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

Electronic meeting, 19th – 27th May, 2021

**Agenda item:** 8.16.2

**Source:** China Telecom

**Title:** SNPN and subscription or credentials by a separate entity

**Document for:** Discussion

# Introduction

This document is the report of the following email discussion:

* [AT114-e][028][eNPN] SNPN and subscription or credentials by a separate entity (China Telecom)

Scope: Start from the baseline, the tdocs under 8.16.2, 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 from companies**

To facilitate the potential discussion, the rapporteur recommends to provide contact information as follows:

|  |  |  |
| --- | --- | --- |
| Company | Name | Email address |
| China Telecom | Jiaxiang Liu | liujiaxiang6@chinatelecom.cn |
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| OPPO | Jiangsheng Fan | fanjiangsheng@oppo.com |
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# Discussion

## SIB for broadcasting GINs

The following agreement of GIN is achieved at RAN2#113-bis meeting:

* GIDs are broadcasted per SNPN in network sharing scenarios.

However, which SIB is responsible for broadcasting GINs is still FFS. Based on contributions provided by companies in this meeting, SIB1 has the advantage of fast SNPN selection procedure [1][3][5][7][8][15]. On the other hand, other SIB for GINs broadcasting could alleviate the burden of SIB1[4][12]. Since SIB10 is introduced for HRNN in Rel-16 NPN, [9][11] proposes to reuse SIB10 for broadcasting GINs. Furthermore, [6][14] recommends a new SIB considering the size limitation of SIB10.

**Q1: Which option do you think is the most reasonable for GINs broadcasting?**

* **Option A: SIB1**
* **Option B: SIB10**
* **Option C: New SIB**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| China Telecom | SIB1 | We think it is the fast way for UE to recognize the GIN information for cell selection. Since we can reuse the Rel-16 restriction of the maximum number of network IDs per cell, there is no extra burden for SIB1. |
| Intel | New SIB | With a separate SIB, the number of Group IDs does not need to be too constrained with the total number of shared networks supported by the cell. The number can be per SNPN and left to Stage-3 discussion. If delay is a concern, the new SIB can also be set to a lower periodicity even though this delay is just for the initial cell selection as the support for GID is SNPN wide. |
| Nokia | New SIB | SIB1 is for essential information that is needed to access the cell. GINs are not essential for cell access (they are not needed for cell selection/reselection), they are only needed for network selection. Moreover, using SIB1 would introduce very strong undesired limitation in the number of GINs that can be supported in a cell. |
| OPPO | SIB1 | Group IDs are used for SNPN selection. Extra delay will be introduced for SNPN selection procedure if Group IDs are put in other SI, so it’s more desirable to include Group IDs in SIB1. If companies still have concern on the SIB1 overhead, we can limit the GIN number. |
| Apple | New SIB | We will not be too constrained on the number of group IDs with a new SIB. SIB1 from our view is getting overloaded due to the other work items as well such as NTN and will severely constrain the number of GINs that can be broadcasted. |
| CATT | New SIB | The size of the GINs list may be a bit large. If there is no separate entity for SNPN external subscription or credentials, the new SIB will not be broadcasted by the network. |
| ZTE | SIB1 | We share the same view as China Telecom and OPPO |
| Qualcomm | New SIB | We share the same concern on SIB1 limiting the number of GINs. SNPN deployments and GINs can be very large and SIB1 size should not be a limiting factor for the operators. |
| Huawei, HiSilicon | B or C | We are fine with option B and C. It is preferred to include GINs in a SIB other than SIB1 due to the large overhead. |
| CMCC | SIB1 | The group IDs are essential for network selection (SNPN selection), which requires low delay as well. The appropriate location to convey the GIDs is the SIB1. Regarding the number restriction, there is no clear commercial model presented now. |
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**Rapporteur’s Summary:** To be added

## Maximum number of GINs

Rel-16 NPN has concluded the maximum number of network IDs for RAN sharing. The total number of networks of PLMN+PNI-NPN+SNPN, is 12 per cell. Some companies [5][7][15] think this restriction could be extended to GINs, i.e. #PLMN+#PNI-NPN+#SNPN+#GIN <= 12. However, some companies [9] think the limitation is independent for GINs, like 12 or 24. Meanwhile, there is still no consensus on the restriction is per cell[3][9][13] or SNPN[6][8].

**Q2.1: Do companies agree with the restriction of Rel-16 NPN could be extended to GINs(i.e. #PLMN+#PNI-NPN+#SNPN+#GIN <= 12)? The granularity is per cell or SNPN?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes/No** | **Per Cell or SNPN** | **Comments(If answer is no, please make your proposal)** |
| China Telecom | Yes | Per cell | We can reuse the original restriction in Rel-16 |
| Intel | No | Per SNPN | If it is in a new SIB, there is no need for such constraint and the max number is just for signalling purpose. Max 12 per SNPN is fine with us. |
| Nokia | No | Per cell, and per SNPN | The restriction on number NPNs is introduced to limit the number of networks that can share a cell. As CHs have no network that share a cell, they should not count to the networks sharing a cell.  A maximum number of GINS per cell is needed to limit the information to be advertised.  A maximum number per SNPN is useful, but not necessary. We propose a limit of 16 per SNPN. |
| OPPO | No | No strong view | We think GIN is in different domain compared to PLMN/SNPN/CAG, it’s not reasonable to extend the legacy limitation. |
| Apple | No | Per SNPN | GIDs are broadcasted per SNPN so the restriction should be per SNPN from our view based on the RAN2#113bis-e agreement. |
| CATT | No | Per cell | We think the GINs and PLMN/SNPN/CAG are not in the same level, and cannot be added together.  There should a max number of GINs per SNPN, but in RAN2 spec the limit of max number per cell is needed. |
| ZTE | Yes | Per cell | Another method maybe restrict **the total number of the legacy Network IDs including (PLMNs, PNI-NPNs, and SNPN) into 12, meanwhile restrict the total number of the Group IDs of all of the SNPNs into another maximum number(e.g. 12)** |
| Qualcomm | No | Per SNPN | Using the existing12 limit for all combinations will severely limit the usefulness of this feature. |
| Huawei, HiSilicon | No | Per cell | How to restrict the number of GINs depends on the answer to Q1.   * If the GINs are included in SIB1, the restriction of Rel-16 NPN could be extended to GINs, and the maximum value may also be extended e.g. to 24. * If the GINs are included in other SIB, the restriction on the number of GINs shall be independent from that of the network IDs in SIB1. |
| CMCC | Yes | Per cell | Up to 12 different Group IDs can be broadcasted in a cell.  If “mixed” network sharing is allowed (i.e. a cell can contain PLMNs, SNPNs/Group IDs), the total number of networks indicated in SIB1 (i.e. #PLMN + #SNPN + #PNI-NPN+ #Group IDs) shall not exceed 12. |

**Rapporteur’s Summary:** To be added

The encoding of GIN determines how many bits one GIN occupies. However, there is a mismatch between TR 23.700-07[19] and TS 23.501[18] as mentioned in [13]. TR 23.700-07 concludes that “Group ID as a specific case of SNPN ID reusing SNPN ID encoding in TS 23.003”, while TS 23.501 states that “GIN reuses the NID encoding in TS 23.003 and can be self-managed or globally unique”.

**Q2.2: Do companies agree with sending LS to SA2 for clarifying whether GIN reuses SNPN ID or NID encoding? If answer is no, please indicate the right understanding.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Yes | We need this clarification |
| Intel | No strong view | This can be check by each company internally. |
| Nokia | No | SA2 specification is clear, GINs are encoded in the same way as SNPN IDs: PLMN ID and NID. (Agree with Intel, companies can check this with theirSA2 delegates.) |
| OPPO | No strong view |  |
| Apple | Yes | Ok to clarify. |
| CATT | Yes | Ok to clarify. |
| ZTE | Yes with comments | This can be check by each company internally, but if still no consensus achieved, we are OK to send this LS if we can’t achieve concensus |
| Qualcomm | It can wait | In current SA2 specifications, it is defined as NID without PLMN. But SA2 is discussing in this meeting whether to change that and add PLMN. We can follow their agreement and they may send us an LS on this anyway. |
| Huawei, HiSilicon | No | According to the approved CR [S2-2101079] to TS 23.501 in, it is clear that the GIN reuses the NID encoding. |
| CMCC | Yes | Ok to clarify. |

**Rapporteur’s Summary:** To be added

## Relationship between GID and indication of accessing using CH

In [3], it notices that for SNPN only support GIN, the separate entity supporting information can be implicitly indicated by broadcasting GIN and the indication shall not be set. However, [1][13] have different opinions and think they are set independently.

**Q3: Do companies think GID is set independently of indication of accessing using CH?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Yes | GID and the indication has different usage and we do not want to involve complexity. |
| Intel |  | This can be discussed later once the ASN.1 structure is made clearer |
| Nokia | No | The flag indicates that the SNPN can be accessed via CH, and GINs are IDs of CHs. If GINs are advertised without setting this flag, then UEs will never use the CHs to access the network as it is not allowed. |
| OPPO | Yes | GIN itself can implicitly indicate the support of third party credential. Even if the third party credential indicator is not set, the UE NAS behaviour is still unchanged. We see no need to combine the two parameters. |
| Apple | Yes | There is no need to combine both the parameters and we can indicate them separately. |
| CATT | Yes | Indicate them separately can make the specification clearer. |
| ZTE |  | For this issue, our concern is on the case that the SNPN only support Group ID. For example, for cell A, the SNPN 1 only support Group ID1, then the UE (with CH 1) that include the SNPN1 in user-controlled list may try on Cell A to access it’s corresponding CH 1, but for the Cell A, it only support Group ID1, it doesn’t support CH1. To solve this issue, the separate entity supporting information can be implicitly indicated by broadcasting Group ID for this case.  Anyway, we can access majorities ’views on it. |
| Qualcomm | Yes/No | There is dependence of GINs on CH but not the other way around. However, agree with others that we should have separate IEs. |
| Huawei, HiSilicon | Yes | Agree with China Telecom. |
| CMCC | Yes | No need to combine both the parameters and we can indicate them separately. |

**Rapporteur’s Summary:** To be added

## HRNN

For manual network selection, Rel-16 involves SIB10 for broadcasting HRNN which corresponds to the NPN identity. [5] proposes that SIB10 is responsible for HRNN of GINs to align with Rel-16. Furthermore, [15] thinks the name of the respective entity separate from the SNPN owning the credentials (e.g. Home SP credentials) can also be sent to NAS. On the contrary, [12][16] think UE selects SNPN not GIN and object HRNN of GIN. However, [1][4][8][11] prefer to wait for SA2 requirement in this issue.

**Q4: Do companies support HRNN of GID? Does RAN2 send LS to SA2 for confirming the requirement of this issue?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes/No** | **Send LS to SA2?** | **Comments** |
| China Telecom | Yes | Yes | We think HRNN of GIN is as useful as HRNN of NPN. It will facilitate manual selection for User. Send LS to SA2 to confirm this requirement. |
| Intel | No | No | Group ID may correspond to multiple networks and does not seem logical to associate a Group ID with a HRNN which is used optionally for manual selection of a network by the UE. |
| Nokia | No | No | The requirement for HRNNs of GINs should come from SA1 or SA2. RAN2 has no technical reason to introduce this requirement. |
| OPPO | No | No | RAN2 is not the first group to discuss HRNN requirement, better to postpone the discussion. |
| Apple | No | No |  |
| CATT | No | No | It is not necessary to introduce HRNN of GINs in RAN2 unless SA2 has the requirement. |
| ZTE | FFS | No | We slightly prefer to wait for LS from SA2/CT1 |
| Qualcomm | No | No | This is not up to RAN2. |
| Huawei, HiSilicon |  |  | No strong views. RAN2 can wait for SA2 requirement. |
| CMCC | Yes | Yes | As we know that both automatic and manual PLMN selection in relation to SNPN along with credentials owned by an entity separate from the SNPN are agreed in SA2. And it obvious that HRNN of GIN is as useful as HRNN of NPN as this can enable the user acquires more information about the private network to determine whether to access it or not, i.e., both SNPN network information (e.g. airport network) and corresponding group information (e.g. Star Alliance). Now that companies think this is up to SA2, why do companies refuse to send LS to check with SA2? |

**Rapporteur’s Summary:** To be added

## Interaction between NAS and AS

RAN2 has agreed the information from AS to NAS as following:

* In the UE, AS reports to NAS about the following broadcasted new parameters:

Indicator that "access using credentials from a separate entity is supported" in the cell per SNPN

Supported Group IDs

Indicator that "whether the SNPN allows registration attempts from UEs that are not explicitly configured to select the SNPN" per SNPN.

When GINs are selected by UE NAS, it is still no agreement about whether AS is visible for selected GINs. Based on the contributions in this meeting, rapporteur notice most companies tend to support that NAS only needs to send selected SNPN to AS as legacy, no other information is needed[1][4][6][8][12][16]. Only one company proposes NAS to indicate GINs and two indications related to external credentials to AS[10].

**Q5: Do companies support NAS sending GINs and two indications related to external credentials to AS?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | No |  |
| Intel | No | Only the selected SNPN (associated with the GID or corresponding to the indications which allow for CHs) is used for cell (re)selection/suitability check in UE and for AMF selection in RAN (as per legacy Rel-16) |
| Nokia | No | Same view as Intel |
| OPPO | No | Same view as Intel |
| Apple | No | Agree with Intel. |
| CATT | No | Agree with Intel. |
| ZTE | No |  |
| Qualcomm | No |  |
| Huawei, HiSilicon |  | This question is related to Q8. If the support of external credentials is not uniform for AMFs in the SNPN, AS needs to signal the indications/GIN to RAN for AMF selection. In this case, NAS should sends the indications/GIN to NAS. |

**Rapporteur’s Summary:** To be added

## Cell (re)selection

RAN2#113bis meeting has agreed that “To support SNPN with subscription or credentials by a separate entity, R2 assumes that there is no impact on cell (re)selection (e.g. no need to change suitable cell criteria).” [8] thinks this meeting needs to confirms that agreement. [2] also analyses that the new agreed CT1 CR does not impact suitable cell definition. However, one company involves new considerations on suitable cells as well as cell barring rules [10].

**Q6: Do companies confirm that to support SNPN with subscription or credentials by a separate entity, there is no impact on cell (re)selection?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Yes |  |
| Intel | Yes |  |
| Nokia | Yes |  |
| OPPO | Yes |  |
| Apple | Yes |  |
| CATT | Yes |  |
| ZTE | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |

**Rapporteur’s Summary:** To be added

## Connected mode mobility

According to SA2’s reply LS in S2-2101076[17], the support of external credentials is uniform for all cells in the SNPN. Therefore, there is no RAN2 impact of intra-SNPN handover [9][16]. Any potential impact is from other WGs like RAN3 or SA2[1][13].

**Q7: Do companies agree that no RAN2 impact of connected mode mobility for third party credential?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Yes |  |
| Intel | Yes | It is clear that there is no UE impact. Whether there are inter-node messaging impact will depend on the request from RAN3 or SA2 |
| Nokia | Yes |  |
| OPPO | Yes | Same view as Intel |
| Apple | Yes |  |
| CATT | Yes |  |
| ZTE | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |

**Rapporteur’s Summary:** To be added

## AMF selection

Based on TS 23.501[18], clause 5.30.2.4, NG-RAN shall inform the AMF of the selected PLMN and NID. [1][13] believe the legacy procedure is enough while [14] wants to depend on the Home SP or GIN for AMF selection. [9] wonders whether the support of external credentials are uniform for all AMFs in an SNPN. The rapporteur recommend to confirm that no matter the AMFs supporting of external credentials are uniform, whether gNB could find the right AMF based on SNPN ID. If the answer is no, we can think about sending LS to SA2.

**Q8: Do companies agree that the legacy AMF selection procedure is enough? Do we need to send LS to SA2 to clarify whether the support of external credentials are uniform for all AMFs in an SNPN**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes/No** | **Send LS to SA2?** | **Comments** |
| China Telecom | Yes | We are OK to send LS to confirm that |  |
| Intel | Yes | No | We do not see a need to send a LS since AMF selection is not in the scope of RAN2. If RAN3 or CT1 think there is need for other information other than selected SNPN ID, they can inform RAN2. |
| Nokia | Yes | No | Same view as Intel: this is not the scope of RAN2. |
| OPPO | Yes | No strong view |  |
| Apple | Yes | Ok to clarify |  |
| CATT | Yes | Ok to clarify |  |
| ZTE | Yes |  | | |
| Qualcomm | Yes | No | Agree with Intel |
| Huawei, HiSilicon | Yes | Yes | If there is no common understanding about whether the support of external credentials are uniform for all AMFs in an SNPN, RAN2 can ask SA2 Ask SA2 to clarify. |
| CMCC | Yes | No | RAN3 is working on the LS to SA2 during this meeting |

**Rapporteur’s Summary:** To be added

## Others

Since some open issues need to be addressed first, the rapporteur to postpone the detail design of ASN.1 mentioned in [1][3][7][8][9]. After RAN2 decides which SIB for GIN broadcasting, whether we need HRNN, etc, we can come back to these contributions.

**Q9.1: Do companies agree that ASN.1 design could be postponed?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Yes |  |
| Intel | Yes |  |
| Nokia | Yes |  |
| OPPO | Yes |  |
| Apple | Yes |  |
| CATT | Yes |  |
| ZTE | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |

**Rapporteur’s Summary:** To be added

It has been proposed in [2] that RAN2 to discuss trusted 3rd party authentication servers. Since this is a new topic never discussed before, the rapporteur recommends to postpone this issue.

**Q9.2: Do companies agree that trusted 3rd party authentication servers related issues could be postponed?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Yes |  |
| Intel |  | This is not in the scope of RAN2. If there is a need for this, it should come from other WGs. |
| Nokia | Yes | Same view as Intel: RAN2 should only work on this if requirements from other WG come. |
| OPPO | Yes |  |
| Apple | No | We feel there will be impact later on atleast from RAN2 perspective in terms of how to indicate trustworthiness of a specific server. One of the use-cases is UEs only authenticating with a trusted authentication server in specific SNPNs. We want to ensure that AS layer can send this indication so that UEs can postpone procedures until after such and indication is obtained. Atleast for such cases a discussion of 3rd party authentication servers is needed. |
| CATT | Yes |  |
| ZTE | Yes |  |
| Qualcomm | Yes+ | This should be dropped; it is not within RAN2 scope. |
| Huawei, HiSilicon | Yes | No discussion on this issue is needed, unless required by other WGs. |
| CMCC | Yes |  |

**Rapporteur’s Summary:** To be added

Access control related proposals are shown in [9][14], the rapporteur recommends to postpone this issue.

**Q9.3: Do companies agree that access control related issues could be postponed?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Yes |  |
| Intel |  | We do not see a need to enhance access control. |
| Nokia | Yes | RAN2 should only work on this if requirements from other WGs come. |
| OPPO | Yes |  |
| Apple | Yes | Can wait for requirements to come from other groups. |
| CATT | Yes |  |
| ZTE | Yes |  |
| Qualcomm |  | It is fine to discuss in the upcoming meetings as it is an optimization. |
| Huawei, HiSilicon | Yes |  |

**Rapporteur’s Summary:** To be added

It has been proposed in [14], for RAN2 to discuss if V-SNPN info of neighbour cells is collected and reported for ANR purpose. [1] supports to extend ANR function for third party credential and Onboarding.

**Q9.4: Do companies agree that ANR related issues could be postponed?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| China Telecom | Yes |  |
| Intel | Yes |  |
| Nokia | Yes |  |
| OPPO | Yes |  |
| Apple | Yes |  |
| CATT | Yes |  |
| ZTE | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |

**Rapporteur’s Summary:** To be added

# 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

# Reference

1. R2-2104767 Support SNPN with subscription or credentials by a separate entity OPPO discussion Rel-17 NG\_RAN\_PRN\_enh-Core
2. R2-2105125 Additional considerations for access of SNPN with credentials from a different entity Apple discussion Rel-17 NG\_RAN\_PRN\_enh-Core
3. R2-2105167 Consideration on the Separate Entity Supporting ZTE Corporation, Sanechips discussion Rel-17 NG\_RAN\_PRN\_enh-Core
4. R2-2105192 Further Consideration on Subscription or Credentials by CH CATT discussion Rel-17 NG\_RAN\_PRN\_enh-Core
5. R2-2105200 Consideration on GIN related issues China Telecommunication discussion Rel-17 NG\_RAN\_PRN\_enh-Core
6. R2-2105244 Discussion on GINs from RAN2 perspective Nokia, Nokia Shanghai Bell discussion Rel-17 NG\_RAN\_PRN\_enh-Core
7. R2-2105291 Remaining issues on supporting SNPN with subscription or credentials by a separate entity vivo discussion
8. R2-2105409 SNPN access with different entity credentials Qualcomm Incorporated discussion
9. R2-2105570 Accessing SNPN with credentials owned by a credentials holder Huawei, HiSilicon discussion
10. R2-2105632 Cell (re)selection for Rel-17 NPN enhancements Asia Pacific Telecom, FGI discussion
11. R2-2105670 RAN2 impact to support SNPN with credentials by a separate entity MediaTek Inc. discussion Rel-17 NG\_RAN\_PRN\_enh-Core R2-2103782
12. R2-2105915 Support of credentials owned by third party entities in SNPN Intel Corporation discussion Rel-17 NG\_RAN\_PRN\_enh-Core
13. R2-2106034 SNPN access using external credentials Ericsson discussion Rel-17 NG\_RAN\_PRN\_enh-Core
14. R2-2106199 On Supporting Visited SNPN with Credentials Samsung discussion NG\_RAN\_PRN\_enh-Core
15. R2-2106246 Left Issues on Supporting SNPN with Credentials by a Separate Entity CMCC discussion Rel-17 NG\_RAN\_PRN\_enh-Core
16. R2-2106296 Resolving issues for access with external CH LG Electronics discussion Rel-17
17. S2-2101076, Reply LS on clarification request for eNPN features, SA2 #143-e
18. TS 23.501, “System architecture for the 5G System (5GS); Stage 2”, V17.0.0, 2021-03
19. TR 23.700-07, “Study on enhanced support of non-public networks”, TSG SA, V17.0.0, 2021-03