3GPP TSG-RAN WG2 Meeting #109 electronic R2- 2001680

24 February – 6 March 2020

**Agenda item: 6.18.2**

**Source: Qualcomm**

**Title: Summary of [PRN] Cell Selection and selection**

**WID/SID: Private Network Support for NG-RAN**

**Document for: Discussion**

# 1 Introduction

This document is for the following email discussion:

|  |
| --- |
| * [AT109e][117][PRN] Cell Selection and selection aspects (Qualcomm)   Scope: Continue the discussion on cell selection and reselection aspects, trying to conclude on proposals from [R2-2001676](file:///C:\Data\3GPP\RAN2\Docs\R2-2001676.zip) not concluded online.  Initial intended outcome:   * + - Initial set of proposals with full consensus (agreeable over email)   Initial intermediate deadline (for companies' feedback): Thursday 2020-02-27 23:59 CET  Initial intermediate deadline (for rapporteur's list of proposals): Friday 2020-02-28 12:00 CET  Proposed agreements not challenged until Monday 2020-03-02 12:00 CET will be declared as agreed by the session chair.  Final intended outcome: summary of the offline discussion in R2-2001680 with:   * + - (Further) set of proposals with full consensus, if any (agreeable over email)     - Set of proposals with almost full consensus to discuss in the follow up conference call     - Set of open issues and proposals to postpone to next meeting     - Open issues that should no longer be pursued   Final deadline (for companies' feedback): Monday 2020-03-02 23:59 CET  Final deadline (for rapporteur's summary): Tuesday 2020-03-03 12:00 CET  Status: Started |

Proposals from R2-2001676 that were concluded online and those that were not concluded online are pointed out in Appendix A.

Note that following agreements have already been made in RAN2#109e:

Agreements:

1. RAN2 understanding is that all mandatory features apply to NPN (we might check this again for Rel-16 features if any problems are found)
2. Proposal 2: Remove the following Editor’s Notes without introducing any other changes

Editor's Note: The need for list of NIDs depends on the RAN sharing scenarios to be supported.

Editor's Note: The support of sharing logical cells is FFS.

1. No PCI range of SNPN cells will be signalled
2. Clarify in Stage 2 that a Rel-15 UE considers a CAG-only cell as acceptable cell if the cell is not barred to Rel-15 UEs, and if a PLMN ID without CAG list is broadcast and that PLMN is "not allowed" (e.g. by use of PLMN ID for which all registration attempts are rejected such that the PLMN ID becomes not allowed). Discuss wording as part of the Stage 2 discussion
3. Proximity indication is not supported CAGs
4. EN-DC is not supported for NPN

# 2 Discussion

## 2.1 PCI range signaling for CAGs

Following options for signalling of PCI range for CAGs was proposed in [8], [10]. [13], [16] and [17] (**companies are encouraged to confirm that all their proposed options are captured below in the condensed list of options**), and discussed in proposal 9c of R2-2001676:

**Question 1: Please indicate preferred option for signalling of PCI range for CAGs:**

1. **Signal PCI range(s) for all CAGs. Number of ranges FFS.**
2. **Signal PCI range(s) per PLMN per frequency. Number of ranges FFS.**
3. **Signal PCI range(s) per CAG ID per frequency. Number of ranges FFS.**
4. **CAG PCI range is introduced as a list of blacklisted/whitelisted cells (no changes required to ASN.1 and NR-U CRs are the baseline).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option(s)** | **comments** |
| Huawei | Option 3 | The reserved PCIs could be different across different CAGs. Considering the PCI range could be non-contiguous, a list of PCI ranges is preferred.  This question is also related to Q5a. If the UE is unaware of the reserved PCIs and associated CAG ID for neighbour cells, UE could not determine whether a neighbour cell is a CAG member cell or not (UE needs to know the CAG ID of the neighbour cell to check if it’s in Allowed CAG list or not), thus could not exclude non-CAG member cells. |
| Nokia | Option 4 | We do not think that additional optimization is necessary |
| Intel | Option 2 |  |
| CATT | Option2 or Option 3 |  |
| Asia Pacific Telecom (APT) | Option2, Option 3 or Option 4 | Per frequency based signalling is beneficial for measurement. |
| ZTE | Option 3 | We slightly prefer option 3, and we can also accept option 1 and option 2. |
| Qualcomm | Option 2 | 2 should be adequate and simple.  1 may be limiting when CAG PCI pool ranges are different in different frequencies, e.g., due to different PCI planning strategies used by operators on different frequencies/bands.  Option 3 has a configuration and overhead downside. PLMN cells will have to be configured with per-CAG-ID PCI ranges and this configuration has to be kept up-to-date as new CAGs are added.  We are not sure if overloading of Rel-15 lists in option 4 works. We are open to the option if it can be clarified how option 4 works. |
| Apple | Option 4 | Simpler implementation |
| Lenovo | Option 4 |
| Futurewei | Option 3 | Access control is done at CAG level, and cell search is done over a frequency. |
| Samsung | Option 2 |  |
| Sony | Option 4 | As mentioned in [13] a blacklist and white list should be enough to indicate the CAG PCI range, which is already per frequency.  If there is a need to distinguish CAG and non-CAG cells, then for any PCI listed in both blacklist and whitelist then the whitelist takes precedence i.e. CAG UE will treat the PCI as whitelist. Non-CAG UE won’t comprehend whitelist. |
| Ericsson | Option 2 |  |

The views are almost split on this. Given option 2 and 3 (proposing an enhancement to Rel-15 signalling) together have a majority (7 out of 10 companies support it), it is recommended to consider the following proposal (with a suggested way forward for number of ranges).

**Proposal 1: PCI values for CAGs are signalled per PLMN per frequency. FFS whether per CAG-ID signalling is allowed. PCI values are signalled as a list of ranges.**

## 2.2 Overriding *cellReservedForOtherUse* in NPN cells

Setting cellReservedForOtherUse = true excludes Rel-15 UEs from accessing a cell. We also need to allow Rel-16 UEs to access such a cell. Next question is aimed at addressing this and is based on proposals 4 and 19 in R2-2001676. Note that “cell does not broadcast any CAG-IDs or NIDs” check is similar to that in a previous agreement copied below:

1. All the R16 UEs will treat the cell as barred when the legacy IE cellReservedForOtherUse is set to “True” and this cell does not broadcast any CAG-IDs or NIDs.

**Question 2: Do you agree with the following:**

1. **When cell broadcasts any CAG IDs or NIDs, NPN-capable Rel-16 UE can treat a cell with cellReservedForOtherUse = true as a candidate during cell selection and cell reselection.**
2. **When cell broadcasts any CAG IDs or NIDs, non-NPN-capable Rel-16 UE can treat a cell with cellReservedForOtherUse = true as a candidate during cell selection and cell reselection.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **(a)**  **Yes/no** | **(b)**  **Yes/no** | **comments** |
| Huawei | Yes | Yes | For a): Since the cell broadcasts NPN information, NPN UEs will ignore the R15 *cellReservedForOtherUse* and refer to the R16 *cellReservedForFutureUse* to check if the cell is reserved or not.  For b): The described cell could an NPN-only cell or PLMN + NPN mixed cell. If it’s a PLMN + NPN mixed cell that wants to prevent the access attempts of R15 UEs but allows the access attempts of R16 UEs, it could only set *cellReservedForOtherUse* to *true*, and in this case the cell should not be viewed as barred for R16 non-NPN capable UEs. |
| Nokia | Yes | No | This question is ambiguous as there is currently no agreement on what a non-NPN-capable Rel-16 UE is (see question 12).  Our understanding that (a) has already been implicitly agreed: RAN2#108 agreement: “cellReservedForOtherUse is used to prevent Rel-15 UEs to access the cell.”  Our view is that NO to (b) does not mean that the cell cannot be an “acceptable” cell |
| Intel | Yes | No | When cell broadcasts any CAG IDs or NIDs, non-NPN-capable Rel-16 UE can treat a cell with cellReservedForOtherUse = true as bar.  To support emergency call on those cell for such UE, the cellReservedForOtherUse = false as well as the IMS flag is set to true to allow the non-NPN capable to UE camp as acceptable cell, like Rel-15 UE. |
| CATT | Yes | No | Non-NPN-capable Rel-16 UE should be treated as R15 UE, so when *cellReservedForOtherUse* is set to true, Non-NPN-capable Rel-16 UE will be barred. |
| SoftBank | Yes | No | Non-NPN-capable UE should be treated as Rel-15 UE. |
| Asia Pacific Telecom (APT) | yes | No |  |
| ZTE | Yes | No | We add a table below to show the possible NW configurations.   1. I think this proposal is about the case 4 in the table and three options are listed.   We prefer option 3 which means Yes to (a) and No to (b).  When NW wants to allow limited service for both Rel-15 UE and non-CAG capable UEs, the cellReservedForOtherUse = false.  When NW wants to bar limited service for both Rel-15 UE and non-CAG capable UEs, the cellReservedForOtherUse = true.  If we go for option 1 (i.e. Yes to (a) & Yes to (b)), the cellReservedForOtherUse = true can only be used to bar the limited service for Rel-15 UE and there is no way to bar the the limited service for non-CAG capable Rel-16 UEs, which is also mentioned by Huawei in Q3a.  If we go for option 2 (i.e. No to (a) & No to (b)), the same results can be achieved by the setting in Case 2 and there is no need to have the setting in Case 4.  Thus, it is obvious that option 3 offers the maximum flexibility in configuration.   1. In addition, if the non-SNPN (including Rel-15 UE and non-SNPN capable UE) is allowed to camp on a SNPN-only cell for limited service, the settings will be the same as that of CAG-only cell in the table below. If the non-SNPN (including Rel-15 UE and non-SNPN capable UE) is not allowed to camp on a SNPN-only cell for limited service, we can go for the option 3 in case 4 so that only SNPN capable UE can camp for service while Rel-15 UE and non-SNPN capable UE are both barred by setting the cellReservedForOtherUse = true.   With the above consideration , the option 3 seems to be a forward compatible solution which is applicable no matter what the response from SA1 is. |
| Qualcomm | Yes | Yes | Saying no to (b) can limit what a Rel-16 non-capable UE can do on a cell with *cellReservedForOtherUse* set to true. |
| Apple | Yes | No | Agree with CATT and Sofbank. Non-NPN capable Rel-16 UE should be treated as a R15 UE. |
| Lenovo | Yes | No | We prefer that a non-NPN-capable Rel-16 UE follows legacy behaviour. |
| Futurewei | Yes | Yes | The difference between R16 Non-NPN capable UE and R15 UE is R16 UE knows if any CAG-IDs or NIDs is broadcast (though it may not use it). |
| Samsung | Yes | No | Agree with CATT view. |
| Sony | Yes | No |  |
| Ericsson | Yes | No |  |

*Table added by ZTE:*

|  |  |  |  |
| --- | --- | --- | --- |
| NW configuration  For a CAG-only cell or CAG+PLMN cell | Rel-15 UE | R16 UE | |
| Non-CAG capable | CAG capable |
| **Case 1:** cellBarred = barred | × | × | × |
| **Case 2:**cellBarred = notBarred  cellReservedForOtherUse =true  cellReservedForFutureUse-r16 =true | × | × | × |
| **Case 3:**cellBarred = notBarred  cellReservedForOtherUse =false  cellReservedForFutureUse-r16 = true  (CAG-only cell: dummy PLMN in the legacy list)  (PLMN+CAG cell: PLMN list +CAG list) | √ CAG-only cell: acceptable  √ PLMN+CAG cell: (suitable/acceptable) | × | × |
| **Case 4:**cellBarred = notBarred  cellReservedForOtherUse =true  cellReservedForFutureUse-r16 =false  (CAG-only cell: dummy PLMN in the legacy list)  (PLMN+CAG cell: PLMN list +CAG list) | × | Option 1:  √ CAG-only cell: (acceptable)  √PLMN+CAG cell: (suitable/acceptable) | Option 1:  √ CAG-only cell: (suitable/acceptable)  √PLMN+CAG cell: (suitable/acceptable) |
| Option 2:  × | Option 2:  × |
| Option 3:  × | Option 3:  √ CAG-only cell: (suitable/acceptable)  √PLMN+CAG cell: (suitable/acceptable) |
| **Case 5:**cellBarred = notBarred  cellReservedForOtherUse =false  cellReservedForFutureUse-r16 =false  (CAG-only cell: dummy PLMN in the legacy list)  (PLMN+CAG cell: PLMN list +CAG list) | √ CAG-only cell: acceptable  √ PLMN+CAG cell: (suitable/acceptable) | √ CAG-only cell: acceptable  √PLMN+CAG cell: (suitable/acceptable) | √ CAG-only cell: (suitable/acceptable)  √PLMN+CAG cell: (suitable/acceptable) |

There is unanimous support for the following:

**Proposal 2.1: When a cell broadcasts any CAG IDs or NIDs, NPN-capable Rel-16 UE can treat the cell with cellReservedForOtherUse = true as a candidate during cell selection and cell reselection.**

A significant majority support the following.

**Proposal 2.2: Non-NPN-capable Rel-16 UE treat a cell with cellReservedForOtherUse = true as barred.**

## 2.3 Emergency calls for Rel-16 UEs

Following agreement has already been made in RAN2#109e

1. Clarify in Stage 2 that a Rel-15 UE considers a CAG-only cell as acceptable cell if the cell is not barred to Rel-15 UEs, and if a PLMN ID without CAG list is broadcast and that PLMN is "not allowed" (e.g. by use of PLMN ID for which all registration attempts are rejected such that the PLMN ID becomes not allowed). Discuss wording as part of the Stage 2 discussion

Following question is based on [7] and [9] and discusses a related issue of enabling emergency calls for Rel-16 UEs in CAG-Only Cells.

**Question 3a: Do you agree that emergency calls for Rel-16 UEs in a CAG-only cell can be supported in the same way as for Rel-15 Ues (as described in the above agreement)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **comments** |
| Huawei | Yes | [9] proposed two ways of supporting emergency calls for Rel-16 UEs in a CAG-only cell:  (1) by setting *cellReservedForOtherUse* = *true* and allowing the Rel-16 UEs to override this flag and access the PLMNs in the NPN list in limited service state;  (2) by setting *cellReservedForOtherUse* = *false* and broadcasting a dummy PLMN in the legacy PLMN list.  We prefer (2). If the operator wants to provide emergency service in a CAG-only cell only to R16 CAG capable UEs, not to R16 non-CAG capable UEs, it cannot be achieved by (1). The current agreement allows emergency service for R16 non-CAG capable UEs, but it is not mandatory. In other words, operators should be able to decide for each CAG-only cell whether to allow emergency service to non-CAG capable UEs.  In this sense, (2) is better. |
| Nokia | No | At RAN2#107 when we answered to SA2 LS we agreed that all Rel-16 UEs can camp on a CAG-only cell for emergency services:  “(Regarding question E2) Rel-16 UEs not supporting the CAG feature can camp on a CAG cell as an acceptable cell to obtain limited service”  The solution described above for Rel-15 UEs is just a guidance for operators how deploy a cell to enable emergency services for “legacy” Rel-UEs (e.g. due to regulatory requirements). From this point the cell is not really a CAG-only cell as it can be selected by UEs based on the advertised PLMN ID in the PLMN list. (SA1 requirement is that this should not happen in CAG-only cells.) 3GPP has no control on PLMN ID assignment and 3GPP cannot restrict the use of a PLMN ID. In practice this deployment can work if operators carefully select the PLMN ID for the PLMN ID list, but this is not a full solution. |
| Intel | Yes |  |
| CATT | No | According to the understanding in Q3 a), for R16 NPN capable UE, no matter *cellReservedForOtherUse* is set to true or false, this type of UE can get limited service in any CAG-only cell.  While for Non-NPN capable R16 UE, this type of UE should be treated the same with R15 UE, so only when *cellReservedForOtherUse* is set to false, Non-NPN capable R16 UE can get limited service in a CAG-only cell.  This question is also related to the definition for CAG-only cell, we think RAN2 should remove the limitation e.g. *cellReservedForOtherUse* is set to ture when we define CAG-only cell.  UE can identify a NPN-only cell by the presence of a dummy PLMN ID and at least one CAG ID/NID in SIB1. |
| SoftBank | ? | The question is not clear. In our understanding, the agreement in the above box is release-independent and applicable for Rel-15 and later UEs. |
| Asia Pacific Telecom (APT) | Yes |  |
| ZTE | Yes | The emergency call for Rel-16 UEs in a CAG-only cell can be supported in the same way as for Rel-15 UEs, by setting the *cellReservedForOtherUse* = *false* and broadcasting a dummy PLMN in the legacy PLMN list. |
| Qualcomm | Yes | This question is in the context of a cell that wants to provide to normal services to Rel-16 CAG-capable member UEs and only emergency services to Rel-15 and other Rel-16 UEs. With this understanding, answer to this question should be yes.  We understand the confusion regarding whether such a cell can be viewed as a “CAG-only” or not, and that needs a separate discussion. |
| Apple | No | We agree with the Nokia sentiment here. Unless the dummy PLMN part itself is standardized, we cannot assume that operators will assign this information. |
| Lenovo | Yes |  |
| Futurewei | Yes | It can be done by setting the cellReservedForOtherUse = false and broadcasting a dummy PLMN in the legacy PLMN list. |
| Samsung |  | We think this question is irrelevant since Q3b) and Q3c) is more specific to address the issue.  We also think the definition of CAG-only cell captured in TS 38.300 and TS 38.304 running CR is not very clear what it means. There is no definition of CAG-only cell in SA2 specs but according to TS 23.501 there is definition of CAG-only UE. |
| Sony | Yes | If dummy PLMN based solution is adopted for Rel-15 UEs in a cell, then the same solution should apply to Rel-16 UEs in the same cell. If we are discussing the emergency call support for Rel-16 CAG UE in a cell not supporting its allowed CAG list, then this should be discussed further. |
| Ericsson | Yes |  |

Based on majority of the views, the following is recommended to be considered. Note updated wording to address some concerns raised about the terminology.

**Proposal 3.1: RAN2 confirms that emergency call is possible using the following for *any* Rel-16 UE on a cell that provides normal services only to UEs accessing CAGs: by setting *cellReservedForOtherUse = false* and if a PLMN ID without CAG list is broadcast and that PLMN is "not allowed" (e.g. by use of PLMN ID for which all registration attempts are rejected such that the PLMN ID becomes not allowed).**

The next question discusses another mechanism from [9] for supporting emergency calls for Rel-16 UEs in CAG-only cell (which cannot be used to support emergency calls for Rel-15 UEs).

**Question 3b: For CAG-capable Rel-16 UE, can emergency calls in a CAG-only cell be supported by setting *cellReservedForOtherUse=true* and allowing the Rel-16 UEs to override this flag and access the PLMNs in the NPN list in limited service state?**

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| --- | --- | --- |
| **Company** | **Yes/no** | **Comments** |
| Huawei | Yes | CAG-capable UEs can override *cellReservedForOtherUse* since the role of checking whether a cell is reserved is taken over by the R16 *cellReservedForFutureUse*. |
| Nokia | Yes | Rewording proposal: “Rel-16 UEs to ignore~~override~~” |
| Intel | Yes | It is just not suitable but can be acceptable for the CAG-capable Rel-16 UE provided the IMS flag is set. |
| CATT | Yes | As we already explained in Q3a, for R16 CAG-capable UEs, they can override *cellReservedForOtherUse*, while for Non-NPN capable R16 UE, this type of UE should be treated the same with R15 UE, so Non-NPN capable R16 UE can’t override *cellReservedForOtherUse.* |
| SoftBank | Yes |  |
| ZTE | Yes | A CAG-capable UE can ignore the *cellReservedForOtherUse=true* and camp on a PLMN in limited service. |
| Qualcomm | Yes | See comment for Q3c |
| Apple | Yes |  |
| Lenovo | Yes | Agree with Nokia that the Rel-16 UEs can ignore the setting of cellReservedForOtherUse. |
| Futurewei | Yes | R16 CAG capable UE can ignore the cellReservedForOtherUse=true. |
| Samsung | Yes | According to Q2a) for which majority indicated “yes” i.e. **When cell broadcasts any CAG IDs, CAG-capable Rel-16 UE can treat a cell with cellReservedForOtherUse = true as a candidate during cell selection and cell reselection.**  With this common understanding we see no problem.  Further RAN2 already agreed that  **All the R16 UEs will treat the cell as barred when the legacy IE cellReservedForOtherUse is set to “True” and this cell does not broadcast any CAG-IDs**  Is the intention of Q3b that **CAG-capable** Rel-16 are able to make emergency calls when the cell is treated as barred ? |
| Sony | Yes | For CAG capable UEs |
| Ericsson | Yes |  |

Based on above views, following proposal 3.2 has unanimous support:

**Proposal 3.2: For CAG-capable Rel-16 UE, emergency calls in a CAG-only cell can be supported by setting *cellReservedForOtherUse=true* and allowing the Rel-16 UEs to ignore this flag and access the PLMNs in the NPN list in limited service state.**

**Question 3c: For non-CAG-capable Rel-16 UE, can emergency calls in a CAG-only cell be supported by setting *cellReservedForOtherUse=true* and allowing the Rel-16 UEs to override this flag and access the PLMNs in the NPN list in limited service state?**

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| --- | --- | --- |
| **Company** | **Yes/no** | **Comments** |
| Huawei | No | As commented in Q3a, we prefer option (2) in [9] for non-CAG-capable UEs. |
| Nokia | Yes | Rewording proposal: “Rel-16 UEs to ignore~~override~~” |
| Intel | No | See our response to Q2 and Q3a |
| CATT | No | As we already explained in Q3a, for R16 CAG-capable UEs, they can override *cellReservedForOtherUse*, while for Non-NPN capable R16 UE, this type of UE should be treated the same with R15 UE, so Non-NPN capable R16 UE can’t override *cellReservedForOtherUse.* |
| SoftBank | No | Non-CAG-capable UE should be treated as Rel-15 UE. |
| ZTE | No | Non-CAG capable Rel-16 UE can initiate emergency call in a CAG-only cell by setting the *cellReservedForOtherUse* = *false* and broadcasting a dummy PLMN in the legacy PLMN list. |
| Qualcomm | Yes | Supporting the behaviour in 3c only requires AS to read all NPN ASN.1 IEs and pass it to NAS, irrespective of UE capabilities.  If we say yes to 3b and no to 3c, NPN-capable UEs and non-NPN capable UEs within Rel-16 see a different set of PLMNs as candidates for limited service camping. |
| Apple | Yes | Agree with Nokia. See our comments to 3a. |
| Lenovo | No | We prefer that a non-CAG-capable Rel-16 UE follows legacy behaviour. |
| Futurewei | Yes but | R16 UE (whether CAG capable or not) should be able to read the non-NPN identityinfo.  This can also be supported by setting cellReservedForOtherUse = false and broadcasting a dummy PLMN in the legacy PLMN list. |
| Samsung | No | According to our response to Q3b, the CAG cell will be barred by non-CAG UE when the ***cellReservedForOtherUse=true***  Then the question which is common for Rel-15 UEs, CAG-capable Rel-16 UEs and non CAG capable Rel-16 UEs, in a cell which is considered barred by the UE, can this cell be considered acceptable cell for supporting emeregy call ?  If this is common understanding then we should consider an unfied approach for all UE types |
| Sony | No | Please see our response to Q3a |
| Ericsson | No |  |

The views in the above question need additional discussion only if Proposal 2.2 is not agreed or postponed.

## 2.4 Excluding SNPN cells during cell reselection

Following question is based on proposal 8c in R2-2001676.

**Question 4a: Do you agree with the following for unlicensed spectrum:**

**For a UE in SNPN AM, if the highest ranked cell or best cell according to absolute priority reselection rules is a cell which is not suitable due to not broadcasting the registered or selected SNPN ID, the UE shall not consider this cell as candidate for cell reselection but should continue to consider other cells on the same frequency for cell reselection.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comments** |
| Huawei | Yes | We could not understand why the differentiation between licensed spectrum and unlicensed spectrum is needed.  For both licensed and unlicensed spectrum, it is possible that multiple operators deploy NPN cells on the same frequency, so other cells on the same frequency should be considered as candidate cells. |
| Nokia | Yes | Our view is that this should be handled in the same way as in case of PLMNs in NR-U. In unlicensed bands UEs could assume that a band is shared by multiple networks. |
| Intel | Yes | This is following unlicensed operation agreement for the PLMN case. |
| CATT | No strong view |  |
| SoftBank | Yes | It is useful for NPN operators sharing the frequency in unlicensed band. |
| Asia Pacific Telecom (APT) | Yes | We assume multiple SNPNs may operate in the same unlicensed spectrum. It is possible that the second highest ranked cell belongs to the UE’s suitable cell (e.g., the cell broadcasting SNPN ID matches the UE’s selected SNPN ID). |
| ZTE | Yes | Agree with Huawei’s comment that it is possible that different SNPN are deployed in the same frequency in both licensed and unlicensed spectrum. UE should continue to consider other cells on the same frequency for cell reselection. |
| Qualcomm | Yes | In a multi-operator deployment (quite possible in unlicensed spectrum), other cells on same frequency as a non-suitable cell should still be candidate for reselection. |
| Apple | Yes | For unlicensed operation for PLMNs |
| Lenovo | Not sure | We wonder why the legacy behaviour in applying the 300s rule can not be applied. |
| Futurewei | Yes | Multi-operator deployment over unlicensed spectrum should be supported. |
| Samsung |  | The sentence in Q4a is modification of existing spec (see below underlined text)  If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable due to being part of the "list of 5GS forbidden TAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered PLMN, the UE shall not consider this cell **and other cells on the same frequency**, as candidates for reselection for a maximum of 300 seconds.  Can you clarify if modified statement is agreed in NR-U for the PLMN case as Nokia and Intel pointed out ? |
| Sony | Yes | We think this is in-principle aligned to PLMN handling in NR-U |
| Ericsson | Yes | Same view as Nokia. This case should be handled in the same way as PLMNs are handled in NR-U. |

The following proposal has support from a substantial majority:

**Proposal 4.1: For unlicensed spectrum and a UE in SNPN AM, if the highest ranked cell or best cell according to absolute priority reselection rules is a cell which is not suitable due to not broadcasting the registered or selected SNPN ID, the UE shall not consider this cell as candidate for cell reselection but should continue to consider other cells on the same frequency for cell reselection.**

**Question 4b: Do you agree with the following for licensed spectrum:**

**For a UE in SNPN AM, if the highest ranked cell or best cell according to absolute priority reselection rules is a cell which is not suitable due to not broadcasting the registered or selected SNPN ID, the UE shall not consider this cell as candidate for cell reselection but should continue to consider other cells on the same frequency for cell reselection.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comments** |
| Huawei | Yes | Same as Q4a. |
| Nokia | No | Our view is that this should be handled in the same way as in case of PLMNs in licensed bands. In licensed bands Ues should not assume that a band is shared by multiple networks. |
| Intel | Yes | This is useful for the case in the RAN sharing case where the SNPN is shared with other SNPN, CAG and PLMN in the same frequency. The UE can decide whether to continue considering other cells in the same frequency, e.g. if RAN sharing occurs in between its SNPN and other SNPN or PLMN or CAG. |
| CATT | No strong view |  |
| SoftBank | Yes | Licensed bands have been already allocated only for private network deployments in some countries. So we think it is natural that NPN operators share the same frequency even if it is licensed band and it makes sense that the UE should consider the other cells for cell reselection on the same frequency. |
| ZTE | Yes | Same as Q4a. |
| Qualcomm | Yes |  |
| Apple | No | This will affect legacy behaviour of licensed bands cell selection and reselection. |
| Lenovo | Not sure | We wonder why the legacy behaviour in applying the 300s rule can not be applied. |
| Futurewei | Yes | Agree with Softbank. |
| Samsung | No | Same view as Nokia |
| Sony | No | We are not sure if UE should be autonomously allowed to reselect the second highest ranked or best cell on the same frequency. This should be under network control and one option is based on existing IFRI bit in MIB. |
| Ericsson | No | Same view as Nokia. |

The following proposal has support from a majority:

**Proposal 4.2: For licensed spectrum and a UE in SNPN AM, if the highest ranked cell or best cell according to absolute priority reselection rules is a cell which is not suitable due to not broadcasting the registered or selected SNPN ID, the UE shall not consider this cell as candidate for cell reselection but should continue to consider other cells on the same frequency for cell reselection.**

The following discusses the role of *intraFreqReselection* in a barred SNPN cell. Note that there is a related open issue about whether unsuitable SNPN cell should be treated as a barred cell or not, and LS R2-1916345 was sent to SA1/SA2 to clarify a related aspect, and we are awaiting a reply on the matter.

**Question 4c: Should the field** ***intraFreqReselection* in MIB message broadcast by a SNPN cell be ignored or not by a UE in SNPN AM in (a) licensed spectrum, (b) not in licensed spectrum?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **(a)**  **Yes/no** | **(b)**  **Yes/no** | **Comments** |
| Huawei | No | No | As pointed out in [21], *intraFreqReselection*only appliesifhighest ranked cell is barred, or treated as barred and not always when it is not suitable.  We do not see a strong need to add extra requirement to UEs in SNPN AM. |
| Nokia | NO | YES, if the cell does not belong to the selected/registered SNPN | Our view is that this should be handled in the same way as in case of PLMNs in licensed and unlicensed bands.  In licensed band this flag is never ignored, as UEs should not assume that a band is shared by multiple networks.  In NR-U the agreement is that the UE can ignore the IFR flag in MIB if the cell does not belong to the selected/registered (e)PLMN, as UEs could assume that a single band is shared by multiple networks. |
| Intel | No | No | IFRI in MIB will only be follow if the SIB1 is broadcasting its registered SNPN ID, otherwise it should not be followed |
| CATT | No | No | The motivation to add more restriction for the use of *intraFreqReselection* is not clear |
| SoftBank | No | - | For b), it may be good to align with NR-U agreements. |
| ZTE | No strong view | No strong view | We don’t have strong view on it. Anyway, we want to share our understanding .  There are 2 phases:   1. Actions on receiving MIB. 2. Actions on receiving SIB1.(We think the proposal focus on this phase, for that only by reading SIB1, the UE can know it’s a SNPN cell)   In phase 1, from the legacy UE aspect, it will check the intraFreqReselection in MIB when the cellbar bit is set to true in the MIB. Thus for the NPN cells, it’s better to always set *intraFreqReselection = allowed* to reduce the impact on the Normal UE.  If not, the legacy R15 UE may make wrong decision when it detect a NPN only cell with *intraFreqReselection = not allowed.* To avoid the similar problem, the R16 UE may ignore the intraFreqReselection in phase 1 and go on reading the SIB1(phase 2), if the registered PLMN or selected PLMN is included, the UE can take intraFreqReselection in to consideration, otherwise, the UE can ignore this indication.  Obviously, the above method may increase UE power consumption by SIB1 reading for some cases. There is a trade-off between UE power consumption and making exact decision on the intra-frequency reselection. Maybe for the R16 UE, it can be left to the UE’s implementation.  Anyway, we don’t have a strong view on it, we can follow the majorities. |
| Qualcomm | No | Yes, same view as Nokia | On unlicensed spectrum, a cell of another SNPN can cause exclusion of whole frequency. We also align with NR-U agreement. |
| Apple | No | No | There is no reason to change the legacy procedure. |
| Lenovo | Yes | Yes | On the same frequency layer there may be many SNPNs deployed but w/o any inter-coordination between them. An SNPN may be deployed only within a densed geographical area and consisting of a limited number of cells. So, if a cell of an SNPN needs to be barred (e.g. due to high overload or temporary failure in the cell), it does not necessarily mean that cells of other SNPNs on the same frequency are barred as well. |
| Futurewei | No | No | There is not much benefit to ignore *intraFreqReselection* if UE anyway needs to read SIB1 to determine this is a SNPN cell. |
| Samsung | No |  | If SNPN deployment is on unlicensed frequency, then we simply follow the NR-U agreements. Can you clarify what is agreed for NR-U for the PLMN case? |
| Sony | No | - | Agree with Softbank |
| Ericsson | No | Yes, if the cell does not belong to the selected/registered SNPN. | Same view as Nokia. We should follow the NR-U behaviour. |

The following proposal has support from a significant majority:

**Proposal 4.3: UE in SNPN AMdoes not ignore *intraFreqReselection* broadcast by a SNPN cell in licensed spectrum.**

There was no clear majority for treatment of *intraFreqReselection* in unlicensed spectrum. Hence, the following is recommended to be discussed to next meeting.

**Proposal 4.4: Postpone the discussion of the following: should the field *intraFreqReselection* in MIB message broadcast by a SNPN cell not in licensed spectrum be ignored or not by a UE in SNPN AM?**

## 2.5 Excluding CAG cells during cell reselection

Following three questions are based on inter-related proposals 7, 8a and 8b in R2-2001676.

**Question 5a: Do you agree with the following: UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2, but may exclude CAG cells that are known by the UE not to be CAG member cells.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comments** |
| Huawei | Yes | As commented in Q1, if the answer in Q5a is “Yes”, we need to figure out how the UE can decide whether a neighbour CAG cell is a CAG member cell or not.  In this sense, we think CAG IDs need to be broadcast along with reserved PCIs. |
| Nokia | Yes | Since no one seems to disagree with the behaviour and not ignoring such cells would decrease performance, we think it should be a requirement on UE side, not only a recommendation i.e. “shall” instead of “may” |
| Intel | No | UE can do it from implementation pov, but should not be reflected in the specification. |
| CATT | Yes | This is a desirable behaviour from UE perspective. |
| SoftBank | Yes | But “shall” should be “may” by proposed by Nokia. |
| Asia Pacific Telecom (APT) | No | This is an optimization issue. |
| ZTE | Yes,but | 1. Based on the following definition of CAG member cell in the running 38.304 CR:   *CAG Member Cell: for a UE, a cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN, and the cell broadcasts a CAG identifier belonging to the Allowed CAG list of the UE for that PLMN.*  It is reasonable that UE exclude non-CAG member cells when performing the ranking if UE is in automatic selection mode.  But we are not sure how UE get to know whether a concerned neighbour cell is a CAG member cell or not. If UE get such information based on the stored history information or the received PCI range, then it is fine. If UE get such information by acquiring the SIB1 from the neighbour cell, it is not consistent with our understanding that UE does not acquire SIB1 from the neighbour when performing the ranking of other cells. UE will acquire SIB1 from the concerned cell after reselection to that cell.   1. Another concern is about the manual selection mode, in which UE is allowed to select a CAG which is not in the allowed CAG list stored at UE side. In that case, some non-CAG member cells should also be considered when performing ranking. |
| Qualcomm | Yes | A “shall” is not a good choice as specification does not define “cells that are **known** by the UE” making “shall” untestable. |
| Apple | Yes | We prefer to keep it “may” and not “shall” because that is the desirable behaviour for UEs. |
| Lenovo | Yes | A “may” is ok for us. We can leave it to UE implementation. |
| Futurewei | Yes | This is a sensible thing to do for CAG cells. |
| Samsung | Yes with the intention | Can be left to smart UE implementation. Anyway this does not affect NW performance |
| Sony | Yes | The current text in the proposal has “may” so we support it. |
| Ericsson | No | Allowing this will result in that the UE selects the non-best cell within a frequency. |

There is support from a substantial majority for the following proposal.

**Proposal 5.1: UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2, but may exclude CAG cells that are known by the UE not to be CAG member cells.**

**Question 5b: Should the field *intraFreqReselection* in MIB message broadcast by a CAG cell be ignored or not by a UE not in SNPN AM in (a) licensed spectrum, (b) not in licensed spectrum?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **(a)**  **Yes/no** | **(b)**  **Yes/no** | **comments** |
| Huawei | No | No | As pointed out in [21], *intraFreqReselection*only appliesifhighest ranked cell is barred, or treated as barred and not always when it is not suitable.  We do not see a strong need to add extra requirement to CAG UEs.  Also, we could not understand why the differentiation between licensed spectrum and unlicensed spectrum is needed.  For both licensed and unlicensed spectrum, it is possible that multiple operators deploy NPN cells on the same frequency, so other cells on the same frequency should be considered as candidate cells. |
| Nokia | NO | YES, if the cell does not belong to the selected/registered PLMN | Our view is that this should be handled in the same way as in case of PLMNs in licensed and unlicensed bands.  In licensed band this flag is never ignored, as UEs should not assume that a band is shared by multiple networks.  In NR-U the agreement is that the UE can ignore the IFR flag in MIB if the cell does not belong to the selected/registered (e)PLMN, as UEs could assume that a band is shared by multiple networks. |
| Intel | No | No | IFRI in MIB will only be follow if the SIB1 is broadcasting its registered or selected or PLMN ID/EPLMN, otherwise it should not be followed. |
| CATT | No | No | The motivation to add more restriction for the use of *intraFreqReselection* is not clear |
| SoftBank | No | - | For b), it may be good to align with NR-U agreements. |
| ZTE | No strong view | No strong view | See the answer to the question 4c |
| Qualcomm | No, but… | Yes, same view as Nokia | *intraFreqReselection* in Rel-15 only applies to barred cells and not to non-suitable cells (non-member CAG cell is considered acceptable by UE).  For (a), an operator may deploy CAG and macro/PLMN cell on same frequency. When CAG non-member UE comes within CAG coverage, it can connect to PLMN cell causing high uplink interference to CAG. Apply IFRI like behaviour in this scenario provides operator-control over interference management.  We welcome further operator input. |
| Apple | No | No | Keeps the behaviour the same for licensed and unlicensed bands |
| Lenovo | Yes | Yes | Neighbour intra-frequency CAG cells may be configured with different set of CAG identifiers. So, if a CAG cell is barred for the set of CAG identifiers broadcast by the concerned cell (e.g. due to high overload or temporary failure in the cell), it does not necessarily mean that other CAG cells on the same frequency are barred as well. |
| Futurewei | No | No | There is not much benefit to ignore *intraFreqReselection* if UE anyway needs to read SIB1 to determine this is a CAG cell. |
| Samsung | No |  | If the UE is not in SNPN AM, then it simply follows legacy behaviour for licensed frequency.  For unlicensed frequency follow the NR-U agreement. Can you clarify what is agreed for NR-U for the PLMN case? |
| Sony | No | - | Agree with SoftBank |
| Ericsson | No | Yes, if the cell does not belong to the selected/registered PLMN or one of its equivalent PLMNs. | Same view as Nokia. We should try to align with the behaviour for NR-U. |

The following proposal has support from a significant majority:

**Proposal 5.2: UE not in SNPN AMdoes not ignore *intraFreqReselection* broadcast by a CAG cell in licensed spectrum.**

There was no clear majority for treatment of *intraFreqReselection* in unlicensed spectrum. Hence, the following is recommended to be discussed to next meeting.

**Proposal 5.3: Postpone the discussion of the following: should the field *intraFreqReselection* in MIB message broadcast by a CAG cell not in licensed spectrum be ignored or not by a UE not in SNPN AM?**

**Question 5c: Do you agree with the following for unlicensed spectrum:**

**for a UE with non-empty allowed CAG list, if the highest ranked cell or best cell according to absolute priority reselection rules is a CAG cell which is not suitable due to not being a CAG member cell, the UE shall not consider this cell as candidate for cell reselection but shall continue considering other cells on the same frequency for cell reselection.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **comments** |
| Huawei | Yes | We could not understand why the differentiation between licensed spectrum and unlicensed spectrum is needed.  For both licensed and unlicensed spectrum, it is possible that multiple operators deploy NPN cells on the same frequency, so other cells on the same frequency should be considered as candidate cells. |
| Nokia | Yes | Our view is that this should be handled in the same way as in case of PLMNs in unlicensed bands: UEs could assume that a band is shared by multiple networks. |
| Intel | Yes |  |
| CATT | Yes | Just follow the legacy way |
| SoftBank | Yes |  |
| ZTE | Yes | Agree with Huawei that it is possible that different CAGs can be deployed on the same frequency and UE should continue to consider other cells on the same frequency for cell reselection. |
| Qualcomm | Yes |  |
| Apple | Yes |  |
| Lenovo | Yes | The configuration of CAG-IDs can be different across the CAG cells on the same frequency. |
| Futurewei | Yes | Multiple CAGs can be deployed on a licensed frequency. |
| Samsung |  | See comments to Q4a |
| Sony | Yes |  |
| Ericsson | Yes, if the cell does not belong to the selected/registered PLMN or one of its equivalent PLMNs. |  |

Views above are incorporated in proposal 5.4.

**Question 5d: Do you agree with the following for licensed spectrum:**

**for a UE with non-empty allowed CAG list, if the highest ranked cell or best cell according to absolute priority reselection rules is a CAG cell which is not suitable due to not being a CAG member cell, the UE shall not consider this cell as candidate for cell reselection but shall continue considering other cells on the same frequency for cell reselection.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **comments** |
| Huawei | Yes | Same as Q5c. |
| Nokia | No | Our view is that this should be handled in the same way as in case of PLMNs in licensed bands. In licensed bands UEs should not assume that a band is shared by multiple networks. |
| Intel | Yes, but | We prefer the same wording as in the SNPN case ‘**should c**ontinue considering other cells on the same frequency for cell reselection’  This is useful for the case in the RAN sharing case where the CAG is shared with other SNPN, CAG and PLMN in the same frequency. The UE can on its own decide whether to continue in a frequency (e.g. if RAN sharing between its CAG and other SNPN/PLMN) |
| CATT | Yes | Just follow the legacy way |
| SoftBank | Yes | Licensed bands have been already allocated only for private network deployments in some countries. So we think it is natural that NPN operators share the same frequency even if it is licensed band and it makes sense that the UE should consider the other cells for cell reselection on the same frequency. |
| ZTE | Yes | See answer to Q5c |
| Qualcomm | FFS | An operator may deploy CAG and macro/PLMN cell on same frequency. When CAG non-member UE comes within CAG coverage, it can connect to PLMN cell causing high uplink interference to CAG. Applying IFRI like behaviour in this scenario to acceptable cells provides operator-control over interference management.  We welcome further operator input. |
| Apple | Yes | Same as 5c |
| Lenovo | Yes | The configuration of CAG-IDs can be different across the CAG cells on the same frequency. |
| Futurewei | Yes | Multiple CAGs can be deployed on a licensed frequency. |
| Samsung | No | Same view as Nokia. Is there a motivation to deviate from legacy behaviour? |
| Sony | Yes |  |
| Ericsson | No | Allowing this will result in that the UE selects a non-best cell within a frequency which will cause inter-cell interference. |

Following proposal (which does not distinguish between licensed and unlicensed spectrum) has support from a substantial majority.

**Proposal 5.4: for a UE with non-empty allowed CAG list, if the highest ranked cell or best cell according to absolute priority reselection rules is a CAG cell which is not suitable due to not being a CAG member cell, the UE shall not consider this cell as candidate for cell reselection but shall continue considering other cells on the same frequency for cell reselection.**

## 2.6 Manual CAG selection

Following question tries to establish a baseline for manual CAG selection based on proposal in [20]. *Please note the updated wording for step #7.*

**Question 6a: Do you agree with the following: AS and NAS operate as discussed below during *manual* CAG selection:**

* **#1. As part of AS-NAS interface, NAS provides AS with *allowed CAG list*.**
* **#2. Upon triggering of manual CAG selection by NAS, AS scans *all* carrier frequencies and obtains PLMNs and CAG IDs broadcast by found cells. Note that UE does not take *allowed CAG list* into accountin this step.**
* **#3. AS provides the found PLMNs and CAGs to NAS.**
* **#4. NAS selects a CAG ID and provides AS with the selected CAG ID (and the selected CAG ID is separate from allowed CAG list provided before).**
* **#5. With cell selection, the UE select a cell belonging to the selected PLMN and the selected CAG ID. Note that UE does not take *allowed CAG list* into accountin this step.**
* **#6. As an outcome of the manual CAG selection procedure the UE is allowed to access a cell which fulfils the cell selection criteria and is not barred or reserved for operator use for UEs not belonging to Access Identities 11 or 15 and inform NAS that access is possible (for location registration procedure).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **comments** |
| Huawei | Yes | The procedures are generally in line with our understanding, but we have one concern on Step#2.  We understands that Step#2 is mimicking LTE CSG’s behaviour: AS should be able to find all available CSG *without any restriction* to allow the UE to attempt registration towards a non-member CSG cell [20].  However, LTE CSG allows the UE to attempt to register to a non-member CSG cell, which is not supported by R16 CAG. Maybe onboarding will be supported in R17 NPN, we are not sure. In this sense, maybe AS should consider allowed CAG list in Step#2. We have no strong preference on this. |
| Nokia | Yes | Some comments:   1. Step#1 can happen after step#3 (as a part of step#4) 2. The procedure essentially the same for automatic selection. There is no need to make AS aware if manual or automatic selection happened. |
| Intel | Yes |  |
| CATT | Yes | The answer is Yes and with the following comments,  1)suggest to change step 3 to “**AS provides the found PLMNs and CAGs to NAS, and optionally the associated HRNN if provided by NG-RAN**” |
| Asia Pacific Telecom (APT) | No | Since the UE does not take allowed CAG list into account for manual CAG selection from Step 1 and Step 6, Step 1 seems not to be needed. |
| ZTE | Yes | Based on the latest LS from SA1 (, UE in manual selection mode is allowed to select a CAG which is not in the allowed CAG list stored at UE side and such new requirement has already been reflected in the step 4.  Minor wording suggestion to step 4:   * **#4. NAS selects a CAG ID and provides AS with the selected CAG ID (and the selected CAG ID can be in or out of the allowed CAG list provided before).**   For the #4#5, there are 2 scenarios:  The selected CAG ID is also included in the allowed CAG list, shall the UE only take the selected CAG ID into consideration or take the whole allowed CAG list. It’s better to confirm with SA/CT colleagues and feedback in this weekend.  The selected CAG ID is out of the allowed CAG list, for this scenario, the registration procedure will be triggered, and if a new allowed CAG list in indicated in the Registration accept Msg, the UE shall take this allowed CAG list into consideration even in the manual mode. |
| Qualcomm | Yes | @Huawei: Our understanding is that onboarding is allowed in R16 and this is addressed by recent SA1 LS S1-201084, which discussed following recently-added requirement:  “The 5G system shall support a mechanism for a PLMN to control whether a user of a UE can manually select a non-public network hosted by this PLMN that the UE is not authorized to select automatically.”  @Nokia, APT: we could say in 1 that “NAS *optionally* provides”  @CATT: agree with your proposed edit |
| Apple | Yes |  |
| Lenovo | Partly | Our understanding of Manual CAG selection is that AS does not need to be aware of the Allowed CAG list, so Step #1 is not needed.  We are not sure whether in Step #4 NAS can select a CAG-ID that is not part of the Allowed CAG list.  We think that Step #5 and #6 can be merged, i.e. “the UE selects a cell belonging to the selected PLMN and the selected CAG ID and which fulfils the cell selection criteria and is not barred or reserved for operator use for UEs not belonging to Access Identities 11 or 15 and inform NAS that access is possible (for location registration procedure).” |
| Futurewei | Yes |  |
| Samsung | Yes i.e. agree with the outcome leading to NAS triggering registration procedure | Question for clarification: What is the AS impact as long the cell fulfils S criterion? We do not specify detailed AS-NAS interaction as elaborated above. |
| Sony | Yes |  |
| Ericsson | No | It would be better if the manually selected CAG ID is added to the Allowed CAG list by NAS since then manual and automatic CAG selection would look identical from AS pov. After the initial cell selection the UE will register to the network and then CN will either reject the UE (if it’s not authorized to access the CAG ID) or it will update the UE’s allowed CAG list. We could send an LS to CT1 where we describe the different options for the AS-NAS interaction and let them decide. |

Based on comments above, following proposal is likely to have majority. The proposal includes “optionally” in #1 and #4 to address a comment above, also uses an updated step #3 based on CATT’s comment and updated #4 based on ZTE’s comment and merged #5 and #6 based on Lenovo’s suggestions (with fewer modifications to original text).

**Proposal 6.1: AS and NAS operate as discussed below during *manual* CAG selection:**

* **#1. As part of AS-NAS interface, NAS optionally provides AS with *allowed CAG list*.**
* **#2. Upon triggering of manual CAG selection by NAS, AS scans *all* carrier frequencies and obtains PLMNs and CAG IDs broadcast by found cells. Note that UE does not take *allowed CAG list* into accountin this step.**
* **#3. AS provides the found PLMNs and CAGs to NAS, and optionally the associated HRNN if provided by NG-RAN.**
* **#4. NAS selects a CAG ID and provides AS with the selected CAG ID (and the selected CAG ID can be in or out of allowed CAG list optionally provided before).**
* **#5. With cell selection, the UE select a cell belonging to the selected PLMN and the selected CAG ID. Note that UE does not take *allowed CAG list* into accountin this step. UE is allowed to access a cell which fulfils the cell selection criteria and is not barred or reserved for operator use for UEs not belonging to Access Identities 11 or 15 and inform NAS that access is possible (for location registration procedure).**

**Question 6b: After performing access on the manual selected CAG, which one of following two UE behaviours is used:**

**a. UE reselects a cell belong to allowed CAG list.**

**b. UE shall prioritize to reselect a cell supporting selected CAG ID, but also can consider cells belonging to allowed CAG list in case that cells supporting selected CAG ID is not available.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option** | **comments** |
| Huawei | a | We are not sure how to capture the “prioritize” behaviour, which may complicate the spec, thus option a) is preferred. |
| Nokia | Option A | There is no SA2 requirement to prioritize the cells supporting the selected CAG ID |
| Intel | Neither | AS should follow NAS on the selected CAG ID. If none is found, the AS should report to NAS. This is probably out of scope of RAN2. |
| CATT | Option B | We Prefer with option B with following justification:   1. From CATT’s point of view, the manually selected CAG ID is user’s preference and it keeps valid until user selects another CAG ID or changes to automatic CAG selection mode. It should be considered in UE’s mobility including cell selection/reselection in idle/inactive mode and handover in connected mode. 2. If we support step #5 in Question 6a. I suppose that means the selected CAG ID will be considered in AS but only once. Then we are wondering why we consider the selected CAG ID in AS for only one time. Does that mean we treat the user’s choice as one shoot? I am not sure if that is the expectation of the manual CAG selection functionality. 3. As other company have already mentioned, we also agree that there is no SA2 requirement to prioritize the cells supporting the selected CAG ID in UE mobility. But there maybe two possibilities for the truth of “no SA2 requirement”, the first one is that SA2 has considered it comprehensively and determined that it is not essential for prioritize the manually selected CAG ID in UE mobility. The other possibility is that it is SA2’s oversight about the role of manually selected CAG ID in UE mobility. From my point of view, since we already have a consensus that selected CAG id is not essential for access control, if we think it is also not essential in UE mobility. Then I cannot figure out why SA2 should specify the feature “ Manual CAG selection”.   So we prefer to request a clarification from SA2/CT as following,  1. Should we prioritize manually selected CAG ID in UE mobility, including cell selection/reselection in idle/inactive and handover in connected mode?  2. If SA2 clarify that manually selected CAG ID does not need to be prioritize in UE mobility, we would like to know further about the purpose of the feature “manual CAG selection”. |
| ZTE | FFS | It depends on the answer to Q6a. |
| Qualcomm | A | Some responses to CATT’s comments above: We agree that manually selected CAG is the user’s preference. If the network wants the behaviour to be applicable with more persistence, network can update the allowed CAG list to include selected CAG ID.  Also agree with Huawei’s comment about complexity and Nokia’s comment about absence of requirements. |
| Apple | Option B | We don’t see a reason to override the manual “user” preference |
| Lenovo | Option A |  |
| Futurewei | Option A | LS can be sent to SA2 and CT1 to let them check if it is consistent with the expected use of manual selection. |
| Samsung |  | We are not sure what the question is trying to address. You state “**After performing access on the manual selected CAG,**”. We understand this as UE has triggered registration according to the scenario in Q6a.  So what UE behaviour are you looking for ? |
| Sony |  | It depends on CAG list priority. |
| Ericsson | Option A | The UE’s allowed CAG list will be updated when the UE registers to the selected network after the initial cell selection. |

Given the split of opinions including different views on desired behaviors, it is recommended that following is postponed to a future meeting.

**Proposal 6.2: Postpone the discussion of the following: After performing access on the manual selected CAG, which one of following two UE behaviours is used:**

**a. UE reselects a cell belong to allowed CAG list.**

**b. UE shall prioritize to reselect a cell supporting selected CAG ID, but also can consider cells belonging to allowed CAG list in case that cells supporting selected CAG ID is not available.**

Following question is based on a proposal in [8].

**Question 6c: For RRC\_IDLE/RRC\_INACTIVE UE in manual CAG/SNPN mode, should UE AS inform the NAS if UE AS can’t search for an acceptable or suitable cell belonging to the selected CAG/SNPN?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **comments** |
| Huawei | No | We don’t see why NAS cares about this. If reported, what is the intended behaviour of NAS? |
| Nokia | Yes | The NAS should select another CAG ID, and inform AS about it, otherwise no CAG ID specific UAC can be performed in AS |
| Intel | Yes | See our response to 6b. Basically it is to inform the NAS/user that the selected CAG ID cannot be found. The NAS/user can decide what to do next either via manual or automatic selection. |
| CATT | Yes | UE AS should prioritize to reselect to a cell supporting selected CAG ID, and should inform the NAS if UE AS can’t search for an acceptable or suitable cell supporting the selected CAG ID |
| ZTE | Yes |  |
| Qualcomm | Yes | Agree with Intel’s comment. |
| Apple | Yes | Agree with Intel too |
| Lenovo | Yes |  |
| Futurewei | No | Manual selection doesn’t just involve NAS, it also involves user to provide instruction. And when UE is in RRC\_IDLE/RRC\_INACTIVE state, the user is probably not using the UE. Hence, there is no point to report that the selected CAG/SNPN is not available, but rather AS should report the found CAG/SNPN to NAS. |
| Samsung | Yes with the intention | In the scenario of Q6c, the UE cannot trigger registration procedure since the cell does not meet S criterion.  This detailed AS-NAS interaction we do not specify |
| Sony | Yes |  |
| Ericsson | Yes | The out-of-coverage indication from AS to NAS seems to be there also for PLMNs since we have this statement in 38.304:  “If the UE loses coverage of the registered PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of available PLMNs is given to the user so that a manual selection can be performed (manual mode).”  We don’t seem to specify the detailed interaction though. |

Following proposal has support from a significant majority.

**Proposal 6.3: For RRC\_IDLE/RRC\_INACTIVE UE in manual CAG/SNPN mode, UE AS informs the NAS if UE AS can’t search for an acceptable or suitable cell belonging to the selected CAG/SNPN.**

## 2.7 NPN-only cell definition update

Next question is based on proposal 11 from R2-2001676.

**Question 7: Should NPN-only cell definition be updated as follows: A cell that is only available for NPNs’ subscriber. This is indicated by setting the *cellReservedForOtherUse* IE to true while the *npn-IdentityInfoList-r16* IE is present in *CellAccessRelatedInfo*.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **comments** |
| Huawei |  | The definition given seems to be identical to the definition in the current 331 running CR (R2-2001035):  NPN-only Cell: A cell that is only available for NPNs’ subscriber. This is indicated by setting the *cellReservedForOtherUse* IE to true while the *npn-IdentityInfoList-r16* IE is present in *CellAccessRelatedInfo*.  We think the definition is ok, but didn’t see the updates. |
| Nokia | Yes |  |
| Intel | Yes |  |
| CATT | No | The definition for NPN-only Cell should be independent with the value of *cellReservedForOtherUse* IE, and UE can identify whether a cell is a NPN-only Cell by dummy PLMN. |
| Asia Pacific Telecom (APT) | Yes |  |
| ZTE | Yes |  |
| Qualcomm | Yes | Share Huawei’s views. |
| Apple | Yes |  |
| Lenovo | Yes |  |
| Futurewei | Yes | We are fine with the proposed definition. |
| Samsung | Yes |  |
| Sony |  | This is related to emergency call handling and should be discussed together. |
| Ericsson | Yes |  |

The following has support from a substantial majority.

**Proposal 7: RAN2 confirms following definition for NPN-only cell: A cell that is only available for NPNs’ subscriber. This is indicated by setting the *cellReservedForOtherUse* IE to true while the *npn-IdentityInfoList-r16* IE is present in *CellAccessRelatedInfo*.**

## 2.8 High quality SNPNs

Next question is related to the following proposal 14 in R2-2001676 (from [19]). Introducing notion of high quality SNPNs will likely have CT1 impacts as current TS 23.122 does not use it.

**Question 8: Should high quality criteria be applicable to SNPNs?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **comments** |
| Huawei | No | We think this issue can be postponed. |
| Nokia | No | In the PLMN selection process, priority is as follows: (E)HPLMN -> VPLMNs in the lists in the USIM -> high quality PLMNs -> non-high quality PLMNs. In the SNPN selection process, such prioritization is not available because there is no concept of equivalent SNPN or roaming. That is the reason that CT1 has not specified high quality SNPN in TS 23.122. |
| Intel | No |  |
| CATT | No | CT1 has not specified high quality SNPN in TS 23.122. |
| SoftBank | No | No requirements. |
| Asia Pacific Telecom (APT) | No |  |
| ZTE | No | The high-quality definition is used when there are multiple candidate PLMNs, the UE can prioritize the PLMN with the high quality, but for the SNPN, in the 23.122, it has said that for the subscribe SNPN list, the order of SNPN is UE implementation. We don’t need to define high quality in AS. |
| Qualcomm | No | This will involve a lot of work and cross-WG impacts. |
| Lenovo | No | High quality signal for SNPN selection is not defined in TS 23.122. |
| Futurewei | No | This can be postponed to later release, as it needs cross-TSG works. |
| Samsung | No |  |
| Sony | No |  |
| Ericsson | ? | This should be something that is decided by CT1 since it is the NAS layer that uses the high-quality indication. |

Following has unanimous support.

**Proposal 8: High quality criteria is not considered for SNPNs in Rel-16.**

## 2.9 Grouping CAG identities of same PLMN identity

Next question is related to issue of restrictions on grouping CAG identities of same PLMN identity discussed in [11], [21] and [28].

**Question 9: Should all CAG identities associated to the same PLMN identity be listed in the same *cag-IdentityList*?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **comments** |
| Huawei | Yes | This is in line with our understanding of the following agreement from #107b:   1. SIB1 allows indication of TAC, RANAC, cellIdentity for each CAG. FFS on other IEs. The fields are indicated per PLMN-ID. FFS whether Rel-15 IEs or Rel-16 IEs are used for the indication. |
| Nokia | No | There is no requirement or technical reason to introduce this type of restriction. |
| Intel | Yes | We do not see a motivation of doing differently |
| CATT | Yes | The same view with Huawei |
| SoftBank | No | It is practical scenario that a PLMN operator deploys different CAG networks located in physically isolated area (belonging to the same PLMN but having different CAG-IDs). Should we really include all CAG-IDs in the same CAG list even in this case? The proposal seems to prevent the above scenario. From operator’s point of view, no need to add such a restriction. |
| Asia Pacific Telecom (APT) | Yes | It can reduce signalling overhead. |
| ZTE | No strong view | We don’t have strong opinion on it, we think it’s up to operators. |
| Qualcomm | No | We don’t see any benefits of the restriction with respect ot either ASN.1 complexity or UE logic complexity. Hence, we agree with Softbank that restriction should not be placed.  @APT: our understanding is that the low-overhead configuration is still allowed (ie, listing multiple CAGs under same CAG identity list) |
| Apple | Yes | Don’t see a benefit in separating the CAG List |
| Lenovo | Yes | In RAN sharing scenario we think that PLMNs (HPLMN/VPLMN) may use different sets of CAG-IDs. |
| Futurewei | Yes | It is aligned with the current agreement, and there doesn’t seem to be any issue – we don’t understand Softbank’s concern, as it is broadcast in a cell’s SIB1. |
| Samsung | Yes |  |
| Sony | Yes |  |
| Ericsson | Yes | We don’t see a motivation for doing differently. |

Following is based on significant majority’s view.

**Proposal 9: All CAG identities associated to the same PLMN identity is listed in the same cag-IdentityList.**

## 2.10 Prioritization of CAG cells

Next question is related to the proposal 16 in R2-2001676 from [15].

|  |
| --- |
| **Proposal 16: To facilitate the cell reselection from a non-CAG cell to a CAG cell, the highest ranked cell or best cell acc. to absolute priority reselection rules should not be applied by the CAG-capable UE.** |

**Question 10: Should CAG-capable UE be able to reselect to a CAG member cell ignoring highest ranked cell or best cell acc. to absolute priority reselection rules?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **comments** |
| Huawei | No | This is contradicting the agreements from #108:   1. UE follows dedicated frequency priorities as in legacy behaviour. If UE run autonomous cell search and at the same time have dedicated frequency priorities, the result from autonomous cell search should not go against that indicated by dedicated frequency priorities (when they are valid). |
| Nokia | No | There is no requirement to prioritize CAG cells over non-CGA cells. Doing so might increase interference. |
| Intel | No | Cell reselection criteria should be followed. |
| CATT | No | The same view with Huawei |
| SoftBank | No | No requirements. |
| Asia Pacific Telecom (APT) | No | The highest ranked cell or best cell acc. to absolute priority reselection rules may be combined together with the cell reselection from a non-CAG cell to a CAG cell. |
| ZTE | FFS | We think this issue is related to the cell-level reseletion priority.  In LTE, there is a similar discussion on the CSG based on the following paper in #63bis meeting.  R2-085381: Qoffsets for CSG Cells Qualcomm Europe Disc  And there was a common understanding that the cell specific Qoffset in LTE is to prioritize some cells, such as CSG cells. Similarly, we can also prioritize some NPN cells by Qoffset to achieve the same purpose as in this question.  However, we also find that for the cell is shared by both the public network and the non-publich network, it would be hard to set cell specific Qoffset.  If we include the neighbor NPN cells with the cell specific Qoffset into the legacy neighbor cell list, the legacy UE and the NPN UE will refer to the same Neighbor cell list, then the legacy UE may get the higher rank for some NPN cells and read the corresponding SIB1 unnecessarily.  Thus, it’s better to add a new Neighcell list for the NPN, then the normal UE and the NPN UE can refer to the Neighbor cell lists accordingly. |
| Qualcomm | No | We prefer to follow operators’ views on this. |
| Apple | No | No need to override reselection criteria |
| Lenovo | Yes | Referring to Huawei comment above: we understood that when the referenced agreement was made only the mobility within CAG cells was considered. However, we are considering the scenario where the CAG-only indication is not configured so that the UE camps on a public cell due to a temporary unavailability of a suitable CAG cell. Due to the fact that the UE is configured with a non-empty CAG list we assume that for cell reselection the UE should always prioritize CAG cells over non-CAG cells. Otherwise, the UE may still camp on the public cell if a suitable neighbouring CAG cell is not the highest ranked cell. We think that this behaviour may not meet user expectation for using CAG. |
| Futurewei | No | It is not aligned the current agreement, and it needs clearer requirement and across-TSG efforts to make it right. |
| Samsung | No |  |
| Sony | No |  |
| Ericsson | No |  |

Following has support from a significant majority.

**Proposal 10: CAG-capable UE is not allowed to reselect to a CAG member cell ignoring highest ranked cell or best cell acc. to absolute priority reselection rules**

## 2.11 More granularity for inter-frequency carrier info in SIB4

Next question is related to the proposal 17 in R2-2001676 based on (opposing views in) proposals in [8] and [18]:

**Question 11: Should NID/CAG ID or network type indicator be broadcast along with the inter-frequency carrier info in SIB4?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **comments** |
| Huawei | Yes | We think it can help UE determine whether the neighbour cell is a CAG member cell or not. The question is also related to Q5a. |
| Nokia | No | This is an optimization that might be introduced later. |
| Intel | No | It is not essential for Rel-16 |
| CATT | Yes | This feature is beneficial for UE to fast evaluate whether a neighbour cell is a candidate cell or not. |
| SoftBank | No | It is not essential for Rel-16. |
| Asia Pacific Telecom (APT) | Yes | NPN should also support inter-frequency cell reselection, which is a mandatory feature. |
| ZTE | No | We don’t think it’s necessary to introduce such optimization.Besides, if indicted does it mean that the NPN UE will consider these frequencies with a littler higher priority, but it has been agreed that  “no new mechanism is introduced to handle the priority of a frequency layer of a CAG cell on which the UE is camped (beyond what cellReselectionPriority provides in SIB4 and in RRCRelease).” |
| Qualcomm | No | It is not essential for Rel-16 |
| Apple | Maybe | We need a clarification on if this question is for Licensed or Unlicensed specturms. For Unlicensed the answer would be “yes” for NID |
| Lenovo | No | We think it would result in much signalling overhead. The NPN-capable can be considered to be able to read SI. |
| Samsung | No | Agree with Nokia and Intel |
| Sony | No | No for Rel-16 |
| Ericsson | No | We don’t see a strong need for this. We also don’t do this for PLMNs sharing the same cell. |

Following is based on majority’s views.

**Proposal 11: No enhancement in Rel-16 to include NID/CAG ID or network type indicator along with the inter-frequency carrier info in SIB4.**

## 2.12 ASN.1 reading and processing capabilities

Next question is based on proposal 20 in R2-2001676 related to ASN.1 reading and processing capabilities. It is related to some of the previous questions (e.g., 2, 3c).

**Question 2: Please indicate your preferred option(s):**

1. **Rel-16 UEs that are not NPN-capable can read and act on all NPN related IEs in Rel-16 ASN.1**
2. **Rel-16 UEs that are not NPN-capable can read all NPN related IEs in Rel-16 ASN.1 but cannot take actions based on some IEs. Actionable IEs and related actions FFS.**
3. **Rel-16 UEs that are not NPN-capable can read all NPN related IEs in Rel-16 ASN.1 but cannot take actions based on it.**
4. **Other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option(s)** | **comments** |
| Huawei | a | We think a) is simple. |
| Nokia | B (A is also OK) | Non-NPN capable UEs should only support the actions that are needed for emergency services. Others could be optional. Option A is also acceptable. |
| Intel | d | **Rel-16 UEs that are not NPN-capable knows the presence of all NPN related IEs in Rel-16 ASN.1 but does not know its definition and does not take actions based on it.** |
| CATT | b or c | Non-NPN capable R16 UE should be treated as R15 UE, all R16 UEs can read R16 introduced IE, but Non-NPN capable R16 UE will ignore some IEs even if they can read it. |
| SoftBank | c or b | Option c is baseline. For option b, we currently don’t see any actionable IEs but it depends on the further analysis. |
| Asia Pacific Telecom (APT) | c |  |
| ZTE | d | **Rel-16 UEs that are not NPN-capable knows the presence of all NPN related IEs in Rel-16 ASN.1 but does not know its definition and does not take actions based on it.**  There is no need for the Rel-16 UEs that are not NPN-capable to read the NPN related IEs. For example; if the cellReservedForOther use is true (such as SNPN-only cell), it can take this cell as barred. If there is only dummy plmn ID (such as CAG only cell) in the legacy PLMN list, it can camp on this cell with limited service. |
| Qualcomm | b | We are okay with all R16 UEs reading all NPN IEs.  But, the actionable IEs and related actions could be discussed after identifying desired behaviours (being discussed in other questions). For instance, if we agree to (b) in Q2, then we are implicitly assuming that non-NPN capable UEs can perform the following action: determine if npn-IdentityInfoList-r16 is broadcast. |
| Apple | d | We need clarification on if it is an ASN.1 syntax issue on NPN IEs. Also define “Action” – does “ignore” mean it is an action ? |
| Lenovo | d | It is left to UE implementation whether to act on NPN related IEs. |
| Futurewei | B | B can be starting point and after case-by-case analysis of IEs we may end up a or c. |
| Samsung | d | Agree with Intel view |
| Sony | C or d |  |
| Ericsson | d | Agree with Intel |

Given the split in views, it is recommended to postpone the discussion of the above issue. Also, there may be more clarity on the issue as other issues related to NPN are resolved.

**Proposal 12: RAN2 to discuss capability for NPN-related ASN.1 reading and actions in next meeting.**

# 3 Rapporteur's list of proposals (initial intermediate deadline)

## 3.1 Proposals with unanimous support

Following proposals had unanimous support in previous discussion.

**Proposal 2.1: When a cell broadcasts any CAG IDs or NIDs, NPN-capable Rel-16 UE can treat the cell with cellReservedForOtherUse = true as a candidate during cell selection and cell reselection.**

**Proposal 3.2: For CAG-capable Rel-16 UE, emergency calls in a CAG-only cell can be supported by setting *cellReservedForOtherUse=true* and allowing the Rel-16 Ues to ignore this flag and access the PLMNs in the NPN list in limited service state.**

**Proposal 8: High quality criteria is not considered for SNPNs in Rel-16.**

**QA. Do you OPPOSE any of the proposals above?**

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| **Company** | **List of proposals you oppose** | **Justification for opposition** | **Suggestions for way forward** |
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## 3.2 Proposals with support from significant majority

This section focuses on proposals that had support from significant majority. Given that this section focuses on proposals with support from s

**QB. Please indicate if you OPPOSE the following proposal.**

**Proposal 2.2: Non-NPN-capable Rel-16 UE treat a cell with cellReservedForOtherUse = true as barred.**

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| **Company** | **Justification for opposition** | **Suggestions for way forward** |
| QC | Creates different behavior for emergency calls by UEs of the same release. | **Problem with proposal 2.2**: Consider the following case. PLMN1 and PLMN2 are sharing a cell, with PLMN2 participating only as CAG and PLMN1 participating as an open cell. A subscriber of PLMN2 that is CAG capable will select PLMN2 for emergency call, while a subscriber of PLMN2 that is not CAG capable will select PLMN1. The CAG non-capable subscriber may not be able to be authenticated on PLMN1 resulting in an unauthenticated emergency call.  For Rel-15 UEs this is unavoidable,  but for the Rel-16 UEs, it is possible to solve this problem by CAG non-capable UEs to have the same behavior as CAG-capable UEs with empty whitelist.  **Way forward:  Non-NPN-capable Rel-16 UE treat a cell with cellReservedForOtherUse=true as barred. *FFS if there is an exception when a Non-NPN-capable UE is placing an emergency call on a cell that is not suitable due to CAG*** |
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**QC. Please indicate if you OPPOSE the following proposal.**

**Proposal 4.1: For unlicensed spectrum and a UE in SNPN AM, if the highest ranked cell or best cell according to absolute priority reselection rules is a cell which is not suitable due to not broadcasting the registered or selected SNPN ID, the UE shall not consider this cell as candidate for cell reselection but should continue to consider other cells on the same frequency for cell reselection.**

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| **Company** | **Justification for opposition** | **Suggestions for way forward** |
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**QD. Please indicate if you OPPOSE the following proposal.**

**Proposal 4.3: UE in SNPN AMdoes not ignore *intraFreqReselection* broadcast by a SNPN cell in licensed spectrum.**

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| **Company** | **Justification for opposition** | **Suggestions for way forward** |
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**QE. Please indicate if you OPPOSE the following proposal.**

**Proposal 5.1: UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2, but may exclude CAG cells that are known by the UE not to be CAG member cells.**

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| --- | --- | --- |
| **Company** | **Justification for opposition** | **Suggestions for way forward** |
| Ericsson | Excluding non-member cells in the ranking will result in that the UE selects a non-best cell within a frequency which will cause inter-cell interference. | This proposal and proposal 5.4 should be discussed together since they are related.  In our view we should always try to ensure that the UE camps on the best cell within a frequency. If the best cell is unsuitable the UE should not consider other intra-frequency cells but it should only consider inter-frequency cells. |
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**QG. Please indicate if you OPPOSE the following proposal.**

**Proposal 5.2: UE not in SNPN AMdoes not ignore *intraFreqReselection* broadcast by a CAG cell in licensed spectrum.**

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| **Company** | **Justification for opposition** | **Suggestions for way forward** |
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**QH. Please indicate if you OPPOSE the following proposal.**

**Proposal 5.4: for a UE with non-empty allowed CAG list, if the highest ranked cell or best cell according to absolute priority reselection rules is a CAG cell which is not suitable due to not being a CAG member cell, the UE shall not consider this cell as candidate for cell reselection but shall continue considering other cells on the same frequency for cell reselection.**

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| --- | --- | --- |
| **Company** | **Justification for opposition** | **Suggestions for way forward** |
| Ericsson | This will result in that the UE selects non-best cell within a frequency which will cause inter-cell interference.  For example, a UE may be located inside a factory but connect to a cell that lies outside the factory. This would disturb the UEs inside the factory which are connecting to the factory cell:   * The outside cell has to use higher transmit power to reach the UE which causes DL interference to the factory Ues.   The UE has to use higher transmit power to reach the outside cell which causes UL interference to the factory Ues. | We should follow the same behaviour as we have for PLMNs.  For licensed spectrum the UE does not consider other cells on a frequency if the highest ranked cell on the frequency is unsuitable due to not being a CAG member cell (the restriction is removed after T seconds).  For unlicensed spectrum the UE is allowed to consider other intra-frequency cells if the highest ranked cell is unsuitable due to not belonging to the selected/registered/equivalent PLMN. This is the behaviour in NR-U. |
| Intel | We are not opposing the proposal | For Proposal 5.4, it covers only the case where a frequency is shared between CAGs. In our response to the offline discussion related to this (as well as in our contribution R2-2001170), we also mentioned the case of RAN sharing where CAG and PLMN/SNPN share the same frequency, which is currently not covered by the proposal.  This case happens when the CAG UE moves from the CAG cell to the PLMN cell and will not be able to get back if other cells within the frequency become not cell reselection candidate. We think this needs to be discussed as well.  It would be good if we can add an FFS for this. |
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**QI. Please indicate if you OPPOSE the following proposal.**

**Proposal 6.1: AS and NAS operate as discussed below during *manual* CAG selection:**

* **#1. As part of AS-NAS interface, NAS optionally provides AS with *allowed CAG list*.**
* **#2. Upon triggering of manual CAG selection by NAS, AS scans *all* carrier frequencies and obtains PLMNs and CAG IDs broadcast by found cells. Note that UE does not take *allowed CAG list* into accountin this step.**
* **#3. AS provides the found PLMNs and CAGs to NAS, and optionally the associated HRNN if provided by NG-RAN.**
* **#4. NAS selects a CAG ID and provides AS with the selected CAG ID (and the selected CAG ID can be in or out of allowed CAG list optionally provided before).**
* **#5. With cell selection, the UE select a cell belonging to the selected PLMN and the selected CAG ID. Note that UE does not take *allowed CAG list* into accountin this step. UE is allowed to access a cell which fulfils the cell selection criteria and is not barred or reserved for operator use for UEs not belonging to Access Identities 11 or 15 and inform NAS that access is possible (for location registration procedure).**

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| --- | --- | --- |
| **Company** | **Justification for opposition** | **Suggestions for way forward** |
| Ericsson | It is simpler if NAS adds the selected CAG ID to the allowed CAG list and then only provides the Allowed CAG list to AS. In this way manual and automatic CAG selection would look identical from AS pov. | Send an LS to CT1 and let them decide which option they prefer for the AS-NAS interaction during manual CAG selection:   1. NAS provides the manually selected CAG ID to AS and then AS uses the selected CAG ID only for the initial cell selection. 2. NAS adds the manually selected CAG ID to the Allowed CAG list and provides to AS which uses it for the initial cell selection.   It also seems companies have different understanding whether the manually selected CAG ID is only used by the UE during the initial cell selection or whether the UE also prioritizes this CAG ID in subsequent cell selections/re-selections (see Q6b and P6.2). This may also be a question that we could ask CT1 in the LS. Our understanding is that the manually selected CAG ID only plays a role in the initial cell selection. |
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**QJ. Please indicate if you OPPOSE the following proposal.**

**Proposal 6.3: For RRC\_IDLE/RRC\_INACTIVE UE in manual CAG/SNPN mode, UE AS informs the NAS if UE AS can’t search for an acceptable or suitable cell belonging to the selected CAG/SNPN.**

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| **Company** | **Justification for opposition** | **Suggestions for way forward** |
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**QK. Please indicate if you OPPOSE the following proposal.**

**Proposal 7: RAN2 confirms following definition for NPN-only cell: A cell that is only available for NPNs’ subscriber. This is indicated by setting the *cellReservedForOtherUse* IE to true while the *npn-IdentityInfoList-r16* IE is present in *CellAccessRelatedInfo*.**

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| --- | --- | --- |
| **Company** | **Justification for opposition** | **Suggestions for way forward** |
| CATT | It will restrict the REL15 UE and Non-NPN-capable Rel-16 UE to access the CAG only for emergency service as REL15 UE and Non-NPN-capable Rel-16 UE treat a cell with cellReservedForOtherUse = true as barred according to Proposal 2.2 | The definition of NPN-only cell should allow REL15 UE and Non-NPN-capable Rel-16 UE to access the CAG only cell for emergency service. |
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**QL. Please indicate if you OPPOSE the following proposal.**

**Proposal 9: All CAG identities associated to the same PLMN identity is listed in the same cag-IdentityList.**

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| **Company** | **Justification for opposition** | **Suggestions for way forward** |
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**QM. Please indicate if you OPPOSE the following proposal.**

**Proposal 10: CAG-capable UE is not allowed to reselect to a CAG member cell ignoring highest ranked cell or best cell acc. To absolute priority reselection rules**

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| **Company** | **Justification for opposition** | **Suggestions for way forward** |
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## 3.3 Proposals with support from a majority (not a significant majority)

Following proposals had a majority but not a significant majority.

**QN. Do you OPPOSE following proposal?**

**Proposal 1: PCI values for CAGs are signalled per PLMN per frequency. FFS whether per CAG-ID signalling is allowed. PCI values are signalled as a list of ranges.**

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| **Company** | **YES/NO** | **Comments** |
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**QO. Do you OPPOSE following proposal?**

**Proposal 3.1: RAN2 confirms that emergency call is possible using the following for *any* Rel-16 UE on a cell that provides normal services only to UEs accessing CAGs:** **by setting *cellReservedForOtherUse = false* and if a PLMN ID without CAG list is broadcast and that PLMN is "not allowed" (e.g. by use of PLMN ID for which all registration attempts are rejected such that the PLMN ID becomes not allowed).**

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| **Company** | **YES/NO** | **Comments** |
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**QP. Do you OPPOSE following proposal?**

**Proposal 4.2: For licensed spectrum and a UE in SNPN AM, if the highest ranked cell or best cell according to absolute priority reselection rules is a cell which is not suitable due to not broadcasting the registered or selected SNPN ID, the UE shall not consider this cell as candidate for cell reselection but should continue to consider other cells on the same frequency for cell reselection.**

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| --- | --- | --- |
| **Company** | **YES/NO** | **Comments** |
| Ericsson | Yes | For SNPNs we should follow the same behaviour as we have for PLMNs. |
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**QQ. Do you OPPOSE following proposal?**

**Proposal 11: No enhancement in Rel-16 to include NID/CAG ID or network type indicator along with the inter-frequency carrier info in SIB4.**

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| **Company** | **YES/NO** | **Comments** |
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## 3.4 Proposals for postponement

Following proposals are potential candidates for postponement due to split in opinions.

**Proposal 4.4: Postpone the discussion of the following: should the field *intraFreqReselection* in MIB message broadcast by a SNPN cell not in licensed spectrum be ignored or not by a UE in SNPN AM?**

**Proposal 5.3: Postpone the discussion of the following: should the field *intraFreqReselection* in MIB message broadcast by a CAG cell not in licensed spectrum be ignored or not by a UE not in SNPN AM?**

**Proposal 6.2: Postpone the discussion of the following: After performing access on the manual selected CAG, which one of following two UE behaviours is used:**

**a. UE reselects a cell belong to allowed CAG list.**

**b. UE shall prioritize to reselect a cell supporting selected CAG ID, but also can consider cells belonging to allowed CAG list in case that cells supporting selected CAG ID is not available.**

**Proposal 12: RAN2 to discuss capability for NPN-related ASN.1 reading and actions in next meeting.**

**QP. Do you DISAGREE with postponement of any of the proposals mentioned in this section? If yes, please justify.**

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| --- | --- | --- |
| **Company** | **List of proposals that should not be postponed** | **Comments** |
| CATT | Proposal 6.2 | As there are split views on the role of manually selected CAG ID in UE mobility, and actually manual CAG selection is a feature defined in NAS, it is the SA2/CT1’s responsibility to clarify the functionality of manual CAG selection including the role of manually selected CAG ID in UE mobility. So we prefer to request a clarification from SA2/CT as following,  1. Should we prioritize manually selected CAG ID in UE mobility, including cell selection/reselection in idle/inactive and handover in connected mode?  2. If SA2 clarify that manually selected CAG ID does not need to be prioritize in UE mobility, we would like to know further about the purpose of the feature “manual CAG selection”. |
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# 4 Summary

## (Further) set of proposals with full consensus, if any (agreeable over email)

TBD

## Set of proposals with almost full consensus to discuss in the follow up conference call

TBD

## Set of open issues and proposals to postpone to next meeting

TBD

## Open issues that should no longer be pursued

TBD

# 5 References

[*1] R2-2000025 Reply LS on Sending CAG ID in NAS layer (R3-197591; contact: Ericsson) RAN3 LS in Rel-16 NG\_RAN\_PRN To:SA3, SA2, RAN2 Cc:CT1*

*[2] R2-2000051 Reply LS on NPN clarifications (S1-193605; contact: Qualcomm) SA1 LS in Rel-16 Vertical\_LAN, NG\_RAN\_PRN To:SA2, RAN3 Cc:RAN2, SA3*

*[3] R2-2001310 PRN Running CR for TS 38.304 Qualcomm Incorporated CR Rel-16 38.304 15.6.0 0148 - B NG\_RAN\_PRN*

*[4] R2-2001311 Report for email discussion [108#71][PRN] Running 38.304 CR (Qualcomm) Qualcomm Incorporated discussion*

*[5] R2-2001035 Introducing the support of Non-Public Networks Nokia Hungary CR Rel-16 38.331 15.8.0 1468 - B NG\_RAN\_PRN-Core*

[6] R2-2000570 Emergency Calls in CAG-Only Cells Nokia (Rapporteur), China Telecom, Ericsson, Intel, Nokia Shanghai Bell, Vodafone, ZTE discussion Rel-16 NG\_RAN\_PRN-Core

[7] R2-2000003 Access Control about NPN CATT discussion Rel-16 NG\_RAN\_PRN-Core

[8] R2-2000004 Idle and Inactive Open Issues for NPN CATT discussion Rel-16 NG\_RAN\_PRN-Core

[9] R2-2000132 Support of emergency calls in NPN-only cells Ericsson discussion Rel-16 NG\_RAN\_PRN-Core

[10] R2-2000357 Remaining issues on the cell reselection ZTE Corporation, Sanechips discussion Rel-16 NG\_RAN\_PRN-Core

[11] R2-2000400 Proposals on Editor’s Notes of running RRC CR Nokia, Nokia Shanghai Bell discussion Rel-16 NG\_RAN\_PRN-Core

[12] R2-2000402 Handling of selected CAG ID in Idle/Inactive mode Nokia, Nokia Shanghai Bell discussion Rel-16 NG\_RAN\_PRN-Core

[13] R2-2000829 Blacklist/whitelist for PCI range signaling and stage-3 details Sony discussion Rel-16 NG\_RAN\_PRN-Core

[14] R2-2001170 Remaining mobility issues for idle mode and connected mode Intel Corporation discussion Rel-16 NG\_RAN\_PRN-Core

[15] R2-2001174 Open issues in the specification of NPN in TS 38.304 Lenovo, Motorola Mobility discussion Rel-16 NG\_RAN\_PRN-Core

[16] R2-2001376 General considerations on idle and inactive mode for NPN Huawei, HiSilicon discussion Rel-16 NG\_RAN\_PRN

[17] R2-2001423 Signalling Design on the PCI Range CMCC discussion Rel-16 NG\_RAN\_PRN-Core

[18] R2-2001526 Resolving miscellaneous issues LG Electronics France discussion NG\_RAN\_PRN-Core

[19] R2-2001527 High Quality Criterion for SNPN LG Electronics France discussion NG\_RAN\_PRN-Core

[20] R2-2001528 Manual CAG selection LG Electronics France discussion NG\_RAN\_PRN-Core

[21] R2-2001331 Open issues in NPN Qualcomm Incorporated discussion

[22] R2-2000005 Connected Mode Open Issues for NPN CATT discussion Rel-16 NG\_RAN\_PRN-Core

[23] R2-2000358 Consideration on the remaining Connected State Issues ZTE Corporation, Sanechips discussion Rel-16 NG\_RAN\_PRN-Core

[24] R2-2001071 Discussion on the proximity indication in connected mode vivo discussion R2-1916098

[25] R2-2001377 General considerations on connected mode for NPN Huawei, HiSilicon, China Telecom discussion Rel-16 NG\_RAN\_PRN

[26] R2-2001430 Access and mobility control for NPN CMCC discussion Rel-16 NG\_RAN\_PRN-Core

[27] R2-2001586 Remaining issues discussion on NPN China Telecom discussion Rel-16 NG\_RAN\_PRN-Core

[28] R2-2000130 Remaining RRC aspects of NPN Ericsson discussion Rel-16 NG\_RAN\_PRN-Core

# 6 Appendix

## Proposals from R2-2001676

Listed below are proposals from including proposals marked in ~~striked-out-green~~ font that were addressed already during online discussion.

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| Potential easy agreement  **~~Proposal 1: RRC\_INACTIVE state is supported for SNPN and CAG.~~**  **~~Proposal 2: Remove the following Editor’s Notes without introducing any other changes:~~**  ~~Editor's Note: The need for list of NIDs depends on the RAN sharing scenarios to be supported.~~  ~~Editor's Note: The support of sharing logical cells is FFS.~~  **Proposal 3: RAN2 confirm that For SNPN, *cellReservedForOperatorUse* is configured per SNPN, while for CAG, *cellReservedForOperatorUse* is configured per PLMN.**  **Proposal 4: When cell broadcasts any CAG IDs or NIDs and the cell status is indicated as "not barred" and "not reserved" for operator use and "true" for other use, and *cellReservedForFutureUse* IEis not indicated as “*true”*, all UEs shall treat this cell as candidate during the cell selection and cell reselection procedures. FFS on how to capture this in the specification accounting for whether a Rel-16 UE non-NPN capable UE is required to be able to read the NPN info broadcasted in the cell.**  **~~Proposal 5: ASN.1 and RRC design shall be such that a Rel-15 UE considers a CAG-only cell as acceptable cell if the cell is not barred to Rel-15 UEs, and if a PLMN ID without CAG list is broadcast and that PLMN is forbidden (e.g. by use of PLMN ID for which all registration attempts are rejected such that the PLMN ID becomes forbidden).~~**  **~~Proposal 9a: PCI range of SNPN cells can be optionally signalled to UEs.~~**  B) need further discussion  **Proposal 6a: Emergency calls for Rel-16 UEs (and Rel-15 UEs) in a CAG-only cell can be supported by setting cellReservedForOtherUse = false, and if a PLMN ID without CAG list is broadcast and that PLMN is forbidden (e.g. by use of PLMN ID for which all registration attempts are rejected such that the PLMN ID becomes forbidden). FFS whether/how NPN capability of UE impacts this.**  **Proposal 6b: Emergency calls for Rel-16 UEs in a CAG-only cell can be supported by setting cellReservedForOtherUse=true and and allowing the Rel-16 UEs to override this flag and access the PLMNs in the NPN list in limited service state. FFS whether/how NPN capability of UE impacts this.**  It is recommended that proposals 7, 8a-8c are discussed together given they are related.  **Proposal 7: The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2, but may exclude CAG-only cells that are known by the UE not to be CAG member cells. FFS whether this applies to CAG-cells other than CAG-only cells.**  **Proposal 8a: RAN2 to discuss if the field *intraFreqReselection* in MIB message is ignored or not for a cell in (a) licensed spectrum, (b) not in licensed spectrum.**  **Proposal 8b: For a UE with non-empty allowed CAG list, if the highest ranked cell or best cell according to absolute priority reselection rules is a CAG cell which is not suitable due to not being a CAG member cell and the cell is not in licensed spectrum, the UE shall not consider this cell as candidate for cell reselection but shall continue considering other cells on the same frequency for cell reselection. It is FFS whether this behaviour is applicable to licensed spectrum.**  **Proposal 8c: For a UE in SNPN AM, if the highest ranked cell or best cell according to absolute priority reselection rules is a cell which is not suitable due to not broadcasting the registered or selected SNPN ID or the CAG ID and the cell is not in licensed spectrum, the UE shall not consider this cell as candidate for cell reselection but should continue to consider other cells on the same frequency for cell reselection. It is FFS whether this behaviour is applicable to licensed spectrum.**  **~~Proposal 9b: RAN2 to the following options for how PCI range of SNPN is signalled:~~**   1. **~~The White list introduced in the NR-U and the Legacy black list can be used to indicate PCI range info for the SNPN [10, 13]~~** 2. **~~PCI-range signalled to UEs is defined as the legacy way, e.g. a single PCI list is signalled to UEs without any info associated to NPN ID/NPN type. [8]~~** 3. **~~PCI-range signalled to UEs is defined per NPN type, e.g. PCI-range signalled to UEs is indicated separately for SNPN/PNI-NPN [8]~~** 4. **~~PCI-range signalled to UEs is defined per NPN ID [8]~~** 5. **~~Separate PCI range list for CAG/SNPN cells, rather than black/white cell list. The PCI list contain one or a list of PCI range of RPN (mixed the CAG Cells and SNPN Cells) for a PLMN. [17]~~**   **Proposal 9c: RAN2 to the following options for how PCI range of CAG is signalled:**   1. **Both the PCI range list and related CAG ID can be signalled to UEs. [8, 16]** 2. **PCI-range signalled to UEs is defined as the legacy way, e.g. a single PCI list is signalled to UEs without any info associated to NPN ID/NPN type [8]** 3. **PCI-range signalled to UEs is defined per NPN type, e.g. PCI-range signalled to UEs is indicated separately for SNPN/PNI-NPN [8]** 4. **Reserve a list of PCI range per PLMN per frequency [10]** 5. **Reserve only one PCI range per PLMN per frequency [10]** 6. **Reserve only one PCI range per CAG ID per frequency [10]** 7. **Reserve a list of PCI range per CAG ID per frequency [10]** 8. **CAG PCI range is introduced as a list of blacklisted/whitelisted cells. No changes required to ASN.1 and NR-U CRs are the baseline.[13]** 9. **Separate PCI range list for CAG/SNPN cells, rather than black/white cell list. The PCI list contain one or a list of PCI range of RPN (mixed the CAG Cells and SNPN Cells) for a PLMN. [17]** 10. **Principles from E-UTRA can be inherited (cp. csg-PhysCellIdRange IE)**   **Proposal 10: RAN2 should discuss whether following can be used as a baseline:**  **AS and NAS operate as discussed below during *manual* CAG selection:**   * **#1. As part of AS-NAS interface, NAS provides AS with *allowed CAG list*.** * **#2. Upon triggering of manual CAG selection by NAS, AS scans *all* carrier frequencies and obtains PLMNs and CAG IDs broadcast by found cells. Note that UE does not take *allowed CAG list* into accountin this step.** * **#3. AS provides the found PLMNs and CAGs to NAS.** * **#4. NAS selects a CAG ID and provides AS with the selected CAG ID (and the selected CAG ID is separate from allowed CAG list provided before).** * **#5. With cell selection, the UE select a cell belonging to the selected PLMN and the selected CAG ID. Note that UE does not take *allowed CAG list* into accountin this step.** * **#6. As an outcome of the manual CAG selection procedure the UE is allowed to access a cell which fulfils the cell selection criteria and is not barred or reserved for operator use for UEs not belonging to Access Identities 11 or 15 and inform NAS that access is possible (for location registration procedure).** * **#7. After the completion of the manual CAG selection, RAN2 should select one from the following two UE behaviors:**   + **#7a. UE reselects a cell belong to allowed CAG list.**   + **#7b. UE shall prioritize to reselect a cell supporting selected CAG ID, but also can consider cells belonging to allowed CAG list in case that cells supporting selected CAG ID is not available.**   **Proposal 11: RAN2 to discuss if NPN-only cell definition needs to be updated as follows: A cell that is only available for NPNs’ subscriber. This is indicated by setting the *cellReservedForOtherUse* IE to true while the *npn-IdentityInfoList-r16* IE is present in *CellAccessRelatedInfo*.**  **Proposal 20: RAN2 to discuss whether a Rel-16 non-NPN capable UE is required to read the NPN identifier information broadcasted in SIB1 by a cell.**  C) a candidate for immediate postpone(at least to the second phase of the e-meeting), is contentious such that it is unlikely to converge at e-Meeting.  **~~Proposal 12: RAN2 to discuss if proximity indication is supported or not for CAGs.~~**  **~~Proposal 13: RAN2 to discuss whether EN-DC is supported in NPNs. If not, trackingAreaCode should be mandatory in NPN-IdentityInfo.~~**  **Proposal 14: It is FFS if high quality criteria applies to SNPNs.**  **Proposal 15: All CAG identities associated to the same PLMN identity shall be listed in the same *cag-IdentityList*.**  **Proposal 16: To facilitate the cell reselection from a non-CAG cell to a CAG cell, the highest ranked cell or best cell acc. to absolute priority reselection rules should not be applied by the CAG-capable UE.**  **Proposal 17: It if FFS whether the supported NID/CAG ID or network type indicator is broadcast along with the inter-frequency carrier info in SIB4.**  **Proposal 18: For RRC\_IDLE/RRC\_INACTIVE UE in manual CAG/SNPN mode, it is FFS whether the UE AS should inform the NAS if UE AS can’t search for an acceptable or suitable cell belonging to the selected CAG/SNPN.**  **Proposal 19: To confirm that all R16 UEs and onward are required to support identification of NPN cell that broadcasts NPN identity and thus be able to consider a cell broadcasting reservedForOtherUse set to TRUE and NPN ID as mobility candidate.** |

## Incoming LSs

Reply LS ‘Reply LS on Sending CAG ID in NAS layer‘ [1] from RAN3 replied as follows:

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| **1. Overall Description:**  RAN3 thanks SA3 for the LS on Sending CAG ID in NAS Layer.  RAN3 has discussed the SA3 proposal to protect the transfer of the selected CAG ID between the UE and the network and concluded that it is feasible from RAN3 point of view to perform initial access control without the UE providing any selected CAG ID to the network.  Further access control during mobility will be performed by NG-RAN based on PNI-NPN specific information provided in the mobility restriction list.  **2. Actions:**  **To SA3, SA2, RAN2 group.**  **ACTION: RAN3 asks SA3, SA2 and RAN2 to take RAN3’s finding into account and provide information about a final decision.** |

Reply LS ‘Reply LS on NPN clarifications’ [2] from SA1 replied as follows:

|  |
| --- |
| **1. Overall Description:**  SA1 thanks SA2 for their LS and query about private networks and CAG Identifiers.  Some highlights from the LS, relevant to SA1, are copied here:  …  SA2 would like to provide the following answers to the RAN3 questions:  For S-NPN:  Q1: RAN3 noticed that in TS 23.502 section 4.9.1.2.2 during Xn handover the target NG-RAN is specified to include the selected NID together with the selected PLMN in the NGAP Path Switch Request message.  RAN3 would like to ask what is the intended behaviour of the AMF upon receiving this information?  *SA2 Answer: The PLMN ID is included in the NGAP Path Switch Request message corresponding to the serving PLMN due to the possibility for 5GC to support multiple equivalent PLMNs. However, as equivalent SNPNs are not supported, i.e. the "PLMN ID and NID" do not change in case of Xn handover, SA2 agreed the attached CR to remove the NID from the Xn HO procedure.*  **For PNI-NPN**:  Q2: should we consider the case that the size of the UE allowed CAG ID could be so large that the AMF may need to filter it based on the CAG IDs supported in the (registration) area where UE is located?  *SA2 Answer: SA2 assumes that RAN3 is referring to the AMF signaling a UE's Allowed CAG list to NG-RAN as part of the Mobility Restrictions. As per current Stage 2 specifications, SA2 does not assume AMF to perform any filtering.*  ***However, SA2 invites SA1 to provide additional guidance on*** ***the number of CAG Identifiers per PLMN per UE to be supported.***  *…<skip text>…*  **To SA1 group. ACTION:** SA2 kindly ask SA1 to provide further guidance related to question 2, if possible.  Regarding PNI-NPNs and CAG IDs, the following SA1 considerations can be provided.  As documented in TS 22.261 clause 6.25.1, "Non-public networks are intended for the sole use of a private entity such as an enterprise".  Based on the use cases in the TRs (22.804, 22.830, 22.821 etc.) driving the normative requirements, for PNI-NPNs, typical enterprise deployment scenarios include NPNs for small-/medium sized enterprises (SMEs), e.g. factories, or NPNs deployed in the different branches of larger corporations.  These use cases suggest that a given UE might be a member of a small number of PNI-NPNs.  SA1 cannot provide an exact quantitative answer to the SA2’s question (on the number of CAG identifiers per PLMN per UE), since SA1 specifications do not define a maximum number of PNI-NPNs per PLMN to which UE is subscribed to. An estimation could be in the order of a few dozens. |

## Proposals from email discussion for Running 38.304 CR

Following proposals were identified as part of email discussion [108#71][PRN] Running 38.304 CR:

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| **Proposal 1: Void.**  **Proposal 2: RAN2 should discuss the following related to manual CAG selection:**   1. **Selected CAG ID is indicated from NAS to AS as a parameter separate from Allowed CAG list.** 2. **Selected CAG ID is used for cell selection immediately after manual CAG selection and not used subsequently (except if it is part of Allowed CAG list).** 3. **As an outcome of the manual CAG selection procedure the UE is allowed to access an acceptable cell which fulfils the cell selection criteria and is not barred or reserved for operator use for UEs not belonging to Access Identities 11 or 15 and inform NAS that access is possible (for location registration procedure).**   **Proposal 3: RAN2 should discuss the following two options about terminology:**   1. **Use “UEs not operating in SNPN access mode”.** 2. **Define PLMN access mode, and use “UEs operating in PLMN access mode” instead of “UEs not operating in SNPN access mode”.**   **Proposal 4: Void.**  **Proposal 5: RAN2 should discuss the following:**  **For a UE not operating in SNPN access mode, the AS need not report CAG-IDs to NAS in case UE does not have any non-empty “allowed CAG list”.**  **Proposal 6: RAN2 should discuss the following:**  **If a CAG ID is provided by NAS as part of PLMN selection, the UE shall search for an acceptable or suitable cell belonging to the provided CAG ID to camp on. When the UE is no longer camped on a cell with the provided CAG ID, AS shall inform NAS.**  **Proposal 7: RAN2 should discuss the following:**  **If a SNPN ID is provided by NAS as part of PLMN selection, the UE shall search for an acceptable or suitable cell belonging to the provided SNPN ID to camp on. When the UE is no longer camped on a cell with the provided SNPN ID, AS shall inform NAS.**  **Proposal 8: RAN2 should discuss the following two options:**  **Optoin a)** **UE shall exclude cells on the same frequency as the barred cell for cell selection/reselection based on *IntraFrequencyReselection* in the MIB.**  **Option b) If the highest ranked cell or best cell according to absolute priority reselection rules is a CAG cell which is not suitable due to not being a CAG member cell, the UE shall not consider this cell as candidate for cell reselection but shall continue considering other cells on the same frequency for cell reselection.**  **Proposal 9: RAN2 should discuss the following:**  **For a UE operating in SNPN AM, if the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable due to being part of the "list of 5GS forbidden TAs for roaming" or belonging to the selected SNPN or belonging to the registered SNPN, the UE shall not consider this cell and other cells on the same frequency, as candidates for reselection for a maximum of 300 seconds.**  **Proposal 10: RAN2 should discuss whether the exclusion below is mandatory or optional:**  **The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2, but may exclude CAG cells that are known by the UE not to be CAG member cells.** |

## Agreements from RAN2#108 (Nov 2019)

Agreements:

1. Access attempts by Rel-15 UEs for emergency services on CAG cell could be allowed based on operator's preference
2. cellReservedForOtherUse is used to prevent Rel-15 UEs to access the cell.
3. NPN information is outside PLMN-IdentityInfoList as a new Rel-16 IE for NPN-only cell and PLMN+NPN cell (the total number of network IDs is still 12)

Working assumption:

1. The new Rel-16 IE with a role similar to role of cellReservedForOtherUse for Rel-15 UEs is cell specific.

Agreements:

1. At least one of the following conditions must be satisfied for a cell to be considered as suitable by a Rel-16 UE not in SNPN AM:

a. Cell is part of either the selected PLMN or the registered PLMN or PLMN of the Equivalent PLMN list of the UE for which the PLMN-ID is broadcast by the cell with no associated CAG-IDs and for which CAG-only indication is absent or false;

b. Cell is part of either the selected PLMN or the registered PLMN or PLMN of the Equivalent PLMN list of the UE for which Allowed CAG list includes a CAG-ID broadcast by the cell.

2. Each SNPN-only cell is treated by Rel-16 UEs not in SNPN AM as if cell status is barred.

3. A CAG cell which is not considered as suitable can be an acceptable cell for a Rel-16 UE not in SNPN AM.

4. A PLMN-only cell or an SNPN+PLMN cell be an acceptable cell for a Rel-16 UE not in SNPN AM for which CAG-only indication is true for any PLMN-ID broadcast by the cell.

5. The following are necessary conditions for an SNPN cell to be considered as a suitable cell by a Rel-16 UE in SNPN AM:

a. the cell is part of either the selected SNPN or the registered SNPN of the UE;

b. the cell is part of at least one TA that is not part of the list of "Forbidden Tracking Areas" which belongs to either the selected SNPN or the registered SNPN of the UE

c. the cell is not barred,

d. the cell selection criteria in clause 5.2.3.2 are fulfilled.

Agreements:

1. Add the following note in TS 38.304 :

NOTE: UE is not required to support manual search and selection of PLMN or CAG or SNPN while in RRC CONNECTED state. The UE may use local release of RRC connection to perform manual search if it is not possible to perform the search while RRC connected.

2. In the UE on request of NAS, the AS shall scan all RF channels in the NR bands according to its capabilities to find available CAGs. On each carrier, the UE shall at least search for the strongest cell, read its system information and report available CAG ID(s) together with their HRNN (if broadcast) and PLMN(s) to the NAS. The search for available CAGs may be stopped on request of the NAS.

If NAS has selected a CAG and provided this selection to AS, the UE shall search for an acceptable or suitable cell belonging to the selected CAG to camp on.

3. In the UE on request of NAS, the AS shall scan all RF channels in the NR bands according to its capabilities to find available SNPNs. On each carrier, the UE shall at least search for the strongest cell, read its system information and report available SNPN identifiers together with their HRNN (if broadcast) to the NAS. The search for available SNPNs may be stopped on request of the NAS.”

1. All the R16 UEs will treat the cell as barred when the legacy IE cellReservedForOtherUse is set to “True” and this cell does not broadcast any CAG-IDs or NIDs.

Agreements:

1. Allow autonomous cell search even in situations when frequency priorities are broadcast in system information.
2. UE follows dedicated frequency priorities as in legacy behaviour. If UE run autonomous cell search and at the same time have dedicated frequency priorities, the result from autonomous cell search should not go against that indicated by dedicated frequency priorities (when they are valid).

Agreements:

1. From RAN2 point of view there is no requirement for CAG ID to be included in RRC signalling at RRC connection establishment.
2. For SNPN, include the SNPN ID in the RRCSetupComplete message. Stage 3 detalls are FFS
3. For SNPN, there is no need to include SNPN ID in the RRCResumeComplete message since the UE context is known to the network.
4. Send a LS to SA3 with Agreement#1 with SA2 and RAN3 in To.

## Agreements from RAN2#107bis (Oct 2019)

Agreements:

1. no new mechanism is introduced to handle the priority of a frequency layer of a CAG cell on which the UE is camped (beyond what cellReselectionPriority provides in SIB4 and in RRCRelease).
2. the UE can optionally implement an autonomous search function of CAG cells. FFS on the relationship with dedicated priorities.
3. reserving a PCI range for CAG cells is purely a deployment issue (does not need to be reflected in the spec)
4. the PCI list of CAG cells can optionally be signalled to UEs. FFS on details of the list
5. FFS whether proximity indication in CONNECTED mode is needed
6. no preliminary access check for CAG cells in CONNECTED mode. The Allowed CAG list is provided to the gNB by the AMF.
7. no new mechanism is introduced to handle the priority of a frequency layer of an SNPN cell on which the UE is camped (beyond what cellReselectionPriority provides in SIB4 and in RRCRelease).
8. There is no autonomous search function of SNPN cells.
9. reserving a PCI range for SNPN cells is purely a deployment issue (does not need to be reflected in the spec)
10. FFS whether PCI range of SNPN cells can optionally be signalled to UEs.
11. No proximity indication in CONNECTED mode is needed for SNPN.
12. no preliminary access check for SNPN cells in CONNECTED mode.

Agreements:

1. SIB1 of NPN-only cell prevents access attempts by Rel-15 UEs for normal services.
2. SIB1/MIB supports prevention of access attempts by Rel-15 UEs on a SNPN-only cell for emergency services.
3. SIB1/MIB supports prevention of access attempts by Rel-15 UEs on a CAG-only cell for emergency services (this does not mean that access attempts by Rel-15 UEs for emergency services on CAG-only cell are always not allowed. This is still FFS.The feasibility of allowing emergency services on CAG-only for Rel-15 UEs will be discussed in the email discussion on RRC aspects/SIB1 design)
4. Access attempts by Rel-15 UEs for emergency services on SNPN-only cell are not allowed.
5. In a NPN-only cell, access attempts for normal services by Rel-16 UEs without support for NPN is not allowed.
6. In a SNPN-only cell, access attempts for emergency services by Rel-16 UEs without support for SNPNs is not allowed.
7. For a PLMN+NPN cell, Rel-15 UEs should be able to access PLMNs associated with the cell for normal and/or limited service.
8. A new Rel-16 IE is needed with a role similar to role of *cellReservedForOtherUse*for Rel-15 UEs (FFS whether this will be PLMN specific)
9. SIB1 allows indication of TAC, RANAC, cellIdentity per SNPN (per PLMN ID + NID). FFS on other IEs. FFS whether Rel-15 IEs or Rel-16 IEs are used for the indication.
10. SIB1 allows indication of TAC, RANAC, cellIdentity for each CAG. FFS on other IEs. The fields are indicated per PLMN-ID. FFS whether Rel-15 IEs or Rel-16 IEs are used for the indication.

Working assumptions:

1. NPN information is outside PLMN-IdentityInfoList as a new Rel-16 IE for NPN-only cell and PLMN+NPN cell (the total number of network IDs is still 12)
2. Access attempts by Rel-15 UEs for emergency services on CAG-only cell could be allowed based on operator's preference

## Agreements from RAN2#107 (Aug 2019)

Agreements

1 The SNPNs (identified by PLMN ID + NID) are broadcasted in SIB1,

FFS whether this is achieved by extending the legacy network list or by introducing a new SNPN specific network list or both.

2 The size and format of the NID will not be discussed in RAN2 (we will be informed by other groups)

3 Up to 12 different SNPNs can be broadcasted in a cell.

4 If “mixed” network sharing is allowed (i.e. a cell can contain both PLMNs and NPNs), the total number of networks indicated in SIB1 (i.e. #PLMN + #SNPN + #PNI-NPN) shall not exceed 12.

5 If HRNN are broadcast then the HRNN should a be broadcasted in a separate SIB (i.e. different from SIB1).

6 SNPN selection functions similar to normal PLMN selection: AS reports the found SNPNs (identified by PLMN ID + NID) to NAS which selects the network. In case of manual selection, the human readable network name (if broadcasted) may also be provided from AS to NAS.

7 Once the UE has selected an SNPN, cell selection/re-selection is only performed within the SNPN, i.e. a cell is only considered suitable if the broadcasted SNPN identifier matches the selected SNPN.

Agreements

1 The PNI-NPNs (identified by PLMN ID + CAG ID) are broadcasted in SIB1

FFS whether this is achieved by extending the legacy network list or by introducing a new PNI-NPN specific network list or both

2 The size and format of the CAG ID will not be discussed in RAN2 (we will be informed by other groups)

3 Up to 12 different PNI-NPNs can be broadcasted in a cell.

4 If HRNN are broadcast then the HRNN should a be broadcasted in a separate SIB (i.e. different from SIB1).

5 Network selection is triggered by NAS whereby AS reports the available PNI-NPNs (identified by PLMN ID + CAG ID) to NAS which selects the network to use. In case of manual network selection, the human readable network name (if broadcasted) may also be provided from AS to NAS.

6 The Allowed CAG list and “CAG only” indication received from upper layers are taken into account in the cell suitability check during cell selection/re-reselection.

Agreements

1 There is no issue identified to support E1 for Rel-16 UEs.

2 (Regarding question E2) Rel-16 UEs not supporting the CAG feature can camp on a CAG cell as an acceptable cell to obtain limited service

3 There is no issue identified to support RS1 for Rel-16 UEs

4 RS2 and RS3 can be supported from RAN2 point of view

Excerpt from SA2 LS S2-1906814 [1] describing scenarios E1-E2 and RS1-RS3 mentioned in the above agreements are copied below:

|  |
| --- |
| SA2 discussed support of the following features for Rel-16 UEs:  1. Support for Emergency services in CAG cells.  2. RAN sharing between PLMNs and Non-Public Networks, including both Standalone NPNs (SNPNs) and Public Network Integrated Non-Public Networks (PNI-NPNs).  Regarding Emergency service in CAG cells:  E1: SA2 concluded that the UE should be allowed to camp for Emergency services for the case where UE supports the CAG feature, but is not authorized for any of the advertised CAG IDs.  E2: SA2 could not conclude whether Rel-16 UEs not supporting the CAG feature should be allowed to camp in a CAG cell in limited service state. There is no SA2 consensus to support this scenario.  Regarding RAN sharing:  RS1: SA2 concluded that the system architecture should support RAN sharing between a PLMN and an SNPN. This feature should be applicable to Rel-16 UEs that do not support the SNPN feature.  RS2: SA2 discussed support for RAN sharing between a PNI-NPN (with CAG) and an SNPN. This feature would be applicable to Rel-16 UEs that support either PNI-NPN with CAG or SNPN or both. However, concerns were raised about the additional complexity in the access stratum to support this scenario.  RS3: SA2 could not conclude whether the system architecture should support RAN sharing between a PLMN and a PNI-NPN with CAG i.e. RAN sharing in a cell that acts as a CAG cell for PLMN1 and as a non-CAG cell for PLMN2. There is no SA2 consensus to support this scenario. |