**3GPP TSG RAN WG1 Meeting #100bis-e R1-200xxxx**

**E-Meeting, April 20 – 30, 2020**

**Agenda Item: 6.2.3.1.1**

**Source: Moderator (Huawei)**

**Title: Feature summary #1 on LTE DL MIMO efficiency enhancement**

**Document for: Discussion and Decision**

# Introduction

Agreements and conclusions in previous meeting for the LTE DL MIMO efficiency enhancements (WI code LTE\_DL\_MIMO\_EE-Core; WID in RP-182901) are summarized in [1].

In this paper, the inputs from companies submitted to RAN1#100-e meeting ([2]-[8]) on remaining issues are summarized.

# Discussion

## Transmission pattern

Issue 1: Indexing of additional SRS symbols.

* As explained in [6], the parameter *l* in may be misleading as the range of the parameter is not defined. The interpretation that is OFDM symbol index within the subframe should be avoided.
* Proposal: Endorse the following text proposal to TS 36.211

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| Mapping to physical resources shall be done according to clause 5.5.3.2.1 with the following exceptions:  - frequency hopping between OFDM symbols is supported and if a UE is configured by higher layer parameter *additionalSRS-GuardSymbolFH*, a guard symbol is added between every frequency hop;  - where is the index of the ~~OFDM symbol number carrying~~ additional SRS transmission occasion within the subframe starting from 0 ~~not counting guard symbol(s)~~ , and is the repetition factor given by the higher-layer parameter *additionalSRS-RepNum*; |

Issue 2: applying restrictions of SRS triggering events associated with different values of SRS transmission parameters and SRS carrier switching for additional SRS.

* As explained in [3], the following restrictions should also be applied to additional SRS:
  + A UE configured for type 1 triggered SRS transmission is not expected to receive type 1 SRS triggering events associated with different values of trigger type 1 SRS transmission parameters, as configured by higher layer signalling, for the same subframe and the same serving cell.
  + A UE configured for type 1 or type 0 triggered SRS transmission and more than one TDD serving cell without PUSCH/PUCCH transmission is not expected to receive type 1 or type 0 SRS triggering events that can result in uplink transmissions beyond the UE's indicated uplink carrier aggregation capability included in the *UE-EUTRA-Capability*.
* Proposal: Endorse the text proposal to 36.213

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| Text proposal to 36.213 8.2 UE sounding procedure <Unchanged parts are omitted>  A UE configured for type 1 or type 2 triggered SRS transmission is not expected to receive type 1 or type 2 SRS triggering events associated with different values of trigger type 1 or type 2 SRS transmission parameters, as configured by higher layer signalling, for the same subframe and the same serving cell.  For a serving cell that is a LAA SCell, a UE configured for type 1 triggered SRS transmission is not expected to receive type 1 SRS triggering event in DCI format 0B associated with a subframe that is not scheduled for PUSCH transmission for the same serving cell.  For a serving cell that is an LAA SCell, if the uplink transmission in a subframe is ending in the end of symbol #3 or in the end of symbol #6, the UE shall not transmit SRS in that subframe.  A UE configured for type 2 or type 1 or type 0 triggered SRS transmission and more than one TDD serving cell without PUSCH/PUCCH transmission is not expected to receive type 2 or type 1 or type 0 SRS triggering events that can result in uplink transmissions beyond the UE's indicated uplink carrier aggregation capability included in the *UE-EUTRA-Capability* [12].  For TDD serving cell *c*, and a UE configured with *EIMTA-MainConfigServCell-r12* for a serving cell *c*, the UE shall not transmit SRS in a subframe of a radio frame that is indicated by the corresponding eIMTA-UL/DL-configuration as a downlink subframe.  A UE shall not transmit SRS whenever SRS and a PUSCH transmission corresponding to a Random Access Response Grant or a retransmission of the same transport block as part of the contention based random access procedure coincide in the same subframe.  A UE not configured with higher layer parameter *ul-STTI-Length* is not expected to be triggered with trigger type 2 SRS transmission in the same symbols as a PUSCH/PUCCH.  <Unchanged parts are omitted> |

## Additional SRS and legacy SRS

Issue 3: Transmission in case of periodic legacy and additional SRS in one subframe.

* As explained in [3][5], RAN1 has agreed that UE can transmit periodic legacy SRS and additional SRS in the same or different subframe. So the support of UE transmitting both the trigger type 0 and type 2 SRS in the same subframe should be captured in TS 36.213.
* Proposal: Endorse the following text proposal to TS 36.213

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| 8.2 UE sounding procedure  <Unchanged parts are omitted>  A UE is not expected to be configured with SRS trigger type 0 on a LAA SCell.  In case both trigger type 0 and trigger type 1 SRS transmissions would occur in the same subframe in the same serving cell, the UE shall only transmit the trigger type 1 SRS transmission. This prioritization rule shall be applied before other prioritization rules defined in this subclause.  In case both trigger type 1 and trigger type 2 SRS transmissions would occur in the same subframe, the UE shall transmit both the trigger type1 and type 2 SRS transmissions.  In case both trigger type 0 and trigger type 2 SRS transmissions would occur in the same subframe, the UE shall transmit both the trigger type 0 and type 2 SRS transmissions.  If higher layer parameter *specialSubframePatterns-v1430* indicates *ssp10*, or if higher layer parameter *specialSubframePatterns-v1450* indicates *ssp10-CRS-LessDwPTS*, the UE shall assume for the purpose of determining that the special subframe configuration is that signalled by *specialSubframePatterns* (without suffix)*.* |

Issue 4: Common/different configurations for legacy aperiodic and additional SRS.

* As explained in [7], the current spec about the configuration of FDD  and  used for additional SRS is not correct. In addition, some legacy aperiodic SRS configurations can be applied to additional SRS.
* Proposal: Endorse the following text proposal to TS 36.213

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| Text proposal to 36.213  < Unchanged parts are omitted> 8.2 UE sounding procedure If the UE is configured with a PUCCH-SCell, the UE shall apply the procedures described in this clause for both primary PUCCH group and secondary PUCCH group unless stated otherwise   * When the procedures are applied for the primary PUCCH group, the terms 'secondary cell', 'secondary cells', 'serving cell', and 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell or serving cells belonging to the primary PUCCH group respectively unless stated otherwise. * When the procedures are applied for secondary PUCCH group, the terms 'secondary cell', 'secondary cells', 'serving cell' and 'serving cells' in this clause refer to secondary cell, secondary cells (not including the PUCCH-SCell), serving cell, serving cells belonging to the secondary PUCCH group respectively unless stated otherwise. The term 'primary cell' in this clause refers to the PUCCH-SCell of the secondary PUCCH group.   A UE shall transmit Sounding Reference Symbol (SRS) on per serving cell SRS resources based on three trigger types:  - trigger type 0: higher layer signalling  - trigger type 1: DCI formats 0/0A/0B/4/4A/4B/1A/6-0A/6-1A for FDD, TDD, and frame structure type 3 and DCI formats 2B/2C/2D/3B for TDD, and frame structure type 3, and DCI format 7-0A/7-0B/7-1E/7-1F/7-1G for TDD if the UE is configured by higher layers for SRS triggering via DCI format 7-0A and has indicated the capability *srs-DCI7-Triggering-FS2-r15/ srs-DCI7-Triggering-FS2-r16* and the UE is configured for SRS triggering with *srs-DCI7-TriggeringConfig-r15/ srs-DCI7-Triggering-FS2-r16*.   * trigger type 2: DCI formats 0/4/1A/6-0A/6-1A for FDD and TDD, and DCI formats 2B/2C/2D/3B for TDD, and DCI format 7-0A/7-0B/7-1E/7-1F/7-1G for TDD if the UE is configured by higher layers for SRS triggering via DCI format 7-0A and has indicated the capability *srs-DCI7-Triggering-FS2-r16* and the UE is configured for SRS triggering with *srs-DCI7-TriggeringConfig-r16*.   A UE is not expected to be configured with SRS trigger type 0 on a LAA SCell.  In case both trigger type 0 and trigger type 1 SRS transmissions would occur in the same subframe in the same serving cell, the UE shall only transmit the trigger type 1 SRS transmission. This prioritization rule shall be applied before other prioritization rules defined in this subclause.  In case both trigger type 1 and trigger type 2 SRS transmissions would occur in the same subframe, the UE shall transmit both the trigger type1 and type 2 SRS transmissions.  If higher layer parameter *specialSubframePatterns-v1430* indicates *ssp10*, or if higher layer parameter *specialSubframePatterns-v1450* indicates *ssp10-CRS-LessDwPTS*, the UE shall assume for the purpose of determining that the special subframe configuration is that signalled by *specialSubframePatterns* (without suffix)*.*  A UE may be configured with SRS parameters for trigger type 0 and trigger type 1/2 on each serving cell. A BL/CE UE configured with CEModeB is not expected to be configured with SRS parameters for trigger type 0 and trigger type 1/2. The following SRS parameters are serving cell specific and semi-statically configurable by higher layers for trigger type 0 and for trigger type 1/2.  - Number of combs  as defined in Subclause 5.5.3.2 of [3] for trigger type 0 and each configuration of trigger type 1/2, if configured  - srs-UpPtsAdd: two or four additional SC-FDMA symbols in UpPTS as defined in [11] for trigger type 0 and trigger type 1, if configured  - Transmission comb , as defined in Subclause 5.5.3.2 of [3] for trigger type 0 and each configuration of trigger type 1/2  - Starting physical resource block assignment , as defined in Subclause 5.5.3.2 of [3] for trigger type 0 and each configuration of trigger type 1/2 for a serving cell that is not a LAA SCell. For a serving cell that is a LAA SCell, .  *- duration*: single or indefinite (until disabled), as defined in [11] for trigger type 0  *- srs-ConfigIndex* ISRS for SRS periodicity  and SRS subframe offset , as defined in Table 8.2-1 and Table 8.2-2 for trigger type 0 and SRS periodicity  and SRS subframe offset , as defined in Table 8.2-4 for trigger type 1 and Table 8.2-5 for trigger type 1/2 for a serving cell that is not a LAA SCell  - SRS bandwidth , as defined in Subclause 5.5.3.2 of [3] for trigger type 0 and each configuration of trigger type 1/2 for a serving cell that is not a LAA SCell. For a serving cell that is a LAA SCell, .  - Frequency hopping bandwidth, , as defined in Subclause 5.5.3.2 of [3] for trigger type 0 and each configuration of type 2  - Cyclic shift , as defined in Subclause 5.5.3.1 of [3] for trigger type 0 and each configuration of trigger type 1/2  - Number of antenna ports  for trigger type 0 and each configuration of trigger type 1/2  - SRS subframe for each configuration of trigger type 1 for a serving cell that is a LAA SCell and DCI format 4B   * Starting OFDM symbol and duration and repetition number as defined in Subclause 5.5.3.2.2 of [3] for each configuration of SRS trigger type 2.   < Unchanged parts are omitted>  For a serving cell that is not a LAA SCell, trigger type 1 SRS configuration of a UE in a serving cell for SRS periodicity,, and SRS subframe offset,, is defined in Table 8.2-4 and Table 8.2-5, for FDD and TDD serving cell, respectively; and trigger type 2 SRS configuration of a UE in a serving cell for SRS periodicity,, and SRS subframe offset,, is defined in Table 8.2-5, for TDD serving cell. The periodicity  of the SRS transmission is serving cell specific and is selected from the set {2, 5, 10} ms or subframes.  For the SRS periodicity  of 2 ms in TDD serving cell configured for PUSCH and/or PUCCH transmission, two SRS resources are configured in a half frame containing UL subframe(s) of the given serving cell. For the SRS periodicity  of 2 ms in TDD serving cell not configured for PUSCH/PUCCH transmission, two or more SRS resources are configured in a half frame containing UL subframe(s) of the given serving cell.  For TDD serving cell configured for PUSCH and/or PUCCH transmission, and a UE configured for type 1/2 triggered SRS transmission in serving cell *c* and configured with the parameter *srs-UpPtsAdd*, the UE is not expected to receive trigger type 1/2 SRS configurations with SRS periodicity  of 2 ms.  A UE configured for type 1/2 triggered SRS transmission in serving cell *c* and not configured with a carrier indicator field shall transmit SRS on serving cell *c* upon detection of a positive SRS request in PDCCH/EPDCCH/MPDCCH/SPDCCH scheduling PUSCH/PDSCH on serving cell *c*.  A UE configured for type 1/2 triggered SRS transmission in serving cell *c* and configured with a carrier indicator field shall transmit SRS on serving cell *c* upon detection of a positive SRS request in PDCCH/EPDCCH/SPDCCH scheduling PUSCH/PDSCH with the value of carrier indicator field corresponding to serving cell *c*.  For a serving cell that is not a LAA SCell, a non-BL/CE UE configured for type 1/2 triggered SRS transmission on serving cell *c* upon detection of a positive SRS request in subframe *n*, slot *2n* or slot *2n+1* of serving cell *c* shall commence SRS transmission in the first subframe satisfying , and  -  if the positive SRS request in PDCCH/SPDCCH with DCI format 7-0A/7-1A is detected in slot *2n* or slot *2n+1,* for TDD  *-* if the UE is configured with higher layer parameter *shortProcessingTime* and the corresponding PDCCH with CRC scrambled by C-RNTI with DCI format other than DCI format 7-0A/7-0B/7-1E/7-1F/7-1G is in the UE-specific search space*,*  *-* otherwise, and  for TDD serving cell *c* with  and for FDD serving cell *c*,  for TDD serving cell *c* with  where for FDD serving cell *c*  is the subframe index within the frame , for TDD serving cell *c*, if the UE is configured with the parameter *srs-UpPtsAdd* for trigger type 1,  is defined in Table 8.2-6; otherwise  is defined in Table 8.2-3. For a TDD serving cell not configured for PUSCH/PUCCH transmission and the positive SRS request detected in PDCCH/EPDCCH scheduling PDSCH and the UE configured with *soundingRS-FlexibleTiming-r14* by higher layer signalling, if the SRS transmission (including any interruption due to uplink or downlink RF retuning time [10]) in the first subframe  happens to overlap with a HARQ-ACK transmission for any serving cell, the UE shall commence SRS transmission in subframe *n + k + l*, where *l* = max( 5, ).  For a type 1/2 SRS triggered for more than one TDD serving cell in DCI format 3B and UE configured with more than 5 TDD serving cells without PUSCH/PUCCH transmission, the order of the triggered SRS transmission on the serving cells follow the order of the serving cells in the indicated set of serving cells configured by higher layers. For a type 1/2 SRS triggered for more than one TDD serving cell in DCI format 3B and UE configured with no more than 5 TDD serving cells without PUSCH/PUCCH transmission, the order of the triggered SRS transmission on the serving cells follow the order of the serving cells with type 1/2 SRS triggered in the DCI. The SRS resource for the *n*-th (*n*>=2) SRS transmission is determined such that it is the first SRS resource on or after the SRS resource for the (*n*-1)-th SRS transmission provided it does not collide with any previous SRS transmission triggered in the DCI format 3B, or interruption due to UL or DL RF retuning time [10].  For a serving cell *c* that is a LAA SCell, a UE configured for type 1/2 triggered SRS transmission on serving cell *c* upon detection of a positive SRS request in subframe *n* of serving cell *c* shall commence SRS transmission, conditioned on the channel access procedures described in subclause 4.2.1 of [13], in subframe , where   * corresponds to the scheduled PUSCH subframe determined in Subclause 8.0 if SRS is triggered in DCI format 0A/4A, * is determined from Table 8.2-0A and the corresponding scheduled PUSCH subframe determined in Subclause 8.0 if SRS is triggered in DCI format 0B, * where the value of *l* is determined from SRS subframe parameter for the indicated SRS parameter set in Table 8.1, is determined from the first scheduled PUSCH subframe determined in Subclause 8.0 and *N* is determined by the procedure in Subclause 8.0 if SRS is triggered in DCI format 4B, * where the value of *l* is determined by the SRS timing offset field in the corresponding DCI if SRS is triggered in DCI format 1A/2B/2C/2D according to Table 8.2-0B.   Table 8.2-0B:  for SRS trigger type 1/2 in DCI format 1A/2B/2C/2D   |  |  | | --- | --- | | Value of SRS timing offset field |  | | '000' | No type 1/2 SRS trigger | | '001' | 1 | | '010' | 2 | | '011' | 3 | | '100' | 4 | | '101' | 5 | | '110' | 6 | | '111' | 7 |   A BL/CE UE configured for type 1/2 triggered SRS transmission on serving cell *c* upon detection of a positive SRS request of serving cell *c* shall commence SRS transmission in the first subframe satisfying , where subframe *n* is the last subframe in which the DCI format 6-0A/6-1A with the positive SRS request is transmitted, and  for TDD serving cell *c* with  and for FDD serving cell *c*,  for TDD serving cell *c* with  where for FDD serving cell *c*  is the subframe index within the frame , for TDD serving cell *c* , if the UE is configured with the parameter *srs-UpPtsAdd* for trigger type 1,  is defined in Table 8.2-6; otherwise  is defined in Table 8.2-3.  A UE configured for type 1/2 triggered SRS transmission is not expected to receive type 1/2 SRS triggering events associated with different values of trigger type 1/2 SRS transmission parameters, as configured by higher layer signalling, for the same subframe and the same serving cell.  For a serving cell that is a LAA SCell, a UE configured for type 1 triggered SRS transmission is not expected to receive type 1 SRS triggering event in DCI format 0B associated with a subframe that is not scheduled for PUSCH transmission for the same serving cell.  For a serving cell that is an LAA SCell, if the uplink transmission in a subframe is ending in the end of symbol #3 or in the end of symbol #6, the UE shall not transmit SRS in that subframe.  A UE configured for type 2, type 1 or type 0 triggered SRS transmission and more than one TDD serving cell without PUSCH/PUCCH transmission is not expected to receive type 2, type 1 or type 0 SRS triggering events that can result in uplink transmissions beyond the UE's indicated uplink carrier aggregation capability included in the *UE-EUTRA-Capability* [12].  For TDD serving cell *c*, and a UE configured with *EIMTA-MainConfigServCell-r12* for a serving cell *c*, the UE shall not transmit SRS in a subframe of a radio frame that is indicated by the corresponding eIMTA-UL/DL-configuration as a downlink subframe.  A UE shall not transmit SRS whenever SRS and a PUSCH transmission corresponding to a Random Access Response Grant or a retransmission of the same transport block as part of the contention based random access procedure coincide in the same subframe.  A UE not configured with higher layer parameter *ul-STTI-Length* is not expected to be triggered with trigger type 2 SRS transmission in the same symbols as a PUSCH/PUCCH.  < Unchanged parts are omitted>  Table 8.2-4: UE Specific SRS Periodicity  and Subframe Offset Configuration   for trigger type 1, FDD   |  |  |  | | --- | --- | --- | | SRS Configuration Index  ISRS | SRS Periodicity   (ms) | SRS Subframe Offset | | 0 – 1 | 2 | ISRS | | 2 – 6 | 5 | ISRS – 2 | | 7 – 16 | 10 | ISRS – 7 | | 17 – 31 | reserved | reserved |   Table 8.2-5: UE Specific SRS Periodicity  and Subframe Offset Configuration   for trigger type 1/2, TDD   |  |  |  | | --- | --- | --- | | SRS Configuration Index  ISRS | SRS Periodicity   (ms) | SRS Subframe Offset | | 0 | reserved | reserved | | 1 | 2 | 0, 2 | | 2 | 2 | 1, 2 | | 3 | 2 | 0, 3 | | 4 | 2 | 1, 3 | | 5 | 2 | 0, 4 | | 6 | 2 | 1, 4 | | 7 | 2 | 2, 3 | | 8 | 2 | 2, 4 | | 9 | 2 | 3, 4 | | 10 – 14 | 5 | ISRS – 10 | | 15 – 24 | 10 | ISRS – 15 | | 25 – 31 | reserved | reserved |   < Unchanged parts are omitted> |

## Collision handling

Issue 5: Clarification of collision between additional SRS and PUSCH/PUCCH/PRACH in the same serving cell.

* As explained in [5], collision between PRACH and additional SRS needs to be handled separately because eNB cannot always know when UE transmits PRACH.
  + Proposal:

**The following text is included to the specification: *The UE shall not transmit trigger type 2 SRS whenever trigger type 2 SRS transmission and PRACH happen to coincide in the same subframe.***

* As explained in [7][8], for UE not capable of sPUSCH/sPUCCH, the current spec is not aligned with the intention of following RAN1 agreements:

**Agreement**

For the handling of collision of SRS and PUCCH/PUSCH/PRACH transmission for UEs not supporting sPUSCH/sPUCCH.

* UE is not expected to be triggered with SRS and PUCCH/PUSCH/PRACH on colliding subframes.
* As explained in [7], for UEs capable of sPUSCH/sPUCCH, propose to drop the additional SRS transmission in the overlapped symbol colliding with slot PUSCH/PUCCH in same serving cell.
* Proposal: Consider the following text proposal to TS 36.213

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| Text proposal to 36.213  Text proposal to 36.213  8.2 UE sounding procedure  < Unchanged parts are omitted>  A UE not configured with higher layer parameter *ul-STTI-Length* is not expected to be triggered with trigger type 2 SRS transmission in the same subframe as a PUSCH/PUCCH transmission in the same serving cell.  A UE configured with higher layer parameter *ul-STTI-Length* shall drop the trigger type 2 SRS transmission in the overlapped symbol when the trigger type 2 SRS transmission and slot PUSCH/PUCCH transmission happens to overlap in the same symbol and same serving cell.  < Unchanged parts are omitted> |

Issue 6: Collision between additional SRS and PUSCH/PUCCH in CA case.

* As explained in [5], collision handling between PUSCH/PUCCH and additional SRS may result in substantial inefficiency because trigger type 2 SRS transmission in a carrier prevents PUSCH/PUCCH transmission in the other carriers in the same subframe.
  + Proposal: **The text in the 36.213 is clarified with alt1 or alt2:**

**Alt1: *A UE not configured with higher layer parameter ul-STTI-Length is not expected to be triggered with trigger type 2 SRS transmission in the same symbols in the same serving cell as a PUSCH/PUCCH.***

**Alt2: *A UE not configured with higher layer parameter ul-STTI-Length is not expected to be triggered with trigger type 2 SRS transmission in the same symbols in any serving cell as a PUSCH/PUCCH.***

* As explained in [5], if collisions between additional SRS and PUSCH/PUCCH should not happen in any cell, then configuration of SCG can be problematic because in dual connectivity scheduling operations in MCG and SCG are assumed to be not coordinated.
  + Proposal: **Consider supporting trigger type 2 SRS only when SCG is not configured.**
* As in explained in [7], for the case that an additional SRS symbol happens to collide with PUSCH/PUCCH in different CCs with same band/TAG/CP, the UE should drop the additional SRS transmission in the overlapped symbol.
  + Proposal: endorse the following text proposal to 36.213

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| Text proposal to 36.213  8.2 UE sounding procedure  < Unchanged parts are omitted>  If a UE is not configured with multiple TAGs and the UE is not configured with the parameter *srs-UpPtsAdd* for trigger type 1 and the UE is not configured with trigger type 2 SRS transmission, or if a UE is not configured with multiple TAGs and the UE is not configured with more than one serving cell of different CPs and the UE is not configured with trigger type 2 SRS transmission, or if a UE is configured for PUSCH transmission in UpPTS and a SRS transmission overlaps with a PUSCH transmission on the same symbol in UpPTS within a TDD serving cell, the UE shall not transmit trigger type 0/1 SRS in a symbol whenever SRS and PUSCH transmissions happen to overlap in the same symbol, except when the SRS is on a TDD serving cell not configured for PUSCH/PUCCH transmission.  For the case when a trigger type 0/1 SRS transmission in a first serving cell happens to overlap in the same symbol as a PUSCH transmission in a second serving cell, and the first and second serving cells are in the same TAG, same band, and use the same cyclic prefix, the UE may drop the trigger type 0/1 SRS transmission.  For the case when a trigger type 2 SRS transmission in a first serving cell happens to overlap in the same symbol as the PUSCH/PUCCH transmission in a second serving cell, and the first and second serving cells are in the same TAG, same band, and use the same cyclic prefix, the UE may drop the trigger type 2 SRS transmission in the overlapped symbol.  For TDD serving cell, and UE not configured with additional SC-FDMA symbols in UpPTS, when one SC-FDMA symbol exists in UpPTS of the given serving cell, it can be used for SRS transmission, when two SC-FDMA symbols exist in UpPTS of the given serving cell, both can be used for SRS transmission and for trigger type 0 SRS both can be assigned to the same UE. For TDD serving cell, and if the UE is configured with two or four additional SC-FDMA symbols in UpPTS of the given serving cell, all can be used for SRS transmission and for trigger type 0 SRS at most two SC-FDMA symbols out of the configured additional SC-FDMA symbols in UpPTS can be assigned to the same UE, except for UE not configured for PUSCH/PUCCH transmission or for UE supporting *ce-srsEnhancement-r14,* where all can be assigned to the same UE. A UE is not expected to be configured with trigger type 2 SRS in UpPTS.  If a UE is not configured with multiple TAGs and the UE is not configured with the parameter *srs-UpPtsAdd* for trigger type 1 and the UE is not configured with trigger type 2 SRS transmission, or if a UE is not configured with multiple TAGs and the UE is not configured with more than one serving cell of different CPs and the UE is not configured with trigger type 2 SRS transmission, or if a UE is configured with multiple TAGs and type 0/1 SRS and PUCCH format 2/2a/2b happen to coincide in the same subframe in the same serving cell, except when the SRS is on a TDD serving cell not configured for PUSCH/PUCCH transmission,  - The UE shall not transmit type 0 triggered SRS whenever type 0 triggered SRS and PUCCH format 2/2a/2b transmissions happen to coincide in the same subframe;  - The UE shall not transmit type 1 triggered SRS whenever type 1 triggered SRS and PUCCH format 2a/2b or format 2 with HARQ-ACK transmissions happen to coincide in the same subframe;  - The UE shall not transmit PUCCH format 2 without HARQ-ACK whenever type 1 triggered SRS and PUCCH format 2 without HARQ-ACK transmissions happen to coincide in the same subframe  If a UE is not configured with multiple TAGs and the UE is not configured with the parameter *srs-UpPtsAdd* for trigger type 1 and the UE is not configured with trigger type 2 SRS transmission, or if a UE is not configured with multiple TAGs and the UE is not configured with more than one serving cell of different CPs and the UE is not configured with trigger type 2 SRS transmission, or if a UE is configured with multiple TAGs and trigger type 0/1 SRS and PUCCH happen to coincide in the same subframe/slot/subslot in the same serving cell, except when the SRS is on a TDD serving cell not configured for PUSCH/PUCCH transmission,  - The UE shall not transmit type 0/1 SRS whenever SRS transmission and PUCCH transmission carrying HARQ-ACK and/or positive SR happen to coincide in the same subframe/slot/subslot if the parameter *ackNackSRS-SimultaneousTransmission* is *FALSE*;  - For FDD-TDD and primary cell frame structure 1, the UE shall not transmit type 0/1 SRS in a symbol whenever SRS transmission and PUCCH transmission carrying HARQ-ACK and/or positive SR using shortened format as defined in Subclauses 5.4.1, 5.4.2A, 5.4.2B, 5.4.2C, and 5.4A of [3] happen to overlap in the same symbol if the parameter *ackNackSRS-SimultaneousTransmission* is *TRUE.*  - Unless otherwise prohibited, the UE shall transmit type 0/1 SRS whenever SRS transmission and PUCCH transmission carrying HARQ-ACK and/or positive SR using shortened format as defined in Subclauses 5.4.1, 5.4.2A, and 5.4A of [3] happen to coincide in the same subframe/slot/subslot if the parameter *ackNackSRS-SimultaneousTransmission* is *TRUE*.  If a UE is not configured with multiple TAGs and the UE is not configured with the parameter *srs-UpPtsAdd* for trigger type 1 and the UE is not configured with trigger type 2 SRS transmission, or if a UE is not configured with multiple TAGs and the UE is not configured with more than one serving cell of different CPs and the UE is not configured with trigger type 2 SRS transmission, the UE shall not transmit SRS whenever SRS transmission on any serving cells and PUCCH transmission carrying HARQ-ACK and/or positive SR using normal PUCCH format as defined in Subclauses 5.4.1, 5.4.2A, and 5.4A of [3] happen to coincide in the same subframe/slot/subslot.  In UpPTS, whenever SRS transmission instance overlaps with the PRACH region for preamble format 4 or exceeds the range of uplink system bandwidth configured in the serving cell, the UE shall not transmit SRS.  < Unchanged parts are omitted> |

* As explained in [7], the additional SRS transmission can be in the symbol 0~13 of a UL normal subframe, which may collide with subframe/slot/subslot PUSCH/PUCCH, or legacy/additional SRS in different CCs with multiple TAGs. If the total transmission power exceeds on any overlapped portion of the symbol, the UE shall drop the additional SRS transmission in the overlapped symbol.
  + Proposal: endorse the following text proposal to 36.213

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| Text proposal to 36.213  5.1.1.1 UE behaviour  < Unchanged parts are omitted>  If the UE is not configured with a SCG or a PUCCH-SCell, and  - If the UE is configured with multiple TAGs, and if the PUCCH/PUSCH transmission of the UE on subframe/slot/subslot  for a given serving cell in a TAG overlaps some portion of the first symbol of the PUSCH transmission on subframe/slot/subslot  for a different serving cell in another TAG the UE shall adjust its total transmission power to not exceed on any overlapped portion.  - If the UE is configured with multiple TAGs, and if the PUSCH transmission of the UE on subframe/slot/subslot  for a given serving cell in a TAG overlaps some portion of the first symbol of the PUCCH transmission on subframe/slot/subslot  for a different serving cell in another TAG the UE shall adjust its total transmission power to not exceed on any overlapped portion.  - If the UE is configured with multiple TAGs, and if the trigger type 0/1 SRS transmission of the UE in a symbol on subframe/slot/subslot  for a given serving cell in a TAG overlaps with the PUCCH/PUSCH transmission on subframe/slot/subslot or subframe/slot/subslot  for a different serving cell in the same or another TAG the UE shall drop trigger type 0/1 SRS if its total transmission power exceeds on any overlapped portion of the symbol.  - If the UE is configured with multiple TAGs, and if the trigger type 2 SRS transmission of the UE in a symbol on subframe/slot/subslot for a given serving cell in a TAG overlaps with the PUCCH/PUSCH transmission on subframe/slot/subslot , or for a different serving cell in the same or another TAG, the UE shall drop the trigger type 2 SRS in the overlapped symbol if its total transmission power exceeds on any overlapped portion of the symbol.  - If the UE is configured with multiple TAGs and more than 2 serving cells, and if the trigger type 0/1 SRS transmission of the UE in a symbol on subframe/slot/subslot  for a given serving cell overlaps with the SRS transmission on subframe/slot/subslot  for a different serving cell(s) and with PUSCH/PUCCH transmission on subframe/slot/subslot or subframe/slot/subslot  for another serving cell(s) the UE shall drop the trigger type 0/1 SRS transmissions if the total transmission power exceeds on any overlapped portion of the symbol.  - If the UE is configured with multiple TAGs and more than 2 serving cells, and if the trigger type 2 SRS transmission of the UE in a symbol on subframe/slot/subslot for a given serving cell overlaps with the SRS transmission on subframe/slot/subslot , or for a different serving cell(s) and with PUSCH/PUCCH transmission on subframe/slot/subslot , or for another serving cell(s), the UE shall drop the trigger type 2 SRS transmission in the overlapped symbol if the total transmission power exceeds on any overlapped portion of the symbol.  - If the UE is configured with multiple TAGs, the UE shall, when requested by higher layers, to transmit PRACH in a secondary serving cell in parallel with SRS transmission in a symbol on a subframe of a different serving cell belonging to a different TAG, drop SRS if the total transmission power exceeds on any overlapped portion in the symbol.  - If the UE is configured with multiple TAGs, the UE shall, when requested by higher layers, to transmit PRACH in a secondary serving cell in parallel with PUSCH/PUCCH in a different serving cell belonging to a different TAG, adjust the transmission power of PUSCH/PUCCH so that its total transmission power does not exceed on the overlapped portion.  < Unchanged parts are omitted> |

Issue 7: PUSCH rate matching for additional SRS.

* As explained in [7], PUSCH rate matching is only applied to legacy SRS (type 0/1 SRS), but not applied to additional SRS (type 2 SRS).
* Proposal: endorsing the following text proposal to 36.211

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| Text proposal to 36.211  < Unchanged parts are omitted> 5.3.4 Mapping to physical resources For each antenna port  used for transmission of the PUSCH in a subframe the block of complex-valued symbols  shall be multiplied with the amplitude scaling factor  in order to conform to the transmit power specified in clause 5.1.1.1 in 3GPP TS 36.213 [4], and mapped in sequence starting with  to physical resource blocks on antenna port  and assigned for transmission of PUSCH. The relation between the index  and the antenna port number  is given by Table 5.2.1-1. The mapping to resource elements  corresponding to the physical resource blocks assigned for transmission shall fulfil the following criteria:  - not used for transmission of reference signals, and  - not part of the last SC-FDMA symbol in a subframe, if the UE transmits SRS in the same subframe in the same serving cell, and  - not part of the last SC-FDMA symbol in a subframe configured with cell-specific SRS for non-BL/CE UEs and BL/CE UEs in CEModeA, if the PUSCH transmission partly or fully overlaps with the cell-specific SRS bandwidth, and  - not part of an SC-FDMA symbol reserved for possible SRS trigger type 1 transmission as specified in [4] in a UE-specific aperiodic SRS subframe in the same serving cell, and  - not part of an SC-FDMA symbol reserved for possible SRS trigger type 1 transmission as specified in [4] in a UE-specific periodic SRS subframe in the same serving cell when the UE is configured with multiple TAGs  - not part of the first SC-FDMA symbol in a subframe if the associated DCI indicates PUSCH starting position '01', '10', or '11' and does not indicate PUSCH mode 2.  - not part of the first SC-FDMA symbol in the second slot in a subframe if the associated DCI indicates PUSCH starting position '01', '10', or '11' and PUSCH mode 2.  < Unchanged parts are omitted> |

Issue 8: PUCCH rate matching/puncturing for additional SRS.

* As explained in [7], PUCCH rate matching/punturing is only applied to legacy SRS (trigger type 0/1 SRS) in the last symbol of a UL normal subframe, but not applied to additional SRS (trigger type 2 SRS).
* Proposal: endorsing the following text proposal to 36.213

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| Text proposal to 36.213  8.2 UE sounding procedure  < Unchanged parts are omitted>  The parameter *ackNackSRS-SimultaneousTransmission* provided by higher layers determines if a UE is configured to support the transmission of HARQ-ACK on PUCCH and SRS in one subframe/slot/subslot. If it is configured to support the transmission of HARQ-ACK on PUCCH and SRS in one subframe/slot/subslot, then in the cell specific SRS subframes of the primary cell in case of subframe-PUCCH or in the last slot/subslot of the cell specific SRS subframes of the primary cell in case of slot/subslot-PUCCH,  - if the UE transmits PUCCH format 1/1a/1b/3, the UE shall transmit HARQ-ACK and SR using the shortened PUCCH format as defined in Subclauses 5.4.1, 5.4.2A, and 5.4A.3 of [3], where the HARQ-ACK or the SR symbol corresponding to the SRS location in the last symbol of the subframe is punctured.  - If the UE transmits PUCCH format 4/5 partly or fully overlapping with the cell specific SRS bandwidth in the cell specific SRS subframes of the primary cell, then UE shall transmit UCI using the shortened PUCCH format as defined in Subclauses 5.4.2B, 5.4.2C, and 5.4A.4 of [3].  For PUCCH format 1/1a/1b/3, this shortened PUCCH format shall be used in a cell specific SRS subframe or the last slot/subslot of the cell specific SRS subframe of the primary cell even if the UE does not transmit SRS in that subframe. For PUCCH format 4/5, this shortened PUCCH format shall be used if the PUCCH transmission partly or fully overlaps with the cell-specific SRS bandwidth in the cell specific SRS subframes or the last slot/subslot of the cell specific SRS subframes of the primary cell even if the UE does not transmit SRS in that subframe, or if the UE transmits SRS in the last symbol of that subframe even if the PUCCH format 4/5 does not partly or fully overlap with the cell-specific SRS. The cell specific SRS subframes are defined in Subclause 5.5.3.3 of [3]. Otherwise, the UE shall use the normal PUCCH format 1/1a/1b as defined in Subclause 5.4.1, and 5.4A.2 of [3] or normal PUCCH format 3 as defined in Subclause 5.4.2A, and 5.4A.3 or normal PUCCH format 4 as defined in Subclause 5.4.2B, and 5.4A.4 or normal PUCCH format 5 as defined in Subclause 5.4.2C of [3].  < Unchanged parts are omitted> |

## Other

Issue 9: Term alignment between specs.

* As explained in [2][3][4][8], the term used in 36.211 is additional SRS symbol while in 36.213 it’s trigger type 2. But it is not specified that trigger type 2 SRS corresponds to additional SRS, and it should be clarified that trigger type 0 SRS and trigger type 1 SRS correspond to periodic SRS and aperiodic SRS of basic SRS respectively.
* Proposal: Endorse one of the following text proposal

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| Text proposal to 36.213  **<Unchanged parts are omitted>**  **8.2 UE sounding procedure**  If the UE is configured with a PUCCH-SCell, the UE shall apply the procedures described in this clause for both primary PUCCH group and secondary PUCCH group unless stated otherwise   * When the procedures are applied for the primary PUCCH group, the terms 'secondary cell', 'secondary cells', 'serving cell', and 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell or serving cells belonging to the primary PUCCH group respectively unless stated otherwise. * When the procedures are applied for secondary PUCCH group, the terms 'secondary cell', 'secondary cells', 'serving cell' and 'serving cells' in this clause refer to secondary cell, secondary cells (not including the PUCCH-SCell), serving cell, serving cells belonging to the secondary PUCCH group respectively unless stated otherwise. The term 'primary cell' in this clause refers to the PUCCH-SCell of the secondary PUCCH group.   A UE shall transmit Sounding Reference Symbol (SRS) on per serving cell SRS resources based on three trigger types:  - trigger type 0: higher layer signalling  - trigger type 1: triggering of basic sounding reference signals as defined in subclause 5.5.3 of [3], by DCI formats 0/0A/0B/4/4A/4B/1A/6-0A/6-1A for FDD, TDD, and frame structure type 3 and DCI formats 2B/2C/2D/3B for TDD, and frame structure type 3, and DCI format 7-0A/7-0B/7-1E/7-1F/7-1G for TDD if the UE is configured by higher layers for SRS triggering via DCI format 7-0A and has indicated the capability *srs-DCI7-Triggering-FS2*  and the UE is configured for SRS triggering with *srs-DCI7-TriggeringConfig* .   * trigger type 2: triggering of additional sounding reference signals as defined in subclause 5.5.3 of [3], by DCI formats 0/4/1A/6-0A/6-1A for FDD and TDD, and DCI formats 2B/2C/2D/3B for TDD, and DCI format 7-0A/7-0B/7-1E/7-1F/7-1G for TDD if the UE is configured by higher layers for SRS triggering via DCI format 7-0A and has indicated the capability *srs-DCI7-Triggering-FS2* and the UE is configured for SRS triggering with *srs-DCI7-TriggeringConfig*.   **<Unchanged parts are omitted>** |

Or

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| Text proposal to 36.213  8.2 UE sounding procedure  If the UE is configured with a PUCCH-SCell, the UE shall apply the procedures described in this clause for both primary PUCCH group and secondary PUCCH group unless stated otherwise   * When the procedures are applied for the primary PUCCH group, the terms 'secondary cell', 'secondary cells', 'serving cell', and 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell or serving cells belonging to the primary PUCCH group respectively unless stated otherwise. * When the procedures are applied for secondary PUCCH group, the terms 'secondary cell', 'secondary cells', 'serving cell' and 'serving cells' in this clause refer to secondary cell, secondary cells (not including the PUCCH-SCell), serving cell, serving cells belonging to the secondary PUCCH group respectively unless stated otherwise. The term 'primary cell' in this clause refers to the PUCCH-SCell of the secondary PUCCH group.   A UE shall transmit Sounding Reference Symbol (SRS) on per serving cell SRS resources based on three trigger types:  - trigger type 0: higher layer signalling  - trigger type 1: DCI formats 0/0A/0B/4/4A/4B/1A/6-0A/6-1A for FDD, TDD, and frame structure type 3 and DCI formats 2B/2C/2D/3B for TDD, and frame structure type 3, and DCI format 7-0A/7-0B/7-1E/7-1F/7-1G for TDD if the UE is configured by higher layers for SRS triggering via DCI format 7-0A and has indicated the capability *srs-DCI7-Triggering-FS2-r15/ srs-DCI7-Triggering-FS2-r16* and the UE is configured for SRS triggering with *srs-DCI7-TriggeringConfig-r15/ srs-DCI7-Triggering-FS2-r16*.   * trigger type 2: DCI formats 0/4/1A/6-0A/6-1A for FDD and TDD, and DCI formats 2B/2C/2D/3B for TDD, and DCI format 7-0A/7-0B/7-1E/7-1F/7-1G for TDD if the UE is configured by higher layers for SRS triggering via DCI format 7-0A and has indicated the capability *srs-DCI7-Triggering-FS2-r16* and the UE is configured for SRS triggering with *srs-DCI7-TriggeringConfig-r16*.   Trigger type 0 and type 1 SRS correspond to periodic SRS and aperiodic SRS of basic SRS respectively in Subclause 5.5.3 of [1]. Trigger type 2 SRS corresponds to additional SRS in Subclause 5.5.3 of [1]. |

Or

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| Text proposal to 36.211  **---- Unchanged parts are omitted ----**  5.5.3 Sounding reference signal  Two types of sounding reference signals can be configured:  - basic sounding reference signal, supporting periodic or aperiodic transmission  - **additional sounding reference signal**, supporting aperiodic transmission only  Basic SRS corresponds to either SRS trigger type 0 or type 1 in 8.2 of [4]. Additional SRS corresponds to SRS trigger type 2 in 8.2 of [4].  **---- Unchanged parts are omitted ----** |

Or

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| -------------------------- Start of proposed TP1 for TS 36.211 ------------------------------------  5.5.1.5 Determining virtual cell identity for sequence generation  The definition of  depends on the type of transmission.  Transmissions associated with PUSCH:  -  if no value for  is configured by higher layers or if the PUSCH transmission corresponds to a Random Access Response Grant or a retransmission of the same transport block as part of the contention based random access procedure,  -  otherwise.  Transmissions associated with SPUCCH/PUCCH:  -  if no value for  is configured by higher layers,  -  otherwise.  ~~Basic s~~Sounding reference signal~~s~~ transmissions of types 0 and 1 as defined in 8.2 of [4]:  - if the higher-layer parameters *nSRS-Identity-Legacy* and *nSRS-Identity* both are configured, where equals the higher-layer parameter *nSRS-Identity*  - otherwise.  ~~Additional s~~Sounding reference signal~~s~~ transmissions of type 2 as defined in 8.2 of [4]:  - if no value for is configured by the higher-layer parameter *nSRS-Identity*  - otherwise.  ----------------------------------------------- Unchanged text omitted -------------------------------------------  5.5.3 Sounding reference signal  Three types of sounding reference signals can be configured as defined in 8.2 of [4]: SRS trigger type 0, SRS trigger type 1, and SRS trigger type 2.  ~~Two types of sounding reference signals can be configured:~~  ~~- basic sounding reference signal, supporting periodic or aperiodic transmission~~  ~~- additional sounding reference signal, supporting aperiodic transmission only~~  5.5.3.1 Sequence generation  5.5.3.1.1 Sequence generation for SRS trigger types 0 and 1 ~~basic SRS~~  The sounding reference signal sequence  is defined by clause 5.5.1, where  is the sequence-group number defined in clause 5.5.1.3,  is the base sequence number defined in clause 5.5.1.4, and . The cyclic shift  of the sounding reference signal is given as  ,  where  is configured separately for periodic and each configuration of aperiodic sounding by the higher-layer parameters *cyclicShift* and *cyclicShift-ap*, respectively, for each UE and  is the number of antenna ports used for sounding reference signal transmission. The parameter  if  , otherwise . The parameter  is given by the higher layer parameter *transmissionCombNum* if configured, otherwise .  5.5.3.1.2 Sequence generation for SRS trigger type 2 ~~additional SRS~~  The sounding reference signal is defined by clause 5.5.3.1.1 with the following exceptions  - is given by the higher-layer parameter *additionalSRS-cyclicShift*  - is given by the higher-layer parameter *additionalSRS-AntennaPort*  - is given by the higher-layer parameter *additionalSRS-transmissionComb*  - the function in clause 5.5.1.3 is given by  where is the OFDM symbol index within the slot and is the number of OFDM symbols per slot  - the function in clause 5.5.1.4 is given by  5.5.3.2 Mapping to physical resources  5.5.3.2.1 Mapping to physical resources for SRS trigger types 0 and 1 ~~basic SRS~~  The sequence shall be multiplied with the amplitude scaling factor  in order to conform to the transmit power  specified in clause 5.1.3.1 in 3GPP TS 36.213 [4], and mapped in sequence starting with  to resource elements  on antenna port  according to    ----------------------------------------------- Unchanged text omitted -------------------------------------------  5.5.3.2.2 Mapping to physical resources for SRS trigger type 2 ~~additional SRS~~  An ~~additional~~ SRS of trigger type 2 spans one or more OFDM symbols in the time domain, where  - the starting OFDM symbol within the subframe is given by the higher-layer parameter *additionalSRS-startPos*;  - the duration in number of OFDM symbols, including potential guard symbols, is given by the higher-layer parameter *additionalSRS-duration*;  Mapping to physical resources shall be done according to clause 5.5.3.2.1 with the following exceptions:  - frequency hopping between OFDM symbols is supported and if a UE is configured by higher layer parameter *additionalSRS-GuardSymbolFH*, a guard symbol is added between every frequency hop;  - where is the index of the OFDM symbol number carrying ~~additional~~ SRS of trigger type 2 within the subframe not counting guard symbol(s), and is the repetition factor given by the higher-layer parameter *additionalSRS-RepNum*;  - is given by the higher-layer parameter *additionalSRS-Bandwidth*;  - is given by the higher-layer parameter *additionalSRS-HoppingBandwidth*;  - is the number of frequency hops for ~~additional~~ SRS of trigger type 2, derived from if antenna switching is not configured for ~~additional~~ SRS of trigger type 2, and from if antenna switching is configured for ~~additional~~ SRS of trigger type 2, where is the repetition factor given by the higher-layer parameter *additionalSRS-RepNum*, is the number of antenna switches for ~~additional~~ SRS of trigger type 2 defined in 8.2 of [4], is the guard-symbol configuration for antenna switching given by the higher-layer parameter *additionalSRS-GuardSymbolAS*, is the guard symbol configuration for frequency hopping given by the higher-layer parameter *additionalSRS-GuardSymbolFH*, and is given by the higher-layer parameter *additionalSRS-duration*;  - is given by the higher-layer parameter *freqDomainPosition-additionalSRS*;  - is given by the higher-layer parameter *additionalSRS-AntennaPort*;  - is given by the higher-layer parameter *additionalSRS-cyclicShift*;  - is given by the higher-layer parameter *additionalSRS-transmissionCombNum*;  - is given by the higher-layer parameter *additionalSRS-transmissionComb*.  ------------------------------------------- End of proposed TP 1 ---------------------------------------------------- |

Issue 10: Aligning the higher layer parameters for virtual cell ID.

* As explained in [3], high layer parameters *srs-VirtualCellID* and *srs-VirtualCellID-AllSRS* are introduced, which are not aligned with the name of *nSRS-Identity* and *nSRS-Identity-Legacy* in TS 36.211
* Proposal: The name of *nSRS-Identity* and *nSRS-Identity-Legacy* in TS 36.211 should be replaced with *srs-VirtualCellID* and *srs-VirtualCellID-AllSRS.*

Issue 11: Typos for power control in 36.213.

* As explained in [4], there are several typos in 36.213 for power control.
* Proposal: Endorse the following text proposal to TS 36.213

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| Text proposal to 36.213  **---- Unchanged parts are omitted ----**  5.1.3 Sounding Reference Symbol (SRS)  5.1.3.1 UE behaviour  The setting of the UE Transmit power for the SRS transmitted on subframe *i* for serving cell is defined by:  for SRS transmission given trigger type 2 or for serving cell with frame structure type 2, and not configured for PUSCH/PUCCH transmission  [dBm]  otherwise  [dBm]  where  - is the configured UE transmit power defined in [6] in subframe *i* for serving cell .  - is semi-statically configured by higher layers for *m=0* and *m=1* for serving cell . For SRS transmission given trigger type 0 then *m=0* and for SRS transmission given trigger type 1 then *m=1*.  - is the bandwidth of the SRS transmission in subframe *i* for serving cell expressed in number of resource blocks.  - is the current PUSCH power control adjustment state for serving cell , see Subclause 5.1.1.1.  - and are parameters as defined in Subclause 5.1.1.1 for subframe , where .  - is the higher layer parameter *alpha-SRS* for SRS transmission given trigger type 0, 1, or is the higher layer parameter *alpha-additionalSRS* for SRS transmission given trigger type 2, configured by higher layers for serving cell .  - is a parameter composed of the sum of a component which is *p0-Nominal-PeriodicSRS,* *p0-Nominal-AperiodicSRS*, or *p0\_Nominal\_AdditionalSRS* provided from higher layers for *m=0,* *1* or *2* respectively, and a component which is *p0-UE-PeriodicSRS,* *p0-UE-AperiodicSRS*, or *p0-Nominal-AdditionalSRS* provided by higher layers for *m=0,* *1* or *2* respectively, for serving cell . For SRS transmission given trigger type 0 then *m=0* and for SRS transmission given trigger type 1 then *m=1* and for SRS transmission given trigger type 2 then *m=2*.  **---- Unchanged parts are omitted ----** |

Issue 12: UL SC-FDMA symbol for additional SRS.

* As explained in [7], a SC-FDMA symbol instead of an OFDM symbol is used for a UL symbol.
* Proposal: Endorse the following text proposal to TS 36.211 and 36.213

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| Text proposal to 36.211  < Unchanged parts are omitted>  5.5.3.1.2 Sequence generation for additional SRS  The sounding reference signal is defined by clause 5.5.3.1.1 with the following exceptions  - is given by the higher-layer parameter *additionalSRS-cyclicShift*  - is given by the higher-layer parameter *additionalSRS-AntennaPort*  - is given by the higher-layer parameter *additionalSRS-transmissionComb*  - the function in clause 5.5.1.3 is given by  where is the SC-FDMA symbol index within the slot and is the number of SC-FDMA symbols per slot  - the function in clause 5.5.1.4 is given by  < Unchanged parts are omitted>  5.5.3.2.2 Mapping to physical resources for additional SRS  An additional SRS spans one or more SC-FDMA symbols in the time domain, where  - the starting SC-FDMA symbol within the subframe is given by the higher-layer parameter *additionalSRS-startPos*;  - the duration in number of SC-FDMA symbols, including potential guard symbols, is given by the higher-layer parameter *additionalSRS-duration*;  Mapping to physical resources shall be done according to clause 5.5.3.2.1 with the following exceptions:  - frequency hopping between SC-FDMA symbols is supported and if a UE is configured by higher layer parameter *additionalSRS-GuardSymbolFH*, a guard symbol is added between every frequency hop;  - antenna switching within a subframe is supported and if a UE is configured by higher layer parameter *additionalSRS-GuardSymbolAS*, a guard symbol is added between every antenna switching;  - where is the index of the SC-FDMA symbol number carrying additional SRS within the subframe not counting guard symbol(s), and is the repetition factor given by the higher-layer parameter *additionalSRS-RepNum*;  < Unchanged parts are omitted> |

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| Text proposal to 36.213  8.2 UE sounding procedure  < Unchanged parts are omitted>  - SRS subframe for each configuration of trigger type 1 for a serving cell that is a LAA SCell and DCI format 4B   * Starting SC-FDMAsymbol and duration and repetition number as defined in Subclause 5.5.3.2.2 of [3] for each configuration of SRS trigger type 2.   < Unchanged parts are omitted> |

# Summary

FL’s view on the issues that are prioritized for discussion in this e-meeting are as following:

* Collision of additional SRS and PUSCH/PUCCH/PRACH
  + - Issues 5, 6, 7, 8
* Term alignment between specs
  + - Issue 9
* Clarifications on transmission pattern or restrictions
  + - Issues 1, 2
* Clarifications of transmission/configuration of legacy/additional SRS.
  + - Issues 3, 4

Issues 10, 11 and 12 are considered to be editorial.

# References

1. R1-1913596, “RAN1 agreements for DL MIMO efficiency enhancements for LTE”, Huawei, Reno, USA, November 2019.
2. R1-2001573 Corrections on additional SRS symbols Huawei, HiSilicon
3. R1-2001593 Maintenance of additional SRS symbols ZTE
4. R1-2001910 Text proposals on additional SRS symbols LG Electronics
5. R1-2001945 Remaining details of additional SRS symbols Nokia, Nokia Shanghai Bell
6. R1-2001981 Corrections to additional SRS Intel Corporation
7. R1-2002178 Additional SRS symbols Qualcomm Incorporated
8. R1-2002486 Maintenance on additional SRS symbols Ericsson