**3GPP TSG-RAN WG2 Meeting #109e R2-2002022**

**24 February – 6 March 2020**

**Agenda item: 6.2.3**

**Source: Qualcomm Incorporated**

**Title: Summary of NR-U Control Plane (AI 6.2.3.1 and 6.2.3.2)**

**Document for: Discussion and decision**

# Introduction

This document will capture the summary of contributions submitted to Agenda Items 6.2.3.1 and 6.2.3.2 and capture a baseline for further discussion via:

* [AT109e][503][NR-U] CP open issues (Qualcomm)

Scope:

* + - Identify/Summarize all remaining open issues related to Mobility and Others from AI 6.2.3.1 and 6.2.3.2 and seek companies feedback on the need to solve the critical issue and preferred solutions.

Intended outcome:

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals with almost full consensus and easy to agree
    - Set of open issues and proposals to postpone to next meeting.
    - Open issues that should no longer be pursued

Deadline for providing comments:

* + - Companies input: Thursday, Feb. 27th 18:00 CET
    - Rapporteur proposals: Friday, Feb. 28th 4:00 CET (one day for rapporteur to make conclusions)
    - Comments on proposals’ wording, Monday March 2nd by 17:00 CET

The new essential issues are prefixed by “E” and optimizations are prefixed by “O”.

The proposals here, after email discussion conclusion, will be color-coded per Session Chair instructions as follows:

* Green for easy agreements (obvious or there is consensus)
* Yellow if further online discussion is needed
* Blue if they should be discussed offline.

# Contributions on existing open issues

Many papers were submitted on issues which were already covered by the email discussion report in R2-2001437 where the companies provided input. These are listed as follows for completeness:

**Stopping of paging monitoring:**

R2-2000151 (Vivo): stop paging monitoring upon SI change or ETWS/CMAS indication

R2-2000336 (Ericsson): do not introduce a new bit for stopping the paging (i.e. revert the RAN2#108 agreement)

R2-2000418 (Oppo): stopPagingMonitoring bit in short message can be used to indicate that UEs either stop monitoring additional paging occasions or continue to monitor.

R2-2001548 (LG): UE stops monitoring further PDCCH monitoring occasion within the PO when any short message is received. Do not introduce the stopping indication in short message.

**Signaling of Q in MIB:**

R2-2000358 (Ericsson) proposes to define a new MIB instead of reusing the existing *ssbSubcarrierSpacingCommon* and possibly *ssb-SubcarrierOffset* with modified interpretations.

**Signaling of intra-cell guard bands:**

R2-2002673 (Nokia) proposes to “signal length of GB”.

**Signaling of interlaced waveform configuration:**

R2-2002672 (Nokia) proposes “single parameter, e.g. in BWP-UplinkCommon (suggested by Nokia) used by all useInterlacePUCH and useInterlacePUSCH parameters proposed by RAN1.

R2-2000964 (HW) proposes “Use one and only one parameter in BWP-UplinkConfigCommon to configure whether interlace is configured for the cell.”

# Contributions with easy agreements

R2-2000336 has proposed to confirm the relationship between SSBs and additional paging monitoring occasions. In particular, the following are proposed:

Proposal 1 Confirm in the chairman minutes that the SSB relation remains unchanged across the ‘X’ PMO subsets.

Proposal 2 Confirm that the legacy NR Rel-15 PO calculation is reused, i.e. the legacy set starts according to legacy, and the additional beam sweeping set(s) occupy the subsequent PDCCH monitoring occasions (PMOs).

The rapporteur thinks that these are obvious from the existing text in 38.304 and nothing new needs to be added to the specification. However, they can be agreed for even further clarification.

# Essential proposals which need further discussion

These are issues which need to be resolved for the completion of the Work Item.

### Issue E1: UE Capability

R2-2000150 (Vivo) has submitted a 38.306 CR, proposing to introduce two UE capabilities: one for 2-step RACH and one for RSSI/CO measurements. The second one has already been agreed by RAN2. R2-2000442 (MTK) also proposed to add capability for RSSI/CO measurements.

Even though RAN1 is still discussing UE features, it might be worthwhile to gather RAN2 feedback at least on the features introduced by RAN2, including:

1. Capability for 2-step RACH for NR-U. Note that 2-step RACH will have its own capabilities, so this should be for whether those are applicable to NR-U as well as other NR-U specific support such as no gap between preamble and PUSCH.
2. Capability for consistent UL LBT detection and recovery (can be separate for PCell, PSCell, and SCells)

**Please provide your opinion on whether UE capabilities should be introduced for above. Please list other UE capabilities if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | y | At least UE capabilities for above features should be introduced so that network may configure it to the UE (as for all other features). |
| **MediaTek** | Yes | UE capabilities of the features should be introduced. There should also be some basic capabilities, mentioning if UE can support (1) NR-U in downlink, (2) NR-U in uplink and (3) handle consistent LBT failure |
| Charter Communications | Yes | For 2-Step RACH, additional capabilities relevant to NR-U may be present for NR-U cells.  For UL LBT failure detection, agree the need for capabilities per cell-type. |
| LG | Yes | UE capabilities should be introduced for above. |
| **Intel** | Yes/No to 2-step RACH capability  Yes to UL LBT detection and recovery | For capability of 2-step RACH for NR-U, the current L1 feature list indicates that the 2-step RACH capability is on a per band. Hence we do not think an additional capability bit is needed here.  For the capability for consistent UL LBT detection and recovery, we would prefer that it is optional for all cases (SpCell and SCell) |
| Huawei | Yes | This can be considered as the baseline. There is no hurry for RAN2 to finalize it now. |
| **OPPO** | Yes for 2 | For 2-step RACH, I’m wondering whether it's enough to have capability in the 2-step RACH discussion, i.e., if UE indicates to support 2-step RACH, it can be applied to NR-U. Do we need to discuss feature by feature on whether 2-step RACH is applied? |
| **vivo** | Partially Yes | 1. There are some differences in 2-step procedure for licensed and unlicensed spectrum, e.g. From MAC perspective, if LBT fails for the preamble, the UE also cancels PUSCH transmission*.* Hence, we think it is necessary to introduce a separate capability for 2-step RACH support in NR-U.  2. In our understanding, consistent UL LBT detection and recovery is mandatory in NR-U without UE capability. |
| Ericsson | Prefer to discuss UE capabilities at the next meeting | 2-step RACH is also discussed as part of UE features in RAN1, and RAN1 will not discuss UE capabilities at this e-Meeting. We think it should be FFS.  We think that UE capabilities are not among the NEW CRITICAL OPEN Issues that were not identified in previous email discussions. |
| Nokia | YES for 2-step-RACH  NO for UL LBT | UL LBT failure detection and recovery should be mandatory for SpCell, the system is designed based on the assumption that all the NR-U UEs supports UL LBT with the counters not increased when LBT failure happens. Otherwise, the UE got stuck. If some UEs support LBT failure detection and some do not, it would be difficult to configure the RACH/RLF counters/timers which are common for all the UEs. |
| Asia Pacific Telecom (APT) | Yes | 2-step RACH on licensed spectrum and 2-step RACH on unlicensed spectrum may be different. Thus, if UE capability for 2-step RACH is supported, it is better to differentiate the 2-step RACH on licensed spectrum and 2-step RACH on unlicensed spectrum. |

**Summary:**

**Proposal.**

### Issue E2: Signaling of Q in SIBs

R2-2000338 proposes to introduce a new IE *SSB-QCL-RelationList* in SIB3 and SIB4 to carry the Q for each cell. In the current running CR, this IE is signaled per cell by using the existing *IntraFreqNeighCellList* in SIB2 and *InterFreqNeighCellList* in SIB4 are used.

**Do you support a new list for neighbour cells in SIB3 or SIB4 to include Q value or prefer to keep the current running CR option of re-using existing lists? Please list other options if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | n | prefer to keep the current running CR |
| **MediaTek** | No | Prefer to use re-use existing lists |
| Charter Communications | No |  |
| LG | No | keep the current running CR |
| **Intel** | Yes | As currently the q-Offset is mandatory in the existing list and it may not be needed in this case. |
| Huawei | No | The signalling does not need to be aligned in terms of ASN.1 per se between SIB3/4 and measObject. Prefer to keep the currentCR |
| **OPPO** | No | To us, the configuration in current running CR is already enough, not sure about the motivation why E/// needs to introduce another new list? |
| **vivo** | No | We prefer to keep the current running CR. |
| Ericsson | Yes | *IntraFreqNeighCellList* in SIB3 and *InterFreqNeighCellList* in SIB4 require the configuration of the cell-specific reselection offset, which is a mandatory parameter. Even though *Q-OffsetCell* can be set to db0, it requires signalling of 5 bits. Also the other 3 optionality bits need to be signaled.  Furthermore, using a separate list can also be easily used for the agreed Q signaling in the **MeasObjectNR**, where cell-specific reselection offsets are not relevant. |
| Nokia | No | We are ok with existing running CR which provides also Q value signalling per cell. |
| Asia Pacific Telecom (APT) | No | Keep the running CR |

**Summary:**

**Proposal.**

### Issue E3: Bands which can be both licensed and unlicensed

The regulations for 6Ghz band are still under discussion by the relevant agencies. One of the proposals for Europe is to use certain sections of 6Ghz band for licensed and the rest for shared spectrum. If this proposal gets through, it is feasible that a band can be licensed in certain parts of the world (e.g. Europe) while unlicensed in other parts (e.g. North America).

This was discussed in two papers:

R2-2000358 (Ericsson) proposes to define a new MIB for shared spectrum where the UE should attempt to decode both legacy and new MIB and use the one for which SIB decoding is successful. The rapporteur thinks that the same can be achieved with the legacy MIB with different interpretations of the fields as being discussed (so-called Alt 1-2 and Alt 1-4) so it is not clear if defining a new MIB helps in any way to solve this problem.

R2-2001469 (Oppo) proposes that *“RAN2 discusses whether it’s an issue that UE may not differentiate NR and NR-U for a given spectrum due to different spectrum allocation policy.”* and *“If the issue is confirmed, RAN2 discusses how to enhance MIB to solve it.”.*

There are several options as a way-forward for RAN2 on this, not mutually exclusive:

* Option 1: Wait for conclusion of regulations on 6Ghz band before making any decision
* Option 2: Wait for RAN1/RAN4 discussion on this, which can happen after conclusion of regulations. For example, RAN4 can introduce different channel rasters for licensed and shared spectrum which can solve this problem without any RAN2 procedural and ASN.1 impact. RAN1 can also potentially come up with a PHY based solution.
* Option 3: UE decoding both MIB options (either legacy MIB or new MIB) and uses SIB1 to determine the band status
* Option 4: Use the spare bit in MIB to differentiate shared and licensed spectrum

**Which Option do you prefer regarding the possible issue of 6Ghz being used for both licensed and shared spectrum?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | Option 2 |  |
| **MediaTek** | Option 2 | Agree with Samsung. We should wait for decision of RAN1/RAN4. |
| **Charter Communications** | Option 2 |  |
| **LG** | Option 2 |  |
| **Intel** | Option 2 |  |
| **Huawei** | Option2 |  |
| **OPPO** | Option 2 | We prefer to let RAN1/RAN4 to decide the way forward on this issue Regarding to the “for example”, it would be good to let RAN4/RAN1 to decide, since according to our RAN1 colleague, it seems sync raster can also achieve this purpose. Maybe we can simply delete the “for example” to avoid any impact on RAN1/RAN4 discussion. |
| **vivo** | Option2 | Same view with Samsung and MediaTek. |
| **Ericsson** | Option 3 or poposed option 5 | For option 1 and 2 we think that there is a high probability that 6 GHz regulations do not conclude before the 3GPP Rel-16 finalization.  We propose another option (5) as follows:  Check with RAN1 if they can define a new scrambling code for a new MIB. Then the UE does not need to check the decoding success of SIB1. This is based on an existing solution used for MIB-MBMS used for the broadcast mode in LTE. |
| **Nokia** | Option X | No changes are needed. We can keep legacy MIB with different interpretations. The “problem” is regarding only initial cell selection and not issues for connected mode or reselections as UE will be aware if carrier is unlicensed or not. For initial cell selection we don’t have performance requirements and UE can try both interpretations and once it decodes SIB1 it will get band number and know if the band is unlicensed or not. |
| Asia Pacific Telecom (APT) | Option 2 |  |

**Summary:**

**Proposal.**

### Issue E4: SIB1 decoding error

R2-2000443 (Nokia) discusses the FFS issue for UE behavior when SIB1 decoding fails and proposes the following:

*If a cell is barred in NR-U,* *the IntraFreqReselection is set “not allowed” and the UE is not able to decode SIB1 then the UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for up to 300 seconds.*

The paper argues that SIB1 decoding error is likely due to interference on this frequency and thus the UE should not try to reselect other cells. In the current running CR, the behavior is opposite where the UE still checks other cells on this frequency. The underlying assumption was that the UE should only follow “not allowed” in MIB if the cells belongs to the UE’s own PLMN and the UE does not know this is the case if it can’t decode the SIB1.

**Do you support barring all cells on a frequency if *IntraFreqReselection* in MIB is set “not allowed” and the UE is not able to decode SIB1?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | No | There is no FFS for this issue. We have discussed this issue in RAN2#107bis and running CR correctly captures the RAN2 agreement made in RAN2#107bis.  RAN2#107bis Agreement:  If a cell is barred in NR-U, due to the registered PLMN or selected PLMN does not match one of the PLMN IDs in SIB1, “IntraFreqReselection” shall be always interpreted as “allowed”. The same applies if SIB1 is not decoded.  Since the UE does not know whether the cell belongs to its PLMN or not, UE should be allowed to search other cells on same frequency. Even if the SIB1 decoding error is due to interference on a cell of a PLMN on frequency F1 does not mean that cells of other PLMN on same frequency F1 will encounter interference as time/frequency location of SIB1 is not same for cells of different PLMNs. |
| **MediaTek** | No | We agree with Samsung and do not prefer barring all cells in the frequency. |
| **Charter Communications** | No | There maybe various reasons for failed SIB1 decoding, and unless it’s accompanied with other measurements, it’s difficult to conclude that failure is due to co-channel interference etc. Hence, prefer not to bar all cells. |
| **Intel** | No? | It does not have to follow IFRI in MIB; just need to condition to UE is unable to decode SIB1 – then it does not conflict with the previous agreement. |
| **Huawei** | No | Can follow the legacy behaviour for failed SIB1 decoding. |
| **OPPO** | No | Agree with Samsung |
| **vivo** | No | In fact, it is hard for the UE to differentiate the following cases:   1. NW LBT failure; 2. SIB1 NOT broadcasting for NSA cell; 3. SIB1 decoding error.   Therefore, we think the UE should not bar all the cells on the frequency. |
| **Ericsson** | No | Agree with Samsung. |
| **Nokia** | Yes |  |
| Asia Pacific Telecom (APT) | No | Agree with Samsung. |

**Summary:**

**Proposal.**

### Issue E5: Abandoning measurement reporting

R2-2000669 (Nokia) discusses an open issue in RAN4 on whether the “the UE shall abandon the measurement report in case the delay caused by successive UL LBT failures exceeds a maximum value”. The paper concludes that “There is no functionality in the U-plane to do withdraw procedure of SRB messages being discussed in RAN4” based on the following observations (copied from the paper):

1. *The uplink transmissions are scheduled by the gNB.*
2. *The measurement report data is mapped in a transport block (TB)*
3. *If a TB is not received at the gNB due to either LBT failure, or poor channel conditions, the gNB will schedule other opportunities for the UE transmissions.*
4. *After a measurement report is mapped in a TB, it is not possible for the UE to drop selectively the data that carries the measurement report, without affecting the TB.*
5. *Other specifications have procedures to control the TB retransmissions.*

*Additionally For the SRB messages there is no possibility to set PDCP discard timer thus having some kind of expiry function would be change to existing U-plane design. Only way to currently to get rid off SRB messages is to do MAC reset e.g. by handover.*

It is proposed that “*we should inform RAN4 that from RAN2 point of view we should not introduce any kind of “withdraw” procedure as it will be either close to impossible or requires huge redesign of U-plane protocols.”*

**Do you support informing RAN4 that there is no “withdraw” procedure for abandoning reporting of measurement results and introduction of such a mechanism will have significant impacts on RAN2 specifications?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | y | We agree with Nokia. |
| **MediaTek** | Yes | Agree. |
| **Charter Communications** | Yes |  |
| **LG** | Yes | Agree |
| **Intel** | Yes | Agree with the contribution that it will be quite difficult to retrieve a measurement report from the user plane side. |
| **Huawei** |  | RAN4 is still discussing about this issue and let’s wait for Ran4 decision |
| **OPPO** | Yes |  |
| **vivo** | Yes | Agree with Nokia. |
| **Ericsson** | Yes |  |
| **Nokia** | Yes | Same open issue also listed in the CG/other one. |
| Asia Pacific Telecom (APT) | Yes | Agree |

**Summary:**

**Proposal.**

### Issue E6: Usage of NR-U term

The running 38.300 used the term NR-U in initial versions to represent NR operation in unlicensed spectrum. In later version and other RAN2 running CRs, the phrase “NR operation with shared spectrum channel access” was used in consistent with RAN1 CRs. It was suggested to remove the term “NR-U” completely from RAN2 CRs.

**Do you support removing the term “NR-U” from RAN2 running CRs and use “NR operation with shared spectrum channel access” instead?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | No strong view |  |
| **MediaTek** | No strong opinion |  |
| **Charter Communications** | Need clarification | It is not clear what type of spectrum the phrase “shared spectrum” refers to? Is it 5/6/60GHz spectrum? Or does it also include CBRS spectrum. If the latter, then LBT is not applicable in CBRS, hence the unlicensed spectrum is more accurate. Note that in wider wireless community, “shared spectrum” primary refers to multi-tier spectrum like CBRS. |
| **Intel** | Yes | Align with RAN1 using **“NR operation with shared spectrum channel access”** |
| **Huawei** | No strong view |  |
| **OPPO** | No strong view | Actually, in 37.340, the term NR-U is still used, we don't see the difference |
| **vivo** | Yes | We prefer to align the terminology. |
| **Ericsson** | Yes | RAN1 consistently uses the term “(NR) operation with shared spectrum **channel access**”. To distinguish from CBRS, the emphasis should be on “channel access” which is clarified in 37.213 to imply contention-based channel access. It can also be noted that TS 37.213 is titled “Physical layer procedures for shared spectrum channel access”.  Since we refer to “shared spectrum channel access”, using the acronym ”NR-U“ would be confusing. |
| **Nokia** |  | We prefer “NR operation with shared spectrum channel access”, but “NR-U” is also acceptable |
| Asia Pacific Telecom (APT) | Need clarification | Alignment is fine. However, to avoid confusion as mentioned by Charter Communications, clarification is suggested. Maybe put a note in the specification. |

**Summary:**

**Proposal.**

### Issue E7: Inter-RAT mobility to NR-U

R2-2000337 (Ericsson) discusses mobility from E-UTRAN to NR-U (stand-alone) and proposes the following:

*Proposal 1 In order to support handover from LTE to NR-U, include ssb-QCL-RelationCommon in RS-ConfigSSB-NR.*

*Proposal 2 In order to include cell-specific Q values for handover from LTE to NR-U, include ssb-QCL-Relation in a new IE SSB-QCL-RelationList within RS-ConfigSSB-NR.*

*Proposal 3 In order to support idle/inactive mode mobility from LTE to NR-U, include ssb-QCL-RelationCommon in CarrierFreqNR within SIB24.*

*Proposal 4 In order to include cell-specific Q values for idle/inactive mode mobility from LTE to NR-U, include ssb-QCL-Relation in a new IE SSB-QCL-RelationList in CarrierFreqNR within SIB24.*

Since NR is the baseline for NR-U and there was no agreement to restrict inter-RAT mobility to NR-U, these proposals seem reasonable. RAN2 can make the high-level agreement and the exact placement of the Q value in LTE RRC can be discussed further.

**Do you see any problems in signalling of Q value in E-UTRAN to enable Connected and Idle mode mobility from E-UTRAN to NR-U?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **MediaTek** | No |  |
| **Charter Communications** | No |  |
| **LG** | No |  |
| **Intel** | Yes |  |
| **Huawei** | No |  |
| **OPPO** | No |  |
| **vivo** | No |  |
| **Ericsson** | No |  |
| **Nokia** | No |  |
| Asia Pacific Telecom (APT) | No |  |

**Summary:**

**Proposal.**

### Issue E8: New MIB

Related to the Issue 2 whether to define a new MIB instead of changing the interpretation of the above IEs in the field description and/or possibly adding a new IE for the last spare bit.

**Do you prefer to define a new MIB to incorporate the new meaning of *ssbSubcarrierSpacingCommon* and possibly *ssb-SubcarrierOffset*****(or alternatively a new IE)** **for NR-U? The other option is to state the new interpretations in the field descriptions.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Nokia** | **No (we prefer new interpretation)** | In theory both options would work but we think it would be easy to just redefine meaning of existing two parameters. This way Ues do not need to change how to decode SIB1 based on what kind of carrier UE is camping on. See also response on corresponding to issue E3 |
| **Intel** | **No** | **See our response to Issue 2** |
| **Ericsson** | **Yes** | If one adopts RAN1’s Alt 1-2, the ASN.1 encoder of the network expects to get the “*ssb-SubcarrierOffset*” as an Integer in the range {0..15}. However, when operating in unlicensed spectrum, the actual SSB subcarrier offset could only be in the range {0..7}. A wrapper around the ASN.1 would have to shift this value by one bit to the left and then fill the right most bit (LSB) with one of the two bits from the node-internal ENUM holding one of the Q bits. If the integer values {0..7} are not appropriate for the new subcarrier offset, one would have to implement also a new mapping from the 8 integer values to the corresponding actual subcarrier offsets.  For the *subCarrierSpacingCommon* the ASN.1 encoder expects the ENUMERATED values scs15or60 or scs30or120 (1 bit). As a consequence, the other Q bit would have to be converted to scs15or60 or scs30or120 and then be fed into the ASN.1 encoder’s field for subCarrierSpacingCommon.  **Certainly, all of this is doable, but it reduces readability based on the ASN.1 parameter names and defeats the purpose of ASN.1 to take care of complex and error-prone conversion of variables into serial bit strings.**  Additonal comments:  We think that we should strive for a clean solution and avoid quick solutions based on reinterpretation/repurposing of IEs at the cost of readability, specifically as we are only in the second release of NR and it should be our primary purpose to build something clean and solid to have a proper basis for future releases in the next years. Note that with a new MIB, the spare bit in legacy will not be used.  Regarding the impact on the specification using reinterpretation of the actual parameters: the spec impact may be small, but the impact may become more cumbersome in the implementation.  Regarding the above statement on SIB1 decoding, the UE also has to decide based on the carrier which table in TS 38.213 it has to use even if the legacy MIB is used.  We think that RAN1 has only looked at number of available bits in the MIB and has not really considered to define a new MIB as this is in the scope of RAN2. |
| **Huawei** | **Yes** | E// has explained a good reason why a new MIB is desirable from the implementation point of view. Our understanding is mainly that, based on the agreement in NRU, a lot of fields in the legacy R15 MIB will not be useful, which are  - PDCCH-configSIB1 does not need 8 bits  - intraCellFrequencyReselection is not needed from RAN2 point of view  - ssb-SubcarrierOffset does not need 4 bits, like E// explained  - subCarrierSpacingCommon not needed, either  So, we prefer to create a new MIB, just like what we did for NB-IoT |
| **vivo** | **No** | **There is no big difference between defining a new MIB and redefining the meaning of the two existing Ies. We think the latter may cause less impact to specification.** |
| **MediaTek** | **-** | **No strong opinion** |
| **Charter Communications** | **No** | **Prefer the new interpretation** |
| **Samsung** | **No** | **We prefer the minimum impact: new interpretation. Note that RAN1 did not list the option for the new MIB from their agreements (see below).**  For signaling of Q for a serving cell with possible values {1,2,4,8}, the following is supported: • If RAN2 agrees to use the spare bit and still allow release independent introduction of the 6 GHz band, then Alt 1-4 is supported, otherwise Alt 1-2 is supported: o Alt 1-2: For operation with shared spectrum channel access, the UE interprets the following 2 bits of the Rel-15 MIB for providing the value of Q § ssbSubcarrierSpacingCommon (1 bit) § LSB of ssb-SubcarrierOffset (1 bit) o Alt 1-4: For operation with shared spectrum channel access, the UE interprets the 2 bits in the following two fields of the Rel-15 MIB for providing the value of Q § ssbSubcarrierSpacingCommon (1 bit) § spare (1 bit) |
| **LG** | **No** | **Prefer the new interpretation** |
| **OPPO** | **No strong view, but prefer not to introduce.** | **If the outcome of E3 is yes from RAN1/RAN4, then introducing a new MIB would be a clean way, otherwise we may need to discuss how to reuse the current MIB to differentiate NR-U from NR** |
| Asia Pacific Telecom (APT) |  | No strong opinion. Either way is doable as Ericsson mentioned. |

**Summary:**

**Proposal.**

### Issue E9: Short Message for Paging Stop

At the first online session in RAN2#109e, it was agreed that “The UE can stop paging monitoring if it receives a short message for SI update and PWS”. It wasn’t concluded if the short message can be used to request the UE to continue paging monitoring when there is an SI update or ETWS/CMAS notification as “FFS on whether we can set the new bit to zero with SI bit set to 1”.

The considered scenario is when the gNB has an SI update or ETWS/CMAS message and also a paging message for the UE but wants to defer the scheduling of the paging message to a later time.

**Do you support gNB asking the UE to extend paging monitoring when there is also an SI update or ETWS/CMAS in this PO? This will be done by setting the corresponding SI or ETWS/CMAS bit to 1 and paging bit to 0 in the short message.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **MediaTek** | **No** | **We prefer using short message only to indicate “Stop Monitoring” PDCCH, as receiving any short message means DL LBT in gNB is successful and UE can stop monitoring to save power.** |
| **Charter Communications** | **Yes** | **It is helpful to extend paging monitoring in above circumstances.** |
| **Samsung** | **No** | **This is reopening the discussion which we had in last meeting as well as in RAN2 107.**  **To minimise UE power consumption, once channel is available, the behaviour should be same as in legacy i.e. gNB indicates SI/PWS notification and Paging together.** |
| **LG** | **No** | **We prefer using short message only to indicate “Stop Monitoring”. This is a RAN2 agreement in the previous meeting. We cannot see any clear reason to revisit this.** |
| **Intel** | **No** | Prior to the above agreements, there is also the following agreement:  RAN2 has agreed to use transmission addressed to P-RNTI for this purpose  And in 1, it is explicitly indicated that it is an additional stopping condition. Following the first agreement, it is obvious that there is need for the stop indication and thus should be set to 1 all the time. |
| **Huawei** | **No** |  |
| **OPPO** | **Yes** | **We see there is a need to make the new bit flexible.**  **If the new bit is always set to 1, it’s useless.** |
| **vivo** | **No** | Agree with MediaTek. |
| **Ericsson** | **No** | Extending the paging monitoring is against current agreement to introduce **stopping conditions** for the extended PO, where the UE should stop monitoring when it has received a PDCCH monitoring occasion adressed to P-RNTI in a PO. The first identified condition is that there is actually a paging message, but since there may be no UE to be paged in a PO, another condition was introduced: the Short Message. Both the paging message as well the Short Message are adressed via PDCCH to P-RNTI.  It seems to be common understanding that *any* Short Message can stop the PDCCH monitoring in a PO. If so, it is not necessary to explicitly define a separate bit. |
| **Nokia** | **Yes** | to minimize UE power consumption is not very logical response here. How it is minimized if the paging reception is delayed because UE would not be listening to possible paging? Thus we prefer to allow NW to indicate whether NW would like UE to listen for paging in this occasion. |
| Asia Pacific Telecom (APT) | No | Based on RAN2#108 agreement, “The indication would be for all the UEs to stop paging monitoring in this PO. If the short message is sent the bit is always set to ‘1’”. Thus, it was agreed that if the short message is sent, the bit is always ‘1’. We don’t need to revert the agreement.  For the case: when the gNB has an SI update or ETWS/CMAS message and also a paging message for the UE but wants to defer the scheduling of the paging message to a later time, it seems to be an NW implementation issue, e.g., the scheduling information of the paging message may be deferred in the next PO. |

**Summary:**

**Proposal.**

### Issue E10: Signaling of intra-cell guard bands

RAN2#109e has discussed the signaling of guard bands and agreed on the following:

1. The guard bands for a cell are signalled by using a starting index and length for each guard band, only when the network wants to configure it.

*(FFS – move to offline) RAN2 should further discuss the signalling for the cases when there is no guard band, when RAN4 specs should be used, and when/if the UE does not support guard bands.*

Several options have come up during the email discussion on how to signal the default case (when RAN4 specs are used) and when there is no guard band (e.g. 20Mhz). Ericsson has also suggested that the UE may not support guard bands; however, RAN1 has not yet made any agreements on this.

**Please provide your suggestions on ASN.1 signaling for the cases there is no guard band, when RAN4 specs should be used, and when/if the UE does not support guard bands. The feedback could be without an ASN.1 snippet, e.g. by saying that explicit IEs are used for default and no guard band or by omitting the configuration for the default case etc.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Intel** |  | **From RAN1 design, it is possible for the network to configure up to 4- intra-cell guard band.**  **So at least if explicitly configured, it will be SEQUENCE (SIZE (1..4)) OF intra-Cell Guardband.**  **We then need to 2 signalling to indication for absent and default, respectively. Absent can be achieved via the absence of the GB for both UL and DL, while default can be added as CHOICE structure with the explicit configuration as we have normally done.** |
| **Huawei** |  | We recomemend the following structure for signaling:  ServingCellConfigCommon ::= SEQUENCE {  ==omitted==  intraCellGuardBandUL-r16 SEQUENCE (SIZE(1..4)) OF intraCellGuardBandperGuardBand OPTIONAL, --need R  intraCellGuardBandDL-r16 SEQUENCE (SIZE(1..4)) OF intraCellGuardBandperGuardBand OPTIONAL, --need R  ==omitted==  }  intraCellGuardBandperGuardBand ::=CHOICE {  default NULL,  withoutGuardband NULL,  withGuardband SEQUENCE (SIZE (1..2)) OF INTEGER (0,..,275)  } |
| **OPPO** |  | No guard band can be achieved by setting the length=0 |
| **Ericsson** | **If absent, no guard band.**  **RAN4 default should be explicitly indicated.** | The general principle in ASN.1 is that a parameter is absent, if not configured. Similarly, if a specific feature is configured, it would be strange to indicate in the corresponding paramter that the feature is not used.  The general structure would be as follows:  IntraCellGuardBands ::= CHOICE {    default        NULL,           -- RAN4 config    guardBandList  GuardBandList -- explicit signaling  } OPTIONAL -- if not present: no guard bands are applied |
| **Nokia** | intraCellGuardBand-r16 ::= SEQUENCE {  guardBandCRB INTEGER (0..275),  guardBandLength INTEGER (0..15)  } | If length = 0 equals to no GB  When intraCellGuardBand IE is not signalled then UE follows RAN4 specs for default guard bands. |

**Summary:**

**Proposal.**

### Issue E11: Configuration of RSSI measurement

In the current running CR, RSSI measurement configuration was added to *ReportConfigNR* IE as follows:

ReportConfigNR ::= SEQUENCE {

reportType CHOICE {

periodical PeriodicalReportConfig,

eventTriggered EventTriggerConfig,

...,

reportCGI ReportCGI,

reportSFTD ReportSFTD-NR,

measRSSI-ReportConfig-r16 MeasRSSI-ReportConfig-r16

}

}

**The choice of this place by the rapporteur was for to have a similar structure as to LTE LAA where the same IE is in *ReportConfigEUTRA* and also given that both RAN1 and RAN2 agreements on RSSI reporting were to use the LTE LAA baseline.**

**Do you agree on the above signalling? If not, please list other option(s).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **LG** | **No** | RAN2 agreed that the RSSI and CO results can be included in periodic reporting or event based reporting triggered by RSRP/RSRQ, as in LTE. However, according to the current CR, only periodic reporting is possible.  measRSSI-ReportConfig-r16 should be placed in PeriodicalReportConfig and EventTriggerConfig. |
| **Huawei** | **No** | Same view as NOK |
| **Ericsson** | **Yes** | reportConfigEUTRA has a different structure than the ReportConfigNR.  measRSSI-ReportConfig was added on top of the triggerType (event or periodical), however, with the following restrictions:  ***measRSSI-ReportConfig***  If this field is present, the UE shall perform measurement reporting for RSSI and channel occupancy and ignore the *triggerQuantity*, *reportQuantity* and *maxReportCells* fields. E-UTRAN only sets this field to *true* when setting  *triggerType* to *periodical* and *purpose* to *reportStrongestCells*.  RSSI/CO measurements report are thus configured separately from other cell measurements.  We think that we can use a similar as for **CLI-RSSI**, i.e. *RSSI-PeriodicalReportConfig* can be added.  RSSI-PeriodicalReportConfig-r16 ::= SEQUENCE {  reportInterval-r16 ReportInterval,  reportAmount-r16 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},  maxReportRSSI-r16 INTEGER (1..maxRSSI-Report-r16),  ...  }  *maxReportRSSI* (to be confirmed) allows to define a number of RSSI measurement resources to be included in the measurement report.  This is similar to *maxReportCells* in legacy *PeriodicalReportConfig* or *maxReportCLI* in the CLI reporting config.  If RAN2 wants to support event-triggered reporting, the event trigger would need to be discussed/defined. |
| **MediaTek** | **No** | Agree with LG and Huawei that measRSSI-ReportConfig-r16 should be placed in PeriodicalReportConfig and EventTriggerConfig |
| Intel | No | Since RAN2 agreed that RSSI and channel occupancy is just piggyback with existing events:   * RSSI and CO measurement quantities can be reported with existing triggers as in LAA * No new triggers. For normal HO and CHO, no new event triggers will be introduced. RRSI CO measurements can be included in the measurement reports.   It should be included as part of the eventTriggered reportType.  RAN2 has also agreed to include periodic reporting as baseline, it should also be included in PeriodicalReportConfig. |
| **OPPO** | **No** | We don't think the configuration in current CR is correct, we share the view with LG |
| **vivo** | **No** | Same view as LG. |
| **Nokia** | **No** | Same view as LG |

**Summary:**

**Proposal.**

### Issue 12: Handling of Forbidden TAs

In the 38.304 running CR, the legacy behaviour for the handling of “forbidden TAs for roaming” was not changed for shared spectrum. In particular, the CR has the following:

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", the UE shall not consider this cell and other cells on the same frequency, as candidates for reselection for a maximum of 300 seconds

Ericsson commented that this may not be suitable for shared spectrum when multiple PLMNs are present. It is not clear to the rapporteur why that would make any difference for the UE behaviour since the UE is only registered on one PLMN.

**Do you see any new issues regarding handling of “forbidden TAs for roaming” for NR shared spectrum? If yes, please suggest solutions.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Nokia** | **No** | We think it is a corner case when 2 ePLMNs use the same NR-U band and one of them has a cell that belongs to a forbidden TA for roaming while the other PLMN’s cell is not. |
| **Huawei** | **No** | Same view with Nokia |
| **Ericsson** | **Yes** | It may be a corner case that there are two E-PLMNs on the same frequency where  cell 1 belongs to E-PLMN 1; forbidden TA: yes cell 2 belongs to E-PLMN 2; forbidden TA: no  The solution is simple: the UE is only required to exclude the cell belonging to the forbidden TA from the candidate list, while it is not required to exclude all cells on a frequency as candidates for cell reselection for a maximum of 300 seconds. It can be left to UE implementation whether it evaluates SIB1 of other candidate cells on the same frequency or not. It is only necessary to clarify that the UE needs to check the TA and PLMN IDs to evaluate whether it can consider the cell as candidate for reselection or not. |
| **Charter Communications** | **No** |  |
| **LG** | **No** |  |
| **Intel** | **No** | Agree with Nokia that it is quite unlikely the neighbour of the RPLMN will have different TA. |
| **OPPO** | **No** |  |
| **vivo** | **No** | Agree with Nokia and Ericsson, it is a corner case that there are two E-PLMNs on the same frequency. |
| Asia Pacific Telecom (APT) | Yes | Agree with Ericsson. |

**Summary:**

**Proposal.**

# Open issues from RAN2#108 email discussion

PLACEHOLDER

There was no consensus on some of the open issues reported in R2-2001437. If they are not resolved during the first online session, they will be added here for further discussion.

# Optimizations

These are issues which do not need to be resolved for the completion of the Work Item.

### Issue O1: SUL for NR-U

R2-2001422 discusses SUL operation for NR-U and propose the following:

*Proposal 1: RAN2 to confirm that SUL is applicable for NR-U.*

*Proposal 2: RAN2 to consider a NR-U specific uplink selection rule. FFS on details.*

Since NR licensed is the baseline for NR-U, Proposal 1 seems obvious but can be confirmed. The open issue is whether SUL selection should be modified for NR-U specific reasons, e.g. channel occupancy.

**Do you support modifying or enhancing SUL selection rules for NR-U? If “Yes”, elaborate on the mechanism.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | Yes | When RSRP of the downlink pathloss reference is >= rsrp-ThresholdSSB-SUL, NUL is selected. However SUL can also be used in this case.  When RSRP of the downlink pathloss reference is >= rsrp-ThresholdSSB-SUL, UE can select SUL if there are consistent LBT failures on NUL. |
| **MediaTek** | - | No strong opinion |
| **Charter Communications** |  | No strong opinion. Nut there maybe use cases where SUL in sub-7GHz are used. |
| **Intel** | No |  |
| **Huawei** | Yes | We do see some issue as we discussed during the first time slot of the meeting, that the current mechanism for UL carrier selection may be problematic for UL LBT recovery in the SpCell. |
| **OPPO** |  | WE are not even sure whether there is un-licensed band with supplementary UL carrier. Even though we use NR as baseline, maybe we need to confirm with RAN4? |
| **vivo** | No | According to the WID (RP-191575), only scenario D is related to SUL. However, it is operated on licensed band, which is described as follows,   * Scenario D: A stand-alone NR cell in unlicensed band and UL in licensed band (single cell architecture). |
| **Ericsson** | No | Not needed. Using DL RSRP is sufficient. |
| Asia Pacific Telecom (APT) |  | No strong opinion |

**Summary:**

**Proposal.**

### Issue O2: RLF due to DL LBT failures

This was discussed several times in RAN2 before and it was not adopted. There were two contributions on this.

R2-2001549 (LG) proposes *“Regardless of whether new RLF mechanism is defined purely based on the “missing RS” indication, the “missing RS” indication should be considered in the existing T310 based mechanism.”*

R2-2000405 (MTK) counter proposes *“Given the fact that it is not possible to clearly distinguish between missing RS samples due to failure and poor DL RS quality in NR-U, UE can still continue with the same RLM process with an increased RLF triggering timer, configured by NR-U gNB.”*

The rapporteur notes that neither RAN1 or RAN4 have not introduced any differentiation between missing RS or poor DL RS.

**Should RAN2 still consider RLF based on missing DL RS samples?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | No |  |
| **MediaTek** | No | Based on current agreements in RAN1 and RAN4, it seems it is not possible to distinguish between missing RS and poor DL RS Quality (R2-2000405). |
| **Charter Communications** | No |  |
| **Intel** | No |  |
| **Huawei** | No |  |
| **OPPO** | No | No new metric is agreed in RAN1, we can reuse legacy in NR-U for RLM. |
| **vivo** | No |  |
| **Ericsson** | No |  |
| Asia Pacific Telecom (APT) | No |  |

**Summary:**

**Proposal.**

### Issue O3: CHO for NR-U

R2-2001547 (LG) has the following regarding CHO for NR-U:

*Observation 1: It is beneficial to support the conditional handover that RAN2 is discussing under mobility enhancement WI for UE mobility in unlicensed carriers.*

*Observation 2: Even if a serving cell is still good, UE may need to perform inter-frequency mobility (e.g. within same gNB) due to high channel occupancy on the serving frequency.*

*Proposal: NR-U specific execution condition for conditional handover based on channel occupancy and RSSI measurement should be supported.*

Since legacy HO in NR-U will not use event triggers for channel occupancy and RSSI, the rapporteur thinks that the same should apply to CHO. It would be good to confirm this in order to prevent further discussion.

**Should Channel Occupancy and RSSI based execution conditions be introduced for CHO in shared spectrum?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | Yes |  |
| **MediaTek** | Yes | Channel Occupancy and RSSI based execution conditions can be introduced for CHO in NR-U |
| **Charter Communications** | Yes |  |
| **LG** | Yes | CHO is the most suitable mechanism to reduce the handover failure caused by LBT failure on unlicensed frequency, but it cannot guarantee the quality of the target cell on unlicensed frequency in terms of channel occupancy.  Therefore, we need to define a new event based on the channel occupancy and RSSI, and the new event can be set as execution condition of CHO in combination with event A3 or A5. |
| **Intel** | No | Already agree that serving cell channel occupancy and RSSI should not be used as trigger for HO. |
| **Huawei** |  | This can be discussed under MobEnh |
| **OPPO** | Yes |  |
| **vivo** | No | It was already agreed in RAN2#107bis that “For normal HO and CHO, no new event triggers will be introduced. RRSI CO measurements can be included in the measurement reports.”  Thus, we prefer no to revert the previous agreement in this stage. |
| **Ericsson** | Yes | When the channel occupancy increases, the UE may not be able to send any Measurement Reports to trigger the normal handover procedure. |
| Asia Pacific Telecom (APT) | Yes |  |

**Summary:**

**Proposal.**

### Issue O4: Cell selection after LBT failures

R2-2001546 (LG) proposes the following:

*Proposal If the RLF is declared due to the consecutive LBT failures, UE treats all cells on the last PCell frequency as if cell status is “Barred” for a given period of time.*

The rapporteur thinks that the cell selection is up to UE implementation and it can consider LBT failures in this decision.

**Do you support the above proposal for barring a frequency after consistent LBT failures on a Pcell on this frequency?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Response** | **Comments** |
| **Samsung** | Yes |  |
| **MediaTek** | No | We prefer to leave cell selection on UE implementation |
| **Charter Communications** |  | While agree with the logic presented above, UE implementation should be able to take care of this. |
| **LG** | Yes (for cell re-selection in IDLE/INACTIVE also) | We need to consider the cell re-selection in IDLE/INACIVE also. When the consecutive LBT failures happen in IDLE/INACTIVE, e.g. when UE performs the UL LBT for RACH, the UE should be able to perform the cell re-selection on another frequency. To achieve this, UE needs to deprioritize the congested frequency or consider all cells on that frequency as barred.  Considering that the consecutive UL LBT failures can happen in IDLE/INACTIVE as well as CONNECTED, it would be desirable to introduce a unified solution that works in both cell selection and cell re-selection. |
| **Intel** | No | Can be left to UE implementation and furthermore, cell selection also needs to take into consideration of RSRQ which has component of RSSI. |
| **Huawei** | Yes | Cell reselection should be triggered and this frequency should be deprioritized for a limited time (300s). |
| **OPPO** | No |  |
| **vivo** | No | We can leave it to UE implementation. |
| **Ericsson** | No | Can be left to UE implementation. |
| Asia Pacific Telecom (APT) | No |  |

**Summary:**

**Proposal.**

# Open issues waiting for RAN1/RAN4

Some papers had proposals on issues which are being discussed in RAN1 and RAN4. Therefore, it is better to postpone these discussions.

R2-200964 (HW) discusses multi-TTI grant and proposes to changes to TDRA table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ericsson** |  | We think that multi-TTI grant was concluded at RAN1#99, Alt 1 from RAN1#98 was selected:   * Alt. 1: Each PUSCH has a separate SLIV and mapping type. The number of scheduled PUSCHs is signalled by the number of indicated valid SLIVs in the row of the TDRA table signalled in DCI.   + FFS: Separate k2 * The FFS was removed, i.e. only one k2 value is used, see text in 38.214 * The Maximum number of PUSCHs that can be configured in a row of the TDRA table: 8 (maxNrofPUSCHs-r16)   This becomes clear from TS 38214:  If *pusch-TimeDomainAllocationList* in *pusch-Config* contains row indicating resource allocation for two to eight contiguous PUSCHs, *K2* indicates the slot where UE shall transmit the first PUSCH of the multiple PUSCHs. Each PUSCH has a separate SLIV and mapping type. The number of scheduled PUSCHs is signalled by the number of indicated valid SLIVs in the row of the *pusch-TimeDomainAllocationList* signalled in DCI format 0\_1.  Possible updates in 38.331:  In PUSCH-Config:  pusch-TimeDomainAllocationList-r16 SetupRelease { PUSCH-TimeDomainResourceAllocationList-r16 }  The IE *PUSCH-TimeDomainResourceAllocation* is used to configure a time domain relation between PDCCH and (the first) PUSCH. *PUSCH-TimeDomainResourceAllocationList* contains one or more of such *PUSCH-TimeDomainResourceAllocations*, where *PUSCH-TimeDomainResourceAllocation* is used to configure one PUSCH or multiple contiguous PUSCHs. The network indicates in the UL grant which of the configured time domain allocations the UE shall apply for that UL grant. The UE determines the bit width of the DCI field based on the number of entries in the *PUSCH-TimeDomainResourceAllocationList*. Value 0 in the DCI field refers to the first element in this list, value 1 in the DCI field refers to the second element in this list, and so on.  PUSCH-TimeDomainResourceAllocationList-r16 ::= SEQUENCE (SIZE(1..maxNrofUL-Allocations)) OF PUSCH-TimeDomainResourceAllocation-r16  PUSCH-TimeDomainResourceAllocation-r16 ::=  SEQUENCE {     k2-r16                                              INTEGER (0..32)                                    OPTIONAL,   -- Need S     multiplePUSCH-Allocations-r16             SEQUENCE (SIZE(1..maxNrofMultiplePUSCHs-r16)) OF PUSCH-TimeDomainResourceAllocation  }   |  | | --- | | ***k2***  Corresponds to L1 parameter 'K2' (see TS 38.214 [19], clause 6.1.2.1). If *PUSCH-TimeDomainResourceAllocation-r16* is configured, *k2-r16* is applied for the PUSCH (if only one PUSCH is configured) or for the first PUSCH of the multiple contiguous PUSCHs (if more than one PUSCH is configured), and *k2* (without suffix) is not configured. When the field *k2* or *k2-r16*, respectively, is absent the UE applies the value 1 when PUSCH SCS is 15/30 kHz; the value 2 when PUSCH SCS is 60 kHz, and the value 3 when PUSCH SCS is 120KHz. | | ***multiplePUSCH-Allocations***  Configures one or more PUSCH time domain resource allocations. If more than one PUSCH is configured, the multiple PUSCHs are contiguous. | |

# Conclusion

Based on the contributions submitted to RAN2#109e Agenda Items 6.2.3, the following are proposed: