**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.**

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| **Company** | **Response** | **Comments** |
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**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.**

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| **Company** | **Response** | **Comments** |
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**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?**

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| **Company** | **Response** | **Comments** |
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**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?**

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| **Company** | **Response** | **Comments** |
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**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?**

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| **Company** | **Response** | **Comments** |
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**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?**

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| **Company** | **Response** | **Comments** |
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**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.**

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| **Company** | **Response** | **Comments** |
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**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?**

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| **Company** | **Response** | **Comments** |
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**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?**

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| **Company** | **Response** | **Comments** |
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**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?**

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| **Company** | **Response** | **Comments** |
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**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.

# Conclusion

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