**3GPP TSG-RAN WG4 Meeting #112 R4-2411817**

**Maastricht, Netherlands, Aug. 19th – Aug. 23rd, 2024**

**Agenda item:** 8.21.3

**Source:** Moderator (Ericsson)

**Title:** Topic summary for [112][222] Netw\_Energy\_NR\_enh

**Document for:** Information

# Introduction

This document is the topic summary for [112][222] Netw\_Energy\_NR\_enh with the following topics covered

* Topic 1: Work plan (AI 8.21.1)
* Topic 2: On-demand SSB(OD-SSB) requirements (AI 8.21.2)
* Topic 3: On-demand SIB1(OD-SIB1) requirements (AI 8.21.2)
* Topic 4: Adaptation of Common Signals and Channels (AI 8.21.2)
* Note: suggested issues for online discussion:

# Topic #1: Work plan (AI 8.21.1)

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **R4-2412508** | Ericsson | The work plan for NES enhancement |

## Open issues summary

### Sub-topic 1-1: Work plan

**Issue 1-1: Workplan proposals**

* Proposals
	+ Option 1: R4-2412508
* Recommended WF
	+ Agree on the work plan in R4-2412508.

# Topic #2: On-demand SSB(OD-SSB) requirements (AI 8.21.2)

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411360**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411360.zip) | CATT | **Proposal 1: RAN4 to define on-demand SSB based SCell activation requirements for the following cases as agreed in RAN1:** * + **Scenario #2 and Case #1**
	+ **Scenario #2 and Case #2**
	+ **Scenario #2A and Case #1**
	+ **Scenario #2A and Case #2**

**Proposal 2: RAN4 to discuss on-demand SSB SCell activation delay requirements using Rel-15 SCell activation as baseline.****Proposal 3: RAN4 to discuss measurement requirements of deactivated SCell based on on-demand SSB.****Proposal 4: For the scenarios that on-demand SSB is triggered before UE receives SCell activation, RAN4 to discuss known condition of SCell activation based on on-demand SSB measurement.** **Proposal 5: For the scenarios that on-demand SSB is triggered when or after UE receives SCell activation, the existing SCell activation delay requirements can be reused.** **Proposal 6: For Case #1 (i.e., No always-on SSB on the cell, the existing SCell activation delay requirements can be reused by clarifying that the SSB used in activation procedure is on-demand SSB.** **Proposal 7: For Case #2 (i.e., Always-on SSB is periodically transmitted on the cell), further discuss how to handle the different configurations e.g., periodicity of two types of SSB.**  |
| [**R4-2411451**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411451.zip) | Apple | **Proposal 1: RAN4 to start work on OD-SSB based deactivated SCell measurement and OD-SSB based SCell activation delay requirement first for scenario 2/2A with case #1 and case #2.****Proposal 2: scenario 3A/3B related RRM requirements can be discussed after RAN1 has concrete conclusions, e.g., OD-SSB based L1/L3 measurements for activated SCell for scenario 3B and SCell activation delay requirement for scenario 3A.****Proposal 3: for OD-SSB based SCell activation requirement, RAN4 to first focus on the single SCell activation case as baseline; and then after we conclude on the baseline case, RAN4 may discuss other enhanced CA scenarios if needed, e.g., multiple SCell activation, PUCCH SCell activation, and direct SCell activation.****Proposal 4: RAN4 to discuss the following issues for SCell activation in case #1 besides the SCell activation delay:*** **Potential issue 1: how to differentiate SSB-less SCell and OD-SSB SCell in Case#1.**
* **Potential issue 2: when to start reporting OOR CQI and lowest L1 SS-RSRP during OD-SSB based SCell activation in Case#1.**
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| [**R4-2411468**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411468.zip) | MediaTek inc. | Proposal 1: RAN4 to discuss SCell activation requirements for R19 NES for the following scenarios:* **Case 1: RRC based / MAC-CE based OD-SSB operation for a SSB SCell**
* **Case 2: RRC based / MAC-CE based OD-SSB operation for a SSB-less SCell**
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| [**R4-2411485**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411485.zip) | OPPO | **Proposal 1: RAN4 starts from Objective#1 to define RRM requirements for on-demand SSB SCell operation.****Proposal 2: RAN4 to consider OD-SSB based L3 measurement on deactivated Scell and Scell activation.****Proposal 3: RAN4 to define OD-SSB based Scell activation requirement based on Rel-15 Scell activation as the baseline.****Proposal 4: RAN4 to consider Not-always-on SSB and Always-on SSB for the known and unknown SCell.****Proposal 5: Wait for RAN1/2’s conclusion on signaling method(s) to support OD-SSB based SCell activation.** |
| [**R4-2411570**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411570.zip) | Nokia, Nokia Shanghai Bell | **Observation #1: Case #1 is independent from SSB-less operation and includes all the cases where no always-on SSB is assumed.** **Observation #2: In legacy behaviour, a UE is required to perform the SSB based measurements on a deactivated SCell following the measurement requirements in TS 38.133 clause 9.2.5.****Proposal 1: Prioritize the OD-SSB discussion in Scenario#2 and Scenario#2A for both Case #1 and Case #2.****Proposal 2: RAN4 shall specify the OD-SSB based direct SCell activation delay when OD-SSB is triggered at the time instance T1 i.e. by SCell addition message in Case #1.****Proposal 3: When OD-SSB is triggered after SCell addition in Case 1, the OD-SSB based measurement before receiving SCell activation command shall be considered to reduce the SCell activation delay.****Proposal 4: In scenario #2, RAN4 can prioritize the case where on-demand SSB is triggered at the time instance T1 over the case where OD-SSB is triggered after T1.** **Proposal 5: RAN4 shall specify the OD-SSB based unknown SCell activation delay when OD-SSB is triggered at the time instance T2 i.e. by SCell activation command in Case #1.****Proposal 6: When OD-SSB is triggered at the time instance T2 in Case #1, the OD-SSB shall be transmitted at least until the end of the SCell activation procedure.****Proposal 7: In Case#1 scenarios, a UE is not expected to perform any measurement on the deactivated SCell before OD-SSB is triggered hence existing measurement requirements for a deactivated SCell does not apply.****Proposal 8: RAN4 shall specify the direct SCell activation delay based on OD-SSB when OD-SSB is triggered at the time instance T1 i.e. by SCell addition message in Case #2.****Proposal 9: When OD-SSB is triggered after SCell addition message in Case#2, RAN4 to discuss how to handle the measurement on the always-on SSBs and OD-SSBs.****Proposal 10: RAN4 shall specify the SCell activation delay based on OD-SSB when OD-SSB is triggered at the time instance T2 i.e. by SCell activation command in Case #2.****Proposal 11: When OD-SSB is triggered at the time instance T2 in Case #2, the UE measurement based on always-on SSBs in the SCell shall be considered to reduce the SCell activation delay.****Proposal 12: In Case #2 scenarios, RAN4 shall discuss the UE measurement behavior and specify the measurement requirements considering both always-on SSB and OD-SSB.**  |
| [**R4-2411621**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411621.zip) | Xiaomi | **Observation 1: It seems there is some ambiguity on agreements from RAN1 of on-demanding SSB scenarios and cases (e.g. whether there are co-existed OD SSB and legacy SSBs).****Proposal 1: RAN4 can firstly align the understanding of the definition of the scenarios for on-demanding SSB.****Proposal 2: RAN4 can start to redefine the RRM requirements below firstly when OD-SSB is introduced in Rel19**Table 1. RRM impacts summary due to OD-SSB

|  |  |
| --- | --- |
| **RRM requirements in TS38.133** | **Updates needed** |
| 8.3. SCell Activation Delay Requirement for Deactivated SCell | FFS |
| 8.3.3 SCell Deactivation Delay Requirement for Activated SCell | FFS |
| 9.2.5 Intra-frequency measurements without measurement gaps | FFS |
| 9.2.7 Intra-frequency measurements with NCSG | FFS |

**Observation 2: When leveraging the current requirements in TS38.133 to the SCell activation/deactivation requirement with on-demanding SSB, whether SCell is known or unknown needs to be differentiated.** **Observation 3: RAN4 can also consider whether further power saving optimization method needs to be accounted when specifying SCell activation/deactivation requirements with on-demanding SSB.****Observation 4: In order to simplify RAN4 discussion, it can assume that from the requirement perspective, we need only to define the scenario when there is only one cell-defining OD SSB available.** **Proposal 3: RAN4 can further discuss the SCell activation/deactivation requirements with OD SSB upon** * **UE known or unknow conditions**
* **the relationship between on-demanding trigger time and Scell activation command receiving**
* **legacy SSB or on-demanding SSB if both of them are activated**
* **further power saving**
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| [**R4-2411724**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411724.zip) | Qualcomm Technologies Ireland | **On-Demand SSB****Observation 1:** On-demand SSB is supported for NCD-SSB, but it has not yet been agreed in RAN1 that on-demand SSB can also be CD-SSB **Proposal 1:** RAN4 should start working on requirements for on-demand SSB that are NCD-SSB. Defining requirements for on-demand SSB that are CD-SSB should be postponed till RAN1 has decided that Alt-1 above is supported.**Observation 2:** Not all existing cases for SCell activation in [2] may be compatible with Case #1A and Case #2A above. **Proposal 2:** RAN4 should study which SCell activation scenarios in [2] can work together with on-demand SSB and define priorities which of them should be enhanced. **Proposal 3:** RAN4 should define requirements for SCell activation for on-demand SSB for cases #1A and #2A, i.e., joint triggering of SCell activation and on-demand SSB. First focus should be Rel-15 SCell activation, i.e., start with chapter 8.3.2 in [1] as a baseline.**Observation 3:** In case of L1 measurements, either the SCell is always unknown or a new condition for a cell to be known needs to be discussed and agreed in RAN4. However, this would also imply RAN2 impact.**Proposal 4:** RAN4 should investigate the conditions for known and unknown SCell depending on the configuration of the on-demand SSB and the configuration of the measurement report and define the SCell activation requirements accordingly.**Proposal 5:** Postpone any RAN4 work on on-demand SSB during activated SCell till RAN1 agrees to support this scenario.  |
| [**R4-2411761**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411761.zip) | CMCC | **Proposal 1: RAN4 should first focus on the scenarios and cases which agreed by RAN1, including:*** **Scenario#2 and Case#1: SCell is configured to a UE but before the UE receives SCell activation command + No always-on SSB on the cell**
* **Scenario#2 and Case#2: SCell is configured to a UE but before the UE receives SCell activation command + Always-on SSB is periodically transmitted on the cell**
* **Scenario#2A and Case#1: When UE receives SCell activation command + No always-on SSB on the cell**
* **Scenario#2A and Case#2: When UE receives SCell activation command + Always-on SSB is periodically transmitted on the cell**

**Proposal 2: RAN4 should investigate on the following on-demand SSB related requirement case by case:*** **deactivated SCell measurement requirement**
* **FR1 and FR2**
* **SCell activation delay requirement**
* **FR1 and FR2**
* **Single SCell activation and multiple SCell activation**

**Proposal 3: For Scenario#2 and Case#1, the L3 deactivated SCell measurement requirement should be re-designed, and it can not be applied before on-demand SSB triggering.****Proposal 4: For Scenario#2 and Case#1, the known condition of to-be-activated SCell should be re-designed, according to the new L3 deactivated SCell measurement requirement.****Proposal 5: For Scenario#2 and Case#2, the L3 deactivated SCell measurement requirement is not needed.****Proposal 6: For Scenario#2 and Case#2, only unknown case need to be considered.****Proposal 7: For Scenario#2A and Case#1, L3 measurement requirement after on-demand SSB triggering and during the SSB periodicity transition period should be re-designed.****Proposal 8: For Scenario#2A and Case#1, the FR1 known condition for SCell activation should be re-designed accordingly.****Proposal 9: For Scenario#2A and Case#2, the legacy L3 measurement requirement and FR1 known condition can be reused.****Proposal 10: For SCell activation delay requirement, the legacy methodology of defining requirements can be reused, which are:*** **For known case and measurement sampling rate before SCell activation command smaller than or equal to 160ms, fine sync time is needed in SCell activation delay.**
* **For known case and measurement sampling rate before SCell activation command larger than 160ms, AGC and fine sync time is needed in SCell activation delay.**
* **For unknown case, AGC and time sync is needed in SCell activation delay.**
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| [**R4-2412120**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412120.zip) | China Telecom | **Observation 1: For legacy SSB SCell operation, many SCell operation scenarios were introduced from Rel-15 to Rel-18, e.g., SCell activation/ deactivation, direct SCell activation, multiple SCell activation/ deactivation, PUCCH SCell activation/ deactivation, fast SCell activation, SCell activation with L3 reporting, etc.****Observation 2: These scenarios for legacy SSB SCell operation can be the** **directions of discussion for on-demand SSB SCell operation. However, there are too many scenarios for legacy SSB SCell operation, thus it’s necessary to select a basic SCell operation scenario and discuss the baseline scenario firstly in Rel-19.****Proposal 1: It’s proposed to discuss and define requirements on single SCell activation supporting on-demand SSB SCell operation firstly.****Proposal 2: It’s proposed to consider Case #1 and Case #2 with known SCell activation and unknown SCell activation.** |
| [**R4-2412205**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412205.zip) | Huawei, HiSilicon | **Proposal 1: RAN4 starts work on following RAN1 agreed scenario and cases, and postpone the discussion on Scenario #3A and Scenario #3B until RAN1 has further progress.*** **Case A: Scenario #2 and Case #1**
* **Case B: Scenario #2 and Case #2**
* **Case C: Scenario #2A and Case #1**
* **Case D: Scenario #2A and Case #2**

**Observation 1: For Case A and Case B, if UE can perform L3 measurement based on OD SSB, UE can maintain the measurement for the deactivated SCell without always on SSB in Case A or with long period always on SSB. Thus, it is beneficial for fast SCell activation and achieving NW energy saving at the same time.****Proposal 2: For Case A (Scenario #2 and Case #1) and Case B (Scenario #2 and Case #2), RAN4 to work on L3 measurement on deactivated SCell based on OD-SSB to enable known SCell activation and SCell activation based on L3 reporting triggered by SCell activation command introduced in Rel-18.****Observation 2: The target Scenario and gain for Case C and Case D is straightforward, which is to enable SCell activation based on OD-SSB with potential delay reduction to achieve NW energy saving and guarantee the SCell activation performance at the same time.****Proposal 3: For Case C (Scenario #2A and Case #1) and Case D (Scenario #2A and Case #2), RAN4 starts work from single SCell activation unknown case (i.e. without L3 measurement/report before SCell activation) for:*** **SCell activation (8.3.2)**
* **PUCCH SCell activation (8.3.12)**

**And multiple SCell activation requirements can be discussed after the discussion on single SCell activation is concluded.** **Observation 3: RAN4 shall wait for further RAN1/2 progress on OD-SSB configurations and triggering.****Observation 4: For L3 measurement based on OD SSB for serving cell (deactivated SCell), there could be potential benefits as analysed for Case A and Case B.****Observation 5: For L3 measurement based on OD SSB for neighbour cell, it is feasibility and reliability are questionable and gain is not clear.****Proposal 4: For L1 measurement based on OD SSB, which is already agreed in RAN1, RAN4 to wait for further RAN1 progress.****Proposal 5: RAN4 to deprioritize the discussion for L3 measurement based on OD SSB for neighbour cell, as feasibility and reliability are questionable and gain is not clear.** |
| [**R4-2412419**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412419.zip) | Intel Corporation | **Observation: From RAN4 perspective, it is possible that at least for some of the scenarios there is no always-on SSB on the target SCell.****Proposal 1: RAN4 specifies enhanced SCell activation delay requirements considering L3 and L1 measurements based on On-demand SSB configurations during the SCell activation process.****Proposal 2: RAN4 specifies enhanced deactivated SCell measurement requirements based on On-demand SSB.****Proposal 3: RAN4 specifies enhanced intra-frequency measurement requirements based on On-demand SSB.** |
| [**R4-2412507**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412507.zip) | Ericsson | **Proposal 1: RAN4 to study OD-SSB impact based on Rel-15 single Scell activation requirement as a start point.****Proposal 2: RAN4 to study whether and how to define requirement for other type of SCell activation in phase 2 after baseline case (Rel-15 single SCell activation) is completed, such as multiple SCells activation, direct SCell activation etc.** * **Note: Phase 2 will start from RAN4 #114 meeting (Feb., 2025)**

**Proposal 3: RAN4 to study OD-SSB SCell activation for both Case 1 and Case 2 as follow.*** **Case 1-1: No always-on SSB on the known cell**
* **Case 1-2: No always-on SSB on the unknown cell**
* **Case 2-1: Always-on SSB periodically transmitted on the known cell**
* **Case 2-2: Always-on SSB periodically transmitted on the unknown cell**

**Proposal 4: RAN4 to study OD-SSB based deactivated Scell measurement and Scell activation requirement first.****Observation 1: To guarantee the known condition, OD-SSB transmission time duration should be longer than deactivated Scell measurement period.****Observation 2: To maximize the NES gain, OD-SSB transmission time duration in phase 2 shall be limited to a shorter duration.****Proposal 5: In Case 1, RAN4 to discuss UE’s measurement behaviour during the deactivated SCell stage to maximize the NES gain.****Proposal 6: In Case 1, UE is assumed to perform deactivated SCell measurement based on OD-SSB when NW indicates the OD-SSB transmission during the deactivated SCell stage.****Proposal 7: RAN4 to support the following scenarios for OD-SSB based known SCell activation.*** **Scenario 1: Single OD-SSB indication for OD-SSB transmission in both deactivated SCell measurement and SCell activation**
* **Scenario 2: Two OD-SSB indications for OD-SSB transmission in deactivated SCell measurement and SCell activation separately**

**Proposal 8: In Case 1, when OD-SSB transmission is before/together with the SCell activation command, UE follows the legacy Rel-15 known SCell activation requirement if the known cell condition is met.** * **FFS: the OD-SSB transmission time instance A**

**Proposal 9: In Case 1, when OD-SSB transmission is before/together with the SCell activation command, UE follows the legacy Rel-15 unknown SCell activation requirement once the unknown cell condition is met.*** **FFS: the OD-SSB transmission time instance A**

**Observation 3: OD-SSB and legacy SSB transmission can have different configurations, such as SMTC periodicities.****Proposal 10: In Case 2, the UE is assumed to switch to OD-SSB to perform measurement/Scell activation when OD-SSB transmission is indicated.****Proposal 11: In Case 2, the UE is assumed to perform measurement based on legacy SSB before UE receiving OD-SSB transmission indicated during deactivated Scell stage.** |
| [**R4-2412525**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412525.zip) | vivo | **Proposal 1 Specify RRM requirements for OD-SSB based cell identification, i.e. SSB-based rough sync, and RSRP/SINR measurement, on an intra-f. layer for de-activated SCell and activated SCell.****Proposal 2 Specify RRM requirements for OD-SSB based SCell activation****Proposal 3 RAN4 to discuss the searcher assumption of OS-SSB based cell identification, which would impact the CSSF of intra-frequency L3 or L1 measurements.** |
| [**R4-2412524**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412524.zip) | Samsung | **Observation 1: For on-demand SSB deployment, Scenario#2 and Scenario#2A with both Case#1 and Case#2 have been agreed in RAN1 discussion, while other Scenarios are still FFS.** **Observation 2: About the signaling to indicate on-demand SSB transmission, further discussion on separate signaling or single signaling are expected, and RRC based and MAC-CE based signaling are supported, FFS on the DCI based signaling.** **Observation 3: For the on-demand SSB indicated via MAC CE, the on-demand SSB burst(s) is expected to be transmitted from time instance A, however the details need further discussion in following RAN1 meetings.****Observation 4: For the measurement of on-demand SSB, L1 measurement based on on-demand SSB should be supported at least, and no conclusion on L3 measurement based on on-demand SSB.****Proposal 1: For on-demand SSB, prioritize the discussion in RAN4 based on Scenario #2 and Scenario #2A with case #1 and case #2.****Proposal 7: For on-demand SSB, RAN4 need to clarify if L3 measurements based on on-demand SSB is needed or not from RAN4 perspective, and discuss the impacts on L1 measurements.****Proposal 8: For on-demand SSB, related requirements for SCell activation and link recovery should be updated accordingly.** |
| [**R4-2412855**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412855.zip) | ZTE Corporation, Sanechips | **Observation 1: The on-demand SSB SCell operation is applicable for the following cases:*** **CONNECTED mode**
* **SCell in intra/inter-band CA(not including PSCell)**
* **Both FR1 and FR2**

**Observation 2: For the on-demand SSB SCell, two cases i.e. with always-on SSB and without always-on SSB are both allowed.****Observation 3: No room to apply the on-demand SSB operation for the phase of SCell addition.****Observation 4: In legacy, during deactivated SCell measurement, the periodicity of *measCycleSCell* instead of SMTC is used to identify the measurement requirements. While from NW side, the SSB periodicity is still assumed as the SMTC periodicity. Not aligned between UE behavior and NW assumption.****Proposal 1: To realize NW power saving, the deactivated SCell could send on-demand SSB with the periodicity of *measCycleSCell.*****Observation 5: Relatively frequent SSB measurement before SCell activation command can accelerate the SCell activation procedure.****Proposal 2: During the deactivated SCell phase, when to trigger the large periodicity of on-demand SSB measurement, and when to terminate the large periodicity on-demand SSB, totally depend on NW.****Proposal 3: During the phase of SCell activation, the motivation of applying on-demand SSB lies in: 1) Accelerate the SCell activation procedure; 2) Align all UEs’ activation procedure.****Observation 6: During SCell activation procedure, multiple alternatives can used to trigger the on-demand SSB, including:** * **Alternative 1: No need to trigger, the on-demand SSB has already triggered during deactivated SCell measurement**
* **Alternative 2: Triggered simultaneously with the SCell activation command**
* **Alternative 3: Triggered by independent command after the SCell activation command**

**Wherein the Alternative 3 would lead to additional delay component.** |

## Open issues summary

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

### Sub-topic 2-1: General On-demand SSB(OD-SSB) requirements

*Sub-topic description: This sub-topic covers OD-SSB requirement general aspects.*

**Issue 2-1-1: OD-SSB work plan**

* Proposal 1
	+ Option 1: Ericsson, CATT, Apple, OPPO, Qualcomm, China Telecom, Huawei, Samsung
		- RAN4 to study OD-SSB impact based on Rel-15 single Scell activation requirement as a start points.
* Proposals 2
	+ Option 1: Ericsson, Apple
		- RAN4 to first focus on the single SCell activation case as baseline.
		- After RAN4 concludes on the baseline case, RAN4 may discuss other enhanced scenarios if needed in phase 2, e.g., multiple SCells activation, PUCCH SCell activation, and direct SCell activation.
			* Note: Phase 2 will start from RAN4 #114 meeting (Feb., 2025)
	+ Option 2: Qualcomm
		- RAN4 should study which SCell activation scenarios can work together with on-demand SSB and define priorities which of them should be enhanced.
	+ Option 3: Huawei
		- For Scenario #2A and Case #1 and Scenario #2A and Case #2, RAN4 starts work from single SCell activation unknown case for:
			* SCell activation (8.3.2)
			* PUCCH SCell activation (8.3.12)
		- Multiple SCell activation requirements can be discussed after the discussion on single SCell activation is concluded.
* Recommended WF
	+ Moderator suggests the group to check whether the following proposal can be agreed.
		- RAN4 to first focus on the single SCell activation case as baseline.
		- After RAN4 concludes on the baseline case, RAN4 may discuss other enhanced CA scenarios if needed in phase 2, e.g., multiple SCells activation, PUCCH SCell activation, and direct SCell activation.
			* Note: Phase 2 will start from RAN4 #114 meeting (Feb., 2025)

**Issue 2-1-2: OD-SSB scenarios**

Background:

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| **RAN1 #116 Agreement**Regarding the UE assumption on SSB transmission on a cell supporting on-demand SSB SCell operation, the following cases are identified for further study:* Case #1: No always-on SSB on the cell
* Case #2: Always-on SSB is periodically transmitted on the cell
* FFS: Whether always-on SSB and on-demand SSB are not cell-defining SSB if transmitted.
* FFS: Which scenario the above applies for

**RAN1 #116 Agreement**For the following identified scenarios for on-demand SSB SCell operation, focus future RAN1 discussion to down-select (both may be selected) between the two scenarios.* Scenario #2: SCell is configured to a UE but before the UE receives SCell activation command (e.g., as defined in TS 38.321)
* Scenario #3: After UE receives SCell activation command (e.g., as defined in TS 38.321)
	+ This does not preclude SCell for which activation is completed
	+ FFS: The case where SCell activation is completed

FFS: Application timing between NW triggering message and on demand SSB transmission**RAN1 #116bis Agreement**For the identified scenarios and cases (as per RAN1#116 agreement), on-demand SSB can be triggered by gNB at least for the following scenarios/cases:* Scenario #2 and Case #1
* Scenario #2 and Case #2
* Scenario #2A and Case #1
* Scenario #2A and Case #2
* FFS: Scenario #3A and Case #1
* FFS: Scenario #3A and Case #2
* FFS: Scenario #3B and Case #1
* FFS: Scenario #3B and Case #2
* For Case #1, once on-demand SSB is triggered, its transmission is in a periodic manner.
	+ Note: This does not imply periodic on-demand SSB is transmitted indefinitely after triggered.
* Notes:
	+ Scenario #2A refers to
		- “When UE receives SCell activation command (e.g., as defined in TS 38.321)”
	+ Scenario #3A refers to
		- “After UE receives SCell activation command (e.g., as defined in TS 38.321) until SCell activation is completed”
	+ Scenario #3B refers to
		- “When SCell activation is completed and SCell is activated” or
		- “After SCell activation is completed and SCell is activated”
	+ For discussion purpose under AI 9.5.1, always-on SSB is SSB supported in Rel-18 specifications.
	+ Timing for on-demand SSB transmission (e.g. when the triggered SSB starts and ends) will be separately discussed.
 |

* Proposals
	+ Option 1: CATT, Apple, Nokia, Qualcomm, CMCC, Huawei, Samsung
		- RAN4 to define on-demand SSB based SCell activation requirements for the following cases as agreed in RAN1:
			* Scenario #2 and Case #1
			* Scenario #2 and Case #2
			* Scenario #2A and Case #1
			* Scenario #2A and Case #2
	+ Option 2: Mediatek
		- RAN4 to discuss SCell activation requirements for R19 NES for the following scenarios:
			* Case 1: RRC based / MAC-CE based OD-SSB operation for a SSB SCell
			* Case 2: RRC based / MAC-CE based OD-SSB operation for a SSB-less SCell
	+ Option 3: OPPO
		- RAN4 to consider Not-always-on SSB and Always-on SSB for the known and unknown SCell.
	+ Option 4: Ericsson, China Telecom
		- RAN4 to study OD-SSB SCell activation for both Case 1 and Case 2 as follow.
			* Case 1-1: No always-on SSB on the known cell
			* Case 1-2: No always-on SSB on the unknown cell
			* Case 2-1: Always-on SSB periodically transmitted on the known cell
			* Case 2-2: Always-on SSB periodically transmitted on the unknown cell
* Recommended WF
	+ Moderator suggests the group to check whether the following proposal can be agreed.
		- RAN4 to discuss OD-SSB based SCell activation requirements based on following RAN1 agreed scenarios.
			* Case A: Case #1 and Scenario #2
			* Case B: Case #1 and Scenario #2A
			* Case C: Case #2 and Scenario #2
			* Case D: Case #2 and Scenario #2A
		- Note: RAN4 needs to further consider the following aspects:
			* Known and unknown SCell activation
			* RRC based and MAC based OD-SSB indication.

**Issue 2-1-3: Deactivated SCell measurement requirement**

* Proposals
	+ Option 1: CATT, Apple, Ericsson, OPPO, Nokia, CMCC, Intel, Huawei, Xiaomi, vivo, Samsung
		- RAN4 to discuss OD-SSB based deactivated Scell measurement and Scell activation requirement.
			* Includes both FR1 and FR2
* Recommended WF
	+ Moderator suggests the group to check whether the following proposal can be agreed.
		- RAN4 to discuss OD-SSB based deactivated Scell measurement and Scell activation requirement.
			* Includes both FR1 and FR2

**Issue 2-1-4: OD-SSB based L3 neighbour cell measurement**

* Proposals
	+ Option 1: Huawei
		- RAN4 to deprioritize OD-SSB based L3 neighbour cell measurement, as feasibility and reliability are questionable and gain is not clear.
	+ Option 2: Samsung
		- RAN4 needs to clarify if L3 measurements based on on-demand SSB is needed or not.
* Recommended WF
	+ Moderator suggests the group to check whether the following proposal can be agreed.
		- RAN4 to focus on OD-SSB based L3 serving cell measurement and deprioritize OD-SSB based L3 neighbour cell measurement.

**Issue 2-1-5: OD-SSB type**

* Background

|  |
| --- |
| **RAN1 #116bis Agreement*** For a cell supporting on-demand SSB SCell operation,
	+ Note: It is up to gNB implementation whether always-on SSB (if transmitted) on the cell is cell-defining SSB or not.
	+ For on-demand SSB on the cell, downselect between the following alternatives
		- Alt-1: It is up to gNB implementation whether on-demand SSB is cell-defining SSB or not.
		- Alt-2: On-demand SSB is limited to non-cell-defining SSB.
			* FFS: Further limitations to on-demand SSB
 |

* Proposals
	+ Option 1: Qualcomm
		- RAN4 should start working on OD-SSB requirements for NCD-SSB.
		- Defining OD-SSB requirements for CD-SSB should be postponed till RAN1 has decided.
* Recommended WF
	+ Moderator suggests the group to check whether the following proposal can be agreed.
		- RAN4 to define OD-SSB based requirements for NCD-SSB first

**Issue 2-1-6: OD-SSB SCell activation requirement - L1 measurements**

* Proposals
	+ Option 1: Intel
		- RAN4 specifies SCell activation delay requirements considering L1 measurements based on OD-SSB configurations during the SCell activation process.
	+ Option 2: Samsung
		- RAN4 discusses the impacts on L1 measurements.
	+ Option 3: Huawei
		- For L1 measurement based on OD SSB, which is already agreed in RAN1, RAN4 to wait for further RAN1 progress.
* Recommended WF
	+ Further discussion

**Issue 2-1-7: Methodology inherited from legacy release SCell activation**

* Proposals
	+ Option 1: CMCC
		- For known case and measurement sampling rate before SCell activation command smaller than or equal to 160ms, fine sync time is needed in SCell activation delay.
		- For known case and measurement sampling rate before SCell activation command larger than 160ms, AGC and fine sync time is needed in SCell activation delay.
		- For unknown case, AGC and time sync is needed in SCell activation delay.
* Recommended WF
	+ Further discussion

**Issue 2-1-8: Reasons to trigger OD-SSB in SCell activation**

* Proposals
	+ Option 1: ZTE
		- 1) Accelerate the SCell activation procedure;
		- 2) Align all UEs’ activation procedure.
* Recommended WF
	+ No discussion needed

### Sub-topic 2-2: OD-SSB requirements(Case 1)

*Sub-topic description: This sub-topic covers OD-SSB requirement Case 1 part.*

Deactivated SCell L3 measurement part

**Issue 2-2-1: Case 1- OD-SSB based deactivated SCell measurement**

* Proposals
	+ Option 1: Ericsson, Nokia, Intel
		- RAN4 specifies enhanced deactivated SCell measurement requirements based on On-demand SSB considering following different aspects.
			* Aspect 1: Maximize the NES gain
			* Aspect 2: Reduce SCell activation delay
* Recommended WF
	+ Further discussion

**Issue 2-2-2: Case 1- OD-SSB based deactivated SCell measurement before OD-SSB indication**

* Proposals
	+ Option 1: Nokia, CMCC
		- The L3 deactivated SCell measurement requirement should be re-designed.
			* UE is not expected to perform any measurement on the deactivated SCell before OD-SSB is triggered.
				+ The existing measurement requirements for a deactivated SCell do not apply.
* Recommended WF
	+ Further discussion

**Issue 2-2-3: Case 1 - OD-SSB based deactivated SCell measurement after OD-SSB indication**

* Proposals
	+ Option 1: Ericsson
		- UE is assumed to perform deactivated SCell measurement based on OD-SSB when NW indicates the OD-SSB transmission during the deactivated SCell stage.
	+ Option 2: vivo
		- Specify RRM requirements for OD-SSB based cell identification, i.e. SSB-based rough sync, and RSRP/SINR measurement, on an intra-f. layer for de-activated SCell and activated SCell.
* Recommended WF
	+ Further discussion

**Issue 2-2-4: OD-SSB periodicity for deactivated SCell measurement**

* Proposals
	+ Option 1: ZTE
		- The deactivated SCell could send on-demand SSB with the periodicity of *measCycleSCell*.
* Recommended WF
	+ Further discussion

**Issue 2-2-5: Case 1 Scenario 2A - OD-SSB based deactivated SCell measurement**

* Proposals
	+ Option 1: CMCC
		- L3 measurement requirement after on-demand SSB triggering and during the SSB periodicity transition period should be re-designed.
	+ Option 2: vivo
		- Specify RRM requirements for OD-SSB based cell identification, i.e. SSB-based rough sync, and RSRP/SINR measurement, on an intra-f. layer for de-activated SCell and activated SCell.
* Recommended WF
	+ Further discussion

SCell activation part

**Issue 2-2-6: Case 1 - SCell activation known condition**

* Proposals
	+ Option 1: CATT
		- RAN4 to discuss known condition of SCell activation based on on-demand SSB measurement considering the following possible aspects.
			* Option 1a: The configuration of the on-demand SSB and the measurement report.(Qualcomm)
			* Option 1b: The new L3 deactivated SCell measurement requirement.(CMCC)
* Recommended WF
	+ Further discussion

**Issue 2-2-7: Case 1 - OD-SSB indication in known SCell activation**

* Proposals
	+ Option 1: Ericsson
		- RAN4 to support the following scenarios for OD-SSB based known SCell activation.
			* Scenario 1: Single OD-SSB indication for OD-SSB transmission in both deactivated SCell measurement phase and SCell activation phase
			* Scenario 2: Two separate OD-SSB indications for OD-SSB transmission in deactivated SCell measurement and SCell activation phases separately
* Recommended WF
	+ Further discussion

**Issue 2-2-8: Case #1 and Scenario #2 - known SCell activation**

* Proposals
	+ Option 1: Ericsson, CATT
		- When OD-SSB transmission is earlier than the SCell activation command, UE follows the legacy Rel-15 known SCell activation requirement if the known cell condition is met.
			* FFS: Clarify that the SSB used in activation procedure is on-demand SSB
			* FFS: the OD-SSB transmission time instance A
* Recommended WF
	+ Further discussion

**Issue 2-2-9: Case #1 and Scenario #2A - known SCell activation**

* Proposals
	+ Option 1: Ericsson, CATT
		- When OD-SSB transmission is together with the SCell activation command, UE follows the legacy Rel-15 known SCell activation requirement if the known cell condition is met.
			* FFS: Clarify that the SSB used in activation procedure is on-demand SSB
			* FFS: the OD-SSB transmission time instance A
* Recommended WF
	+ Further discussion

**Issue 2-2-10: Case #1 and Scenario #2 - unknown SCell activation**

* Proposals
	+ Option 1: Ericsson
		- When OD-SSB transmission is earlier than the SCell activation command, UE follows the legacy Rel-15 unknown SCell activation requirement once the unknown cell condition is met.
			* FFS: Clarify that the SSB used in activation procedure is on-demand SSB
			* FFS: the OD-SSB transmission time instance A
* Recommended WF
	+ Further discussion

**Issue 2-2-11: Case #1 and Scenario #2A - unknown SCell activation**

* Proposals
	+ Option 1: Nokia
		- RAN4 shall specify the OD-SSB based unknown SCell activation delay in Case #1 and Scenario #2A.
	+ Option 1a: Ericsson, CATT
		- When OD-SSB transmission is together with the SCell activation command, UE follows the legacy Rel-15 unknown SCell activation requirement once the unknown cell condition is met.
			* FFS: Clarify that the SSB used in activation procedure is on-demand SSB
			* FFS: the OD-SSB transmission time instance A
* Recommended WF
	+ Further discussion

### Sub-topic 2-3: OD-SSB requirements(Case 2)

*Sub-topic description: This sub-topic covers OD-SSB requirement Case 2 part.*

Deactivated SCell measurement part

**Issue 2-3-1: Case 2 Scenario 2 - Deactivated SCell measurement**

* Proposals
	+ Option 1: Ericsson
		- The UE is assumed to perform measurement based on legacy SSB before UE receiving OD-SSB transmission indicated during deactivated Scell.
		- The UE is assumed to switch to OD-SSB to perform measurement/Scell activation when OD-SSB transmission is indicated.
	+ Option 2: Nokia
		- RAN4 to discuss how to handle the measurement on the always-on SSBs and OD-SSBs.
			* The UE measurement based on always-on SSBs in the SCell shall be considered to reduce the SCell activation delay.
	+ Option 3: CMCC
		- In case 2 scenario 2, the L3 deactivated SCell measurement requirement is not needed.
* Recommended WF
	+ Further discussion

**Issue 2-3-2: Case 2 Scenario 2A - Deactivated SCell measurement**

* Proposals
	+ Option 1: CMCC
		- In case 2 scenario 2A, the legacy L3 measurement requirement can be reused.
* Recommended WF
	+ Further discussion

SCell activation part

**Issue 2-3-3: Case 2 Scenario 2: SCell activation**

* Proposals
	+ Option 1: CATT
		- RAN4 to discuss how to handle the different configurations e.g., periodicity of two types of SSB.
	+ Option 2: Nokia
		- RAN4 shall specify the SCell activation requirement based on OD-SSB in case 2 scenario 2A.
	+ Option 3: CMCC
		- In case 2 scenario 2, only unknown case needs to be considered.
* Recommended WF
	+ Further discussion

**Issue 2-3-4: Case 2: known condition for SCell activation**

* Proposals
	+ Option 1: CMCC
		- The legacy FR1 known condition can be reused.
* Recommended WF
	+ Further discussion

**Issue 2-3-5: Which type of SSB shall be used by UE in case2**

* Background: For case 2, there are two types of SSB are available for UE measurement purpose. One is the activated OD SSB the other always-on SSB. It is up to UE to choose any of them to obtain the measurement results. Thus, RAN4 may firstly clarify UE’s behaviour.
* Proposals
	+ Option 1: Xiaomi
		- For Rel19 NES capable UE, the requirements under case2 shall assume only OD-SSB to be used.
* Recommended WF
	+ Further discussion needed

### Sub-topic 2-4: Other miscellaneous

*Sub-topic description: This sub-topic covers some important issues but they’re difficult to be covered in the OD-SSB based single SCell activation part.*

**Issue 2-4-1: Case 1: out of range (OOR) CQI and lowest L1-RSRP reporting**

* Proposals
	+ Option 1: Apple
		- RAN4 to discuss when to start reporting out of range(OOR) CQI and lowest L1 SS-RSRP during OD-SSB based SCell activation.
* Recommended WF
	+ Further discussion

**Issue 2-4-2: Case 1: SSB-less SCell and OD-SSB SCell differentiation**

* Proposals
	+ Option 1: Apple
		- RAN4 to discuss how to differentiate SSB-less SCell and OD-SSB SCell
* Recommended WF
	+ Further discussion

**Issue 2-4-3: Searcher assumption for OD-SSB**

* Proposals
	+ Option 1: vivo
		- RAN4 to discuss the searcher assumption of OD-SSB based cell identification, which would impact the CSSF of intra-frequency L3 or L1 measurements.
* Recommended WF
	+ Further discussion

**Issue 2-4-4: OD-SSB signalling indication**

* Proposals
	+ Option 1: OPPO
		- Wait for RAN1/2’s conclusion on signaling method(s) to support OD-SSB based SCell activation.
* Recommended WF
	+ Postpone the discussion

**Issue 2-4-5: OD-SSB lifecycle**

* Proposals
	+ Option 1: Nokia
		- When OD-SSB is triggered in Case #1 and Scenario 2A, the OD-SSB shall be transmitted at least until the end of the SCell activation procedure.
	+ Option 2: ZTE
		- It’s up to NW to decide when to trigger the large periodicity of on-demand SSB measurement, and when to terminate the large periodicity on-demand SSB.
* Recommended WF
	+ Further discussion

**Issue 2-4-6: Multiple SCells activation**

* Proposals
	+ Option 1: CMCC
		- RAN4 should investigate on the on-demand SSB related multiple SCells activation requirement
* Recommended WF
	+ Postpone the discussion

**Issue 2-4-7: Direct SCell activation**

* Proposals
	+ Option 1: Nokia
		- RAN4 shall specify the OD-SSB based direct SCell activation delay when OD-SSB is triggered at the time instance T1 i.e. by SCell addition message in both Case #1 and Case #2.
		- In scenario #2, RAN4 can prioritize the case where on-demand SSB is triggered at the time instance T1(i.e. at the time instance when UE receives SCell activation via RRC message) over the case where OD-SSB is triggered after T1.
* Recommended WF
	+ Postpone the discussion

**Issue 2-4-8: Scenario #3A and #3B**

* Proposals
	+ Option 1: Apple, Qualcomm, Huawei
		- RAN4 to postpone the discussion until RAN1 has concrete conclusions
	+ Option 2: CATT
		- When OD-SSB is triggered after UE receives SCell activation, the existing SCell activation delay requirements can be reused.
	+ Option 3: Intel
		- Regarding scenario #3B, RAN4 specifies intra-frequency measurement requirements based on On-demand SSB.
* Recommended WF
	+ Postpone the discussion

**Issue 2-4-8: Scenario #3A and #3B**

* Proposals
	+ Option 1: Apple, Qualcomm, Huawei

RAN4 to pos

# Topic #3: On-demand SIB1(OD-SIB1) requirements (AI 8.21.2)

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411360**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411360.zip) | CATT | **Proposal 8: No RRM impact is identified for on-demand SIB1 and RAN4 to wait for further progress from other groups.**  |
| [**R4-2411451**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411451.zip) | Apple | **Proposal 5: no RRM work is needed for OD-SIB1 in R19 NES WI.** |
| [**R4-2411621**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411621.zip) | Xiaomi | **Proposal 4: Deprioritize RAN4 RRM works for OD SIB unless there is any explicit concerns from other WGs.** |
| [**R4-2411724**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411724.zip) | Qualcomm Technologies Ireland | **Proposal 6: Postpone RAN4 work on on-demand SIB1 till the RAN #105 plenary decision and RAN1/RAN2 work has made more progress.**  |
| [**R4-2412120**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412120.zip) | China Telecom | **Proposal 3: It’s proposed to deprioritize on-demand SIB1 discussion in RAN4 only if the impacts in RAN4 RRM are identified.** |
| [**R4-2412205**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412205.zip) | Huawei, HiSilicon | **Proposal 6: RAN4 to postpone the discussion for On-demand SIB1 since it is still under study in other WGs.** |
| [**R4-2412419**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412419.zip) | Intel Corporation | **Proposal 4: Wait until RAN1 confirms On-demand SIB1 feature for RAN4 to start working on requirements for UL-WUS.** |
| [**R4-2412507**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412507.zip) | Ericsson | **Proposal 12: RAN4 to deprioritize the OD-SIB1 requirement discussion unless any RRM impact is identified.**  |
| [**R4-2412525**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412525.zip) | vivo | **Proposal 4: For RRM requirements impact from on-demand SIB1 and the related uplink WUS desgin, RAN4 discuss the necessity of new RRM requirements after more conclusions from RAN1/2 is achieved.** |

## Open issues summary

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

### Sub-topic 3-1: RRM impact on OD-SIB1

*Sub-topic description: This sub-topic covers OD-SIB1 RAN4 requirement identification.*

**Issue 3-1-1: RRM impact of OD-SIB1**

* Proposals
	+ Option 1: CATT, Apple
		- No RRM impact.
	+ Option 2: Xiaomi, Qualcomm, China Telecom, Huawei, Intel, Ericsson, vivo
		- Postpone RAN4 work until any RRM impact is identified.
	+ Option 2-1: Qualcomm
		- Postpone RAN4 work till the RAN #105 plenary decision.
* Recommended WF
	+ Postpone RAN4 work until any RRM impact is identified.

# Topic #4: Adaptation of Common Signals and Channels requirements (AI 8.21.2)

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411360**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411360.zip) | CATT | **Proposal 9: No RRM impact is identified for PRACH adaptation and paging adaptation, and RAN4 to wait for further progress from other groups.** **Proposal 10: RAN4 to discuss the impact on measurement period requirements due to SSB adaptation.**  |
| [**R4-2411451**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411451.zip) | Apple | **Proposal 6: RAN4 to discuss the RRM requirement for SSB adaption and RACH adaptation after more concrete conclusions are made by RAN1.****Proposal 7: No need to discuss RRM requirement for PO adaptation.** |
| [**R4-2411468**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411468.zip) | MediaTek inc. | Proposal 2: RAN4 to further discuss the necessity of introducing RRM requirements on the transitions behavior for the time domain adaptation of SSB/PRACH/Paging occasion. |
| [**R4-2411570**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411570.zip) | Nokia, Nokia Shanghai Bell | **Observation #3: Options 1 and 2 are discussing the alternating between 2 SSB periodicities or SSB configurations.****Observation #4: Only one SSB pattern is active at a time, and this may have different SSB burst periodicity.****Observation #5: RAN1 has been discussing SSB adaptation only for UEs in connected mode so far.****Proposal 13: For RRM impact, RAN4 shall focus on Option 1 as starting point.****Proposal 14: RAN4 to start investigation of RRM impacts** **for SSB adaptation in time domain for a single SSB pattern, due to usage of different SSB burst periodicities.****Proposal 15: RAN4 to prioritize the discussion for UEs in connected mode.** **Proposal 16: RAN4 to maintain the specified range for SSB burst periodicity i.e. 5ms to 160ms.** **Proposal 17: RAN4 to consider the impact of processing time for decoding the updated SSB burst periodicity.** **Proposal 18: RAN4 to consider the L1/L3 measurement impact due to a change of the SSB burst periodicity.** **Proposal 19: RAN4 to investigate whether a transition period with no or relaxed RRM requirements can serve as starting point when changing SSB burst periodicity for defining the RRM impact.**  |
| [**R4-2411621**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411621.zip) | Xiaomi | **Observation 5: For the SSB adaptation, the more than one SSB burst periodicity will be used. But how to indicate the one NW used for UE measurement are still FFS.****Observation 6: In current spec, the total L3 measurement delay requirements depend on the SMTC periodicity which is configured by NW RRC message.** **Observation 7: UE’s measurement requirements can be little impacted because SMTC period are still decided by NW.****Proposal 4: RAN4 can wait RAN1’s progress on SSB adaptation to define the necessary requirements or update the current spec**.**Observation 8: the adaptation SSB configuration procedure happened within a successful measurement report period may result in the measurement requirements updates.****Proposal 5: When defining the requirement with adaptation SSB, only the case in which there is no any SSB adaptation period changed within one reporting interval.** **Proposal 6: RAN4 can wait RAN1’s progress on PRACH adaptation to define the necessary requirements or update the current spec.****Observation 9: There is little impacts on cell selection/reselection requirements in RRC\_Idle TS38.133 （e.g. 4.2.2.6 Maximum interruption in paging reception）.** |
| [**R4-2411724**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411724.zip) | Qualcomm Technologies Ireland | **Proposal 7:** RAN4 should start investigating requirements for SSB adaptation for UEs in connected mode that do not imply that the SSB is a CD-SSB.**Observation 4:** PRACH adaptation applies for UE in connected as well as in idle/inactive mode. Not many additional agreements have been made for PRACH adaptation.**Observation 5:** RAN4 already defines minimum requirements for the measurement procedures at transitions in the configurations. Change of the periodicity of SSB and PRACH is a similar transition.**Proposal 8:** RAN4 should investigate what requirements are impacted by those periodicity transitions by SSB and PRACH adaptation in time domain.**Proposal 9:** Postpone RAN4 work on paging occasion adaptation in time domain till more progress in RAN1 and RAN2 has been made.  |
| [**R4-2411761**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411761.zip) | CMCC | **Proposal 11: RAN4 also start the SSB adaptation discussion with connected mode requirements, including L1 and L3 measurement.****Proposal 12: RAN4 study how to define the measurement requirement during SSB periodicity transitions period.****Proposal 13: Deprioritize PRACH adaptation and paging occasion adaptation until clear RAN4 impact is observed from the agreement of RAN1 and RAN2.** |
| [**R4-2412120**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412120.zip) | China Telecom | **Proposal 4: It’s proposed to start the discussion after RAN4 has sufficient information on adaptation of SSB/ PRACH/ paging occasions in RAN1.** |
| [**R4-2412205**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412205.zip) | Huawei, HiSilicon | **Observation 6: For PRACH adaptation, from RAN4 RRM requirements perspective, there is no significant impacts as PRACH is usually only referred to and the end point of certain RRM activities, and the detailed PRACH occasion is directly referred to other spec.****Proposal 7: For SSB adaptation, there are RAN4 RRM impacts in different aspects. RAN4 shall start the work with further RAN1 conclusion when the scenario becomes clearer.** |
| [**R4-2412419**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412419.zip) | Intel Corporation | **Proposal 5: Wait until the concrete conclusion of RAN1 is available that RAN4 works on details of the requirements.** |
| [**R4-2412507**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412507.zip) | Ericsson | **Proposal 13: RAN4 to wait RAN1’s further progress on Paging Occasion/RACH adaptation.**Observation 4: Dynamic adaptation of SSB periodicity provides additional network energy savings, e.g., 16% when SSB periodicity changes from 20ms to 40ms.**Proposal 14: RAN4 to define SSB adaptation requirement for both PCell and/or SCell(s).****Proposal 15: RAN4 to focus on NW controlled SSB adaptation firstly.****Proposal 16: RAN4 to prioritize the study of SSB adaptation requirement in CONNECTED mode, such as L1/L3 measurement impact.** |
| [**R4-2412525**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412525.zip) | vivo | **Proposal 5 For SSB periodicity adaptation, RAN4 further check whether it could be covered by existing transition period requirements for RLM/BFD/CBD, L1-RSRP/L1-SINR measurement and L3 measurement.** |
| [**R4-2412524**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412524.zip) | Samsung | **Observation 5: Based on RAN1 agreements, SSB adaptation triggered by NW is taken as a preferred solution****Observation 6: For the applicability of PRACH adaptation, UEs in idle/inactive mode and connected mode UEs are both supported****Observation 7: For the adaptation of SSB in time-domain, it is possible to support the scenario of UEs in idle/inactive mode****Observation 8: Based on RAN1 agreements, there are two applicable cases for intra-cell deployment. 1) Serving cell with only Rel-19 NES-capable UE; 2) Serving cell with both legacy and Rel-19 NES-capable UE****Observation 9: For the case of serving cell with both legacy and Rel-19 NES-capable UE assumption, occasion/resources collision issues may arise if the additional adaptation resources overlap with the legacy resources****Observation 10: For adaptation of SSB in time domain, different adaptation mechanisms may present different RRM requirement impacts and different level of impact****Observation 11: From RAN4 side, no RA procedure requirements in idle mode were defined in the current Spec. TS 38.133****Observation 12: For adaptation of SSB in time domain in NES, the following requirements may be impacted:*** **Section 6: RRC\_CONNECTED state mobility. 6.1.1 Handover; 6.2 RRC Connection Mobility Control;**
* **Section 8: Signalling characteristics. 8.1.2 Requirements for SSB based radio link monitoring; 8.3 SCell Activation and Deactivation Delay; 8.5.2 Requirements for SSB based beam failure detection; 8.5.5 Requirements for SSB based candidate beam detection; 8.9 NR-DC: PSCell Addition and Release Delay; 8.10 Active TCI state switching delay; 8.11 PSCell Change;**
* **Section 9: Measurement Procedure. 9.2 NR intra-frequency measurements (including cell identification, measurement);9.3 NR inter-frequency measurements (including cell identification, measurement); 9.5 L1-RSRP measurements for Reporting; 9.8 L1-SINR measurements for Reporting; 9.13 L1-RSRP measurements for a cell with different PCI from serving cell [inter-cell, mTRP]**

**Observation 13: For adaptation of PRACH in time domain in NES, the requirements shown in Table 1 may be impacted****Proposal 2: Since RAN1 agree to support UEs in connected mode, for adaptation mechanisms of SSB in time-domain, the RRM requirements for the scenarios of Rel-19 NES-capable UEs in connected mode can be discussed at current stage****Proposal 3: RAN4 to wait for RAN1 progress on which scenario (s): PCell and/or SCell(s) are supported for adaptation mechanisms of SSB in time-domain** **Proposal 4: If Rel-19 NES-capable UE’s SCell (s) are supported for adaptation of SSB in time-domain, suggest to wait and combine the RAN1 conclusions of on-demand SSB and SSB adaptation to define the corresponding SCell requirements****Proposal 5: For adaptation of common signal/channel transmissions, RAN4 to discuss:** * **Which deployment assumption should be considered to define the new requirements (if any)**
	+ **Intra-cell and/or inter-cell deployment**
* **For the deployment assumption, which applicable case should be considered to define the new requirements (if any)**
	+ **Serving cell with only Rel-19 NES-capable UE and/or serving cell with both legacy and Rel-19 NES-capable UE**

**Proposal 6: For adaptation of SSB in time domain, RAN4 to wait for RAN1 progress on whether the scenarios of UEs in idle/inactive can be supported****Proposal 9: In connected mode, the impact on the following RRM requirements can be studied on adaptation of SSB in time domain with high priority under the applicable scenario*** **L1 measurements including L1-RSRP/BFD/CBD/L1-SINR**
* **L3 measurement including intra-frequency and inter-frequency**
* **SCell activation and deactivation delay**

**Proposal 10: On adaptation of SSB in time domain for NES, how to define RRM requirements (if any) should depend on RAN1 progress on SSB adaptation mechanism discussions.****Proposal 11: On adaptation of PRACH in time domain for NES, how to define RRM requirements (if any) in connected mode should depend on RAN1 progress on:*** **Collision/Overlap between additional PRACH resources for NES-capable UEs and PRACH resources for legacy UEs.**
* **Adaptation at PRACH association period**
* **SSB-RO mapping for the additional PRACH resource**
 |
| [**R4-2412855**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412855.zip) | ZTE Corporation, Sanechips | **Proposal 4: For the sake of NW power saving, we believe larger SSB periodicity than 160ms could be introduced to allow the PCell, SCell sending SSB less frequently.** |

## Open issues summary

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

### Sub-topic 4-1: SSB Adaptation requirements

*Sub-topic description: This sub-topic covers SSB adaptation requirement identification in RAN4.*

**Issue 4-1-1: SSB adaptation in IDLE/CONNECTED mode**

* Proposals
	+ Option 1: Nokia, Qualcomm, CMCC, Ericsson, Samsung
		- RAN4 to prioritize the SSB adaptation discussion in CONNECTED mode.
	+ Option 2: Samsung
		- RAN4 to wait for RAN1 progress on whether idle/inactive can be supported.
* Recommended WF
	+ Moderator suggests the group to check whether the following proposal can be agreed.
		- RAN4 to prioritize the SSB adaptation discussion in CONNECTED mode.

**Issue 4-1-2: SSB adaptation impact in RRM requirement**

* Proposals
	+ Option 1: CATT, Nokia, Qualcomm, CMCC, Ericsson, Samsung
		- RAN4 to discuss the RRM requirement impact due to SSB periodicity adaptation.
		- Option 1-1: Nokia, CMCC, Ericsson, Samsung
			* RAN4 to study the L1/L3 measurement impact.
		- Option 1-2: Samsung
			* RAN4 to study the SCell activation and deactivation delay impact.
	+ Option 2: Apple, Xiaomi, CTC, Huawei, Intel
		- Wait until the concrete conclusion of RAN1 is available.
* Recommended WF
	+ Moderator suggests the group to check whether the following proposal can be agreed.
		- For SSB adaptation in time-domain, RAN4 to discuss the L1/L3 measurement requirement impact due to SSB periodicity adaptation.

**Issue 4-1-3: SSB adaptation scenario in time domain**

Background

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| --- |
| **RAN1 #117 Agreement**For adaptation of SSB in time-domain, Option 1 is supported* Option 1: Adaptation of SSB burst periodicity using one or more SSB burst periodicity value(s)
* Note: Using Option 2 to realize Option 1 is not precluded
	+ Option 2: Adaptation based on two SSB configurations [where up to two configurations can be active]
		- FFS: details of the differences between the two SSB configurations, e.g. two different periodicities
* FFS: Details including applicable scenarios
* FFS: Support of Cell DTX for connected mode UEs for SSB
 |

* Proposals
	+ Option 1: Nokia
		- RAN4 shall focus on Option 1 as starting point.
			* RAN4 to start investigation for a single SSB pattern.
* Recommended WF
	+ Moderator suggests the group to check whether the following proposal can be agreed.
		- RAN4 to study SSB burst periodicity adaptation requirement using one or more SSB burst periodicities as a starting point.

**Issue 4-1-4: SSB burst adaptation periodicity**

* Proposals
	+ Option 1: Nokia
		- RAN4 to maintain the legacy SSB burst periodicity.
	+ Option 2: ZTE
		- Larger SSB periodicity than 160ms could be introduced.
* Recommended WF
	+ Moderator suggests to postpone the issue.

**Issue 4-1-5: The transition period of SSB burst adaptation**

* Proposals
	+ Option 1: Qualcomm, Nokia, CMCC, vivo
		- RAN4 to investigate transition period requirements by SSB periodicity adaptation.
	+ Option 1-1: Nokia, vivo
		- RAN4 to investigate whether legacy SSB burst transition period requirement can be a starting point.
	+ Option 2: MediaTek
		- RAN4 to discuss the necessity of SSB time domain adaptation requirements on the transitions.
	+ Option 3: Xiaomi
		- Not to define the transition period requirement.
			* Only define requirement when no SSB adaptation period changes within one reporting interval
* Recommended WF
	+ Further discussion.

**Issue 4-1-6: SSB burst adaptation processing time**

* Proposals
	+ Option 1: Nokia
		- RAN4 to consider the processing time for decoding the SSB burst periodicity update, e.g., based on DCI, MAC-CE or RRC
* Recommended WF
	+ Moderator suggests to postpone the issue.

**Issue 4-1-7: The applicable network deployment for SSB adaptation**

* Proposals
	+ Option 1: Ericsson
		- RAN4 to define SSB adaptation requirement for both PCell and/or SCell(s).
	+ Option 2: Samsung
		- wait for RAN1 progress on which scenario (s): PCell and/or SCell(s) are supported.
* Recommended WF
	+ Moderator suggests to postpone the issue.

**Issue 4-1-8: The triggered mechanism of SSB adaptation in time-domain**

**Background**

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| --- |
| **RAN1 #116 Agreement**For the adaptation mechanisms of SSB in time-domain, study further following mechanisms: * Adaptation mechanism indicated or configured by gNB without UE trigger
* Adaptation triggered by UE (if any)

FFS: Details of associated signaling/indication/configuration**RAN1 #116bis Agreement**For indication of adaptation of SSB in time-domain, Support at least SSB adaptation provided by gNB without UE trigger |

* Proposals
	+ Option 1: Ericsson
		- RAN4 to focus on NW controlled SSB adaptation first.
* Recommended WF
	+ Moderator suggests the group to check whether the following proposal can be agreed
		- RAN4 to focus on NW controlled SSB adaptation first.

**Issue 4-1-9: SSB type in SSB adaptation**

Background:

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| **RAN1 #116bis Agreement**Adaptation mechanism(s) of SSB in time-domain is supported at least for one of the following scenario(s): * For cell with both legacy UEs and Rel-19 NES-capable UEs
	+ Rel-19 NES-capable UE’s PCell (Connected mode)
		- Study from the following options:
			* Option A1: adaptation for CD-SSB
			* Option A2: adaptation for SSB that is not CD-SSB
			* Option A3: adaptation for SSB not on sync raster
	+ Rel-19 NES-capable UE’s SCell
		- Study from the following options:
			* Option B1: adaptation for CD-SSB
			* Option B2: adaptation for SSB that is not CD-SSB
			* Option B3: adaptation for SSB not on sync raster
	+ FFS: Rel-19 NES-capable UE in idle/inactive mode
* Note: Impact to idle/inactive UEs shall be minimized
 |

* Proposals
	+ Option 1: Qualcomm
		- RAN4 start investigating requirements that not to imply the CD-SSB adaptation in CONNECTED mode.
* Recommended WF
	+ Moderator suggests to postpone the issue.

**Issue 4-1-10: Other miscellaneous in SSB adaptation**

* Proposals
	+ Option 1: Samsung
		- Combine the RAN1 conclusions of on-demand SSB and SSB adaptation to define the corresponding SCell requirements if SSB adaptation is supported in SCells
		- Which deployment assumption should be considered to define the new requirements (if any)
			* Intra-cell and/or inter-cell deployment
		- For the deployment assumption, which applicable case should be considered to define the new requirements (if any)
			* Serving cell with only Rel-19 NES-capable UE and/or serving cell with both legacy and Rel-19 NES-capable UE
* Recommended WF
	+ Moderator suggests to postpone the issue.

### Sub-topic 4-2: Impact on Paging Adaptation requirements

*Sub-topic description: This sub-topic covers paging adaptation requirement identification in RAN4.*

**Issue 4-2-1: Paging adaptation**

* Observation
	+ Xiaomi: There are little impacts on IDLE mode cell selection/reselection requirements in RRM
* Proposals
	+ Option 1: CATT, CMCC, CTC, Huawei, Intel, Ericsson
		- Deprioritize Paging adaptation until the concrete conclusion of RAN1 is available.
	+ Option 2: Apple
		- No need to discuss paging adaptation in RAN4
* Recommended WF
	+ Deprioritize PRACH adaptation until the RAN1 concrete conclusion is available.

### Sub-topic 4-3: Impact on PRACH Adaptation requirements

*Sub-topic description: This sub-topic covers PRACH adaptation requirement identification in RAN4.*

**Issue 4-3-1: PRACH adaptation**

* Observation
	+ Huawei: From RAN4 RRM requirements perspective, there is no significant impacts as PRACH is usually only referred to and the end point of certain RRM activities, and the detailed PRACH occasion is directly referred to other spec.
* Proposals
	+ Option 1: CATT, Xiaomi, Qualcomm, CMCC, CTC, Huawei, Intel, Ericsson, Samsung
		- Deprioritize PRACH adaptation until the RAN1 concrete conclusion is available.
	+ Option 2: Qualcomm
		- RAN4 to investigate transition period requirements by PRACH periodicity adaptation.
* Recommended WF
	+ Deprioritize PRACH adaptation until the RAN1 concrete conclusion is available.