**3GPP TSG-RAN WG2 Meeting #123R2-230xxxx**

**Toulouse, France, August 21-25, 2023**

**Agenda item:** 7.2.4

**Source:** CATT

**Title:** [Post122][401][POS] SRS configuration and activation in LPHAP (CATT)

**Document for:** Discussion and Agreement

# 1 Introduction

This is to discuss the SRS configuration and activation/deactivation functionality.

* [Post122][401][POS] SRS configuration and activation in LPHAP (CATT)

Scope: Discuss the SRS configuration and activation/deactivation functionality, including:

* determining if there are separate messages, the conditions under which they are used, and if all messages can use the same signalling method;
* evaluating the signalling options (RRC and MAC CE); and
* understanding if there is interest in pursuing the option of using a dedicated preamble.

Intended outcome: Report to next meeting

Deadline: Thursday 2023-08-10 1000 UTC

Rapporteur would like to have the following schedule for this email discussion.

* Phase 1: Companies are invited to provide inputs and comments to questions by 2023-08-04 18:00 UTC
* Phase 2: Rapporteur will provide draft summary with proposals, companies are invited to provide comments to the summary proposals by 2023-08-1010:00 UTC.

The purpose is to collect the views and identify the commonalties and differences in order to provide proposals for next meeting, i.e. RAN2#123.

# 2 Organization of the discussion

Firstly, the rapporteur would like to clarify there are two mechanisms on enhanced SRS configuration according to the WID and previous contributions by companies.

* Configured UE-specific SRS with validity area via RRC signalling;
* Preconfigured SRSs (with/without validity area).

In RAN2#122, the issue of “SRS configuration request” and “SRS activation request” has been discussed online. It is observed that, some companies’ views on related issues may be confused between these two enhanced mechanisms. Hence, the rapporteur would like to organize the discussion on these two enhanced mechanisms separately.

***Related agreements***

* For UE-specific SRS with validity area, the agreements on SRS configuration request were achieved.

RAN2#121 Agreements:

RAN2 assume when the UE reselects out of the positioning validity area during SRS transmission, the UE may send an RRC message to the network for SRS configuration request.

LS to RAN3 to confirm this.

RAN2#121-bis Agreement:

SRS configuration request can be indicated via Msg3/MsgA transmission. FFS if the request is in the RRC message or an accompanying MAC CE.

* For preconfigured SRSs, the agreement on activation was achieved.

RAN2#122 Agreement:

RAN2 will introduce an activation indication and/or request for preconfigured SRS using at least Msg3/MsgA; FFS if Msg1 would be supported also. FFS RRC signalling or MAC CE for the Msg3/MsgA case, as for the configuration request. This agreement does not imply that the UE will be allowed to transmit autonomously.

***Organization of this email discussion***

The remainder of this document is organized as the following. Section 3 is the questionnaire on the UE-specific SRS with validity area, containing SRS configuration request and SRS activation/deactivation. Section 4 is the questionnaire on the preconfigured SRS, contains activation indication and/or request for preconfigured SRS.

# 3 Configured UE-specific SRS with validity area

In RAN2#121-bis, it has been agreed that, RRCRelease message can be used to provide SRS configuration with validity area for UE in RRC\_INACTIVE. The SRS configuration is UE-specific within the validity area, and there will be no resource conflict problems.

## 3.1 SRS configuration request

For UE-specific SRS with validity area, it has been agreed that UE can request SRS configuration via Msg3/MsgA. Companies are invited to further discuss the detailed solution on how to request SRS configuration using Msg3/MsgA.

**Q1: For the mechanism of Configured UE-specific SRS with validity area, please provide your view on which message is used to send the SRS configuration request via Msg3/MsgA.**

* **Alt1: RRCResumeRequest**
* **Alt2: new RRC message**
* **Other**

**For the supported message, which** **following signalling method of sending the SRS configuration request do you support? Please also provide the detailed content/information of SRS configuration request in the comments column.**

* **Option A: In the RRC message, e.g. define a new resume cause in *RRCResumeRequest***
* **Option B: Accompanying MAC CE.**

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| --- | --- | --- | --- |
| **Company** | **Supported message (Alt1/Alt2/other)** | **Signalling method (Option A/B)** | **Comments** |
| Samsung | Alt1 | Option A | In our view, 1 bit indication in RRC message is enough for the SRS configuration request. A new ResumeCause value (e.g., SRS-ConfigRequest) can be introduced for it. (We still have 5 remaining spare bits in ResumeCause.) |
| OPPO | Alt1 | Option A | Anyway, the UE needs to perform transmission of the RRCResumeRequest towards the network when sending the SRS configuration request, so the most efficient way is to include the request in the msg3 |
| vivo | Alt1 | Option A | Alt1 with Option A is the simplest from the signalling overhead and complexity perspective.  Besides, UE can update the TA by initiating the RRCResumeRequest message with the new cause value, when the UE is still within the valid area but the area-specific timer gets invalid. |
| Xiaomi | Alt 1 | Option A | Since the SRS configuration with validity area is for RRC INACTIVE UE, the RRCResumeRequest message is the straightforward way. |
| ZTE | Alt 1 | Option A | The SRS configuration does not need to contain extra information but to request NW to configure a new SRS configuration to the UE. So a 1 bit new resume cause is enough |
| Huawei, HiSilicon | Alt1 | Option A | The scenario for LPHAP is positioning in RRC\_INACTIVE state. Therefore, Msg3/MsgA include *RRCResumeRequest*.  This question is actually related to the issue of multiple pre-configured validity area. We don’t think there is a need to support multiple pre-configured validity area for the same cell. Thus, if there is only a single pre-configured validity area for a certain cell, the SRS configuration is not ambiguous without sending an index from the UE to the gNB. Thus, we do not see the need to use a new RRC message or an accompanying MAC CE. |
| Ericsson | Alt1 | Option A | Agree with Huawei that there is a need to support multiple pre-configured validity area for the same cell. |
| LG | Alt1 | Option A | RRCResumeRequest with a new cause (there are 5 spares in ResumeCause) is simple and enough. We do not see a need of new RRC message and MAC CE. |
| CATT | Alt1 | Option A | The indication of SRS configuration request can be fulfilled by one bit, a simply way to realize that is to define a new resume cause, i.e., use one spare bit in IE ResumeCause. The stage 3 spec can take the following structure as baseline.  ResumeCause ::= ENUMERATED {emergency, highPriorityAccess, mt-Access, mo-Signalling,  mo-Data, mo-VoiceCall, mo-VideoCall, mo-SMS, rna-Update, mps-PriorityAccess,  mcs-PriorityAccess, posSRS-request, spare1, spare2, spare3, spare4} |
| Sony | Alt 1 | Option A | See no need for new message, since bits in Resume cause can be used. |
| Lenovo | Alt1 | Option A | UE in RRC\_INACTIVE uses 1bit to indicate the SRS configuration request in the message, a new resume cause in *RRCResumeRequest* message is the simple and straightforward way to carry the request. |
| Spreadtrum Communications | Alt1 | Option A | Reuseing RRCResumeRequest with one new cause is enough. |
| Qualcomm | Alt1 | Option A | It seems a 1-bit indication for this use case would be sufficient. The use case seems to imply that the UE has no pre-configured SRS for the new camped-on cell/area stored. Otherwise, a (new) activation request for pre-configured SRS would apply. (See also our response to Q5) |
| Intel | Alt1 | Option A | Agree with others. |
| Fraunhofer | Alt1 | Option A | Same view |

**Summary:**

## 3.2 SRS activation/deactivation

According to the online discussion in RAN2#122, for the UE-specific SRS with validity area, there are two main issues which are ambiguous in companies’ views.

Issue 1: Within the validity area, does the UE need to get permission for SRS transmission, e.g. via activation/deactivation procedure?

Issue 2: If the UE can send SRS without network permission, how to solve the issue of NW continuous monitoring SRS?

* ***For issue 1***
* Some companies think activation procedure is needed for the UE to get permission of transmitting SRS.
* Other companies think the UE has been allowed to transmit the SRS upon receiving the configuration and the activation procedure is not needed. The activation procedure will bring power consumption.
* Some companies think this issue depends on the SRS type. If periodic SRS is supported for SRS with validity area, activation/deactivation is not needed. But if aperiodic or semi-persistent SRS is supported, activation/deactivation is needed.

In Rel-18, we haven’t discussed which SRS type is supported for SRS with validity area. The SRS type will be taken into consideration as well.

**Q2: For UE-specific SRS with validity area, which SRS type do you support? For each supported SRS type, please provide your view on whether activation/deactivation is required when the SRS configuration is valid.**

* **Alt1: periodic SRS**
* **Alt2: semi-persistent SRS**
* **Alt3: aperiodic SRS**

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| **Company** | **Supported type for SRS with validity area (Alt1/Alt2/Alt3)** | **For each type of SRS, whether the** **activation/deactivation is required** | | |
| **Periodic (Yes/No)** | **semi-persistent (Yes/No)** | **Aperiodic (Yes/No)** |
| Samsung | Alt. ½ | No | Yes | - |
| OPPO | Alt 1 | no | Yes. | No. if a certain time-frequency resource is assigned for the SRS, then the UE does not need to be activated for SRS transmission, similar with the current implementation |
| vivo | Alt1 and Alt2 | No | Yes with comments.  Follow R17 to support SP-SRS in RRC\_INACTIVE. The activation/deactivation MAC CE from NW to UE can be reused. | No.  LPHAP is for Use case 6, i.e., periodic positioning. Therefore, aperiodic SRS is not suitable. |
| Xiaomi | Alt1 and Alt2 | No | Yes | No |
| ZTE | Alt1 and Alt2 | No | Yes | Support periodic and semi-persistent SRS. Support using the legacy MAC CE to trigger activation/deactivation of the Rel-18 SP-SRS |
| Huawei, HiSilicon | Alt1/Alt2 | No | Yes |  |
| Ericsson | Alt1 | No | No, we think periodic should be enough. We can avoid MAC CE Activation/Deactivation in RRC INACTIVE mode. | No. |
| LG | Alt1 and Alt2 | No | Yes | No |
| CATT | At least Alt1,  FFS Alt2 | No | If Alt 2 is supported, the activation/deactivation is needed.  But the activation/deactivation procedure (may include activation request and activate steps) will bring power consumption to UE.  We also wonder whether the legacy activation/deactivation procedure is suitable for LPHAP. | - |
| SONY | Alt 1 and Alt 2 | No | Yes | Could be an option In case of support for a-periodic. |
| Lenovo | Alt1, FFS on Alt2 | No | Yes. We intend to reuse legacy activation procedure as possible if SP-SRS is supported, otherwise, it can be omitted for LPHAP to avoid additional enhancement. But fine to follow majority of view on the support of SP-SRS. | No |
| Spreadtrum Communications | Alt1, FFS on Alt 2 | No | Yes. If SP-SRS is supported, we intend to reuse legacy activation procedure. However there is a concern that activation/deactivation procedure will bring power consumption to UE. After all, LPHAP was originally intended for use cases 6, which only requires periodic positioning. |  |
| Qualcomm | Alt 1,2  Under the assumption that this question is not related to pre-configured SRS (i.e., legacy SRS with validity area). | No for activation  Yes for deactivation  (same as legacy) | Yes (same as legacy) | - |
| Intel | Alt 1, Alt2 (assuming legacy activation/deactication mechanism can be reused) | Not | Yes (same as legacy) |  |
| Fraunhofer | Alt 1, 2 | No for activation, yes for deactivation (but not same as legacy, potentially due to long DRX cycles).  Our assumption is that the periodic SRS is stopped when the LMF has determined that the UE position with needed accuracy is met. Then the UE enters the sleep phase. | Yes. Our assumption is MAC-CE deactivates the semi-persistent positioning when the NW has determined that the UE position is available before the UE goes into sleep mode. |  |

**Summary:**

If the activation/deactivation is required when the SRS configurations are valid mentioned in Q2, the activation procedure may include the activation indication from UE to gNB, as well as the activation command from gNB to UE which depend on the detailed solutions on different SRS types. The activation indication from UE to gNB will be discussed here according to email discussion scope. We will further discuss if and how gNB activate the SRS later.

**Q2-1: For each supported SRS type, if you think activation/deactivation is required, please provide your view on which message is used to send the SRS activation request via Msg3/MsgA.**

* **Alt1: RRCResumeRequest**
* **Alt2: new RRC message**
* **Alt3: Other**
* **Alt4: No need**

**Which following signalling method of sending the SRS activation request do you support? Please also provide the detailed content/information of SRS activation request in the comments column.**

* **Option A: In the RRC message, e.g. define a new resume cause in *RRCResumeRequest***
* **Option B: Accompanying MAC CE.**

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| **Company** | **For each type of SRS, the detailed solution on how to send the SRS activation request with validity area** | | | | | | **Comments** |
| **periodic** | | **semi-persistent** | | **aperiodic** | |
| **Supported message (Alt1/2/3/4)** | **Signalling method (Option A/B)** | **Supported message (Alt1/2/3/4)** | **Signalling method (Option A/B)** | **Supported message (Alt1/2/3/4)** | **Signalling method (Option A/B)** |
| Samsung | Alt4 | - | Alt1 | Option A | - | - | Please, see our comments to Q5/6 below. |
| OPPO | - | - | Alt1 | Option A | - | - | The SRS configuration is dedicated to the UE, so the UE only needs to simply indicate activation/deactivation of the SRS towards the network. A new resume cause in the RRCResumeRequest msg is enough. |
| Vivo | Alt 4 |  | Alt 3, reuse existing activation MAC CE from NW to UE |  |  |  | If the UE needs to get the SRS transmission permission via activation request, the SRS configuration should be categorized as pre-configuration. |
| Xiaomi | Alt 4 |  | Alt 4 |  | Alt 4 |  | We think there is no need to introduce the activation/deactivation from UE to gNB for the SRS with validity area. |
| ZTE | Alt 4 |  | Alt 4 |  |  |  | For SRS within validity area, there is no need to introduce SRS activation request from UE to gNB. Only certain type of SRS (SP-SRS) may need to be activated/deactivated by DL MAC CE like legacy approach. |
| Huawei, HiSilicon | Alt 4 |  | Alt 4 |  |  |  | SRS activation request is used for preconfigured SRS according to RAN2 agreement. |
| Ericsson | Alt1, we see the need of UE informing it to the NW. | A | Do not support |  | Do not support |  |  |
| LG | Alt4 |  | Alt1 | Option A |  |  |  |
| CATT | Alt 4 | - | Alt 1 | Option A | - | - | Under the mechanism of configured SRS with validity area, the UE already has a valid SRS configuration, so it doesn't need to send the legacy event report to LMF. Without the activation request, the network will not know which cell the UE is camping on and when to activate the SP SRS. |
| Sony | Alt 4 |  |  |  |  |  |  |
| Lenovo | Alt4 |  | Alt4 |  | Alt4 |  | For the activation of semi-persistent SRS, if UE still needs to transmit activate request before each SRS transmission, the power saving benefit may not be guaranteed. We prefer to reuse the R17 activation mechanism from network to UE in RRC\_INACTIVE. |
| Spreadtrum Communications | Alt 4 |  | Alt 4 |  |  |  | For SRS with validity area mechanism, there is not necessary to introduce activation request, which belongs to pre-configured SRS. |
| Qualcomm | Alt 4  Under the assumption that this question is not related to pre-configured SRS (i.e., legacy SRS with validity area). |  | Alt 4  Under the assumption that this question is not related to pre-configured SRS (i.e., legacy SRS with validity area). |  | - |  | According to RAN2 agreement:  "When configured with SRS configuration along with SRS validity area, if the UE reselects to another cell within the SRS validity area during SRS transmission, the UE continues the SRS transmission, subject to validation for SRS transmission."  I.e., the SRS was already activated before cell-reselection. |
| Intel | Alt 4 |  | Alt 4 |  |  |  | For preconfigured multiple SRS configurations, if allowed by the network, UE sends ResumeCause of RRCResumeRequest message to indicate the change of SRS configuration when different SRS configuration is selected due to cell reselection. But if the UE is still in the same validity area, no indication is needed. |
| Fraunhofer | Alt 4  (For location requests scheduled by NW)  Alt 1  (For event triggered LR, because NW does not know exactly when to perform measurement and we discussed NW not wanting to continuously process SRS configuration) | Also for Alt1, we see a certain configuration of Msg-1 as trigger, | Alt 4 |  |  |  |  |

**Summary:**

**Q2-2: For each supported SRS type, if you think activation/deactivation is required, please provide detailed solution on how to deactivate the SRS resource with validity area.**

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| **Company** | **For each type of SRS, the detailed solution on how to deactivate the SRS with validity area** | | |
| **periodic** | **semi-persistent** | **aperiodic** |
| Samsung | - | NW can deactivate semi-persistent SRS resource set using MAC CE as in legacy and the LMF can request the deactivation. | - |
| vivo | No need | Reuse existing deactivation MAC CE from NW to UE |  |
| ZTE | NW re-configures UE without the periodic SRS configuration | Legacy MAC CE to deactivate |  |
| Huawei, HiSilicon |  | Reuse legacy. |  |
| Ericsson | No Need | Do not support |  |
| LG | No need | Prefer to reuse existing MAC CE |  |
| CATT | No need | We wonder whether the legacy mechanism is suitable for SRS with validity area. In R17, if there is ongoing SDT, gNB can send deactivation command to UE. Otherwise the gNB will wait for the TA timer expired.  For SRS with validity area, after cell reselection, the configured CG-SDT becomes invalid, so there is no way for gNB to send deactivation MAC CE to UE. And we haven’t agreed that the legacy TA timer is applicable for SRS with validity area.  If SP SRS is supported, a timer can be used to deactivate the SRS. When the SRS is activated, UE starts the timer. | - |
| Lenovo | No need | As legacy, network determines the deactivation of semi-persistent SRS by sending the deactivation command if there is ongoing SDT procedure or wait for the TA timer expires. |  |
| Spreadtrum Communications | No need | Reuse legacy MAC CE |  |
| Qualcomm | RRC Reconfiguration  (same as legacy) | NW sends a deactivation MAC-CE (same as legacy) | - |
| Intel | RRC reconfiguration without periodic SRS configuration | Deactivation MAC CE same as Legacy. |  |
| Fraunhofer | MAC-CE (Deactivating periodic SRS to go to sleep), assuming at next DRX cycle, the UE needs to use the same configuration to send SRS.  For completely releasing the periodic SRS configuration, RRCReconfiguration. | MAC-CE. |  |

**Summary:**

* ***For issue 2***
* After the network configures the SRS via RRCRelease message, if the activation/deactivation in Q2 is not needed, the network may has no idea of which cell the UE in RRC\_INACTIVE is camping on and when it will perform SRS transmission for positioning. Some companies raised the concern on continuous monitoring by the network. To avoid this issue, they think the UE need to indicate the NW that it is going to transmit SRS, e.g. via dedicate preamble.

**Q3: If the activation/deactivation in Q2 is not needed, do you agree the issue of continuous monitoring by the network needs to be solved? If yes, please provide the detailed solution in the comments column.**

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| **Company** | **Yes/No** | **Comments** |
| Samsung | See our comment | We understand the motivation of having validity area is to allow the UE to continue SRS transmission using the same SRS resources within a certain area. Once the SRS resources associated with a certain validity area are configured (for periodic type) or activated (for semi-persistent type), the UE can keep using the SRS resources without additional signalling overhead within that validity area. When the UE leaves the area or the NW releases/deactivates the SRS resources, the UE stops SRS transmission and NW can stop monitoring for the SRS resources.  To prevent the blind monitoring in multiple validity areas, only one SRS configuration (associated with the current validity area) can be allowed to be included in RRCRelease message. Multiple SRS Resource Sets can be included in the single SRS configuration, but multiple SRS configurations associated with multiple validity areas should be excluded. The UE can request new SRS configuration after moving to a new validity area as discussed in Q1 above. |
| OPPO | No | After all, the R18 LPHAP enhancement aims at reducing the power consumption of the UE side. The activation/deactivation will definitely consume the UE power, which is against the LPHAP enhancement purposes. On the other hand, we think that instead of UE-initiated activation/deactivation method, network-based solution, such as letting the LMF notifying of the gNBs in the validity area to start to monitor the SRS when the UE is entering into the configured validity area could be pursued and is more power-efficient from the perspective of UE. |
| vivo | No | Agree with OPPO that the intention is not in the scope of WID   * + For UL and DL+UL positioning for UEs in RRC\_INACTIVE state, specify SRS configuration enhancements based on SRS positioning validity area to avoid frequent RRC connection for SRS (re)configuration [RAN2, RAN1, RAN3].   The validity area is introduced to enable SRS transmission across different cells and the network does not need to know which cell the UE in RRC\_INACTIVE is camping on. |
| Xiaomi | No | We are not clear why the network need to monitor the SRS continuously. In our understanding, the network measure the SRS based on the LMF request and LMF also can indicate the network to stop measuring the SRS. |
| ZTE | No | We think in a validity area the UE does not need to notify network where the UE is, UE just sends SRS among cells, and LMF can notify all the gNBs within the validity area to monitor the SRS simultaneously. |
| Huawei, HiSilicon | No | A common SRS can be used by the UE within the validity area. The SRS is configured/activated by the network, and the network knows when the UE will perform SRS transmissions, which is controlled by the area-specific TAT.  The network only needs to monitor the SRS transmission when it knows the UE is transmitting the SRS |
| Ericsson | The term “continuous monitoring” is unclear | We think the UE and NW is synched with respect to SRS transmission. We do not see UE autonomously transmitting. But if that is not the case, then we see some discussion might be needed. |
| LG | No | It is hard to track which cell UE camped on in RRC\_INACTIVE. So, all gNBs within validity area will monitor SRS transmission when UL or DL+UL positioning is ongoing, which can be aware between LMF, gNBs and UE. That aims UE low power positioning, not network resource efficiency. |
| CATT | Yes | We see some companies’ view is the network knows when the UE will perform SRS transmission. However, although there is a periodic positioning requirement in use case-6, the positioning interval is “15s to 30s”. So the network doesn’t know the exact positioning time.  Additionally, the validity area may contain a large amount of TRPs. For one positioning event of an UE, most of these TRPs are out of the positioning/measurement coverage where the measurement of this target UE is not required.  Without an indication, all the TRPs within the validity area need listen to the SRS all the time.  We can introduce a dedicate preamble (common to all the UE), when the positioning event is detected, the UE can transmit the dedicate preamble to the network. After receiving the dedicate preamble, the network will know one UE will perform SRS transmission, and it will start listening the SRS. |
| SONY | See comment | The network would know the UE is configured for SRS transmissions. But there should also be a possibility for the network to trigger the activation and de-activation, and this would require some DL paging indication. Hence a Network triggered MT-LR procedure activating the already preconfigured SRS configuration (s). |
| Lenovo | No | On the one hand, network just needs to monitor the SRS during the SRS transmission which is controlled by the area-specific TA timer, since the SRS configuration is provided by network, the network can know the SRS transmission of UE and then perform monitoring. On the other hand, R18 LPHAP focus on the Power saving of UE side, the energy saving of network side may not within the scope. |
| Spreadtrum Communications | No | The network does not need to know which cell the UE is camping on. LMF can notify the gNBs within the validity area to start/stop SRS monitoring. |
| Qualcomm | No with comment | The "issue of continuous monitoring by the network" is not quite clear. We assume the TRPs which have received the measurement request continue (after cell-reselection) to measure the UE/SRS at the indicated time like today. Which TRPs are selected by an LMF for measurement is usually up to implementation/deployment, and a configured validity area may be considered when selecting TRPs for measurement. |
| Intel | See comments | The issue is related to whether the network can configure multiple SRS confgigurations to a UE.  To our understanding, the spirit of the objective is, the network provides multiple configurations (per area) to the UE, and the UE can select the SRS based on camped cell. Therefore the network does not need to update the SRS configuration when the UE moves to another cell (in Rel-17, the network only configures the SRS for the cell where the UE moves to RRC\_INACTIVE, and the UE will release the SRS configuration when it moves to another cell). We do agree that it can save the power caused by additional RRC signalling. However, the measured gNB has no idea on which cell the UE is camping, i.e. which SRS configuration the UE is transmitting. Therefore, the measured gNB has to measure all candidate SRS configurations for the UE which will increase the processing load of the measured gNB which should be avoided. To avoid the additional complexity on gNB side, RAN2 should find a solution to resolve the issue.  The simple way could be when the UE selects different SRS configuration, e.g. upon moving to another cell or the area for different SRS configuration, the UE shall use ResumeCause of RRCResumeRequest message to indicate the change of SRS configuration to gNB. |
| Fraunhofer | Depends | If the NW knows exactly (e.g. scheduled location time) when the UE sends its SRS then the LMF can prepare all TRPs to measure the signal. If the NW does not exactly when UE might transmit (for example, triggered due to motion), then triggering is needed. This may be by activation as discussed in previous questions, or by listening to a PRACH. |

**Summary:**

# 4 Preconfigured SRSs (with/without validity area)

From the rapporteur’s perspective, the “preconfigured SRS” concept used in the previous discussions refer to the preconfigured common SRSs. For example, the network broadcast a list of positioning SRSs, all the UEs which camp on the cell can receive these SRSs. When the positioning event is detected, the UE will coordinate with the network to choose a SRS within the broadcast SRSs for this positioning.

## 4.1 Activation indication and/or request for preconfigured SRS

With the mechanism of network preconfigured common SRSs to UE, e.g. via posSIB, all the UEs camp on the cell can receive these SRS configurations. To avoid the conflict caused by two or more UEs which choose the same SRS at the same time, coordination between UE and RAN is needed. In RAN2#122, the following agreement was achieved.

Agreement:

RAN2 will introduce an activation indication and/or request for preconfigured SRS using at least Msg3/MsgA; FFS if Msg1 would be supported also. FFS RRC signalling or MAC CE for the Msg3/MsgA case, as for the configuration request. This agreement does not imply that the UE will be allowed to transmit autonomously.

Companies are invited to further discuss the detailed solution on how to send the activation indication and/or request for preconfigured common SRSs using Msg3/MsgA.

**Q4: For the mechanism of preconfigured SRSs, do you agree the preconfigured SRSs mean the preconfigured common SRSs?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | No. | The motivation of having pre-configured SRS is to reduce UE’s wake up duration for receiving SRS configuration in RRC\_INACTIVE state. For that, UE-specific SRS configuration can be delivered to UE via dedicated signalling (e.g., RRCRelease or RRCReconfiguration) before UE goes to RRC\_INACTIVE state. There is no clear motivation that the pre-configuration should be common to all UEs within cell/validity area. Also for the pre-configured common SRS, it is assumed that multiple common SRS resource(set)s will be broadcasted via (pos)SIB. In that case, to prevent SRS resource collision between UEs, every time one of the SRS resource(set)s is activated for a certain UE, it should be deleted from (pos)SIB. This makes UEs consume more power to receive the updated SIB. Thus, we think the pre-configuration should be UE-specific. |
| OPPO | No | Agree with Samsung. In addition, how to set the spatial relation of the SRS for positioning configuration is another problem. |
| vivo | No | Agree with SS that pre-configuration should be send to UE by dedicated signalling rather than broadcast as common SRS configuration.  For common SRSs in posSIB, once one of the pre-configurations is successfully completed by a target UE, the posSIB should be updated, which will lead to frequent SI acquisition and more power consumption.  Besides, the title of section 4 should be refined. According to WID, pre-configured SRSs are also associated with validity area:   * For UL and DL+UL positioning for UEs in RRC\_INACTIVE state, specify SRS configuration enhancements based on SRS positioning validity area to avoid frequent RRC connection for SRS (re)configuration [RAN2, RAN1, RAN3].   + SRS for positioning configurations in multiple cells [RAN2, RAN1].     - Note: Details including issues such as interference, timing advance, spatial relation information, pathloss reference and common SRS parameters across multiple cells can be further discussed during normative work.   + Pre-configuration of one or multiple SRS for positioning configurations [RAN2, RAN3].   + SRS for positioning activation/request procedure(s) [RAN2, RAN1]. |
| Xiaomi | See comments | If the preconfigured common SRS means all UE use the same SRS configuration, we think it is not feasible. If the preconfigured common SRS means the multiple preconfigured SRS are broadcasted by the Pos SIB, it could be considered. |
| ZTE | No | We understand that the pre-configured SRS means dedicated RRC signaling containing multiple pre-configured SRS for a UE, it is introduced in order to reduce the times that UE moves from RRC INACTIVE to RRC CONNECTED.  If the SRS is common via SIB, UE and NW has to do the hand-shake to avoid SRS collision. This is not power saving from LPHAP UE perspective |
| Huawei, HiSilicon | No | From our understanding, preconfigured SRS means an SRS configuration can be sent to the UE in advance, e.g. before a positioning session. Then the UE can send activation request to the receiving gNB when an event is detected, and the receiving gNB can directly activate the SRS by only updating the TA information without LMF involvement, which reduces latency and saves signalling overhead.  We think the preconfigured SRS can be delivered to UE via dedicated signalling or via system information. |
| Ericsson | No | Agree with Samsung, Oppo and Vivo. We do not see the need to include broadcast solution. |
| LG | No | Uplink positioning SRS should be dedicated per UE to avoid inter-UE interreference. No reason to broadcast UE-specific SRS configuration. |
| CATT | Yes, but see the comment | From our perspective, the preconfigured SRS means common SRSs (e.g. broadcast in posSIB). The UE need to interact with the network to get one UE-specific SRS from these preconfigured SRSs.  If preconfigured SRS doesn’t mean preconfigured common SRSs, we cannot see the difference between “preconfigured SRS” and “SRS in multiple cells”. In the mechanism of “SRS in multiple cells”, the SRS within validity area are pre-configured SRS because the SRS is configured not based on event trigger. This also meets the definition of preconfigure.  If most companies don’t support preconfigure common SRSs, e.g. via posSIB, we can follow the majority. |
| SONY | See comments | Multiple pre-configurations could be supported and could be configured/provided via RRC signalling or System information. The trigger/activation of a specific configuration is then done during RACH procedure, using SDT procedure. |
| Lenovo | See comments | We understood that from rapporteur’ descriptions above, the pre-configured common SRSs means one or more common SRSs are broadcasted in PosSIB which can be used by multiple UEs in the cell, we intent to think this case is feasible, and considering the additional power consumption caused by the coordination between UEs and gNB, the maximum limit on number of pre-configured SRSs may be delivered to the UE, e.g., 2.  In addition, pre-configured multiple SRSs for each UE may also be supported, the pre-configured SRS may be delivered to UE by RRC signalling when UE is in RRC-connected. posSIB is not suggested to deliver the UE-specific preconfigured SRS. |
| Spreadtrum  Communications | No | Pre-configured SRS can be delivered to UE by dedicated RRC signalling (e.g. RRCRelease or RRCReconfiguration). |
| Qualcomm | No | SRS must be UE specific at the end. Otherwise there is no way to identify the measured UE by a TRP/LMF. E.g., for "common SRS broadcast" solution, some individual SRS parameter (e.g., sequence ID) must be UE-specific at the end and can be provided/"over-written" in the activation command. |
| Intel | No | Agree with others. |
| Fraunhofer | No | UE specific. The parameters may be common to a group of UEs and some parameters specific to a UE. Common can be broadcasted. In our opinion, parameters defining time/frequency resources can be common in a validity area, and sequence can be related to UE. |

**Q5: For the mechanism of preconfigured SRSs, please provide your view on which message is used for UE to send the activation indication and/or request for preconfigured SRS using Msg3/MsgA.**

* **Alt1: RRCResumeRequest**
* **Alt2: new RRC message**
* **Other**

**Which following signalling method of sending the activation indication and/or request for preconfigured SRSs do you support?** **Please also provide the detailed content/information of activation indication and/or request for preconfigured SRS in the comments column.**

* **Option A: In the RRC message, e.g. define a new resume cause in *RRCResumeRequest***
* **Option B: Accompanying MAC CE.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Supported message**  **(Alt1/Alt2/other)** | **Signalling method**  **(Option A/B)** | **Comments** |
| Samsung | Alt1 | Option A | From our understanding, semi-persistent SRS configured in RRCRelease message can be regarded as the pre-configured SRS. When the UE needs to activate any SRS resource set for positioning, it can just request the activation of pre-configured SRS and the serving gNB can activate one of the pre-configured SRS resource sets. Thus, we think that 1 bit indication is enough for the activation request and one spare bit in ResumeCause can be used for that. (FFS. on whether we can have one common cause value for both ‘SRS configuration request’ and ‘pre-configured SRS activation request’.) |
| OPPO | Alt1 | Option A | Preconfigured SRS should be dedicated to one UE and 1 bit indication for activation is enough |
| vivo | Alt1 | Option A | We prefer to use the unified mechanism for SRS (pre-)configuration request and SRS pre-configuration activation indication to achieve a simpler design. That is, RRCResumeRequest with the same resume cause will apply for both SRS (pre-)configuration request and SRS activation indication. To achieve this, the SRS pre-configuration should be UE-specific and configured by dedicated RRC message.  Regarding the specific procedure of the unified method,  **-Step 1**: If UE wants to send SRS (pre-)configuration request or SRS activation indication, UE will initiate the RRCResumeRequest with the same resume cause.  **-Step 2:** the resume gNB obtains UE context, if the resume cell is within the validity area, gNB will know the RRCResumeRequest initiated by UE is for SRS activation indication. If the resume cell isn’t within the validity area, the gNB can reconfigure a new SRS (pre-)configuration with validity area. If theresume gNB can’t obtain UE context, the UE will receive RRCSetup message and enter RRC-CONNECTED state, and the positioning fails. |
| Xiaomi | Alt 1 | See comment | One cell may associated with multiple preconfigured SRS, so the RRC resume request message carrying preconfigured SRS ID can be considered. |
| ZTE | Alt 1 or Alt 2 | Option A | If the pre-configured SRS is associated with the cell identity (e.g., validity area), the SRS activation request can only contain the information that “I want to transmit SRS according to the SRS-cell association”. so UE can reuse the RRCResumeRequest with a new cause, 1 bit;  If the pre-configured SRS is not associated with the cell identity, the SRS activation request should contain the information that “I want to transmit SRS according to the SRS-cell association” and ‘which SRS do I want to transmit’. in this case the legacy RRCResumeRequest can not be extended to contain SRS ID, so a new UL RRC message can be introduced.  Furthermore, we agree with vivo that the two feature should be unified as one, i.e., only one additional resume cause in RRCResumeRequest can be applied to both SRS configuration request, and SRS activation request. |
| Huawei, HiSilicon | Alt 1 | Option A with comments | SRS configuration request message can be reused for activation of preconfigured SRS, i.e. no need to introduce a separate new cause for activation request. |
| Ericsson | Alt 1 | Option A | Agree with vivo and Huawei. Besides, there should be only one SRS config for one validity area |
| LG | Alt1 | Option A | Agree with vivo. |
| CATT | See the comment |  | Based on our comment in Q4, if preconfigured SRS doesn’t mean preconfigured common SRSs, we think Q5 is the same as Q2-1.  We think one SRS for one area is enough. Within each validity area, the corresponding SRS should be used. If SP SRS is configured, activation/deactivation is needed. |
| SONY | Alt 1 |  |  |
| Lenovo | Alt1 or Alt2 | See comments | Share the view with ZTE and Xiaomi, in the case of multiple pre-configured SRSs are delivered to UE, no matter UE specific pre-configured SRS or common SRS, UE may need to request to NW on which pre-configured SRS want to use explicitly, then the explicit SRS configuration should be indicated in the request, Alt 2 is suggested in this case.  Otherwise, Alt1 can be used, in the case Alt1 is used, the cause value can reuse the resume cause of SRS configuration request if the *RRCResumerequest* message is used to transmit the request.  In addition, for a pre-configured UE-specific SRS, it also depends on whether the pre-configured SRS is periodic SRS or SP-SRS. For the periodic SRS, no (de)activation is needed, while for the pre-configured SP-SRS, we think it similar with the (de)activation from Q2. To reduce complexity, we intend to support only periodic SRS type for the pre-configured UE-specific SRS. |
| Spreadtrum  Communications | Alt 1 | Option A | Agree with vivo and Huawei. |
| Qualcomm | Alt 1 or 2 | Option B | The MAC-CE or RRC message should indicate which pre-configured SRS(-ID) is requested. |
| Intel | Alt 1 | Option A | Agree with vivo and Huawei, common design is desirable. |
| Fraunhofer | Alt 1 | Option A | If single SRS is preconfigured (with an intention of using later), then activation can be by Option A. Otherwise, identifier needs to be indicated by MAC-CE. |

**Summary:**

Companies are invited to further discuss whether Msg1 would be supported to send the activation indication and/or request for preconfigured common SRSs.

**Q6: For the mechanism of preconfigured SRSs, do you support UE sending the activation indication and/or requesting for preconfigured SRS using Msg1? If yes, please also provide the detailed solution.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes | When RRC signalling is used for the activation request, the UE should transmit MSG3 (RRCResume message) and receive the following activation command MAC CE from the gNB. However, the request/confirm procedure can be simplified using Msg1-based activation request.  For example, when there is only one pre-configured SRS resource set within a certain cell/validity area, the UE can request activation of the SRS resource set by using the dedicated PRACH resource (e.g., dedicated preamble) for the UE and the activation can be confirmed by Msg2 (RAR) from gNB.  Meanwhile, if there are multiple pre-configured SRS resource sets, the UE can request activation of a certain SRS resource set by using the dedicated PRACH resource associated with the target SRS resource set and the activation can be confirmed by Msg2 (RAR) from gNB. |
| OPPO | No. | Msg3 is enough. In the case of using dedicated preamble/RO, if the UE does not request activation of the SRS resource for long time, the RACH resource is wasted. |
| vivo | No | Considering that the msg1 resource is limited, no need to have another solution to support activation indication. |
| Xiaomi | No | We are not clear about the advantages of MSG 1 compared to the MSG3 solution. |
| ZTE | No | If the SRS activation request is via Msg1 preamble, gNB needs to know the UE identity. So the Msg1 preamble should be UE specific dedicate preamble.  The problem is that there may not be enough dedicate preamble resources if the cell owns plenty of LPHAP UEs. And the dedicate preamble of the UE should be reserved by all the neighbor gNBs.  Furthermore, if the dedicate preamble should further associated with SRS ID, that will make the preamble resource even more scarce. |
| Huawei, HiSilicon | No | See Q5, SRS configuration request message can be reused, so there is no need to introduce a Msg1, e.g. dedicated preamble. |
| Ericsson | No | This is rather complicated and we do not see benefit for this. |
| LG | No | We already agreed to have a solution using Msg3/A. We could not see significant benefit to have another solution. |
| CATT | No | See our comment in Q5. |
| Sony | No |  |
| Lenovo | No | We do not see the necessity to use Msg1 solution. |
| Spreadtrum Communications | No | We are not clear about the benefits of Msg1 compared to Msg3 solutions. |
| Qualcomm | No | The benefit is not quite clear. Multiple PRACH resources would be needed to indicate different pre-configured SRS(-IDs) per UE. There may not be enough preamble resources available. |
| Intel | No | Agree with others. |
| Fraunhofer | Yes | By listening to PRACH, only the TRPs that measure the PRACH above a threshold value, instead of all TRPs performing measurements. But still, the NW needs to know which UE is starting – so MSG-3 or MSG-A would be needed later. However, allows the UE to transmit and go to sleep (and not wait until the LMF has triggered neighbouring TRPs too). 🡺 Means buffering samples and post-processing (once configuration is available at the TRPs) |

**Summary:**

# 5 Conclusion

Based on company feedback, the following is observed and proposed:

TBD

# 6 References

1. 3GPP TS 38.331 Radio Resource Control (RRC) protocol specification (Release 17).
2. 3GPP TS 38.305 Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN
3. RAN2#121-bis Chair note.
4. RAN2#122 Chair note.

# 7 Participants

|  |  |
| --- | --- |
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