3GPP TSG-RAN WG2 #114-e draft R2-2106662

Electronic meeting, 20th – 27th May, 2021

Agenda Item: 8.16.3

Source: Ericsson

Title: UE onboarding and provisioning for NPN

Document for: Discussion

# 1 Introduction

This document is to kick-off the following email discussion:

* [AT114-e][029][eNPN] UE onboarding and provisioning for NPN (Ericsson)

 Scope: Start from the baseline, the tdocs under 8.16.3, identify easy agreements, potential agreements, discussion/open points, and identify questions to ask other group, if any,

 Intended outcome: Report that paves the way for on-line agreements.

 Deadline: May 24 1600 UTC (In time for CB online May 25)

#### Rapporteur’s note

The intention of the present document is to identify common views regarding the remaining open issues.
Based on the companies' responses, the Rapporteur's proposals will be classified as:

* Cat-a: Proposals that could be agreed upon quickly
* Cat-b: Proposals that require further discussion
* Cat-c: Proposals that can be postponed

The aim is then, for Cat-a Proposals to be quickly treated online, allowing for Cat-b issues that require a more in-depth discussion or that have been on the table for some time already (e.g., congestion control), to be addressed during the online session.

The deadline for inputs has been set so that there is enough time to take into account any further comments and fine-tune details of the Email Discussion Summary prior to the online session scheduled on May 25.

## Contact information

To make it easier to find the correct contact delegate in each company for potential follow-up questions, the rapporteur encourages the delegates to provide their contact information in the following table:

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

The list of Tdocs considered for this email discussion is available in the Reference section below.

Before continuing, it should be noted that RAN2 agreed to use the term “Group IDs for Network Selection” (GINs) to refer to the Group IDs. Thus, herein we use “GIN” as abbreviation instead of “GID”.

## 2.1 Broadcasting information

The following two notes are captured in the conclusion of TR 23.700-07 [16] (see clause 8.4.1):

NOTE 3: The Group ID(s) in the SIB that UE can use for selecting an O-SNPN are the same as the Group ID(s) in the SIB that the UE uses for SNPN selection as part of KI#1.

NOTE 4: Whether the indication for Onboarding is sufficient or more SIB information is needed can be further discussed in the normative phase.

The understanding of NOTE 3 is not the same among the companies that commented on this matter. On the one hand, [1], [5], [10], [11] believe that the information in the note must be taken as it is, i.e., the *same* GINs as the ones used to access SNPNs with subscriptions/credentials from a separate entity should be used for onboarding (i.e., the broadcast information does not distinguish whether the GIN is used for one purpose or the other). However, on the other hand, [3], [12] believe that since onboarding is a completely different procedure compared to the one of accessing an SNPN by using external credentials, there should be different “GIN lists” for each. Finally, [4] and [8] believe that this should be clarified by SA2.

**Q1.1. How do you interpret NOTE 3 in the TR?**

* **Option A: same “GIN list” for the purpose of onboarding and accessing an SNPN with external credentials,**
* **Option B: different “GIN lists” should be used for each purpose,**
* **Option C: SA2 should clarify.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option A, B, C** | **Comments** |
| Ericsson | Option A | NOTE 3 in the TR is clear. The broadcast information does not distinguish between GINs used to select an O-SNPN or GINs used to select an SNPN to access by using external credentials. We believe that the diagram provided by Intel (see Fig. 1 in [R2-2105916](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105916.zip)) accurately depicts this scenario. Moreover, we are aware that this was already discussed/decided in SA2, which is why NOTE 3 was added to the TR. |
| OPPO | Option A | Based on our analysis in paper R2-2104768, we see no serious consequence even if the broadcast information does not distinguish between GINs used to select an O-SNPN or GINs used to select an SNPN to access by using external credentials. So we prefer to use the same GIN for both cases. |
| ZTE | Option B | The Note3 is quite confusion, but we have confirmed with our SA2 guy, and the note 3 only means that the same format of the GIN would be adopted for both on-boarding and CH, it doesn’t mean the same GIN values. |
| Nokia | Option A | Our view is that NOTE 3 is clear, we agree with Ericsson. This view is confirmed by our SA2 delegate. |
| Sony | Option A | In our understanding if introduction of GINs is transparent to AS layer then same GINs can be used for both cases.  |
| Intel | Option A | Same as Ericsson, our understanding is that this has already been discussed in SA2 and the result of it is NOTE 3 in the TR. |
| Apple | Option B/C | We agree with ZTE. But prefer SA2 to clarify. The issue at hand is whether AS layer can truly indicate using the same GIDs or same GID format.  |
| Huawei, HiSilicon | Option C | In our understanding, GINs for onboarding purpose has not been confirmed by SA2 in the normative phase now. As informed by our SA2 colleagues, at the latest SA2 #144e, the GIN for onboarding was not approved to be included in the SA2 specification. RAN2 can wait for SA2’s progress or send an LS to ask SA2 to clarify. |
| CATT | Option C | We understand onboarding and access using credential by separate entity are two independent functions provided by the SNPN. It seems not reasonable to impose a restriction that the Group IDs used for onboarding purpose and for credential by separate entity are always same. Nonetheless, this issue is in the scope of SA2, it should be clarified further by SA2. |
| Qualcomm | Option A/C | Agree with Ericsson on Note 3 in the TR. But it is also fine to ask SA2 to confirm this. |
| CMCC | Option B/Option C | From our view, the Group ID served different purpose and scenarios for on-boarding and for credential by separate entity and the Group ID may represent different company groups even they have the same ID since the group ID could be defined by any private group. However, we think the Group ID should be in the same format no matter the purpose is for onboarding or for credential by separate entity. And could wait for further SA2’s clarification. |
| China Telecom | Option C | We prefer Option B for network deployment. Since there are different views on Option A and B from RAN2 perspective, we recommend to send LS to SA2 for clarification. |
| Samsung | Option B | Since Onboarding and Supporting external CH are two different features, a GIN having SLA with an SNPN for providing onboarding service need not provide other services. So GINs for onboarding and external CH supports should be broadcasted separately. |
| vivo | Option C | From our understanding, SA2 should clarify whether the same GIN can be used both for third party credential and onboarding. Based on that, RAN2 can determine whether the same “GIN list” or different “GIN lists” should be adopted for the purpose of onboarding and accessing an SNPN with external credentials. |
| MediaTek | Option C | Our understanding is Option A, but given the divergence of views in R2, this can be clarified by SA2. |
| Asia Pacific Telecom | Option A/C | Our understanding is Option A, but it is okay to clarify with SA2. |

**Rapporteur’s Summary:** 7 out of 16 companies interpret NOTE 3 as the same GIN-List to be used for purposes of onboarding and accessing an SNPN with external credentials (i.e., Option A), with 1 of those companies open to the option of SA2 clarifying this issue (Option C). 4 companies think that one separate GIN-List is needed for each purpose (i.e., Option B), with 2 of them thinking it is OK if SA2 clarifies. A total of 8 companies (half of the companies) support SA2’s clarification of the matter. In view of the above, this is not an issue that can be quickly agreed upon. The following is thus proposed.

1. (Cat-b) RAN2 to discuss whether a common list of GINs can be used for both onboarding and accessing an SNPN using external credentials. If no consensus, send an LS to SA2 to clarify.

As for NOTE 4, [2] and [4] believe that it would be beneficial to add additional information. More particularly, [2] see the need for NPNs to signal whether it only supports onboarding for a specific group of UEs. And [4] would like RAN2 to discuss whether an SNPN should indicate if it supports only onboarding, or both onboarding and regular services.

The Rapporteur then considers that, in order to facilitate the progress of the WI in RAN2, it might be beneficial to continue with this discussion, if and only if, SA2 sees the need to incorporate additional information that could be useful for UE onboarding to SNPNs.

**Q1.2. Do you agree that no extra information is needed in the broadcast (i.e., in addition to the already agreed onboardingEnabled indication and optional GINs) unless requested by SA2 (or other groups)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes | The already agreed broadcast information is in line with what is requested in SA2’s TR. Any requirement in this line should be driven by other WGs.  |
| OPPO | Yes | The same view with Ericsson. |
| ZTE | Yes | Agree with Ericsson |
| Nokia | Yes | Same view as Ericsson. |
| Sony | Yes |  |
| Intel | Yes |  |
| Apple | No | We prefer to have this discussion as we believe it is a fundamental part of AS broadcast design.  |
| Huawei, HiSilicon | Yes | No extra information is needed, unless required by other WGs. |
| CATT | No | Agree with Apple |
| Qualcomm | Yes | We should only follow SA2 requests. The proposals above are not within RAN2 scope. |
| CMCC | Yes |  |
| China Telecom | Yes |  |
| Samsung | Yes | Same view as Ericsson, but FFS on congestion control related parameters |
| vivo | Yes | Agree with Ericsson, RAN2 should only work on this if requirements from other WG come. |
| MediaTek | Yes | Agree with Ericsson |
| Asia Pacific Telecom | Yes |  |

**Rapporteur’s Summary:** 14 out of the 16 companies participating in this email discussion think that no extra information is needed in the broadcast unless requested by other WGs. Since only 2 companies believe that RAN2 should further discuss this issue, the following is proposed.

1. (Cat-a) No additional information except for the already agreed parameters is discussed unless requested by other WG.

## 2.2 PLMN acting as onboarding network

RAN2 agreed during RAN2#113-e to focus on the O-SNPN scenario, while SA2 discussed any RAN-related impact regarding PLMNs acting as onboarding networks. On this matter, the TR 23.700-07 [16] now concludes in clause 8.4.1 that:

- Using PLMN credentials for UE onboarding and PLMN as Onboarding Network (ON) is already possible.

This is reaffirmed by the following text in a recently approved SA2 CR to TS 23.501 (see [S2-2102974](https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_144E_Electronic/Docs/S2-2102974.zip)):

Only some companies have provided their thoughts regarding this topic [4], [10], [11]. However, all of them agree that there is no need to extend the broadcasting information mechanisms for PLMNs.

“This clause applies only when the UE is not in SNPN access mode.

When the UE is using PLMN credentials for accessing a PLMN as the Onboarding Network (ONN), then regular network selection, as per TS 23.122 [17] and regular initial registration procedures apply, as per TS 23.502 [3]…”

**Q2. Do you agree that there is no need to introduce the 1-bit onboarding indication and optional GINs for PLMNs acting as onboarding networks?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes |  |
| OPPO | Yes | It’s clear to confirm this based on SA2 TR. |
| ZTE | Yes |  |
| Nokia | Yes | Additional flags would only be needed if SA2 requested it. |
| Sony | Yes |  |
| Intel | Yes |  |
| Apple | Yes |  |
| Huawei, HiSilicon | Yes | This is clear according to the approved SA2 CR to TS 23.501 (S2-2102974). |
| CATT | Yes |  |
| Qualcomm | Yes | Unless SA2 changes their mind and requests otherwise. |
| CMCC | Yes |  |
| China Telecom | Yes |  |
| Samsung | Yes |  |
| vivo | Yes |  |
| MediaTek | Yes |  |
| Asia Pacific Telecom | Yes |  |

 **Rapporteur’s Summary:** Since all companies agree, the following is proposed.

1. (Cat-a) There is no need to introduce the 1-bit onboarding indication in SIB1 and optional GINs for PLMNs acting as onboarding networks.

## 2.3 RAN congestion and cell access control

This topic has been brought up in company contributions since this WI was first discussed in RAN2#113-e. However, RAN2 has not been able to discuss it during online sessions. Nevertheless, this has not prevented companies from refining their understanding and some have even modified their proposals.

As proposed in the last meeting’s AI 8.3.16 Summary [15], RAN2 should discuss the following 2 options for congestion control:

**Option A) Use the onboarding indication in the SIB
Option B) Use the UAC approach**

It seems that the trend is now slightly tilted towards letting the network use the onboarding indication in SIB1 [4], [5], [6], [9], [10], [11], [14], (as clarified in SA2’s LS Reply, see [S2-2101076](http://www.3gpp.org/ftp/tsg_sa/WG2_Arch//TSGS2_143e_Electronic/Docs//S2-2101076.zip) [17]), with some mentioning that there is no need to change the UAC procedure due to onboarding [5], [9], [10].

However, some companies argue about benefits of differentiating an access due to onboarding from others in view of the UAC framework [1], [3], [7], [8], [12], [13]. Those in favour of the latter, are concerned that the former approach does not provide enough granularity to deal with congestion and cell access control.

The Rapporteur understands that at this stage it is practically impossible to reach a consensus to decide which approach should be used to address congestion due to onboarding requests. However, the Rapporteur believes that it is possible to reach intermediate agreements to move forward with the discussion. Further technical details could be then discussed in depth during the online session. In this regard, companies are invited to answer some preliminary questions.

**Q3.1. Do you agree that toggling the 1-bit onboarding indication allows to (at least partially) control congestion due to onboarding requests?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes | Indeed, we think this mechanism is enough for a process that occurs seldomly, arguably once in a UE’s lifetime and which can possibly be pre-planned by the network controller.  |
| OPPO | Partially | RAN2 agreed that Onboarding indicator is configured per SNPN ID, if RAN2 uses the same indicator for cell load control purpose, the cell load is controlled per SNPN. But actually, when the one SNPN network is overload for onboarding, the same situation for the other SNPN networks as all the SNPN networks in one cell share the same resources of that cell. It’s better to have a per cell indicator to bar all UEs for Onboarding access.On top of this, no enhancement is needed for cell selection, which can simplify our spec work. |
| ZTE | Yes with comments | But we don’t think only 1-bit on-boarding indication is enough. It would block all of the access from all of the on-boarding UEs. We also see that some operators e.g. CMCC have demands to partially block the UEs.  |
| Nokia | Yes | Note that toggling the onboarding bit is possible without additional specification. RAN2 should not invent new access control requirements, RAN2 should only specify solutions based on SA1/SA2 requirements. |
| Sony | Yes | Agree with Nokia |
| Intel | Yes | We see the toggling the indication the same as enabling/disabling of the onboarding indication. |
| Apple | Yes with comments | This works for some scenarios only. We really want to confirm if this toggling would cause all UEs to stop on-boarding or only some. RAN2 to needs to understand that some services might still need to go through so service based priorities cannot be done using a single bit indication.  |
| Huawei, HiSilicon | Yes, but | This mechanism may provide misleading information to UE that onboarding is not supported by a cell, although the original intention might just be to control the access of those onboarding UEs to some extent, instead of completely prohibiting this feature. |
| CATT | Yes,but | It is up to gNB implementation, and should have no spec impact. |
| Qualcomm | Yes, but | As changing the indication by the gNB has no spec impact, it is already the baseline. But other optimizations as below can be discussed further. |
| CMCC | Yes with comments | But The UAC value may bring more flexibility for the operator to control the congestion level. |
| China Telecom | Yes | Option 1 is simple. Since onboarding is not high priority, all UEs for onboarding are blocked is acceptable when the cell is congested. |
| Samsung | Yes with comments | Toggling of the onboarding indication can be useful in case of blocking all onboarding attempts but might not provide granular access control so UAC based approach should also be considered. |
| vivo | Yes | Toggling the 1-bit onboarding indication is useful for at least the following scenario:For the network supporting both onboarding and normal service, some UEs may try to access the network for normal service, and other UEs may try to access the network for onboarding simultaneously, the network has to perform congestion control to provide priority for UEs subscribed to its service. |
| MediaTek | Yes | We see little reason to introduce congestion control mechanisms for a procedure that seldom occurs (typically once in a UEs lifetime). Toggling the onboarding indication is sufficient to address congestion control, if needed, by the NW. |
| Asia Pacific Telecom | Yes | Toggling the 1-bit onboarding indication per SNPN can be used to address the RAN congestion and cell access control by the NW. |

 **Rapporteur’s Summary:** There is a consensus that toggling the 1-bit onboarding indication in SIB1 allows to (at least partially) control congestion due to onboarding requests. 1 company thinks this can be further simplified (per cell instead of per SNPN), 7 companies think that the bit toggling is sufficient and 5 companies think that more flexibility/optimization could be introduced. Thus, the following preliminary Proposal is then suggested. Bear in mind that Proposals concerning UAC-related enhancements are discussed below.

1. (Cat-a) Toggling the 1-bit onboarding indication in SIB1 allows to control congestion due to onboarding request.

The Rapporteur is aware that UAC is already in place. Indeed, companies already express that legacy UAC (framework) can be used for onboarding, [4], [7], where [4] mentions that an existent Access Category could be used to do so. Let us refer to this as scenario “a)”.

On the other hand, different approaches have been mentioned. These include; b) define a new Access Category and/or Access Identity [4], [7], [8], [12], [13], c) cell barring indicator [1], d) operator defined UAC values [13].

The Rapporteur believes that as proposed in [5], any kind of changes to UAC can be considered by RAN2 if explicitly requested by other WGs.

The following question could then eventually clarify this diverse panorama.

**Q3.2. Would you agree to involve SA1 and CT1 in the discussion regarding how UAC should be used for onboarding?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Not needed | SA1 has not defined any new requirements for UE onboarding (no new Access Category/Identity). It is in CT1 scope how the existent UAC framework could be used for onboarding.  |
| OPPO | Yes for CT1 | At least CT1 is involved if discussing the enhancement for UAC. |
| ZTE | FFS | We are OK to involve SA1 and CT1 in the discussion |
| Nokia | Not needed | RAN2 should not invent new access control requirements, RAN2 should only specify solutions based on SA1/SA2 requirements. At the moment we are not aware such a requirement.  |
| Sony | Not needed | If these WGs find something, then they will let RAN2 know. |
| Intel | Not needed |  |
| Apple | FFS |  |
| Huawei, HiSilicon | Yes | RAN2 to ask SA1 and CT1 whether a new AC is needed for onboarding. |
| CATT | Not needed |  |
| Qualcomm | Yes | For any changes to UAC, CT1 and SA1 should be involved since Access Categories and Identities are defined in their specifications. |
| CMCC | Yes |  |
| China Telecom | FFS | No strong views. |
| Samsung | Yes |  |
| vivo | Yes | Regarding the UAC mechanism, CT1 and SA1 are involved, e.g. whether to define a new access category or new access identity for onboarding. |
| MediaTek | Not needed | We do not need to introduce UAC for this procedure, as it seldom occurs (expected that onboarding typically only takes place once in the UEs lifetime). |
| Asia Pacific Telecom | Yes | Agree with QC |

**Rapporteur’s Summary:** 7 out of 16 companies support the idea of involving other WGs, with 1 of those proposing to ask SA1 and CT1 whether a new Access Category is needed. While 6 believe that this is not needed. Moreover, 3 replied “FFS” (with 1 OK to involve SA1 and CT1). This outcome will be considered for the evaluation of the following question.

The Rapporteur thinks that to further facilitate the discussion, it might be beneficial for those companies proposing to have onboarding-specific UAC parameters, to agree on the best approach along these lines. Note that companies not in favour of any UAC-related modification are also invited to comment.

**Q3.3. If onboarding-specific UAC parameters are to be introduced, which of the following options do you think would be the most appropriate?**

* **Option A: New Access Control indicator or barring configuration (e.g. similar to Category a/b/c applied to Access Category 1)**
* **Option B: New Access Category**
* **Option C: New Access Identity**
* **Option D: Operator defined UAC values**
* **Option E: Other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| OPPO | Option A | Cell barring indicator is simpler for onboarding access control and RAN2 alone can decide. More addition, on top of this, the onboarding indicator can be configured uniformly per SNPN, no enhancement is needed for cell selection. |
| ZTE | Option B |  |
| Nokia | Option BOption C | Defining a new Access Category or Access Identity is not in the scope of RAN2 |
| Sony | Option B |  |
| Apple | Option B | Option C is also ok. |
| Huawei, HiSilicon | B or D |  |
| Qualcomm | B or D | Access Category is more natural since this is a new type of access request. But this should be confirmed with CT1/SA2. |
| CMCC | Option B or D |  |
| Samsung | Option A or B | **First preference would be for Option A** but also fine with option B. |
| vivo | Option B/C |  |
| MediaTek | No mechanism needed | See response to Q3.2 |
| Asia Pacific Telecom | Option B or D | RAN2 cannot decide and should confirm with CT1/SA2 |

 **Rapporteur’s Summary:** Proponents and also other companies provided their views on possible optimizations (if any are needed). 10 consider a new Access Category is an appropriate solution (i.e., Option B). 4 are open to operator defined UAC values. 2 inclined to a new Access Control indicator or barring configuration. And 2 OK with a new Access Identity. Clearly, among the different options introducing a new Access Category is the preferred one. However, it is the Rapporteur’s understanding that defining a new Access Category is not in the scope of RAN2, but of SA1. While, CT1 oversees how NAS should map the Access Category applicable for an access attempt. Therefore, any requirement-related discussion is also out of the scope of CT1. Hence, by also taking the outcome of Q3.2, the following is proposed.

1. Among the UAC-based enhancement proposals, most companies prefer a new Access Category for onboarding.
2. (Cat-b) RAN2 to reach an agreement on whether it is necessary to involve SA1 and/or CT1 in the discussion on a new Access Category for onboarding.

## 2.4 Cell (re)selection

### 2.4.1 Assumption that onboarding will not impact cell reselection

During RAN2#113bis-e the following agreement was already reached:

* R2 assumes that onboarding will not impact cell reselection.

On this matter, some companies explicitly propose to confirm the agreement above [7], [14]. However, [3] mentions that the onboarding indication is to be considered for cell reselection in “any cell state”.

**Q4.1. Would you confirm that onboarding does not impact the cell reselection procedure?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes | Given the nature of the onboarding, it is not justified to modify the cell reselection procedure for this purpose. In fact, RAN2 has not even decided whether an onboarding UE would even perform cell reselection, since such an event might simply trigger the UE to abort the initial registration. Further, onboarding is considered a one-shot procedure. |
| OPPO | Yes | UE will detach from the onboarding network after onboarding and then the legacy network selection procedure applies, so we see no need to enhance cell reselection procedure for onboarding.  |
| ZTE | Partially | **We agree that for the comped normally state, onboarding will not impact cell reselection.**We know that the on-boarding is a one-shot procedure, but it doesn’t mean that the UE can always find a suitable cell before registration for on-boarding. For the case that the UE can’t find a suitable cell before registration(on-boarding) successfully, the UE may enter into camped on any cell state, for this state, the UE will execute cell resection. Obviously, during cell reselection, only the cell that belongs to the selected SNPN and meanwhile satisfy the on-boarding related requirements can be considered as the suitable/candidate cell. So we have the below proposal**Ran2 confirm that for the cell reselection of the camped on any cell state, only the cell that belongs to the selected SNPN and meanwhile satisfy the on-boarding related requirements can be considered as the suitable/candidate cell.**Please also note that in the current spec, for the cell reselection, it has said, only the suitable cell can be taken as re-selection candidate, so even if RAN2 confirm with this proposal , it wouldn’t introduce any additional spec modification, for that it only have impacts the suitable cell definition (We assume that anyway, the suitable cell definition would be affected for the cell selection) |
| Nokia | Yes | Even if the onboarding is a one-shot process, it is not guaranteed that UE will not move to IDLE/INACTIVE during onboarding. Onboarding happens over a user plane connection, and there can be e.g., delays/breaks in the communication. SA2 clarified that during onboarding the UE may move to any cells of the onboarding network (no need to consider the onboarding flag), therefore, no need to change the cell reselection procedure. |
| Sony | Yes | Agree with OPPO and we see no motivation to deviate from SA2 |
| Intel | Yes | Our understanding is that if cell selection/reselection occurs after network selection or while UE is performing initial registration for onboarding, UE will have to abort the initial registration procedure and then re-perform the network selection and the onboarding NAS procedure again as like any initial registration based on the cell access info in the SIB in the new cell. If DRBs are not enabled yet, handover will not be supported during this mobility as is the case with legacy NAS registration procedures. If DRBs are not enabled yet, handover will not be supported during this mobility as is the case with legacy NAS registration procedures. If DRBs are established, normal handover will be supported. |
| Apple | Yes | Agree with Oppo. There is really no need to enhance on-boarding procedure for cell-reselection. This can be done once on-boarding is complete.  |
| Huawei, HiSilicon | No strong views | We confirm that onboarding does not impact the cell reselection for UE camped normally. However, regarding with UE camped on any cell, it seems sensible to consider the onboarding indication for cell reselection. |
| CATT | Maybe | It depends on Q4.2, suitable cell criteria is also used in cell reselection.so if the onboarding indicator should be checked in the suitable cell criteria, then it will impact cell reselection. |
| Qualcomm | Yes |  |
| CMCC | Yes | The on-boarding procedure is considered as one shot procedure. |
| China Telecom | Yes |  |
| Samsung | Yes | Since onboarding is a onetime procedure, there is no need to modify the cell (re)selection procedure. |
| vivo | Yes with comments | UE may perform cell reselection even if the onboarding is a one-shot process. We are also fine if we agree not to optimize this use case. |
| MediaTek | Yes |  |
|  |  |  |

**Rapporteur’s Summary:** 12 out of 15 companies answering this question agree to confirm that onboarding does not impact the cell reselection procedure. 1 company replied “Partially”, while showing concerns for when users perform cell reselection in “any cell” state. 1 company shows “No strong views”. And 1 company answered that it depends of the outcome of the next question (Q4.2). In light of the above, the following is proposed.

1. (Cat-a) RAN2 confirms that onboarding does not impact the cell reselection procedure.

### 2.4.2 Cell suitability and cell selection process

SA2 stated in their reply LS, [S2-2101076](https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_143e_Electronic/Docs/S2-2101076.zip) [17], that the “onboardingEnabled” bit is used to assist the UE in network selection:

|  |
| --- |
| **[SA2 answer]** The ”onboardingEnabled” bit can be set/enabled per cell e.g. when onboarding is enabled in only part of the SNPN network and can also be used to avoid the load from onboarding UEs. The parameter is used to assist the UE in network selection. |

However, views within RAN2 are divided as to whether the suitability of a cell is impacted by the onboarding indication in SIB1. On the one hand, [5], [7], [10], [11], [13], [14], believe that there is no impact. Whereas, [1], [3], [4], [6], [8], believe that there is an impact.

As discussed above, “R2 assumes that onboarding will not impact cell reselection”. In the Rapporteur's view, if onboarding is not considered to impact the suitability of a cell for cell reselection, then implicitly, there should not be any impact on the suitability criteria for the (initial) cell selection process either. As mentioned in [5], the Rapporteur also believes that the above does not preclude the onboardingEnabled indication from being considered by a UE wanting to onboard to an SNPN. But instead, the initial selection of a cell could be left to UE implementation, as argued in [7].

In relation to the above, [8] proposes that the standard should make such a differentiation (i.e., between the suitability of a cell for cell selection and reselection).

Since there is an almost even split as to whether or not onboarding impacts the suitability of a cell, it seems very unlikely that a consensus can be reached directly on this issue within this email discussion framework. However, the Rapporteur believes that it is possible to reach a preliminary agreement (see next question).

**Q4.2. Do you foresee any impact on cell suitability during the (initial) cell selection?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | No | No, as SA2 stated, this is only to assist network selection, and no further enhancements are needed. Any change of the cell after network selection is a corner case and not justified. |
| OPPO | Yes | Based on SA2 reply LS, the onboarding indicator is not configured uniformly per SNPN, on top of this, the enhancement is needed for cell selection. Obviously, this is not up to UE implementation. But if we don’t use the onboarding indicator for access control, i.e., the onboarding indicator is configured uniformly per SNPN, no enhancement is needed for cell selection. This is the story on the table, it’s not reasonable to use onboarding indicator for access control while considering no enhancement for onboarding cell selection at the same time. |
| ZTE | Yes | To better understanding this issue, in our paper we give a general initial cell selection procedure as below based on 38304 and 23122

|  |
| --- |
| 38304:On request of the NAS, the AS shall perform a search for available SNPNs on only NR cells and report them to NAS. The UE shall scan all RF channels in the NR bands according to its capabilities to find available SNPNs.On each carrier, the UE shall search for the strongest cell and read its system information, in order to find out which SNPN(s) the cell belongs to. (Step 1/2 below)If the UE can read one or several SNPN identities in the strongest cell, each found SNPN (see the SNPN reading in TS 38.331 [3]) shall be reported to the NAS. (Step 3)Once the UE has selected a SNPN, the cell selection procedure shall be performed in order to select a suitable cell of that SNPN to camp on. (Step 4 and the following steps) |

Then combined with the LS from SA2 of the last meeting which has clearly clarified that there is no uniform support (on-boarding feature) for a O-SNPN. the UE NAS shall indicate the on-boarding related requirements to the UE AS, including on-boarding support indication and/or GIDs as shown in the step 5.Then the UE AS shall only consider the cell that belongs to the selected SNPN and meanwhile satisfy the on-boarding related requirements as the suitable cell. |
| Nokia | Yes | Beyond the normal suitability criteria, which should not be changed, the UE shall also check the onboarding flag during initial cell selection. |
| Sony | No | In our understanding this can be left to UE implementation and UE does not always need to prioritize a cell based on onboarding flag. |
| Intel | No | We have similar view as Ericsson that any change of the cell after network selection is a corner case and not justified. As mentioned in our response to Q4.1, if UE moves to a new cell after network selection or while UE is performing initial registration for onboarding, UE will have to abort the initial registration procedure (AS informs NAS the RRC Connection fails) and then re-perform the network selection and the onboarding NAS procedure again as like any initial registration based on the cell access info in the SIB in the new cell.In some contributions, it seems to assume that NAS is not informed of the initial registration failure, If this is the case, the probability that the UE moves away from the cell used to perform network selection is low and the probability that the next cell not supporting onboarding may even be lower. Even if this happen, the network can anyway still reject the UE onboarding by rejecting the registration over the NAS. |
| Apple | Yes | Agree with Oppo and Nokia. |
| Huawei, HiSilicon | Yes | The following two aspects are impacted (see R2-2105554): 1) Cell suitability for cell selection. UE Onboarding related information (e.g. "onboarding support" indication) shall be taken into consideration for cell suitability check. 2) Cell selection triggering conditions. A new triggering condition for cell selection - "onboarding indication received" should be introduced. We would like to again emphasize that the impact on the cell suitability check, if really any, shall be specified in a way that it applies only to the UEs performing onboarding. Any side-effect to the UEs not supporting onboarding is unacceptable to us.  |
| CATT | Yes | According to SA2 reply LS, a specific cell of a onboarding SNPN may set the ”onboardingEnabled” bit to TRUE or FALSE. Hence, even a SNPN supporting onboarding has been selected by NAS at UE side, UE performing onboarding should again check whether the candidate cell supports onboarding or not before chosing it as the target cell during cell selection/reselection.Therefore the legacy SNPN suitable cell criteria need to be modified to reflect this new requirement. |
| Qualcomm | No | The cell selection should be left to UE implementation as it has always been. The UE can take into account the onboarding process in its decision. In addition, a new AS-NAS interaction is not completely up to RAN2 and any changes should be confirmed by SA2 and CT1. |
| CMCC | No | In the TS23.501 [1], it is indicated that the UE is not in SNPN access mode when it take the PLMN as an on-boarding network to perform the on-boarding procedure and remote provisioning and if the UE take an SNPN as an on-boarding network, it must be in SNPN access mode. Therefore, no modification is needed in TS38.304 for the definition of suitable cell. |
| China Telecom | Yes |  |
| Samsung | No |  |
| vivo  | Yes | According to the LS from SA2, the “onboardingEnabled” bit can be set/enabled per cell. Thus, when NAS initiates the onboarding procedure, AS of UE has to be informed that onboarding procedure is performed and then select a suitable cell of the selected SNPN that supports onboarding. Thus, there is a need to consider the onboarding indication into the definition of the suitable cell. |
| MediaTek | No | Agree with QC that this should be left to UE implementation |
| Asia Pacific Telecom | Yes | Agree with ZTE. At least the definition of a suitable cell will be impacted. |

**Rapporteur’s Summary:** Predictably, views to this question vary between companies. On the one hand, 7 companies do not foresee any impact on cell suitability during (initial) cell selection. While, 9 believe there will be an impact. As it is not possible to reach a quick agreement at this point, and since a proposal of the likes of, e.g. "RAN2 to discuss whether there is an impact on the definition of cell suitability due to onboarding" will get us nowhere (i.e., we will get during the online discussion the same answers/arguments that have been provided to Q4.2). The Rapporteur proposes the following preliminary Proposal.

1. (Cat-b) RAN2 to discuss whether we can assume that there is no specification impact on (initial) cell selection and cell suitability, and that optimizations can be left to UE implementation.

## 2.5 NAS-AS interaction

It is proposed in [3] that UE AS should forward the GINs per SNPN to UE NAS for network selection. However, this was already agreed during RAN2#113bis-e. See the following agreements:

|  |
| --- |
| * UE AS forwards the onboarding indication (and Group IDs if Proposal#1 is agreed) per SNPN to UE NAS for onboarding network selection.
* Group IDs per SNPN for onboarding purpose is broadcast in the SIB. FFS whether the Group IDs for onboarding purpose and for credential by separate entity are different.
 |

Moreover, it has been suggested in [3] that some information needs to be exchanged also in the other direction, i.e. from NAS to AS: “UE NAS shall indicate the on-boarding related requirements to the UE AS, including on-boarding support indication and/or GIDs”.

**Q5. In addition to the selected SNPN, do you see the need for the UE’s NAS layer to send to AS the onboarding indication and the GIN associated with the selected SNPN?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | No | The NAS layer is only responsible for SNPN network selection. No further information is needed by AS for e.g. cell (re)selection. |
| OPPO | Maybe Yes | If onboarding requirements should be considered for onboarding cell selection procedure, the answer is Yes. |
| ZTE | Yes | Similar to the above To better understanding this issue, in our paper we give a general initial cell selection procedure as below based on 38304 and 23122Then combined with the LS from SA2 of the last meeting which has clearly clarified that there is no uniform support (on-boarding feature) for a O-SNPN. the UE NAS shall indicate the on-boarding related requirements to the UE AS, including on-boarding support indication and/or GIDs as shown in the step 5. |
| Nokia | Yes, onboarding indication | Onboarding indication is needed to indicate AS that a cell that supports onboarding shall be selected. As the support of GINs is uniform in a network, the selected GIN is not needed for cell selection. |
| Sony | No | AS layer being transparent to GINs is aligned to SA2 response. Perhaps onboarding indication may be needed for msg5. |
| Intel | No for cell selection/suitability check after network selection | For network selection, only the selected SNPN is needed. GIN and the onboarding indication are not needed. Selected SNPN and the onboarding indication is needed only for AMF selection over the RRC message. I don’t think this question is referring to this. |
| Apple | Maybe | Agree with Oppo, ZTE and Nokia |
| Huawei, HiSilicon | Partially yes | 1) onboarding indication: yes. This indication needs to be sent to AS, so that AS can select the cells supporting onboarding.2) GINs: Not so far. As answered in Q1.1, the broadcast of GINs for onboarding has not been supported in SA2 TS yet. This can be discussed after SA2 makes firm conclusion. |
| CATT | Yes | AS should know whether it need to select a cell supporting onboarding. |
| Qualcomm | No | As mentioned above, this is unnecessary and can be done via UE internal signaling when needed. RAN2 can’t make such decisions by itself. |
| China Telecom | Yes for onboarding indication |  |
| Samsung | Yes | Network would need additional information like the selected GINs for AMF selection purpose, NAS should inform AS the GIN used for network selection along with indication that the registration is for onboarding purpose and the selected SNPN. |
| vivo | Yes for onboarding indication | According to the LS from SA2 of the last meeting, the “onboardingEnabled” bit can be set/enabled per cell. Thus, when NAS initiates the onboarding procedure, AS of UE has to be informed that onboarding procedure is performed and then select a suitable cell of the selected SNPN that supports onboarding. |
| MediaTek | No | Agree with QC that this can be done by UE implementation |
| Asia Pacific Telecom | No | The AS of the UE may receive the onboarding indication from a cell that broadcasts the selected SNPN reported by the NAS layer of the UE to the AS layer of the UE. Thus, there is no need for the NAS layer of the UE to send the onboarding indication to the AS layer of the UE. |

**Rapporteur’s Summary:** 6 companies think that UE NAS only transfers to AS the selected SNPN. On the other hand, 7 companies support the idea of additionally transferring the onboarding indication. 2 companies think GINs should also be transferred. However, on this matter, 4 companies mentioned explicitly that GINs should not be transferred since the support of GINs is uniform in an SNPN. Furthermore, 2 companies replied “Maybe”, with 1 of them thinking that this depends on the cell selection impact. Given the above the following is proposed.

1. (Cat-b) RAN2 to discuss whether UE NAS needs to send the onboarding indication to AS for cell selection.

## 2.6 Onboarding request (AMF selection)

Some companies have discussed whether additional information, on top of the already agreed onboarding request indication in RRCSetupComplete (Msg5) should be added in Msg5. The Rapporteur understands that this is mostly to further assist the NG RAN in the AMF selection process. On this subject, [4] proposes not to include the GINs nor the Subscription Owner SNPN (SO-SNPN) in Msg5. [7] also thinks that the latter information is not needed. [8] proposes that RAN2 should wait for progress in RAN3/SA2 discussion before deciding whether the GINs are needed for AMF selection. While [12] proposes RAN2 to discuss whether there is a need to send the previously mentioned information in Msg5.

To the Rapporteur's knowledge, there has been no request so far to add additional information in Msg5 (to what has already been agreed). In this regard, as not all companies have commented on this issue, it would be beneficial to know the different views on the following question.

**Q6. Do you agree that no additional information is needed in the onboarding request in Msg5, unless other working groups (e.g. RAN3/SA2) consider it necessary?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes |  |
| OPPO | Maybe Yes | If AMF routing info is only used to differentiate onboarding capable AMF from normal AMF, the already agreed onboarding indicator in MSG5 is sufficient. But if AMF routing info can also be used to differentiate one onboarding capable AMF from other onboarding capable AMF, i.e. NG-RAN connects to multiple onboarding capable AMFs and different onboarding capable AMF supports different GIN. On top of this, GIN may be considered in MSG5, but the requirements should come from other groups, e.g. SA2/RAN3. |
| ZTE | FFS | We are not sure whether Group ID is needed just as some companies proposed. For that the on-boarding is not uniformly supported among the whole O-SNPN, so we are open to discuss this issue |
| Nokia | Yes |  |
| Sony | Yes |  |
| Intel | Yes |  If any further information, it should be requested by other groups. |
| Apple | FFS | Agree with oppo and ZTE. |
| Huawei, HiSilicon | Yes | No need to include information other than the onboarding indication in Msg 5. |
| CATT | Yes |  |
| Qualcomm | Yes | AMF selection is not within RAN2 scope. RAN2 should not make decisions for other groups based on assumptions and speculations. |
| CMCC | Yes |  |
| China Telecom | Yes |  |
| Samsung | FFS | Each SNPN can support multiple GINs and AMFs associated with each of the supported GINs can be different. So Network might need the GIN information from UE for AMF selection. Can ask as LS to SA2/RAN3.  |
| vivo | Yes |  |
| MediaTek | Yes |  |
| Asia Pacific Telecom | Yes |  |

**Rapporteur’s Summary:** 12 out of the 16 companies agree that no additional information is needed in the onboarding request in Msg5. 1 company answered “Maybe Yes” but supporting the idea the requirements should come from other WGs. While 3 companies replied “FFS”. Hence, the following is proposed.

1. (Cat-a) No extra information is needed in addition to the already agreed onboarding request indication in RRCSetupComplete, unless explicitly requested by other WGs.

## 2.7 Other topics

Certain companies ([1], [6], [7], [13]) have provided their understanding regarding some ASN.1 detail on different aspects of this AI, including e.g., how to broadcast the onboarding indication, how/where to broadcast the GINs, etc. However, since there are still a number of open issues to be sorted out, the Rapporteur believes that such discussions could be left for a later stage.

**Q7.1. Do you agree that ASN.1 related discussion can be postponed?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| ZTE | Yes | And we think the ASN.1 for the on-boarding and separate entity feature maybe need to discuss together, for that both of them may have impact to the SIB size.As Rapporteur suggested, we can have some conclusions on how to include On-boarding/Separate Entity information in the system Information first, then discuss the ASN.1 Detail. |
| Nokia | Yes |  |
| Sony | Yes |  |
| Intel | Yes |  |
| Apple | Yes |  |
| Huawei, HiSilicon | Yes  | Too early to discuss ASN.1, as it is not clear which parameters for onboarding needs to be broadcast now. |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| CMCC | Yes |  |
| China Telecom | Yes |  |
| Samsung | Yes |  |
| vivo | Yes |  |
| MediaTek | Yes |  |
| Asia Pacific Telecom | Yes |  |

**Rapporteur’s Summary:** Since all companies agree to postpone the discussion, the following is proposed.

1. (Cat-c) Postpone any ASN.1-related discussion until the WI development is sufficiently mature.

It has been proposed in [12], for RAN2 to discuss if O-SNPN information of neighbour cells is collected and reported for ANR purpose.

**Q7.2. Do you agree that ANR related discussions can be postponed?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| ZTE | Yes |  |
| Nokia | Yes |  |
| Sony | Yes |  |
| Intel | Yes |  |
| Apple | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| CMCC | Yes |  |
| China Telecom | Yes |  |
| Samsung | Yes |  |
| vivo | Yes |  |
| MediaTek | Yes |  |
| Asia Pacific Telecom | Yes |  |

**Rapporteur’s Summary:** Since all companies agree to postpone the discussion, the following is proposed.

1. (Cat-c) RAN2 to postpone any ANR-related discussion.

It is proposed in [2], for RAN2 to discuss whether an LS to CT1 is needed to clarify if UE onboarding can be limited to selected set of UEs using uSIM tags.

**Q7.3. Do you think that such an LS is needed?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | No | Such discussion can be triggered within CT1 if considered needed. |
| OPPO | No | RAN2 is not the first group to discuss this issue. |
| ZTE | No | Share the same view as Ericsson. |
| Nokia | No |  |
| Sony | No |  |
| Intel | No |  |
| Apple | Yes | Such an indication from CT1 would need broadcast information change. But we will go with majority view for now. |
| Huawei, HiSilicon | No | Out of the scope of RAN2. |
| CATT | No |  |
| Qualcomm | No |  |
| China Telecom | No |  |
| Samsung | No | Doesn’t seem like a point that comes under RAN2 scope |
| vivo | No |  |
| MediaTek | No |  |
| Asia Pacific Telecom | No |  |

**Rapporteur’s Summary:** Only the proponent company thinks that an LS to CT1 is needed to clarify if UE onboarding can be limited to a selected set of UEs using uSIM tags. The LS is thus not pursued.

1. (Cat-a) Any limitation to a selected set of UEs using uSIM tags is out of RAN2 scope.

# 3 Conclusion

Proposals that could potentially be agreed upon quickly

[Proposal 2 No additional information except for the already agreed parameters is discussed unless requested by other WG.](#_Toc72834374)

[Proposal 3 There is no need to introduce the 1-bit onboarding indication in SIB1 and optional GINs for PLMNs acting as onboarding networks.](#_Toc72834375)

[Proposal 4 Toggling the 1-bit onboarding indication in SIB1 allows to control congestion due to onboarding request.](#_Toc72834376)

[Proposal 6 RAN2 confirms that onboarding does not impact the cell reselection procedure.](#_Toc72834378)

[Proposal 9 No extra information is needed in addition to the already agreed onboarding request indication in RRCSetupComplete, unless explicitly requested by other WGs.](#_Toc72834381)

[Proposal 12 Any limitation to a selected set of UEs using uSIM tags is out of RAN2 scope.](#_Toc72834384)

Proposals that require further discussion

[Proposal 1 RAN2 to discuss whether a common list of GINs can be used for both onboarding and accessing an SNPN using external credentials. If no consensus, send an LS to SA2 to clarify.](#_Toc72834373)

[Proposal 5 RAN2 to reach an agreement on whether it is necessary to involve SA1 and/or CT1 in the discussion on a new Access Category for onboarding.](#_Toc72834377)

[Proposal 7 RAN2 to discuss whether we can assume that there is no specification impact on (initial) cell selection and cell suitability, and that optimizations can be left to UE implementation.](#_Toc72834379)

[Proposal 8 RAN2 to discuss whether UE NAS needs to send the onboarding indication to AS for cell selection.](#_Toc72834380)

Proposals that can be postponed

[Proposal 10 (Cat-c) Postpone any ASN.1-related discussion until the WI development is sufficiently mature.](#_Toc72834382)

[Proposal 11 (Cat-c) RAN2 to postpone any ANR-related discussion.](#_Toc72834383)

Moreover, the following observations was made:

[Observation 1 Among the proposals, most companies preferred a new Access Category for onboarding.](#_Toc72829077)

# 4 References

**List of Tdocs submitted to RAN2#114-e, Agenda Item 8.16.3:**

1. [R2-2104768](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2104768.zip), “Support UE onboarding and provisioning for NPN”, OPPO

1. [R2-2105124](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105124.zip), “Additional considerations for UE on-boarding and provisioning for NPN”, Apple

1. [R2-2105168](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105168.zip), “Consideration on the Onboarding and Provisioning for NPN”, ZTE Corporation, Sanechips

1. [R2-2105193](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105193.zip), “Further Discussion on UE Onboarding and Provisioning for NPN”, CATT

1. [R2-2105245](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105245.zip), “Onboarding related considerations”, Nokia, Nokia Shanghai Bell

1. [R2-2105292](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105292.zip), “Remaining issues on supporting UE onboarding and provisioning for NPN”, vivo

1. [R2-2105410](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105410.zip), “UE onboarding and provisioning”, Qualcomm Incorporated

1. [R2-2105554](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105554.zip), “UE onboarding and remote provisioning for SNPN”, Huawei, HiSilicon

1. [R2-2105709](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105709.zip), “Discuss the need of UAC for UE on-boarding”, Sony

1. [R2-2105916](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105916.zip), “Support UE Onboarding and provisioning for NPN”, Intel Corporation

1. [R2-2106035](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2106035.zip), “UE onboarding”, Ericsson

1. [R2-2106200](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2106200.zip), “On Supporting Onboarding SNPN”, Samsung

1. [R2-2106228](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2106228.zip), “Discussion the left issues to support UE on-boarding and remote provisioning”, CMCC

1. [R2-2106297](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2106297.zip), “Resolving issues for UE onboarding and provisioning for NPN, LG Electronics

**Additional references:**

1. [R2-2104492](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_113bis-e/Docs//R2-2104492.zip), “Summary for UE onboarding and provisioning for NPN”, Intel, RAN2#113bis-e, 2021-04
2. TR 23.700-07, “Study on enhanced support of non-public networks”, TSG SA, V17.0.0, 2021-03

1. [S2-2101076](https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_143e_Electronic/Docs/S2-2101076.zip), “Reply LS on clarification request for eNPN features”, SA2, SA2#143e, 2021-03
2. TS 22.261, “Service requirements for the 5G system; Stage 1”, TSG SA, V18.1.1, 2021-01
3. TS 24.501, “Non-Access-Stratum (NAS) protocol for 5G System (5GS)”, TSG CT, V17.2.1, 2021-04
4. TS 38.304, “User Equipment (UE) procedures in idle mode and in RRC Inactive state”, TSG RAN, V16.4.0, 2021-03