

# Views on the support of L3 measurements for Rel-18 NR BWP without restrictions

Agenda Item: 9.3.4.14

Source: Intel Corporation

Document for: Decision



# Introduction

- A new RAN4-led WI on “Support for BandWidth Part operation without restriction in NR ” was approved in RAN #99 ([RP-230805](#))
- The WI objective is to enable NR BWP operation without CD-SSB (Rel-15 FG 6-1a) based on several solutions:
  - **Option A)** Perform BM/RLM/BFD based on CSI-RS within active BWP.
  - **Option B-1-1)** Perform BM/RLM/BFD based on SSB outside active BWP using larger BW covering SSB outside active BWP without interruptions.
  - **Option B-1-2)** Perform BM/RLM/BFD based on SSB outside active BWP using larger BW covering SSB outside active BWP with interruptions.
  - **Option C)** NCD-SSB approach which would work with existing UE hardware architectures (FG6-1) and be compatible with existing RAN4 specifications for BM/RLM/BFD.

## Work Item Objectives

- **For Option A**
  - Study and specify if any clarifications of the existing requirements are needed, e.g., applicability of requirements, conditions of gap configuration etc. (RAN4)
- **For Option B-1-1**
  - Specify support of BM/RLM/BFD based on SSB outside the active BWP without interruptions (RAN4, RAN2, RAN1)
- **For Option C**
  - Specify support of BM/RLM/BFD based on NCD-SSB within active BWP for non-RedCap UEs (RAN4, RAN2, RAN1)
- **For Option B-1-2**
  - Specify support of BM/RLM/BFD based on SSB outside the active BWP with interruptions with the following conditions (RAN4, RAN2, RAN1):
    - The UE shall be allowed to use B-1-2 only if there is no CSI-RS, no NCD SSB and no CD SSB configured for RLM/BM/BFD in the active BWP of the corresponding carrier(s) to be measured; and
    - UE shall support option (C) NCD-SSB (subject to IoDT availability).
  - The interruption related requirements will be decided and specified in RAN4.

# RAN4 discussions on L3 measurements in Q2'2023

- The support of L3 intra-frequency measurements for BWP operation without restriction was discussed in RAN4 #106bis-e and #107 meetings based on companies' proposals.
- The common RAN4 understanding is that the **NR\_BWP\_wor WI scope focuses on enabling BM/RLM/BFD measurements, while L3 measurements are not explicitly included in the WI objectives.** Therefore, RAN4 work in Q2'2023 focused on enabling L1 measurements based on NCD-SSB only.
- LS R4-2310177 to RANP was approved and RAN is asked to decide if any updates to the NR\_BWP\_wor WID is needed with respect to support of L3 measurements:

## 1. Overall Description:

RAN4 started the work on WI of complete the specification support for BandWidth Part operation without restriction in NR in the RAN4#106-bis-e meeting. There were proposals on RRM impacts due to L3 measurements for the different options. RAN4 discussed the proposals.

It is a common RAN4 understanding that support of L3 measurement requirements impact for options B-1-1, B-1-2 and C are not explicitly included in the WI objectives. In the RAN4#106-bis-e meeting it was agreed that the support of L3 measurements based on NCD-SSB for Option C can be beneficial. RAN4 is not planning to introduce the support of L3 measurements in Rel-18 unless the respective objectives are included in the NR\_BWP\_wor WID.

Note: the L3 measurements above are L3 SSB-based intra-frequency measurements.

## 2. Actions:

To: RAN Plenary

**ACTION:** RAN4 kindly asks RAN plenary to decide if any updates to the NR\_BWP\_wor WID are needed with respect to support of L3 measurements.

# Support of L3 measurements for BWP operation without restriction

- Previously RAN4 conducted initial analysis of mobility impacts for all Options and summarized in LS R4-2220437 (*LS on BWP operation without bandwidth restriction*)
- L3 measurements are an important part of NW and UE functionality, and respective requirements shall be clarified for all Options
- The mechanism and applicable requirements for the support of L3 intra-frequency measurements for NR BWP operation without restriction for all Options needs to be clarified in order to allow respective network and UE implementations

*Table 3: High-level analysis of candidate options on Mobility performance impact [R4-2220437]*

Options	Technical analysis
Option A	<ul style="list-style-type: none"> <li>• <b>Measurement gap is needed for intra-frequency L3 measurement:</b> i.e., legacy intra-frequency L3 measurements with gap requirements apply.</li> <li>• Measurement gap is needed for inter-frequency L3 measurement</li> </ul>
Option B-1-1	<ul style="list-style-type: none"> <li>• <b>No measurement gap is needed for intra-frequency L3 measurement: i.e., legacy intra-frequency L3 measurements without gap requirements apply.</b></li> <li>• Measurement gap is needed for inter-frequency L3 measurement</li> <li>• Can also help L3 intra-frequency measurement</li> </ul>
Option B-1-2	<ul style="list-style-type: none"> <li>• <b>No measurement gap is needed for intra-frequency L3 measurement: i.e., legacy intra-frequency L3 measurements without gap requirements apply.</b></li> <li>• Measurement gap is needed for inter-frequency L3 measurement</li> </ul>
Option C	<ul style="list-style-type: none"> <li>• <b>Measurement gap may or may not be needed for intra-frequency L3 measurement depending on whether or not NCD-SSBs from all neighbor cells are present within UE active BWP.</b></li> <li>• Measurement gap is needed for inter-frequency L3 measurement.</li> </ul>

# Support of L3 measurements for BWP operation without restriction

## Inter-frequency L3 measurements

- Per RAN4 conclusions “MG is needed for inter-frequency L3 measurements” for all Options and no further clarifications are needed. Existing MG-related requirements would apply.

## Intra-frequency L3 measurements

- **Option A (CSI-RS within active BWP)**
  - RAN4 conclusions “MG is needed for intra-frequency L3 measurement”.
  - Intel view: No further RAN4 work is expected, and existing MG-related requirements would apply.
- **Option B-1-1 and B-1-2 (SSB outside active BWP)**
  - RAN4 conclusions: “No MG is needed for intra-frequency L3 measurement: i.e., legacy intra-frequency L3 measurements without gap requirements apply”
  - Based on TS 38.133 the UE can perform intra-frequency SSB based measurements without MG if: 1) SSB is completely contained in the active BWP of the UE; or 2) the UE indicates ‘no-gap’ via `intraFreq-needForGap` for intra-frequency measurement.
  - Intel view: Respective L3 intra-frequency measurements are already supported depending on UE capabilities (`intraFreq-needForGap`). Clarification on applicability of the respective capability is needed in RAN2 or RAN4 specs.

# Support of L3 measurements for BWP operation without restriction

## Intra-frequency L3 measurements (cont.)

### ▪ Option C (NCD-SSB within active BWP)

- RAN4 conclusions: “MG may or may not be needed for intra-frequency L3 measurement depending on whether NCD-SSBs from all neighbor cells are present within UE active BWP.”
- The existing TS 38.133 does not explicitly allow use of NCD-SSBs for L3 measurements for non-RedCap UEs, while the specification clearly allows use of both CD-SSB and NCD-SSB for RedCap UEs.
- Applicability of NCD-SSB for L3 intra-frequency measurements needs to be specified and requires minimum changes.
- Intel view: Support enabling L3 intra-frequency measurements based on NCD-SSB for Option C capable UEs with minimum specification impact

# Summary

## Conclusions

- The NR\_BWP\_wor WI scope focuses on enabling BM/RLM/BFD measurements, while L3 measurements are not explicitly included in the WI objectives
- Intra-frequency L3 measurements for Options A, B-1-1 and B-1-2 are already supported by the existing specification
- Support of intra-frequency L3 measurements for Option C requires a minor specification update

## Proposals

- Revise the NR\_BWP\_wor WID to introduce support of L3 intra-frequency measurements for Option C (NCD-SSB)
- Further clarify applicability of 'no-gap' intraFreq-needForGap capability for UEs supporting Options A, B-1-1 and B-1-2 in RAN2/4 specs.

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