3GPP TSG-RAN WG2 Meeting #116bis-e *draft* R2-2201705

E-Meeting, 17th – 25th Jan, 2022

**Agenda item: 8.3.2**

**Source: China Telecom**

**Title: Summary of [AT116bis-e][230][MUSIM] Paging collision handling(China Telecom)**

**WID/SID: LTE\_NR\_MUSIM-Core**

**Document for: Discussion and Decision**

# 1 Introduction

This document serves as a summary of the following offline discussion:

* [AT116bis-e][230][MUSIM] Paging collision handling (China Telecom)

Scope: Discuss 1) LTE paging offset calculation: How is the LTE paging collision avoidance specified in 36.304? 2) Is there a need to specify the AS-NAS interaction for UE assistant information in EPS 3) Is there are issue with SI change aspects for paging collision?

* Intended outcome: Discussion summary in R2-2201705.

Comment deadline: Thursday W1, 1600 UTC (for collecting views)

Rapporteur proposals: Friday W1, 0900 UTC (proposed resolution of issues)

Document deadline: Monday W2, 1200 UTC (report or agreed CRs)

# 2 Contact Information

To make it easier to find the contact delegate for potential follow-up questions, delegates are encouraged to provide their contact information in the following table:

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email** |
| China Telecom | Ting Zhang | zhangt77@chinatelecom.cn |
| Vodafone | Chris Pudney | chris.pudney at vodafone.com |
| Lenovo | Prateek Basu Mallick | pmallick @ lenovo.com |
| OPPO | Jiangsheng Fan | fanjiangsheng@oppo.com |
| Huawei/HiSilicon | Rama Kumar Mopidevi | rama.kumar@huawei.com |
| NEC | Wangda | wangda@labs.nec.cn |
| Nokia | Srinivasan Selvaganapathy | Srinivasan.selvaganapathy@nokia.com |
| Futurewei | Mazin Al-Shalash | mazin.shalash@Futurewei.com |
| Charter Communications | Reza Hedayat | Reza.hedayat@charter.com |
| vivo | Kimba Dit Adamou,Boubacar | kimba@vivo.com |
| Samsung | Sangyeob Jung | sy0123.jung@samsung.com |
| MediaTek | Felix Tsai | Chun-fan.tsai@mediatek.com |
| Ericsson | Lian | [lian.araujo@ericsson.com](mailto:lian.araujo@ericsson.com) |
| Intel | Sudeep Palat | Sudeep.k.palat@intel.com |
| Apple | Sethuraman Gurumoorthy | sethu@apple.com |
| Qualcomm | Ozcan Ozturk | oozturk@qti.qualcomm.com |
| Spreadtrum | Qufang Huang | Qufang.huang@unisoc.com |
| Sharp | Fangying Xiao | Fangying.xiao@cn.sharp-world.com |
| LGE | Hongsuk Kim | hassium.kim@lge.com |

# 2 Discussion

## 2.1 Alternative IMSI calculation formula

During the online discussion in RAN2 116e meeting, it is agreed that alternative IMSI or offset should be calculated in AS. However, it is not clearly decided whether AS layer should use the formula defined by 23.401 or AS spec should re-define a new formula from its perspective. During post meeting discussion on TS 36.304 running CR two companies suggest to define the alternative IMSI calculation formula in 36.304 as alternative IMSI = (IMSI + Accepted IMSI Offset) and a contribution [1] in this meeting also propose to use this formula. The main concern is that the formula defined by 23.401 needs MSIN value/MSIN address space and it is not clear how AS layer gets this information i.e. whether it can be left to UE implementation.

**Q1: Which option do you prefer?**

**Option A: Re-defining a formula as alternative IMSI = (IMSI + Accepted IMSI Offset) in 36.304.**

**Option B: Refer to the formula defined by SA2.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| China Telecom | Option A | No strong views. Option A is more simple and straight forward for AS layer. |
| Vodafone | Shall align with MME | Within the network, the “UE ID” calculation is made within the MME. Hence it is important that the UE implementation shall be synchronised with how the MME calculates “UE ID”. |
| Lenovo | Option A |  |
| OPPO | Option A |  |
| Huawei/HiSilicon | Option A | As CT commented, Option A is simpler and straight forward for AS layer. From TS 36.413, MME will calculate UE Identity Index value as specified in TS 36.304. Hence we think that MME and UE will use the same formula if it’s specified in TS 36.304. |
| NEC | Option A | Considering that Alternative IMSI is only used for paging occasion determination, there is no need to remain MCC and MNC part unchanged, so we don’t see any reason of using the very complex formula in 23.401. And as indicated by the rapporteur, the length of MSIN also needs to be passed from NAS layer to RRC/AS layer for alternative IMSI calculation, which requires additional efforts, so we prefer to use Option A which is simpler. |
| Nokia | Option A | In current specification, AS layer knows the complete IMSI from higher layer. And UE-ID is derived from the given IMSI. When paging collision happens and NAS layer receives the offset for UE-ID, it can provide the offset value to AS. AS layer uses UE-ID+offset as UE-ID in the calculations. |
| Futurewei | Option A | Seems straightforward |
| Charter Communications | Option A |  |
| vivo | Option A | Agree with CT and NEC. |
| Samsung | Option B | Though we have some sympathy with others, we think that for AS-NAS interaction it can be left to UE implementation how AS layer gets MSIN value/MSIN address space as it is anyway internal UE behavior. With this, it can avoid any specification impact on RAN2/SA2 specifications at this late stage. |
| ZTE | Option B | We share the similar view as Samsung, we don’t see the strong motivation to change the SA2’s agreements. |
| MediaTek | Option A |  |
| Ericsson | Option B | IMSI, Alternative IMSI, IMSI-offset are NAS level parameters. These parameters are used for UE-ID calculation. AS can get this UE-ID info from NAS layer (or input parameterAlternative IMSI, from NAS if the UE\_ID calculation is seen as part of the AS layer work) and use the UE-ID info in the PO calculation formula. In this way there is no impact in AS layer and we do not need to specify it further. |
| Intel | Option B | With option B, we don’t see any need to specify NAS/AS interaction. Whatever option we take, we should not have to update SA2 spec. |
| Apple | Option A | Option A is straightforward. |
| Qualcomm | Option B | It seems much simple to put in 36.304 that the alternative ID instead of IMSI is used when provided by upper layers. Note that gNB will do the same upon getting alternative ID from MME. We should try avoiding unnecessary conflict between RAN2 and other groups at this stage. |
| Spreadtrum | Option A | Option A is simple. |
| Sharp | Option A |  |
| LGE | Option A | Option A is straightforward. |

## 2.2 AS-NAS interaction

CT1 has defined the procedure to forward IMSI offset value to lower layers or indicates the lower layers to erase any IMSI offset value.

TS 24.301

If the ATTACH ACCEPT message contains Negotiated IMSI offset IE, the MUSIM capable UE shall forward the IMSI offset value to lower layers. If the ATTACH ACCEPT message does not contain Negotiated IMSI offset IE, the MUSIM capable UE shall indicate to lower layers to erase any IMSI offset value, if available.

RAN2 has already defined the AS layer procedure when an Accepted IMSI Offset is forwarded by upper layers. One contribution [2] suggests that RAN2 add the corresponding procedure upon receiving the indication to erase any IMSI Offset value from upper layers.

**Q2: Do you agree that RAN2 add the description underlined below?**

**If an Accepted IMSI Offset is forwarded by upper layers, UE shall use the IMSI Offset value and IMSI to calculate an alternative IMSI value as defined in 23.401[23]. Upon receiving the indication to erase any IMSI Offset value from upper layers, the UE shall remove the Accepted IMSI Offset value, if available.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Yes | To be aligned with 24.301 it is better to add this text. |
| Vodafone | Yes | Seems logical |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Huawei/HiSilicon | Yes |  |
| NEC | Yes |  |
| Nokia | FFS | Existing interface with offset set to 0 can be used. Hence, no special indication to erase offset is needed. Moreover, we don’t see scenario where there is need to erase the offset already configured to UE. As per signalling steps for collision reporting, AS reports collision to NAS and NAS suggests offset to CN and only after CN accept the new offset is given to AS. Do we assume that UE starts using the offset before NW accepting the same? This will not be beneficial as anyhow UE cannot receive paging in new location until network accepts it. |
| Futurewei | Yes | Perhaps it would be simpler to state the proposal as:  **If an Accepted IMSI Offset is forwarded by upper layers, UE shall use the IMSI Offset value and IMSI to calculate an alternative IMSI value as defined in 23.401[23]. Upon receiving the indication to erase any IMSI Offset value from upper layers, the UE shall set the IMSI Offset value to 0.**  This may address Nokia’s concern |
| Charter Communications | Yes | Agree with the Futurewei suggested text |
| vivo | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes |  |
| MediaTek | Yes | And the text from Futurewei looks okay |
| Ericsson | No | If we follow option-B on Q1, we would not have to handle this case. |
| Intel |  | No strong view. It is good to align with SA2. On the other hand, the current text also implies deleting it when not configured and it doesn’t seem essential to go into this level of detail on the NAS/AS interaction. |
| Apple | Yes | Agree with Futurewei suggested text |
| Qualcomm | FFS | If we go with Option A, yes. |
| Spreadtrum | Yes | It is align with SA. |
| Sharp | Yes |  |
| LGE | Yes | Agree with set to 0 when the UE erases the offset. |

One contribution [3] mentions that UE AS layer knows specific paging parameters and is more reasonable for UE AS to provide a preferred IMSI Offset (including clearing the stored IMSI Offset at the UE NAS/MME). Therefore, when UE AS detects paging collision issue or the configured IMSI offset is not needed anymore, the UE AS can provide the preferred IMSI Offset information to the UE NAS.

**Q3: Do you agree to define the AS layer procedure as below?**

**When UE AS detects paging collision issue or the configured IMSI offset is not needed anymore, the UE AS can provide the preferred IMSI offset info to the UE NAS.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Maybe not | In last meeting, RAN2 has agreed that   * For LTE and NR, RAN2 leaves it up to UE implementation how UE AS indicates to UE NAS that paging collision issue is identified.   It is better not to go back to this. |
| Vodafone | No. | It is very important that just because the IMSI offset is no longer needed by AS the lower layers **shall NOT** tell upper layers.This would lead to unnecessary NAS signalling load.  Only if the AS detects that the current IMSI offset is now causing paging collisions, then the AS should notify NAS to request that it removed/modified.  A suggested text modification is below:  **When UE AS detects paging collision ~~issue or the configured IMSI offset is not needed anymore~~, the UE AS can provide the preferred IMSI offset info to the UE NAS (including the case that the current IMSI offset is causing collisions and should be removed).** |
| Lenovo | No | Leaving to UE implementation, as agreed before, seems sufficient. |
| OPPO | No | Agree with China Telecom |
| Huawei/HiSilicon | No | Agree with CT; Should be left to UE implementation, as agreed in the last meeting. |
| NEC | No | As agreed before it is up to UE implementation. |
| Nokia | No | This can be left upto UE implementation. |
| Futurewei |  | No strong opinion However, we agree with other companies. This can be left to UE implementation. |
| Charter Communications |  | We should stick with the previous agreement. Agree with VF to avoid unnecessary NAS signalling. |
| vivo | Yes | Compared to UE NAS, the UE AS knows the IMSI, IMSI offset (if configured), and paging parameters in RAN. Thus, it is more reasonable for UE AS to provide some input to assist the UE NAS to request a proper IMSI offset or to remove the configured one.  As discussed in Q2, “**Upon receiving the indication to erase any IMSI Offset value from upper layers, the UE shall remove the Accepted IMSI Offset value, if available.**”, it is unclear to us how the upper layers decide to erase any IMSI offset.  But if the majority view is leave it to UE implementation, we are also fine. |
| Samsung | No |  |
| ZTE | No |  |
| MediaTek | No | This should be just left to UE implementation |
| Ericsson | No | It is sufficient to leave this for UE implementation. |
| Intel | No | This is internal to UE and it is not required to specify. |
| Apple | No | This should be left to internal UE implementation |
| Qualcomm | No |  |
| Spreadtrum | No | When to remove the offset is the NAS implementation. |
| Sharp | No |  |
| LGE |  | We have a similar feeling with vivo but we are ok to be left to the UE implementation as RAN2 has agreed before. |

## 2.3 Paging collision avoidance for other scenarios

In contribution [4], it is mentioned that paging collision will impact SI change detection. Therefore, it proposed that if the UE’s own paging occasion collides with the PO of other USIM, UE shall monitor for SI change indication in any paging occasion at least once per modification period or in every DRX cycle. Similarly, for ETWS or CMAS capable UEs in RRC\_IDLE or in RRC\_INACTIVE state.

**Q4: Do you agree to define the following requirement?**

**To monitor SI change, if the UE’s own paging occasion collides with the PO of other USIM, UE shall monitor for SI change indication in any paging occasion at least once per modification period or in every DRX cycle. Similarly, for ETWS or CMAS capable UEs in RRC\_IDLE or in RRC\_INACTIVE state.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | No | The IMSI Offset can solve this issue. This proposal is more like UE implementation. |
| Vodafone | Probably not | Any (important) ETWS and CMAS broadcasts ought to be duplicated by all networks in that country. Hence there should be no need to monitor more than one network for this information. UE implementations probably already handle other SI changes. |
| Lenovo | Yes | A UE depending on its subscription may not expect any MT calls and therefore paging collisions are not important unless these affect reception of SI changes and ETWS/ CMAS notification.  Also, is it clear that all USIMs/ SIMs (e.g., from sensor devices periodically sending heartbeat/ temperature only) would receive ETWS/ Notification? The UE may depend on the other USIM for these. |
| OPPO | No | PO collision is a low probability event, once happen, it will not take a long time for UE to solve the PO collision issue first, so no need to consider the co-existence between PO collision and SI update. |
| Huawei/HiSilicon | No | In case of emergency, the information will be broadcast in both the NWs and UE can handle this with implementation.  From our understanding, this was discussed in ED (RP-192547) of RAN-P before defining WID and we don’t need to re-discuss this again.  (4 use cases were discussed:  1-1: Collision between Paging receptions from network A and network B  1-2: Collision between paging reception from network A and MSI/SI-message reception from network B  1-3: Collision between MSI/SI reception from network A and MSI/SI-message reception from network B  1-4: Collision between ETWS/CMAS receptions (both camped on network A or network A and network B) |
| NEC | No | The IMSI Offset/5G-GUTI re-allocation can solve this issue already. |
| Nokia | Not needed | The collision is reported immediately and resolved via signalling procedure. Handling the paging collision scenario until it is resolved is left to UE implementation and it is applicable here also. |
| Futurewei | Probably not | This does not seem that critical, as it should be straightforward for offset/GUTI reallocation procedure to address this. Of course, there is nothing preventing a UE implementation to also perform such “non-standard” monitoring during period between detecting the potential paging collision and offset/GUTI reallocation. So, we don’t see strong motivation to specify the UE behaviour to address such very rare events. |
| Charter Communications | No | No need to specify UE behaviour here. Agree with others that ETWS and CMAS would be broadcasted by both networks |
| vivo | No | The IMSI Offset/5G-GUTI re-allocation can solve this issue. And agree with others that ETWS and CMAS would be broadcasted by both networks. |
| Samsung | No | Same view as others |
| ZTE | Yes | This proposal can be accepted by us. |
| MediaTek | No | We don’t think this is needed. It can be solved by IMSI offset method or can just be left to UE implementation. |
| Ericsson | No | Agree with China Telecom. |
| Intel | No | As others mentioned, this is a short transient period and no need to specify this. |
| Apple | No | Agree with China Telecom. |
| Qualcomm | No | This can be handled by UE implementation. |
| Spreadtrum | No | It is due to UE implementation. |
| Sharp | No | It should be left for UE implementation. |
| LGE | No | Since the UE can perform the paging collision avoidance procedure, the collision is reported via signalling soon. |

# 3 Conclusion

# 4 References

1. R2-2200571 Alternative IMSI calculation for paging collision avoidance NEC discussion Rel-17 LTE\_NR\_MUSIM-Core
2. R2-2200470 Remaining issues on 36.304 running CR China Telecommunications, Samsung discussion Rel-17
3. R2-2200802 Remaining issue for EPS Paging Collision avoidance vivo discussion Rel-17 LTE\_NR\_MUSIM-Core
4. R2-2200414 SI Change Lenovo, Motorola Mobility discussion LTE\_NR\_MUSIM-Core