3GPP TSG RAN WG1 #115 R1-23NNNN

Chicago, USA, November 13th – 17th, 2023

Agenda Item: 8.3.5

Source: Ericsson

Title: Feature Lead summary #1 for Positioning for RedCap UEs

Document for: Discussion, Decision

# Introduction

This document summarizes the proposals received as part of Agenda Item 8.3.5 for RAN1#115 for the Rel-18 work item on expanded and improved NR positioning [1]. The objectives relevant for this agenda item are as follow:

|  |
| --- |
| * Specify support of positioning for UEs with Reduced Capabilities (RedCap UEs)   + Specify support of Frequency Hopping (FH) beyond maximum RedCap UE bandwidth for reception of DL PRS and transmission of UL SRS for positioning [RAN1, RAN2].     - NOTE: The complexity of the corresponding capabilities for RedCap UEs should be addressed for the introduction of appropriate capabilities for RedCap UEs.   + Specify RRM requirements for positioning including RRM measurements and procedures for RedCap UEs for both with and without frequency hopping [RAN4]. |

# [HIGH] Text Proposals

## Summary of TPs

Several contributions provided text proposals related to previous agreement already captured in specifications. For these proposals it is possible to discuss directly the TPs.

|  |  |  |
| --- | --- | --- |
| Source | Proposal | FL Summary |
| [2] | P3 | Clarification of the collision rules for the case where the time between hop allows to go back to active BWP |
| [2] | P9/P10 | Use of SRS-po with FH with non-redcap UEs.  Proposal 9: The features of PRS Rx hopping and SRS Tx hopping (including the feature of transmitting SRS outside the active UL BWP) should also be applicable to non-RedCap UEs, and Rel-18 eRedCap UEs. |
| [3] | P6 | Simplification of the equation for mapping to physical resources for the case of tx hopping |
| [5] | TP1 for 211 | Clarification that the hopping parameter N\_hop is only applicable to the SRS for positioning. |
| [5] | TP2 for 211 | Further clarification to the configuration of tx hopping including use of c\_srs, hop index and n0 |
| [5] | TP3 for 211 | Clarification of slot configuration for SRS with tx hopping |
| [5] | TP1 for 214 | Clarification of “cycle” in 38.214 |
| [5] | TP2 for 214  P5 | Collision with the mimo and positioning SRS with tx hopping |
| [5] | P5 | SRS with tx hopping power control |
| [6] | P6 |  |
| [6] | P7 |  |
| [7] | P2 | Parameters for the SRS with tx hopping not listed in 38.214 |
| [11] | P3 | SRS Hopping across slot boundary is not allowed. |
| [11] | P5 | Collision rules with UL signals |
| [11] | P7 | Clarification of “cycle” in 38.214 |
| [11] | P10 | Corrects a typo in 38.211 |
| [12] | P6 | SRS Hopping across slot boundary is not allowed. |
| [14] | P3 | Same TP as [7] P2 |
| [20] | TP1 | Collision rules with PUSCH and PUCCH and SRS with tx hopping |
| [20] | TP2 | Collision rules for A-SRS with positioning and tx hopping |
| [20] | TP3 | Collision rules with PRACH and SRS with tx hopping |
| [20] | TP4 | SRS with tx hopping power control |
| [20] | TP5 | UTW configuration per serving cell |

## UE behaviour between SRS with tx hopping hops

### Text proposal

|  |  |
| --- | --- |
| **TP 2.1-1** | |
| reason for change: | The UE behaviour between hops in SRS with tx hopping is not clear as to whether it should return to the active BWP if needed. |
| summary of change: |  |
| Consequences if not approved: |  |
| ------------ Start of Text Proposal for TS 38.214 clause 6.2.1.4.1 ------------  < Unchanged parts are omitted >  6.2.1.4.1 SRS frequency hopping for positioning  The reduced capability UE may be configured via [*higher layer parameter*], subject to UE capability, to perform transmit frequency hopping separate from the UL BWP configuration and outside of the UL BWP, where the UE may be configured with subcarrier spacing, CP and bandwidth that are different from the UL active BWP. The reduced capability UE transmit frequency hopping is configured within one SRS resource for positioning, that may be configured with a bandwidth larger than the maximum bandwidth of the reduced capability UE, in RRC\_CONNECTED or RRC\_INACTIVE mode. The reduced capability UE transmit frequency hopping, may be configured with overlapping or non-overlapping frequency hops in the frequency domain.  The reduced capability UE may be configured, via [higher layer parameter], subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit the SRS for positioning using frequency hopping. The UE is not expected to be configured with one [cycle] of the transmit frequency hopping that is partially overlapped with the time window.  If the SRS symbol(s), including the switching time to or from the active bandwidth part, of the transmit frequency hopping collides with the transmission of PUSCH or PUCCH or the reception of DL signals and channels, and if the UE determines the SRS to be dropped, the colliding SRS symbol(s) are dropped.  If the [time offset] between two consecutive hops exceeds the sum of the switching time to and from the active BWP, the UE is expected to switch back to the active BWP after UE transmits each hop.    < Unchanged parts are omitted >  ---------------------------- End of Text Proposal for TS 38.214 ---------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.1-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Support of Tx hopping for non-redcap UEs

### Text proposal

|  |  |
| --- | --- |
| **TP 2.2-1** | |
| reason for change: | The features of PRS Rx hopping and SRS Tx hopping (including the feature of transmitting SRS outside the active UL BWP) should also be applicable to non-RedCap UEs, and Rel-18 eRedCap UEs. |
| summary of change: | Add supports to non-redcap UEs in the SRS frequency hopping for positioning sections |
| Consequences if not approved: | SRS with tx hopping for positioning is limited to redcap UEs. |
| ------------ Start of Text Proposal for TS 38.214 ------------  < Unchanged parts are omitted > 5.1.6.5.1 PRS receiver frequency hopping The UE may be configured to measure and report, subject to UE capability, via [higher layer parameter] the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, or UE Rx-Tx time difference using receiver frequency hopping for a DL PRS resource, with a requested bandwidth of all hops that may be greater than the maximum UE channel bandwidth. The UE performing receiver frequency hopping may report via [*higher layer parameter*] one measurement associated with one received frequency hop or one measurement based on multiple hops of the DL PRS. [In RRC\_CONNECTED mode], the UE is expected to use a single instance of a configured measurement gap to receive all hops of the DL PRS using receiver frequency hopping.  < Unchanged parts are omitted >  6.2.1.4.1 SRS frequency hopping for positioning  The UE may be configured via [*higher layer parameter*], subject to UE capability, to perform transmit frequency hopping separate from the UL BWP configuration and outside of the UL BWP, where the UE may be configured with subcarrier spacing, CP and bandwidth that are different from the UL active BWP. The UE transmit frequency hopping is configured within one SRS resource for positioning, that may be configured with a bandwidth larger than the maximum bandwidth of the UE, in RRC\_CONNECTED or RRC\_INACTIVE mode. The UE transmit frequency hopping, may be configured with overlapping or non-overlapping frequency hops in the frequency domain.  The UE may be configured, via [higher layer parameter], subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit the SRS for positioning using frequency hopping. The UE is not expected to be configured with one [cycle] of the transmit frequency hopping that is partially overlapped with the time window.  If the SRS symbol(s), including the switching time to or from the active bandwidth part, of the transmit frequency hopping collides with PUSCH or PUCCH including the switching time to or from the active bandwidth part, and if the UE determines the SRS to be dropped, the colliding SRS symbol(s) are dropped.  < Unchanged parts are omitted >  ---------------------------- End of Text Proposal for TS 38.214 ---------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.2-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Frequency hopping text in 38.211

### Text proposal

|  |  |
| --- | --- |
| **TP 2.3-1** | |
| reason for change: | In the current TS 38.211, the new offset for Tx frequency hopping denoted by is added to such that , where . The equation might have already included n\_shift of Alt.2 into the offset, however the n\_shift is still in , such that , given by Clause 6.4.1.4.3. |
| summary of change: | The frequency domain position equation is broken in two cases, when tx hopping is supported and when it is not supported. |
| Consequences if not approved: | 38.211 specification for tx hopping is not clear. |
| ---------------------------- Start of Text Proposal for TS 38.211 clause 6.2.4.1 -----------------------------  < Unchanged parts are omitted >  The frequency-domain starting position is defined by  If the higher layer parameter *SRShoppingNrofHops* is configured,  *,*  *,*  *,*  Otherwise,  Where  is the initial hop index  < Unchanged parts are omitted >  --------------------------------------- End of Text Proposal ---------------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.3-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Clarification for tx hopping in 38.211

### Text proposal

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| --- | --- |
| **TP 2.4-1** | |
| reason for change: | It needs to be distinguished that frequqency hopping here is for SRS for positioning, or MIMO SRS, which improves specification readability and reduce ambiguity. |
| summary of change: | Section 6.4.1.4.1 in TS 38.211  1.Add the description that ‘ is for SRS for postioning’.  2. Typo fixed. |
| Consequences if not approved: | SRS for postioning frequency hopping and MIMO SRS frequency hopping may be confused by the reader. |
| ---------------------------- Start of Text Proposal for TS 38.211 ------------------  **< Unchanged text omitted >**  **6.4.1.4.1 SRS resource**  An SRS resource is configured by the *SRS-Resource* IE or the *SRS-PosResource* IE and consists of  - antenna ports , where the number of antenna ports is given by the higher layer parameter *nrofSRS-Ports* if configured, otherwise , and when the SRS resource is in a SRS resource set with higher-layer parameter *usage* in *SRS-ResourceSet* not set to 'nonCodebook', or determined according to [6, TS 38.214] when the SRS resource is in a SRS resource set with higher-layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook'  - , the number of hops for SRS Tx hopping for an SRS resource configured by *SRS-PosResource* given by the higher layer parameter *SRShoppingNrofHops* if configured, otherwise .  - consecutive OFDM symbols given by the field *nrofSymbols* contained in the higher layer parameter *resourceMapping*. If ,is the number of consecutive OFDM symbol per hop~~s~~.  - , the starting position in the time domain given by  where the offset counts symbols backwards from the end of the slot and is given by the field *startPosition* contained in the higher layer parameter *resourceMapping* and . If is the starting position of each hop in the time domain, determined by the field *startPosition* for each SRS transmission hop.  - , the frequency-domain starting position of the sounding reference signal  **< Unchanged text omitted >**  < Unchanged parts are omitted >  --------------------------------------- End of Text Proposal ---------------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.4-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Clarifications for tx hopping in 38.211

### Text proposal

FL Note: the changes on the use of a parameter for n\_0 in this text proposal need to be discussed separately.

|  |  |
| --- | --- |
| **TP 2.5-1** | |
| reason for change: | 1.The specification lacks the description of C\_SRS of the previous agreement.   * For the hop bandwidth common to all hops   + Configuration re-uses C\_SRS   + The values of C\_SRS in legacy SRS for positioning such that the maximum bandwidth is: 104 PRBs, 48 PRBs, 132 PRBs, 64 PRBs, for 15,30,60,120 KHz respectively when B\_SRS equal 0.   2. Based on current description, it is still not clear how to get , e.g., how to get the relationship between and each hop. A straightforward way is to configure hop time index together with the starting slot offset and starting symbol for each hop. In addition, change the definition of ‘’ to ‘hop index counter in time domain’ to distinguish from the hop index represented by .  3. The specification lacks the description of where comes from.  4. The specification lacks the description of which represents the starting RB of the first hop in time domain, especially considering corresponding description is deleted in TS38.214.  ~~When the reduced capability UE is configured to perform transmit frequency hopping it expects to be configured via [higher layer parameter] with the starting PRB of the first frequency hop~~. |
| summary of change: | Section 6.4.1.4.3 in TS 38.211  1.Add the description of C\_SRS following the previous agreement.  2.Add the description of based on higher-layer configuration. And change the definition of ‘’ to ‘hop index counter in time domain’.  3.Add the description of based on higher-layer configuration.  4.Add the description of represents the starting RB of the first hop in time domain. |
| Consequences if not approved: | Incomplete descriptions for SRS for postioning frequency hopping. |
| ---------------------------- Start of Text Proposal for TS 38.211 ------------------  **< Unchanged text omitted >**  **6.4.1.4.3 Mapping to physical resources**  Throughout this clause, when the higher layer parameter *SRShoppingNrofHops* is provided for *SRS-PosResource*, the sounding reference signal sequence definitions applies to a given hop.  When SRS is transmitted on a given SRS resource, the sequence for each OFDM symbol and for each of the antenna ports of the SRS resource shall be multiplied with the amplitude scaling factor  in order to conform to the transmit power specified in [5, 38.213] and mapped in sequence starting with  to resource elements  in a slot for each of the antenna ports  according to  The length of the sounding reference signal sequence is given by  where is given by a selected row of Table 6.4.1.4.3-1 with  where  is given by the field *b-SRS* contained in the higher-layer parameter *freqHopping* if configured, otherwise . The row of the table is selected according to the index  given by the field *c-SRS* contained in the higher-layer parameter *freqHopping*. If *SRShoppingNrofHops* for *SRS-PosResource* is provided, the row of the table is selected according to the index with the limitation of the maximum bandwidth of104 PRBs, 48 PRBs, 132 PRBs, 64 PRBs, for 15,30,60,120 KHz respectively when The quantity is given by the higher-layer parameter *FreqScalingFactor* if configured, otherwise . When *FreqScalingFactor* is configured, the UE expects the length of the SRS sequence to be a multiple of 6.  The frequency-domain starting position is defined by  where  and  and  - is given by the higher-layer parameter *StartRBIndex* if configured, otherwise ;  - is given by Table 6.4.1.4.3-3 with  if the higher-layer parameter *EnableStartRBHopping* is configured, otherwise .  - is given by the higher-layer parameter YYY  - is the hop index counter in time domain, given by the higher-layer parameter [ZZ].  - is the initial hop index, given by the higher-layer parameter [ZZZ]  The quantity is given by  - if the higher-layer parameter *combOffsetHopping* is not configured:  - if the higher-layer parameter *combOffsetHopping* is configured:  where and is the th entry and the cardinality of the set  respectively, where is given by the higher-layer parameter *combOffsetHoppingSubset* if configured, otherwise .  The pseudo-random sequence is defined by clause 5.2.1 and shall be initialized with at the beginning of each radio frame for which , where the comb hopping identity is contained in the higher-layer parameter *combOffsetHopping*.  If the higher-layer parameter *hoppingWithRepetition* is configured, , otherwise .  If *SRShoppingNrofHops* is configured:  - The reference point for is the lowest subcarrier of the configured bandwidth for SRS with Tx hopping configured by the parameter XXX in *TxhoppingBandwidth*.  otherwise:  - If the reference point for is subcarrier 0 in common resource block 0, otherwise the reference point is the lowest subcarrier of the BWP.  If the SRS is configured by the IE *SRS-PosResource*, the quantity is given by Table 6.4.1.4.3-2, otherwise .  The frequency domain shift value adjusts the SRS allocation with respect to the reference point grid and is contained in the higher-layer parameter *freqDomainShift* in the *SRS-Resource* IE or the *SRS-PosResource* IE. If *SRShoppingNrofHops* for *SRS-PosResource* is provided, the frequency domain shift value represents the starting RB of the first hop in time domain. The transmission comb offset is contained in the higher-layer parameter *transmissionComb* in the *SRS-Resource* IE or the *SRS-PosResource* IE and is a frequency position index.  Frequency hopping of the sounding reference signal is configured by the parameter , given by the field *b-hop* contained in the higher-layer parameter *freqHopping* if configured, otherwise .  If , frequency hopping is disabled and the frequency position index remains constant (unless re-configured) and is defined by    for all OFDM symbols of the SRS resource. The quantity  is given by the higher-layer parameter *freqDomainPosition* if configured, otherwise , and the values of and for are given by the selected row of Table 6.4.1.4.3-1 corresponding to the configured value of .  If , frequency hopping is enabled and the frequency position indices are defined by  where is given by Table 6.4.1.4.3-1,    and where regardless of the value of . The quantity counts the number of SRS transmissions. For the case of an SRS resource configured as aperiodic by the higher-layer parameter *resourceType*, it is given by within the slot in which the symbol SRS resource is transmitted. The quantity is given by if the higher-layer parameter *nrofSRS-Ports-n8* equals ‘ports8tdm’, otherwise . The quantity is the repetition factor given by the field *repetitionFactor* if configured, otherwise .  For the case of an SRS resource configured as periodic or semi-persistent by the higher-layer parameter *resourceType*, the SRS counter is given by  for slots that satisfy . The periodicity  in slots and slot offset  are given in clause 6.4.1.4.4.  **< Unchanged text omitted >**  --------------------------------------- End of Text Proposal ---------------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.5-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Slot configuration for SRS with tx hopping

### Text proposal

|  |  |
| --- | --- |
| **TP 2.6-1** | |
| reason for change: | The specification lacks the description of SRS slot configuration for each hop. The starting position of each hop can be configured independently and does not depend on the relative relationship with the first hop. When reflecting the SRS slot configurtation in TS38.214, we only need to follow the existing formula without generating a new formula. |
| summary of change: | Section 6.4.1.4.4 in TS 38.211  Add description ofSRS slot configuration for each hop. |
| Consequences if not approved: | Incomplete descriptions of SRS slot configuration for each hop. |
| ------------ Start of Text Proposal for TS 38.211 -----------6.4.1.4.4 Sounding reference signal slot configuration Throughout this clause, when the higher layer parameter *SRShoppingNrofHops* is provided for *SRS-PosResource*, the sounding reference signal slot configuration applies to a given hop.  For an SRS resource configured as periodic or semi-persistent by the higher-layer parameter *resourceType*, a periodicity  (in slots) and slot offset  are configured according to the higher-layer parameter *periodicityAndOffset-p* or *periodicityAndOffset-sp* in the *SRS-Resource* IE, or *periodicityAndOffset-p* or *periodicityAndOffset-sp* in the *SRS-PosResource* IE. Candidate slots in which the configured SRS resource may be used for SRS transmission are the slots satisfying    SRS is transmitted as described in clause 6.2.1 of [6, TS 38.214].  < Unchanged parts are omitted >  ---------------------------- End of Text Proposal for TS 38.211 ---------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.6-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Clarifications of [cycle] in 38.214

### Text proposal

|  |  |
| --- | --- |
| **TP 2.7-1a** | |
| reason for change: | It is not clear what the [cycle] means since there is no such definition in the specification. |
| summary of change: | Section 6.2.1.4.1 in TS 38.214:  Add a clear decription to represent the meaning of ‘one [cycle]’ of Tx frequency hopping. |
| Consequences if not approved: | Unclear description of ‘one [cycle]’ of Tx frequency hopping. |
| ------------ Start of Text Proposal for TS 38.214 -----------6.2.1.4.1 SRS frequency hopping for positioning The reduced capability UE may be configured via [*higher layer parameter*], subject to UE capability, to perform transmit frequency hopping separate from the UL BWP configuration and outside of the UL BWP, where the UE may be configured with subcarrier spacing, CP and bandwidth that are different from the UL active BWP. The reduced capability UE transmit frequency hopping is configured within one SRS resource for positioning, that may be configured with a bandwidth larger than the maximum bandwidth of the reduced capability UE, in RRC\_CONNECTED or RRC\_INACTIVE mode. The reduced capability UE transmit frequency hopping, may be configured with overlapping or non-overlapping frequency hops in the frequency domain.  The reduced capability UE may be configured, via [higher layer parameter], subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit the SRS for positioning using frequency hopping. The UE is not expected to be configured with ~~one [cycle]~~ hops given by higher layer parameter [*XX*]of the transmit frequency hopping that is partially overlapped with the time window.  If the SRS symbol(s), including the switching time to or from the active bandwidth part, of the transmit frequency hopping collides with PUSCH or PUCCH including the switching time to or from the active bandwidth part, and if the UE determines the SRS to be dropped, the colliding SRS symbol(s) are dropped.    ---------------------------- End of Text Proposal for TS 38.214 ---------------------------- | |

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| --- | --- |
| **TP 2.7-1b** | |
| reason for change: |  |
| summary of change: |  |
| Consequences if not approved: |  |
| ------------ Start of Text Proposal for TS 38.214 -----------6.2.1.4.1 SRS frequency hopping for positioning <omitted text>  The reduced capability UE may be configured, via [higher layer parameter], subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit the SRS for positioning using frequency hopping, where the window is not partially overlapped with the transmit frequency hopping of an SRS resource. ~~The UE is not expected to be configured with one [cycle] of the transmit frequency hopping that is partially overlapped with the time window.~~  <omitted text>    ---------------------------- End of Text Proposal for TS 38.214 ---------------------------- | |

|  |  |
| --- | --- |
| **TP 2.7-1c** | |
| reason for change: | [cycle] is put within square brackets in the spec, but based on RAN1’s agreements, it is clear that one cycle contains all hops and UE is not expected to be configured with a SRS for positioning hopping cycle partially overlapping with UTW. |
| summary of change: | remove the square brackets of [cycle] |
| Consequences if not approved: | unstable spec |
| ------------ Start of Text Proposal for TS 38.214 ----------- 6.2.1.4.1 SRS frequency hopping for positioning  The reduced capability UE may be configured via [*higher layer parameter*], subject to UE capability, to perform transmit frequency hopping separate from the UL BWP configuration and outside of the UL BWP, where the UE may be configured with subcarrier spacing, CP and bandwidth that are different from the UL active BWP. The reduced capability UE transmit frequency hopping is configured within one SRS resource for positioning, that may be configured with a bandwidth larger than the maximum bandwidth of the reduced capability UE, in RRC\_CONNECTED or RRC\_INACTIVE mode. The reduced capability UE transmit frequency hopping, may be configured with overlapping or non-overlapping frequency hops in the frequency domain.  The reduced capability UE may be configured, via [higher layer parameter], subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit the SRS for positioning using frequency hopping. The UE is not expected to be configured with one cycle of the transmit frequency hopping that is partially overlapped with the time window. If the SRS symbol(s), including the switching time to or from the active bandwidth part, of the transmit frequency hopping collides with PUSCH or PUCCH including the switching time to or from the active bandwidth part, and if the UE determines the SRS to be dropped, the colliding SRS symbol(s) are dropped.   ---------------------------- End of Text Proposal for TS 38.214 ---------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TPs in the table below, including which TP should be selected.

**TP 2.7-1 (a or b or c):**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Collision of SRS with tx hopping with the mimo SRS

### Text proposal

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| --- | --- |
| **TP 2.8-1** | |
| reason for change: | The description of collision between SRS for positioning frequency hopping and MIMO SRS is missing. |
| summary of change: | Section 6.2.1 in TS 38.214:  Add the description of collision between SRS for positioning frequency hopping and MIMO SRS. |
| Consequences if not approved: | Incomplete description of collision between SRS for positioning frequency hopping and MIMO SRS. |
| **< Unchanged text omitted >**  For operation in the same carrier, the UE is not expected to be configured on overlapping symbols with a SRS resource configured by the higher layer parameter *SRS-PosResource* and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as 'periodic'.  For operation in the same carrier, the reduced capability UE is not expected to be configured on overlapping symbols with a SRS resource of the transmit frequency hopping including the switching time to or from the active bandwidth part configured by the higher layer parameter [*XX*] and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as 'periodic'.  For operation in the same carrier, the UE is not expected to be activated or triggered to transmit SRS on overlapping symbols with a SRS resource configured by the higher layer parameter *SRS-PosResource* and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as 'semi-persistent' or 'aperiodic'.  For operation in the same carrier, the reduced capability UE is not expected to be activated or triggered to transmit SRS on overlapping symbols with a SRS resource of the transmit frequency hopping including the switching time to or from the active bandwidth part configured by the higher layer parameter [*XX*] and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as 'semi-persistent' or 'aperiodic'.  **< Unchanged text omitted >** | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.8-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Parameters for the SRS for positioning with tx hopping

### Text proposal

|  |  |
| --- | --- |
| **TP 2.9-1** | |
| reason for change: | All SRS frequency hopping related configuration parameters need to be captured in 6.2.1.4 in 38.214. |
| summary of change: | Section 6.2.1.4 in 38.214: Clarify SRS frequency hopping related configuration parameters. |
| Consequences if not approved: | SRS frequency hopping configuration is not clear in 38.214. |
| ------------ Start of Text Proposal for TS 38.214 ----------- The reduced capability UE may be configured via [*higher layer parameter*], subject to UE capability, to perform transmit frequency hopping separate from the UL BWP configuration and outside of the UL BWP, where the UE may be configured with subcarrier spacing, CP and bandwidth that are different from the UL active BWP. The reduced capability UE transmit frequency hopping is configured within one SRS resource for positioning, that may be configured with a bandwidth larger than the maximum bandwidth of the reduced capability UE, in RRC\_CONNECTED or RRC\_INACTIVE mode. The reduced capability UE transmit frequency hopping, may be configured with overlapping or non-overlapping frequency hops in the frequency domain. When the reduced capability UE is configured to perform transmit frequency hopping it expects to be provided with the following parameters:.  - The starting PRB of the first frequency hop in [higher layer parameter]  - The starting slot offset and starting symbol for each hop in [higher layer parameter]  - The number of symbols in each hops in [higher layer parameter]  - The hop bandwidth in [higher layer parameter]  - The overlap between hops, if present, in [higher layer parameter]  - The number of hops in [higher layer parameter].  ---------------------------- End of Text Proposal for TS 38.214 ---------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.9-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Hopping across slot boundary

### Text proposal

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| --- | --- |
| **TP 2.10-1 a** | |
| reason for change: | The agreed “UE does not expect to be configured for any hops across slot boundaries, i.e.the starting position + duration of a hop cannot exceed a slot duration” was not captured in current spec. |
| summary of change: | Capture the following agreement in the spec. |
| Consequences if not approved: | Without any clarifications, UE may be configured with a hop across slot boundary. |
| ------------ Start of Text Proposal for TS 38.214 ----------- 6.2.1.4.1 SRS frequency hopping for positioning  The reduced capability UE may be configured via [*higher layer parameter*], subject to UE capability, to perform transmit frequency hopping separate from the UL BWP configuration and outside of the UL BWP, where the UE may be configured with subcarrier spacing, CP and bandwidth that are different from the UL active BWP. The reduced capability UE transmit frequency hopping is configured within one SRS resource for positioning, that may be configured with a bandwidth larger than the maximum bandwidth of the reduced capability UE, in RRC\_CONNECTED or RRC\_INACTIVE mode. The reduced capability UE transmit frequency hopping, may be configured with overlapping or non-overlapping frequency hops in the frequency domain. When the reduced capability UE is configured to perform transmit frequency hopping, the UE does not expect to be configured for any hop across slot boundaries  The reduced capability UE may be configured, via [higher layer parameter], subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit the SRS for positioning using frequency hopping. The UE is not expected to be configured with one [cycle] of the transmit frequency hopping that is partially overlapped with the time window.  If the SRS symbol(s), including the switching time to or from the active bandwidth part, of the transmit frequency hopping collides with PUSCH or PUCCH including the switching time or from the active bandwidth part, and if the UE determines the SRS to be dropped, the colliding SRS symbol(s) are dropped.  ---------------------------- End of Text Proposal for TS 38.214 ---------------------------- | |

|  |  |
| --- | --- |
| **TP 2.10-1 b** | |
| reason for change: | For SRS with Tx hopping, each hop must be contained within a slot. |
| summary of change: | Add the following description in TS 38.214: UE does not expect to be configured for any hops across slot boundaries, i.e., the starting position + duration of a hop cannot exceed a slot duration. |
| Consequences if not approved: | The configuration of the starting position and hop duration for SRS with Tx hopping is not clear. |
| ------------ Start of Text Proposal for TS 38.214 clause 6.2.1.4.1 ----------- The reduced capability UE may be configured via [*higher layer parameter*], subject to UE capability, to perform transmit frequency hopping separate from the UL BWP configuration and outside of the UL BWP, where the UE may be configured with subcarrier spacing, CP and bandwidth that are different from the UL active BWP. The reduced capability UE transmit frequency hopping is configured within one SRS resource for positioning, that may be configured with a bandwidth larger than the maximum bandwidth of the reduced capability UE, in RRC\_CONNECTED or RRC\_INACTIVE mode. The reduced capability UE transmit frequency hopping, may be configured with overlapping or non-overlapping frequency hops in the frequency domain. When the reduced capability UE is configured to perform transmit frequency hopping, it does not expect to be configured with [*StartingSymbol*] and [*Length*] for a hop that exceeds a slot duration.  ---------------------------- End of Text Proposal for TS 38.214---------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TPs in the table below

**TP 2.10-1 (a or b):**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Collision with UL signals and SRS with tx hopping

### Text proposal

|  |  |
| --- | --- |
| **TP 2.11-1** | |
| reason for change: | (1) Replace “PUSCH or PUCCH” with “other UL signals” to include the case when MIMO SRS and SRS for hopping have collision. (2) Based on RAN’s agreement, if the SRS symbol(s), including the retuning time to/from the active BWP, collides with PUSCH or PUCCH, when UE determines that SRS with Tx hopping is to be dropped, the colliding SRS symbol(s) are dropped. However, in the current spec wording, switching time is counted twice. (3) If the SRS hop is outside the active BWP, the rule defined in Rel-17 for RRC\_INACTICE state outside initial BWP can be reused, i.e. SRS is lower priority. |
| summary of change: | (1) Replace “PUSCH or PUCCH” with “other UL signals”; (2) delete “including the switching time to or from the active bandwidth part” following “collides with PUSCH or PUCCH”; (3) add the collision case when the SRS hop is outside the active BWP |
| Consequences if not approved: | SRS symbols even without collision with data may be dropped. |
| ------------ Start of Text Proposal for TS 38.214 ----------- 6.2.1.4.1 SRS frequency hopping for positioning  <Omitted>  If the SRS symbol(s), including the switching time to or from the active bandwidth part, of the transmit frequency hopping collides with other UL signals , and if the UE determines the SRS to be dropped, the colliding SRS symbol(s) are dropped. If the positioning SRS symbol(s) is outside the active BWP, including the switching time to or from the active bandwidth part, of the transmit frequency hopping collides with other UL signals, the UE determines the SRS to be dropped on the colliding symbol(s).  ---------------------------- End of Text Proposal for TS 38.214---------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.11-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Editiorial change in 38.211

### Text proposal

|  |  |
| --- | --- |
| **TP 2.12-1** | |
| reason for change: | Correction of typo in 38.211 |
| summary of change: | Correction of typo in 38.211 |
| Consequences if not approved: |  |
| ------------ Start of Text Proposal for TS 38.211 ----------- 6.4.1.4.1 SRS resource  An SRS resource is configured by the *SRS-Resource* IE or the *SRS-PosResource* IE and consists of  - antenna ports , where the number of antenna ports is given by the higher layer parameter *nrofSRS-Ports* if configured, otherwise , and when the SRS resource is in a SRS resource set with higher-layer parameter *usage* in *SRS-ResourceSet* not set to 'nonCodebook', or determined according to [6, TS 38.214] when the SRS resource is in a SRS resource set with higher-layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook'  - , the number of hops for SRS Tx hopping given by the higher layer parameter *SRShoppingNrofHops* if configured, otherwise .  - consecutive OFDM symbols given by the field *nrofSymbols* contained in the higher layer parameter *resourceMapping*. If ,is the number of consecutive OFDM symbol per hop.  - , the starting position in the time domain given by where the offset counts symbols backwards from the end of the slot and is given by the field *startPosition* contained in the higher layer parameter *resourceMapping* and . If is the starting position of each hop in the time domain, determined by the field *startPosition* for each SRS transmission hop.  - , the frequency-domain starting position of the sounding reference signal  <Unrelated part omitted>  6.4.1.4.3 Mapping to physical resources  Throughout this clause, when the higher layer parameter *SRShoppingNrofHops* is provided for *SRS-PosResource*, the sounding reference signal sequence definition applies to a given hop.  <Unrelated part omitted>  ---------------------------- End of Text Proposal for TS 38.211 ---------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.12-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Collision rules with PUSCH and PUCCH

### Text proposal

|  |  |
| --- | --- |
| **TP 2.13-1** | |
| reason for change: | Current specification for the SRS for positioning only partially captures the UE behaviour for the SRS for positioning with Tx hopping for the case of collision with PUSCH. |
| summary of change: | Includes the collision rules for SRS collisions with PUSCH and PUCCH, for the cases of   * PUSCH priority 1 * PUCCH for the different PUCCH content colliding with periodic or SP SRS. |
| Consequences if not approved: | Collision rules specified in 38.214 are incomplete. |
| ---------------------------- Start of Text Proposal for TS 38.214 -----------------------------  < Unchanged parts are omitted >  If a PUSCH transmission with a priority index 1 or a PUCCH transmission with a priority index 1, including potential retuning time to or from the active UL bandwidth part if the SRS transmission is configured with frequency hopping for positioning as described in clause 6.2.1.4.1, would overlap in time with an SRS transmission on a serving cell, the UE does not transmit the SRS in the overlapping symbol(s).  < Unchanged parts are omitted >  For PUCCH and SRS on the same carrier, a UE shall not transmit SRS when semi-persistent or periodic SRS is configured in the same symbol(s) with PUCCH carrying only CSI report(s), or only L1-RSRP report(s), or only L1SINR report(s) , including symbols for potential retuning time to or from the active UL bandwidth part if the SRS transmission is configured with frequency hopping for positioning as described in clause 6.2.1.4.1. A UE shall not transmit SRS when semi-persistent or periodic SRS is configured or aperiodic SRS is triggered to be transmitted in the same symbol(s) with PUCCH carrying HARQ-ACK, link recovery request (as defined in clause 9.2.4 of [6, 38.213]) and/or SR including symbols for potential retuning time to or from the active UL bandwidth part if the SRS transmission is configured with frequency hopping for positioning as described in clause 6.2.1.4.1. In the case that SRS is not transmitted due to overlap with PUCCH, only the SRS symbol(s) that overlap with PUCCH symbol(s) are dropped. PUCCH shall not be transmitted when aperiodic SRS, including potential retuning time between hops when the SRS transmission is configured with frequency hopping for positioning as described in clause 6.2.1.4.1, is triggered to be transmitted to overlap in the same symbol with PUCCH carrying semi-persistent/periodic CSI report(s) or semi-persistent/periodic L1-RSRP report(s) only, or only L1-SINR report(s).  < Unchanged parts are omitted >  6.2.1.4 UE sounding procedure for positioning purposes  < Unchanged parts are omitted >  For operation on the same carrier, if an SRS configured by the higher parameter *SRS-PosResource* collides with a scheduled PUSCH, including potential retuning time to or from the active UL bandwidth part if the SRS transmission is configured with frequency hopping for positioning as described in clause 6.2.1.4.1, the SRS is dropped in the symbols where the collision occurs. 6.2.1.4.1 SRS frequency hopping for positioning The reduced capability UE may be configured via [*higher layer parameter*], subject to UE capability, to perform transmit frequency hopping separate from the UL BWP configuration and outside of the UL BWP, where the UE may be configured with subcarrier spacing, CP and bandwidth that are different from the UL active BWP. The reduced capability UE transmit frequency hopping is configured within one SRS resource for positioning, that may be configured with a bandwidth larger than the maximum bandwidth of the reduced capability UE, in RRC\_CONNECTED or RRC\_INACTIVE mode. The reduced capability UE transmit frequency hopping, may be configured with overlapping or non-overlapping frequency hops in the frequency domain.  The reduced capability UE may be configured, via [higher layer parameter], subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit the SRS for positioning using frequency hopping. The UE is not expected to be configured with one [cycle] of the transmit frequency hopping that is partially overlapped with the time window.  --------------------------------------- End of Text Proposal ---------------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.13-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Collision rules with aperiodic SRS for positioning

### Text proposal

|  |  |
| --- | --- |
| **TP 2.14-1** | |
| reason for change: | Current specification for the SRS for positioning do not capture the rules for aperiodic SRS for positioning with frequency hopping. |
| summary of change: | Includes the collision rules for SRS collisions for the case of aperiodic SRS for positioning with frequency hopping. |
| Consequences if not approved: | SRS for positioning with Tx hopping collision rules are undefined for aperiodic SRS. |
| ---------------------------- Start of Text Proposal for TS 38.214 ----------------------------- 6.2.1 UE sounding procedure < Unchanged parts are omitted >  In case a SRS resource with *resourceType* set as 'aperiodic' is triggered on the OFDM symbol(s) configured with periodic/semi-persistent SRS transmission, the UE shall transmit the aperiodic SRS resource and only the periodic/semi-persistent SRS symbol(s) overlapping within the symbol(s), including potential RF retuning time for SRS for positioning with frequency hopping as described in clause 6.1.2.4.1, are dropped, while the periodic/semi-persistent SRS symbol(s) that are not overlapped with the aperiodic SRS resource are transmitted. In case a SRS resource with *resourceType* set as 'semi-persistent' is triggered on the OFDM symbol(s) configured with periodic SRS transmission, the UE shall transmit the semi-persistent SRS resource and only the periodic SRS symbol(s) overlapping within the symbol(s) , including potential RF retuning time for SRS for positioning with frequency hopping as described in clause 6.1.2.4.1, are dropped, while the periodic SRS symbol(s) that are not overlapped with the semi-persistent SRS resource are transmitted.  \*\*\* Unchanged parts are omitted \*\*\*  --------------------------------------- End of Text Proposal ---------------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.14-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Collision rules for PRACH and SRS for positioning with tx hopping

### Text proposal

|  |  |
| --- | --- |
| **TP 2.15-1** | |
| reason for change: | Collision rules for SRS for positioning with FH colliding with PRACH are not clearly defined. |
| summary of change: | Clarifies that for collision rules of positioning SRS with FH and PRACH, the retuning time of the SRS FH should be included in the colliding slots. |
| Consequences if not approved: | SRS for positioning scheduling rules for the case of FH are not clear |
| ---------------------------- Start of Text Proposal for TS 38.213 -----------------------------  < Unchanged parts are omitted > 8.1 Random access preamble \*\*\* Unchanged parts are omitted \*\*\*  For single cell operation or for operation with contiguous carrier aggregation in a same frequency band or for operation with non-contiguous carrier aggregation in a same frequency band if the UE is not provided with *intraBandNC-PRACH-simulTx-r17*, a UE does not transmit PRACH and PUSCH/PUCCH/SRS, including RF retuning time applicable to SRS tx hopping when configured, in a same slot with respect to the smallest SCS configuration between the SCS configuration for the UL BWP with the PRACH and the SCS configuration for the UL BWP with the PUSCH/PUCCH/SRS transmissions or when a gap between the first or last symbol of a PRACH transmission in a first slot is separated by less than symbols from the last or first symbol, respectively, of a PUSCH/PUCCH/SRS transmission in a second slot where for or 1, for or , for , for , and is the smallest SCS configuration between the SCS configuration for the UL BWP with the PRACH and the SCS configuration for the UL BWP with the PUSCH/PUCCH/SRS transmissions. For a PUSCH transmission with repetition Type B, this applies to each actual repetition for PUSCH transmission [6, TS 38.214].  \*\*\* Unchanged parts are omitted \*\*\*  --------------------------------------- End of Text Proposal ---------------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.15-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## UTW configuration per serving cells

### Text proposal

|  |  |
| --- | --- |
| **TP #2.16-1** | |
| reason for change: | The UTW definition states that it applies to all SRSs for positioning with Tx hopping in the serving cell it is configured. This is not captured in the current 38.214 specification. |
| summary of change: | * Clarifies that the UTW applies to the configured SRS with tx hopping resources in the serving cell. |
| Consequences if not approved: | UTW application range is unclear. |
| ---------------------------- Start of Text Proposal for TS 38.214 -----------------------------  < Unchanged parts are omitted > 6.2.1.4.1 SRS frequency hopping for positioning < Unchanged parts are omitted >  The reduced capability UE may be configured, via [higher layer parameter], subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels in a serving cell and is only expected to transmit the SRS for positioning using frequency hopping. The UE is not expected to be configured with one [cycle] of the transmit frequency hopping that is partially overlapped with the time window.  < Unchanged parts are omitted >  --------------------------------------- End of Text Proposal ---------------------------------- | |

### Round 1

Companies are encouraged to comment on the proposed TP in the table below

**TP 2.16-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Power control for SRS with tx hopping

### Text proposal

|  |  |
| --- | --- |
| **TP #2.17-1 a** | |
| reason for change: | Current specification for the SRS for positioning power control do not account for the configuration of the SRS with Tx hopping outside of the active BWP |
| summary of change: | Include configuration of the SRS for positioning with tx hopping in the power control equations. |
| Consequences if not approved: | SRS for positioning with Tx hopping power control is undefined. |
| ---------------------------- Start of Text Proposal for TS 38.213 -----------------------------  < Unchanged parts are omitted > 7.3.1 UE behaviour \*\*\* Unchanged parts are omitted \*\*\*  If a UE transmits SRS for positioning with Tx hopping based on a configuration by *SRS-PosResourceSet* in [TBD RAN2], , the active UL BWP *b* refers to configuration provided by [*bwp*] in *[TBD RAN2]*.  If a UE transmits SRS based on a configuration by *SRS-PosResourceSet* in *SRS-PosRRC-InactiveConfig-ValidityArea* in RRC\_INACTIVE state [12, TS 38.331], the active UL BWP *b* refers to the BWP provided by *bwp* in *SRS-PosRRC-InactiveConfig-ValidityArea*. If the UE is not provided *pathlossReferenceRS-Pos* in *SRS-PosResourceSet*, or if the UE is provided *pathlossReferenceRS-Pos* in *SRS-PosResourceSet* and the UE cannot accurately measure a pathloss, the UE calculates using an RS resource from an SS/PBCH block with same index as the one the UE used to obtain *MIB*; otherwise, the UE uses the RS indicated by *pathlossReferenceRS-Pos* to calculate .  \*\*\* Unchanged parts are omitted \*\*\*  --------------------------------------- End of Text Proposal ---------------------------------- | |

|  |  |  |  |
| --- | --- | --- | --- |
| **TP #2.17-1 b** | | | |
| Reason for change | Based on the following agreement, SRS for positioning with Tx hopping is configured outside UL BWP. So, for power control of SRS with Tx hopping, ‘the active BWP b’ should refer to the BWP configuration for SRS with Tx hopping. However, such description is not captured in TS38.213.   |  | | --- | | Agreement  SRS for positioning with Tx hopping can be configured outside of the active UL BWP   * The configuration may include SCS, CP size and bandwidth (position and size), which can use a SCS, CP size and bandwidth different from the UL active BWP | |
| Summary of change | Section 7.3.1 in TS 38.213:  Add description regarding ‘the active BWP b’ for SRS for positioning frequency hopping power control. |
| Consequences if not approved | Incorrect description for SRS for positioning frequency hopping power control regarding the BWP reference. |
| **< Unchanged text omitted >**  If a UE transmits SRS based on a configuration by *SRS-PosResourceSet* outside initial UL BWP of carrier *f* of serving cell *c* in RRC\_INACTIVE state, the active UL BWP *b* refers to the BWP configuration provided by *bwp-NUL* or *bwp-SUL* in *SRS-PosRRC-InactiveConfig* for the corresponding carrier.  If a UE transmits SRS on multiple SRS resources for positioning bandwidth aggregation according to *linkage* [6, TS 38.214], the UE calculates using the same values of , , and for each of the multiple SRS resources.  If a UE transmits SRS based on a configuration by *SRS-PosResourceSet* in *SRS-PosRRC-InactiveConfig-ValidityArea* in RRC\_INACTIVE state [12, TS 38.331], the active UL BWP *b* refers to the BWP provided by *bwp* in *SRS-PosRRC-InactiveConfig-ValidityArea*. If the UE is not provided *pathlossReferenceRS-Pos* in *SRS-PosResourceSet*, or if the UE is provided *pathlossReferenceRS-Pos* in *SRS-PosResourceSet* and the UE cannot accurately measure a pathloss, the UE calculates using an RS resource from an SS/PBCH block with same index as the one the UE used to obtain *MIB*; otherwise, the UE uses the RS indicated by *pathlossReferenceRS-Pos* to calculate .  If a reduced capability UE performs SRS transmit frequency hopping based on a configuration by [*SRS-PosResourceSet*] in [*higher layer parameter*] outside of the active UL BWP of carrier *f* of serving cell *c* in RRC\_CONNECTED state [12, TS 38.331], the active UL BWP *b* refers to the BWP configuration provided by [*bwp*] in [*higher layer parameter*].  If a reduced capability UE performs SRS transmit frequency hopping based on a configuration by [*SRS-PosResourceSet*] in [*higher layer parameter*] outside of the intial UL BWP of carrier *f* of serving cell *c* in RRC\_INACTIVE state [12, TS 38.331], the active UL BWP *b* refers to the BWP configuration provided by [*bwp*] in [*higher layer parameter*].  **< Unchanged text omitted >** | | |

### Round 1

Companies are encouraged to comment on the proposed TPs in the table below

**TP 2.17-1 (a or b):**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

# Measurement reporting

The proposals on measurement reporting revolve around the following issues:

* hop indication for multi hop reporting
* use of single-hop or multi-hop reporting
* number of hops included in a measurement request
* special case for multi-RTT measurements

## [HIGH] Single / multi hop indication

### Summary of contributions

Indication of a report being for single-hop or multi-hop measurement was proposed in [2,3,6,9,11,12,13,18]. In [16] the indication is not supported.

Company views are summarized in the table below:

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [2] | Proposal 7: Support the indication on either a single-hop or multi-hop measurement is reported. |
| [3] | **Proposal 1:** RAN1 supports the following text proposal on Clause 5.1.6.5.1 of TS 38.214.   |  | | --- | | 5.1.6.5.1 PRS receiver frequency hopping The reduced capability UE may be configured to measure and report, subject to UE capability, via [higher layer parameter] the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, or UE Rx-Tx time difference using receiver frequency hopping for a DL PRS resource, with a requested bandwidth of all hops that may be greater than the maximum reduced capability UE bandwidth. The reduced capability UE performing receiver frequency hopping may report via [*higher layer parameter*] one measurement associated with one received frequency hop or one measurement based on multiple hops of the DL PRS. In the measurement report via [*higher layer parameter*], the reduced capability UE includes the number of consecutive hops of the DL PRS used for the measurement.  <omitted text> |   **Proposal 10**: Support at least one of the following features:   * Alt.1: The gNB explicitly indicates frequency hops used for a reported positioning measurement. * Alt 2: The gNB indicates if the reported positioning measurement is from a single hop or multiple hops. |
| [6] | Proposal 1  • For DL PRS or UL SRS for positioning with frequency hopping, positioning measurements based on single hop and multiple hops are separately reported.  • A single indication of “single-hop” and “multiple-hop” can be included in the measurement report. |
| [9] | Proposal 2: An indicator is needed to indicate the measurement based on multiple hops or based on one hop.  Proposal 3: Adopt the TP #1 regarding measurement report in clause 5.1.6.5.1 of TS 38.214 [3][4]. |
| [11] | Proposal 9: For DL Rx hopping, the measurement report from UE indicates which of a single-hop or multi-hop measurement is being reported. |
| [13] | Proposal 3: The UE/gNB can report either a single-hop or multi-hop measurement and the measurement report indicates which of a single-hop or multihop measurement is being reported. |
| [12] | Proposal 2: For measurements based on DL PRS with Rx frequency hopping or UL SRS with Tx hopping, support that:  • UE/gNB can report either a single-hop or multi-hop measurement.  • Indication on which of a single-hop or multi-hop measurement is reported. |
| [16] | Proposal 3: which of a single-hop or multi-hop measurement is not being reported. |
| [18] | Proposal 3: For DL Rx hopping,  • A UE may report either a measurement based on receiving multiple hops, or the measurement based on single hop.  o Introduce a signaling that indicated whether a “measurement based on receiving multiple hops” or “measurement based on single hop” is being reported  • Up to RAN4 to define any conditions on when the measurements are reported, what/if accuracy requirements are needed to be specified if there collisions or hops are being dropped. |

### Round 1

The discussion is a continuation from the previous meeting and it seems the views are more or less stable. The majority support the indication of multi or single-hop.

**Proposal 3.1-1:**

**For measurements based on DL PRS with Rx frequency hopping or UL SRS with Tx hopping:**

* **UE/gNB can report either a single-hop or multi-hop measurement.**
* **Indication of which of a single-hop or multi-hop measurement is reported.**

Companies are encouraged to comment on the proposed TP in the table below

**Proposal 3.1-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## [MEDIUM] Hop ID / number of hops in measurement reports

### Summary of contributions

This issue has been ongoing for several meeting and proposals in [3,11,12,13,18] are similar from previous meeting. The proposals are all centered on reporting either the which hops were used to produced the reported measurements, or how many hops were used. In [12,18] no further enhancements are supported.

Company views are summarized in the table below:

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [3] | **Proposal 1:** RAN1 supports the following text proposal on Clause 5.1.6.5.1 of TS 38.214.   |  | | --- | | 5.1.6.5.1 PRS receiver frequency hopping The reduced capability UE may be configured to measure and report, subject to UE capability, via [higher layer parameter] the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, or UE Rx-Tx time difference using receiver frequency hopping for a DL PRS resource, with a requested bandwidth of all hops that may be greater than the maximum reduced capability UE bandwidth. The reduced capability UE performing receiver frequency hopping may report via [*higher layer parameter*] one measurement associated with one received frequency hop or one measurement based on multiple hops of the DL PRS. In the measurement report via [*higher layer parameter*], the reduced capability UE includes the number of consecutive hops of the DL PRS used for the measurement.  <omitted text> |   **Proposal 10**: Support at least one of the following features:   * Alt.1: The gNB explicitly indicates frequency hops used for a reported positioning measurement. * Alt 2: The gNB indicates if the reported positioning measurement is from a single hop or multiple hops. |
| [11] | Proposal 8: For UL SRS Tx hopping, support TRP to report either a single-hop or multi-hop measurement   The measurement report includes how many and which hops are used. |
| [12] | Proposal 1: For DL Rx hopping or UL Tx hopping, NO need to include the following contents in a measurement report:  • Indication of which hop is used for a single-hop measurement;  • Indication of which hops are used for multiple-hop measurement. |
| [13] | Proposal 4: If multi-hop based measurement is supported, the UE can either indicate hop indices of received hops or number of hops used to determined the measurement |
| [18] | Proposal 2: Do not support an additional indication of how many received hops / which received hops where used in the measurement report.  • Note: A UE may, up to UE implementation, to use the quality metric and the ReportingGranularityfactor to inform the LMF that a more accurate measurement is being reported. |

### Round 1

Similar to the previous meeting, based on the proposals received there is no consensus to support reporting the number of hops, or which hops were used in the measurement by the UE or gNB. However, a majority of proposal support indicating the hop index (for single hop measurement) or the number of hops (or list of indices) in the measurement report.

**Proposal 3.1-1:**

**For measurements based on DL PRS with Rx frequency hopping or UL SRS with Tx hopping:**

* **the UE/gNB can additionally report** 
  + **Indication of which hop(s) were used to produce the DL positioning measurement for UE reported DL positioning measurements**
  + **Indication of which hop(s) were used to produce the UL positioning measurement for gNB reported UL positioning measurements.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 3.2-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
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## [MEDIUM] Single-hop as fallback for multi-hop measurement

### Summary of contributions

In [9] the proposal to use single hop as a fall back to multiple hop when measurement for multihop fails is brought again for discussion.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [9] | **Proposal 1: When the measurement based on multiple hops is reported, the measurement based on one hop should not be reported. When the measurement based on multiple hops fails, the measurement based on one hop can be reported as a fallback.** |

### Round 1

**Proposal 3.3-1: When the measurement based on multiple hops is reported, the measurement based on one hop should not be reported. When the measurement based on multiple hops fails, the measurement based on one hop can be reported as a fallback.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 3.3-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## [LOW] Carrier phase measurements

### Summary of contributions

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [3] | Proposal 12: The gNB can report CP measurement made from the combined hops of SRS transmission.  Proposal 13: The RedCap UE can report CP measurement subject to the UE capability. |

### Round 1

from the FL perspective, there is nothing prohibiting the use of Carrier phase positioning in a redcap UE which supports CPP, but we should not aim at specific enhancement for CPP. It is not obvious that such an agreement would be needed, but we can try to collect more views:

**Proposal 3.4-1: For carrier phase measurements:**

* **for UL CP measurements based on SRS for positioning with tx hopping, The gNB can report CP measurement made from the combined hops of SRS transmission.**
* **For DL CP measurements The RedCap UE can report CP measurement subjects to the UE capability.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 3.4-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

# DL-PRS Frequency Hopping

## [MEDIUM] DL PRS antenna port indication across repetitions

### Proposals

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [2] | Proposal 8: The assistance data includes an indicator per PRS resource set on whether the PRS resource repetitions are from the same antenna port. |

### Round 1

this is a new proposal. from the FL view, a PRS resource transmission is single-port, therefore all transmitted symbols for a given PRS resource occasion should come from the same port.

**Proposal 4.1-1: The assistance data includes an indicator per PRS resource set on whether the PRS resource repetitions are from the same antenna port.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 4.1-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Assistance data for DL PRS with RX hopping

### Proposals

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [13] | Proposal 6: Support configurable number of Rx hops for DL PRS with Rx frequency hopping.  Proposal 7: Support configurable amount of overlap between Rx hops for DL PRS with Rx frequency hopping. |

### Round 1

this proposal is similar to proposals made in previous meeting to provide more information in the DL PRS assistance data for Rx hopping and include the number of Rx hops and overlap. In general the comments from previous meeting was to leave this to UE implementation.

**Proposal 4.2-1: for DL PRS Rx hopping, the assistance data includes**

* **the number of Rx hops for DL PRS with rx hopping**
* **the PRB overlap between Rx hops**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 4.2-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## Assistance data for RSTD with rx hopping

### Summary of proposals

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [13] | Proposal 1: The UE should be configured with the same number of PRS repetitions transmitted from the reference transmission point and target transmission point when Rx hopping is enabled.  Proposal 2: When Rx hopping is enabled, the UE determines RSTD based on a hop pair basis where a hop pair consists of two PRSs with the same repetition occasion index each transmitted from different transmission point |

### Round 1

this proposal aims at clarifying how the UE is supposed to do the RSTD measurement with Rx hopping. From the FL perspective, it could be left to implementation. It seems that both proposal can be alternatives to ensure that PRSs pairs are using the same repetitions.

**Proposal 4.3-1: For redcap UEs performing RSTD measurement using DL PRS rx hopping:**

* **Alt1: The UE should be configured with the same number of PRS repetitions transmitted from the reference transmission point and target transmission point when Rx hopping is enabled.**
* **Alt2: When Rx hopping is enabled, the UE determines RSTD based on a hop pair basis where a hop pair consists of two PRSs with the same repetition occasion index each transmitted from different transmission point.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 4.3-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

## [HIGH] DL PRS repetition factor

### Proposal

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [20] | Proposal 4 Extend the value range of PRS repetition factor to {1, 2, 4, 6, 8, 16, 32, 64, 128} or {1, 2, 4, 6, 8, 16, 32, 40, 80, 160} for RedCap positioning. |

### Round 1

the proposal is to extend the values available for PRS repetition so that Rx hopping can be performed while maintaining coverage. Let’s first collect views on the issue.

**Proposal 4.4-1: Extend the value range of PRS repetition factor to {1, 2, 4, 6, 8, 16, 32, 64, 128} or {1, 2, 4, 6, 8, 16, 32, 40, 80, 160} for RedCap positioning.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 4.2-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

# UL SRS Tx Hopping

## UL SRS Tx hopping configuration

### [HIGH] Parameter for initial hop index n0

#### Background

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [1] | Proposal 1: For SRS positioning with Tx hopping wrapping pattern, support:   * alt2: |
| [2] | Proposal 1: Support Alt2 for the definition of the initial frequency hop index.  Proposal 2: Endorse the following TP to clause 6.4.1.4.3 of TS 38.211. |
| [3] | Proposal 5: RAN1 supports a revised alt 2 of the WA RAN1#114-bis   * alt2:   + Note: The reference point for starting PRB of the first hop and nshift is defined as lowest RB provided by the agreed configuration that may include SCS, CP size and bandwidth (position and size)     - is the starting PRB of the first hop     - In k0, nshift is replaced by , where |
| [4] | Proposal 2: Alt2 seems to be a more proper solution than Alt.1. nshift should be replaced by . |
| [5] | Proposal 2   * Regarding frequency hop index of the initial hop, support Alt1: is the frequency hop index of the initial hop (new configured parameter). |
| [6] | Proposal 3   * For the SRS for positioning with Tx hopping wrapping pattern, Alt. 2 is supported: * is the initial frequency hop index defined as |
| [7] | Proposal 1: n0 is the initial frequency hop index defined as |
| [9] | Proposal 7: The working assumption in RAN1#114bis for the SRS for positioning with Tx hopping wrapping pattern should be confirmed, where alt2 is used for the calculation of . |
| [10] | Proposal 2: Support Alt-2 for determining the start point in frequency domain for each hop in the working assumption.  Proposal 3: Support special handling for determining the start point in frequency domain for the hop across bandwidth boundary, and can be applied for the final offset determination of each hop.  Proposal 4: Support limit the start point of the first hop to ensure no hop is across the boundary of hopping band when wrapping is happened, and maximize the number of UEs multiplexed within a same time and frequency resource. |
| [11] | Proposal 1: Confirm the following working assumption with Alt.2. |
| [12] | Proposal 3 Confirm the working assumption with Alt. 2: |
| [13] | Proposal 8: Regarding “FFS: whether/how special handling for the last hop overlap”, the UE is expected to be configured with the bandwidth within which all hops in the pattern are contained, i.e., no special handling for the last hop overlap is needed |
| [14] | Proposal 1:   * The initial frequency hop index should be defined and calculated according to the other parameters. |
| [15] | Proposal 3: For the Tx hopping pattern for SRS for positioning:  alt2:   * + - * + Note: The reference point for starting PRB of the first hop and nshift is defined as lowest RB provided by the agreed configuration that may include SCS, CP size and bandwidth (position and size) |
| [16] | Proposal 1: the working assumption for the new offset nFH is confirmed with alt.1. |
| [17] | Proposal 1: For the SRS for positioning with Tx hopping wrapping pattern, the frequency hop index of the initial hop should be configured with new parameter. |
| [18] | Proposal 4: For UL SRS Tx hopping, confirm the related WA and support either Alt. 1 or Alt. 2 (small preference towards Alt. 2). |
| [19] | Proposal 2-1: Support alt. 2 as the solution for the initial frequency hop index n0 |
| [20] | Proposal 7 The starting hop index is defined as .   * + No new parameter is defined. |

#### Round 1

Every contribution in the agenda item had a proposal on this issue, and all but [5,16,17] support alt2, that is to say, that the variable is not a new parameter. Let’s see if this is agreeable to the companies supporting alt1.

There was also TPs on this topic. Once we have an agreement, we can further work on an agreeable TP.

**Proposal 5.1.1-1 for SRS for positioning with Tx hopping n0 is the initial frequency hop index defined as**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.1.1-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |
|  |  |

### [MEDIUM] Comb offset hopping

#### Background

In [6] it is mentioned that comb offset hopping, introduced for SRS for MIMO, is not to be supported for SRS for positioning. From the FL perspective, this may not be required, as the parameter *combOffsetHoppingWithRepetition* is not available in SRS-config for SRS for positioning resources.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [6] | Proposal 4   * Comb offset hopping is not supported for positioning SRS with frequency hopping for RedCap UEs. |

#### Round 1

**Proposal 5.1.2-1 Comb offset hopping is not supported for positioning SRS with frequency hopping for RedCap UEs.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.1.2-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |
|  |  |

### [HIGH] Slot offset configuration

#### Background

For the slot offset values of the hops following the first hop when Tx hopping is for periodic or semi persistent , the values and applicability to SP-SRS have not yet been decided.

|  |
| --- |
| Agreement  For SRS Tx hopping, the configuration parameters values are:   * For the hop bandwidth common to all hops   + Configuration re-uses C\_SRS   + The values of C\_SRS in legacy SRS for positioning such that the maximum bandwidth is: 104 PRBs, 48 PRBs, 132 PRBs, 64 PRBs, for 15,30,60,120 KHz respectively when B\_SRS equal 0. * For the starting RB of the first hop in time domain:   + Configuration re-uses the IE freqDomainShift   + The range is {0,268} RBs * For the single overlap common to all hops for the SRS resource   + The value can be 0,1,2,4 RBs   + Note: This is a new IE * For the starting slot offset and starting symbol for the SRS resource with tx hopping (first hop in time)   + The value range is {0,1,2…, nrof slot in periodicity} in slots for the slot offset     - Note: this is for the periodic [and semi-persistent] SRS   + Starting symbol: {0,1,2,…13} in symbol   + Starting slot reuses the SRS-PeriodicityAndOffset IE   + Starting symbol reuses the starting position *startPosition* in the IE resourceMapping * The starting slot offset and symbol for each of the hops following the first hop in time,   + FFS: The value range is {0,1,2…, nrof slot in periodicity} in slots for the slot offset     - Note: this is for the periodic [and semi-persistent] SRS   + Starting symbol: {0,1,2,…13} in symbol   + this is a new IE * The number of consecutive symbols in a hop common to all hops   + Values are 1,2,4,8 and 12 symbols   + Configuration re-uses the IE *nrofsymbols* in *resourcemapping* * The number of hops   + Values are 2,3,4,5,6   + This is a new IE |

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [5] | Proposal 1:  • Regarding the starting slot offset and symbol for each of the hops following the first hop in time, the value range can be {0,1,2…, nrof slot in periodicity} in slots for the slot offset.  • The value range of {0,1,2…, nrof slot in periodicity} in slots for the slot offset for each hop applies to both the periodic and semi-persistent SRS. |
| [4] | Proposal 1 The relative position scheme has smaller parameter size the absolute scheme, the value range of the slot offset range can be {0,1,2,…,6}. |
| [13] | Proposal 9 : From the agreement about the configuration parameter values for hopping for SRS for positioning, remove square brackets as follows, “Note: this is for the periodic ~~[~~and semi-persistent~~]~~ SRS” due to the agreement to support both aperiodic and semi-persistent SRS for Tx frequency hopping |

#### Round 1

The proposal in [5] is to remove the FFS. In [4] it is proposed to have a reduced slot offset range that is relative to the previous hop. [13] proposes to remove the brackets for SP SRS case.

**Proposal 5.1.3-1 For the values of the starting slot offset for each of the hops following the first hop in time:**

* **Alt1: the value range can be {0,1,2…, nrof slot in periodicity} in slots for the slot offset.**
* **Alt2: the slot offset for each hop is relative to the preceding hop with range (0,1,2…,6)**
* **The value range slot offset for each hop applies to both the periodic and semi-persistent SRS.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.1.3-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |
|  |  |

### [HIGH] Hop index configuration

#### Background

In both [5][11] it is proposed to clarify that the hop index is in the time domain. Additionally, [5] proposes to make the hop index a parameter. From the FL perspective, it is not clear that a parameters need to be provided. The hop index can be inferred by other parameters, e.g. the slot offset, since a wrapped staircase has been agreed.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [5] | Proposal 3:  • Hop index in time domain can be configured together with the starting slot offset and starting symbol for each hop. |
| [11] | Proposal 2: Adopt TP#1 for TS 38.211 for SRS Tx hopping of RedCap UE  Summary of change: Clarify that in 38.211 is the SRS hop transmission counter in time domain |

#### Round 1

We can start with the proposal in [5,11]:

**Proposal 5.1.3-1 for the SRS for positioning with Tx hopping:**

* **The hop index is in the time domain**
* **Hop index in time domain can be configured together with the starting slot offset and starting symbol for each hop.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.1.3-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |
|  |  |

### [HIGH] Parameters for SRS configuration with frequency hopping

#### Background

In [1] and [17] it is proposed to clarify that a separate configuration from the active BWP is used to configure tx hopping, and this configuration hosts all SRS resources with tx hopping.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [1] | Proposal 6: The virtual BWP for positioning SRS with frequency hopping is configured independently from any data BWP. |
| [17] | Proposal 7: Configuration of SRS for positioning with Tx hopping including SCS, CP size and reference point for bandwidth determination is common to all configured SRS for positioning with Tx hopping resource(s). |

#### Round 1

This proposal will help clarifying how to put the configuration in the RRC parameter list hierarchy. We can start with the following proposal:

**Proposal 5.1.5-1 The Configuration of SRS for positioning with Tx hopping including SCS, CP size and reference point for bandwidth determination is common to all configured SRS for positioning with Tx hopping resource(s).**

* **The configuration for positioning SRS with frequency hopping is configured independently from any data BWP.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.1.5-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |
|  |  |

## UL time window (option 1)

### [MEDIUM] UTW covering the duration of a SRS occasion

#### Background

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [13] | Proposal 10: In the agreement related to coexistence of UTW and prioritization rule, reword the note as follows, “Note: UE is not expected to be configured with a SRS for positioning hopping ~~cycle~~ wrapping pattern partially overlapping with UTW.” |
| [17] | Proposal 2: Support to update the agreement as following:   |  | | --- | | Agreement  For RedCap UEs positioning transmitting the UL SRS with frequency hopping, regarding the collisions between other UL and DL signals/channels and the UL SRS with frequency hopping, support both of the following options   * Option 1: UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit FH SRS for positioning.   + FFS details of an UL time window   + Note: it implies that UE drops the transmission of other signals/channels and transmits SRS for positioning * Option 2: new collision rules between the UL SRS with frequency hopping and other UL and DL signals/channels/. Option 2 can apply without or outside UL time window (i.e. option 1)   + FFS: details on the collision rules   Note: it is understood that option 2 is a component of the feature for UL SRS Tx hopping (FG 41-5-2), and option 1 is a separate feature group.  Note: UE is not expected to be configured with a SRS for positioning hopping cycle, including the retuning time required ahead of the first hop and after the last hop, partially overlapping with UTW. | |

#### Round 1

From the FL side, it’s not clear wheather we need to spend time rewording the agreement, or if a TP agreement is enough. We can start with the proposal in [17]

**Proposal 5.2.1-1:**

Support to update the agreement as following:

|  |
| --- |
| Agreement  For RedCap UEs positioning transmitting the UL SRS with frequency hopping, regarding the collisions between other UL and DL signals/channels and the UL SRS with frequency hopping, support both of the following options   * Option 1: UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit FH SRS for positioning.   + FFS details of an UL time window   + Note: it implies that UE drops the transmission of other signals/channels and transmits SRS for positioning * Option 2: new collision rules between the UL SRS with frequency hopping and other UL and DL signals/channels/. Option 2 can apply without or outside UL time window (i.e. option 1)   + FFS: details on the collision rules   Note: it is understood that option 2 is a component of the feature for UL SRS Tx hopping (FG 41-5-2), and option 1 is a separate feature group.  Note: UE is not expected to be configured with a SRS for positioning hopping cycle, including the retuning time required ahead of the first hop and after the last hop, partially overlapping with UTW. |

**Proposal 5.2.1-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### [LOW] UL time window activation/deactivation mechanisms

#### Background

In [7,9], dynamic activation mechanisms for UTW are proposed:

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [7] | Proposal 3: UL time window activation/deactivation mechanisms (e.g., though DCI or MAC CE) should be supported. |
| [9] | Proposal 5: Support serving gNB to activate/deactivate the UTW by MAC CE. |

#### Round 1

From the FL perspective, this is not a critical issue to be resolve and could be seen as an enhancement. However, we can collect some views on the proposal:

**Proposal 5.2.2-1 support activation/deactivation of the UL time window via**

* **Alt1: DCI**
* **Alt2: MAC-CE**

**Proposal 5.2.2.2-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### [LOW] UL time window location for aperiodic SRS

#### Background

In [7] it is proposed to discuss how the UTW can be placed for aperiodic SRS. We have previously agreed a semi-static UTW which is periodic. This proposal proposes to dynamically place the UTW for the special case of aperiodic SRS. From the FL perspective, this is a non-critical optimization.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [7] | Proposal 4: For aperiodic SRS transmission, the following two schemes to determine the UL time window can be considered.   * Configure the length of the uplink transmission window through high-level parameters, and DCI indicates the starting position of the uplink transmission window. * UE determines the starting position and length of the uplink time window based on the SRS resource time position in the SRS resource set triggered by DCI. |

#### Round 1

**Proposal 5.2.3-1: For aperiodic SRS transmission, the following two schemes to determine the UL time window can be considered.**

* **Configure the length of the uplink transmission window through high-level parameters, and DCI indicates the starting position of the uplink transmission window.**
* **UE determines the starting position and length of the uplink time window based on the SRS resource time position in the SRS resource set triggered by DCI.**

**Proposal 5.2.3-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

### [MEDIUM] UL time window and Measurement gaps

#### Background

In [7] it is proposed that when the UL time window overlaps with a measurement gap, the window is not valid. This proposal was already captured during previous meetings but not discussed during offline sessions.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [7] | Proposal 5: When the UL time window overlaps with the measurement gap, the UL time window becomes invalid. |

#### Round 1

**Proposal 5.2.4-1: When the UL time window overlaps with the measurement gap, the UL time window becomes invalid.**

**Proposal 5.2.4-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

### [MEDIUM] UL time window request

#### Background

[9] proposes to have LMF signaling to request UTW for a UE.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [9] | Proposal 4: Support LMF to request UTW for a UE, and serving gNB to configure UTW for the UE through RRC signaling. |

#### Round 1

**Proposal 5.2.5-1: Support LMF to request UTW for a UE, and serving gNB to configure UTW for the UE through RRC signaling.**

**Proposal 5.2.5-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

### [MEDIUM] UL time window configuration

#### Background

In [17] it is proposed to clarify that only UL slot are applicable for the UTW. In [18] the configuration of the UTW is within the part configuring the SRS for positioning with frequency hopping, also refered sometimes as the “virtual BWP”.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [17] | Proposal 3: A UE expects that UL time window is configured only within UL slot(s). |
| [18] | Proposal 5: For to the UL time window for SRS frequency hopping,   * With regards to the configuration of the window:   + It is part of the configuration that includes the SRS for positioning with frequency hopping |

#### Round 1

**Proposal 5.2.6-1: The UTW is configured as part of the configuration that includes the SRS for positioning with frequency hopping**

* **The UTW only applies to UL slots**

**Proposal 5.2.6-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

### [MEDIUM] UE behaviour in UTW with no SRS transmission

#### Background

This topic was already seen in previous meeting. In [13,15,17] the case of an “empty” UTW is discussed, and it is proposed in that case that UL transmission of other signal is allowed in the empty UTW.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [13] | Proposal 5: UL signals or channels can be transmitted during the UL time window if SRS for positioning is not scheduled to be transmitted during the UL time window. ` |
| [15] | Proposal 2: Within a UTW, if no SRS is to be transmitted, other UL channels can be transmitted. |
| [17] | Proposal 5: Within the UTW, UE can transmit other uplink transmission in slot(s) where no actual transmission of SRS-pos with frequency hopping is configured/indicated. |

#### Round 1

**Proposal 5.2.7-1: UL signals or channels can be transmitted during the UL time window if SRS for positioning is not scheduled to be transmitted during the UL time window.**

**Proposal 5.2.7-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

### [LOW] SCS for UTW

#### Background

In [17] it is propose to link the SCS within the UTW to the minimum SCS among the SCSs of all configured BWP.

From the FL side, the SCS for the SRS with tx hopping is configured separately from the UL BWPs for data. Therefore, it feels natural that the UTW will use the same SCS as the SRS for tx hopping.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [17] | Proposal 4: SCS of UTW is determined with respect to the minimum SCS among the SCSs of all configured UL BWPs. |

#### Round 1

**Proposal 5.2.8-1:** **SCS of UTW is determined with respect to the minimum SCS among the SCSs of all configured UL BWPs.**

**Proposal 5.2.8-1:**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

## Additional Collision rules (option 2)

### Background

### [MEDIUM] condition for returning to active BWP between hops

#### Background

In [10] it is proposed to discuss the conditions for returning to the active BWP between hops. From the FL side, it does not seem necessary to specify such conditions. Instead, it should be enough to have the dropping and collision rules specified, and let the UE return to the active BWP accordingly.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [10] | Proposal 5: To handle the collision between gap and UL channel/signals, support UE switches back to the activate BWP only when both the two conditions meets:  1) The time between hop and the UL channel/signals exceed the retuning time to the active BWP  2) The time between the UL channel/signals and hop exceed the retuning time from the active BWP |

#### Round 1

We can check the views on the proposal:

**Proposal 5.3.1-1 To handle the collision between gap and UL channel/signals, support UE switches back to the activate BWP only when both the two conditions meets:**

**1) The time between hop and the UL channel/signals exceed the retuning time to the active BWP**

**2) The time between the UL channel/signals and hop exceed the retuning time from the active BWP**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.3.1-1**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |
|  |  |

### [MEDIUM] Collisions with MIMO SRS

#### Background

[11] and [18] discuss the collision with MIMO SRS. [11] discuss the special case of collision while the SRS with tx hopping is transmitting outside of the BWP, and propose that in that case SRS is considered low priority.

|  |  |
| --- | --- |
| **Company** | **Proposal** |
| [11] | ***Proposal 4:*** *For RedCap UEs positioning transmitting the positioning SRS with frequency hopping, regarding the collisions between other UL signals/channels including MIMO SRS and the positioning SRS with frequency hopping,*   * *If the positioning SRS hop is within the active BWP, the existing dropping rule for RRC\_CONNECTED state is reused.* * *If the positioning SRS hop is outside the active BWP, Rel-17 defined rule for SRS outside initial BWP in RRC\_INACTIVE state is reused, i.e. SRS has low priority.* |
| [18] | Proposal 6: For the collisions between SRS for Positioning with frequency and MIMO SRS:  • The existing rules can be applied with the additional clarification that SRS symbols include the retuning time to/from the active BWP. |

#### Round 1

We can check the views on the proposal from [11]:

**Proposal 5.3.2-1 For RedCap UEs positioning transmitting the positioning SRS with frequency hopping, regarding the collisions between other UL signals/channels including MIMO SRS and the positioning SRS with frequency hopping,**

**• If the positioning SRS hop is within the active BWP, the existing dropping rule for RRC\_CONNECTED state is reused.**

**• If the positioning SRS hop is outside the active BWP, Rel-17 defined rule for SRS outside initial BWP in RRC\_INACTIVE state is reused, i.e. SRS has low priority.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.3.2-1**

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |
|  |  |

### [LOW] SRS with tx hopping priorities

#### Background

In [9] it is proposed to introduce priority levels for the SRS with tx hopping:

|  |  |
| --- | --- |
| **Company** | **Proposal** |

|  |  |
| --- | --- |
| [9] | Proposal 6: Support the following collision rules between the UL SRS with frequency hopping and other UL and DL signals/channels.  • UE can be configured with two priority states.  − State 1: UL SRS is higher priority than all PUCCH/PUSCH/CSI-RS.  − State 2: UL SRS is lower priority than all PUCCH/PUSCH/CSI-RS. |

#### Round 1

We can check the views on the proposal from [9]. From the FL perspective, this is not an essential item but we can at least gather some comments:

**Proposal 5.3.3-1 For SRS with Tx hopping, the UE can be configured with two priority states.**

**− State 1: UL SRS is higher priority than all PUCCH/PUSCH/CSI-RS.**

**− State 2: UL SRS is lower priority than all PUCCH/PUSCH/CSI-RS.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.3.3-1**

|  |  |
| --- | --- |
| **Company** | **Comment** |
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### [HIGH] timeline for A-SRS

#### Background

The timeline for validation of A-SRS is discussed in [6,15].

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| --- | --- |
| **Company** | **Proposal** |
| [6] | **Proposal 5**   * For aperiodic positioning SRS with frequency hopping, switching time is included in the minimal time interval between the last symbol of PDCCH triggering A-SRS and the first symbol of SRS resource in the first hop if the first hop is outside the active UL BWP. * Agree on TP#1 for the timeline of aperiodic positioning SRS with frequency hopping for RedCap UEs. |
| [15] | Proposal 1: For aperiodic SRS for positioning with Tx hopping, the UE should not expect the DCI that triggers SRS with frequency hopping to occur at a specified duration before the retuning time to the active BWP. |

#### Round 1

The issue needs to be settled to complete the aperiodic SRS design with Tx hopping. We can start the discussion based on the proposal in [6], and proceed with a TP once we have an agreement:

**Proposal 5.3.4-1 For aperiodic positioning SRS with frequency hopping, switching time is included in the minimal time interval between the last symbol of PDCCH triggering A-SRS and the first symbol of SRS resource in the first hop if the first hop is outside the active UL BWP.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.3.4-1**

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| --- | --- |
| **Company** | **Comment** |
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### [HIGH] timeline for PUSCH collisions

#### Background

For the timeline for PUSCH collisions the proposals are as follow:

* Reuse the rule with at least N2 symbols between the end of PDCCH carrying the DCI for PUSCH transmission and the start of the SRS transmission
  + Supported by [2,12,16,18,20]
  + [12,18,20] includes also switching time added to the N2 symbols.

|  |  |
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| **Company** | **Proposal** |
| [2] | Proposal 4: The timeline for determining the collision is defined as within the N2 symbols after the end of the reception of the last symbol of the PDCCH carrying the DCI scheduling the PUSCH, i.e., if UE determines the presence of PUSCH that collides the SRS transmission within N2, the colliding SRS symbol(s) are dropped.  ‐ Endorse the following TP to clause 6.2.1.4.1 of TS 38.214. |
| [11] | Proposal 6: Do not further introduce timeline for determination of colliding channels/signals. |
| [12] | Proposal 4: When SRS for Tx frequency hopping symbol(s), including the retuning time to/from the active BWP, collides with PUSCH, the UE should apply the collision rule considering that:  • DCI for which the time interval between the last symbol of PDCCH and the starting symbol of the SRS for Tx frequency hopping is at least a processing time T.  • UL channels/signals considered active at least a processing time T before the starting symbol of the SRS for Tx frequency hopping.  where the processing time T include N2 symbols of preparation time and an additional time duration for switching from active BWP. |
| [16] | Proposal 2: when the UE determines the potential PUSCH/PUCCH transmission later than N symbol before a SRS transmission symbol, then such SRS transmission symbol is expected to be transmitted and the potential PUSCH/PUCCH is not required to transmit. |
| [18] | Proposal 7: Related to the timeline for the determination of SRS for positioning frequency hopping and colliding PUSCH or PUCCH channels:  For an SRS transmission for positioning with frequency hopping starting in symbol N\_(c\_1 ) and a PUSCH or PUCCH transmission starting in symbol N\_S, where T\_(SRS\_h ), is the retuning time to/from the active BWP, the UE shall apply the dropping rules taking into account:  PUSCH or PUCCH channels determined to be colliding at least N\_2 symbols and an additional time duration T\_(SRS\_h ) before N\_(c\_1 ), and determined to be colliding at least N\_2 symbols before N\_S. |
| [20] | Proposal 5 For the case of dynamic PUSCH controlled by UL DCI, the UE is not expected to transmit the PUSCH if the DCI scheduling the UL transmission is received less than Y symbols before the first symbol of SRS with Tx hopping, including symbols required for retuning.  Proposal 6 For the case of CG PUSCH , the UE is not expected to transmit the PUSCH if the CG activating the UL transmission is received less than Y symbols before the first symbol of SRS with Tx hopping, including symbols required for retuning. |

#### Round 1

The issue seems straightforward. We can re-use the proposal form [18] to start the discussion.

**Proposal 5.3.5-1: for the determination of collision between PUSCH and the SRS with tx hopping:**

* **For an SRS transmission for positioning with frequency hopping starting in symbol and a PUSCH or PUCCH transmission starting in symbol, where , is the retuning time to/from the active BWP, the UE shall apply the dropping rules taking into account:**
  + **PUSCH or PUCCH channels determined to be colliding at least symbols and an additional time duration before , and determined to be colliding at least symbols before .**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.3.5-1**

|  |  |
| --- | --- |
| **Company** | **Comment** |
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### [MEDIUM] overlapping SRS resources with Tx hopping

#### Background

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| --- | --- |
| **Company** | **Proposal** |
| [2] | Proposal 5: UE does not expect to be configured with more than one SRS frequency hopping resources overlap.   * Endorse the following TP to clause 6.2.1.4.1 of TS 38.214. |
| [3] | Proposal 8: For the same resourceType of SRS-PosResource and SRS-Resource, the UE is not expected to be configured with SRS-Resource on the symbol(s) of an SRS resource configured with SRS-PosResource including retuning time. |
| [20] | Proposal 8 For SRS for positioning with Tx hopping, the UE is not expected to be configured with Tx hopping so that one SRS resource with Tx hopping transmission begins before the end of the preceding Tx hopping transmission. |

#### Round 1

The received proposals extend the exisiting rule in 38.214, ie. SRS resources should not overlap when they are of the same type. The main change is the resource may need to also include retuning time as proposed in [3]. We can start with the proposal in [3] and discuss a TP once we have an agreement:

**Proposal 5.3.6-1: For the same resourceType of SRS-PosResource and SRS-Resource, the UE is not expected to be configured with SRS-Resource on the symbol(s) of an SRS resource configured with SRS-PosResource including retuning time.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.3.6-1**

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| --- | --- |
| **Company** | **Comment** |
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## [MEDIUM] timing change within the SRS resource with tx hopping

### Background

Two proposals have been brought forward, in [3] when timing changes during the SRS transmission, the transmission is either interrupted, or the timing change is relayed to the gNB. In [17] the timing change is only applied once the ongoing SRS transmission is completed.

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| --- | --- |
| **Company** | **Proposal** |
| [3] | Proposal 11: If the UE Tx timing is changed while performing Tx frequency hopping in the same SRS Tx hopping cycle/occasion, RAN1 supports either one of the following alternatives:  Alt 1: The UE drops the remaining hops of SRS transmission.  Alt 2: The UE does not drop the remaining hops of SRS transmission but reports information on the hops affected by the Tx timing change so that the gNB can selects hops to combine them. |
| [17] | Proposal 6: If UE is indicated to apply an adjustment for the uplink transmission timing at a slot where SRS for positioning with Tx hopping is configured/indicated, the UE is expected to apply a corresponding adjustment for the uplink transmission timing at the slot after the slot in which last hop is configured. |

#### Round 1

**Proposal 5.4-1: : When the UE Tx timing is to be changed while performing Tx frequency hopping in the same SRS Tx hopping cycle/occasion (downselect)**

* **Alt 1: The UE drops the remaining hops of SRS transmission.**
* **Alt 2: The UE does not drop the remaining hops of SRS transmission but reports information on the hops affected by the Tx timing change so that the gNB can selects hops to combine them.**
* **Alt3: the UE is expected to apply a corresponding adjustment for the uplink transmission timing at the slot after the slot in which last hop is configured.**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.4-1**

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| --- | --- |
| **Company** | **Comment** |
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## [MEDIUM] LMF request for SRS FH parameters

### Summary of contributions

In [12,18], proposals are put forward to include requested SRS tx hopping configuration parameters in the SRS LMF request.

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| --- | --- |
| Company | Proposal |
| [18] | Proposal 8: An LMF should be able to request from the serving gNB, using the “Requested SRS Transmission Characteristics IE”, to configure an SRS for positioning with “SRS frequency hopping” configuration is needed.  Proposal 9: An LMF should be able to request, using the “Requested SRS Transmission Characteristics IE”,  • Total Bandwidth (reuse the existing field in NRPPa)  • The amount of overlap between 2 consecutive hops, hopping bandwidth of each hop. |
| [12] | Proposal 5: For the LMF to request SRS Tx frequency hopping configuration for a UE, if the UE capability of supporting SRS Tx frequency hopping is provided to the LMF, support an indication to enable SRS Tx frequency hopping on top of the SRS total bandwidth.  • Details are up to RAN3. |

### Round 1

**Proposal 5.4-1: As part of the LMF request for SRS for positioning configuration, support the following to be included in the request:**

* **An indicator to request SRS with Tx hopping**
* **The amount of overlap between hops**
* **Total bandwidth across hops**
  + **The exisiting field for bandwidth in the SRS for positioning LMF request can be re-used**

Companies are encouraged to comment on the proposal in the table below:

**Proposal 5.4-1:**

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| --- | --- |
| **Company** | **Comment** |
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## [MEDIUM] SRS transmission priority for Multi-RTT with Rx/Tx hopping

### Summary of contributions

In [3] a text proposal is put forward to add a condition that when configured for PRS measurement performed for Multi-RTT the UE should prioritize SRS transmission.

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| --- | --- |
| **Company** | **Proposal** |
| [3] | **Proposal 7:** RAN1 supports the following text proposal on Clause 6.2.1.4.1 of TS 38.214.   |  | | --- | | 6.2.1.4.1 SRS frequency hopping for positioning <omitted text>  The reduced capability UE may be configured, via [higher layer parameter], subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit the SRS for positioning using frequency hopping. The UE is not expected to be configured with one [cycle] of the transmit frequency hopping that is partially overlapped with the time window. If the reduced capability UE is expected to perform a UE Rx-Tx time difference measurement and uses receiver frequency hops of a DL PRS resource, transmission of SRS using transmit frequency hopping on an SRS resource has higher priority than other channels and signals.  <omitted text> | |

### Round 1

As the issue was never discussed, we should first capture some more comments on the proposed TP to see whether to move forward.

**Issue 3.3:**

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| --- | --- |
| **Company** | **Comment** |
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# UE features

The following proposals in [3,10] discuss issues suitable for UE feature discussion in AI 8.16.3.

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| --- | --- |
| Company | Proposal |
| [3] | Proposal 2: RAN1 supports that the UE reports the required number of symbols per frequency hop of DL PRS resources per TRP considering the coverage performance.  Proposal 3: UE provides the LMF with the maximum number of frequency hops that it can measure, to guarantee the measurement error less than a certain threshold considering UE mobility, for a given DL PRS resource configuration including repetitions.  Proposal 4: UE provides the LMF with the maximum number of frequency hops that it needs to measure to guarantee a certain level of the measurement accuracy for a given DL PRS resource configuration including repetitions. |
| [10] | Proposal 1: For frequency hopping of positioning RS, support UE reporting the capability related to the phase offset to facilitate the overlap size’s configuration. |
|  |  |

# Other issues

|  |  |
| --- | --- |
| Company | Proposal |
| [6] | Proposal 8   * For HD-FDD RedCap UE, collision handling between DL PRS and UL channels/signals within a configured PPW needs to be addressed at least for the case where DL PRS is configured without Rx frequency hopping.   FL note: there is one TP in [2] proposal 3 that may resolve the issue  Proposal 2  • For DL PRS with Rx frequency hopping for RedCap UEs, only MG-based measurement is supported.  FL note: at this stage of the WI hopefully we do not need to have a conclusion on this issue. |
| [8] | 1. ***For RedCap UEs positioning, support the SRS frequency hopping across multiple BWPs within one SRS resource.***   FL note: this contradict the exisiting agreements to hop within a resource. |
| [14] | Proposal 2:  • RAN1 should make the explicit conclusion to support frequency hopping for eRedCap UEs  FL note: while eRedCap support is not precluded, it is not clear what RAN1 needs to do to support these UEs. as we are in the maintenance phase, we should not start any new issue. |
| [20] | Proposal 1 For measurements using Rx hopping, do not support M=1 sample measurements in Rel-18.  Proposal 2 For measurements using Rx hopping, do not consider the use of TEG framework.  Proposal 3 (for conclusion, if needed) RAN1 will not discuss further the case of no overlap in DL PRS Rx hopping. |

# Offline sessions

# Online sessions

# Conclusion

# References

1. R1-2310823, On remaining open issues and maintenance for RedCap UE Positioning, FUTUREWEI
2. R1-2310842, Maintenance of RedCap positioning, Huawei, HiSilicon
3. R1-2310981, Remaining issues on Positioning for RedCap UEs, Nokia, Nokia Shanghai Bell
4. R1-2310989, Remaining issues of positioning for RedCap UEs, New H3C Technologies Co., Ltd.
5. R1-2311100, Remaining issues on positioning for RedCap UEs, vivo
6. R1-2311146, Remaining details of Positioning for RedCap Ues, Intel Corporation
7. R1-2311168, Remaining issues on positioning for RedCap UEs, Spreadtrum Communications
8. R1-2311227, Remaining issues of positioning for RedCap UEs, OPPO
9. R1-2311345, Maintenance issues on positioning for RedCap UEs, CATT
10. R1-2311418, Remaining issues on positioning for RedCap UEs, NEC
11. R1-2311462, Maintenance on Positioning for RedCap UEs, ZTE
12. R1-2311485, Maintenance on RedCap UE positioning, CMCC
13. R1-2311601, Remaining issues on positioning for RedCap UEs, InterDigital, Inc.
14. R1-2311625, Remaining issues on positioning for RedCap UEs, NTT DOCOMO, INC.
15. R1-2311687, Remaining Issues On Positioning for RedCap UEs, Apple
16. R1-2311847, Maintenance on Positioning for RedCap UEs, Samsung
17. R1-2311913, Remaining issues on positioning support for RedCap UEs, LG Electronics
18. R1-2312039, Maintenance for Positioning for Reduced Capabilities UEs, Qualcomm Incorporated
19. R1-2312094, Maintenance for RedCap UE for positioning, MediaTek Korea Inc.
20. R1-2312191, Remaining issues on positioning for RedCap Ues, Ericsson