**3GPP TSG RAN WG2 Meeting #116bis-e**   **R2-220xxxx**

**E-Meeting, 17th – 25th January 2022**

**Agenda Item:** **8.16.3**

**Source:**  **Intel Corporation**

**Title:** **Report of Offline on Rel-17 NPN UE capability for Rel-17 NPN**

**Document for:** **Discussion/Decision**

# Introduction

his email discussion is to discuss the following offline topic:

* [AT116bis-e][032][eNPN] UE capabilities (Intel)

      Scope: Initial discussion on UE caps. Identify agreements (for offline agreement), and Open issues, to be addressed at next meeting. If need is high, e.g. if LS out is needed, can also identify some point for online CB W2.

      Intended outcome: Report

      Deadline: EOM (or earlier for CB point if needed).

This document aims to summarize all the papers that have been submitted to agenda item 8.16.3 of RAN2#116bis-e and provides agreeable proposals and open issues on the following UE capabilities.

* Onboarding over SNPN
* Third party credential holder over SNPN
* IMS emergency services over SNPN

# Companies’ point of contact

|  |  |  |
| --- | --- | --- |
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# Need of UE capabilities for onboarding and external credential holder over SNPN

These are the proposals from the different companies associated with UE capabilities for onboarding and external credential holder over SNPN:

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| OPPO [1] | **Proposal 1: Introduce an independent UE capability bit (1 optional per UE bit without xDD/FRx differentiation) for supporting third party credential feature in eNPN.****Proposal 2: Introduce an independent UE capability bit (1 optional per UE bit without xDD/FRx differentiation) for supporting onboarding feature in eNPN.** |
| Huawei [2] | Proposal 1: The UE capability information on the support of eNPN features is not needed. |
| Intel, Nokia [3] | **Proposal#1:** No UE AS capabilities for onboarding and external credential holder need to be specified in TS38.306.**Proposal#2:** If RAN2 agreed to specified UE AS capabilities for both onboarding and external credential holders access, RAN2 needs to decide whether these UE AS capabilities are ‘Optional without UE capability signalling’ specified in Clause 5.4 or ‘Conditional mandatory without UE capability signalling’. |
| China Telecom [5] | **Proposal 1: No UE capability is needed to indicated whether external credential, onboarding and emergency service are supported.****Proposal 2: No UE capability is needed to indicated whether GINs are supported.****Proposal 3: No UE capability is needed to indicated whether UE is in SNPN AM.** |
| CMCC [6] | **Proposal 1: There is no need to introduce a separate AS UE capability for supporting SNPN with subscription or credentials by a separate entity.****Proposal 2: There is no need to introduce a separate AS UE capability for onboarding and provisioning for NPN.** |
| ZTE [7] | **Proposal 1: No UE capabilities for the CH and On-boarding feature.** |
| Vivo [8] | **Proposal 1: Introduce a UE capability on whether UE supports to access SNPN by using subscriptions/credentials owned by an entity separate from the SNPN. It is an optional feature without UE radio access capability parameters.****Proposal 2: Introduce a UE capability on whether the UE supports onboarding. It is an** **optional feature without UE radio access capability parameters.** |
| LG [9] | **Proposal 1**: The support for access with external credential and support for onboarding access is purely optional without capability signaling. **Proposal 2**: GIN related capabilities including interpretation of a new SIB are mandatory for UEs supporting access with external credential holder or onboarding access. No stage-3 capability description in 38.306 on GIN-related capability signaling is needed.  |
| Samsung [10] | **Proposal 1: No new UE capability bit is introduce to indicate UE’s support for external CH access via SNPN****Proposal 2: No new UE capability bit is introduce to indicate UE’s support of onboarding and provisioning over SNPN.** |
| Ericsson [11] | 1. Existing UE capabilities are sufficient to address new Rel-17 NPN functionalities.
 |

On whether UE AS capability signalling is needed for CH and onboarding, only [1] think there is a need while others [2-11] think that no capability signalling is needed as gNB does not need to know. Since it is the majority view, a straight proposal as follow:

**Proposal#1:** No UE AS capability signalling is needed for CH and onboarding.

**1. Do companies agree to the above proposal 1?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes or No** | **Comments** |
| Intel | Yes |  |
| ZTE | Yes |  |
| Nokia | Yes |  |
| Samsung | Yes |  |
| vivo | Yes |  |
| OPPO | Yes | We think our proposal was misunderstood, we also think no UE AS capability signalling is needed for CH and onboarding, but slightly prefer to define the capability without reporting. |
| LGE | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Ericsson | Yes |  |
| CMCC | Yes |  |
| Apple | Yes |  |
| MediaTek | Yes |  |

*Rapporteur’s summary:*

*All companies agree Proposal 1*

*Proposal A [13/13]: No UE AS capability signalling is needed for CH and onboarding.*

On whether UE AS capabilities need to be included in TS38.306 either as “Optional without UE capability signalling” or “Conditional mandatory without UE capability signalling”:

[3] thinks that there is no need to specify neither as “Optional without capability signalling” nor as “Conditional mandatory without capability signalling” in TS38.306 since both CH and onboarding are NAS features and if UE supports the features in NAS, the associated AS functions (just forwarding the SIBs) have to be mandatorily supported and the link is quite obvious.

On the other hand, [8] and [9] thinks that CH and onboarding should be specified as “Optional without UE capability signalling” since some AS functions are specified for onboarding and external CHs (e.g. support of the onboarding indication in the SIB1 etc.) and these functions do not have to be mandatory.

**2. Do companies think that there is a need to specify CH and onboarding AS capabilities (without capability signalling) in TS38.306? If there is a need to specify in TS38.306, should it be specified as (a) “Optional without capability signalling” or as (b) “Conditional mandatory without capability signalling”?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Companies** | **Yes or No** | **(a) or (b)** | **Comments** |
| Intel | No | (a), if companies feel that it is necessary to add | We do not think either optional is needed or conditional mandatory is suitable to link AS with corresponding NAS feature since both CH and onboarding are NAS features and if UE supports the features in NAS, the associated AS functions (just forwarding the SIBs etc.) have to be mandatorily supported and the link is quite obvious. |
| ZTE | No | (a) | We share the view with Intel. We don’t see the strong motivation to include it in 38.306 |
| Nokia | No |  |  |
| Samsung | No | Neither | No need of specifying in 38.306.  |
| vivo | Yes | (a) | The NAS does not define such a capability according to the latest TS 24.501. However, the AS needs to identify/decode the corresponding broadcast parameters of CH and onboarding and forward them to the NAS. It is inappropriate to mandate every R17 SNPN capable UE be equipped with the capability to support CH and onboarding. Therefore, there is a need to specify CH and onboarding AS capabilities, it’s optional without capability signalling. |
| OPPO | Maybe Yes | (a) | We don’t have strong view, but think the UE AS layer should forward the CH and onboarding related system information to NAS layer once received, during which UE may process the enhanced system information, for instance, restructure the relationship between GIN(s) and the associated SNPN ID, we believe processing eNPN specific IE should be controlled by a UE capability bit without UE capability signaling. |
| LGE | Y | (a) | We seem some value to make this optional capability visible in RAN2 spec. However, Intel view is also reasonable.  |
| CATT | Yes | (a) | The feature is not an essential feature which needs to be mandatorily supported in R17, but it adds new AS actions such as reading the related SIB and send to upper layer, therefore it could be considered as an optional feature, without capability bit. |
| Huawei, HiSilicon | No |  |  |
| Ericsson | No |  |  |
| CMCC | No |  |  |
| Apple | No |  |  |
| MediaTek | Yes | (a) | We see value in associating this RAN2 functionality with RAN2 capabilities.  |

*Rapporteur’s summary:*

*8 companies think that there is no need to specify CH and onboarding AS capabilities (without capability signalling) in TS38.306.*

*3 companies think there is a need.*

*2 companies have no strong view but see some values of having it. 1 company among these also sees it reasonable to not have it.*

*Since CH and onboarding are NAS features and even though there are AS functions for the NAS features, the AS functions will have to be supported if NAS supports the feature and so the link is obvious. It is clear that UE AS will not implement the AS functions if NAS is not supporting the feature. By simply taking the majority view and this reasoning, it is hopeful that companies will accept the following:*

*Proposal B [8/13]: No CH and onboarding AS capabilities without capability signalling needs to be specified in TS38.306*

## Need of UE capability for CGI report

The following are the relevant proposals on this.

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| Huawei [2] | Proposal 1: The UE capability information on eNPN relevant CGI report is not needed. |
| China Telecom [5] | **Proposal 4: UE capability for CGI reporting is needed in eNPN.** |

[2] thinks that it is not needed for CH since the support of external credentials is uniform across the whole SNPN and for onboarding, the onboarding related indicators do not affect the mobility management functions, referring to TS 23.501 [1] as follows:

|  |
| --- |
| When the SNPN supports Onboarding of UEs for SNPNs (i.e. the SNPN can be used as ON-SNPN), the NG-RAN node additionally broadcasts the following information:- An onboarding enabled indication that indicates whether onboarding is currently enabled for the SNPN. The onboarding enabled indication is broadcasted per cell e.g. to allow start of the onboarding procedure only in parts of the SNPN.NOTE: Onboarding enabled indication per cell does not affect mobility management functions, i.e. once the UE selects the ON-SNPN as described in clause 5.30.2.10.2.5 and successfully registers within ON-SNPN as described in clause 5.30.2.10.2.6, the UE can move to a cell of the ON-SNPN not indicating onboarding support and continue with the remote provisioning as described in clause 5.30.2.10.4. |

On the hand, [5] thinks that it is needed to align with Rel-16 CGI reporting UE capability introduced for ANR function in NPN.

**3. Do companies think that there is a need** **to specify UE AS capability signalling for CGI reporting for CH and onboarding?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes or No** | **Comments** |
| Intel | No |  |
| ZTE | No |  |
| Nokia | No |  |
| Samsung | No |  |
| vivo | No |  |
| OPPO | No |  |
| LGE | No |  |
| CATT | No |  |
| Huawei, HiSilicon | No |  |
| Ericsson | No |  |
| CMCC | No |  |
| Apple | No |  |
| MediaTek | No |  |

*Rapporteur’s summary:*

*All companies agree that there is no need* *to specify UE AS capability signalling for CGI reporting for CH and onboarding.*

*Proposal C [13/13]: There is no need* *to specify UE AS capability signalling for CGI reporting for CH and onboarding*

# UE capability for IMS emergency services over SNPN

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| OPPO [1] | **Proposal 3: Introduce an independent UE capability bit (1 optional per UE bit without xDD/FRx differentiation) for supporting IMS voice and emergency services for SNPN in eNPN.** |
| Intel, Nokia [3] | **Proposal#3:** For IMS emergency services over SNPN in limited-service state, similar to Rel-15 IMS emergency call, it should be conditional mandatory to that the UE operating in SNPN access mode is IMS voice capable with the following update to TS38.306 in Clause 6.

|  |  |
| --- | --- |
| IMS emergency service over SNPN | It is mandatory for UEs operating in SNPN access mode which are IMS voice capable to support IMS emergency service over SNPN in limited service state, according to *ims-SNPN-EmergencySupport* as specified in TS38.331 [9]. |

 |
| CMCC [6] | **Proposal 3: There is no need to introduce a separate AS UE capability for SNPN for IMS voice and emergency services.** |
| ZTE [7] | **Proposal 2: No new UE capabilities for the eNPN IMS feature, the legacy capabilities (*e.g. VoiceOverNR/IMS emergency call*) can be reused.** |
| Vivo [8] | **Proposal 3: Introduce a new UE capability on whether the UE supports IMS emergency call through SNPN cell. It is a conditionally mandatory feature without UE radio access capability parameters.**  |
| LG [9] | **Proposal 3**: To specify in 38.306 that the support for emergency services in SNPN is mandatory for Rel-17 and onward UEs supporting IMS voice in NR. **Proposal 4**: To allow early implementation of emergency services support by Rel-16 SNPN capable UEs supporting IMS voice services.  |
| Ericsson [11] | Proposal 1 Existing UE capabilities are sufficient to address new Rel-17 NPN functionalities.  |
| Apple | Agree with vivo and LG (P3).Note that the UE capability text should not mention “in limited service state” because emergency service over SNPN is a more general feature, not restricted to “limited service state”. Note that UE capability is different from the bit we introduced into SIB, which indeed indicates the support of emergency in limited service state in the cell. This comment is specifically on the draft CR proposed in [4]. |

On whether UE AS capability signalling is needed for IMS emergency services, 6 companies think that there is no need except for one. Since it is the majority view, a straight proposal as follow:

**Proposal#2:** No UE AS capability signalling is needed for IMS emergency services.

**4. Do companies agree to the above proposal 2?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes or No** | **Comments** |
| Intel | Yes |  |
| ZTE | Yes | But we think the legacy capability “VoiceOverNR” can be reused to indicate whether the UE support Voice over NR when operating in the SNPN mode. |
| Nokia | Yes |  |
| Samsung | Yes |  |
| vivo | Yes |  |
| OPPO | Yes |  |
| LGE | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Ericsson | Yes |  |
| CMCC | Yes |  |
| Apple | Yes |  |
| MediaTek | Yes |  |

*Rapporteur’s summary:*

*All companies agree that no UE AS capability signalling is needed for IMS emergency services..*

*Proposal D [13/13]: No UE AS capability signalling is needed for IMS emergency services.*

On whether UE AS capabilities need to be included in TS38.306 as AS capabilities without capability signalling, [3], [8] and [9] think that there a need to specify that the support for emergency services in SNPN is mandatory on the condition that the UE is IMS voice capable. [7] thinks that the existing ISM emergency call can be reused.

**5. Do companies think that there is a need to specify IMS emergency call over SNPN AS capability without signalling in TS38.306? If there is a need to specify in TS38.306, can (a) the existing conditional mandatory without capability signalling for IMS emergency call be reused or (b) a new “Conditional mandatory without capability signalling” be introduced?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Companies** | **Yes or No** | **(a) or (b)** | **Comments** |
| Intel | Yes | (b) | It should be conditional mandatory to UE supporting IMS voice over SNPN. |
| ZTE | Yes | (a) | We think the legacy capability can be reused, e.g.1. When the UE is operating in the SNPN mode (and registered in the SNPN network), the legacy *VoiceOverNR/IMS emergency call* would be used to indicate whether UE support IMS voice and IMS emergency call for the SNPN network
2. When the UE is not operating in the SNPN mode, the legacy *VoiceOverNR/IMS emergency call* would be used to indicate whether UE support IMS voice and IMS emergency call for the public network.

If go to option (b), does it mean that we also need to introduce a new signaling to replace the legacy *VoiceOverNR* for the SNPN network? |
| Nokia | Yes | (a) |  |
| Samsung | Yes | (a) | Existing conditional mandatory clause for IMS emergency calls can be reused for SNPN access mode as the present clause does not explicitly differentiate PLMN access and SNPN access mode. |
| vivo | Yes | (b) | There may be some UEs that are only be used in the factory. For this kind of UEs, they only can camp on SNPN cell(s) and can’t camp on PLMN cell(s). Thus, introducing a new UE capability indication to indicate that UE supports IMS emergency call through SNPN cell is preferred. |
| OPPO | Yes | (a) |  |
| LGE | Yes | (a)  |  |
| CATT | Yes | (b) |  |
| Huawei, HiSilicon | Yes | (a) |  |
| Ericsson | Yes | (a)  | Agree with Samsung.Adding the following to the existing clause could also be acceptable: "If the UE supports SNPNs, it is mandatory to support IMS emergency call in SNPNs for UEs which are IMS voice capable in NR." |
| CMCC | Yes | (a) |  |
| Apple | Yes | (b) |  |
| MediaTek | Yes | (b) |  |

*Rapporteur’s summary:*

*All companies think that there is a need to specify IMS emergency call over SNPN AS capability without signalling in TS38.306. However, on whether existing conditional mandatory with capability signalling for IMS emergency call be reused or new conditional mandatory without capability signalling be introduced:*

*8 companies think that the existing conditional mandatory with capability signalling for IMS emergency call can be reused. Reason(s) given is that the existing clause does not explicitly differentiate between PLMN access and SNPN access mode and also that there is no new VoiceOverNR for SNPN access mode. Basically, UE will use the same capability for testing in PLMN and in SNPN access mode.*

*5 companies think that new conditional mandatory without capability signalling be introduced. One reason is that UE may only support SNPN access mode*

*Looking at the reasoning, rapporteur also think that the existing conditional mandatory with capability signalling for IMS emergency call can be reused since UE can either be in PLMN access mode or SNPN access mode at any one time. One compromise suggested is to add in the existing capability that* "If the UE supports SNPNs, it is mandatory to support IMS emergency call in SNPNs for UEs which are IMS voice capable in NR." *A modified version is provided in the proposal.*

*Proposal E [8/13]: The existing conditional mandatory without capability signalling for IMS emergency call can be reused for IMS emergency call for UE in SNPN access mode. Add the following to the existing capability:* “It is mandatory to support IMS emergency call over SNPN for UEs that are IMS voice capable over SNPNs”

On the early implementation [9], the rapporteur thinks that this can be postponed to the next meeting when the capability signalling for the eNPN is decided, noting that early implementation also depends on CT1 NAS support.

# Phase 2

*Proposal A [13/13]: No UE AS capability signalling is needed for CH and onboarding.*

**Is Proposal A agreeable?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes or No** | **Comments (if no, why?)** |
| Intel | Yes |  |
| Nokia | Yes |  |
| China Telecom | Yes |  |
| Samsung | Yes |  |
| vivo | Yes |  |
| Ericsson | Yes |  |
| OPPO  | Yes |  |

*Proposal B [8/13]: No CH and onboarding AS capabilities without capability signalling needs to be specified in TS38.306*

**Is Proposal B agreeable?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes or No** | **Comments (if no, why?)** |
| Intel | Yes |  |
| Nokia | Yes |  |
| China Telecom | Yes |  |
| Samsung | Yes |  |
| vivo | No | Some new IEs and a new SIB are introduced for supporting the feature of CH and onboarding in Rel-17 eNPN, the UE AS needs to identify/decode these parameters and forward them to the NAS once received. These features are optional feature in Rel-17, only UEs that support CH and onboarding need to identify/decode these parameters. However, the NAS does not define such a capability according to the latest TS 24.501, so an AS capability on whether UE supports CH and onbording is needed, it is an optional feature without capability signalling. |
| Ericsson | Yes |  |
| OPPO | No | We see some value to have this AS capability, for instance, if this AS capability is not set, UE AS will never process and forward CH/onboarding related parameters to upper layer whennever received; without this AS capability, no matter UE NAS supports CH /onboarding feature or not, UE AS will always forward the CH and onboarding related parameters which is unnecessary for sometime.More addition, we also recognize that CH/onboarding is a NAS feature, but as raised by vivo, this is no such NAS capability introduced, whether UE NAS supports CH /onboarding is implicitly indicated by the related NAS configuration. Introducing a AS capability will not impact NAS behavior but can optimize NAS-AS interaction, it’s hard to imagine NAS has the CH/onboarding configuration while UE AS disables the related capability. We believe this AS capability will be set if NAS has CH/onboarding related configuration, while this AS capability will not be set if NAS doesn’t supports CH/onboarding. Once the AS capability disabled, no CH/onboarding related parameters will be processed and forwarded to upper layer, UE can benefit from this AS capability. |

*Proposal C [13/13]: There is no need* *to specify UE AS capability signalling for CGI reporting for CH and onboarding*

**Is Proposal C agreeable?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes or No** | **Comments (if no, why?)** |
| Intel | Yes |  |
| Nokia | Yes |  |
| China Telecom | Yes |  |
| Samsung | Yes |  |
| vivo | Yes |  |
| Ericsson | Yes |  |
| OPPO  | Yes |  |

*Proposal D [13/13]: No UE AS capability signalling is needed for IMS emergency services.*

**Is Proposal D agreeable?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes or No** | **Comments (if no, why?)** |
| Intel | Yes |  |
| Nokia | Yes |  |
| China Telecom | Yes |  |
| Samsung | Yes |  |
| vivo | Yes |  |
| Ericsson | Yes |  |
| OPPO  | Yes |  |

*Proposal E [8/13]: The existing conditional mandatory without capability signalling for IMS emergency call can be reused for IMS emergency call for UE in SNPN access mode. Add the following to the existing capability:* “It is mandatory to support IMS emergency call over SNPN for UEs that are IMS voice capable over SNPNs”

**Is Proposal E agreeable?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes or No** | **Comments (if no, why?)** |
| Intel | Yes |  |
| Nokia | Yes |  |
| China Telecom | Yes |  |
| Samsung | Yes |  |
| vivo | No | Since there may be some UEs that can only camp on SNPN cell(s) (i.e., can’t camp on PLMN cell(s) ), we prefer a separate/new UE capability indication to indicate that UE supports IMS emergency call through SNPN cell. But we can follow the majority’s view. |
| Ericsson | Yes |  |
| OPPO  | Yes |  |

# Conclusion

*To be added later*

# References

[1] R2-2200233 UE Capabilities for eNPN OPPO discussion Rel-17 NG\_RAN\_PRN\_enh-Core

[2] R2-2200293 Discussion on UE capability for eNPN Huawei, HiSilicon discussion Rel-17 NG\_RAN\_PRN\_enh-Core

[3] R2-2200508 UE capability for Rel-17 NPN Intel Corporation, Nokia, Nokia Shanghai Bell discussion Rel-17 NG\_RAN\_PRN\_enh-Core

[4] R2-2200509 UE capability for Rel-17 NPN Intel Corporation, Nokia, Nokia Shanghai Bell draftCR Rel-17 38.306 16.7.0 NG\_RAN\_PRN\_enh-Core

[5] R2-2200521 Discussion of UE capability of eNPN China Telecom discussion Rel-17 NG\_RAN\_PRN\_enh-Core

[6] R2-2200849 Discussion on UE capability for NPN CMCC discussion Rel-17 NG\_RAN\_PRN\_enh

[7] R2-2201236 Consideration on the eNPN UE Capability ZTE Corporation, Sanechips discussion Rel-17 NG\_RAN\_PRN\_enh-Core

[8] R2-2201266 Discussion on UE capabilities for R17 NPN vivo discussion Rel-17 NG\_RAN\_PRN\_enh-Core

[9] R2-2201469 UE capabilities LG Electronics discussion Rel-17

[10] R2-2201524 Discussion on UE capabilities relating to Rel17 eNPN features Samsung R&D Institute India discussion Rel-17 NG\_RAN\_PRN\_enh-Core

[11] R2-2201566 UE capabilities for eNPN Ericsson discussion Rel-17 NG\_RAN\_PRN\_enh-Core