**3GPP TSG RAN WG1 #102-e R1- 200XXXX**

**e-Meeting, August 17th – August 28th, 2020**

**Agenda item: 7.2.2.2.1**

**Source: Moderator (Nokia)**

**Title: Summary of [102-e-NR-unlic-NRU-ChAcc-01] Email discussion/approval on XXXX**

**Document for: Discussion and Decision**

# 1 Introduction

This document captures the discussion in the following RAN1#102-e email thread:

[102-e-NR-unlic-NRU-ChAcc-01] Email discussion/approval on the following from R1-2006675 by 8/20; if necessary, endorse associated TPs by 8/26 – Timo (Nokia)

* Issue#1: Indication of LBT type, CP extension and CAPC; N1 timeline for UL transmissions with CP extension
* Issue#4: Clarifications to channel access for semi-static channel occupancy
* Issue#5: DL and UL Channel Access related
* Issue#6: Multi-channel Channel Access

This contribution summarizes the discussion and collects companies views on each question and is organized as follows:

[1 Introduction 1](#_Toc48566745)

[2. Issue #1 2](#_Toc48566746)

[2.1 LBT type for non-contiguous SRS and PUSCH/PUCCH 2](#_Toc48566747)

[2.2 CP extension and LBT type for semi-static channel access 4](#_Toc48566748)

[2.3 Other CP extension / LBT type indication related issues 6](#_Toc48566749)

[2.4 CAPC of fallback UL grants 6](#_Toc48566750)

[3. Issue #4 7](#_Toc48566751)

[3.1 Deployment scenario for semi-static channel access 8](#_Toc48566752)

[3.2 Editorial corrections related to semi-static channel access 9](#_Toc48566755)

[3.3 Clarification of the initiating node for FFPs 10](#_Toc48566756)

[3.4 Other clarifications related to semi-static channel access 11](#_Toc48566761)

[4. Issue #5 13](#_Toc48566762)

[4.1 Clarifications to restrictions for Type 1 DL channel access / DRS 13](#_Toc48566763)

[4.2 Clarifications to DL CWS adjustment 14](#_Toc48566764)

[4.3 Clarifications to UL CWS adjustment 16](#_Toc48566767)

[4.4 CWS for channels without explicit feedback 19](#_Toc48566771)

[5. Issue #6 20](#_Toc48566776)

[5.1 Clarifications to DL Multi-channel access procedures 20](#_Toc48566777)

[5.2 Clarifications to UL Multi-channel access procedures 21](#_Toc48566779)

[6. Editorial Issues 23](#_Toc48566786)

[7. Conclusions 25](#_Toc48566787)

[References 25](#_Toc48566788)

# 2. Issue #1

**Issue #1** Indication of LBT type, CP extension and CAPC; N1 timeline for UL transmissions with CP extension

|  |  |
| --- | --- |
| LBT type for non-contiguous SRS and PUSCH/PUCCH | R1-2006020 (p3)R1-2006095 (p5)R1-2006301 (p1, p2)R1- 2006370 (p2) |
| CP extension and LBT type for semi-static channel access | R1-2005600 (p1)R1-2006763 (section 3) |
| other CP extension related | R1-2006301 (p5) |
| CAPC of fallback UL grants | R1-2006763 (section 2)R1-2005600 (p7) |

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

Four contributions discuss the determination of LBT type and other related parameters for non-contiguous SRS and PUSCH/PUCCH transmissions, that are triggered with a single DCI.

**R1-2006020 (p3)**

|  |
| --- |
| ***Proposal 3****: for cases where one DCI schedules/triggers two UL transmissions, select the following one option** *Option 1: LBT type and CP extension indication are used for the first UL transmission, default LBT type and CP extension are used for the second UL transmission.*
* *Option 2: LBT type and CP extension indication are used for both UL transmissions.*
* *Option 3: LBT type and CP extension indication are used only for PUSCH (if DCI 0\_1) or for PUCCH (if DCI*
* *Note: the indicated CAPC in DCI 0\_1 is always used for PUSCH.*
 |

**R1-2006095 (p5)**

“applying the indicated CP extension and channel access only for first UL signal/channel is sufficient.”

|  |
| --- |
| ================================= Start of TP for TS 38.211 ================================5.3.1 OFDM baseband signal generation for all channels except PRACH and RIM-RS================================ Unchanged Texts Omitted =================================- for dynamically scheduled PUSCH, SRS, and PUCCH transmissions where is given by Table 5.3.1-1 with for , for , and and given by the higher-layer parameters *cp-ExtensionC2-r16* and *cp-ExtensionC3-r16*, respectively, and given by clause 4.3.1. For contention-based random access, or in absence of higher-layer configuration of and , the value of shall be set to the largest integer fulfilling for each of the values of . *Text* is applied to the first UL transmission scheduled by the scheduling DCI.================================ Unchanged Texts Omitted ================================================================== End of TP for TS 38.211 ================================= |

**R1-2006301 (p1, p2)**

|  |
| --- |
| Proposal #1: For the transmission of SRS that is scheduled without PUSCH or PUCCH, UE shall perform channel access type and apply CP extension indicated by the corresponding DCI.Proposal #2: For the transmission of SRS that is scheduled with PUSCH or PUCCH, UE shall apply indicated channel access type and CP extension to SRS if the SRS is transmitted prior to the PUSCH or PUCCH, otherwise, apply to PUSCH or PUCCH. |

**R1-2006370 (p2)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposal 2:*** *When discontinuous Aperiodic SRS and PUSCH/PUCCH are scheduled with a single DCI:** *the LBT type and the CP extension for the first one of the scheduled transmissions is as indicated in the DCI*
* *the LBT type and the CP extension for the second one of the transmissions is determined as in the two tables below.*

|  |  |
| --- | --- |
| **LBT type in the DCI (used also for the first transmission)** | **LBT Type for the second transmission**  |
| Type 1 (Cat 4) | Outside of a gNB COT Type 1 (Cat 4)Within a gNB or UE COT Type 2A (Cat2 25 us) |
| Type 2A (Cat2 25 us) | Type 2A (Cat2 25 us) |
| Type 2B (Cat2 16 us) | Type 2A (Cat2 25 us) |
| Type 2C (no LBT) | Type 2A (Cat2 25 us) |

|  |  |
| --- | --- |
| CP extension in the DCI (used also for the first transmission) | CP extension for the second transmission  |
| 0 (i.e. no CP extension) | 0 |
| C1\*symbol length – 25 us | 0 OR C1\*symbol length – 25 us |
| C2\*symbol length – 16 us – TA | 0 OR C1\*symbol length – 25 us |
| C3\*symbol length – 25 us – TA | 0 OR C1\*symbol length – 25 us |

 |

**Summary**:

All TDocs seem to be ok with applying the indicated CP extension and LBT Type for the first of the discontinuous UL transmissions that is scheduled with DCI 0\_1 or 1\_1, irrespective of whether that is SRS or PUSCH/PUCCH.

For the second UL transmissions, that is not contiguous with the first one, the options are:

* Alt 1: a default LBT type and CP extension are used for the second UL transmission.
	+ one example of default values is in R1-2006370
* Alt 2: the indicated LBT type and CP extension are used for both first and 2nd UL transmissions
* Alt 3: a zero-CP extension is used for the 2nd transmissions, irrespective of what was indicated for the first UL transmission
	+ (how to determine the LBT type in this case?)

Companies are asked to provide their views related to the above proposals with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | Ok with the 1st transmission following the indicated CP extension and the LBT type, regardless whether it is SRS or PUSCH/PUCCHThe 2nd transmission uses Type 2A LBT regardless of what was indicated for the 1st one, unless it falls outside of the gNB COT, in which case Type 1 LBT is used.We support Alt 1: The 2nd transmission uses ‘0’ CP extension, unless the gap between the 1st and 2nd transmission gap is one symbol, in which case C1\*symbol length – 25 us to ensure a gap of exactly 25 us.  |
| OPPO | Nokia’s proposal seems reasonable.  |
| Intel | We also OK with following the CP extension and LBT type, regardless of the UL transmission for the 1st transmission. As for the 2nd transmission, we also support Alt 1, and we are OK with Nokia’s proposal. |
| Huawei, Hisilicon | We agree with applying the indicated CP extension and LBT Type for the first of the discontinuous UL transmissions that is scheduled by DCI 0\_1 or 1\_1, irrespective of whether that is SRS or PUSCH/PUCCHWe also agree that the 2nd transmission uses Type 2A LBT regardless of what was indicated for the 1st one, unless it falls outside of the gNB COT, in which case Type 1 LBT is used.However, we think that only ‘0’ CP extension for the 2nd UL transmission is reasonable in Alt 1 due to the following:* The gap needs to be at least 25us to perform Type 2A before the 2nd UL transmission (no need to be exactly 25us)
* I understand that if the gap between transmissions is 1 symbol, using ‘C1\*symbol length – 25 us’ does not work in the case of 60kHz SCS in which C1=2 symbols
* ‘ C1\*symbol length – 25 us’ is inconsistent with the CPE calculation in 38.211
 |
| ZTE, Sanechips | we are fine to determine CP extension and LBT type for the 2nd UL transmission. But it seems Alt. 3 is simpler and also does not force a binding relationship with what was indicated for the 1st UL transmission. As for how to determine the LBT type, my understanding is that we can follow Nokia’s suggest, that is Outside of a gNB COT using Type 1 (Cat 4), while Within a gNB or UE COT using Type 2A (Cat2 25 us). |
| WILUS | We support to apply the indicated CP extension and channel access only for first UL transmission regardless of whether it is SRS or PUSCH/PUCCH. For the 2nd transmission, Type 2A LBT can be used within gNB COT and Type 1 LBT is used outside of gNB COT as mentioned by Nokia. |

## 2.2 CP extension and LBT type for semi-static channel access

At RAN1#101e there was some discussion related to how to determine the CP extension and especially LBT type with semi-static channel access, where the LBT definition is not 100% the same as in the case of LBE.

A related proposal in R1-2005600 is:

**R1-2005600**

|  |
| --- |
| **Proposal 1: The agreement on CP extension and LBT can be achieved by gNB implementation without modification the current spec.**  |

**R1-2006763** also discusses the same issue and concludes:

|  |
| --- |
| To simply the change to the current version of the spec, we propose to make these fields available for semi-static channel access as well, while introduce the following special handling:* UE ignores CAPC value
* UE does not expected to be configured entries with cat 4 LBT
* UE does not expect to be configured with entries with CP extension values other than C2\*symbol length – 16 us – TA or 0

These can be captured in 37.213 4.3 and 38.212 7.3.1.1.2. ============TP for 38.212==================================7.3.1.1.2 Format 0\_1----------Unchanged text omitted------------------------ ChannelAccess-CPext-CAPC – 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *ULDCI-trigerred-UL-ChannelAccess-CPext-CAPC-List-r16* for operation in a cell with shared spectrum channel; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 are configured by the higher layer parameter *ULDCI-trigerred-UL-ChannelAccess-CPext-CAPC-List-r16.* When *ChannelAccessMode-r16*=”*semi-static*”, UE will ignore the CAPC value indicated by ChannelAccess-CPext-CAPC.----------Unchanged text omitted-----------------------===================================================================TP for 37.213 4.3==================================4.3 Channel access procedures for semi-static channel occupancyIf the absence of any other technology sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation) and 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 every within every two consecutive radio frames, starting from the even indexed radio frame at with a maximum channel occupancy time, where in , is a higher layer parameter provided in *semiStaticChannelAccessConfig-r16* and *.* In the following procedures in this subclause, 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 subclauses 4.1.5 and 4.2.3, respectively.A channel occupancy initiated by a gNB and shared with UE(s) shall satisfy thefollowing:- The gNB shall transmit a DL transmission burst(s) starting at the beginning of the channel occupancy time immediately after sensing the channel to be idle for at least a sensing slot duration . If the channel is sensed to be busy, the gNB shall not perform any transmission during the current channel occupancy time. - The gNB may transmit a DL transmission burst(s) within the channel occupancy time immediately after sensing the channel to be idle for at least a sensing slot duration if the gap between the DL transmission burst(s) and any previous transmission burst is more than .- The gNB may transmit DL transmission burst(s) after UL transmission burst(s) within the channel occupancy time without sensing the channel if the gap between the DL and UL transmission bursts is at most  - A UE may transmit UL transmission burst(s) after detection of a DL transmission burst(s) within the channel occupancy time as follows:- If the UL transmission is indicated by DCI format 0\_1 or DCI format 1\_1 to use Type 2C channel access, the UE may transmit UL transmission burst(s) after a DL transmission burst(s) within the channel occupancy time without sensing the channel.- If the UL transmission is indicated by DCI format 0\_0 or DCI format 1\_0 or RAR UL grant to use Type 1 channel access or Type 2A channel access, or if the UL transmission is indicated by DCI format 1\_1 or DCI format 0\_1 to use Type 2A channel access, the UE may transmit UL transmission burst(s) after a DL transmission burst(s) within the channel occupancy time after sensing the channel to be idle for at least a sensing slot duration before transmission.- The gNB and UEs shall not transmit any transmissions in a set of consecutive symbols for a duration of at least before the start of the next channel occupancy time.======================================================= |

Companies are asked to provide their views related to the above proposals with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | ok with the modifications in R1-2006763. It may indeed be better to refer to the indicated LBT type rather than the gap, which may be unknown to the UE. |
| OPPO | Proposal looks reasonable |
| Intel | We support proposed modifications in R1-2006763.As for the proposed changes for TS 38.212, since the UE may not be aware of the gaps, we also believe it is necessary to explicitly provide to the UE operating in semi-static channel access mode the LBT type to use, and indicate in the spec how to reinterpret the “ChannelAccess-CPext-CAPC” field.Also as for the proposed changes in TS 37.213, we also believe that the definition of Ty should be revised, and incorporate for the constraint from ETSI BRAN, which imposes a minimum idle period of at least 100us.  |
| Huawei, HiSilicon | We are Ok with the changes to 38.212 and definition of Ty in 37.213However, we have the following questions about the approach in the TP listing the DCI formats and indicated LBT types instead of the gap duration* For a gap of at most 16us, why the fallback DCIs 0\_0/1\_0 cannot be used to indicate Type 2C? If the intention is to indicate Type 2C with 0 CPE only using the non-fallback DCIs, then nothing in the current spec defines the UE behavior if the Type 2C is indicated with C2 symbols-16us-TA which is not precluded.

For a gap more than 16us, when non-fallback DCIs 0\_1/1\_1 indicate Type 2A LBT it is combined with CPE 0, C1 symbols-25us, or C3 symbols-25us-TA. This, however, make the TP confusing as it seems contradicting the proposal “UE does not expect to be configured with entries with CP extension values other than C2\*symbol length – 16 us – TA or 0”  |
| ZTE, Sanechips | We don’t think there is need to change the current spec, and the agreement on CP extension and LBT can be achieved by gNB implementation.if most companies agree to capture the agreement of the the previous meeting in the current spec, then the following mentioned issues need to be dealt with properly first, such as:* Balance benefits to do this and costs of standardization;
* Need to consider how to handle additional indicated CAPC information, which is always carried in DCI format 0\_1 within the field ChannelAccess-CPext-CAPC;
* How to cope with indicated Type 2A UL channel access procedure, which is carried in DCI format 0\_1 and 1\_1, because this Type 2A UL channel access procedure is different with 25us duration LBT specified for FBE operation.

Further, if the above issues are not well resolved, we think we should handle with it first and then come back to solve how to capture CP extension and LBT type for semi-static channel access in spec.  |
| WILUS | We support to change from the current text to 38.212 and definition of Ty in 37.213 to TPs in R1-2006763. Regarding 2nd and 3rd part change, it should be kept as it is considering consistency with other parts mentioning the gaps in 37.213. |

## 2.3 Other CP extension / LBT type indication related issues

One Tdoc addressed the issue of the duration of CP extension being capped to 1 symbol, e.g. in the case of misaligned assumption of the TA value at the UE and gNB. The related proposal is listed below:

**R1- 2006301**

|  |
| --- |
| **Proposal #5: If , the UL transmission performed with Cat-1 or Cat-2 LBT should be dropped, and the UL transmission performed with Cat-4 LBT can be transmitted with CP extension length of .** |

Companies are asked to provide their views related to the proposal above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | we agree that some degree of ambiguity will always be there, but such cases occur fairly seldom. We are in principle of with the proposal, but see this as non-essential. |
| OPPO | Agree with Nokia |
| Intel | We have the same understanding as Nokia, and we believe that this proposal is not essential. |
| Huawei, HiSilicon | Agree with Nokia and Intel |
| ZTE, Sanechips | Agree with Nokia and Intel. |
| WILUS | Agree with Nokia and Intel. |

## 2.4 CAPC of fallback UL grants

Two contributions discuss the determination of CAPC of fallback UL grants. The related proposals are as follows:

**R1-2005600**

|  |
| --- |
| ------------------------------------------------------- Start of TP #6-----------------------------------------------------------------4.1.3 DL channel access procedures in a shared channel occupancyFor 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.For the case where a gNB acquires a channel occupancy time (COT) using channel access procedures as described in subclause 4.1.1 and shares the corresponding channel occupancy time (COT) with a UE, the UE assumes channel access priority class (CAPC) value p=4 used by gNB to obtain channel occupancy time (COT) if channel access priority class (CAPC) used by gNB is not indicated explicitly in UL grant of RAR.-------------------------------------------------------- End of TP #6----------------------------------------------------------------The reference to the modification for Section 4.1.3 of TS 37.213 is based on the agreement of RAN1 #99 meeting in Part3 of the Appendix.**Proposal 7: It is proposed to capture a missing agreement that “In RAR, the UE assumes CAPC=4 was used by the gNB to acquire the CO when CAPC is not indicated explicitly” in Section 4.1.3 of the latest version of TS 37.213.** |

**R1-2006763**

|  |
| --- |
| ==TP for 37.213 4.2.1=================4.2.1 Channel access procedures for uplink transmission(s)--unchanged text omitted----When a UE uses Type 1 channel access procedures for PUSCH transmissions on configured resource, the UE determines the corresponding UL channel access priority in Table 4.2.1-1 following the procedures described in Subclause 5.6.2 in [9].When a UE uses Type 1 channel access procedures for PUSCH transmissions with user plane data indicated by a UL grant or related to random access procedure where the corresponding UL channel access priority is not indicated, the UE determines in Table 4.2.1-1 following the same procedures as for PUSCH transmission on configured resources using Type 1 channel access procedures.When a UE uses Type 2A, Type 2B, or Type 2C UL channel access procedures for PUSCH transmissions indicated by a fallback UL grant or related to random access procedure where the corresponding UL channel access priority is not indicated, the UE assumes gNB uses channel access priority class for the *Channel Occupancy Time*.A UE shall not transmit on a channel for a *Channel Occupancy Time* that exceeds where the channel access procedure is performed based on the channel access priority class associated with the UE transmissions, as given in Table 4.2.1-1.The total *Channel Occupancy Time* 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----=================================  |

Companies are asked to provide their views related to the above proposals with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | we are in principle ok with both proposals |
| OPPO | Proposals look reasonable |
| Intel | We are ok with both TPs. |
| Huawei, HiSilicon | Agree in principle |
| ZTE, Sanechips | Except our TP, my understanding is that Qualcomm’s TP is also okey to me. If there is no consensus for these two TPs, I tend to leave it to the editor. |
| WILUS | We are ok in principle with both TPs |

# 3. Issue #4

**Issue #4** Clarifications to channel access for semi-static channel occupancy

|  |  |
| --- | --- |
| Clarifications to channel access for semi-static channel occupancy | R1-2005600 (p3, p4, p5, p6)R1-2005809 (p10)R1-2005914 (p1)R1-2006351 (p1, p2, p3, p4, p5)R1- 2006370 (p1) |

## 3.1 Deployment scenario for semi-static channel access

Two TDocs addressed the issue in Section 4.3 of 37.213, where use of semis-static channel access is limited to the case when other technologies are not-present on a long-term basis.

**R1-2005914:**

Proposal 1 Remove the condition on presence or absence of other technologies in 37.213 for semi-static channel access procedures.

* + Adopt the following TP1 for clause 4.3 of TS37.213:

|  |
| --- |
|  ----------------------------------------------- Beginning of Text Proposal1 (TS 37.213)----------------------------------------------------4.3 Channel access procedures for semi-static channel occupancyIf ~~the absence of any other technology sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation) and 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 every within every two consecutive radio frames, starting from the even indexed radio frame at with a maximum channel occupancy time , where in , is a higher layer parameter provided in *semiStaticChannelAccessConfig-r16* and *.*  ----------------------------------------------- End of Text Proposal ---------------------------------------------------- |

**R1-2006730**

|  |
| --- |
| ***Proposal 1****: remove the limitation in 37.213 on semi-static channel access being applicable only in absence of other technologies.*-------- Beginning of Text Proposal (**TS 37.213**) ------------ 4.3 Channel access procedures for semi-static channel occupancyIf ~~the absence of any other technology sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation) and 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 every within every two consecutive radio frames, starting from the even indexed radio frame at with a maximum channel occupancy time , where in , is a higher layer parameter provided in *semiStaticChannelAccessConfig-r16* and *.*  ---------- End of Text Proposal ------------- |

A related proposal in R1-2005600 proposes a different clarification to the same section:

**R1-2005600**

|  |
| --- |
| ------------------------------------------------------------- Start of TP #2--------------------------------------------------------4.3 Channel access procedures for semi-static channel occupancyIf the absence of any other technology and other nodes with *ChannelAccessMode-r16* = "*dynamic*" or *ChannelAccessMode-r16* is absent sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation) and 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 every within every two consecutive radio frames, starting from the even indexed radio frame at with a maximum channel occupancy time , where in , is a higher layer parameter provided in *semiStaticChannelAccessConfig-r16* and *.* <unchanged part omitted>--------------------------------------------------------- End of TP #2----------------------------------------------------------------As shown in Part 1 in the Appendix, FBE operation for the scenario where it is guaranteed that LBE nodes are absent on a long term basis (e.g., by level of regulation) in TS 38.889. Therefore, it is proposed to capture the assumption for the description of FBE.**Proposal 3: It is proposed to add “and other nodes with ChannelAccessMode-r16 = "dynamic"or ChannelAccessMode-r16 is absent” after “any other technology”, to clarify the FBE scenario in Section 4.3 of the latest version of TS 37.213.** |

Companies are asked to provide their views related to the above proposals with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | we support the TPs in R1-2005914 and R1-2006730 (both are identical) and disagree with the TP in R1-2005600. During the SI, it was acknowledged that deploying FBE is beneficial especially when other technologies are not present, as otherwise FBE would have poor chances of accessing the channel due to conservative channel access. However, there is no reason for putting deployment restrictions for FBE into RAN1 specs since those are not required by regulation either. It should be up to the operator to decide what type of NR-U channel access is used in a given deployment.  |
| OPPO | This is not an essential issue. Even without this TP, it does not make much of difference in practical deployment.  |
| Intel | We also agree with OPPO, and we believe this is not essential. |
| Huawei, HiSilicon | We support the TPs in R1-2005914 and R1-2006730 for the same reasons mentioned by Nokia  |
| ZTE, Sanechips | I support our TP in R1-2005600. our TP is just to make spec more clear and accurate.Further, we tend not to remove this sentence “If the absence of any other technology sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation)”, in my view, its existence is actually similar as some description added in spec to guide us how to do it when there is other technology or other channel access node and how to do it without other technology or other channel access node. |
| ETRI | Agree with Nokia and support the TPs from R1-2005914 and R1-2006730. |
| WILUS | We agree with OPPO and Intel that this is not essential. But we are fine with a TP in R1-2005914 and R1-2006730.  |

## 3.2 Editorial corrections related to semi-static channel access

R1-2005600 proposes a few editorial corrections to Section 4.3 of 37.213:

|  |
| --- |
| ----------------------------------------------------------------- Start of TP #3--------------------------------------------------------If the absence of any other technology sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation) and 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 every within every two consecutive radio frames, starting from the even indexed radio frame at with a maximum channel occupancy time , where in , is a higher layer parameter provided by SIB1 or dedicated configuration in *semiStaticChannelAccessConfig-r16* and *.* <unchanged part omitted>--------------------------------------------------------- End of TP #3----------------------------------------------------------------**Proposal 4: It is proposed to remove “by SIB1 or dedicated configuration” after “ChannelAccessMode-r16 ='semistatic'” and add the words in front of “in SemiStaticChannelAccessConfig” in Section 4.3 of the latest version of TS 37.213.** |
| ----------------------------------------------------------------- Start of TP #4--------------------------------------------------------If the absence of any other technology sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation) and 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 every within every two consecutive radio frames, starting from the even indexed radio frame at with a maximum channel occupancy time , where in , is a higher layer parameter provided in *semiStaticChannelAccessConfig-r16* and *.* <unchanged part omitted>--------------------------------------------------------- End of TP #4----------------------------------------------------------------**Proposal 5: It is proposed to change the parameter form “” to “” in Section 4.3 of the latest version of TS 37.213.** |
| ----------------------------------------------------------------- Start of TP #5--------------------------------------------------------If the absence of any other technology sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation) and 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 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 *~~s~~SemiStaticChannelAccessConfig~~-r16~~* and *.* <unchanged part omitted>--------------------------------------------------------- End of TP #5----------------------------------------------------------------**Proposal 6: It is proposed to change the higher layer parameters from “Period” to “period” and “semiStaticChannelAccessConfig-r16” to “SemiStaticChannelAccessConfig” in Section 4.3 of the latest version of TS 37.213 .** |

Companies are asked to provide their views related to the three proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | We are not sure if TP#3 really makes things clearer. The current text seems fine.the change of x🡪 i is ok in principle but not critical.typo fixes are ok and can be handled directly by the editor. |
| OPPO | Fine with the TPs |
| Intel | We are OK with TP#4 and TP#5, but we share the same concerns as Nokia for TP#3.  |
| Huawei, HiSilicon | We share the same views as Nokia and Intel |
| ZTE, Sanechips | Support our TP#3, TP#4 and TP#5. |
| ETRI | OK with TP#4 and TP#5. |
| WILUS | We are OK with TP#4 and TP#5, but we share the same concerns as Nokia for TP#3 |

## 3.3 Clarification of the initiating node for FFPs

R1-2005809 proposes clarifications to Section 4.3 based on the fact that UE-initiated FFPs are not supported in Rel-16, as well as some editorial modifications.

**R1-2005809**

|  |
| --- |
| \*\*\* <Beginning of **Text Proposal 7**> \*\*\*4.3 Channel access procedures for Semi-static channel occupancyIf the absence of any other technology sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation) and 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 only every within every two consecutive radio frames, starting from the even indexed radio frame at with a maximum channel occupancy time , where in , is a higher layer parameter provided in *semiStaticChannelAccessConfig-r16* and *.* In the following procedures in this subclause, when a gNB or a UE scheduled/configured by a gNB 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 subclauses 4.1.5 and 4.2.3, respectively.A channel occupancy initiated by a gNB and shared with UE(s) shall satisfy thefollowing:- The gNB shall transmit a DL transmission burst starting at the beginning of the channel occupancy time immediately after sensing the channel to be idle for at least a sensing slot duration . If the channel is sensed to be busy, the gNB shall not perform any transmission during the current period.\*\*\* Unchanged text is omitted \*\*\*- The gNB and UEs shall not transmit any transmissions in a set of consecutive symbols for a duration of at least before the start of the next period.\*\*\* <End of **Text Proposal 7**> \*\*\****Proposal 10：Adopt TP7 into section 4.3 of TS 37.213 as it would also impact developing the specifications for UE-initiated semi-static CO under the Rel-17 IioT/URLLC work item*** |

Companies are asked to provide their views related to the TP above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | The changes are ok in principle. The word “only” seems redundant.  |
| Intel | We are in principle OK with the TP. However, in addition to “only”, we also thing that “scheduled/configured by a gNB” may not be needed. |
| Huawei, HiSilicon | We support the TP. Yes, “Only” could be removed. “scheduled/configured by a gNB” is just used following the style in 37.213 to refer herein to the ‘responding device’  |
| ZTE, Sanechips | We support the motivation of modification from HW, but seems we can further to polish wording for this TP. |
| ETRI | Support the TP, and also agree with HW’s proposal on the exact wording. |
| WILUS | We are in principle ok with the modified TP which “only” is removed. But adding of “scheduled/configured by a gNB” seems not to be essential. |

## 3.4 Other clarifications related to semi-static channel access

R1-2006351 discusses a few further issues related to semi-static channel access-

|  |
| --- |
| **Proposal 1**: Update TS 37.213 Clause 4.3 based on TP #1.-------------------------------------------------------- Start of TP #1 ----------------------------------------------------If the absence of any other technology sharing a channel can be guaranteed on a long-term basis (e.g. by level of regulation) and 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 every within every two consecutive radio frames, starting from the even indexed radio frame at ~~with a maximum channel occupancy time ,~~ where in , is a higher layer parameter provided in *semiStaticChannelAccessConfig-r16* and . Each comprises a channel occupancy time from the beginning and an idle period from the end.-------------------------------------------------------- End of TP #1 ----------------------------------------------------- |
| **Proposal 2**: In FBE, when DCI 2\_0 does not contain SFI, UE cancels the reception of periodic or semi-persistent CSI-RS configured by higher layers on downlink and flexible symbols (including the case where no semi-static TDD configuration is provided to the UE) if the periodic or semi-persistent CSI-RS location is outside the acquired CO duration, where the CO is acquired by a detection of DCI 2\_0. |
| **Proposal 3**: In FBE, UE performs UL transmission validation (as well as CSI-RS reception) on reception of DCI format 2\_0. Update TS 37.213 Clause 4.3 based on TP #2.-------------------------------------------------------- Start of TP #2 ----------------------------------------------------- A UE may transmit UL transmission burst(s) after detection of a DCI format 2\_0 ~~DL transmission burst(s)~~ within the channel occupancy time as follows:- If the gap between the UL and DL transmission bursts is at most , the UE may transmit UL transmission burst(s) after a DL transmission burst(s) within the channel occupancy time without sensing the channel.- If the gap between the UL and DL transmission bursts is more than , the UE may transmit UL transmission burst(s) after a DL transmission burst(s) within the channel occupancy time after sensing the channel to be idle for at least a sensing slot duration within a interval ending immediately before transmission.-------------------------------------------------------- End of TP #2 ----------------------------------------------------- |
| **Proposal 4**: Update TS 37.213 Clause 4.3 based on TP #3.-------------------------------------------------------- Start of TP #3 ----------------------------------------------------* The gNB and UEs shall not transmit any transmissions in a set of ~~consecutive~~ symbols overlapping with ~~for~~ a duration of ~~at least~~ before the start of the next channel occupancy time.

-------------------------------------------------------- End of TP #3 ----------------------------------------------------- |
| **Proposal 5**: Discuss for FBE the necessity of a short DRS transmission in a FFP in which the CCA failed. |

Companies are asked to provide their views related to the TPs and proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | In principle, the UE does not need to detect DCI 2\_0 to verify that the gNB has acquired the channel at the start of the FFP, but any DL signal will suffice. We are therefore not sure is any of the changes in R1-2006351 are needed. |
| OPPO | It becomes confusing on the UE behaviour of the CSI-RS reception in FBE. Should it depend on the detection of DCI 2\_0 or any DL transmission? |
| Intel  | We do not support this TP. We agree with Nokia: a UE does not need to necessarily detect DCI 2\_0 to assess that the gNB’s FFP is valid, since this could be potentially done through the detection of any DL signal. The specific DL signal or signals to use can be up to UE’s implementation. |
| Huawei, HiSilicon | We agree with Nokia and Intel |
| ZTE, Sanechips | Not support this TP. |
| ETRI | These proposals stem from the DL discussion in the last meeting about UE’s CO-duration acquisition in FBE. We think two aspects are related to the channel access.1. Exact definition of COT in FBE
2. Reliability of DL signal/channel for COT acquisition

Proposal 1 is about 1). We think the current spec just mentions “maximum COT”, and the definition of the actual COT occupied by gNB and shared by UE and the end-of-COT is not fully clear.Proposal 2 is about clarification of CSI-RS reception behavior for FBE. We think CO-duration indication field is not needed in FBE.Proposal 3 is about 2), i.e., reliability of DL signal/channel that UE uses for COT acquisition. Our proposal is to use only DCI 2\_0 which is reliable. And another potential relevant issue is the processing delay for DL detection. We provide more details in our tdoc and a companion tdoc R1-2006357 submitted in AI 7.2.2.3 Others.Proposal 4 is not related to the above three. This proposal is to clarify the meaning of an idle period in NR-U frame structure. |
| WILUS | We agree with Nokia. A UE is not necessarily required to detect DCI 2\_0 for transmitting UL transmission within the channel occupancy time. |

# 4. Issue #5

**Issue #5:** DL and UL Channel Access related

|  |  |
| --- | --- |
| Clarifications to restrictions for Type 1 DL channel access / DRS | R1-2006095 (p1)R1-2006351 (p6) |
| Clarifications to DL CWS adjustment | R1-2005809 (p1)R1-2006881 (p2, p3) |
| Clarifications to UL CWS adjustment | R1-2005809 (p2, p3, p4)R1-2006095 (p2, p3, p4)R1-2006301 (p6, p8) |
| CWS for channels without explicit feedback | R1-2006301 (p7)R1-2005809 (p3, p4) |

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

**R1-2006095** proposes a clarification to the definition of the duty cycle for DRS transmissions.

|  |
| --- |
| ================================ Start of TP for TS 37.213 =================================4.0 General================================ Unchanged Texts Omitted =================================- A *discovery burst* refers to a DL transmission burst including a set of signal(s) and/or channel(s) confined within a window and associated with a duty cycle. The duty cycle is defined as , wherein is the duration of the discovery burst and determined according to the transmission starting instance of the discovery burst, and is determined as the periodicity of the discovery burst transmission window, as described in subclause 4.1 of [7]. The *discovery burst* can be any of the following:- Transmission(s) initiated by an eNB that includes a primary synchronization signal (PSS), secondary synchronization signal (SSS) and cell-specific reference signal(s)(CRS) and may include non-zero power CSI reference signals (CSI-RS).- Transmission(s) initiated by a gNB that includes at least an SS/PBCH block consisting of a primary synchronization signal (PSS), secondary synchronization signal (SSS), physical broadcast channel (PBCH) with associated demodulation reference signal (DM-RS) and may also include CORESET for PDCCH scheduling PDSCH with SIB1, and PDSCH carrying SIB1 and/or non-zero power CSI reference signals (CSI-RS).================================= End of TP for TS 37.213 ================================= |

**R1-2006351** proposes another clarification to the condition for choosing LBT type DRS transmission in Section 4.1.1.

|  |
| --- |
| -------------------------------------------------------- Start of TP #4 ----------------------------------------------------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 including PDSCH/PDCCH not multiplexed with discovery burst, or- Transmission(s) initiated by a gNB including discovery burst multiplexed with unicast information, or- Transmission(s) initiated by a gNB ~~with~~ including only discovery burst or ~~with~~ including 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 part omitted>~~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 subclause.~~ 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. A gNB may use any channel access priority class for performing the procedures above to transmit other transmission(s) described in this subclause.-------------------------------------------------------- End of TP #4 ----------------------------------------------------- |

Companies are asked to provide their views related to the TPs and proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | Ok in principle to add the definition of duty cycle, although there is hardly and room for confusion with the current specs.The changes in R1-2006351 no not appear to change the gNB behaviour and are non-critical. |
| OPPO | Changes are not essential |
| Intel | For both TPs, we think that the current text is already quite clear.  |
| Huawei, HiSilicon | Agree in principle with the TP in R1-2006095. Detailed wording can be discussedThe top part of TP #4 in R1-2006351 is Ok as it covers PDSCH/PDCCH with non-user plane data such as RRC |
| ZTE, Sanechips | Share the same view with Intel |
| WILUS | We don’t see any clear motivation to change current spec text for both TPs.  |

## 4.2 Clarifications to DL CWS adjustment

**R1-2005809** proposes clarifications to Section 4.1.4.2:

|  |
| --- |
| \*\*\* <Beginning of **Text Proposal 1**> \*\*\*4.1.4.2 Contention window adjustment procedures for DL transmissions by gNBIf a gNB transmits transmissions including PDSCH that are associated with channel access priority class on a channel, the gNB maintains the contention window value and adjusts before step 1 of the procedure described in subclause 4.1.1 for those transmissions using the following steps:1. For every priority class set .
2. If HARQ-ACK feedback is available after the last update of , go to step 3. Otherwise, if the gNB transmission after procedure described in subclause 4.1.1 does not include a retransmission or is transmitted within a duration from the end of the *reference duration* corresponding to the earliest DL channel occupancy after the last update of , go to step 5; otherwise go to step 4.
3. The HARQ-ACK feedback(s) corresponding to PDSCH(s) in the *reference duration* for the latest DL channel occupancy for which HARQ-ACK feedback is available is used as follows:
	1. If at least one HARQ-ACK feedback is ‘ACK’ for PDSCH(s) with transport block based feedback or at least 10% of HARQ-ACK feedbacks is ‘ACK’ for CBGs overlapping with the channel and in PDSCH(s) with code block group based feedback, go to step 1; otherwise go to step 4.
4. Increase for every priority class to the next higher allowed value.
5. For every priority class *,* maintain as it is; go to step 2.

The *reference duration* and duration in the procedure above are defined as follows:- The *reference duration* corresponding to a channel occupancy initiated by the gNB including transmission of PDSCH(s) is defined in this subclause as a duration starting from the beginning of the channel occupancy until the end of the first slot where at least one unicast PDSCH is transmitted over all the resources allocated for the PDSCH, or until the end of the first transmission burst by the gNB that contains unicast PDSCH(s) transmitted over all the resources allocated for the PDSCH, whichever occurs earlier. If the channel occupancy includes a unicast PDSCH, but it does not include any unicast PDSCH transmitted over all the resources allocated for that PDSCH, then, the duration of the first transmission burst by the gNB within the channel occupancy that contains unicast PDSCH(s) is the *reference duration* for CWS adjustment.- where is the duration of the transmission burst from start of the *reference duration* in and if the absence of any other technology sharing the channel can not be guaranteed on a long-term basis (e.g. by level of regulation), and otherwise.\*\*\* Unchanged text is omitted \*\*\*\*\*\* <End of **Text Proposal 2**> \*\*\* |

**R1-2006881** raises another issue, related to CWS reset for CBG case.

|  |  |
| --- | --- |
| * *Proposal 3: We propose to reset CW as a minimum under CWS adjustment procedure if all CBG-NACKs generated by being not correctly detecting TB at the UE are received at the gNB when a part of total CBGs is retransmitted by the gNB. The text proposal for TS 37.213 is as follows:*

|  |
| --- |
| ===========================Start of Text Proposal for TS37.213============================4.1.4.2 Contention window adjustment procedures for DL transmissions by gNBIf a gNB transmits transmissions including PDSCH that are associated with channel access priority class on a channel, the gNB maintains the contention window value and adjusts before step 1 of the procedure described in clause 4.1.1 for those transmissions using the following steps:1) For every priority class set .2) If HARQ-ACK feedback is available after the last update of , go to step 3. Otherwise, if the gNB transmission after procedure described in clause 4.1.1 does not include a retransmission or is transmitted within a duration from the end of the *reference duration* corresponding to the earliest DL transmission burst after the last update of transmitted after the procedures described in clause 4.1.1, go to step 5; otherwise go to step 4.3) The HARQ-ACK feedback(s) corresponding to PDSCH(s) in the reference duration for the latest DL transmission burst for which HARQ-ACK feedback is available is used as follows:a. If at least one HARQ-ACK feedback is 'ACK' for PDSCH(s) with transport block based transmissions or at least 10% of HARQ-ACK feedbacks is 'ACK' for PDSCH(s) with code block group based transmissions or if all of HARQ-ACK feedbacks are ‘NACK’ for PDSCH(s) with code block group based transmissions which is generated by being not correctly detecting transport block at the UE when a part of total code block group based transmission is retransmitted by the gNB, go to step 1; otherwise go to step 4.4) Increase for every priority class to the next higher allowed value.5) For every priority class *,* maintain as it is; go to step 2.The *reference duration* and duration in the procedure above are defined as follows:- The *reference duration* corresponding to a channel occupancy initiated by the gNB including transmission of PDSCH(s) is defined in this clause as a duration starting from the beginning of the channel occupancy until the end of the first slot where at least one unicast PDSCH is transmitted over all the resources allocated for the PDSCH, or until the end of the first transmission burst by the gNB that contains unicast PDSCH(s) transmitted over all the resources allocated for the PDSCH, whichever occurs earlier. If the channel occupancy includes a unicast PDSCH, but it does not include any unicast PDSCH transmitted over all the resources allocated for that PDSCH, then, the duration of the first transmission burst by the gNB within the channel occupancy that contains unicast PDSCH(s) is the *reference duration* for CWS adjustment.- where is the duration of the transmission burst from start of the *reference duration* in and if the absence of any other technology sharing the channel can not be guaranteed on a long-term basis (e.g. by level of regulation), and otherwise.=========================== End of Text Proposal for TS37.213============================ |

 |

Companies are asked to provide their views related to the TPs and proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | R1-2005809: since the reference duration is defined in relation to channel occupancy rather than tx burst, the proposed change seems correct.R1-2006881: we are not sure how the gNB can in this case distinguish from the UE just not receiving the PDSCH correctly. It maybe simpler not to have a special treatment for this rare case.  |
| Intel | We support TP from R1-2005809.As for the TP from R1- 2006881, we share same view as Nokia. |
| Huawei, HiSilicon | Support TP in R1-2005809.For the TP in R1- 2006881, we share same view as Nokia and Intel. |
| ZTE, Sanechips | Support R1-2005809.Regarding TP from R1-2006881, we share same view as Nokia. |
| WILUS | Support both TPs in R1-2005809 and in R1-2006881.Regarding proposal in R1-2006881, it seems necessary to explain more as an example below. * From the gNB’s perspective, the gNB can distinguish whether or not the UE successfully received all of retransmitted a part of CBGs by comparing previous CBG HARQ feedbacks with current CBG HARQ feedbacks regardless of detecting the TB correctly. For an example, if the total # of CBGs per TB is 4 and the first two CBGs (i.e. CBG#0, CBG#1) are successfully received by the UE and the last two CBGs (i.e. CBG#2, CBG#3) are not detected correctly during the initial transmission, the UE generates {ACK, ACK, NACK, NACK} as CBG HARQ feedback and transmits them to the gNB. Then, the gNB performs CBG retransmissions (i.e. CBG#2, CBG#3) to the UE. If the UE decodes the retransmitted CBGs (i.e. CBG#2, CBG#3) correctly and does not correctly detect the TB for the corresponding CBGs, the UE generates all CBG NACKs (i.e. {NACK, NACK, NACK, NACK}) and transmits them to the gNB. For this case, the gNB can recognize that the UE successfully received all of retransmitted CBGs by comparing previous CBG HARQ feedbacks {ACK, ACK, NACK, NACK} with current CBG HARQ feedbacks {NACK, NACK, NACK, NACK} and the gNB can know that the current CBG HARQ feedbacks, all NACKs, i.e. {NACK,NACK, NACK, NACK} mean TB CRC failure by the UE. Therefore, the gNB can reset CWS for this case not doubling the CWS.
 |

## 4.3 Clarifications to UL CWS adjustment

**R1-2005809** discusses issues related to determination of the reference duration for CWS update, and in particular use of “transmission burst” and “channel occupancy. Related TP is below:

|  |
| --- |
| \*\*\* <Beginning of **Text Proposal 2**> \*\*\*4.2.2.2 Contention window adjustment procedures for UL transmissions scheduled/configured by gNBIf a UE transmits transmissions using Type 1 channel access procedures that are associated with channel access priority class on a channel, the UE maintains the contention window value and adjusts for those transmissions before step 1 of the procedure described in subclause 4.2.1.1, using the following steps:1. For every priority class , set ;
2. If HARQ-ACK feedback is available after the last update of , go to step 3. Otherwise, if the UE transmission after procedure described in subclause 4.2.1.1 does not include a retransmission or is transmitted within a duration from the end of the *reference duration* corresponding to the earliest UL channel occupancy after the last update of , go to step 5; otherwise go to step 4.
3. The HARQ-ACK feedback(s) corresponding to PUSCH(s) in the *reference duration* for the latest UL channel occupancy for which HARQ-ACK feedback is available is used as follows:
	1. If at least one HARQ-ACK feedback is ‘ACK’ for PUSCH(s) with transport block (TB) based feedback or at least 10% of HARQ-ACK feedbacks is ‘ACK’ for CBGs overlapping with the channel and in PUSCH(s) with code block group (CBG) based feedback go to step 1; otherwise go to step 4.
4. Increase for every priority class to the next higher allowed value;
5. For every priority class , maintain as it is; go to step 2.

\*\*\* Unchanged text is omitted \*\*\*\*\*\* <End of **Text Proposal 2**> \*\*\* |

Companies are asked to provide their views related to the TPs and proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | Similarly as for DL, we are ok with the change.  |
| Intel | We support this TP  |
| Huawei, HiSilicon | Support the TP |
| ZTE, Sanechips | It is okey for us |
| WILUS | We support this TP. |

**R1-2006095** discusses also CWS adjustment and makes following proposals, accompanied by a TP:

|  |
| --- |
| **Proposal 2: Reuse the RRC configured minimum duration *cg-minDFIDelay-r16* for the minimum latency between reference duration and the following UL grant or CG-DFI for CWS adjustment.****Proposal 3: Specify CWS adjustment based on valid HARQ-ACK defined in TS 38.213.**================================= Start of TP for TS 37.213 ================================4.2.2.2 Contention window adjustment procedures for UL transmissions scheduled/configured by gNB================================ Unchanged Texts Omitted =================================The HARQ-ACK feedback, *reference duration* and duration in the procedure above are defined as the following:- HARQ-ACK feedback for PUSCH(s) transmissions are expected to be provided to UE(s) explicitly or implicitly where implicit HARQ-ACK feedback for the purpose of contention window adjustment in this subclause, is determined based on the indication for a new transmission or retransmission in the DCI scheduling PUSCH(s) as follows:- If a new transmission is indicated, 'ACK' is assumed for the transport blocks or code block groups in the corresponding PUSCH(s) for the TB-based and CBG-based transmission, respectively.- If a retransmission is indicated for TB-based transmissions, 'NACK' is assumed for the transport blocks in the corresponding PUSCH(s).- If a retransmission is indicated for CBG-based transmissions, if a bit value in the code block group transmission information (CBGTI) field is '0' or '1' as described in subclause 5.1.7.2 in [8], 'ACK' or 'NACK' is assumed for the corresponding CBG in the corresponding PUSCH(s), respectively.Explicit HARQ-ACK feedback for the purpose of contention window adjustment in this subclause is determined based on valid HARQ-ACK in the CG-DFI as described in subclause 10.5 in [7].- The *reference duration* corresponding to a channel occupancy initiated by the UE including transmission of PUSCH(s) is defined in this subclause as a duration starting from the beginning of the channel occupancy until the end of the first slot where at least one unicast PUSCH is transmitted over all the resources allocated for the PDSCH, or until the end of the first transmission burst by the gNB that contains unicast PUSCH(s) transmitted over all the resources allocated for the PDSCH, whichever occurs earlier, and the duration starting no later than a number of symbols provided by *cg-minDFIDelay-r1* before an UL grant or a CG-DFI. If the channel occupancy includes a unicast PDSCH, but it does not include any unicast PDSCH transmitted over all the resources allocated for that PUSCH, and the duration starting no later than a number of symbols provided by *cg-minDFIDelay-r1* before an UL grant or a CG-DFI, then, the duration of the first transmission burst by the UE within the channel occupancy that contains PUSCH(s) is the *reference duration* for CWS adjustment.- where is the duraon of the transmission burst from start of the *reference duration* in and if the absence of any other technology sharing the channel cannot be guaranteed on a long-term basis (e.g. by level of regulation), and otherwise.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 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 for TS 37.213 ================================= |

**R1-2006301** also discusses similar issue, and proposes:

|  |
| --- |
| **Proposal #8: 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*.** |

Companies are asked to provide their views related to the TPs and proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | the TP in R1-2006095 seems fine |
| Intel | We support the TP from R1-2006095. |
| Huawei, HiSilicon | We agree with the following clarification that Explicit HARQ-ACK feedback is based only on Valid HARQ-ACK “Explicit HARQ-ACK feedback for the purpose of contention window adjustment in this subclause is determined based on valid HARQ-ACK in the CG-DFI as described in subclause 10.5 in [7].” However, we do not support the rest of that TP as our understanding is that in NR-U the *reference duration* itself is defined independently from whether the HARQ-ACK feedback is available or not. It is rather defined based on the presence of transmissions that can represent the beginning of the CO.The CWS procedure already handles the cases wherein HARQ-ACK feedback is available or not for a given reference duration. Therefore, clarifying that the available explicit HARQ-ACK feedback has to be Valid is sufficient.  |
| ZTE, Sanechips | It is fine for the TP from R1-2006095 |
| WILUS | We support this TP in R1-2006095. |

## 4.4 CWS for channels without explicit feedback

**R1-2006301** discusses CWS adjustment for RACH procedure and makes a proposal along with a TP:

|  |
| --- |
| **Proposal #6: The CWS for Msg3 can be adjusted based on the reception of Msg4.**================================ Start of TP#4 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#4 for TS 37.213 ================================ |

**R1-2005809** makes also a similar proposal:

|  |
| --- |
| ***Proposal 3：Since Msg 3 PUSCH satisfies the subclause in section 4.2.2.2 of TS 37.213 as a UL channel with implicit HARQ feedback NACK, receiving Msg 4 in response should be considered as an implicit HARQ feedback ACK for the purpose of CWS adjustment.***\*\*\* <Beginning of **Text Proposal 3**> \*\*\*4.2.2.2 Contention window adjustment procedures for UL transmissions scheduled/configured by gNB\*\*\* Unchanged text is omitted \*\*\*The HARQ-ACK feedback, *reference duration* and duration in the procedure above are defined as the following:* HARQ-ACK feedback for PUSCH(s) transmissions are expected to be provided to UE(s) explicitly or implicitly where implicit HARQ-ACK feedback for the purpose of contention window adjustment in this subclause, is determined based on either the indication for a new transmission or retransmission in the DCI scheduling PUSCH(s) or the success or failure of receiving of an associated channel/signal in response as follows:

- If a new transmission is indicated, ‘ACK’ is assumed for the transport blocks or code block groups in the corresponding PUSCH(s) for the TB-based and CBG-based transmission, respectively.- If a retransmission is indicated for TB-based transmissions, ‘NACK’ is assumed for the transport blocks in the corresponding PUSCH(s).- If a retransmission is indicated for CBG-based transmissions, if a bit value in the code block group transmission information (CBGTI) field is ‘0’ or ‘1’ as described in subclause 5.1.7.2 in [8], ‘ACK’ or ‘NACK’ is assumed for the corresponding CBG in the corresponding PUSCH(s), respectively.- If the UE successfully receives Msg 4 in response to its transmission of Msg 3 PUSCH, ‘ACK’ is assumed for the corresponding TB in the corresponding PUSCH.- The *reference duration* corresponding to a channel occupancy initiated by the UE including transmission of PUSCH(s) is defined in this subclause as a duration starting from the beginning of the channel occupancy until the end of the first slot where at least one PUSCH is transmitted over all the resources allocated for the PUSCH, or until the end of the first transmission burst by the UE that contains PUSCH(s) transmitted over all the resources allocated for the PUSCH, whichever occurs earlier. If the channel occupancy includes a PUSCH, but it does not include any PUSCH transmitted over all the resources allocated for that PUSCH, then, the duration of the first transmission burst by the UE within the channel occupancy that contains PUSCH(s) is the *reference duration* for CWS adjustment.\*\*\* Unchanged text is omitted \*\*\*\*\*\* <End of **Text Proposal 3**> \*\*\* |

Companies are asked to provide their views related to the TPs and proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | we do not think these changes are critical. Considering all possible cases where there may be implicit feedback for certain transmissions, may cause unnecessary complications to specs.  |
| Intel | This TP is not essential. |
| Huawei, Hisilicon | This subclause considers PUSCH transmissions with explicit or implicit feedback, It is obvious that retransmitting Msg 3 shall be always counted as an implicit NACK “If a retransmission is indicated for TB-based transmissions, ‘NACK’ is assumed for the transport blocks in the corresponding PUSCH(s).”However, inconsistently, we currently have no means for counting ACKs for such successful PUSCH transmissions.  |
| ZTE, Sanechips | Share the same view with Nokia and Intel. |
| WILUS | We don’t think this is essential as like Nokia. |

# 5. Issue #6

**Issue #6:** Multi-channel Channel Access:

|  |  |
| --- | --- |
| Clarifications to DL Multi-channel access procedures | R1-2005809 (p5) |
| Clarifications to UL Multi-channel access procedures | R1-2005809 (p6, p7, p8, p9)R1-2006301 (p3) |

## 5.1 Clarifications to DL Multi-channel access procedures

**R1-2005809** proposes a clarification to DL Multi-channel access procedures related to transmission overlapping multiple channels:

|  |
| --- |
| \*\*\* <Beginning of **Text Proposal 4**> \*\*\*4.1.6.1.1 Type A1 multi-channel access proceduresCounter as described in subclause 4.1.1 is independently determined for each channel and is denoted as . If the absence of any other technology sharing the channel cannot be guaranteed on a long term basis (e.g. by level of regulation), when the eNB/gNB ceases transmission on any one channel , for each channel , the eNB/gNB can resume decrementing when idle sensing slots are detected either after waiting for a duration of , or after reinitialising .For determining for channel , any PDSCH that fully or partially overlaps with channel , is used in the procedure described in subclause 4.1.4.2.4.1.6.1.2 Type A2 multi-channel access proceduresCounter is determined as described in subclause 4.1.1 for channel , and is denoted as , where is the channel that has the largest value. For each channel , .When the eNB/gNB ceases transmission on any one channel for which is determined, the eNB/gNB shall reinitialise for all channels.For determining for channel , any PDSCH that fully or partially overlaps with channel , is used in the procedure described in subclause 4.1.4.2.\*\*\* <End of **Text Proposal 4**> \*\*\* |

Companies are asked to provide their views related to the TPs and proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | ok with the TP |
| Intel | We support this TP |
| Huawei, HiSilicon | Support the TP |
| ZTE, Sanechips | There is no strong view for this TP. |
| WILUS | OK with this TP |

## 5.2 Clarifications to UL Multi-channel access procedures

**R1-2005809** discusses UL multi-channel access and makes following proposals:

|  |
| --- |
| ***Proposal 6: UE should be allowed to switch CAT4 LBT to CAT2 LBT on the same RB set(s) where DCI format 2\_0 carrying available RB set indicator is detected when the available RB set indicators indicate all RB sets are not available for reception.******Proposal 7：Adopt TP5 into section 4.2.1.0.0 of TS 37.213.***\*\*\* <Beginning of **Text Proposal 5**> \*\*\*4.2.1.0.0 Channel access procedures upon detection of a common DCI \*\*\* Unchanged text is 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.- If the UE determines from a DCI format 2\_0 that all RB sets are not available, the UE may switch from Type 1 channel access procedures to Type 2A channel access procedures on the same RB set(s) where the DCI format 2\_0 was detected.\*\*\* Unchanged text is omitted \*\*\*\*\*\* <End of **Text Proposal 5**> \*\*\* |

|  |
| --- |
| ***Proposal 8: For an NR-U UE scheduled with a PUSCH on multiple RB sets and indicated with type 1 channel access, if the channel frequencies of the corresponding set of channels C is NOT a subset of one of the sets of channel frequencies defined in subclause 5.7.4 in [2], the UE performs type 1 channel access procedure on each channel individually.******Proposal 9：Adopt TP6 into section 4.2.1.0.4 of TS 37.213.***\*\*\* <Beginning of **Text Proposal 6**> \*\*\*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 grant for the UL transmission on the set of channels , or- 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 a configured resources on the set of channels with Type 1 channel access procedure, 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 subclause 5.7.4 in [2]- the UE may transmit on channel using Type 2 channel access procedure as described in subclause 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 subclause 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 subclause 5.7.4 in [2], the UE may transmit on channel using type 1 channel access procedure as described in subclause 4.2.1.1.\*\*\* Unchanged text is omitted \*\*\*\*\*\* <End of **Text Proposal 6**> \*\*\* |

**R1-2006301** discusses also related aspects and proposes.

|  |
| --- |
| **Proposal #3: 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.**
 |

Companies are asked to provide their views related to the TPs and proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | R1-2005809: we are ok with TP#5. For TP#6, we are ok with the last change. The first two ones seem clear enough already. Alternatively, one could change it as:“is scheduled to transmit on a set of channels , and if Type 1 channel access procedure is indicated by the UL scheduling grant(s) for ~~the~~one or more 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”For R1-2006301 we would like to see the corresponding TP(s). |
| Intel | We are OK with both TPs from R1-2005809.  |
| Huawei, HiSilicon | We support both TPs in R1-2005809. We also fine with Nokia’s edits if agreed by the group; we think we should also cover wideband configured UL though. |
| ZTE, Sanechips | In R1-2005809, in my understanding, the premise of supporting TP#5 is that we should first determine whether to allow the introduction of all “0” special state in AI 7.2.2.1.2 DL. Otherwise, it is not necessary to discuss it here. So I don’t support this TP#5.For TP#6 of R1-2005808, I don’t think that the current spec will allow to support such behavior for this case that the channel frequencies of set of channels is not a subset of one of the sets of channel frequencies defined in subclause 5.7.4 in [2], the UE may transmit on channel using type 1 channel access procedure as described in subclause 4.2.1.1” and I don’t clear what the motivation is and its necessary. |

# 6. Editorial Issues

**Editorial Issues:**

|  |  |  |
| --- | --- | --- |
| #1 | order of ChannelAccess-CPext field in DCI 0\_0 | R1- 2005333 (p2) |

**R1- 2005333** raises the issue of the order of DCI fields in DCI 0\_0.

|  |
| --- |
| In DCI format 0\_0, the “UL/SUL indicator” is meant to be located in the last bit position of DCI format 0\_0. However, in current spec, the “ChannelAccess-CPext” is added after the “UL/SUL indicator”. Therefore, the “ChannelAccess-CPext” should be moved to the front of “UL/SUL indicator” as shown in text proposal 2.----------------------------------------------- Start of text proposal 2 ------------------------------------------------------TS 38.212**7.3.1.1.1 Format 0\_0**<unchanged text omitted>The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:……- ChannelAccess-CPext – 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4 for operation in a cell with shared spectrum channel access; 0 bit otherwise.- UL/SUL indicator – 1 bit for UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell as defined in Table 7.3.1.1.1-1 and the number of bits for DCI format 1\_0 before padding is larger than the number of bits for DCI format 0\_0 before padding; 0 bit otherwise. The UL/SUL indicator, if present, locates in the last bit position of DCI format 0\_0, after the padding bit(s).- If the UL/SUL indicator is present in DCI format 0\_0 and the higher layer parameter *pusch-Config* is not configured on both UL and SUL the UE ignores the UL/SUL indicator field in DCI format 0\_0, and the corresponding PUSCH scheduled by the DCI format 0\_0 is for the UL or SUL for which high layer parameter *pucch-Config* is configured;- If the UL/SUL indicator is not present in DCI format 0\_0 and *pucch-Config* is configured, the corresponding PUSCH scheduled by the DCI format 0\_0 is for the UL or SUL for which high layer parameter *pucch-Config* is configured. - If the UL/SUL indicator is not present in DCI format 0\_0 and *pucch-Config* is not configured, the corresponding PUSCH scheduled by the DCI format 0\_0 is for the uplink on which the latest PRACH is transmitted.……The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by TC-RNTI:- ChannelAccess-CPext – 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4 for operation in a cell with shared spectrum channel access; 0 bit otherwise- UL/SUL indicator – 1 bit if the cell has two ULs and the number of bits for DCI format 1\_0 before padding is larger than the number of bits for DCI format 0\_0 before padding; 0 bit otherwise. The UL/SUL indicator, if present, locates in the last bit position of DCI format 0\_0, after the padding bit(s).- If 1 bit, reserved, and the corresponding PUSCH is always on the same UL carrier as the previous transmission of the same TB<unchanged text omitted>----------------------------------------------- End of text proposal 2 -------------------------------------------------------- |

Companies are asked to provide their views related to the TPs and proposals above with the table below:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | We would like to understand the implication of not making the proposed change before agreeing to it. |
| Intel | From our perspective, the motivation of this TP is not clear, and some further explanation is needed. |
| Huawei, HiSilicon | We share the same views as Nokia and Intel |
| ZTE, Sanechips | Support in principle, but need to obtain some further explanation. |
| WILUS | We share the same views as Nokia and Intel |

# 7. Conclusions

TBA

# References

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | [**R1-2005333**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005333.zip) | Remaining issues on the channel access procedures | vivo |
| 2 | [**R1-2005600**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005600.zip) | Remaining issues on the channel access procedure for NR-U | ZTE, Sanechips |
| 3 | [**R1-2005809**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005809.zip) | Maintenance on channel access procedures | Huawei, HiSilicon |
| 4 | [**R1-2005914**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005914.zip) | Channel access procedures | Ericsson |
| 5 | [**R1-2006020**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006020.zip) | Discussion on the remaining issues of channel access procedure | OPPO |
| 6 | [**R1-2006095**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006095.zip) | Channel access procedures for NR-U | Samsung |
| 7 | [**R1-2006301**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006301.zip) | Remaining issues of channel access procedure for NR-U | LG Electronics |
| 8 | [**R1-2006351**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006351.zip) | Remaining issues on channel access procedures for NR-U | ETRI |
| 9 | **[R1-2006370](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006370.zip)** | Remaining Issues on Channel Access Procedures for NR-U | Nokia, Nokia Shanghai Bell |
| 10 | [**R1-2006763**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006763.zip) | TP for Channel access procedures for NR unlicensed | Qualcomm Incorporated |
| 11 | [**R1-2006881**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006881.zip) | Remaining issues on channel access procedure for NR-U | WILUS Inc. |