**3GPP TSG-RAN WG4 Meeting # 96-e R4-2XXXXX**

**Electronic Meeting, 17 – 28 Aug., 2020**

**Agenda item:** 7.1.5.10, 7.1.5.11 and 7.1.5.13

**Source:** Moderator (Nokia, Nokia Shanghai Bell)

**Title:** Email discussion summary for [96e Bis][208]NR\_unlic\_RRM\_3

**Document for:** Information

# Introduction

This is the document for the email discussion of the following items under the NR-U RRM agenda:

7.1.5.10 – Measurement requirements

7.1.5.11 – Measurement capability

7.1.5.13 – Other requirements maintenance

The following topics and sub-topics are treated in this summary:

Topic #1: Remaining issues intra and inter-frequency measurements and measurement capability

Sub-topic 1-1: Monitoring of QCL beams in NR-U

Sub-topic 1-2: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts

Sub-topic 1-3: UE behaviour in case of successively exceeding the maximum number of DL LBT failure during measurements

Sub-topic 1-4: Scheduling restrictions during SS-RSRP, SS-RSRQ and SS-SINR measurements

Sub-topic 1-5: UE behavior when receiving the MAC CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the ACK

Sub-topic 1-6: Measurement capability

Topic #2: RSSI and CO measurements

Sub-topic 2-1: Intra-frequency measurement definition and the use of measurement gaps

Sub-topic 2-2: RSSI measurement bandwidth

Sub-topic 2-3: RSSI measurement period

Sub-topic 2-4: Scheduling restriction during RSSI measurements

Guidance to first round discussions:

* Companies to provide comments on the open issues and CRs in this document.

Guidance to second round discussions:

* Companies to provide comments on the open issues in this document.
* The discussion on the WF and revised CRs will be done in the e-mail reflector, in separate e-mail threads, as in the previous meetings. These discussions need to be kicked off by the responsible companies.

# Topic #1: Remaining issues intra and inter-frequency measurements and measurement capability

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009871 | Qualcomm | Observation 1. UE can signal capability to support only semi-static channel access mode, only dynamic channel access mode, or both. Observation 2. In semi-static channel access mode, UE can assume that unavailability of DL due to LBT in a fixed frame period leads to unavailability of all consecutive SSBs within the same fixed frame period (FFP). Observation 3. Per agreed UE feature list, default mode in semi-static channel access is when SMTC window is not larger than FFP. Proposal 1. For UE’s supporting semi-static channel access, monitoring multiple QCL’ed SSB’s within an SMTC occasion is irrelevant. Effectively, N2=1 per agreements in RAN1 UE feature list. Proposal 2. For dynamic channel access mode, UE is required to monitor the first N2 = 2 SSBs that are QCL’ed within an SMTC window regardless of the value of Q. Observation 4. At least from MAC (RAN2) layer perspective, UE follows the actions related to MAC-CE activation/deactivation command immediately after decoding the MAC-CE command regardless of whether UE is able to send HARQ-ACK feedback or not.Proposal 3. After N unsuccessful measurement attempts of an already identified cell due to exceeding max number of unavailable SMTC occasions, the UE shall perform the detection procedure again like for any other SSB. Proposal 4. After no SSBs of a cell can be received during up to 8 seconds, the cell will not be considered as detectable and the Rel-15 UE behavior will apply. No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed.Proposal 5. When the UE performs intra-frequency measurements in unlicensed spectrum, the following restrictions apply due to SS-RSRP or SS-SINR measurement - 5a: The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, and on 1 data symbol before each consecutive SSB symbols configured to be measured and 1 data symbol after each consecutive SSB symbols configured to be measured within SMTC window duration if deriveSSB\_IndexFromCell is enabled. If the high layer in TS 38.331 signalling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.- 5b: The UE is not expected to transmit PUCCH/PUSCH/SRS within the SMTC window to be measured, and on 1 data symbol before the start of the SMTC window be measured and 1 data symbol after the end of SMTC window to be measured if deriveSSB\_IndexFromCell is not enabled. If the high layer in TS 38.331 signalling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.Proposal 6. When the UE performs intra-frequency measurements in unlicensed spectrum, the following restrictions apply due to SS-RSRQ measurement - 6a: The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB configured to be measured/RSSI symbols and 1 data symbol after each consecutive SSB configured to be measured/RSSI symbols within SMTC window duration if deriveSSB\_IndexFromCell is enabled.. If the high layer signalling of smtc2 is configured(in TS 38.331), the SMTC periodicity follows smtc2; Otherwise the SMTC periodicity follows smtc1.- 6b: The UE is not expected to transmit PUCCH/PUSCH/SRS with the SMTC window to be measured, RSSI measurement symbols, and on 1 data symbol before the start of the SMTC window to be measured measured/RSSI symbols and 1 data symbol after the end of the SMTC window to be measured/RSSI symbols if deriveSSB\_IndexFromCell is not enabled.. If the high layer signalling of smtc2 is configured(in TS 38.331), the SMTC periodicity follows smtc2; Otherwise the SMTC periodicity follows smtc1. When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols. |
| R4-2009910 | Apple | Proposal 1: agree on option 1: UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure the serving cell for consecutive SSB bursts.Proposal 2: in RRC\_CONNECTED mode, - when the s-MeasureConfig is configured and PCell measurement does not need MG, UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure on the PCell for at least Mp\_connected consecutive number of SSB bursts not available at the UE, where,• Mp\_connected = 7 when Max(TDRX, TSMTC)≤ 40ms,• Mp\_connected = 5 when 40ms< Max(TDRX, TSMTC)≤320ms, • Mp\_connected = 3 when TDRX >320ms.- when the s-MeasureConfig is configured and PCell measurement needs MG, UE shall initiate measurements on neighbour cells indicated by the PCell if it is unable to measure on the serving cell for at least Mp\_connected\_gaps consecutive number of SSB bursts not available at the UE, where,• Mp\_connected\_gaps = 7 when Max(TDRX, TSMTC, MGRP)≤ 40ms, • Mp\_connected\_gaps = 5 when 40ms< Max(TDRX, TSMTC, MGRP)≤320ms,• Mp\_connected\_gaps = 3 when TDRX >320ms. |
| R4-2010082 | ZTE | Proposal 1: For UE behaviour in RRC\_CONNECTED mode when the serving cell is unavailable for consecutive SSB bursts, keep current UE behavior as Option 2 and further study the feasibility of Option 1 as a possible enhancement to NR-U in Rel-17 phase.Proposal 2: Signaling of smtc2 is applicable to unlicensed band.Proposal 3: If UE cannot transmit HARQ-ACK on MAC-CE deactivation due to UL CCA failure, UE continues to be in its previous state, i.e., it should measure and report L1-RSRP until it successfully transmits HARQ-ACK. |
| R4-2010215 | MediaTek Inc. | Proposal 1: In a given discovery burst transmission window, UE is required to monitor at least one candidate SBI corresponding to the same SBI.Proposal 2: Capture the number of candidate SBIs corresponding to the same SBI UE should monitor to in the terminology for unavailable SSB/SMTC occasions.Proposal 3: In FR1 inter-band CA, the scheduling restriction due to one CC shall not apply to other CCs on the other bands.Proposal 4: If deriveSSB\_IndexFromCell is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within DRS window duration. |
| R4-2011083 | Huawei, HiSilicon | Proposal 1: Upon successively exceeding the maximum number of DL LBT failure during measurement, UE shall: restart from detection stage like for any other SSB.Observation 1: The benefits of initiating the neighbour cell measurement is clear that UE could handover to other cells before RLF to avoid long time interruption.Observation 2: The similar behavior in IDLE mode has been defined in NR-U.Proposal 2: UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure the serving cell for consecutive SSB bursts. |
| R4-2011353 | Ericsson | • Proposal 1: After no SSBs of a cell can be received during up to 8 seconds, the cell will not be considered as detectable and the Rel-15 UE behavior will apply. No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed.• Proposal 2: Upon successively exceeding N times the Lmax value for measurements, the UE shall stop the measurement attempts on this SSB and assume that the cell is not detected, whereo The UE cannot measure this SSB again without first detecting ito The UE performs the detection procedure like for any other SSBo N is not explicitly specified and determined by the existing procedures, e.g., the UE can reattempt the measurements until the earlier agreed 8 seconds limit (during which the undetectable cell can remain know) expires.• Proposal 3: Signaling of smtc2 is applicable to unlicensed band.• Proposal 4 (Proposal 4 in [6]): Define the core NR-U requirements transparent to the number of SSBs to monitor.• Proposal 5 (Proposal 5 in [6]): Design test cases with two candidate SSB positions.• Proposal 6: Agree on the same approach to address the number of SSBs to monitor for all relevant NR-U requirements, including measurements, RLM, BM, etc. |
| R4-2010592 | Nokia | Observation 1: RAN1 has introduced a feature in NR-U to allow for multiple opportunities for sending the SSBs during a DRS transmission window. The purpose of this feature is to minimize the effects of LBT failures for sending SSBs, allowing for some flexibility for sending DRS.Observation 2: The RAN1 design on beam cycling is applicable only to LBE, since it assumes that within the same frame the gNB might have different opportunities to get channel access. In FBE the gNB is expected to always transmit the first Q candidate SSB indexes.Proposal 1: RAN4 not to specify N2 values for FBE mode.Observation 3: The duration of the DRS transmission window is configurable by the gNB, from 0.5 to 5 ms.Observation 4: To keep a long DRS transmission window when it is not necessary to do so, i.e. in low interference conditions, is inefficient for the gNB. In low interference conditions, the DRS transmission window will be shorter, so that the gNB can allocate the resources in a more efficient manner.Observation 5: In high interference conditions, the DRS transmission window might be longer, but that is precisely the scenario for which the RAN1 enhancement was introduced.Observation 6: In the reply LS from RAN1, it was stated that if there are no different performance requirements for different N1/N2 capabilities, the introduction of N1/N2 UE capabilities is not necessary.Proposal 2: RAN4 not to specify a UE capability with N2 values for LBE networks.Observation 7: If the UE is not required to monitor all the candidate positions within the DRS transmission window for a given SSB index, there are two reasons for a given SSB index not being available at the UE, which will affect the probability of detecting the SSB:3. The SSB index was not sent within the entire duration of the DRS transmission window, i.e. all candidate positions were blocked by LBT failure. 4. The monitored candidate positions were blocked by LBT failure. Observation 8: The fact that the UE might not monitor all the SSB candidate positions with the DRS transmission window can significantly impact the probability of SSB detection in LBE, resulting in an unnecessary extension of the measurement periods.Observation 9: The gNB has no control on the candidate position that will be used for transmission, since it depends on the channel access conditions. It is not possible to guarantee that the same SSB index will be always transmitted at the same candidate position.Observation 10: During cell detection, the UE needs to measure all Q SSBs, i.e., the UE needs to search all candidate positions. Proposal 3: For cell detection, UE is required to monitor all candidate positions within the DRS transmission window.Proposal 4: For RRM measurements, UEs shall be capable of monitoring the configured SSB index, no matter in which candidate position the SSB index is sent within the DRS transmission window. RAN4 can consider the options below to ensure proper UE behavior:1) Define that UEs shall monitor all candidate positions corresponding to a given SSB index within the DRS transmission window in LBE, until the detection of the SSB index.2) Define that it is up to UE implementation to define for each measurement period how many candidate positions are monitored during the DRS transmission window, as long as the UE is able to detect a SSB within the monitored candidate positions. In case the UE fails to detect any SSB within the monitored candidate positions in at least [20%] of the expected DRS transmission windows in a given measurement period, the UE shall monitor all candidate positions during the remaining DRS transmission windows in this measurement period.Proposal 5: The RRM performance tests shall ensure proper UE behavior in different LBT scenarios: scenarios in which the LBT failure blocks the transmission of all candidate positions in a SSB burst, and scenarios in which the LBT failures block only some candidate positions. |
| R4-2011082 | Huawei, HiSilicon | Observation 1: The number of candidate SSB positions that UE is required to monitor within a SSB set shall not be defined as a UE capability, and shall not be differentiated for LBE and FBE.Observation 2: Option 2 and option 2a could be the as option 4 that UE is required to monitor all candidate SSB positions without restriction.Observation 3: Under the condition that the measurement capability of NR-U is same as that of R15, the number of cell that UE could measure will greatly decreased. Proposal 1: For L3 measurement, UE shall monitor one additional candidate SSB positions which is QCL-ed with the detected one and the number of cells and SSB index the UE is required to measure shall be scaled accordingly.Proposal 2: For RLM and L1-RSRP, UE shall monitor one additional candidate SSB position which is QCL-ed with the configured SSB index, and the number of SSB for RLM and the number of SSB resource for L1-RSRP shall be scaled accordingly.Proposal 3: At least one SSB positions shall remain detectable during the whole detection stage |
| R4-2009908 | Apple | Proposal 1: Same as licensed MO merging requirement on same NR carrier frequency layer, the principle to merge MOs on same NR-U carrier frequency layer is that those MOs would not need different measurement efforts from UE.Proposal 2: UE won’t merge NR-U MOs on the same frequency layer from PCell and PSCell if any of the following conditions is met,- different RSSI measurement resources or- different deriveSSB-IndexFromCell indications or- different SMTC configurations or,- different ssb-PositionQCL-Common-r16 indications or cell list of ssb-PositionQCL or,- different rmtc-Config-r16 indication.  |

## Open issues summary

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

### Sub-topic 1-1: Monitoring of QCL beams in NR-U

**Background:** In the last meeting, this discussion was postponed, since RAN4 was waiting for RAN1 reply. RAN4 got the following LS (R1-2004992):

|  |
| --- |
| RAN1 would like to thank RAN4 for their LS [1] related to NR-U SSB monitoring capabilities.Related to the four questions asked by RAN4, RAN1 feedback is as follows.**[Question 1]** Provide feedback whether monitoring within a given discovery burst transmission window all candidate SS/PBCH block indexes corresponding to the same SS/PBCH block index is mandatory for UEs.**[RAN1 answer]** During RAN1 discussion, we did not reach consensus on how to set N1 and N2 values. However, it is RAN1 understanding that RAN4 may choose not to define different RLM/RRM performance requirements corresponding to different N1/N2 capabilities. Hence, assuming a single RLM/RRM performance requirement, the introduction of N1/N2 UE capabilities is not necessary. It is RAN1 understanding that how many candidate SS/PBCH block indexes corresponding to the same SS/PBCH block index the UE should monitor in a given discovery burst transmission window can be left as UE implementation, as long as the single RLM/RRM performance requirement is met.As a consequence, RAN1 has agreed that from RAN1 perspective, N1 and N2 should not be defined as UE capabilities.**[Question 2]** Provide feedback on the values of N1 and N2, considering the impact on the network performance if UEs are not monitoring all candidate positions. **[RAN1 answer]** See answer to question 1 (N1 and N2 should not be defined as UE capabilities).**[Question 3]** Provide feedback on whether differentiation is needed for UEs operating in FBE and LBE modes.**[RAN1 answer]** See answer to question 1 (N1 and N2 should not be defined as UE capabilities). **[Question 4]** Provide feedback for the case when Q is not provided to the UE**[RAN1 answer]** For both RRM and RLM/BFD/CBD measurements, Q is always provided to the UE. More details of the indication of Q can be found in R1-2003044 [2].  |

#### Issue 1-1-1: Monitoring of QCL beams during cell detection in NR-U

|  |
| --- |
| **Issue 1-1-1: Monitoring of QCL beams during measurements in NR-U** * Proposals
	+ Option 1: At least one SSB positions shall remain detectable during the whole detection stage
		- Huawei, HiSilicon R4-2011082, Proposal 3
	+ Option 2: For cell detection, UE is required to monitor all candidate positions within the DRS transmission window
		- Nokia, Nokia Shanghai Bell, R4-2010592, Proposal 3.
	+ Option 3: Define the core NR-U requirements transparent to the number of SSBs to monitor. Design test cases with two candidate SSB positions. Agree on the same approach to address the number of SSBs to monitor for all relevant NR-U requirements, including measurements/detection, RLM, BM, etc. - see also topic #1 in email thread [96e][206]
		- Ericsson
* Recommended WF

**More discussion is needed.** |

#### Issue 1-1-2: Monitoring of QCL beams during measurements in NR-U

Diverse proposals were presented in this topic. In general, they can be grouped in the following options:

**Option 1:** **Define the core NR-U requirements transparent to the number of SSBs to monitor, and design test cases with two candidate SSB positions.**

Ericsson, R4-2011353, proposals 4-6:

* + - Proposal 4 (Proposal 4 in [6]): Define the core NR-U requirements transparent to the number of SSBs to monitor.
		- Proposal 5 (Proposal 5 in [6]): Design test cases with two candidate SSB positions.
		- Proposal 6: Agree on the same approach to address the number of SSBs to monitor for all relevant NR-U requirements, including measurements, RLM, BM, etc

**Option 2:** **Do not define N2 for FBE.** **For LBE, leave the number of SSBs to be monitored for UE implementation, as long as it is ensured that SSBs are detected within the discovery transmission window. If the UE fails to detect SSBs in at least [20%] of the expected DRS transmission windows in this measurement period, the UE shall monitor all candidate positions in the remaining DRS transmission windows in this measurement period. Capture the behavior in the tests.**

Nokia, R4-2010592, proposals 1, 2, 4 and 5

* Proposal 1: RAN4 not to specify N2 values for FBE mode.
* RAN4 not to specify a UE capability with N2 values for LBE networks.
* Proposal 4: For RRM measurements, UEs shall be capable of monitoring the configured SSB index, no matter in which candidate position the SSB index is sent within the DRS transmission window. RAN4 can consider the options below to ensure proper UE behavior:
	+ 1)     Define that UEs shall monitor all candidate positions corresponding to a given SSB index within the DRS transmission window in LBE, until the detection of the SSB index.
	+ 2)     Define that it is up to UE implementation to define for each measurement period how many candidate positions are monitored during the DRS transmission window, as long as the UE is able to detect a SSB within the monitored candidate positions. In case the UE fails to detect any SSB within the monitored candidate positions in at least [20%] of the expected DRS transmission windows in a given measurement period, the UE shall monitor all candidate positions during the remaining DRS transmission windows in this measurement period.
* Proposal 5: The RRM performance tests shall ensure proper UE behavior in different LBT scenarios: scenarios in which the LBT failure blocks the transmission of all candidate positions in a SSB burst, and scenarios in which the LBT failures block only some candidate positions.

**Option 3:** **Specify N2=2 for LBE, for FBE N2 is irrelevant.**

1. Qualcomm, R4-2009871, proposals 1 and 2
* Proposal 1: For UE’s supporting semi-static channel access, monitoring multiple QCL’ed SSB’s within an SMTC occasion is irrelevant. Effectively, N2=1 per agreements in RAN1 UE feature list.
* Proposal 2: For dynamic channel access mode, UE is required to monitor the first N2 = 2 SSBs that are QCL’ed within an SMTC window regardless of the value of Q.

**Option 4: Specify N2 values, N2 = 2, and scale the number of cells and SSB index the UE is required to measure accordingly. For L1-RSRP the number of SSB resource shall be scaled accordingly.**

1. Huawei, HiSilicon R4-2011082, proposals 1, 2 and 3
* Proposal 1: For L3 measurement, UE shall monitor one additional candidate SSB positions which is QCL-ed with the detected one and the number of cells and SSB index the UE is required to measure shall be scaled accordingly.
* Proposal 2: For RLM and L1-RSRP, UE shall monitor one additional candidate SSB position which is QCL-ed with the configured SSB index, and the number of SSB for RLM and the number of SSB resource for L1-RSRP shall be scaled accordingly.
	1. Note from the moderator: The RLM part of this proposal should be discussed in another summary.

**Option 5: In a given discovery burst transmission window, UE is required to monitor at least one candidate SBI corresponding to the same SBI. Capture the number of candidate SBIs corresponding to the same SBI UE should monitor to in the terminology for unavailable SSB/SMTC occasions.**

1. MediaTek, R4-2010215, proposals 1 and 2
* In a given discovery burst transmission window, UE is required to monitor at least one candidate SBI corresponding to the same SBI.
* Capture the number of candidate SBIs corresponding to the same SBI UE should monitor to in the terminology for unavailable SSB/SMTC occasions.

|  |
| --- |
| **Issue 1-1-2: Monitoring of QCL beams during measurements in NR-U** * Proposals
	+ Option 1: Define the core NR-U requirements transparent to the number of SSBs to monitor. Design test cases with two candidate SSB positions. Agree on the same approach to address the number of SSBs to monitor for all relevant NR-U requirements, including measurements, RLM, BM, etc. - see also topic #1 in email thread [96e][206]
		- Ericsson
	+ Option 2: Do not define N2 for FBE. For LBE, leave the number of SSBs to be monitored for UE implementation, as long as it is ensured that SSBs are detected within the discovery transmission window. If the UE fails to detect SSBs in at least [20%] of the expected DRS transmission windows in this measurement period, the UE shall monitor all candidate positions in the remaining DRS transmission windows in this measurement period. Capture the behavior in the tests.
		- Nokia, Nokia Shanghai Bell
	+ Option 3: Specify N2=2 for LBE, for FBE N2 is irrelevant.
		- Qualcomm
	+ Option 4: Specify N2 values, N2 = 2, and scale the number of cells and SSB index the UE is required to measure accordingly. For L1-RSRP the number of SSB resource shall be scaled accordingly.
		- Huawei, HiSilicon
	+ Option 5: In a given discovery burst transmission window, UE is required to monitor at least one candidate SBI corresponding to the same SBI. Capture the number of candidate SBIs corresponding to the same SBI UE should monitor to in the terminology for unavailable SSB/SMTC occasions.
		- MediaTek
* Recommended WF

**More discussion is needed.**In your comments, please address: 1. Should RAN4 define N2 values, or define CORE requirements transparent to N2?
2. Should N2 be defined only for LBE?
3. Should RAN4 consider the number of candidate positions to be monitored in the test cases?
4. If RAN4 defines N2, what value of N2 should be used?
	1. N2 = 2
	2. N2 = at least 1
	3. Other?
 |

### Sub-topic 1-2: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts

In the last RAN4 meeting, the following was discussed:

* *UE behaviour in RRC\_CONNECTED mode when the serving cell is unavailable for consecutive SSB bursts*
* *Candidate options:*
	+ *Option 1:* *UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure the serving cell for consecutive SSB bursts.*
	+ *Option 2: After no SSBs of a cell can be received during up to 8 seconds, the cell will not be considered as detectable and the Rel-15 UE behavior will apply. No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed.*

In this sub-topic, the following issues are discussed:

Issue 1-2-1: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts

Issue 1-2-2: Consecutive number of SSB bursts not available before UE is required to measure neighbour cells

#### Issue 1-2-1: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts

In this meeting, the following option is discussed:

**Option 1: UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure the serving cell for consecutive SSB bursts.**

* Apple, R4-2009871, Proposal 1: agree on option 1: UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure the serving cell for consecutive SSB bursts.
* Huawei, HiSilicon, R4-2011083, Proposal 2: UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure the serving cell for consecutive SSB bursts.

**Option 2: After no SSBs of a cell can be received during up to 8 seconds, the cell will not be considered as detectable and the Rel-15 UE behavior will apply. No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed.**

* ZTE, R4-2010082, Proposal 1: For UE behaviour in RRC\_CONNECTED mode when the serving cell is unavailable for consecutive SSB bursts, keep current UE behavior as Option 2 and further study the feasibility of Option 1 as a possible enhancement to NR-U in Rel-17 phase.
* Ericsson, R4-2011353, Proposal 1: After no SSBs of a cell can be received during up to 8 seconds, the cell will not be considered as detectable and the Rel-15 UE behavior will apply. No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed.
* Qualcomm, R4-2009871, Proposal 4: After no SSBs of a cell can be received during up to 8 seconds, the cell will not be considered as detectable and the Rel-15 UE behavior will apply. No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed.

|  |
| --- |
| **Issue 1-2-1: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts*** Proposals
	+ Option 1: UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure the serving cell for consecutive SSB bursts.
		- Huawei, HiSilicon, Apple
	+ Option 2: After no SSBs of a cell can be received during up to 8 seconds, the cell will not be considered as detectable and the Rel-15 UE behavior will apply. No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed.
		- ZTE, Ericsson, Qualcomm.
	+ Option 2b: No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed for R16, further study Option 1 in R17 as possible enhancement to NR-U.
		- ZTE
* Recommended WF
	+ **More discussion is needed.**
 |

#### Issue 1-2-2: Consecutive number of SSB bursts not available before UE is required to measure neighbour cells

This issue depends on the conclusion of issue 1-2-2.

|  |
| --- |
| **Issue 1-2-2: Consecutive number of SSB bursts not available before UE is required to measure neighbour cells*** Proposals
	+ Option 1 (Apple, R4-2009910, Proposal 2): in RRC\_CONNECTED mode,

- when the s-MeasureConfig is configured and PCell measurement does not need MG, UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure on the PCell for at least Mp\_connected consecutive number of SSB bursts not available at the UE, where,• Mp\_connected = 7 when Max(TDRX, TSMTC)≤ 40ms,• Mp\_connected = 5 when 40ms< Max(TDRX, TSMTC)≤320ms, • Mp\_connected = 3 when TDRX >320ms.- when the s-MeasureConfig is configured and PCell measurement needs MG, UE shall initiate measurements on neighbour cells indicated by the PCell if it is unable to measure on the serving cell for at least Mp\_connected\_gaps consecutive number of SSB bursts not available at the UE, where,• Mp\_connected\_gaps = 7 when Max(TDRX, TSMTC, MGRP)≤ 40ms, • Mp\_connected\_gaps = 5 when 40ms< Max(TDRX, TSMTC, MGRP)≤320ms,• Mp\_connected\_gaps = 3 when TDRX >320ms.* Recommended WF
	+ **More discussion is needed.**
		- This issue depends on the conclusion of issue 1-2-1.
 |

### Sub-topic 1-3: UE behaviour in case of successively exceeding the maximum number of DL LBT failure during measurements

In the last RAN4 meeting, the following was discussed:

* *Issue 2-1-1: UE behaviour in case of successively exceeding the maximum number of DL LBT failure during measurements*
	1. *After N unsuccessful measurement attempts of an already identified cell due to exceeding the max number of unavailable SMTC occasions, UE shall stop the measurement attempts on this SSB.*
		+ *The UE cannot measure this SSB again without first detecting it.*
		+ *FFS: whether UE shall restart directly from detection stage again for this SSB or the UE performs the detection procedure like for any other SSB.*

In this sub-topic, the following issues are discussed:

Issue 1-3-1: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts

Issue 1-3-2: Value of N

#### Issue 1-3-1: UE behaviour in case of successively exceeding the maximum number of DL LBT failure during measurements

In this meeting, the following option is discussed:

**Option 1: After N unsuccessful measurement attempts of an already identified cell due to exceeding max number of unavailable SMTC occasions, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again like for any other SSB.**

* Qualcomm, R4-2009871, Proposal 3: After N unsuccessful measurement attempts of an already identified cell due to exceeding max number of unavailable SMTC occasions, the UE shall perform the detection procedure again like for any other SSB.
* Huawei, HiSilicon, R4-2011083, Proposal 1: Upon successively exceeding the maximum number of DL LBT failure during measurement, UE shall: restart from detection stage like for any other SSB.
* Ericsson, R4-2011353, Proposal 2: Upon successively exceeding N times the Lmax value for measurements, the UE shall stop the measurement attempts on this SSB and assume that the cell is not detected, where

o The UE cannot measure this SSB again without first detecting it

o The UE performs the detection procedure like for any other SSB

o N is not explicitly specified and determined by the existing procedures, e.g., the UE can reattempt the measurements until the earlier agreed 8 seconds limit (during which the undetectable cell can remain know) expires.

|  |
| --- |
| **Issue 1-3-1: UE behaviour in case of successively exceeding the maximum number of DL LBT failure during measurements*** Proposals
	+ Option 1: After N unsuccessful measurement attempts of an already identified cell due to exceeding max number of unavailable SMTC occasions, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again like for any other SSB.
		- Huawei, HiSilicon, Qualcomm, Ericsson
* Recommended WF
	+ **After N unsuccessful measurement attempts of an already identified cell due to exceeding max number of unavailable SMTC occasions, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again like for any other SSB.**
 |

#### Issue 1-3-2: Value of N

|  |
| --- |
| **Issue 1-3-2: Value of N*** Proposals
	+ Option 1 (Ericsson, R4-2011353, Proposal 2): N is not explicitly specified and determined by the existing procedures, e.g., the UE can reattempt the measurements until the earlier agreed 8 seconds limit (during which the undetectable cell can remain known) expires.
* Recommended WF
	+ **Option 1 was agreed on last meeting (slide 11, R4-2009249). Do not discuss this issue in this meeting.**
 |

### Sub-topic 1-4: Scheduling restrictions during SS-RSRP, SS-RSRQ and SS-SINR measurements

In the last RAN4 meeting, the following was discussed:

* *Issue 2-4-1: To define scheduling restrictions during SS-RSRP, SS-SINR and SS-RSRQ measurement*
	1. *RAN4 to define scheduling restrictions during SS-RSRP, SS-SINR and SS-RSRQ measurements in NR-U*
* *Issue 2-4-2: Applicability of the signaling of SMTC2 to NR-U*
	1. *Candidate Options*
		+ *Option 1: The signaling of smtc2 is not applicable in unlicensed band.*
		+ *Option 2: Signaling of smtc2 is applicable to unlicensed band.*
		+ *Option 3: Send a LS to RAN1/RAN2 about this issue.*
* *Issue 2-4-3: Different scheduling restriction when deriveSSB\_IndexFromCell is enabled, or not enabled, during SS-RSRQ measurements and Issue 2-4-4:Different scheduling restriction when deriveSSB\_IndexFromCell is enabled during SS-RSRP and SS-SINR measurements*
	1. *In NR-U, scheduling restriction should depend on the signaling of deriveSSB\_IndexFromCell.*
* *Issue 2-4-5: Scheduling restriction of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH****.***
	1. *In NR-U, the scheduling restriction of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH (clause 9.2.5.3.2 in TS 38.133) is applicable.*
	2. *FFS: scheduling restriction to intra-band and inter-band CA.*

In this meeting, the following issues are discussed:

Issue 1-4-1: Applicability of SMTC2 signaling to NR-U

Issue 1-4-2: Scheduling restriction during SS-RSRP, SS-RSRQ and SS-SINR when deriveSSB\_IndexFromCell is not enabled.

Issue 1-4-3: Scheduling restrictions during SS-RSRP and SS-SINR measurements

Issue 1-4-4: Scheduling restrictions during SS-RSRQ

Issue 1-4-5: Scheduling restrictions in inter-band CA

#### Issue 1-4-1: Applicability of SMTC2 signaling to NR-U

|  |
| --- |
| **Issue 1-4-1: Applicability of SMTC2 signaling to NR-U*** Proposals
	+ Option 1: Signaling of smtc2 is applicable to unlicensed band.
		- ZTE (proposal 2 in R4-2010082), Ericsson (proposal 3 in R4-2011353).
* Recommended WF
	+ **Signaling of smtc2 is applicable to unlicensed band.**
 |

#### Issue 1-4-2: Scheduling restriction during SS-RSRP, SS-RSRQ and SS-SINR when deriveSSB\_IndexFromCell is not enabled.

|  |
| --- |
| **Issue 1-4-2: Scheduling restriction during SS-RSRP, SS-RSRQ and SS-SINR when deriveSSB\_IndexFromCell is not enabled.*** Proposals
	+ Option 1: If deriveSSB\_IndexFromCell is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within DRS window duration
		- MediaTek (proposal 4 in R4-2010215)
* Recommended WF
	+ **If deriveSSB\_IndexFromCell is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within DRS window duration**
 |

#### Issue 1-4-3: Scheduling restrictions during SS-RSRP and SS-SINR measurements

|  |
| --- |
| **Issue 1-4-3: Definition of scheduling restrictions during SS-RSRP and SS-SINR measurements*** Proposals
	+ Option 1: When the UE performs intra-frequency measurements in unlicensed spectrum, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, and on 1 data symbol before each consecutive SSB symbols configured to be measured and 1 data symbol after each consecutive SSB symbols configured to be measured within SMTC window duration if deriveSSB\_IndexFromCell is enabled. If the high layer in TS 38.331 signalling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.- The UE is not expected to transmit PUCCH/PUSCH/SRS within the SMTC window to be measured, and on 1 data symbol before the start of the SMTC window be measured and 1 data symbol after the end of SMTC window to be measured if deriveSSB\_IndexFromCell is not enabled. If the high layer in TS 38.331 signalling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.* + - Qualcomm (proposal 5 in R4-2009871)
* Recommended WF
	+ **Agree on Option 1.**
 |

#### Issue 1-4-4: Scheduling restrictions during SS-RSRQ

|  |
| --- |
| **Issue 1-4-4: Definition of scheduling restrictions during SS-RSRQ measurements*** Proposals
	+ Option 1: When the UE performs intra-frequency measurements in unlicensed spectrum, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB configured to be measured/RSSI symbols and 1 data symbol after each consecutive SSB configured to be measured/RSSI symbols within SMTC window duration if deriveSSB\_IndexFromCell is enabled.. If the high layer signalling of smtc2 is configured(in TS 38.331), the SMTC periodicity follows smtc2; Otherwise the SMTC periodicity follows smtc1.- The UE is not expected to transmit PUCCH/PUSCH/SRS with the SMTC window to be measured, RSSI measurement symbols, and on 1 data symbol before the start of the SMTC window to be measured measured/RSSI symbols and 1 data symbol after the end of the SMTC window to be measured/RSSI symbols if deriveSSB\_IndexFromCell is not enabled.. If the high layer signalling of smtc2 is configured(in TS 38.331), the SMTC periodicity follows smtc2; Otherwise the SMTC periodicity follows smtc1. When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.* Qualcomm (proposal 6 in R4-2009871)
* Recommended WF
	+ **Agree on Option 1.**
 |

#### Issue 1-4-5: Scheduling restrictions in inter-band CA

|  |
| --- |
| **Issue 1-4-5: Definition of scheduling restrictions during SS-RSRQ measurements*** Proposals
	+ Option 1: In FR1 inter-band CA, the scheduling restriction due to one CC shall not apply to other CCs on the other bands.
		- MediaTek (proposal 3 in R4-2010215)
* Recommended WF
	+ **Agree on Option 1.**
 |

### Sub-topic 1-5: UE behavior when receiving the MAC CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the ACK

In the last RAN4 meeting, the following was discussed:

* ***Issue 2-5-1: UE behavior when receiving the MAC CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the ACK***
	1. *Candidate Options:*
		+ *Option 1: Option 1: Detailed UE behavior when receiving the MAC CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the ACK*
			- *If UE cannot transmit HARQ-ACK on MAC-CE deactivation due to UL CCA failure, UE continues to be in its previous state, i.e., it should measure and report L1-RSRP until it successfully transmits HARQ-ACK*
		+ *Option 2: UE should stop the semi-persistent CSI reporting when UE cannot transmit HARQ-ACK for MAC CE deactivation command.*

#### Issue 1-5-1: UE behavior when receiving the MAC CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the ACK

|  |
| --- |
| **Issue 1-5-1: UE behavior when receiving the MAC CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the ACK*** Proposals
	+ Option 1 (Qualcomm, Observation 4 in R4-2009871): At least from MAC (RAN2) layer perspective, UE follows the actions related to MAC-CE activation/deactivation command immediately after decoding the MAC-CE command regardless of whether UE is able to send HARQ-ACK feedback or not.
	+ Option 2 (ZTE, Proposal 3 in R4-2010082): If UE cannot transmit HARQ-ACK on MAC-CE deactivation due to UL CCA failure, UE continues to be in its previous state, i.e., it should measure and report L1-RSRP until it successfully transmits HARQ-ACK.
* Recommended WF
	+ **Wait for the RAN1 response to the LS sent last meeting (R4-2008576).**
 |

### Sub-topic 1-6: Measurement capability

In last RAN4 meeting, the draft CR of R4-2006183 has been technically endorsed, but there are still some remaining issues in the UE measurement capability requirement:

Editor note: the MO merging requirement is FFS

#### Issue 1-6-1: MO merging for NR-U

|  |
| --- |
| **Issue 1-5-1: MO merging for NR-U*** Proposals
	+ Option 1 (Apple, Proposals 1 and 2 in R4-2009908):
	+ Proposal 1: Same as licensed MO merging requirement on same NR carrier frequency layer, the principle to merge MOs on same NR-U carrier frequency layer is that those MOs would not need different measurement efforts from UE.
	+ Proposal 2: UE won’t merge NR-U MOs on the same frequency layer from PCell and PSCell if any of the following conditions is met,

- different RSSI measurement resources or- different deriveSSB-IndexFromCell indications or- different SMTC configurations or,- different ssb-PositionQCL-Common-r16 indications or cell list of ssb-PositionQCL or,- different rmtc-Config-r16 indication. * Recommended WF
	+ **Agree with:**
		- **Same as licensed MO merging requirement on same NR carrier frequency layer, the principle to merge MOs on same NR-U carrier frequency layer is that those MOs would not need different measurement efforts from UE.**
		- **UE won’t merge NR-U MOs on the same frequency layer from PCell and PSCell if any of the following conditions is met,**
		- **- different RSSI measurement resources or**
		- **- different deriveSSB-IndexFromCell indications or**
		- **- different SMTC configurations or,**
		- **- different ssb-PositionQCL-Common-r16 indications or cell list of ssb-PositionQCL or,**
		- **- different rmtc-Config-r16 indication.**
 |

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1: Sub topic 1-2:….Others: |
| Huawei | Sub topic 1-1 Issue 1-1-1We support option 1.Sub topic 1-1 Issue 1-1-2:RAN4 should define N2 in the core requirements; otherwise the UE requirements are unclear.We can agree not to define N2 for FBE is only the case that the SMTC is no longer than FFP is supported.Sub topic 1-2 Issue 1-2-1We support option 1.The conditions for a detectable cell in the existing requirement is for neighbor cell, and it unclear what is the meaning or corresponding UE behavior when the serving cell is not detectable.Sub topic 1-3 Issue 1-3-1We support the recommended WF.Sub topic 1-4 Issue 1-4-3We support the recommended WF.Sub topic 1-4 Issue 1-4-4We support the recommended WF.Sub topic 1-4 Issue 1-4-5We support the recommended WF.Sub topic 1-5 Issue 1-5-1:We support the recommended WF. |
| ZTE | Issue 1-1-1: We support Option 2 that the UE should monitor all candidate SSb positions.Issue 1-1-2: for FBE no need to define N2. We prefer Option 2 over options with a fixed N2 value as option 2 can allow the UE to adapt to different cases and provide more flexibility.Issue 1-2-1: Support Option 2b, which is not to define new UE behaviors now but further study this as a possible enhancement to NR-U in R17 phase. The reason is that in our view the suggested UE behavior can be seen as an improvement and considering tight schedule left for R16 core part, we think it’s better to de-prioritize the discussion and discuss later in R17. We’re generally fine with the suggested change while our concern is about whether we have enough time to agree on the requirements.Issue 1-3-1, 1-3-2, 1-4-1: Support the recommended WF.Issue 1-5-1: We can agree on the recommended WF which is to wait for LS reply. |
| Mediatek | Issue 1-1-1: Option 1Issue 1-1-2:To Q1: Define CORE requirements transparent to N2 is acceptable to us, since it is more aligned with R1’s LS. To Q2: prefer to have N2 for both LBE and FBE, if N2 is definedTo Q3: yes, the number of candidate positions to be monitored should be considered in the test case.To Q4: support option b. N2 = at least 1, to allow allow different UE implementations. Since how many candidate SBIs corresponding to the same SBI the UE should monitor can be left as UE implementation in RAN1's LS reply (R1-2004992). Issue 1-2-1Option 2Issue 1-3-1 & 1-3-2We support the recommended WF.Issue 1-4-1More discussion is needed. The motivation to support SMTC2 in unlicensed band is unclear.In our understanding, smtc2 is more frequent than smtc 1 to provide more reliable signals, as a macro cell in the heterogeneous deployment of small cell and macro cell. But we failed to see the same scenarios in unlicensed band.Issue 1-4-2: We support the recommended WF.Issue 1-4-3 & 1-4-4The wording in the 2nd bullet is a bit different with the wording in R15 (9.2.5.3.2). We suggest to align the wording as R15 as suggested below: "If *deriveSSB\_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration."Issue 1-4-5: We support the recommended WF.Issue 1-5-1: We support the recommended WF to wait for LSIssue 1-6-1:Option 1 |
| Qualcomm | Issue 1-1-1: We support option 1. We also note that option 1 and 2 are not mutually exclusive of each other. Even if UE monitors all candidate SSB positions during the transmission window, at the detection stage, SSB is not detected and UE needs multiple samples from multiple windows to form an aggregate sample for detection. The main point here is that UE cannot benefit from the Q information during the detection stage.Issue 1-1-2: Support option 3 which is more specific than option 4. We can agree with option 2 if the proposal is sharpened a bit. At present, the condition to trigger going into the state of monitoring all SSBs is not very clear (20% of what? Successive windows? Over an evaluation period?) and the UE implementation in this state is very specific (does not need to be) and the condition for coming out of this state is not specified. Answer to Qs: 1) yes, 2) yes, 3) yes, 4) N2=2 for LBE.Issue 1-2-1: we support option 2 and do not see the need for option 1. Issue 1-2-2: Not needed.Issue 1-3-1: WF is agreeable.Issue 1-3-2: WF is agreeable.Issue 1-4-1: WF is agreeable.Issue 1-4-2: WF is agreeable.Issue 1-4-3: WF is agreeable. We can align the wording to R15 text.Issue 1-4-4: WF is agreeable. We can align the wording to R15 text.Issue 1-4-5: WF is agreeable.Issue 1-5-1: WF is ok but we are wondering how this issue can be resolved given that this is the last meeting for core requirements.Issue 1-6-1: WF is agreeable.  |
| Ericsson | Issue 1-1-1: We prefer one generic solution for different procedures, as discussed in R4-2011354 (email thread #206, sub topic 1-1). We prefer the following:* In NR-U work, RAN4 assumes that no explicit or signaled UE capabilities will be defined for the number of SSBs to be monitored by UE for RLM/RRM.
* No differentiation between UE in FBE and LBE modes.
* Do not further discuss the case when a UE is not provided with the parameter Q (this case does not exist, according to RAN1).
* Define the core NR-U requirements transparent to the number of SSBs to monitor.
* Design test cases with two candidate SSB positions.

Issue 1-2-1: Option 2Issue 1-2-2: same as for issue 1-2-1Issue 1-3-1: Option 1Issue 1-4-1: the recommended WF is agreeable.Issue 1-4-2: The commended WF is OkIssue 1-5-1: This issue should be discussed in for [96e][207] NR\_unlic\_RRM\_2 Issue 4-2, because the chairman created new agenda 7.1.5.9, dedicated to beam management (BFD, CBD, and L1-RSRP). So we suggest not to discuss this issue in this email thread. |
| Apple | Issue 1-1-1: support option 1.Issue 1-1-2: support option 5. Don’t understand the rationale behind N2=2 when RAN1 LS suggested it to be UE implementation.Issue 1-2-1: Support option1. It’s not clear what the R15 UE behavior is after 8sec, and now the scenario is NR-U with LBT failure which is quite different from R15, the option 1 helps to maintain the UE performance from RLF.Issue 1-2-2: up to Issue 1-2-1.Issue 1-3-1: Agree with recommended WF.Issue 1-3-2: Agree with recommended WF.Issue 1-4-1: Agree with recommended WF.Issue 1-4-2: Agree with recommended WF.Issue 1-4-3: Agree with recommended WF.Issue 1-4-4: Agree with recommended WF.Issue 1-4-5: We cannot agree on this since the R15 legacy requirement is still open for inter-band CA case. In UE capability of TS38.306, supporting mixed numerology between CCs in FR1 CA is still optional.Issue 1-5-1: Agree with recommended WF.Issue 1-6-1: Agree with recommended WF. |
| Intel | **Issue 1-1-1: Monitoring of QCL beams during measurements in NR-U** In comparison with Opt2, we slightly prefer Option 1.**Issue 1-1-2: Monitoring of QCL beams during measurements in NR-U** For Option 2&3, it seems revoke RAN1’s agreement. No different requirements for LBE and FBE. For Option 1, the measurement requirements shall be scaled anyway even it is transparent to SSB number. We prefer Option4 but N2 can be >=2. For the questions raised by moderator:1. Should RAN4 define N2 values, or define CORE requirements transparent to N2?

Not strong preference to define “N2”. But the requirements shall be scaled by something like “N2”1. Should N2 be defined only for LBE?

Both FBE and LBE shall use the same requirements. 1. Should RAN4 consider the number of candidate positions to be monitored in the test case

OK.1. If RAN4 defines N2, what value of N2 should be used?
	1. N2 = 2
	2. N2 = at least 1

Other?N2 can be at lease 2. And also define N2 up to UE power class.Sub-topic 1-2: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB burstsIssue 1-2-1: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB burstsSupport Option 1 as it can avoid the too long measurement time because of the LBT failure of same cell.Issue 1-2-2: Consecutive number of SSB bursts not available before UE is required to measure neighbour cellsSupport Option 1Sub-topic 1-3: UE behaviour in case of successively exceeding the maximum number of DL LBT failure during measurements**Issue 1-3-1: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts** Agree this recommended WF**Issue 1-3-2: Value of N**Agree this recommended WF**Issue 1-4-1: Applicability of SMTC2 signaling to NR-U**There is no any restriction on smtc-2 in NR-U. So the recommended WF can be agreed**.****Issue 1-4-2: Scheduling restriction during SS-RSRP, SS-RSRQ and SS-SINR when deriveSSB\_IndexFromCell is not enabled****Agree this WF.****Issue 1-4-3: Definition of scheduling restrictions during SS-RSRP and SS-SINR measurements****Agree this WF****Issue 1-5-1: UE behavior when receiving the MAC CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the ACK**We can wait for RAN1’s LS reply. But in our understanding, with current mechanism in Rel15 for CSI-RS feedback, Option 1 is quite more straightforward and little impacts on the current spec .**Issue 1-6-1: MO merging for NR-U**Agree this recommended WFOthers: |
| Nokia | Issue 1-1-1: We prefer option 2, since due to LBT failure, it is not possible to guarantee that a given SSB index will be always detectable at the same SSB candidate position. We would also be ok with Option 3, if this case is captured in the test requirements.Issue 1-1-2: Option 1 or Option 3. We showed in our paper that there might be a performance loss when a low number of candidate positions are monitored and the LBT failure probability is high. Having said that, for the sake of progress and finalization of this WF, we are willing to compromise on this issue. We would be OK either with the proposal of Ericsson (Option 1) or Qualcomm (Option 3).If the option from Ericsson is agreed, we think that differentiation would be needed in the test cases between LBE and FBE, because for FBE it does not make sense to have more than one candidate position per Q. Issue 1-2-1: We prefer option 2, and do not see it necessary to specify option 1. Issue 1-2-2: Not needed in our view, but it is up to the discussion in 1-2-1.Issue 1-3-1: Agree with the WFIssue 1-3-2: - no need to discuss it, it was agreed in the last meeting.Issue 1-4-1: Agree with the WF. Issue 1-4-2: Agree with the WF.Issue 1-4-3: Agree with the WF.Issue 1-4-4: Agree with the WF.Issue 1-5-1: Agree with the WF. If we get RAN1 answer in this meeting, we can discuss this issue.Issue 1-6-1: Agree with the WF. |

### CRs/TPs comments collection

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

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2009911 | Draft CR on serving cell evaluation in RRC connected mode for NR-U, Apple |
| Ericsson: to be updated to align with the agreements in this meeting |
| Company B |
|  |
|  |
| R4-2010594 | CR to TS 38.133 to address NR-U inter-frequency measurements, Nokia, Nokia Shanghai Bell |
| Ericsson: to be updated to align with the agreements in this meeting |
| Company B |
|  |
|  |
| R4-2010595 | CR to TS 36.133 to address NR-U inter-RAT measurements, Nokia, Nokia Shanghai Bell |
| Ericsson: to be updated to align with the agreements in this meeting |
| Company B |
|  |
|  |
| R4-2011074 | CR on introduction of intra-frequency measurement requirements in NR-U, Huawei, Hisilicon |
| Ericsson: to be updated to align with the agreements in this meeting |
| Company B |
|  |
|  |
| R4-2010667 | CR 36.133 (8.17.2.2.a) Clarification of UE behavior, Ericsson |
| Nokia: Some of the already endorsed changes might need to be revised. For example, Table 8.17.2.2.a-2: Maximum number of missed “DRS” occasions is not aligned with the current discussions in thread [206] |
| Company B |
|  |
|  |
| R4-2009909 | On UE measurement capability of NR-U for R16 – Apple |
| Nokia: depends on ongoing discussions. |
| Company B |
|  |
|  |

## Summary for 1st round

### Open issues

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

|  |
| --- |
| **Issue 1-1-1: Monitoring of QCL beams during cell detection in NR-U** *Tentative agreements: No**Candidate options:**Option 1 (Huawei, HiSilicon, MediaTek, Qualcomm, Apple):* At least one SSB positions shall remain detectable during the whole detection stage*Option 2 (ZTE, Intel, Nokia):* For cell detection, UE is required to monitor all candidate positions within the DRS transmission window*Option 3 (Ericsson):* - In NR-U work, RAN4 assumes that no explicit or signaled UE capabilities will be defined for the number of SSBs to be monitored by UE for RLM/RRM.- No differentiation between UE in FBE and LBE modes.- Do not further discuss the case when a UE is not provided with the parameter Q (this case does not exist, according to RAN1).- Define the core NR-U requirements transparent to the number of SSBs to monitor.- Design test cases with two candidate SSB positions.*Recommendations for 2nd round:*Continue discussing the proposals. We suggest to discuss this issue on the GoToWebinar session.  |

|  |
| --- |
| **Issue 1-1-2: Monitoring of QCL beams during measurements in NR-U** *Tentative agreements: No. There was no consensus in the first round.**Candidate options:** + Option 1 (Ericsson): Define the core NR-U requirements transparent to the number of SSBs to monitor. Design test cases with two candidate SSB positions. Agree on the same approach to address the number of SSBs to monitor for all relevant NR-U requirements, including measurements, RLM, BM, etc. - see also topic #1 in email thread [96e][206]
		- Nokia can compromise to this solution if differentiation between LBE and FBE is done on the test cases
		- MediaTek can compromise to this solution
	+ Option 2 (Nokia, ZTE, Qualcomm can compromise if the proposal is sharpened): Do not define N2 for FBE. For LBE, leave the number of SSBs to be monitored for UE implementation, as long as it is ensured that SSBs are detected within the discovery transmission window. If the UE fails to detect SSBs in at least [20%] of the expected DRS transmission windows in this measurement period, the UE shall monitor all candidate positions in the remaining DRS transmission windows in this measurement period. Capture the behavior in the tests.
	+ Option 3 (Qualcomm, Nokia can compromise to this solution): Specify N2=2 for LBE, for FBE N2 is irrelevant.
		- Huawei can agree not to specify N2 if SMTC is no longer than FFP.
	+ Option 5 (MediaTek, Apple): In a given discovery burst transmission window, UE is required to monitor at least one candidate SBI corresponding to the same SBI. Capture the number of candidate SBIs corresponding to the same SBI UE should monitor to in the terminology for unavailable SSB/SMTC occasions.
* Additionally, the moderator asked the following questions during the 1st round:
* Should RAN4 define N2 values, or define CORE requirements transparent to N2?
	+ Transparent: Ericsson, MediaTek can compromise, Nokia can compromise if differentiation between LBE and FBE is defined in the test cases
	+ Define N2 values in the core requirements: Huawei, Qualcomm
	+ No strong preference, if the requirements are scaled by N2: Intel
* If N2 is defined, should it be defined only for LBE?
	+ Yes: ZTE, Nokia, Qualcomm
	+ Yes, if SMTC is no longer than FFP: Huawei
	+ No: MediaTek, Intel
* Should RAN4 consider the number of candidate positions to be monitored in the test cases?
	+ Yes: Ericsson, MediaTek, Nokia, Qualcomm, Intel
* If RAN4 defines N2, what value of N2 should be used?
	+ N2 = at least 1 for LBE and FBE. Mediatek
	+ N2 = 2 for LBE, Qualcomm, Nokia can compromise to this solution
	+ N2 = at least 2, Intel
	+ N2 is up to UE implementation, as long as UE monitors all candidate positions after missing [20%] of the SSBs in this measurement period, Nokia, ZTE

*Recommendations for 2nd round:*Continue discussing the proposals. We suggest to discuss this issue on the GoToWebinar session. |

|  |
| --- |
| **Issue 1-2-1: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts***Tentative agreements: No**Candidate options:*Option 1 (Huawei, HiSilicon, Apple, Intel): UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure the serving cell for consecutive SSB bursts.Option 2 (MediaTek, Qualcomm, Ericsson, Nokia, Nokia Shanghai Bell): After no SSBs of a cell can be received during up to 8 seconds, the cell will not be considered as detectable and the Rel-15 UE behavior will apply. No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed.Option 2b (ZTE) No other UE behavior or requirement on the consecutive SSBs in the serving cell is needed for R16, further study Option 1 in R17 as possible enhancement to NR-U.*Recommendations for 2nd round:*Continue discussing the proposals.  |

|  |
| --- |
| **Issue 1-2-2: Consecutive number of SSB bursts not available before UE is required to measure neighbour cells***Tentative agreements: No, this topic depends on the issue 1-2-1**Candidate options:** + Option 1 (Intel, Apple): in RRC\_CONNECTED mode,

- when the s-MeasureConfig is configured and PCell measurement does not need MG, UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure on the PCell for at least Mp\_connected consecutive number of SSB bursts not available at the UE, where,• Mp\_connected = 7 when Max(TDRX, TSMTC)≤ 40ms,• Mp\_connected = 5 when 40ms< Max(TDRX, TSMTC)≤320ms, • Mp\_connected = 3 when TDRX >320ms.- when the s-MeasureConfig is configured and PCell measurement needs MG, UE shall initiate measurements on neighbour cells indicated by the PCell if it is unable to measure on the serving cell for at least Mp\_connected\_gaps consecutive number of SSB bursts not available at the UE, where,• Mp\_connected\_gaps = 7 when Max(TDRX, TSMTC, MGRP)≤ 40ms, • Mp\_connected\_gaps = 5 when 40ms< Max(TDRX, TSMTC, MGRP)≤320ms,• Mp\_connected\_gaps = 3 when TDRX >320ms.Option 2 (Nokia, Nokia Shanghai Bell, Qualcomm, Ericsson): Not needed*Recommendations for 2nd round:*Continue discussing the proposals.  |

|  |
| --- |
| **Issue 1-3-1: UE behaviour in case of successively exceeding the maximum number of DL LBT failure during measurements***Tentative agreements:* **After N unsuccessful measurement attempts of an already identified cell due to exceeding max number of unavailable SMTC occasions, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again like for any other SSB.** |

|  |
| --- |
| **Issue 1-3-2: Value of N***This topic was discussed last meeting. All companies agreed not to discuss it.* |

|  |
| --- |
| **Issue 1-4-1: Applicability of SMTC2 signaling to NR-U***Tentative agreements: No**Candidate options:** + Option 1 (ZTE, Qualcomm, Ericsson, Apple, Intel and Nokia): Signaling of smtc2 is applicable to unlicensed band.

*Recommendations for 2nd round:*Continue the discussions.Only one company did not support the recommended WF in the first round, mentioning that more discussions are needed. The applicability of smtc2 to NR-U was not questioned in other groups. The recommendation for the second round is, therefore, try to agree on Option 1, given the tight schedule to complete Rel-16 NR-U.  |

|  |
| --- |
| **Issue 1-4-2: Scheduling restriction during SS-RSRP, SS-RSRQ and SS-SINR when deriveSSB\_IndexFromCell is not enabled.***Tentative agreements:* If deriveSSB\_IndexFromCell is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within DRS window duration |

|  |
| --- |
| **Issue 1-4-3: Definition of scheduling restrictions during SS-RSRP and SS-SINR measurements***Most of the companies supported the way forward. One company mentioned that the wording in the second bullet could be aligned with Rel-15. Therefore, the moderator changed the original wording as suggested by MediaTek.**Candidate option:* * + When the UE performs intra-frequency measurements in unlicensed spectrum, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, and on 1 data symbol before each consecutive SSB symbols configured to be measured and 1 data symbol after each consecutive SSB symbols configured to be measured within SMTC window duration if deriveSSB\_IndexFromCell is enabled. If the high layer in TS 38.331 signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration if *deriveSSB\_IndexFromCell* is not enabled. If the high layer in TS 38.331 signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.*Recommendations for 2nd round:*Discuss if the text above is agreeable. |

|  |
| --- |
| **Issue 1-4-4: Definition of scheduling restrictions during SS-RSRQ measurements** *Most of the companies supported the way forward. MediaTek mentioned that the wording in the second bullet could be aligned with Rel-15. Therefore, the moderator changed the original wording as suggested by MediaTek.**Candidate Option:* * + When the UE performs intra-frequency measurements in unlicensed spectrum, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB configured to be measured/RSSI symbols and 1 data symbol after each consecutive SSB configured to be measured/RSSI symbols within SMTC window duration if deriveSSB\_IndexFromCell is enabled. If the high layer signaling of smtc2 is configured(in TS 38.331), the SMTC periodicity follows smtc2; Otherwise the SMTC periodicity follows smtc1.- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration if *deriveSSB\_IndexFromCell* is not enabled. If the high layer in TS 38.331 signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.* + When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols

*Recommendations for 2nd round:*Discuss if the text above is agreeable. |

|  |
| --- |
| **Issue 1-4-5: Scheduling restrictions in inter-band CA** *Tentative agreements: No. The Option 1 below was objected by Apple, that mentioned that the Rel-15 requirements are still open.* *Candidate options:** + Option 1 (MediaTek, Qualcomm): In FR1 inter-band CA, the scheduling restriction due to one CC shall not apply to other CCs on the other bands.

*Recommendations for 2nd round:*Continue the discussions. |

|  |
| --- |
| **Issue 1-5-1: UE behavior when receiving the MAC CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the ACK***Tentative agreements: No. The recommendation in the 1st round was to not discuss the issue, since RAN4 did not get an LS response from RAN1 on this topic. Ericsson proposed that this issue is discussed with BFD requirements in thread [207]**Candidate options:** + Option 1 (originally from Qualcomm): At least from MAC (RAN2) layer perspective, UE follows the actions related to MAC-CE activation/deactivation command immediately after decoding the MAC-CE command regardless of whether UE is able to send HARQ-ACK feedback or not.
	+ Option 2 (originally from ZTE): If UE cannot transmit HARQ-ACK on MAC-CE deactivation due to UL CCA failure, UE continues to be in its previous state, i.e., it should measure and report L1-RSRP until it successfully transmits HARQ-ACK.

*Recommendations for 2nd round:*The recommendation in the 1st round was to not discuss this topic, since in the last meeting, RAN4 sent an LS to RAN2 about the topic and no answer was received yet. The LS response was not received until the end of the 1st round discussions. The recommendation for the 2nd round is to discuss the issue, if the LS is received from RAN1 in this meeting.  |

|  |
| --- |
| **Issue 1-6-1: Measurement capability***There was no objection to this proposal in the 1st round.**Tentative agreements:* Same as licensed MO merging requirement on same NR carrier frequency layer, the principle to merge MOs on same NR-U carrier frequency layer is that those MOs would not need different measurement efforts from UE.* + Proposal 2: UE won’t merge NR-U MOs on the same frequency layer from PCell and PSCell if any of the following conditions is met,

- different RSSI measurement resources or- different deriveSSB-IndexFromCell indications or- different SMTC configurations or,- different ssb-PositionQCL-Common-r16 indications or cell list of ssb-PositionQCL or,- different rmtc-Config-r16 indication.  |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,** |
| #1 | **WF on RRM requirements Part 3** | **Nokia, Nokia Shanghai Bell** |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2009911  | To be revised, pending agreements in this meeting. |
| R4-2010594 | To be revised, pending agreements in this meeting. |
| R4-2010595 | To be revised, pending agreements in this meeting. |
| R4-2011074 | To be revised, pending agreements in this meeting. |
| R4-2010667 | To be revised, pending agreements in this meeting. |
| R4-2009909 | Return to |

## Discussion on 2nd round (if applicable)

|  |
| --- |
| **Issue 1-1-1: Monitoring of QCL beams during cell detection in NR-U** *Tentative agreements: Not in the 1st round, but there were disucssions on the GoToWebinar session on August 21st . The following agreement applies do this issue:*Agreements* RRM core requirements are defined under assumption what UE monitors the first 2 successive QCL’ed candidate SSB positions (i.e. N1 = N2 = 2)
	+ FFS if same values apply for cell detection
		- Option 1: For cell detection the requirements are defined under assumption that UE monitors at least 1 candidate SSB position in one SSB block burst
		- Option 2: Same value applies as for other RRM measurements

The total number of candidate SSBs indexes and number of cell UE shall monitor remains unchanged*Candidate options:** Option 1:* For cell detection the requirements are defined under assumption that UE monitors at least 1 candidate SSB position in one SSB block burst* Option 2: Same value applies as for other RRM measurements**Recommendations for 2nd round:*Discuss the new options. |
|  **Qualcomm:** We still believe option 1 makes more sense. Detection stage is not one-shot and per RAN1 requirements, UE is not supposed to combine SSBs from QCL’ed positions in the same SMTC window. With these observations, it is not possible for UE to even tell whether an SSB is present in a candidate SSB position in the detection stage.  |
| **Apple:** for cell detection, we support to use option 1 to cover the all possible UE implementation in a minimum requirement. |
| **Mediatek:** Option 1. To clarify, although UE will detect multiple positions, but if once the position of a SSB has been changed, the cell may not be successfully detected, since it requires several SMTCs to detect a cell during detection stage.  |

|  |
| --- |
| **Issue 1-1-2: Monitoring of QCL beams during measurements in NR-U** *This issue was solved during the webinar session on August, 21st. For the sake of completeness, we copy here the agreements from the chairman notes. Moderator suggests not to discuss this issue in the 2nd round.*Agreement: In NR-U work, RAN4 assumes that no explicit or signalled UE capabilities will be defined for the number of candidate SS/PBCH block indexes corresponding to the same SS/PBCH block index the UE should monitor in a given discovery burst transmission window (for RRM) or within the set of configured resources (for RLM/CBD/BFD).Agreements* No differentiation between UE in FBE and LBE modes in NR-U RRM Core requirements.
* Different test case will be defined for UE in FBE and LBE modes in NR-U RRM Performance requirements.

Agreements* RRM core requirements are defined under assumption what UE monitors the first 2 successive QCL’ed candidate SSB positions (i.e. N1 = N2 = 2)
	+ FFS if same values apply for cell detection
		- Option 1: For cell detection the requirements are defined under assumption that UE monitors at least 1 candidate SSB position in one SSB block burst
		- Option 2: Same value applies as for other RRM measurements
	+ The total number of candidate SSBs indexes and number of cell UE shall monitor remains unchanged
 |

|  |
| --- |
| **Issue 1-2-1: UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts***Agreement from the GTW session on August, 24th.** + Do not specify additional UE behavior in RRC\_CONNECTED mode when serving cell is unavailable for consecutive SSB bursts
 |

|  |
| --- |
| **Issue 1-2-2: Consecutive number of SSB bursts not available before UE is required to measure neighbour cells***Issue closed. No need to discuss this topic, since it was agreed on issue 1-2-1 not to specify a new UE behavior.*  |

|  |
| --- |
| **Issue 1-3-1: UE behaviour in case of successively exceeding the maximum number of DL LBT failure during measurements***Tentative agreements:* **After N unsuccessful measurement attempts of an already identified cell due to exceeding max number of unavailable SMTC occasions, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again like for any other SSB.***Comment from the moderator: this issue had no objections in the 1st round, however it was not captured in the chairman notes as an agreement in the 1st round. The suggestion is not to further discuss it, and confirm this agreement in the 2nd round.* |

**Issue 1-3-2: Value of N was agreed in RAN4 #95e**

|  |
| --- |
| **Issue 1-4-1: Applicability of SMTC2 signaling to NR-U***Tentative agreements: No**Candidate options:** + Option 1 (ZTE, Qualcomm, Ericsson, Apple, Intel and Nokia): Signaling of smtc2 is applicable to unlicensed band.

*Recommendations for 2nd round:*Continue the discussions.Only one company did not support the recommended WF in the first round, mentioning that more discussions are needed. The applicability of smtc2 to NR-U was not questioned in other groups. The recommendation for the second round is, therefore, try to agree on Option 1, given the tight schedule to complete Rel-16 NR-U.  |
|  **Qualcomm:** Option 1 is ok to us.  |
| **Apple:** option 1 |
| **Mediatek:** We can follow the majority’s veiw (Option 1).  |

|  |
| --- |
| **Issue 1-4-2: Scheduling restriction during SS-RSRP, SS-RSRQ and SS-SINR when deriveSSB\_IndexFromCell is not enabled.***Tentative agreements:* If deriveSSB\_IndexFromCell is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within DRS window duration |
| *Comment from the moderator: this issue had no objections in the 1st round, however it was not captured in the chairman notes as an agreement in the 1st round. The suggestion is not to further discuss it, and confirm this agreement in the 2nd round.* |

|  |
| --- |
| **Issue 1-4-3: Definition of scheduling restrictions during SS-RSRP and SS-SINR measurements***Most of the companies supported the way forward. One company mentioned that the wording in the second bullet could be aligned with Rel-15. Therefore, the moderator changed the original wording as suggested by MediaTek.**Candidate option:* * + When the UE performs intra-frequency measurements in unlicensed spectrum, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, and on 1 data symbol before each consecutive SSB symbols configured to be measured and 1 data symbol after each consecutive SSB symbols configured to be measured within SMTC window duration if deriveSSB\_IndexFromCell is enabled. If the high layer in TS 38.331 signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration if *deriveSSB\_IndexFromCell* is not enabled. If the high layer in TS 38.331 signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.*Recommendations for 2nd round:*Discuss if the text above is agreeable. |
| **Qualcomm:** The suggested wording in candidate option above is ok to us.  |
| **Apple:** agree the above context |
| **Huawei: We are fine with the text above.** |
| **Mediatek:** We are fine with the text above. |

|  |
| --- |
| **Issue 1-4-4: Definition of scheduling restrictions during SS-RSRQ measurements** *Most of the companies supported the way forward. MediaTek mentioned that the wording in the second bullet could be aligned with Rel-15. Therefore, the moderator changed the original wording as suggested by MediaTek.**Candidate Option:* * + When the UE performs intra-frequency measurements in unlicensed spectrum, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB configured to be measured/RSSI symbols and 1 data symbol after each consecutive SSB configured to be measured/RSSI symbols within SMTC window duration if deriveSSB\_IndexFromCell is enabled. If the high layer signaling of smtc2 is configured(in TS 38.331), the SMTC periodicity follows smtc2; Otherwise the SMTC periodicity follows smtc1.- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration if *deriveSSB\_IndexFromCell* is not enabled. If the high layer in TS 38.331 signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.* + When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols

*Recommendations for 2nd round:*Discuss if the text above is agreeable. |
| **Qualcomm:** The suggested wording in candidate option above is ok to us.  |
| **Apple:** agree the above context |
| **Huawei: We are fine with the test above.** |
| **Mediatek:** We are fine with the text above. |

|  |
| --- |
| **Issue 1-4-5: Scheduling restrictions in inter-band CA** *Tentative agreements: No. The Option 1 below was objected by Apple, that mentioned that the Rel-15 requirements are still open.* *Candidate options:** + Option 1 (MediaTek, Qualcomm): In FR1 inter-band CA, the scheduling restriction due to one CC shall not apply to other CCs on the other bands.

*Recommendations for 2nd round:*Continue the discussions. |
|  **Qualcomm:** Support option 1.  |
| **Apple:** we have concern on option 1, because in R15 the scheduling restriction for inter-band CA case is missing and in RAN2 capability definition, supporting mixed numerology between CCs on different bands in FR1 CA is still optional. |

|  |
| --- |
| **Issue 1-5-1: UE behavior when receiving the MAC CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the ACK***Tentative agreements: No. The recommendation in the 1st round was to not discuss the issue, since RAN4 did not get an LS response from RAN1 on this topic. Ericsson proposed that this issue is discussed with BFD requirements in thread [207]**Candidate options:** + Option 1 (originally from Qualcomm): At least from MAC (RAN2) layer perspective, UE follows the actions related to MAC-CE activation/deactivation command immediately after decoding the MAC-CE command regardless of whether UE is able to send HARQ-ACK feedback or not.
	+ Option 2 (originally from ZTE): If UE cannot transmit HARQ-ACK on MAC-CE deactivation due to UL CCA failure, UE continues to be in its previous state, i.e., it should measure and report L1-RSRP until it successfully transmits HARQ-ACK.

*Recommendations for 2nd round:*The recommendation in the 1st round was to not discuss this topic, since in the last meeting, RAN4 sent an LS to RAN2 about the topic and no answer was received yet. The LS response was not received until the end of the 1st round discussions. The recommendation for the 2nd round is to discuss the issue, if the LS is received from RAN1 in this meeting.  |
|  **Qualcomm:** We’re not aware of any LS reply from RAN1.  |
| **Comments company B** |

|  |
| --- |
| **Issue 1-6-1: Measurement capability***Tentative agreements:* Same as licensed MO merging requirement on same NR carrier frequency layer, the principle to merge Mos on same NR-U carrier frequency layer is that those Mos would not need different measurement efforts from UE.* + Proposal 2: UE won’t merge NR-U Mos on the same frequency layer from Pcell and PSCell if any of the following conditions is met,

- different RSSI measurement resources or- different deriveSSB-IndexFromCell indications or- different SMTC configurations or,- different ssb-PositionQCL-Common-r16 indications or cell list of ssb-PositionQCL or,- different rmtc-Config-r16 indication. *Comment from the moderator: this issue had no objections in the 1st round, however it was not captured in the chairman notes as an agreement. The suggestion is not to further discuss it and confirm this agreement in the 2nd round.* |

The following CRs will be discussed on the e-mail:

|  |  |  |  |
| --- | --- | --- | --- |
|  **Original numbers CR/TP number** | **New number + chairman recommendation**  | **Company** | **Title** |
| R4-2009911  | Chair: CR R4-2012098 was allocated instead. Please capture updates in CR and request CR number from MCC | Apple | Draft CR on serving cell evaluation in RRC connected mode for NR-U |
| R4-2010594 | R4-2012099 | Nokia, Nokia Shanghai Bell | CR to TS 38.133 to address NR-U inter-frequency measurements |
| R4-2010595 | R4-2012100 | Nokia, Nokia Shanghai Bell | CR to TS 36.133 to address NR-U inter-RAT measurements |
| R4-2011074 | R4-2012101 | Huawei, HiSilicon | CR on introduction of intra-frequency measurements requirements for NR-U |
| R4-2010667 | R4-2012102 | Ericsson | CR 36.133 (8.17.2.2.a) Clarification of UE behaviour |
| R4-2009909 | Return to | Apple | CR on UE measurement capability of NR-U for R16 |

And the WF will also be discussed by e-mail:

|  |  |  |
| --- | --- | --- |
| **Tdoc Number** | **Company** | **Title** |
| R4-2012092  | Nokia | WF on NR-U RRM requirements – Part 3 |

## Summary on 2nd round (if applicable)

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

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

# Topic #2: RSSI and CO measurements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009871 | Qualcomm | Proposal 7. No additional condition is needed for the definition of intra-frequency RSSI/CO measurement. Proposal 8. Measurement gaps are needed for RSSI/CO measurements when RSSI BW is not fully within the active DL BWP of the UE.Observation 5. For UE not capable of wideband operation in NR-U, RSSI measurement period scales with the number of Mos not requiring measurement gap according to CSSFoutside-gap,i.Proposal 9. When measurement gap is not required, RSSI/CO measurement period corresponds to:• Nintra-MO.max(reportInterval, rmtc-Period) when DRX is not used • Nintra-MO.max(reportInterval, rmtc-Period, DRXcycle length) when DRX is usedwhere Nintra-MO , reportInterval, and rmtc-Period is defined as the number of measurement objects that can be measured without gaps, configured reporting interval, and configured RMTC period, respectively. Proposal 10. When measurement gap is required, RSSI/CO measurement period corresponds to:• max(reportInterval, rmtc-Period, MGRP).CSSFinter when DRX is not used • max(reportInterval, rmtc-Period, MGRP, DRXcycle length).CSSFinter when DRX is usedwhere CSSFinter is determined according to CSSFwithin-gap,I in clause 9.1.5.2 for measurement conducted within measurement gaps.Proposal 11. When the UE performs intra-frequency RSSI/CO measurements in unlicensed spectrum, the following restrictions apply due to RSSI/CO measurements- The UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI measurement symbols configured by RMTC, and on 1 data symbol before the first RSSI measurement symbol configured by RMTC, and 1 data symbol after the last RSSI measurement symbol configured by RMTCWhen intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols. |
| R4-2011086 | Huawei, HiSilicon | Observation 1: UE shall use the same SCS as active DL BWP when the RSSI measurement is confined with in the active DL BWP.Observation 2: For the case when the RSSI measurement is not confined within the active DL BWP, UE shall use the SCS equal or larger than the configured reference SCS for RSSI measurement.Proposal 1: SCS condition is not needed for the definition of intra-frequency measurement.Proposal 2: Gap is only needed when the RSSI measurement BW is not fully within the active DL BWP.Proposal 3: The RSSI measurement is LBT bandwidth.Proposal 4: Define scheduling restriction during RSSI/CO measurements and do not differentiate the cases in which deriveSSB\_IndexFromCell is enabled or not for the definition of scheduling restriction. |
| R4-2010215 | MediaTek Inc. | Proposal 5: An intra-frequency RSSI measurement shall meet the condition that the RMTC configured SCS is the same as the SCS of active BWP (Option 2a).Proposal 6: For a RSSI measurement outside measurement gap, measurement period is scaled up by CSSFoutside\_gapProposal 7: No requirement for the RMTC which is overlapping with SMTC.Proposal 8: If deriveSSB\_IndexFromCell is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within RMTC window duration.Proposal 9: Scheduling restriction shall apply on the RMTC window duration if the SCS configured in RMTC is different from the SCS of data. |
| R4-2011353 | Ericsson | • Proposal 7: Measurement gaps are not needed when the RSSI channel BW is fully inside the active BWP.1. • Proposal 8: SCS is taken into account in the intra-/inter-frequency definition for RSSI and CO measurements, e.g., RSSI/CO is inter-frequency if SCS configured for RSSI is different from the SCS of the active BWP

• Proposal 9: RSSI measurement bandwidth is the LBT bandwidth (which is already decided by RAN1 and specified in TS 38.215).• Proposal 10: No need to define scheduling restrictions for RSSI measurements in NR-U.• Proposal 11: The RSSI and CO measurement periods depend on:o max(reportInterval, rmtc-Period, CSSFoutside\_gap,i) in non-DRX when measurement gaps are not required,o max(reportInterval, rmtc-Period, DRX, , CSSFoutside\_gap,i) in DRX when measurement gaps are not required, oro max(reportInterval, rmtc-Period, MGRP, CSSFwithin\_gap,i) in DRX when measurement gaps are required.• Proposal 12: CSSF outside measurement gaps needs also to be adapted to account for RSSI/CO measurements. |
| R4-2010592 | Nokia, Nokia Shanghai Bell | Observation 11: RAN1 has agreed that ·       The RSSI measurement duration is based on the: measDuration-r16, which is given by the number of symbols regarding the reference SCS in the RSSI measurement configurationThe agreement contains a note that for RSSI measurement confined within the active DL BWP, UE performs RSSI measurement using the numerology of the DL bandwidth part, and that for RSSI measurements within the active DL BWP, the UE does not expect a non-integer number of symbols.Proposal 6: No additional condition is needed in the definition of an intra-frequency RSSI measurement.Proposal 7: An inter-frequency RSSI measurement is defined when the RSSI measurement BW is not fully within the channel/carrier BW of the UE.Proposal 8: For RSSI, measurement gaps are used for inter-frequency measurements and for intra-frequency measurements when the measurement BW is not fully within the active DL BWP.Observation 12: The RSSI measurement is an absolute power measurement, that is independent on any network signals, so the scheduling restriction should not depend on deriveSSB\_IndexFromCell being enabled or not. Proposal 9: The scheduling restriction for RSSI measurements does not depend on deriveSSB\_IndexFromCell being enabled or not.Proposal 10: Define the scheduling restriction for RSSI measurements as: the UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI symbols, and on 1 data symbol before RSSI symbols and 1 data symbol after RSSI symbols within RMTC window duration Proposal 11: For RSSI measurements, do not use the scaling factor of 1.5 when DRX ≤ 320ms. |

## Open issues summary

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

### Sub-topic 2-1: Intra-frequency measurement definition and the use of measurement gaps

Issues discussed in this sub-topic

* + Issue 2-1-1 Intra-frequency RSSI measurement definition
	+ Issue 2-1-2 Need for measurement gaps in RSSI measurements

#### Issue 2-1-1 Intra-frequency RSSI measurement definition

In the last meeting, the following was agreed:

* *Intra-frequency measurement definition*
	+ *An intra-frequency RSSI measurement is defined when:*
		- *RSSI channel BW is contained within the channel/carrier BW of the UE.*
	+ *Further study whether to include SCS conditions into the definition and how to handle RSSI measurements under assumption of different SCS in RSSI, active BWP, etc.*
	+ *Options discussed in RAN4 95:*
		- *Option 2a: RMTC configured SCS is the same as the SCS of active BWP*
		- *Option 2b: the SCS of the RSSI measurement is the same as the SCS of an intra-frequency SSB or CSI-RS*
		- *Option 2c: No additional condition is needed.*
		- *Option 2d: the SCS configured for the RSSI measurement is the same as the SCS of a serving cell, where the SCS of a serving cell is FFS.*

In this meeting, the following options are discussed:

**Option 1: No additional condition is needed for the intra-frequency measurement definition**

* Qualcomm, R4-2009871: Proposal 7. No additional condition is needed for the definition of intra-frequency RSSI/CO measurement.
* Huawei, HiSilicon: R4-2011086: Proposal 1: SCS condition is not needed for the definition of intra-frequency measurement.
* Nokia, Nokia Shanghai Bell, R4-2010592, Proposal 6: No additional condition is needed in the definition of an intra-frequency RSSI measurement.

**Option 2: RMTC configured SCS is the same as the SCS of active BWP**

* Mediatek, R4-2010215: Proposal 5: An intra-frequency RSSI measurement shall meet the condition that the RMTC configured SCS is the same as the SCS of active BWP (Option 2a).
* Ericsson, R4-2011353: Proposal 8: SCS is taken into account in the intra-/inter-frequency definition for RSSI and CO measurements, e.g., RSSI/CO is inter-frequency if SCS configured for RSSI is different from the SCS of the active BWP

**Further information:**

RAN1 has sent a LS to RAN2, with the following agreement (R4-2009506):

|  |
| --- |
| The set of values for the parameter *measDuration-r16* is {sym1, sym14or12, sym28or24, sym42or36, sym70or60} which is in units of the reference numerology configured by *ref-SCS-CP-r16** “sym14or12” refers to 14 symbols of the reference numerology for NCP and 12 symbols for ECP, respectively, and so on
* Notes (Can be captured in specifications as needed):
	+ The UE derives the RSSI measurement duration from a combination of *measDuration-r16* and *ref-SCS-CP-r16*
	+ At least for RSSI measurement confined within the active DL BWP, UE performs RSSI measurement using the numerology of the active DL bandwidth part during the derived measurement duration. Otherwise, the numerology used by the UE for measurements is up to UE implementation.
	+ For RSSI measurements within the active DL BWP, the UE does not expect a non-integer number of symbol(s) with respect to the numerology of the active DL BWP.
* Inform RAN2 of this decision and cc RAN4
 |

|  |
| --- |
| **Issue 2-1-1: Intra-frequency RSSI measurement definition*** Proposals
	+ Option 1: No additional condition is needed for the intra-frequency measurement definition
		- Qualcomm, Nokia, Nokia Shanghai Bell, Huawei, HiSilicon
	+ Option 2: RMTC configured SCS is the same as the SCS of active DL BWP
		- Ericsson, MediaTek
* Recommended WF
* **No additional condition is needed for the intra-frequency measurement definition**
	+ Considering the LS from RAN1, it is the moderator understanding that if the measurement bandwidth is within the active DL BWP, the measurement will always be performed using the numerology of the active DL BWP. Outside the active BWP, the numerology is up to UE implementation. Therefore, the condition would not be needed in the intra-frequency measurement definition.
 |

#### Issue 2-1-2 Need for measurement gaps in RSSI measurements

In the last meeting, the following was agreed:

* *Need of measurement Gaps during RSSI measurements*
	+ *Measurement gaps are needed at least when:*
		- *RSSI BW is not fully within the active BWP of the UE.*
			* *FFS: if another condition is needed.*

In this meeting, the following option is discussed:

**Option 1:** **Measurement gaps are needed for RSSI/CO measurements when RSSI BW is not fully within the active DL BWP of the UE.**

* Qualcomm, R4-2009871: Proposal 8. Measurement gaps are needed for RSSI/CO measurements when RSSI BW is not fully within the active DL BWP of the UE.
* Huawei, HiSilicon: R4-2011086: Proposal 2: Gap is only needed when the RSSI measurement BW is not fully within the active DL BWP.
* Nokia, Nokia Shanghai Bell, R4-2010592, Proposal 8: For RSSI, measurement gaps are used for inter-frequency measurements and for intra-frequency measurements when the measurement BW is not fully within the active DL BWP.
* Ericsson, R4-2011353, Proposal 7: Measurement gaps are not needed when the RSSI channel BW is fully inside the active BWP.

|  |
| --- |
| **Issue 2-1-2: Need for measurement gaps in RSSI measurements*** Proposals
	+ Option 1: Measurement gaps are needed for RSSI/CO measurements when RSSI BW is not fully within the active DL BWP of the UE.
		- Qualcomm, Nokia, Nokia Shanghai Bell, Huawei, HiSilicon, Ericsson
* Recommended WF
	+ **Measurement gaps are needed for RSSI/CO measurements when RSSI BW is not fully within the active DL BWP of the UE.**
 |

### Sub-topic 2-2: RSSI measurement bandwidth

#### Issue 2-2-1 RSSI measurement BW

In the last meeting, the following was agreed:

* *RSSI measurement bandwidth*
	+ *Candidate options:*
		- *Option 1: RSSI measurement bandwidth is the LBT bandwidth (which is already decided by RAN1 and specified in TS 38.215).*
		- *Option 2: RAN4 discuss this in the performance requirements.*

In this meeting, the following option is discussed:

**Option 1: The RSSI measurement is LBT bandwidth.**

* Huawei, HiSilicon, R4-2011086, Proposal 3: The RSSI measurement is LBT bandwidth.
* Ericsson, R4-2011353, Proposal 9: RSSI measurement bandwidth is the LBT bandwidth (which is already decided by RAN1 and specified in TS 38.215).

|  |
| --- |
| **Issue 2-2-1: RSSI measurement BW*** Proposals
	+ Option 1: RSSI measurement bandwidth is the LBT bandwidth
		- Huawei, HiSilicon, Ericsson
* Recommended WF
	+ **The RSSI measurement bandwidth is the LBT bandwidth.**
 |

### Sub-topic 2-3: RSSI measurement period

In the last meeting, the following was agreed:

* + *RSSI measurement period*
		- *The RSSI and CO measurement period depends at least on:*
			* *max(reportInterval, rmtc-Period) in non-DRX when measurement gaps are not required,*
			* *max(reportInterval, rmtc-Period, DRX) in DRX when measurement gaps are not required, or*
			* *max(reportInterval, rmtc-Period, MGRP and gap sharing) in DRX when measurement gaps are required.*
		- *For RSSI measurement within measurement gap, measurement period is scaled with CSSFwithin\_gap,i*
		- *For RSSI measurement outside measurement gap, measurement period is scaled with CSSFoutside\_gap,i*
		- *FFS: For UE not capable of wideband operation in NR-U, RSSI measurement period scales with the number of mOs not requiring measurement gap according to CSSFoutside\_gap,I, CCA*
		- *FFS: Whether the scaling factor of 1.5 shall be used if DRX* *≤ 320ms*

In this sub-topic, the following issues are discussed:

* + Issue 2-3-1 RSSI measurement period when measurement gaps are not required
	+ Issue 2-3-2 RSSI measurement period when measurement gaps are required
	+ Issue 2-3-3 Scaling factor for DRX ≤ 320ms
	+ Issue 2-3-4 CSSF definition

#### Issue 2-3-1 RSSI measurement period when measurement gaps are not required

In this meeting, the following options are discussed:

|  |
| --- |
| **Issue 2-3-1: RSSI measurement period when measurement gaps are not required*** Proposals
	+ Option 1 (Qualcomm, R4-2009871, Proposal 9): When measurement gap is not required, RSSI/CO measurement period is scaled with Nintra-MO, and corresponds to:
		- Nintra-MO.max(reportInterval, rmtc-Period) when DRX is not used
		- Nintra-MO.max(reportInterval, rmtc-Period, DRXcycle length) when DRX is used
	+ where Nintra-MO , reportInterval, and rmtc-Period is defined as the number of measurement objects that can be measured without gaps, configured reporting interval, and configured RMTC period, respectively.
	+ Option 2 (Ericsson , R4-2011353, Proposal 11): The RSSI and CO measurement periods depend on:
		- max(reportInterval, rmtc-Period)\*CSSFoutside\_gap,i in non-DRX when measurement gaps are not required,
		- max(reportInterval, rmtc-Period, DRX)\*CSSFoutside\_gap,i in DRX when measurement gaps are not required,
	+ Option 3 (MediaTek, R4-2010215, Proposal 6 and 7) For a RSSI measurement outside measurement gap, measurement period is scaled up by CSSFoutside\_gap, if RMTC is allowed to be overlapped with SMTC. CSSFoutside\_gap is not required if RMTC is not allowed to be overlapped with SMTC.
		- No requirement for the RMTC which is overlapping with SMTC.
* Recommended WF
	+ **More discussion is needed.**
	+ In the discussion, address the following:
		- Should RAN4 specify requirements for the case in which RMTC and SMTC are overlapping?
		- Should the measurement period be scaled by CSSFoutside\_gap or Nintra-MO ?
 |

#### Issue 2-3-2 RSSI measurement period when measurement gaps are required

In this meeting, the following options are discussed:

|  |
| --- |
| **Issue 2-3-2: RSSI measurement period when measurement gaps are required*** Proposals
	+ Option 1 (Qualcomm, R4-2009871, Proposal 10): When measurement gap is required, RSSI/CO measurement period corresponds to:

• max(reportInterval, rmtc-Period, MGRP).CSSFinter when DRX is not used • max(reportInterval, rmtc-Period, MGRP, DRXcycle length).CSSFinter when DRX is usedwhere CSSFinter is determined according to CSSFwithin-gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps”"* + Option 2 (Ericsson , R4-2011353, Proposal 11): The RSSI and CO measurement periods depend on.
		- max(reportInterval, rmtc-Period, MGRP,DRX)\* CSSFwithin\_gap,i in DRX when measurement gaps are required
* Recommended WF
	+ **More discussion is needed.**
 |

#### Issue 2-3-3 Scaling factor for DRX ≤ 320ms

|  |
| --- |
| **Issue 2-3-3: RSSI measurement period when measurement gaps are required*** Proposals
	+ Option 1 (Nokia, R4-2010592, Proposal 11): For RSSI measurements, do not use the scaling factor of 1.5 when DRX ≤ 320ms.
* Recommended WF
	+ **For RSSI Measurements, do not use the scaling factor of 1.5 when DRX ≤ 320ms.**
 |

#### Issue 2-3-4 CSSF outside measurement gaps

|  |
| --- |
| **Issue 2-3-4: CSSF definition outside measurement gaps*** Proposals
	+ Option 1 (Ericsson, R4-2010592, Proposal 12): CSSF outside measurement gaps needs also to be adapted to account for RSSI/CO measurements.
* Recommended WF
	+ **Discussion is needed, this issue depends on issue 2-3-1.**
 |

### Sub-topic 2-4: Scheduling restriction during RSSI measurements

In the last meeting, the following was agreed:

* ***Issue 2-4-6: Scheduling restriction during RSSI/CO measurements***
* *Candidate Options:*
	+ *Option 1: Define scheduling restriction during RSSI/CO measurements and differentiate the cases where deriveSSB\_IndexFromCell is enabled or not for the definition of scheduling restrictions during RSSI/CO measurements.*
	+ *Option 2: Define scheduling restriction during RSSI/CO measurements and do not define differentiation between the cases in which deriveSSB\_IndexFromCell is enabled or not for the definition of scheduling restrictions during RSSI/CO measurements*
	+ *Option 3: No need to define scheduling restrictions for RSSI measurements in NR-U.*

The issues discussed in this sub-topic are:

Issue 2-4-1 RAN4 to define scheduling restrictions during RSSI/CO measurements

Issue 2-4-2 Differentiate the scheduling restriction during RSSI measurements when deriveSSB\_indexFromCell is enabled or not

Issue 2-4-3 Exact definition of scheduling restriction during RSSI/CO measurements

Issue 2-4-4 Define scheduling restriction during RSSI measurements when the configured SCS in RMTC is different from the data SCS

#### Issue 2-4-1 RAN4 to define scheduling restrictions during RSSI/CO measurements

**Option 1: Yes**

* Huawei, HiSilicon, R4-2011086, Proposal 4: Define scheduling restrictions during RSSI/CO measurements and do not differentiate the cases in which deriveSSB\_indexFromCell is enabled or not for the definition of the scheduling restriction.
* Nokia, Nokia Shanghai Bell, R4-2010592, Proposal 9: The scheduling restriction for RSSI measurements does not depend on deriveSSB\_IndexFromCell being enabled or not.
* Nokia, Nokia Shanghai Bell, R4-2010592, Proposal 10: Define the scheduling restriction for RSSI measurements as: the UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI symbols, and on 1 data symbol before RSSI symbols and 1 data symbol after RSSI symbols within RMTC window duration
* Qualcomm, R4-2009871, Proposal 11: When the UE performs intra-frequency RSSI/CO measurements in unlicensed spectrum, the following restrictions apply due to RSSI/CO measurements
	+ - The UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI measurement symbols configured by RMTC, and on 1 data symbol before the first RSSI measurement symbol configured by RMTC, and 1 data symbol after the last RSSI measurement symbol configured by RMTC
	+ When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.
* MediaTek, R4-2010215, Proposal 8: If deriveSSB\_IndexFromCell is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within RMTC window duration.
* MediaTek, R4-2010215, Proposal 9: Scheduling restriction shall apply on the RMTC window duration if the SCS configured in RMTC is different from the SCS of data.

**Option 2: No**

* Ericsson, R4-2011353, Proposal 10: No need to define scheduling restrictions for RSSI measurements in NR-U.

|  |
| --- |
| **Issue 2-4-1: RAN4 to define scheduling restrictions during RSSI/CO measurements*** Proposals
	+ Option 1: Yes
		- Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Qualcomm, MediaTek
	+ Option 2: No
		- Ericsson
* Recommended WF
	+ **RAN 4 to define scheduling restrictions during RSSI/CO measurements**
		- The majority of companies support defining scheduling restrictions during RSSI/CO measurements.
 |

#### Issue 2-4-2 Differentiate the scheduling restriction during RSSI measurements when deriveSSB\_indexFromCell is enabled or not

**Option 1: No**

* Huawei, HiSilicon, R4-2011086, Proposal 4: Define scheduling restrictions during RSSI/CO measurements and do not differentiate the cases in which deriveSSB\_indexFromCell is enabled or not for the definition of the scheduling restriction.
* Nokia, Nokia Shanghai Bell, R4-2010592, Proposal 9: The scheduling restriction for RSSI measurements does not depend on deriveSSB\_IndexFromCell being enabled or not.
* Nokia, Nokia Shanghai Bell, R4-2010592, Proposal 10: Define the scheduling restriction for RSSI measurements as: the UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI symbols, and on 1 data symbol before RSSI symbols and 1 data symbol after RSSI symbols within RMTC window duration
* Qualcomm, R4-2009871, Proposal 11: When the UE performs intra-frequency RSSI/CO measurements in unlicensed spectrum, the following restrictions apply due to RSSI/CO measurements
	+ - The UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI measurement symbols configured by RMTC, and on 1 data symbol before the first RSSI measurement symbol configured by RMTC, and 1 data symbol after the last RSSI measurement symbol configured by RMTC
	+ When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

**Option 2: Yes**

* MediaTek, R4-2010215, Proposal 8: If deriveSSB\_IndexFromCell is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within RMTC window duration.

|  |
| --- |
| **Issue 2-4-2: Differentiate the scheduling restriction during RSSI measurements when deriveSSB\_indexFromCell is enabled or not*** Proposals
	+ Option 1: No
		- Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Qualcomm
	+ Option 2: Yes
		- MediaTek
* Recommended WF
	+ **For scheduling restrictions during RSSI/CO measurements, do not differentiate the cases in which deriveSSB\_indexFromCell is enabled or not**
		- The majority of companies support not differentiating cases in which deriveSSB\_indexFromCell is enabled or not
 |

#### Issue 2-4-3 Exact definition of scheduling restriction during RSSI/CO measurements

|  |
| --- |
| **Issue 2-4-3: Exact definition of scheduling restriction during RSSI/CO measurements*** Proposals
	+ Option 1 (Nokia, Nokia Shanghai Bell, R4-2010592, Proposal 10): Define the scheduling restriction for RSSI measurements as: the UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI symbols, and on 1 data symbol before RSSI symbols and 1 data symbol after RSSI symbols within RMTC window duration
	+ Option 2 (Qualcomm, R4-2009871, Proposal 11) When the UE performs intra-frequency RSSI/CO measurements in unlicensed spectrum, the following restrictions apply due to RSSI/CO measurements
		- The UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI measurement symbols configured by RMTC, and on 1 data symbol before the first RSSI measurement symbol configured by RMTC, and 1 data symbol after the last RSSI measurement symbol configured by RMTC
	+ When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.
* Recommended WF
	+ Both proposals are similar, varying only on the text. Companies could indicate the preferred option, or if they have concerns with these proposals.
 |

#### Issue 2-4-4 Define scheduling restriction during RSSI measurements when the configured SCS in RMTC is different from the data SCS

|  |
| --- |
| **Issue 2-4-4: Define scheduling restriction during RSSI measurements when the configured SCS in RMTC is different from the data SCS*** Proposals
	+ Option 1 (MediaTek, R4-2010215, Proposal 9): Scheduling restriction shall apply on the RMTC window duration if the SCS configured in RMTC is different from the SCS of data.
* Recommended WF
	+ Discuss the proposal.
 |

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 2-1: Sub topic 2-2:….Others: |
| Huawei  | Sub topic 2-1 Issue 2-1-1We support the recommended WF.Sub topic 2-1 Issue 2-1-2We support the recommended WF.Sub topic 2-2 Issue 2-2-1We support the recommended WF.Sub topic 2-4 Issue 2-4-1We support the recommended WF.Sub topic 2-4 Issue 2-4-2We support the recommended WF.Sub topic 2-4 Issue 2-4-3It is further decided by the conclusion of issue 2-1-1 and 2-1-2. From our understanding, when the RSSI BW is fully confined within the active BWP, UE will use the SCS of the BWP. When the RSSI is not fully confined within the BWP, gap is needed. Thus we think the scheduling restriction may not needed.Moderator: Is the comment above to issue 2-4-4? |
| ZTE | Issue 2-1-2: Support the recommended WF.Issue 2-4-1: We think scheduling restrictions should be defined in this case, support Option 1. |
| Mediatek | Issue 2-1-1: We support the recommended WF.Issue 2-1-2: We support the recommended WF.Issue 2-2-1: We do not support the recommended WF.The RSSI measurement bandwidth that UE actually used can be discussed in the performance part. The actual UE BW for RSSI measurement bandwidth can be up to UE implementation, as long as UE fulfils the measurement accuracy and delay requirements. Issue 2-3-1:We prefer not to specify requirements for the case in which RMTC and SMTC are overlapping. If RMTC and SMTC are overlapping, the RSSI measurement will be biased since it captures SSBs but not actual loading information. And requirements can be simplified. Without the overlapping case, the measurement period can be simply scaled by the # of MO contains RMTC.  With the overlapping case, the measurement period should be scaled up by CSSFoutside\_gap, to include both SSB based measurement and RSSIBesides, it seems a typo on Option 2, where CSSF should be out side the max(.).Issue 2-3-2:OK with Option 1. It seems a typo on Option 2, where CSSF should be outside the max(.). And then it makes no difference between option 1 & 2.Issue 2-3-3: We support the recommended WF.Issue 2-3-4: We agree the CSSF should account for the RSSI/CO. And it needs to further discuss on how to account. E.g. if one MO contains both SSB based measurement and RSSI measurement, how to calculate the CSSF. Issue 2-4-1: We support the recommended WF.Issue 2-4-2:Before we agree on the WF, we need to understand what is the timing reference of RMTC ?If the timing reference is a serving cell or a single cell, then it is not necessary to define the cases depending on *deriveSSB\_indexFromCell*, since there is no sync/async question. In R15, the timing reference of RSRQ is clearly specified in 38.215 but it is unclear for RSSI. Issue 2-4-3:It’s unclear why “+1/-1 data symbol” is required for purely RSSI measurement.It is also related to the timing reference assumption, as mentioned in issue 2-4-2.If the timing reference is a serving cell or a single cell, then there is no issue such as SSB from different cells arriving in different time, and thus “+1/-1 data symbol” is not necessary. Further comment: It’s still unclear to us how the RMTC timing is impacted by the async scenario.The difference between aync and unsync is neighboring cell’s timing. However, RSSI measurement is for a carrier rather than for a specific cell, so we don’t understand why “+1/-1 symbol” is necessary for the async scenario.Issue 2-4-4:It would depend on the issue 2-1-2. For RSSI measurements outside the active DL BWP, the scheduling restriction would be needed if no gap is considered.For RSSI measurements within the active DL BWP, the scheduling restriction is not required, since the UE does not expect a non-integer number of symbol(s) with respect to the numerology of the active DL BWP as the note in RAN1 LS. |
| Qualcomm | Issue 2-1-1: Support WF.Issue 2-1-2: support WF.Issue 2-2-1: this can be discussed in the perf phase. We don’t understand why this has to be specified and believe the only requirement from UE side is to meet the accuracy requirements. How UE meets these requirements is left to UE implementation. Cannot support WF.Issue 2-3-1: Support option 1. We don’t understand why measurement period should be scaled with CSSFoutside,gap since RMTC is generally configured to be non-overlapping with SMTC. For the scenario of overlapping SMTC and RMTC, our view is that RAN4 should not define requirements in this case since RSSI/CO results are not useful anyway.Issue 2-3-2: Support option 1 which is more accurate and specific compared to option 2. Issue 2-3-3: We can support the WF but we think before this agreement, RAN4 should agree that SMTC and RMTC will be non-overlapping.Issue 2-3-4: Option 1 is not agreeable based on our comments in issue 2-3-1.Issue 2-4-1: Option 1 clearly makes sense.Issue 2-4-2: support WF. Irrespective of timing reference, this is not needed since deriveSSB\_indexFromCell does not have anything to do with RSSI measurement over RMTC window.Issue 2-4-3: support WF and agree that the proposals are similar. In response to MTK about +/- 1 symbol, this is needed for async scenario since the symbol boundary of RMTC may not align with serving cell symbol boundary.Issue 2-4-4: Not needed. If RSSI BW is outside of active DL BWP, then UE needs a measurement gap and scheduling restriction is obvious. If RSSI BW is contained in active DL BWP, UE behavior is specified in RAN1 agreement.  |
| Ericsson | 2-1-1: “No additional condition is needed for the intra-frequency measurement definition” is acceptable, but the clarification wording “…will always be performed using the numerology of the active DL BWP…” is confusing since the configured SCS is still used to define the duration.Moderator: That text is not part of the suggested WF. It will not be captured in any agreement.2-1-2: agree with the recommended WFIssue 2-2-1: agree with the recommended WFIssue 2-3-1: Option 2 (the typo is corrected, thanks MediaTek). To not limit NW flexibility, the overlapping case for RMTC and SMTC should also be covered by the requirements. The scaling should be by CSSF.Issue 2-3-2: Option 2 (CSSF is the one within gap not inter-frequency CSSF)Issue 2-3-3: agree with the recommended WFIssue 2-3-4: option 1Issue 2-4-1: the recommended WF is acceptableIssue 2-4-2: Option 1 |
| Apple | Issue 2-1-1: agree with recommended WFIssue 2-1-2: agree with recommended WFIssue 2-2-1: agree with recommended WFIssue 2-3-1: We agree with MTK and QC that RAN4 does not need to specify requirement when SMTC overlapping with RMTC. But we have question on option 1 about scaling factor Nintra-MO, if two mOs are configured with different frequencies but both of them are RSSI measurement without MG e.g. in two CCs of a NR-U CA, should it also be counted in the scaling factor Nintra-MO? Except this question, we are fine with option 1.Issue 2-3-2: fine with option 1.Issue 2-3-3: agree with recommended WFIssue 2-3-4: same comment as to issue 2-3-1.Issue 2-4-1: agree with recommended WFIssue 2-4-2: we think most likely the reference time to apply the RMTC is based on the serving cell timing, and option 1 makes sense.Issue 2-4-3: we agree with MTK observation that if the RMTC window is referred to the serving cell timing, then 1 symbol before and after RMTC might be not necessary.Issue 2-4-4: No need to have this scheduling restriction since mix numerologies within active BWP for RSSI/CO measurement does not exist. |
| Intel | **Issue 2-1-1: Intra-frequency RSSI measurement definition**Support Option 1. And the recommended WF can be agreed.**Issue 2-1-2: Need for measurement gaps in RSSI measurements**Just clarify, the scenario defined in WF is actual inter-frequency measurement with gap?Issue 2-2-1: The recommended WF can be agreed.Issue 2-4-1The recommended WF can be agreed |
| Nokia | Issue 2-1-1: agree with the recommended WF. Issue 2-1-2: agree with the recommended WF.Issue 2-2-1: agree with the recommended WF. We see that it is important to define this in the core requirements to avoid the issue that happened in the LTE-LAA RSSI measurements. Furthermore, this is anyway what is defined in the RAN1 specification.Issue 2-3-1: We agree with Ericsson. We can have two sets of requirements Option 1 (depending on the clarification asked from Apple) for the non-overlapping case and option 2 for the overlapping case. This way we do not limit the network implementation.Issue 2-3-2: With the correction, option 1 and 2 are very similar. Agree with option 1 because it is more complete than option 2.Issue 2-3-3: Agree with the recommended WF.Issue 2-4-1: Agree with the recommended WF.Issue 2-4-2: Agree with the recommended WF.Issue 2-4-3: We are OK with proposal 2 which is more complete than option 1.Issue 2-4-4: We don’t think this is necessary. In the active DL BWP, the SCS used in the measurement is the same from the SCS of active DL BWP per RAN1 LS. Outside the active DL BWP the measurement SCS is up to UE implementation, and it might require gap anyway (pending discussions above). |

### CRs/TPs comments collection

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

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

|  |
| --- |
| **Issue 2-1-1: Intra-frequency RSSI measurement definition***There was no objection to the recommended WF. One company mentioned that the clarification was not clear, but the moderator explained that the clarification was not part of the agreement. Therefore, we believe that the recommended WF is agreeable.**Tentative agreements:* **No additional condition is needed for the intra-frequency measurement definition** |

|  |
| --- |
| **Issue 2-1-2: Need for measurement gaps in RSSI measurements***There was no objection to the recommended WF.* *Tentative agreements:* **Measurement gaps are needed for RSSI/CO measurements when RSSI BW is not fully within the active DL BWP of the UE.**  |

|  |
| --- |
| **Issue 2-2-1: RSSI measurement BW***Tentative agreements: No**Candidate options:** + Option 1 (Ericsson, Apple, Intel and Nokia): RSSI measurement bandwidth is the LBT bandwidth
	+ Option 2 (MediaTek, Qualcomm): The discussion can take place in the performance work

*Recommendations for 2nd round:* |

|  |
| --- |
| **Issue 2-3-1: RSSI measurement period when measurement gaps are not required***Tentative agreements: No. During the discussions, companies also included their views on whether RAN4 should specify requirements for the case in which SMTC and RMTC are overlapping. Therefore, the original options were slightly modified to take into account this. The modified part is underlined. The original Option 3 was excluded, because it is covered by the new Option 1, and a new Option 3 was created instead.**Candidate options:** + Option 1 (MediaTek, Qualcomm, [Apple]) : Not to specify requirements for the case in which the SMTC is overlapping with RMTC. When measurement gap is not required, RSSI/CO measurement period is scaled with Nintra-MO, and corresponds to:
		- Nintra-MO.max(reportInterval, rmtc-Period) when DRX is not used
		- Nintra-MO.max(reportInterval, rmtc-Period, DRXcycle length) when DRX is used
	+ where Nintra-MO , reportInterval, and rmtc-Period is defined as the number of measurement objects that can be measured without gaps, configured reporting interval, and configured RMTC period, respectively.
	+ Option 2 (Ericsson): To specify requirements also when the SMTC and RMTC are overlapping. The RSSI and CO measurement periods depend on:
		- max(reportInterval, rmtc-Period)\*CSSFoutside\_gap,i in non-DRX when measurement gaps are not required,
		- max(reportInterval, rmtc-Period, DRX)\*CSSFoutside\_gap,i in DRX when measurement gaps are not required,
	+ Option 3 (Nokia) To have requirements for both cases. Option 1 for when the RMTC and SMTC are not overlapping, and Option 2 for when the RMTC and SMTC are overlapping.

*Recommendations for 2nd round: Suggest to take this discussion to the GTW*Continue the discussions considering the new options. Apple asked for clarification on option 1: *“if two mOs are configured with different frequencies but both of them are RSSI measurement without MG e.g. in two CCs of a NR-U CA, should it also be counted in the scaling factor Nintra-MO?”*  |

|  |
| --- |
| **Issue 2-3-2: RSSI measurement period when measurement gaps are required***Tentative agreements: No. Most of the companies agree with Option 1. Ericsson made one comment: “*Option 2 (CSSF is the one within gap not inter-frequency CSSF)*”, which is consistent with the WF from the last meeting. Therefore, we included a third option.* *Candidate options:** + Option 1 (MediaTek, Qualcomm, Apple and Nokia): When measurement gap is required, RSSI/CO measurement period corresponds to:

• max(reportInterval, rmtc-Period, MGRP).CSSFinter when DRX is not used • max(reportInterval, rmtc-Period, MGRP, DRXcycle length).CSSFinter when DRX is usedwhere CSSFinter is determined according to CSSFwithin-gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps”"* + Option 2 (Ericsson): The RSSI and CO measurement periods depend on.
		- max(reportInterval, rmtc-Period, MGRP,DRX)\* CSSFwithin\_gap,i in DRX when measurement gaps are required
	+ Option 3 (Moderator): When measurement gap is required, RSSI/CO measurement period corresponds to:

• max(reportInterval, rmtc-Period, MGRP). CSSFwithin\_gap,i when DRX is not used • max(reportInterval, rmtc-Period, MGRP, DRXcycle length) CSSFwithin\_gap,i when DRX is usedwhere CSSFwithin-gap,i is determined in clause 9.1.5.2 for measurement conducted within measurement gaps”"*Recommendations for 2nd round:*Is Option 3 agreeable? |

|  |
| --- |
| **Issue 2-3-3: Scaling factor for DRX ≤ 320ms** *There was no objection to the proposed WF.**Tentative agreements:* **For RSSI Measurements, do not use the scaling factor of 1.5 when DRX ≤ 320ms.** |

|  |
| --- |
| **Issue 2-3-4: CSSF definition outside measurement gaps***Tentative agreements: No, this discussion depends on the item 2-3-1.* *Candidate options:** + Option 1 (Ericsson, MediaTek, Qualcomm and Apple): CSSF outside measurement gaps needs also to be adapted to account for RSSI/CO measurements.

*Recommendations for 2nd round:*If RAN4 agrees that requirements are also needed in the case in which there is RMTC overlap with SMTC, is Option 1 agreeable?  |

|  |
| --- |
| **Issue 2-4-1: RAN4 to define scheduling restrictions during RSSI/CO measurements**There was no objection to the recommended Way Forward.*Tentative agreements:* **RAN 4 to define scheduling restrictions during RSSI/CO measurements** |

|  |
| --- |
| **Issue 2-4-2: Differentiate the scheduling restriction during RSSI measurements when deriveSSB\_indexFromCell is enabled or not***There was a question for clarification from MediaTek: what is the timing reference of RMTC ? MediaTek mentioned that if it is the serving cell, Option 1 can be agreed. Some companies mentioned that we can assume it is the serving cell timing, other companies mentioned it does not matter for the purpose of RSSI measurements.* *Tentative agreements: No.* *Candidate options:** + Option 1 (Huawei, Ericsson, Qualcomm, Apple and Nokia): For scheduling restrictions during RSSI/CO measurements, do not differentiate the cases in which deriveSSB\_indexFromCell is enabled or not

*Recommendations for 2nd round:*Discuss MediaTek’s concerns with this option and try to agree on Option 1.  |

|  |
| --- |
| **Issue 2-4-3: Exact definition of scheduling restriction during RSSI/CO measurements***In general there was no opposition to Option 1, other than questions on whether it is necessary to include the +1 -1 data symbol for RSSI measurements, from MediaTek and Apple. Qualcomm mentioned that it is necessary due to the async scenarios. Therefore, the moderator suggests to agree in the rest of the proposal, and keep discussing whether to include the “+1-1 data symbol” in the scheduling restriction.* * + *Tentative agreements:*
	+ When the UE performs intra-frequency RSSI/CO measurements in unlicensed spectrum, the following restrictions apply due to RSSI/CO measurements
		- The UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI measurement symbols configured by RMTC.
	+ When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.
	+ FFS: whether it is necessary to include the restriction on 1 data symbol before the first RSSI measurement symbol configured by RMTC, and 1 data symbol after the last RSSI measurement symbol configured by RMTC

*Candidate options:** + Option 1: include the restriction on 1 data symbol before the first RSSI measurement symbol configured by RMTC, and 1 data symbol after the last RSSI measurement symbol configured by RMTC
	+ Option 2: do not include the restriction.

*Recommendations for 2nd round:*Discuss the options and FFS in the agreement.  |

|  |
| --- |
| **Issue 2-4-4: Define scheduling restriction during RSSI measurements when the configured SCS in RMTC is different from the data SCS***The majority of companies did not support the introduction of these scheduling restrictions. Huawei and MediaTek mentioned that it depended on the conclusions of Issues 2-1-1 and 2-1-2. In their comments they made it clear that if RSSI measurements outside the active DL BWP requires gaps (as agreed in 2-1-2), the restriction would not be needed.* *Tentative agreements:*Do not define scheduling restriction when the RMTC window duration if the SCS configured in RMTC is different from the SCS of data.  |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

|  |
| --- |
| **Issue 2-1-1: Intra-frequency RSSI measurement definition***From the 1st round:* Agreement: No additional condition is needed for the intra-frequency measurement definition |

|  |
| --- |
| **Issue 2-1-2: Need for measurement gaps in RSSI measurements***From the 1st round:* Agreement: Measurement gaps are needed for RSSI/CO measurements when RSSI BW is not fully within the active DL BWP of the UE.  |

|  |
| --- |
| **Issue 2-2-1: RSSI measurement BW***Tentative agreements: No**Candidate options:** + Option 1 (Ericsson, Apple, Intel and Nokia): RSSI measurement bandwidth is the LBT bandwidth
	+ Option 2 (MediaTek, Qualcomm): The discussion can take place in the performance work

*Recommendations for 2nd round:* Continue the discussions. However, since this is the last meeting for NR-U, if RAN4 does not reach an agreement, would it be acceptable to discuss it in the performance work?  |
| **Qualcomm:** Option 2. Core requirements have priority.  |
| **Apple:** we are fine with option 1 but can also accept to further discuss in perf part. |
| Huawei: Prefer option 1 but ok with option 2. As analyzed before, the measurement BW for RSSI is not only related to the measurement accuracy. The measurement results over 20 MHz and 5 MHz is completely different to NW without normalization. |
| **Mediatek**: Option2 to further discuss in perf part. |

|  |
| --- |
| **Issue 2-3-1: RSSI measurement period when measurement gaps are not required***Agreement from the GTW session on August, 24th.* * Agreement:
	+ SMTC and RMTC are overlapping
		- The RSSI and CO measurement periods depend on:
			* max(reportInterval, rmtc-Period)\*CSSFoutside\_gap,i in non-DRX when measurement gaps are not required,
			* max(reportInterval, rmtc-Period, DRX)\*CSSFoutside\_gap,i in DRX when measurement gaps are not required,
			* CSSFoutside\_gap,i takes into account the overlap between SMTC and RMTC
	+ SMTC and RMTC are not overlapping
		- RSSI/CO measurement period is scaled with Nintra-MO, and corresponds to:
			* Nintra-MO.max(reportInterval, rmtc-Period) when DRX is not used
			* Nintra-MO.max(reportInterval, rmtc-Period, DRXcycle length) when DRX is used
			* where Nintra-MO , reportInterval, and rmtc-Period is defined as the number of measurement objects that can be measured without gaps, configured reporting interval, and configured RMTC period, respectively.
 |

|  |
| --- |
| **Issue 2-3-2: RSSI measurement period when measurement gaps are required***Tentative agreements: No. Most of the companies agree with Option 1. Ericsson made one comment: “*Option 2 (CSSF is the one within gap not inter-frequency CSSF)*”, which is consistent with the WF from the last meeting. Therefore, we included a third option.* *Candidate options:** + Option 1 (MediaTek, Qualcomm, Apple and Nokia): When measurement gap is required, RSSI/CO measurement period corresponds to:

• max(reportInterval, rmtc-Period, MGRP).CSSFinter when DRX is not used • max(reportInterval, rmtc-Period, MGRP, DRXcycle length).CSSFinter when DRX is usedwhere CSSFinter is determined according to CSSFwithin-gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps.”* + Option 2 (Ericsson): The RSSI and CO measurement periods depend on.
		- max(reportInterval, rmtc-Period, MGRP,DRX)\* CSSFwithin\_gap,i in DRX when measurement gaps are required
	+ Option 3 (Moderator): When measurement gap is required, RSSI/CO measurement period corresponds to:

• max(reportInterval, rmtc-Period, MGRP). CSSFwithin\_gap,i when DRX is not used • max(reportInterval, rmtc-Period, MGRP, DRXcycle length) CSSFwithin\_gap,i when DRX is usedwhere CSSFwithin-gap,i is determined in clause 9.1.5.2 for measurement conducted within measurement gaps.”*Recommendations for 2nd round:*Is Option 3 agreeable? |
|  |
| **Qualcomm:** Option 3 is ok to us.**Comments Company B** |
| **Apple:** fine with option 3 |
| **Mediatek:** fine with option 3 |

|  |
| --- |
| **Issue 2-3-3: Scaling factor for DRX ≤ 320ms** *Agreement on the 1st round:* Agreement: For RSSI Measurements, do not use the scaling factor of 1.5 when DRX ≤ 320ms. |

|  |
| --- |
| **Issue 2-3-4: CSSF definition outside measurement gaps***Tentative agreements: No, this discussion depends on the item 2-3-1.* *Candidate options:** + Option 1 (Ericsson, MediaTek, Qualcomm and Apple): CSSF outside measurement gaps needs also to be adapted to account for RSSI/CO measurements.

*Recommendations for 2nd round:*If RAN4 agrees that requirements are also needed in the case in which there is RMTC overlap with SMTC, is Option 1 agreeable?  |
| **Qualcomm:** I believe option 1 was agreed in GTW.  |
| **Mediatek:** no need to discussed, since it has been captured in Issue 2-3-1. |

|  |
| --- |
| **Issue 2-4-1: RAN4 to define scheduling restrictions during RSSI/CO measurements***Agreement on the 1st round:* Agreement: RAN 4 to define scheduling restrictions during RSSI/CO measurements |

|  |
| --- |
| **Issue 2-4-2: Differentiate the scheduling restriction during RSSI measurements when deriveSSB\_indexFromCell is enabled or not***There was a question for clarification from MediaTek: what is the timing reference of RMTC ? MediaTek mentioned that if it is the serving cell, Option 1 can be agreed. Some companies mentioned that we can assume it is the serving cell timing, other companies mentioned it does not matter for the purpose of RSSI measurements.* *Tentative agreements: No.* *Candidate options:** + Option 1 (Huawei, Ericsson, Qualcomm, Apple and Nokia): For scheduling restrictions during RSSI/CO measurements, do not differentiate the cases in which deriveSSB\_indexFromCell is enabled or not

*Recommendations for 2nd round:*Discuss MediaTek’s concerns with this option and try to agree on Option 1.  |
|  |
| **Qualcomm:** Support option 1.Huawei: Support option 1. It is reasonable to use the serving cell timing. |
| **Mediatek:** We fell that Issue 2-4-2 and Issue 2-4-3 are bundled. ok with option 1 for issue 2-4-2 and option 2 for Issue 2-4-3. |

|  |
| --- |
| **Issue 2-4-3: Exact definition of scheduling restriction during RSSI/CO measurements***In general there was no opposition to Option 1, other than questions on whether it is necessary to include the +1 -1 data symbol for RSSI measurements, from MediaTek and Apple. Qualcomm mentioned that it is necessary due to the async scenarios. Therefore, the moderator suggests to agree in the rest of the proposal, and keep discussing whether to include the “+1-1 data symbol” in the scheduling restriction.* * + *Tentative agreements:*
	+ When the UE performs intra-frequency RSSI/CO measurements in unlicensed spectrum, the following restrictions apply due to RSSI/CO measurements
		- The UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI measurement symbols configured by RMTC.
	+ When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.
	+ FFS: whether it is necessary to include the restriction on 1 data symbol before the first RSSI measurement symbol configured by RMTC, and 1 data symbol after the last RSSI measurement symbol configured by RMTC

*Candidate options:** + Option 1: include the restriction on 1 data symbol before the first RSSI measurement symbol configured by RMTC, and 1 data symbol after the last RSSI measurement symbol configured by RMTC
	+ Option 2: do not include the restriction.

*Recommendations for 2nd round:*Discuss the options and FFS in the agreement.  |
|  |
|  **Qualcomm:** We support option 1 as we don’t see how this is any different than FR1 TDD requirements which also have one symbol before and after. **Comments company B** |
| **Apple:** we think option 2 is more reasonable. The reason is: for FR1 TDD, the +/-1 symbol is because of the misalignment between neighbor cell and serving cell on the same frequency(we considered cell phase misalignment and propagation delay difference). But in this case, if the RMTC is for purely RSSI measurement and the reference timing is based on UE serving cell, then we do not need to consider this +/-1 symbol limitation. |
| Huawei: Similar views as Apple, the RSSI measurement shall be based on the serving cell’s timing as mentioned in issue 2-4-2. There is no need to consider the misalignment. |
| **Mediatek:** We fell that Issue 2-4-2 and Issue 2-4-3 are bundled. ok with option 1 for issue 2-4-2 and option 2 for Issue 2-4-3. |

|  |
| --- |
| **Issue 2-4-4: Define scheduling restriction during RSSI measurements when the configured SCS in RMTC is different from the data SCS***Tentative agreements:*Do not define scheduling restriction when the RMTC window duration if the SCS configured in RMTC is different from the SCS of data. *Recommendation for the 2nd round: Confirm the agreement, since it was not captured in the chairman notes.* |
| **Qualcomm:** Tentative agreement is ok. |
| **Apple:** fine with tentative agreement. |
| **Mediatek:** fine with tentative agreement. |

## Summary on 2nd round (if applicable)

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

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