3GPP TSG-RAN WG1 Meeting #103-e R1-20xxxxx

e-Meeting, 26th October – 13th November, 2020

Agenda Item: 7.2.2

Source: Moderator (Ericsson)

Title: Feature lead summary for Maintenance of UL Signals and Channels

Document for: Discussion, Decision

# 1 Introduction

This document contains a summary of the contributions related to UL Signals and Channels made under the agenda item 7.2.2 "Maintenance of NR-based Access to Unlicensed Spectrum." The following table is a summary of the identified issues; more details are provided in the subsequent sections.

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| **#** | **Issue** | **Contribution(s)** |
| UL-01 | UE assumption on RB set configuration for PRACH and for MsgA PUSCH transmissions | [2]: R1-2008042  [3]: R1-2008385 |
| UL-02 | Starting OFDM symbol index for SRS resource | [4]: R1-2008521 |
| UL-03 | FDRA for PUSCH scheduled by RAR UL Grant or by DCI 0\_0 Addressed to TC-RNTI | [1]: R1-2007778 |
| UL-04 | Clarification on DCI size matching rules for DCI 0\_0 | [2]: R1-2008042  [3]: R1-2008385 |

# 4 Issue UL-01: UE assumption on RB set configuration for PRACH and for MsgA PUSCH transmissions

In the previous meeting, it was identified that if there is a mix of UEs in IDLE and CONNECTED that are in contention during RACH, there can be an ambiguity at the gNB side on which RBs are used by the UE for the case of PUSCH scheduled by a RAR UL Grant or PUSCH scheduled by DCI 0\_0 addressed to TC-RNTI if interlacing is configured. The ambiguity can occur since a IDLE UE assumes the nominal guard bands defined in the RAN4 spec (38.101-1) whereas a UE in CONNECTED may be configured with *intraCellGuardBandUL-r16* that is different than the nominal guardbands. This ambiguity was resolved by specifying that all UEs will assume nominal guard bands for the case of PUSCH scheduled by RAR UL grant and PUSCH scheduled by DCI 0\_0 addressed to TC-RNTI.

It is observed by LGE (R1-2008042) and Sharp (R1-2008385) that the same ambiguity occurs for PRACH transmission on a wideband (>20 MHz carrier) regardless of whether the PRACH transmission occurs for 4-step RACH or 2-step RACH. This is easily fixed with change to 38.211 to introduce the same UE assumption on guard bands for PRACH transmission as agreed last meeting for PUSCH transmission. LGE proposes that the same assumptions should apply also to MsgA PUSCH.

**FL Proposal**: Discuss issue UL-01 in RAN1#103-e

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| **Company** | **Summary of Proposals** |
| LGE  R1-2008042 | ***Proposal 2: For PRACH preamble (RO) as well as Msg. A PUSCH (PO) transmissions, the UL RB set size/range is determined based on nominal intra-cell guard band configuration.***   * ***The corresponding TP is provided in Section 3.***  3.1 Correction to 38.211 [1]   5.3.2 OFDM baseband signal generation for PRACH  […]  The time-continuous signal  on antenna port for PRACH is defined by  where  and  -  is given by clause 6.3.3;  -  is the subcarrier spacing of the initial uplink bandwidth part during initial access. Otherwise,  is the subcarrier spacing of the active uplink bandwidth part;  - is the largest value among the subcarrier spacing configurations by the higher-layer parameter *scs-SpecificCarrierList*;  -  is the lowest numbered resource block of the initial uplink bandwidth part and is derived by the higher-layer parameter *initialUplinkBWP* during initial access. Otherwise,  is the lowest numbered resource block of the active uplink bandwidth part and is derived by the higher-layer parameter *BWP-Uplink*;  - is the frequency offset of the lowest PRACH transmission occasion in frequency domain with respect to physical resource block 0 of the active uplink bandwidth part. The quantity is given by the higher-layer parameter *msgA-RO-FrequencyStart* if configured and a type-2 random-access procedure is initiated as described in clause 8.1 of [5, TS 38.213], otherwise by *msg1-FrequencyStart* as described in clause 8.1 of [5 TS 38.213];  -  is the PRACH transmission occasion index in frequency domain for a given PRACH transmission occasion in one time instance as given by clause 6.3.3.2;  -  is the number of resource blocks occupied and is given by the parameter allocation expressed in number of RBs for PUSCH in Table 6.3.3.2-1.  - is the start CRB index of uplink RB set . The UE assumes that the uplink RB set is defined as when the UE is not provided *intraCellGuardBandUL-r16.* [6, TS 38.214]  - is the index of the RB set which contains the lowest PRACH transmission occasion in frequency domain indicated by . The UE may assume that is configured such that each PRACH transmission occasion is fully contained within an RB set.  […] 3.2 Correction to 38.213 [3] 8.1A PUSCH for Type-2 random access procedure  […]  A UE determines time resources and frequency resources for PUSCH occasions in an active UL BWP from *msgA-PUSCH-Config* for the active UL BWP. If the active UL BWP is not the initial UL BWP and *msgA-PUSCH-Config* is not provided for the active UL BWP, the UE uses the *msgA-PUSCH-Config* provided for the initial UL BWP.  A UE determines a first interlace or first RB for a first PUSCH occasion in an active UL BWP respectively from *interlaceIndexFirstPO-MsgA-PUSCH* or from *frequencyStartMsgA-PUSCH* that provides an offset, in number of RBs in the active UL BWP, from a first RB of the active UL BWP. A PUSCH occasion includes a number of interlaces or a number of RBs provided by *nrofInterlacesPerMsgA-PO* or by *nrofPRBs-perMsgA-PO*, respectively. Consecutive PUSCH occasions in the frequency domain of an UL BWP are separated by a number of RBs provided by *guardBandMsgA-PUSCH*. A number of PUSCH occasions in the frequency domain of an UL BWP is provided by *nrofMsgA-PO-FDM*. If a UE is provided with *useInterlacePUCCH-PUSCH* by *BWP-UplinkCommon* or *BWP-UplinkDedicated,* the UE assumes that the RB set is defined as when the UE is not provided *intraCellGuardBandUL-r16* [6, TS 38.214].  If a UE does not have dedicated RRC configuration, or has an initial UL BWP as an active UL BWP, or is not provided *startSymbolAndLengthMsgA-PO*, *msgA-PUSCH-timeDomainAllocation* provides a SLIV and a PUSCH mapping type for a PUSCH transmission by indicating  - one of the first *maxNrofUL-Allocations* values from *PUSCH-TimeDomainResourceAllocationList*, if *PUSCH-TimeDomainResourceAllocationList* is provided in *PUSCH-ConfigCommon*  - one of the entries from table 6.1.2.1.1-2 or table 6.1.2.1.1-3 in [6, TS 38.214], if *PUSCH-TimeDomainResourceAllocationList* is not provided in *PUSCH-ConfigCommon*  else, the UE is provided a SLIV by *startSymbolAndLengthMsgA-PO*, and a PUSCH mapping type by *mappingTypeMsgA-PUSCH* for a PUSCH transmission.  […] |
| Sharp  R1-2008385 | **Proposal 1: For connected mode UE, assume nominal intra-cell guard bands for RO mapping of PRACH with sequence length 1151 and 571.**  --------- beginning of text proposal for TS 38.212  5.3.2 OFDM baseband signal generation for PRACH  The time-continuous signal  on antenna port for PRACH is defined by  where  and  -  is given by clause 6.3.3;  -  is the subcarrier spacing of the initial uplink bandwidth part during initial access. Otherwise,  is the subcarrier spacing of the active uplink bandwidth part;  - is the largest value among the subcarrier spacing configurations by the higher-layer parameter *scs-SpecificCarrierList*;  -  is the lowest numbered resource block of the initial uplink bandwidth part and is derived by the higher-layer parameter *initialUplinkBWP* during initial access. Otherwise,  is the lowest numbered resource block of the active uplink bandwidth part and is derived by the higher-layer parameter *BWP-Uplink*;  - is the frequency offset of the lowest PRACH transmission occasion in frequency domain with respect to physical resource block 0 of the active uplink bandwidth part. The quantity is given by the higher-layer parameter *frequencyStartMsgA-PUSCH* if configured and a type-2 random-access procedure is initiated as described in clause 8.1 of [5, TS 38.213], otherwise by *msg1-FrequencyStart* as described in clause 8.1 of [5 TS 38.213];  -  is the PRACH transmission occasion index in frequency domain for a given PRACH transmission occasion in one time instance as given by clause 6.3.3.2;  -  is the number of resource blocks occupied and is given by the parameter allocation expressed in number of RBs for PUSCH in Table 6.3.3.2-1.  - is the start CRB index of UL RB set defined as in Clause 7 for the case when the UE is not configured with *intraCellGuardBandUL-r16*. [6, TS 38.214]  - is the index of the RB set which contains the lowest PRACH transmission occasion in frequency domain indicated by . The UE expects that is configured such that each PRACH transmission occasion is fully contained within an RB set.  -------- Unchanged contents are omitted  --------- end of text proposal |
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# 2 Issue UL-02: Starting OFDM symbol index for SRS resource

In Rel-15, it was only possible to configure an SRS resource to start within the last 6 symbols of the slot. In Rel-16, it was agreed to support an SRS resource starting at any symbol of the slot. This feature is optional with per-band UE capability signaling (FG 10-11). CATT (R1-2008521) proposes that 38.214 be corrected to capture that the configuration is subject to UE capability.

**FL Proposal**: Discuss issue UL-02 in RAN1#103-e

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| **Company** | **Summary of Proposals** |
| CATT  R1-2008521 | 6.2.1 UE sounding procedure  <Unrelated part omitted>  Subject to UE’s capability, the UE may be configured by the higher layer parameter *resourceMapping* in *SRS-Resource* with an SRS resource occupying  adjacent OFDM symbols within the last 6 symbols of the slot or at any symbol location within the slot, where all antenna ports of the SRS resources are mapped to each symbol of the resource. When the SRS is configured with the higher layer parameter *SRS-PosResourceSet-r16* the higher layer parameter *resourceMapping* in *SRS-PosResource-r16* with an SRS resource occupying adjacent symbols anywhere within the slot.  <Unrelated part omitted> |
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# 3 Issue UL-03: FDRA for PUSCH scheduled by RAR UL Grant or by DCI 0\_0 Addressed to TC-RNTI

In the previous meeting, it was identified that if there is a mix of UEs in IDLE and CONNECTED that are in contention during RACH, there can be an ambiguity at the gNB side on which RBs are used by the UE for the case of PUSCH scheduled by a RAR UL Grant or PUSCH scheduled by DCI 0\_0 addressed to TC-RNTI if interlacing is configured. The ambiguity can occur since a IDLE UE assumes the nominal guard bands defined in the RAN4 spec (38.101-1) whereas a UE in CONNECTED may be configured with *intraCellGuardBandUL-r16* that is different than the nominal guardbands. This ambiguity was resolved by specifying that all UEs will assume nominal guard bands for the case of PUSCH scheduled by RAR UL grant and PUSCH scheduled by DCI 0\_0 addressed to TC-RNTI.

Fujitsu (R1-200778) discusses another potential ambiguity (see Figure 2 below) for the case when UE2 is configured with *intraCellGuardBandUL-r16* such that the RB set in which PRACH is transmitted is smaller than the RB set according to the nominal guard bands. If UE2 is configured with an active UL BWP spanning only one RB set as shown in Figure 2, it seems like the UE2 might be required to transmit outside the active BWP if it must assume RB set configuration according to the nominal guard bands.



Figure 2: Example of BWP and RB set configuration for different UEs

**I**t is the moderator's view that the above scenario can be viewed as misconfiguration. Such a misconfiguration is easily avoided by gNB implementation: the gNB should avoid configuring *intraCellGuardBandUL-r16* and *BWP-UplinkDedicated* such that the above scenario occurs, since the UE cannot be expected to transmit on RBs outside the active UL BWP.

**FL Proposal**: It is not essential to further discuss issue UL-03

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| **Company** | **Summary of Proposals** |
| Fujitsu  R1-2007778 | **Proposal 1:** For PUSCH scheduled by a RAR UL grant or by DCI 0\_0 addressed to TC-RNTI, clarify whether the UE uses the RBs which belong to the corresponding RB set defined by RAN4 but are outside of the active BWP.  **Proposal 2:** For PUSCH scheduled by a RAR UL grant or by DCI 0\_0 addressed to TC-RNTI,if the UE is not allowed to use the RBs which belong to the corresponding RB set defined by RAN4 but are outside of the active BWP, consider an alternative to resolve the ambiguity issue, i.e. when a UE configured with *intraCellGuardBandUL-r16*, the RB sets which may be used for PUSCH scheduled by a RAR UL grant or by DCI 0\_0 addressed to TC-RNTI shall be configured to be same as the corresponding RB set defined by RAN4. TPs are provided.  ------------------------------------- Text Proposal for Clause 8.3 of TS 38.213---------------------------------  \*\*\* Unchanged text omitted \*\*\*  If *useInterlace-PUCCH-PUSCH* is provided by *BWP-UplinkCommon* or *BWP-UplinkDedicated*, the frequency domain resource allocation is by uplink resource allocation type 2 [6, TS 38.214]. A UE processes the frequency domain resource assignment field as follows  - truncate the frequency domain resource assignment field to the LSBs if , or to the LSBs if  - for interlace allocation of a PUSCH transmission, interpret the MSBs of the truncated frequency domain resource assignment field for the active UL BWP as for the MSBs of the frequency domain resource assignment field in DCI format 0\_0 [6, TS 38.214]  - for RB set allocation of a PUSCH transmission, the RB set of the active UL BWP is the RB set of the PRACH transmission associated with the RAR UL grant. When the UE is configured with *intraCellGuardBandUL-r16*，t~~T~~he UE ~~assumes~~ expects that the RB set is configured to be same ~~defined~~ as when the UE is not provided *intraCellGuardBandUL-r16* [6, TS 38.214].  \*\*\* Unchanged text omitted \*\*\*  ------------------------------------------------ End Text Proposal --------------------------------------------------  --------------------------------- Text Proposal for Clause 6.1.2.2.3 of TS 38.214------------------------------  \*\*\* Unchanged text omitted \*\*\*  In uplink resource allocation of type 2, the resource block assignment information defined in [5, TS 38.212] indicates to a UE a set of up to *M* interlace indices, and for DCI 0\_0 monitored in a UE-specific search space and DCI 0\_1 a set of up to contiguous RB sets, where *M* and interlace indexing are defined in Clause 4.4.4.6 in [4, TS 38.211]. Within the active UL BWP, the assigned physical resource block is mapped to virtual resource block For DCI 0\_0 monitored in a UE-specific search space and DCI 0\_1, the UE shall determine the resource allocation in frequency domain as an intersection of the resource blocks of the indicated interlaces and the union of the indicated set of RB sets and intra-cell guard bands defined in Clause 7 between the indicated RB sets, if any. For DCI 0\_0 monitored in a common search space, the UE shall determine the resource allocation in frequency domain as an intersection of the resource blocks of the indicated interlaces and a single uplink RB set of the active UL BWP. For DCI 0\_0 monitored in a CSS with CRC scrambled by an RNTI other than TC-RNTI, the uplink RB set is the lowest indexed one amongst uplink RB set(s) that intersects the lowest-indexed CCE of the PDCCH in which the UE detects the DCI 0\_0 in the active downlink BWP. If there is no intersection, the uplink RB set is RB set 0 in the active uplink BWP. For DCI 0\_0 with CRC scrambled by TC-RNTI, the uplink RB set is the same one in which the UE transmits the PRACH associated with the RAR UL grant, and when the UE is configured with *intraCellGuardBandUL-r16* the UE expects that the RB set is configured to be same~~in which case the UE assumes that the uplink RB set is defined~~ as when the UE is not configured with *intraCellGuardBandUL-r16* (see Clause 7).  \*\*\* Unchanged text omitted \*\*\*  ------------------------------------------------ End Text Proposal -------------------------------------------------- |
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# 5 Issue UL-04: Clarification on DCI size matching rules for DCI 0\_0

LGE (R1-2008042) proposes that the size matching rules should be clarified for DCI 0\_0 when UL resource allocation Type 2 (Interlacing) is configured.

Sharp (R1-2008385) proposes that the size of the FDRA field of DCI 0\_0 should not depend on whether or not interlacing is configured. Hence, the size of the FDRA field is determined by instead of 5+Y / 6 + Y.

This issue was raised in the previous meeting for potential discussion, and a large majority of companies identified this as low priority. Hence it is the moderator's view that this issue is not essential discuss, especially due to the limited number of email threads; however, companies are free to provide alternative viewpoints.

**FL Proposal**: It is not essential to further discuss issue UL-04

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| **Company** | **Summary of Proposals** |
| LGE  R1-2008042 | ***Proposal 3: For DCI format 0\_0 transmitted in CSS, X bit size of FDRA field in the DCI format 0\_0 is determined based on the SCS of the initial UL BWP.***   * ***In case when the SCS of active UL BWP is different from that of initial BWP, some handling is required by considering the difference between X bit size of FDRA field in DCI format 0\_0 and the required number of bits for PUSCH resource allocation.*** |
| Sharp  R1-2008385 | **Proposal 2: Condition on DCI size determination for FDRA field in DCI format 0\_0 should be removed as TP#2.\**  Moderator's note: the TP below is not based on the latest version of 38.212 (V16.3.0)  --------- beginning of text proposal for TS 38.212  7.3.1.1.1 Format 0\_0  DCI format 0\_0 is used for the scheduling of PUSCH in one cell.  The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:  - Identifier for DCI formats – 1 bit  - The value of this bit field is always set to 0, indicating an UL DCI format  - Frequency domain resource assignment –  bits, where  is defined in clause 7.3.1.0  - For PUSCH hopping with resource allocation type 1:  -  MSB bits are used to indicate the frequency offset according to Clause 6.3 of [6, TS 38.214], where  if the higher layer parameter *frequencyHoppingOffsetLists* contains two offset values and  if the higher layer parameter *frequencyHoppingOffsetLists* contains four offset values  -  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]  - For non-PUSCH hopping with resource allocation type 1:  -  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]  - if any of the higher layer parameters *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* and *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured  - 5+Y most significant bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 30 kHz and the DCI format 0\_0 is monitored in a UE-specific search space. If the DCI 0\_0 is monitored in a common search space Y = 0.  - 6+Y most significant bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 15 kHz and the DCI format 0\_0 is monitored in a UE-specific search space. If the DCI 0\_0 is monitored in a common search space Y = 0.  The value of Y is determined by where is the number of RB sets contained in the UL BWP as defined in clause 7 of [6, TS38.214].  - Time domain resource assignment – 4 bits as defined in Clause 6.1.2.1 of [6, TS 38.214]  - Frequency hopping flag – 1 bit according to Table 7.3.1.1.1-3, as defined in Clause 6.3 of [6, TS 38.214]  - Modulation and coding scheme – 5 bits as defined in Clause 6.1.4.1 of [6, TS 38.214]  - New data indicator – 1 bit  - Redundancy version – 2 bits as defined in Table 7.3.1.1.1-2  - HARQ process number – 4 bits  - TPC command for scheduled PUSCH – 2 bits as defined in Clause 7.1.1 of [5, TS 38.213]  - Padding bits, if required.  - UL/SUL indicator – 1 bit for UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell as defined in Table 7.3.1.1.1-1 and the number of bits for DCI format 1\_0 before padding is larger than the number of bits for DCI format 0\_0 before padding; 0 bit otherwise. The UL/SUL indicator, if present, locates in the last bit position of DCI format 0\_0, after the padding bit(s).  - If the UL/SUL indicator is present in DCI format 0\_0 and the higher layer parameter *pusch-Config* is not configured on both UL and SUL the UE ignores the UL/SUL indicator field in DCI format 0\_0, and the corresponding PUSCH scheduled by the DCI format 0\_0 is for the UL or SUL for which high layer parameter *pucch-Config* is configured;  - If the UL/SUL indicator is not present in DCI format 0\_0 and *pucch-Config* is configured, the corresponding PUSCH scheduled by the DCI format 0\_0 is for the UL or SUL for which high layer parameter *pucch-Config* is configured.  - If the UL/SUL indicator is not present in DCI format 0\_0 and *pucch-Config* is not configured, the corresponding PUSCH scheduled by the DCI format 0\_0 is for the uplink on which the latest PRACH is transmitted.  - ChannelAccess-CPext – 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4 for operation in a cell with shared spectrum channel access; 0 bit otherwise.  The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by TC-RNTI:  - Identifier for DCI formats – 1 bit  - The value of this bit field is always set to 0, indicating an UL DCI format  - Frequency domain resource assignment – number of bits determined by the following:  - bits, where  -  is the size of the initial UL bandwidth part.  - For PUSCH hopping with resource allocation type 1:  -  MSB bits are used to indicate the frequency offset according to Table 8.3-1 in Clause 8.3 of [5, TS 38.213], where  if  and  otherwise  -  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]  - For non-PUSCH hopping with resource allocation type 1:  -  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]  - if the higher layer parameter *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* is configured  - 5 most significant bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 30 kHz  - 6 most significant bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 15 kHz  - Time domain resource assignment – 4 bits as defined in Clause 6.1.2.1 of [6, TS 38.214]  - Frequency hopping flag – 1 bit according to Table 7.3.1.1.1-3, as defined in Clause 6.3 of [6, TS 38.214]  - Modulation and coding scheme – 5 bits as defined in Clause 6.1.4.1 of [6, TS 38.214]  - New data indicator – 1 bit, reserved  - Redundancy version – 2 bits as defined in Table 7.3.1.1.1-2  - HARQ process number – 4 bits, reserved  - TPC command for scheduled PUSCH – 2 bits as defined in Clause 7.1.1 of [5, TS 38.213]  - Padding bits, if required.  - UL/SUL indicator – 1 bit if the cell has two ULs and the number of bits for DCI format 1\_0 before padding is larger than the number of bits for DCI format 0\_0 before padding; 0 bit otherwise. The UL/SUL indicator, if present, locates in the last bit position of DCI format 0\_0, after the padding bit(s).  - If 1 bit, reserved, and the corresponding PUSCH is always on the same UL carrier as the previous transmission of the same TB  - ChannelAccess-CPext – 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4 for operation in a cell with shared spectrum channel access; 0 bit otherwise  -------- Unchanged contents are omitted  --------- end of text proposal |
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# References

1. R1-2007778 Clarification on resource allocation for PUSCH scheduled by RAR UL grant or DCI addressed to TC-RNTI Fujitsu
2. R1-2008042 Remaining issues of random access for NR-U LG Electronics
3. R1-2008385 Remaining issues on initial access and UL signals/channels for NR-U Sharp
4. R1-2008521 Correction on SRS position CATT