**3GPP TSG RAN WG1 #110 R1-220xxxx**

**Toulouse, France, August 22nd – 26th, 2022**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **38.214** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **17.2.0** |  |
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| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)*** *on using this form: comprehensive instructions can be found at <http://www.3gpp.org/Change-Requests>.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Draft CR on SRS enhancement in TS 38.214 |
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| ***Source to WG:*** | Moderator (ZTE), ZTE |
| ***Source to TSG:*** | R1 |
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| ***Work item code:*** | NR\_feMIMO-Core |  | ***Date:*** | 2022-8-12 |
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| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | First, there is the following agreement in RAN1#106b

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| **Agreement**Bit width of SOI depends on the maximum number of “t” values configured for any of the aperiodic SRS resource sets* The SOI field is 0 bit if the maximum number of ‘t’ values is one
* If at least one resource set has “t” configured
	+ For the resource sets with “t” value configured, each of them is configured with K values of “t”, where 1<=K<=4
	+ t=0 applies for the resource set(s) without “t” configured in RRC
* If none of the resource sets is configured with “t” values, follow Rel-15 approach to determine slot offset
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But in current specification, t=0 applies for each SRS resource set when there is at least one SRS resource set without ‘t’ configured in RRC. It doesn’t match above agreement and it may lead a useless configuration for ‘t’ for another SRS resource set. In addition, the wording ‘otherwise’ in the section about the case where none of the resource sets is configured with “t” values is controversial, because that there are two conditions before the ‘otherwise’. Then, from spec perspective, it is ambiguous about what is the exact condition corresponding to the ‘otherwise’, i.e., the case where at least one of the resource sets is configured with “t” values and/or the case where the UE is not configured with ca-SlotOffset for at least one of the triggered cell and triggering cell.Finally, some editorial issues are corrected accordingly.  |
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| ***Summary of change:*** | Clarify description for available slot offset and condition for AP-SRS timeline (i.e., in the case that the UE is not configured with *ca-SlotOffset* for both the triggered and triggering cell).  |
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| ***Consequences if not approved:*** | It will lead misalignement for AP-SRS timeline between gNB and UE sides. |
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| ***Clauses affected:*** | 6.2.1 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | **Isolated impact analysis:**This is just a correction, so there is no isolated impact. |
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| ***This CR's revision history:*** | This is the first version for this CR. |

6.2.1 UE sounding procedure

**<Unchanged parts are omitted>**

The following SRS parameters are semi-statically configurable by higher layer parameter *SRS-Resource* or *SRS-PosResource*.

- *srs-ResourceId* or *SRS-PosResourceId* determines SRS resource configuration identity.

- Number of SRS ports, as defined by the higher layer parameter *nrofSRS-Ports* and described in clause 6.4.1.4 of [4, TS 38.211]. If not configured, *nrofSRS-Ports* is 1.

*-* Time domain behaviour of SRS resource configuration as indicated by the higher layer parameter *resourceType*, which may be periodic, semi-persistent, aperiodic SRS transmission as defined in clause 6.4.1.4 of [4, TS 38.211].

- Slot level periodicity and slot level offset as defined by the higher layer parameters *periodicityAndOffset-p* or *periodicityAndOffset-sp* for an SRS resource of type periodic or semi-persistent. The UE is not expected to be configured with SRS resources in the same SRS resource set *SRS-ResourceSet* or *SRS-PosResourceSet* with different slot level periodicities. For an *SRS-ResourceSet* configured with higher layer parameter *resourceType* set to 'aperiodic', a slot level offset is defined by the higher layer parameter *slotOffset.* For an *SRS-ResourceSet* configured with higher layer parameter *resourceType* set to 'aperiodic', a list of zero or up to four different available slot offset values from the reference slot *n* + *k* to the slot where the aperiodic SRS resource set is transmitted where *n* is the slot with triggering DCI and *k* is *SlotOffset,* can be configured by the higher layer parameter *AvailableSlotOffset.* The parameter *AvailableSlotOffset* can be configured up to 4 different values*.* For an *SRS-PosResourceSet* configured with higher layer parameter r*esourceType* set to 'aperiodic', the slot level offset is defined by the higher layer parameter *slotOffset* for each SRS resource.

- Number of OFDM symbols in the SRS resource, starting OFDM symbol of the SRS resource within a slot including repetition factor R as defined by the higher layer parameter *resourceMapping* and described in clause 6.4.1.4 of [4, TS 38.211]. If *R* is not configured, then *R* is equal to the number of OFDM symbols in the SRS resource.

**<Unchanged parts are omitted>**

For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'aperiodic':

- the UE receives a configuration of SRS resource sets,

- the UE receives a downlink DCI, a group common DCI, or an uplink DCI based command where a codepoint of the DCI may trigger one or more SRS resource set(s). For SRS in a resource set with usage set to 'codebook' or 'antennaSwitching', the minimal time interval between the last symbol of the PDCCH triggering the aperiodic SRS transmission and the first symbol of SRS resource is *N2*  symbols and an additional time duration *Tswitch*. Otherwise, the minimal time interval between the last symbol of the PDCCH triggering the aperiodic SRS transmission and the first symbol of SRS resource is *N2* +14 symbols and an additional time duration *Tswitch*. The minimal time interval unit of OFDM symbol is counted based on the minimum subcarrier spacing given by min(*µPDCCH, µUL*) where *µUL* is given by min(*µUL,carrier1, µUL,carrier2, µSRS*) when the UE is configured with the higher layer parameter *uplinkTxSwitchingOption* set to 'dualUL' for uplink carrier aggregation, and by *µSRS*otherwise. *µSRS* and *µPDCCH*are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively.

- *Tswitch*, *µUL,carrier1* and *µUL,carrier2* are defined in clause 6.4.

- When UE reporting *[Triggering SRS* only in DCI 0\_1/0\_2*],* the UE can be indicated with DCI 0\_1 and 0\_2 to trigger aperiodic SRS without data and without CSI as described in clause 7.3.1.1 of TS38.212. Otherwise, except for DCI format 0\_1/0\_2 with CRC scrambled by SP-CSI-RNTI, a UE is not expected to receive a DCI format 0\_1/0\_2 with UL-SCH indicator of "0" and CSI request of all zero(s) as described in clause 7.3.1.1 of [5, TS 38.212].

- If the UE receives the DCI triggering aperiodic SRS in slot *n* and at least one resource set is configured with parameter *availableSlotOffset* across all configured BWPs in a component carrier except when SRS is configured with the higher layer parameter *SRS-PosResource*,

- If ca-*SlotOffset* is configured, the UE transmits aperiodic SRS in each of the triggered SRS resource set(s) in the (*t* + 1)-th available slot counting from slot ,

- otherwise the UE transmits aperiodic SRS in each of the triggered SRS resource set(s) in the (*t* + 1)-th available slot counting from slot $\left⌊n⋅\frac{2^{μ\_{SRS}}}{2^{μ\_{PDCCH}}}\right⌋+k$, where

*- k* is configured via higher layer parameter *slotOffset* for each triggered SRS resources set and is based on the subcarrier spacing of the triggered SRS transmission, *µSRS* and *µPDCCH* are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command, respectively;

*-* $N\_{slot, offset, PDCCH}^{CA}$ and $μ\_{offset,PDCCH}$ are the $N\_{slot, offset}^{CA}$ and the, respectively, which are determined by higher-layer configured *ca-SlotOffset* for the cell receiving the PDCCH, $N\_{slot, offset, SRS}^{CA}$ and $μ\_{offset,SRS}$ are the $N\_{slot, offset}^{CA}$ and the, respectively, which are determined by higher-layer configured *ca-SlotOffset* for the cell transmitting the SRS, as defined in [4, TS 38.211] clause 4.5.

- An available slot is a slot satisfying there are UL or flexible symbol(s) for the time-domain location(s) for all the SRS resources in the resource set and it satisfies UE capability on the minimum timing requirement between triggering PDCCH and all the SRS resources in the resource set. From the first symbol carrying the SRS request DCI to the last symbol of the triggered SRS resource set, UE does not expect to receive SFI indication, UL cancellation indication or dynamic scheduling of DL channel/signal(s) on flexible symbol(s) that may change the determination of available slot.

*- t* is configured via higher layer parameter *availableSlotOffset* with up to four different valuesfor each triggered SRS resources set and is based on the subcarrier spacing of the triggered SRS transmission. When one or more SRS resource sets across all configured BWPs in a component carrier are configured, and at least one resource set is configured with *availableSlotOffset* parameter of more than one values, the indicated value of *availableSlotOffset* is indicated by SOI field in DCI scheduling PUSCH/PDSCH and DCI 0\_1/0\_2 without data and without CSI request described in [5, TS 38.212]. The UE shall apply indicated value of *availableSlotOffset* set specificallyfor those sets with configured *availableSlotOffset* parameter. When one or more SRS resource sets across all configured BWPs in a component carrier are configured and at least one resource set is configured with *availableSlotOffset* parameter, and the *availableSlotOffset* parameter for each SRS resource set has only one value, the UE shall apply the configured value of *availableSlotOffset* specificallyfor those sets with configured *availableSlotOffset* parameter. For SRS resource set configured with *availableSlotOffset* parameter, each of resource set is configured with *K* values of *availableSlotOffset* parameter. For an SRS resource set configured without *availableSlotOffset* parameter, *t* = 0 is applied for the SRS resource set.

- If the UE receives the DCI triggering aperiodic SRS in slot *n* and none of the resource sets is configured with parameter *availableSlotOffset* across all configured BWPs in a component carrier, and if the UE is configured with *ca-SlotOffset* for at least one of the triggered and triggering cell, except when SRS is configured with the higher layer parameter *SRS-PosResource*, the UE transmits aperiodic SRS in each of the triggered SRS resource set(s) in slot , otherwise if the UE is not configured with *ca-SlotOffset* for both the triggered and triggering cell , the UE transmits aperiodic SRS in each of the triggered resource set(s) in slot $K\_{s}=\left⌊n⋅\frac{2^{μ\_{SRS}}}{2^{μ\_{PDCCH}}}\right⌋+k+K\_{offset}⋅\frac{2^{μ\_{SRS}}}{2^{μ\_{K\_{offset}}}}$, where $K\_{offset}$is a parameter configured by higher layer as specified in clause 4.2 of [6 TS 38.213], and where

*- k* is configured via higher layer parameter *slotOffset* for each triggered SRS resources set and is based on the subcarrier spacing of the triggered SRS transmission, *µSRS* and *µPDCCH* are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively;

*-* $μ\_{K\_{offset}}$is the subcarrier spacing configuration for $K\_{offset}$ with a value of 0 for frequency range 1.

- $N\_{slot, offset, PDCCH}^{CA}$ and $μ\_{offset,PDCCH} $are the $ N\_{slot, offset}^{CA}$ and the, respectively, which are determined by higher-layer configured *ca-SlotOffset* for the cell receiving the PDCCH, $N\_{slot,offset,SRS}^{CA}$ and $μ\_{offset,SRS}$ are the  and the , respectively, which are determined by higher-layer configured *ca-SlotOffset* for the cell transmitting the SRS, as defined in [4, TS 38.211] clause 4.5.

**<Unchanged parts are omitted>**