3GPP TSG RAN WG1 #102-e R1-200xxxx

e-Meeting, August 17th – 28th, 2020

Source: Moderator (vivo)

Title: Summary of [102-e-NR-L1enh-URLLC-InterUE-01] Remaining issues on inter-UE prioritization/multiplexing

Agenda Item: 7.2.5.5

Document for: Discussion and Decision

# Introduction

The document provides a summary for the following email discussion

[102-e-NR-L1enh-URLLC-InterUE-01] Remaining issues on inter-UE prioritization/multiplexing (including issues #1, #7, #8, #9 from FL’s summary) - Xueming (vivo)

* Discussion and agreement by 8/21
* TPs by 8/28

# Discussions

## **2.1 Issue 1: Allowing earlier cancellation relaxation for UL CI [1][2][4][5][9][10][11]**

To allow UE implementation flexibility and to keep consistent with intra-UE cancellation behaviour, it is proposed in [1][9][11] that UE should be allowed to start the cancellation earlier than the indicated symbol, while [2] [4] [5] proposed to not allow this and keep the current spec unchanged, due to unclear UE complexity issue and the ambiguity caused to gNB.

[10] proposed a compromised proposal which allows flexibility for the UE but with some constraint, as the following

***Proposal: When UE receives a cancellation indication, UE cancels PUSCH not earlier than X symbols before the first symbol indicated by the CI.***

* Moderator comment: Split views, same situation and argument as last meeting.

**Discussion point: Please share your view on whether earlier cancellation relaxation for UL CI should be supported and what is the spec impact?**

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| --- | --- |
| Company | Comments |
| Sony | Proposal is fine but is X configurable or a UE capability? |
| Samsung | OK in principle but would be good to re-word proposal (and close the discussions) as something like “UE cancels PUSCH/SRS at least by the first symbol indicated by the CI” |
| CATT | From our point of view, the specification is clear enough and workable. No issue is identified if keep the current wording hence there is not any necessity to change it.  From technique point of view, although has been debated for a long time, the following aspects are provided:   1. Inter UE MUX and intra UE MUX is different. For intra UE MUX, a UE has to cancel a PUSCH and prepare for another. The complexity may be an issue. For Inter UE MUX, UE only need to cancel the transmitting PUSCH and doesn’t need to prepare another PUSCH. Furthermore, we have already defined the minimum offset between the CI and RUR to ensure the UE have sufficient time to decode the CI and handle the cancellation, UE can start cancelation at any position in RUR and it should not impact the UE complexity. 2. As mentioned by several companies, the uncertain cancellation timing is harmful to CBG transmission and the case wherein PUSCH has a long duration but only a small portion of it is cancelled. 3. It may also be harmful for the HARQ-ACK transmission which is piggybacked on the PUSCH. To be specific, the HARQ-ACK bit(s) can be mapped on the REs follows the DMRS symbol if timeline is satisfied. If uncertain cancellation timing is allowed, HARQ-ACK bit cannot be piggybacked on the PUSCH even if timeline is satisfied. 4. If the uncertain cancellation timing is allowed, the DTX detection on the scheduled symbols will be in vain once the UE does not transmit anything on them. |
| DOCOMO | Share the same view with CATT. We don’t think the earlier cancellation should be supported for UL CI. In case UE is indicated to cancel PUSCH transmission(s) by UL CI, the UE should continue to transmit the symbols before the first symbol indicated by UL CI in order to ensure better performance especially with CBG transmission. |
| HW/HiSI | We do not agree with the proposal.  The specification is already clear. In addition to that no specification effort is needed, agreeing to the proposal would not only overturn the existing specification but also significantly degrade the network performance in case of inter UE multiplexing. In inter UE multiplexing, one URLLC transmission may overlap with more than one eMBB transmission. The cancellation should take place as late as possible and at a distinct symbol. Otherwise, the performance will be degraded significantly.  Proponents of the previous proposal, to allow the UE to cancel earlier than what currently is specified, refer to the choice that has been made for the LP cancellation in intra-UE prioritization. It is claimed that a consistent UE behaviour for the two cases should be achieved. The compromise proposal above does not seem achieve a consistent behaviour.  In our view, the decision that RAN1 has made for intra-UE multiplexing to cancel freely before a deadline is maybe helpful but not critical to help the UE implementation of intra-UE prioritization. In our view, also in the case of intra-UE multiplexing it is absolutely fine for the UE to cancel the transmission at a defined symbol (which is not precluded according to the agreement we made for intra-UE multiplexing).  Thus, a consistent UE behaviour can be achieved already now without changing any specification. And if proponents really want to overturn existing specifications, we would prefer to change the intra-UE cancellation, because we think it would be better to specify consistent predictable behaviour than consistent random behaviour. |

## **2.2 Issue 7: UE processing order between UL CI and power scaling/PHR calculation in UL CA [8]**

[8] discussed the processing order between UL CI and power scaling in UL CA

* Possible processing order 1: Priority handling including power adjustment 🡪 DCI format 2\_4
* Possible processing order 2: Priority handling 🡪 DCI format 2\_4 🡪 Power adjustment

In our understanding, the section 7.1 in the TS 38.213 applies to the actual UL transmission, and the order 2 is preferred to the order 1 and will achieve the higher throughput. This argument can also apply to the dynamic power sharing in the DC scenario and to the UL CA scenario.

**Proposal 1:** The power scaling of a UL transmission is supported after some simultaneous UL transmissions are cancelled due to the DCI format 2\_4.

[8] further discussed the processing order between UL CI and PHR calculation

* Possible processing order 1: PHR calculation based on the actual transmission after applying cancellation
* Possible processing order 2: PHR calculation based on the reference transmission before applying cancellation

In our understanding, the section 7.7.1 in the TS 38.213 applies to the actual PUSCH transmission in the power headroom report after the UL priority/multiplex resolution, which will be carried in the initial PUSCH transmission.

**Proposal 2:** The power headroom report is based on UL transmissions after UL prioritization/multiplex processing if the timeline allows.

* Moderator comment: Would be good to achieve a common understanding on both issues.

**Discussion point 1: In case of UL CA, please share your view on UE processing order between UL power scaling and UL cancellation due to UL CI, and what is the required spec impact?**

* Option 1: UL power scaling is processed first not considering the UL cancellation, then UL cancellation due to UL CI is processed
* Option 2: UL cancellation due to UL CI is processed first then UL power scaling is processed based on the actual transmissions

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| Company | Comments |
| Sony | Option 2 is preferable but isn’t there a timeline consideration, i.e. is there sufficient time to calculate the PHR after reading the UL CI and transmitting the PHR? |
| Samsung | UL power scaling is a symbol-by-symbol operation. Option 2 is the consequence but there is no need for additional specifications. No difference than for SFI in Rel-15. |
| CATT | Option 2. Don’t see the spec impact. |
| DOCOMO | Option 2 without spec impact. |
| HW/HiSi | We slightly prefer Option 2, it seems to result in better throughput. But have no strong opinion which option to support, as long as we can clarify the rule. |

**Discussion point 2: Please share your view on UE processing order between PHR calculation and UL cancellation due to UL CI, and what is the required spec impact?**

* Option 1: PHR calculation is processed first not considering the UL cancellation, then UL cancellation due to UL CI is processed
* Option 2: UL cancellation due to UL CI is processed first then PHR calculation is processed based on the actual transmissions

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| Company | Comments |
| Sony | Prefer Option 2. Should we consider the processing time as per previous comment. |
| Samsung | Option 2 is what is currently supported in the specifications based on the cancelation timelines and PUSCH processing timelines. No difference than for SFI in Rel-15. |
| CATT | Option 2. Don’t see the spec impact. |
| DOCOMO | Option 2 without spec impact. |
| HW/HiSi | Option 2 without spec impact. |

## **2.3 Issue 8: Clarifying texts for ULCI applications to RACH [8]**

[8] discussed the following

According to the section 11.2A in the TS 38.213, the applicable UL signals/channels are PUSCH and SRS. However, more detailed explanation is missing. The related texts are copied below.

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| --- |
| TS 38.213-g20, section 11.2A  …  An indication by a DCI format 2\_4 for a serving cell is applicable to a PUSCH transmission or an SRS transmission on the serving cell. … |

In our view, the Msg 3/A PUSCH can be interpreted as a special case for ULCI applications. We note that the section 8.1A and the section 8.3 explains the procedure for Msg A PUSCH and for Msg 3 PUSCH, respectively, and tells nothing about the ULCI.

We suggest to limit the application of ULCI to PUSCH, in order to capture the previous agreements, by saying the applicable scrambling id. In our understanding, the PUSCH would be scrambled by C/MCSC/CS-RNTI if ULCI is applicable. Other way of formulation would be introduce exceptions by saying Msg 3/A explicitly.

**Proposal 3:** Clarify the scrambling initialization to capture applicable PUSCH transmissions to the ULCI.

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| --- |
| TS 38.213-g20, section 11.2A  …  An indication by a DCI format 2\_4 for a serving cell is applicable to a PUSCH transmission, scrambling initialization by a C-RNTI, a MCS-C-RNTI, or a CS-RNTI, or an SRS transmission on the serving cell. … |

* Moderator comment: Would be good to clarify.

**Discussion point 1: Do you think the issue should be explicitly addressed by specification and if so any comments to the proposed TP above?**

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| --- | --- |
| Company | Comments |
| Sony | Agree. TP is simple enough. |
| Samsung | Do not agree with the TP/proposal. Current specifications are clear.  No need to exclude Msg3 PUSCH – gNB can always avoid in practice if it so chooses, or schedule retransmission. |
| CATT | Agree, the TP align the spirit of previous agreement. |
| DOCOMO | Agree with the TP. |
| HW/HiSi | Agree with the TP |

## **2.4 Issue 9: Clarification of enhanced OL PC for PUSCH repetitions**

[11] discussed the following

For Rel-16 enhanced uplink power control (i.e., dynamic open-loop power control), a UE may be dynamically indicated the P0 values in DCI via the open-loop power control field. At the same time, the UE may also be configured or dynamically scheduled with PUSCHs with repetitions that occurs in multiple slots. When PUSCH are scheduled with repetitions (either repetition Type A or Type B) and is indicated by DCI to do power boosting (i.e., if the OLPC field in the scheduling DCI indicates 1 or 01 or 10), shall the UE perform power-boosting on all repetitions, or on a subset of repetitions? For simplicity, we propose that the power boosting is applied to all PUSCH repetitions scheduled by the DCI.

**Proposal 2: for Rel-16 PUSCH, clarify that the open-loop power control parameter indicated in DCI format 0\_1/0\_2 applies to all PUSCH repetitions scheduled by the DCI.**

* Moderator comment: Would be good to clarify. As all the corresponding PUSCHs (including repetitions) are scheduled by one UL grant, it would be natural to assume that the OLPC indication in the UL grant applies to all the PUSCHs including repetitions.

**Discussion point 1: Do you agree with the following as a conclusion without spec change?**

* In case of PUSCH repetitions, it is understood that the open-loop power control parameter set indication in the UL grant applies to all the PUSCH repetitions.

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| --- | --- |
| Company | Comments |
| Sony | Agree |
| Samsung | Agree – same as in Rel-15. |
| CATT | Agree |
| DOCOMO | Agree |
| HW/HiSi | Agree |

# Previous agreements

## **RAN1#96bis**

Working assumption:

* PDCCH is used for UL cancelation indication
  + The Working assumption can be revisited if the DCI for cancelation indication only carry very small number of information bits, e.g. 1 bit.

Agreements:

* Upon detecting an UL cancelation indication, at least stop without resuming is supported
  + FFS whether and how to support stop with resume

Agreements:

* Further discuss which UL transmissions that can potentially be cancelled by the UL cancelation indication, including
  + Dynamic scheduled UL transmissions, including PUSCH, PUCCH, SRS
  + Semi-persistent UL transmissions, including PUSCH, PUCCH, SRS
  + Periodic UL transmissions, including configured grant PUSCH, PUCCH, SRS
  + PRACH

Agreements:

* Further discuss, aiming for down-selection, the group common DCI and UE-specific DCI for UL cancelation indication
  + For group common DCI (different from Rel-15 SFI)
    - UE is configured to monitor a group common DCI which indicates the time/frequency region on which the UL cancellation indication applies
  + For UE specific-DCI
    - When applicable, UE is configured to monitor a second UL grant for the same TB as an earlier PUSCH indicating UL cancellation before the end of the earlier PUSCH transmission. In this case, the UE follows the UL cancellation indication.

**Conclusion**:

* Further discuss the following power control enhancements
  + Increased TPC range
    - FFS details, e.g. supported value range, number of TPC bits, accumulated and/or absolute TPC, configurability of the TPC tables, applicability to SRS/PUCCH.
  + Indication of open-loop parameter sets based on scheduling DCI without using SRI
  + Indication of open-loop parameter sets based on GC-PDCCH

## **RAN1#97**

Agreements:

* Support at least group common DCI for cancelation indication
  + FFS whether or not to additionally support UE-specific DCI for cancelation indication

**Conclusion:**

To down-select from the following options for enhanced power control

* Option 1: Indication of open-loop parameter sets by DCI
* For DG-PUSCH, an open-loop parameter set indicated to the UE by scheduling DCI without using SRI is applied to the scheduled transmission
* FFS At least for single active CG-PUSCH, an open-loop parameter set is indicated to the UE by a UE-specific field in group common DCI
  + - FFS for the case of multiple active CG-PUSCH
* FFS For a UE, the open-loop parameter sets for DG-PUSCH and CG-PUSCH may be same or different
* Option 2: Indication of TPC with increased range by DCI
* For DG-PUSCH, a TPC with increased range is indicated to the UE by the TPC field in scheduling DCI
* FFS At least for single active CG-PUSCH (and potentially also for DG-PUSCH), a TPC with increased range is indicated to the UE by a UE-specific TPC field in group common DCI
  + - FFS for the case of multiple active CG-PUSCH
* At least for DG-PUSCH, for a UE, the number of TPC entries (4 or 8) and power adjustment value for each entry is higher layer configured
* FFS For a UE, the TPC configuration for DG-PUSCH and CG-PUSCH may be same or different
* Option 3:
* For DG-PUSCH, use either the solution from option 1 or option 2 for DG-PUSCH as above
  + - To down-select from option 1 and 2
* FFS At least for single active CG-PUSCH, UE derives the transmissions power based on the time/frequency resource indicated by a group common DCI
  + - If a CG-PUSCH transmission overlaps with the indicated time/frequency resource, UE use one open-loop parameter set with higher power for the transmission
    - If a CG-PUSCH transmission does NOT overlap with the indicated time/frequency resource, UE use another open-loop parameter set with lower power for the transmission
    - FFS for the case of multiple active CG-PUSCH
    - Note: some companies have concern that this was not captured in the TR as one potential solutions

## **RAN1#98**

Agreements:

* Reuse the existing methods for search space configuration to support UL CI monitoring
  + FFS possible restrictions
  + Note: this means both symbol level and slot level monitoring periodicities are possible from specification perspective

Agreements:

* The UE DCI size budget is not increased by UL CI monitoring
* Further discuss methods to reduce the UE monitoring for UL CI, e.g.
  + The number of aggregation levels and/or candidates for the UL CI monitoring should be limited
  + Conditions for eMBB UE UL CI monitoring:
    - For UL transmission with associated PDCCH,
      * Option 1: UE starts UL CI monitoring after the PDCCH is decoded
      * Option 2: UE monitors UL CI at least at the latest monitoring occasion ending no later than X symbols before the start of the UL transmission, and X is related to UL CI processing time.
    - For UL transmission without associated PDCCH, UE monitors UL CI at least at the latest monitoring occasion that ends no later than X symbols before the start of the UL transmission, and X is related to UL CI processing time.
    - Other conditions?
  + Others?
* FFS the enhancement of UE capability (number of non-overlapping CCE and/or blind decodes) for UL CI monitoring

Agreements:

* Upon detecting an UL cancelation indication, for the transmission of UL signal/channels, “stop with resuming” is not supported
  + Except:
    - SRS can still be transmitted on the non-cancelled symbols (conditioned on if SRS can be pre-empted)
    - FFS for the PUSCH repetition (Rel-15 & Rel-16) case
    - FFS for the PUCCH repetition case (conditioned on if PUCCH can be pre-empted)
  + FFS whether another PUSCH can be scheduled in non-pre-empted resource
  + FFS impact (e.g. phase continuity issue) to a different carrier due to UL cancelation

[**R1-1909774**](file:///E:\3GPP%20meetings\WG1_RL1\2019\RAN1%2398bis\R1-1909774.zip)

Agreements:

* The following UL channel/signals can be cancelled by UL cancelation indication
  + PUSCH (including DG-, CG- and SP-)
  + FFS for SRS
  + FFS for PUCCH
    - Option 1: PUCCH (all types) can be cancelled
    - Option 2: Some PUCCH can be cancelled, e.g. PUCCH carrying CSI
    - Option 3: PUCCH cannot be cancelled
  + FFS for PRACH (preamble and/or MSG 3 PUSCH)

Agreements:

* The UE processing time requirement for UL cancelation indication based on N2 defined in Rel-15 UE cap#2 is supported
  + FFS whether the processing time requirement for UL cancelation indication larger than N2 as defined in Rel-15 UE cap#2 can also be supported as an UE capability
  + FFS whether the processing time requirement for UL cancelation indication shorter than N2 as defined in Rel-15 UE cap#2 as can also be supported an UE capability

Agreements:

* For a DG-PUSCH, an open-loop parameter set indicated to the UE by scheduling DCI using a separate field than SRI is supported.
  + FFS number of bits for the indication

## **RAN1#98bis**

Agreements:

* Regarding UL CI monitoring, support the following:
  + A new RNTI (e.g. CI-RNTI) is used for UL CI
  + FFS: Monitoring periodicity larger than [5] slot is not supported for UL CI
  + The aggregation level(s) and the number of PDCCH candidates configured by RRC
    - FFS possible restrictions, e.g., the ones associated with SFI
  + The DCI payload size for UL CI is configured by RRC
    - FFS possible values

Agreements:

* SRS can be cancelled by UL CI
* PUCCH cannot be cancelled by UL CI
* RACH related UL transmissions cannot be cancelled by UL CI, including MSG 1/3 in case of 4-step RACH, MSG A in case of 2-step RACH.

Agreements:

* Cross-carrier UL cancelation indication is supported using the same way as Rel-15 SFI/DL PI
  + The indication field position in DCI for each cross-carrier indicated serving cell is configured by RRC

Agreements:

* Different UE processing time capability for UL CI (i.e. shorter or longer than T\_proc2 for cap#2 UE) is not considered in Rel-16
  + d2,1=0 also when DMRS and UL-SCH (for the PUSCH to be cancelled) are multiplexed in the 1st symbol

Agreements:

* In case of PUSCH repetitions, UL CI is applied to each repetition individually (actual repetition in case of Rel-16 PUSCH repetition) that overlaps with the resource (in time and frequency) indicated by UL CI.

Agreements:

* + The reference time region where a detected UL CI is applicable is determined by the following:
    - * The reference time region starts from X symbols after the ending symbol of the PDCCH CORESET carrying the UL CI, where X is at least equal to the minimum processing time for UL cancelation
        + FFS X can be configured to be larger than the minimum processing time for UL cancelation
      * The duration of the reference time region is configured by RRC
        + FFS Possible values (e.g. 2OS, 4OS, 7OS, 14OS, 28OS?)
      * FFS DL symbols are excluded from the reference time region

Agreements:

* + - The reference frequency region where a detected UL CI is applicable is configured by RRC

Agreements:

Support the following for UL CI

* + Each UL cancelation indicator per serving cell has a RRC configurable field size of X bits
    - * One value of X is 14
      * FFS other values (e.g. X can be N (N>0) times of 7)
  + The time domain granularity for the reference time region is configured by RRC
    - * FFS the possible values (e.g. the time region can be divided into [1],[2],[4],[7],[14],…portions)
      * FFS valid configurations according to the duration of the time reference region
  + The frequency domain granularity is determined based on the configured time domain granularity and the configured bit field size of each indicator
  + The time and frequency resource for cancellation is jointly indicated by a 2D-bitmap (i.e. similar as DL PI) over the time and frequency partitions within the reference region
    - * FFS dynamic 2D-bitmap

Agreements:

* For DG-PUSCH, one bit (separately from SRI) in UL grant is used to indicate the open loop power control parameter set
  + Introduce one new RRC parameter that contains one additional P0-PUSCH-Set per SRI
  + The one bit indication is present in the UL grant when the above new RRC parameter is configured
  + If present, the one bit in the DCI is used to switch between the P0 value from the existing P0-PUSCH-AlphaSet and the P0 value from the newly configured P0-PUSCH-Set

**Conclusion**:

No enhancement for CG-PUSCH power control in Rel-16 for inter-UE multiplexing

## **RAN1#99**

Agreements:

* There is no enhancement to PDCCH monitoring capability (number of BD and non-overlapping CCEs) specifically for UL CI monitoring purpose

Agreements:

* The maximum monitoring periodicity for UL CI is [5] slots

Agreements:

* Up to X BDs can be configured for UL CI
  + FFS per UL CI monitoring occasion or per span
  + The value of X is to be concluded during this week
  + Note: UE is not expected to be configured with search space configuration for UL CI with AL and number of candidates exceeding X BDs

Agreements:

* The maximum size for *dci-PayloadSize-forCI* is 126

Agreements:

* Possible values for RRC parameter *timedurationforCI* can be:
  + If the configured UL CI monitoring periodicity is >1 slot or 1-slot with only one monitoring occasion
    - At least the same as the configured UL CI monitoring periodicity
      * FFS whether or not to additionally support multiple of UL CI monitoring periodicity
  + Otherwise (i.e., >1 monitoring occasion within 1 slot when 1-slot is the configured UL CI monitoring periodicity)
    - {2, 4, 7, [14]} OS, which SCS is used when determine the time duration
      * SCS for the DL BWP carrying UL CI
    - FFS The UE is not expected to be configured with a time duration for CI less than the time different (in symbols) between any adjacent monitoring occasions in a slot

Agreements**:**

* + Possible values (16 values) for RRC parameter *CI-PayloadSize are* 
    - *{[1],2,4,[5],7,8,[10],14,16,[20],[25],28,32,[35],56,112}*
  + *timeGranularityforCI* is defined as number of partitions within the time region, and possible values are
    - *{1,2,4,7,14,28}*
  + The configured value of *CI-PayloadSize* shall be a multiple integer of the configured value of *timeGranularityforCI*

Agreements:

* + The frequency region for UL CI is derived by the following
    - A RIV indication configured by RRC within value range of (0..37949) (i.e. the same way as IE “locationAndBandwidth” for BWP configuration ), the configuration is per serving cell specific
      * The reference point is derived based on the RRC parameter *offsetToCarrier* (existing parameter, same way as BWP configuration)
    - A reference SCS (no RRC configuration) for a serving cell (to handle the case where a UE is configured with multiple BWPs using different SCSs on the serving cell),
      * Use the SCS for the DL BWP carrying UL CI as the reference SCS

Agreements:

* Support per serving cell configuration for the following parameters
* *CI-PayloadSize*
* *timedurationforCI*
* *timeGranularityforCI*
* *frequencyRegionforCI*

Agreements:

* If a serving cell is configured with SUL, each UL carrier (SUL and non-SUL) can be configured with different *positionInDCI.*

Agreements:

* The DL symbols indicated by *tdd-UL-DL-ConfigurationCommon* are excluded from the reference time region for UL CI
  + The partition of reference time region is done after excluding the DL symbols
  + The symbols used for SSB are also excluded

Agreements:

* Clarification of 2D-bitmap
  + 2D-bitmap is to use *X* bits for bitmap indication over a time/frequency region with M partitions in time and N partitions in frequency, and X=M x N

Agreements:

Regarding “FFS whether or not to additionally support multiple of UL CI monitoring periodicity”

* If the configured UL CI monitoring periodicity is >1 slot or 1-slot with only one monitoring occasion, no additionally support that the time duration to be multiple of UL CI monitoring periodicity

Agreement

To determine the P0 value in case SRI is not configured in the DCI

* Option 1A: The open-loop power control parameter set indication field in the DCI can be configurable to be 1 or 2bits
  + *P0-PUSCH-Set can* provide up to two P0 value*s*
    - UE uses the P0 values according to open loop power control indication field in DCI
    - UE use P0 from *P0-PUSCH-AlphaSet* when
      * open-loop power control parameter set indication field is 1bit and “0” is indicated, or
      * open-loop power control parameter set indication field is 2bits and “00” is indicated
  + Open-loop power control parameter set indication field can be separately configurable for DCI format 0\_1 and DCI format 0\_2
    - If open-loop power control parameter set indication field is not present for a DCI format, use P0 from *P0-PUSCH-AlphaSet*
  + A single configuration of P0-PUSCH-Set applies to both DCI format 0\_1 and DCI format 0\_2

## **RAN1#100-e**

Agreements:

* Confirm that 14OS can be configured for timedurationforCI (when 1-slot is the configured UL CI monitoring periodicity with more than one monitoring occasions within 1 slot)
* The possible values for *CI-PayloadSize*, are {1,2,4,5,7,8,10,14,16,20, 28,32,35,42,56,112}

The following TP is endorsed

------------------------------------ Start of TP for 38.213 --------------------------------------------

**11.2A Cancellation indication**

< Unchanged parts are omitted >

For a group of symbols, ** bits from each set of bits have a one-to-one mapping with  groups of PRBs where each of the first ** groups includes ** PRBs and each of the remaining ** groups includes ** PRBs. A UE determines a first PRB index as  and a number of contiguous RBs as  from frequencyRegionforCI that indicates an offset  and a length  as RIV according to [6, TS 38.214], and from offsetToCarrier in FrequencyInfoUL-SIB that indicates  for a SCS configuration of an active DL BWP where the UE monitors PDCCH for DCI format 2\_4 detection.

< Unchanged parts are omitted >

------------------------------------ End of TP for 38.213 --------------------------------------------

Agreements:

* The maximum UL CI monitoring periodicity is 10 slots.
* Up to X BDs can be configured per UL CI monitoring occasion, X to be decided between X=1 or X=2 in RAN1#100bis.

No RAN1 spec impact - RRC parameter update only.

Agreements:

* UE derives the RUR start based on “logical time” (i.e. assuming DL timing difference is 0 and TA=0) and the actual cancellation symbol based on “actual time” (i.e. assuming actual DL timing difference, actual TA)
* A new RRC parameter delta\_offset d having possible values {0, 1, 2} OFDM symbols is introduced, update the spec as the following

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| --- |
| For the serving cell, the UE determines the first symbol of the symbols to be the first symbol that is after + d from the end of a PDCCH reception where the UE detects the DCI format 2\_4.corresponds to the PUSCH processing capability 2 [6, TS 38.214] assuming  with being the smallest SCS configuration between the SCS configurations of the PDCCH and of a PUSCH transmission or of an SRS transmission on the serving cell. |

* Clarify the following by a RAN1 spec update (see below)
  + UE is not expected to cancel the transmission of SRS or PUSCH before the first symbol that is T\_proc,2 after the end of the reception of the last symbol of the PDCCH carrying the ULCI including the effect of the timing advance.

38.213 Text proposal (maybe further refined by spec editor)

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| An indication by a DCI format 2\_4 for a serving cell is applicable to PUSCH or SRS transmissions on the serving cell. For the serving cell, the UE determines the first symbol of the symbols to be the first symbol that is after from the end of a PDCCH reception where the UE detects the DCI format 2\_4, where *d* is provided by higher layer parameter [xxxx]. corresponds to the PUSCH processing capability 2 [6, TS 38.214] assuming with being the smallest SCS configuration between the SCS configurations of the PDCCH and of a PUSCH transmission or of an SRS transmission on the serving cell. UE is not expected to cancel the transmission of SRS or PUSCH before the first symbol that is after the end of the reception of the last symbol of the PDCCH carrying the ULCI including the effect of the timing advance. |

Agreements:

* UE performs the UL cancellation based on any detected UL CI, no additional specification for the case of overlapping reference time region for multiple UL CI occasions.
* A cancelled PUSCH transmission by a UE is counted towards the number of PUSCH that a UE can support per slot

Conclusion:

* It is possible for a UE to indicate both  *pa-PhaseDiscontinuityImpacts*  (i.e. 6-23) and the support of UL CI for intra-band UL CA
* For a UE indicates a capability to cancel overlapping PUSCHs on different intra-band serving cells (if any), and the capability of *pa-PhaseDiscontinuityImpacts*, and if the PUSCH on at least one serving cell is cancelled, the UE cancels the (repetition of the) PUSCHs transmission on all other intra-band serving cell(s). The cancellation of the (repetition of the) PUSCH transmission on a the set of intra-band serving cell(s) includes all symbols from the earliest symbol that is overlapping with the first cancelled symbol of the PUSCH on the serving cell for which the DCI format 2\_4 is applicable to.

## **RAN1#100bis-e**

Agreements:

  UE behavior of handling intra-UE prioritization/multiplexing for overlapping UL transmissions is not affected by UL CI.

Agreeement:

* If both UL CI and intra-UE priority indicator are configured for a given UE, support a new RRC parameter to configure Behavior #1
  + Behaviour #1: UL CI is only applicable to the UL transmissions indicated/configured as low priority level
* When the RRC parameter is not provided to the UE, behaviour #2 is used
  + Behaviour #2: UL CI is applicable to UL transmission irrespective of its priority level
* Note: the RRC signaling details will be decided by RAN2

Agreement:

* Up to X BDs can be configured per UL CI monitoring occasion
  + For ULCI monitoring occasion determination, search space sets start at a same OFDM symbol correspond to a same monitoring occasion
  + X=1

Agreement:

* UE uses the smallest SCS configuration between the SCS configurations of the PDCCH for DCI format 2\_4 detection and the SCS configurations in *scs-SpecificCarrierList*of UL carrier to determine the RUR starting symbol.
* UE uses the smallest SCS configurations in *scs-SpecificCarrierList*of UL carrier to determine offset d.
* Adopt the TP below for 38.213 section 11.2A

TP for 38.213 section 11.2A

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| --- |
| **11.2A  Cancellation indication**  ---------------------------Other   parts are omitted -------------------------------  An indication by a DCI format 2\_4 for a serving cell is applicable to a PUSCH transmission or a SRS transmission on the serving cell. For the serving cell, the UE determines the first symbol of the cid:image001.png@01D61F9F.E92893A0 symbols to be the first symbol that is after cid:image002.png@01D61F9F.E92893A0 from the end of a PDCCH reception where the UE detects the DCI format 2\_4, where cid:image003.png@01D61F9F.E92893A0 is provided by XXX with the smallest SCS configuration~~between the SCS configurations of the PDCCH and the SCS configurations~~ provided in scs-SpecificCarrierList of UL carrier. cid:image004.png@01D61F9F.E92893A0 corresponds to the PUSCH processing capability 2 [6, TS 38.214] assuming cid:image005.png@01D61F9F.E92893A0 with cid:image006.png@01D61F9F.E92893A0 being the smallest SCS configuration between the SCS configurations of the PDCCH and the SCS configurations provided in scs-SpecificCarrierList of UL carrier~~of a PUSCH transmission or of an SRS transmission on the serving cell~~. The UE does not expect to cancel the PUSCH transmission or the SRS transmission before a corresponding symbol that is cid:image004.png@01D61F9F.E92893A0 after a last symbol of a CORESET where the UE detects the DCI format 2\_4.  <---------------------------Other   parts are omitted -------------------------------> |

Agreements:

To adopt the following TP for 38.213

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| --- |
| **11.2A     Cancellation indication** =====omitted text ======  For a serving cell having an associated field in DCI format 2\_4, for the field denote by  -    *N*CI a number of bits provided by CI-PayloadSize  -    *B*CI a number of PRBs provided by frequencyRegionforCI in timeFrequencyRegion  -    *T*CI a number of symbols, excluding symbols for reception of SS/PBCH blocks and DL symbols indicated bytdd-UL-DL-ConfigurationCommon, from the time duration provided by timeDurationforCI in timeFrequencyRegion if the configured UL CI monitoring periodicity is 1 slot with more than one monitoring occasions. Otherwise, the time duration is equal to the PDCCH monitoring periodicity provided by the value of monitoringSlotPeriodicityAndOffset, as described in Clause 10.1.  -      *G*CI a number of partitions for the *T*CI symbols provided by timeGranularityforCI in timeFrequencyRegion  =====omitted text ====== |

**Agreement: Adopt the following text proposal for TS38.213 section 11.2A**

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| ----------------------------- **Text proposal starts for TS 38.213, v16.1.0, Section 11.2A** -----------  A UE that detects a DCI format 2\_4 for a serving cell cancels a PUSCH transmission, or a repetition of a PUSCH transmission [6, TS 38.214] if the PUSCH transmission is with repetitions, or an SRS transmission on the serving cell if, respectively,  -     a group of symbols, from the symbols, has ~~a corresponding~~ at least one bit value of '1' in the corresponding set of *N*BI bits in the DCI format 2\_4 and includes a symbol of the (repetition of the) PUSCH transmission or of the SRS transmission, and  -     a group of PRBs, from the PRBs, has a corresponding bit value of '1' in the set of bits corresponding to the group of symbols in the DCI format 2\_4 and includes a PRB of the (repetition of the) PUSCH transmission or of the SRS transmission,  where  -     the cancellation of the (repetition of the) PUSCH transmission includes all symbols from the earliest symbol of the (repetition of the) PUSCH transmission that ~~are~~ is in ~~one~~ ~~or more~~ a group~~s~~ of symbols having corresponding bit values of '1' in the DCI format 2\_4;  -     the cancellation of the SRS transmission includes only symbols that are in one or more groups of symbols having corresponding bit values of '1' in the DCI format 2\_4.  ----------------------------- **Text proposal ends for TS 38.213, v16.1.0, Section 11.2A** ------------- |

**Agreement**

•          When UE is configured with both DCI format 0\_1 and 0\_2 with SRI presents in only one of the DCI formats, then for the DCI format without SRI field

  For 1 bit OLPC parameter indication, if OLPC parameter set indication in DCI is set to ‘1’

  P0-PUSCH-Set having the lowest p0-PUSCH-SetId is used.

  For 2 bit OLPC parameter indication, if OLPC parameter set indication in DCI is set to ‘01’ or ‘10’

  P0-PUSCH-Set having the lowest p0-PUSCH-SetId is used.

**Agreement: Adopt the following text proposal for TS38.213 section 7.1.1**

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| TP for 38.213 16.1.0 Section 7.1.1  **<**Unchanged text is omitted>  -     If the PUSCH transmission is scheduled by a DCI format that does not include a SRI field, or if *SRI-PUSCHPowerControl* is not provided to the UE, cid:image003.png@01D61B4C.5453A280,  -     If *P0-PUSCH-Set* is provided to the UE and the DCI format includes an open-loop power control parameter set indication field, the UE determines a value of cid:image004.png@01D61B4C.5453A280 from  -     a first *P0-PUSCH-AlphaSet* in *p0-AlphaSets* if a value of the open-loop power control parameter set indication field is '0' or '00'  -     a first value in *P0-PUSCH-Set* with the lowest *p0-PUSCH-SetId* value if a value of the open-loop power control parameter set indication field is '1' or '01'  -     a second value in *P0-PUSCH-Set* with the lowest *p0-PUSCH-SetId* value if a value of the open-loop power control parameter set indication field is '10'  -     else, the UE determines cid:image005.png@01D61B4C.5453A280 from the value of the first *P0-PUSCH-AlphaSet* in *p0-AlphaSets*  **<**Unchanged text is omitted> |

Agreement: Adopt the following text proposal for 38.213 section 11.2A

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| --- |
| 11.2A Cancellation indication If a UE is provided *UplinkCancellation*, the UE is provided a CI-RNTI by *ci-RNTI* for monitoring PDCCH candidates for a DCI format 2\_4 [5, TS 38.212]. *UplinkCancellation* additionally provides to the UE  -     a set of serving cells, by *ci-ConfigurationPerServingCell*,that includes a set of serving cell indexes and a corresponding set of locations for fields in DCI format 2\_4 by *positionInDCI*  -     a number of fields in DCI format 2\_4, by *positionInDCI-forSUL*, for each serving cell for a SUL carrier ~~for a SUL carrier~~, if the serving cell is configured with a SUL carrier  ~~for SUL of a serving cell if the serving cell configured with SUL~~  -     an information payload size for DCI format 2\_4 by *dci-PayloadSize-forCI*  -     an indication for time-frequency resources by *timeFrequencyRegion*  For a serving cell having an associated field in DCI format 2\_4, for the field denote by  -     a number of bits provided by *CI-PayloadSize*  -     a number of PRBs provided by *frequencyRegionforCI* in *timeFrequencyRegion*  -     a number of symbols, excluding symbols for reception of SS/PBCH blocks and DL symbols indicated by *tdd-UL-DL-ConfigurationCommon*,provided by *timeDurationforCI* in *timeFrequencyRegion*  -     a number of partitions for the symbols provided by *timeGranularityforCI* in *timeFrequencyRegion*  sets of bits from the MSB of the bits have a one-to-one mapping with groups of symbols where each of the first groups includes symbols and each of the remaining groups includes symbols. A UE determines a symbol duration with respect to a SCS configuration of an active DL BWP where the UE monitors PDCCH for DCI format 2\_4 detection.  For a group of symbols, bits from MSB of each set of bits have a one-to-one mapping with groups of PRBs where each of the first groups includes PRBs and each of the remaining groups includes PRBs. A UE determines a first PRB index as and a number of contiguous RBs as from *frequencyRegionforCI* that indicates an offset and a length as RIV according to [6, TS 38.214], and from *offsetToCarrier* in FrequencyInfoUL-SIB that indicates for a SCS configuration of an active DL BWP where the UE monitors PDCCH for DCI format 2\_4 detection.  An indication by a DCI format 2\_4 for a serving cell is applicable to a PUSCH transmission or a SRS transmission on the serving cell. For the serving cell, the UE determines the first symbol of the symbols to be the first symbol that is after from the end of a PDCCH reception where the UE detects the DCI format 2\_4, where is provided by *~~XXX~~* higher layer parameter *delta\_offset\_d*. corresponds to the PUSCH processing capability 2 [6, TS 38.214] assuming with being the smallest SCS configuration between the SCS configurations of the PDCCH and of a PUSCH transmission or of an SRS transmission on the serving cell. The UE does not expect to cancel the PUSCH transmission or the SRS transmission before a corresponding symbol that is after a last symbol of a CORESET where the UE detects the DCI format 2\_4.  A UE that detects a DCI format 2\_4 for a serving cell cancels a PUSCH transmission, or a repetition of a PUSCH transmission [6, TS 38.214] if the PUSCH transmission is with repetitions, or an SRS transmission on the serving cell if, respectively,  -     a group of symbols, from the symbols, has a corresponding bit value of ‘1’ in the DCI format 2\_4 and includes a symbol of the (repetition of the) PUSCH transmission or of the SRS transmission, and  -     a group of PRBs, from the PRBs, has a corresponding bit value of ‘1’ in the DCI format 2\_4 and includes a PRB of the (repetition of the) PUSCH transmission or of the SRS transmission,  where  -     the cancellation of the (repetition of the) PUSCH transmission includes all symbols from the earliest symbol of the (repetition of the) PUSCH transmission that are in one or more groups of symbols having corresponding bit values of ‘1’ in the DCI format 2\_4;  -     the cancellation of the SRS transmission includes only symbols that are in one or more groups of symbols having corresponding bit values of ‘1’ in the DCI format 2\_4. |

Agreement: Adopt the following text proposal for 38.212 section 7.3.1.3.5

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| 7.3.1.3.5                       Format 2\_4 DCI format 2\_4 is used for notifying the PRB(s) and OFDM symbol(s) where UE cancels the corresponding UL transmission from the UE according to Clause 11.2A~~5~~ of [5, TS 38.213].  The following information is transmitted by means of the DCI format 2\_4 with CRC scrambled by CI-RNTI:  -     Cancellation indication 1, Cancellation indication 2, …, Cancellation indication indication *N*.  The size of DCI format 2\_4 is configurable by higher layers parameter *dci-PayloadSize-forCI* up to 126 bits, according to Clause 11.2A~~5~~ of [5, TS 38.213]. The number of bits for each cancellation indication is configurable by higher layer parameter *CI-PayloadSize*. For a UE, there is at most one cancellation indication for an UL carrier.  <Unchanged text is omitted> |

## **RAN1#1001-e**

**Agreement**

(Alt 1) A DCI format 2\_4 is only applicable to an uplink grant scheduling PUSCH/SRS if the ending symbol of the PDCCH carrying the UL grant is earlier than the first symbol of the PDCCH carrying DCI format 2\_4.

**Agreement**

(Alt1) If the UE does not cancel a transmission in resources indicated by DCI format 2\_4, the UE can receive an UL grant scheduling a transmission on the resource indicated by the DCI format 2\_4, if the ending symbol the PDCCH carrying UL grant is no earlier than the first symbol of the PDCCH carrying DCI format 2\_4.

* The above applies regardless whether RRC parameter applicabilityforCI is configured or not.

**Agreement**

(Alt 1) If UE has to cancel a DG-PUSCH1 based on the detected UL CI, another DG-PUSCH2 can NOT be scheduled on cancelled symbols of DG-PUSCH1

* The cancelled symbols of DG-PUSCH1 include the symbols within and outside the resource indicated by the UL CI
* The above applies regardless whether RRC parameter applicabilityforCI is configured or not.

**Agreement**

(Alt 1) For a UE configured with behaviour#2 (i.e. RRC parameter applicabilityforCI not provided), if a PUCCH/SRS is cancelled by another PUSCH of higher priority, the prioritized PUSCH can be cancelled by UL CI

* No spec impact

**Agreement**

The text proposal in Section 2 of R1-2004734 is endorsed for the editor’s CR on TS38.213.

**Agreement**

(Alt 1) If UE has to cancel a PUSCH transmission or an SRS transmission based on the detected UL CI, another DG-PUSCH2 **CAN** be scheduled on the resource indicated by the UL CI but not overlapping with cancelled symbols, if the ending symbol of the PDCCH carrying the 2nd UL grant is **no earlier** than the  first symbol of the PDCCH carrying the UL CI.

* The above applies regardless whether RRC parameter *applicabilityforCI* is configured or not
* No additional spec impact expected.

**Agreement**

After the UE determines the overlapping PUCCH or PUSCH for multiplexing/prioritization, the UE cancels the PUCCH or PUSCH that has overlapping with semi-static configured DL symbols or SSB symbols, and then the multiplexing/prioritization is performed among the non-cancelled overlapping transmissions

**Conclusion**

The 1st editor’s note in section 11.2A of endorsed 38.213CR (R1-2003176) is removed.

**Conclusion**

There is no consensus to support UL CI in the scenarios where processing capability#2 is not defined

**Agreement**

The text proposal in Section 2 of R1-2004735 is endorsed for the editor’s CR on TS38.213.

**Agreement**

The text proposals in Section 2 of R1-2004736 are endorsed for the editor’s CR on TS38.213.

## **TR 38.824**

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| --- |
| 7.2 Potential enhancements In the following sub-sections, potential enhancements for UL inter UE Tx prioritization/multiplexing are presented. It is recommended to specify both UL cancelation scheme and enhanced UL power control scheme in the work item phase. 7.2.1 UE UL cancelation mechanisms UE UL cancelation mechanisms are considered as one potential enhancement for UL inter-UE Tx prioritization/multiplexing and are studied from several aspects, including the potential mechanisms (e.g. UE UL cancelation/pausing indication, UL continuation indication, UL re-scheduling indication), physical channel/signal used for the UL cancelation indication, UE processing timeline for the UL cancelation indication, UE monitoring behaviours for the UL cancelation indication, UE PDCCH monitoring capability if the UL cancelation indication is by PDCCH, methods to ensure the reliability of the indication for UE UL cancelation.  Either PDCCH or sequence can be considered as potential options for the UL cancelation indication. If PDCCH is used, either group common DCI or UE-specific DCI can be considered as potential options. If sequence is used, either group common sequence or UE-specific sequence can be considered.  The monitoring periodicity for the UL cancelation indication should be configurable by the gNB and UE supporting UL cancelation indication should be able to support more than one monitoring occasions for the UL cancelation indication in a slot. If PDCCH is used, whether the UE PDCCH monitoring capability (number of CCEs/BDs per slot) should be increased is to be further investigated.  The UE processing time for UL cancelation indication should be equal or shorter than N2 defined in Rel-15 UE capability#2.  Upon detecting an UL cancelation indication, UE cancels the corresponding UL transmission. The corresponding UL transmission may include an on-going UL transmission, or an UL transmission that has not been started. After cancelation, the UE may resume the transmission afterwards as one option, or may not resume the transmission afterwards as another option. 7.2.2 Enhanced UL power control Enhanced UL power control is considered as one potential enhancement for UL inter-UE Tx prioritization/multiplexing and the study mainly focuses on enhanced dynamic power boost for URLLC UE, including dynamic change of power control parameters (e.g. P0 and alpha without SRI configured) and enhanced TPC (e.g. increased TPC range and finer granularity). The need of URLLC UE power change during one transmission instance is not envisioned. It is assumed that there is no change of eMBB UE power control scheme in this study item.  Enhanced dynamic power boost for URLLC UE are studied from several aspects, including feasibility of boosting UE power in power limited or interference limited scenarios, physical channel/signal used for the signalling, UE processing timeline for the signalling, UE monitoring behaviours for the signalling, UE PDCCH monitoring capability if the signalling is by PDCCH and methods to ensure the reliability of the signalling.  It is concluded that the potential enhanced UL power control may include UE determining the power control parameter set (e.g. P0, alpha) based on scheduling DCI indication without using SRI, or based on group-common DCI indication. Increased TPC range compared to Rel-15 may also be considered. Power boosting is not applicable to power limited UEs. |

# List of contributions and proposals

|  |  |  |
| --- | --- | --- |
| [**R1-2005351**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005351.zip) | UL inter UE Tx prioritization for URLLC | vivo |
| [**R1-2005417**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005417.zip) | Remaining issues on UL inter-UE multiplexing between eMBB and URLLC | ZTE |
| [**R1-2005510**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005510.zip) | Remaining Issue of Inter-UE Prioritization and Multiplexing of  UL Transmissions | Ericsson |
| [**R1-2005676**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005676.zip) | Remaining issues on inter-UE UL multiplexing | CATT |
| [**R1-2005791**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005791.zip) | Corrections on UL inter-UE multiplexing | Huawei, HiSilicon |
| [**R1-2006055**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006055.zip) | Inter UE Tx prioritization and multiplexing | OPPO |
| [**R1-2006113**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006113.zip) | Maintenance on inter-UE multiplexing | Samsung |
| [**R1-2006355**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006355.zip) | Enhanced inter UE Tx prioritization/multiplexing | ETRI |
| [**R1-2006492**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006492.zip) | Remaining Issues on Inter-UE Cancellation for eURLLC | Apple |
| [**R1-2006660**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006660.zip) | Inter-UE prioritization/multiplexing | InterDigital, Inc. |
| [**R1-2006778**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006778.zip) | Remaining issues on uplink Inter-UE Tx Multiplexing and Prioritization | Qualcomm Incorporated |