**3GPP TSG RAN WG2 Meeting #129bis R2-250xxxx**

Wuhan, China, April 7th– 11th, 2025

Agenda Item: 8.2.4

Source: Xiaomi

Title: Report of [POST129][036][AIoT] AS ID (Xiaomi)

Document for: Discussion and Decision

# Introduction

This report provides a summary for the following post-meeting email discussion:

* [POST129][036][AIoT] AS ID (Xiaomi)

Intended outcome: Discuss the pros/cons of the related CFRA and CBRA options and validity of AS ID

Deadline: long

Rapporteurs would suggest to have two phases discussion:

**Phase 1**: Companies are invited to provide comments/inputs on the pros/cons of each option for CFRA/CBRA and validity of AS ID.

Deadline for providing comments for phase 1 is March 14th, 2025, 10:00UTC.

**Phase 2**: Rapporteur will provide summary based on the inputs from companies in Phase 1. Companies are invited to provide comment on the summary and new questions from Rapporteur.

Deadline for providing comments for phase 2 is March 20th, 2025, 10:00UTC.

Companies providing input to this email discussion are requested to leave contact information below.

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| --- | --- | --- |
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# Phase 1 Discussion

## AS ID assignment for CFRA

Based on offline discussion “R2-2501510 [AT129][020][AIoT] AS ID (XiaomiHuawei)”, RAN2 discussed the need of AS ID for CFRA and candidate options for AS assignment for CFRA and concluded that:

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| 1. RAN2 assumes, AS ID is needed for CFRA at least for inventory + command procedure 2. For CFRA, if a valid AS ID is not already assigned, continue the discussion on AS-ID assignment based on the following options:  * Option 2: the device includes a random ID in “Msg 1”. And same as CBRA, it is up to Reader to decide whether to reuse the random ID as the AS ID or to assign a new AS ID. * Option 3: New “Msg 2” for AS ID assignment, complementary option or independent from option 2 * Option 4: “Msg 2” (including the “Command”) for AS ID assignment, complementary option or independent from option 2 |

During offline discussion, 4 options were listed as below, but option 1 has been precluded during online discussion.

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| **Option 1**: the reader assigns AS ID via Msg0 Paging  **Option 2**: the device includes a random ID in Msg 1. And same as CBRA, it is up to Reader to decide whether to reuse the random ID as the AS ID or to assign a new AS ID.  **Option 3**: New Msg 2 for AS ID assignment, complementary option or independent from option 2  **Option 4**: Msg 2 (command) for AS ID assignment, complementary option or independent from option 2  - Option 1: 4  - Option 2: 7  - Option 3: 8  - Option 4: 11 |

In addition, based on the offline discussion, there was clear consensus that AS ID is needed for data transmission, i.e., Command procedure after inventory procedure. Therefore we may focus on whether AS ID can be used for Command procedure when analyse Option2-4.

As RAN2 concluded that “1. NACK based mechanism is supported for D2R messages to determine re-access for at least msg3.”, the successful Inventory+Command procedure for CFRA could be:



##### Q1-0: Do companies agree with the above AS ID assignment procedure for CFRA which will be used for further analysis?

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| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes | Option s may be combined as already hinted above and option 2+4 would be something that would be similar to CBRA for instance. |
| OPPO | Yes | But the usage of the AS ID for CFRA case may need to be discussed in the first place. At least for us, the reason why AS ID shall be needed for the CFRA is not clear |
| Lenovo | Yes | For option 4, in the bracket after command, it should be *read* instead of *reader?* |
| NEC | See Comments | We understand that “Msg.1” in the above figure (CF access) refers to “the first D2R data transmission” in the TR38.769 Figure 6.3.1-1.    Figure 6.3.1-1 Overall AS procedures between A-IoT device and reader  Considering “A-IoT Msg.1, A-IoT Msg.2” are only defined for CBRA case in TR38.769, to avoid unnecessary confusion, we suggest not using “Msg.1~Msg.5”, followings can possibly be used instead:  Msg 1→the first D2R data transmission of CFRA  Msg.2→the first R2D command transmission of CFRA  Msg.3→command response to the first R2D command transmission of CFRA  Msg.4→R2D command transmission of CFRA  Msg.5→command response  With the above, we have 1 question for clarification: Whether device ID is included in the first D2R data transmission of CFRA?  According to TR38.769 6.3.1 and 6.3.4 (copied below), seems the answer is Yes?  *(6.3.1) Step B: D2R data (device ID) transmission. Triggered A-IoT device(s) perform the device ID transmission via the A-IoT random access procedure or without using the A-IoT random access procedure. See clause 6.3.4 (and 6.3.5).*  *(6.3.4) If the random access is contention-free access:*  *- Selects the indicated D2R occasion/resource;*  *- Skips the contention resolution in Step 2 and performs the data transmission in accordance to clause 6.3.5.* |
| vivo | Yes, with comments | For all options, the Inventory Response in MSG1 includes the Upper layer Device ID. While RN16 needs to be included in MSG1 only for **Option 2**. Therefore, we suggest adding the one common step for MSG1 as “MSG1: Inventory Response (Device ID)” following the step for the paging message. |
| CATT | Yes with comment | We agree to the general procedure on the allocation of AS ID in CFRA for inventory + command procedure. AS ID here is not for CFRA, but for being scheduled for inventory + command procedure. During last meeting discussion, we had precluded the parallel services by the same reader. In this case, all the R2D messages are targeted for the single device during the service period. Even we consider the scenario where the device is located at the overlapping area by two readers, the readers should execute the service request from CN (paging associated with the same transaction ID) in TDM manner (reader 1 by [t1 t2], reader 2 by [t2 t3]) so that the device can successfully receive the R2D message (As per my RAN1 colleague, the device cannot filter FDMA signals due to low complexity). If we take the assumption that CFRA here means the following command(s) is always for the single target device, it seems AS ID is not required. |
| MediaTek | Yes | Option 2 as described doesn’t specify which message optionally assigns the AS ID, but we understand it is compatible with options 3 and 4. |
| CMCC | Yes, with comments | We think for inventory only case, the AS ID is not needed, because there is not subsequent scheduling and command.  Same question as vivo mentioned, we wonder whether the upper layer device id in paging message need to be included in the MSG1 for option 2/3/4? There is a trade-off between efficiency and forward compatible. The upper layer device id is ~hundred bits long id which impacts the efficiency. And for forward compatibility, CFRA paging message may include multiple device id in future release, without replying upper layer id, it is difficult to figure out which device is replying. |
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During online discussion and offline discussion, companies already explained the Pros/Cons of each option. Rapporteur try to summarize them as below:

**Option 2**: the device includes a random ID in Msg 1 (Inventory Response). Same as CBRA, it is up to Reader to decide whether to reuse the random ID as the AS ID or to assign a new AS ID (The assignment can be done via Option 3 or Option 4).

**Pros:**

* The random ID included in Msg1 (Inventory Response) can be used in “New Msg2” or “Msg 2 Command” to associate the resources and identify the device if the ID can be reused;
* If new ID is needed, the RN 16 indicated in Msg1 can be used to identify the device and associate with the resources.

**Cons**:

* Additional signalling overhead in Msg 1 (Inventory Response); But same content as Msg3 for CBRA if RAN2 agrees that AS ID is contained in D2R message if available. FFS on RN 16 collision case

##### Q1-1. Do companies agree the above analysis on Pros/Cons of option 2 (the device includes a random ID in Msg 1 (Inventory Response))?

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| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes | The additional overhead I guess is there in MSG1, when compared to the case when there is no RN16 in MSG1 but UE directly includes UE ID. But, then the paging message needs to include ASID in the other option (i.e. option 1). It is worth clarifying hence what the additional signalling overhead is with respect to… |
| OPPO | Yes | There is no guarantee that, for CFRA procedure, subsequent D2R transmission is needed. If there is no subsequent D2R transmission, then transmission of the random ID in msg1 is totally waste of energy and signalling overhead. |
| Lenovo | Yes | And different as CBRA, RN16 in Msg1 of CFRA is not for contention resolution, but only for AS ID allocation. It’s unnecessary to let AIoT device generate random number only for AS ID allocation, which increase the device burden. Besides, whether there follows command may not known by the device, so there could be unnecessary to generate RN16 if there does not follows command messages. In this sense, we think the reader allocate AS ID for CFRA is more suitable. |
| NEC | Basically Yes | Two pros listed by the rapporteur are the same in our understanding.  Regarding Cons, if there is RN16 collision, then reader can assign a new ID like in CBRA case, maybe FFS part is not needed. |
| vivo | Yes, with comments | Cons: RN16 is not needed for Inventory-only procedure; however, from a device perspective, it does not differentiate whether the CFRA is for Inventory-only or Inventory+Command procedure but always transmits RN16 in all cases, which means signaling overhead due to RN16 transmission would be quite worse in **Option 1**. |
| CATT | Yes | We tend to agree with the rapporteur understanding on the pro/cons of option 2. Further comments please see our Q1-0 response. |
| MediaTek | Yes | The preceding comments are correct that there are cases where the RN16 is useless, but the overhead has to be weighed against device complexity. If we see that there are some cases where it’s useful to have RN16, it should be included consistently rather than trying to optimize with a conditional behaviour at the device. |
| CMCC | With comments | We understand for both inventory only and inventory+ command case, the random ID is not necessary to be contained in Msg1. Device can send device ID for acknowledge the paging or for AS ID assignment purpure.  For the Cons, we wonder why it is same as Msg3 for CBRA. For Msg3 of CBRA, the content includes AS ID+device ID; for option2, the content of Msg 1 includes Random ID+device ID. We suggest to update the Cons as, same ~~content~~ **bits** as Msg3 for CBRA if RAN2 agrees that AS ID is contained in D2R message if available. |

Regarding the impact of Msg 1 Inventory Response message, it is related to whether AS ID should be contained in D2R message. Rapporteur would like to check companies’ view on this.

##### Q1-2. Do companies see the need to contain AS-ID in D2R message when it is available?

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| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes | Some sort of ID should be included in MSG1. It can be either RN16 or some other ID. So, whatever is the content of MSG1, it can be called ASID for this purpose. |
| OPPO | No | For CFRA, the reader knows exactly in which time-frequency resource to find the D2R transmission, and there is only one A-IOT device involved.so it seems that AS ID is not needed to be carried in the D2R message for the reader to identify the A-IOT device. |
| Lenovo | Yes | We think the purposes for introducing such AS ID are for scheduling and data transmission between device and reader, to avoid including device ID or RN16 in each D2R/R2D transmission, for security or collision consideration. Then If AS ID is allocated, AS ID will be included in D2R transmission. |
| NEC | See comments | It depends on whether there are other devices’ A-IoT procedures (including D2R transmission) being performed in parallel from the reader perspective. If no other devices' D2R transmissions are being performed in parallel, then there is no need to include an AS-ID in the D2R message. |
| vivo | No | Since the R2D message contains an AS ID for a device and the subsequent D2R resources allocation scheduled by this AS ID, the associated D2R resources for D2R message transmission are enough to identify the device. |
| CATT | No | The AS ID is the ID which is assigned from reader to device. The first RN 16 in D2R which is mentioned by ZTE is not AS ID yet which is out of scope of this question. The AS ID which is assigned from reader to device is for distinguishing which device is being scheduled. However, the AS ID is not needed in D2R because the reader knows which device is being scheduled by the allocated time-frequency resource(s) before as OPPO mentioned.  In summary, there is no need of AS ID which is assigned by reader in the following D2R message. |
| MediaTek | No for Msg1, other D2R transmissions need discussion | We agree with OPPO’s point about Msg1.  Later D2R transmissions are also scheduled by the reader as noted in CATT’s comment, so in principle it seems that the reader may know which device it’s hearing without an explicit indication. However, if we consider that collisions are possible (e.g., between devices scheduled by two different readers in proximity), then the AS ID could be sent as a disambiguation of which device is transmitting. |
| CMCC | Yes, with comment | We think the motivation of allocating AS ID to devices is for D2R/R2D data transmission and R2D scheduling. If the reader assigns AS ID to device, it should be contained in D2R message. However, it does not mean it has always been assigned. |
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In addition, RAN2 has agreed that

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| For CBRA, it is up to Reader to decide whether to reuse the random ID as the AS ID or to assign a new AS ID. FFS how this is signalled, which message is used and size of AS ID. |

If RN 16 can be reused as the AS ID, the size of AS ID should be same as RN 16, i.e. 16 bits. RAN2 discussed the issue during online discussion, but no conclusion. Rapporteur assumes to support max around 60000 devices, 16 bits ID is needed at least for CBRA. And it could be good to have common ID size for CFRA and CBRA.

##### Q1-3. Do companies agree that the AS ID size is same as RN 16, i.e. 16 bits for both CFRA and CBRA?

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| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes | Having a fixed and uniform length of ID across all options would be simpler. |
| OPPO | Yes | CFRA could be applied to the multi-device case in the next release, so it is to keep the same AS ID across CBRA and CFRA |
| Lenovo | Yes | Since for CBRA, RN16 may be reused for AS ID. Then we also expect that the reader may allocate AS ID with the size of 16 bits for unification consideration. Otherwise, there will be different AS ID formats which will increase the complexity. |
| NEC | Yes |  |
| vivo | Yes | The AS ID size is better to be shared for both CFRA and CBRA for a reader to uniquely identify a device under its coverage. |
| CATT | Yes |  |
| MediaTek | Yes | We think it’s important for device simplicity to have the ID in one place and with a consistent size for all cases, so that parsing the address of an R2D message and matching it to the stored ID is a single automatic operation. |
| CMCC | Yes | Uniform size for CBRA and CFRA can be beneficial to device implementation. |
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Note: Q1-2 and Q1-3 are more or less related to RAN1 discussion on whether CRC is not needed. If AS ID is always contained in D2R message, the alternatives listed in option 1 cannot be met, i.e. only option 2 can work.

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| **R1-2501437** Summary #3 for coding aspects of physical channel design Moderator (CMCC)  Agreement  When CRC is attached to a PRDCH or PDRCH transmission,   * When the number of information bits is ≤ X bits, CRC-6 is used. Otherwise, when the number of information bits is > X bits, CRC-16 is used. Down-selection by RAN1#120bis from the following for X considering the balance of overhead and probability of undetected error:   + Alt. 1: 24   + Alt. 2: 56 * FFS impact of segmentation, if any   + Note: impact may not be in RAN1   **R1-2501592** Summary #5 for coding aspects of physical channel design Moderator (CMCC)  Agreement  One or both of the following options are supported to determine when no CRC is used,   * Option 1: A threshold of number of information bits Y. When the number of information bits is ≤ Y bits, no CRC is used. Down-selection from the following for Y:   + Alt. 1: 16   + Alt. 2: 8   + Alt. 3: 6 * Option 2: Specified condition(s), e.g., device transmits PDRCH for Msg 1 upon receiving a PRDCH triggering random access. FFS specified condition(s) and/or how to determine the specified condition(s). |

**Option 3**: “New Msg” for AS ID assignment, work with/without option 2

**Pros**:

* The AS ID assigned in the “new Msg “can be used for “the first Command message, i.e. Msg 2 Comand message, and “subsequent R2D Command messages” to associate the resources and identify the device;
* No impact on Msg 1 (Inventory Response) if option 2 is not supported;

**Cons**:

* Additional delay/overhead/procedure due to the new message;
* Device ID needs to be contained in “new Msg” in order to identify the device, to associate with the newly assigned AS ID in new Msg if option 2 is not supported;

##### Q1-4. Do companies agree the above analysis on Pros/Cons of option 3 (“New Msg” for AS ID assignment)?

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| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes, and… | One of the main disadvantages with these approaches is that the device procedure starts to diverge for various RACH options. i.e. the device has to follow different procedure between CBRA and CFRA. This should be captured as a Con. |
| OPPO | No | Device ID is not needed to be contained in the ‘msg’. In the last RAN2 meeting, we already agreed that parallel service requests by the same reader is not supported, so in a certain time duration, we think that there is no need to address the R2D message to specific A-IOT device for the CFRA procedure. Due to the same reason, we doubt the need of AS ID in the R2D message also in the CFRA procedure. |
| Lenovo | Yes | Agree with the analysis provided by the Rapp, and compared with Option 4, we think option 3 has no advantages, which only increase the signalling overhead and introduce additional procedure and delay as analysed by the Rapp. |
| NEC | Yes |  |
| vivo | Yes |  |
| CATT | Yes | If we go with option 3, we generally agree to the rapporteur’s analysis on the pros/cons of this option. New MSG is low efficient. But further comments please see our Q1-0 response. |
| MediaTek | Mostly yes | Agree with ZTE’s comment about divergence.  Regarding OPPO’s comment, we are not sure if it works to send the new message without some form of explicit addressing. The assumption seems to be that there will be certain R2D resources that are reserved for only this message, so the device can know “this is for me”?  Finally, the first pro (ability to use the AS ID for the first command message) is literally true but doesn’t seem to give a practical benefit over option 4, so we find it to be a bit of an empty advantage. |
| CMCC | Yes, with comments | We agree with the pros and cons listed by Rapp. However, we tend to agree the comments from ZTE. the devices complexity may increase if considering different AS ID assignment procedure for CBRA and CFRA. |
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**Option 4**: Msg 2 (Command message) for AS ID assignment, work with/without option 2

**Pros**:

* The AS ID assigned in the “Msg 2 Command message “can be used for “Msg 4” and subsequent R2D Command message” to associate the resources and identify the device;
* No impact on Msg 1 (Inventory Response) if option 2 is not supported;
* Not need to introduce new procedures;

**Cons**:

* Device ID needs to be contained in “Msg2” in order to identify the device, to associate with the newly assigned AS ID in Msg2 if option 2 is not supported, i.e. AS ID cannot be used for the first Command message;

##### Q1-5. Do companies agree the above analysis on Pros/Cons of option 4 ( Msg 2 (Command message) for AS ID assignment)?

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| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes |  |
| OPPO | No | The same opinion as mentioned for Q1-4 |
| Lenovo | Yes | Anyway command message needs to contain device id for the target AIoT device, since the device id is expected included by core network together with command message. |
| NEC | Yes | Pros: the last bullet can be revised to  “no additional delay/overhead/procedure compared to Option 3” |
| vivo | Yes |  |
| CATT | Yes | If we go with option 4, we generally agree to the rapporteur’s analysis on the pros/cons of this option. But further comments please see our Q1-0 response. |
| MediaTek | Yes | Regarding OPPO’s comment (referring back to Q1-4), we think the handling of Msg2 in CFRA may need to be clarified. In CBRA, Msg2 of course contains contention resolution information, and every device in random access needs to receive every instance of Msg2 and check to see if its RN16 is included. Do we assume the same for CFRA? Or is “Msg2” in CFRA just an ordinary R2D data transmission that needs to be addressed to the device? |
| CMCC | Yes |  |
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## AS ID assignment for CBRA

During the online discussion, RAN2 concluded that

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| **Agreements**   1. For CBRA, it is up to Reader to decide whether to reuse the random ID as the AS ID or to assign a new AS ID. FFS how this is signalled, which message is used and size of AS ID. 2. From device perspective, it is only required to use one AS ID. |

To assign a new AS ID, there were different options, e.g. AS ID is assigned in Msg2 together with RN 16, option 3 or 4 listed for CFRA.

The successful Inventory+Command procedure for CBRA is shown as below:



##### Q2-0: Do companies agree with the above AS ID assignment procedure for CBRA which will be used for further analysis?

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| --- | --- | --- |
| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes |  |
| OPPO | Yes |  |
| Lenovo | Yes | In the bracket after command, it should be *read* instead of *reader*? |
| NEC | Yes |  |
| vivo | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes |  |
| CMCC | With comments | For option 3, we wonder whether the “new message” is sent after the Msg3 or not? If the new AS ID is assigned after the Msg3 transmission, does that mean the Msg3 should contains the Random ID and device ID? |
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During online discussion and offline discussion, companies already explained the Pros/Cons of each option. Rapporteur try to summarize them as below:

**Option 1**: Msg 2 for AS ID assignment;

**Pros:**

* The AS ID assigned in the “Msg2 “can be used for “the first Command message i.e. Msg 4 and subsquent Command messages” to associate the resources and identify the device;
* Not need to introduce new procedures

**Cons**:

* Additional signalling overhead in Msg 2, especially when multiplexing is supported;

##### Q2-1. Do companies agree the above analysis on Pros/Cons of option 1 (Msg 2 for AS ID assignment)?

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| --- | --- | --- |
| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes | Additional disadvantage is that assigning ASID in MSG2 unnecessarily impacts inventory procedure and yet for inventory purpose, reader assigned ASID is not useful/necessary. |
| OPPO | No for cons | AS ID allocation always requires signalling overhead, no matter if it is Msg2 |
| Lenovo | Yes, with comments | We generally agree with the Pro and Cons provide by the Rapp. Additional concern from our side on option1 is that: since Msg2 is used of the contention resolution during CBRA procedure, the reader may not know whether there have subsequent commands target to this device when sending the Msg2. If no subsequent commands, whether the AS ID allocated in MSG2 is necessary for MSG3/MSG4 or not needs to be considered. |
| NEC | Yes |  |
| vivo | Yes |  |
| CATT | No for cons | Same view as OPPO |
| MediaTek | Mostly yes, but see comment | We agree with OPPO that there will always be some overhead somewhere, and we don’t see a big problem with the cases where no assignment is needed. To keep the PDU format fixed, maybe the easiest thing is for a reserved value to mean “don’t change” (e.g., all-bits-zero means the device should keep its RN16 as the AS ID). So we consider the con listed above to be literally true but not very important. |
| CMCC |  | Same view as OPPO on cons. |
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**Option 3 (reuse the number of CFRA)**: “New Msg” for AS ID assignment

**Pros**:

* The AS ID assigned in the “new Msg “can be used for “the first Command message, i.e. Msg 4 Comand message, and “subsequent R2D Command messages” to associate the resources and identify the device;
* No impact on Msg 2;

**Cons**:

* Additional delay/overhead/procedure due to the new message;
* Device ID or RN16 needs to be contained in “new Msg” in order to identify the device, to associate with the newly assigned AS ID in the new Msg; FFS on RN 16 collision case

##### Q2-2. Do companies agree the above analysis on Pros/Cons of option 3 (“New Msg” for AS ID assignment)?

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| --- | --- | --- |
| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes |  |
| OPPO | Yes |  |
| Lenovo | Yes | Agree with the Pros and Cons provided by the Rapp. |
| NEC | Yes |  |
| vivo | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes, but | We don’t see these pros as very meaningful. Of course the AS ID can be used to address any message after it is assigned, but there seems to be no intrinsic gain from introducing another message so that we can use the AS ID to address a later Msg2. |
| CMCC | Yes |  |
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**Option 4 (reuse the number of CFRA)**: Msg 4 (First Command message) for AS ID assignment

**Pros**:

* The AS ID assigned in the “Msg 4 Command message “can be used for “Msg 6” and subsequent R2D Command message” to associate the resources and identify the device;
* No impact on Msg 2;
* Not need to introduce new procedures;

**Cons**:

* Device ID or RN16 needs to be contained in “Msg 4 Command message” in order to identify the device, to associate with the newly assigned AS ID in the new Msg; FFS on RN 16 collision case
* The reader has to reuse RN16 or device ID for the first Command message;

##### Q2-3. Do companies agree the above analysis on Pros/Cons of option 4 ( Msg 4 (First Command message) for AS ID assignment)?

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| --- | --- | --- |
| **Company** | **Yes/No** | **Remark (add your view if any)** |
| ZTE | Yes |  |
| OPPO | Yes | The second bullet on the cons is a serious problem, using device ID to address A-IOT device will lead to the problem of large signalling overhead; using NR16 can not solve the problem of RN16 collision across different access occasions. |
| Lenovo | Yes | Agree with the Pros and Cons provided by the Rapp. |
| NEC | Yes |  |
| vivo | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes, and | We have a similar concern to OPPO about this option. The problem scenario is that device A has RN16=X, in a different access occasion device B also selects RN16=X, and they both pass through CBRA successfully, but the reader has no opportunity to assign an AS ID to either of them yet. Then an R2D message (remembering that Msg4 is just an R2D data message) comes addressed to X, and both devices think it is for them.  This scenario shouldn’t happen with options 2 and 3, since a device in random access will only process the new message/Msg2, and a device not in random access will never process the new message/Msg2. Considering this issue, we think it looks a bit dangerous to delay the assignment of the AS ID to outside the actual random access procedure. |
| CMCC | Yes |  |
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## Validity of AS ID

In last RAN2 meeting, validity of AS ID was discussed during offline discussion. But different from the discussion on AS ID assignment, we did not discuss the details of each option. Based on the options mentioned by companies during offline discussion, and proposals from companies in their contributions, Rapporteur listed following options for further discussion.

**Option 1**: The device releases the AS ID upon receiving Paging with new transaction id, i.e. different session/service

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| **Company** | **Arguments** |
| IDC R2-2500495 | Instead, release could be based on reception of a specific D2R message such as the occasion start message or paging message,  Once a device has determined/stored its AS ID, it should remember it for a finite period. Specifically, use of the same AS ID indefinitely may pose a security risk. Furthermore, we can expect that the storage of the AS ID may consume some energy at the device, and it should be avoided if unnecessary. |
| Xiaomi R2-2500253 | • Reception of paging message with a different session ID |
| Lenovo R2-2500387 | Slightly negative  For opt2, the device may maintain more than one AS ID if re-access is triggered in the same round, which may then cause misalignment between reader and device. |

Considering we did not discuss the details of the option during the meeting, Rapporteur would like to collect companies’ view on the Pros/Cons of the option.

##### Q3-1. Companies are invited to provide Pros/Cons for option 1 (The device releases the AS ID upon receiving Paging with new transaction id).

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| **Company** | **Pros/Cons** |
| ZTE | If this is the only way to release the ASID, then the problem is for the case where the device misses the paging message. Can the reader then reuse the ASID for a different device without impacting the other devices (across paging cycles) or not?  i.e. the protocol seems to rely on all devices correctly receiving the paging messages all the time, which is not preferrable. |
| OPPO | Cons:  after receiving paging targeted to itself with new transaction ID, definitely the A-IOT device will obtain a new AS ID in the new access procedure, releasing the AS ID upon receiving paging with new transaction ID seems an unnecessary operation. The time difference between receiving the paging message with new transaction ID and the subsequent R2D message for allocation of the new AS ID is quite short. |
| Lenovo | Pros: It’s reasonable to release AS ID upon receiving Paging associated with a new service request. Based on our agreements, when Paging with new transaction id is received by device, device will trigger RACH for response and generates random ID, and reader determines whether to re-use the random ID as AS ID or assign new AS ID. This option aligns well with our agreed procedures.  Cons: This option cannot support AS ID update during the current service period. |
| NEC | We think Option 1 here is the basic mechanism to avoid devices store unnecessary ASID. Do not see any Cons. |
| vivo | For Pros: **Option 1** is straightforward. There is no use case for the reader to use the same AS ID for a device across different paging rounds with a new transaction ID.  For Cons: **Option 1** requires the device to maintain an AS ID with an unnecessary duration. The arrival interval before receiving paging with a new transaction ID is uncertain and also can be very long. |
| CATT | Cons: This option seems to be not friendly to the device energy. If the device acquires one AS ID during a certain service procedure, the device will keep this AS ID until it receives next service request with new transaction ID that triggers a new service procedure. The concern is that how soon the new service request will occur? The device will keep this AS ID in vain for a time period until it receives the new service request triggered by paging with a new transaction ID. |
| MediaTek | First, we think we should stick to the agreement that the device maintains only one AS ID (including RN16) at a time, and when something happens that causes it to acquire a new ID (e.g., re-access or new paging causing generation of a new RN16), it should forget/overwrite the old ID.  Pros: The device does not need to maintain multiple AS IDs (simple implementation).  Cons: (1) By itself, this option does not enable AS ID update after random access. (2) Requires a way to release the ID in case of missed paging. |
| CMCC | Pros: Neither additional timer nor signalling is needed, which minimizes the overhead and complexity. |
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**Option 2**: The device releases the AS ID upon timer expiry; The Timer could be configured by the reader, or pre-defined in the specification;

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| **Company** | **Arguments** |
| Vivo R2-2500131 | Furthermore, the AS ID can also be released based on a pre-defined/configured timer expiry. The timer will be restarted upon each R2D/D2R transmission and separate timers can be maintained at both device and reader side. When timer expires, the AS ID is released respectively at device and reader side without explicit release signaling. |
| Lenovo R2-2500387 | Negative  For opt4, it may be difficult to configure a suitable timer value considering the service time is dynamic. |
| Panasonic R2-2500672 | Negative on timer  There was another proposal in previous meeting to introduce a timer for the validity of AS ID. However, in our view, such scheme is not preferred because it further increases the complexity of AS ID maintenance in device and it is difficult to set the appropriate timer value.  Positive on predefined timer?  **The device shall keep volatile memory contents including AS ID for the certain duration.** |

Considering we did not discuss the details of the option during the meeting, Rapporteur would like to collect companies’ view on the Pros/Cons of the option.

##### Q3-2. Companies are invited to provide Pros/Cons for option 2 (The device releases the AS ID upon timer expiry, predefined or configured timer).

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| **Company** | **Pros/Cons** |
| ZTE | The advantage of this is that this doesn’t rely on the devices receiving (or not receiving) certain messages.  The disadvantage is that the device needs to maintain a timer. But, we think the device will need to have the means to maintain some (even if coarse) timers for other AS purposes anyway. |
| OPPO | Cons:  1.Timer based solution requires the A-IOT device always countdown the timer, which may bring additional complexity to the A-IOT device.  2.the running length of the timer could be in long-term, e.g., in seconds. As mentioned by other companies, in such cases, the probability of setting an inaccurate time length for this timer is large.  3.the timing synchronization performance of A-IOT device is questionable, which implies that the timer running time, in practice, may be deviated from the set value. |
| Lenovo | Cons: As proposed in our contribution, it’s difficult to configure a suitable timer value considering the AIoT service time is dynamic. Moreover, it also increases the device complexity to maintain a timer additionally. |
| NEC | Agree with OPPO. Not sure about the syn. requirements of A-IoT devices. Basically, timer-based mechanism should be avoided in our understanding. |
| vivo | For Pros: **Option 2** is complementary to other options which rely on certain messages to release the AS ID fails, e.g., due to the device moving out of its serving reader’s coverage.  Besides, we think timer length is typically in seconds level (e.g., 1-10s) by referring to the Max. allowed end-to-end latency requirement (see SA1 TS 22.369 Table 6.2-1 KPIs for inventory). |
| CATT | Cons: difficult to determine the suitable value of this timer. |
| MediaTek | Pros: Allows synchronized ID maintenance between the reader and the device.  Cons: (1) Requires the device to run a timer. (2) Timer value would need to be configured to the device per service, complexifying the paging/access procedures. |
| CMCC | Cons: Device cannot maintain accurate timing, which may result to mismatch between reader and device.  To our understanding, the minimum time to store AS id in VM should be a requirement for devices, which should be captured in specification. |
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**Option 3**: The device releases the AS ID upon receiving new assigned AS ID from the Reader

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| **Company** | **Arguments** |
| Lenovo R2-2500387 | **Proposal 12:** From device side, AS ID is valid until reader assigns a new AS ID. From reader side, it’s up to reader implementation to determine the validity of AS ID. |

Considering we did not discuss the details of the option during the meeting, Rapporteur would like to collect companies’ view on the Pros/Cons of the option.

##### Q3-3. Companies are invited to provide Pros/Cons for option 3 (The device releases the AS ID upon receiving new assigned AS ID from the Reader).

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| **Company** | **Pros/Cons** |
| ZTE | This can work but it is unclear why we need to assign a new ID and release the previous one. The device ID can simply be released (without assigning a new one), otherwise, ASIDs will be occupied unnecessarily. |
| OPPO | Pros: this reduces the complexity of the A-IOT device. Naturally, when a new AS ID is received from the reader during another access procedure triggered by a subsequent paging message, the old AS ID shall be deleted |
| Lenovo | For clarification: Proposal 12 is based on the assumption that AS ID is always assigned by the reader. Since we have agreed that reader determines whether to re-use random ID as AS ID or assign new AS ID in RAN2#129 meeting, the option needs to be updated as: The device releases the AS ID upon new random ID is generated or receiving new assigned AS ID from the reader.  Pros: This option is straightforward and flexible. It can achieve similar effect as option 1. When device receives Paging associated with new service request, device generates random ID and the previous AS ID is released. In addition, this option can support reader updates AS ID when needed by assigning new AS ID. |
| NEC | We think Option 3 is the basic mechanism too. Do not see any Cons. |
| vivo | For Cons: It is not justified the use case/scenario for the reader to reassign a new AS ID to the device. During one inventory and command procedure, the reader may assign an AS ID to a device just once and use it until the completion of the procedure. |
| CATT | Cons: similar view as our comment in Q3-1**.** The device needs to wait for the new service request to trigger the update of the AS ID. From our point of view, the AS ID should be unchanged within a certain service procedure. |
| MediaTek | Pros: Straightforward implementation if there is a way to assign a new AS ID at any time.  Cons: Seems incomplete and can lead to “zombie” AS IDs that are not being used for anything but persist for a long time, unless option 6 is also specified. |
| CMCC | Cons: No clear what the use case is to assign AS ID twice. We should avoid over-design. |
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**Option 4a**: The device releases the AS ID upon reaching the max number of received Command Messages

Collected via offline discussion.

Considering we did not discuss the details of the option during the meeting, Rapporteur would like to collect companies’ view on the Pros/Cons of the option.

##### Q3-4a. Companies are invited to provide Pros/Cons for option 4a (The device releases the AS ID upon reaching the max number of received Command Messages).

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| **Company** | **Pros/Cons** |
| ZTE | Not sure what the advantage of this is compared to other options. |
| OPPO | Cons: it is questionable how to set a proper value of the max umber of received Command Messages. |
| Lenovo | Cons: This option seems not reasonable. It’s possible that the max number of received Command Messages is reached and AS ID is released, but the AIoT service is not completed, which degrades the system performance. So it is hard to configure a suitable max number, and additionally the device needs to store such parameter. |
| NEC | Cons: Devices have to count/store the number of received Command Messages which may result in complexity increasing. |
| vivo | For Cons: Not clear how to specify the max number of received Command messages. It is also noticeable that no such service requirement/KPI was found according to SA1 TS 22.369. |
| CATT | Cons: same view as Lenovo. |
| MediaTek | We don’t understand this proposal too well, and we agree with the comments above. |
| CMCC | Not needed and not support. It is over design. |
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**Option 4b**: The device releases the AS ID after completion of the command procedure

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| **Company** | **Arguments** |
| IDC R2-2500495 | As a result, the device could release the AS ID after completion of the command procedure. If multiple commands need to be issued to the device, such approach may be cumbersome. |
| Xiaomi R2-2500253 | * ***Complete the transmission of the D2R response to a “command”*** |
| CATT R2-2500272 | Proposal 3b: The device should release the AS ID, if it determines the service is completed.  If the device confirms that it had completed the service triggered by the reader, the device should release the AS ID.  So this optional feedback indication can be used by the device to determine the successful reception of the last data transmission by the reader, i.e., the service has been completed by the device. |

Considering we did not discuss the details of the option during the meeting, Rapporteur would like to collect companies’ view on the Pros/Cons of the option.

##### Q3-4b. Companies are invited to provide Pros/Cons for option 4b (The device releases the AS ID after completion of the command procedure).

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| **Company** | **Pros/Cons** |
| ZTE | The advantage is that there is a well defined message to release the ASID and hence the reader and device can be always in sync  The disadvantage is that this message may be missed by the device. In which case, we need to discuss whether we also need a timer or not. i.e. it is unclear whether we can solely rely on a reader based mechanism when the DL message may be missed. |
| Lenovo | Pros: It’s reasonable that AS ID is valid during the current service period, e.g., before completion of the command procedure.  Cons: However, we need to consider how does device determine the completion of the command procedure.  To make this option clear, more details related to the completion of command procedure need to be defined, e.g., the device releases the AS ID upon receiving the ‘end’ indication from reader, or upon completed the last D2R message transmission. |
| NEC | Cons: Not sure how devices to determine the procedure is completed. It may result in complexity increasing. |
| vivo | For Cons: the completion of the command procedure is known by the reader but not known at the device. Anyway, reader indication to the device to release the AS ID is needed, e.g., Option 6 is a way to achieve such a purpose. |
| CATT | As one of the source companies, our intention is to emphasise the AS ID is only valid in device during the on-going of a certain service. Then the issue is converted to how to determine the completion of the service by the device.  A candidate solution is that an indication of end of this service for this device is sent from reader to device. So the target device will release AS ID. If the indication is unfortunately missed by the target device which doesn’t always happen, the AS ID has to be maintained until the device runs out of power or the device receives a new paging message. |
| MediaTek | Pros: (1) Unambiguous (as long as the end of the procedure is well-defined). (2) Complies with the “one ID” principle. (3) Does not introduce overhead to signal an ID field in extra messages.  Cons: Requires a clear definition of the end of the procedure (last segment of response transmitted?). |
| CMCC | Cons:   1. As long as device has energy, it should keep monitoring, even if the device is released. 2. If the release message is lost, it will cause misalignment. In such case, it still rely on other solutions such as paging with new transaction id or timer. |
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**Option 5**: The device releases the AS ID upon power off

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| **Company** | **Arguments** |
| Xiaomi R2-2500253 | * ***when the device is powered off, all information stored in the register memory needs to be cleared including the AS ID.*** |

Considering we did not discuss the details of the option during the meeting, Rapporteur would like to collect companies’ view on the Pros/Cons of the option.

##### Q3-5. Companies are invited to provide Pros/Cons for option 5 (The device releases the AS ID upon power off).

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| **Company** | **Pros/Cons** |
| ZTE | This is needed anyway. I guess ASID is in volatile memory and whenever the device runs out of power, the ASID is released. So, regardless of pros and cons, we have to discuss how the protocol should actually support this case (i.e. this is something the protocol has to live with). |
| OPPO | Pros: such operation is simple, if we agree that AS ID shall be stored in the volatile memory |
| Lenovo | Pros: This option is natural if AS ID is stored in the volatile memory.  However, we understand this option should be used together with other solutions, i.e., only option 5 is not a complete AS ID release solution. When device has energy, it’s also possible the AS ID is not valid and should be released. |
| NEC | We think it is the basic mechanism too. Do not see any Cons. |
| vivo | For Pros: Option 5 is straightforward. Similar to normal UE, the assigned AS ID is part of the AS context, which is released upon power off (i.e., out of energy). No spec impact is foreseen for this case. |
| CATT | Same view as ZTE. This option may work together with option 4b. |
| MediaTek | Pros: Seems inevitable unless we specify that AS ID shall always be stored in NVRAM, which looks like an unreasonable requirement.  Cons: (1) Difficult to guarantee sync with the reader. (2) AS ID may persist for a really long time if the device can harvest enough energy to stay powered on, even if it is not engaged in any procedures.  We agree with Lenovo: This is a valid condition but not a complete solution. |
| CMCC | Pro: no additional signalling or overhead introduced.  In addition, we think the minimum time to store AS id in VM should be a requirement for devices, which should be captured in specification. |
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**Option 6**: The device releases the AS ID upon receiving explicit release indication from the Reader

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| **Company** | **Arguments** |
| Vivo R2-2500131 | Explicit release indication from reader is the most straightforward solution, e.g., upon reader reception of service ending indication from CN. |
| IDC R2-2500495 | we could rely on an explicit indication by the reader (e.g., included with the data transmission scheduling). |
| Lenovo R2-2500387 | Negative  For opt5, it may be unnecessary to use an explicit indication (e.g., AS ID release indication). |

Considering we did not discuss the details of the option during the meeting, Rapporteur would like to collect companies’ view on the Pros/Cons of the option.

##### Q3-6. Companies are invited to provide Pros/Cons for option 6 (The device releases the AS ID upon receiving explicit release indication from the Reader).

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| **Company** | **Pros/Cons** |
| ZTE | Need for an explicit message is unclear (e.g. if implicit release upon completion of certain procedures is sufficient). |
| OPPO | Cons: one additional R2D command is needed for the A-IOT device to release AS ID, which is not friendly to resource usage, especially considering that the R2D message could occupy all the frequency band, i.e., FDM may be not possible for the R2D direction, according to RAN1 current process. |
| Lenovo | Pros: this option is straightforward.  Cons: however, it’s not necessary to introduce an explicit signalling for AS ID release, which increases signalling overhead. The implicit conditions/signalling like option 1/3/4b is enough. |
| NEC | Pros: it is a simple and straightforward solution. Devices just follow the reader command to release the previous AS-ID. |
| vivo | Pros: The AS ID management, including assignment and release, is all controlled by one node, i.e., reader. |
| CATT | Pros: straightforward  Cons: need additional R2D message for this purpose. |
| MediaTek | Pros: (1) Straightforward. (2) Guarantees sync.  Cons: Requires a bit in the R2D data MAC header. (A separate message should be usually avoidable if the release instruction piggybacks on the last R2D transmission.) |
| CMCC | Cons:   1. Increase additional signalling overhead and device behaviour. 2. If the release message is lost, it will cause misalignment. In such case, it still rely on other solutions such as paging with new transaction id or timer. |
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##### Q3-7. Companies are invited to add if any options are missing.

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| **Company** | **New options** |
| ZTE | Combination of some of the options above.  e.g. a reader-based release (either implicitly or explicitly) + device releasing it upon expiry of a timer (e.g. like an inactivity timer).  Pros: This works for all cases and covers the cases where the R2D message is missed by the device |
| vivo | Share a similar view as ZTE. The above options are not exclusive and can be complementary to each other. The questionnaire in the next phase discussion is better to collect views on a reasonable list of option combinations instead of down-selecting one option. |
| MediaTek | We agree that combinations of the options should be considered. 3+5+6 looks like it works, for example. |
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## Others

Rapporteur would like to check companies’ view on whether any other aspects need to be considered in this email discussion.

##### Q4-1: Any other aspects on AS-ID need to be considered in this email discussion?

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| **Company** | **Comment** |
| ZTE | One of the requirements for ASID management is for the reader to have a well-known point when the ASID can be reassigned/reused. There should be no ambiguity at the reader whether the ASID is still in use by some other device or if it is released and hence can be reused for a different UE. |
| OPPO | For ZTE’ s concern, we think that the AS ID bit space could be large enough to remove the need of a well-known point when the ASID can reassigned. |
| vivo | There is a remaining issue regarding if AS ID can be based on partial upper layer device ID (see highlighted below). Not sure if it can be handled in this email or not.  *From TR 38.769*  From higher layer perspective, it is assumed that "AS ID" (if defined according to the design in clause 6.1) is used at least for purpose of D2R scheduling and R2D reception. From higher layer perspective, it is assumed that this "AS ID" should be a short AS layer ID, rather than the full upper layer device ID. It needs to be further discussed if this "AS ID" can be based on partial upper layer device ID. It needs to be further discussed on the length of this "AS ID". From higher layer perspective, following options are possible for this "AS ID" (it is aimed to define one common design for all access procedures in clause 6.3.4, if technically possible): |
| MediaTek | We agree with ZTE’s concern. Enlarging the ID doesn’t fully address the problem, since the reader will still want to reuse ID values eventually and it should know which values are available. |

# Phase 2 Discussion

After phase 1 discussion, Rapporteur will provide summary based on the inputs from companies during Phase 1. Companies are invited to provide further comment on the summary and new questions from Rapporteur.

# Conclusion

# Reference

[1] R2-2501510 [AT129][020][AIoT] AS ID (XiaomiHuawei) Xiaomi, Huawei

[2] R2-2500131 AIoT Data Transmission vivo

[3] R2-2500495 Data Transmission and General Aspects for Ambient IOT InterDigital

[4] R2-2500253 Protocol design principle and considerations on Data transmission Xiaomi

[5] R2-2500272 Discussion on the A-IoT Data Transmission and Other General Aspects CATT

[6] R2-2500387 Discussion on A-IoT data transmission and other general aspects Lenovo

[7] R2-2500672 Discussion on AS ID, segmentation and control signaling format Panasonic

# Annex – RAN2 AS ID related agreements

RAN2 #127 meeting

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| **Agreements on AS ID**   1. RAN2 assumes that if “AS ID” is defined it is used at least for purpose of D2R scheduling and R2D reception. Up to RAN1 to decide whether a “AS ID” is defined. 2. RAN2 assumes this “AS ID” should be a short AS layer ID, rather than the full upper layer device ID. FFS on the length. FFS if AS ID can be based on partial upper layer device ID. |

RAN2 #129 meeting

**Agreements**

1. NACK based mechanism is supported for D2R messages to determine re-access for at least msg3. FFS details including whether we need a timer or explicit message and when reader sends feedback

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| **Agreements**   1. For CBRA, it is up to Reader to decide whether to reuse the random ID as the AS ID or to assign a new AS ID. FFS how this is signalled, which message is used and size of AS ID. 2. From device perspective, it is only required to use one AS ID. 3. CFRA is not supported for group ID 4. RAN2 assumes, AS ID is needed for CFRA at least for inventory + command procedure 5. For CFRA, if a valid AS ID is not already assigned, continue the discussion on AS-ID assignment based on the following options:  * Option 2: the device includes a random ID in “Msg 1”. And same as CBRA, it is up to Reader to decide whether to reuse the random ID as the AS ID or to assign a new AS ID. * Option 3: New “Msg 2” for AS ID assignment, complementary option or independent from option 2 * Option 4: “Msg 2” (including the “Command”) for AS ID assignment, complementary option or independent from option 2 |