**3GPP TSG-RAN WG4 Meeting #112 R4-2411809**

**Maastricht, Netherlands, 19th – 23rd August 2024**

**Agenda item:** 8.4.4

**Source:** Moderator (Intel Corporation)

**Title:** Topic summary for [112][214] NR\_FR1\_lessthan\_5MHz\_BW\_Ph2

**Document for:** Information

# Introduction and recommendations

This document is the TDocs summary for [112][214] NR\_FR1\_lessthan\_5MHz\_BW\_Ph2 with the following topics covered.

* Topic 1: RRM work plan for NR\_FR1\_lessthan\_5MHz\_BW\_Ph2 (AI 8.4.3)
* Topic 2: RRM scope discussions for NR\_FR1\_lessthan\_5MHz\_BW\_Ph2 work item (AI 8.4.3)

The moderator recommends the below topics to be discussed during the online session under the Vice Chair guidance.

The recommendation to discuss the below issues online is in order of priority identified by the moderator.

***RRM workplan***

**Issue 1-1-1 Workplan for RRM core parts**

***CA***

**Issue 2-1-1: SCell activation and deactivation delay requirements:**

**Issue 2-1-2: Measurement requirements for deactivated SCC:**

**Issue 2-1-3: Whether intra-band CA is in the scope:**

**Issue 2-1-4: IDLE mode CA measurement reporting:**

***DC***

**Issue 2-2-1: PSCell addition and release, conditional PSCell addition delay requirements:**

**Issue 2-2-2: PSCell change, conditional PSCell change delay requirements:**

**Issue 2-2-3: Handover with PSCell, conditional handover including target MCG and SCG:**

**Issue 2-2-4: SCG activation and deactivation delay requirements:**

***Others***

**Issue 2-3-1: NW indication on PBCH BW in MO configuration:**

**Issue 2-3-2: CGI reading:**

**Issue 2-3-3: EMR requirements:**

# Topic #1: RRM work plan

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2412416 | Intel Corporation | RRM work plan for Rel-19 less than 5MHz work item phase 2**Workplan for RRM core parts**

|  |  |
| --- | --- |
| Meeting | RRM |
| RAN4#112Aug’24 | Discussions on * Scope of RRM requirements for PCell/SCell operating with 3MHz channel bandwidth

Agreements on* Scope of RRM requirements
 |
| RAN4#112bisOct’24  | Discussions on* RRM requirements for SCell operating with 3MHz channel bandwidth
* Possible draftCR contents

Agreements on* RRM requirements for SCell operating with 3MHz channel bandwidth
* draftCR contents
 |
| RAN4#113Nov’24 | Discussions on* (continued) RRM requirements for SCell operating with 3MHz channel bandwidth
* CR contents

Agreements on* RRM requirements for SCell operating with 3MHz channel bandwidth
* CR contents
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## Open issues summary for topic #1

### Sub-topic 1-1 RRM work plan

**Issue 1-1-1 Workplan for RRM core parts**

|  |  |
| --- | --- |
| Meeting | RRM |
| RAN4#112Aug’24 | Discussions on * Scope of RRM requirements for PSCell/SCell operating with 3MHz channel bandwidth

Agreements on* Scope of RRM requirements
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| RAN4#112bisOct’24  | Discussions on* RRM requirements for PSCell/SCell operating with 3MHz channel bandwidth
* Possible draftCR contents

Agreements on* RRM requirements for PSCell/SCell operating with 3MHz channel bandwidth
* draftCR contents
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| RAN4#113Nov’24 | Discussions on* (continued) RRM requirements for PSCell/SCell operating with 3MHz channel bandwidth
* CR contents

Agreements on* RRM requirements for PSCell/SCell operating with 3MHz channel bandwidth
* CR contents
 |

* Recommended WF
	+ Endorse the RRM work plan.

# Topic #2: RRM scope discussion

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2411295 | Ericsson | Discussion on RRM requirements for NR CA/DC in less than 5 MHz[**Observation 1** **NR CA/DC for less than 5MHz would not impact the handover requirements.**](#_Toc174114095)[**Observation 2** **NR CA/DC for less than 5MHz would not impact the HO requirements with PSCell-PCell and PSCell-PSCell.**](#_Toc174114096)[**Observation 3** **No seen impact to timing requirements with CA/DC support for less than 5MHz CBWs.**](#_Toc174114097)[**Observation 4** **Other working groups (WGs) will need to be informed so they can identify any specification impact or update on the UE Feature list to reflect the support of NR CA/DC in less than 5MHz CBW.**](#_Toc174114098)Based on the discussion in the previous sections, we propose the following:[**Proposal 1** **RAN4 to define whether the UE supports inter-band contiguous and non-contiguous NR CA/DC for less than 5MHz.**](#_Toc174114099)[**Proposal 2** **RAN4 to support NR-DC for less than 5MHz in Rel-19.**](#_Toc174114100)[**Proposal 3** **SCell activation requirements shall be further investigated for potential impact.**](#_Toc174114101)[**Proposal 4** **PSCell activation requirements shall be investigated for potential impact.**](#_Toc174114102)[**Proposal 5** **Conditional PSCell activation requirements shall be investigated for potential impact.**](#_Toc174114103)[**Proposal 6** **SCG activation requirements shall be investigated for potential impact.**](#_Toc174114104)[**Proposal 7** **RAN4 should define conditional handover requirements for less than 5 MHz**](#_Toc174114105)[**Proposal 8** **RAN4 to discuss and decide whether CGI reading is considered for less than 5MHz.**](#_Toc174114106)[**Proposal 9** **RAN4 to Study the Cell detection requirements in EMR measurements for less than 5MHz.**](#_Toc174114107)[**Proposal 10** **Legacy requirements can be reused for Idle mode CA/DC measurements with no apparent impact.**](#_Toc174114108) |
| R4-2411448 | Apple | On RRM core for less than 5MHz Phase 2***Proposal 1: the features/scenarios not considered in R18 less than 5MHz RRM shall not be discussed in R19 CA/DC with less than 5MHz band, e.g., CSI-RS based L1/L3/RLM/BFD/CBD measurement.******Proposal 2: In CA/DC with less than 5MHz, if PCell is using 3MHz, the legacy R18 less than 5MHz RRM requirement in RRC connected mode can still be applied on this PCell.******Proposal 3: RAN4 to decide the corresponding RRM requirement after RF session has concrete conclusions, e.g., whether or not we need multiple SCell activation, or whether or not more than 2 serving cells shall be considered in this inter-band CA with less than 5MHz.******Proposal 4:*** ***If SCell can use 12PRB SSB bandwidth in R19, it’s necessary to provide assistance information to UE regarding whether the PBCH is 12 or 20 PRBs in either MO or HO command.******Proposal 5: agree the following summary table.***

|  |  |  |
| --- | --- | --- |
| Section ID | CA/DC requirements | Impacts due to less than 5MHz band |
| 6.1.5 | HO with PSCell | Yes. SSB index acquisition of less than 5MHz cell can be extended in legacy requirement. |
| 6.1.6 | NR Conditional Handover including target MCG and target SCG | Yes. SSB index acquisition of less than 5MHz cell can be extended in legacy requirement. |
| 7.1 | UE transmit timing | No, the reference cell for timing requirement can reuse the legacy assumption. |
| 7.5, 7.6 | MRTD/MTTD requirement | No, reuse the legacy CA/DC requirement. |
| 8.2.2, 8.2.4 | Interruption requirement related with SCell/PSCell operation | No, reuse the legacy interruption requirement. |
| 8.3 | SCell Activation and Deactivation Delay | Need FFS, if target to-be-activated SCell is using 3MHz, the SSB index acquisition of less than 5MHz cell may extend the SCell activation requirement. |
| 8.4 | UL carrier RRC reconfiguration delay | No, reuse the legacy requirement. |
| 8.5.9 | Requirements for Beam Failure Recovery in SCell | No, reuse the legacy BFR requirement. |
| 8.9, 8.9A, 8.9C | NR-DC: PSCell Addition and Release Delay;Conditional PSCell Addition Delay;Subsequent Conditional PSCell Addition Delay | Need FFS, if target PSCell is using 3MHz, the SSB index acquisition of less than 5MHz cell may extend the PSCell addition requirement. |
| 8.11, 8.11B, 8.11E | PSCell Change;Conditional PSCell Change;Subsequent Conditional PSCell Change | Need FFS, if target PSCell is using 3MHz, the SSB index acquisition of less than 5MHz cell may extend the PSCell change requirement. |
| 8.17 | SCG Activation and Deactivation Delay | Need FFS, if target PSCell is using 3MHz, the SSB index acquisition of less than 5MHz cell may extend the PSCell activation requirement. |
| 9.1.2 | Measurement gap | No, reuse the legacy MG requirement. |
| 9.1.3 | UE Measurement capability | No, reuse the legacy requirement. |
| 9.1.4 | Capabilities for Support of Event Triggering and Reporting Criteria | No, reuse the legacy requirement. |
| 9.1.5 | CSSF | No, reuse the legacy CSSF requirement. |
| 9.1.7~13 | MG enh and MUSIM MG | NA for this WI (MG enh is not considered) |
| 9.2.3 | Number of cells and number of SSB (FR1) | No, reuse the legacy requirement. |
| 9.2.5 | Intra-frequency measurements without measurement gaps | Yes, time period for time index detection for deactivated SCell or deactivated PSCell can be extended of this SCell or PSCell is using 3MHz. |
| 9.2.6 | Intra-frequency measurements with measurement gaps | No, reuse the legacy requirement. SCell and PSCell measurement is not in this section. |
| 9.2.7 | Intra-frequency measurements with NCSG | NA for this WI (MG enh is not considered) |
| 9.3 | NR inter-frequency measurements | No, reuse the legacy requirement. SCell and PSCell measurement is not in this section. |

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| R4-2412386 | ZTE Corporation, Sanechips | Initial discussion on RRM impacts for less than 5MHz BW**Proposal 1: RAN4 will define SSB-based L1/L3 measurement requirements. And CSI-RS based L1/L3 measurement is recommended to be accorded a lower priority.****Proposal 2: RAN4 to study impact of reduced PBCH BW of 12PRBs for 3MHz channel bandwidth on at least the following RRM requirements:*** + **EMR measurement with SSB index reading**
	+ **SCell activation/deactivation**
	+ **PSCell addition/change/release**
	+ **SCG activation/deactivation**

**Observation 1: In Rel-18, SSB index identification delay*** 1. **Unknown intra-frequency cell (Es/Iot≥-6 dB): 3+4 samples**
	2. **Unknown inter-frequency cell (Es/Iot≥-4 dB): 3+3 samples**

**Proposal 3: For 3MHz channel bandwidth, N2=[3+3] if the NR inter-frequency carrier for idle mode CA/DC measurement reporting is in FR1.****Observation 2: In the latest version of TS 38.133, T\_delta = 3\*Trs for both known and unknown target cells operating with 12 PRB SSB BW.** **Proposal 4: Samilar as HO requirements, T\_delta should be updated and additional two Trs should be added for PSCell addition/change/release delay** |
| R4-2412415 | Intel Corporation | RRM scope for Rel-19 less than 5MHz work item phase 2**Proposal 1: Specify time period requirements for time index detection for UE operating on a target cell with less than 5MHz SSB for deactivated SCell measurements in FR1.****Proposal 2: Specify new requirements for fine time tracking time which is included in the SCell activation delay requirements in FR1.****Proposal 3: Specify new PSCell addition delay requirements for PSCell configured with less than 5MHz channel bandwidth.** |
| R4-2412667 | Huawei, HiSilicon | Initial discussion on RRM requirements for less than 5MHz Ph2**Proposal 1: RAN4 to discuss the impacts of less than 5MHz, in particular PBCH puncturing, to at least the following requirements*** **SSB index reading in deactivated SCC measurement**
* **PSCell change and addition**

**Proposal 2: RAN4 to discuss whether NW indication on PBCH BW in MO configuration is needed considering a cell with less than 5MHz can be SCell.** |
| R4-2412799 | Nokia | Discussion on RRM impact for NR\_FR1\_lessthan\_5MHz\_BW\_Ph21. RAN4 to work on defining the SCell and PSCell delay requirements related to such 3MHz carrier used for CA or DC.

We also provide an initial list of potentially impacted sections. Additionally, RAN4 would need to discuss the expected RRM scope of a device supporting the NR channel BW less than 5MHz for FR1 Phase 2 feature in order to make correct scoping of which requirements RAN4 should be working on.1. RAN4 to discuss the expected RRM scope of a device supporting the NR channel BW less than 5MHz for FR1 Phase 2 feature. At least the following sections can be considered:
* 8.3 SCell Activation and Deactivation Delay
* 8.9 PSCell Addition and Release Delay
* 8.9A Conditional PSCell Addition Delay
* 8.11 PSCell Change
* 8.17 SCG Activation and Deactivation Delay
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## Open issues summary for topic #2

### Sub-topic 2-1 RRM scope for SCell configured with less than 5MHz bandwidth

**Issue 2-1-1: SCell activation and deactivation delay requirements:**

* Proposals
	+ Option 1: Investigate if new SCell activation and deactivation delay requirements are needed to support less than 5MHz bandwidth in the target SCell in FR1.
	+ Option 2: Specify new requirements for fine time tracking time which is included in the SCell activation delay requirements in FR1.
* Recommended WF
	+ Agree on option 1.

**Issue 2-1-2: Measurement requirements for deactivated SCC:**

* Proposals
	+ Option 1: RAN4 to discuss the impacts of less than 5MHz, in particular PBCH puncturing, to SSB index reading in deactivated SCC measurement.
	+ Option 2: Specify time period requirements for time index detection for UE operating on a target cell with less than 5MHz SSB for deactivated SCell measurements in FR1.
* Recommended WF
	+ Agree on option 1 or 2.

**Issue 2-1-3: Whether intra-band CA is in the scope:**

* Proposals
	+ Option 1: Consider intra-band CA (both contiguous and non-contiguous) within the scope of the RRM requirements in Rel-19.
	+ Option 2: Wait until RF room has concrete conclusion on intra-band CA combinations.
* Recommended WF
	+ Discussion is needed.

**Issue 2-1-4: IDLE mode CA measurement reporting:**

* Proposals
	+ Option 1: For 3MHz channel bandwidth, N2=[3+3] if the NR inter-frequency carrier for idle mode CA/DC measurement reporting is in FR1.
* Recommended WF
	+ Discussion is needed.

### Sub-topic 2-2 RRM scope for PSCell configured with less than 5MHz bandwidth in NR-DC

**Issue 2-2-1: PSCell addition and release, conditional PSCell addition delay requirements:**

* Proposals
	+ Option 1: Specify new PSCell addition delay requirements for PSCell configured with less than 5MHz channel bandwidth.
* Recommended WF
	+ Agree on option 1.

**Issue 2-2-2: PSCell change, conditional PSCell change delay requirements:**

* Proposals
	+ Option 1: RAN4 to discuss the impacts of less than 5MHz, in particular PBCH puncturing, to PSCell change delay requirements.
* Recommended WF
	+ Agree on option 1.

**Issue 2-2-3: Handover with PSCell, conditional handover including target MCG and SCG:**

* Proposals
	+ Option 1: SSB index acquisition of less than 5MHz cell can be extended in legacy requirement.
* Recommended WF
	+ Agree on option 1.

**Issue 2-2-4: SCG activation and deactivation delay requirements:**

* Proposals
	+ Option 1: Need FFS, if target PSCell is using 3MHz, the SSB index acquisition of less than 5MHz cell may extend the PSCell change requirement.
* Recommended WF
	+ Agree on option 1.

### Sub-topic 2-3 Other RRM impacts

**Issue 2-3-1: NW indication on PBCH BW in MO configuration:**

* Proposals
	+ Option 1: RAN4 to discuss whether NW indication on PBCH BW in MO configuration is needed considering a cell with less than 5MHz can be SCell.
	+ Option 2: If SCell can use 12PRB SSB bandwidth in R19, it’s necessary to provide assistance information to UE regarding whether the PBCH is 12 or 20 PRBs in either MO or HO command.
* Recommended WF
	+ Discussion is needed.

**Issue 2-3-2: CGI reading:**

* Proposals
	+ Option 1: RAN4 to discuss and decide whether CGI reading is considered for less than 5MHz.
* Recommended WF
	+ Discussion is needed.

**Issue 2-3-3: EMR requirements:**

* Proposals
	+ Option 1: RAN4 to Study the Cell detection requirements in EMR measurements for less than 5MHz.
	+ Option 2: RAN4 to study impact of reduced PBCH BW of 12PRBs for 3MHz channel bandwidth on EMR measurement with SSB index reading.
* Recommended WF
	+ Discussion is needed.