3GPP TSG-RAN Meeting #90-eRP-202847

Electronic Meeting, 7-11 December 2020

Agenda Item: 9.11

Source: Email discussion moderator (Intel)

Title: Report from Email Discussion [90E][36][SUL\_UL-DL]

Document for: Discussion and decision

# 1 Introduction

This documents reports on the following email discussion during RAN#90-e:

**[90E][36][SUL\_UL-DL]**

Goal: Generate an agreeable way forward.

Input contributions covered: RP-202747.

## 2 Initial Round

The tdoc RP-202747 makes 2 proposals:

**Proposal 1:**

* **RAN to decide between Option 1 and Option 2**
  + **Option 1: DL/UL configuration will not be introduced for SUL**
  + **Option 2: DL/UL configuration will be introduced for SUL**

**Proposal 2:**

* **In case Option 1 is chosen**
  + **From the capabilities, and all other perspectives, SUL is treated as FDD**
* **In case Option 2 is chosen** 
  + **From the capabilities and all other perspectives, SUL is treated the same as the band it shares frequency with (in case there are multiple such bands, RAN4 can make the determination which duplex mode is to be considered)**

Proposal 2 is reliant on the outcome of Proposal 1 and so for the initial round of discussion companies are requested to provide their views on Proposal 1 only. After making some conclusion on proposal 1 the discussion can be expanded to cover proposal 2.

Companies feedback related to Proposal 1.

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| **Company** | **Comments** |
| Huawei | Option 1.  In RAN4 it is clear that SUL, SDL, FDD and TDD are four different duplex mode and the corresponding bands are specified. And in WID for SUL on 2.3GHz and 1.9GHz, it is clear that those bands are purely uplink.  And RAN4 finalized all the SUL bands with the frequency range corresponding to TDD bands based on the assumption that all slots are available for UL on the SUL band as clearly shown in the agreed CRs. So only Option 1 is aligned with RAN4 assumption in Rel-16.  We do not see there is any agreement to introduce Option 2. Option 2 seems new and can only be considered for later releases, but for Rel-16 there is only one possible choice, i.e., Option 1. |
| Qualcomm | We somewhat prefer Option 1 but would not object to either.  Choosing Option 1 will require overturning a RAN1 decision on considering SUL as TDD when SUL is in a TDD band. |
| vivo | We think option 1 is more straightforward thus preferred. But the question we have is do we make such clarification from Rel-15 or Rel-16?? |
| OPPO | This is tightly coupled with the discussion of [90e][38], where [38] goes for a CR to treat the SUL as FDD, and [36] proposes to add a DL/UL configuration to handle the SUL for TDD case.  In our understanding, although so far the SUL for TDD case is currently not so critical as analysed in 2569, option-2 in proposal-1 is more future proof. Considering the reasoning in 2569, even if we go for introduction of D/U configuration as in option-2 of proposal-1, would the intention of 2569/2570 be also covered, if a full UL configuration is defined / allowed for SUL of TDD band? |
| CATT | Option 1.  Although SUL in TDD band was introduced in Rel-16 but it is clearly stated in the WIDs that the band is dedicated for SUL so there is no co-existence issue. |
| Huawei-2 | We would like to ask Qualcomm which RAN1 agreement you are referring to?  The proposal 1 is too general. When SUL overlaps with paired spectrum, we do not need to discuss applicability of DL/UL configuration. We should be careful about the conclusion.  By the way, we would like to provide more background on what happens for SUL in Rel-16. There are three new SUL bands specified in Rel-16, which corresponds to the frequency range of the existing TDD bands (n95, n97 and n98), as shown in our paper RP-202569. Take n98 for an example. In the WID RP-201363, it is clearly stated in the justification part that  *Band n39 with frequency range* *1880-1920MHz is an NR TDD band. There are no co-existence issues in n39/B39 and in China there is only one operator deployed in 1880-1920MHz. In order to meet the potential network deployment request of operator, a new SUL band (1880-1920MHz) will be defined under this WI*.  In the objective part, it is stated that  *NOTE: all the slots can be used as UL in this SUL band*.  In the agreed CR R4-2014330, there is a note  *NOTE 15: The requirements for this band are applicable only where no other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area. For scenarios where other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.*  So it is clear that in Rel-16 only Option 1 is the assumption based on which the work is done. Thus we prefer to adopt Option 1 and finalize the Rel-16 work. If companies still are interested in this work, we can discuss the other option in the future release. |
| ZTE | At this point, we are open to consider either Option1 or Option2 but we would like to first understand what each of these options implies. So we have the following questions:   1. Is it a common understanding that each of these Options implies what proposal 2 has? 2. Regardless of which option we decide, do we assume the same principle across the specs including e.g. TDD/FDD differentiation for UE capabilities and UE behaviour on SUL defined in the specs? 3. Is it a common understanding on the statements in the WID highlighted by Huawei above that the potential co-existence issue for the scenarios where SUL is overlapped with TDD operation does not exist? Based on the WID, it seems that such scenarios may still exist but it is just that special co-existence requirements for such scenarios are not covered by the 3GPP RAN4 spec. Then when RAN1 specs are designed, should it be based on the assumption that this co-existence issue does not exist? 4. Which RAN1 decision Qualcomm was referring to when they said “considering SUL as TDD when SUL is in a TDD band”? 5. Which release(s) does this proposal apply to? |
| Nokia, NSB | We are fine to go with Option 1 if that is indeed the majority preference, but with this option it would be good to clearly note that the specifications do not support SUL on a TDD band that has any bi-directional operation on that band. One also needs to address consistency with the related RAN1 agreements, as pointed out by Qualcomm, as well as ensure that RAN4 work including co-existence should also take this into account. |

### 2.1 Moderator summary from Initial Round

8 companies have provided comments to the discussion. Option 1 is preferred or acceptable to all companies. Option 2 would be an acceptable approach for 3 companies and one of those companies considers that this option is more future proof. Given these responses, it seems clear that there is no strong motivation to introduce new signalling of the DL/UL configuration for an SUL carrier into Release 16 at this late stage.

**Moderator conclusion from the Initial Round**: No new signalling will be introduced in Rel-16 to provide a DL/UL configuration for an SUL carrier.

## 3 Intermediate Round

Given the conclusion from the initial round, the next question to conclude is whether in Rel-16 any further clarification to the handing of SUL carriers is required. In RP-202747, Qualcomm consider that some clarification is required for the interpretation of UE capabilities, specifically when a per UE capability related to SUL is differentiated between FDD and TDD and the SUL carrier is within unpaired spectrum, should the FDD or TDD capability be considered?

Furthermore, some of the responses have suggested that there may be additional aspects within the specifications that could need some clarification, for example:

- The Nokia suggestion to clarify that the "specifications do not support SUL on a TDD band that has any bi-directional operation on that band ".

- Clarification such as that proposed in RP-202569 and discussed within email discussion [38]

With these points in mind, in the Intermediate Round company feedback on 3 aspects is requested.

**Question 1:** Companies are requested to provide feedback, if any, on the moderator conclusion from the Initial Round. Furthermore, in the Initial Round a question was asked by some companies to Qualcomm to clarify what was meant by "RAN1 decision on considering SUL as TDD when SUL is in a TDD band. ". I would like to request that Qualcomm give a response to this question here.

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| **Company** | **Comments** |
| Qualcomm | **[103-e-AI5-LS-06] Email discussion/approval for a potential reply LS in response to R1-2005208 by 10/29 – Samsung (Seunghoon)**  Update on 10/29 – deadline extended to 11/4  Update on 11/4  **Conclusion:**   * Per-UE capabilities for SUL/SDL bands can be differentiated on the duplex mode(s) for Rel-15 and Rel-16.   FFS: how to decide whether FDD or TDD capabilities apply to SUL/SDL including whether or not to add common or dedicated signaling of semi-static DL/UL configuration for SUL/SDL |
| Huawei | Regarding the above agreement, our interpretation is that 3GPP will discuss how to apply the Rel-15 per-UE capabilities, which is differentiated by duplex mode(s), to SUL and SDL. Unfortunately, in Rel-15 discussion, 3GPP only discuss the application with respect to FDD and TDD and not discuss SUL and SDL. But in RAN4 SUL and SDL are specified as duplex mode since Rel-15.  According to our understanding, it is hard to derive “considering SUL as TDD when SUL is TDD” from the above sentence in pink. The above conclusion is dedicated to question 1 of RAN2 LS LS on UE capability xDD differentiation for SUL/SDL bands in R1-2005208. The question 1 in the LS is shown below:  ***Question 1:*** *Could per-UE capabilities for SUL/SDL bands be differentiated on the duplex mode(s) for Rel-15 and Rel-16?* |
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**Question 2:** Companies are requested to provide feedback on the interpretation of a per UE capability related to SUL that is differentiated between FDD and TDD. The proposal from RP-202747 is that the FDD capability is always considered (which would imply that the TDD version of this capability has no usage).

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| **Company** | **Comments** |
| Intel | From RAN1 103e,  **Conclusion:**   * Rel-16 per-UE capabilities with xDD differentiation and FRx differentiation can be differentiated for SUL/SDL bands by "per-band” capability signaling for each SUL band and SDL band. * FFS for Rel-15 per-UE capabilities with xDD differentiation. * FFS if two different bands are involved in the Rel-15/Rel-16 UE capability   Thus, it seems the question is for Rel-15 or Rel-17+ as Rel-16 case can be handled by per-band capability signaling.  Our preference is:   * For an SUL band overlapped with TDD, TDD capability is applied. * For an SUL band overlapped with FDD, FDD capability is applied. * For an SUL band overlapped with neither TDD nor FDD, FDD capability is applied (this is for future proof, not the case up to now). |
| Samsung | Based on the conclusion and comments of companies from the initial round discussion, it is clear that SUL can be treated as FDD since “*all the slots can be used as UL in this SUL band”*. We are not convinced that additional TDD/FDD differentiation for SUL is necessary. Therefore, we think considering only FDD capability for SUL is enough. |
| OPPO | We prefer further discussion on this at WG level. This problem was triggered by RAN2, covering both SUL and SDL, and later replied by RAN4 without too much preference expressed, and by RAN1 with the conclusion as indicated by Intel above.  For Rel-15 capability, it is preferred to leave it to further discussion at RAN1 first, as indicated in the LS R1-2009576. Or if companies would like to solve at RAN level, we tend to limit the conclusion to R15 only (i.e., do not predict for R17), for which we only need to solve the SUL with clear corresponding FDD band. |
| Qualcomm | We understand that other companies’ view (including at least Huawei’s and Intel’s view) is that since in Rel-16 all per UE capabilities that were xDD differentiated have been converted to ‘per band’, this resolved the issue being discussed. However, we didn’t agree with the view that this solved the issue. The above (purple) RAN1 conclusion applies not only to per UE capabilities that are xDD differentiated but also to those that are TDD-only. As far as I know (could be wrong), these were not converted to ‘per band’ by RAN2.  Take for example Rel-16 SRS-RSRP measurement (FG 17-1), which is per UE. If a UE indicates SRS-RSRP measurement support and also that it supports SUL in an SUL band overlapping with a TDD band then with the above (purple) conclusion, or with the Intel proposal above, the interpretation is that the UE must support CLI measurement in that SUL band, which I don’t believe represent the common view. So if we go with Option 1, either of the following change would be needed:   1. Change the above (purple) conclusion to say that SUL/SDL bands are not differentiated based on duplex mode but rather they are always considered FDD from the UE features perspective and all other perspectives 2. Change the conclusion that CLI capabilities are per UE and change them to per band   Regarding the comment from Samsung immediately above, the language “*all the slots can be used as UL in this SUL band”* only applies to a specific band. Bands can be added in the future that apply to Rel-16 without having the same language. |
| Nokia, NSB | The Conclusion from RAN1#103-e mentioned by Intel above also includes the following part:  **Conclusion:**   * PerUE capabilities for SUL/SDL bands can be differentiated on the duplex mode(s) for Rel-15 and Rel-16. * FFS: how to decide whether FDD or TDD capabilities apply to SUL/SDL including whether or not to add common or dedicated signaling of semistatic DL/UL configuration for SUL/SDL   As per the conclusion of the initial phase of this discussion it seems that no signalling will be added, but it still remains undecided whether FDD or TDD capabilities apply to SUL/SDL. In that respect we agree with Samsung’s observation above, i.e. FDD capability applies for SUL. As we pointed out before, a direct consequence of this is that specifications do not support SUL on a TDD band that has any bi-directional operation on that band. Such restriction has to be clarified to ensure consistency, e.g. in 38.300 and/or 38.101-1. |
| vivo | We agree with Samsung above, i.e. to treat SUL as FDD for the UE capabilities with xDD differentiation. |
| MediaTek | Share the same views as Samsung & Nokia, i.e. treat SUL as FDD and it should be clarified in the spec that all slots are UL to a UE in an SUL band when it overlaps with a TDD band. |
| Huawei | We agree that we can reuse FDD capability indication for SUL when applying per UE capability in this release, which is differentiated by duplex mode, related to SUL. |
| Ericsson | We are fine ti support SUL as FDD for the UE capabilities with xDD differentiation. |
| ZTE | We slightly prefer Intel’s proposal only for the case where differentiation bit exists.   * For an SUL band overlapped with TDD, TDD capability is applied. * For an SUL band overlapped with FDD, FDD capability is applied. * For an SUL band overlapped with neither TDD nor FDD, FDD capability is applied   For the TDD-only and FDD-only capabilities, SUL is not applicable.  If treat SUL as FDD, the same discussion should be needed i.e. whether FDD-only capabilities should be applicable to SUL. e.g. ***fdd-PCellUL-TX-AllUL-Subframe-r16***  is a FDD-only capability but it may not make sense to apply this to SUL. |

**Question 3:** Companies are requested to provide feedback on whether any additional specification clarifications may be required. The proposal from RP-202747 was that in "all other perspectives, SUL is treated as FDD ". However, this wording seems too general to be a useful basis for discussion so I would like companies to give more definite examples for what further clarifications are required.

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| **Company** | **Comments** |
| Intel | See Intel’s answer to Question 2 |
| Samsung | We do not think additional clarification is needed since it is already clearly described in WID as captured by Huawei. From RAN1 specification point of view, there is another email discussion of [38] related to clarification on PUCCH repetition on SUL band. If the CR discussed in [38] is agreed, there is no ambiguity on UE behaviour anymore. |
| OPPO | As replied to Q2.  We also prefer a conclusion to a concrete issue, e.g., how to handle the per-UE capability for R15. In that case, conclusion like “SUL is treated as FDD” can be a candidate. But as replied in Q2, our first preference is to leave this to WG discussion. |
| Qualcomm | Same proposal as in RP-202747  Regarding what is meant by “all other perspectives”, examples include RP-202570 which is dependent on this discussion outcome and RP-201847 which was already agreed at RAN#89 and which is consistent with Option 1. |
| Nokia, NSB | See Nokia’s answer to Question 2. |
| vivo | Same as Q2. |
| Huawei | We see no need to reach such general agreement. The question is just for applying per-UE capability to SUL. We only need focus on answering that question. |
| Ericsson | This issue needs further discussions in the WGs. |
| ZTE | We prefer to apply general rule on both capabilities and UE behaviour in the specs. |

### 3.1 Moderator summary from Intermediate Round

No company raised concern with the moderator conclusion from the Initial Round so this can now be considered agreed

**Agreement**: No new signalling will be introduced in Rel-16 to provide a DL/UL configuration for an SUL carrier.

Regarding question 2 on the interpretation of UE capabilities, the only outcome from this discussion that I could see as potentially agreeable in RAN#90 is that capabilities that are FDD/TDD differentiated when applied to SUL carriers are always considered FDD (i.e. in effect the capabilities are not FDD/TDD differentiated for this case). Even if this is agreeable then it seems very unlikely appropriate CRs can be made available and reviewed during this RAN plenary and so it would be necessary to task the WGs (RAN1 and/or RAN2) to work on appropriate CRs. If this approach is not agreed then the topic will need to be returned to the WGs for more discussion.

**Moderator's conclusion from Intermediate round (1):** UE Capabilities that are FDD/TDD differentiated when applied to SUL carriers are always considered FDD (i.e. in effect the capabilities are not FDD/TDD differentiated for this case). WGs (RAN1 and/or RAN2) are tasked to prepare CRs to capture this agreement.

Regarding question 3, other than the issue in RP-202570 that is discussed by email discussion 38 the only proposal for further clarification was from Nokia who proposed to capture that the "specifications do not support SUL on a TDD band that has any bi-directional operation on that band ". While this seems to be common understanding among companies based on the WID it is not clear to the moderator whether it would be acceptable to companies to capture this limitation in the specification. I would like to check if this would be acceptable and if not then the topic of any further clarification will be left open for further discussion in the WGs. Taking this agreement would of course not prevent the WGs discussing any further clarifications if a need was identified.

**Moderator's conclusion from Intermediate round (2):** Capture in the specifications that they do not support SUL overlapping with a TDD band where there is any bi-directional operation on that band. WGs (RAN1 and/or RAN2) are tasked to prepare CRs to capture this agreement.

## 4 Final round

Companies are invited to provide feedback to the moderator's conclusion from Intermediate round (1):

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| **Company** | **Comments** |
| Qualcomm | We support the conclusion if the following can be added:  UE Capabilities that are FDD/TDD differentiated when applied to SUL carriers are always considered FDD (i.e. in effect the capabilities are not FDD/TDD differentiated for this case). WGs (RAN1 and/or RAN2) are tasked to prepare CRs to capture this agreement.  UE Capabilities that are designated as TDD-only, do not apply to SUL carriers  In addition, probably it is worthwhile to decide which WG is asked to prepare the CRs to avoid duplication. |
| Huawei | We support the moderator’s conclusion for Question 2, i.e.,  *UE Capabilities that are FDD/TDD differentiated when applied to SUL carriers are always considered FDD (i.e. in effect the capabilities are not FDD/TDD differentiated for this case). WGs (RAN1 and/or RAN2) are tasked to prepare CRs to capture this agreement*.  To Qualcomm proposed wording, we do not see the need. The moderator conclusion is already clear enough. The Capabilities differentiated by FDD/TDD applies either as FDD or as TDD. We are not sure what the additional wording implies. |
| Intel | Given lack of signalling for DL/UL configuration (as per the first agreement), we are fine with moderator’s conclusion.  One other request is to clarify all those agreements will be applied for Rel-15/16. If there is a concern, any clarification would be appreciated. |
| Samsung | We support the moderator’s conclusion. We share the similar view as Huawei and Intel that additional text for clarification from Qualcomm seems not necessary. |
| OPPO | We are fine with moderator’s conclusion.  Similar to Intel, we believe it would be beneficial to clarify this agreement applies to Rel-15. For Rel-16, the following question addressed the possible unclear part. |
| CATT | We are fine with moderator’s conclusion. |
| ZTE | We are okay with the conclusion and the additional clarification by Qualcomm since TDD-only capabilities may not be categorized as “UE capabilities that are FDD/TDD differentiated”. Therefore, such clarification is useful. I don’t see any reason to object this additional clarification unless companies really think TDD-only capabilities can be applicable to SUL carriers. |
| Moderator | I have 2 comments to try to help resolve this discussion  1/ I understand the additional sentence proposed from Qualcomm not related to the UE Capabilities that are FDD/TDD differentiated - i.e. it is not attempting to further clarify the text in the moderator's proposal. It is a separate point about UE capabilities that are TDD only and the question is whether these TDD only capabilities can apply to SUL carriers. With this in mind I would like ask if companies have comments on that additional sentence.  2/ Regarding the Rel-15/Rel-16 question my understanding is that this applies to both Rel-15 and Rel-16 (and onwards). The UE Capabilities that are FDD/TDD differentiated that we are talking about exist in both Rel-15 and Rel-16 specs, so I cannot see how the conclusion could only be applicable to Rel-15. |
| Huawei | Regarding whether these TDD only capabilities can apply to SUL carriers,  [Answer]: in Rel-15 and Rel-16, these TDD only capabilities cannot apply to SUL carriers. For the features in future release, more discussion is needed case by case.  Regarding release  [Answer]: The conclusion applies to Rel-15 and Rel-16. In the future, maybe the per-UE capability would be differentiated by FDD, TDD, SUL and SDL. The conclusion may not apply for future release. So we do not need apply conclusion for beyond Rel-16. |

Companies are invited to provide feedback to the moderator's conclusion from Intermediate round (2):

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| **Company** | **Comments** |
| Qualcomm | We are supportive of the Nokia proposal.  We think there is some lack of clarity regarding the following part though  “…do not support SUL overlapping with a TDD band where there is any bi-directional operation on that band”  In the above, “where” could mean “if” (without geographical proximity) or it could mean “in the same region”. We propose to clarify which one is the meaning. If it is the latter, probably replacing “where” with “if in the same coverage area” would be better. |
| Huawei | The similar topic was extensively discussed in previous RAN4 meetings. If the experts looked at the CR in R4-2014330, the compromise has already been reached:  *NOTE 15: The requirements for this band* (referring to SUL operation) *are applicable only where no other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area. For scenarios where other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.*  The proposed wording above is almost the same as the original proposed wording in RAN4 meeting. After extensive discussions the above compromise was reached. |
| Intel | We are fine with Nokia’s proposal. |
| Samsung | We share the similar view with Huawei. On top of it, based on RAN4 text of “*For scenarios where other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.*”,we think the proposed wording does not need to be captured. |
| OPPO | We share the similar view with Huawei and Samsung, that we can rely on the conclusion in RAN4 for this issue. |
| CATT | We also do not think further clarification is needed. |
| ZTE | We are supportive of the proposal from Nokia. It should be discussed in which spec(s) this clarification should be captured or whether this should be captured in the cover sheet of proposed CR in RP-202570. |
| Nokia, NSB | The CR mentioned by Huawei above is certainly relevant to this discussion, thanks for bringing it up. The problem still remains that that CR is specific to a single band, which is a natural part of RAN4 work. But the decisions we are making in this thread are about RAN1 specifications, which are band-agnostic in nature. Hence, we need a general statement that applies to every possible band where SUL support may be defined in the future. If companies would prefer to allow RAN4 to make the decisions on coexistence on a band-by-band basis, then we would need to revert the discussion we did earlier this week and actually define signalling support in RAN1 for a futureproof solution. We do not prefer such approach especially considering the essentially unanimous decision to go for Option 1 already early this week. |
| CMCC | We can not agree to capture this sentence, if no special requirements are raised to 3GPP, how can we intervene the deployment? if someone deployed like that. Just like two TDD gNB adopt different DL/UL configuration in the same region, even it is not expected, it will occur, especially when dynamic TDD applied. |

## Annex: Contacts

Please provide a company contact that the email discussion moderator can contact if required.

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