**3GPP TSG-RAN WG2 Meeting #127bis R2-24xxxxx**

**Hefei, China, October 14-18, 2024**

**Source: Qualcomm Incorporated**

**Title: Summary of offline discussion [AT127bis][009][Cell Barring] behaviour (Qualcomm)**

**Document for: Decision**

**Agenda Item: 7.24.2.2**

# Introduction

* [AT127bis][009][Cell Barring] behaviour (Qualcomm)

Intended outcome: face to face offline to discuss the different technical aspects from Huawei and Qualcom’s paper and then move this to a post meeting email discussion.

Deadline: 10-17-24

# Discussion

* 1. IFRI handling
     1. 2Rx XR UE

The handling of 2Rx XR specific IFRI, *intraFreqReselection2RxXR*, is specified in 38.331 as follows.

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| 5.2.2.4.2    Actions upon reception of the *SIB1*  […]  1>    if the UE is a 2Rx XR UE and is in RRC\_IDLE or in RRC\_INACTIVE, or if the 2Rx XR UE is in RRC\_CONNECTED while *T311* is running:  2>    if the *cellBarred2RxXR* is present in the acquired *SIB1*:  3>    consider the cell as barred in accordance with TS 38.304 [20];  3>    if the *intraFreqReselection2RxXR* is present in the acquired *SIB1*:  4>    perform barring based on *intraFreqReselection2RxXR* as specified in TS 38.304 [20] upon which the procedure ends;  3>    else:  4>    perform barring as if *intraFreqReselection2RxXR* is set to allowed upon which the procedure ends; |

It should be noted that the cell can also be barred by MIB. In this case, there are following cases to consider.

Case 1: *cellBarred2RxXR* is not present in SIB1 > The UE shall follow MIB IFRI.

Case 2: *cellBarred2RxXR* is present in SIB1.

Case 2-1: The UE follows *intraFreqReselection2RxXR* if present.

Case 2-2: The UE considers as if *intraFreqReselection2RxXR* is allowed, if it is not present.

It was found that the current TS38.304 does not cover Case 1 and Case 2-2.

It is proposed to make the following corrections to TS38.304.

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| 5.3.1 Cell status and cell reservations  […]  - If the UE is a RedCap UE, the UE shall acquire SIB1 and, in the remainder of this procedure, consider '*intraFreqReselection* in MIB' to be '*intraFreqReselectionRedCap* in SIB1', if available; or,  - If the UE is an eRedCap UE, the UE shall acquire SIB1 and, in the remainder of this procedure, consider '*intraFreqReselection* in MIB' to be '*intraFreqReselection-eRedCap* in SIB1', if available; or,  - If the UE is a 2Rx XR UE, the UE shall acquire SIB1 and, in the remainder of this procedure, consider '*intraFreqReselection* in MIB' to be '*intraFreqReselection2RxXR* in SIB1', if available:  - If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the SIB1:  - the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.  - the UE may select another cell on the same frequency if the selection criteria are fulfilled.  - If the cell status "barred" is indicated in *MIB* but the UE is unable to acquire the SIB1; or  - If the cell is to be treated as if the cell status is "barred" due to not supporting (e)RedCap UEs: or  - If the UE is a 2Rx XR UE, *cellBarred2RxXR* is present in SIB1 and *intraFreqReselection2RxXR* in SIB1 is not available:- the UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.  - the UE may select another cell on the same frequency if re-selection criteria are fulfilled.  - If the UE is neither a RedCap UE nor an eRedCap UE, or if the UE is a RedCap UE and *intraFreqReselectionRedCap* in SIB1 is available, or if the UE is an eRedCap UE and *intraFreqReselection-eRedCap* in SIB1 is available, or if the UE is a 2Rx XR UE and *intraFreqReselection2RxXR* in SIB1 is available:  - If the field *intraFreqReselection* in *MIB* message is set to "allowed":  - the UE may select another cell on the same frequency if re-selection criteria are fulfilled;  - If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:  - the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds; |

* + 1. (e)RedCap UE

For an (e)RedCap UE, the cell can be barred based on cell barring in MIB, or by SIB1 based on the presence of (e)RedCap specific IFRI, *intraFreqReselectionRedCap* / *intraFreqReselection-eRedCap*. The (e)RedCap UE determines if the cell supports (e)RedCap or not based on the (e)RedCap specific IFRI as follows.

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| ***intraFreqReselection-eRedCap***  Controls cell selection/reselection to intra-frequency cells for eRedCap UEs when this cell is barred, or treated as barred by the eRedCap UE, as specified in TS 38.304 [20]. If not present, an eRedCap UE treats the cell as barred, i.e., the UE considers that the cell does not support eRedCap. |
| ***intraFreqReselectionRedCap***  Controls cell selection/reselection to intra-frequency cells for RedCap UEs when this cell is barred, or treated as barred by the RedCap UE, as specified in TS 38.304 [20]. If not present, a RedCap UE treats the cell as barred, i.e.,the UE considers that the cell does not support RedCap. |

It should be noted that according to 38.304, (e)RedCap UE always relies on the (e)RedCap specific IFRI (including its presence) to determine the intra-frequency cell reselection behavior regardless of the reason for cell barring, i.e. MIB IFRI is never used. It is not entirely clear however in 38.331 especially in case of MIB barring. This is because the procedural text results in “double barring” in MIB and SIB1 as follows.

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| 5.2.2.4.1 Actions upon reception of the *MIB* Upon receiving the *MIB* the UE shall:  1> store the acquired *MIB*;  1> if the UE is in RRC\_IDLE or in RRC\_INACTIVE, or if the UE is in RRC\_CONNECTED while *T311* is running:  2> if the access is not for NTN or the UE is not capable of NTN; and  2> if the UE does not support *nes-CellDTX-DRX*; and  2> if the access is not for ATG or the UE is not capable of ATG; and  2> if the *cellBarred* in the acquired *MIB* is set to *barred*:  3> if the UE is an (e)RedCap UE or a 2Rx XR UE and if *ssb-SubcarrierOffset* indicates *SIB1* is transmitted in the cell (TS 38.213 [13]):  4> acquire the *SIB1,* which is scheduled as specified in TS 38.213 [13];  3> consider the cell as barred in accordance with TS 38.304 [20];  3> perform cell re-selection to other cells on the same frequency as the barred cell as specified in TS 38.304 [20];  2> else:  3> apply the received *systemFrameNumber*, *pdcch-ConfigSIB1*, *subCarrierSpacingCommon*, *ssb-SubcarrierOffset* and *dmrs-TypeA-Position*.  NOTE 1: A UE capable of NTN access should acquire SIB1 to determine whether the cell is an NTN cell.  NOTE 2: A UE capable of ATG access should acquire SIB1 to determine whether the cell is an ATG cell.  NOTE 3: A UE indicating any of the values in *nes-CellDTX-DRX* should acquire SIB1 to determine the cell barring status when the *cellBarred* in MIB is set to *barred*. 5.2.2.4.2 Actions upon reception of the *SIB1* Upon receiving the *SIB1* the UE shall:  […]  1> if the UE is a RedCap UE and it is in RRC\_IDLE or in RRC\_INACTIVE, or if the RedCap UE is in RRC\_CONNECTED while *T311* is running:  2> if *intraFreqReselectionRedCap* is not present in *SIB1*:  3> consider the cell as barred in accordance with TS 38.304 [20];  3> perform barring as if *intraFreqReselectionRedCap* is set to allowed, upon which the procedure ends;  2> else:  3> if the *cellBarredRedCap1Rx* is present in the acquired *SIB1* and is set to *barred* and the UE supports 1 Rx branch; or  3> if the *cellBarredRedCap2Rx* is present in the acquired *SIB1* and is set to *barred* and the UE supports 2 Rx branches; or  3> if the *halfDuplexRedCapAllowed* is not present in the acquired *SIB1* and the UE supports only half-duplex FDD operation:  4> consider the cell as barred in accordance with TS 38.304 [20];  4> perform barring based on *intraFreqReselectionRedCap* as specified in TS 38.304 [20], upon which the procedure ends; |

It is proposed to make the following corrections to TS38.304, to make the intended behaviour clearer.

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| 5.3.1 Cell status and cell reservations  […]  - If the UE is a RedCap UE, the UE shall acquire SIB1 and, in the remainder of this procedure, consider '*intraFreqReselection* in MIB' to be '*intraFreqReselectionRedCap* in SIB1', if available; or,  - If the UE is an eRedCap UE, the UE shall acquire SIB1 and, in the remainder of this procedure, consider '*intraFreqReselection* in MIB' to be '*intraFreqReselection-eRedCap* in SIB1', if available; or,  - If the UE is a 2Rx XR UE, the UE shall acquire SIB1 and, in the remainder of this procedure, consider '*intraFreqReselection* in MIB' to be '*intraFreqReselection2RxXR* in SIB1', if available:  - If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the SIB1:  - the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.  - the UE may select another cell on the same frequency if the selection criteria are fulfilled.  - If the cell status "barred" is indicated in *MIB* but the UE is unable to acquire the SIB1; or  - If the UE is a RedCap UE and *intraFreqReselectionRedCap* in SIB1 is not available; or  - If the UE is a eRedCap UE and *intraFreqReselection-eRedCap* in SIB1 is not available;  - the UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.  - the UE may select another cell on the same frequency if re-selection criteria are fulfilled.  - If the UE is neither a RedCap UE nor an eRedCap UE nor a 2Rx XR UE, or if the UE is a RedCap UE and *intraFreqReselectionRedCap* in SIB1 is available, or if the UE is an eRedCap UE and *intraFreqReselection-eRedCap* in SIB1 is available, or if the UE is a 2Rx XR UE and *intraFreqReselection2RxXR* in SIB1 is available:  - If the field *intraFreqReselection* in *MIB* message is set to "allowed":  - the UE may select another cell on the same frequency if re-selection criteria are fulfilled;  - If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:  - the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds; |

* + 1. Potential clean-up for IFRI behaviour

One could observe from the discussion above that having duplicated / inconsistent description in 38.331 and 38.304 can be prone to errors and cause confusions. One possible clean up approach is to remove detailed description on IFRI from 38.331, and keep only pointers to 38.304.

**Potential way forward 1:** Remove detailed description on IFRI from 38.331, and keep only pointers to 38.304.

* 1. Overall clean-up

We discussed different approaches for overall clean-up. Note that both approaches share the same goal to make things consistent among features “within” a specification (38.331 / 38.304). Key difference between the two approaches is as follows.

**Approach#1:** Keep the current duplications between 38.331 and 38.304 (R2-2408293 / Huawei, HiSilicon, Samsung)

**Approach#2:** Avoid duplications between 38.331 and 38.304 (R2-2408368 / Qualcomm, Ericsson)

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|  | **Pros** | **Cons** |
| **Aprroach#1** | Smaller changes, risk of making errors this time is low. | Larger effort in the future cases where feature specific barring behaviour is added. Risk of making errors is high |
| **Aprroach#2** | Smaller effort in the future cases where feature specific barring behaviour is added. Risk of making errors is low. | Large surgery, risk of making errors this time is high and can affect many features. |

Rapporteur felt that the concerns on making errors which can affect many features outweigh the desire to do full-fledged clean-up.

**Potential way forward 2:** Take the approach#1 for overall clean-up.

* 1. Other issues
     1. NCR-MT / IAB-MT in 38.304

For IAB/NCR-MT, descriptions for cell reservations and determination of NPN-only cell are also duplicated in 38.331 and 38.304. Furthermore, 38.304 only captures the behaviour by NOTEs, i.e. non-normative.

This discussion point is about confirming that the descriptions in 38.304 on NCR-MT / IAB-MT are kept as NOTEs, in taking the approach#1 for overall clean-up.

**Potential way forward 3:** Descriptions in 38.304 on NCR-MT / IAB-MT are kept as NOTEs.

* + 1. Cell barring exemption

Currently barring exemption for (e)RedCap and 2Rx XR is defined in 38.304. The flow goes through between 38.331 and 38.304 as follows.

1. In 38.331, the UE determines the cell is barred, and **“procedure ends”**.
2. In 38.304, the UE considers the cell barring is overturned and the cell is an acceptable cell, **only if** the cell barring was only based on the feature specific barring.

The following two papers pointed out essentially the step 2 requiring the UE to check other cell barring condition (e.g. channel BW compatibility) after the cell is considered an acceptable cell contradicts with the text “procedure ends” in 38.331. The exact proposal is to apply the behaviour “procedure ends” only if cell is still considered barred after cell barring exemption check in 38.304.

R2-2408661 SIB1 processing correction for (e)RedCap and 2Rx XR UEs [EM\_Call\_Exemption] Nokia CR Rel-18 38.331 18.3.0 5027 - F NR\_redcap-Core, TEI18, NR\_redcap\_enh-Core

R2-2408128 Correction on barring exemption for (e)Redcap and XR 2RX UEs vivo, Guangdong Genius, Apple draftCR Rel-18 38.331 18.3.0 TEI18

**Rapporteur’s proposal:** Discuss if this issue needs to be addressed.

**Potential way forward 4:** If agreed to be addressed, solution is discussed once stable CRs implementing overall clean-up are available.

# Conclusion

# Reference

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