3GPP TSG RAN WG1 Meeting #121 R1-250xxxx

**St Julian’s, Malta, May 19th – 23rd, 2025**

Source: Moderator (ZTE)

Title: Summary of discussion on SRS frequency hopping with repetition for STxMP in TS 38.213

Agenda Item: 7

**Document for: Discussion and Decision**

# Introduction

In this contribution, the summary of discussion on SRS frequency hopping was provided.

# Discussion

Regarding SRS frequency hopping procedure as described in section 6.2.1.1 in TS 38.214, as per the parts highlighted in yellow as follows, it was specified that each of the antenna ports of the SRS resource in each slot is mapped to the same set of subcarriers within each set of R adjacent OFDM symbols. However, when comb offset hopping is enabled to the SRS resource (i.e., the higher layer parameter *combOffsetHopping* is configured) and the corresponding comb offset hopping pattern is symbol-level (i.e., the higher layer parameter *hoppingWithRepetition* is set to 'symbol'), it is intuitive that each of the antenna ports of the SRS resource in each slot is mapped to **different sets of subcarriers** in different OFDM symbols within each set of R adjacent OFDM symbols. More precisely, the set of subcarriers for each of the antenna ports of the SRS resource in each slot is changed symbol by symbol within each set of R adjacent OFDM symbols.

Besides, for the case of frequency hopping within an SRS resource in each slot is configured without repetition (*R=1*), if the higher layer parameter *combOffsetHopping* is configured to the SRS resource, it should be clarified that **different transmission comb values** are assumed for different OFDM symbols. However, that was wrongly captured in the current TS 38.214 as per the parts highlighted in cyan as follows.

* **TS 38.214 V18.6.0**

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| 6.2.1.1 UE SRS frequency hopping procedure  For a given SRS resource, the UE is configured with repetition factor R∈{1,2,4} or R∈{1,2,3,4,5,6,7,8,10,12,14} by higher layer parameter *resourceMapping* in *SRS-Resource* where *R*≤*Ns*. When frequency hopping within an SRS resource in each slot is not configured (*R=Ns*), each of the antenna ports of the SRS resource in each slot is mapped in all the  symbols to the same set of subcarriers in the same set of PRBs. When frequency hopping within an SRS resource in each slot is configured without repetition (*R=1*), according to the SRS hopping parameters , and defined in clause 6.4.1.4 of [4, TS 38.211], each of the antenna ports of the SRS resource in each slot is mapped to different sets of subcarriers in each OFDM symbol, where the same transmission comb value is assumed for different sets of subcarriers. When both frequency hopping and repetition within an SRS resource in each slot are configured (*Ns*≥ *4, R* ≥ *2*), each of the antenna ports of the SRS resource in each slot is mapped to the same set of subcarriers within each set of R adjacent OFDM symbols, and frequency hopping across the sets is according to the SRS hopping parameters , and , where should be divisible by .  For operation with shared spectrum channel access in FR1, the UE does not expect that multiple hops of an SRS resource transmission are in different RB sets.  A UE may be configured adjacent symbol aperiodic SRS resource with intra-slot frequency hopping within a bandwidth part, where the full hopping bandwidth is sounded with an equal-size subband across  symbols when frequency hopping is configured with *R=1*. A UE may be configured *Ns*≥ *4* adjacent symbols aperiodic SRS resource with intra-slot frequency hopping within a bandwidth part, where the full hopping bandwidth is sounded with an equal-size subband across sets of *R* adjacent OFDM symbols, when frequency hopping is configured with *R* ≥ *2, Ns*≥ *R* and *Ns*should be divisible by *R*. Each of the antenna ports of the SRS resource is mapped to the same set of subcarriers within each set of R adjacent OFDM symbols of the resource.  A UE may be configured symbol periodic or semi-persistent SRS resource with inter-slot hopping within a bandwidth part, where the SRS resource occupies the same symbol location in each slot. A UE may be configured symbol periodic or semi-persistent SRS resource with intra-slot and inter-slot hopping within a bandwidth part, where the SRS resource occupies the same symbol location(s) in each slot. For *Ns*≥ *4*, when frequency hopping is configured with *R* ≥ *2*, intra-slot and inter-slot hopping is supported with each of the antenna ports of the SRS resource mapped to different sets of subcarriers across sets of *R* adjacent OFDM symbol(s) of the resource in each slot, where should be divisible by *R*. Each of the antenna ports of the SRS resource is mapped to the same set of subcarriers within each set of *R* adjacent OFDM symbols of the resource in each slot. For *Ns= R*, when frequency hopping is configured, inter-slot frequency hopping is supported with each of the antenna ports of the SRS resource mapped to the same set of subcarriers in *R* adjacent OFDM symbol(s) of the resource in each slot. |

To address the above issues of SRS frequency hopping as specified in the current TS 38.214, the corresponding draft CR was provided as follows as in [1].

* **TS 38.214 V18.6.0**

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| 6.2.1.1 UE SRS frequency hopping procedure  For a given SRS resource, the UE is configured with repetition factor R∈{1,2,4} or R∈{1,2,3,4,5,6,7,8,10,12,14} by higher layer parameter *resourceMapping* in *SRS-Resource* where *R*≤*Ns*. When frequency hopping within an SRS resource in each slot is not configured (*R=Ns*), except for the case when the higher layer parameter *combOffsetHopping* is configured for the SRS resource and the higher layer parameter *hoppingWithRepetition* is set to'symbol', each of the antenna ports of the SRS resource in each slot is mapped in all the  symbols to the same set of subcarriers in the same set of PRBs. When frequency hopping within an SRS resource in each slot is configured without repetition (*R=1*), according to the SRS hopping parameters , and defined in clause 6.4.1.4 of [4, TS 38.211], each of the antenna ports of the SRS resource in each slot is mapped to different sets of subcarriers in each OFDM symbol, where the same transmission comb value is assumed for different sets of subcarriers if the higher layer parameter *combOffsetHopping* is not configured for the SRS resource, otherwise the transmission comb value is defined in clause 6.4.1.4.3 of [4, TS 38.211]. When both frequency hopping and repetition within an SRS resource in each slot are configured (*Ns*≥ *4, R* ≥ *2*), except the higher layer parameter *combOffsetHopping* is configured for the SRS resource and the higher layer parameter *hoppingWithRepetition* is set to 'symbol', each of the antenna ports of the SRS resource in each slot is mapped to the same set of subcarriers within each set of R adjacent OFDM symbols, and frequency hopping across the sets is according to the SRS hopping parameters , and , where should be divisible by .  For operation with shared spectrum channel access in FR1, the UE does not expect that multiple hops of an SRS resource transmission are in different RB sets.  A UE may be configured adjacent symbols aperiodic SRS resource with intra-slot frequency hopping within a bandwidth part, where the full hopping bandwidth is sounded with an equal-size subband across  symbols when frequency hopping is configured with *R=1*. A UE may be configured *Ns*≥ *4* adjacent symbols aperiodic SRS resource with intra-slot frequency hopping within a bandwidth part, where the full hopping bandwidth is sounded with an equal-size subband across sets of *R* adjacent OFDM symbols, when frequency hopping is configured with *R* ≥ *2, Ns*≥ *R* and *Ns*should be divisible by *R*. Except the higher layer parameter *combOffsetHopping* is configured for the SRS resource and the higher layer parameter *hoppingWithRepetition* is set to 'symbol', each of the antenna ports of the SRS resource is mapped to the same set of subcarriers within each set of R adjacent OFDM symbols of the resource.  A UE may be configured symbol periodic or semi-persistent SRS resource with inter-slot hopping within a bandwidth part, where the SRS resource occupies the same symbol location in each slot. A UE may be configured symbol periodic or semi-persistent SRS resource with intra-slot and inter-slot hopping within a bandwidth part, where the SRS resource occupies the same symbol location(s) in each slot. For *Ns*≥ *4*, when frequency hopping is configured with *R* ≥ *2*, intra-slot and inter-slot hopping is supported with each of the antenna ports of the SRS resource mapped to different sets of subcarriers across sets of *R* adjacent OFDM symbol(s) of the resource in each slot, where should be divisible by *R*. Except the higher layer parameter *combOffsetHopping* is configured for the SRS resource and the higher layer parameter *hoppingWithRepetition* is set to 'symbol', each of the antenna ports of the SRS resource is mapped to the same set of subcarriers within each set of *R* adjacent OFDM symbols of the resource in each slot. For *Ns= R*, when frequency hopping is configured, except the higher layer parameter *combOffsetHopping* is configured for the SRS resource and the higher layer parameter *hoppingWithRepetition* is set to 'symbol', inter-slot frequency hopping is supported with each of the antenna ports of the SRS resource mapped to the same set of subcarriers in *R* adjacent OFDM symbol(s) of the resource in each slot.  When the higher layer parameter *combOffsetHopping* is configured for an SRS resource and the higher layer parameter *hoppingWithRepetition* is set to 'symbol', each of the antenna ports of the SRS resource is mapped to the same set of PRBs within each set of R adjacent OFDM symbols of the resource in each slot and is mapped to different sets of subcarriers in different OFDM symbols within each set of R adjacent OFDM symbols of the resource in each slot as defined in clause 6.4.1.4.3 of [4, TS 38.211]. |

**Contact Information**

For any potential offline discussions, please provide the contact information in the table below:

Table 0 Contact Information

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**Company Input**

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| **Company** | **Input** |
| Mod | Companies are welcome to provide comments by taking the following questions into consideration.   * Q1: Do you agree with ;he issues of SRS frequency hopping in the current TS 38.214 according to the above elaborations? If not, please provide your understanding for clarification. * Q2: If your answer to Q1 is yes, do you agree with the draft CR provided in [1]? If not, please provide anything for improvement. |
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# Conclusion

[TBD]

# References

1. R1-2503683, Draft CR on SRS frequency hopping with repetition in TS 38.214, ZTE Corporation, Sanechips