**3GPP TSG RAN WG1 #100bis-e** **R1-200XXXX**

**e-meeting, April 20-30, 2020**

**Agenda item: 7.2.2.2.1**

**Source: Moderator (Nokia)**

**Title: Summary of [100b-e-NR-unlic-NRU-ChAcc-02] Email discussion/approval on clarifications to UL to DL COT sharing**

**Document for: Discussion and Decision**

# 1 Introduction

This document captures the discussion in the following RAN1#100bis-e email thread:

[100b-e-NR-unlic-NRU-ChAcc-02] Email discussion/approval on clarifications to UL to DL COT sharing by 4/24; if necessary, followed by endorsing the corresponding TPs by 4/29 – Timo (Nokia)

During the preparation phase it was identified that the following TDocs and proposals relate to corrections and clarifications to UL to DL COT sharing:

**Issue #3** Clarifications to UL to DL COT sharing

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| Clarifications to UL to DL COT sharing | R1-2001652 (2.2)  R1-2001705 (2.1)  R1-2001759 (2.3, 2.4)  R1-2001935 (p5, p6)  R1-2002247 (p1)  R1-2002530 (p3)  R1-2002632 (p1)  R1-2002684 (p1, p2, p3) |

Note: Proposals p2 and p3 in R1-2002684 will be discussed in a later meeting together with other CWS update related CRs.

# 2. Issues identified in the contributions

To organize the email discussion, the issues have been grouped according to the chairman’s guidance.

## 2.1 ED Threshold for COT sharing

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| **R1-2001652**  *Proposal 2: The UL to DL COT sharing ED threshold should be dynamically indicated to the UE or gNB.* |
| **R1- 2001935**  *Proposal #5: For a UE configured with ED threshold to be used for UE-initiated channel occupancy, the UE is allowed to select between configured ED threshold and ED threshold calculated based on UE’s configured maximum transmission power. If the UE does not choose the configured ED threshold, the UE indicates the row index corresponding to no COT sharing information in CG-UCI.*  *Proposal #6: For a UE configured with ED threshold to be used for UE-initiated channel occupancy, UL grant indicates which ED threshold between configured ED threshold and ED threshold calculated based on UE’s configured maximum transmission power is applied to channel access procedure for the scheduled PUSCH.* |

**FL Proposal #1**: *Discuss whether the above two proposals are agreeable.*

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| **Company / Org.** | **View on FL proposal #1** |
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## 2.2 UL-DL gap > 25 us

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| **R1-2001705**  **Proposal 1**: ***For the COT sharing, the gNB behavior of the gap between a DL transmission and the last PUSCH transmission is larger than 25us shall be clarified. It is preferred to follow the same behavior with the case that the gap is equal to 25us.***  4.1.3 DL channel access procedures in a shared channel occupancy  --------------------------------------------------------- Start of TP #1----------------------------------------------------------------  If a gNB shares a channel occupancy initiated by a UE using the channel access procedures described in clause 4.2.1.1 on a channel, the gNB may transmit a transmission that follows a PUSCH transmission on scheduled or configured resources by the UE after a gap as follows:  - The transmission shall contain transmission to the UE that initiated the channel occupancy and can include non-unicast and/or unicast transmissions where any unicast transmission that includes user plane data is only transmitted to the UE that initiated the channel occupancy.  - If the higher layer parameters *ul-toDL-CO-SharingED-Threshold-r16* is not provided, the transmission shall not include any unicast transmissions with user plane data and the transmission duration is not more than the duration of 2, 4 and 8 symbols for subcarrier spacing of 15, 30 and 60 kHz of the corresponding channel, respectively.  - If the gap is up to , the gNB can transmit the transmission on the channel after performing Type 2C DL channel access as described in clause 4.1.2.3.  - If the gap is at least or equal to , the gNB can transmit the transmission on the channel after performing Type 2A or Type 2B DL channel access procedures as described in clause 4.1.2.1 and 4.1.2.2, respectively.  <unchanged part omitted>  For the case where a gNB uses channel access procedures as described in clause 4.1.1 to initiate a transmission and shares the corresponding channel occupancy with a UE that transmits a transmission as described in clause 4.2.1.2, the gNB may transmit a transmission within its channel occupancy that follows the UE's transmission if any gap between any two transmissions in the gNB channel occupancy is at least or up to 16us. In this case the following applies:  - If the gap is at least 25us or equal to 16us, the gNB can transmit the transmission on the channel after performing Type 2A or 2B DL channel access procedures as described in clause 4.1.2.1 and 4.1.2.2, respectively.  - If the gap is up to , the gNB can transmit the transmission on the channel after performing Type 2C DL channel access as described in clause 4.1.2.3.  <unchanged part omitted>  --------------------------------------------------------- End of TP #1----------------------------------------------------------------- |
| **R1-2002530**  **Proposal 3. For UL to DL COT sharing, if the gap is more than 25 us, Type 2A channel access can be used by gNB to transmit**  ==============TP for 37.213 4.1.3===================================  ----------------unchanged text removed-----------------------  If a gNB shares a channel occupancy initiated by a UE using the channel access procedures described in clause 4.2.1.1 on a channel, the gNB may transmit a transmission that follows a PUSCH transmission on scheduled or configured resources by the UE after a gap as follows:  - The transmission shall contain transmission to the UE that initiated the channel occupancy and can include non-unicast and/or unicast transmissions where any unicast transmission that includes user plane data is only transmitted to the UE that initiated the channel occupancy.  - If the higher layer parameters *ul-toDL-CO-SharingED-Threshold-r16* is not provided, the transmission shall not include any unicast transmissions with user plane data and the transmission duration is not more than the duration of 2, 4 and 8 symbols for subcarrier spacing of 15, 30 and 60 kHz of the corresponding channel, respectively.  - If the gap is up to , the gNB can transmit the transmission on the channel after performing Type 2C DL channel access as described in clause 4.1.2.3.  - If the gap is no less than or is , the gNB can transmit the transmission on the channel after performing Type 2A or Type 2B DL channel access procedures as described in clause 4.1.2.1 and 4.1.2.2, respectively. |
| **R1-2001537**  ***Proposal 1：Some rows should be added to the cg-COT-SharingList-r16 table such that each additional row indicates a possible UL-burst-end symbol within a slot.***   * ***If the gNB receives a CG-UCI indicating a row index providing a UL-burst-end before the start of a slot-based DL transmission opportunity sharing the UL COT, the gNB may transmit the DL transmission after a gap from the symbol indicated by the UL-burst-end in the immediately preceding slot.***   \*\*\* <Beginning of **Text Proposal 1**> \*\*\*  4.1.3 DL channel access procedures in a shared channel occupancy  \*\*\* Unchanged text is omitted \*\*\*  For the case where a gNB shares a channel occupancy initiated by a UE with configured grant PUSCH transmission, the gNB may transmit a transmission that follows the configured grant PUSCH transmission by the UE as follows:  - If the higher layer parameter *ul-toDL-CO-SharingED-Threshold-r16* is provided, the UE is configured by cg-*COT-SharingList-r16* where cg-*COT-SharingList-r16* provides a table configured by higher layer. Each row of the table provides a channel occupancy sharing information given by higher layer parameter *CG-COT-Sharing-r16*. One row of the table is configured for indicating that the channel occupancy sharing information is not available.  - If the 'COT sharing information' in CG-UCI indicates a row index that corresponds to a *CG-COT-Sharing-r16* that provides channel occupancy sharing information, the gNB can share the UE channel occupancy assuming a channel access priority class *p=channelAccessPriority-r16*, starting from *O=offset-r16* slots from the end of the slot where CG-UCI is detected, for a duration of *D=duration-r16* slots where *duration-r16*, *offset-r16* and *channelAccessPriority-r16* are higher layer parameters provided by *CG-COT-Sharing-r16*.   * If additional rows are configured in the table provided by *cg-COT-SharingList-r16* wherein each additional row indicates a possible ‘*UL-burst-end’* symbol within a slot and if the gNB receives a 'COT sharing information' in a CG-UCI indicating a row index that corresponds to a *ulBurstEnd-r16* before the start of a DL transmission opportunity sharing the UL COT, the gNB assumes that the CG UL burst will end at the symbol indicated by the *ulBurstEnd-r16* in the slot immediately preceding the slot determined by the parameter *offset-r16* in another CG-UCI received before the start of the DL transmission opportunity. In that case, the gNB may transmit the DL transmission after a gap duration specified earlier in this subclause from the symbol indicated by the *ulBurstEnd-r16.*     - If the higher layer parameter *ul-toDL-CO-SharingED-Threshold-r16* is not provided, and if 'COT sharing information' in CG-UCI indicates '1', the gNB can share the UE channel occupancy and start the DL transmission X= *cg-COT-SharingOffset-r16* symbols from the end of the slot where CG-UCI is detected, where *cg-COT-SharingOffset-r16* is provided by higher layer. The transmission shall not include any unicast transmissions with user plane data and the transmission duration is not more than the duration of 2, 4 and 8 symbols for subcarrier spacing of 15, 30 and 60 kHz of the corresponding channel, respectively.  \*\*\* Unchanged text is omitted \*\*\*  \*\*\* <End of **Text Proposal 1**> \*\*\* |

**FL Proposal #2**: *Discuss whether and how to capture the support for UL-DL gap larger than 25 us in a UE-initiated COT*

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## 2.3 Clarification of the max duration of a UL-DL shared COT

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| **R1-2001759**  ***Proposal 4:*** *For uplink COT sharing, clarify that the total duration of UL and DL transmissions should not exceed the MCOT which initiated by the UE.*   * *Adopt TP4 into section 4.1.3 of TS 37.213.*   ----------------------------------- TP4: Start of TP 37.213 section 4.1.3 ---------------------------------------------  4.1.3 DL channel access procedures in a shared channel occupancy  <Unchanged parts are omitted>  If a gNB shares a channel occupancy initiated by a UE using the channel access procedures described in subclause 4.2.1.1 on a channel, the gNB may transmit a transmission that follows a PUSCH transmission on scheduled or configured resources by the UE after a gap as follows:  - The transmission shall contain transmission to the UE that initiated the channel occupancy and can include non-unicast and/or unicast transmissions where any unicast transmission that includes user plane data is only transmitted to the UE that initiated the channel occupancy.  - If the higher layer parameters *ul-toDL-CO-SharingED-Threshold-r16* is not provided, the transmission shall not include any unicast transmissions with user plane data and the transmission duration is not more than the duration of 2, 4 and 8 symbols for subcarrier spacing of 15, 30 and 60 kHz of the corresponding channel, respectively.  - The total duration of a PUSCH transmission on scheduled or configured resources including the following DL transmission obtained by Type 1 channel access procedure with UL channel access priority class , shall not exceed , where is given in Table 4.2.1-1.  - If the gap is up to , the gNB can transmit the transmission on the channel after performing Type 2C DL channel access as described in subclause 4.1.2.3.  - If the gap is or , the gNB can transmit the transmission on the channel after performing Type 2A or Type 2B DL channel access procedures as described in subclause 4.1.2.1 and 4.1.2.2, respectively.  <Unchanged parts are omitted>  ----------------------------------------End of TP 37.213 section 4.1.3 ---------------------------------------------- |

**FL Proposal #3**: *Discuss whether and how to capture the above clarification into 37.213*

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## 2.4 COT sharing indication in CG-UCI

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| **R1-2001759**  ***Proposal 5:*** *The gNB shall ignore the COT sharing indication in CG-UCI if the CG-UCI and the corresponding CG-PUSCH is transmitted within the gNB’s COT.*   * *Adopt TP5 into section 4.2.1.0.0 of TS 37.213.*   -----------------------------------TP5: Start of TP 37.213 section 4.2.1.0.0------------------------------------  4.2.1.0.0 Channel access procedures upon detection of a common DCI  <Unchanged parts are omitted>  If a UE determines the duration in time domain and the location in frequency domain of a remaining channel occupancy initiated by the gNB from a DCI format 2\_0 as described in subclause 11.1.1 of [7], the following is applicable:  - The UE may switch from Type 1 channel access procedures as described in subclause 4.2.1.1 to Type 2A channel access procedures as described in subclause 4.2.1.2.1 for its corresponding UL transmissions within the determined duration in time and location in frequency domain of the remaining channel occupancy. In this case, if the UL transmissions are PUSCH transmissions on configured resources, the UE may assume any priority class for the channel occupancy shared with the gNB. The gNB shall ignore the ‘COT sharing information’ in CG-UCI.  <Unchanged parts are omitted>  ----------------------------------------End of TP 37.213 section 4.2.1.0.0------------------------------------------ |

**FL Proposal #4**: *Discuss whether and how to capture the above clarification into 37.213*

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## 2.5 Correction on DL channel access in a shared COT initiated by a UE

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| **R1-2002632**   * *Proposal 1: Adopt the following text proposal on TS 37.213.*  |  | | --- | | ===========================Start of Text Proposal for TS37.213============================  4.1.3 DL channel access procedures in a shared channel occupancy  For the case where an eNB shares a channel occupancy initiated by a UE, the eNB may transmit a transmission that follows an autonomous PUSCH transmission by the UE as follows:  - If 'COT sharing indication' in AUL-UCI in subframe indicates '1', an eNB may transmit a transmission in subframe , where is subframeOffsetCOT-Sharing, including PDCCH but not including PDSCH on the same channel immediately after performing Type 2A DL channel access procedures in clause 4.1.2.1, if the duration of the PDCCH is less than or equal to duration of two OFDM symbols and it shall contain at least AUL-DFI or UL grant to the UE from which the PUSCH transmission indicating COT sharing was received.  If a gNB shares a channel occupancy initiated by a UE using the channel access procedures described in clause 4.2.1.1 on a channel, the gNB may transmit a transmission that follows a PUSCH transmission on scheduled or configured resources by the UE after a gap as follows:  - The transmission shall contain transmission to the UE that initiated the channel occupancy and can include non-unicast and/or unicast transmissions where any unicast transmission is only transmitted to the UE that initiated the channel occupancy.  - If the higher layer parameters *ul-toDL-CO-SharingED-Threshold-r16* is not provided, the transmission shall not include any unicast transmissions and the transmission duration is not more than the duration of 2, 4 and 8 symbols for subcarrier spacing of 15, 30 and 60 kHz of the corresponding channel, respectively.  - If the gap is up to , the gNB can transmit the transmission on the channel after performing Type 2C DL channel access as described in clause 4.1.2.3.  - If the gap is or , the gNB can transmit the transmission on the channel after performing Type 2A or Type 2B DL channel access procedures as described in clause 4.1.2.1 and 4.1.2.2, respectively.  For the case where a gNB shares a channel occupancy initiated by a UE with configured grant PUSCH transmission, the gNB may transmit a transmission that follows the configured grant PUSCH transmission by the UE as follows:  - If the higher layer parameter *ul-toDL-CO-SharingED-Threshold-r16* is provided, the UE is configured by *cg-COT-SharingList-r16* where *cg-COT-SharingList-r16* provides a table configured by higher layer. Each row of the table provides a channel occupancy sharing information given by higher layer parameter *CG-COT-Sharing-r16*. One row of the table is configured for indicating that the channel occupancy sharing information is not available.  - If the 'COT sharing information' in CG-UCI indicates a row index that corresponds to a *CG-COT-Sharing-r16* that provides channel occupancy sharing information, the gNB can share the UE channel occupancy assuming a channel access priority class *p= channelAccessPriority-r16*, starting from *O=offset-r16* slots from the end of the slot where CG-UCI is detected, for a duration of *D=duration-r16* slots where *duration-r16*, *offset-r16*, and *channelAccessPriority-r16* are higher layer parameters provided by *CG-COT-Sharing-r16*.  - If the higher layer parameter *ul-toDL-CO-SharingED-Threshold-r16* is not provided, and if 'COT sharing information' in CG-UCI indicates '1', the gNB can share the UE channel occupancy and start the DL transmission X= *cg-COT-SharingOffset-r16* symbols from the end of the slot where CG-UCI is detected, where *cg-COT-SharingOffset-r16* is provided by higher layer. The transmission shall not include any unicast transmissions and the transmission duration is not more than the duration of 2, 4 and 8 symbols for subcarrier spacing of 15, 30 and 60 kHz of the corresponding channel, respectively.  <unchanged parts are omitted>  =========================== End of Text Proposal for TS37.213============================ | |

**FL Proposal #5**: *Discuss whether and how to capture the above change into 37.213*

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## 2.6 Clarifications

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| **R1-2002247**  *In the DL channel access procedures in a shared COT, from our understanding, gNB can perform a DL transmission following any UL transmission if the prior UL burst includes a PUSCH. However, in TS 37.213 Subclause 4.1.3, it may be misread that a DL transmission in a shared COT should directly follow a PUSCH after a gap with the PUSCH [1]. To be clearer, the following change is proposed.*  **Proposal 1**: Update TS 37.213 Subclause 4.1.3 based on the following TP.  -------------------------------------------------------- Start of TP #1 ----------------------------------------------------  If a gNB shares a channel occupancy initiated by a UE using the channel access procedures described in clause 4.2.1.1 on a channel, the gNB may transmit a transmission that follows a UL transmission including a PUSCH transmission on scheduled or configured resources by the UE after a gap as follows:  <unchanged part omitted>  For the case where a gNB shares a channel occupancy initiated by a UE with configured grant PUSCH transmission, the gNB may transmit a transmission that follows a UL transmission including the configured grant PUSCH transmission by the UE as follows:  -------------------------------------------------------- End of TP #1 ----------------------------------------------------- |

**FL Proposal #6**: *Discuss whether and how to capture the above clarification into 37.213*

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| **Company / Org.** | **View on FL proposal #6** |
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# 3. Conclusions

TBA

# References

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| 1 | [**R1-2001534**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001534.zip) | Maintainance on the channel access procedure | Huawei, HiSilicon |
| 2 | [**R1-2001652**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001652.zip) | Remaining issues on the channel access procedures | vivo |
| 3 | [**R1-2001705**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001705.zip) | Remaining issues on the channel access procedure for NR-U | ZTE, Sanechips |
| 4 | [**R1-2001759**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001759.zip) | Discussion on the remaining issues of channel access procedure | OPPO |
| 5 | [**R1-2001935**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001935.zip) | Remaining issues of channel access procedure for NR-U | LG Electronics |
| 6 | [**R1-2001987**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001987.zip) | Channel access mechanism for NR-unlicensed | Intel Corporation |
| 7 | [**R1-2002031**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002031.zip) | Channel access procedures | Ericsson |
| 8 | [**R1-2002117**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002117.zip) | Channel access procedures for NR-U | Samsung |
| 9 | [**R1-2002193**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002193.zip) | Remaining Issues on Channel Access Procedures for NR-U | Nokia, Nokia Shanghai Bell |
| 10 | [**R1-2002247**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002247.zip) | Remaining issues on channel access procedures for NR-U | ETRI |
| 11 | [**R1-2002383**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002383.zip) | Remaining issues and corrections on channel access procedure for NR-U | Sharp |
| 12 | [**R1-2002405**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002405.zip) | Remaining issues on channel access for NR-U operation | MediaTek Inc. |
| 13 | [**R1-2002434**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002434.zip) | Remaining issues on channel access procedures for NR-U | NTT DOCOMO, INC. |
| 14 | [**R1-2002465**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002465.zip) | TP on shared spectrum in NR-U | NEC |
| 15 | [**R1-2002530**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002530.zip) | TP for Channel access procedures for NR unlicensed | Qualcomm Incorporated |
| 16 | [**R1-2002632**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002632.zip) | Remaining issues on channel access procedure for NR-U | WILUS Inc. |
| 17 | [**R1-2002684**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002684.zip) | COT sharing information in CG-UCI | Lenovo, Motorola Mobility |