE, Sharp, Nokia, NSB

Study both Options

* Intel

Include Option 3 (Low-layer Only):

* Interdigital

Defer an agreement:

* OPPO, vivo, Apple, Ericsson

I interpret that the 3 companies that suggest to defer an agreement, they mean to defer a downselection, but still keep the options for further study.

To Xiaomi: Yes the intention is to consider all the necessary SL PRS parameters, and time-freq. resource is one of them.

1 company suggested that the details (shown in red) in Option 2 are not needed at this point. Companies are encouraged to check these further.

Based on the above, the updated proposal is:

##### [CLOSED]Feature Lead Proposal 4.2.5-v1

With regards to the configuration~~/activation/triggering~~ of SL-PRS, study the following options:

* Option 1: High-layer-only signaling involvement in the SL-PRS configuration
  + No Lower layer involvement, e.g., SL-MAC-CE or SCI or DCI, for the activation or the triggering of a SL-PRS.
  + Based on the study, this option may correspond to
    - A SL-PRS configuration that is a single-shot or multiple shots
    - A high-layer configuration that may be received from an LMF, a gNB, or a UE
* Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration
  + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
  + High layer signaling can be used for SL-PRS configuration and lower layer signaling can be used for triggering/activating transmission of SL-PRS.
* Option 3: Only lower-layer signaling involvement in the SL-PRS configuration
  + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
* Based on the study, different options may be more appropriate for different scenarios (e.g., in-coverage, partial coverage, out of coverage), for different resource allocation selections procedures, resource reservation mechanisms, etc. Include aspects in the study related to flexibility, overhead, and reliability as/if needed.

##### Companies views

|  |  |
| --- | --- |
| vivo | Our previous comment of deferring is meant for the whole discussion, not for agreement/down selectiong of options.  Furthermore, we have concern on the last bullet which seems speculative before the actual study “Based on the study, different options may be more appropriate for different scenarios”.  We cannot accept this proposal as is for now. |
| Futurewei | We are OK with the proposal. We interpret the proposal as just enumeration of possible options without excluding and combination at this stage. We think that Option 2 will offer the highest flexibility and come naturally from RAN1 study. |
| Samsung | For option 2, lower layers can also deactivate SL-PRS   * Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration   + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI   + High layer signaling can be used for SL-PRS configuration and lower layer signaling can be used for triggering/activating/deactivating transmission of SL-PRS.   Last bullet is not needed and should be deleted. This should be discussed after the study is completed. |
| LGE | We’re ok in general with FL proposal. It seems that all the possibilities are on the table for study. One point is that the latency is a very important factor in SL positioning. Considering that, initiating SL positioning can also be done in a lower layer for short latency. For example, UE can initiate SL positioning by requesting other UEs to participate in SL positioning as an anchor/server node. We propose to add the following.   * + High layer signaling can be used for SL-PRS configuration and lower layer signaling can be used for initiating SL positioning and triggering/activating transmission of SL-PRS.   The same can also be applied to option 3. |
| xiaomi | Thanks for the clarification. We are generally fine with the proposal.  From our opinion, Option 2 is preferred. In addition, on the second subbullet of option 2, we think resource indication by PHY layer signaling shall also be included, other than triggering/activating:  High layer signaling can be used for SL-PRS configuration and lower layer signaling can be used for triggering/activating/indicating transmission of SL-PRS. |
| NEC | OK for the main bullets but the sub-bullets are premature to discuss at the current stage. |
| Sharp | OK |
| CMCC | We are OK with this proposal with comments. Howerver, we think this may couple with the question in section 5.1. If separate resource pool configuration is adopted, we think this question in target for the signaling exchanging in a sidelink data resource pool, not the PRS dedicated resource pool, resource indication/reservation can be done in the dedicated resource pool. But if shared resource pool is adopted, we think the following modification may be needed to clarify the functionality of lower layer signaling, at least for SCI.   * + High layer signaling can be used for SL-PRS configuration and lower layer signaling can be used for triggering/activating transmission and potential resource indication/reservation of SL-PRS. |
| CATT | Support the proposal in principle.  We prefer Option 2, and we think lower layer signaling can also be used for SL-PRS configuration, such as SL-PRS resource allocation, e.g., introduce the resource indication information in SCI(just like the similar information in SCI format 1-A in Rel-16 V2X).  So, our preferred revision as follows,   * Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration   + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI   + High layer signaling can be used for SL-PRS configuration and lower layer signaling can be used for configuration /triggering/activating transmission of SL-PRS. |
| Nokia, NSB | OK in principle; but it is not clear why “~~/activation/triggering”~~ was removed from the first sentence, giving the impression that the proposal is only about configuration, but the subbullets then discuss both configuration and activation/triggering |
| Huawei, HiSilicon | OK |
| OPPO | Do we really need this conclusion? The 3 options do not preclude anything, without conclusions on other aspects as mentioned in the last bullet, it is difficult to make comparison or downselection among the 3 options. |
| ZTE | This proposal is highly related to Proposal 5.1, if SL-PRS share resource pool with SL communication, the lower layer signaling is essential for resource conflicts information transmission. On the other hand, only if we assume SL-PRS is configured in a dedicated resource pool where other sidelink signals can not be trasmmitted or received, option 2 can be considered. Therefore, even though we are generally fine with this proposal, we prefer to defer any further discussion. |
| Intel | Thanks for the updates.  We would still insist on removing the sub-bullet in red. As should be evident from the responses above, such level of details are bit premature at this point and we should not limit the design to one specific option before any analyses/evaluations are done. |
| InterDigital | We agree with the revision from Samsung. We suggest to add UE deactivation using lower layer signaling into the Option 2. |
| Qualcomm | We can accept the proposal even though we do not think Option 3 is necessary. |

This proposal is in a relatively unstable state. A few companies seem to want remove all or part of the subbullets (e.g., NEC, Intel), or even not discuss it at this stage (vivo, OPPO), and others seem to be interested in doing some progress and comment to improve the subbulets.

With regards to the first line, my proposal is to keep the word activation/triggering as it was initially, since there are options (Option 2 & 3) that include those. My suggestion is not to focus on that introductory sentence, since it is not the point of this proposal.

In this proposal, we are trying to create some framework so that we can have constructive discussion later on. Indeed, at this point, it doesn’t seem to preclude an option, but at least it will allow to potentially start limit the options as we move forward in the next meetings. In that sense, i consider it important to continue, at a minimum to write all the options without any subbulet (Alt. 2 in the new proposal below).

I move it to a “LOW” importance, since it seems there are at least 2 companies that appear to not consider it of high interest.

##### [LOW][OPEN] Feature Lead Proposal 4.2.5-v1

With regards to the configuration/activation/triggering of SL-PRS, study the following options:

* Alt. 1:
  + Option 1: High-layer-only signaling involvement in the SL-PRS configuration
    - No Lower layer involvement, e.g., SL-MAC-CE or SCI or DCI, for the activation or the triggering of a SL-PRS.
    - Based on the study, this option may correspond to
      * A SL-PRS configuration that is a single-shot or multiple shots
      * A high-layer configuration that may be received from an LMF, a gNB, or a UE
  + Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration
    - Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
    - High layer signaling can be used for SL-PRS configuration and lower layer signaling can be used for [initiating SL positioning and/or] configuration/triggering/activating/deactivating/indicating and potential resource indication/reservation transmission of SL-PRS.
  + Option 3: Only lower-layer signaling involvement in the SL-PRS configuration
    - Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
  + [Note 1: Based on the study, different options may be more appropriate for different scenarios (e.g., in-coverage, partial coverage, out of coverage), for different resource allocation selections procedures, resource reservation mechanisms, etc. Include aspects in the study related to flexibility, overhead, and reliability as/if needed]
* Alt. 2:
  + Option 1: High-layer-only signaling involvement in the SL-PRS configuration
    - No Lower layer involvement, e.g., SL-MAC-CE or SCI or DCI, for the activation or the triggering of a SL-PRS.
  + Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration
  + Option 3: Only lower-layer signaling involvement in the SL-PRS configuration
  + Note: Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
  + [Note 1: Based on the study, different options may be more appropriate for different scenarios (e.g., in-coverage, partial coverage, out of coverage), for different resource allocation selections procedures, resource reservation mechanisms, etc. Include aspects in the study related to flexibility, overhead, and reliability as/if needed]

Companies are encouraged to comment which of the above alternatives they support, and whether they really want to keep the note, or want to remove it, or they can be OK either way.

##### Companies views

|  |  |
| --- | --- |
| CATT | We prefer Option 2 for both Alt.1 and Alt.2  Either Alt.1 or Alt.2 is fine for us. Maybe we can leave the details for next meeting(Alt.2), in order to reach the consensus on this issue. |
| ZTE | We are OK with both Alt. 1 and Alt. 2. |
| LGE | We prefer Alt 1 with the note. They makes the proposal clearer regarding the rationale of the proposal. |
| Xiaomi | OK with either alt 1 or alt 2 |
| vivo | As we commented before, we have concern on the last bullet of note 1 which seems speculative of the study outcome “Based on the study, different options may be more appropriate for different scenarios” before actual study.  We cannot accept this proposal with note 1. |
| InterDigital | We prefer Alt. 1, but we are fine with Alt.2 too. |
| Futurewei | We can live with Option 2 in bolth Alt 1 and Alt2. |
| Intel | Alt 2 may be easier to converge on at this stage. |
| Qualcomm | Alt 1. We prefer to keep some details to avoid ambiguity. We would like to remove Note 1. |
| Apple | We are fine with Alt-1 |
| Sharp | We are OK with either one between Alt.1 and Alt.2. |
| Nokia, NSB | OK; can accept either one of the two alternatives |

##### FL Observations

Alt. 1:

* LGE, Qualcomm, Apple

Alt. 2:

* Intel

Either one is fine

* CATT, ZTE, Xiaomi, Sharp, Interdigital, Nokia, NSB

2 companies suggested to remove the Note. 1 company suggested to keep the note. At least one of the companies that are not OK with the Note is commenting about the 1st sentence of the Note. Wondering if we could just remove this sentence and keep only the 2nd sentence as shown below.

There seems to be a preference to go with Alt. 1. I think the main concern from Intel is regarding the subbulet of Option 2 that it may appear as if it precludes other ways for using High-layer / dynamic signaling. Would it be acceptable for Intel (and everyone) to update the Alt. 2 with “For example” and “can -> may” as shown below?

##### [CLOSED]Feature Lead Proposal 4.2.5-v2

With regards to the configuration/activation/triggering of SL-PRS, study the following options:

* Option 1: High-layer-only signaling involvement in the SL-PRS configuration
  + No Lower layer involvement, e.g., SL-MAC-CE or SCI or DCI, for the activation or the triggering of a SL-PRS.
  + Based on the study, this option may correspond to
    - A SL-PRS configuration that is a single-shot or multiple shots
    - A high-layer configuration that may be received from an LMF, a gNB, or a UE
* Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration
  + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
  + For example, high layer signaling ~~can~~ may be used for SL-PRS configuration and lower layer signaling ~~can~~ may be used for initiating SL positioning and/or configuration/triggering/activating/deactivating/indicating and potential resource indication/reservation transmission of SL-PRS.
* Option 3: Only lower-layer signaling involvement in the SL-PRS configuration
  + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
* Note 1: ~~Based on the study, different options may be more appropriate for different scenarios (e.g., in-coverage, partial coverage, out of coverage), for different resource allocation selections procedures, resource reservation mechanisms, etc.~~ Include aspects in the study related to flexibility, overhead, and reliability as/if needed.

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We support the proposal. |
| Futurewei | Support |
| CMCC | Support |
| ZTE | Support. |
| Spreadtrum | Support. |
| CATT | Support.  We prefer Option 2. |
| DCM | OK |
| LGE | We’re ok with the FL update.  We just need clarification on the following sub-bullet.   * A SL-PRS configuration that is a single-shot or multiple shots   Does it mean that SL-PRS can be configurated at one time or at multiple times? Or a single or multiple configurations of SL-PRS? What’s the exact meaning of the bullet? |
| Lenovo | Support the options as a study. Suggest to consider latency as well as part of the criteria in the note: Include aspects in the study related to flexibility, overhead, latency and reliability as/if needed. |
| Sharp | Support |
| Samsung | We sugget to add ‘de-activation’ in the main bullet. |
| Xiaomi | OK |
| Qualcomm | We are ok with the proposal |
| Nokia, NSB | OK; support including “latency”, as suggested by Lenovo |

##### FL Observations

Seems there is some good convergence here. The comments that are received hopefully are minor.

To LGE: “single-shot” or “multiple-shot” correspond to a high-layer configured PRS that is transmitted once (or multiple times) (get a high layer configured to configure with a periodicity and number of instances, wheren the instances can be 1 or more than 1). The intention of the bullet is to not wrongly assume that a high-layer configured PRS means it has to be “periodic” with many instances necessarily, and thatn we can discuss all these going forward.

I am hopefully that the above addresses the concern, and there will not be a concern for adding “latency: in the last bullet. So, i will attempt to go for Email Endorsement.

##### [EMAIL ENDORSEMENT]Feature Lead Proposal 4.2.5-v4

With regards to the configuration/activation/triggering of SL-PRS, study the following options:

* Option 1: High-layer-only signaling involvement in the SL-PRS configuration
  + No Lower layer involvement, e.g., SL-MAC-CE or SCI or DCI, for the activation or the triggering of a SL-PRS.
  + Based on the study, this option may correspond to
    - A SL-PRS configuration that is a single-shot or multiple shots
    - A high-layer configuration that may be received from an LMF, a gNB, or a UE
* Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration
  + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
  + For example, high layer signaling can may be used for SL-PRS configuration and lower layer signaling can may be used for initiating SL positioning and/or configuration/triggering/activating/deactivating/indicating and potential resource indication/reservation transmission of SL-PRS.
* Option 3: Only lower-layer signaling involvement in the SL-PRS configuration
  + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
* Note 1: Include aspects in the study related to flexibility, overhead, latency, and reliability as/if needed.

#### 4.2.6 AGC & Tx-Rx turnaround time considerations for SL-PRS

Based on the submitted contributions, some companies commented with regards to the AGC and Tx-Rx turnaround time for the SL-PRS:

|  |  |
| --- | --- |
| Huawei, HiSilicon | There should be an AGC symbol before the SL-PRS symbols and a GAP symbol after the SL-PRS symbols. |
| Vivo | AGC and GP symbol are needed for the SL PRS pattern. |
| CMCC | Slot structure in NR sidelink should be reused as much as possible for sidelink positioning RS slot, which including AGC symbol, GP symbol and the potential PSCCH symbols, the remaining symbols can be regarded as candidates for positioning RS. |
| ZTE | For the number of OFDM symbols within a slot for SL-PRS, consider adding AGC symbol for power adjustment and gap symbol(s) for Rx/Tx switch |
| Qualcomm | Sidelink PRS transmissions accommodate AGC training at the receiver and RAN1 to further study the details.  Sidelink PRS transmission accommodate Rx-Tx turnaround time and RAN1 to further study the details |
| LGE | In a resource pool for SL positioning, if both transmission and reception resource are allocated within a slot, a TX/RX switching gap between two resources needs to be supported |
|  |  |

Based on the submitted tdocs, and proposals summarized above, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 4.2.6-v0

SL PRS structure should include time for AGC training and Rx-Tx turnaround time, when needed.

* Study the details, including at least: number of symbol(s), if any, for AGC and Rx-Tx turnaround time, conditions under which these are needed.

##### Companies views

|  |  |
| --- | --- |
| CATT | Support. |
| MTK | okay |
| ZTE | Support adding AGC symbol for power adjustment and gap symbol(s) for Rx-Tx turnaround time. |
| Huawei, HiSilicon | Support. |
| Spreadtrum | Support. |
| InterDigital | We think this topic is related to whether a SL PRS can be multiplexed with other SL channels/signals in one SL slot, either in time or in frequency. The consideration of AGC and guard symbol associated with the SL PRS can be different depending on how SL PRS is multiplexed (e.g., in a SL PRS-only slot, SL PRS + PSCCH slot). Thus, we suggest the following change to the proposal.  SL PRS structure should include time for AGC training and Rx-Tx turnaround time, when needed.   * Study the details, including at least: consideration for multiplexing between PRS and other channels within a slot, number of symbol(s), if any, for AGC and Rx-Tx turnaround time, conditions under which these, are needed. |
| Futurewei | Support |
| CMCC | Support. |
| NEC | Support |
| OPPO | Support. |
| Lenovo | Support |
| vivo | Support |
| Apple | There needs to be a discussion on if the SL PRS is in a standalone slot, or multiplexed with other signals. If multiplexed with other signals, the relative BWs (and power boosting) may determine if separate AGC and gap signals are needed. As an example, if the SL PRS is of the same BW as the PSSCH (and placed in the PSSCH region of the slot), and it is based on a comb and is power boosted, then no gap or AGC signal is needed. This can change if one of the conditions changes e.g. different BW.  Addition by InterDigital can address this issue. With the following modification:  SL PRS structure should include time for AGC training and Rx-Tx turnaround time, if ~~when~~ needed. |
| Vivo2 | On the suggested modification from InterDigital, we don’t think multiplexing with other channels should be emphasized here as part of AGC/GP study given the multiplexing is already covered as part of study in proposal 5.1. |
| Locaila | Support. |
| Samsung | OK for the direction of proposal 4.2.6 in general |
| Qualcomm | Support |
| DCM | This proposal is related to whether SL-PRS is independent signal (i.e. standalone) or multiplexed on another chanel. Further study is necessary. |
| LGE | Support |
| Sharp | Support |
| xiaomi | If SL PRS are multiplexed with other SL channels, it may be able to reuse the AGC/GP symbol of that SL channels. From our understanding, this possibility is not precluded but included in the details part. With thiss understanding, we support this proposal. |
| Nokia, NSB | OK |
| Ericsson | Share similar view as DCM. |
| Intel | We support the proposal, and prefer to include the update from InterDigital. |

##### FL Observations

Most companies seem OK with the current version of the proposal. It was pointed out by a few companies that this proposal is related to whether the SL-PRS is standalone or multiplexwed with other channels. Overall, the expression of the proposal “conditions under which these are needed” is trying to encompass different considerations and reasons for which AGC and Rx-Tx turnaround time may be needed. Therefore, significant changes may not be needed at this point. Potentially, I am suggesting to change the “when”, to “if”, even though at this early point of the study, its not clear whether it creates any difference of the meaning of the proposal.

##### [CLOSED]Feature Lead Proposal 4.2.6-v1

SL PRS structure should include time for AGC training and Rx-Tx turnaround time, if ~~when~~ needed.

* Study the details, including at least: number of symbol(s), if any, for AGC and Rx-Tx turnaround time, conditions under which these are needed.

##### Companies views

|  |  |
| --- | --- |
| vivo | Support |
| Futurewei | Support |
| Samsung | OK |
| LGE | Support |
| Xiaomi | Support |
| NEC | Support |
| Sharp | Support |
| CMCC | Support |
| CATT | Support |
| Nokia, NSB | OK |
| Huawei, HiSilicon | OK |
| OPPO | OK |
| ZTE | Support. |
| Intel | OK |
| InterDigital | Support |
| Qualcomm | Support in principle.  AGC training and Rx-Tx turnaround time are always needed. The issues raised about whether AGC/gap symbol of SL transmission are used if SL-PRS is multiplexed with PSSCH are about how these times are ensured, not whether they are needed and we think that would be part of the details studied here. Hence, we propose to remove “if needed” from the main bullet.  SL PRS structure should include time for AGC training and Rx-Tx turnaround time, ~~if when needed~~.   * Study the details, including at least: number of symbol(s)~~, if any,~~ for AGC and Rx-Tx turnaround time, conditions under which these are needed. |

##### FL Observations

Support the proposal

* Vivo, Futurewei, Samsung, LGE, Xiaomi, NEC, Sharp, CMCC, CATT, Nokia, NSB, Huawei, HiSilicon, OPPO, ZTE, Intel, Interdigital

Support in principle, but minor updated

* Qualcomm

##### [CLOSED]Feature Lead Proposal 4.2.6-v2

SL PRS structure should include time for AGC training and Rx-Tx turnaround time, [if needed].

* Study the details, including at least: number of symbol(s), [if any], for AGC and Rx-Tx turnaround time, conditions under which these are needed.

Please comment if you want to keep the text in brackets, or you want to remove it, or if either way is fine.

##### Companies views

|  |  |
| --- | --- |
| MTK | ok |
| CMCC | “If needed” should be removed since AGC training and Rx-Tx turnaround time are always needed. |
| CATT | We believe AGC and GP symbols should be needed for SL-PRS slots.  However, we support to keep the text in the brackets and make the conclusion in next meeting, since maybe other companies want more time to study this issue. |
| ZTE | We are fine without the text in brackets. |
| OPPO | Prefer to keep the text in brackets, we agree that AGC is always needed for SL siganls, but not sure about Rx-Tx turnaround time at this stage, e.g., if there is UE transmitting/receiving SL-PRS only the turnaround time is not needed. |
| LGE | We support the proposal with keeping the text in bracket. In the sub-bullet, the study already includes the conditions under which AGC and TX/RX switching gap are needed. So, there should be no issue with the main text in including ‘if needed’. |
| Xiaomi | We support to include “if needed” in the proposal, to avoid potential misunderstanding. |
| Vivo | We are OK to remove the the text in brackets. We are also OK if companies want to keep them as part of study. |
| NEC | OK |
| Futurewei | We are OK with the proposal. The second [if any] seems redundant. |
| Intel | We support keeping the texts in brackets. As discussed in previous rounds, there can be situations when specific consideration of symbol(s) for AGC setting or switching times may not be needed for SL-PRS. |
| Qualcomm | OK. We have the same view as CMCC to remove “if needed” |
| Samsung | We prefer the original proposal: to deleate bracket. We already have “conditions under which these are needed” so there could be cases when it is not needed. |
| Apple | Can accept the proposal without the brackets base on the text “conditions under which needed” as pointed out by Samsung. |
| Sharp | Either way is fine. |
| Huawei, HiSilicon | In general OK. |
| DCM | As we commented, this proposal is related to whether SL-PRS is independent signal (i.e. standalone) or multiplexed on another chanel. Further study is necessary.  We can live with this proposal if ‘if needed’ ‘if any’ are maintained. |
| SONY | OK and “if needed” is not necessary. |
| Nokia, NSB | OK; prefer to remove the brackets |

##### FL Observations

Keep the text in the brackets

* CATT, OPPO, LGE, Xiaomi, Intel, NTT DOCOMO, Samsung, Apple, Nokia, NSB

Remove the text in the brackets

* CMCC, ZTE, vivo (1st) , Qualcomm, Sony,

Either way is fine

* Vivo(2nd), Sharp

In the above responses, it may be unclear whether a statement “remove the brackets” means: Keep the text without the brackets, or remove the text in the brackets. I tried to judge by also looking at the previous responses, hopefully it is correct.

As was pointed out, the subbulet clearly includes “conditions under which these are needed”. This means that there may be cases that will be studied that this may not be needed. Since, this is the 1st meeting of the SI, keeping the “if needed” may be a more appropriate way forward. Companies would have to describe when such AGC/Rx-Tx turnaround time is needed, and we would have to agree. Looking at the situation, it appears to me that the initial proposal “when needed” was more stable than the “if needed”. It is clear to me that the companies are expected to study when these con

To address the comment from NTT DOCOMO (and previous similar comment from Ericsson), what if we add the termin “for a potential new SL PRS” as Ericsson suggested in a different Proposal?

##### [LOW]Feature Lead Proposal 4.2.6-v3

For a potential new SL PRS structure should include time for AGC training and Rx-Tx turnaround time if needed.

* Study the details, including at least: number of symbol(s) for AGC and Rx-Tx turnaround time, conditions under which these are needed.

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We support the proposal. |
| Futurewei | Support |
| CMCC | Although we think the most straightforward way is just following the NR sidelink slot structure with both time for AGC training and Rx-Tx turnaround time, we can accept “if needed” for progresss. |
| vivo | We prefer to remove “if needed”.  Otherwise, the main sentence may need rewording. It currently says something “should” include AGC and GP if needed. If we’re not sure about whether needed, guess we need to use some wording other than “should”. Suggest rewording if the intention is to study. |
| Intel | Support in general.  To address vivo’s concern, and as also observed by the Moderator, we could perhaps reconsider reverting “if needed” back to “when needed” as below:  For a potential new SL PRS structure should include time for AGC training and Rx-Tx turnaround time ~~if~~ when needed.   * Study the details, including at least: number of symbol(s) for AGC and Rx-Tx turnaround time, conditions under which these are needed. |
| ZTE | Support in principle but the wording may need be polished. For example:  For a potential new SL PRS structure, ~~should include~~ time for AGC training and Rx-Tx turnaround time should be included if needed |
| Spreadtrum | We agree with ZTE’s version. |
| CATT | Support the proposal in principle with small changes as follows (changes in BLUE color), Updated [HIGH]Feature Lead Proposal 4.2.6-v3 For a potential new SL PRS, SL PRS structure should include time for AGC training and Rx-Tx turnaround time if needed.   * Study the details, including at least: number of symbol(s) for AGC and Rx-Tx turnaround time, conditions under which these are needed. |
| DCM | Same view with ZTE. |
| LGE | AGC and TX/RX swithching gap are necessary in a slot, but not for SL PRS itself. We suggest to add the clarification.  For a potential new SL slot ~~PRS~~ structure for SL PRS transmission should include time for AGC training and Rx-Tx turnaround time if needed.   * Study the details, including at least: number of symbol(s) for AGC and Rx-Tx turnaround time, conditions under which these are needed. |
| Lenovo | Generally supportive of proposal |
| NEC | We support the suggestion from LGE. |
| Sharp | We support the proposal with ZTE’s modification. |
| OPPO | We suggest the following, note that “AGC training and Rx-Tx turnaround time” is changed to “AGC training and/or Rx-Tx turnaround time” to be more generic.  For a potential new SL PRS structure study further the following: ~~should include time for AGC training and Rx-Tx turnaround time if needed.~~   * conditions under which AGC training and/or Rx-Tx turnaround time are needed * ~~Study the details, including at least:~~ number of symbol(s) for AGC and/or Rx-Tx turnaround time~~, conditions under which these are needed~~. |
| Samsung | OK |
| Xiaomi | OK |
| Huawei, HiSilicon | Either ZTE’s or CATT’s proposal is fine.  We do not support LGE’s proposal given that the number of SL PRS symbols are still open. |
| Qualcomm | Sorry to be repeating our earlier comments, but AGC settling and Rx-Tx turnaround times are always needed in sidelink and are always incorporated. The only question is whether they are incorporated into the SL PRS or other SL channels.  For a potential new SL PRS structure should include time for AGC training and Rx-Tx turnaround time ~~if needed~~.   * Study the details, including at least: number of symbol(s) for AGC and Rx-Tx turnaround time, conditions under which ~~these are needed~~ AGC training and Rx-Tx turnaround times are met by other sidelink channels if applicable. |
| Nokia, NSB | OK; Qualcomm’s wording is also OK |

##### FL Observations

Unfortunately this one got unstable in the latest version. The debate between “if/when” seems to be taken more seriously by the companies than it really should, likely due to the fact that the proposal seems rather strong by saying “should include AGC time”. Maybe, a softer version will make the companies more comfortable here, so i would like to proposal the OPPO’s version, which should be much easier agreeable.

LGE suggested to change the “SL PRS” to “SL slot” under the argument that “ AGC and TX/RX swithching gap are necessary in a slot, but not for SL PRS itself”. My understanding is that this may not be necessarily true depending on what companies consider: If a company considers a SL-PRS that as an AGC before every time is transmitted, its really associated with the SL-PRS and not so much with the slot. So changing, the proposal at this stage may appear as if we are excluding this option, which is not the case. We don’t also exclude what LGE is saying: that eventuall the AGC is associated with the SL slot and not with the SL-PRS. The wording “SL-PRS structure”, and making this “study the conditions” is covering LGE’s concerns. A condition could be that AGC is needed only once a slot for example, etc, etc.

Hopefully the softer version shown below will be agreeable in this meeting.

##### [LOW][OPEN]Feature Lead Proposal 4.2.6-v4

For a potential new SL PRS structure study further the following: ~~should include time for AGC training and Rx-Tx turnaround time if needed.~~

* Conditions under which AGC training and/or Rx-Tx turnaround time are needed
* ~~Study the details, including at least:~~ number of symbol(s) for AGC and/or Rx-Tx turnaround time~~, conditions under which these are needed~~.

##### Companies views

|  |  |
| --- | --- |
|  |  |

#### 4.2.7 SL-PRS Numerology

Based on the submitted contributions, there was some limited discussion the SL-PRS numerology:

|  |  |
| --- | --- |
| Lenovo | SL PRS can support the same numerology as already supported in SL FR1 |

##### [CLOSED]Feature Lead Request

Companies are encouraged to provide more views with regards to the SL-PRS numerology (SCS & CP options for FR1, FR2)

##### Companies views

|  |  |
| --- | --- |
| CATT | We prefer to support the SCS&CP options which had been specified in R16 V2X for SL-PRS. |
| ZTE | Due to lack of basic FR2 functionalities, e.g. beam management in Rel-16/17 sidelink, we prefer to deprioritize FR2 enhancement for SL positioning in Rel-18 and focus on the numerology for FR1. |
| Huawei, HiSilicon | Suppport. |
| InterDigital | We think the SL PRS numerology should align with the current SL BWP configuration. |
| Futurewei | Support |
| CMCC | SCS & CP in NR sidelink should be reused. |
| NEC | We prefer not to introduce any new numerology design |
| Sony | We have the same view as CATT that we should reuse the numerology that has been specified for V2X. |
| OPPO | SCS&CP options as NR sidleink and NR Uu should be resused for SL-PRS. |
| Lenovo | Support |
| vivo | We also support to focus on SL-PRS for FR1 with the same numerology as for NR sidelink. |
| Apple | Re-use the existing numerology. |
| Locaila | Support. |
| Samsung | Use the same numerology as already supported in SL FR1 |
| Qualcomm | We support using the SL SCS and CP already defined for NR sidelink. |
| DCM | Same numerology is preferred. FR2 should not be included. |
| LGE | We share the same view with CATT that R16 numerology can be a baseline for SL PRS. |
| Sharp | We support using the same numerology as already supported in SL FR1 |
| Xiaomi | Same numerology as NR SL communication shall be supported for SL PRS. |
| Nokia, NSB | Support the Rel-16 sidelink numerologies. |
| Intel | Same numerology as for SL SCS and CP. |

##### [CLOSED]Feature Lead Proposal 4.2.7-v0

With regards to the numerologies of the SL-PRS, limit the study, to those supported for NR Sidelink.

##### Companies views

|  |  |
| --- | --- |
| vivo | OK |
| Futurewei | Support |
| Samsung | OK |
| LGE | Support |
| NEC | OK but suggest removing the comma after ‘limit the study’ |
| Sharp | OK |
| CMCC | Support |
| CATT | Support |
| Nokia, NSB | OK |
| Huawei, HiSilicon | OK |
| OPPO | OK |
| ZTE | Support. |
| Intel | OK |
| InterDigital | Support |
| Qualcomm | Support |

##### FL Observations

All companies supported the proposal

##### [CHECKPOINT 1[REOPEN] Feature Lead Proposal 4.2.7-v0

With regards to the numerologies of the SL-PRS, limit the study, to those supported for NR Sidelink.

##### FL Observations

During the email correspondence in the reflector, there was a request from Samsung to change the proposal as follows:

With regards to the numerologies of the SL-PRS, limit the study, to those supported for NR Sidelink, i.e., {15, 30, 60 kHz} in FR1 and {60, 120 kHz} in FR2.

There was a comment by NTT DOCOMO whether the above means that we are discussing whether FR2 shall be studied or not, and whether it implies that FR2 is studied.

FL understanding of the SID is that FR2 is not mentioned as being excluded from the study. In the above proposal, there is no intention to imply/reinforce that FR2 is in scope or, vice versa, to exclude FR2 with this proposal. Also, as Samsung noted: NR sidelink numerologies supports both FR1 and FR2 but not optimized for FR2.

Following the above comment from Samsung & NTT DOCOMO, what if we change it as follows:

##### [CLOSED]Feature Lead Proposal 4.2.7-v1

With regards to the numerologies of the SL-PRS, limit the study to those supported for NR Sidelink.

* Note 1: NR Sidelink supports {15, 30, 60 kHz} in FR1 and {60, 120 kHz} in FR2
* Note 2: This doesn’t imply that SL-PRS FR2-specific optimization(s) are expected to be studied

Please comment if are OK with the above proposal:

##### Companies views

|  |  |
| --- | --- |
| Lenovo | Support |
| Futurewei | Support |
| Qualcomm | OK |
| Samsung | Support |
| Apple | Okay with proposal |
| OPPO | OK |
| Sharp | Support |
| Huawei, HiSilicon | OK |
| DCM | OK |
| Nokia, NSB | OK |
|  |  |

##### FL Observations

It seems the above proposal appears to be agreeable including Samsung and NTT DOCOMO that brought up some questions during the previous attempt for Email Endorsement. Based on this stautus, my suggestion is to go again for Email Endorsement.

##### [EMAIL ENDORSEMENT]Feature Lead Proposal 4.2.7-v1

With regards to the numerologies of the SL-PRS, limit the study to those supported for NR Sidelink.

* Note 1: NR Sidelink supports {15, 30, 60 kHz} in FR1 and {60, 120 kHz} in FR2
* Note 2: This doesn’t imply that SL-PRS FR2-specific optimization(s) are expected to be studied

# SL Positioning Resource Allocation

Based on the submitted contributions, it may be beneficial to start the topic of SL Positioning Resource Allocation, by discussing it in two subtopics:

## 5.1 Resource pool for SL Positioning or Shared resource pool?

|  |  |
| --- | --- |
| Nokia, NSB | Study which SL resources (e.g., PSCCH, PSSCH, etc. within SL resource pools or independent time/frequency resources as in the case of S-SSB) can be utilized to transmit/receive SL PRS, and any required changes to the SL frame structure.  Allocation of frequency bands for SL positioning purposes, and any required modifications to the configuration and use of SL resource pools should consider the bandwidth requirements of SL positioning based on the performance evaluations to be conducted. |
| Huawei, HiSilicon | Support a dedicated resource pool used for SL positioning only.  Consider the reserved slots as a part of the dedicated resource pool for positioning to transmit SL-PRS. |
| Samsung | Study the following approaches for SL positioning resource configuration as   * Approach 1: SL positioning resources are configured in the same resource pool with SL data transmission. * Approach 2: SL positioning resources are configured in separate resource pools with SL data transmission. |
| CATT, GOHIGH | Considering the compatibility for Rel-16/17, the dedicated resource pool for sidelink positioning should be introduced  The SPCI used for the scheduling of S-PRS, can be transmitted in the dedicated resource pool for sidelink positioning or the legacy resource pool for Rel-16/17 sidelink. |
| vivo | A dedicated resource pool should be studied for SL PRS transmission in Rel-18. |
| CMCC | In Rel-18, dedicated resource pool for SL positioning RS should be (pre)configured other than multiplexing with data in a same resource pool, and only TDM configuration is supported for SL data and positioning RS resource pools. |
| ZTE | For SL-PRS resource configuration, we are open to study the following options:   * Alt 1: Dedicated SL-PRS configuration   + SL-PRS configuration is separate from SL resource pool. * Alt 2: SL-PRS is configured in SL resource pool   In Rel-18, TDM between SL-PRS and SL-data is only considered |
| China Telecom | It is beneficial to configure a dedicated sidelink PRS resource pool and support the trigger scheme of sidelink PRS transmission |
| Qualcomm | Support SL PRS-only resource pools where only SL-PRS transmissions can take place without other SL signals or channels  There is no data/control transmission in time-frequency grid of SL PRS resources  FDM multiplexing with other signals at RE level inside of SL PRS time-frequency grid is precluded  Transmission of other SL signals and channels in the same OFDM symbol as SL PRS is precluded |
| Apple | Decide on whether or not the time resources for the SL positioning signal transmission are within the time resources of the slots for the resource pool  Decide on the frequency resources for SL-positioning signals  SL positioning reference signal can be configured   * + in same slot as SL PSSCH/PSCCH/PSFCH (uses same resource allocation method as PSSCH/PSCCH/PSFCH).     - Discussion needed on modifications to SL-slot structure   + in independent SL positioning slots (uses independent resource allocation method)     - Discussion needed on structure of a new SL positioning slot |
| Xiaomi | Study whether sidelink positioning reference signal can use a separate frequency layer/BWP than sidelink communication BWP. |
| OPPO | Standalone SL-PRS transmission within a slot from a single UE perspective should be considered for SL-PRS design in sidelink positioning.  Following 2 options should be considered for SL-PRS resource pool:   * + Option 1: Dedicated resource pool;   + Option 2: Shared resource pool with sidelink communication. |
| Lenovo | RAN1 to study the possibility of multiplexing SL PRS with existing sidelink physical channels considering aspects such interference and resource efficiency  RAN1 to study and define the hierarchical SL PRS resource configuration considering the potential relationship among SL Positioning frequency layers or SL BWPs or resource pool |
| LGE | It needs to be studied whether a resource pool is shared for both SL positioning and SL communication, or a separate resource pool is configured for each SL service.  If a resource pool for SL communication is shared for SL positioning, a solution to protect the legacy SL communication from SL positioning needs to be developed  If a separate resource pool is configured for SL positioning, SL PRS resource set and SL PRS resource similar to NR positioning are defined for SL positioning  It is supported that UE selects the SL PRS resources based on sensing  When UE selects the SL PRS resources, the resource selection procedure based on sensing defined in Rel.16 NR SL communication is reused as much as possible  Control channel associated with the SL PRS resources needs to be transmitted to indicate the control information for the SL PRS resources being transmitted, and the resource reservation information  Congestion control in SL positioning needs to be studied |
| Intel | For SL-PRS resource allocation, resource pool(s) may be (pre-)configured either dedicated for SL-PRS or shared with resource pool(s) (pre-)configured for PSSCH.  Both cases wherein SL-PRS may or may not be multiplexed with PSSCH in a slot from a transmitting UE should be considered for further study. |
| NEC | Both reusing frequency resource within PSSCH bandwidth and introducing dedicated frequency resource should be considered for S-PRS transmission.  The resource allocation of S-PRS in time and frequency domain should support non-continuous resource allocation. |
| Interdigital | Study a mechanism to share time and frequency resources to support co-existence between SL communication and SL positioning  Study how SCI can be multiplexed with PRS |

Based on the submitted tdocs, and proposals summarized above, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 5.1-v0

With regards to the SL Positioning resource allocation, study further the following 2 options for SL Positioning resource (pre-)configuration:

* + Option 1: Dedicated resource pool for SL-PRS
    - This option may or may not include control information for the purpose of SL positioning operation, but it precludes PSSCH/ PSFCH included in the same resource pool
    - Include in the study at least the following aspects:
      * + which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)
        + the bandwidth requirements of SL positioning based on the performance evaluations
  + Option 2: Shared resource pool with sidelink communication.
    - Include in the study at least the following aspects:
      * + co-existence between SL communication and SL positioning, backward compatibility
        + Multiplexing considerations of SL-PRS with other PHY channels (PSCCH, PSSCH, PSFCH) and any modifications in the SL-slot structure

##### Companies views

|  |  |  |
| --- | --- | --- |
| CATT | Support to study both options.  We prefer Option 1, i.e., dedicated resource pool for SL-PRS. | |
| MTK | We prefer option 1 | |
| ZTE | The above two options in Proposal 5.1-v0 is a good starting point for discussion. For Option 1, the hierarchical sidelink resource configuration is SL Frequency --> SL BWP --> SL resource pool according to TS 38.331 [6]. If dedicated SL-PRS configuration is supported, we should further discuss whether SL-PRS resources are configured on dedicated SL-PRS Frequency or dedicated SL-PRS BWP or dedicated SL-PRS resource pool.  For Option 2, even though SL-PRS and SL-data share resource pool, we need consider enlarging the frequency domain range of SL-PRS for high-accuracy positioning. | |
| Huawei, HiSilicon | Fine in general. Better to clarify “control information”, I assume it is saying SCI scheduling PRS or resource for measurement reporting. | |
| Spreadtrum | We are fine to study both Option 1 and Option 2. | |
| InterDigital | We agree with the options. | |
| Futurewei | We are open to study both options. | |
| CMCC | Both of the options can be studied and our preference is option 1, since option 2 may make the resource allocation more complicated due to the collision b/w SL-PRS and dara, moreover, FDM b/w positioning RS and data should be avoided. | |
| NEC | We should study both options and we think both options can be supported for different circumstances | |
| Sony | At this stage, we need to study both options. We prefer to prioritize option 1. | |
| OPPO | Support the 2 options. Available spectrum for SL is very limited, shared resource pool with SL communication should be strived for, especially for on-demand transmitted SL-PRS, to ensure resource efficiency. Dedicated resource pool can also be considered for the cases where SL-PRS cannot co-ex with SL communication channels, or always-on SL-PRS. |
| Lenovo | We are open to study both options at this current stage. Furthermore, we also share ZTE’s view that further study is needed on whether to define SL PRS Frequency layer or dedicated SL-PRS BWP due to special BW requirements for positioning  SL PRS resource configuration design should also be thought from a forward compatibility point of view e.g., SL PRS resource pool configuration may also be incompatible when aggregating PRS resources in a SL multi-carrier scenario to leverage even larger BWs.  Hence, the SL-PRS configuration should study whether there is a need to introduce a SL PRS frequency layer or SL PRS BWP in addition to its relationship to a dedicated SL PRS resource pool. | |
| vivo | Our preference is option 1.  We have a question on the aspects listed for study of option 2. Why only co-existence and multiplexing are mentioned, while bandwidth requirement and performane evalution is not mentioned as part of study for option 2 even though they are explicitly mentioned for option 1? We don’t think these apects listed are fair for comparison between option 1 and option 2. | |
| Apple | We are fine with studying both options. A decision can be made on whether to down-select to one or keep both based on the positioning scenario. | |
| Samsung | Direction is fine. However, we can simplify this proposal as follows:  With regards to the SL Positioning resource allocation, study further the following 2 options for SL Positioning resource (pre-)configuration:   * + Option 1: Dedicated resource pool for SL-PRS     - This option may or may not include control information for the purpose of SL positioning operation, ~~but it precludes PSSCH/ PSFCH included in the same resource pool~~     - This option may or may not include sensing for resource allocation of SL-PRS     - ~~Include in the study at least the following aspects:~~       * + ~~which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)~~         + ~~the bandwidth requirements of SL positioning based on the performance evaluations~~   + Option 2: Shared resource pool with sidelink communication.     - Include in the study at least the following aspects:       * + co-existence between SL communication and SL positioning, backward compatibility         + ~~Multiplexing considerations of SL-PRS with other PHY channels (PSCCH, PSSCH, PSFCH) and any modifications in the SL-slot structure~~ | |
| Qualcomm | We prefer Option 1 as it will minimize interference seen by PRS and improve measurement quality. | |
| DCM | Option 2.  Separate pool degrades SL communication performance since the resources becomes always unavailable. | |
| LGE | We support the proposal with one comment  For clarification, option 1 needs slight modification.   * + Option 1: Dedicated resource pool for SL positioning   As said above, we need FFS whether control information, measurement report related to SL PRS is transmitted in the dedicated pool or the SL communication pool. | |
| Sharp | We are OK to study both options. | |
| Xiaomi | We share ZTE and Lenovo view that option 1 shall also include the study on whether a dedicated frequency layer/BWP is needed for SL PRS. In addition, as we have not discussed which layer the control information for SL PRS belongs to, it may be too early to preclude PSSCH in the dedicated resource pool option. | |
| Philips | We support studying both options. | |
| Nokia, NSB | OK to study both Option 1 and Option 2. | |
| Ericsson | Ok to study both options. | |
| Intel | OK in general. We think both of these options have their own applicability in different use-cases and scenarios, and hence, should be studied further. No need to prioritize any option at this point. | |

##### FL Observations

Support/preference/prioritize Option 1:

* CATT, MTK, CMCC, Sony, vivo, Samsung, Qualcomm, LGE

Support/preference Option 2:

* NTT DOCOMO

Support Both options

* OPPO

Study Both options

* ZTE, spreadtrum, Huawei, HiSilicon, NEC, Apple, Sharp, Philips, Nokia, NSB, Ericsson, Intel

At least 3 companies suggested to add in the items to be studied “whether a dedicated frequency layer/BWP is needed for SL PRS”.

1 company suggested to remove the aspects that are noted for further study, while adding an additional item for study.

* In order to be inclusive at this early stage of the study item, and in order to guide what companies consider useful to be added, I prefer to be inclusive of the items that should be considered.

Based on all the above comments, the revised proposal reads as follows:

##### [CLOSED]Feature Lead Proposal 5.1-v1

With regards to the SL Positioning resource allocation, study further the following 2 options for SL Positioning resource (pre-)configuration:

* + Option 1: Dedicated resource pool for SL-PRS Positioning
  + This option may or may not include control information (i.e., configuration/activation/triggering of SL-PRS and/or resource for reporting) for the purpose of SL positioning operation~~, but it precludes PSSCH/ PSFCH included in the same resource pool~~
    - Include in the study at least the following aspects:
      * + which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)
        + whether a dedicated frequency layer/BWP is needed for SL PRS
        + sensing for resource allocation of SL-PRS
        + Whether control information, measurement report related to SL Positioning is transmitted in the dedicated pool or the SL communication pool.
  + Option 2: Shared resource pool with sidelink communication.
    - Include in the study at least the following aspects:
      * + co-existence between SL communication and SL positioning, backward compatibility
        + Multiplexing considerations of SL-PRS with other PHY channels (PSCCH, PSSCH, PSFCH) and any modifications in the SL-slot structure

For either Option, study the bandwidth requirements of SL positioning based on the performance evaluations.

##### Companies views

|  |  |
| --- | --- |
| vivo | We have concern on current wording of option 1. Option 1: Dedicated resource pool for SL-PRS Positioning  This categorization seems contradict with the sub-bullet “Whether control information, measurement report related to SL Positioning is transmitted in the dedicated pool or the SL communication pool”. In case SL positioning report is on shared resource pool, is it still count as dedicated resource pool for SL-PRS positioning? We prefer not to have “Positioning” in the end and just “Option 1: Dedicated resource pool for SL-PRS” |
| Futurewei | We are OK with the proposal and removal of “Positioning” as vivo suggested.  One note: First option may or may not allow control and measurement in the SL communication pool. Therefore, co-existence between SL communication and SL positioning control and measurements,and backward compatibility may be necessary to be addressed. |
| Samsung | For option 1 as one of the options is consider is using the RP for SL-PRS and Positioining measuremet report, we prefer the following update (marked in blue):   * + Option 1: Dedicated resource pool (RP) for SL~~-PRS~~ Positioning   + Wherether this option includes: (1) RP for SL-PRS or (2) RP for SL-PRS and positioning measurement report.   + This option may or may not include control information (i.e., configuration/activation/triggering of SL-PRS and/or resource for reporting) for the purpose of SL positioning operation~~, but it precludes PSSCH/ PSFCH included in the same resource pool~~     - Include in the study at least the following aspects:       * + which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)         + whether a dedicated frequency layer/BWP is needed for SL PRS         + sensing for resource allocation of SL-PRS and/or positioning measurement reports.         + Whether control information, measurement report related to SL Positioning is transmitted in the dedicated pool or the SL communication pool. |
| LGE | Support with correction on a typo.   * + Option 1: Dedicated resource pool for SL~~-PRS~~ Positioning |
| Xiaomi | We also suggest to remove the Positioning in the main bullet of option 1. We are fine with other parts. |
| NEC | Support in principle, regarding the definition of dedicated resource pool, we share the similar view as vivo and suggest to remove “Positioning”. |
| Sharp | We are OK with the proposal.  We are also OK with vivo’s modification. |
| CMCC | We propose to do following modifications for option 1. The reason is that  in NR sidelink only 1 BWP is supported, we do not think we can revert this in Rel-18;  Sensing is based on resource reservation;  The measurement report is certainly should be limited in a separate resource pool, otherwise, this would not be a exact “dedicated” resource pool.   * + - * + ~~whether a dedicated frequency layer/BWP is needed for SL PRS~~         + sensing/resource reservation for resource allocation of SL-PRS         + ~~Whether control information, measurement report related to SL Positioning is transmitted in the dedicated pool or the SL communication pool.~~ |
| CATT | We prefer to keep original wording of main bullet of Option 1 as follows, since whether control information, measurement report related to SL Positioning is transmitted in the dedicated pool or the SL communication pool is FFS.   * + Option 1: Dedicated resource pool for SL-PRS ~~Positioning~~ |
| Nokia, NSB | OK in principle. But it seems that Option 1, as worded currently, really consists of two suboptions:  Option 1a: Dedicated resource pool for SL-PRS  Option 1b: Dedicated resource pool for SL-PRS and associated signaling  It would perhaps be clearer to make these suboptions explicit |
| Huawei, HiSilicon | Agree with vivo’s comment. Positioning should be removed.  The intention should focus on SL RS. |
| OPPO | We also prefer to remove “Positioning”, as this concept is a bit wide, including all channels/siganls that can contribute to SL positioning.  We are considering both network-centric and autonomous resource selection for SL PRS, sensing may not be needed for resource allocation.  For a dedicated resource pool for SL PRS, we think what matters is whether there is other SL channels/siganls inside, regardless what information is carried in the SL channels/siganls.  In general, we suggest following changes (highlighted in yellow) :   * + Option 1: Dedicated resource pool for SL-PRS ~~Positioning~~   + This option may or may not include control information (i.e., configuration/activation/triggering of SL-PRS and/or resource for reporting) for the purpose of SL positioning operation~~, but it precludes PSSCH/ PSFCH included in the same resource pool~~     - Include in the study at least the following aspects:       * + which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)         + whether a dedicated frequency layer/BWP is needed for SL PRS         + ~~sensing for~~ resource allocation of SL-PRS         + Whether allow other SL channels/siganls ~~control information, measurement report related to SL Positioning is transmitted~~ in the dedicated pool ~~or the SL communication pool~~. |
| ZTE | We agree with vivo’s revision: Option 1: Dedicated resource pool for SL-PRS ~~Positioning~~  For option 2, even though the SL-PRS is configured in one SL resource pool, the frequency domain range of SL-PRS can be larger than one or several SL resource pools. As shown in our contribution:  Therefore, how to deal with this kind of resource collision should also be further studied. |
| Philips | We are OK with vivo’s proposal. |
| Intel | Same view as vivo to remove “Positioning” in name fo Option 1.  Also, we do not think the last sentence is necessary: For either Option, study the bandwidth requirements of SL positioning based on the performance evaluations.  This is a rather obvious consideration, especially in light of the SI objectives and does not add anything to the current proposal. |
| InterDigital | We support the proposal in principle. In our view, both Mode 1 (e.g., DCI format and content) and Mode 2 (e.g., sensing) resource allocation should be included in the study for Option 1. Secondly, we would like to note SL multi-carrier is a R18 topic, which will start later and potentially multiple active SL BWPs and related design will be discussed under that topic. Currently, there is only one active SL BWP and we think it is important to prioritize discussion of positioning frequenc allocation (e.g., resource pool) in one SL BWP. Thus we propose to the change below   * + - Include in the study at least the following aspects:       * + which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)         + whether a dedicated frequency ~~layer/BWP~~ allocation is needed for SL PRS         + ~~sensing for resource allocation of SL-PRS~~ Mode 1 and Mode 2 resource allocation for SL PRS         + Whether control information, measurement report related to SL Positioning is transmitted in the dedicated pool or the SL communication pool. |
| Qualcomm | The addition of “positioning” to the end of Option 1 is not clear to us and propose removing it as suggested by others. We also propose removing the following “sensing for resource allocation of SL-PRS” since sensing would be part of resource allocation and not the resource pool structure. |

##### FL Observations

Rewording 1 for Option 1: Keep the “SL-PRS” and remove the word “Positioning”

* Vivo, Futurewei, Xiaomi, NEC, Sharp, CATT, Nokia, NSB, Huawei, HiSilicon, OPPO, ZTE, Philips, Intel, Qualcomm

Rewording 2 for Option 1: Keep the “SL Positioning” and remove the word “PRS”

* Samsung, LGE

FL Proposal: Keep the “SL-PRS” and remove the word “Positioning”

With regards to the remaining points of discussion:

* Following the recommendation of 2 companeis, I am suggesting to make it more clear that Option 1 has 2 options to be investigated (1A and 1B).
* Since now it is clear that 1B is the option that has RP for SL-PRS and Positioning measurement report, adding again, in the remaining bullets, the “resource for positioning” is not needed.
* Similarly, since the 2 subbulet of Option 1 says that “this option may or may not include control information”, the sub-sub-bullet that says “whether control information… SL communication pool” is not needed; it’s a repetition
* As suggested by Intel, removed the last sentence, since its also a repetition of an explicit request in the SID.
* The debate whether to write “dedicated frequency layer/BWP”, or “frequency allocation”, or remove it at all, I am suggesting to resolve it as follows: “dedicated frequency allocation (e.g., layer/BWP)”. I understand that there is single BWP in NR Rel-17, but I prefer at this stage to be inclusive since this is the first meeting for SL Positioning. Downselection/downscoping for all these can start from next meeting.
* With regards to “sensing for resource allocation”: Instead of fully removing it, or adding “resource reservation”, we could generalize to “relation to resource allocation”. This will include any item that companies want to bring up with regards to how they envision the dedicated resource pool to interact/complement the resource allocation schemes in a working system.
* On the same sub-sub-bullet, with regards to adding “mode 1 / mode 2”, just adding “resource allocation” is more appropriate since we haven’t agreed to such modes yet.

##### [CLOSED]Feature Lead Proposal 5.1-v2

With regards to the SL Positioning resource allocation, study further the following 2 options for SL Positioning resource (pre-)configuration:

* + Option 1: Dedicated resource pool for SL-PRS ~~Positioning~~
  + Whether this option includes: (1A) RP for SL-PRS or (1B) RP for SL-PRS and positioning measurement report.
  + This option may or may not include control information (i.e., configuration/activation/triggering of SL-PRS ~~and/or resource for reporting~~) for the purpose of SL positioning operation
    - Include in the study at least the following aspects:
      * + which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)
        + whether a dedicated frequency allocation (e.g., layer/BWP) is needed for SL PRS
        + relation to ~~sensing~~ ~~for~~ resource allocation of SL-PRS
        + ~~Whether control information, measurement report related to SL Positioning is transmitted in the dedicated pool or the SL communication pool.~~
  + Option 2: Shared resource pool with sidelink communication.
    - Include in the study at least the following aspects:
      * + co-existence between SL communication and SL positioning, backward compatibility
        + Multiplexing considerations of SL-PRS with other PHY channels (PSCCH, PSSCH, PSFCH) and any modifications in the SL-slot structure

~~For either Option, study the bandwidth requirements of SL positioning based on the performance evaluations.~~

##### Companies views

|  |  |
| --- | --- |
| CATT | We can live with this proposal, and prefer to add “FFS” before the blue bullet as follows to make the meanings of the bullet clear,   * + FFS: Whether this option includes: (1A) RP for SL-PRS or (1B) RP for SL-PRS and positioning measurement report. |
| ZTE | Support in general.  We need explain that RP is short for resource report in Option 1. |
| LGE | We support the proposal with the following comment   * Remove “multiplexing of SL-PRS with control information (if included in the same slot)” as the sub-bullet in option 1 includes ‘this option may or may not include control information.’ Only after this decision, the multiplexing can be studied.   So we suggest the following modification.   * + - Include in the study at least the following aspects:       * + which slots can be used, SL frame structure, SL positioning slot structure, ~~multiplexing of SL-PRS with control information (if included in the same slot)~~ |
| Xiaomi | OK |
| vivo | We assume “RP” means resource pool. If so, it’d be bette to spell out.  On LGE’s suggestion to remove “~~multiplexing of SL-PRS with control information (if included in the same slot)~~”, we think no need to remove given it is already said “if included” and seems will not cause confusion. |
| Lenovo | Support, Clarification is needed under Option 1 that “RP” stands for “Resource Pool”. Furthermore. the text in blue can be added as an FFS point as CATT mentioned. |
| InterDigital | We support the proposal. |
| Futurewei | OK in general. Suggest to make first sub-bulet of the Option 1 more clear:  Whether this option includes: (1A) dedicated resource pool only for SL-PRS or (1B) dedicated resource pool(s) for SL-PRS and positioning measurement report.  Further, the sub-bullet:   * + - * + relation to ~~sensing~~ ~~for~~ resource allocation of SL-PRS   is not clear, relation between what entities? Is the relation between dedicated resource pool for SL-PRS and resource allocation of SL-PRS as the identation indicates? |
| Intel | Mostly OK. But we are also not entirely clear on the following bullet:   * + - * + relation to ~~sensing~~ ~~for~~ resource allocation of SL-PRS   Is it referring to relation to resource allocation *procedure(s)*? |
| Qualcomm | The motivation for having SL-PRS in a dedicated resource is to improve positioning/ranging performance.  The measurement report is a form of data and it is not clear why that needs to go in the dedicated resource pool instead of the data resource pool. Hence, we propose to remove (1B)  For the control information, we propose to either include it as a subbullet of “Include in the study at least the following aspects” or make it an FFS. Otherwise it could be interpreted as an integral part of Option 1 not subject to study, which we do not agree with. |
| Spreadtrum | Support. |
| Apple | Agree that RP (as Resource Pool) should be spelt out. |
| OPPO | It seems problematic to split Option 1 per information included in the resource pool. For 1A the resource pool includes SL PRS and/or control information, for 1B the resource pool includes SL PRS and/or control information and measurement report. Then if both the control information and the measurement report are all conveyed by PSCCH, or both of them are conveyed by PSCCH/PSSCH (assuming there is no standalone PSSCH based on legacy design), what is the difference between 1A and 1B. And what if there is additional information(in addition to the control information and measurement report) for the purpose of sidelink positioning identified in the future, should we introduce another option?  In our view, in contrast to Option 2, backward compatibility is not considered in Option 1, on top of that, what will impact the design in the future is whether the dedicated resource pool includes SL PRS and/or PSCCH only or can include SL PRS and PSCCH/PSSCH, which information is conveyed in the channel does not make any difference.  In general, we suggest the following, we also prefer to add [without considering backward compatibility] at the end of Option 1 as clear distinction with Option 2.  With regards to the SL Positioning resource allocation, study further the following 2 options for SL Positioning resource (pre-)configuration:   * + Option 1: Dedicated resource pool for SL-PRS ~~Positioning~~[without considering backward compatibility]   + ~~Whether this option includes: (1A) RP for SL-PRS or (1B) RP for SL-PRS and positioning measurement report.~~   + This option may or may not include control information (i.e., configuration/activation/triggering of SL-PRS ~~and/or resource for reporting~~) for the purpose of SL positioning operation   + Whether this option includes: (1A) RP for only SL-PRS and/or PSCCH for converying the control information (1B) RP for SL-PRS and PSCCH/PSSCH for conveying information for the purpose of SL positioning operation (e.g. the control information and SL positioning measurement report, etc.) ~~positioning measurement report~~.     - Include in the study at least the following aspects:       * + … |
| Sharp | We support the FL proposal. |
| Huawei, HiSilicon | OK in general, although we do not see 1B possible. |
| DCM | OK for making progress. |
| Nokia, NSB | OK |

##### FL Observations

This seems to not be a very stable version unfortunately yet.

* The comments from OPPO are hopefully addressed below in a way that is agreeable to the other companies.
* The comment from LGE to remove the following part: “~~multiplexing of SL-PRS with control information (if included in the same slot)”~~ . As vivo pointed out, the expression “if included in the same slot” is for that explicit purpose.
* Qualcomm suggests to add the whole main subbulet of Option 1 as “FFS”. I am adding it as shown below.
* To Intel and Futurewei: Yes the intention is to generalize the “sensing of resource allocation”, to an expression that could be agreeable from all. I think the suggestion of adding “relation to resource allocation **procedure(s)** of SL-PRS” may address the concerns.

##### [CLOSED]Feature Lead Proposal 5.1-v~~2~~3

With regards to the SL Positioning resource allocation, study further the following 2 options for SL Positioning resource (pre-)configuration:

* + Option 1: Dedicated resource pool for SL-PRS
  + FFS: Whether this option includes: (1A) dedicated Resource Pool only for SL-PRS with or without PSCCH for converying the control information, or (1B) dedicated Resource Pool(s) for SL-PRS, with or without PSCCH/PSSCH for conveying information for the purpose of SL positioning operation (e.g. the control information and SL positioning measurement report, etc.) ~~and positioning measurement report~~.
    - Include in the study at least the following aspects:
      * + which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)
        + whether a dedicated frequency allocation (e.g., layer/BWP) is needed for SL PRS
        + relation to resource allocation **procedure(s)** of SL-PRS
        + This option may or may not include control information (i.e., configuration/activation/triggering of SL-PRS) for the purpose of SL positioning operation
  + Option 2: Shared resource pool with sidelink communication.
    - Include in the study at least the following aspects:
      * + co-existence between SL communication and SL positioning, backward compatibility
        + Multiplexing considerations of SL-PRS with other PHY channels (PSCCH, PSSCH, PSFCH) and any modifications in the SL-slot structure
  + [Note: In contrast to Option 2, backward compatibility is not considered in Option 1]

Companies are encouraged to provide further comments and explicitly comment on the Note added above.

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We are fine with proposal. |
| Futurewei | Support. One observation: shouldn’t be Proposal 5.1- v3 instead of v2?  FL(05/18/2022 7:00am UTC): Thanks for the correction, I updated it! |
| CMCC | OK |
| ZTE | We doubt the necessarity of the new green added part. For option 1 we already have one subbullet: “This option may or may not include control information (i.e., configuration/activation/triggering of SL-PRS) for the purpose of SL positioning operation”.  Moreover, we want to confirm whether this is common understanding that if dedicated resource pool is assumed for SL positioning it is still possible to have time or frequency overlapping between SL-PRS resource pool and SL communication resource pool. Especially when they share the same BWP and SL-PRS need occupy the whole or most of the frequency resource. |
| Spreadtrum | Support. |
| CATT | We can live with this proposal.   * We prefer Option 1. |
| DCM | New 1A/1B became more complicated. Such a update is not preferred. Previous version is suggested. |
| LGE | We’re still not clear on the following sub-bullet.   * + relation to resource allocation **procedure(s)** of SL-PRS   As some companies mentioned, relation is defined between two things, but there is only one in the sub-bullet. We can just simply say to study the resource allocation procedure, so suggest the following.   * + ~~relation to~~ resource allocation **procedure(s)** of SL-PRS |
| Lenovo | We are ok to study both options. Additioanal details as expressed in the note is not required in our view as this is a common understanding. |
| NEC | The boundary of 1A and 1B is not clear since they can both include the cases of S-PRS only and S-PRS + PSCCH. We suggest to further divide it into three sub cases as 1A) S-PRS only, 1B) S-PRS + PSCCH, 1C) S-PRS + PSCCH + PSSCH. |
| Sharp | OK |
| OPPO | Support the proposal, we are also fine to remove the whole FFS bullet. The previous version is not preferable, as it does not make sense to split per information included in the resource pool.  We support the note in bracket at the end, which is helpful to avoid potential ambiguities. |
| Samsung | We think that there is some overlap between the first FFS bullet and the bullet marked in yellow. So, it would be good to deleate this. Instead, we suggest add the bullet marked in cyan. Also, the note is necessary since it is captured in the bullet marked in green in the bellow.  Also, we suggest to add ‘deactivation’ in the second yellow maked bullet as:  With regards to the SL Positioning resource allocation, study further the following 2 options for SL Positioning resource (pre-)configuration:   * + Option 1: Dedicated resource pool for SL-PRS   + ~~FFS: Whether this option includes: (1A) dedicated Resource Pool only for SL-PRS with or without PSCCH for converying the control information, or (1B) dedicated Resource Pool(s) for SL-PRS, with or without PSCCH/PSSCH for conveying information for the purpose of SL positioning operation (e.g. the control information and SL positioning measurement report, etc.) and positioning measurement report.~~     - Include in the study at least the following aspects:       * + which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)         + positioning measurement report         + whether a dedicated frequency allocation (e.g., layer/BWP) is needed for SL PRS         + relation to resource allocation **procedure(s)** of SL-PRS         + This option may or may not include control information (i.e., configuration/activation/deactivation triggering of SL-PRS) for the purpose of SL positioning operation   + Option 2: Shared resource pool with sidelink communication.     - Include in the study at least the following aspects:       * + co-existence between SL communication and SL positioning, backward compatibility         + Multiplexing considerations of SL-PRS with other PHY channels (PSCCH, PSSCH, PSFCH) and any modifications in the SL-slot structure   + ~~[Note: In contrast to Option 2, backward compatibility is not considered in Option 1]~~ |
| Xiaomi | We do not think the green wording is needed and prefer to remove it. Detailes on whether/when/how PSCCH/PSSCH can be transmitted in the dedicated resource pool can be FFS. |
| Huawei, HiSilicon | In general, the FFS under Option 1 is necessary. |
| Qualcomm | We think the proposal is becoming unnecessarily complex. The common part that is always performed in both (1A) and (1B) is the PRS, PSCCH may or not not be included in the pool, and PSSCH is only discsssed in (1B). We propose to remove PSCCH from 1A and put it as an “FFS whether PSCCH is transmitted in the dedicated resource pool” and similarly move PSSCH into an “FFS whether PSSCH is transmitted in the dedicated resource pool”. |
| Nokia, NSB | The suboptions of Option 1 are now overlapping, rather than mutually exclusive as originally intended. Suggest to revert to previous version; alternatively, Qualcomm’s suggestion would also be an improvement. |

##### FL Observations

Support the proposal

* Interdigital, Futurewei, CMCC, Spreadtrum, CATT, Lenovo, Sharp

Green part of the Option 1 is not needed / New 1A/1B got too complicated Or unclear

* ZTE, CATT, NEC, OPPO, Samsung, Xiaomi, Nokia, NSB, Qualcomm

Unfortunately this proposal got even more unstable when trying to clarify the sub-options. A lot of comments on the subbulets and the new FFS. It is unlikely we ll converge with all these details spelled out now. So, lets just try to strip out much of the subbullets, and just provide a generic direction of 2 options to be further discussed in the next meeting.

Therefore, my proposal is not to attempt to adjust the FFS in Option 1, and rather fully remove it. We all understand based on the “study the following aspects” that companies will have to describe whtether there will be control, measurement report, any dedicated frequency allocation, aspects related to resource allocation, etc.

##### [MEDIUM] [OPEN]Feature Lead Proposal 5.1-v4

With regards to the SL Positioning resource allocation, study further the following 2 options for SL Positioning resource (pre-)configuration:

* + Option 1: Dedicated resource pool for SL-PRS
  + ~~FFS: Whether this option includes: (1A) dedicated Resource Pool only for SL-PRS with or without PSCCH for converying the control information, or (1B) dedicated Resource Pool(s) for SL-PRS, with or without PSCCH/PSSCH for conveying information for the purpose of SL positioning operation (e.g. the control information and SL positioning measurement report, etc.) and positioning measurement report.~~
    - Include in the study at least the following aspects:
      * + which slots can be used, SL frame structure, SL positioning slot structure, multiplexing of SL-PRS with control information (if included in the same slot)
        + positioning measurement report
        + whether a dedicated frequency allocation (e.g., layer/BWP) is needed for SL PRS
        + ~~relation to~~ resource allocation **procedure(s)** of SL-PRS
        + This option may or may not include control information (i.e., configuration/activation/deactivation/triggering of SL-PRS) for the purpose of SL positioning operation
  + Option 2: Shared resource pool with sidelink communication.
    - Include in the study at least the following aspects:
      * + co-existence between SL communication and SL positioning, backward compatibility
        + Multiplexing considerations of SL-PRS with other PHY channels (PSCCH, PSSCH, PSFCH) and any modifications in the SL-slot structure
  + ~~[Note: In contrast to Option 2, backward compatibility is not considered in Option 1]~~

##### Companies views

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## 5.2 SL Positioning Resource Allocation Modes

|  |  |
| --- | --- |
| Nokia, NSB | Prioritize re-using existing resource allocation modes 1 and 2 from NR SL communications for scheduling SL PRS transmissions, and study any necessary modifications |
| Huawei, HiSilicon | For in-coverage scenarios, both mode 1 based and mode 2 based SL positioning resource allocation should be supported.  For out-of-coverage, mode-2 based SL positioning resource allocation should be supported |
| Samsung | Study feasibility of UE allocated resources for SL positioning including:   * Sensing based resource allocation * Resource allocation by another UE   Study feasibility of network allocated resources for SL positioning including:   * Resources for SL positioning reference signals * Resources for reporting SL positioning measurements. |
| CATT, GOHIGH | For the resource allocation of S-PRS in resource pool:   * Under the in-coverage scenario, gNB should schedule the resources of S-PRS for all UEs, similar to the Mode 1 mechanism in Rel-16 NR V2X. * Under the out-of-coverage scenario or partial coverage scenario, the resources of S-PRS should be allocated by resource sensing and exclusion, similar to the Mode 2 mechanism in Rel-16 NR V2X. Random resource selection mechanism can also be considered to reduce the sidelink positioning latency. |
| Vivo | SL mode 1 and mode 2 resource allocation mechanisms should be studied.  SL mode 2 resource allocation can be used for SL PRS resource allocation with some modification (e.g., the SL PRS is used for RSRP measurement). |
| CMCC | Resource allocation for SL positioning PRS should reuse the Rel-16 mechanism in NR sidelink as much as possible.   * For mode 1, gNB should take the responsibility for resource allocation; * For mode 2, take the legacy mode 2 resource selection procedure as baseline with the consideration of potential enhancements towards RE-level multiplexing of SL positioning RS.   Centralized scheduling mechanism, e.g., mode 2(d) like method discussed in Rel-16 NR sidelink, can be considered for resource allocation for SL positioning PRS |
| ZTE | Support both Mode 1 and Mode 2 resource allocation for SL positioning |
| Qualcomm | The network indicates resources for SL-PRS and trigger or configure SL-PRS transmission for in-coverage UEs  Higher layers indicate resources for SL-PRS and trigger or configure SL-PRS transmission for out-of-coverage UEs. |
| Xiaomi | Both gNB scheduling and UE autonomous resource selection based resource allocation shall be supported for NR sidelink positioning. |
| OPPO | Both network centric (mode 1 like) and UE autonomous resource allocation (mode 2 like) should be considered for SL-PRS |
| Lenovo | RAN1 to support Mode 1 coordination of SL PRS resources for one or more UEs participating in a SL positioning session  RAN1 to support Mode 2 coordination of SL PRS resources for one or more UEs participating in a SL positioning session |
| Spreadtrum | For SL PRS transmission, the resource allocation mode 1 and the resource allocation mode 2 can be considered |
| Intel | RAN1 to investigate potential solutions for both gNB-controlled resource allocation as well as UE-autonomous resource selection for SL-PRS. |
| NEC | Both network based and UE based resource allocation for S-PRS resources and related reporting should be supported.  − If the dedicated frequency resource for S-PRS is introduced, corresponding resource allocation scheme should be studied separately. |
| Interdigital | Study both mode 1 and mode 2 for PRS resource allocation/scheduling where mode 1 and mode 2 can be considered at least for in-coverage or out-of-coverage scenario, respectively. |
|  |  |
| Mediatek | RAN1 to study the coordination mechanism for SL-PRS configuration |

Based on the submitted tdocs, and proposals summarized above, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 5.2-v0

With regards to the SL Positioning resource selection, study the following two schemes:

* Scheme 1: Network-centric operation SL positioning resource selection (e.g. similar to a legacy Mode 1 solution)
  + The network (e.g. gNB, LMF, gNB & LMF) is responsible and control the resource selection
  + At least applicable to in-coverage scenarios
* Scheme 2: UE autonomous resource allocation (e.g. similar to legacy Mode 2 solution)
  + One, or one or more, of the UE(s) participating in the sidelink positioning operation is responsible for resource selection
  + At least applicable to out-of-coverage scenarios
* Study also which mode shall be applicable to partial coverage scenarios.
* In either scheme, include in the study any potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs.

##### Companies views

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| --- | --- |
| CATT | Support the proposal in principle, and we prefer the following revision:  And we prefer to de-prioritize the partial coverage scenarios to reduce the work load. Updated Feature Lead Proposal 5.2-v0 With regards to the SL-PRS ~~Positioning~~ resource allocation~~selection~~, study the following two schemes:   * Scheme 1: Network-centric operation SL-PRS ~~Positioning~~ resource allocation~~selection~~ (e.g. similar to a legacy Mode 1 solution)   + The network (e.g. gNB, LMF, gNB & LMF) is responsible and control the SL-PRS resource allocation~~selection~~   + At least applicable to in-coverage scenarios * Scheme 2: UE autonomous SL-PRS resource allocation (e.g. similar to legacy Mode 2 solution)   + One, or one or more, of the UE(s) participating in the sidelink positioning operation is responsible for SL-PRS resource allocation~~selection~~   + At least applicable to out-of-coverage scenarios * ~~Study also which mode shall be applicable to partial coverage scenarios.~~ * In either scheme, include in the study any potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs. |
| MTK | Okay for CATT’s revision |
| ZTE | Support. |
| Huawei, HiSilicon | Per the last bullet, study SL-PRS resource coordination across a number of transmitting UEs. I assume this SL-PRS resource coordination across a number of transmitting UEs is possible for scheme 2 but what this means in scheme 1 is unclear. In addition, similar to legacy mode 2 solution, scheme 2 should also be supported in coverage scenarios. |
| Spreadtrum | Support. |
| InterDigital | We agree with the schemes for study. |
| Futurewei | As we proposed in our contribution R1-2203058, the IUC like solutions may be considered for defining the resource allocation and coordination between SL UEs for OOC. We support both NW centric and SL-UE autonomous resource allocation. |
| CMCC | Support the proposal and the modifications from CATT, but one more comment is, the meaning of “One, or one or more” in scheme 2 should be further clarified. |
| NEC | Support |
| Sony | OK to study |
| OPPO | A general comments, in our view the resource allcoaiton scheme is only related to the coverage status of the UE to use the allocated resource, it has nothing to do with the coverage status of other UEs, so it seems not proper to tie a resource allocation scheme with coverage scenario, which is a concept for coverage status of multiple UEs.  For Scheme 1, it can be used as long as the UE to use the resource is in coverage, if Scheme 1 discussed here is similar as legacy Mode 1, which means the scheduling is received directly from gNB(rather than forwarded from another in coverage UE), only in coverage UE can support this scheme.  And, Scheme 2 can work even the UE is in coverage if the network configures the UE to do so.  For the last sub-bullet, if coordination across transmitting UEs are introduced into either Scheme 1 or Scheme 2, to avoid potential confusion, they should be regarded as new schemes.  In general, we suggest the following:  With regards to the SL Positioning resource selection, study the following two schemes:   * Scheme 1: Network-centric operation SL positioning resource selection (e.g. similar to a legacy Mode 1 solution)   + The network (e.g. gNB, LMF, gNB & LMF) is responsible and control the resource selection   + ~~At least~~ Only applicable to an in-coverage UE ~~scenarios~~. * Scheme 2: UE autonomous resource allocation (e.g. similar to legacy Mode 2 solution)   + One, or one or more, of the UE(s) participating in the sidelink positioning operation is responsible for resource selection   + ~~At least applicable to out-of-coverage scenarios~~ * ~~Study also which mode shall be applicable to partial coverage scenarios.~~ * Study other scheme(s) ~~In either scheme~~, include ~~in the study~~ any potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs on top of either Scheme 1 or Scheme 2. |
| Lenovo | Support FL’s proposal. We prefer that the partial coverage scenario be kept at the current stage so that the study is open to all coverage scenarios. |
| Vivo | We have a similar understanding that scheme 1 is only for in-coverage and scheme 2 is applicable to in-/partial-/out-of-coverage.  We prefer not to study any new scheme rather the study should be on the details of scheme 1 and 2 (i.e., potential modification(s) to legacy mode 1 and mode 2 resource allocation for SL-PRS). |
| Apple | Fine with CATT’s update. |
| Samsung | OK for the direction of proposal 5-2 in general  Suggest to remove the last two bullets. |
| Qualcomm | We support the proposal and would be ok with CATT’s modifications. |
| DCM | OK with FL version.  We do not support CATT’s version since ‘SL-PRS resource allocation’ implies standalone signaling, which is not agreed yet. High-level text is better. |
| LGE | Scheme 1 is only available in in-coverage area. Scheme 2 should be available regardless of the network coverage. This is in line with the existing SL mode-1 and mode-2 operation. We propose to clarify this point on top of CATT version. Updated Feature Lead Proposal 5.2-v0 With regards to the SL-PRS ~~Positioning~~ resource allocation~~selection~~, study the following two schemes:   * Scheme 1: Network-centric operation SL-PRS ~~Positioning~~ resource allocation~~selection~~ (e.g. similar to a legacy Mode 1 solution)   + The network (e.g. gNB, LMF, gNB & LMF) is responsible and control the SL-PRS resource allocation~~selection~~   + ~~At least~~Only applicable to in-coverage scenarios * Scheme 2: UE autonomous SL-PRS resource allocation (e.g. similar to legacy Mode 2 solution)   + One, or one or more, of the UE(s) participating in the sidelink positioning operation is responsible for SL-PRS resource allocation~~selection~~   + ~~At least~~ applicable regardless of the network coverage ~~to out-of-coverage scenarios~~ * ~~Study also which mode shall be applicable to partial coverage scenarios.~~   In either scheme, include in the study any potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs. |
| Sharp | Support |
| xiaomi | Similar as that in SL communication, scheme 2 shall apply to all coverage scenarios. UEs in RRC\_idle state cannot use scheme 1 but can use scheme 2 when IC. |
| Philips | We support the proposal and would be ok with CATT’s modifications. |
| Nokia, NSB | Support with CATT+LGE’s updates |
| Ericsson | schemes can be further studied. But we prefer not to use SL-PRS as proposed by CATT. Note that we still have the proposal to study existing reference signals as proposed in Section 4.1. So we prefer the language in the original FL proposal. |
| Intel | Support the version from CATT, except that we think we should not delete the bullet on partial-coverage scenario. Even if evaluation efforts for partial coverage scenarios are de-prioritized, the SL Positioning solutions should be workable in partial-coverage scenarios. |

##### FL Observations

Overall good support in the direction of looking at both schemes. Several suggestions from a lot of companies, which hopefully are all addressed in the revised proposal below. 1 company raises concerns on the CATT’s version (and additional changes on top of that made by other companies) due to: “‘SL-PRS resource allocation’ implies standalone signaling, which is not agreed yet”. This proposal is related to SL-PRS, and it is a “study” proposal. It doesn’t imply that SL-PRS, a standalone signaling is agreed. I also note this proposal as “MEDIUM”, to see if there is first progress on the “HIGH” proposal (Section 4.2.1) that clearly says that SL-PRS is being studied.

##### [CLOSED]Feature Lead Proposal 5.2-v1

With regards to the SL-PRS ~~Positioning~~ resource allocation~~selection~~, study the following two schemes:

* Scheme 1: Network-centric operation SL-PRS ~~Positioning~~ resource allocation~~selection~~ (e.g. similar to a legacy Mode 1 solution)
  + The network (e.g. gNB, LMF, gNB & LMF) is responsible and control the SL-PRS resource allocation~~selection~~
  + ~~At least~~ Only applicable to an in-coverage UE ~~scenarios~~.
* Scheme 2: UE autonomous SL-PRS resource allocation (e.g. similar to legacy Mode 2 solution)
  + ~~One, or one or more~~,At least one of the UE(s) participating in the sidelink positioning operation is responsible for SL-PRS resource allocation~~selection~~
  + ~~At least~~ applicable regardless of the network coverage ~~to out-of-coverage scenarios~~
* ~~Study also which mode shall be applicable to partial coverage scenarios.~~
* ~~In either scheme,~~ Other Schemes are not precluded to be studied; Include in the study, when applicable, any potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs (e.g. IUC-like solutions).

##### Companies views

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| vivo | OK in principle.  Suggest to split the last bullet   * Include in the study, when applicable, any potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs (e.g. IUC-like solutions). * Note: other schemes are not precluded to be studied. |
| Futurewei | We understand the FL intention. However, the second sub-bullet of Scheme 1 “Only applicable to an in-coverage UE” may lead to o contradiction with Scheme 2 for partial coverage scenarios. In such case is expected that NW control at least in coverage UE , which based on Scheme 2 may control the UE partial in coverage . Therefore de facto gNB controls both in coverage and partial coverage UEs. We suggest to add partial coverage as follows:   * Only applicable to in-coverage UEs and partial coverage UEs” |
| Samsung | We suggest to also consider the SL measurement report inaddition to SL-PRS. Our modification is marked in blue.  With regards to the SL-PRS ~~Positioning~~ and/or positioning measurement report resource allocation~~selection~~, study the following two schemes:   * Scheme 1: Network-centric operation SL-PRS ~~Positioning~~ and/or positioning measurement report resource allocation~~selection~~ (e.g. similar to a legacy Mode 1 solution)   + The network (e.g. gNB, LMF, gNB & LMF) is responsible and control the SL-PRS and/or positioning measurement report resource allocation~~selection~~   + ~~At least~~ Only applicable to an in-coverage UE ~~scenarios~~. * Scheme 2: UE autonomous SL-PRS and/or positioning measurement report resource allocation (e.g. similar to legacy Mode 2 solution)   + ~~One, or one or more~~,At least one of the UE(s) participating in the sidelink positioning operation is responsible for SL-PRS and/or positioning measurement report resource allocation~~selection~~   + ~~At least~~ applicable regardless of the network coverage ~~to out-of-coverage scenarios~~ * ~~Study also which mode shall be applicable to partial coverage scenarios.~~ * ~~In either scheme,~~ Other Schemes are not precluded to be studied; Include in the study, when applicable, any potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs (e.g. IUC-like solutions). * FFS how to handle resource allocation of SL-Positioning measurement report |
| LGE | Support |
| Xiaomi | support |
| NEC | Agree with Futurewei. |
| Sharp | We are OK in principle. As for applicability of Scheme 1, we have similar view with Futurewei |
| CMCC | Support |
| CATT | Support  Regarding the resource allocation of positioning measurement report, we think it is related to [MEDIUM] Feature Lead Proposal 7.2-v1(With regards to the Sidelink Positioning measurement report), maybe we can wait for the conclusion of Proposal 7.2-v1, then to discuss the resource allocation of positioning measurement report. |
| Nokia, NSB | OK |
| Huawei, HiSilicon | We are fine with FW’s suggestion. |
| OPPO | Support the proposal.  As to Futurewei’s comments, firstly, paritial coverage is a concept for multiple UEs, from a given UE perspective, it can only be in coverage or out of coverage. Moreover, the Scheme 1 being discussed is similar to legacy mode 1, where the UE directly receive SL DCI and/or RRC siganling from gNB to obtain the allocated resource, that is the UE can only be in coverage, other schemes with ehhancment on top of this is covered by the last bullet. |
| ZTE | Support in principle.  For scheme 1, the wording “Only applicable to an in-coverage UE” seems too restrictive. For partial coverage acenario, at the UE over network’s coverage can control the SL-PRS resource allocation. Why don’t we change the wording as follows:   * Scheme 1: Network-centric operation SL-PRS ~~Positioning~~ resource allocation~~selection~~ (e.g. similar to a legacy Mode 1 solution)   + The network (e.g. gNB, LMF, gNB & LMF) is responsible and control the SL-PRS resource allocation~~selection~~   + ~~At least Only~~ applicable to an in-coverage UE ~~scenarios~~.   Note: Further study the feasibility for partial-coverage Ues after the SL-PRS related design for in-coverage and out-of-coverage scenario is completed. |
| Philips | OK |
| Intel | We share similar concerns as ZTE on the wording of “Only applicable to an in-coverage UE”, and support their suggestion to delete “Only”.  Also, as mentioned in previous round, we need to ensure that proper resource allocation methods are available for partial coverage scenarios. Thus, we suggest to add a bullet:   * Study applicability of each Scheme in partial-coverage scenarios. |
| InterDigital | We are ok with the suggestion from Intel. |
| Qaulcomm | Support |

##### FL Observations

Seems like the main discussion point resolves around the “in-coverage/partial-coverage” debate, as it is happening in other proposals. Even though i understand it is something that we may need to resolve, i don’t want to spend time on this now, especially at each proposal. Therefore, my suggestion is to fully remove that subbullet for scheme 1, and let the contributions in the next meeting to point us to a way forward.

With regards to the comment from Samsung on “resource allocation of SL-Positioning measurement report”, i would prefer not to attempt to destabilize the proposal and add the “and/or positioning measurement report” across both schemes at this stage. Therefore, I keep it brackets and ask companies for their views. At a minimum

##### [CLOSED]Feature Lead Proposal 5.2-v2

With regards to the SL-PRS [and/or positioning measurement report] resource allocation, study the following two schemes:

* Scheme 1: Network-centric operation SL-PRS [and/or positioning measurement report] resource allocation (e.g. similar to a legacy Mode 1 solution)
  + The network (e.g. gNB, LMF, gNB & LMF) is responsible and control the SL-PRS resource [and/or positioning measurement report] allocation
  + ~~Only applicable to an in-coverage UE~~
* Scheme 2: UE autonomous SL-PRS [and/or positioning measurement report] resource allocation (e.g. similar to legacy Mode 2 solution)
  + At least one of the UE(s) participating in the sidelink positioning operation is responsible for SL-PRS [and/or positioning measurement report] resource allocation
  + Applicable regardless of the network coverage
* Include in the study, when applicable, any potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs (e.g. IUC-like solutions).
* Note: Other Schemes are not precluded to be studied
* [FFS how to handle resource allocation of SL-Positioning measurement report]

Companies are encouraged to comment on the following:

* Do they want to keep or remove the text in brackets [and/or positioning measurement report]?
  + If you prefer to remove this text from this proposal, are you OK to keep at least the last bullet [FFS how to handle resource allocation of SL-Positioning measurement report]? If not why?

##### Companies views

|  |  |
| --- | --- |
| CMCC | We prefer to remove the text in brackets [and/or positioning measurement report], positioning measurement report is certainly carried by PSSCH, which shall follow the resource allocation mechanism in Rel-16 NR sidelink, then we only need to focus on SL-PRS here.  We are OK to keep the last bullet [FFS how to handle resource allocation of SL-Positioning measurement report]. |
| CATT | We prefer to remove [and/or positioning measurement report].  In Rel-16 Positioning, LPP is used for Uu positioning request and measurement report. For SL positioning, we believe SLPP will be used for SL positioning request and measurement report. Anyway, the transmission of SL positioning request and measurement report will be treated as the same way with SL data which had been specified in Rel-16 V2X. Therefore, there is no need to consider new resource allocation mechanism for SL positioning request and measurement report.  We can live with keep it as the last bullet [FFS how to handle resource allocation of SL-Positioning measurement report]. |
| ZTE | Remove the text in brackets [and/or positioning measurement report] and keep the last bullet. |
| LGE | We support the proposal with removing the text in brackets. With brackets, there is only two ways of resource allocation for the measurement report – either mode-1 or mode-2. But there is another possibility that the resource for the measurement report can be decided by the rule based on the associated SL-PRS resource. Therefore we prefer the lask bullet sentence of leaving it as FFS. |
| Xiaomi | We prefer to remove the [and/or positioning measurement report] part. |
| vivo | We also support this proposal without adding [and/or positioning measurement report].  We’re fine to keep the last FFS bullet. |
| Lenovo | Support proposal, and share most of the companies view to remove [and/or positioning measurement report] and retain the last bullet |
| InterDigital | We prefer to remove [and/or positioning measurement report] and [FFS how to handle resource allocation of SL-Positioning measurement report]. Similar to FL’s removal of “positioning” from 5.2.v2, we’d like to focus this discussion on SL PRS and we can discuss the resource allocation of SL positiong measurement report when we make progress on on topics e.g., like dedicate/shared resource pool. |
| Futurewei | We are OK to remove the bracket [and/or positioning measurement report] and leave it for FFS |
| Intel | Also support removal of [and/or positioning measurement report]. OK to keep last FFS. |
| Qualcomm | We prefer to remove the text in brackets. |
| Spreadtrum | We support this proposal without [and/or positioning measurement report]. |
| Apple | Fine with proposal. Can mveo the positioning measurement report to FFS |
| OPPO | We also prefer to remove the text in bracket except the last sub-bullet. |
| Sharp | We prefer to remove [and/or positioning measurement report] and keep last FFS part. |
| Huawei, HiSilicon | We agree with others that the [positioning measurement report] is not necessary. The transport of positioning measurement report should follow the existing sidelink communication framework. |
| DCM | Accept if all texts with blue color are removed. |
| Nokia, NSB | SL PRS and measurement report can be treated separately as far as resource allocation is concerned, so “[and/or positioning measurement report]” should be removed; OK to keep the last FFS. |

##### FL Observations

It is evident that the proposal appears stable without the [and/or positioning measurement report].

A few companies seem OK to keep the FFS in the last bullet

* CMCC, CATT, ZTE, LGE, vivo, Lenovo, Futurewei, Intel, Apple, OPPO, Sharp, Nokia, NSB

Based on the above, I remove the text in the [] and keep the FFS. Hopefully this proposal is stable now.

##### [CLOSED]Feature Lead Proposal 5.2-v3

With regards to the SL-PRS resource allocation, study the following two schemes:

* Scheme 1: Network-centric operation SL-PRS resource allocation (e.g. similar to a legacy Mode 1 solution)
  + The network (e.g. gNB, LMF, gNB & LMF) is responsible and control the SL-PRS resource allocation
* Scheme 2: UE autonomous SL-PRS resource allocation (e.g. similar to legacy Mode 2 solution)
  + At least one of the UE(s) participating in the sidelink positioning operation is responsible for SL-PRS resource allocation
  + Applicable regardless of the network coverage
* Include in the study, when applicable, any potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs (e.g. IUC-like solutions).
* Note: Other Schemes are not precluded to be studied
* ~~[~~FFS how to handle resource allocation of SL-Positioning measurement report~~]~~

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We support the proposal. |
| Futurewei | Support |
| CMCC | Support |
| ZTE | OK. |
| Spreadtrum | Support. |
| CATT | Support |
| DCM | OK |
| LGE | Support |
| Lenovo | Support |
| NEC | OK |
| Sharp | Support |
| OPPO | Support the proposal. |
| Samsung | For the bullet marked in yellow, it is not sure what is the meaning of responsible, We don’t think we have used this term before better say that it is allocating resources for SL PRS.  For the bullet marked in green, this bullet can be FFS and no need to mention examples.  We are OK without the [and/or positioning measurement report] but support removing square brackets in the last FFS bullet.  With regards to the SL-PRS resource allocation, study the following two schemes:   * Scheme 1: Network-centric operation SL-PRS resource allocation (e.g. similar to a legacy Mode 1 solution)   + The network (e.g. gNB, LMF, gNB & LMF) ~~is responsible and control~~ allocates resources for ~~the~~ SL-PRS ~~resource allocation~~ * Scheme 2: UE autonomous SL-PRS resource allocation (e.g. similar to legacy Mode 2 solution)   + At least one of the UE(s) participating in the sidelink positioning operation ~~is responsible~~ allocates resources for SL-PRS ~~resource allocation~~   + Applicable regardless of the network coverage * ~~Include in the study, when applicable, any~~ FFS: potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs ~~(e.g. IUC-like solutions)~~. * Note: Other Schemes are not precluded to be studied * ~~[~~FFS how to handle resource allocation of SL-Positioning measurement report~~]~~ |
| Bosch | OK |
| Xiaomi | OK |
| Huawei, HiSilicon | OK |
| Qualcomm | We support the proposal |
| Nokia, NSB | OK |

##### FL Observations

Support the proposal

* Interdigital, Futurewei, CMCC, Spreadtrum, CATT, DCM, LGE, Lenovo, NEC, Sharp, OPPO, Bosch, Xiaomi, Huawei, HiSilicon, Qualcomm, Nokia, NSB

Suggest changes

* Samsung

I really don’t want to destabilize this proposal due to some “word/expression” not being used before in Sidelink, especially when there is already such majority support, and we don’t have online time. Also, Samsung’s previous response in Round 2 didn’t point out that these changes are needed. Either way, these changes do not seem to change the intention, so we could give it one more round before Email Endorsement.

With regards to removing the “e.g., IUC like solutions” it was also there as an example from Round 2. We need to suggest only the very necessary changes at this point, and not comment over things that we could live with. So, i would like to be inclusive and keep it. It is just an example, I am confident we can live with it!

##### [MEDIUM][OPEN]Feature Lead Proposal 5.2-v4

With regards to the SL-PRS resource allocation, study the following two schemes:

* Scheme 1: Network-centric operation SL-PRS resource allocation (e.g. similar to a legacy Mode 1 solution)
  + The network (e.g. gNB, LMF, gNB & LMF) ~~is responsible and control~~ allocates resources for ~~the~~ SL-PRS ~~resource allocation~~
* Scheme 2: UE autonomous SL-PRS resource allocation (e.g. similar to legacy Mode 2 solution)
  + At least one of the UE(s) participating in the sidelink positioning operation ~~is responsible~~ allocates resources for SL-PRS ~~resource allocation~~
  + Applicable regardless of the network coverage
* ~~Include in the study, when applicable, any~~ FFS: potential mechanisms, if needed, for SL-PRS resource coordination across a number of transmitting UEs (e.g. IUC-like solutions).
* Note: Other Schemes are not precluded to be studied
* [FFS how to handle resource allocation of SL-Positioning measurement report]

##### Companies views

|  |  |
| --- | --- |
|  |  |

# SL PHY-layer Positioning Procedures

With regards to the SL PHY-layer positioning procedures, we could start the discussion from the following 2 topics:

## 6.1 SL-PRS Power control

|  |  |
| --- | --- |
| CATT, GOHIGH | S-PRS power control should be introduced in Rel-18.   * The minimum pathloss between DL pathloss and SL pathloss can be adopted as the compensated pathloss for the S-PRS power control. |
| Vivo | Open-loop power control scheme should be studied for SL PRS. |
| ZTE | Study power control for SL-PRS transmission |
| Qualcomm | RAN1 to study power control for SL-PRS, including whether it is necessary |
| OPPO | In sidelink positioning SL-PRS is at least subject to DL pathloss based power control. |
| Lenovo | RAN1 to study SL power control and interference mitigation methods to improve SL PRS detectability/hearability |
| LGE | Further discussions are needed whether DL pathloss or SL pathloss or both are needed to adapt the transmission power of the SL PRS |
| Mediatek | Develop the power control mechanism for SL-PRS |

Based on the submitted tdocs, and proposals summarized above, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 6.1-v0

Study power control mechanisms for SL-PRS transmission, including whether it is necessary, whether and which aspects of the SL Power control mechanisms can be reused, any differentiations needed for out of coverage, in coverage and partial coverage cases.

##### Companies views

|  |  |
| --- | --- |
| CATT | Support. |
| ZTE | Support to study the power control of SL-PRS. |
| Huawei, HiSilicon | OK. |
| Spreadtrum | We are fine to shtuy the power control of SL-PRS. |
| InterDigital | We agree with the proposal. |
| Futurewei | Support |
| CMCC | Support. |
| Sony | OK to study the above |
| OPPO | Support. |
| Lenovo | Support |
| vivo | Support |
| Apple | We are fine to study this. |
| Locaila | Support. |
| Samsung | OK. However, we can remove the some details as  Study power control mechanisms for SL-PRS transmission, including whether it is necessary, ~~whether and which aspects of the SL Power control mechanisms can be reused, any differentiations needed for out of coverage, in coverage and partial coverage cases~~. |
| Qualcomm | Support |
| DCM | OK |
| LGE | Support |
| Sharp | Support |
| Xiaomi | OK |
| Nokia, NSB | OK |
| Ericsson | ok to study |
| Intel | Support. |
| Qualcomm | Support |

##### [CLOSED]Feature Lead Proposal 6.1-v1

Study power control mechanisms for SL-PRS transmission, including whether it is necessary.

##### Companies views

|  |  |
| --- | --- |
| vivo | OK |
| Futurewei | Support |
| Samsung | OK |
| LGE | Support |
| Xiaomi | OK |
| NEC | OK |
| Sharp | Support |
| CMCC | Support |
| CATT | Support |
| Nokia, NSB | OK |
| Huawei, HiSilicon | OK |
| OPPO | OK |
| ZTE | Support. |
| InterDigital | Support |
| Qualcomm | Support |

##### FL Observations

All companies supported the proposal

##### [CHECKPOINT 1][AGREED] Feature Lead Proposal 6.1-v1

Study power control mechanisms for SL-PRS transmission, including whether it is necessary.

## 6.2 SL-PRS Beam management

|  |  |
| --- | --- |
| CATT, GOHIGH | There is no need to specify S-PRS beam management in Rel-18. |
| ZTE | Deprioritize Rel-18 NR sidelink positioning in FR2 |
| China Telecom | For the angle estimation based on the RSRP measurement, consider the possibility of the CSI-RS or PRS as the reference signal used here for positioning, and some modifications of physical procedures especially beam management related are required |
| LGE | Support |

Based on the submitted tdocs, and proposals summarized above, the following proposal is made:

##### [CLOSED]Feature Lead Request

Companies are encouraged to provide more views with regards to SL-PRS beam management procedures

##### Companies views

|  |  |
| --- | --- |
| CATT | We think there is no need to specify S-PRS beam management in Rel-18, since the sidelink beam management mechanism has not been introduced in legacy NR V2X |
| ZTE | Depriorite SL-PRS beam management and wait until specifying regular SL communication is completed. |
| Huawei, HiSilicon | We think it should be in general deprioritized because FR2 beam management is not supported yet for SL communication. |
| Spreadtrum | Depriorite SL-PRS beam management. |
| InterDigital | SL FR2 design is included in R18 and may be dealt with after RANP #97. Thus we propose to defer SL positioning with beam management until after R18 SL FR2 baseline design is completed. |
| Futurewei | Deprioritize |
| CMCC | No need to discuss at this stage since it has not been started discussing in NR sidelink evolution. |
| Sony | Low priority |
| OPPO | It is out of the scope of this study item. |
| Lenovo | Can be deprioritized |
| vivo | Depriorite SL-PRS beam management until SL communication for FR2 is completed. |
| Apple | Low priority |
| Locaila | Low priority. |
| Samsung | This issue depends on SL in FR2, which is deferred to Q4. So SL-PRS beam management should not be within the scope of this study. |
| Qualcomm | Even though Rel-16 and Rel-17 sidelink communications were not fully optimized for FR2, the system is able to work over FR2 and we think that SL-PRS design should follow the same principle. For example, S-SSB has a (pre-)configurable number of repetitions to better accommodate operation over FR2 and PTRS is also included for the same purpose. |
| DCM | Deprioritize |
| LGE | We also agree to deprioritize the beam management for SL PRS |
| Sharp | Low priority |
| Xiaomi | Agree to deprioritize |
| Nokia, NSB | Deprioritize SL-PRS beam management. This does not imply that FR2 cannot be used, AT&T’s field measurements in Rel-16 have demonstrated that FR2 sidelink can work well without beam management. |
| Ericsson | The scope may be too huge if we consider the beam management aspect. Suggest to deprioritize this. |
| Intel | Agree with most others that consideration of FR2 support and beam management for SL-PRS should be de-prioritized. However, just as in the example from QC, the design should be sufficiently forward-compatible to be able to accommodate beam management and usage of SL-PRS in FR2 bands in future releases. |

##### FL Observations

All companies prefer to deprioritize this aspect.

##### [CLOSED]Feature Lead Proposal 6.2-v0

Deprioritize SL-PRS beam management study, until at least, SL communication for FR2 has progressed.

##### Companies views

|  |  |
| --- | --- |
| vivo | OK |
| Futurewei | Support |
| Samsung | OK |
| LGE | Support |
| NEC | OK |
| Sharp | Support |
| CATT | Support |
| Nokia, NSB | OK |
| Huawei, HiSilicon | OK |
| OPPO | OK |
| ZTE | Support. |
| InterDigital | Support |
| Qualcomm | Given the majority view, we would be ok to revisit the issue once beam management has progressed in the Sidelink Evolution item. We propose the following:  ~~Deprioritize~~ Defer SL-PRS beam management study, until ~~at least,~~ SL communication for FR2 in Agenda Item 9.4 has progressed  Note: this does not preclude FR2 operation. |

##### FL Observations

All companies seem OK with the proposal, except 1. Qualcomm had a suggestion to reword the proposal, which we could try in order to attempt to find a consensus through email discussion without going to GTW for this. So, we make the following additional attempt:

##### [LOW]Feature Lead Proposal 6.2-v1

[Deprioritize/Defer] SL-PRS beam management study, until [at least,] SL communication for FR2 in Agenda Item 9.4 has progressed

[Note: this does not preclude FR2 operation.]

Companes are encouraged to comment at least with regards to the following:

* Do you have strong views in keeping the word “Deprioritize” instead of “Defer”? If yes why?
* Do you have strong views in keeping the word “at least”? If yes why?
* Are you OK with the Note? If not why?

##### Companies views

|  |  |
| --- | --- |
| CATT | We prefer to keep [Deprioritize] and [at least].  The reason is the time line and work load, even if SL communication for FR2 in Agenda Item 9.4 has progressed, we worried about we don’t have enough time to introduce the beam management feature into the SL-PRS. We prefer to consider this feature in next release.  For the note, we can live with the [Note: this does not preclude FR2 operation]. |
| ZTE | Prefer the original Proposal 6.2-v0 without the Note. |
| LGE | We support the original proposal. The modified proposal leaves it open depending on the progress of other SI, which is not desirable considering the work load of the SL postioning SI. |
| vivo | We also prefer the original proposal.  On the added note: what does it mean? This does not preclude FR2 operation for SL? Or this does not preclude FR2 operation for SL positioning? The former is out of scope of this agenda. We’re not sure how the latter can be supported for now. |
| InterDigital | We don’t have strong view about the wording, however, we think the original proposal has clearly represented the consensus of the companies and no further changes are necessary. |
| Futurewei | We also prefer the original text. |
| Intel | Sorry, we missed responding to this in the previous round.  Agree with CATT and support keeping “at least”.  On “deprioritize vs. defer”, just to confirm our understanding here – the proposal is about handling of SL-PRS beam management [at least] until “SL communication in FR2 has progressed”.  Further, couple of questions for our understanding:   * First, we are wondering how we measure that, at a given point in time, progress for SL communication in FR2 is sufficient for us to pick up for positioning? * Second, as proposed, isn’t it that “defer” means we would not discuss about SL positioning BM [at least] until “progress in AI 9.4”, while “deprioritize” would imply it can be discussed, but with lower priority? Is this common understanding? This part was not clear from reading some of the responses above that seem to prefer not to bother about BM for SL positioning in this release.   In any case, we would suggest a simpler statement to deprioritize BM for SL positioning without any conditions. |
| Qualcomm | We are ok with the proposal and prefer “Defer”. We also support inclusion of the note to avoid any potential confusion. RAN1 has not precluded NR sidelink operation in FR2 at any point, only did not optimize for FR2 in some cases. |
| OPPO | We share similar view as CATT and ZTE, and prefer to keep “Deprioritize” and “at least”.  We support the note, as FR2 is supported in R16 SL communication although beam management is not supported, thus SL positiong on FR2 should also be considered. |
| Sharp | We prefer original FL proposal in last round. |
| DCM | We prefer to use ‘deprioritize’. ‘defer’ may imply it is to be discussed later. But we do not support such intention. From similar reason, the note is not necessary.  On ‘at least’ same view with CATT. |
| Nokia, NSB | Prefer “Defer”. The Note is OK and its brackets can be removed – as we pointed out before, FR2 can work without specification of beam management. |
| Ericsson | we prefer to Deprioritize |

##### FL Observations

Depriorize SL BM without condition

* Intel

Support of previous proposal

* CATT, ZTE, LGE, vivo, Futurewei, OPPO, Sharp, NTT DOCOMO, Nokia, NSB, Ericsson

Prefer previous proposal but may accept the new proposal

* Interdigital

Support the new proposal

* Qualcomm

Clear majority wants to use the previous wording. Some of these companies (e.g. CATT, OPPO, Nokia, NSB) seem OK with the Note.

As a middle ground, we propose to use the initial wording as the majority has clearly indicated together with the Note that was proposed by Qualcomm, that seems to be aggregable by a subset of the first set of companies.

##### [EMAIL ENDORSEMENT]Feature Lead Proposal 6.2-v2

Deprioritize SL-PRS beam management study, until at least, SL communication for FR2 in Agenda Item 9.4 has progressed

Note: this does not preclude FR2 operation for SL positioning

# SL Positioning Architecture And Signaling Discussion

A lot of companies provided proposals and discussions on the high-layer architecture, procedures, and System-level proposals; topics that are already being discussed in SA2 ([TR 23.700-86](https://www.3gpp.org/ftp/Specs/archive/23_series/23.700-86/23700-86-020.zip)). It may be more efficient to try to avoid repetition of the discussions unless it is considered necessary. Example of proposals that appear to be already discussed in SA2, and may be more related to potential SL Positioning architecture(s) are shown in the subsections below:

## General proposals

|  |  |
| --- | --- |
| NTT DOCOMO | * Support the following SL-positioning procedure to obtain its own location.   + Step 1: UE that requires its own location transmits information and/or signal to surrounding UEs   + Step 2: The surrounding UEs receive the information and/or signal and transmit corresponding information and/or signal to the UE * Study whether a case where a UE requires other UE’s location is considered in Rel-18 SL positioning or not. |
| Samsung | Study a procedure for SL UE to decide whether to perform absolute positioning or relative positioning or ranging depending on availability and quality of measurement source(s). |
| CATT, GOHIGH | The sidelink positioning procedure can be triggered by the positioning operation indication signaling or the positioning operation request signaling. |
| vivo | Unicast, groupcast and broadcast should be studied for SL positioning in Rel-18. |
| Apple | RAN1 should discuss the specifics of the SL positioning techniques based on the existing RAN-dependent techniques and update the associated signaling, measurements and procedures for the new SL-positioning schemes.. Issues to be addressed include:  Identification of the positioning set and the target UE  Establishment of new SL measurements. |
| Sony | Consider to adapt positioning procedure based on the region/zone of the UE.  Consider supporting positioning procedure with the assistance of another UE for the estimation of relative positioning and relative angle |
| Lenovo | Support the following 4 different models for SL positioning, which distinguish the configuration entity and positioning calculation entity for in-coverage, and partial and out-of-coverage scenarios:   * SL Positioning Model 1a - UE-assisted positioning * SL Positioning Model 1b – UE-assisted positioning * SL Positioning Model 2a – UE-based positioning * SL Positioning Model 2b - UE-based positioning   In SL positioning, both the initiator and responding UEs can be supported to perform SL positioning measurements within the same session |
| LGE | It is supported that LMF/gNB calculates the final location of the UE  It is supported that UE initiates the SL PRS procedure, including the SL positioning group selection  It is supported that UE calculates the final location of the UE  SL positioning procedure needs to be shortened from that of Rel.17 NR positioning, so that the SL positioning latency requirement can be met.  For SL positioning, a group of UEs that participate in SL positioning needs to be associated into a SL positioning group.  The SL positioning group can be created by a UE or LMF/gNB. Further discussions are needed on which UE can initiate or join the SL positioning group, how to generate and accept the request, how to leave or release the SL positioning group, etc. |
| Mediatek | RAN1 to discuss whether the capability transfer and the items are required for positioning measurement. The capability may contain the measurement and transmission capability. Once agreed, RAN2 may further deal with the corresponding signalling |
| Intel | For SL-PRS transmissions, both unicast and groupcast-based identification of destination UEs should be considered. |
| Interdigital | Study both MO-LR and MT-LR for sidelink positioning  Study information exchange among UEs and necessity of each cast type, i.e., broadcast, multi-cast and unicast, using SL communication as the starting point  Study both UE-assisted and UE-based SL positioning for in-coverage, partial-coverage and out-of-coverage  Study discovery methods to find anchor UEs |

In addition to the set of proposals shown above, there were several proposals that were targeted to In-coverage/partial-coverage scenarios, and others targeted to Out Of coverage scenarios as shown in the following subsections:

## In and Partial coverage Proposals

|  |  |
| --- | --- |
| Futurewei | In this study RAN1 should consider as working assumption that LMF is extended to support SL positioning for SL UE in coverage or partial coverage.  RAN1 should send a LS to RAN2 and RAN3 to ask extending the existing LMF protocol for SL UEs in coverage or partial coverage. |
| CEWiT, Reliance Jio, Saankhya Labs, IITM, IITK | For in coverage and partial coverage scenarios, present positioning architecture should be sufficient. |
| Qualcomm | Study positioning procedures that enable the calculation entity being:   * In partial-coverage/in-coverage scenarios, UE(s) involved in a SL positioning session or the LMF. |
| Apple | RAN1 should discuss the assumption on the positioning entity (LMF) in the case of in-coverage, partial-coverage and out of-coverage cases |
| NEC | Both UE assisted and UE based positioning methods should be supported.  −    Including corresponding signalling and procedure for study |
| Interdigital | Study the destination of measurement reports sent from the target UE : anchor UE, LMF or gNB  Study roles of the LMF in SL (sidelink) positioning and its interaction with the gNB which schedules resources for SL positioning |
| Ericsson | It should be possible for LMF to request sidelink positioning measurements between UEs. |
| CATT | For the operations of SL positioning with LMF, the legacy Uu positioning system architecture and signalling procedures with LMF can be reused as defined in TR 38.305 [3]. |
| ZTE | For the design of NG-RAN UE SL positioning architecture, in order to reduce the spec impact, we suggest to take the existing positioning architecture (including communications between UE and NG-RAN, UE and LMF, NG-RAN and LMF) as a baseline and introduce or update the UE-2-UE positioning module. |
| Intel | In terms of measurement reporting, they may be reported to gNB or to another UE(/RSU) and include references for PRS resource set and resource IDs.  In general, the measurement reports can be routed to the LMF via a serving gNB. Similar to Uu positioning, GNSS-RTK assistance data or other assistance information may be broadcasted by serving cell when in coverage. |
| LGE | The SL positioning group can be created by a UE or LMF/gNB. Further discussions are needed on which UE can initiate or join the SL positioning group, how to generate and accept the request, how to leave or release the SL positioning group, etc. |

Based on the above set of proposals, the on-going work in SA2, and that, in the SID description, the study of positioning architecture and signalling to enable sidelink positioning covering both UE based and network based positioning is within RAN2 scope, including coordination and alignment with RAN3 and SA2 as required, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 7.1.1-v0

* From RAN1 perspective, for in-coverage and partial coverage scenarios, RAN1 assumes that the network may be involved in the SL positioning/ranging, and/or hybrid (SL/Uu) Positioning, which are all up for study in the other WGs.

##### Companies views

|  |  |
| --- | --- |
| CATT | We prefer to de-prioritize the partial coverage scenarios to reduce the work load, so the partial coverage scenarios can be removed in the proposal. |
| ZTE | Fine with FL’s assessment. |
| Spreadtrum | Support. |
| Futurewei | Support |
| CMCC | Agree with CATT to de-prioritize the partial coverage scenarios due to workload. |
| NEC | Support but partial coverage should be clearly defined. |
| Sony | We should focus on the introduction of SL-Positioning (e.g. signal design, etc) and this can be facilitated in in-coverage scenario. |
| OPPO | Support. |
| Lenovo | Support |
| Apple | Support |
| vivo | Is the intention to focus on out-of-coverage in RAN1? If so, we support this proposal. |
| Samsung | OK |
| Qualcomm | Support |
| DCM | OK |
| LGE | First of all, we prefer to deprioritize the involvement of gNB/LMF in SL positioning. We prefer to prioritize the stand-alone SL positioning.  Apart from the prioritization, as commented in other proposal, stand-alone SL positioning should be available regardless of the network coverage. Especially in in-coverage area, stand-alone SL positioning without involvement with gNB/LMF would be beneficial in shortening the SL positioning latency. We don’t support to assume the involvement of gNB/LMF for SL positioning in in-coverage area. We propose the following modification. Feature Lead Proposal 7.1.1-v0 From RAN1 perspective, for in-coverage and partial coverage scenarios, ~~RAN1 assumes~~ it is supported that the network may be involved in the SL positioning/ranging, and/or hybrid (SL/Uu) Positioning, which are all up for study in the other WGs. |
| Xiaomi | OK |
| Huawei, HiSilicon | On partial coverage, we do not need to exlucde it in the solution. On other hand, the support of partial coverage do not rely on the RAN1 specification effort. |
| Philips | In partial-coverage/in-coverage scenarios, we should consider that either the UE(s) involved in a SL positioning session or the LMF can be the position calculating entity. |
| Nokia, NSB | OK |
| Ericsson | Do not agree with the view from LG. We cannot agree to deprioritizing network involvement.  The concern we have with this proposal is the ‘which are all up for study in the other WGs’. We need to idenfy if there is any RAN1 specification impact. For those aspects that don’t involve RAN1 spec impact, we don’t need to discuss them in RAN1. |
| Intel | We acknowledge the intent behind the proposal, but one concern is that this could imply that there is nothing for RAN1 to study for partial-coverage scenario. However, this is not the case. For instance, at least resource allocation procedure for partial-coverage should be studied by RAN1. In fact, this aspect is as significant as SL-PRS in OOC since a large majority of practical scenarios involving OOC UEs are partial-coverage scenarios.  Thus, suggest to update the wording as:   * From RAN1 perspective, for in-coverage and partial coverage scenarios, RAN1 assumes that the network may be involved in the SL positioning/ranging, and/or hybrid (SL/Uu) Positioning, with the exact architecture and signalling framework being up for study in other WGs. |

##### FL Observations

Support of the proposal

* ZTE, Spreadtrum, Futurewei, OPPO, Lenovo, Apple, Samsung, Qualcomm, NTT DOCOMO, Xiaomi, Nokia, NSB

Deprioritize partial coverage from the proposal

* CATT, CMCC

1 company comments that “On partial coverage, we do not need to exlucde it in the solution”. There seems to be a bit of different preferences on whether we should prioritize parital coverage or not. In either case, with regards to this proposal, we could limit to the “in coverage”. This does not mean that RAN1 has made an agreement of prioritizing or deprioritizing partial coverage, rather it means that this proposal just treats one of the scenarios.

1 company suggests, to try to include in a single proposal a statement for all the coverage scenarios, that, the network may or may not be involved. Such a statement is even more broad than trying to clarify some basic principles for the individual coverage scenarios. There is strong support, to make sure that we are all on the same page that, for OoO, the network is not involved. It was also suggested to change the “From RAN1 perspective, RAN1 assumes”, to the expression, “It is supported”. Since positioning architecture decisions are up to the other WGs, i believe that it is more appropriate to use the expression “From RAN1 perspective, RAN1 assumes”, rather than “It is supported”.

Based on the above considerations, the revised proposal is:

##### [CLOSED] Feature Lead Proposal 7.1.1-v1

* From RAN1 perspective, for in-coverage ~~and partial coverage~~ scenarios, RAN1 assumes that the network may be involved in the SL positioning/ranging, and/or hybrid (SL/Uu) Positioning.
* Note: Positioning architecture and signalling procedures are up for study in the other WGs

##### Companies views

|  |  |
| --- | --- |
| vivo | OK |
| Futurewei | We understand that the partial coverage scenario may be de-prioritized, but we do not want to be excluded as from start. We did not see any technical argument on why NW may not be involved in the SL positioning for partial coverage. We prefer to leave patial coverage included. Note that the proposal mentions that “may be involved” rather than “shall be involved” , therefore the case of partial coverage should be maintained. |
| Samsung | OK |
| LGE | Support |
| NEC | OK |
| CMCC | OK |
| CATT | Support |
| Nokia, NSB | OK |
| Huawei, HiSilicon | OK |
| OPPO | Partial coverage should be kept.  SL postioning may involve multiple UEs, if a feature requires all UEs are in the same coverage status, this would significantly restrict the applicability of the feature. For example, if partial coverage is not supported, how to support ranging or relative positioning between an in coverage UE and an out of coverage UE, and absolute positioning for a out of coverage UE based on SL-PRS transmitted by in coverage anchor UEs? |
| ZTE | Prefer to include partial coverage and add a note to clarify that companies should focus on in-coverage scenario first. |
| Philips | We agree with Futurewei and OPPO. |
| Intel | Agree with Futurewei and others that partial-coverage should be kept. |
| Qualcomm | Support |

##### FL Observations

OK with current proposal:

* Vivo, Samsung, LGE, NEC, CMCC, CATT, Nokia, NSB, Huawei, HiSilicon, Qualcomm

Keep “partial coverage in the proposal”

* Fututrewei, OPPO, ZTE, Philips, Intel

Based on the above considerations, wondering if a compromise would be the ZTE’s suggestion as shown below:

##### [LOW] Feature Lead Proposal 7.1.1-v2

* From RAN1 perspective, for in-coverage and partial coverage scenarios, RAN1 assumes that the network may be involved in the SL positioning/ranging, and/or hybrid (SL/Uu) Positioning.
* Note 1: Positioning architecture and signalling procedures are up for study in the other WGs
* Note 2: Companies are encouraged to focus their study in the in-coverage scenario first.

##### Companies views

|  |  |
| --- | --- |
| CATT | OK |
| ZTE | Support. |
| LGE | We can compromise with Note 2. And in align with Proposal 7.1.2, we prefer to remove Note 1. |
| vivo | OK |
| Lenovo | Support |
| InterDigital | We support the proposal. |
| Futurewei | OK, Note 1 is not necessary in our view. |
| Intel | OK |
| Qualcomm | OK |
| Spreadtrum | Support. |
| Apple | OK |
| OPPO | Disagree with Note 2. Partial coverage is as important as in coverage in our view, supporting all coverage scenarios is the main advantage of SL positioning comparing to Uu positioning, and it is also the clear target of this SI according to the SID. As commented in the last round, we also see some important partial coverage cases in reality that SL positioning should support. |
| Huawei, HiSilicon | OK |
| Nokia, NSB | OK |

##### FL Observations

Support the proposal:

* CATT, ZTE, vivo, Lenovo, Interdigital, intel, Qualcomm, Support, Apple, Huawei, HiSilicon, Nokia, NSB

Note 1 is not necessary:

* Futurewei, LGE

Note 2:

* Not support: OPPO

Looking at the responses between 7.1.2 and 7.1.1 it seems, there is majority to Keep Note 1. With regards to Note 2, there is clear majority to keep it. So, the proposal is not changed. We may have to go online for this one if there is time.

##### [CLOSED] Feature Lead Proposal 7.1.1-v3

* From RAN1 perspective, for in-coverage and partial coverage scenarios, RAN1 assumes that the network may be involved in the SL positioning/ranging, and/or hybrid (SL/Uu) Positioning.
* Note 1: Positioning architecture and signalling procedures are up for study in the other WGs
* Note 2: Companies are encouraged to focus their study in the in-coverage scenario first.

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We agree with the proposal. |
| Futurewei | Support |
| CMCC | Support |
| ZTE | OK. |
| Spreadtrum | Support. |
| CATT | OK |
| DCM | OK |
| LGE | We still prefer to remove Note 1 as it is described in SID. However, as long as the intention of Note 1 is exactly same as those in SID, we can accept the proposal for progress. |
| Lenovo | Support proposal and share the understanding that Note 1 aligns with the SID description. |
| NEC | We don’t think note 2 is necessary. In evalution discussion, it might be needed to reduce workload. But for enhancements study partial coverage is equally important as other coverage scenarios. |
| OPPO | We do not agree with Note 2. Partial coverage scenario should be supported, for that, we have to guarantee that OoC UE can receive SL PRS transmitted by IC UE, and vice versa, which should be taken into account from the begaining of SL positioning design. |
| Samsung | OK |
| Bosch | OK |
| Qualcomm | We support the proporal. |
| Nokia, NSB | OK |

##### FL Observations

Support the proposal

* Interdigital, Futurewei, CMCC, ZTE, Spreadtrum, DCM, LGE, Lenovo, Samsung, Bosch, Qualcomm, Nokia, NSB

Do not include Note 2

* NEC, OPPO

I suggest we go to GTW for this.

##### [GTW] Feature Lead Proposal 7.1.1-v3

* From RAN1 perspective, for in-coverage and partial coverage scenarios, RAN1 assumes that the network may be involved in the SL positioning/ranging, and/or hybrid (SL/Uu) Positioning.
* Note 1: Positioning architecture and signalling procedures are up for study in the other WGs
* Note 2: Companies are encouraged to focus their study in the in-coverage scenario first.
  + Support keeping Note 2
    - Interdigital, Futurewei, CMCC, ZTE, Spreadtrum, DCM, LGE, Lenovo, Samsung, Bosch, Qualcomm, Nokia, NSB
  + Do not include Note 2
    - NEC, OPPO

## Out of Coverage (OOC) Scenarios

|  |  |
| --- | --- |
| Futurewei | The SL positioning solutions should support the necessary configurations and controls for OOC SL positioning.  Consider reusing or extending the IUC framework defined in Rel 17 for OOC SL positioning solutions. |
| Nokia, NSB | UEs may perform functionalities related to coordination and/or configuration of a SL positioning session, especially in out-of-coverage scenarios. Such role may depend on the capability, eligibility, and suitability of UEs that might be potentially involved in SL positioning.  Study mechanisms to allow UEs to exchange information on resources used for SL positioning to coordinate between concurrent SL positioning sessions. |
| CEWiT, Reliance Jio, Saankhya Labs, IITM, IITK | Out-of-coverage case should be considered for sidelink-based positioning architecture enhancements. |
| ZTE | Consider the SL positioning structure design via PC5 interface including PC5-S and PC-5 RRC. |
| Apple | RAN1 should discuss the assumption on the positioning entity (LMF) in the case of in-coverage, partial-coverage and out of-coverage cases |
| Qualcomm | Study positioning procedures that enable the calculation entity being:   * in out-of-coverage scenarios, UE(s) involved in a SL Positioning session |
| NEC | Both UE assisted and UE based positioning methods should be supported.  −    Including corresponding signalling and procedure for study |
| Interdigital | Study the destination of measurement reports sent from the target UE : anchor UE, LMF or gNB |
| Ericsson | In out-of-coverage, UE-based positioning solution should between pairs of UEs, where UEs discover other UEs capable of supporting in positioning, and initiate unicast ranging measurements towards these nodes. A UE acting as a location server for another UE, i.e. centralizing assisdance data from other UEs, is not supported. |
| CATT | For the operation of SL positioning without LMF, the following issues are suggested to be addressed:   * In the relative positioning, ranging and absolute positioning scenarios of SL positioning, the target UE can directly send a request information to other assisted UEs to initiate the positioning. This may be defined as device to device location service(request) which will be discussed in SA2. * In the absolute positioning scenarios of SL positioning, the assisted UEs may be the positioning anchor nodes (e.g. RSUs), and the assisted UEs can broadcast positioning indication information to assist the target UE to trigger the positioning procedure. This may be defined as group location service in SA2. |

Based on the above set of proposals, the on-going work in SA2, and that, in the SID description, the study of positioning architecture and signalling to enable sidelink positioning covering both UE based and network based positioning is within RAN2 scope, including coordination and alignment with RAN3 and SA2 as required, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 7.1.2-v0

* From RAN1 perspective, at least for out of coverage scenarios, RAN1 assumes that the network is not involved in a SL positioning/ranging, which is up for study in the other WGs.

##### Companies views

|  |  |
| --- | --- |
| CATT | Support |
| MTK | Okay. |
| ZTE | Fine with FL’s assessment. |
| Spreadtrum | Support. |
| InterDigital | We agree with the proposal. |
| Futurewei | Support |
| CMCC | Support |
| NEC | OK |
| OPPO | Support. |
| Lenovo | Support |
| Apple | Support |
| vivo | We don’t understand the last part of sentence of this proposal “which is up for study in the other WGs”. What is the word “which” referring to? The network is not involved in SL positioning for out-of-coverage? What will other WGs to study? To study RAN1’s assumption or what?  Either we remove it (our modification is below) or add more text to clarify. Right now, this proposal is confusing.  From RAN1 perspective, at least for out of coverage scenarios, RAN1 assumes that the network is not involved in a SL positioning/ranging~~, which is up for study in the other WGs~~. |
| Samsung | OK |
| Qualcomm | Support |
| DCM | OK |
| LGE | As commented in other proposal, stand-alone SL positioning should be available regardless of the network coverage. It has a benefit of less latency for SL positioning, compare to one with gNB/LMF involvement. We propose the following modification. Feature Lead Proposal 7.1.2-v0 From RAN1 perspective, ~~at least for out~~ regardless of coverage scenarios, ~~RAN1 assumes~~ it is supported that the network ~~is~~ may not be involved in a SL positioning/ranging, which is up for study in the other WGs. |
| Xiaomi | OK |
| Huawei, HiSilicon | We would like to clarify whether this “out of coverage scenario” corresponds to the “out of coverage” definition in TS 38.304, which is SL frequency specific rather than UE specific. In this definition, it should be possible that the SL carrier is out of coverage, while UE may still has access to the network, but the network has no control over the SL carrier. |
| Philips | It is ok to focus on out-of-coverage, but we should design the solutions by keeping in mind the partial coverage and in-coverage scenarios to make sure the solution for sidelink positioning can also be reused for the partial coverage and in-coverage scenarios. |
| Nokia, NSB | OK |
| Ericsson | Similar comment as previous proposal.  The concern we have with this proposal is the ‘which are all up for study in the other WGs’. We need to idenfy if there is any RAN1 specification impact. For those aspects that don’t involve RAN1 spec impact, we don’t need to discuss them in RAN1. |
| Intel | OK. |

##### FL Observations

Support of the proposal

* CATT, MTK, ZTE, Spreadtrum, Interdiital, Futurewei, CMCC, NEC, OPPO, Lenovo, Apple, Samsung, Qualcomm, NTT DOCOMO, Xiaomi, Nokia, NSB, OK

1 company suggests, to try to include in a single proposal a statement for all the coverage scenarios, that, the network may or may not be involved. Such a statement is even more broad than trying to clarify some basic principles for the individual coverage scenarios. There is strong support, to make sure that we are all on the same page that, for OoO, the network is not involved. It was also suggested to change the “From RAN1 perspective, RAN1 assumes”, to the expression, “It is supported”. Since positioning architecture decisions are up to the other WGs, i believe that it is more appropriate to use the expression “From RAN1 perspective, RAN1 assumes”, rather than “It is supported”.

1 company would like to understand what was the intention behind the “which is up for study in the other WGs”. The intention was to say that the “positioning architecture and signaling procedures” is up to the other WGs (as is already written in the SID).

1 company wanted to clarify

* whether this “out of coverage scenario” corresponds to the “out of coverage” definition in TS 38.304, which is SL frequency specific rather than UE specific. In this definition, it should be possible that the SL carrier is out of coverage, while UE may still has access to the network, but the network has no control over the SL carrier.

In my understanding, i don’t see how, one way or the other way would change the discussion in this proposal. The intention is, from RAN1 perspective, to agree that we are planning to discuss SL Positioning solutions without assuming the network is involved in these cases.

##### [CLOSED] Feature Lead Proposal 7.1.2-v1

* From RAN1 perspective,
  + For out of coverage scenarios, RAN1 assumes that the network is not involved in a SL positioning/ranging.
* Note: Positioning architecture and signalling procedures are up for study in the other WGs

##### Companies views

|  |  |
| --- | --- |
| vivo | OK |
| Futurewei | Support. Just for clarification, the signaling procedure in the note should refer to the upper layers signaling. |
| Samsung | OK |
| LGE | Support except the note. We agree with Ericsson that any RAN1 impact can be identified. If this is already written in SID, we don’t need the note in the proposal. Suggest to remove it. |
| NEC | OK |
| CMCC | OK |
| CATT | Support |
| Nokia, NSB | OK |
| Huawei, HiSilicon | We want to clarify that under the definition fo carrier-specific OCC, it should be possible Uu+PC5 can still be supported, and network may also get involved in configuring UE to report the measurement on the OOC SL carrier. |
| OPPO | OK |
| ZTE | Support. |
| Philips | OK |
| Intel | OK |
| Qualcomm | Support |

##### FL Observations

Good support from the companies. LGE suggested to remove the note and Huawei, HiSilicon to clarify network involvement in the case of carrier specific OOC cases.

##### [MEDIUM] Feature Lead Proposal 7.1.2-v2

* From RAN1 perspective,
  + For out of coverage scenarios, RAN1 assumes that the network is not involved in a SL positioning/ranging.
* [Note: Positioning architecture and signalling procedures are up for study in the other WGs]
* FFS: Network involvement for carrier-specific Out Of coverage scenarios

Companies are encouraged to

* provide their views whether they think Note is essential to be kept at this point or can be removed.
* Whether they are OK with the new FFS added. If not why?

##### Companies views

|  |  |
| --- | --- |
| CATT | We can live without the note.  The FFS is OK for us. |
| ZTE | We prefer to delete the FFS. There is only one carrier frequency supported in NR sidelink communication currently. |
| LGE | We prefer to remove the Note. Regarding the FFS, what is the definition of ‘carrier-specific OOC’? |
| vivo | We prefer to remove both note and FFS. |
| Lenovo | Ok with the note, can remove the FFS. The definition for carrier-specific OOC is not clear. |
| InterDigital | We are okay to support the proposal without the FFS. We support to add the Note. We agree when a UE cannot detect any cell on a SL carrier, it will consider itself to be out-of-coverage for NR SL communication on that carrier frequency. But we think the OOC/IC/partial scenario referred to in WID is specific to Uu coverage, which will make the SL positiong solution space scope clearly defined in terms of NW involvement. |
| Futurewei | OK. The note is not necessary.We have the same question as LGE , what is the understanding of “carrier-specific OOC”? |
| Intel | Prefer to remove the FFS. |
| Qualcomm | We are ok to keep the note and prefer to remove the FFS |
| Apple | We would prefer the note but can remove the FFS |
| OPPO | Agree with the note.  For the FFS, we cannot understand the meaning of “carrier specif OOC scenario” either, if our understanding is correct (pls. proponent to confirm), it is to say the involvement of a network deployed on a carrier different from the SL carrier, if so we support the intention and propose the following:   * FFS: The involvement of network ~~involvement~~ deployed on a carrier other than the SL carrier ~~involvement for carrier-specific Out Of coverage scenarios~~ |
| Huawei, HiSilicon | We prefer to keep the Note. If carrier-specific OOC is mis-leading, we can change it to “SL frequency specific OOC”.  The existing SL frequency specific IC/OOC should be reused from TS 38.304.  If the UE detects at least one cell on the frequency which UE is configured to perform NR sidelink communication on fulfilling the S criterion in accordance with clause 8.2.1, it shall consider itself to be in-coverage for NR sidelink communication on that frequency. If the UE cannot detect any cell on that frequency meeting the S criterion, it shall consider itself to be out-of-coverage for NR sidelink communication on that frequency. |
| Nokia, NSB | OK; don’t consider the Note essential, but OK to keep it. Prefer to remove the FFS. |

##### FL Observations

With regards to the Note:

* Keep the Note: Lenovo, Interdigital Qualcomm, Apple, OPPO, Huawei, HiSilicon
* Remove the note: CATT, LGE, vivo, Futurewei,
* Either way: Nokia, NSB

With regards to the FFS:

* Remove it: LGE, vivo, ZTE, Lenovo, Interdigital, Futurewei, Qualcomm, Intel, Apple, Nokia, NSB
* Keep it: Huawei, HiSilicon
* OPPO proposes a rewording and seems to be positive for the note.
* Huawei, HiSilicon proposes a different rewording

There some majority to keep the Note, so my suggestion remains to keep it.

Lets try if any of these FFS would be acceptable.

##### [CLOSED] Feature Lead Proposal 7.1.2-v3

* From RAN1 perspective,
  + For out of coverage scenarios, RAN1 assumes that the network is not involved in a SL positioning/ranging.
* Note: Positioning architecture and signalling procedures are up for study in the other WGs
* FFS:
  + Alt. 1: Involvement of the network in a SL positioning/ranging when it is deployed on a carrier other than the SL carrier.
  + Alt. 2: Involvement of the network for SL frequency specific Out-Of-coverage
  + Alt. 3: No FFS is needed

Please indicate which alternative you support with regards to the “FFS” item, and with which you “can live with”.

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We prefer Alt 3 for the “FFS” |
| Futurewei | Support. We prefer Alt 3 (No FFS is needed). Alt 2 seems to contradict the RAN1 assumption. Alt 1 is not clear to us given that the main sub-bullet assumes that network is not involved and does not distinguish on each carrier (SL or other) |
| CMCC | Support and prefer Alt 3, for out of coverage scenario, NW should not be involved. |
| ZTE | Support Alt. 3 and no FFS is needed. |
| Spreadtrum | We support Alt 3 for the FSS. |
| CATT | Alt.1 is preferred, since it clearly says the intention of this FFS. |
| DCM | Alt 3. OoC means the UE is not in any base-station coverage, this is my understanding. Alt 1/2 seems contradict. |
| LGE | Same as in Proposal 7.1.1, as long as the intention of Note is exactly same as those in SID, we can accept Note for progress.  Thanks OPPO and Huawei/HiSilicno for clarification on the meaning of carrier-specific OOC. According to Huawei’s comment, in SL frequency specific out-of-coverage, there in no cell that can be detected by UE. So Alt. 2 corresponds to the first sub-bullet case, and it’s not necessary. When UE is connected to other carrier than SL carrier, network involvement may be possible for SL positioning in SL carrier. So Alt.1 can be supported as FFS, if our understanding is correct. We suggest the following modification for more clarification.   * FFS:   + Alt. 1: Involvement of the network in a SL positioning/ranging when UE is connected to a cell for SL positioning on a carrier other than the SL carrier.   + ~~Alt. 2: Involvement of the network for SL frequency specific Out-Of-coverage~~   + ~~Alt. 3: No FFS is needed~~ |
| Lenovo | Support the proposal Alt. 3, we assume that the out-of-coverage scenario will in any case include the definitions stated in Alt. 1 as is already the case. Otherwise we are also fine to keep Alt. 1 if any clarification is really needed. |
| NEC | OK with Alt. 3 |
| OPPO | Agree with LGE. We’d like to clarify that based on current specification out of coverage is defined per carrier, a UE out of coverage on a carrier for SL can be in coverage on another carrier. |
| Samsung | Alt 3. |
| Huawei, HiSilicon | There has been some discussion in RAN-P during the Rel-17 SI where the OOC definition follows OOC definition in TS 38.304, but it was not concluded.  The understanding from our side is that SL frequency specific OOC means that network cannot provide configuration on the SL frequency either via SIB or dedicated RRC signalign, in which UE should use the preconfiguration.  This should be understood that the use of ITS band may be considered SL frequency specific OOC if gNB deployed on licensed band has no control over the operations on the ITS band, and UE served by different PLMN should be able to access the same spectrum. However this does mean that UE cannot be connected to the network or network cannot be involved in such case.  We think this concept should be aligned in the first place, and unless we add another OOC state in the spec, we prefer to reuse the existing definition.  LGE’s revision of Alt.1 is OK from our perspective. |
| Qualcomm | We support the proposal with Alt 3. |
| Nokia, NSB | OK with Alt 3 |

##### FL Observations

* FFS:
  + Alt. 1: Involvement of the network in a SL positioning/ranging when it is deployed on a carrier other than the SL carrier. (Or changes)
    - CATT, LGE, OPPO
  + Alt. 2: Involvement of the network for SL frequency specific Out-Of-coverage
  + Alt. 3: No FFS is needed
    - Interdigital,Futurewei, CMCC, ZTE, Spreadtrum, DCM, Lenovo, Samsung, Nokia, NSB

Based on the above, I am not sure there can be more progress through email discussion at this stage. From FL perspective, this is an “FFS” bullet and should not be creating such controversy. Hopefully, if we go online, there will be opportunity to cla

##### [GTW] Feature Lead Proposal 7.1.2-v4

* From RAN1 perspective,
  + For out of coverage scenarios, RAN1 assumes that the network is not involved in a SL positioning/ranging.
* Note: Positioning architecture and signalling procedures are up for study in the other WGs
* FFS:
  + Alt. 1: Involvement of the network in a SL positioning/ranging when when UE is connected to a cell for SL positioning it is deployed on a carrier other than the SL carrier.
    - CATT, LGE, OPPO, Huawei, HiSilicon
  + Alt. 3: No FFS is needed
    - Interdigital,Futurewei, CMCC, ZTE, Spreadtrum, DCM, Lenovo, Samsung, Qualcomm, Nokia, NSB

## 7.2 Positioning Measurements Report

Based on the submitted contributions, the following proposals are identified with regards to the sidelink positioning measurement report:

|  |  |
| --- | --- |
| CATT, GOHIGH | For all types of S-PRS (periodic, semi-persistent and aperiodic S-PRS), the required measurements are configured through SLPP (the definition is up to RAN2). And corresponding SL measurements are also reported through SLPP. |
| Apple | RAN1 should discuss the specifics of the SL positioning techniques based on the existing RAN-dependent techniques and update the associated signaling, measurements and procedures for the new SL-positioning schemes.. Issues to be addressed include:  Feedback of positioning measurement and assistance information to the positioning estimator |
| Fraunhofer IIS, Fraunhofer HHI | Integrate the reporting of sidelink measurements into the reporting framework for DL-TDOA, UL-TDOA and multi-RTT based positioning |
| Lenovo | Measurement quality metrics should also be supported to assess quality of SL positioning measurements  Support different SL Positioning reporting types including one-shot, triggered and periodic reports |
| Interdigital | Study contents measurements and destination of measurement reports applicable for SL positioning methods in in-coverage, out-of-coverage or partial coverage scenarios |
| Intel | In terms of measurement reporting, they may be reported to gNB or to another UE(/RSU) and include references for PRS resource set and resource IDs.  In general, the measurement reports can be routed to the LMF via a serving gNB. Similar to Uu positioning, GNSS-RTK assistance data or other assistance information may be broadcasted by serving cell when in coverage. |
| Qualcomm | From RAN1 perspective, with regards to the SL positioning measurement report, use as a starting point the assumption that a SL positioning report shall be a high-layer report. Up to RAN2 & SA2 working groups to identify and design the necessary architecture, signaling and protocols  Study information to be included in a sidelink positioning measurement report, in addition to the basic UE measurements, including at least the following: time stamp(s), quality metric(s), UE-ID(s), SL-PRS resource ID(s). |
| ROBERT BOSCH GmbH | For studying sidelink positioning method (e.g., TDO, RTT, AOA/D, …) keep L1/L2 layer impact being minimum and independent of sidelink positioning signal design. |

Based on the submitted tdocs, and proposals summarized above, the following proposal is made:

##### [CLOSED]Feature Lead Proposal 7.2-v0

With regards to the Sidelink Positioning measurement report,

* Study the contents of the measurement report (e.g. time stamp(s), quality metric(s), ID(s))
* Study the time domain behavior of the measurement report (e.g. one-shot, triggered, periodic)
* RAN1 assumes that the Sidelink Positioning measurement report shall be a high-layer report.

##### Companies views

|  |  |
| --- | --- |
| CATT | Support.  We prefer that SLPP should be introduced to configure/report the measurements. |
| ZTE | Where to process the SL positioning measurement request/report (e.g.PC5-S, PC5-RRC, or others) should be defined in RAN2. |
| Huawei, HiSilicon | It is not clear what this “high-layer” means, especially for L2 (MAC). Can FL clarify? |
| **Feature Lead Clarification** | With regards to Huawei, HiSilicon question, the intention of the 3rd bullet is to consider reporting above MAC layer. Assume, the bullet is rewritten to the following and provide further based on that . Sorry for the ambiguity.   * RAN1 assumes that the Sidelink Positioning measurement report shall be a a higher-layer report (wherein higher-layer report in this proposal doesn’t include MAC-CE reporting). |
| InterDigital | For clarification, examples for high-layer signaling used to carry reports should be mentioned, e.g., RRC, LPP. Lower-layer based measurement reporting should not be precluded (e.g., MAC-CE, SCI-2). Thus we propose to remove the third bullet. Feature Lead Proposal 7.2-v0 With regards to the Sidelink Positioning measurement report,   * Study the contents of the measurement report (e.g. time stamp(s), quality metric(s), ID(s)) * Study the time domain behavior of the measurement report (e.g. one-shot, triggered, periodic) * ~~RAN1 assumes that the Sidelink Positioning measurement report shall be a high-layer report.~~ |
| Futurewei | Support in principle. The last bullet may not be necessary. A separate discussion on architecture is needed, and maybe RAN2 involved. |
| CMCC | Support.  We prefer to reuse the design in NR Uu positioning as much as possible. |
| NEC | Ok in principle, and share the similar view as above to remove the last bullet. |
| Sony | Generally fine. However, the above proposal on the measurement contents does not explicitly mention the actual measurement result itself? (e.g., timing-based measurement, such as RTT /TDOA results, or angle or power-based measurement results?) |
| OPPO | Support the proposal. |
| Lenovo | Support FL’s proposal. Due to the potential size of such SL Pos. measurement reports, we prefer to use higher-layer signalling. |
| Apple | Support general proposal. On assumption of higher layer report, we should have a discussion on this first. We may end up at the same conclusion but we should understand what measurements are needed first. |
| vivo | We’re not sure we need to agree on this at the early stage of SI. We prefer to defer the discussion until more progress of PHY SL-PRS design. |
| Samsung | OK for the direction of proposal 7-2 in general.  We suggest to remove the third bullet. |
| Qualcomm | We support the proposal |
| DCM | Probably third bullet should also be studied. |
| LGE | Support the proposal in general. We may study the benefit of reporting the measurement report in a lower layer for short latency. We propose to include the following FFS.   * RAN1 assumes that the Sidelink Positioning measurement report shall be a a higher-layer report (wherein higher-layer report in this proposal doesn’t include MAC-CE reporting).   FFS whether the measurement can be reported in a lower layer |
| Sharp | Fine |
| Xiaomi | We are fine with the proposal. |
| Huawei, HiSilicon2 | Thanks for the clarification from the FL  We tend to agree with InterDigital/vivo/SS that the last bullet should be deleted for now. |
| Philips | Agree with Interdigital and LG to not exclude lower layer reporting. |
| Nokia, NSB | Lower layer reporting should not be precluded at this point, so we agree with InterDigital and LGE. |
| Ericsson | Ok to further study |
| Intel | Support |

##### FL Observations

There is good support for the first 2 bullets of the proposal.

* At least 9 companies suggested to remove the 3rd bullet at this point of the study / or study it further
  + Huawei, HiSilicon, Interdigital, vivo, Samsung, NEC, Apple, NTT DOCOMO, Philips, Nokia, NSB
* The 3rd bullet is supported by at least 6 companies
  + CATT, CMCC, Lenovo, Qualcomm, Xiaomi, Intel
* 1 company suggests to keep the 3rd bullet, but add “"FFS whether the measurement can be reported in a lower layer”
* Indeed, the proposal would make some progress without the 3rd bullet, at this early stage of the study, so the new Proposal is the following:

##### [CLOSED] Feature Lead Proposal 7.2-v1

With regards to the Sidelink Positioning measurement report,

* Study the contents of the measurement report (e.g. time stamp(s), quality metric(s), ID(s), angular/timing/power measurements, etc)
* Study the time domain behavior of the measurement report (e.g. one-shot, triggered, periodic)
* ~~RAN1 assumes that the Sidelink Positioning measurement report shall be a high-layer report.~~

##### Companies views

|  |  |
| --- | --- |
| vivo | OK |
| Futurewei | Support |
| Samsung | For time domain behavior, not clear on the difference between one-short and triggered. Suggest to include: aperiodic, semi-persistent and aperiodic   * Study the time domain behavior of the measurement report (e.g. one-shot, ~~triggered,~~ aperiodic, semi-persistent and periodic) |
| LGE | Support |
| Xiaomi | OK |
| NEC | OK |
| Sharp | Support |
| CMCC | OK |
| CATT | We can live with the proposal.  We think the procedures related to Sidelink Positioning request and measurement report are related to RAN2. As we commented before, we prefer that SLPP should be introduced to configure/report the measurements. Anyway, it is RAN2/SA2 issue. |
| Nokia, NSB | OK |
| Huawei, HiSilicon | Ok |
| OPPO | OK |
| ZTE | OK |
| Philips | OK |
| Intel | OK; also OK with Samsung’s update. |
| Qualcomm | Not support. Positioning measurements are higher layer reports in Uu and we prefer to resue existing positioning principles. We would be ok with LG’s proposal form the previous round to have lower layer report as an FFS.  With regards to the Sidelink Positioning measurement report,   * RAN1 assumes that the Sidelink Positioning measurement report shall be a high-layer report.   + FFS whether the measurement can also be reported in a lower layer |

##### FL Observations

Support the proposal:

* Vivo, Futurewei, LGE, Xiaomi, NEC, Sharp, CMCC, CATT, Nokia, NSB, Huawei, Hisilicon, OPPO, ZTE Philips

Not Support

* Qualcomm

##### [CLOSED] Feature Lead Proposal 7.2-v2

With regards to the Sidelink Positioning measurement report,

* Study the contents of the measurement report (e.g. time stamp(s), quality metric(s), ID(s), angular/timing/power measurements, etc)
* Study the time domain behavior of the measurement report (e.g. one-shot, [triggered], [aperiodic, semi-persistent] periodic)
* [RAN1 assumes that the Sidelink Positioning measurement report shall be a high-layer report.
  + FFS whether the measurement can also be reported in a lower layer]

Companies are encouraged to comment whether they are OK keep the text in brackets.

##### Companies views

|  |  |
| --- | --- |
| CATT | We support to keep the third bullet as follows:   * [RAN1 assumes that the Sidelink Positioning measurement report shall be a high-layer report.   + FFS whether the measurement can also be reported in a lower layer] |
| ZTE | We prefer not to decide whether SL positioning measurement report is a high-layer report or lower-layer report in such an early stage.  The text in brackets can be removed or replace by “FFS whether the measurement can be reported in a high layer or a lower layer” |
| LGE | Regarding the time domain behavior of the measurement report, let’s keep the all the examples including the texts in the bracket.  Regarding the last sub-bullet, it is the study phase and seems too early to conclude the baseline operation. Let’s make the whole part as FFS as a compromise.   * FFS whether the Sidelink Positioning measurement can be a high-layer report and/or a lower layer report. |
| vivo | We’re fine to keep the 3rd bullet as FFS as suggested by LGE. |
| Lenovo | Support FL’s proposal, we are of the understanding that triggered reporting refers to an event-based type reporting of location information. If so, we would be supportive of “event-based” being added as an example. |
| InterDigital | The last bullet regarding measurement report signaling should be removed. First higher layer connection is not always available on SL, e.g. for a broadcast type communication. Second there may be scenarios where lower layer signaling could be considered, e.g., to adapt to high mobility and for small payload relative positioning information. At this early stage, we prefer to keep the options open.  We are also ok to support the suggestion from LGE. |
| Futurewei | We are OK with the FFS proposed by LGE |
| Intel | Prefer to keep the last bullets:   * [RAN1 assumes that the Sidelink Positioning measurement report shall be a high-layer report.   + FFS whether the measurement can also be reported in a lower layer] |
| Qualcomm | We support keeping the text that is in brackets. |
| Apple | We think it may be too early to make a decision on this topic. We can make the whole bullet FFS as suggested by LGE. |
| OPPO | Support to keep all the text in brackets. |
| Sharp | We are OK to keep the text in brackets. |
| DCM | We support keeping the text that is in brackets. |
| Nokia, NSB | OK to keep the text in brackets. |

##### FL Observations

Too early to make an agreement that Sidelink Positioning report shall be a high-layer report, ,and it should be FFS

* ZTE, LGE, vivo, Interdigital, Futurewei, Apple

OK to keep the text in brackets

* Qualcomm, OPPO, Sharp, NTT DOCOMO, Nokia, NSB, Intel

It is clear that there is no consensus to agree on High-layer report. So, the revised proposal is to be further studied. I believe, given the situation, it should be acceptable for the companies that want to agree now that the report will be high-layer report.

##### [CLOSED] Feature Lead Proposal 7.2-v3

With regards to the Sidelink Positioning measurement report,

* Study the contents of the measurement report (e.g. time stamp(s), quality metric(s), ID(s), angular/timing/power measurements, etc)
* Study the time domain behavior of the measurement report (e.g. one-shot, triggered, aperiodic, semi-persistent, periodic)
* FFS whether the Sidelink Positioning measurement can be a high-layer report and/or a lower layer report.

##### Companies views

|  |  |
| --- | --- |
| InterDigital | We support the proposal. |
| Futurewei | Support |
| CMCC | Support |
| ZTE | Support. |
| Spreadtrum | Support. |
| CATT | Support  We prefer sidelink positioning measurement report shall be a high-layer report, and carried by sidelink LPP, which is similar to UU positioning measurement report. |
| DCM | OK |
| LGE | Support |
| Lenovo | Support |
| NEC | We think one-shot report can be a special case of aperiodic report and thus no need to keep it here. |
| Sharp | OK |
| OPPO | Support the proposal. |
| Samsung | OK |
| Xiaomi | OK |
| Huawei, HiSilicon | OK |
| Qualcomm | We can accept the proposal for progress. |
| Nokia, NSB | OK |

All companies except one support the current version.

* NEC commented that “one-shot” can be a special case of aperiodic, but at this point, i really prefer to not change a stable proposal. Technically speaking, “one-shot” can be a semi-persisment that receives a deactivation after a single instance, or a periodic that is configured to be transmitted only a single instance. So, “one-shot” doesn’t necessarily mean aperiodic. Furthermore, the reverse is not also true. An aperiodic SL-PRS can be multiple shots: Get a single SCI and transmit multiple shots of a SL-PRS.

Having said the above, i think we can just keep the examples shown above, and proceed with this for email endorsement. Hopefully the above explanation is acceptable for NEC.

##### [EMAIL ENDORSEMENT] Feature Lead Proposal 7.2-v3

With regards to the Sidelink Positioning measurement report,

* Study the contents of the measurement report (e.g. time stamp(s), quality metric(s), ID(s), angular/timing/power measurements, etc)
* Study the time domain behavior of the measurement report (e.g. one-shot, triggered, aperiodic, semi-persistent, periodic)
* FFS whether the Sidelink Positioning measurement can be a high-layer report and/or a lower layer report.

# Other Proposals

|  |  |
| --- | --- |
| Nokia, NSB | * Target UE: UE to be positioned (in this context, using SL, i.e. PC5 interface).   Note: We prefer to use a simpler definition than the one provided in 3GPP TR 23.700-86 [2].   * Anchor UE (or Supporting UE): UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.   Note: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.  Note: In [2], the terms called “Reference UE” and “Assistant UE” are defined. From the RAN perspective, we see that the naming “Reference UE” might create confusion with the Positioning Reference Unit (PRU) introduced in Rel. 17. Second, we see that the defined roles for “Reference UE” and “Assistant UE” in [2] are interchangeable, and see no need to define such types of UEs separately.   * Sidelink positioning: Positioning UE using reference signals transmitted over SL, i.e., PC5 interface, to obtain absolute position, relative position, or ranging information.   Note: In [2], the definition of “sidelink positioning” is not logically connected to absolute/relative positioning or ranging over SL. We propose to have “sidelink positioning” as a collective term that covers all, so as not to list them every time separately and explicitly.   * Ranging: determination of the distance and/or the direction between a UE and another entity, e.g., anchor UE.   Note: While relative positioning information refers to relative coordinates of a UE with respect to another entity, ranging information refers to only the distance and/or angle between them.  Note: In [2], ranging definition also covers relative positioning. However, we see these terms differently as captured in the Note above.   * Sidelink positioning reference signal (SL PRS): reference signal transmitted over SL for positioning purposes. * SL PRS (pre-)configuration: (pre-)configured parameters of SL PRS such as time-frequency resources including its bandwidth and periodicity. The (pre-)configuration information provided to UEs can be part of an “assistance data for SL positioning”.   Align on the above-provided terminology on SL positioning, to be used (at least) during the study. |
| NTT DOCOMO | * For SL-positioning,   + Study measurement UE determination   + Study cast-type to be used in SL-positioning method |
| CATT, GOHIGH | Proposal 1: the solutions for sidelink positioning should include the following aspects:.   1. Sidelink positioning methods 2. Sidelink positioning reference signal 3. Sidelink positioning measurement and configuration 4. Sidelink positioning physical-layer procedures |
| CMCC | The evaluation of TDOA and RTT should be based on ITS band (20/40MHz) and licensed band in FR1in Rel-18 SL positioning. |
| ZTE | Rel-18 NR sidelink positioning can focus on ITS and licensed spectrum first. |
| ROBERT BOSCH GmbH | Study the impact of sidelink positioning to improved positioning integrity of, e.g., Uu-based positioning |
| Xiaomi | RAN1 shall study whether/how to evaluate the impact of in-band emission on sidelink positioning solutions |
| Sony | Consider to support UE-types classification for V2X positioning (e.g., RSU, VRU, Car). |
| Lenovo | Focus the licensed band SL Positioning study on FR1. Consider FR2 for evaluation if time permits and based on ongoing FR2 SL enhancements in separate SI  RAN1 to discuss the relationship between Uu PRS and SL PRS configuration and associated measurements for hybrid positioning model A (using both Uu and SL interfaces)  RAN1 to further discuss the benefits of PRUs in the context of SL positioning |
| Spreadtrum | Energy efficiency for sidelink positioning reference signals transmission should be considered. |
| NEC | The potential sidelink positioning methods should be evaluated based on sidelink features to identify the feasible items.  The applicability of absolute positioning and relative positioning should be studied to meet different sidelink positioning requirements. |
| Interdigital | Agree on the following definitions : “anchor UE” as the UE who transmit PRS to or receive PRS from the “target UE” whose position is to be determined  A study a framework to allow the target UE to process PRS measurements for SL positioning |
| Ericsson | 3GPP should prioritize exploiting complementary benefits of fixed wireless network infrastructure to benefit over competing non-3GPP ranging solutions. |
| Fraunhofer IIS, Fraunhofer HHI | Support the transmission and reception of positioning sidelink RSs with PRUs. |

##### [CLOSED]Feature Lead Request

Companies are encouraged to suggest whether any of the proposals above should be included in the other sections/subsections, or whether any of these proposals are considered beneficial to be discussed in this meeting.

##### Companies views

|  |  |
| --- | --- |
| Huawei, HiSilicon | We think that the terminology alignment from Nokia could be considered as the baseline in the discussion.  Some clarification between anchor UE and reference UE (used by other WG) could be needed. |
| InterDigital | To facilitate the discussion, it will be good to align terminologies about UEs involved in SL positioning. In our proposal, we propose to use anchor UE and target UE. We defined “target UE” as the UE who position is to be determined. “Anchor UE” transmit PRS to or receive PRS from the “target UE”. |
| Futurewei | We are open to discuss Nokia’s proposal as the basis for terminology. |
| NEC | Comment 1: we also support ternomology proposed by Nokia.  Comment 2: we think how to choose anchor UE should also be studied since some UE may not be suitable as anchor UE, e.g., UE with very high speed.  Comment 3: identification of anchor UEs should also be studied. |
| Lenovo | We are fine with Nokia’s terminology as a good starting point. In addition, in the context of ranging we propose to introduce the terminology “Initiator UE – A UE that initiates/triggers a SL positioning/ranging session” and “Responder UE – A UE that responds to a SL positioning/ranging session from an initiator UE”. An initiating UE may not necessarily be an anchor UE, while positioning measurements can be performed either at the Initiating UE and/or Responding UE as in the case with e.g., double-sided RTT. |
| Apple | Agree that we should decide on common terminology for this study. |
| vivo | Fine to discuss common terminology. |
| LGE | We’re fine with the terminologies provided by Nokia except one point. If the ranging includes both distance and direction, it is equivalent to the relative positioning. It becomes just a matter of representation. So to avoid unnecessary confusion, we propose the following modification to the definition of ranging as follows.   * Ranging: determination of the distance ~~and/~~or the direction between a UE and another entity, e.g., anchor UE.   Note: While relative positioning information refers to relative coordinates of a UE with respect to another entity, ranging information refers to only the distance ~~and/~~or angle between them. |
| Xiaomi | We are fine with Nokia’s terminology. On Ranging, we think distance and/or the direction shall be kept. For example, when performing evaluation, for relative positioning, the horizontal possitioing accuracy will be evaluated; while for ranging, the ranging distance accuracy and/or ranging direction accuracy will be evaluated. |
| Nokia, NSB | Agree to align on terminology. Regarding LGE’s proposal on ranging, the problem is that ranging has already been defined by SA1, e.g. in TS 22.261 “Ranging-based services are the applications utilizing the distance between two UEs **and/or** the direction of one UE from the other one”; if we replace “and/or” by “or”, then this will result in inconsistent definitions of ranging. |

##### FL Observations

At least 10 companies (Huawei, HiSilicon, Interdigital, Futurewei, NEC, Lenovo, Apple, Vivo, LGE, Xiaomi, Nokia, NSB) showed interest in discussing some terminology to facilitate the discussion. Based on this, the following section & proposal is initiated:

## Terminology Alignment

The following proposals were made with regards to the terminology:

|  |  |
| --- | --- |
| Nokia | * **Target UE:** UE to be positioned (in this context, using SL, i.e. PC5 interface).   Note: We prefer to use a simpler definition than the one provided in 3GPP TR 23.700-86 [2].   * **Anchor UE (or Supporting UE):** UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.   Note: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.  Note: In [2], the terms called “Reference UE” and “Assistant UE” are defined. From the RAN perspective, we see that the naming “Reference UE” might create confusion with the Positioning Reference Unit (PRU) introduced in Rel. 17. Second, we see that the defined roles for “Reference UE” and “Assistant UE” in [2] are interchangeable, and see no need to define such types of UEs separately.   * **Sidelink positioning:** Positioning UE using reference signals transmitted over SL, i.e., PC5 interface, to obtain absolute position, relative position, or ranging information.   Note: In [2], the definition of “sidelink positioning” is not logically connected to absolute/relative positioning or ranging over SL. We propose to have “sidelink positioning” as a collective term that covers all, so as not to list them every time separately and explicitly.   * **Ranging:** determination of the distance and/or the direction between a UE and another entity, e.g., anchor UE.   Note: While relative positioning information refers to relative coordinates of a UE with respect to another entity, ranging information refers to only the distance and/or angle between them.  Note: In [2], ranging definition also covers relative positioning. However, we see these terms differently as captured in the Note above.   * **Sidelink positioning reference signal (SL PRS):** reference signal transmitted over SL for positioning purposes. * **SL PRS (pre-)configuration:** (pre-)configured parameters of SL PRS such as time-frequency resources including its bandwidth and periodicity. The (pre-)configuration information provided to UEs can be part of an “assistance data for SL positioning”. |
| Lenovo | * **Initiator UE:** A UE that initiates/triggers a SL positioning/ranging session * **Responder UE:** A UE that responds to a SL positioning/ranging session from an initiator UE.   An initiating UE may not necessarily be an anchor UE, while positioning measurements can be performed either at the Initiating UE and/or Responding UE as in the case with e.g., double-sided RTT. |
| LGE | * **Ranging:** determination of the distance ~~and/~~or the direction between a UE and another entity, e.g., anchor UE.   Note: While relative positioning information refers to relative coordinates of a UE with respect to another entity, ranging information refers to only the distance ~~and/~~or angle between them. |
| InterDigital | * “anchor UE” as the UE who transmit PRS to or receive PRS from the “target UE” whose position is to be determined |

Companies are encouraged to provide their support or not support (or suggested modifications) on the following Terminology:

##### [CLOSED] Feature Lead Proposal 8.1-v0

For the purpose of RAN1 discussion during this stuty item, the following terminology is used:

* **Target UE:** UE to be positioned (in this context, using SL, i.e. PC5 interface).
* **Anchor UE (or Supporting UE):** UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.
  + Note: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.
* **Sidelink positioning:** Positioning UE using reference signals transmitted over SL, i.e., PC5 interface, to obtain absolute position, relative position, or ranging information.
* **Ranging:** 
  + Option 1: determination of the distance and/or the direction between a UE and another entity, e.g., anchor UE.
  + Option 2: determination of the distance or the direction between a UE and another entity, e.g., anchor UE.
* **Sidelink positioning reference signal (SL PRS):** reference signal transmitted over SL for positioning purposes.
* **SL PRS (pre-)configuration:** (pre-)configured parameters of SL PRS such as time-frequency resources including its bandwidth and periodicity. The (pre-)configuration information provided to UEs can be part of an “assistance data for SL positioning”.
* **Initiator UE:** A UE that initiates/triggers a SL positioning/ranging session
* **Responder UE:** A UE that responds to a SL positioning/ranging session from an initiator UE.

##### Companies views

|  |  |
| --- | --- |
| vivo | We’d like to get clarification on the last two terms: **Initiator and Responder UE.** It’s not clear to us how these two will affect the PHY SL-PRS aspects? If they are for higher layerprotocol and procedure, shouldn’t it be up to other WGs? |
| Samsung | We have similar view as vivo |
| LGE | We support option 2 for the terminology ‘Ranging’ to avoid confusion with ‘Relative distance’ as commented in the previous round.  In addition, when the intiator UE requests SL positioning to other UEs and the responder UEs accepts the request, those UEs that participate in the SL positioning can be grouped into a SL positioning group. This terminology may be useful for e.g. SL TDOA or SL multi-RTT to differentiate the UEs of interest for SL positioning from other non-relevant UEs. We propose to add the following.   * **Sidelink positioning group:** A group of UEs that particiapte in the same SL positioning. |
| Xiaomi | For ranging, option 1 is preferred. Even if “and” is included, ranging and relative positioinig are different at least from evaluation perspective. If ranging is considered, the distance accuracy and/or angle accuracy needs to be evaluated; while for relative positioning, only horizontal position accuracy needs to be evaluated. |
| NEC | Maybe the last three definitions are not needed. |
| Nokia, NSB | For ranging, we prefer option 1 because   * It is aligned with SA1 definition * Option 2 is ambiguous, since “or” can mean either inclusive or (hence same as Option 1) or exclusive or (either one or the other, but not both) |
| Lenovo | Support, also prefer Option 1. Normally in the context of SL, we refer to the TX UE and RX UE to disitinguish SL communication between a pair of UEs. We also understand that RAN1 impacts somewaat depends on a parallel proposal discussion on SL-PRS Configuration/ Triggering/ Activation (Proposal 4.2.5-v0) . In any case, we think there should be some sort of terminology alignment for disitinguishing relative positioning between a pair of UEs. In this case, both the Initiator and Responder UE can be both a TX and RX UEs at a given time within the same SL positioning session. |
| Huawei, HiSilicon | We think that initiator UE/responder UE needs further discussion, which is out of RAN1 scope.  On the anchor UE, the terminology is created to differentiate reference UE defined in SA2.  We would suggest to add the following Note:   * **Anchor UE (or Supporting UE):** UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.   + In the context of ranging, the anchor UE is the same as the reference UE.   + Note: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session. |
| ZTE | We agree with vivo’s understanding. The initiator UE/responder UE should not be defined by RAN1.  For the definition of Ranging, we should refer to TS 22.261 as follows:   |  | | --- | | **Ranging**: refers to the determination of the distance between two UEs and/or the direction of one UE from the other one via direct device connection. | |
| Qualcomm | OK |
|  |  |

##### FL Observations

With regards to Option 1 & 2 for ranging:

* Option 1
  + Xiaomi, Lenovo, Nokia, NSB, ZTE
* Option 2
  + LGE

Based on all the comments, we make the following updates:

##### [HIGH][OPEN] Feature Lead Proposal 8.1-v1

For the purpose of RAN1 discussion during this study item, the following terminology is used:

* **Target UE:** UE to be positioned (in this context, using SL, i.e. PC5 interface).
* **Anchor UE (or Supporting UE):** UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.
  + [In the context of ranging, the anchor UE is the same as the reference UE.]
  + Note: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.
* **Sidelink positioning:** Positioning UE using reference signals transmitted over SL, i.e., PC5 interface, to obtain absolute position, relative position, or ranging information.
* **Ranging:** 
  + Option 1: determination of the distance and/or the direction between a UE and another entity, e.g., anchor UE.
  + ~~Option 2: determination of the distance or the direction between a UE and another entity, e.g., anchor UE.~~
* **Sidelink positioning reference signal (SL PRS):** reference signal transmitted over SL for positioning purposes.
* **SL PRS (pre-)configuration:** (pre-)configured parameters of SL PRS such as time-frequency resources including its bandwidth and periodicity. The (pre-)configuration information provided to UEs can be part of an “assistance data for SL positioning”.
* FFS: **Initiator UE:** A UE that initiates/triggers a SL positioning/ranging session
* FFS: **Responder UE:** A UE that responds to a SL positioning/ranging session from an initiator UE.
* **[Sidelink positioning group:** A group of UEs that particiapte in the same SL positioning.]

Companies are encouraged to comment whether they want to keep the text in brackets, and/or the text in FFS (or fully remove them).

##### Companies views

|  |  |
| --- | --- |
| ZTE | We prefer to fully remove the text in FFS and the text in brackets. But we are open to further discuss. |
| OPPO | Prefer to remove the FFS and the text in brackets, if the terminologies are used by companies in the future, we think it is not difficult to describe what the terminology mean. |
| Fraunhofer | Okay with the proposal |
| LGE | We can accept the proposal with keeping the text in bracket as a compromise for progress. |
| Xiaomi | We are fine with the proposal. We prefer to remove the FFS and sentence in blanket as they are highly related to the detailed positioning procedure. We can agree on additional terminology when necessary. |
| vivo | As we commented before, we don’t support the last three bullets because not only they are not relevant to RAN1 discussion but also the definition of “the same SL positioning” is not clear to us. |
| NEC | For SL PRS (pre-)configuration, the second sentence is not needed since it is not definition but nore related to signaling and procedures. The last bullet point should also be FFS since we are not sure that we need such group now. |
| Lenovo | Supportive, of the FL’s proposal. We are ok to keep the FFS bullets as an ongoing FFS and companies are welcome to rephrase the concepts as required in future meetings. On SL positioning group suggest following revision: **[Sidelink positioning group:** A group of UEs that ~~participate~~ participate in the same SL positioning session.] |
| InterDigital | We are okay with the proposal. It appears that Proposal 4 from our contribution was not captured in 8.1 so we have added our proposal in the table, with tracked changes. |
| Futurewei | We support . Sidelink positioning group definitions requires more discussions. For instance, is the “group” of two UEs (ranging) a sidelink positioning group? What is the relation between a sidelink prosioning group and multicast? We prefer to postpone this discussion until we clarify when and why such group is necessary. |
| Intel | Support keeping the last bullet:   * **[Sidelink positioning group:** A group of UEs that particiapte in the same SL positioning.] |
| Qualcomm | Generally OK. Is there a “session” missing at the end of sidelink positioning group? |
| Samsung | We suggest remove last bullet “**Sidelink positioning group**”. No need to add this now |
| Apple | We are fine with keeping the last bullet.  On the text in the red brackets, need to define the “reference UE” (or identify where the definition came from). |
| Sharp | OK. But we think it is just definition for the RAN1 discussion and no need to put “FFS:”.  If some companies don’t see the need of some of the above terms, they can just ignore those terms. |
| DCM | We prefer to keep the FFS bullets. Further discussion can be done in future meeting. |
| Nokia, NSB | OK with Lenovo’s correction |
| Ericsson | Under sidelink positioning, we suggest to add the following note:  Note: Additional signals or measurements performed over Uu could be included as part of the positioning event  We suggest to remove the following bullet:   * **~~[Sidelink positioning group:~~** ~~A group of UEs that particiapte in the same SL positioning.]~~ |

##### FL Observations

* At least the following companies do not prefer to agree on the terminology in brackets/FFS (ZTE, OPPO, vivo, Xiaomi).
* At least the following companies are OK with keeping the sentences in brackets / FFS (Lenovo, LGE, NTT DOCOMO, Fraunhofer, Interdigital)
* At least 4 companies noted that there needs to be more discussion on the “Sidelink Positioning Group” (Ericsson, Samsung, Futurewei, NEC), and at least 1 company wants to keep it.
* NEC prefers to remove the 2nd sentence of the SL PRS (pre-)configuration
* Apple points that “reference UE” definition is missing from this list.

I think a way forward is to keep the terminology for the first 6 terms that seem to be agreeable, and add a Note that further terminology clarification may be possible as we move forward, together with the examples of terminology that was considered in the previous proposal. That way, at least we capture some progress on this, and continue further.

##### [CLOSED] Feature Lead Proposal 8.1-v2

For the purpose of RAN1 discussion during this study item, at least the following terminology is used:

* **Target UE:** UE to be positioned (in this context, using SL, i.e. PC5 interface).
* **Anchor UE (or Supporting UE):** UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.
  + Note: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.
* **Sidelink positioning:** Positioning UE using reference signals transmitted over SL, i.e., PC5 interface, to obtain absolute position, relative position, or ranging information.
* **Ranging:** 
  + Option 1: determination of the distance and/or the direction between a UE and another entity, e.g., anchor UE.
* **Sidelink positioning reference signal (SL PRS):** reference signal transmitted over SL for positioning purposes.
* **SL PRS (pre-)configuration:** (pre-)configured parameters of SL PRS such as time-frequency resources including its bandwidth and periodicity.
* Continue discussion on additional terminology clarification(s) such as: Initiator UE, Responder UE, Sidelink Positioning group, reference UE, etc, including whether such terminology is needed within RAN1 discussion.

##### Companies views

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| --- | --- |
| InterDigital | We are okay with the proposal. |
| Futurewei | Support |
| CMCC | Support |
| vivo | OK |
| Intel | OK |
| ZTE | OK. |
| CATT | For Anchor UE, its location coordinates should be known.  So we prefer the revsion of Anchor UE part as follows (Changes in Blue),   * **Anchor UE (or Supporting UE):** UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.   + Note1: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.   + Note2: The location coordinates of anchor UE should be known. |
| DCM | OK |
| LGE | Support except Note.  The proposal is about the terminology for efficient discussions afterwards. But the note is about the operation rather than terminology, which can be decided in a separate proposal after agreeing on the terminology itself. We suggest to remove the note.   * **Anchor UE (or Supporting UE):** UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.   + ~~Note: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.~~ |
| Lenovo | Just spotted a potential issue with the Note under the Anchor UE (Supporting UE) definition, which may cause confusion (as CATT and LGE hinted). The note is ambiguous as it reads, since the Target UE is supposed to be positioned and yet at the same time it can switch to an anchor UE role (which is already assumed to have a fixed/known location) or vice versa. We tend to believe that the anchor/supporting UEs know their locations beforehand and therefore may not be a target UE and anchor UE at the same or switch to being a target UE. The note may therefore be removed.  We also think that similar to the anchor UE, the target UE may transmit and receive SL-PRS. Suggest adding the following statement for the Target UE: “The target UE may also transmit and/or receive reference signals for positioning and/or providing positioning-related information, etc., over the SL interface”  Also one additional missing point is the definition of the configuration and positioning calculation entities, which may be different depending on the coverage scenario and resource allocation scheme (e.g. Mode 1 or Mode 2). This could be added as another discussion point on the last bullet (in green text).  Otherwise fine with remaining aspects of the proposal text. |
| NEC | ‘Option 1’ under ranging can be removed. The last bullet sounds more like a guidance on how to further develop the terminology set, which says something obvious. We suggest to remove it. |
| Sharp | OK |
| OPPO | Share similar view as LGE and Lenovo, the note under Anchor UE should be removed, we are fine with other terminologies. |
| Samsung | OK |
| Bosch | OK |
| Xiaomi | Support |
| Huawei, HiSilicon | We do not support the Note2 added by CATT, which is exactly the reason that we want to add “reference UE” in the previous round.  It should be clear when relative positioning between two UEs is performed, the ground truth location of either UE does not need to be known.  We prefer to revise the Note2 from CATT   * + Note1: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.   + Note2: The location coordinates of anchor UE may or may not be known. |
| Qualcomm | We are generally OK and propose to add “other parameters are not precluded” to SL PRS (pre-)configuration. |
| Nokia, NSB | OK, but   * remove ‘Option 1’ under Ranging and simply define “**Ranging:** determination of the distance and/or the direction between a UE and another entity, e.g., anchor UE.”   The Note about switching roles is controversial and can be removed for now, since it is anyway not really part of the definition itself. This Note is presumably based on the following Note in TR 23.700-86: “NOTE 2: Any UE participating in the Ranging/Sidelink Positioning can be both a Target UE and a Reference UE and can switch roles in the same Ranging/Sidelink Positioning session.” The crucial difference however is the use of “Reference UE” instead of “Anchor UE”; for a Reference UE there is no expectation of known absolute position, so this symmetry of roles makes sense; for an Anchor UE on the other hand, this role switching seems problematic. |

##### FL Observations

Support current proposal

* Interdigital, Futurewei, CMCC, vivo, Intel, ZTE, DCM, Lenovo, Sharp, Samsung, Bosch, Xiaomi

Remove the Note from “Anchor UE”

* LGE, OPPO, Lenovo

LGE has a point that the subbulet seems to be operational-related rather than terminology. Removing it doesn’t affect the definition of the anchor.

However, the new Note that Huawei, HiSilicon suggested appears to me to be related to the definition and how an Anchor/Supporting UE can be used. Based on that, I would like to go for Email Endorsement of all the terms beyond the Anchor UE:

##### [EMAIL ENDORSEMENT] Feature Lead Proposal 8.1-v3

For the purpose of RAN1 discussion during this study item, at least the following terminology is used:

* **Target UE:** UE to be positioned (in this context, using SL, i.e. PC5 interface).
* **Sidelink positioning:** Positioning UE using reference signals transmitted over SL, i.e., PC5 interface, to obtain absolute position, relative position, or ranging information.
* **Ranging:** 
  + ~~Option 1:~~ determination of the distance and/or the direction between a UE and another entity, e.g., anchor UE.
* **Sidelink positioning reference signal (SL PRS):** reference signal transmitted over SL for positioning purposes.
* **SL PRS (pre-)configuration:** (pre-)configured parameters of SL PRS such as time-frequency resources (other parameters are not precluded) including its bandwidth and periodicity.
* Continue discussion on additional terminology clarification(s) such as: Initiator UE, Responder UE, Sidelink Positioning group, reference UE, etc, including whether such terminology is needed within RAN1 discussion.

With regards to the Anchor UE, lets continue for a Round 5:

##### [HIGH][OPEN] Feature Lead Proposal 8.1-v4

For the purpose of RAN1 discussion during this study item, at least the following terminology is used:

* **Anchor UE (or Supporting UE):** UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.
  + ~~Note: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.~~
  + Note:
    - Alt. 1: The location coordinates of anchor UE may or may not be known.
    - Alt. 2: The location coordinates of anchor UE should be known.

Companies are requested to sug

##### Companies views

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# Proposals for GTW (TBD)

This section will contain the stable proposals for discussion during online time

## GTW – 05/17/2022

The following proposals have gone through 3 rounds of Email discussion. I consider them close to stable, but we may need Online discussion, if available. Otherwise, we ll continue with Round 4.

##### [HIGH] Feature Lead Proposal 3.1-v3

With regards to the Positioning methods supported using SL measurements study further the following methods:

* + SL-RTT / SL multi-RTT
    - Study both single-sided (also known as one-way) and double-sided (also known as two-way) RTT
  + SL-AoA
    - Include both Azimuth of arrival (AoA) and zenith of arrival (ZoA) in the study
  + SL-TDOA
  + SL-AoD
    - Corresponds to a method where RSRP and/or RSPPP measurements similar to the DL-AoD method in Uu.
    - Include both Azimuth of departure (AoD) and zenith of departure (ZoD) in the study
* Consider in the study at least the following aspects:
  + Definition(s) of the corresponding SL measurements for each method
  + Which method is applicable to absolute or relative positioning or ranging, including whether such categorization is needed to be discussed.
  + For angle-based methods, antenna configuration consideration(s) using practical UE capabilities
  + Per-panel location estimation, if UE uses multiple panels.
  + UE’s mobility, especially for V2X scenarios
  + Impact of synchronization error(s) between UEs
  + Use of existing SL measurements (e.g. RSSI, RSRP), and UE ID information (e.g. destination/source IDs information, zone-ID information, other UE-ID(s)), etc, may be used.
* Note: The above categorization does not necessarily mean that there will be separate SL positioning methods specified, or whether there will be a unified SL Positioning method.

##### [HIGH] Feature Lead Proposal 3.2-v3

At least for in-coverage scenarios, study hybrid positioning methods wherein one or more of the UE(s) perform SL measurements and UE position/ranging is estimated using measurements derived on both SL and Uu positioning.

* Note: Companies are encouraged to focus their study on the solutions for standalone SL positioning, while providing information on how their solutions would enable hybrid positioning.
* Note: Uu positioning corresponds to RAT dependent methods

##### [HIGH]Feature Lead Proposal 4.2.1-v3

Study new reference signal for SL positioning/ranging using the existing PRS/SRS design and SL design framework as a starting point.

* The study could at least include: Sequence design, frequency domain pattern, time domain pattern (e.g. number of symbols, repetitions, etc), time domain behavior, configuration/triggering/activation/de-activation of the SL-PRS, AGC time, Tx-Rx Turanround time, supportable bandwidth(s), multiplexing options with other SL channels, randomization/orthogonalization options.
* Note: The study of existing SL reference signal for SL positioning/ranging is not precluded. Companies are encouraged to perform performance evaluation/comparison to investigate whether such reference signals can meet the positioning accuracy requirements.

##### [HIGH]Feature Lead Proposal 4.2.2-v3

Study further both the following options with regards to the sequence design for a potential SL Positioning Reference Signal:

* Option 1: ZC-based design, (e.g. similar to the sequences used for NR SRS)
* Option 2: Pseudorandom sequence (e.g. Gold sequence signals, similar to DL-PRS, or SL-CSI-RS).
* Note 1: Companies are encouraged to consider at least the following aspects in their study: Benefit of PAPR aspects, high mobility, commonality with other SL-RS, performance evaluation(s)
* Note 2: RAN1 shall strive to downselect one of the options

##### [HIGH] Feature Lead Proposal 4.2.3-v3

With regards to the frequency domain pattern, study further a Comb-N SL-PRS design. Study at least the following aspects:

* N>=1 (where N=1 corresponds to full RE mapping pattern)
* Fully staggered SL-PRS pattern (e.g., N symbols of SL-PRS with comb-N and, at each symbol a different RE offset is used), Partially staggered SL-PRS pattern (e.g., N symbol(s) of SL-PRS with comb-M, with M>N, at each symbol a different RE offset is used), Unstaggered SL-PRS patterns (e.g., N symbol(s) of SL-PRS with comb-M, at each symbol a same RE offset is used, M> 1)
* The number of symbols of SL-PRS within a slot, any relation to the comb-N option, RE offset repetitions within a slot

##### [HIGH]Feature Lead Proposal 4.2.6-v3

For a potential new SL PRS structure should include time for AGC training and Rx-Tx turnaround time if needed.

* Study the details, including at least: number of symbol(s) for AGC and Rx-Tx turnaround time, conditions under which these are needed.

##### [HIGH] Feature Lead Proposal 8.1-v2

For the purpose of RAN1 discussion during this study item, at least the following terminology is used:

* **Target UE:** UE to be positioned (in this context, using SL, i.e. PC5 interface).
* **Anchor UE (or Supporting UE):** UE supporting positioning of target UE, e.g., by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc., over the SL interface.
  + Note: Any UE can be both target UE and anchor UE at the same time, or switch roles during a positioning session.
* **Sidelink positioning:** Positioning UE using reference signals transmitted over SL, i.e., PC5 interface, to obtain absolute position, relative position, or ranging information.
* **Ranging:** 
  + Option 1: determination of the distance and/or the direction between a UE and another entity, e.g., anchor UE.
* **Sidelink positioning reference signal (SL PRS):** reference signal transmitted over SL for positioning purposes.
* **SL PRS (pre-)configuration:** (pre-)configured parameters of SL PRS such as time-frequency resources including its bandwidth and periodicity.
* Continue discussion on additional terminology clarification(s) such as: Initiator UE, Responder UE, Sidelink Positioning group, reference UE, etc, including whether such terminology is needed within RAN1 discussion.

## GTW

##### [GTW]Feature Lead Proposal 4.2.2-v3

Study further both the following options with regards to the sequence design for a potential SL Positioning Reference Signal:

* Option 1: ZC-based design, (e.g. similar to the sequences used for NR SRS)
* Option 2: Pseudorandom sequence (e.g. Gold sequence signals, similar to DL-PRS, or SL-CSI-RS).
* Note 1: Companies are encouraged to consider at least the following aspects in their study: Benefit of PAPR aspects, high mobility, commonality with other SL-RS, performance evaluation(s)
* Note 2: RAN1 shall strive to downselect one of the options
  + Support/Accept Note as is
    - Interdigital, Futurewei, CMCC, vivo, Intel, ZTE, Spreadtrum, CATT, DCM, LGE, Lenovo, NEC, Sharp, OPPO, Samsung, Xiaomi, Sony, Huawei, HiSilicon, Nokia, NSB
  + Change the Note to “RAN1 should downselect one of the options”
    - Qualcomm

##### [GTW] Feature Lead Proposal 7.1.1-v3

* From RAN1 perspective, for in-coverage and partial coverage scenarios, RAN1 assumes that the network may be involved in the SL positioning/ranging, and/or hybrid (SL/Uu) Positioning.
* Note 1: Positioning architecture and signalling procedures are up for study in the other WGs
* Note 2: Companies are encouraged to focus their study in the in-coverage scenario first.
  + Support keeping Note 2
    - Interdigital, Futurewei, CMCC, ZTE, Spreadtrum, DCM, LGE, Lenovo, Samsung, Bosch, Qualcomm, Nokia, NSB
  + Do not include Note 2
    - NEC, OPPO

##### [GTW] Feature Lead Proposal 7.1.2-v4

* From RAN1 perspective,
  + For out of coverage scenarios, RAN1 assumes that the network is not involved in a SL positioning/ranging.
* Note: Positioning architecture and signalling procedures are up for study in the other WGs
* FFS:
  + Alt. 1: Involvement of the network in a SL positioning/ranging when when UE is connected to a cell for SL positioning it is deployed on a carrier other than the SL carrier.
    - * CATT, LGE, OPPO, Huawei, HiSilicon
  + Alt. 3: No FFS is needed
    - * Interdigital,Futurewei, CMCC, ZTE, Spreadtrum, DCM, Lenovo, Samsung, Qualcomm, Nokia, NSB

# EMAIL ENDORSEMENT

# Updated 05/18/2022 After Round 3

##### [EMAIL ENDORSEMENT] Feature Lead Proposal 3.1-v4

Include the following 2 Notes in the agreement that was made in the 9.5.1.3 subagenda during the GTW session of 05/17/2022:

* Note: When the study of carrier phase positioning and the evaluations of sidelink positioning have progressed, it can be reviewed whether carrier phase for sidelink can be considered in further work. Checkpoint at RAN1#110-e-Bis to see if sufficient information is available for this review.
* Note: Companies are encouraged to describe the role of SL nodes and their interaction/coordination participating in each method.

##### [EMAIL ENDORSEMENT]Feature Lead Proposal 4.2.7-v1

With regards to the numerologies of the SL-PRS, limit the study to those supported for NR Sidelink.

* Note 1: NR Sidelink supports {15, 30, 60 kHz} in FR1 and {60, 120 kHz} in FR2
* Note 2: This doesn’t imply that SL-PRS FR2-specific optimization(s) are expected to be studied

##### [EMAIL ENDORSEMENT]Feature Lead Proposal 6.2-v2

Deprioritize SL-PRS beam management study, until at least, SL communication for FR2 in Agenda Item 9.4 has progressed

Note: this does not preclude FR2 operation for SL positioning

# Updated 05/18/2022 After Round 4

##### [EMAIL ENDORSEMENT]Feature Lead Proposal 4.2.1-v3

Study new reference signal for SL positioning/ranging using the existing PRS/SRS design and SL design framework as a starting point.

* The study could at least include: Sequence design, frequency domain pattern, time domain pattern (e.g. number of symbols, repetitions, etc), time domain behavior, configuration/triggering/activation/de-activation of the SL-PRS, AGC time, Tx-Rx Turanround time, supportable bandwidth(s), multiplexing options with other SL channels, randomization/orthogonalization options.
* Note: The study of existing SL reference signal for SL positioning/ranging is not precluded. Companies are encouraged to perform performance evaluation/comparison to investigate whether such reference signals can meet the positioning accuracy requirements.

##### [EMAIL ENDORSEMENT]Feature Lead Proposal 4.2.5-v4

With regards to the configuration/activation/triggering of SL-PRS, study the following options:

* Option 1: High-layer-only signaling involvement in the SL-PRS configuration
  + No Lower layer involvement, e.g., SL-MAC-CE or SCI or DCI, for the activation or the triggering of a SL-PRS.
  + Based on the study, this option may correspond to
    - A SL-PRS configuration that is a single-shot or multiple shots
    - A high-layer configuration that may be received from an LMF, a gNB, or a UE
* Option 2: High-layer and lower-layer signaling involvement in the SL-PRS configuration
  + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
  + For example, high layer signaling can may be used for SL-PRS configuration and lower layer signaling can may be used for initiating SL positioning and/or configuration/triggering/activating/deactivating/indicating and potential resource indication/reservation transmission of SL-PRS.
* Option 3: Only lower-layer signaling involvement in the SL-PRS configuration
  + Lower-layer may correspond to SL-MAC-CE, or SCI, or DCI
* Note 1: Include aspects in the study related to flexibility, overhead, latency, and reliability as/if needed.

##### [EMAIL ENDORSEMENT] Feature Lead Proposal 7.2-v3

With regards to the Sidelink Positioning measurement report,

* Study the contents of the measurement report (e.g. time stamp(s), quality metric(s), ID(s), angular/timing/power measurements, etc)
* Study the time domain behavior of the measurement report (e.g. one-shot, triggered, aperiodic, semi-persistent, periodic)
* FFS whether the Sidelink Positioning measurement can be a high-layer report and/or a lower layer report.

##### [EMAIL ENDORSEMENT] Feature Lead Proposal 8.1-v3

For the purpose of RAN1 discussion during this study item, at least the following terminology is used:

* **Target UE:** UE to be positioned (in this context, using SL, i.e. PC5 interface).
* **Sidelink positioning:** Positioning UE using reference signals transmitted over SL, i.e., PC5 interface, to obtain absolute position, relative position, or ranging information.
* **Ranging:** 
  + ~~Option 1:~~ determination of the distance and/or the direction between a UE and another entity, e.g., anchor UE.
* **Sidelink positioning reference signal (SL PRS):** reference signal transmitted over SL for positioning purposes.
* **SL PRS (pre-)configuration:** (pre-)configured parameters of SL PRS such as time-frequency resources (other parameters are not precluded) including its bandwidth and periodicity.
* Continue discussion on additional terminology clarification(s) such as: Initiator UE, Responder UE, Sidelink Positioning group, reference UE, etc, including whether such terminology is needed within RAN1 discussion.

# References

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      4. R1-2203335 Consideration on potential solutions for SL positioning Spreadtrum Communications
      5. R1-2203467 Discussion on potential solutions for SL positioning CATT, GOHIGH
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