**3GPP TSG-RAN Meeting #90-e RP-20xxxx**

**Electronic, December 7th – 11th 2020**

**Agenda Item:**

**Source: Huawei, HiSilicon**

**Title: Summary of [90E][22]Single UL operation for intra-band ENDC**

**Document for: Discussion and decision**

# Introduction

This document summarizes the following offline discussion for the below document:

RP-202622 Clarification on single uplink operation (SUO) for intra-band EN-DC

# Contact from companies

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# Initial Discussion (clarification added)

**Q1-1 Do companies agree that for the intra-band ENDC band combinations, which clearly stated in RAN4 spec “Only single switched UL is supported”, it means that the UE has to support singleUL-Transmission capability?**

**Moderator: the above question might lead to some misunderstanding after reading QC’s comment. The intention was to say the UE is required to report singleUL-Transmission capability if the UE reports an intra-band ENDC band combination which is defined as “Only single switched UL is supported” in RAN4 spec.**

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | Yes | We think the UE needs to report the support the singleUL-Transmission capability if the band combinations in RAN4 indicated only single switched UL is supported. Otherwise the network will become confused, if the UE reports such a BC but without support singleUL-Transmission, i.e. whether this BC is really supported by the UE or not. |
| OPPO | Yes |  |
| Qualcomm | No | singleUL-Transmission is not really a capability the UE has to support in any case. “dualUL-Transission” would be a capability that the UE would have to support where it is mandatory. Moderator: please see above clarification.  |
| ZTE | No | It seems nice to have this capability indication to help network understand the UE better , however the current wording is not precluding UE to report that information.Indicates that the UE does not support simultaneous UL transmissions as defined in TS 38.101-3 [4]. The UE may only include this field for certain band combinations defined in TS 38.101-3 [4]In addition, why only intra-band EN-DC is mentioned here. In the approved WF R4-2011934, DC\_12\_n71, it was agreed that :Only single switched uplink can be used for DC\_12\_n71.In other words, the CR is not complete to cover all the existing cases if clarification is needed.Moderator: please see above clarification. The intention of the question is not to preclude UE to report this information, instead it is to ensure the UE does report this capability when reporting such a BC.  |
| Ericsson | No | Because the note is supposed to be interpreted in the context of minimum requirements. It has nothing to do with the UE supporting the capability *singleUL-transmission*.Moderator: Please check the approved WF in R4-2011934. |
| Intel | Yes | UE needs to support single UL capability if UE indicates the support of the EN-DC BC for which “Only single switched UL is supported” is captured in RAN4 specs. |
| Nokia, Nokia Shanghai Bell | Yes | Just to be clear: There are two capabilities (both of which are per-BC capabilities within IE *MRDC-Parameters*) related to single UL operation:* *singleUL-Transmission* (only allowed for BCs listed in 38.101-3)
* *tdm-Pattern* (mandatory to suppport for a BC where UE indicates suppport for *singleUL-Transmission*)

Since the first capability implies the second one, we should focus on that: In our understanding, if BC requires single UL, then UE must support *singleUL-Transmission* for that BC and this was always the intention. If UE doesn't indicate *singleUL-Transmission* capability for a BC that requires it, then that BC cannot be used by the network, which implies inconsistent UE capabilities.However - see our replies to Q1-2: We think there may be misunderstanding from some companies on **when** UE is required to support the *singleUL-Transmission* capability. |
| Bell Mobility | Yes | Agree with Nokia. There is misunderstanding on **when** UE is required to support the *singleUL-Transmission* capability. Support to *singleUL-Transmission* is required for a combination that requires single switch uplink. This this must be clarified. |
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**Q1-2 Do companies agree to add clarification in 38.306 to avoid any inter-operability issue, i.e. to clarify that the UE shall report singleUL-Transmission capability as long as the UE reports a BC on which “Only single switched UL is supported”?**

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | Yes | As explained above, it is worth clarifying in 38.306. Otherwise it is still unclear whether the UE shall report such capability for the BCs on which only single switched UL is supported. |
| OPPO | No | The cited RAN4 table already show such information there. So if UE reports relevant intra-band band combination it should sufficient for network to understand. Plus the wording looks like this is mandatory feature but actually this is not the intention, I guess. |
| Qualcomm | No | We understand the motivation for making this signaling mandatory. However, if this problem is observed then anyhow there are existing Rel-15 UEs that will not follow this change. Therefore, the problem persists.The more straightforward solution is that the future introduction of dual UL requirements (in bands that currently support only single UL operation) will be associated with a particular future release. All UEs of earlier releases (including Rel-15) will be assumed not to support dual UL operation.  |
| ZTE | No | Tend to agree with QC that problematic UE in earlier release if existing cannot be addressed by this CR.  |
| Ericsson | No | If the UE supports the aforementioned BCs and do not indicate support for single UL transmission, our interpretation is that the UE supports dual TX but that there are no minimum requirements in RAN4 specification. The device has to meet the regulatory requirements under all circumstances. To resolve this issue, perhaps the note in RAN4 specification could be updated to clarify the context of minimum requirements. |
| Intel | No | From RAN4 specification perspective there are 3 types of EN-DC band combinations:* Type 1: Only Single UL is supported
* Type 2: Single UL or Dual UL can be supported
* Type 3: Only Dual UL is supported

In our understanding singleUL-Transmission capability shall be indicated for UEs which operate in single switched UL mode (i.e. for the Type 1 and for Type 2 combinations). Same time, we think that further clarifications to the RAN2 specification are redundant.Overall, we prefer to further discuss in the WGs. In case an issue is identified, then RAN4 can send LS to RAN2. |
| Nokia, Nokia Shanghai Bell | Maybe (RAN2 discussion required) | If there is an IODT problem, we need to discuss how to resolve that - it's necessary to solve such cases if they cannot be resolved otherwise, but that might require RAN2 discussion.We also wonder if there are misunderstandings on what "intra-band EN-DC band combination" means here, and this could be reason why some companies are saying "no" to the question: UE is required to support single UL if it supports UL on the BC part where single UL is needed, but if it supports UL only on different BC parts, then this is not the case. **For example**: We assume that if UE supports e.g. *DC\_****2A****\_7A\_66A\_****n66A*** (i.e. UL allowed in 2A and n66A only), then it is not required to support single UL for the BC since it doesn't actually support the single UL part of the BC that requires single UL. But if it would indicate support for *DC\_2A\_7A\_****66A****\_****n66A*** (i.e. UL allowed in 66A and n66A), then it would be required to indicate support for single UL.Therefore, it would be necessary to be clear on what the "intra-band EN-DC" means in this case (and we would note also the offline [90e][40] concerns similar definition issue!). RAN4 requirements are clear and therefore, no urgent RAN plenary action is needed.  |
| TELUS | Yes | We believe at least some clarification and discussion is needed and agree with Nokia’s view. The example shown above (DC\_2A\_7A\_66A\_n66A) applies to our network and clearly we need to have a mechanism to prevent this combo from being considered as an intra-band EN-DC with inter-band if the intra-band portion doesn’t work due to lack of support for single switched UL.  |
| Bell Mobility | Yes | More discussion and clarification is needed. It would also be good to have a confirmation from UE vendors if single switch uplink was ever implemented in Release 15. |
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## Initial discussion summary

For Q 1-1, on the main principle of whether the UE is required to report singleUL-Transmission when the band combination is defined as “only single switched UL is supported”, some companies think it is the correct understanding while some companies do not think so. There seems no clear majority. Among the companies who do not support the principle, the reasoning is also diverging. It seems that a common understanding is worth trying to be achieved, as otherwise the definition of BCs as “only single switched UL is supported” remains ambiguous among companies.

For Q 1-2 on potential clarification, views from companies are diverging and it seems that more discussion in RAN2/RAN4 seems required based on the feedback. As Q 1-2 is actually dependent on the understanding of Q 1-1, the moderator sees no enough time to continue discussion on Q 1-2 during this RAN plenary.

**It is therefore to propose to continue discussion on Q 1-1, aiming at having a common understanding on it and potential clarification can be discussed further in RAN2/RAN4 once Q 1-1 is concluded.**

# Intermediate Discussion

To avoid any misunderstanding on Q 1-1, the moderator made some clarification on it and also provides some clarification to some companies’ feedback on the background and intention of the question.

Companies are invited to provide your input if not yet in initial round, or to update your previous comments expressed in initial discussion based on the clarification by the moderator.

**Q1-1 is revised as below to make it clearer:**

**Do companies agree the below analysis that the UE is required to indicate support of singleUL-Transmission when the UE reports a band combination including the intra-band ENDC part with “Only single switched UL is supported” defined in RAN4?**

Case 1: the UE reports *DC\_****2A****\_7A\_66A\_****n66A*** and singleUL-Transmission is not required to be reported

Case 2: the UE reports *DC\_2A\_7A\_****66A****\_****n66A*** and singleUL-Transmission is required to be reported

Case 3: the UE reports DC 66A\_n66A and singleUL-Transmission is required to be reported

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | Yes | If UE supports intra-band EN-DC, according to the RAN4 specification, for most of the combinations a note indicates that only single switched UL is supported. Since no dual Tx requirements are defined for these combinations, there is a risk that regulatory requirements could be violated is dual Tx scheduled. Thus clear indication via signallig “*singleUL-tranmission*” should be reported to network. Otherwise, the network would assume the UE supports dual TX. Case 1: Since UE does not support UL DC configuration DC\_66A\_n66A, *singleUL-Transmission* is not required to be reported and in this case UL DC configuration is DC\_2A\_n66ACase 2: Since UE supports UL DC configuration DC\_66A\_n66A, *singleUL-Transmission* is required to be reported. Case 3: Since UE supports UL DC configuration DC\_66A\_n66A, *singleUL-Transmission* is required to be reported. |
| Qualcomm | No | Firstly, thanks for the moderator for clarifying Q 1-1. Yes, that clarification changes our response. However, with that clarification, the two questions in the initial round kind of become one and the same. Therefore, you can replace our answer to Q 1-1 with our answer to Q 1-2. Regarding the comment from Nokia, we would categorically have a problem if this discussion gets mixed up with the Case 1 HARQ timing capability *tdm-Pattern*. We are discussing here the *singleUL-Transmission* bit and that bit alone. *singleUL-Transmission* is more of an ‘RF capability’ indicating whether the UE cannot/can support simultaneous transmission while meeting the requirements (where requirements exist). The UE can support single UL transmission in one of two ways: HARQ timing Case #1 and/or HARQ timing Case #2. The bit ‘*tdm-Pattern*’ indicates which mode the UE supports, and there is no ambiguity how it is set. If the bit *tdm-Pattern* is not included, the UE support single UL transmission only with HARQ timing Case #2. We would have an objection to any late changes to this Rel-15 solution.Back to the original question(s), as we said, we can sympathise with the motivation. However, we still don’t fully understand the benefit of the change. What we mean is that surely if we had a time machine and went back to change all Rel-15 UEs according to the proposal, we would see the benefit. But given that we don’t have a time machine, the underlying issue will remain. If in the future simultaneous UL support is introduced in a band that doesn’t currently support it, it cannot be turned on for any Rel-15 device, simply because the base station doesn’t know whether it is a pre-December’20 Rel-15 UE or a post-December’20 Rel-15 UE it is talking with. Therefore, we question what this late change would achieve compared to the proposal we described (without repeating it here).  |
| ZTE | NO | Firstly, we think that the current wording for *singleUL-tranmission* allow UE to report its capability to network, there should be no ambiguity on that. Currently, motivation to add further clarification for intra-band EN-DC is based on assumption that UE with wrong implementation e.g. UE with only single uplink allowed doesn’t report anything and network doesn’t check UE capability for that band combination during developing the system, however at least we didn’t see such troubling case so far and this could be also avoided during trial test. Secondly,Case 1: singleUL-Transmission is not required to be reported;Case 2: singleUL-Transmission is required to be reported;Case 3: singleUL-Transmission is required to be reported; |
| Ericsson | - | Case 1: Yes, singleUL-Transmission is not required to be reported. There is only one UL configured in n66A. There is no intra-band EN-DC in the UL in this case.Case 2: Yes, if the UE only supports the requirements for single UL. In some bands these are the only specified requirements.Case 3: Yes. Same as case 2. |
| Nokia, Nokia Shanghai Bell | Yes | We agree with Case1-3 interpretations from rapporteur.To Qualcomm's points: It was exactly our proposal to focus only on the *singleUL-Transmission* - capability: To us it is clear that UE must indicate this according to Case1/2/3 explanations. This might require further RAN2 discussion as the capability text is not fully in line with RAN4 specifications. Whether clarifications to 38.306 are needed should be discussed in RAN2. |
| Intel | Yes | We confirm our understanding from the initial round: singleUL-Transmission capability shall be indicated for UEs which operate in single switched UL mode. This applies for all band combinations including the band combinations for which “Only single switched UL is supported” defined in RAN4.In case the singleUL-Transmission capability is not provided, then the network may assume that UE supports dual UL. However, given that there are no requirements defined for the case of dual UL for these BCs it is not possible to guarantee proper performance. So, we think that the network is not expected to schedule UE to avoid potential performance degradation.Case 1: UE is not required to report singleUL-TransmissionCase 2/3: UE is required to report singleUL-Transmission. |
| TELUS | YES | Agree with the case 1/2/3 reporting requirements as summarized nicely by Intel.  |
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# Fine Tuning

Based on the feedback from intermediate discussion, 5 companies agree when the UE is required to report singleUL-Transmission for the 3 cases and 2 companies not. However among these two companies, one company’s feedback on the 3 cases are exactly the same as the moderator’s proposal and the concern is whether it is essential to make any clarification, and the other company’s comment is mainly to argue if UEs in the field cannot support such a reporting, nothing needs to be changed now. Therefore there is no real strong disagreement on the technical principle and the main question left is whether any clarification is required in the specification. This part is better to be further discussed in RAN2, to ensure there is no inter-operability issue between the UE side and the network side. For instance, as also several companies commented in previous rounds, it needs to be clear how the network handles UEs which do not report as expected.

It is therefore proposed the following:

**Observation 1: it is the common understanding on the technical principle of when the UE is required to report singleUL-Transmission**

Case 1: the UE reports *DC\_****2A****\_7A\_66A\_****n66A (***i.e. UL allowed in 2A and n66A only***)***, singleUL-Transmission is not required to be reported

Case 2: the UE reports *DC\_2A\_7A\_****66A****\_****n66A (***i.e. UL allowed in 66A and n66A)***,*** singleUL-Transmission is required to be reported

Case 3: the UE reports DC 66A\_n66A, singleUL-Transmission is required to be reported

**Proposal 1: RANP to task RAN2 to further check if any specification clarification is needed to ensure there is no inter-operability issue between the UE side and network side, considering the report of singleUL-Transmission and the report of band combinations including intra-band ENDC.**

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| **Company** | **Comments on the observation and proposal** |
| Qualcomm | Would like to start with saying that we would not object to this observation and proposal. However, it would increase the level of comfort if Telus or other proponents could answer the question we keep asking: * Is it true that there are existing UEs that for either Case 2 or 3 don’t include *singleUE-Transmission*?
* If Yes to the above, is it true that making the agreement here would not change those UEs or make them disappear?
* If Yes to both the above, isn’t it true that there is no practical difference between making this agreement and not making it?

I know that there must be an alternate answer to some detail of the above but we don’t know where. It would be appreciated if this can be clarified so as to understand what scenario the commenting companies are expecting to occur in the field.  |
| Bell Mobility | Answer to Qualcomm regarding UE’s in Bell Mobility network* Is it true that there are existing UEs that for either Case 2 or 3 don’t include *singleUE-Transmission*? **No, only Case 1 exists in our network**.
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| CHTTL | In general ok, also agree with the Case1-3 interpretations here.  |
| Intel | The moderator proposal is ok for us.Regarding observation 1 it is also makes sense to list the general principle that UE needs to report singleUL-Transmission capability for the band combinations which qualify as “Only Single UL is supported” |
| ZTE | Further information added for case 1/2/3, otherwise it might be confusing without UL DC configuration explicitly listed. Fine with proposal, however for how to handle problematic Rel-15 UE if existing from network side should be further clarified., based on our understanding, this UE should be scheduled with only single uplink.  |
| Ericsson | The observation is fine for us. Regarding the proposal we don't think any changes to 38.306 are needed, thus "RAN2" should be replaced with "RAN4" in the proposal. RAN4 should take a closer look at their specifications as it seems this note "NOTE 6: Only single switched UL is supported" could be one source of confusion and misunderstanding. |