**3GPP TSG-RAN4 Meeting #102-eR4-2207055**

Electronic Meeting, Feb 21- Mar 4, 2022

**Agenda item:** 10.10.2.1

**Source:** Moderator (Apple)

**Title:** Email discussion summary for [102-e][214] NR\_RRM\_enh2\_1

**Document for:** Information

# Introduction

This email discussion summary includes general (10.10.1) and SRS antenna port switching (10.10.2.1).

# Topic #1: SRS antenna port switching (10.10.2.1)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2203717**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203717.zip) | Qualcomm, Inc. | **Proposal 1: No requirement applies for AP/P/SP L1-RSRP/L1-SINR measurement colliding with AP SRS.**

|  |  |
| --- | --- |
| Scenario 2 | Interruption Length (slots) |
| Victim SCS (kHz) | 15 | 30 | 60 |
| 15 | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |

Table 2‑2 SRS antenna switch interruption**Proposal 2: SRS antenna switching interruption for scenario 2 is specified as Table 2-2 for NR SA. In EN-DC, interruption on LTE carrier is the same as victim SCS = 15kHz case in NR SA.**

|  |  |
| --- | --- |
| Scenario 1 | Interruption Length (symbols) |
| Victim SCS (kHz) | 15 | 30 | 60 |
| 15 | 3 | 2 | 2 |
| 30 | 5 | 3 | 3 |
| 60 | 8 | 5 | 4 |
| 120 | 14 | 9 | 7 |

Table 2‑3 Scenario 1 interruption in symbols**Proposal 3: SRS antenna switching interruption for scenario 1 is 2 slots for all aggressor/victim SCS combinations in slot unit, and in Table 2-3 in symbol unit.** |
| [**R4-2203783**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203783.zip) | Apple | ***Proposal 1: NR measurement are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement. No exception case needs to consider.******Proposal 2:*** * ***The interruption requirement of SRS antenna port switching for scenario 1 sync case is as following,***

|  |  |
| --- | --- |
| ***Victim CC SCS(kHz)*** | ***Aggressor CC SCS (kHz)*** |
| ***15***  | ***30*** | ***60*** |
| ***15 (NR or LTE)*** | ***3*** | ***2*** | ***2*** |
| ***30*** | ***4*** | ***3*** | ***3*** |
| ***60*** | ***7*** | ***5*** | ***4*** |
| ***120*** | ***13*** | ***9*** | ***7*** |

***Unit of interruption requirement is symbol of victim CC**** ***The interruption requirement of SRS antenna port switching for scenario 1 async case is 2 slots of victim carrier’s SCS, as following,***

|  |  |
| --- | --- |
| ***Victim CC SCS(kHz)*** | ***Aggressor CC SCS (kHz)*** |
| ***15***  | ***30*** | ***60*** |
| ***15 (NR or LTE)*** | ***2*** | ***2*** | ***2*** |
| ***30*** | ***2*** | ***2*** | ***2*** |
| ***60*** | ***2*** | ***2*** | ***2*** |
| ***120*** | ***2*** | ***2*** | ***2*** |

***Unit of interruption requirement is slot for NR and subframe for LTE of victim CC.**** ***The interruption requirement of SRS antenna port switching for scenario 2 is summarized as:***

|  |  |
| --- | --- |
| ***Victim CC SCS(kHz)*** | ***Aggressor CC SCS (kHz)*** |
| ***15***  | ***30*** | ***60*** |
| ***15 (NR or LTE)*** | ***2*** | ***2*** | ***2*** |
| ***30*** | ***2*** | ***2*** | ***2*** |
| ***60*** | ***3*** | ***2*** | ***2*** |
| ***120*** | ***5*** | ***3*** | ***3*** |

***Unit of interruption requirement is slot for NR and subframe for LTE of victim CC.******Proposal 3: regarding issue 1-5-3, no need to discuss option 1 from R17 FeMIMO assumption.***  |
| [**R4-2203921**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203921.zip) | CATT | **Proposal 1: We prefer option2, i.e. no requirement applies for AP/P/SP L1-RSRP/L1-SINR measurement colliding with AP SRS.****Proposal 2: We prefer option 2, i.e. generic requirement is preferred and no need to consider option 1 (considering Tx-to- Tx, or Tx-to-Rx etc.).****Proposal 3: 2 slots interruption is allowed for all cases of scenario 1 async case.****Proposal 4: it is proposed int[(1 SRS symbol length + 2\*15us)/(symbol length of victim CC)]+1 symbols interruption is allowed for scenario 1 sync case.****Proposal 5: the following table can be accepted for interruption requirements for scenario 2 for both sync and async case.**

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15 | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |
| Note: Unit of interruption requirement is slot for NR and subframe for LTE. |

**Proposal 6: We prefer option 2, i.e. no need to discuss option 1 in current WI.** |
| [**R4-2203922**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203922.zip) | CATT | Draft CR |
| [**R4-2204242**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204242.zip) | Xiaomi | **Proposal 1: RAN4 to define interruption requirement of SRS antenna port switching for scenario 1 sync case as:**

|  |
| --- |
| **Table 1: Interruption length (symbols) for SRS antenna switching** |
| **Victim CC SCS(kHz)** | **Aggressor CC SCS (kHz)** |
| **15** | **30** | **60** |
| **15** | **2** | **1** | **1** |
| **30** | **3** | **2** | **2** |
| **60** | **6** | **4** | **3** |
| **120** | **12** | **8** | **6** |

**Proposal 2: RAN4 to define interruption requirement of SRS antenna port switching for scenario 1 async case as:**

|  |
| --- |
| **Table 2: Interruption length (slots) for SRS antenna switching** |
| **Victim CC SCS(kHz)** | **Aggressor CC SCS (kHz)** |
| **15** | **30** | **60** |
| **15** | **2** | **2** | **2** |
| **30** | **2** | **2** | **2** |
| **60** | **2** | **2** | **2** |
| **120** | **2** | **2** | **2** |

**Proposal 3: RAN4 to define generic interruption requirement of SRS antenna port switching for scenario 2 based on async case as:**

|  |
| --- |
| **Table 3: Interruption length (slots) for SRS antenna switching** |
| **Victim CC SCS(kHz)** | **Aggressor CC SCS (kHz)** |
| **15** | **30** | **60** |
| **15** | **2** | **2** | **2** |
| **30** | **2** | **2** | **2** |
| **60** | **3** | **2** | **2** |
| **120** | **5** | **3** | **3** |

 |
| [**R4-2204265**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204265.zip) | CMCC | ***Proposal 1: symbol-level for scenario 1(X=1), sync case, the interruption requirements are proposed as following:******Table 1 symbol-level interruption for scenario 1(X=1), sync case***

|  |  |
| --- | --- |
| ***Victim CC SCS(kHz)*** | ***Aggressor CC SCS (kHz)*** |
| ***15***  | ***30*** | ***60*** |
| ***15***  | ***3 symbols*** | ***3 symbols*** | ***3 symbols*** |
| ***30***  | ***5 symbols*** | ***4 symbols*** | ***4 symbols*** |
| ***60***  | ***9 symbols*** | ***7 symbols*** | ***6 symbols*** |
| ***120***  | ***17 symbols*** | ***13 symbols*** | ***11 symbols*** |

***Proposal 2: slot-level for scenario 1(X=1), async case, the interruption requirements are proposed as following:******Table 2 slot-level interruption for scenario 1(X=1), async case***

|  |  |
| --- | --- |
| ***Victim CC SCS(kHz)*** | ***Aggressor CC SCS (kHz)*** |
| ***15***  | ***30*** | ***60*** |
| ***15***  | ***2 slots*** | ***2 slots*** | ***2 slots*** |
| ***30***  | ***2 slots*** | ***2 slots*** | ***2 slots*** |
| ***60***  | ***2 slots*** | ***2 slots*** | ***3 slots*** |
| ***120***  | ***3 slots*** | ***3 slots*** | ***3 slots*** |

***Proposal 3: slot-level for scenario 2 (X=6), async/sync case, the interruption requirements are proposed as following:******Table 3 slot-level interruption for scenario 2 (X=6) async/sync case***

|  |  |
| --- | --- |
| ***Victim CC SCS(kHz)*** | ***Aggressor CC SCS (kHz)*** |
| ***15***  | ***30*** | ***60*** |
| ***15***  | ***2*** | ***2*** | ***2*** |
| ***30***  | ***2*** | ***2*** | ***2*** |
| ***60***  | ***3*** | ***2*** | ***2*** |
| ***120***  | ***5*** | ***3*** | ***3*** |

 |
| [**R4-2204274**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204274.zip) | OPPO | ***Proposal 1: No requirement applies for aperiodic L1-RSRP/L1-SINR measurement collides with aperiodic SRS in the same OFDM symbol.******Proposal 2: For slot-level interruption requirements of SRS antenna port switching for scenario 1 async case, the interruption requirements can be:******Table 1: Interruption length X1 (slots)***

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 2 | 2 | 2 |
| 120 | 2 | 2 | 2 |

 Unit of interruption requirement is slot for NR and subframe for LTE.***Proposal 3: For symbol-level interruption requirement for scenario 1 sync case, the interruption requirements can be:******Table 2: Interruption length X1 (symbols)***

|  |  |
| --- | --- |
| Scenario 1 | Interruption Length (symbols) |
| Victim SCS (kHz) | 15 | 30 | 60 |
| 15 | 4 | 3 | 3 |
| 30 | 6 | 4 | 4 |
| 60 | 9 | 6 | 5 |
| 120 | 14 | 10 | 8 |

***Proposal 4: For slot-level interruption requirements of SRS antenna port switching for scenario 2, the interruption requirements can be:******Table 3: Interruption length X1 (slots)***

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |

Unit of interruption requirement is slot for NR and subframe for LTE. |
| [**R4-2204314**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204314.zip) | LG Electronics Inc. | * ***Proposal*** 1: The antenna switching time (15us) should be applied only when the symbol before or after SRS transmission occasion is uplink symbol since the switching time is for Tx-to-Tx, and the transient time for Tx(Rx)-to-Rx(Tx) is 10us.
* ***Proposal 2***: For intra-band DC/CA in TDD synchronous case, there is no interruption issue on downlink symbols in the victim cell regardless of MTTD/MRTD, TA, or antenna switching time when the symbol before or after configured SRS resource for antenna port switching is the downlink symbol since the transient time 13us for Tx-to-Rx (NTX-RX) and Rx-to-Tx (NRX-TX) is guaranteed when a UE transmits (or receives) the uplink (or downlink) after the end of the last received (or transmitted) downlink (or uplink) symbol according to TS38.211.
* ***Proposal 3***: For inter-band DC/CA in TDD synchronous case without the capability of simultaneous Rx and Tx, there is no interruption issue on downlink symbols in the victim cell regardless of MTTD/MRTD, TA, or antenna switching time when the symbol before or after configured SRS resource for antenna port switching is the downlink symbol since the transient time 13us for Tx-to-Rx (NTX-RX) and Rx-to-Tx (NRX-TX) is guaranteed when a UE transmits (or receives) the uplink (or downlink) after the end of the last received (or transmitted) downlink (or uplink) symbol according to TS38.211.
* ***Proposal 4***: For scenario 1 in the synchronous case, the interruption requirements could be defined in Table 1 and Table 2.

Table 1 Interruption for scenario 1 in inter-band MR-DC/CA synchronous case

|  |  |
| --- | --- |
| Victim cell SCS [kHz] | Interruption length [symbols] |
| Aggressor cell SCS [kHz] |
| 15 | 30 | 60 |
| 15 | 3 | 3 | 2 |
| 30 | 6 | 5 | 4 |
| 60 | 11 | 9 | 8 |
| 120 | 21 | 17 | 15 |
| Note: The downlink symbols are excluded from the defined interruption symbols if UE does not support *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA*. |

Table 2 Interruption for scenario 1 in intra-band MR-DC (EN-DC) synchronous case

|  |  |
| --- | --- |
| Victim cell SCS [kHz] | Interruption length [symbols] |
| Aggressor cell SCS [kHz] |
| 15 | 30 | 60 |
| 15 | 2 | 2 | 1 |
| 30 | 4 | 3 | 2 |
| 60 | 7 | 5 | 4 |
| 120 | 13 | 9 | 7 |
| Note: The downlink symbols are excluded from the defined interruption symbols. |

* ***Proposal 5***: For scenario 1 in the asynchronous case and scenario 2 in the synchronous/asynchronous case, the interruption requirements could be defined as Table 3.

Table 3 Interruption for scenario 1 in asynchronous and scenario 2 in synchronous/asynchronous case

|  |  |
| --- | --- |
| Victim cell SCS [kHz] | Interruption length [slot] |
| Aggressor cell SCS [kHz] |
| 15 | 30 | 60 |
| 15 | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 2 |
| Note 1: In inter-band TDD synchronous case, the downlink symbols are excluded from the defined interruption slots if UE does not support *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA.*Note 2: In intra-band TDD synchronous case, the downlink symbols are excluded from the defined interruption slots. |

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| [**R4-2204335**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204335.zip) | vivo | **Proposal 1 Adopt option 1 with clarifications to the main bullet:** **Add clarifications that longer delay for L1-RSRP/L1-SINR measurements will be expected if the interrupted DL symbols due to SRS antenna switching colliding with the DL symbol for AP L1-RSRP or L1-SINR measurements, and no requirement is specified.****Observation 1 There are some issues on the requirements for L1-RSRP/L1-SINR measurement if there is collision between AP SRS and PUCCH in the same carrier or between SRS and PUSCH/PUCCH in UL CA, even though the DL measurements are always prioritized over the SRS transmission.****Proposal 2 NR measurement are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement. Clarify in the WF to L1-RSRP/L1-SINR measurement period requirements,** **‘Note: Longer measurement period is expected if a PUCCH carrying the semi-persistent/periodic L1-RSRP or L1-SINR report is scheduled in the same symbol with aperiodic SRS in the same carrier, or if PUCCH/PUSCH carrying the L1-RSRP or L1-SINR report in one carrier is collided with SRS interruption time in another carrier’.****Proposal 3 The interruption requirements for scenario 2 is specified in number of slots as**

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |

**Proposal 4 The interruption requirement for async case in scenario 1 is specified in number of slots as**

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 2 | 2 | 2 |
| 120 | 2 | 2 | 2 |

**Proposal 5 The interruption requirement for sync case in scenario 1 is specified in number of symbols as**

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 4 | 3 | 3 |
| 60 | 7 | 5 | 4 |
| 120 | 13 | 9 | 7 |

**Proposal 6 For the sync case of scenario 1, further discuss whether the case when the last symbol in the slot on the aggressor CC is not used for SRS transmission is only considered for test case design, in which the maximum number interrupted slots for SRS antenna switching is 1 for all 15kHz and 30kHz aggressor CC SCS cases.** |
| [**R4-2204362**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204362.zip) | MediaTek Inc. | **Proposal 1: No requirement applies for aperiodic L1-RSRP/L1-SINR measurement collides with aperiodic SRS in the same OFDM symbol. A part from collision with aperiodic L1-RSRP/L1-SINR measurement, when SRS resource and the NR measurement are scheduled in the same OFDM symbol, NR measurements (including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR) are always prioritized.****Proposal 2: For the antenna switch time, same generic requirement (15us before and after SRS transmission occasion) is applied for Tx-to-Tx, Tx-to-Rx and Rx-to-Tx cases.****Proposal 3: For scenario 1 sync case (X=1 SRS symbols), extra [1] and [2] margin symbol(s) are considered for FR1 and FR2 victim cells due to TA impact.****Proposal 4: For scenario 1 sync case (X=1 SRS symbols), the SRS antenna switching interruption requirement should be specified as follows.**Table X. Interruption length (symbols) due to SRS antenna switch

|  |  |
| --- | --- |
| **Victim cell SCS(KHz)** | **Aggressor Cell SCS (KHz)** |
| **15** | **30** | **60** |
| **15** | **3** | **2** | **2** |
| **30** | **4** | **3** | **3** |
| **60** | **7** | **5** | **4** |
| **120** | **14** | **10** | **8** |

**Proposal 5: For scenario 1 async case (X=1 SRS symbols), the SRS antenna switching interruption requirement should be specified as follows.**Table X. Interruption length (slots) due to SRS antenna switch

|  |  |
| --- | --- |
| **Victim cell SCS(KHz)** | **Aggressor Cell SCS (KHz)** |
| **15** | **30** | **60** |
| **15** | **2** | **2** | **2** |
| **30** | **2** | **2** | **2** |
| **60** | **2** | **2** | **2** |
| **120** | **2** | **2** | **2** |

**Proposal 6: For scenario 2 (X=6 SRS symbols), the SRS antenna switching interruption requirement should be specified as follows.**Table X. Interruption length (slots) due to SRS antenna switch

|  |  |
| --- | --- |
| **Victim cell SCS(KHz)** | **Aggressor Cell SCS (KHz)** |
| **15** | **30** | **60** |
| **15** | **2** | **2** | **2** |
| **30** | **2** | **2** | **2** |
| **60** | **3** | **2** | **2** |
| **120** | **5** | **3** | **3** |

**Proposal 7: No need to discuss the case when the SRS resources of a set in a slot are configured in non-consecutive manner.** |
| [**R4-2204399**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204399.zip) | Intel Corporation | **Proposal 1: NR measurement are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement.****Proposal 2: For scenarios 1, the symbol based requirement will apply if one SRS resource set is configured. It’s FFS when two SRS resource sets are configured in two consecutive slots.****Proposal 3: If interruption length based on symbol level is defined, MRTD/MTTD and TA margin needs to be considered.****Proposal 4: When X=1 SRS symbol is configured in a slot for SRS antenna port switching, the interruption** **lengths for synchronization case are as follows:****Tab.1 Interruption Length for synchronization case for X=1(symbols)**

|  |  |
| --- | --- |
|  | **aggressor SCS** |
| **Victim SCS**  | **15kHz** | **30kHz** | **60kHz** |
| **15kHz** | **4** | **4** | **4** |
| **30kHz** | **6** | **4** | **4** |
| **60kHz** | **11** | **7** | **4** |

**Proposal 5: When X=1 SRS symbol is configured in a slot for SRS antenna port switching, the interruption** **lengths for asynchronization case** **are as follows:****Tab.2 Interruption Length for asynchronization case for X=1(slots)**

|  |  |
| --- | --- |
|  | **aggressor SCS**  |
| **Victim SCS**  | **15kHz** | **30kHz** | **60kHz** |
| **15kHz** | **2** | **2** | **2** |
| **30kHz** | **2** | **2** | **2** |
| **60kHz** | **2** | **2** | **2** |

 |
| [**R4-2204704**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204704.zip) | Nokia, Nokia Shanghai Bell | **Proposal 1: For Scenario 1 synchronous case, where X=1 SRS symbol is configured in a slot for SRS antenna switching, the interruption length shall be defined as X1 in Table 1.** Table 1: Interruption length X1 for synchronous scenario 1 (symbols)

|  |  |  |
| --- | --- | --- |
|  | NR Slot length(ms) of victim cell | Interruption length X1 (symbols) |
|  | Sub carrier spacing for aggressor cell (kHz) |
|  | 15 | 30 |
| 0 | 1 | 2 | 2 |
| 1 | 0.5 | 4 | 3 |
| 2 | 0.25 | 8 | 6 |

**Proposal 2: The interruption is not appliable to FR2 cells due to SRS antenna switching on FR1 band(s).** **Proposal 3: For Scenario 1 asynchronous case, where X=1 SRS symbol is configured in a slot for SRS antenna switching, the interruption length shall be defined as X2 in Table 2.** Table 2: Interruption length X2 for asynchronous Scenario 1 (slots)

|  |  |  |
| --- | --- | --- |
|  | NR Slot length(ms) of victim cell | Interruption length X1 (slots) |
|  | Sub carrier spacing for aggressor cell (kHz) |
|  | 15 | 30 |
| 0 | 1 | 2 | 2 |
| 1 | 0.5 | 2 | 2 |
| 2 | 0.25 | 2 | 2 |

**Proposal 4: For Scenario 2, where X=6 SRS symbols in a slot are assumed for SRS antenna switching, the interruption length shall be defined as X3 in Table 3.** Table 3: Interruption length X3 for scenario 2 (slots)

|  |  |  |
| --- | --- | --- |
|  | NR Slot length(ms) of victim cell | Interruption length X1 (slots) |
|  | Sub carrier spacing for aggressor cell (kHz) |
|  | 15 | 30 |
| 0 | 1 | 2 | 2 |
| 1 | 0.5 | 2 | 2 |
| 2 | 0.25 | 3 | 2 |

**Proposal 5: The interruption requirement applies only if SRS resources are allowed to be configured in the last 6 OFDM symbols in a slot.****Proposal 6: The interruption requirement does not apply if the SRS resources of a set in a slot are configured in non-consecutive manner.** **Proposal 7: Do not define the requirements when AP NR SRS resource and the P/SP CSI-RS for NR L1-RSRP/L1-SINR measurement are scheduled in the same OFDM symbol, or the prioritization needs to be clarified for this particular case.** |
| [**R4-2204705**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204705.zip) | Nokia, Nokia Shanghai Bell | Draft CR |
| [**R4-2204869**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204869.zip) | Huawei, Hisilicon | **Observation 1: The reason why requirements don’t apply for aperiodic case is not well justified if compared with existing requirements.****Proposal 1: NR measurements are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement when colliding with SRS.****Proposal 2: Define generic requirements and no need to consider whether symbols before and/or after SRS transmission are UL or DL symbols.****Table I Interruption requirement in number of symbols for scenarios 1 sync case**

|  |  |
| --- | --- |
|  | **Aggressor CC SCS(kHz)** |
| **Victim CC SCS (kHz)** | **15** | **30** | **60** |
| **15** | 3 | 2 | 2 |
| **30** | 4 | 3 | 3 |
| **60** | 7 | 5 | 4 |
| **120** | 13 | 9 | 7 |

**Table II Interruption requirement in number of slots for scenarios 1 async case**

|  |  |
| --- | --- |
|  | **Aggressor CC SCS(kHz)** |
| **Victim CC SCS (kHz)** | **15** | **30** | **60** |
| **15** | 2 | 2 | 2 |
| **30** | 2 | 2 | 2 |
| **60** | 2 | 2 | 2 |
| **120** | 2 | 2 | 2 |

**Table III Interruption requirement in number of slots for scenarios 2**

|  |  |
| --- | --- |
|  | **Aggressor CC SCS(kHz)** |
| **Victim CC SCS (kHz)** | **15** | **30** | **60** |
| **15** | 2 | 2 | 2 |
| **30** | 2 | 2 | 2 |
| **60** | 3 | 2 | 2 |
| **120** | 5 | 3 | 3 |

**Proposal 3: Define the interruption requirements for scenarios 1 and 2 as above tables.****Observation 2: According to the agreements on how to formulate the requirements, there is no need to discuss non-consecutive SRS transmission in a slot.****Proposal 4: Clarify that the requirements apply when SRS resources are allocated in the last 6 symbols in a slot if necessary.** |
| [**R4-2205836**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205836.zip) | Ericsson | **Proposal 1: RAN4 not to define any additional prioritizations rules when AP SRS collided with NR measurements in NR SA as it was agreed that NR measurements are always prioritized over SRS.** **Proposal 2: Table 1 to be agreed as Interruption length for scenario 1 and sync case.** Table 1: Interruption length in symbols for scenario 1 and sync case

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 3 | 3 | 3 |
| 30 | 6 | 5 | 3 |
| 60 | 10 | 8 | 7 |
| 120 | 20 | 14 | 14 |

**Proposal 3: Table 2 to be agreed as Interruption length for scenario 1 and async case.**Table 2: Interruption length in slots for scenario 1 and async case

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2  | 2 | 2 |
| 60 | 2 | 2 | 2 |
| 120 | 2 | 2 | 2 |

**Proposal 4: Table 3 to be agreed as Interruption length for scenario 2 and async case.**Table 3: Interruption length in slots for scenario 2 and async case

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2  | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |

 |
| [**R4-2205837**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205837.zip) | Ericsson | Draft CR |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1: Impact of SRS antenna port switching to other requirements

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-1: Impact of SRS antenna port switching to RRM requirements in NR-SA**

* Proposals
* Option 1 (Apple, Intel, HW, Ericsson): NR measurements are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement
* Option 2: NR measurements are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement, and,
	+ Option 2a (QC, CATT): No requirement applies for AP/P/SP L1-RSRP/L1-SINR measurement colliding with AP SRS.
	+ Option 2b (OPPO, MTK): No requirement applies for aperiodic L1-RSRP/L1-SINR measurement collides with aperiodic SRS in the same OFDM symbol.
	+ Option 2c (Nokia): Do not define the requirements when AP NR SRS resource and the P/SP CSI-RS for NR L1-RSRP/L1-SINR measurement are scheduled in the same OFDM symbol, or the prioritization needs to be clarified for this particular case.
	+ Option 2d (vivo): Add clarifications that longer delay for L1-RSRP/L1-SINR measurements will be expected if the interrupted DL symbols due to AP SRS antenna switching colliding with the DL symbol for AP L1-RSRP or L1-SINR measurements, and no requirement is specified.
* Recommended WF
	+ TBA.
* 1st round Comment collection:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 1. In current TS38.133 we have scheduling restriction on SRS transmission when it’s colliding with L1-RSRP measurement, and that means SRS has low priority than L1-RSRP. But we are fine to compromise to option 2a if majority companies think it makes more sense, as long as the UE behavior of prioritization can be clearly defined.  |
| Ericsson | Our preference is Option 1 as we think NW may not schedule aperiodic SRS in overlapping occasion of NR measurements. It may be error case and if it happens, and we are fine with not defining any requirements for that case.  |
| Huawei | We support option 1 which is aligned with existing principles in TS 38.133. But for sake of progress, we can compromise to option 2b.  |
| Intel | We prefer option 2b. We can also support option 1 by consider the legacy requirement defined for L1-RSRP/L1-SINR. |
| MediaTek | Support option 1 to avoid the mis-alignment with scheduling restriction for L1-RSRP measurement. |
| Nokia | Option 2c and can compromise to Option 2a. |
| CATT | Support Option 2a |
| vivo | Corrected typo in option 2d. 2d is the same as 2b if the typo is corrected. Support option 2b and 2d, but also OK option 2a. We are also fine for option 1 if clarification is done in the WF. |
| QC | We prefer option 2a and can accept option 2b. No requirement or longer requirement on P/SP/AP CSI-RS when colliding with AP SRS AS are both good for us.Apple, Huawei (and MediaTek) pointed out that L3 measurement has scheduling restriction on SRS, but that only covers the same carrier. However, the interruption from SRS antenna switch on carrier 1 can interruption L3 measurement on carrier 2, but carrier 2 scheduling restriction by L3 doesn’t avoid scheduling SRS antenna switch on carrier 1.Intel pointed out the priority of SRS, but the issue for AP SRS priority is grant processing timeline not enough to avoid interruption to the measurements.Ericsson argued that AP SRS collide with measurement should be an error case. If this is an error case, there should be no requirement instead of still imposing the prioritization requirement on an error case. |
| Moderator | GTW agreement:* Agreements
	+ NR measurements are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement
		- FFS whether to define requirement for L1-RSRP/L1-SINR measurements colliding with AP SRS

Could companies compromise to “no requirement for L1-RSRP/L1-SINR measurements colliding with AP SRS”? |

### Sub-topic 2: Interruption requirement design

*Sub-topic description*

|  |
| --- |
| * Agreements in previous RAN4 meetings
	+ The components of interruption time of SRS antenna port switching in FR1 are
		- Antenna switching time before and after SRS transmission occasion (2\*15us)
		- SRS transmission time of X symbols
			* Requirements would be defined for two scenarios:
				+ Scenario 1: when X=1 SRS symbol is configured in a slot for SRS antenna port switching, the configured number of SRS symbols is used as SRS transmission time
				+ Scenario 2: otherwise, using X=6 SRS symbols in a slot as assumption of SRS transmission time

Define the following interruption requirements:* Based on symbol-level for scenario 1 sync case
* Based on slot-level for scenario 1 async case
* Based on slot-level for scenario 2 async case (note: same interruption requirement would be applied for both sync and async case, and this requirement is defined based on async case)

Note: the MTTD/MRTD assumption for sync and async is defined in section 7.5/7.6 of TS38.133 |

*Open issues and candidate options before e-meeting:*

**Issue 2-1: Antenna switching time**

* Proposals
	+ Option 1 (LGE): The antenna switching time (15us) should be applied only when the symbol before or after SRS transmission occasion is uplink symbol since the switching time is for Tx-to-Tx, and the transient time for Tx(Rx)-to-Rx(Tx) is 10us.
	+ Option 2 (CATT, MTK, HW): generic requirement is preferred and no need to consider option 1.
* Recommended WF
	+ TBA.
* 1st round Comment collection:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 2. We prefer to use generic requirement and this 15us has been agreed already in previous RAN4 meeting. |
| LGE | Prefer option 1 to make clear based on specification. |
| Ericsson | We think different switching time (10us/15us) does not result in different interruption length. Even for 120kHz, symbol length is roughly 9us and it is more than 10us transient period. For both 10us/15 switching period, it occupies two symbols anyway. SO there is no advantage considering different switching lengths.  |
| Huawei | We support option 2. We think it is the basic assumption in RRM discussion that 15 us is the antenna switching time when defining the requirements.  |
| ZTE | Option 2. Prefer to define a generic requirement. |
| OPPO | Support Option 2 |
| Intel | We prefer more generic requirement, i.e. Option 2. |
| Xiaomi | Support Option 2 to define generic requirement. |
| MediaTek | Support option 2 |
| Nokia | We think Option 1 is correct technically but wonder if we need such condition in RRM requirements as transient period is not defined in RRM. Probably it is sufficient to define the RRM requirements for the worse case.  |
| CATT | Support option 2 |
| vivo | We support option 2. |
| QC | Question to LGE: what’s the difference you see on number of symbols/slots when change 15us to 10us? |
| LGE3 | To QC,Our intention for the proposal is to confirm that SRS antenna switching time should not affect the victim cell downlink when UE belonging to aggressor cell switches from uplink transmission to downlink reception since the transient time for Tx-to-Rx (NTX-RX) based on RAN1 specification is guaranteed, if UE does not support simultaneous Rx/Tx in intra-/inter-band TDD sync cases as we proposed in Issue 2-2.If companies are same understanding for above our intention, we are fine to skip this issues.  |

**Issue 2-2: Intra-band and inter-band DC/CA**

* Proposals:
	+ Option 1 (LGE): clarify in interruption requirement as followings:
		- For intra-band DC/CA in TDD synchronous case, there is no interruption issue on downlink symbols in the victim cell regardless of MTTD/MRTD, TA, or antenna switching time when the symbol before or after configured SRS resource for antenna port switching is the downlink symbol since the transient time 13us for Tx-to-Rx (NTX-RX) and Rx-to-Tx (NRX-TX) is guaranteed when a UE transmits (or receives) the uplink (or downlink) after the end of the last received (or transmitted) downlink (or uplink) symbol according to TS38.211.
		- For inter-band DC/CA in TDD synchronous case without the capability of simultaneous Rx and Tx, there is no interruption issue on downlink symbols in the victim cell regardless of MTTD/MRTD, TA, or antenna switching time when the symbol before or after configured SRS resource for antenna port switching is the downlink symbol since the transient time 13us for Tx-to-Rx (NTX-RX) and Rx-to-Tx (NRX-TX) is guaranteed when a UE transmits (or receives) the uplink (or downlink) after the end of the last received (or transmitted) downlink (or uplink) symbol according to TS38.211.
	+ Option 2: define generic requirement and no need to clarify option 1 in the requirement
* Recommended WF
	+ **Moderator suggestion:** the option 1 is new and would probably diverse the discussion from last meeting. Since this meeting is the last one for WI core completion, we can discuss it in this meeting but if we cannot have consensus on this issue 2-2, it could be further checked during maintenance stage, but it should not delay/block the core part completion.
* 1st round Comment collection:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 2. For inter-band DC/CA without capability of simultaneous Rx/Tx, UE would not have Rx when it performs SRS transmission and therefore no interruption requirement would be applied, and we think it’s a common understanding and no need to explicitly capture in the spec (like other interruptions requirement in TDD DC/CA system).  |
| LGE | Option 1. As commented Apple, UE would not have Rx when SRS transmission is performed if UE is not support simultaneous Rx/Tx in TDD intra/inter-band sync case based on RAN1 specification. But, for the discussion of the interruption requirements for scenario 1 and 2 cases below, it seems that the interruption length is based on the assumption supporting simultaneous Rx/Tx. So, we need to clarify it and add ‘Note’ in requirement table.  |
| Nokia | We have agreed to define DL/UL interruption based on the UE capability. The understanding is that UE is able to determine if there is any DL interruption on the victim cell and indicates the band entry in UE capability message accordingly. If this is the case, we can leave the decision to UE and don’t have to specify the exact conditions in Option 1.*According to RAN2 capability definition, txSwitchImpactToRx indicates the SRS antenna port switching impact to DL only, and txSwitchWithAnotherBand indicates the SRS antenna port switching impact to UL only. If any issue is identified, this conclusion could be revisited.* |
| CATT | Option 2. TA is an uncertain parameter and the impact of MRTD/MTTD on the carrier being interrupted is also uncertain, so we suggest to define the generic requirements and not to differentiate the scenarios into more details.  |

**Issue 2-3: Interruption requirement (symbol-level) proposals for scenario 1 sync case**

* Proposals:
	+ Option 1 (QC):

|  |  |
| --- | --- |
| Scenario 1 | Interruption Length (symbols) |
| Victim SCS (kHz) | 15 | 30 | 60 |
| 15 | 3 | 2 | 2 |
| 30 | 5 | 3 | 3 |
| 60 | 8 | 5 | 4 |
| 120 | 14 | 9 | 7 |

* + Option 2 (Apple, HW):

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 3  | 2 | 2 |
| 30 | 4  | 3 | 3 |
| 60 | 7  | 5 | 4 |
| 120 | 13  | 9 | 7 |

***Unit of interruption requirement is symbol of victim CC***

* + Option 3 (CATT): it is proposed int[(1 SRS symbol length + 2\*15us)/(symbol length of victim CC)]+1 symbols interruption is allowed for scenario 1 sync case.
	+ Option 4 (Xiaomi):

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15 | 30 | 60 |
| 15 | 2 | 1 | 1 |
| 30 | 3 | 2 | 2 |
| 60 | 6 | 4 | 3 |
| 120 | 12 | 8 | 6 |

* + Option 5 (CMCC):

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15  | 3 symbols | 3 symbols | 3 symbols |
| 30  | 5 symbols | 4 symbols | 4 symbols |
| 60  | 9 symbols | 7 symbols | 6 symbols |
| 120  | 17 symbols | 13 symbols | 11 symbols |

* + Option 6 (OPPO):

|  |  |
| --- | --- |
| Scenario 1 | Interruption Length (symbols) |
| Victim SCS (kHz) | 15 | 30 | 60 |
| 15 | 4 | 3 | 3 |
| 30 | 6 | 4 | 4 |
| 60 | 9 | 6 | 5 |
| 120 | 14 | 10 | 8 |

* + Option 7 (LGE):
* Table 1 Interruption for scenario 1 in inter-band MR-DC/CA synchronous case

|  |  |
| --- | --- |
| Victim cell SCS [kHz] | Interruption length [symbols] |
| Aggressor cell SCS [kHz] |
| 15 | 30 | 60 |
| 15 | 3 | 3 | 2 |
| 30 | 6 | 5 | 4 |
| 60 | 11 | 9 | 8 |
| 120 | 21 | 17 | 15 |
| Note: The downlink symbols are excluded from the defined interruption symbols if UE does not support *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA*. |

* Table 2 Interruption for scenario 1 in intra-band MR-DC (EN-DC) synchronous case

|  |  |
| --- | --- |
| Victim cell SCS [kHz] | Interruption length [symbols] |
| Aggressor cell SCS [kHz] |
| 15 | 30 | 60 |
| 15 | 2 | 2 | 1 |
| 30 | 4 | 3 | 2 |
| 60 | 7 | 5 | 4 |
| 120 | 13 | 9 | 7 |
| Note: The downlink symbols are excluded from the defined interruption symbols. |

* + Option 8 (vivo):

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 4 | 3 | 3 |
| 60 | 7 | 5 | 4 |
| 120 | 13 | 9 | 7 |

* + Option 9 (MTK):

|  |  |
| --- | --- |
| Victim cell SCS(KHz) | Aggressor Cell SCS (KHz) |
| 15 | 30 | 60 |
| 15 | 3 | 2 | 2 |
| 30 | 4 | 3 | 3 |
| 60 | 7 | 5 | 4 |
| 120 | 14 | 10 | 8 |

* + Option 10 (Intel):

|  |  |
| --- | --- |
|  | aggressor SCS |
| Victim SCS  | 15kHz | 30kHz | 60kHz |
| 15kHz | 4 | 4 | 4 |
| 30kHz | 6 | 4 | 4 |
| 60kHz | 11 | 7 | 4 |

* + Option 11 (Nokia): The interruption is not appliable to FR2 cells due to SRS antenna switching on FR1 band(s)

|  |  |  |
| --- | --- | --- |
|  | NR Slot length(ms) of victim cell | Interruption length X1 (symbols) |
|  | Sub carrier spacing for aggressor cell (kHz) |
|  | 15 | 30 |
| 0 | 1 | 2 | 2 |
| 1 | 0.5 | 4 | 3 |
| 2 | 0.25 | 8 | 6 |

* + Option 12 (Ericsson):

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 3 | 3 | 3 |
| 30 | 6 | 5 | 3 |
| 60 | 10 | 8 | 7 |
| 120 | 20 | 14 | 14 |

* Recommended WF
	+ The summary of the interruption requirement proposals for scenario 1 sync case

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 (vivo, Xiaomi, Nokia)3 (Apple, QC, CMCC, MTK, HW, Ericsson)4 (OPPO, Intel) | 1 (Xiaomi)2 (Apple, QC, vivo, MTK, Nokia, HW)3 (CMCC, OPPO, Ericsson)4 (Intel) | 1 (Xiaomi)2 (Apple, QC, vivo, MTK, HW)3 (CMCC, OPPO, Ericsson)N/A (Nokia) |
| 30 | 3 (Xiaomi)4 (Apple, vivo, MTK, Nokia, HW)5 (QC, CMCC)6 (OPPO, Intel, Ericsson) | 2 (Xiaomi)3 (Apple, QC, vivo, MTK, Nokia, HW)4 (CMCC, OPPO, Intel)5 (Ericsson) | 2 (Xiaomi)3 (Apple, QC, vivo, MTK, HW, Ericsson)4 (CMCC, OPPO, Intel)N/A (Nokia) |
| 60 | 6 (Xiaomi)7 (Apple, vivo, MTK, HW)8 (QC, Nokia)9 (CMCC, OPPO)10 (Ericsson)11 (Intel) | 4 (Xiaomi)5 (Apple, QC, vivo, MTK, HW)6 (OPPO, Nokia)7 (CMCC, Intel)8 (Ericsson) | 3 (Xiaomi)4 (Apple, QC, vivo, MTK, Intel, HW)5 (OPPO)6 (CMCC)7 (Ericsson)N/A (Nokia) |
| 120 | 12 (Xiaomi)13 (Apple, vivo, HW)14 (QC, OPPO, MTK)17 (CMCC)20 (Ericsson)N/A (Nokia) | 8 (Xiaomi)9(Apple, QC, vivo, HW)10 (OPPO, MTK)13 (CMCC)14 (Ericsson)N/A (Nokia) | 4 (Intel)6 (Xiaomi)7 (Apple, QC, vivo, HW)8 (OPPO, MTK)11 (CMCC)14 (Ericsson)N/A (Nokia) |
| Note 1: Option 7 from LGE is not merged into this summary table since option 7 is using a different methodology/structure to define separated interruption requirement for intra-band/inter-band cases. But we can also discuss option 7 when we discuss this table.Note 2: Option 3 from CATT is not reflected directly in this summary table since option 3 is a principle description. Please CATT feel free to indicate their position on those candidate values based on their option 3 principle. |

Based on the summary, moderator propose to consider choosing medium value among proposals from companies for requirement design, unless certain specific values can be strongly justified.

Regarding FR1 SRS switching impact FR2, RAN4 agreed that the interruption requirement is up to the signaling indication of “txSwitchImpactToRx” or “txSwitchWithAnotherBand”, and RAN1/2 didn’t preclude UE to indicate FR1 impact FR2 for these signalings, we may not need to remove the FR1 SRS AS impact to FR2 at this stage but could further check it during maintenance stage.

**Tentative compromise for discussion:**

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15 | 30 | 60 |
| 15 (NR or LTE) | [3] | [2] | [2] |
| 30 | [4] | [3] | [3] |
| 60 | [8] | [6] | [5] |
| 120 | [14] | [10] | [8] |

Unit of interruption requirement is symbol of victim CC

* 1st round Comment collection:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple(corrected) | Support tentative compromise. Our calculation is: $\left⌈\frac{aggressive-symbol-length(with CP)+30us}{victim-symbol-length(with CP)}\right⌉+1$ |
| LGE | For clarification of the interruption length, in our understanding, the interruption length could be calculated by MTTD/MRTD/antenna switching time. So, we think that the interruption length for inter-band and intra-band would be different since MTTD/MRTD for both cases is different. Our proposed interruption length is based on 2xMTTD and antenna switching time. Since network cannot know which signal (from victim or aggressor cell) is arrived at UE, so 2xMTTD is considered for interruption length.  |
| Apple2 | We would like to clarify to LGE comment. MTTD/MRTD cannot be used as part of interruption length, because MTTD/MRTD only provides the time difference uncertainty between two CCs. Based on legacy interruption concept, it’s not assumed that the symbols or slots within time difference uncertainty would be treated as interruption, because network does not know the interruption position and network keeps scheduling on all slots but allow ACK/NACK loss based on interruption length/ratio, and the interruption length is based on: 2\*15us + aggressor SRS symbol. |
| Ericsson | Maybe we first need to decide on computation formula. My thinking behind our proposal is as follows. In async scenarios where MRTD is large, NW may know the MRTD or MTTD experienced by UE and only interruption length is only needed to consider SRS transmission time plus antenna switching time. However, for sync scenario, since MRTD is 33us, I assumed NW may not know where the interruption happens, hence considered MRTD in the interruption computation. Since MRTD can be +/-ve w.r.t victim cells, we considered MRTD both the sides. With above thinking we used 2\*MRTD+2\*antenna switching time+ SRS tx. Time.If MRTD/MTTD is not required to be considered in interruption length computation, we are fine to accept moderator suggestion. |
| Huawei | Support option 2. But for sake of progress we can agree with compromised valued by moderator. Though minor difference among options, the main difference is whether to have the interruption requirements considering MRTD/MTTD/TA, which is more like the potentially impacted symbols. The other approach is only consider the SRS symbols and 2\*15 us, which is only about the number of interrupted symbols.  |
| CMCC | After further check, we are OK with Apple/HW comments to only consider the SRS symbols and 2\*15 us for the calculation. We support option 2. And the recommended WF is also fine for us to move forward. |
| OPPO | We can support tentative compromise. |
| Intel | With the clarification from moderator, we are fine with the compromised value with the assumption that MRTD/MTTD didn’t need to be considered. Since we will only count on the ACK/NACK loss, the interruption length will be the same no matter where the interruption happens. |
| Xiaomi | The tentative compromise is acceptable. |
| LGE2 | Thank Apple for clarification.The reason why we consider MTTD/MRTD in the interruption calculation is that we think potential impacted symbols should be considered when symbol level is defined unlike slot level since allowed ACK/NACK loss based on symbol level interruption is a bit ambiguous for us. But, if MTTD/MRTD do not need to be taken into account in the interruption calculation based on Apple’s clarification, we are fine the tentative compromise. |
| MediaTek | we are fine the tentative compromise |
| Nokia | In general, we are fine with the tentative compromised values. But why do we need 60kHz aggressor cells? For FR1, we only consider 15kHz and 30kHz in SRS carrier based switching. Is there any reason to add 60kHz in FR1 aggressor cells? We also support separating the intra-band from inter-band sync cases. As now the interruption is in symbol-level, the difference on MRTD/MTDD between intra-band and inter-band becomes nonnegligible. It may help to differentiate the interruptions for the two synchronized cases. But the values need to be revisited.  |
| CATT | Suggest to define the requirements as int[(1 SRS symbol length + 2\*15us)/(symbol length of victim CC)]+1 symbols。

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15 | 30 | 60 |
| 15 (NR or LTE) | 3 | 2 | 2 |
| 30 | 4 | 3 | 2 |
| 60 | 6 | 4 | 3 |
| 120 | 12 | 8  | 6 |

 |
| vivo | Fine to the tentative agreements. |
| Moderator | GTW agreement:* Agreements
	+ Interruption requirement (symbol-level) for scenario 1 sync case
		- Note: Unit of interruption requirement is symbol of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15 | 30 | 60 |
| 15 (NR or LTE) | [3] | [2] | [2] |
| 30 | [4] | [3] | [3] |
| 60 | [8] | [6] | [5] |
| 120 | [14] | [10] | [8] |

Please companies comment if bracket could be removed or not. |

**Issue 2-4: Interruption requirement (slot-level) proposals for scenario 1 async case**

* Proposals
	+ Option 1 (QC, Apple, CATT, Xiaomi, OPPO, vivo, MTK, Intel(except 120kHz row), HW, Ericsson):

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 2 | 2 | 2 |
| 120 | 2 | 2 | 2 |

Unit of interruption requirement is slot for NR and subframe for LTE of victim CC.

* + Option 2 (CMCC):

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15  | 2 slots | 2 slots | 2 slots |
| 30  | 2 slots | 2 slots | 2 slots |
| 60  | 2 slots | 2 slots | 3 slots |
| 120  | 3 slots | 3 slots | 3 slots |

* + Option 3 (LGE):

|  |  |
| --- | --- |
| Victim cell SCS [kHz] | Interruption length [slot] |
| Aggressor cell SCS [kHz] |
| 15 | 30 | 60 |
| 15 | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 2 |
| Note 1: In inter-band TDD synchronous case, the downlink symbols are excluded from the defined interruption slots if UE does not support *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA.*Note 2: In intra-band TDD synchronous case, the downlink symbols are excluded from the defined interruption slots. |

* + Option 4 (Nokia): The interruption is not appliable to FR2 cells due to SRS antenna switching on FR1 band(s)

|  |  |  |
| --- | --- | --- |
|  | NR Slot length(ms) of victim cell | Interruption length X1 (slots) |
|  | Sub carrier spacing for aggressor cell (kHz) |
|  | 15 | 30 |
| 0 | 1 | 2 | 2 |
| 1 | 0.5 | 2 | 2 |
| 2 | 0.25 | 2 | 2 |

* Recommended WF
	+ Moderator: Regarding FR1 SRS switching impact FR2, RAN4 agreed that the interruption requirement is up to the signaling indication of “txSwitchImpactToRx” or “txSwitchWithAnotherBand”, and RAN1/2 didn’t preclude UE to indicate FR1 impact FR2 for these signalings, we may not need to remove the FR1 SRS AS impact to FR2 at this stage but could further check it during maintenance stage.
	+ Can companies compromise to option 1?
* 1st round Comment collection:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Support option 1. |
| LGE | Support option 1. |
| Ericsson | Option 1. |
| Huawei | Option 1 |
| ZTE | Support option 1. |
| CMCC | OK with option 1. |
| OPPO | Support option 1. |
| Intel | Option 1 |
| Xiaomi | Support option 1. |
| MediaTek | Option 1 |
| Nokia | Fine with Option 1. And same question as in Issue 2-3: Why do we need 60kHz aggressor cells? For FR1, we only consider 15kHz and 30kHz in SRS carrier-based switching. Is there any reason to add 60kHz in FR1 aggressor cells? |
| CATT | Fine with option 1.  |
| vivo | Option 1. |
| Moderator | GTW agreement:* + Interruption requirement (slot-level) for scenario 1 async case
		- Note: Unit of interruption requirement is slot for NR and subframe for LTE of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 2 | 2 | 2 |
| 120 | 2 | 2 | 2 |

This issue is closed. |

**Issue 2-5: Interruption requirement (slot-level) proposals for scenario 2**

* Proposals
	+ Option 1 (QC, Apple, CATT, Xiaomi, CMCC, OPPO, vivo, MTK, HW, Ericsson):

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |

Unit of interruption requirement is slot for NR and subframe for LTE of victim CC.

* + - Option 1a (LGE): add following notes in option 1.
			* Note 1: In inter-band TDD synchronous case, the downlink symbols are excluded from the defined interruption slots if UE does not support *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA.*
			* Note 2: In intra-band TDD synchronous case, the downlink symbols are excluded from the defined interruption slots.
	+ Option 2 (Nokia): The interruption is not appliable to FR2 cells due to SRS antenna switching on FR1 band(s)

|  |  |  |
| --- | --- | --- |
|  | NR Slot length(ms) of victim cell | Interruption length X1 (slots) |
|  | Sub carrier spacing for aggressor cell (kHz) |
|  | 15 | 30 |
| 0 | 1 | 2 | 2 |
| 1 | 0.5 | 2 | 2 |
| 2 | 0.25 | 3 | 2 |

* Recommended WF
	+ Moderator: Can companies compromise to option 1?
* 1st round Comment collection:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Support option 1. |
| LGE | Support option 1 with option 1a Note as commented in Issue 2-2. |
| Ericsson | Option 1. |
| Huawei | Option 1 |
| ZTE | Support option 1. |
| CMCC | Support option 1 |
| OPPO | Support option 1. |
| Intel | Option 1 |
| Xiaomi | Support option 1. |
| MediaTek | Option 1 |
| Nokia | We can compromise to Option 1. |
| CATT | Support option 1. |
| vivo | Option 1 |
| LGE3 | We’d like to provide further clarification following FFS point

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |

* + - FFS how to handle UEs supporting *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA*
		- FFS whether to exclude downlink symbols from interruption requirements for intra-band TDD synchronous case.

We fully agree the generic requirements for scenario 2 both sync and async. However, we think we need to clarify the interruption following specific cases **if UE does not support simultaneous Rx/Tx in intra-/inter-band TDD sync*** Case 1: the slot (symbol) after SRS transmission is downlink
* Case 2: the symbol before SRS transmission is uplink in special slot

As commented in GTW and Issue 2-2, if UE does not support simultaneous Rx and Tx, UE would not receive Rx when SRS transmission is performed in intra-band and inter-band TDD sync case. We provide an example for Case 1 (15kHz SCS) based on our understanding. As shown in figure below, after SRS transmission in slot n, slot n+1 downlink slot (symbols) of victim cell is not interrupted since transient time NTX-RX is guaranteed by RAN1 specification. Therefore, we think the interruption slot length is 1 in this case. Some of other SCS cases would be similar situation. And also Case 2 is similar. So, we would like to add Note (proposal 1a) to handle Case 1 and Case 2 without separated requirement table. The wording we proposed could be revised if needed. |
| Moderator | GTW agreement:* Agreements
	+ Interruption requirement (slot-level) for scenario 2
		- Note: Unit of interruption requirement is slot for NR and subframe for LTE of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |

* + - FFS how to handle UEs supporting *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA*
		- FFS whether to exclude downlink symbols from interruption requirements for intra-band TDD synchronous case.

Keep discussion on above FFS notes.  |

### Sub-topic 3: Miscellaneous issues

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 3-1: Impacts from SRS antenna port switching enhancement in R17 FeMIMO**

* Proposal 1: The interruption requirement applies only if SRS resources are allowed to be configured in the last 6 OFDM symbols in a slot.
	+ Option 1 (Nokia, HW): need to clarify above applicability.
	+ Option 2 (Apple, CATT): no need to discuss above applicability.
* Proposal 2: The interruption requirement does not apply if the SRS resources of a set in a slot are configured in non-consecutive manner.
	+ Option 1 (Nokia): need to clarify above applicability.
	+ Option 2 (Apple CATT, HW): no need to discuss above applicability.
* Recommended WF
	+ Moderator: please check if followings could be a compromise:
		- Clarify that the interruption requirements applies when SRS resources are allocated in the last 6 symbols in a slot.
		- No need to discuss whether or not the SRS resources of a set in a slot are configured in non-consecutive manner.
* 1st round Comment collection:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Support recommended WF.  |
| LGE | Support recommended WF. |
| Ericsson | Ok with recommended WF |
| Huawei | Support recommended WF. |
| ZTE | Support the recommended WF. |
| OPPO | Support recommended WF. |
| Intel | Fine with the recommended WF. |
| Xiaomi | Support the recommended WF. |
| MediaTek | Ok with the recommended WF |
| Nokia | Fine with the first bullet in recommended WF.As for the second bullet, the intention is also to clarify we only consider the consecutive SRS switching in a slot. We understood the non-consecutive case is under discussion in FeMIMO. Do the companies promoting Option 2 think the non-consecutive case is also applicable, or this is common understanding?  |
| CATT | Fine with the recommended WF.  |
| vivo | OK with the recommended WF. |

**Issue 3-2: further clarifications on interruption requirement**

* Proposal 1 (vivo): For the sync case of scenario 1, further discuss whether the case when the last symbol in the slot on the aggressor CC is not used for SRS transmission is only considered for test case design, in which the maximum number interrupted slots for SRS antenna switching is 1 for all 15kHz and 30kHz aggressor CC SCS cases.
* Proposal 2 (Intel): For scenarios 1, the symbol based requirement will apply if one SRS resource set is configured. It’s FFS when two SRS resource sets are configured in two consecutive slots.
* Recommended WF
	+ Moderator: further clarifications on interruption requirement could be discussed in this meeting with low priority, and if no consensus in this meeting it could be discussed during the maintenance stage.
* 1st round Comment collection:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Proposal 1: we can discuss it in performance stage, but our understanding is regardless of the SRS configuration UE is only required to meet the core requirement in the test. Proposal 2: our understanding is interruption requirement focus on SRS antenna port switching within one SRS resource set, and multiple SRS resource sets could be considered in future release if needed. |
| LGE | Proposal 1: we think this proposal is for performance phase discussion.Proposal 2: RAN4 already agreed to define interruption length only for scenario 1 and scenario 2 in this release, and the scenario 1 is for one SRS resource set in our understanding. So we think the scenario for two SRS resource sets configuration would be out of scope in this release.  |
| Ericsson | We think last symbol is not used for SRS transmission in all practical scenarios. We could consider that as the assumption in deriving the requirements. |
| Huawei | For proposal 2, as discussed in issue 2-3, it seems the interruption length is one symbol +2\*15 us. We are wondering is there anything special that the conclusion in 2-3 cannot apply to the case mentioned in proposal 2?  |
| Intel | With the clarification that current requirement apply for one SRS resource set, we are fine to further discuss the case if two SRS resource sets are configured in maintain part or future release.To Huawei:RAN1 updated the spec with a guard period between SRS resource set in two consecutive slots.

|  |
| --- |
| The UE is configured with a guard period of *Y* symbols, in which the UE does not transmit any other signal, in the case the SRS resources of a set are transmitted in the same slot. The guard period is in-between the SRS resources of the set. For two SRS resource sets of an antenna switching located in two consecutive slots, if UE is capable of transmitting SRS in all symbols in one slot, a guard period of *Y* symbols exists between the last OFDM symbol occupied by the SRS resource set in the first slot and the first OFDM symbol occupied by the SRS resource set in the second slot. |

In RF session and RAN1, there are ongoing discuss about how to handle the interval between SRS resource set in two consecutive slots. In RF session, a LS is sent to RAN1 to inform RAN1 about the initial discussion outcomes. the issue will continue to be discussed in this meeting. If the conclusion is that UE can still transmit uplink signal between two sets, it’s possible that same requirement can be re-used. |
| MediaTek | For proposal 1, as mentioned in other comment, we think it should be discussed in performance phase.For proposal 2, agree with Apple, LGE and intel. |
| Nokia | P1 can be discussed in performance part.About P2, we are fine to leave out the case when two SRS resource sets are configured. But why is it only for scenario 1 but not scenario 2?  |
| CATT | Proposal 1: for sync case of scenario 1, the interruption is defined as symbol level, and the carrier being interrupted is also symbol level coding/decoding, there is no impact no matter whether the SRS is configured on the last symbol. Proposal 2: agree with Apple.  |
| vivo | Proposal 1: We agree it is for performance phase discussion.Proposal 2: We think the feature discussed here should be based on R15. But we are open to disucss. |
| QC | Agree with Apple |

## Companies views’ collection for 1st round

### Open issues

Comments are collected in section 1.2

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2203922**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203922.zip) (CATT CR) | Apple: the prioritization might be revised based on issue 1-1. |
| LGE: For clarification of “for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [38], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101-3 [54].”, is this required condition for SRS transmission for antenna port switching? |
| Huawei: Same views as LGE.  |
| Nokia: this is up to conclusion in Issue 1-1.  |
| QC: 1. active serving cell receiving\* => reception\*2. txSwitchImpactToRx and txSwitchWithAnotherBand are band groups instead of indication, could you check 38.331 and revise the description?3. typo: transmt => transmit4. What is 7.36.1 for? Seems identical to 7.32And agree with the comment from Apple |
| [**R4-2205837**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205837.zip) (Ericsson CR) | Apple: (1) we may not need to repeat the definition of xTyR and capability “*SRS-TxPortSwitch*” in RAM4 spec, since those have been specified in TS38.306. (2) interruption table could be revised based on issue 2-3/4/5. |
| Huawei: Similar views as Apple that the description about SRS AS maybe no needed in RAN4 spec. The condition “the SRS switching is not colliding with E-UTRA measurement” should only apply to EN-DC and NE-DC.  |
| Nokia: The interruption length and impact to RRM measurements needs to be aligned with open issues discussion. |
| QC:We provided a revised draft according to the following comment for clause 8.2.1.2.18 Interruptions at NR SRS antenna port switching. If this version is acceptable, could Ericsson update the rest clauses accordingly? The revision is uploaded to:https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_102-e/Inbox/Drafts/%5B102-e%5D%5B214%5D%20NR\_RRM\_enh2\_1/WF\_LS\_CRs/R4-2205837\_QC.docx1. Remove the following paragraph:SRS transmission from UE helps gNB in acquisition of the DL CSI (full channel) at the gNB. When UE has a higher number of RX antenna compared to TX antenna, UE sounds the SRS on all the RX antenna with the help of SRS antenna port switching to help gNB acquire full channel. This feature is mandatory with capability signalling, “SRS-TxPortSwitch”. The indicated UE antenna switching capability of ′xTyR′ corresponds to a UE, capable of SRS transmission on ′x′ antenna ports over total of ′y′ antennas, where ′y′ corresponds to all or subset of UE receive antennas. The requirements in this clause applicable for different SRS antenna switch patterns. 2. L1 measurement conflict is pending RRM discussion3. There is no priorization rule between SRS and E-UTRAN measurement4. txSwitchImpactToRx or txSwitchWithAnotherBand are not indications5. Scenario 1 and 2 are not suitable wording for capturing the interruption spec, configuration category is a better description. Moreover, scenario 2 covers all the configurations except number of SRS symbol = 1 |
| [**R4-2204705**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204705.zip)(Nokia CR) | Apple: as working splitting in previous meeting, recommend to merge Nokia CR to Ericsson CR. |
| Nokia: This CR is not for defining the interruption requirements at SRS switching. Instead, it adds SRS switching to “introduction” sub-sections which are not available in Ericsson CR.  |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

**Sub-topic 1: Impact of SRS antenna port switching to other requirements**

|  |  |
| --- | --- |
|  | **Status summary**  |
| Issue 1-1: Impact of SRS antenna port switching to RRM requirements in NR-SA  | GTW agreement:* + NR measurements are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement
		- FFS whether to define requirement for L1-RSRP/L1-SINR measurements colliding with AP SRS

*Candidate options:**Recommendations for 2nd round:*Continue the discussion in 2nd round. Conclusions would be captured in the WF. Please companies check if can compromise to “no requirement for L1-RSRP/L1-SINR measurements colliding with AP SRS”. |
|  |  |
|  |  |

**Sub-topic 2: Interruption requirement design**

|  |  |
| --- | --- |
|  | **Status summary**  |
| Issue 2-1: Antenna switching time | *Tentative agreements:*11 companies agreed with option 2 and 1 companies support option 1. Since LGE can compromise to option 2, the tentative agreement could be:Agreement: generic requirement is preferred and no need to consider option 1 for issue 2-1.*Candidate options:**Recommendations for 2nd round:*This issue is closed. Conclusions would be captured in the WF.  |
| Issue 2-2: Intra-band and inter-band DC/CA | *Tentative agreements:*3 companies agreed with option 1 and 1 companies support option 2. Since this issue would be discussed in issue 2-5 (the notes for interruption table), we could skip this issue 2-2 in 2nd round.*Candidate options:**Recommendations for 2nd round:*Skip this issue 2-2 and directly discuss it in issue 2-5 in 2nd round.  |
| Issue 2-3: Interruption requirement (symbol-level) proposals for scenario 1 sync case  | GTW agreement:* + Interruption requirement (symbol-level) for scenario 1 sync case
		- Note: Unit of interruption requirement is symbol of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15 | 30 | 60 |
| 15 (NR or LTE) | [3] | [2] | [2] |
| 30 | [4] | [3] | [3] |
| 60 | [8] | [6] | [5] |
| 120 | [14] | [10] | [8] |

*Candidate options:**Recommendations for 2nd round:*Please companies confirm if bracket could be removed or not in 2nd round. Conclusions would be captured in the WF. |
| Issue 2-4: Interruption requirement (slot-level) proposals for scenario 1 async case  | GTW agreement:* + Interruption requirement (slot-level) for scenario 1 async case
		- Note: Unit of interruption requirement is slot for NR and subframe for LTE of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 2 | 2 | 2 |
| 120 | 2 | 2 | 2 |

*Candidate options:**Recommendations for 2nd round:*This issue is closed. Conclusions would be captured in the WF. |
| Issue 2-5: Interruption requirement (slot-level) proposals for scenario 2 | GTW agreement:* + Interruption requirement (slot-level) for scenario 2
		- Note: Unit of interruption requirement is slot for NR and subframe for LTE of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |

* + - FFS how to handle UEs supporting *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA*
		- FFS whether to exclude downlink symbols from interruption requirements for intra-band TDD synchronous case.

*Candidate options:**Recommendations for 2nd round:*Keep discussion on the following notes for the above interruption requirement in 2nd round. Conclusions would be captured in the WF.* + FFS how to handle UEs supporting *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA*
	+ FFS whether to exclude downlink symbols from interruption requirements for intra-band TDD synchronous case.
 |

**1.2.5 Sub-topic 3: Miscellaneous issues**

|  |  |
| --- | --- |
|  | **Status summary**  |
| Issue 3-1: Impacts from SRS antenna port switching enhancement in R17 FeMIMO | *Tentative Agreement:** Clarify that the interruption requirements applies when SRS resources are allocated in the last 6 symbols in a slot.
* No need to discuss whether or not the SRS resources of a set in a slot are configured in non-consecutive manner.
	+ the non-consecutive case is an issue from R17 FeMIMO WI, and we don’t consider R17 FeMIMO in this FeRRM WI

*Candidate options:**Recommendations for 2nd round:*Check the tentative agreement in 2nd round. Conclusions would be captured in the WF. |
| Issue 3-2: further clarifications on interruption requirement | *Tentative Agreement:**Candidate options:** Proposal 1 (vivo): For the sync case of scenario 1, further discuss whether the case when the last symbol in the slot on the aggressor CC is not used for SRS transmission is only considered for test case design, in which the maximum number interrupted slots for SRS antenna switching is 1 for all 15kHz and 30kHz aggressor CC SCS cases.
	+ Option 1-1 (Apple, LGE, MTK, Nokia, vivo, QC): can discuss it in performance stage
	+ Option 1-2 (CATT): whether or not the SRS is configured on the last symbol has no difference for scenario 1 sync case
* Proposal 2 (Intel): For scenarios 1, the symbol based requirement will apply if one SRS resource set is configured. It’s FFS when two SRS resource sets are configured in two consecutive slots.
	+ Option 2-1 (Apple, LGE, MTK, Nokia, CATT, QC): multiple SRS resource sets could be considered in future release if needed.

*Recommendations for 2nd round:*Please companies check if following conclusions are acceptable:* For “Proposal 1: For the sync case of scenario 1, further discuss whether the case when the last symbol in the slot on the aggressor CC is not used for SRS transmission is only considered for test case design, in which the maximum number interrupted slots for SRS antenna switching is 1 for all 15kHz and 30kHz aggressor CC SCS cases.”,
	+ Tentative Agreement: can discuss proposal 1 in performance stage
* For “Proposal 2: For scenarios 1, the symbol based requirement will apply if one SRS resource set is configured. It’s FFS when two SRS resource sets are configured in two consecutive slots.”
	+ Tentative Agreement: multiple SRS resource sets could be considered in future release if needed.

Conclusions would be captured in the WF. |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

In 2nd round companies could discuss directly on the WF, and all the comments recorded in WF would be moved to this summary after 2nd round.

**Issue 1-1: Impact of SRS antenna port switching to RRM requirements in NR-SA**

**GTW agreement:**

* NR measurements are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement
	+ FFS whether to define requirement for L1-RSRP/L1-SINR measurements colliding with AP SRS

Agreement in 2nd round:

* NR measurements are always prioritized including L3 measurement, RLM/BFD/CBD and L1-RSRP/L1-SINR measurement
	+ No requirement for AP L1-RSRP/L1-SINR measurements colliding with AP SRS

|  |  |
| --- | --- |
| **Company** | **Comments** |
| QC | We support moderator’s compromised proposal. As we explained in GTW and in the first round, processing timeline is a concern for conflict resolution for AP SRS which is a grant based procedure. |
| Apple | We are fine to the compromised proposal. |
| Ericsson | We could compromise to no requirement for AP L1-RSRP/L1-SINR colliding with AP SRS. For periodic or semi-persistent L1-RSRP/L1-SINR we think UE could prioritize L1-RSRP/L1-SINR. |
| Nokia | We are fine with moderator’s proposal.  |
| Huawei | We would also like to check whether option 2b is a compromise solution, which is also acceptable to many companies in 1st round. From our understanding, if we can agreed that RLM/BFD/CBD is prioritized over AP SRS, similarly P/SP L1-RSRP/L1-SINR should follow the same principle without much additional burden. |
| Intel | We are OK to the compromised proposal. |
| Moderator | Based on companies’ comments, update the 2nd round agreement, and please companies further comment if you have concern on it. |
| MediaTek | Fine with the moderator’s compromised proposal. We are also fine with Ericsson’s version. |
| vivo | Fine with the latest version from moderator. |
| CATT | We can compromise to the latest proposal.  |

**Issue 2-1: Antenna switching time**

* Proposals
	+ Option 1 (LGE): The antenna switching time (15us) should be applied only when the symbol before or after SRS transmission occasion is uplink symbol since the switching time is for Tx-to-Tx, and the transient time for Tx(Rx)-to-Rx(Tx) is 10us.
	+ Option 2 (CATT, MTK, HW): generic requirement is preferred and no need to consider option 1.

Agreement in 1st round: generic requirement is preferred and no need to consider option 1 for issue 2-1.

**Issue 2-3: Interruption requirement (symbol-level) proposals for scenario 1 sync case**

**GTW agreement:**

* Interruption requirement (symbol-level) for scenario 1 sync case
	+ Note: Unit of interruption requirement is symbol of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15 | 30 | 60 |
| 15 (NR or LTE) | [3] | [2] | [2] |
| 30 | [4] | [3] | [3] |
| 60 | [8] | [6] | [5] |
| 120 | [14] | [10] | [8] |

Agreement in 2nd round:

* Interruption requirement (symbol-level) for scenario 1 sync case
	+ Note: Unit of interruption requirement is symbol of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15 | 30 | 60 |
| 15 (NR or LTE) | 3 | 2 | 2 |
| 30 | 4 | 3 | 3 |
| 60 | 8 | 6 | 5 |
| 120 | 14 | 10 | 8 |

|  |  |
| --- | --- |
| **Company** | **Comments** |
| LGE | We are fine to remove [ ]. |
| QC | Brackets can be removed. |
| Apple | [] can be removed. |
| Ericsson | May be a clarification question. By using the 1 SRS symbol length and 2\*15us switching time, we are seeing following table.

|  |  |
| --- | --- |
| Victim CC SCS(kHz) | Aggressor CC SCS (kHz) |
| 15 | 30 | 60 |
| 15 (NR or LTE) | 3 | 2 | 2 |
| 30 | 4 | 3 | 2 |
| 60 | 6 | 4 | 3 |
| 120 | 12 | 8  | 6 |

Since all companies agree with formula for calculation is 15us+ SRS symbol length + 15us, can we agree with the above table. We do not understand why 2 additional symbols interruption are required for 60 and 120kHz victim cc.If any company have concern on the above table, for the sake of progress we are fine to remove [] from GTW discussion.  |
| Nokia | Fine to remove brackets. |
| Huawei | Fine with the value. |
| Intel | OK with the value. |
| Xiaomi | Fine with the value. |
| Moderator | Based on companies’ comments, update the 2nd round agreement.To Ericsson’s comment, from moderator perspective, those values were chosen based on the medium value among companies’ proposals in 1st round since different companies added different margins. Thanks! |
| MediaTek | Ok with removing []. |
| CATT | Fine to remove the [].  |

**Issue 2-4: Interruption requirement (slot-level) proposals for scenario 1 async case**

**GTW agreement:**

* Interruption requirement (slot-level) for scenario 1 async case
	+ Note: Unit of interruption requirement is slot for NR and subframe for LTE of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 2 | 2 | 2 |
| 120 | 2 | 2 | 2 |

**Issue 2-5: Interruption requirement (slot-level) proposals for scenario 2**

**GTW agreement:**

* Interruption requirement (slot-level) for scenario 2
	+ Note: Unit of interruption requirement is slot for NR and subframe for LTE of victim CC

|  |  |
| --- | --- |
| Victim CC SCS (kHz) | Aggressor CC SCS (kHz) |
| 15  | 30 | 60 |
| 15 (NR or LTE) | 2 | 2 | 2 |
| 30 | 2 | 2 | 2 |
| 60 | 3 | 2 | 2 |
| 120 | 5 | 3 | 3 |

* + FFS how to handle Ues supporting *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA*
	+ FFS whether to exclude downlink symbols from interruption requirements for intra-band TDD synchronous case.

Moderator: discuss on the following notes for the above interruption requirement in 2nd round. If it cannot be concluded in this meeting, it could be further discussed in maintenance stage but won’t impact this WI’s timeline for core part completion.

* + FFS how to handle Ues supporting *simultaneousRxTxInterBandENDC* or *simultaneousRxTxInterBandCA*
	+ FFS whether to exclude downlink symbols from interruption requirements for intra-band TDD synchronous case.

Agreement in 2nd round:

Not add above FFS notes in the CR for WI closing. But companies could still bring in this issue for discussion in maintenance stage.

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| **Company** | **Comments** |
| LGE | For FFS point, We fully agree the generic requirements for scenario 2 both sync and async. However, we think we need to clarify the interruption following specific cases **if UE does not support simultaneous Rx/Tx in intra-/inter-band TDD sync*** Case 1: the slot (symbol) after SRS transmission is downlink
* Case 2: the symbol before SRS transmission is uplink in special slot

As commented in GTW and Issue 2-2 in 1st round, if UE does not support simultaneous Rx and Tx, UE would not receive Rx when SRS transmission is performed in intra-band and inter-band TDD sync case. We provide an example for Case 1 (15kHz SCS) based on our understanding. As shown in figure below, after SRS transmission in slot n, slot n+1 downlink slot (symbols) of victim cell is not interrupted since transient time NTX-RX is guaranteed by RAN1 specification. Therefore, we think the interruption slot length is 1 in this case (reduced by 1 slot from the above agreed interruption slot length). Some of other SCS cases would be similar situation. And also Case 2 is similar. So, we would like to add Note (proposal 1a in 1st round) to handle Case 1 and Case 2 without separated requirement table. The wording we proposed could be revised if needed. |
| QC | To LGE: the example you have assume certain timing alignment. But based on the previous agreement, even in sync we can have MRTD, i.e., misaligned slot boundary, and an additional slot interruption should be specified. Moreover, we can list all the difference special cases that reduces one slots/symbols from the agreed requirement. Qualcomm can come up with some if we want. However, we don’t want to spend time on discussing this because we don’t think it is feasible for network to dynamically schedule grant to leverage addition slot/symbols according to these corner cases, and for UE to react on all these grants. Note that the gain from doing all this is negligible, but the implementation complexity increase is significant.  |
| Apple | Similar view as QC. Generic minimum requirement is preferable from our perspective. |
| Nokia | We wonder if the proposal is still valid in async scenario, if half a slot MRTD is considered? As this was not defined in existing interruption sections, what is the reason to specify it at SRS antenna switching?  |
| LGE2 | To QCThanks for response. As you mentioned, even in sync case, MRTD/MTTD/TA exist. So, interruption slot or symbol could occur due to misaligned receiving or transmitting timing between aggressor and victim cell. However, RAN1 specification has already addressed this for not supporting simultaneous Rx/Tx as follows:

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| ***From TS38.211***A UE not capable of full-duplex communication and not supporting simultaneous transmission and reception as defined by parameter *simultaneousRxTxInterBandENDC, simultaneousRxTxInterBandCA or simultaneousRxTxSUL* [10, TS 38.306] among all cells within a group of cells is not expected to transmit in the uplink in one cell within the group of cells earlier than $N\_{Rx-Tx}T\_{c}$ after the end of the last received downlink symbol in the same or different cell within the group of cells where $N\_{Rx-Tx}$ is given by Table 4.3.2-3. A UE not capable of full-duplex communication and not supporting simultaneous transmission and reception as defined by parameter *simultaneousRxTxInterBandENDC*, *simultaneousRxTxInterBandCA* *or simultaneousRxTxSUL* [10, TS 38.306] among all cells within a group of cells is not expected to receive in the downlink in one cell within the group of cells earlier than $N\_{Tx-Rx}T\_{c}$ after the end of the last transmitted uplink symbol in the same or different cell within the group of cells where $N\_{Tx-Rx}$ is given by Table 4.3.2-3.  |

In our understanding, according to RAN1 specification, downlink slot or symbol interruption due to misalignment tx/rx timing between the cells caused by MRTD/MTTD/TA cannot be considered as interruption at least intra/inter-band TDD synchronous without simultaneous Rx/Tx capability. So, adding Note, we’d like to clarify this in the interruption requirements in order to avoid unnecessary downlink interruption allowance. |
| Huawei | As commented by companies during GTW, if the motivation of the note is that there is no DL for UE not supporting this capability, then there is no DL interruption for sure. If it is about 10/15 us transient time, based on the agreement in issue 2-1, it seems companies are fine to define generic requirements. |
| Xiaomi | As it has been agreed in previous meeting to define the interruption requirements for scenario 2 based on async case, the generic minimum requirement is preferred. |
| Moderator | Since companies still have concern on it, suggest to not add those notes in the CR for WI closing. But companies could still bring in this issue for discussion in maintenance stage. |
| MediaTek | We understand concern from LGE. The problem is that T2R switch time is only 13us according RAN1 spec, but here in RAN4 we assume 15us. This means that there could be only 2us overlapped to the next DL slot. If we always allow interruptions to the next DL slot, it seems like an overkill. I.e., the next slot becomes totally useless, even if the 2us overlapped part may only affect on the CP of the first OFDM symbol of the next slot. We are open to discuss whether the DL interruption should be allowed, if it comes right after the SRS transmission. Maybe we can have this discussion in the maintenance stage. |
| LGE3 | To MTK,Thanks for response. For the transient time of Tx-to-Rx and SRS antenna switching, as we proposed in Issue2-1, the 15us antenna switching time is only for Tx-to-Tx case, and 10us transient time for Tx-to-Rx or Rx-to-Tx based on RF specification. So, we raised the issue for antenna switching time. Based on this understanding, there is no issue commented by MTK. We are fine with moderator suggestion, and we can have further discussion in the maintenance phase if interested |

**Issue 3-1: Impacts from SRS antenna port switching enhancement in R17 FeMIMO**

Agreement in 2nd round:

* Clarify that the interruption requirements applies when SRS resources are allocated in the last 6 symbols in a slot.
* No need to discuss whether or not the SRS resources of a set in a slot are configured in non-consecutive manner.
	+ the non-consecutive case is an issue from R17 FeMIMO WI, and we don’t consider R17 FeMIMO in this FeRRM WI

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| **Company** | **Comments** |
| LGE | Support the tentative agreements.  |
| QC | Support the tentative agreements.  |
| Apple | Fine with the tentative agreement. |
| Nokia | Fine with the tentative agreement. |
| Intel | Support the tentative agreements. |
| Xiaomi | Support the tentative agreements. |
| Moderator | Based on companies’ comments, update the 2nd round agreement. |
| MediaTek | Fine with the tentative agreement. |
| vivo | Fine with the tentative agreement |
| CATT | Fine with the tentative agreement.  |

**Issue 3-2: further clarifications on interruption requirement**

Agreement in 2nd round :

* For “Proposal 1: For the sync case of scenario 1, further discuss whether the case when the last symbol in the slot on the aggressor CC is not used for SRS transmission is only considered for test case design, in which the maximum number interrupted slots for SRS antenna switching is 1 for all 15kHz and 30kHz aggressor CC SCS cases.”,
	+ Tentative Agreement: can discuss proposal 1 in performance stage
* For “Proposal 2: For scenarios 1, the symbol based requirement will apply if one SRS resource set is configured. It’s FFS when two SRS resource sets are configured in two consecutive slots.”
	+ Tentative Agreement: multiple SRS resource sets could be considered in future release if needed.

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| **Company** | **Comments** |
| LGE | Support the tentative agreements. |
| QC | Support the tentative agreements.  |
| Apple | Fine with the tentative agreement. |
| Ericsson | Proposal 1: tentative agreement is fine.Proposal 2: We do not think this restriction is needed.  |
| Nokia | Fine with the tentative agreement.  |
| Huawei | Fine with tentative agreements. Proposal 2 we believe is related to the discussion in R17 FeMIMO. |
| Intel | Fine with the tentative agreement.To Ericsson, it’s better to clarify that requirement apply for one SRS resource set. Since if two SRS resource sets are configured in two consecutive slots, a guard period is defined between two SRS resource sets. |
| Xiaomi | Fine with the tentative agreement.  |
| Moderator | Based on majority companies’ view, update the 2nd round agreement, and please companies further comment if you have concern on it. |
| MediaTek | Support the tentative agreements. |
| vivo | Support the tentative agreements. |
| CATT | Fine with the tentative agreement.  |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on further RRM enhancement for NR and MR-DC - SRS antenna port switching | Apple | Wayfoward |
|  |  |  |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| [**R4-2203922**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203922.zip)  | Interruption requirement to LTE serving cell, and impacts to other LTE RRM | CATT | revised |  |
| [**R4-2205837**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205837.zip) | Draft CR on Interruption requirement to NR serving cell, and impacts to other NR RRM requirement (if applicable) | Ericsson | revised |  |
| [**R4-2204705**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204705.zip) | draftCR on introduction of SRS antenna port switching | Nokia | agreeable | No technical comment received in 1st round. |
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Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2206861 | WF on further RRM enhancement for NR and MR-DC - SRS antenna port switching | Apple | Agreeable |  |
| R4-2206862 | Interruption requirement to LTE serving cell, and impacts to other LTE RRM | CATT | Agreeable |  |
| R4-2206863 | Draft CR on Interruption requirement to NR serving cell, and impacts to other NR RRM requirement (if applicable) | Ericsson | Agreeable |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

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|  |  |  |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)