3GPP TSG-RAN WG2#115-e R2-2108963

Electronic meeting, 16th August – 27th August 2021

Agenda Item: 8.13.2.2

Source: OPPO

Title: Report of [AT115e][821][SON/MDT] 2-Step RA related SON (OPPO)

Document for: Discussion, Decision

# 1 Introduction

Regarding the 2-step RA related SON contributions in this RAN2#115e meeting, a summary of them has been given in [1]. According to [AT115-e][800][SON/MDT] Organizational Hu, the following email discussion has been assigned to be initiated during RAN2#115 meeting so that proposals 1-4 in [1] could be further converged and then submitted to the online discussion for potential agreements achieving:

[AT115e][821][SON/MDT] 2-Step RA related SON (OPPO)

**Scope:** Focus on the the proposal 1, 2, 3 and 4 in R2-2108840

      **Intended outcome**: Report with Agreements in R2-21088963

      **Deadline**: 11:00 UTC, Wednesday August 25th

      Intended outcome: Approved LS

      Deadline:11:00 UTC, Friday August 20th

This document aims to provide the summary of the opinions of different companies and based on that, rapporteaur could further conclude potentially easly agreements.

# 2 Discussion

## 2.1 RA type indication in RA Report

The related proposal have been made in [1] as follows:

**Proposal 1: RAN2 to agree that the RACH type is not needed to be included in the RACH report, since it could be easily inferred from other 2-step RACH specific information included in the RACH report.**

The reason why the summary rapporteaur draw this conclusion is that in the post RAN2 #113e meeting email discussion [8], 8 among 13 companies think the RA type can be inferred by the network according to the previously agreed 2-step RA specific information, e.g.,

  **1. At least following RACH frequency related information should be included in RACH report for optimization of 2-step RACH:**

** msgA-FrequencyStart-r17**

** msgA-FrequencyStartCFRA-r17**

** msgA-SubcarrierSpacing-r17**

** msgA-SubcarrierSpacingCFRA-r17**

** msgA-FDM-r17**

** msgA-FDMCFRA-r17**

 **2. UE includes the measured RSRP of DL pathloss reference obtained just before performing RACH procedure in 2step RA report. FFS how to reduce the report overhead.**

**Question-1: Do you agree with the proposal 1 associated to implicit indication of 2-step RACH type in the RACH report:**

**P1: RAN2 to agree that the RACH type is not needed to be included in the RACH report, since it could be easily inferred from other 2-step RACH specific information included in the RACH report.**

|  |  |  |
| --- | --- | --- |
| **Company name** | **Agree with P1?** | **Comments**  |
| Qualcomm | Agree | Fields included in the RA-report are sufficient to determine the RACH type. |
| vivo | Agree |  |
| Samsung | Agree |  |
| Sharp  | Agree  |  |
| CATT | Agree |  |
| Apple | Agree |  |
| ZTE |  | Though we prefer to use explicit bit but we can accept this proposal based on majorities view. |
| Ericsson | Agree |  |
| Huawei | Agree |  |
| CMCC |  | We also prefer to use explicit indication, but we follow majority view. |
| Nokia |  | Same view as ZTE and CMCC. We think the indication on RACH Type could help the network process the RA Report and makes it more self-explanatory without the need to first parse the different entries. E.g., if it is a 4-step RACH that started the procedure and there is an indicator about that in the beginning of the row, the network knows that there won’t be any switching/fall-back. But we can accept majorty view  |
| OPPO | Agree |  |

**Rapporteur Summary:**

Based on the above, all participating companies agree P1. So we conclude P1 is a easily agreeable proposal.

**Proposal 1: RAN2 to agreement that the RACH type is not needed to be included in the RACH report.**

## 2.2 Switching information in 2-step RA report

The related proposals have been made in [1] as follows:

**Proposal 2: RAN2 to discuss which option should be made for RACH type switch indication in the RACH report:**

* **Option 1: including an explicit switch indication in the IE related to the last/first RA attempt before/after the 2-step to 4-step RA switch.**
* **Option 2: including the parameter MsgA-Transmax in each RA-InformationCommonIE.**

As presented in [3], Option 2 only consumes 8 bits overload, while the Option 1 will need at most 200 bits for switching indication since each ***PerRAAttemptInfo*** IE needs to embrace 1-bit such indication. Bearing this in mind, rapporteaur suggest to go with Option 2：

**Proposal 2: RAN2 to agree to include the parameter MsgA-Transmax in each RA-InformationCommon IE in the RACH report for indication of the switching information from 2-step to 4-step RACH.**

**Question-2: Do you agree with the Proposal 2 associated to the indication of the switching information from 2-step to 4-step RACH in the RACH report:**

|  |  |  |
| --- | --- | --- |
| **Company name** | **Agree with P2?** | **Comments**  |
| Qualcomm | Disagree | I believe that option 1 is conditional inclusion of the switching, i.e. it is included only once upon the switching is performed. Therefore, the consumption there is a single bit consumption.  |
| vivo | Disagree | First of all, we’d like to confirm the intention of including the switch indicator:1) to make NW aware that a switch occurred;2) to make NW aware of that in which attempt the switch occurred.**If the intention is the former case, we think the switching information could be derived implicitly:*** there are only two cases, i.e., fallback and switch situations, where 4-step and 2-step frequency-related parameters coexist;
* it was agreed to explicitly indicate the fallback case;
* thus it can be derived whether the switch was performed based on the coexistence of 4-step and 2-step frequency-related parameters, and the explicit indication for fallback. For instance, if network receives a RA report with both 4-step and 2-step parameters, and there is no indication for fallback, then network could deduce that a switch has occurred.

**If the intention is the latter case, we think whether the explicit indication is needed depends on the stage-3 signalling design:*** In order to find out for which attempt the switch occurred, the information included in the per RA attempt should outstands itself as a 2-step RA attempt, e.g., an explicit indicator, or a field that signalled this attempt belongs to 2-step RA.
* Note that we agreed *‘The reporting granularity of whether the DL beam quality, associated to the used 2 step RA resource, is above or below the msgA-RSRP-ThresholdSSB is per-RA-attempt.’*, but whether this is indicated by reusing the legacy field *dlRSRPAboveThreshold* (contained in PerRAInfo) or a new field has not been decided.
* If a new field is used to indicate the 2-step RA case, then the network can understand that this entry is created due to a 2-step RACH attempt, otherwise an indicator is needed.

In summary, at least we disagree with Opt2 in P2, Opt1 depends on stage-3 signalling design if the intention is to find out for which attempt the switch occurred, otherwise it is still NOT necessary to introduce an explicit indicator. |
| Samsung | Disagree | Fine with Option 1 |
| Sharp | Disagree | We agree with Vivo’s view that whether the explicit indication is needed depends on the detailed signaling design.And if an explicit indicator is needed, we are fine with option 1, as a single bit indicator can be included in the PerRAAttemptInfo IE instead of 200 bits for option 1. |
| CATT | Agree | We support option 2 as it requires lower signaling overhead. We see some points need to be clarified in the previous comments, please see below. **@ Qualcomm: we have different understanding on the signaling g overhead of option 1/2.** **For option 1**, the indication should be indicated in RA report per attempt. For the structure of this indication maybe as following:switchingOccur-r17 ENUMERATED{true} OPTIONALswitchingOccur-r17 (or some name else, e.g. lastRAfor2step-r17/firstRAfor4step-r17) will occupy 1 bit in each RA attempt to indicate whether the switching/lastRA attempt/firstRA attempt occurs or not, **it cannot only add just 1 bit in the whole RA report entry to indicate the last/first RA attempt before/after the 2-step to 4-step RA switch**. Since this indication should be set per attempt, if there are at most 200 attempts, as many as 200bits are needed.**For option 2,** the structure of MsgA-Transmax may reuse the current ENUMERATED values:maxNumberOfMsgA-Trans-r17 ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200} OPTIONALThis structure just needs a mandatory value size of 4+1=5 bits.**@Vivo: Here we think singaling overhead needs to be taken into account.** If a new field like *dlRSRPAboveThreshold* is introduced for 2-step RA, extra overhead will be introduced, i.e. at least 1 bit each RA attempt to indicate whether the legacy *dlRSRPAboveThreshold or the dlRSRPAboveThreshold2step* should be choose. The added bits may be as much as option 1. But if the option 2 of “*MsgA-Transmax*” is used, the legacy field *dlRSRPAboveThreshold* can be directly used with small description modification to include both 2 step and 4 step cases. |
| Apple  | Agree | But we can accept option 1 if that’s the majority view |
| ZTE | Agree | We share similar views with CATT. If one-bit indication is used, than it will need to be incorporate for each RA attempt, otherwise NW still don’t know at which attempt UE performs switch. Thus option1 requires more than one-bit indication. Also option 1 still cannot be used to differentiate the case no switch happens is due to not configuring MsgA-Transmax or UE haven’t reach the maximum allowed transmission time.Also fallback case is different from RA type switch. RA type switch can only happens on MsgA-Transmax is configured and RA attempt exceeds the MsgA-Transmax configured. While fallback only means NW fails to decode the PUSCH successfully, it doesn’t imply co-existence of 4stepRA resource and 2stepRA resource, and certainly not whether MsgA-Transmax is configured or not. |
| Ericsson | Disagree (Option 1) | We agree with Qualcomm, it can be conditionally included. Additionally option 1 is future proof, e.g. in case in future RAN2 agrees that the switch can be performed before the MsgA-Transmax.Related to Vivo´s comment, that depends on the ASN.1 modeling. Since it is not clear yet whether common threshold for the 4-step and 2-step is used, we can revisit agreements on Option1/2 depending on the ASN.1 structure.  |
| Huawei | Disagree | Option 1 has an obvious advantage over Option 2 in terms of bits used. The switch indicator just included one-time per RACH procedure and 1 bits enough, but *PerRAInfo* can reach up to 200 times per RACH procedure and each *MsgA-Transmax* may use more than 1 bits to indicate its value. |
| CMCC | Agree | Actually, option 1 requires higher signaling overhead than option2, since the indication is transmitted per RA attempt. While the **MsgA-Transmax in carried in each RA-InformationCommon**, which is much less frequent than option 1. |
| Nokia | Agree to Option 1 | Another alternative could be that we do not indicate MsgA-Transmax but an indicator that this parameter is exceeded |
| OPPO | Agree  | Agree with ZTE and CATT’s view |

**Rapporteur Summary:**

Based on the above discussion, it seems that still companies have different understanding on the ASN.1 structure design details. For example, whether or not including a switching indicator in the switching related RA attempt will imply that one switching indicator is needed for each RA attempt IE. In addition, ZTE think that Option 1 has a drawback that the Option 1 cannot be used to differentiate the reason why no switch happens: not configuring MsgA-Transmax or UE haven’t reached the maximum allowed transmission time. On the other hand, Ericsson thin that Option 1 is more future proof, though the email discussion rapporteur does not think this a fair reason to objective to the Option2. In all, the rapporteur invites all companies to think carefully about the ASN.1 structure design details and postpone the decision on this issue since neither option obtained majority support.

**Proposal 2: FFS which option should be made for RACH type switch indication in the RACH report:**

* **Option 1: including an explicit switch indication in the IE related to the last/first RA attempt before/after the 2-step to 4-step RA switch.**
* **Option 2: including the parameter *MsgA-Transmax* in each RA-InformationCommon IE.**

## 2.3 Reducing the reporting overhead of the measured RSRP of DL pathloss reference obtained prior to 2-step RACH procedure

The related proposals have been made in [1] as follows:

**Proposal 3: RAN2 to agree that the measured RSRP of DL pathloss reference obtained just before performing RACH procedure to be logged in 2-step RACH report is of per RACH procedure granularity.**

A FFS is left in the last RAN2 #114e meeting regarding how to reduce the report overhead regarding ‘including the measured RSRP of DL pathloss reference obtained just before performing RACH procedure in 2step RACH report’. Regarding this issue, two contributions [4][5] have been submitted in this meeting, they all support to have the indication per RACH procedure for reducing the overhead. As a result, the rapporteaur suggest keep the RAN3 as ablove.

**Question-3:Do you agree with the Proposal 3?**

|  |  |  |
| --- | --- | --- |
| **Company name** | **Agree with P3?** | **Comments**  |
| Qualcomm | Agree |  |
| vivo | Agree |  |
| Samsung | Agree |  |
| Sharp  | Agree  |  |
| CATT | Agree |  |
| Apple | Agree |  |
| ZTE | Agree |  |
| Ericsson | Agree, but…  | We agree to have it for RA procedure, but we should clarify where/when the pathloss measurement is taken. Is that taken with respect to the first SSB selected for RA? |
| Huawei | Agree |  |
| CMCC | Agree |  |
| Nokia | Agree | It would basically determine whether the RACH that “started the RACH procedure” is 2-step or 4-step  |
| OPPO | Agree |  |

**Rapporteur Summary:**

**All companies agreed P3. Regarding the Ericsson’s comments, it seems not relevant to reducing the reporting overhead. As a result, the email discussion rapporteur suggests the following easily agreeable agreement:**

**Proposal 3: RAN2 to agree that the measured RSRP of DL pathloss reference obtained just before performing RACH procedure to be logged in 2-step RACH report is of per RACH procedure granularity.**

## 2.4 MSGA PUSCH related information

The related proposals have been made in [1] as follows:

**Proposal 4: RAN2 discusses the necessity of including the MSGA PUSCH resource related information in 2-step RA Report. FFS further details of the contents to be included in the RACH report.**

In detail, following information has been suggested by different companies to be included in the RACH report:

* A: the payload size transmitted in MSGA for a 2-step RACH attempt (from [4] Nokia)
* A2: Indication of whether the payload size is above or below the *ra-MsgA-SizeGroupA* threshold
* B: the group type of a preamble i.e., group type A or B (from [4] Nokia, [6] Ericsson)
* C: the MCS index(from [5] ZTE)
* D: the number of PRB per PO of the PUSCH resource(from [5] ZTE)
* E: the combination of start symbol and length and PUSCH mapping type(from [5] ZTE)
* F:PUSCH group information(from [5] ZTE, [6] Ericsson)
* G:Offset of lowest PUSCH occasion in frequency domain with respect to PRB 0(from [5] ZTE)
* H:The number of msgA PUSCH occasions FDMed in one time instance(from [5] ZTE)
* I: Indication of pathloss above or below the pathloss threshold for groupA/B (from [6] Erricsson)
* J:MSGA PUSCH resource information (from [6] Errcsson and [7] CMCC)

**To make a further step, the rapporteaur invites companies to show their preferences on the above set of information.**

|  |  |  |
| --- | --- | --- |
| **Company name** | **Preference on A-J (example of a possible Answer:A, C, D)** | **Comments**  |
| Qualcomm | None | I believe PUSCH and payload used for RACH don’t change per RACH attempt. On successful RACH procedure, the network knows which parameters have been used for the RACH procedure. Therefore, no need to include these parameters in the RA-report.  |
| Samsug | Other | An indicator can be introduced to indicate whether MSGA PUSCH was transmitted or not during this RA attempt. |
| Sharp  |  | Not sure whether the network stores these information for successful RA procedure. If not, RAN2 can discuss later whether to optimize PUSCH resource configuration. |
| CATT | Maybe no | The fallback indication can be used to indicate whether the MSGA PUSCH resource should be optimized.If the fallback RAR is received in MSGB, it maybe means the MSGA PUSCH payload is not successfully received. |
| Apple | None | We are not convinced it provides enough value |
| ZTE | Yes to all. | I agree with Qualcomm that PUSCH resource will not be changed based on each RA attempt but it is the same for RA resource configuration, and we still log RA configuration, because we need collect all required information and analysis the collective data to perform optimization. As emphasized in our contribution, only adjust RA configuration is not sufficient for 2step RA. Also considering PUSCH resource will require reserve large amount of physical resource, more information is needed to avoid overlapped situation as well as improve the resource efficiency.Based on current specification, there could be two groups of PUSCH resource configured, if only fallback indication is included, although NW can know the PUSCH resource is improper NW still don’t know which group of PUSCH information is used and which configuration is used. Therefore, at least the PUSCH group information as well as PUSCH resource configuration will be needed (F.J, G,H).For the C,D,E it is used to calculate the PUSCH occasion for each group of PUSCH configuration, and together with the information in and NW can adjust the PO size to match with the the typical used TB size transmitted in 2stepRA.Regarding to B and I, I understand this is to optimize the preamble group division, which relates to both pathloss and Msg3 payload, we think it is also useful to include this information as well. |
| Ericsson | B/F, A2, I  | Including indication of the preamble group used is useful to aid the network to properly dimension the group A/B resources and the transmitting power. A2, I is beneficial to aid the network understanding the reason why a UE selected group A or group B, e.g. msg size below/above the is than the ra-MsgA-SizeGroupA, or if that is for pathloss reasons. |
| Huawei | J | Network can use the MSGA PUSCH resource information to perform optimization to avoid 2-step RA Failure due to insufficient PUSCH Resources. |
| CMCC | A, G, H,J | The exact PUSCH resource that UE used should report to the network, so that network could optimize the PUSCH configuration later. |
| Nokia | A, B | Proponents |

**Rapporteur Summary:**

The number of Supporting companies for each option:

A or A2: 4

B:3

C:1

D:1:

E:1:

F:1

G:2

H:2

I:2

J:2

As indicated as above, none of above attracts support from majority of companies. As a result, the email discussion rapporteur suggests postponing the discussion on this topic. In addition, some companies think that reporting PUSCH resource related information towards network is not needed for configuration optimization.

**Proposal 4: RAN2 to discuss the necessity of including the MSGA PUSCH resource related information in 2-step RA Report. FFS further details of the contents to be included in the RACH report.**

# 3 Conclusion

In this email discussion report, based on the summary of all participating companies’ opinions, the rapporteur gives the following proposals:

Easily agreeable proposals:

**Proposal 1: RAN2 to agreement that the RACH type is not needed to be included in the RACH report.**

**Proposal 3: RAN2 to agree that the measured RSRP of DL pathloss reference obtained just before performing RACH procedure to be logged in 2-step RACH report is of per RACH procedure granularity.**

Proposals requiring further discussions:

**Proposal 2: FFS which option should be made for RACH type switch indication in the RACH report:**

* **Option 1: including an explicit switch indication in the IE related to the last/first RA attempt before/after the 2-step to 4-step RA switch.**
* **Option 2: including the parameter *MsgA-Transmax* in each RA-InformationCommon IE.**

**Proposal 4: RAN2 to discuss the necessity of including the MSGA PUSCH resource related information in 2-step RA Report. FFS further details of the contents to be included in the RACH report.**

# References

[1] R2-2108840, [Pre115-e][802][SON/MDT] Summary on agenda item 8.13.2.2 2-step RA related SON aspects, OPPO

[2] R2-2103093, Report of [Post113-e][852][NR17 SON/MDT] 2 step RA and other SON changes, CATT

[3] R2-2107822, The remaining Issues of RACH Report for 2-step RACH, CATT

[4] R2-2107507, Remaining Issues and New Aspects in 2-step NR UE RACH Report, Nokia

[5] R2-2108354, 2-step RA related enhancements, ZTE

[6] R2-2108418, 2-step RA information for SON purposes, Ericsson

[7] R2-2108542, SON Enhancement for 2-step RA, CMCC

[8] R2-2103093, Report of [Post113-e][852][NR17 SON/MDT] 2 step RA and other SON changes, CATT