**3GPP TSG RAN WG1 Meeting #104bis-e R1-210xxxx**

**April 12th – April 20th, 2021**

**Agenda item: 7.2.2**

**Source: Moderator (Nokia)**

**Title: FL summary for channel access signals procedures for NR-U**

**Document for: Discussion and Decision**

# Introduction

This paper summarizes the CR proposals for channel access procedures for NR-U.

To summarize:

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| Issue # | Area of proposal | Contributions |
| CA-1 | Clarifying the conditions for indicating Type 2 LBT for wideband scheduled PUSCH | [1] |
| CA-2 | China-specific aspects related to CCA time and gaps | [1] |
| CA-3 | Correction to SR reporting due to consistent LBT failure recovery | [2] |
| CA-4 | Clarifications on applicability of Type 2A DL Channel Access | [3], [5] |
| CA-5 | UL contention window adjustment procedures | [4] |
| CA-6 | DL COT Detection in Semi-static Channel Access | [6] |

After the conclusion of the preparation phase, further discussion was focused on a subset of topics:

[104b-e-NR-NRU-02] Email discussion/approval on channel access until Apr-16 – Timo (Nokia)

* CA-1, CA-3, CA-4

Companies are invited to provide their view on the three topics above using the tables in the document

# Summary of issues

## Issue CA-1: Clarifying the conditions for indicating Type 2 LBT for wideband scheduled PUSCH

In [1], it is proposed to clarify the conditions for when Type LBT is used in the case of wideband operation, The related TPO is below.

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| ================== Start of TP#2 for TS 37.213 v16.5.0 ===================4.2.1.0.3 Conditions for indicating Type 2 channel access proceduresAn eNB/gNB may indicate Type 2 channel access procedures in the DCI of a UL grant or DL assignment scheduling transmission(s) including PUSCH on one or more channels or PUCCH on a channel, respectively, as follows: If the UL transmissions occur within the time interval starting at and ending at , where- ,- is the time instant when the eNB/gNB has started transmission on the carrier according to the channel access procedure described in clause 4.1.1,- value is determined by the eNB/gNB as described in clause 4.1.1,- is the total duration of all gaps of duration greater than that occur between the DL transmission of the eNB/gNB and UL transmissions scheduled by the eNB/gNB, and between any two UL transmissions scheduled by the eNB/gNB starting from ,then,- the eNB/gNB may indicate Type 2 channel access procedures in the DCI if the eNB/gNB has transmitted on the channel(s) according to the channel access procedures described in clause 4.1.1 or the multi-channel access procedures in clause 4.1.6, or- the eNB may indicate using the 'UL duration and offset' field that the UE may perform a Type 2 channel access procedure for transmissions(s) including PUSCH on a channel in a subframe when the eNB has transmitted on the channel according to the channel access procedure described in clause 4.1.1, or- the eNB may indicate using the 'UL duration and offset' field and 'COT sharing indication for AUL' field that a UE configured with autonomous UL may perform a Type 2 channel access procedure for autonomous UL transmissions(s) including PUSCH on a channel in subframe when the eNB has transmitted on the channel according to the channel access procedure described in clause 4.1.1 and acquired the channel using the largest priority class value and the eNB transmission includes PDSCH, or- the eNB/gNB may schedule UL transmissions on a channel, that follow a transmission by the eNB/gNB on that channel with Type 2A channel access procedures for the UL transmissions as described in clause 4.2.1.2.1 after a duration of .The eNB/gNB shall schedule UL transmissions between and without gaps between consecutive UL transmissions if they can be scheduled contiguously. For a UL transmission on a channel that follows a transmission by the eNB/gNB on that channel using Type 2A channel access procedures as described in clause 4.2.1.2.1, the UE may use Type 2A channel access procedure for the UL transmission.If the eNB/gNB indicates Type 2 channel access procedure for the UE in the DCI, the eNB/gNB indicates the channel access priority class used to obtain access to the channel in the DCI.For indicating a Type 2 channel access procedure, if the gap is at least , or equal to , or up to , the gNB may indicate Type 2A, or Type 2B, or Type 2C UL channel procedures, respectively, as described in clauses 4.2.1.2.================== End of TP#2 for TS 37.213 v16.5.0 =================== |

Companies are asked provide their views on the TP in [1] with the table below.

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| Company  | Comments |
| Nokia, NSB | We support the proposal |
| Samsung | We support the proposal.  |
| Intel | We are OK with the TP. |
| Charter Communications | We support the proposal. |
| Huawei, HiSilicon | We support the TP  |
| NTT DOCOMO | We are fine with the TP.  |

## Issue CA-2: China-specific aspects related to CCA time and gaps

In [1], it is proposed modify the CCA time and the requirement for gap duration with no-LBT for both dynamic and semi-static channel access.

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| ===========Start of TP#3 for TS 37.213 v16.5.0===========4.3 Channel access procedures for semi-static channel occupancyChannel 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.A channel occupancy initiated by a gNB and shared with UE(s) satisfies 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. - 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 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.- A UE may be indicated by the gNB to transmit UL transmission burst(s) within the channel occupancy time without sensing the channel or after sensing the channel to be idle for at least a sensing slot duration within a interval ending immediately 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 period.The sensing slot duration , except for the case of operating in China wherein .If a UE fails to access the channel(s) prior to an intended UL transmission to a gNB, Layer 1 notifies higher layers about the channel access failure.===========End of TP#3 for TS 37.213 v16.5.0=========== |

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| =====================Start of TP#4 for TS 38.212 v16.5.0===================<Unchanged parts are omitted>**Table 7.3.1.1.1-4A: Channel access type & CP extension if *ChannelAccessMode-r16* = "*semistatic*" is provided**

|  |  |  |
| --- | --- | --- |
| **Bit field mapped to index** | **Channel Access Type**  | **The CP extension T\_"ext" index defined in Clause 5.3.1 of [4, TS 38.211]** |
| 0 | No sensing as defined in Clause 4.3 in TS 37.213 | 0 |
| 1 | No sensing as defined in Clause 4.3 in TS 37.213 | 2 |
| 2 | Sensing within a 25us interval as defined in Clause 4.3 in TS 37.213 | 0 |
| 3 | - | - |

<Unchanged parts are omitted>=====================End of TP#4 for TS 38.212 v16.5.0=================== |

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| ==============================End of TP#5 for TS 37.213 v16.5.0====================4.1.1 Type 1 DL channel access procedures<Unchanged parts are omitted>The eNB/gNB may transmit a transmission after first sensing the channel to be idle during the sensing slot durations of a defer duration and after the counter is zero in step 4. The counter is adjusted by sensing the channel for additional sensing slot duration(s) according to the steps below:1) set , where is a random number uniformly distributed between 0 and , and go to step 4;2) if and the eNB/gNB chooses to decrement the counter, set ;3) sense the channel for an additional sensing slot duration, and if the additional sensing slot duration is idle, go to step 4; else, go to step 5;4) if , stop; else, go to step 2.5) sense the channel until either a busy sensing slot is detected within an additional defer duration or all the sensing slots of the additional defer duration are detected to be idle;6) if the channel is sensed to be idle during all the sensing slot durations of the additional defer duration , go to step 4; else, go to step 5;If an eNB/gNB has not transmitted a transmission after step 4 in the procedure above, the eNB/gNB may transmit a transmission on the channel, if the channel is sensed to be idle at least in a sensing slot duration when the eNB/gNB is ready to transmit and if the channel has been sensed to be idle during all the sensing slot durations of a defer duration immediately before this transmission. If the channel has not been sensed to be idle in a sensing slot duration when the eNB/gNB first senses the channel after it is ready to transmit or if the channel has been sensed to be not idle during any of the sensing slot durations of a defer duration immediately before this intended transmission, the eNB/gNB proceeds to step 1 after sensing the channel to be idle during the sensing slot durations of a defer duration . The defer duration consists of duration immediately followed by consecutive sensing slot durations , and includes an idle sensing slot duration at start of . The duration , except for the case of operating in China wherein the duration .<Unchanged parts are omitted>4.2.1.1 Type 1 UL channel access procedure<Unchanged parts are omitted>A UE may transmit the transmission using Type 1 channel access procedure after first sensing the channel to be idle during the slot durations of a defer duration , and after the counter is zero in step 4. The counter is adjusted by sensing the channel for additional slot duration(s) according to the steps described below. 1) set , where is a random number uniformly distributed between 0 and , and go to step 4;2) if and the UE chooses to decrement the counter, set ;3) sense the channel for an additional slot duration, and if the additional slot duration is idle, go to step 4; else, go to step 5;4) if , stop; else, go to step 2.5) sense the channel until either a busy slot is detected within an additional defer duration or all the slots of the additional defer duration are detected to be idle;6) if the channel is sensed to be idle during all the slot durations of the additional defer duration , go to step 4; else, go to step 5;If a UE has not transmitted a UL transmission on a channel on which UL transmission(s) are performed after step 4 in the procedure above, the UE may transmit a transmission on the channel, if the channel is sensed to be idle at least in a sensing slot duration when the UE is ready to transmit the transmission and if the channel has been sensed to be idle during all the slot durations of a defer duration immediately before the transmission. If the channel has not been sensed to be idle in a sensing slot duration when the UE first senses the channel after it is ready to transmit, or if the channel has not been sensed to be idle during any of the sensing slot durations of a defer duration immediately before the intended transmission, the UE proceeds to step 1 after sensing the channel to be idle during the slot durations of a defer duration . The defer duration consists of duration immediately followed by consecutive slot durations where each slot duration is , and includes an idle slot duration at start of . The duration , except for the case of operating in China wherein the duration .<Unchanged parts are omitted>==============================End of TP#5 for TS 37.213 v16.5.0=================== |

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| ==============================Start of TP#6 for TS 37.213 v16.5.0===================4.1.6.2 Type B multi-channel access procedure A channel is selected by the eNB/gNB as follows:- the eNB/gNB selects by uniformly randomly choosing from before each transmission on multiple channels , or- the eNB/gNB selects no more frequently than once every 1 second,where is a set of channels on which the eNB/gNB intends to transmit, , and is the number of channels on which the eNB intends to transmit. To transmit on channel - the eNB/gNB shall perform channel access on channel according to the procedures described in clause 4.1.1 with the modifications described in clause 4.1.6.2.1 or 4.1.6.2.2.To transmit on channel , - for each channel , the eNB/gNB shall sense the channel for at least a sensing interval immediately before the transmitting on channel , and the eNB/gNB may transmit on carrier immediately after sensing the channel to be idle for at least the sensing interval . The channel is considered to be idle for if the channel is sensed to be idle during all the time durations in which such idle sensing is performed on the channel in given interval . The sensing interval , except for the case of operating in China wherein the sensing interval .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]. <Unchanged parts are omitted>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 immediately after sensing the channel to be idle for at least a sensing interval , - if the sensing 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 channel is considered to be idle for if the channel is sensed to be idle during all the time durations in which such idle sensing is performed on the channel in given interval . The sensing interval , except for the case of operating in China wherein the sensing interval . - if a UE is configured without intra-cell guard band(s) on a UL bandwidthpart as described in clause 7 in [8], the UE may not transmit on a channel within the bandwidth of the carrier, if the UE fails to access any of the channels of the UL bandwidthpart.- otherwise, 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.<Unchanged parts are omitted>==============================End of TP#6 for TS 37.213 v16.5.0=================== |
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## Issue CA-3: Correction to SR reporting due to consistent LBT failure recovery

One contribution [2], points out that use of SR for indication of consistent LBT failures is missing from L1 spces. corresponding TPs are below:

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| START OF THE CHANGE9.2.4 UE procedure for reporting SRA UE can be configured by *SchedulingRequestResourceConfig* a set of configurations for SR in a PUCCH transmission using either PUCCH format 0 or PUCCH format 1. A UE can be configured by *schedulingRequestID-BFR-SCell* a configuration for LRR in a PUCCH transmission using either PUCCH format 0 or PUCCH format 1. A UE can be configured by *schedulingRequestID-LBT-SCell* a configuration for consistent LBT failure recovery, as described in [11, TS 38.321], in a PUCCH transmission using either PUCCH format 0 or PUCCH format 1. The UE can be provided, by *phy-PriorityIndex* in *SchedulingRequestResourceConfig*, a priority index 0 or a priority index 1 for the SR. If the UE is not provided a priority index for SR, the priority index is 0.The UE is configured a PUCCH resource by *SchedulingRequestResourceId*, or by *schedulingRequestID-BFR-SCell*, or by *schedulingRequestID-LBT-SCell*, providing a PUCCH format 0 resource or a PUCCH format 1 resource as described in Clause 9.2.1. The UE is also configured a periodicity  in symbols or slots and an offset  in slots by *periodicityAndOffset* for a PUCCH transmission conveying SR. If  is larger than one slot, the UE determines a SR transmission occasion in a PUCCH to be in a slot with number  [4, TS 38.211] in a frame with number  if .If  is one slot, the UE expects that  and every slot is a SR transmission occasion in a PUCCH. If  is smaller than one slot, the UE determines a SR transmission occasion in a PUCCH to start in a symbol with index  [4, TS 38.211] if  where  is the value of *startingSymbolIndex*.If the UE determines that, for a SR transmission occasion in a PUCCH, the number of symbols available for the PUCCH transmission in a slot is smaller than the value provided by *nrofSymbols*, the UE does not transmit the PUCCH in the slot. SR transmission occasions in a PUCCH are subject to the limitations for UE transmissions described in Clause 11.1 and Clause 11.1.1. The UE transmits a PUCCH in the PUCCH resource for the corresponding SR configuration only when the UE transmits a positive SR. For a positive SR transmission using PUCCH format 0, the UE transmits the PUCCH as described in [4, TS 38.211] by obtaining  as described for HARQ-ACK information in Clause 9.2.3 and by setting . For a positive SR transmission using PUCCH format 1, the UE transmits the PUCCH as described in [4, TS 38.211] by setting .END OF THE CHANGE |

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| START OF THE CHANGE9.2.5.1 UE procedure for multiplexing HARQ-ACK or CSI and SR in a PUCCHIn the following, a UE is configured to transmit PUCCHs for respective SRs in a slot, as determined by a set of *schedulingRequestResourceId*, a *schedulingRequestResourceId* associated with *schedulingRequestID-BFR-SCell*, and a *schedulingRequestResourceId* associated with *schedulingRequestID-LBT-SCell*, with SR transmission occasions that would overlap with a transmission of a PUCCH with HARQ-ACK information from the UE in the slot or with a transmission of a PUCCH with CSI report(s) from the UE in the slot.If a UE would transmit a PUCCH with positive SR and at most two HARQ-ACK information bits in a resource using PUCCH format 0, the UE transmits the PUCCH in the resource using PUCCH format 0 in PRB(s) for HARQ-ACK information as described in Clause 9.2.3. The UE determines a value of  and  for computing a value of cyclic shift  [4, TS 38.211] where  is provided by *initialCyclicShift* of *PUCCH-format0*, and  is determined from the value of one HARQ-ACK information bit or from the values of two HARQ-ACK information bits as in Table 9.2.5-1 and Table 9.2.5-2, respectively. If the UE would transmit negative SR and a PUCCH with at most two HARQ-ACK information bits in a resource using PUCCH format 0, the UE transmits the PUCCH in the resource using PUCCH format 0 for HARQ-ACK information as described in Clause 9.2.3.Table 9.2.5-1: Mapping of values for one HARQ-ACK information bit and positive SR to sequences for PUCCH format 0

|  |  |  |
| --- | --- | --- |
| HARQ-ACK Value | 0 | 1 |
| **Sequence cyclic shift** |  |  |

Table 9.2.5-2: Mapping of values for two HARQ-ACK information bits and positive SR to sequences for PUCCH format 0

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| HARQ-ACK Value | {0, 0} | {0, 1} | {1, 1} | {1, 0} |
| **Sequence cyclic shift** |  |  |  |  |

If a UE would transmit SR in a resource using PUCCH format 0 and HARQ-ACK information bits in a resource using PUCCH format 1 in a slot, the UE transmits only a PUCCH with the HARQ-ACK information bits in the resource using PUCCH format 1. If the UE would transmit positive SR in a first resource using PUCCH format 1 and at most two HARQ-ACK information bits in a second resource using PUCCH format 1 in a slot, the UE transmits a PUCCH with HARQ-ACK information bits in the first resource using PUCCH format 1 as described in Clause 9.2.3. If a UE would not transmit a positive SR in a resource using PUCCH format 1 and would transmit at most two HARQ-ACK information bits in a resource using PUCCH format 1 in a slot, the UE transmits a PUCCH in the resource using PUCCH format 1 for HARQ-ACK information as described in Clause 9.2.3.If a UE would transmit a PUCCH with  HARQ-ACK information bits in a resource using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 in a slot, as described in Clauses 9.2.1 and 9.2.3,  bits representing a negative or positive SR, in ascending order of the values of *schedulingRequestResourceId*,a *schedulingRequestResourceId* associated with *schedulingRequestID-BFR-SCell*, and a *schedulingRequestResourceId* associated with *schedulingRequestID-LBT-SCell*, are appended to the HARQ-ACK information bits and the UE transmits the combined  UCI bits in a PUCCH using a resource with PUCCH format 2 or PUCCH format 3 or PUCCH format 4 that the UE determines as described in Clauses 9.2.1 and 9.2.3. If one of the SRs is a positive LRR, the value of the  bits indicates the positive LRR. An all-zero value for the  bits represents a negative SR value across all SRs. If a UE would transmit a PUCCH with  CSI report bits in a resource using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 in a slot,  bits representing corresponding negative or positive SR, in ascending order of the values of *schedulingRequestResourceId*, a *schedulingRequestResourceId* associated with *schedulingRequestID-BFR-SCell*, and a *schedulingRequestResourceId* associated with *schedulingRequestID-LBT-SCell*, are prepended to the CSI information bits as described in Clause 9.2.5.2 and the UE transmits a PUCCH with the combined  UCI bits in a resource using the PUCCH format 2 or PUCCH format 3 or PUCCH format 4 for CSI reporting. If one of the SRs is a positive LRR, the value of the  bits indicates the positive LRR. An all-zero value for the  bits represents a negative SR value across all SRs. If a UE transmits a PUCCH with  HARQ-ACK information bits,  SR bits, and  CRC bits using PUCCH format 2 or PUCCH format 3 in a PUCCH resource that includes  PRBs, the UE determines a number of PRBs  for the PUCCH transmission to be the minimum number of PRBs, that is smaller than or equal to a number of PRBs provided respectively by *nrofPRBs* in *PUCCH-format2* or *nrofPRBs* in *PUCCH-format3* and starts from the first PRB from the number of PRBs, that results to  and, if , , where , , , and  are defined in Clause 9.2.5.2. For PUCCH format 3, if  is not equal  according to [4, TS 38.211],  is increased to the nearest allowed value of *nrofPRBs* for *PUCCH-format3*[12, TS 38.331]. If , the UE transmits the PUCCH over the  PRBs.If a UE is provided a first interlace of PRBs by *interlace0* in *InterlaceAllocation* and transmits a PUCCH with HARQ-ACK information bits, SR bits, and CRC bits using PUCCH format 2 or PUCCH format 3, the UE transmits the PUCCH over the first interlace if ; otherwise, if the UE is provided a second interlace by *interlace1* in *PUCCH-format2* or *PUCCH-format3*, the UE transmits the PUCCH over the first and second interlaces.END OF THE CHANGE |

Companies are asked provide their views on the two TPs in [2] with the Table below.

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| Company  | Comments |
| Nokia, NSB | We support the proposal |
| Samsung | We are ok with the proposal.  |
| Intel | We are OK with both the TP related to Issue CA-2, and the TP related to Issue CA-3. |
| Charter Communications | We are fine with the proposal. |
| Huawei, HiSilicon | We would like to thank Intel for supporting the TPs related to Issue CA-2.We support the TP to address the Issue CA-3  |
| NTT DOCOMO | We are fine with the TP.  |

## Issue CA-4: Clarifications on applicability of Type 2A DL Channel Access

Following the discussion at RAN1#104-e (Issue 2.4) , [3] and [5] propose various ways of clarifying which DL signals and channels may use Type 2A DL channel access procedures, and when Type 1 should be used. For the related TPs, please refer to the corresponding contributions.

Companies are asked provide their views on the TPs in [3] and [5] with the Table below. Specifically:

* is a spec change needed and if so,
* which on of the alternatives below (O1, O2, O3 in [3], or TP1, TP1’, TP2, TP3 in [5]) should be chosen, and are any further changes needed?

[3]:

* Option 1:
	+ Remove the list for Type 1 in clause 4.1.1.
	+ Add a statement in 4.1.1 to make it applicable to all transmissions.
	+ Add a statement in 4.1.2 that Type 2 is applicable only to the listed transmissions in that clause.
* Option 2:
	+ Add a statement in 4.1.1 to make it applicable to all transmissions by adding “at least” before the list.
	+ Add a statement in 4.1.2 that Type 2 is applicable only to the listed transmissions in that clause.
* Option 3:
	+ Add more examples to the list for Type 1 in clause 4.1.1, to make it complete

[5]:

* TP1: Based on the general principle that Type 1 channel access is applicable to all transmission, we are trying to avoid redundant description in the specification by removing the listed transmission(s) for both LTE-LAA and NR-U applicable to Type 1, while emphasizing that Type 2 is applicable for only a limited set of transmission(s).
* TP1’: This is similar to TP1 but we are trying to intentionally limit it to NR to avoid having further discussions on LTE-LAA aspect, by keeping LTE-LAA related description as is while applying the same fundamental as in TP1 to only NR-U aspect. This approach solves the issue for NR but introduces redundant description in specification for LTE-LAA that should be preferably avoided if possible.
* TP2: TP2 is another way, where “at least” is added for Type 1 to clarify any other DL transmission(s), to which Type 2 is not applicable, are not precluded. This approach solves the issue but introduces redundant description in specification which should be avoided when possible.
* TP3: TP3, the last one, is to explicitly add the missed DL transmission(s), i.e., PDCCH-only and RS-only transmissions in our understanding. This approach understandably is not future proof and does not guarantee that the issue is completely solved in case another DL transmission is identified to be missing from the list.

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| Company  | Comments |
| Nokia, NSB | A change is beneficial, and all proposals are very similar. Our slight preference is not to touch aspects related to LTE-LAA. In that respect, we support the “alternative TP for option 1” in [3], and TP1’ in [5], that seem to be exactly the same. |
| Samsung | We support one of the TPs as one of the proposing companies. A change to current specification is needed to clarify the channel access behaviour, especially for those channels and signals not included in either of the lists, and we are ok with either with the TPs, and none of the TPs is perfect (due to the speciality of TS 37.213 to include LTE LAA as well). Slightly prefer “alternative TP for option 1” in [3], or TP1’ in [5], which are the same, and resolves the issue without touching LTE spec.  |
| Intel | With similar motivations as Nokia and Samsung, our preference is either TP1 in [5] o the “alternative TP for option 1” provided in [3]. |
| Charter Communications | Agree with Samsung |
| Huawei, HiSilicon | We prefer the approach of TP2 in [5] using “at least” We do not think it is necessary to delete the agreed conditions for discovery burst transmissions after long debates; it is much clearer to keep these conditions explicitly stated. We also acknowledge the motivation not to impact LTE LAA bullet. So, a slight variation of TP2 could move down the “at least” to be specific to NR-U as follows:================================== Start of TP 2 ======================================4.1.1 Type 1 DL channel access proceduresThis 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- At least transmission(s) initiated by a gNB including- 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 ================================= |
| NTT DOCOMO | We slightly prefer TP1’ in [5], which is the same as “alternative TP for option 1” in [3], as one of the proposing companies, with the same understanding with Samsung. The concern on using “at least” would be also applicable to NR-U part in our understanding.  |

## Issue CA-5: UL contention window adjustment procedures

In [4], a few aspects related to UL CW adjustment are considered, with the following proposals.

Note: This was already discussed at RAN1#104-e as item 2.5 without consensus. FL recommendation is not to revisit the discussion.

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| **Proposal #5: The CWS for Msg3 can be adjusted based on the reception of Msg4.****Proposal #6: 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 #7: 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*.** |

## Issue CA-6: DL COT Detection in Semi-static Channel Access

In [6]], modifications to the rules for DL COT/FFP detection are proposed, such that later introduction of UE initiated FFPs is possible in Rel-17. The related proposal and TP is as follows:

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| **Proposal: *For the purpose of gNB-UE COT sharing, the UE may transmit in a gNB COT only if it has detected a DL transmission during the first [14] symbols of a gNB FFP.***============= Start of TP for TS 37.213 ============4.3 Channel access procedures for semi-static channel occupancy============= Unchanged parts are omitted ===============A channel occupancy initiated by a gNB and shared with UE(s) satisfies 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. - 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 first [14] symbols of 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.- A UE may be indicated by the gNB to transmit UL transmission burst(s) within the channel occupancy time without sensing the channel or after sensing the channel to be idle for at least a sensing slot duration within a interval ending immediately 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 period.If a UE fails to access the channel(s) prior to an intended UL transmission to a gNB, Layer 1 notifies higher layers about the channel access failure.============= End of TP for TS 37.213 ============ |

# References

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| 1 | [**R1-2102325**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2102325.zip) | Maintenance on channel access and HARQ procedures for NR Unlicensed | Huawei, HiSilicon |
| 2 | [**R1-2102938**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2102938.zip) | Correction on 38.213 for SR reporting due to consistent LBT failure recovery | vivo |
| 3 | [**R1-2103212**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103212.zip) | Correction on the conditions for DL channel access procedure | Samsung |
| 4 | [**R1-2103335**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103335.zip) | Remaining issues of DL signals and channels and channel access procedure for NR-U | LG Electronics |
| 5 | [**R1-2103554**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103554.zip) | Maintenance for DL channel access mechanism | NTT DOCOMO, INC., Ericsson |
| 6 | [**R1-2103732**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103732.zip) | Discussion on DL COT Detection in Semi-static Channel Access | Nokia, Nokia Shanghai Bell |