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

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

Source: moderator (vivo)

Title: Feature lead summary on NRU configured grant enhancement

Agenda Item: 7.2.2.2.4

Document for: Discussion and Decision

1. Introduction

In this contribution, contributions submitted in AI 7.2.2.2.4 are summarized. In section 2, the remaining issues raised in the contributions are listed.

1. Remaining issues
   1. Issue 1: On RV ID

Option1:

-------------- TP for 38.214 6.1.2.3.1----------------------------------------------------------------------------------

<unchanged part omitted>

The procedures described in this clause apply to PUSCH transmissions of PUSCH repetition Type A with a Type 1 or Type 2 configured grant.

The higher layer parameter *repK-RV* defines the redundancy version pattern to be applied to the repetitions. If *cg-RetransmissionTimer* is provided, the redundancy version for uplink transmission with a configured grant is determined by the UE~~[, except for the redundancy version of the first repetition that is set to 0]~~ . If the parameter *repK-RV* is not provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, the redundancy version for uplink transmissions with a configured grant shall be set to 0. If the parameter *repK-RV* is provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, for the *n*th transmission occasion among *K* repetitions, *n*=1, 2, …, *K*, it is associated with *(mod(n-1,4)+1)th* value in the configured RV sequence. If a configured grant configuration is configured with *Configuredgrantconfig-StartingfromRV0* set to *‘off’*, the initial transmission of a transport block may only start at the first transmission occasion of the *K* repetitions.

<unchanged part omitted>

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Option2:

-----------------------------------TP2: Start of TP 38.214 section 6.1.2.3.1------------------------------------

6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grant

The procedures described in this clause apply to PUSCH transmissions of PUSCH repetition Type A with a Type 1 or Type 2 configured grant.

The higher layer parameter *repK-RV* defines the redundancy version pattern to be applied to the repetitions. If *cg-RetransmissionTimer* is provided, and if repK=1, the redundancy version for uplink retransmission with a configured grant is determined by the UE.~~, [except for the redundancy version of the first repetition that is set to 0]~~ If repK>1, the redundancy version is determined by the UE and the UE is not expected to select the redundancy version for all repetitions to 2 or 3. If the parameter *repK-RV* is not provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, the redundancy version for uplink transmissions with a configured grant shall be set to 0. If the parameter *repK-RV* is provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, for the *n*th transmission occasion among *K* repetitions, *n*=1, 2, …, *K*, it is associated with *(mod(n-1,4)+1)th* value in the configured RV sequence. If a configured grant configuration is configured with *Configuredgrantconfig-StartingfromRV0* set to *‘off’*, the initial transmission of a transport block may only start at the first transmission occasion of the *K* repetitions. Otherwise, the initial transmission of a transport block may start at

- the first transmission occasion of the *K* repetitions if the configured RV sequence is {0,2,3,1},

- any of the transmission occasions of the *K* repetitions that are associated with RV=0 if the configured RV sequence is {0,3,0,3},

- any of the transmission occasions of the *K* repetitions if the configured RV sequence is {0,0,0,0}, except the last transmission occasion when *K≥8*.

<Unchanged parts are omitted>

----------------------------------------End of TP 38.214 section 6.1.2.3.1------------------------------------------

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* 1. Issue 2: on CG-PUSCH repetition

Option1:

-----------------------------------TP1: Start of TP 38.214 section 6.1.2.3.1------------------------------------

6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grant

<Unchanged parts are omitted>

For both Type 1 and Type 2 PUSCH transmissions with a configured grant, when *K >* 1*,* the UE shall repeat the TB across the *K* consecutive slots applying the same symbol allocation in each slot, except if the UE is provided with higher layer parameters *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16*, in which case the UE may repeat~~s~~ the TB in up to the *repK* earliest consecutive transmission occasion candidates within the same configuration from any transmission occasion for which the related channel procedure described in 37.213 is successful. A Type 1 or Type 2 PUSCH transmission with a configured grant in a slot is omitted according to the conditions in Clause 11.1 of [6, TS38.213].

<Unchanged parts are omitted>

----------------------------------------End of TP 38.214 section 6.1.2.3.1------------------------------------------

Option2:

-----------------------------------------------< BEGIN TEXT PROPOSAL >-------------------------------------------------

6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grant

\*\*\* Unchanged text is omitted \*\*\*

For both Type 1 and Type 2 PUSCH transmissions with a configured grant, when the UE is configured with *repK >* 1*,* the UE shall repeat the TB across the *repK* consecutive slots applying the same symbol allocation in each slot, except if the UE is provided with higher layer parameters *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16*, in which case the UE repeats the TB in the *repK* earliest consecutive transmission occasion candidates within the same configuration. For operation with shared spectrum channel access, where the UE is provided with higher layer parameters *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16*  and *repK>1,* the UE shall start the transmission of the first repetition in the earliest transmission occasion for which the related channel access procedure described in 37.213 is successful. A Type 1 or Type 2 PUSCH transmission with a configured grant in a slot is omitted according to the conditions in Subclause 11.1 of [6, TS38.213].

\*\*\* Unchanged text is omitted \*\*\*

-----------------------------------------------< END TEXT PROPOSAL >-------------------------------------------------

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* 1. Issue 3: CG-PUSCH time domain resource allocation

============= Start of TP for TS 38.214 =======================

6.1.2.3 Resource allocation for uplink transmission with configured grant

================ Unchanged Texts Omitted =================

A set of allowed periodicities *P* are defined in [12, TS 38.331]. The higher layer parameter *cg-nrofSlots-r16*, provides the number of consecutive slots allocated within a configured grant period. The higher layer parameter *cg-nrofPUSCH-InSlot-r16* provides the number of consecutive PUSCH allocations within a slot, where the first PUSCH allocation follows the higher layer parameter *timeDomainAllocation* for Type 1 PUSCH transmission or *Time domain resource assignment* field in the activation DCI for Type 2 PUSCH transmission, and the remaining PUSCH allocations have the same length and PUSCH mapping type, and are appended following the previous allocations without any gaps. The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots.

================== Unchanged Texts Omitted ================

====================== End of TP for TS 38.214 =======================

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* 1. Issue 4: TPs for DFI related issues

TP#1 for TS 38.213

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| 10.5 HARQ-ACK information for PUSCH transmissions  ……………….  For a PUSCH transmission configured by *ConfiguredGrantConfig*, HARQ-ACK information for a transport block of a corresponding HARQ process number is valid if a first symbol of the PDCCH reception is after a last symbol of the PUSCH transmission, or of any repetition of the PUSCH transmission, by a number of symbols provided by *cg-minDFIDelay-r16* associated to the latest PUSCH transmission configured by *ConfiguredGrantConfig* for the transport block of the corresponding HARQ process number.  For an initial transmission by a UE of a transport block in a PUSCH configured by *ConfiguredGrantConfig*, if the UE receives a CG-DFI that provides HARQ-ACK information for the transport block, the UE assumes that the transport block was correctly decoded if the HARQ-ACK information value is ACK; otherwise, the UE assumes that the transport block was not correctly decoded.  For a PUSCH transmission scheduled by a DCI format, HARQ-ACK information for a transport block of a corresponding HARQ process number is valid if a first symbol of the PDCCH reception is after a last symbol of the PUSCH transmission by a number of symbols provided by *cg-minDFIDelay-r16*  or, if the PUSCH transmission is over multiple slots,  - after a last symbol of the PUSCH transmission in a first slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is ACK.  - after a last symbol of the PUSCH transmission in a last slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is NACK. |

TP#2 for TS 38.213

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| 10.5 HARQ-ACK information for PUSCH transmissions  ………………………….  For a PUSCH transmission scheduled by a DCI format, HARQ-ACK information for a transport block of a corresponding HARQ process number is valid if a first symbol of the PDCCH reception is after a last symbol of the PUSCH transmission by a number of symbols provided by *cg-minDFIDelay-r16* associated to the latest PUSCH transmission configured by *ConfiguredGrantConfig* for the transport block of the corresponding HARQ process number or, if the PUSCH transmission is over multiple slots,  - after a last symbol of the PUSCH transmission in a first slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16* associated to the latest PUSCH transmission configured by *ConfiguredGrantConfig* for the transport block of the corresponding HARQ process number, if a value of the HARQ-ACK information is ACK.  - after a last symbol of the PUSCH transmission in a last slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16* associated to the latest PUSCH transmission configured by *ConfiguredGrantConfig* for the transport block of the corresponding HARQ process number, if a value of the HARQ-ACK information is NACK. |

TP#3 for TS 38.213

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| 10.5 HARQ-ACK information for PUSCH transmissions  ………………………….  For a PUSCH transmission scheduled by a DCI format, scrambled by CS-RNTI, HARQ-ACK information for a transport block of a corresponding HARQ process number is valid if a first symbol of the PDCCH reception is after a last symbol of the PUSCH transmission by a number of symbols provided by *cg-minDFIDelay-r16*  or, if the PUSCH transmission is over multiple slots,  - after a last symbol of the PUSCH transmission in a first slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is ACK.  - after a last symbol of the PUSCH transmission in a last slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is NACK. |

TP#4 for TS 38.213

===================== Start of TP for TS 38.213 ==========================

10.5 HARQ-ACK information for PUSCH transmissions

================== Unchanged Texts Omitted ================

For an initial transmission by a UE of a transport block in a PUSCH configured by *ConfiguredGrantConfig*, if the UE receives a CG-DFI that provides HARQ-ACK information for the transport block, the UE assumes that the transport block was correctly decoded if the HARQ-ACK information value is ACK; otherwise, the UE assumes that the transport block was not correctly decoded.

(Option 1) For a PUSCH transmission scheduled by a DCI format, if the UE receives a CG-DFI that provides HARQ-ACK information for the transport block, the UE assumes that the transport block was correctly decoded if the HARQ-ACK information value is ACK; otherwise, the UE assumes that the transport block was not correctly decoded.

(Option 2) For a PUSCH transmission scheduled by a DCI format, if the UE receives a CG-DFI that provides HARQ-ACK information for the transport block, the UE assumes that at least one of CBG for the transport block was correctly decoded if the HARQ-ACK information value is ACK; otherwise, the UE assumes that the transport block was not correctly decoded.

(Option 3) For a PUSCH transmission scheduled by a DCI format, if the UE receives a CG-DFI that provides information for the transport block, the UE sets CWp = CWmin,p for every priority class if the information value is 1; otherwise, the UE increases CWp for every priority class to the next higher allowed value.

(Option 4) For a PUSCH transmission scheduled for a slot by a DCI format, if a UE is provided *PUSCH-CodeBlockGroupTransmission* for a serving cell, a value of HARQ-ACK information for a transport block of a corresponding HARQ process number is ACK if at least 10% of all the CBGs of PUSCH(s) scheduled by any DCI format in the same slot was correctly decoded; otherwise, a value of HARQ-ACK information is NACK.

For a PUSCH transmission scheduled by a DCI format, HARQ-ACK information for a transport block of a corresponding HARQ process number is valid if a first symbol of the PDCCH reception is after a last symbol of the PUSCH transmission by a number of symbols provided by *cg-minDFIDelay-r16* or, if the PUSCH transmission is over multiple slots,

- after a last symbol of the PUSCH transmission in a first slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is ACK.

- after a last symbol of the PUSCH transmission in a last slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is NACK.

============ Unchanged Texts Omitted ================

=============== End of TP for TS 38.213 ============================

TP#5 for TS 38.212

7.3.1.1.2 Format 0\_1

===================== Unchanged Texts Omitted =====================

DCI format 0\_1 is used for the scheduling of one or multiple PUSCH in one cell, or indicating CG downlink feedback informatin (CG-DFI) to a UE.

The following information is transmitted by means of the DCI format 0\_1 with CRC scrambled by C-RNTI or CS-RNTI or SP-CSI-RNTI or MCS-C-RNTI:

- Identifier for DCI formats – 1 bit

- The value of this bit field is always set to 0, indicating an UL DCI format

- Carrier indicator – 0 or 3 bits, as defined in Clause 10.1 of [5, TS38.213].

- DFI flag – 0 or 1 bit

- 1 bit if the UE is configured to monitor DCI format 0\_1 with CRC scrambled by CS-RNTI and for operation in a cell with shared spectrum channel access, where the UE is not configured with *supplementaryUplink* in *ServingCellConfig* for the cell or configured with *supplementaryUplink* in *ServingCellConfig* for the cell and UL carrier is configured for PUSCH transmission. For a DCI format 0\_1 with CRC scrambled by CS-RNTI, the bit value of 0 indicates activating type 2 CG transmission and the bit value of 1 indicates CG-DFI. For a DCI format 0\_1 with CRC scrambled by C-RNTI/SP-CSI-RNTI/MCS-C-RNTI, the bit is reserved.

- 0 bit otherwise;

================= Unchanged Texts Omitted =====================

======================== End of TP#2 for TS 38.212 =========================

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* 1. Issue 5: on UCI multiplexing

---------------------------------------- TP3: Start of TP 38.213 section 9.0 ---------------------------------------------

9 UE procedure for reporting control information

<Unchanged parts are omitted>

If a UE transmits multiple PUSCHs in a slot on respective serving cells that include first PUSCHs that are scheduled by DCI formats and second PUSCHs configured by respective *ConfiguredGrantConfig* or *semiPersistentOnPUSCH*, and the UE would multiplex UCI in one of the multiple PUSCHs, and the multiple PUSCHs fulfil the conditions in Clause 9.2.5 for UCI multiplexing, the UE multiplexes the UCI in a PUSCH from the first PUSCHs.

For operation with shared channel access, if a UE transmits multiple PUSCHs in a slot configured by *ConfiguredGrantConfig* on respective serving cells and the UE would multiplex UCI in one of the multiple PUSCHs, and the multiple PUSCHs fulfil the conditions in Subclause 9.2.5 for UCI multiplexing, the UE multiplexes the UCI in a PUSCH from the last PUSCHs.

<Unchanged parts are omitted>

----------------------------------------End of TP 38.213 section 9.0 ---------------------------------------------

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* 1. Issue 6: NDI field for validation activation/release

TP #1:

----------------------------------------- TP #2 for 38.214 6.1.2.1.1------------------------------------------------------

Table 6.1.2.1.1-1A Applicable PUSCH time domain resource allocation for DCI format 0\_1 in UE specific search space scrambled with C-RNTI, MCS-C-RNTI, CS-RNTI or SP-CSI-RNTI

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| *pusch-ConfigCommon* includes *pusch-TimeDomainAllocationList* | *pusch-Config* includes *pusch-TimeDomainAllocationList* | *pusch-Config* includes *pusch-TimeDomainAllocationList* *-ForDCIformat0\_1* | *pusch-Config includes pusch-TimeDomainAllocationList –ForMultiPUSCH* | PUSCH time domain resource allocation to apply |
| No | No | No | No | Default A |
| Yes | No | No | No | *pusch-TimeDomainAllocationList* provided in *pusch-ConfigCommon* |
| No/Yes | Yes | No | No | *pusch-TimeDomainAllocationList* provided in *pusch-Config* |
| No/Yes | No/Yes | Yes | *-* | *pusch-TimeDomainAllocationList-ForDCIformat0\_1* provided in *pusch-Config* |
| No/Yes | No/Yes | - | Yes | *pusch-TimeDomainAllocationList –ForMultiPUSCH provided in pusch-Config* |

-------------------------------------------------END OF TP #2--------------------------------------------------------------

TP #2:

----------------------------------------- TP #3 for 38.213 10.2------------------------------------------------------

10.2 PDCCH validation for DL SPS and UL grant Type 2

A UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or a configured UL grant Type 2 PDCCH if

- the CRC of a corresponding DCI format is scrambled with a CS-RNTI provided by *cs-RNTI*, and

- the new data indicator field in the DCI format for the enabled transport block is set to '0' or set to all ‘0’ when DCI includes NDIs for multiple PUSCHs, and

- the DFI flag field, if present, in the DCI format is set to '0', and

- if validation is for scheduling activation and if the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format is present, the PDSCH-to-HARQ\_feedback timing indicator field does not provide an inapplicable value from dl-DataToUL-ACK.

<unchanged part omitted>

-------------------------------------------------END OF TP #3--------------------------------------------------------------

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* 1. Issue 7: beta offset

< Start of text proposal 1>

**9.3 UCI reporting in physical uplink shared channel**

Offset values are defined for a UE to determine a number of resources for multiplexing HARQ-ACK information and for multiplexing CSI reports in a PUSCH. Offset values are also defined for multiplexing CG-UCI [5, TS 38.212] in a CG-PUSCH. The offset values are signalled to a UE either by a DCI format scheduling the PUSCH transmission or by higher layers.

If a DCI format that does not include a beta\_offset indicator field schedules the PUSCH transmission from the UE and the UE is provided *betaOffsets = 'semiStatic'*, the UE applies the , , and  values that are provided by *betaOffsets = 'semiStatic'* for the corresponding HARQ-ACK information, Part 1 CSI reports and Part 2 CSI reports.

If the PUSCH transmission is with a configured grant and the UE is provided *CG-UCI-OnPUSCH= 'semiStatic'*, the UE applies the , , , and  values that are provided by *CG-UCI-OnPUSCH = 'semiStatic'* for the corresponding HARQ-ACK information, CG-UCI, Part 1 CSI reports and Part 2 CSI reports.

If the PUSCH is scheduled by DCI format 0\_0 and the UE is provided *betaOffsets = 'dynamic'*, the UE applies the , , and  values that are determined from the first value of  *betaOffsets = 'dynamic'*.

If the PUSCH is a configured grant Type 2 PUSCH activated by DCI format 0\_0 and the UE is provided *CG-UCI-OnPUSCH* =*'dynamic'*, the UE applies the , , , and  values that are determined from the first value of *CG-UCI-OnPUSCH = 'dynamic'*.

HARQ-ACK information offsets  are configured to values according to Table 9.3-1. The *betaOffsetACK-Index1*, *betaOffsetACK-Index2*, and *betaOffsetACK-Index3* respectively provide indexes , , and  for the UE to use if the UE multiplexes up to 2 HARQ-ACK information bits, more than 2 and up to 11 HARQ-ACK information bits, and more than 11 bits in the PUSCH, respectively.

CG-UCI offsets are configured to values according to Table 9.3-1.

Part 1 CSI report and Part 2 CSI report offsets  and , respectively, are configured to values according to Table 9.3-2. The *betaOffsetCSI-Part1-Index1* and *betaOffsetCSI-Part2-Index1* respectively provide indexes  and  for the UE to use if the UE multiplexes up to 11 bits for Part 1 CSI reports or Part 2 CSI reports in the PUSCH. The *betaOffsetCSI-Part1-Index2* and *betaOffsetCSI-Part2-Index2* respectively provide indexes  or  for the UE to use if the UE multiplexes more than 11 bits for Part 1 CSI reports or Part 2 CSI reports in the PUSCH.

If a DCI format that includes a beta\_offset indicator field with one bit or two bits, as configured by *uci-OnPUSCH*, schedules the PUSCH transmission from the UE, the UE is provided by each of {*betaOffsetACK-Index1*, *betaOffsetACK-Index2*, *betaOffsetACK-Index3*} a set of two or four  indexes, by each of {betaOffsetCG-UCI-r16} a set of four indexes, by each of {*betaOffsetCSI-Part1-Index1*, *betaOffsetCSI-Part1-Index2*} a set of two or four  indexes, and by each of {*betaOffsetCSI-Part2-Index1*, *betaOffsetCSI-Part2-Index2*} a set of two or four  indexes from Tables 9.3-1 and 9.3-2, respectively, for multiplexing HARQ-ACK information, CG-UCI, Part 1 CSI reports, and Part 2 CSI reports, respectively, in the PUSCH transmission. The beta\_offset indicator field indicates a  value, a value, a  value and a  value from the respective sets of values, with the mapping defined in Table 9.3-3 and in Table 9.3-3A.

For a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes CG-UCI, the UE multiplexes CG-UCI in the PUSCH transmission if the UE is provided by *betaOffsetCG-UCI-r16* a value, from a set of values, with the mapping defined in Table 9.3-1. If the UE multiplexes HARQ-ACK information in the PUSCH transmission, as described in Clause 9.2.5, the UE jointly encodes the HARQ-ACK information and the CG-UCI [5, TS 38.212] and determines a number of resources for multiplexing the combined information in a PUSCH using which provides indexes and for the UE to use if the UE multiplexes up to 11, and more than 11 combined information bits, respectively.

< End of text proposal 1>

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# References

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| [**R1-2005336**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005336.zip) | Remaining issues on the enhancements to configured grant | vivo |
| [**R1-2005603**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005603.zip) | Remaining issues on the configured grant for NR-U | ZTE, Sanechips |
| [**R1-2005812**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005812.zip) | Maintenance on the configured grant procedures | Huawei, HiSilicon |
| [**R1-2005828**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005828.zip) | Text proposals for configured grant enhancement for NR-U | Lenovo, Motorola Mobility |
| [**R1-2005917**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2005917.zip) | Configured grant enhancement | Ericsson |
| [**R1-2006023**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006023.zip) | Discussion on the remaining issues of configured grant enhancements | OPPO |
| [**R1-2006098**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006098.zip) | Configured grant enhancement for NR-U | Samsung |
| [**R1-2006303**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006303.zip) | Remaining issues of configured grant for NR-U | LG Electronics |
| [**R1-2006766**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006766.zip) | TP for Enhancements to configured grants for NR-U | Qualcomm Incorporated |
| [**R1-2006866**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_102-e/Docs/R1-2006866.zip) | Remaining issues for DFI in NR-U | ASUSTeK |