**3GPP TSG RAN WG1 #104-e R1- 210XXXX**

**e-Meeting, January 25th – February 5th, 2021**

**Agenda item: 7.2.2**

**Source: Moderator (Nokia)**

**Title: Feature Lead Summary on Channel Access Procedures for NR-U**

**Document for: Discussion and Decision**

# 1 Introduction

This document summarizes the main issues brought forward in the contributions submitted to AI 7.2.2 that are related to Channel Access Procedures. Earlier agreements reached during the Study Item are captured in TR 38.889.

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[2. Issues identified in the contributions](#_Toc62028869)

[2.1 LBT type for non-contiguous SRS and PUSCH/PUCCH](#_Toc62028870)

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# 2. Issues identified in the contributions

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

## 2.1 LBT type for non-contiguous SRS and PUSCH/PUCCH

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| LBT type for non-contiguous SRS and PUSCH/PUCCH | [**R1-2101072**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101072.zip) |

One company proposes clarification to the case of non-consecutive SRS transmissions.

[**R1-2101072**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101072.zip)**:**

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| **Proposal 1: When an SRS resource are split by the gNB COT, it is clarified that two SRS subsets have own channel access and the SRS subset in the gNB COT can change the indicated channel access**  The revised text is proposed below to address our clarifications.   |  | | --- | | TS 37.213-g430, section 4.2.1.0.1 Channel access procedures for consecutive UL transmission(s)  <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 clause 11.1.1 of [7], the following is applicable:  - The UE may switch from Type 1 channel access procedures as described in clause 4.2.1.1 to Type 2A channel access procedures as described in clause 4.2.1.2.1 for its corresponding UL transmissions including PUSCH, or SRS symbol(s) within the remaining channel occupancy initiated by the gNB, 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.  <omitted>  TS 37.213-g430, section 4.2.1.0.1 Channel access procedures for consecutive UL transmission(s)  <omitted>  - If a UE is scheduled to transmit a set of UL transmissions including PUSCH, or SRS symbol(s) within the remaining channel occupancy initiated by the gNB, using one or more UL grant, and if the UE cannot access the channel for a transmission in the set prior to the last transmission according to one of Type 1, Type 2, or Type 2A UL channel access procedures, the UE shall attempt to transmit the next transmission according to the channel access type indicated in the corresponding UL grant. Otherwise, if the UE cannot access the channel for a transmission in the set prior to the last transmission according to Type 2B UL channel access procedure, the UE shall attempt to transmit the next transmission according to Type 2A UL channel access procedure.  <omitted> | |

Comments:

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| **Company** | **Comment** |
| Qualcomm | The first change (Type 1 to Type 2A upgrade) does not seem to be necessary. The original text already mention “UL transmissions”, which naturally cover PUSCH, SRS etc. There may not need to spell everything out.  The second change may need to consider PUSCH, SRS triggered by DL and UL grant, and PUCCH triggered by DL grants. Propose the following TP  <omitted>  - If a UE is scheduled to transmit a set of UL transmissions using one or more grant(s), and if the UE cannot access the channel for a transmission in the set prior to the last transmission according to one of Type 1, Type 2, or Type 2A UL channel access procedures, the UE shall attempt to transmit the next transmission according to the channel access type indicated in the corresponding grant. Otherwise, if the UE cannot access the channel for a transmission in the set prior to the last transmission according to Type 2B UL channel access procedure, the UE shall attempt to transmit the next transmission according to Type 2A UL channel access procedure.  <omitted> |
| ZTE, Sanechips | Share the same view as Qualcomm and updated TP from Qualcomm seems better. |
| Sharp | As the proposed TP do not change any UE behavior, we do not see the need of this TP, except for “one or more UL grant” which should be discussed in section 2.2 below. |
| WILUS | We do not see necessity of the first change as mentioned by QC and “within the remaining channel occupancy initiated by the gNB” is also already described above.  For the 2nd change, it seems not necessary to have this TP except for “one or more UL grant” since the UL transmissions including PUSCH, or SRS symbols in the paragraph are not restricted within the remaining channel occupancy initiated by the gNB. And this paragraph is only describing consecutive PUSCH transmissions case and for a set of consecutive PUSCH or SRS transmissions are already mentioned in the other paragraphs in section 4.2.1.0.1 of 37.213 rather than this paragraph. |
| Spreadtrum | Agree with Qualcomm and fine with Qualcomm’s updated TP. |
| LG | We don’t see necessity of the TP. |
| vivo | Agree with Qualcomm’s TP. |
| Nokia, NSB | The first change is not necessary as “UL transmission” already covers SRS.  For the 2nd change, we are not sure if it is worthwhile optimizing the behavior of multi-SRS transmissions in the case LBT fails prior to the first SRS transmissions. |
| Lenovo, Motorola Mobility | We don't see a need for the first fix. The second fix with Qualcomm's modification is fine. |
| Samsung | If the intention is to address two SRS subsets in different CO, there is no need of first change, because UL transmission includes SRS. For the second change, “If a UE is scheduled to transmit a set of UL transmissions ~~including PUSCH using UL grant~~” is sufficient, or Qualcomm’s TP is ok. |
| Intel | We do think the first TP is needed. As for the second TP, we are OK with the proposed text from Qualcomm. |
| Ericsson | We also thing first change is not needed, since “UL transmission” covers SRs too.  On second change, we prefer QC TP. However, is the intention to cover PUCCH too? Or only PUSCH and SRS? If it is the former (which suggests by QC TP), a rephrasing is needed since the term “DL assignment” and “UL grant” are used in 37.213 for DL and UL DCI, respectively. |
| Huawei, HiSilicon | We share the view as Ericsson. It should be noted however, that “DL grant” has been also used in 37.213 at least in 4 occurrences. |

## 2.2 Clarifications to LBT with consecutive UL transmissions

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| Clarifications to LBT with consecutive UL transmissions | [**R1-2101671**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101671.zip) |

One contribution discusses the UL channel access procedure after LBT failure in the case of multi-slot scheduling without gap by multiple UL grants with the following TP:

[**R1-2101671**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101671.zip)**:**

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| * *Proposal 2: Adopt the following text proposal on TS 37.213.*  |  | | --- | | ===========================Start of Text Proposal for TS37.213===========================  4.2.1.0.1 Channel access procedures for consecutive UL transmission(s)  For contiguous UL transmission(s), the following are applicable:  - If a UE is scheduled to transmit a set of UL transmissions including PUSCH using one or more UL grant(s) , and if the UE cannot access the channel for a transmission in the set prior to the last transmission according to one of Type 1, Type 2, or Type 2A UL channel access procedures, the UE shall attempt to transmit the next transmission according to the channel access type indicated in the UL grant. Otherwise, if the UE cannot access the channel for a transmission in the set prior to the last transmission according to Type 2B UL channel access procedure, the UE shall attempt to transmit the next transmission according to Type 2A UL channel access procedure.  - If a UE is scheduled by a gNB to transmit a set of UL transmissions including PUSCH or SRS symbol(s) using one or more UL grant(s), the UE shall not apply a CP extension for the remaining UL transmissions in the set after the first UL transmission after accessing the channel.  - If a UE is scheduled to transmit a set of consecutive UL transmissions without gaps including PUSCH using one or more UL grant(s), PUCCH using one or more DL grant(s), or SRS with one or more DL grant(s) or UL grant(s) and the UE transmits one of the scheduled UL transmissions in the set after accessing the channel according to one of Type 1, Type 2, Type 2A, Type 2B or Type 2C UL channel access procedures, the UE may continue transmission of the remaining UL transmissions in the set, if any.  - If a UE is configured to transmit a set of consecutive PUSCH or SRS transmissions on resources configured by the gNB, the time domain resource configuration defines multiple transmission occasions, and if the UE cannot access the channel according to Type 1 UL channel access procedure for transmitting in a transmission occasion prior to the last transmission occasion, the UE shall attempt to transmit in the next transmission occasion according to Type 1 UL channel access procedure. If the UE transmits in one of the multiple transmission occasions after accessing the channel according to Type 1 UL channel access procedure, the UE may continue transmission in the remaining transmission occasions in the set, wherein each transmission occasion starts at the starting symbol of a configured grant PUSCH within the duration of the COT.  - If a UE is configured by the gNB to transmit a set of consecutive UL transmissions without gaps including PUSCH, periodic PUCCH, or periodic SRS and the UE transmits one of the configured UL transmissions in the set after accessing the channel according to Type 1 UL channel access procedures, the UE may continue transmission of the remaining UL transmissions in the set, if any.  - A UE is not expected to be indicated with different channel access types for any consecutive UL transmissions without gaps in between the transmissions, except if Type 2B or Type 2C UL channel access procedures are identified for the first of the consecutive UL transmissions.  ============================<<unchanged text omitted>>==============================  ===========================End of Text Proposal for TS37.213=========================== | |

Comments:

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| **Company** | **Comment** |
| Qualcomm | Support the TP |
| ZTE, Sanechips | This TP seems to partial overlap with updated TP in Section 2.1.  If the previous updated TP in Section 2.1 is supported, the first change can refer to it directly.  Further, for the second change, it may also need to consider PUCCH in addition to PUSCH, SRS. So the suggested TP is as follows:  .....  - If a UE is scheduled to transmit a set of UL transmissions using one or more grant(s) , and if the UE cannot access the channel for a transmission in the set prior to the last transmission according to one of Type 1, Type 2, or Type 2A UL channel access procedures, the UE shall attempt to transmit the next transmission according to the channel access type indicated in the corresponding grant. Otherwise, if the UE cannot access the channel for a transmission in the set prior to the last transmission according to Type 2B UL channel access procedure, the UE shall attempt to transmit the next transmission according to Type 2A UL channel access procedure.  - If a UE is scheduled by a gNB to transmit a set of UL transmissions using one or more grant(s), the UE shall not apply a CP extension for the remaining UL transmissions in the set after the first UL transmission after accessing the channel.  ..... |
| Sharp | For the first part of the proposed correction (i.e. the correction to the 1st bullet), we support it.  For the second part of the proposed correction (i.e. the correction to the 2nd bullet), it is not necessary. As a set of UL transmissions is contiguous in this context, the second UL grant does not indicate non-zero CP extension. |
| WILUS | Support the TP as the proponent, and we are fine with the modification by ZTE to cover UL transmission such as PUSCH, SRS triggered by DL and UL grant, and PUCCH triggered by DL grants. |
| Spreadtrum | We are fine with the first change. For the second change, we are fine with ZTE’s updated TP. |
| LG | Support the TP. |
| vivo | Support the TP |
| Nokia, NSB | We are not convinced that the TP is necessary. The first two bullets were meant to specifically cover the case of multi-PUSCH allocation.  The first change does not seem needed, since the 3rd bullet already describes the behavior with back to back transmissions. In the case of individual grants, it is clear that the UE shall apply the LBT type indicated in the DCI for accessing the channel. The second change is also not needed, as Sharp points out. |
| Lenovo, Motorola Mobility | Changing from "a" to "one or more" is editorial, so we think it is not necessary. The other modification suggested by ZTE is fine. |
| Samsung | OK with the TP. |
| Intel | We are OK with this TP. |
| Ericsson | We don’t agree with TP.  As Nokia mentioned, this part of spec is intended for one grant for multiple PUSCH (multi-PUSCH scheduling by single DCI). Suggested changes creates problem with the follow up text, since it is assumed all these UL transmission are indicated to use same channel access (due to single DCI or single grant). If one adds more grant, it is not clear how to interpret the rest of the cases since number of combinations of LBT types for these UL transmissions would explode. |
| Huawei, HiSilicon | We do not support this TP for the reasons mentioned by Nokia and Ericsson |

## 2.3 Clarifications to channel access for semi-static channel occupancy

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| Clarifications to channel access for semi-static channel occupancy | [**R1-2100072**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100072.zip)  [**R1-2100147**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100147.zip)  [**R1-2100199**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100199.zip)  [**R1-2100628**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100628.zip)  [**R1-2101284**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101284.zip)  [**R1-2101304**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101304.zip)  **[R1-2101531](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101531.zip)** |

Six companies propose clarifications to the conditions under which a UE is permitted to transmit within a gNB COT (the TPs are not copied below due to space restrictions:

[**R1-2100072**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100072.zip)Proposals 1 - 3

[**R1-2100147**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100147.zip)Proposal 1

[**R1-2100199**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100199.zip)Proposals 1&2

[**R1-2100628**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100628.zip)Proposal 3

[**R1-2101284**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101284.zip) Proposal 1

[**R1-2101304**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101304.zip) Proposals 4&5, Observations 1-3

One company proposes a change to COT definition for semi-static channel access:

[**R1-2101531**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101531.zip)**:**

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| **Proposal 1:**   * **Update the definition of COT for semi-static channel access procedures in clause 4.3 so that it is aligned with ETSI EN 301 893.**    + **Adopt Text proposal #1 for TS37.213.**  |  | | --- | | **Text proposal #1**  --------- beginning of text proposal for TS 37.213  **<omitted>** 4.3 Channel access procedures for semi-static channel occupancy Channel assess procedures based on semi-static channel occupancy as described in this Clause, are intended for environments where the absence of other technologies is guaranteed e.g., by level of regulations, private premises policies, etc. If a gNB provides UE(s) with higher layer parameters *ChannelAccessMode-r16 ='semistatic'* by SIB1 or dedicated configuration, a periodic channel occupancy can be initiated by the gNB every within every two consecutive radio frames, starting from the even indexed radio frame at with a maximum channel occupancy time , where *period* in , is a higher layer parameter provided in *SemiStaticChannelAccessConfig* and *.* For determining a *Channel Occupancy Time* based on semi-static channel access procedures, duration of any transmission gap within is counted in the channel occupancy time.  In the following procedures in this clause, when a gNB or UE performs sensing for evaluating a channel availability, the sensing is performed at least during a sensing slot duration . The corresponding adjustment for performing sensing by a gNB or a UE is described in clauses 4.1.5 and 4.2.3, respectively.  **<omitted>** | |

Comments:

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| **Company** | **Comment** |
| Qualcomm | Support the TP |
| ZTE, Sanechips | Such definition on “Channel Occupancy Time” had been specified in Clause 4.0 of 37.213. in my understanding, it can be applied for FBE and LBE. original text is copied below: 4 Channel access procedure4.0 General *A Channel Occupancy Time refers to the total time for which eNB/gNB/UE and any eNB/gNB/UE(s) sharing the channel occupancy perform transmission(s) on a channel after an eNB/gNB/UE performs the corresponding channel access procedures described in this clause. 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. A channel occupancy time can be shared for transmission between an eNB/gNB and the corresponding UE(s).*  Besides, I noticed that the issue on “clarifications to the conditions under which a UE is permitted to transmit within a gNB COT” has not been handled yet. |
| Sharp | Regarding ChannelAccess-CPext-CAPC and ChannelAccess-CPext field discussion, either option resolve the issue, but option 2, i.e. decoupling of FBE from LBE, looks slightly cleaner.  Support the TP in R1-2101531 as the proponent.  @ZTE, the intention of the TP in R1-2101531 is that gaps with any length are counted as a part of a COT in FBE while only gaps with less than or equal to 25us are counted as a part of a COT in LBE. |
| Spreadtrum | Fine with the TP. |
| LG | Support the TP. |
| ZTE(1) | Response to Sharp: in principle, we have no objection to this TP. But if it is captured in Clause 4.3, it seems necessary to limit the definition on “channel occupancy time” in Clause 4.0 for LBE mode.  For the issue on “clarifications to the conditions under which a UE is permitted to transmit within a gNB COT”, we tend to reuse the existing specs architecture as much as possible, e.g., the TPs proposed in our contribution. However, there is still an issue to be solved, that is, need to further clarify whether configured grant UE can identify the length of gap between the ending of DL and the starting of UL. |
| vivo | Support the TP in [**R1-2101531**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101531.zip).  Regarding other proposals on the LBT type and CPE for FBE, agreement should first be made on how to apply *ChannelAccess-CPext-CAPC* and *ChannelAccess-CPext* fields for scheduled UL transmission with FBE channel access mechanism. |
| Nokia, NSB | For the first aspect we support the TP in R1-2101284 as a simple correction. If one wants to go for a more comprehensive and complete correction, we can also be ok with Option 3 in R1-2101304: i.e. coupling signaling and decoupling channel access procedures FBE and LBE channel access procedures, and the corresponding TPs for 38.212 and 37.213.  We also support the TP#1 in R1-2101531. |
| Lenovo, Motorola Mobility | Support the TP in R1-2101531.  Option 3 in R1-2101304 looks generally fine, however:  TP#1 for 38.212: It may be a stronger statement if we remove the word "Note" in the changes, but we are open to go with the majority view on this specific aspect.  TP#2 for 38.213 may need further consideration: With the current TP, it would say  "A channel occupancy initiated by a gNB and shared with UE(s) shall satisfy thefollowing: […] A UE may be indicated by the gNB to […]"  It seems strange to "satisfy" by a "may" statement. |
| Samsung | For the first issue, we are ok with option 3 in R1-2101304, although our position was more aligned with option 2 for a clear spec writing. We’re ok with the TP based on option 3 in R1-2101304 with minor revision with exactly the same wording in 37.213 “Otherwise, the UE assumes “9us sensing as defined in Clause 4.3 in 37.213”.” -> “Otherwise, the UE assumes “9us sensing **within a interval** as defined in Clause 4.3 in 37.213”  For the second issue, we are ok with the clarification as in R1-2101531. |
| Intel | We are OK with the proposed TP within [R1-2101531](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101531.zip).  Also for the more fundamental issue related to the signaling of the channel access type and CP extension for FBE, we are supportive of Option 2 from R1-2101304, which is in line with our proposed TP (R1-2100628). The reason is that the specification would be much cleaner, and would facilitate the work moving forward to Rel.17. As for the specific values to include within the new Table, these could be discussed further by the group. |
| Ericsson | * We fully support the proposed TP in [R1-2101531](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101531.zip). The TP fits very well with the structure of the spec and resolved the misalignment. * Our preference is definitely Option 2. It is a better framework for Rel-17 as Intel explained. As we mentioned, our impression from last meeting was that the group supports Option 3. If Option 3 is adopted, we may need for Rel-17 spec, make some additional changes to accommodate the signaling needed for Rel-17.   + On suggested changes for Option 3 in R1-2101304, we agree with Samsung and Lenovo.   + Remove “Note:” in TP1.   + Add “within a 25us interval” as Samsung suggested to TP2.   + Include the following change for TP2 (if it enough to have “shall” in the first bullet: “-The gNB shall transmit ..”. The rest should remain as “may”.):   “A channel occupancy initiated by a gNB and shared with UE(s) ~~shall satisfy~~ satisfies thefollowing:”   * If the group agrees on Option 2, we are in principle fine with TP in R1-2100628 but we have some editorial comments that we can share, if we decide for Option 2. |
| Huawei, HiSilicon | We support the proposed TP in [R1-2101531](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101531.zip) for clarifying the COT duration for FBE.  Regarding the clarification for LBT type and CPE, our preference is Option 3 as explained in R1-2101304 and proposed for example in TPs in our tdoc R1-2100199. However, if the there is consensus to follow Option 2, we are also fine with it but with share the same view as Intel that the specific values to include within the new Table, should be discussed further by the group. |

## 2.4 Clarifications to restrictions for Type 1 DL channel access / DRS

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| Clarifications to restrictions for Type 1 DL channel access / DRS | [**R1-2101172**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101172.zip)  [**R1-2101531**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101531.zip) |

One TDoc proposes clarifications to restrictions for Type 1 DL channel access / DRS:

[**R1-2101172**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101172.zip)**:**

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| **Proposal 1:**   * **Adopt TP1 for TS 37.213.**   ================================ Start of TP1 for TS 37.213 ===================== 4.1.1 Type 1 DL channel access procedures This clause describes channel access procedures to be performed by an eNB/gNB where the time duration spanned by the sensing slots that are sensed to be idle before a downlink transmission(s) is random. The clause is applicable to transmission(s) initiated by an eNB/gNB and Type 2A DL channel access procedure is not applicable, including the following transmissions:  - Transmission(s) initiated by an eNB including PDSCH/PDCCH/EPDCCH, or  - Transmission(s) initiated by a gNB including unicast PDSCH with user plane data, or unicast PDSCH with user plane data and unicast PDCCH scheduling user plane data, or  - Transmission(s) initiated by a gNB with only discovery burst or with discovery burst multiplexed with non-unicast information, where the transmission(s) duration is larger than or the transmission causes the discovery burst duty cycle to exceed .  ================================ Unchanged Text Omitted =================================  ================================ End of TP1 for TS 37.213 |

Another company proposes clarifications to 2.1 DL channel access procedure for PDCCH only transmission without PDSCH:

[**R1-2101671**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101671.zip)

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| * *Proposal 1: We propose to have one of the following options on CAPC selection for transmission initiated by a gNB including PDCCH only transmission.*   + *Alt-1:*      - *We propose to have the highest priority (i.e., CAPC, p=1) for transmission initiated by a gNB including PDCCH only transmission with DCI format 2\_x series for other purposes.*     - *We propose to follow the CAPC of UL data scheduled by the UL grant for transmission including PDCCH only transmission with UL grant only.*     - *The detailed text proposal in 37.213 can be provided if this principle above is agreed.*   + *Alt-2: If left undefined on selecting CAPC for that transmission, it needs to be captured in the Chairman's Note as follows:*     - *It is up to a gNB’s implementation on CAPC selection for the PDCCH-only transmission with DCI format 2\_x series or DCI format 0\_x (i.e., UL grant) without user plane data initiated by a gNB.*   + *Alt-3: Adopt the following text proposal in section 4.1.1. on 37.213*  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 4.1.1 Type 1 DL channel access procedures  This clause describes channel access procedures to be performed by an eNB/gNB where the time duration spanned by the sensing slots that are sensed to be idle before a downlink transmission(s) is random. The clause is applicable to the following transmissions:  - Transmission(s) initiated by an eNB including PDSCH/PDCCH/EPDCCH, or  - Transmission(s) initiated by a gNB including unicast PDSCH with user plane data, or unicast PDSCH with user plane data and unicast PDCCH scheduling user plane data, or  - Transmission(s) initiated by a gNB with only discovery burst or with discovery burst multiplexed with non-unicast information, where the transmission(s) duration is larger than or the transmission causes the discovery burst duty cycle to exceed .  ============================<<unchanged text omitted>>==============================  An eNB/gNB 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 eNB/gNB transmissions, as given in Table 4.1.1-1.  If an eNB/gNB transmits discovery burst(s) as described in clause 4.1.2 when in the procedure above, the eNB/gNB shall not decrement during the sensing slot duration(s) overlapping with discovery burst(s).  A gNB may use any channel access priority class for performing the procedures above to transmit transmission(s) including discovery burst(s) satisfying the conditions described in this clause.  A gNB may use any channel access priority class for performing the procedures above to transmit transmission(s) including PDCCH only transmission without user plane data.  A gNB shall use a channel access priority class applicable to the unicast user plane data multiplexed in PDSCH for performing the procedures above to transmit transmission(s) including unicast PDSCH with user plane data.  For and , if the absence of any other technology sharing the channel can be guaranteed on a long term basis (e.g. by level of regulation), , otherwise, .  **Table 4.1.1-1: Channel Access Priority Class (CAPC)**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Channel Access Priority Class ()** |  |  |  |  | **allowed sizes** | | 1 | 1 | 3 | 7 | 2 ms | {3,7} | | 2 | 1 | 7 | 15 | 3 ms | {7,15} | | 3 | 3 | 15 | 63 | 8 or 10 ms | {15,31,63} | | 4 | 7 | 15 | 1023 | 8 or 10 ms | {15,31,63,127,255,511,1023} | | |

Comments:

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| --- | --- |
| **Company** | **Comment** |
| Qualcomm | TP is fine, but may not be absolutely necessary consider it is obvious |
| ZTE, Sanechips | No need. |
| Sharp | Support the TP in R1-2101172.  For R1-2101671, more generic description is better, instead of “PDCCH only transmission without user plane data”, because the TP in R1-2101172 causes some other cases for which clarification on CAPC is necessary. |
| WILUS | TP in R1-2101172 is fine but it may not be necessary considering that section title is “Type 1 DL channel access procedure.  For this TP in R1-2101671, we need to discuss the above options to select CAPC for PDCCH only transmission without user plane data before discussing TP itself. |
| Spreadtrum | The TP in R1-2101172 may not be necessary, because obviously only one type of LBT can be applied for one transmission.  For the TP in R1-2101671, it can left to gNB’s implementation. |
| LG | Agree with QC’s comments. The TP seems not necessary. |
| vivo | No need |
| Nokia, NSB | Neither of the changes seems essential. The wording of the first changes is somehow broken, and in any case it should be clear that the context is Type 1 DL channel access. The second change does not seem necessary either. |
| Lenovo, Motorola Mobility | No need for the TP in R1-2101172.  From the proposals in R1-2101671, we think it can be left for eNB/gNB implementation. No TP is necessary. |
| Samsung | We support the first TP in R1-2101172 as the proposing company. We believe companies replying didn’t get the intention of our TP. The condition for using Type 1 channel access procedure should be clarified since the list is not exclusive. In current spec, there are cases not applicable to either Type 1 or Type 2 channel access procedure, e.g. broadcast channel, RS only transmission, PDCCH only transmission, so without the TP, how to determine the channel access type for those cases?  For the TP in R1-2101671, it’s not essentially needed, but we are ok with it for a clarification. |
| Intel | We believe the TPs are not needed. |
| Ericsson | * The TP in R1-2101172 is not needed. Considering Samsung concern, Type 1 is the slowest channel access. Of course, it can be used for any transmission listed for Type 2. But the reverse is not applicable. Also agree with observations from Nokia and SPreatrum. * The TP in R1-2101671 is not needed. When there is no mention of CAPC, it means that it is left by implementation to use any CAPC. |
| Huawei, HiSilicon | We do not see the need for these TPs |

## 2.5 Clarifications to UL CWS adjustment

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| Clarifications to UL CWS adjustment | [**R1-2100890**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100890.zip) |

One document proposes clarifications to UL CWS update with implicit HARQ-feedback during RACH procedure, as well as UL reference duration for CWS adjustment.

[**R1-2100890**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100890.zip)**:**

|  |
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| **Proposal #3: The CWS for Msg3 can be adjusted based on the reception of Msg4.**  **Proposal #4: Adopt Text Proposal #3 into section 4.2.2.2 of TS 37.213.**  ================================ Start of TP#3 for TS 37.213 ===============================  4.2.2.2 Contention window adjustment procedures for UL transmissions scheduled/configured by gNB  ================================ Unchanged Texts Omitted =================================  If a UE transmits transmissions using Type 1 channel access procedures associated with the channel access priority class on a channel and the transmissions are not associated with explicit or implicit HARQ-ACK feedbacks as described above in this subclause, the UE adjusts before step 1 in the procedures described in subclause 4.2.1.1, using the latest used for any UL transmissions associated with explicit or implicit HARQ-ACK feedbacks on the channel using Type 1 channel access procedures associated with the channel access priority class . If the corresponding channel access priority class has not been for any UL transmission on the channel, is used.  ================================ Unchanged Texts Omitted =================================  ================================= End of TP#3 for TS 37.213 ================================  **Proposal #5: The reference duration for UL CWS adjustment can be defined in the recent UL burst starting before n-X, where n and X correspond to the starting time of UL grant and the minimum time between UL grant and the end of reference duration, respectively, and X is configured by RRC signalling or is set to the same value with*****cg-minDFIDelay-r16*.** |

Comments:

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| --- | --- |
| **Company** | **Comment** |
| Qualcomm | Not an essential change. Might be too late for this discussion. |
| ZTE, Sanechips | Share the same views as Qualcomm. |
| Sharp | Share the view from Qualcomm. |
| WILUS | We share the same view as QC. |
| Spreadtrum | Share the same view as Qualcomm |
| LG | We think that the TP is needed to clarify the CWS adjustment procedure with implicit feedback. |
| vivo | Agree with Qualcomm |
| Nokia, NSB | This is not an essential correction. It is too late to optimize Rel-16 for this case anymore. |
| Lenovo, Motorola Mobility | Agree with Proposal 3. Additionally, we think the CWS needs to be adjusted if a retransmission for Msg3 is requested. |
| Samsung | This issue has been discussed for many meetings. Although we were supportive of the proposal, we thought it’s too late to adopt it and modify the spec. |
| Intel | We share the same view as other companies, and we believe that it is late to reopen this discussion. |
| Ericsson | We share same view as other companies. TP is not needed. We are in maintenance phase. |
| Huawei, HiSilicon | We support this TP for the following technical reasons. We agree that this issue was proposed several times from the start of the maintenance phase, but we also note that it was put aside without any technical reasoning.  We note that the understanding of the group during the WI is that in fairness to other coexisting RATs, implicit feedback should be considered for BOTH resetting and increasing the CWS and not just for resetting the CWS.  The current specifications however is unfair to NR-U as it allows only to penalize the NR-U system. Msg 3 PUSCH obviously satisfies the subclause in section 4.2.2.2 of TS 37.213 as a UL channel with implicit HARQ feedback NACK, the CWS would be have to be increased if a retransmission happens. Inconsistently, successful reception of Msg 3 PUSCH would not reset the CWS. Hence, receiving Msg 4 in response should be considered as an implicit HARQ feedback ACK for the purpose of CWS adjustment. |

## 2.6 Multi-channel Channel Access:

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| Clarifications to UL Multi-channel access procedures | [**R1-2100199**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100199.zip)  [**R1-2100890**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100890.zip) |

Two documents consider clarifications to UL Multi-channel access procedures.

[**R1-2100199**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100199.zip)

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| ***Proposal 3: UE should perform individual type 1 channel access on each of the channels overlapped scheduled PUSCH if these channels are not a subset of one of the sets of channel frequencies defined in clause 5.7.4 in [2].***  \*\*\* <Beginning of **Text Proposal 3**> \*\*\*  4.2.1.0.4 Channel access procedures for UL multi-channel transmission(s)  If a UE  - is scheduled to transmit on a set of channels , and if Type 1 channel access procedure is indicated by the UL scheduling grants for the UL transmissions on the set of channels , and if the UL transmissions are scheduled to start transmissions at the same time on all channels in the set of channels , or  - intends to perform an uplink transmission on configured resources on the set of channels with Type 1 channel access procedure, and if UL transmissions are configured to start transmissions on the same time all channels in the set of channels , and  if the channel frequencies of set of channels is a subset of one of the sets of channel frequencies defined in clause 5.7.4 in [2]  - the UE may transmit on channel using Type 2 channel access procedure as described in clause 4.2.1.2,  - if Type 2 channel access procedure is performed on channel immediately before the UE transmission on channel , , and  - if the UE has accessed channel using Type 1 channel access procedure as described in clause 4.2.1.1,  - where channel is selected by the UE uniformly randomly from the set of channels before performing Type 1 channel access procedure on any channel in the set of channels .  - the UE may not transmit on channel within the bandwidth of a carrier, if the UE fails to access any of the channels, of the carrier bandwidth, on which the UE is scheduled or configured by UL resources.if the channel frequencies of set of channels is not a subset of one of the sets of channel frequencies defined in clause 5.7.4 in [2], the UE may transmit UL transmissions on the set of channels only if UE has accessed each channel using Type 1 channel access procedure as described in clause 4.2.1.1.  \*\*\* <End of **Text Proposal 3**> \*\*\* |

[**R1-2100890**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100890.zip)

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| **Proposal #1: Reflect the followings in TS 37.213:**   * **For UL active BWP configured with no intra-cell guard band, a UE is allowed to transmit UL transmission only if the UE succeeds LBT for all RB set(s) corresponding to the UL BWP.** * **For DL, if gNB transmits DL transmission to a UE configured with DL active BWP where *intraCellGuardBandDL-r16* for the corresponding serving cell indicates to the UE that no intra-cell guard-bands are configured, gNB is allowed to transmit DL transmission to the UE only if gNB succeeds LBT for the whole DL BWP.**   **Proposal #2: Adopt the following TP#1 and TP#2 for TS 37.213**  ========================= Start of TP#1 for TS 37.213 ==========================  4.2.1.0.4 Channel access procedures for UL multi-channel transmission(s)  ========================= Unchanged Texts Omitted ==========================  if the channel frequencies of set of channels is a subset of one of the sets of channel frequencies defined in clause 5.7.4 in [2]  - the UE may transmit on channel using Type 2 channel access procedure as described in clause 4.2.1.2,  - if Type 2 channel access procedure is performed on channel immediately before the UE transmission on channel , , and  - if the UE has accessed channel using Type 1 channel access procedure as described in clause 4.2.1.1,  - where channel is selected by the UE uniformly randomly from the set of channels before performing Type 1 channel access procedure on any channel in the set of channels .  - the UE may not transmit on channel within the bandwidth of a carrier, if the UE fails to access any of the channels, of the carrier bandwidth, on which the UE is configured for the UL BWP if *nrofCRBs-r16=*0 is provided for all intra-cell guard band(s) on the carrier as described in [8, 38.214], otherwise, on which the UE is scheduled or configured by UL resources.  ======================== Unchanged Texts Omitted ===========================  ========================= End of TP#1 for TS 37.213 ==========================  ========================= Start of TP#2 for TS 37.213 ==========================  4.1.6.1 Type A multi-channel access procedures  ========================= Unchanged Texts Omitted ==========================  An eNB/gNB shall perform channel access on each channel , according to the procedures described in clause 4.1.1, where is a set of channels on which the eNB/gNB intends to transmit, and , and is the number of channels on which the eNB/gNB intends to transmit.  The counter described in clause 4.1.1 is determined for each channel and is denoted as . is maintained according to clause 4.1.6.1.1 or 4.1.6.1.2.  If gNB provides *nrofCRBs-r16*=0 for all intra-cell guard band(s) on a carrier, the gNB may not transmit on channel within the bandwidth of the carrier, if the gNB fails to access any of the channels, of the carrier bandwidth.  ======================== Unchanged Texts Omitted ===========================  4.1.6.2 Type B multi-channel access procedure  ========================= Unchanged Texts Omitted ==========================  The eNB/gNB shall not transmit a transmission on a channel , , for a period exceeding as given in Table 4.1.1-1, where the value of is determined using the channel access parameters used for channel .  For the procedures in this clause, the channel frequencies of the set of channels selected by gNB, is a subset of one of the sets of channel frequencies defined in [6].  If gNB provides *nrofCRBs-r16*=0 for all intra-cell guard band(s) on a carrier, the gNB may not transmit on channel within the bandwidth of the carrier, if the gNB fails to access any of the channels, of the carrier bandwidth.  ======================== Unchanged Texts Omitted ===========================  ========================= End of TP#2 for TS 37.213 ========================== |

Comments:

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| --- | --- |
| **Company** | **Comment** |
| Qualcomm | TP3 may not be necessary. Our understanding of 4.2.1.0.4 is, if a UE is scheduled to transmit on a set of channel not a subset of “one of the sets of channel frequencies defined in clause 5.7.4 in [2]”, the UE will perform channel access on each subset of set of channels that is a subset of “one of the sets of channel frequencies defined in clause 5.7.4 in [2]”. In that case, the behaviour for the TP is already supported.  For TP1, we support in principle, but TP can be further clarified. We think it will be cleaner to start a new paragraph says “If a UE is configured with the UL BWP with *nrofCRBs-r16=0* for all intra-cell guard band(s) on the carrier as described in [8, 38.214], the UE may not transmit on carriers UE is scheduled or configured by UL resources, if UE fails to access any of the channels”  We support TP2. |
| ZTE, Sanechips | For [R1-2100199](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100199.zip), it seems the behavior described in TP3 have been covered in the current spec.  For [R1-2100890](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100890.zip), we agree to capture Proposal 1 in the current spec, but specific TP needs to be discussed further. |
| Sharp | Not sure if the TP in R1-2100199 should adopt.  For the proposals in R1-2100890, we are OK with the TPs. |
| WILUS | TP3 in R1-2100199 may not be necessary. We support TP1 and TP2 in R1-2100890. |
| Spreadtrum | Regarding TP3, we share the same view as Qualcomm.  Regarding TP1 and TP2, we are fine with them. |
| LG | TP3 in R1-2100199 is not necessary. For our TPs in R1-2100890, we are fine with the modified TP proposed by QC but the original TP seems okay as is. |
| vivo | We support TP1 and TP2. |
| Nokia, NSB | For R1-2100199, it seems clear already based on the text that Type 1 CA must be applied unless the conditions for Type 2 are satisfied, and hence the TP is not needed.  We are in principle ok with the TPs in R1-2100890. The “otherwise, on which” -condition may not be very clear and could benefit from rewording. |
| Samsung | We are ok with two TPs. |
| Intel | For the TP in R1-2100199, we believe the TP is already covered by current specification.  As for the proposals in R1-2100890, we are OK with both TP1 and TP2. |
| Ericsson | Agree that TP3 is not needed.  On TP1 and TP2 : We are fine, but the text should be revised.  As Editor (😊) mentioned few times, generic terms are used in 37.213. Terms like UL BWP, better to be avoided. (TP2 better than TP1). Also, if possible, instead of using *nrofCRBs-r16*=0 , could be use a text ? That would be preferred if possible. |
| Huawei, HiSilicon | We also agree that TP3 is not necessary.  WE are OK to capture TP1 and TP2 in principle but exact wording should be further discussed  Regarding the proposal in R1-2100199, some further clarification is provided      Channel Bonding for option 2 multiple channel operation  If a UE is scheduled with a PUSCH within the bonded channels (blue box in the figure), the mechanism defined in section 4.1.2.0.4 can be used. However, if a UE is scheduled a PUSCH across the bonded channels (red box in the figure), it is not clear how to perform type 1 channel access on the channels overlapped with the scheduled channels. We propose to use similar scheme as eLAA that UE should perform individual type 1 channel access on each of the channels overlapped scheduled PUSCH if type 1 channel access is indicated in the UL grant of the PUSCH. |

## 2.7 LBT type indication in DCI 0\_2 and 1\_2

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|  | [**R1-2100147**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100147.zip) |

One TDoc proposes to clarify if LBT type and CP extension should be indicated with DCI formats 0\_2 and 1\_2.

[**R1-2100147**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100147.zip)

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| ***Proposal 2: Clarify whether LBT type and CP extension indication for scheduled PUCCH/PUSCH should be introduced for DCI format 0\_2 and DCI format 1\_2 or not.*** |

Comments:

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| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We believe it is too late to discuss this. |
| ZTE, Sanechips | This issue should be discussed in A.I 8.3.2 Enhancements for unlicensed band URLLC/IIoT |
| Sharp | In our view, it should be supported by DCI format 0\_2 and DCI format 1\_2, too, as “non-fallback” in the agreements from RAN1#99 intended to cover them. |
| WILUS | We share the same view as QC. We also think it can be discussed in unlicensed aspects under Rel-17 URLLC/IIoT WI. |
| Spreadtrum | We think it should be discussed in Rel-17 URLLC/IIoT WI |
| LG | We are fine to discuss this issue. |
| vivo | It should be discussed in Rel-17 URLLC/IIoT WI |
| Nokia, NSB | Although we have also proposed this e.g. in R1-2000501, we feel it is too late to introduce this in Rel-16 anymore. Preferably the Rel-17 URLLC/IIoT WI adds support for this functionality |
| Lenovo, Motorola Mobility | We think it is not essential to include those fields in DCI Format 0\_2 and 1\_2 in Rel-16. |
| Samsung. | This issue is not explicitly supported in Rel-16 (either NR-U or eURLLC), then it’s not supported in Rel-16. It should be discussed in Rel-17 URLLC IIOT over unlicensed band. |
| Intel | We also believe it is too late to discuss this topic here for the purpose of Rel.16, but this should be further discussed in Rel.17 URLLC/IIoT WI. |
| Ericsson | Although we are supportive of this proposal, it seems to be late for maintenance phase. It is definitely on agenda for Rel-17. |
| Huawei, HiSilicon | We also think that this enhancement should be discussed within Rel-17 |

# 3 Discussion for the preparation phase

Companies’ views on the essentiality of the issues will be summarized in the table below. Companies are invited to add their views on the criticality/essentiality of the issues in the tables below (and if necessary, provide more detailed background explanations in the tables provided for each issue in section 2):

Legend for the table

Y = essential

N = disagree, not needed

blank= neutral

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| **Company** | **CA 2.1** | **CA 2.2** | **CA 2.3** | **CA 2.4** | **CA 2.5** | **CA 2.6** | **CA 2.7** |
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# References

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| **1** | [**R1-2100072**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100072.zip) | Remaining issue on the channel access for FBE | ZTE, Sanechips |
| **2** | [**R1-2100147**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100147.zip) | Discussion on the remaining issues of channel access procedure | OPPO |
| **3** | [**R1-2100199**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100199.zip) | Maintenance on channel access procedures for NR Unlicensed | Huawei, HiSilicon |
| **4** | [**R1-2100628**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100628.zip) | Remaining issues on NR-U | Intel Corporation |
| **5** | [**R1-2100890**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100890.zip) | Remaining issues of channel access procedure and DL signals and channels for NR-U | LG Electronics |
| **6** | [**R1-2101072**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101072.zip) | Remaining issues on UL transmissions | ETRI |
| **7** | [**R1-2101172**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101172.zip) | Correction on the condition to use Type 1 DL channel access | Samsung |
| **8** | [**R1-2101284**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101284.zip) | Corrections on Channel Access Procedures for NR-U | Nokia, Nokia Shanghai Bell |
| **9** | [**R1-2101304**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101304.zip) | Corrections related to DL, UL, and channel access | Ericsson |
| **10** | [**R1-2101531**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101531.zip) | Correction on FBE COT definition | Sharp |
| **11** | [**R1-2101671**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2101671.zip) | Correction on DL/UL channel access procedure for NR-U | WILUS Inc. |