**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

|  |  |
| --- | --- |
| 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 R1-2002632 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

|  |
| --- |
| **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.*

|  |  |
| --- | --- |
| **Company / Org.** | **View on FL proposal #1** |
| Intel | Forcing a UE to use a specific ED threshold configured by gNB may reduce greatly the channel access probability of the UE. Therefore, we believe that the choice of the ED threshold to use should be left to the UE. However, the UE should always use the ED threshold configured by the gNB in case it decides to share its remaining COT with the gNB for transmissions longer than 2/4/ or 8 symbols for 15/30 and 60 KHz subcarrier spacing, respectively. If the UE decides to use the ED threshold calculated by the UE based on the UL transmission power, the UE should always indicate within the CG-UCI that there will be no COT sharing with the gNB. Also we believe that the ED threshold used by the UE should be transparent to the gNB, and there is no necessity for the UE to indicate this explicitly to the gNB. |
| ZTE, Sanechips | Disagree, it is just an optimization issue. |
| LG | It should be noted that forcing a UE to use ED threshold configured by gNB may reduce the channel access probability of the UE if configure ED threshold is more sensitive than the ED threshold value calculated by the UE based on the UL transmission power configured by gNB. Therefore, it should be considered for a UE to choose its ED threshold to be applied for its transmission and the ED threshold used by UE can be indicated explicitly by the row index corresponding to no COT sharing information is included in the CG-UCI.  In addition, for the case of dynamic scheduled PUSCH, the ED threshold for the UE to use for PUSCH transmission can be explicitly indicated by UL grant. In other word, the ED threshold can be determined by gNB depending on whether or not it will share channel occupancy initiated by the DG-PUSCH. |
| Nokia, NSB | We support the principle of the change. Allowing the UE to choose the ED threshold improves chances f channel access and is compliant with regulations. As for signalling, it is sufficient just to indicate “no COT sharing” in case a different ED threshold than the configured one is used. |
| Broadcom | Agree to Proposal 5 and Proposal 6 in principle. However, Proposal 2 is very broad and without any detail it can also imply that the ED threshold can vary dynamically without any other condition. So, we don’t agree to Proposal 2 in its current form. |
| vivo | As mentioned by Intel, always using the configured UL to DL COT sharing ED threshold may dramatically reduce the channel access probability. Therefore, it is reasonable for UE to choose the ED threshold by itself. According to current spec, the COT sharing information with length of is always there if UL to DL COT sharing ED threshold is configured, therefore, it is no harm to indicate “no COT sharing information” when UE chooses to use the ED threshold calculated with its own transmission power. Or a new entry can be included in the “CG-COT-Sharing-r16” to indicate that UE use the ED threshold calculated with its own transmission power. The “no COT sharing information” together with the ED threshold calculated with UE’s transmission power indicate that slot/symbol n+X is applicable for sharing, and gNB is allowed to transmit control/broadcast signal/channels with length of 2/4/8 OSs for 15/30/60kHz, similar as the case when no UL to DL COT sharing ED threshold is configured.  For scheduled PUSCH, gNB could indicate which ED threshold is used depending on the need to share UE’s COT at gNB side. |
| WILUS | We don’t see the motivation to explicitly indicate the ED threshold used by the UE to the gNB on whether the UE uses an ED threshold configured by the gNB or ED threshold based on UE transmission power. |
| Lenovo, Motorola Mobility | We support allowing UE to select either the gNB-configured ED threshold or UE-determined ED threshold. However, it is noted that no COT sharing indicator should be indicated in CG-UCI when UE uses its determined ED threshold such that the UE-initiated COT is not to be shared. We think this flexibility can bring more channel access probability for UE.  Regarding dynamic scheduled PUSCH, RAN1 has already agreed to support UE-initiated COT sharing for transmitting scheduled PUSCH. We support one-bit COT sharing indicator in UL grant. When gNB intends to share the UE-initiated COT, gNB can enable the COT sharing indicator so that UE shall use the configured ED threshold and share remaining COT to gNB; When gNB does not intend to share the UE-initiated COT, gNB can disable the COT sharing indicator so that UE can use its own determined ED threshold and indicate no COT sharing in CG-UCI. |
| Samsung | Share the similar view with Intel that the choice of the ED threshold to use should be up to UE, but UE should ensure a proper ED threshold according to the conditions of whether/the duration of shared COT with the gNB as previously agreed. |
| CL | We disagree with Proposal 2, since we find it too broad.  We agree with Proposals 5 and 6. |
| Ericsson | Proposal#5 is already covered. We are not supportive of Proposal#2 and #6.  With respect to configured grant, and COT sharing, if the UE choses not to use the configured threshold, then it doesn’t share the COT and indicates that in the CG-UCI. That is already covered in the specification.  With respect to scheduled UL transmission, everything is controlled by gNB. So, it is gNB who decides whether to share a COT initiated by UE or not and plans the next transmissions based on that. In that case, UE should follow the configured threshold and do as it is commanded to. |
| OPPO | Agree with Nokia |

## 2.2 UL-DL gap > 25 us

|  |
| --- |
| **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*

|  |  |
| --- | --- |
| **Company / Org.** | **View on FL proposal #2** |
| Intel | We believe that the support of type 2A if the gap within a UE’s shared COT between UL and DL is larger than 25us would be beneficial for the UE’s shared COT procedure and widen its utilization. Otherwise, the use of the UE’s shared COT will be very restrictive.  As for proposal in R1-2001537, we are not supportive. While we understand the motivation behind it, we feel this is an optimization which is not essential at this point of the WI. |
| ZTE, Sanechips | Support our Proposal and TP in R1-2001705, because the similar behavior has been supported for gNB initiated COT |
| LG | We support for UL-DL gap later than 25us in a UE-initiated COT since similar behaviour is already introduced in a gNB-initiated COT. |
| Nokia, NSB | We support the TP in R1-2001705. Without this functionality, the gNB can more seldom make use of COT sharing due to processing time limitations. The wording for the corresponding change in R1-2002530 is less accurate.  The change in R1-2001537 seems less crucial. |
| Broadcom | We disagree to gaps > 25us between a UL burst and DL burst for the purpose of UL-to-DL COT sharing. The reasons are as follows:  The motivation of COT sharing with a pause > 25us in LAA was to accommodate the scheduling delay for a UL transmission and the UE condition of being able to transmit only at ms boundaries. There is no similar scheduling delay or transmission start time restriction for an NR-U gNB.  This proposal has been made multiple times since feLAA over various study items and work items. Each time, as a group we have discussed and decided not to support it. Now when the work item is closed, we would like to ask if it is a valid procedure to still bring this feature as a CR that has been discussed multiple times earlier and not agreed. |
| vivo | A gap between the UL and DL larger than 25us should be supported for UL to DL sharing, which makes the COT sharing more flexible and efficient. |
| WILUS | We support this for UL to DL COT sharing with a gap > 25us within a UE initiated COT as used in gNB-initiated COT. |
| Lenovo, Motorola Mobility | We support the TP in R1-2001705.  The proposal in R1-2001537 seems not clear. |
| Samsung | Support a UL-DL gap >25us in a UE-initiated COT.  TP in R1-2001537 is not essential from our point of view. |
| CableLabs | The >25 s (UL🡪DL bursts) gaps proposal has been discussed and not agreed in the past. We disagree with the proposal. |
| Ericsson | In general, we could be fine with the proposal, and we think it is up to the group whether it should be prioritized or not.  With respect to comments on LAA, we would like to point out that 3GPP technologies for unlicensed operation should benefit the same level of flexibility and possibilities of evolution as other technologies where similar proposal is suggested for 11be. |
| OPPO | We are fine to support the TP in R1-2001705. |

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

|  |
| --- |
| **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*

|  |  |
| --- | --- |
| **Company / Org.** | **View on FL proposal #3** |
| Intel | We support this clarification text. However, the text should not be restrictive to one switching point but should be written such a way that multiple switching points are allowed (as already agreed during the WI). Also the text should explicitly mention that the gaps between UL and DL bursts are also counted toward the . Therefore, the text may be revised as follows:  The total duration of all PUSCH transmissions on scheduled or configured resources including ~~the following~~ all DL transmissions and gaps inside the same channel occupancy 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. |
| ZTE, Sanechips | it seems to be a common sense and there is no big problem if it is not be captured in spec. |
| LG | We support this text proposal. |
| Nokia, NSB | We are ok with the change, and agree with Intel’s refined wording. Just as a further point, gaps longer than 25 us should not count in in the duration of COT, see Clause 4.0 of 37.213: “For determining a *Channel Occupancy Time*, if a transmission gap is less than or equal to , the gap duration is counted in the channel occupancy time.”. So we could say:  The total duration of all PUSCH transmissions on scheduled or configured resources including ~~the following~~ all DL transmissions and gaps shorter or equal to inside the same channel occupancy 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. |
| Broadcom | We are ok with this change if it also specifies that a COT also includes all gaps <= 25us. This is also required by the ETSI harmonized standard for 5 GHz.  Further to Intel’s point: UL-DL-UL switch in a UE initiated COT has not been agreed in the study item or work item, so we disagree to including this case. |
| vivo | We think the clarification is not necessary. For CG UL transmission, UE determines the shared duration to gNB by indicating the duration and offset in the “COT sharing information”. Therefore, it is not reasonable for UE to indicate a duration which is larger than its remaining COT. For DG UL transmission, the channel access priority class is indicated by gNB, which means that gNB knows the MCOT of the UE. gNB will not perform DL transmission exceeding the MCOT. |
| WILUS | We support this clarification and it seems more accurate with modification by Nokia. |
| Lenovo, Motorola Mobility | Generally fine with this proposal since it makes spec clearer.  One question from our side is whether the gap between UL and DL switching is counted in the MCOT? |
| Samsung | We are OK with this proposal. |
| CableLabs | We support BDCM’s position. |
| Ericsson | We agree with the intention and support to make changes. However, I would like to suggest the following changes where basically are the same as those proposed by others but with some slight differences as the following:   * In section 4.0, Channel Occupancy Time is defined whihc includes the gap up to 25 us. So, no need to repeat the same thing here. * We realized, a similar statement for Cat4 for UL on the MCOT restiriciton is missing for UL. * Also, scheduled UL transmisison is not only PUSCH. It can be PUCCH (for HARQ).   4.2.1 Channel access procedures for uplink transmission(s)  <unchanged text omitted>  A UE shall not transmit on a channel for a *Channel Occupancy Time* that exceeds where the channel access procedures are performed based on a channel access priority class associated with the UE transmissions, as given in Table 4.2.1-1.  The total duration of autonomous uplink transmission(s) obtained by the channel access procedure in this clause, including the following DL transmission if the UE sets 'COT sharing indication' in AUL-UCI to '1' in a subframe within the autonomous uplink transmission(s) as described in Subclause 4.1.3, shall not exceed , where is given in Table 4.2.1-1.  <unchanged text omitted> 4.1.3 DL channel access procedures in a shared channel occupancy <unchanged text omitted>  If a gNB shares a channel occupancy initiated by a UE within the UE corresponding *Channel Occupancy Time* 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~~ UL transmission on scheduled resources or a PUSCH transmission on configured resources by the UE after a gap as follows:  <unchanged text omitted>  For the case where a gNB shares a channel occupancy initiated by a UE within the UE corresponding *Channel Occupancy Time* with configured grant PUSCH transmission, the gNB may transmit a transmission that follows the configured grant PUSCH transmission by the UE as follows:  <unchanged text omitted>  ======================================== |
| OPPO | OK with the TP |

## 2.4 COT sharing indication in CG-UCI

|  |
| --- |
| **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------------------------------------------ |
| **R1-2002684**  *Proposal 1: COT sharing information in CG-UCI for indicating the shared resources is updated slot by slot; the indication is consistent.*  *Proposal 2: Upon reception of COT sharing information in CG-UCI, only DL unicast data with CAPC value not larger than the UL CAPC value indicated by the COT sharing information is allowed to be transmitted in the shared resources.*  *Proposal 3: Adopt the TP to reflect the above two proposals in TS37.213:*  -----------------------------------------------< BEGIN TEXT PROPOSAL >-------------------------------------------------  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 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 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 both the higher layer parameter *ul-toDL-CO-SharingED-Threshold-r16* and the higher layer parameter *cg-COT-SharingList-r16* are provided to the UE, the UE transmits CG-UCI with bits for COT sharing information, where *C* is the number of rows in a table provided in *cg-COT-SharingList-r16*. 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 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*. Only the DL unicast transmission with user plane data having CAPC value not larger than the *channelAccessPriority-r16* is allowed to be transmitted in the UE channel occupancy. The ‘COT sharing information’ in CG-UCI is updated by the UE slot by slot.  - If the 'COT sharing information' in CG-UCI indicates a row index that corresponds to a *CG-COT-Sharing-r16* that indicates channel occupancy sharing is not available, there is no channel occupancy sharing to gNB.  - If the higher layer parameter *ul-toDL-CO-SharingED-Threshold-r16* is not provided and the higher layer parameter *cg-COT-SharingOffset-r16* is provided to the UE, the UE transmits CG-UCI with 1 bit COT sharing information. 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. 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.  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 most . In this case the following applies:  - If the gap is , 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.  -----------------------------------------------< END TEXT PROPOSAL >------------------------------------------------- |

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

|  |  |
| --- | --- |
| **Company / Org.** | **View on FL proposal #4** |
| Intel | We support both TPs. |
| ZTE, Sanechips | We think it can be solved by gNB implementation. |
| LG | We think that both TPs are not necessary. Whether or not to use the COT sharing information can be decided by the gNB without specification impact. |
| Nokia, NSB | R1-2001759: we do not see a need for this, as gNB will need to handle it anyway  R1-2002684: this seems necessary |
| Broadcom | We agree to the TPs. |
| vivo | TP5 and proposal 2 in R1-2002684 are OK but not necessary.  We disagree with the proposal 1 in R1-2002684. The COT sharing information should not be updated slot by slot, the only requirement is that indication in the latter slot should not revert the indication in the former slot. E.g., if in slot 1, UE indicates a valid entry in “COT sharing information”, in the next slot, UE can indicate “no COT sharing information”, which means that there is no COT sharing information available, gNB continues using the pervious COT sharing information.  Besides, for the case when the “higher layer parameter *ul-toDL-CO-SharingED-Threshold-r16”* is not configured, COT sharing information is 1 bit, and indicating if slot/symbol n+X is applicable for UL to DL sharing. E.g., 1 indicates that slot/symbol n+X is applicable, 0 means that no COT sharing information is available. Assume X = 56, UE can indicate in slot 1, with COT sharing information value 1 to indicate that slot 5 (1+4) is applicable for sharing. In slot 2, 3 and 4, UE can indicate COT sharing information with value 0 to show that no further COT sharing information is available. gNB continues using the COT sharing information indicated in slot 1. |
| WILUS | We don’t see a need for both TPs. It can be handled by a gNB. |
| Lenovo, Motorola Mobility | We support both TPs. |
| Samsung | Not support TP in R1-2001759, because it is kind of optimization to handle the case that UE may not have sufficient time to re-generate COT sharing information in CG-UCI after UE detects CG-PDCCH. Following the current spec, if there is no sufficient time to re-generate CG-UCI, UE can choose not to switch to Type-2 channel access and still perform Type-1 channel access to share COT to gNB.  Support TP in R1-2002684. |
| CL | We support both TPs. |
| Ericsson | * Proposal 1 is not needed because it is already covered. In 38.213 we state that CG-UCI is send with PUSCH. Also, in 37.213, section 4.2.3 we state:   For the case where a UE performs channel access procedures as described in clause 4.2.1.2.1 and shares its corresponding channel occupancy time with the gNB, is set equal to the value provided by the higher layer parameter *ul-toDL-CO-SharingED-Threshold-r16*, if provided.  Proposal 2, we disagree it is needed in 37.213. The CAPC related issues are covered in 38.300. Please see Proposal 2 in our contribution R1-2002031 as an example. |
| OPPO | We support the TP in R1-2001759. It is necessary to clarify the use case of ‘COT sharing information’.  In addition, it should be clarified that ‘COT sharing information’ is not expected to be configured in CG-UCI in FBE case, since CG-PUSCH is transmitted always within a gNB’s COT. |

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

|  |  |
| --- | --- |
| **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*

|  |  |
| --- | --- |
| **Company / Org.** | **View on FL proposal #5** |
| Intel | We do not support this TP and changes, since we believe that current text is very clear. Furthermore, during the WI we made the agreement that user plane data is not supported when ED threshold is not configured, and the specification text should reflect it. |
| ZTE, Sanechips | Support |
| LG | We are ok with this text proposal. |
| Nokia, NSB | We are ok with the change |
| Broadcom | We do not agree to this TP, as it tries to remove a restriction on the UE-to-gNB COT sharing agreement made in RAN1#98bis. |
| vivo | The current text aligns with the agreement, no further change is needed. |
| WILUS | According to the agreement at RAN1#98bis below,   |  | | --- | | ***Agreement at RAN1#98bis:***  *Sharing of a UE-initiated channel occupancy (either CG-PUSCH or scheduled UL) with gNB is supported, such that the gNB is allowed to transmit control/broadcast signals/channels for any UEs as long as the transmission contains transmissions for the UE that initiated the channel occupancy and/or DL signals/channels (PDSCH, PDCCH, reference signals) meant for the UE that initiated the channel occupancy.*   * *The ED threshold that the UE applies when initiating a channel occupancy to be shared with the gNB is configured by gNB (RRC signaling)*   + *if ED threshold that the UE applies when initiating a channel occupancy to be shared with the gNB is not configured, the transmission of the gNB in UE initiated COT may include only control/broadcast signals/channels transmissions of up to 2/4/8 OFDM symbols in duration for 15/30/60 kHz SCS*   + *When absence of WiFi cannot be assumed based on e.g. regulation, the ED threshold that the gNB configures to the UE to apply when initiating the channel occupancy is determined based on the max gNB TX power* |   if DL signals/channels (PDSCH, PDCCH, reference signals) is included on a transmission from a gNB to the UE that initiated the channel occupancy, the gNB is allowed to transmit control/broadcast signals/channels for any UEs. In other words, the DL signals/channels do not confine to the unicast transmission with user plane only. Regardless of including the user plane data, if the unicast transmission such as PDCCH or reference signals for the UE that initiated the channel is contained on the transmission from the gNB, the gNB may transmit a DL transmission that follows a PUSCH transmission on scheduled or configured resources by the UE after a gap. Therefore, we need to clarify this with the first correction as a TP above.  Similarly, according to the agreement at RAN1#98bis above, if ED threshold that the UE applies when initiating a channel occupancy to be shared with the gNB is not configured, the transmission of the gNB in UE initiated COT may include only control/broadcast signals/channels transmissions of up to 2/4/8 OFDM symbols in duration for 15/30/60 kHz SCS. The transmission of the gNB shall not include any unicast transmissions and the unicast transmission shall not be limited to inclusion of user plane data. The unicast transmission can include reference signals. As a result, the transmission of the gNB in UE initiated COT may include only control/broadcast signals/channels transmissions. Therefore, we need to clarify this with the second/third correction as a TP above. |
| Lenovo, Motorola Mobility | We are OK with this proposal. |
| Samsung | The TP is not needed. Current text in the spec correctly reflects the agreement. |
| CL | We consider the existent text as being clear. We do not agree with any changes. |
| Ericsson | We don’t agree with the TP because the current text is intended to capture the corresponding agreement. |
| OPPO | We share same views as Intel and do not support this TP and changes. |

## 2.6 Clarifications

|  |
| --- |
| **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*

|  |  |
| --- | --- |
| **Company / Org.** | **View on FL proposal #6** |
| Intel | We believe the current specification text is already quite clear, and this text is unnecessary. |
| ZTE, Sanechips | Share same views as Intel |
| LG | We are ok with this text proposal. |
| Nokia, NSB | we are ok with the change |
| Broadcom | The proposed change does not seem necessary. |
| vivo | The TP is not necessary, current text is clear enough. |
| WILUS | We are ok with this change. |
| Lenovo, Motorola Mobility | We are OK with this proposal. |
| Samsung | This editorial change is not essential. |
| CL | Same position as Intel |
| Ericsson | We are OK with the intention but have slightly alternative wording. It seems mistakenly, scheduled UL only covers the PUSCH case which is not aligned with the agreement. Hence, we suggest to update the proposed TP#1 as the following (also see our comment on Section 2.3 above):  -------------------------------------------------------- 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~~ UL transmission on scheduled resources or a PUSCH transmission on 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 ----------------------------------------------------- |
| OPPO | Don’t know if the intention of the TP is to clarify that if the UL transmission is PUCCH or SRS, the gNB is also allowed to share the UE-COT? |

# 3. Conclusions

TBA

# References

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |