3GPP RAN WG2 Meeting #130 *R2-25xxxxx*

Malta, Malta, May 19th – 23rd, 2025

Agenda Item: 8.11.1

Source: Huawei, HiSilicon

Title: Remaining RRC open issues in feature SBFD

Document for: Discussion, Decision

# Introduction

The following document includes a list of open issues (and proposals applicable) according to the following email discussion:

* [Post129bis][212][SBFD] Running CR for 38.331 (Huawei)

Intended outcome: Updated running CR based on new agreements for endorsement, open issue list (if needed)

Deadline: Long

Companies are invited to provide feedback on open issue list by: **01 May 2025**

# Remaining open issues for specification RRC

**Open issue number RRC-1: RO indication by RRC signalling, MAC CE or PDCCH indication.**

**Issue description:** In RAN2#129 meeting, there is one FFS regarding the detailed signalling for the NT indicating the RO type for the case of CBRA.

* **For initial RA transmission, the network can indicate the RO type (legacy RO or additional RO) to the SBFD-aware UE for the case of CBRA. Detailed signalling is FFS.**

According to [18], there can be several options which can be compared from the aspects of how dynamic the NT intends this signalling to be, the signalling overhead and the availability of the signalling to the SBFD-aware UEs.

* Option 1) RRC signaling, e.g., additional field in *RACH-ConfigCommon* IE to indicate RO type;
* Option 2) MAC CE using broadcast RNTI; or
* Option 3) PDCCH indication (e.g., DCI scrambled with P-RNTI, similar to time domain PRACH adaptation discussed in NES WI)

Rapporteurs understands that the proponent is open to each option and there are no discussion on this siganlling design from other companies. It is proposed to discuss and try to converge to one option in this email discussion. If there is majority view then no need for contributions for the May meeting.

**Proposed resolution: Discuss and converge to one signalling design option.**

**Proposal : To select one option for RO type indication signalling:**

- **Option 1) RRC signaling, e.g., additional field in RACH-ConfigCommon IE to indicate RO type;**

**- Option 2) MAC CE using broadcast RNTI; or**

**- Option 3) PDCCH indication (e.g., DCI scrambled with P-RNTI, similar to time domain PRACH adaptation discussed in NES WI)**

(only for cases as described above) Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to which option?** | **Other comments** |
| OPPO | Option 1 | For initial RA transmission (e.g. handover and RRC state transition), the UE would anyway need to use *RACH-ConfigCommon*. Then it is straightforward to add the RO type indication in *RACH-ConfigCommon*. Other dynamic solutions including both Option 2 and Option 3 seems not needed. |
| Apple | At least modification to Option 1 | We share the concern from [18]. Current agreement implying 1 bit indicator on “SBFD” or “non-SBFD” does not well operate. For example, when network sets the bit to “non-SBFD”, all SBFD UE(s) would go to legacy RACH resources immediately, leaving SBFD RACH resources not used at all very soon. If NW would like those SBFD aware UE(s) to occupy SBFD RACH resources again, another SIB modification is required. If companies feel Option 2/3 are too dynamic, we think a comprise way is to introduce some “distribution factor” in SIB, to distribute a percentage of SBFD UE(s) to legacy RACH resources. |
| Interdigital | Option 1 | We prefer the option 1 that RO type indication via RRC signalling (e.g., SIB) is reasonable. If RO type indication is not provided, RSRP thresholds for RO type selection needs to be provided via RRC signalling. From our view, RRC signalling is suitable for simplified signalling design and spec design. There is no clear motivation to use MAC CE or PDDCH indication.  |
| Xiaomi | Option 1 | We think RRC signalling is simple and straightforward. Using MAC CE or DCI introduces additional complexity, and can cause more delay since UE needs to acquire the MAC CE / DCI before performing RACH. |
| ZTE | Option 1 but needs clarification | RACH-ConfigCommon can be contained in both SIB1 (for initial BWP) and in UE dedicated signalling (for each configured BWP). So if the RO type indicator is include in RACH-ConfigCommon, it should clarify whether it can be contained in both SIB1 and dedicated signalling, or only in either one of them. |
| Ericsson | Option 1 is the baseline, but also fine with Option 3 as an additional option | Option 1 should be the baseline. If companies have concern that the SIB modification for conveying updated setting may be too infrequent, we are also fine with Option 3 as an additional option. E.g., in Short Message (38331 6.5), there are unused bits, which can be reused to carry the indicator. |
| Sony  | Option 1 | In addition, the RRC signalling could be multi-level value to indicate a “distribution factor”, for example percentage/probability the UE selects SBFD resources, 2-bits representing {100%, 80%, 50%, 0%} or similar. |
|  |  |  |

[**Summary**]

**Open issue number RRC-2:**

**Issue description:** In RAN2#129-bis meeting, there is one FFS regarding triggering events in SBFD resource.

* **Random access procedure in SBFD symbols is supported for all the existing RACH trigger events except for SI request. FFS for LTM.**

As there was no much discussion about the RACH procedure triggered by the event of ” Early UL synchronization with an LTM candidate cell” and ”RACH-based LTM cell switch” (both are LTM related), it is suggested that companies can discuss whether ” Early UL synchronization with an LTM candidate cell” and/or ”RACH-based LTM” can be supported in symbols in their contributions for May meeting, and if supported, what is the impact on RRC spec (especially for Early UL synchronization case). Rapporteur intends to discuss only the RRC impact here.

**Proposed resolution: Companies discuss whether ” Early UL synchronization with an LTM candidate cell” and/or ”RACH-based LTM” can be supported in symbols in their contributions.**

**Proposal: If RACH triggering event “Early UL sync with an LTM candidate cell” is supported in SBFD symbols, the RO type is indicated in *EarlyUL-SyncConfig*. [2]**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| OPPO | No | To support “Early UL sync with an LTM candidate cell”, it is not sufficient to only adding the RO type in *EarlyUL-SyncConfig*. We also need to add the additional RO configuration in *EarlyUL-SyncConfig*. It is also unclear whether this will create more issues for inter-node coordination, as *EarlyUL-SyncConfig* is from the target node. We expect that to support SBFD for LTM, we would need the support from both RAN1 and RAN3. |
| Apple | No | We prefer not supporting this. Similar reason as OPPO, it requires RRC signaling change to include SBFD RACH resource configuration into *EarlyUL-SyncConfig*. |
| Interdigital | No | RACH with SBFD symbols based on LTM procedure is mobility enhancement. This is beyond Rel-19 scope and it can be considered in the future release.  |
| Xiaomi | No | Agree with comments above that this requires cross WG efforts and might be out of Rel-19 scope. |
| ZTE | Yes | Firstly we support LTM + SBFD RO, since LTM is introduced to reduce handover latency, and SBFD RO can also reduce latency **which can help the LTM to further reduce handover latency**, and helps to acquire better handover performance.Secondly, LTM has two kinds of CFRA procedure:* LTM early sync: candidate cell sends *EarlyUL-SyncConfig to source cell, then source cell sends EarlyUL-SyncConfig* and PDCCH order to UE. Candidate cell can indicate RO type in *EarlyUL-SyncConfig* to let source cell know that candidate cell can support SBFD RO or not. So source cell can set the correct RO type in PDCCH order. **This does not have any RAN3 spec impact since *EarlyUL-SyncConfig* is just a container in F1AP message. RAN2’s signaling is enough.**
* LTM cell switch: candidate cell sends *RACH-ConfigDedicated* to source cell, then source cell send LTM cell switch command MAC CE to UE. Since *RACH-ConfigDedicated* already contains RO type, so if the *RACH-ConfigDedicated* is generated from candidate cell, source cell can indicate SBFD RO in the LTM cell switch command MAC CE. **This also does not require RAN3 spec impact.**
 |
| Ericsson | comments | Agree with OPPO and Apple, one additional indicator on RO type is not enough, more ASN.1 changes are needed 1. SBFD RACH configuration/resource in *EarlyUL-SyncConfig if the indicator indicates SBFD RO*
2. the UE also needs to know SBFD T/F configuration of neighbour/target cell (which is signalled in SIB1 of the target cell)
 |
| Sony | No | There are more specification impacts as companies highlighted above.  |
|  |  |  |

**[Summary]**

**Open issue number RRC-3:**

In last meeting, RAN2 agrees to support RO-Type change from legacy RO to additional RO in SBFD symbols and assume the threshold is the same with the fallback from additional RO to legacy RO.

* **Issue description: RO-Type change procedure on RO type selection from legacy RO to additional RO in SBFD symbols is supported when the number of PRACH transmission attempts exceed a threshold (we assume it is the same threshold with the fallback from additional RO to legacy RO). If fallback from legacy RO to additional RO occurs, no further fallback to legacy RO is supported.**

The NT indicates this threshold/maximum preamble transmission number to the UE. The possible values for this number needs to be decided.

Rapporteur suggests to solve this signaling issue in this email discussion, no contributions for May meeting are needed for this simple issue.

**Proposed resolution: Decide the preamble transmission number range based on the majority view in this email discussion.**

**Proposal: To choose between:**

**Option 1: {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200}. (same as for *msgA-TransMax* and)** ***preambleTransMax-Msg1-Repetition*)**

**Option 2: {n3, n4, n5, n6, n7, n8, n10, n20, n50, n100, n200}, (same as for *preambleTransMax*).**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Other comments** |
| OPPO | No strong view | We slightly prefer Option 2. However, we can follow the majority view. |
| Apple | Slightly prefer Option 1 |  |
| Interdigital | Option 2 | Not a strong view. We prefer the option 2 because the option 1 is related to 2-step RA parameter. |
| Xiaomi | Slightly prefer Option 2 | No strong view either. As commented by Interdigital, Option 1 is related to 2-step RACH, so we think Option 2 is more suitable. |
| ZTE | Option 1 | If use option 2, then gNB configures 2-step legacy resource to 4-step legacy resource after at minimum one time of failure, but the gNB can only configure 2-step legacy resource to 4-step SBFD RACH resource after at minimum 3 time of failure. So it seems imply that fallback from 2-step legacy resource to 4-step legacy resource will have slightly priority over fallback from 2-step legacy resource to 4-step SBFD RACH resource. So we slightly prefer option 1 |
| Ericsson | comments | The value range of the threshold would depend on whether the UE resets the counter when the fallback occurs. If the counter value is not reset when fallback occurs, the value range of the threshold should be lower than ***preambleTransMax,*** (which is used to trigger RACH problem/RLF in legacy). We need to ensure that the UE does not declare RACH problem/RLF before fallback occurs.Shall we create another issue to discuss if PREAMBLE\_TRANSMISSION\_COUNTER needs to be reset or not when fallback occurs? Or at least check whether RAN1 has concluded on this. If this is not concluded, we cannot decide the value range for the threshold. |

**[Summary]**

**Open issue number RRC-4:**

According to [25] and [30], RAN2 can confirm that the CSI-RS resource configured for a L3 measurement can be in both DL subband of SBFD symbols and non-SBFD DL symbols, and the separate Layer 3 measurement report for CSI-RS resources in SBFD symbol is not supported. [27] has the opposite proposal that to support the separate Layer3 measurement report for CSI-RS resources in SBFD symbol.

Rapporteur understands both sides expect no or minor RRC spec impact and suggests to try to discuss/agree on one way forward and especially on the spec impact. Rapporteur encourages compromise if there is no critical difference between these two approaches.

**Proposed resolution: Try to agree on one way forward, no need for meeting contributions if compromise can be reached.**

**Proposal: RAN2 to select between:**

**Option 1 : The separate Layer 3 measurement report for CSI-RS resources in SBFD symbol is not supported, no RRC spec impact is expected.**

**Option 2: Support the separate Layer3 measurement report for CSI-RS resources in SBFD symbol, please input on the RRC spec impact.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

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| --- | --- | --- |
| **Company** | **Option** | **Other comments** |
| OPPO | Option 1 | From our understanding, there is no extra standard impact in RRC for Option 1, as we can follow the RAN1 parameter list to implement the corresponding CSI-RS resource configuration. The L3 measurement report is used for handover. When the UE changes its serving cell, the cell-level measurement report including both SBFD symbol and non-SBFD symbol should be used. Then, it is sufficient to have a single L3 measurement report for cell change. Option 2 would at least need two servingMO from our understanding, and the UE would need to evaluate the cell-level L3 measurement separately for SBFD symbol and non-SBFD symbol. |
| Apple |  | We prefer waiting for RAN4 conclusion. |
| Interdigital | Option 1 | Layer-3 measurement reports based on CSI-RS measurements on separated symbol types for handover are not justified to be enhanced in terms of Rel-19 Duplex enhancement. This can be further studied for future releases. |
| Xiaomi | Option 1 | We don’t see much benefits to differentiate the Layer 3 measurements results on SBFD and non-SBFD symbols since UEs can be scheduled in both type of symbols. |
| ZTE  | Option 1 | Option 2 has technical problem. Only using CSI-RS measurement on SBFD resource or on legacy resource cannot reflect the cell quality accurately, since the cell quality is generated by multiple L1 measurements from different beams to do the average. So both L1 CSI-RS measurement on SBFD resource and L1 CSI-RS measurement on legacy resource should be taken into account when generating one cell measurement (L3 measurement). |
| Ericsson | Option 1 | We prefer no further spec change needed for this issue. Unless RAN1 or RAN4 indicates the need to support separate L3 report. |

**[Summary]**

# Other identified open issues

Companies are invited to describe any other identified open issues not currently included within this document. Further open issues can also be added as well during RRC running CR (including RAN1 higher layer parameter list implementation) review.

|  |  |
| --- | --- |
| **Company** | **Other identified open issues? (please describe)** |
| ZTE | Since option 1 and option 2 are currently configured in *BWP-UplinkCommon*, and *BWP-UplinkCommon* can be configured under both NUL and SUL, so current implementation seems to allow SBFD RACH to be configured on SUL. Whether this case is feasible should be further discussed before agree. |
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**[Summary]**

# Conclusions

The following proposals have been provided based on feedback to the above document:

[Proposals for easy agreement]

[Proposals for discussion]

# References

1. R2-2501797 Discussion on RACH in SBFD Xiaomi
2. R2-2501849 Random Access in SBFD symbols CATT
3. R2-2501860 Random Access for SBFD Operation NEC
4. R2-2501878 Impacts on the random access by the evolution of duplex operation Huawei, HiSilicon
5. R2-2501945 Discussion on Random Access in SBFD Sharp
6. R2-2502000 Random access in SBFD Samsung
7. R2-2502082 Discussion on random access procedure in SBFD ZTE Corporation
8. R2-2502316 Random Access Operation of SBFD Nokia Corporation
9. R2-2502387 Discussion on random access procedure in SBFD vivo
10. R2-2502394 Remaining issues of SBFD RACH procedure OPPO
11. R2-2502495 Random access for SBFD Operation Sony
12. R2-2502510 Remaining issues for RACH in SBFD Apple
13. R2-2502565 SBFD RA aspects Ericsson
14. R2-2502566 CSI-RS measurements and SBFD operation in CA and DC Ericsson
15. R2-2502588 Views on random access for SBFD Qualcomm Incorporated
16. R2-2502642 Discussion on Random Access operation in SBFD InterDigital, Inc.
17. R2-2502706 Discussion on random access in SBFD CMCC
18. R2-2502850 Discussion on Random Access procedure for SBFD LG Electronics Inc.
19. R2-2502967 Random Access in SBFD Lenovo
20. R2-2501850 Discussion on other aspects of SBFD CATT
21. R2-2501883 Other aspects of SBFD Xiaomi
22. R2-2502083 Discussion on multiple carrier and measurements in SBFD ZTE Corporation
23. R2-2502318 Other impacts by the evolution of duplex operation Huawei, HiSilicon
24. R2-2502388 SBFD other aspects vivo
25. R2-2502395 Discussion on the SBFD related measurement and BFR OPPO
26. R2-2502644 Discussion on resource configuration in SBFD InterDigital, Inc.
27. R2-2502801 Other Aspects of SBFD Samsung
28. R2-2502851 Other aspects on SBFD LG Electronics Inc.
29. R2-2502918 Other aspects of SBFD Nokia
30. R2-2502589 Other aspects of SBFD Qualcomm Incorporated discussion

# Appendix: Agreement of SBFD in RAN2:

# RAN2#127

## Random access in SBFD

* Working assumption: Random access procedure in SBFD symbols is supported for all the existing RACH trigger events.
* RAN2 assume RACH configuration for SBFD via SIB and/or dedicated RRC signalling is supported. Detailed signalling FFS.
* RAN2 to strive for a common SBFD CBRA framework independent of RRC state.
* FFS whether/how early indication is used during a SBFD RA procedure.
* RAN2 focus on 4-step RACH for SBFD RA, FFS on 2-step if needed.

## Other aspects

* Cell-specific SBFD time/frequency configuration is provided by SIB1 (or via dedicated signalling to covey cell specific configuration). FFS on UE specific dedicated RRC configuration if needed, pending on RAN1 progress.

# RAN2#127-bis

## Random access in SBFD

* RAN2 understand that if additional RO is selected by SBFD-aware UE, early identification via Msg1 is possible from NW point of view for this UE without specification impact.
* From R2 point of view, there is no need to introduce SBFD as a new feature combination in the current PRACH preamble partitioning framework.
* Upon initiation of CBRA RACH procedure for a SBFD-aware UE, UE selects one type of ROs between legacy-ROs and additional-ROs based on certain specified/configured conditions/prioritizations, if no additional indication (FFS if there needs to be any) is from network.
* For the PRACH transmission re-attempt in one RACH procedure, after certain (configured) number of times of RACH attempt in SBFD RACH occasions, UE is allowed to switch to legacy RACH occasions. FFS about the case when UE select legacy ROs first.
* The following two RACH configuration options are considered for SBFD based random access:
	+ - Option 1: Use one single RACH configuration based on the existing parameters of the single RACH configuration. Can extend the existing parameters if needed.
		- Option 2: Use two separate RACH configurations, including one legacy RACH configuration and one additional RACH configuration
* For RACH configuration Option 2, RAN2 needs to specify RRC signalling for the new SBFD based RACH configuration with a new set of parameters.
* The RACH configuration for SBFD is transmitted via SIB1. FFS dedicated RRC signalling detail. FFS whether NW can provide both configurations.

## Other aspects

* For UL resource muting for PUSCH, the configuration of time and frequency location for UL resource muting should be introduced based on R1 agreement.
* For L1 based UE-to-UE CLI measurement mechanism, the configuration of periodic, semi-persistent or aperiodic UE-to-UE CLI measurement resource (set) should be introduced based on R1 agreement.
* For L1 based UE-to-UE CLI reporting mechanism, the configuration of report quantities should be introduced based on R1 agreement.

# RAN2#128

## Random access in SBFD

CFRA

* The RO type is indicated by NW for CFRA. FFS on signaling (can FFS for the SI request case if needed).

CBRA

* FFS on the following options

**Option 1**

**Upon initiation of RACH procedure for a SBFD-aware UE, network provides the indication on the prioritization of the additional ROs over legacy RO.**

**If there is no such indication from the NW, FFS on the following mechanism**

* **UE select legacy RO or SBFD RO based on SSB RSRP, or**
* **UE select the legacy RO, or**
* **UE select the SBFD RO, or**
* **Other metrics than SSB RSRP.**

**Option 2**

**UE select legacy RO or SBFD RO based on SSB RSRP if such condition is configured, and if not configured, then UE can prioritize one type of the ROs, FFS which one.**

RACH configuration

* Only one RACH configuration option (i.e., either RACH configuration Option 1 with Alt 1-1 or RACH configuration Option 2) is supported in a cell.

## Other aspects

* Prioritization of SBFD cells / frequencies during cell reselection is not considered.
* RAN2 wait for input from the other WGs regarding whether for inter-cell CSI-RS measurements, UE needs to be provided with information of the SBFD configuration of neighbouring cells.

# RAN2#129

## Random access in SBFD

RACH configuration

* **When a SBFD aware UE supporting one or both SBFD RACH configuration options accesses a cell, the UE can apply the supported SBFD RACH configuration option in the cell.**
* **When a SBFD aware UE supporting a SBFD RACH configuration option accesses a cell configured with a different SBFD RACH configuration option, the UE applies the legacy RA operation, and does not apply the SBFD RACH configuration.**

RACH procedure, RO selection criteria

* **For initial RA transmission, the network can indicate the RO type (legacy RO or additional RO) to the SBFD-aware UE for the case of CBRA. Detailed signalling is FFS.**
* **If no RO type indication is provided by the NW, a UE selects RO type based on a SSB RSRP threshold. FFS whether NW can further indicate whether to select the additional RO type below or above this SSB RSRP threshold.**

RACH procedure, RO selection before or after selecting a set of RA resources

* **FFS whether RO type selection is performed before or after the RA type selection.**

RACH procedure, fallback behaviour

* **FFS if switching from the PRACH resources in non-SBFD symbols to the PRACH resources in SBFD symbols is supported.**

## Other aspects

* **A new SP CLI measurement resource set activation/deactivation MAC CE is introduced to activate/deactivate the SP CLI measurement resource.**

# RAN2#129-bis

## Random access in SBFD

Output of email discussion [Post129][217]

* **On RO type signaling for CFRA**

**1. For CFRA triggered by BFR, the RO type is indicated in BeamFailureRecoveryConfig.**

**2. For CFRA triggered by ReconfigurationwithSync, the RO type is indicated in RACH-ConfigDedicated.**

* **When both NW indication on RO type and RSRP threshold are absent, it is up to UE implementation to select the RO type.**
* **Random access procedure in SBFD symbols is supported for all the existing RACH trigger events except for SI request. FFS for LTM.**

On RSRP threshold for RO type selection (e.g., configuration, related procedure, etc.)

* **NW indicate via explicit signaling whether the SBFD RO is selected when SSB RSRP are 'below' or 'above' the configured threshold.**

RO type selection before or after RA type selection

* **Working assumption: For SBFD-aware UE, the selection of RO type is suggested to be performed before the selection of the set of Random Access resources.**

On RO type fallback

* **RO-Type change procedure on RO type selection from legacy RO to additional RO in SBFD symbols is supported when the number of PRACH transmission attempts exceed a threshold (we assume it is the same threshold with the fallback from additional RO to legacy RO). If fallback from legacy RO to additional RO occurs, no further fallback to legacy RO is supported.**

## Other aspects

SBFD in DC

* **Send an LS to RAN1 (CC RAN3 and RAN4) on whether SBFD and DC can be configured simultaneously, and whether there is any issue for such configuration.**

MAC CE design SP CLI Measurement Resource Set Activation/Deactivation

* **Working assumption: The configured SP CLI measurement resource sets are initially deactivated upon (re-) configuration by upper layers and after reconfiguration with sync.**
* **SP CLI measurement resource set activation/deactivation MAC CE includes following fields: A/D, Serving Cell ID, BWP ID, CLI measurement resource set ID (for CLI-RSSI or SRS-RSRP measurement), TCI State IDs.**