3GPP TSG-RAN WG2 Meeting #118 Electronic R2-2206350

Online, May 9th – May 20th, 2022

Agenda Item: 6.5.2

Source: Ericsson

Title: Summary of [AT118-e][505][IIoT] CP open issues and CR 38.331 (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This paper collects companies’ views for the remaining issues after (first week) Tuesday’s online session.

* [AT118-e][505][IIoT] CP open issues and CR 38.331 (Ericsson)

 CP open issues and CR capturing agreed corrections

Deadline: To be set by rapporteur aiming to have company inputs and proposals by

Contact person(s) for each participating company:

|  |  |  |
| --- | --- | --- |
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# 2 Discussion

## 2.1 *RRCReconfiguration* or *DLInformationTransfer* message

The paper [2] proposes to move *ta-PDC* and *sib9Fallback* to *RRCReconfiguration* message.

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| R2-2206006 Discussion on ta-PDC and sib9Fallback for IioT ZTE Corporation, SanechipsMoreover, we think handover case need to be further considered. With *ta-PDC* in *DLInformationTransfer*, if *ta-PDC* is activated in the source cell and then UE moves to the target cell, the target cell cannot know this and may configure UE with *rxTxTimeDiff-gNB-r17*. This is not allowed. So it seems more suitable to put ta-PDC in *RRCReconfiguration*. For *sib9Fallback*, similar issue may exist in handover case. Therefore, we suggest RAN2 further discuss whether it’s better to move *ta-PDC* and *sib9Fallback* to *RRCReconfiguration* message.**Proposal 3: RAN2 is suggested to further discuss whether it’s better to** **move *ta-PDC* and *sib9Fallback* to *RRCReconfiguration* message.** |

The above proposal 3 is further discussed online without a conclusion. Chair notes copied below

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| [R2-2206006](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_118-e%5CDocs%5CR2-2206006.zip) Discussion on ta-PDC and sib9Fallback for IioT ZTE Corporation, Sanechips discussion Rel-17 NR\_IIOT\_URLLC\_enh-CoreProposal 3: RAN2 is suggested to further discuss whether it’s better to move ta-PDC and sib9Fallback to RRCReconfiguration message- Nokia thinks that this has nothing to do with the NAS message so no need to have in DL transfer message, so there may be some point. - Ericsson points out that this was discussed in previous releases and it ended up where it is now. - Qualcomm thinks that Nokia is correct but this may create more problems with the sib9fallback=> Noted |

**Why in RRC Reconfiguration message?**

1. DL Information transfer was primarily defined for transfer of NAS containers that are transparent to AS.
2. During handover, the target cell may not be aware of the configuration in the source cell which is transmitted in the DLInformationTransfer. It seems suitable to add the field in the *RRCReconfiguration* so that the configuration (like ta-PDC or sib9Fallback) can be done together with handover commands. Otherwise, the network needs to, e.g., configure *sib9Fallback* separately in DLInformationTransfer, in the case that the source cell transmitted in unicast while the target cell intends to transmit in SIB9.
3. [More] For *ta-PDC*, it may be possible that *ta-PDC* is previously activated in the source cell. After handover, the target cell cannot know this and may configure UE with *rxTxTimeDiff-gNB-r17*. UE may consider this is wrong configuration as there is restriction in field description of *rxTxTimeDiff-gNB-r17* “The network does not configure this field, if the UE is configured with ta-PDC with value activate.”
4. For *sib9Fallback*, UE may be configured *sib9Fallback* in the source cell, then UE would keep using time info in SIB9*.* After handover, if no *DLInformationTransfer* is received or *DLInformationTransfer* is received while both *referenceTimeInfo* and *sib9Fallback* are absent, we assume UE would continuously use time info in SIB9. But if *DLInformationTransfer* is received with *referenceTimeInfo* present and *sib9Fallback* absent, we tend to think (but cannot sure) UE would back to use time info in *DLInformationTransfer*. It can be seen UE may have different process in the two cases that *sib9Fallback* is absent. In order to avoid any ambiguity, we hope target cell can be aware of the configuration of source cell. And furthermore, hope network can have the way to explicitly disable “fall back to SIB9”, .e.g., not let UE implicitly depend on whether this is *referenceTimeInfo* in *DLInformationTransfer*.

**Why in DLInformationTransfer message?**

1. Reference time information has been agreed to be part of the DL Information transfer since LTE Rel-15. Also the usage of the DL information transfer has been extended not only to reference time information, but also to IAB-DU specific F1-C related information, see below text.

The *DLInformationTransfer* message is used for the downlink transfer of NAS dedicated information, timing information for the 5G internal system clock, or IAB-DU specific F1-C related information.

1. If configurations are in two different RRC messages, then it incurs overhead/problems. For example, if the network decides to de-activate *ta-PDC* while activate UE RTT-based method, then the network has to transmit both RRC Reconfiguration message and DLInformationTransfer message. It is not clear how it would work unless all reference time related information is moved to RRCReconfiguration, which seems not possible due to NBC.
2. The RRC Reconfiguration message may almost be empty with a single filed of ta-PDC or sib9Fallback in the case there is no handover or RRC reestablishment.
3. [More] ?

**Q1. Do companies prefer RRCReconfiguration message or DLInformationTransfer message? Additional comments are highly appreciated.**

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| --- | --- | --- |
| **Company** | **RRCReconf or DLInfoTransfer ?** | **Additional comments** |
| CATT | *DLInformationTransfer* | From our perspective, the main drawback is that expressed in point 2 under “Why in DLInformationTransfer message?”. We prefer keeping all time-related info in the same place, i.e. *DLInformationTransfer*. We don’t see that a too big issue to send *DLInformationTransfer* message after handover procedure. |
| OPPO | *DLInformationTransfer* | We agree with the rapporteur’s analysis, and the main drawbacks are clearly mentioned in bullet 2 and 3 under “Why in DLInformationTransfer message?”. For the issue raised by the proponent company, it can be resolved by the gNB implementation, i.e. the target gNB sends *DLInformationTransfer* message after HO ASAP. |
| Ericsson | *DLInformationTrasnfer* |  |
| Apple | *DLInformationTransfer* | We have some sympathy to RRCReconfiguration message. But as we are already in the maintenance phase, we prefer to stick to the previous agreement unless severe technical issues are observed. In this case, there seems to be more technical issues if we use RRCReconfiguration message rather than *DLInformationTransfer.* |
| Qualcomm | *DLInformationTransfer* | Both are workable, however, *RRCReconfiguration* would require some new changes to work properly as, for example, the case mentioned by rapporteur. Furthermore, this would require occasionally sending an empty *RRCReconfiguration* msg just to instruct the UE to fallback to SIB9 which is not preferable. In our view, nothing breaks if we keep the agreement to use *DLInformationTransfer*, which is preferable at late stage. For HO, the target cell can always send SIB9Fallback to UEs to make sure they are not stuck on the ignore SIB9 command, we do not think that’s an issue.  |
| Nokia | *Both* | It should be at least added to RRCReconf to allow reconfiguration upon HO. It can be kept in DLInformationTransfer as well to avoid sending two RRC messages for some cases.  |
| Samsung | *RRCReconfiguration* | We agree the motivation. Since it’s the last meeting, we have a chance to relocate.  |
| LGE | *DLInformationTransfer* | The target gNB can send *DLInformationTransfer* after handover, which seems not an issue. |
| Intel | *DLInformationTransfer* | Nothing is broken when using *DLInformationTransfer*. Given that time reference information is included in *DLInformationTransfer* in Rel-16, we prefer to keep timing synchronization related fields in *DLInformationTransfer*. |
| Huawei, HiSilicon | *DLInformationTransfer* | Handover scenario is not regarded as “high-priority” scenario in IIOT discussion.  |
| Sequans | *DLInformationTransfer* | No strong view but we don't see issue with keeping the existing location. |
| Xiaomi | *DLInformationTransfer* | We are also ok to add extra configuration in *RRCReconfiguration*. |
| ZTE | *RRCReconfiguration* | As mentioned above, in our contribution R2-2206006, we mainly mentioned a possible issue, e.g., *ta-PDC* is previously activated in the source cell. The target cell cannot know this and may configure UE with *rxTxTimeDiff-gNB-r17* later. As this is not allowed according to current specification, then would UE think there is something wrong with this *DLInformationTransfer* received in target cell and discard it? We have had considered a possible way may be that, if the target cell wants to activate UE RTT-based method, it can always send “deactivate” *ta-PDC* together with “*rxTxTimeDiff-gNB-r17*”. Firstly, we think it may require UE to deal with these two IEs in a certain order, hope UE can do this. Secondly, (always) sending “deactivate” *ta-PDC* is obviously unnecessary in other cases that UE is not activated ta-PDC in the source cell.The *sib9Fallback* in *DLInformationTransfer* may also cause some ambiguity. |

**Conclusion**

* **Ten companies (CATT, OPPO, Ericsson, Apple, Qualcomm, LGE, Intel, Huawei, Sequans, Xiaomi) prefer *DLInformationTransfer*, but Xiaomi is also oaky to add in *RRCReconfiguration***
* **One company (Nokia) prefers both.**
* **Two companies (Samsung, ZTE) prefer RRC Reconfiguration.**

**In addition to the pros/cons listed above, companies also point out that the target gNB can send *DLInformationTransfer* after handover. Adding in the *DLInformationTransfer* (since LTE rel-15) is not optimal in retrospect, but moving to RRC Reconfiguration seems to bring more technical issues.**

**Proposal 1 RAN2 confirms that the fields *ta-PDC* and *sib9Fallback* are kept in the RRC message *DLInformationTransfer*. (10/13)**

## 2.2 Multi TB scheduling in CG

In Rel-16, multi-TB CGs are NOT supported for licensed band with a UE capability restriction, i.e., only supported in unlicensed band. The capability bit “*cg-resourceConfig-r16*” is only in the IE *SharedSpectrumChAccessParamsPerBand*.

In Rel-17, when *cg-retransmissionTimer* is not configured in unlicensed band, the HARQ formula is used and it indicates the same HARQ ID for each of the slots/occasions within the same CG period. This is wrong in case when multiple TBs are used. There were proposals to solve this issue, but none agreed. The paper [1] proposes to capture this restriction in RRC spec.

**Q2. Do companies agree with the below proposal?**

 **Multi-TB in CG is supported only when cg-retransmissionTimer is configured for unlicensed band**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes, No?** | **Comments** |
| CATT | No | There is no reason to introduce such artificial restriction as there is no technical system issue identified. Current spec works perfectly fine as is. |
| OPPO | No | We see no critical issue if we keep the current spec as it is.  |
| Ericsson | Yes | It remains unclear whether multi TB is supported with cg-retransmissionTimer not configured in the unlicensed band.  |
| Apple | Yes | We are concerned about impacts to implementation due to potential ambiguity at this stage. |
| Qualcomm | See comment | To clarify, multi-TB scheduling is just cg-nrofPUSCH-InSlot or cg-nrofSlots not equal to one. It is true that the current HARQ ID determination does not consider that case. It can be easy to just **adjust the HARQ formula** to do that. Below is a simple example.Suppose the number of slots allocated is N and the number of PUSCH occasions in a slot is M. Meanwhile, the repetition factor for TB is K. We need L = N\*M/K HARQ process IDs to cover the CG-UL resources in one period. The L HARQ process IDs can be determined as 1. Every period will take sequential L HARQ processes, for a period, the staring HARQ process can be HARQ Process ID = { [floor(CURRENT\_symbol/*periodicity*)] modulo [*nrofHARQ-Processes/L*]}*\*L*
	* CURRENT\_symbol is the first symbol of the first CG-UL resource and CURRENT\_symbol=(SFN × numberOfSlotsPerFrame × numberOfSymbolsPerSlot + slot number in the frame × numberOfSymbolsPerSlot + symbol number in the slot)
		+ numberOfSlotsPerFrame refer to the number of consecutive slots per frame
		+ numberOfSymbolsPerSlot refer to the number of consecutive symbols per slot

The remaining HARQ process IDs will be (HARQ Process ID + j) modulo (*nrofHARQ-Processes*), with j = 0, 1, …, L-11. The first K resources will take the first HARQ process ID, and every next K resources for the next HARQ process ID, until the last K resource take the last HARQ process ID.

Below is a simple example.Let us say N = 2 slots; M = 3 PUSCH occasions; K = 2 repetition. The number of HARQ process = 6Then, L = N\*M/K = 2\*3/2 = 3. The HARQ Process ID calculated by first symbol in current period = 4 and HARQ process IDs (H\_ID) will be 4, 5, 0 as depicted in figure below. |
| Nokia | Yes | Otherwise new HARQ formula would be needed to enable multi-TB without cg-retransmissionTimer which has too much impact. |
| Samsung | Yes | We prefer not to revise the formula at this late stage. It’s mainly for non-UCE scenario. It’s better to not allow it. |
| LGE | Yes | It is not good to adjust the HARQ formula for this at this stage. Also, we don’t see much benefit of having multi-TB with cg-RetransmissionTimer as pointed out by Ericsson.  |
| Intel | No | We think current spec works fine as is and there is no need for further restriction. |
| Huawei, HiSilicon | Yes | We prefer not to introduce new HARQ formula |
| Sequans | Yes |  |
| Xiaomi | Yes |  |
| ZTE | No |  |

**Q3. If companies reply yes to the previous question, do you agree with TP in [1] ?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes, No?** | **Comments** |
| Ericsson | Yes |  |
| Apple | Yes |  |
| Nokia | Yes |  |
| Samsung | Yes |  |
| LGE | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Sequans | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes  | If companies are not convinced of the mentioned issues. |

**Conclusion**

* **Eight companies (Ericsson, Apple, Nokia, Samsung, LGE, Huawei, Sequans, Xiaomi) agree that “multi-TB in CG is supported only when *cg-retransmissionTimer* is configured for unlicensed band “**
* **One company (Qualcomm) does not agree but acknowledge the issue of HARQ formula.**
* **Four companies (CATT, OPPO, Intel, ZTE) do not agree, but they don’t provide comments on the HARQ formula issue**

**As one company points out, the issue to support multi-TB in CG without cg-retransmissionTimer is the discussion on the HARQ process formula, e.g., if need to change and how to change. From rapporteur point of view, this does not seem a correction but an introduction of a new feature. The below is a re-wording and hope it is acceptable.**

**Proposal 2 Multi-TB scheduling in CG is not supported when cg-retransmissionTimer is not configured for unlicensed band in Rel-17. Adopt the TP in R2-2205508. (8/13)**

# 3 Conclusion

TBD

# 4 References

1. R2-2205508 Multi-TB scheduling in UCE Ericsson discussion
2. R2-2206006 Discussion on ta-PDC and sib9Fallback for IIoT ZTE Corporation, Sanechips discussion Rel-17 NR\_IIOT\_URLLC\_enh-Core