**3GPP TSG RAN WG1 Meeting #103-e R1-200xxxx**

**e-Meeting, October 26th – November 13th, 2020**

**Agenda Item:** 5

**Source:** Moderator (Samsung)

**Title:** Summary of [103-e-AI5-LS-06] Email discussion/approval of a potential reply LS in response to R1-2005208

**Document for:** Discussion and Decision

# **Introduction**

[103-e-AI5-LS-06] Email discussion/approval for a potential reply LS in response to R1-2005208 by 10/29 – Samsung (name TBD)

# **Discussion**

* What is your view about the following first question from RAN2 LS [1]?

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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| **Company** | **The answer is yes or no?** | **Comments** |
| ZTE | Yes | From our perspective, both UE capabilities with xDD differentiation and UE capabilities with “TDD only”/”FDD-only” should be discussed because the same issue exists for both of them. |
| Huawei, HiSilicon | Yes | For Rel-16, RAN2 has decided in R1-2005212 to introduce “per-band” capability signaling for the concerned xDD UE capabilities, which means the differentiation has been able to be supported by such individual capability signaling for each SUL band and SDL band.  For Rel-15, the same mechanism in R1-2005212 could be reused by allowing those concerned capabilities to be signaled additionally on per SUL/SDL band. Alternatively, the values of concerned capabilities reported for FDD/TDD can be reused. To be specific, a UE can report such capability for FDD/TDD by two ways currently. If the reported value for a UE is via the common signaling of FDD/TDD UE capability, it is straightforward to be reused to SUL/SDL if applicable. If the reported value is via differentiated signaling of FDD/TDD capability, either the FDD value or the TDD value is reused to SUL/SDL if applicable. We prefer FDD value in this case because SUL/SDL has no TDD UL-DL configuration in Rel-15.  Regarding “TDD-only”/”FDD-only” UE capabilities, we don’t feel they need special discussion here because in Rel-15 no UE capability is applicable to either SUL or SDL and in Rel-16 per-band capability has been introduced in R1-2005212 which ensures forward compatibility for them. |
| ZTE2 |  | There are some “TDD only” per-UE FGs in both Rel-15 and Rel-16. If we apply “FDD” for SUL/SDL, it means that these “TDD only” per-UE FGs are not applicable to SUL/SDL. Another way, if we apply our proposal (i.e., the support of per-UE capability with TDD/FDD differentiation for SDL/SUL is based on the support of this capability for both TDD and FDD), then these “TDD only” or “FDD only” per UE FGs are not applicable to SUL/SDL.  In any case, we may need to clarify how to interpret these “TDD only” or “FDD only” per UE FGs because the issue is the same as the issue for per-UE FGs with xDD differentiation. |
| Huawei, HiSilicon2 |  | Thank ZTE very much for follow-up. With respect to duplex mode, there are two kinds of per-UE capabilities, per-UE capabilities for all bands, and per-UE capabilities with FDD/TDD differentiation. The reason why the latter is additionally needed on top of the former one is to allow UE only implement the feature for either FDD or TDD bands, instead of forcing UE to implement both.  ZTE’s proposal “support of this capability for both TDD and FDD” is equivalently downgrading the per-UE capability from FDD/TDD differentiation to no differentiation, which is not in line with the original motivation of introduction of FDD/TDD differentiation for the UE capabilities concerned by the LS. Therefore, we are afraid that ZTE’s proposal cannot resolve the issue raised by RAN2 LS.  Regarding “TDD only”, after exploring all relative capabilities in both Rel-15 and Rel-16 specs, we found none of them are applicable to SUL/SDL. Therefore, we don’t see an issue for it and prefer to keep the discussion scope unchanged. If the concern is about future “TDD only” capabilities, we could just remind RAN2 in LS to avoid potential issue during the future capability introduction. |
| Qualcomm | TBD | Firstly, we would like to clarify that the discussion here should be about FGs for which all the following is true   * FG is per UE * FG is xDD differentiated * FG is not FRx differentiated   For theses cases, our understanding at least is that there was no RAN2 agreement to add per band capability signaling, so we don’t agree with Huawei regarding the relevance of R1-20005212 here.  Second, we think that in order to answer the question in R1-2005208, there needs to be a more basic decision on the following:   * Is there a plan to add common or dedicated signaling of semi-static DL/UL configuration for SUL (or SDL)?   Our understanding is that this signaling is not available today. At the same time, given the strong concerns expressed by certain operators in the past regarding adjacent channel coexistence issues, we would like to understand whether such concerns still exist and whether there is any plan to add DL/UL configuration for SUL bands that occupy spectrum that had been identified or used as TDD bands before.  We believe that in order to answer R1-2005208, the answer to the above needs to be decided by either RAN1 or RAN.  In the hypothetical case where an SUL band is categorized as FDD (or TDD), all the UEs FDD (or TDD) capabilities should apply. |
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**Observation:**

* Per-UE capabilities for SUL/SDL bands could be differentiated on the duplex mode(s) for Rel-15 and Rel-16.
  + Yes: ZTE, HW

**Possible conclusion:**

* What is your view about the following second question from RAN2 LS [1]?

Question 2: “Which duplex mode(s) (i.e. FDD or TDD) for the per-UE capabilities which are differentiated by FDD and TDD are applied for SUL/SDL in both Rel-15 and Rel-16?”

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| **Company** | **Which duplex mode(s) are applied for SUL/SDL?** | **Comments** |
| ZTE |  | From our perspective, not all the UE capabilities are applicable to SDL/SUL. We may need to first discuss which UE capability is applicable to SUL and which UE capability is applicable to SDL for both Rel-15 and Rel-16. As discussed in our tdoc R1-2007729, we have the following proposals.  ***Proposal 2****:*  *The following Rel-15 UE capabilities are applicable to both SDL and SUL.*  *- dynamicSFI, twoDifferentTPC-Loop-PUCCH, twoDifferentTPC-Loop-PUSCH and ul-SchedulingOffset*  *The following Rel-15 UE capabilities are applicable to SDL but not applicable to SUL.*  *- dl-SchedulingOffset-PDSCH-TypeA and dl-SchedulingOffset-PDSCH-TypeB*  *The following Rel-15 UE capabilities are applicable to SUL but not applicable to SDL.*  *- twoPUCCH-F0-2-ConsecSymbols*  ***Proposal 3****: Rel-15 and Rel-16 UE capabilities marked with “TDD only” or “FDD only” are not applicable to SDL and SUL.*  Regarding which duple mode is adopted, we believe a unified solution is preferred. Among all the unified solutions, it seems only the following is a complete solution, i.e., support of per-UE capability with TDD/FDD differentiation for SDL/SUL is based on the support of this capability for both TDD and FDD. Thus, we have the following proposal.  ***Proposal 5****: Regarding the applicability of the per-UE capabilities with TDD/FDD differentiation to SDL/SUL,* *the support of per-UE capability with TDD/FDD differentiation for SDL/SUL is based on the support of this capability for both TDD and FDD.* |
| Huawei, HiSilicon | FDD for Rel-15  “per-band” signaling for Rel-16 | As replied to the first question, the answer should be different for Rel-15 and Rel-16. For Rel-16, the “per-band” signaling in R1-2005212 is sufficient and better for SUL/SDL bands. For Rel-15, the value reported for FDD bands is better to be reused for SUL/SDL bands because SUL/SDL has no TDD UL-DL configuration like TDD bands. Alternatively the “per-band” signaling can be introduced in Rel-15 for SUL/SDL.  Regarding “TDD-only” and “FDD-only” capabilities, we don’t need any conclusion to preclude their applicability in Rel-16 for SUL/SDL because “per-band” signaling has provided flexibility for a UE to report and has no issue.  Additionally, we have one proposal to address one additional issue. If two different bands are involved in the UE capability, e.g. ul-SchedulingOffset involving one band for DL PDCCH and the other band for UL PUSCH in case of SUL, a concern was raised in the last meeting on which band the reported UE capability should be applied. It is a similar issue that has been well discussed for cross-carrier scheduling operation. We think the solution in R1-2007334 is applicable to the case of SUL here, which is the interpretation of such kind of UE capability on SUL band is “based on the support of this capability for the band of the scheduled/triggered/indicated cell only.”, i.e. based on the SUL band itself. Therefore, we have the following proposal.  ***Proposal 1****: The interpretation of a UE capability within Phy-ParametersXDD-Diff is based on the support of this capability for the SUL band if the capability involves both SUL band and non-SUL band in a SUL band combination, e.g. ul-SchedulingOffset.* |
| ZTE2 |  | As we can see in the RAN4 spec, there are both SUL bands overlapping with TDD bands and SUL bands overlapping FDD bands. As also pointed by companies, the band/band combination defined in RAN4 are release-independent, which means RAN1 needs to consider SUL bands overlapping with TDD bands. Companies are discussing whether we need to do something to address the potential cross-link inteference for UL bands overlapping with TDD bands in **[103-e-NR-7.1CRs-03]**. If that is the case, the UE behaviour is more like "TDD operation" for SUL bands overlapping with TDD bands. This will end up with the following   * For SUL bands overlapping with TDD bands, the interpretation of UE feature may need to follow TDD. * For SUL bands overlapping with FDD bands, the interpretation of UE feature may need to follow FDD.   However, the above interpretation is not a unified solution. Furthermore, the above interpretation may not be future-proof. Currently, although all SUL bands are always overlapping with one certain NR bands. However, there is SDL band (e.g., band 29) that is not overlapped with any NR band. In the future, there may be some SUL bands that are not overlapping with any NR band, then it is not clear whether UE feature should follow TDD or FDD because there is none TDD/FDD NR band overlapping it at all.   |  |  |  |  | | --- | --- | --- | --- | | n29 | N/A | 717   MHz – 728 MHz | SDL |   Based on the above analysis, we believe the following proposal is unified solution and is a future-proofed solution.  ***Proposal 5****: Regarding the applicability of the per-UE capabilities with TDD/FDD differentiation to SDL/SUL,* *the support of per-UE capability with TDD/FDD differentiation for SDL/SUL is based on the support of this capability for both TDD and FDD.* |
| Huawei, HiSilicon2 |  | Thank ZTE very much for follow-up. In response to ZTE’s proposal, we would like to remind that ZTE’s proposal does not resolve any so called cross-link interference if it exists in one network deployment. Because if any TDD operation needed to avoid interference, only the RRC indication from network to UEs can clearly indicate either TDD operation or FDD operation for the UE. It cannot be resolved by forcing a UE to support both TDD operation and FDD operation where the UE is still not aware of the operation mode. On the contrary, if a UE supports only FDD operation but the network needs TDD operation, then the solution becomes simple as that the network has sufficient information not to configure the UE in the bandwidth which requires TDD operation, resulting in no so called cross-link interference.  If the concern is to get a perfect solution, then we have to firstly add RRC indication, then add UE capability signaling to differentiate two different operations on SUL/SDL bands. However, such additional capability signaling has been provided as a per-band signaling by RAN2 LS R1-2005212 for Rel-16. The best solution of signaling for Rel-15 seems to simply reuse it. |
| Qualcomm | TBD | Unclear how this discussion can be progressed until the answer to the previous question is decided.  Once there is a clear definition or procedure on how to decide whether FDD or TDD capabilities apply to SUL (or SDL), the answer to this question will also be clear.  In the hypothetical case where an SUL band is categorized as FDD (or TDD), all the UEs FDD (or TDD) capabilities should apply. If for a particular FG further granularity was deemed necessary, then the reporting type for that FG should be changed to per band to automatically solve the issue.  Lastly, there can be FGs that apply to either FDD or TDD but do not apply to SDL or SUL. We don’t think there needs to be detailed description or discussion of these. For example, we already have DL-only CA, where SCells have only DL. We didn’t need to have a detailed description to explain that UL power control capabilities do not apply to these SCells for example. |
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**Observation:**

* Issue 1: Whether or not a discussion on the applicability for Rel-15/Rel-16 UE capabilities with “TDD only”/”FDD-only” to SDL/SUL bands is necessary.
  + Yes: ZTE
  + No: HW
* Issue 2: For Rel-16 UE capabilities with xDD differentiation, RAN2 has decided to use "per-band” capability signaling for them. Therefore, Rel-16 per-UE capabilities can be differentiated for SUL/SDL bands by such individual capability signaling for each SUL band and SDL band.
  + Yes: HW
* Issue 3: For Rel-15 UE capabilities with xDD differentiation,
  + Alt.1: a support of per-UE capability with TDD/FDD differentiation for SDL/SUL bands is based on the support of this capability for both TDD and FDD.
    - Supporting company: ZTE
  + Alt.2: a value reported for FDD bands is reused for SUL/SDL bands.
    - Supporting company: HW
  + Alt.3: “per-band” signaling is introduced for SUL/SDL bands.
    - Supporting company: HW
* Issue 4: If two different bands are involved in the Rel-15/Rel-16 UE capability (e.g. *ul-SchedulingOffset* involving one band for DL PDCCH and the other band for UL PUSCH in case of SUL), it should be clarified the reported UE capability on which band should be applied.
  + Alt.1: The interpretation of a UE capability with xDD differentiation is based on the support of this capability for the SUL band if the capability involves both SUL band and non-SUL band in a SUL band combination
    - Supporting company: HW

**Possible conclusion:**

# **Conclusion**

**TBD**

# **Reference**

[1] R1-2005208 LS on UE capability xDD differentiation for SUL/SDL bands Samsung

[2] R1-2007508 Reply LS on UE capability xDD differentiation for SUL/SDL bands RAN4, ZTE

[3] R1-2007728 [DRAFT] Reply LS on UE capability xDD differentiation for SULSDL bands ZTE

[4] R1-2007729 Discussion on UE capability xDD differentiation for SULSDL bands ZTE

[5] R1-2008778 Discussion on UE capability xDD differentiation for SUL/SDL bands Huawei, HiSilicon