3GPP TSG-RAN WG2 Meeting #116bis Electronic R2-220xxxx

Elbonia, 17 – 25 January 2022

**Agenda item: 8.6.3**

**Source: Nokia (Rapporteur)**

**Title: Report of [Post116-e][510][SDT] CCCH and DCCH (Nokia)**

**WID/SID: NR\_SmallData\_INACTIVE - Release 17**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the report of the following email discussion:

* [Post116-e][510][SDT] CCCH and DCCH (Nokia)

 Scope: Aim to have CRs describing each solution and discuss technical points on the two solution such that a decision can take place next meeting.

 Deadline: Long

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

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| Company | Name | Email Address |
| Nokia (Rapporteur) | Samuli Turtinen | samuli.turtinen@nokia.com |
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# 3 Discussion

Agreeing on a solution option between CCCH- and DCCH-based solution for the non-SDT data arrival during SDT procedure has been challenging and open for several meetings already. Details of the solutions and related issues have been discussed, e.g., in [1-7] in the previous RAN2#116-e meeting.

The intention of this discussion is to gather companies’ views on the presented issues for both solutions to guide the discussion on agreeing on a solution basis for the long-lasting issue.

Since solution opponents for both solutions provided specific issues of the solutions, it seems fair to ask what companies think about these issues as online discussion was mainly about debating that there are open issues in both solutions without solid answers if the issues were actually meaningful in terms of specification effort. The intention would be also to describe how the issue is solved in the solution option, ie., more details of each solution should be described.

Even though both solutions on high level have been clear for pretty much everyone, they are shortly recapped hereinafter for convenience:

 When SDT procedure is ongoing (ie., SDT has been initiated by RRC layer) and data arrives into a buffer of at least one SRB/DRB not configured for SDT, the UE

* DCCH solution: triggers a transmission of an RRC message over SRB1 (tbc.) indicating the availability of data in the buffer of the SRB(s)/DRB(s) not configured for SDT. The RRC message is transmitted as SDT data in the SDT procedure. Based on the RRC message, the NW may bring the UE into CONNECTED mode.
* CCCH solution: terminates the SDT procedure and triggers an RRC resume procedure (non-SDT). Based on the *RRCResumeRequest*, the NW may bring the UE into CONNECTED mode.

## 3.1 Questions on DCCH based solution

[2, 6] provides a set of open issues wrt. DCCH-based solution. These issues are discussed hereinafter.

Firstly, it should be discussed whether a new resume cause is needed, e.g. if non-SDT is triggered by RNA update or signalling while SDT was triggered for data etc. The CT1 reply on this aspect provided in [8] is not completely clear but seems to assume that for suspended resources, NAS will require Service Request procedure to be initiated and NAS will need to provide UAC parameters based on the reason for that Service Request. This may need to be further clarified from CT1.

**Question 1**: Do you agree that resume cause needs to be indicated in the RRC message for non-SDT data indication for DCCH based solution? Further, should this be confirmed from CT1 with an LS?

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| Answers to Question 1 |
| Company | Yes/No | CT1 LS: Yes/No | Technical Arguments |
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**Summary 1**: TBD.

**Proposal 1**: TBD.

Regardless of the responses to Question 1, the details of the content of the RRC message for non-SDT data indication should be discussed. For instance, is there a need to include further information on top of the indication, like SRB(s)/DRB(s) information with data, *resumeCause* (see previous question), amount of data, etc.

**Question 2**: What information should be included in the RRC message for non-SDT data indication for DCCH based solution?

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| Answers to Question 2 |
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**Summary 2**: TBD.

**Proposal 2**: TBD.

Another issue is whether a new UL RRC message would be defined, or an existing UL RRC message (like *UEAssistanceInformation*) could be utilized for the purpose.

**Question 3**: Do you prefer to introduce a new UL RRC message for the non-SDT data indication for DCCH based solution? If not, which existing UL RRC message is preferred to be utilized and why?

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| Answers to Question 3 |
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**Summary 3**: TBD.

**Proposal 3**: TBD.

The error recovery for DCCH based solution is also unclear, unlike in CCCH based solution where T319 is started when the resume procedure is initiated. While the details of the SDT failure timer are yet unclear, generally it has been agreed to be longer than T319 to account the unknown time required to complete the SDT procedure. Hence, the SDT failure timer applicability for non-SDT data arrival is questionable, for instance, in case the non-SDT data is high priority traffic, e.g. an emergency call.

**Question 4**: Do you agree the SDT failure timer is not sufficient for error handling in case of non-SDT data indication for DCCH based solution? If yes, what should be the UE behaviour in case the network is not responding for the DCCH based non-SDT data indication?

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| Answers to Question 4 |
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**Summary 4**: TBD.

**Proposal 4**: TBD.

For CCCH based solution, the NW can respond with existing RRC messages as specified. For DCCH based solution, however, this is not completely clear. For instance, can the NW respond with *RRCReject* based on the RRC message for the non-SDT data indication and would the UE go to RRC\_INACTIVE mode based on it? Furthermore, would the UE terminate the ongoing SDT procedure or continue with it?

**Question 5**: Do you agree that the NW can respond with *RRCReject* for the RRC message for the non-SDT data indication? If yes, what should be the UE behaviour in this case?

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| Answers to Question 5 |
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**Summary 5**: TBD.

**Proposal 5**: TBD.

Another case described in [6] is in case the NW initiates the transmission of *RRCRelease* message before receiving the RRC message for non-SDT data indication from the UE, what would be the UE behaviour. Naturally, the UE does not know if the NW received the non-SDT data indication before or after triggering the RRC Release.

**Question 6**: What should be the UE behaviour in case it receives *RRCRelease* message after transmitting the RRC message for non-SDT data indication to NW?

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| Answers to Question 6 |
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**Summary 6**: TBD.

**Proposal 6**: TBD.

RAN3 has agreed that the last serving gNB decides whether to relocate the UE context or not when the SDT procedure is initiated. However, in case the RRC message for non-SDT data indication is received by the receiving gNB, the context shall be transferred to the receiving gNB in case the UE is brought into RRC\_CONNECTED mode. This would be no longer a decision of the last serving gNB.

**Question 7**: Do you agree that the receiving gNB shall be able to indicate to the last serving gNB and force UE context relocation in case of RRC message for non-SDT data indication is received by the receiving gNB (ie., against current RAN3 agreement)?

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| Answers to Question 7 |
| Company | Yes/No | Technical Arguments |
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**Summary 7**: TBD.

**Proposal 7**: TBD.

Finally, DCCH based solution is described to overperform CCCH based solution since the link between the UE and the NW is already “available”. However, since the SDT procedure is considered to be fairly short, the likelihood that the RA procedure for initial SDT transmission has not been completed upon the non-SDT data arrival into the UE buffer can be regarded also meaningful, ie., most of the time in the SDT procedure is spent in the RA procedure in case the SDT data can be included in the MSGA/Msg3 completely. Same applies for CG-SDT transmission, ie., NW may have not responded to the UE (or the UE even transmitted the initial CG transmission) before the non-SDT data arrival. Since the payload size of SDT Msg3/MsgA/CG is generally thought to be larger, the probability for it to succeed compared to regular RA procedure Msg3/MsgA could be thought to be lower – also since the UE may be moving away from cell centre.

**Question 8**: Do you agree CCCH solution would generally outperform DCCH solution when RA procedure for RA-SDT is not completed or when no response is received for initial CG-SDT transmission?

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| Answers to Question 8 |
| Company | Yes/No | Technical Arguments |
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**Summary 8**: TBD.

**Proposal 8**: TBD.

## 3.2 Questions on CCCH-based solution

[5] lists number of issues for CCCH based solution. These issues are discussed hereinafter.

Firstly, security issues are described. [5] indicates that UE autonomous horizontal key derivation when switching from SDT procedure to RRC resume procedure would violate security principles. This may need to be clarified from SA3.

**Question 9**: Do you see a concern in UE autonomous horizontal key derivation when switching from SDT procedure to RRC resume procedure? Further, should this be confirmed from SA3 with an LS?

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| Answers to Question 9 |
| Company | Yes/No | SA3 LS: Yes/No | Technical Arguments |
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**Summary 9**: TBD.

**Proposal 9**: TBD.

[5] further indicates that same security key would be used by two NW nodes in case the KgNB used to cipher the UL data during the SDT procedure is used as input key for the *resumeMAC-I* generation for the *RRCResumeRequest* used for the non-SDT data indication. This may need to be clarified from SA3.

**Question 10**: Do you see a concern in using the same KgNB used to cipher the UL data during SDT procedure for *resumeMAC-I* generation for the *RRCResumeRequest* used for non-SDT data indication? Further, should this be confirmed from SA3 with an LS?

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| Answers to Question 10 |
| Company | Yes/No | SA3 LS: Yes/No | Technical Arguments |
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**Summary 10**: TBD.

**Proposal 10**: TBD.

On the other hand, it was not completely clear if the horizontally generated key would be used for the *resumeMAC-I* generation for the *RRCResumeRequest* used for non-SDT data indication. Or whether another solution is intended.

**Question 11**: What key should be used and which input parameters for the *resumeMAC-I* generation for the *RRCResumeRequest* used for non-SDT data indication?

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| Answers to Question 11 |
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**Summary 11**: TBD.

**Proposal 11**: TBD.

Next issue described is that the security keys between UE and network may go out of sync (e.g. if the 2nd *RRCResumeRequest* used for non-SDT data indication using the new key is sent before the contention resolution of the 1st *RRCResumeRequest* is completed, ie., in the SDT procedure). On the other hand, it seems the UE could take this into account already when terminating the SDT procedure and initiating the RRC resume procedure for non-SDT data indication in which case it could use the initial key which should work as in legacy.

**Question 12**: Do you agree the UE can use the initial key (the same key used for *resumeMAC-I* for the *RRCResumeRequest* in SDT procedure) for deriving the *resumeMAC-I* for the *RRCResumeRequest* used for non-SDT data indication in case the RA procedure of the SDT procedure is not completed?

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| Answers to Question 12 |
| Company | Yes/No | Technical Arguments |
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**Summary 12**: TBD.

**Proposal 12**: TBD.

Data loss is indicated in [5] to be a bigger concern compared to DCCH based solution as the NW may be transmitting DL SDT data and UL SDT data in the UE could be lost. While the DL data is more for NW implementation to handle, the UL data loss should be discussed. Currently, the UE discards all stored PDCP PDUs upon suspend procedure while the PDCP SDUs should be kept. In that sense, it seems the UL data loss should be less of an issue.

**Question 13**: Do you agree the PDCP entity retains the PDCP SDUs in the buffer upon PDCP entity suspend and, hence, the data loss in UL should basically not happen in case of CCCH based solution? Do you see a concern in DL data handling?

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| Answers to Question 13 |
| Company | UL data Yes/No | DL data Yes/No | Technical Arguments |
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**Summary 13**: TBD.

**Proposal 13**: TBD.

Another issue is how the NW would identify the *RRCResumeRequest* used for non-SDT data indication, e.g., in the case the NW did not know the UE attempted SDT before the RRC resume procedure. For instance, is there a need to specify a new *resumeCause* for the purpose, does the UE indicate this in an LCID in the MAC layer (similarly to RedCap identification indication), is the UE provisioned with different I-RNTI to use in this case, or is this left to NW implementation.

**Question 14**: Do you agree the UE shall indicate to NW the *RRCResumeRequest* is used for non-SDT data indication? If yes, which solution should be specified for this purpose?

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| Answers to Question 14 |
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**Summary 14**: TBD.

**Proposal 14**: TBD.

Similarly to DCCH based solution wrt. Question 7, some RAN3 impact may be foreseen when the new *RRCResumeRequest* used for non-SDT data indication is received by the NW. For instance, whether the UE context shall not be released by the last serving gNB only after the SDT procedure for the UE is completed (either by moving the UE into CONNECTED mode or directing back to INACTIVE mode). On the other hand, if the context was already relocated, would it not be possible for the receiving gNB to perform the UE integrity check in this case; while, in case the context was not already relocated, then the last serving gNB obviously has the context and could do the check.

**Question 15**: Do you see that there may be some RAN3 impact with the CCCH solution? If yes, what impact is foreseen, and do you see a concern with it?

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| Answers to Question 15 |
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**Summary 15**: TBD.

**Proposal 15**: TBD.

Last question in [5] considers cell re-selection during SDT procedure. This should generally not be the decision point to select between DCCH and CCCH based solution since regardless of the CCCH solution, the cell re-selection case may not be specified. However, it would be good to get an understanding if companies would prefer this case to be specified in case the CCCH solution is selected.

**Question 16**: Would you agree to specify to specify solution based on the CCCH based solution for cell re-selection during SDT procedure (in case CCCH based solution is agreed to be specified)?

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| Answers to Question 16 |
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**Summary 16**: TBD.

**Proposal 16**: TBD.

## 3.3 Draft CRs

In the previous meeting, [2] (Annex) and [4] presented initial RRC CRs for the CCCH based solution and DCCH based solution, respectively. Given the above issues not resolved, complete CRs could not be presented before the issues are resolved. However, companies are being asked if the above CR drafts can be used as baseline for both of the solutions and start from those when further details are clarified based on the questions.

**Question 17**: Do you agree to use [2] (Annex) and [4] CR drafts as baseline CRs for the CCCH based solution and DCCH based solution, respectively? If not, what are the issues?

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| Answers to Question 17 |
| Company | CCCHYes/No | DCCHYes/No | Technical Arguments |
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**Summary 17**: TBD.

**Proposal 17**: TBD.

## 3.4 Preferred option(s) & possible compromise

The selection process between DCCH and CCCH based solutions have been in a deadlock for a while and a compromise proposal to specify both solutions was presented in the previous meeting. For instance, such that the CCCH based solution is used in case the RA procedure for the SDT procedure has not been completed or no NW response has been received for the initial CG-SDT transmission; and DCCH based solution is used after this point. Naturally, this would require more discussion after the above issues are resolved if the compromise would be preferred by most of the companies.

In the following, companies are asked still to provide their preferred option(s) from the following:

 - Option 1: DCCH solution

 - Option 2: CCCH solution

 - Option 3: Compromise solution (ie., both)

If you are OK with both options individually **but not with compromise solution** please indicate Option 1/2.

**Question 18**: Which option(s) do you prefer?

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| Answers to Question 18 |
| Company | Option(s) | Technical Arguments |
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**Summary 18**: TBD.

**Proposal 18**: TBD.

# 4 Conclusion

TBD.

# References

[1] [R2-2109617](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_116-e%5CDocs%5CR2-2109617.zip) *DCCH-based indication of non-SDT data arrival*, Intel Corporation, ZTE corporation, Sanechips, Samsung, CMCC, Qualcomm, OPPO, Sharp, Xiaomi, Sony, CATT, FGI, Asia Pacific Telecom, Radisys

[2] [R2-2110596](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_116-e%5CDocs%5CR2-2110596.zip) *Non-SDT data arrival*, Huawei, HiSilicon, InterDigital, LGE, Ericsson, ASUSTeK, Nokia, Nokia Shanghai Bell, Google, Rakuten Mobile, Fujitsu, NEC

[3] [R2-2109619](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_116-e%5CDocs%5CR2-2109619.zip) *DCCH vs CCCH based approach for indication of non-SDT data arrival*, Intel Corporation, ZTE corporation, Sanechips, Samsung, Qualcomm, OPPO, Sharp, Xiaomi, Sony, CATT, Apple

[4] [R2-2109618](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_116-e%5CDocs%5CR2-2109618.zip) *Draft CR for introduction of DCCH solution for non-SDT data arrival*, ZTE corporation, Sanechips, Intel Corporation, Samsung, CMCC, Qualcomm, OPPO, Sharp, Xiaomi, Sony, CATT, FGI, Asia Pacific Telecom, Radisys

[5] [R2-2111275](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_116-e%5CDocs%5CR2-2111275.zip) *Comments on the proposed CCCH solution for non-SDT data arrival*, Intel Corporation, Apple, ZTE

[6] [R2-2111509](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_116-e%5CDocs%5CR2-2111509.zip) *Further clarifications on non-SDT arrival solutions*, Huawei, HiSilicon, InterDigital, LGE, Ericsson, ASUSTeK, Nokia, Nokia Shanghai Bell, Google, NEC, Fujitsu, Rakuten Mobile

[7] [R2-2111523](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_116-e%5CDocs%5CR2-2111523.zip) *Comments to* [*R2-2111509*](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_116-e%5CDocs%5CR2-2111509.zip) *for non-SDT data arrival*, Intel Corporation, ZTE corporation, Sanechips, Samsung, Xiaomi, Qualcomm, Apple, Radisys

[8] R2-2109308, *Reply LS on Small data transmission*, Source: CT1