**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-210XXXX**

**Electronic Meeting, 12th – 20th April, 2021**

**Agenda item:** 12.1

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [98-bis-e][149] NR\_reply\_LS\_Part\_1

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

RAN1 sent LS (R1-2102146) ask RAN4 to confirm the TX-RX and RX-TX transient time assumption. The scope of the [149] is to discuss the companies view and provide the LS response to RAN1 after the consensus reached. The 1st round is to discuss the views for the transient time and other related topic and 2nd round it to prepare the LS response based on 1st discussion and consensus.

# Topic #1: Title

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2104542**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104542.zip) | vivo | **Observation 1**: HD-FDD UE also needs Tx<->Rx transition time to avoid self-interference which is similar to TDD.  **Observation 2**: HD-FDD UE architecture would be similar to TDD and the actual transition time is also similar.  Based on those observations, here is the following proposal:  **Proposal**: Reuse current Transition time and for HD-TDD is technically reasonable. It is proposed to reply RAN1 based on this understanding |
| [**R4-2106671**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106671.zip) | Huawei, HiSilicon | **Observation 1:** The RedCap UE architectures are same among HD-FDD bands, variable duplex HD-FDD bands and non-simultaneous RxTx SUL band combinations.  **Proposal 1:** It’s proposed to include these cases, e.g. HD-FDD bands, variable duplex HD-FDD bands and non-simultaneous RxTx SUL band combinations when RAN4 reply this LS.  **Proposal 2:** RAN4 confirms RAN1’s working assumption about RedCap UE’s transition time for HD-FDD bands, variable duplex HD-FDD bands and non-simultaneous RxTx SUL band combinations. |
| [**R4-2107186**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107186.zip) | Nokia, Nokia Shanghai Bell | **Proposal 1:** From RAN4 perspective, confirm RAN1’s working assumption to reuse existing switching times for UE not capable of full duplex (Table 4.3.2-3 in TS 38.211) for RedCap UE with half-duplex FDD operation**.** |
| [**R4-2107340**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107340.zip) | Qualcomm Incorporated | **Proposal:** Half duplex switching time for Type-A HD-FDD needs further discussion before fixing or optimizing the transition time. For power saving and timing advance of R17 RedCap UEs, the switching time could be more than the numbers in Table 4.3.2-3. TS 38.211 |
| [**R4-2107248**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107248.zip) | Ericsson | **Observation#1:** No frequency tuning is required for Type A HD-FDD RedCap UE when switching between Tx and Rx.  **Observation#2:** FR1 transition time in Table 4.3.2-3 in TS 38.211 applies to Type A HD-FDD device Tx-Rx turn around transition time. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

The transition time for Type A HD-FDD UE based on RAN1 assumption is reusing the transition time in Table 4.3.2-3 in TS 38.211. Companies present their views based on discussion of the UE architecture, implementation, power saving, system performance etc. Most companies agree with the RAN1 assumption and one company think the general transition time mask needs change for power saving purpose and thus propose different number other than RAN1 assumption. One company think the SUL band combination should also apply to HD-FDD UE on top of normal FDD band in FR1. Based on companies view, the topic is listed below to facilitate the consensus on possible LS response during the 1st round.

1. Sub-topic 1-1: SUL band Applicability (variable duplex HD-FDD bands and non-simultaneous RxTx SUL band combinations.)
2. Sub-topic 1-2: Applicability of general ON-OFF time mask (sub-clause 6.3.3.2, TS 38.101-1)
3. Sub-topic 1-3: Transition time for HD-FDD

### Sub-topic 1-1

*Sub-topic description:*

In TR 38.875, the type A/B HD-FDD device is defined based on the reference NR device (FR1 FDD, FR1 TDD and FR2 respectively, in chapter 6.1) and also based on the removal of the duplex for cost saving. One company propose SUL band and its combination also apply to Type A/B HD-FDD UE and to RedCap UE in general. It is not clear the SUL band and its combination should be included in RAN4 RedCap working scope. Companies can provide views on this.

*Open issues and candidate options before e-meeting:*

**Issue 1-1: SUL band and its combination on RedCap UE in** **RedCap WI RAN4 scope**

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + TBA

### Sub-topic 1-2

*Sub-topic description*

One company want to further reduce the current consumption for HD-FDD device by shutting down TX PLL and thus violate the ON-OFF mask assumption which assume the TX RF block remains ON during the transient time. The transient time proposed is around 65 us and also a change of the OFF state definition. Another company propose the general ON-OFF time mask apply to Type A HD-FDD as the HD-FDD device needs to coexist with non-RedCap NR UE. Companies can provide views on this.

*Open issues and candidate options before e-meeting:*

**Issue 1-2: Applicability of general ON-OFF time mask**

* Proposals
  + Option 1: General ON-OFF time mask does not apply to Type A HD-FDD device, Fixing or optimizing the transition time for HD-FDD considering the redefinition of the OFF state.
  + Option 2: General ON-OFF time mask applies to Type A HD-FDD device.
* Recommended WF
  + Option 2.

### Sub-topic 1-3

*Sub-topic description*

Several companies agree with the reusing the transition time for TDD UE on Type A HD-FDD device. One company has different view. In this sub-topic, only the transient time is discussed Thus company views are needed.

*Open issues and candidate options before e-meeting:*

**Issue 1-3: Transit time for Type A HD-FDD UE**

* Proposals
  + Option 1: transition time in Table 4.3.2-3 in TS 38.211 applies to Type A HD-FDD UE.
  + Option 2: Other transit time than stated in Table 4.3.2-3 in TS 38.211
* Recommended WF
  + Option 1.

## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

Sub topic 1-1

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| --- | --- |
| **Company** | **Comments** |
| Huawei | We prefer option 1.  1) Based on the analysis, the RF chain is quite similar between Half-duplex operation on FDD bands and the non-simultaneous RxTx operation on SUL band combinations.  2) Referring to the table 4.3.2-1 from TS 38.211, “the transition time and is applicable to the UE not capable of full-duplex communication and not supporting simultaneous transmission and reception as defined by parameter *simultaneousRxTxInterBandENDC*, *simultaneousRxTxInterBandCA* or *simultaneousRxTxSUL”.*  We can confirm that the transition time and is also applicable to non-simultaneous RxTx operation for SUL band combinations on RedCap UE.  3) For simultaneous RxTx operation for SUL band combinations, the diplexer can be added comparing to the non-simultaneous RxTx case from implementation perspective. It’s feasible to implement SUL band combinations on RedCap UE.  In total, SUL band and its combinations on RedCap UE should be included into RedCap WI RAN4 scope. We can reply LS to RAN1 with the confirmation on the transition time requirements for the non-simultaneous RxTx operation for SUL band combinations together. |
| Ericsson | Option 2. It is our understanding that the SUL and its band combination is not included in the WID and thus not in the RAN4 working scope. The CA and DC and wideband included neither.  This WI has the following objectives:   * Specify support for the following UE complexity reduction features [RAN1, RAN2, RAN4]:   + […]   + *Duplex operation:*     - *HD-FDD type A with the minimum specification impact (Note that FD-FDD and TDD are also supported.)* * Specify definition of one RedCap UE type including capabilities for RedCap UE identification and for constraining the use of those RedCap capabilities only for RedCap UEs, and preventing RedCap UEs from using capabilities not intended for RedCap UEs including at least carrier aggregation, dual connectivity and wider bandwidths. [RAN2, RAN1]   + The existing UE capability framework is used; changes to capability signalling are specified only if necessary. * […]   Notes:   * […]   This WI focuses on SA mode and single connectivity with operation in a single band at a time |
| Apple | Option 2: No  SUL cannot work as a stand-alone band and can only work together with another NR band as a combination where the radio hardware complexity is equivalent to supporting an UL CA. This would defeat the purpose of RedCap UE in reducing the device complexity. |
| CBN | Option 1.  As an operator, we have demand on RedCap UE supporting SUL band combinations. |
| CMCC | Option1.  It seems that RedCap UE supporting SUL and it band combinations will not pose a challenge to the implementation of RF architectures,  If no additional complex devices need to be introduced perhaps we can consider adding this feature to RedCap UE. |
| vivo | Option 2  We think SUL is pretty much similar to the case of CA, and this extended scope are not quite aligned with the common understanding of intention of Redcap and the WID. |
| Nokia | Option 2. The RedCap WI in RP-210918 does not specify support for SUL bands / band combinations to be in the scope of RedCap; rather support for FDD and TDD bands is specified. Such discussion is outside the scope of this reply LS. |
| Huawei | To Ericsson, I don’t think SUL band combinations belong to carrier aggregation, dual connectivity. The SUL is clearly a different thing from wider bandwidth, which we supposed to be well understood to Ericsson as rapporteur. One can check the ran plenary discussion where in one of the intermediate version （RP-202864 listed as below） SUL was mentioned in addition to wider bandwidth, but after more discussion it was removed from the approved version, leaving it open as all other optional legacy UE features.  C:\Users\z00471447\AppData\Roaming\eSpace_Desktop\UserData\z00471447\imagefiles\CBDE2200-947F-4C9F-9F67-10A8A706863D.png  To Apple, only single UL is used for SUL band combinations. That means it isn’t equivalent to support an UL CA (Two UL). From technical perspective, supporting SUL band combinations didn’t increase the complexity about the RF architecture and implementation. The single band operation is restricted to be at a given time, which is also included in the case for SUL where single RF is used. Actually, per RAN1 study, RedCap is supposed, or at least as UE implementation to be able to support multi-bands for commerlization while not UL CA which requires multiple RF.  To Vivo, SUL band combinations don’t belong to carrier aggregation. Based on our analysis, the RF chain is quite similar between Half-duplex operation on FDD bands and the non-simultaneous RxTx operation on SUL band combinations. From implementation perspective, it doesn’t increase the complexity of RedCap UE.  To Nokia, However, the RedCap WI in RP-210918 doesn’t specify support for FDD bands and TDD bands as well. We can’t understand the RedCap WI using that way. We need to confirm and inform RAN1 that transition time and is also applicable to non-simultaneous RxTx operation for SUL band combinations on RedCap UE. |

Sub topic 1-2

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| **Company** | **Comments** |
| Huawei | Option 2 |
| Qualcomm | The definition in the spec is clear for General ON-OFF, but we have a concern of applying the mask to all types of devices such as RedCap. |
| Ericsson | Option 2, we have concern on the coexisting RedCap and non-RedCap in general and believe if RedCap UE cannot meet the general On-OFF mask, the time orthogonality ensured by ON-OFF mask for the UE:es uplink operation will be lost. |
| Apple | Option 2: General ON-OFF time mask applies to Type A HD-FDD device.  In our view, the general ON-OFF time mask transient period should not be longer than Tx to Rx and Rx to Tx switching time for half-duplex operation. |
| vivo | Option 2 |
| MediaTek | We have a similar concern as in Qualcomm comment. |
| Nokia | Option 2. This UE type was not studied in TR 38.875. Thereafter RAN1 agreed for the RedCap WI to specify requirements for Type A HD-FDD device (based on duplexer replacement) with no relaxation of the general ON-OFF time mask. |
| Intel | Option 2. Note that please remember even for NB\_IoT devices the general E-UTRAN ON-OFF mask applies (except 3.75khz). We don’t see justification of need to further relax. |

Sub topic 1-3

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| **Company** | **Comments** |
| Huawei | Option 1 |
| Qualcomm | Option 2. RAN1 discussed the HD-FDD switching time in TS 38.211, Table 4.3.2-3 as a working assumption only. UE will benefit from current savings for wearable devices and should consider a longer gap for Type A HD-FDD due to more relaxed latency and throughput requirements than regular TDD device. So, it is worthwhile to have more time (May meeting?) for investigating an option to define a TX/RX switching requirement specific for RedCap. |
| Ericsson | Option 1. |
| Apple | Option 3: Though we think the transition time defined in Table 4.3.2-3 in TS 38.211 is feasible to Type A HD-FDD UE, we are also open to have further discussions in RAN4 if allowing longer transition time would benefit power consumption. Notice that RedCap UE RF requirement development has not been started in RAN4 yet. |
| vivo | Option 1. |
| MediaTek | Although the RAN1 working assumption may be feasible for RedCap, however, it is worth having more time (May meeting) to investigate the benefit of longer switching time period on power saving. |
| Nokia | Option 1 |
| Intel | Option 1. |

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 1-1 : SUL band Applicability** | Three companies think the SUL band combination applies to RedCap UE and four companies think it does not. The proponent of SUL band applicability to RedCap UE provided the more explanation but not sure other companies has time to read/response it and it is worthwhile to continue to discuss it during the 2nd round to capture companies input. A WF assigned should be good way to further discuss it as this topic also relate to the coming RAN4 RedCap working scope.  *Tentative agreements:*  *Candidate options:*  *SUL band applicability to RedCap UE*  *Opton 1: Yes*  *Option 2: No*  *Option 3: FFS*  *Recommendations for 2nd round: WF discussion* |
| **Issue 1-2: Applicability of general ON-OFF time mask** | Six companies think the ON-OFF time mask applicable to RedCap UE and two companies did not comment on this and this aspect need to be discussed during 2nd round and companies consensus is to be captured in WF.  *Tentative agreements:*  *Candidate options:*  *General ON-OFF time mask applies to RedCap UE*  *Option 1: Yes*  *Option 2: FFS*  *Recommendations for 2nd round: WF discussion* |
| **Issue 1-3: Transit time for Type A HD-FDD UE** | Five companies agree with RAN1 transition time assumption while two companies want to investigate more on the transition time proposed by RAN1 from power saving aspects and one company think RAN4 can delay the response till next meeting as the formal RedCap work not start yet. Moderator recommend to delay LS response to next meeting as no consensus was made during 1st round and not likely during 2nd round. Companies are encouraged to bring more concrete technical paper for the proposed transient number next meeting and thus there is no need to discuss the transition time during the 2nd round. Capture the tentative agreement below in WF.  *Tentative agreements:* Companies are encouraged to bring more concrete technical paper for the proposed transient number next meeting  *Recommendations for 2nd round: No discussion needed.* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

**Issue 1-1: SUL band and its combination on RedCap UE in RedCap WI RAN4 scope**

*Candidate options:*

*SUL band applicability to RedCap UE*

*Opton 1: Yes*

*Option 2: No*

*Option 3: FFS*

**Issue 1-2: Applicability of general ON-OFF time mask**

*General ON-OFF time mask applies to RedCap UE*

*Option 1: Yes*

*Option 2: FFS*

Sub topic 1-1

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| **Company** | **Comments** |
| Ericsson | Option 3. In TS 38.101-1, the SA operation of SUL band combination mandates the con-current band operation “For UE supporting SUL band combination simultaneous Rx/Tx capability is mandatory”, thus it is against the RedCap WID note which is “single band at a time”. From this point of view, the SUL band combination is not in scope of the RedCap WID.  Paper 6671 propose that for HD-FDD operation, the SUL band combination can be applied with the recommended reduced RF complexity. The logic is that if FDD band RedCap UE can reduce its cost by removing duplexer so does the SUL band combination UE. It is common understanding that RedCap UE also operate with a normal FDD and TDD band on top of the HD-FDD operation, it is not clear that a RedCap UE can operate with a SUL band combination because it will be against the “single band operation at a time” as mentioned earlier.  Even if SUL band combination applies to HD-FDD operation as the RAN1 specification allows it with signalling “simultaneousRxTxSUL”, it is not clear if such UE with HD-FDD SUL band combination will be defined as RedCap UE as the RF architecture is based on FDD UE RF architecture defined in TR38.875. There may be different UE RF architecture for SUL band combination as there is also a two-UL-carrier switching requirement (0us) in TS 38.101-1. The clarification point on the RF architecture would be how many PLL such UE will have for two UL carrier and one DL carrier. The Type A HD-FDD assumes two PLL which one for UL and one for DL. If SUL band combination UE also follow this, it would mean there will be PLL tuning delay when it switches between SUL UL carrier and NR band UL carrier. This would mean either the Type A HD-FDD device assumption cannot hold for SUL band combination UE or the switch time needs to be discussed separately. Either cases would mean more investigation would be needed before RAN4 reach consensus that for UE supporting SUL band combination can be defined as a RedCap UE when it operates at HD-FDD mode. |
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Sub topic 1-2

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| **Company** | **Comments** |
| Ericsson | Option 1. As mentioned in 1st round, we have concern on the coexisting RedCap and non-RedCap in general and believe if RedCap UE cannot meet the general On-OFF mask, the time orthogonality ensured by ON-OFF mask for the UE:es uplink operation will be lost.  As the ON/OFF mask transient time is part of the RX-TX or TX-RX turn-around time, so it will good to hear proponent view who is against to apply this requirement. |
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# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on transition time for Type A HD-FDD UE | Ericsson |  |
|  |  |  |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-2104542 | Discussion and reply LS on Half-duplex FDD switching time for RedCap | vivo | Noted |  |
| R4-2106671 | Discussion and draft Reply LS on Half-duplex FDD switching time for RedCap UE | Huawei | Noted |  |
| R4-2107186 | Discussion on HD-FDD switching times for RedCap UE | Nokia | Noted |  |
| R4-2107248 | Reply LS to Half-duplex FDD switching for RedCap UE | *Ericsson* | Noted |  |
| R4-2107340 | Type-A Half-duplex FDD switching time for RedCap UE | *Qualcomm* | Noted |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents