**3GPP TSG RAN Meeting #93-e RP-21xxxx**

**Electronic Meeting, September 13 - 17, 2021**

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**Source:** LG Electronics (moderator)

**Title:** Email discussion [93e-10-SL-Positioning-TR] on Study on scenarios and requirements of in-coverage, partial coverage, and out-of-coverage NR positioning use cases

**Document for:** Report

# **Introduction**

This contribution summarizes the email discussion [93e-10-SL-Positioning-TR] on “Study on scenarios and requirements of in-coverage, partial coverage, and out-of-coverage NR positioning use cases.” Input contributions covered: RP-211808, 2004, 2022, 2036, 2037, 2105, 2131, 2132, 2410, 2498, 2460, 2038, 2035.

# **Discussion: Initial round**

2.1. Changes for “5.1 Network coverage”

Q1: [RP-211808, OPPO] proposed to remove the TS 38.304 reference of in-coverage definition as this definition is made in a carrier specific manner.

Please provide your view on this.

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| Company | Comment |
| LGE | Okay with the proposal. |
| Xiaomi | ok |
| Futurewei | ok |
| Qualcomm | Fine with the proposal, as it is good to clarify the coverage terminology (which is different for communication vs. positioning).  |
| CATT | Support |
| OPPO | Proponent |
| Intel  | OK to remove reference |
| Nokia | Not sure why we need to remove reference to 38.304 for a definition of “in-coverage”. Even with the quoted text from TS 23.287, this definition in 38.304 still holds true. We prefer not to re-open discussions on what is the definition of “in-coverage”. |

Q2: One FFS in the editor’s note is about “the need for transitions between coverage states.” [RP-212004, Intel] proposed to clarify that network coverage scenarios may change in time. Similarly, [RP-212131, Huawei] proposed to capture that there are operation scenarios in V2X and PS that need to support transitions between different coverage states.

Please provide your view on this.

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| Company | Comment |
| LGE | We support the wording proposed by Intel. |
| Xiaomi | Agree with the wording by intel |
| Futurewei | Support |
| Qualcomm | It is fine to capture that V2X and PubS have scenarios where the UE may change coverage states. However, there should be some clarification regarding the requirements derived from such scenarios, i.e. they need a positioning mechanism that works in all coverage states.  |
| CATT | Okay to add “A UE may transition between in-coverage, partial coverage and out-of-coverage scenarios”, as proposed by Intel. |
| OPPO | We are generally fine with the wording proposed by Intel, yet wondering if the following update would be needed“~~A~~ The at least two UEs may transit~~ion~~ between in-coverage, partial coverage and out-of-coverage scenarios.”Since it is a bit misleading to talk about “partial coverage” for a single UE, considering partial coverage is defined as “Partial coverage means that one UE remains inside the network coverage but the other UE is outside the network coverage.” |
| Intel  | OK with RP-212004 |
| Nokia | Agree to capture the transition between coverage states but the actual text proposal needs further discussion. If Intel text proposal is considered, our suggestion is to reword “measurements” to make it “assistance” to make it more generic.In the Intel text proposal, the deleted editor note covered solutions where one interface can assist another for the solution, but the proposed new text takes away this mention of “assistance”. The existing text only talks from the perspective of measurements. |

Q3: [RP-212036, LGE], [RP-212410, ZTE], [RP-212460, Lenovo] proposed to add a figure illustrating the three coverage scenarios.

Please provide your view on this.

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| Company | Comment |
| LGE | Support. We prefer the figure in RP-212036 as the others used vehicles as UEs and thus may not be suitable in covering non-vehicle operation scenarios. |
| Xiaomi | Agree to add the figure in 212036 |
| Futurewei | Support |
| CATT | Support. We prefer the figure in RP-212036. |
| OPPO | We are fine with the figure in 2036, with the revision of “PC-5” to “PC5”. |
| Intel  | Agree. Figures in RP-212036 are preferred. |
| Nokia | Agree to add a figure illustrating the three coverage scenarios. Prefer the figure in RP-212036. |

Q4: [RP-212131, Huawei] proposed to add that some V2X and public safety use cases require to be in network coverage while some other use cases are independent of the network coverage. It also proposed to add that there are scenarios operating with no network and GNSS coverage.

Please provide your view on this.

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| Company | Comment |
| LGE | Support in general. But we don’t want to specify which use cases require network coverage as this may lead to solution-level discussions not for the positioning but for the data communication. So we prefer simple clarification that there are V2X and public safety use cases that require positioning with no network and GNSS coverage. |
| Xiaomi | Ok to add this clarification |
| Futurewei | Ok with it |
| Qualcomm | Agree with LGE. |
| CATT | Partial agree. For the network coverage scenarios, we think it has already captured by the in-coverage, partial coverage and out-of-coverage and transition between coverage states (in Q2), no need to further clarify.We support to include the clarification on operating with/without GNSS coverage. |
| OPPO | We are fine to add clarification like: There are V2X and public safety use cases that require positioning when there is no network coverage (and GNSS coverage). |
| Intel  | Clarification is needed. Original proposal seems refer to communication use cases while TR is about positioning. Suggestion from LGE looks reasonable. |
| Nokia | Agree with LGE. Adding some text without example use cases is fine. Note that 22.872 is already referenced in TR 38.845 and so PS use case is already covered. So, is V2X use case. If any clarification about dependencies to network coverage is required, then it should be captured under the respective use case in Section 4.2 and 4.3. |

Q5: [RP-212498, Ericsson] proposed to capture that the description of the partial coverage scenario needs to include whether GNSS is available and whether autonomous network deployment or coverage extension is possible.

Please provide your view on this.

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| Company | Comment |
| LGE | Not support. The coverage extension mentioned in RP-212498 is considered as a part of network coverage so we understand the current network coverage description already covers the cases in the proposal. The text discussed in Q4 is enough to deal with the GNSS coverage. |
| Xiaomi | Not agree, covered by Q4 |
| Futurewei | Do not support. Same understanding as LGE. |
| Qualcomm | This is also related to the Q1 regarding the coverage definition. It should be clarified regarding the "coverage" is referring to communication or positioning. Additionally, the autonomous network deployment or coverage extension does not necessarily provide positioning coverage. Therefore, we do not support the proposal.  |
| CATT | Our understanding is that use cases clearly cover different network coverage with/without GNSS coverage. We are fine to include the descriptions of the autonomous network deployment and Coverage extension scenarios. |
| OPPO | Same view as LGE, i.e., autonomous network deployment or coverage extension are in-coverage scenario. |
| Intel  | OK to clarify that partial coverage scenario may or may not have GNSS available. |
| Nokia | The autonomous network deployment is about on-demand network coverage through private network deployment or base stations on wheels while the GNSS availability is about GNSS coverage as opposed to cellular network coverage. Both aspects are covered by “in-coverage” scenarios. We can consider some clarifications to these aspects as part of network coverage in the TR. |

Q6: If you think other changes are necessary for this sub-section, please specify them.

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2.2. Changes for “5.2 Radio link”

Q1: One FFS in the editor’s note is about “RAT independent positioning.”

[RP-212004, Intel], [RP-212036, LGE], [RP-212410, ZTE], [RP-212498, Ericsson] proposed to add RAT independent positioning (e.g., GNSS, sensors, etc.) which can complement RAT dependent positioning.

Please provide your view on this.

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| Company | Comment |
| LGE | We support the text proposal in RP-212004 or RP-212036. |
| Xiaomi | We are ok with intel’s proposal |
| Futurewei | Support |
| Qualcomm | It is fine to add the description.  |
| CATT | We support the text proposal in RP-212004. |
| OPPO | We support the TP in 2036 (not quite sure if there is a need to describe hybrid RAT (in)dependent solution as in 2004) |
| Intel  | Prefer TP in RP-212004 |
| Nokia | We are OK to capture the support for RAT-independent positioning. However, the use of hybrid RAT-dependent and RAT-independent has always been allowed for implementations and so there is nothing new that needs to be said about it. The TP in RP-212036 is preferred. |

Q2: [RP-212131, Huawei] proposed to include that a Uu-based solution consists of UL and/or DL positioning and a PC5-based solution consists of SL positioning.

Please provide your view on this.

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| Company | Comment |
| LGE | Support in general. We prefer a simple general clarification that Uu interface uses UL and/or DL and PC5 interface uses sidelink. |
| Xiaomi | No need for this clarification |
| Futurewei | Prefer not to add wording wrt ‘solution’. So, LGE proposal is ok.  |
| Qualcomm | Agree with LGE.  |
| CATT | Support. A hybrid solution consists of SL positioning and UL and/or DL positioning. |
| OPPO | The only point to add seems to be that Uu-positioning includes both UL and DL (we do not think there is any ambiguity on PC5/SL), which is fine for us, although it seems clear enough already. |
| Intel | No strong preference. Details can be discussed during design framework; we do not see the strong motivation behind proposal at this stage. |
| Nokia | The current text in Section 5.2 about the definition of Uu-based solution and PC5-based solution already allows the possibilities covered by the proposal in RP-212131. We think the currently level of details in the TR is sufficient and such details about UL and/or DL and SL positioning can be addressed in the solution discussion phase. |

Q3: [RP-212410, ZTE] proposed to capture that, in the context of “Uu based solution with assistance of PC5 interface and PC5 based solution with assistance of Uu interface,” PC5 interface can forward the Uu based positioning measurement and vice versa.

Please provide your view on this.

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| Company | Comment |
| LGE | We don’t think the wording “Uu based solution with assistance of PC5 interface and PC5 based solution with assistance of Uu interface” is necessary. We can clarify that the measurement can be sent to the positioning calculation entity using Uu or PC5 interface. This wording can be merged to the text to be discussed Q1 for 5.3 Positioning calculation entity. |
| Xiaomi | Unclear to us |
| Futurewei | Same comment as Q2 above. |
| Qualcomm | The intention of the proposal is unclear. If this is trying to clarify the which entity makes the positioning calculation, it should be placed into the corresponding clauses, and describe what are the possible interfaces used for the information transfer. If this is trying to clarify which radio interface is used for positioning signal measurements, the above description seems to create more confusion. It should rather just simply clarify that Uu and/or PC5 may be used for positioning measurements, and that can be independent from the measurements results transfer.  |
| CATT | It seems we may need to consider whether to use the terms of “Uu-based solution” and “PC5-based solution”. We have already defined UE-based and network-based solutions, where ‘UE’ and ‘network’ refer to the network entities where the position is calculated, but Uu and PC5 are not network entities, but interfaces.  |
| OPPO | Same view as LGE. |
| Intel  | Prefer to discuss based on concrete TP. The ‘assistance’ wording is confusing. It seems the intention is to clarify that sidelink measurements can be sent over Uu air-interface and DL/UL measurements over PC5 interface, which is OK in principle. |
| Nokia | We support it. See our comments to Q2. We prefer to make the text generic by changing “measurements” to “assistance”. |

Q4: If you think other changes are necessary for this sub-section, please specify them.

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2.3. Changes for “5.3 Positioning Calculation Entity”

Q1: [RP-212131, Huawei] proposed to mention that, for UE based positioning, the UE may receive necessary information from another UE or the network for the positioning calculation at the UE, at least for SL positioning.

Please provide your view on this.

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| Company | Comment |
| LGE | We can simply say that necessary information for positioning, including the measurement, can be sent using Uu or PC5 interface. |
| Xiaomi | Ok with the proposal |
| Qualcomm | Given that this clause is about "calculation entity", the following should be captured:"The UE can be the calculation entity for SL positioning, with information received from other UEs or network via PC5 or Uu interface."  |
| CATT | Huawei’s proposal is fine to us. |
| OPPO | The simplified wording suggested by LGE is fine for us. In general, this clarification seems to go into detailed solution level rather than requirement, would be good to rely on further WG work to down-select between the options. |
| Intel  | OK in principle |
| Nokia | The definitions of network-based and UE-based in Section 5.3 is clear. The additional involvement of SL in positioning and how it impacts the existing terminologies of network-based and UE-based positioning can be discussed in the solutions phase. However, through generalization of text under Radio Link section, this involvement of SL involvement can be covered. |

Q2: [RP-212131, Huawei] proposed to capture that positioning with SL measurements can be done at the network or at a UE.

Please provide your view on this.

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| Company | Comment |
| LGE | We don’t think this is strictly necessary because there is no limitation in using PC5-based solution under the architecture of network-based and UE-based positioning. The same understanding applies to Uu-based solution. |
| Xiaomi | Not need for the clarification |
| Futurewei | Not seeing this as important clarification at this time |
| Qualcomm | It should be clarified that for the calculation at the network option, it only applies to cases where UEs are in network (communication) coverage.  |
| CATT | We are fine to clarify that both network based SL positioning and UE based SL positioning are supported with SL measurements as suggested by Huawei. We also agree with QC’s comments. |
| OPPO | We do not see the need of this clarification, due to similar reason as replied to Q1 above. |
| Intel  | In general case, all DL/UL/SL measurements can be used for UE or NW based positioning. Whether to enable this and which measurements can be transferred over Uu and PC5 interface is a solution space that can discussed at a later stage. |
| Nokia | This level of solution details can be addressed during the solutions phase. These are not precluded in our understanding. |

Q3: [RP-212410, ZTE] proposed to add that the network based architecture is preferred for in-coverage scenario and UE based architecture is suitable for out-coverage scenario.

Please provide your view on this.

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| Company | Comment |
| LGE | Not support. The issue of which solution is better needs to be discussed in a WG-level study. |
| Xiaomi | Can be discussed in WG level study |
| Futurewei | Cant agree with such conclusive wordings. |
| Qualcomm | This is not acceptable. Similarly, the definition of "in-coverage" is unclear here. Even if this means that the UE is in communication coverage, it does not always be beneficial to use network-based architecture, as it depends on the solution and use cases. Agree with LGE that such discussion should happen when the exact positioning solution is designed and reviewed at WG level.  |
| CATT | We assume which architecture is preferred is implementation dependent. |
| OPPO | We do not see the need of this clarification, due to similar reason as replied to Q1 above. |
| Intel  | Both options are possible. There is no objective to discuss/conclude on which option is more suitable.  |
| Nokia | Agree with LGE and Xiaomi |

Q4: If you think other changes are necessary for this sub-section, please specify them.

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2.4. Changes for “5.4 UE types”

Q1: Several contributions made proposals on the power consumption aspect.

* [RP-212004, Intel], [RP- 212022, vivo], [RP-212036, LGE], [RP-212460, Lenovo] proposed to add that a UE installed in a device of VRU may have more limited battery capacity. In addition, [RP- 212022, vivo] proposed to add a requirement that sidelink positioning for VRU type of devices should not impact the duration of VRU type of device by more than [5]%.
* [RP- 212022, vivo], [RP-212460, Lenovo] proposed to add that UEs in public safety use case are battery limited.

Please provide your view on this.

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| Company | Comment |
| LGE | Support. The TR needs to capture that some UEs in VRU and public safety may have limited battery and/or processing capability. But we don’t think there is a concrete numerical requirement on the power saving aspect, so capturing some quantitative requirement is not preferred. |
| Xiaomi | Agree to add battery limited UEs |
| Qualcomm | It is potentially useful to identify the different types of UEs that may make use of positioning service. However, it is impossible to place any definite requirements based on that. Therefore, we cannot agree with the proposal in RP- 212022. In general, there can be high level descriptions on the UE types, and clarify that while some UEs, and the positioning mechanisms need to take these into account and accommodate the differences.  |
| CATT | We are in general fine to add that a UE of a VRU may be more limited battery capacity comparing to UE installed in a vehicle or a road side unit. |
| vivo | Support to differentiate the UE types. |
| OPPO | Same view as LGE that a generalized sentence like, a UE installed in a device of VRU or a UE in public safety use are battery limited. |
| Intel  | Support w/o mentioning any explicit requirement |
| Nokia | OK to capture that different UE types may have different power profiles i.e. different battery capacity. Any specific requirements and bands assumed will need further discussion. |

Q2: [RP- 212022, vivo], [RP-212036, LGE], [RP-212131, Huawei] proposed to reference the antenna configuration and panel distribution in TR 37.885 as an example of a distributed antenna system.

Please provide your view on this.

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| Company | Comment |
| LGE | Support. We can simply give a reference to 37.885 as in RP-212036 since this is for the evaluation purpose and the detailed information can be found there. |
| Xiaomi | Agree to simply add a reference to 37.885 |
| CATT | Support. |
| vivo | Support. |
| OPPO | Agree to simply add a reference to 37.885 |
| Intel  | In our view this is a part of evaluation methodology assumption and discussion. It is OK to add reference. |
| Nokia | This level of details about reference antenna configuration can be discussed during the solutions evaluation phase. |

Q3: [RP- 212022, vivo] proposed to reference the UE antenna configurations for 700MHz in TR38.802 as an example of UE antenna in public safety use cases.

Please provide your view on this.

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| Company | Comment |
| LGE | No strong view but we think such detailed antenna configuration can be discussed in WGs, e.g., as a part of evaluation methodology. |
| Xiaomi | Agree to add the referece of 38.802 |
| Qualcomm | Agree with LGE and this level of details should not be added now with WG level discussions.  |
| CATT | We share the similar view as LGE that detailed antenna configuration can be discussed in WGs. |
| vivo | Support to clarify this in the deployment scenarios. |
| OPPO | Agree to simply add a reference to 38.802 |
| Intel | In our view this is a part of evaluation methodology assumption and discussion. It is OK to add reference. |
| Nokia | This level of details about reference antenna configuration can be discussed during the solutions evaluation phase. |

Q4: [RP-212036, LGE] proposed to add that some UEs may be capable of transmissions with higher power such as Power class 1 in public safety use cases.

Please provide your view on this.

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| Company | Comment |
| LGE | Support. |
| Xiaomi | Agree |
| CATT | We stick to the existing UE Power Class definition for public safety scenario, i.e. The UE power class 1 requirements for Band n14 are applicable for public safety scenario only (please see Table 6.2.1-1: UE Power Class in 38.101-1). If more bands are expected for power class 1, RAN4 study work should be involved at first. |
| OPPO | We are not quite sure if this needs to be captured as requirement or maybe better to leave it as a factor to be considered during solution discussion in WG level. |
| Nokia | See comments to Q1 under Section 2.4 above. For now it is sufficient to capture that different UE types may have different power profiles i.e. different battery capacity. Any specific requirements and bands assumed will need further discussion. |

Q5: If you think other changes are necessary for this sub-section, please specify them.

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2.5. Changes for “5.5 Spectrum”

Q1: [RP-212004, Intel] proposed to clarify that the spectrum currently captured for V2X use case can be considered for both Uu and PC5 interfaces.

Please provide your view on this.

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| Company | Comment |
| LGE | Okay. |
| Xiaomi | agree |
| Futurewei | Support |
| Qualcomm | Support to capture these.  |
| CATT | We would like to understand what it means by “spectrum currently captured for V2X use case can be considered for both Uu and PC5 interfaces.” We assume the spectrum for Uu interface is independent of the spectrum of V2X or PC5 interfaces. |
| vivo | Support to capture these. |
| OPPO | The addition is confusing, it reads like ITS-dedicated spectrum can be considered also for Uu interface. |
| Intel  | Support |
| Nokia | Should be driven by regulatory requirements and can be studied further in RAN4 during solutions phase. |

Q2: Several contributions made proposals on the spectrum for public safety use case.

* [RP-212004, Intel] proposed to add that licensed and unlicensed spectrum can be considered for public safety use cases.
* [RP- 212022, vivo] proposed to add that licensed spectrum can be considered for public safety use cases.

Please provide your view on this.

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| Company | Comment |
| LGE | We think licensed spectrum can be mentioned for public safety and would like to get feedback from the public safety players about the potential usage of unlicensed spectrum. |
| Xiaomi | Agree with intel’s proposal |
| Futurewei | Support |
| Qualcomm | We support the proposal to include licensed and unlicensed spectrum for public safety use cases (if the positioning mechanism supports unlicensed operation, there is no reason to not use it for Public Safety cases) |
| CATT | Share a similar view as LGE. We like to understand from public safety players on which spectrum should be considered. |
| OPPO | Same view as LGE, the usage of unlicensed spectrum for PS use case needs to be evaluated. |
| Intel  | Support proposed changes in RP-212004 |
| Nokia | Should be driven by regulatory requirements and can be studied further in RAN4 during solutions phase. |

Q3: [RP-212036, LGE] proposed to add possible bandwidth and frequency locations of ITS-dedicated, licensed, and unlicensed spectrum.

Please provide your view on this.

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| Company | Comment |
| LGE | Support. |
| Xiaomi | Agree |
| Futurewei | Support |
| Qualcomm | Fine to capture these, but the final text proposal requires review.  |
| CATT | Partial agree. We think it is too early to add possible bandwidth and frequency locations of unlicensed spectrum. The support of unlicensed spectrum for SL positioning should be supported after the sidelink in unlicensed spectrum is supported. |
| vivo | Not sure how bandwidth/frequency location could be determined at RANP level. |
| OPPO | Do not see the need since this is quite detailed solution level description that may be mainly useful for stage-4 RAN4 spec.. so prefer not to add these uncertain information, as possible bandwidth and frequency location may not facilitate the following work.  |
| Intel | OK in principle. Is there intention to add text from 5GAA LS or just give some examples for selected country/region or refer to RAN4 specs?  |
| Nokia | Should be driven by regulatory requirements and can be studied further in RAN4 during solutions phase. |

Q4: [RP-212131, Huawei] proposed to add that the use of unlicensed bands for SL positioning would only be efficient to introduce after there is support for sidelink in unlicensed spectrum in general.

Please provide your view on this.

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| Company | Comment |
| LGE | Not support. We cannot preclude at this moment a scenario where only positioning measurement is done in the unlicensed band and all the necessary communications take place in ITS/licensed spectrum. |
| Xiaomi | Not agree. TR already captures that “with a note that there is no mechanism corresponding to regulatory requirements to use unlicensed spectrum in Rel-17 NR sidelink”. No need for further mis-leading interpretation. |
| Qualcomm | Do not support. Sidelink PRS operation has no dependence on sidelink communication in the same band. Sidelink unlicensed operation is not a prerequisite for transmitting SL-PRS over unlicensed. It is highly possible to have Sidelink communication in licensed and ITS bands, and the SL-PRS in unlicensed bands. Therefore, it is technically not correct to claim that SL positioning in unlicensed band requires SL communication also in unlicensed.  |
| CATT | Support. Our preference is that the support of unlicensed spectrum for SL positioning is supported after the sidelink in unlicensed spectrum is supported. |
| OPPO | Support the proposal, sidelink transmission on unlicensed spectrum has not been support yet, the working load may not be acceptable if unlicensed spectrum is considered in this item, and it is also unclear how to design sidelink PRS as the structure of other sidelink channels/signals are unkonwn. |
| Intel  | Do not support. It is premature to draw such conclusions in TR as the design framework is not defined yet.  |
| Nokia | Should be driven by regulatory requirements and can be studied further in RAN4 during solutions phase. |

Q5: If you think other changes are necessary for this sub-section, please specify them.

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2.6. Changes for “6 Conclusion”

Q1: Several contributions proposed text for the conclusion section: [RP-212004, Intel], [RP-212036, LGE], [RP-212105, Qualcomm], [RP-212132, Huawei]

Please provide your view on how to prepare the conclusion text.

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| Company | Comment |
| LGE | We think the conclusion should simply summarize what has been considered in identifying the requirements and operation scenarios instead of recommending future works. In this sense, we prefer the wording in RP-212004 or RP-212036. |
| Xiaomi | We prefer intel’s proposal. It is much clearer. |
| Futurewei | Agree with LGE suggestion |
| Qualcomm | Fine to capture the conclusions. However, it is preferrable to also recommend the next step.  |
| CATT | For spectrum part, we think it would be better to add a note “NOTE: The support of unlicensed spectrum for SL positioning can be supported after the sidelink in unlicensed spectrum is supported.” |
| OPPO | Also prefer Intel proposal in 2004, after some revision based on the questionnaire output above. |
| Intel  | TP in RP-212004 is preferred. |
| Nokia | Too early to discuss in the initial phase of this discussion. We should first settle down on other changes proposed to the TR before reviewing the conclusions. |

2.7. Other aspects

Q1: [RP-212036, LGE] proposed to send the final version of the TR to 5GAA and SAE Advanced Applications Technical Committee.

Please provide your view on this.

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| Company | Comment |
| LGE | Support. |
| Xiaomi | Ok |
| CATT | Ok. |
| OPPO | Agree |
| Intel | OK |
| Nokia | Too early to discuss in the initial phase of this discussion. We should first settle down on other changes proposed to the TR before reviewing the conclusions. |

Q2: If you think any other aspects need to be discussed, please specify them.

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