3GPP TSG-RAN WG2 #114-e R2-21XXXXX

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:

|  |  |  |
| --- | --- | --- |
| Company | Name | Email address |
| Ericsson | Felipe Arraño Scharager | felipe.arrano.scharager@ericsson.com |
| OPPO | Jiangsheng Fan | fanjiangsheng@oppo.com |
| ZTE | Wentling Li | li.wenting@zte.com.cn |
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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.**

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| **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. |
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**Rapporteur’s Summary:** To be added

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)?**

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| **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 |
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**Rapporteur’s Summary:** To be added

## 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?**

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes |  |
| OPPO | Yes | It’s clear to confirm this based on SA2 TR. |
| ZTE | Yes |  |
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 **Rapporteur’s Summary:** To be added

## 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?**

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| **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.  |
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 **Rapporteur’s Summary:** To be added

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?**

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| **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 |
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 **Rapporteur’s Summary:** To be added

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**

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| **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 |  |
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 **Rapporteur’s Summary:** To be added

## 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?**

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| **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) |
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 **Rapporteur’s Summary:** To be added

### 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:

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| **[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?**

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| **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

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| 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. |
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Rapporteur’s Summary:** To be added

## 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:

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| * 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.
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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?**

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| **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. |
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**Rapporteur’s Summary:** To be added

## 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?**

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| **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 |
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**Rapporteur’s Summary:** To be added

## 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?**

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| **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. |
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**Rapporteur’s Summary:** To be added

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?**

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| ZTE | Yes |  |
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**Rapporteur’s Summary:** To be added

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?**

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| **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. |
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**Rapporteur’s Summary:** To be added

# 3 Conclusion

Proposals that could potentially be agreed upon quickly

To be added

Proposals that require further discussion

To be added

Proposals that can be postponed

To be added

# 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
2. [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
3. [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
4. [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
5. [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
6. [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
7. [R2-2105410](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2105410.zip), “UE onboarding and provisioning”, Qualcomm Incorporated
8. [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
9. [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
10. [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
11. [R2-2106035](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2106035.zip), “UE onboarding”, Ericsson
12. [R2-2106200](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_114-e/Docs//R2-2106200.zip), “On Supporting Onboarding SNPN”, Samsung
13. [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
14. [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
3. [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
4. TS 22.261, “Service requirements for the 5G system; Stage 1”, TSG SA, V18.1.1, 2021-01
5. TS 24.501, “Non-Access-Stratum (NAS) protocol for 5G System (5GS)”, TSG CT, V17.2.1, 2021-04
6. TS 38.304, “User Equipment (UE) procedures in idle mode and in RRC Inactive state”, TSG RAN, V16.4.0, 2021-03