3GPP TSG-RAN WG2 #121bis R2-2304199

eMeeting, 17th Apr. – 26th Apr 2023

Agenda Item: 7.25.1

Source: MediaTek Inc.

**Title:** **Report of** **[AT121bis-e][023][MGE] Measurements without gap with interruption**

Document for: Discussion and decision

# 1 Introduction

This is report for the following AT121bis-e mail discussion.

* [AT121bis-e][023][MGE] Measurements without gap with interruption (MediaTek)

 Scope: Converge on solution. If possible, revise draft CRs to be agreeable. If needed produce a reply LS (intel, Catt).

 Intended outcome: Report, endorsed CRs (if possible), approved LS out - if needed

 Deadline: EOM (CB online only if needed, otherwise offline only).

Deadline – Tuesday (04/25), 0500 UTC

There may be a need to comeback online, so please provide your initial comment before **Tuesday (04/25), 0500 UTC**. Early feedback is appreciated.

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| MediaTek (Rapp) | Felix Tsai | chun-fan.tsai@mediatek.com |
| Qualcomm Inc | Mouaffac | mambriss@qti.qualcomm.com  |
| CATT | Jie Shi | shijie@catt.cn |
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# 3 Discussion

## 3.1 Backward Compatibility

The current discussion note is as below:

[R2-2302431](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2302431.zip) LS on measurements without gap (R4-2303306; contact: Intel, CATT) RAN4 LS in Rel-18 NR\_MG\_enh2-Core To:RAN2

Moved from 7.25.3

* Noted

[R2-2303103](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CRAN2%5C2304_R2_121bis%5CDocs%5CR2-2303103.zip) Discussion on NeedForGaps with interruption Huawei, HiSilicon discussion Rel-18 NR\_MG\_enh2-Core

[R2-2302776](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CRAN2%5C2304_R2_121bis%5CDocs%5CR2-2302776.zip) Discussion on RAN4 LS for Rel-18 measurement gaps Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_MG\_enh2-Core

DISCUSSION

- MTK think both approaches work (Nokia vs Huawei). Prefers the simpler HW approach but ok in general. HW approach is reflected in the proposed CRs below.

- Nokia think that the issue with legacy is semantical UE indicate gaps when it need interruption.

- MTK and Nokia both think there is a difference of opinion how to interpret the R16 behaviour (and they have different opinions). There is no intention to resolve that part in R2.

- Apple prefer R16 extension, seems to work, but also agrees with Nokias explanation.

- ZTE wonder what is meant by R16 ext, isn’t that the Nokia proposal?

- CATT think we need no update of R16 behaviour ..

- Chair: There seems to be confusion on the detailed level what is proposed.

* Both Noted
* In the current R2 discussion/CRs there is no intention to change legacy definitions or behviour (It is understood that there may be difference of opinions).

RAN2 concluded there is no intention to change legacy behavior (although there may be different view). There should be no further discussion on the meaning of R16 (or R17) fields.

However, during the discussion, some company seems have different understanding on what UE should indicate the Rel-16 fields while the UE reporting new Rel-18 indicator on interruption is needed or not. From rapporteur point of view, it is clear from the LS (see below) that RAN4 are discussing the scenario of “UE report “no-gap” and there is additional capability signaling request to differentiate interruption is needed or not for this scenario.

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| 1. **NR SSB-based inter-frequency and intra-frequency measurements without gaps**

Firstly, for the case of the NR SSB based inter/intra-frequency measurement without gap when UE report “no-gap” via *NeedForGapsInfoNR (Rel16),* RAN4 has discussed this issue and reached the following agreement:

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| **<Agreement in R4#105>*** Introduce additional Rel-18 UE signalling to differentiate UE supporting no gap with interruption
 |

Therefore, RAN4 would like to ask RAN2 to introduce additional Rel-18 UE signalling to enable the UE to indicate to the NW whether interruption is needed for the case of NR SSB based inter/intra-frequency measurement without gap. |

It should be nature to assume the UE also indicating no-gap in Rel-16 NeedForGap signaling while new interruption indicator is reported (as proposed by several companies).

Companies are invited to provide view on this aspect. In particular, do you think there is compatibility issue here.

**Question 1: Do companies agree that UE reporting Rel-18 signaling to indicate “no-gap with interruption” or “no-gap without interruption” should also report “no-gap” in Rel-16 NeedForGap signaling?**

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| **Company** | **Agreed or not** | **Comments** |
| MediaTek | Agreed | We understand this is original intention from RAN4. Legacy gNB who doesn’t understand the Rel-18 fields will just assume measurement gap is NOT needed. It is unclear whether there is interruption, but it doesn’t matter. The situation is the same as handling Rel-16 UE reporting no-gap. Note that there is no R16 RAN4 requirement for Rel-16 NeedForGap feature and that’s why RAN4 is discussing the requirement in this Rel-18 WID.It is strange for a UE to indicate no gap needed (with interruption) in Rel-18 capability but indicating gap is needed in Rel-16 capability.  If companies have strong concern, we can also consider independent reporting of Rel-18 and Rel-16 capability.  |
| Qualcomm Inc | Check comment | In case we agreed on having the Rel-18 extension as part of Rel-16/Rel17, then we need to make sure both reported IEs are consistent.  |
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| CATT | Agree | Considering legacy gNB also needs to know the no-gap information from UE side and only R16 IE could be interpreted, we think this behaviour is right. |
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## 3.2 NR Solution

For NR, according to contribution from companies, there could be several different options to introduce new capability to indicate the interruption is needed or not.

* **Option 1 (new R18 reporting)**: Introduce *NeedForGapsInfoNR-r18*, i.e. {gap, [no-gap-with-interruption], [no-gap-no-Interruption]}.
* **Option 2 (new R18 reporting, including NCSG)**: Introduce *NeedForGapNCSG-InfoNR-r18*, i.e. {gap, ncsg, [no-gap-with-interruption], [no-gap-no-Interruption]}.
* **Option 3 (extend the R16 reporting)**: Introduce a new *NeedForInterruptionInfoNR-r18* IE to indicate whether interruption is needed when UE reports no-gap in *NeedForGapsInfoNR-r16*.

Sample ASN.1 code for option 1

NeedForGapsInfoNR-r18 ::= SEQUENCE {

 intraFreq-needForGap-r18 NeedForGapsIntraFreqList-r18,

 interFreq-needForGap-r18 NeedForGapsBandListNR-r18

}

NeedForGapsIntraFreqList-r18 ::= SEQUENCE (SIZE (1.. maxNrofServingCells)) OF NeedForGapsIntraFreq-r18

NeedForGapsBandListNR-r18 ::= SEQUENCE (SIZE (1..maxBands)) OF NeedForGapsNR-r18

NeedForGapsIntraFreq-r18 ::= SEQUENCE {

 servCellId-r18 ServCellIndex,

 gapIndicationIntra-r18 ENUMERATED {gap, no-gap-with-interruption, no-gap-no-interruption}

}

NeedForGapsNR-r18 ::= SEQUENCE {

 bandNR-r18 FreqBandIndicatorNR,

 gapIndication-r18 ENUMERATED {gap, no-gap-with-interruption, no-gap-no-interruption}

}

Sample ASN.1 code for option 2

NeedForGapNCSG-InfoNR-r18 ::= SEQUENCE {

 intraFreq-needForNCSG-r18 NeedForNCSG-IntraFreqList-r18,

 interFreq-needForNCSG-r18 NeedForNCSG-BandListNR-r18

}

NeedForNCSG-IntraFreqList-r18 ::= SEQUENCE (SIZE (1.. maxNrofServingCells)) OF NeedForNCSG-IntraFreq-r18

NeedForNCSG-BandListNR-r18 ::= SEQUENCE (SIZE (1..maxBands)) OF NeedForNCSG-NR-r18

NeedForNCSG-IntraFreq-r18 ::= SEQUENCE {

 servCellId-r18 ServCellIndex,

 gapIndicationIntra-r18 ENUMERATED {gap, ncsg, no-gap-with-interruption, no-gap-no-interruption}

}

NeedForNCSG-NR-r18 ::= SEQUENCE {

 bandNR-r18 FreqBandIndicatorNR,

 gapIndication-r18 ENUMERATED {gap, ncsg, no-gap-with-interruption, no-gap-no-interruption}

}

Sample ASN.1 code for option 3

NeedForInterruptionInfoNR-r18 ::= SEQUENCE {

 intraFreq-needForInterruption-r18 SEQUENCE(SIZE (1.. maxNrofServingCells)) OF NeedForInterruptionNR-r18,

 interFreq-needForInterruption-r18 SEQUENCE(SIZE (1..maxBands)) OF NeedForInterruptionNR-r18

}

NeedForInterruptionNR-r18 ::= SEQUENCE {

 intrIndication-r18 ENUMERATED {no-gap-with-interruption, no-gap-no-interruption} OPTIONAL

}

Note that companies prefer O3 should agree on Q1. Companies prefer O1 or O2 could agree on Q1, which implies additional field description to ensure “consistent” reporting from UE.

**Question 2: Which option do companies prefer to introduce new Rel-18 gap with interruption capability in NR?**

* **Option 1 (new R18 reporting)**: Introduce *NeedForGapsInfoNR-r18*, i.e. {gap, [no-gap-with-interruption], [no-gap-no-Interruption]}.
* **Option 2 (new R18 reporting, including NCSG)**: Introduce *NeedForGapNCSG-InfoNR-r18*, i.e. {gap, ncsg, [no-gap-with-interruption], [no-gap-no-Interruption]}.
* **Option 3 (extend the R16 reporting)**: Introduce a new *NeedForInterruptionInfoNR-r18* IE to indicate whether interruption is needed when UE reports no-gap in *NeedForGapsInfoNR-r16*.
* **Other** – Please provide in your comments

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| **Company** | **Preferred option** | **Comments** |
| MediaTek | Option 3 | We believe that O3 is more aligned with RAN4 intention. O1/O2 could also work but request more SPEC change. |
| Qualcomm Inc | Option-2 | Reason behind supporting Option-2:* Option-1 seems incomplete version of option-2 as it does not provide the “NCSG” option. So for sake of completeness option-2 seems more adequate to cover all possible cases.
* Option-3 is an extension of Rel.16, so if UE does not support Rel-16 MGE feature, instead it only supports Rel-17 MGE, in this case, this UE won’t be able to support the “no gap with interruption” option, as Rel-17 only has “gap/no-gap-no-ncsg/no-ga-ncsg”. So extending Rel.16, is not enough, we need to extend Rel.17 as well in this case.
 |
| CATT | See comments. | The legacy gap indication for NSCG is similar as follows. If we extend it to NSCG, this R18 IE in option2 seems not correct. It should include the case of no gap with no interruption, no gap with interruption, no gap and no NCSG and with interruption, no gap and no NCSG with interruption. Furthermore, if we agree to introduce the interruption case to NSCG, the correct way may be to make the *NeedForGapNCSG-InfoNR-r18 includ* no gap and no NCSG and with intterrupiton, no gap and no NCSG with interruption, at the same time, to extent *NeedForGapsInfoNR-r16* with no gap with no interruption, no gap with interruption as what is done in option 3.NeedForNCSG-IntraFreq-r17 ::= SEQUENCE { servCellId-r17 ServCellIndex, gapIndicationIntra-r17 ENUMERATED {gap, ncsg, nogap-noncsg}}Besidse, the UE only reporting R17 IE not R16 IE seems a corner case, as we know, some combination of legacy IE and new IE is applied to indicate a specific case is a common method in RAN2. |
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One company ([R2-2303400](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CRAN2%5C2304_R2_121bis%5CDocs%5CR2-2303400.zip)) suggests to discuss whether to introduce a network configuration to enable Rel-18 interruption reporting.

Rapporteur understands for option 1 or 2, new network configuration to enable Rel-18 interruption reporting is needed while in option 3, it may reuse the existing control flag from Rel-16.

If there is new network configuration to enable the reporting, it seems that we should also have new capability to indicate that whether the UE supports the interruption reporting.

**Question 3: Whether a network configuration (like *NeedForGapsConfigNR-r16*) to enable Rel-18 interruption reporting is needed? Whether a new capability (like *nr-NeedForGap-Reporting-r16*) to indicate UE supporting of Rel-18 interruption reporting is needed?**

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| **Company** | **New control (O1, O2)** | **New control (O3)** | **Comments** |
| MediaTek | Yes | No strong view | For option 3, it can work with or without controlling flag. If no new controlling flag, it is assumed that the UE always report the interruption information if R16 flag is enabled. The legacy gNB could just ignore the unknown Rel-18 extension. This is even simpler but may be tricky because NW will not understand some field in Reconfiguration Complete or Resume Complete message.New capability is needed if we have new controlling flag. Otherwise, new capability is not needed.  |
| Qualcomm Inc | Yes | Yes for both (configuration and capability) | For O1/O2, it’s very obvious that configuration and capability are neededFor O3:-new capability is definitely needed for Rel-18 extension -if UE signalled the support Rel-18 extension, UE still does not know if network do support the Rel-18 extension, hence UE can not just report the Rel-18 extension unless network explicitly requested, to avoid interoperability issue when network is a Rel-18 network.  |
| CATT  | Yes |  |  |
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Another discussion point is mentioned in [R2-2303294](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303294.zip) on extension the interruption indicator to NCSG (R17 field)

* Proposal 1: There is a need for RAN2 to extend the concept ‘no-gap measurement with interruption’ to NCSG, i.e. UE needs to indicate to NW whether the interruption is needed or not when reporting ‘nogap-noncsg’ via *NeedForGapNCSG-InfoNR-r17*.

**Question 4: Do companies agree to extend the concept ‘no-gap measurement with interruption’ to NCSG?**

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| **Company** | **Agreed or not** | **Comments** |
| MediaTek | Tend to disagree | We think that this is NOT discussed in RAN4 although it makes some sense.  |
| Qualcomm Inc | Check comments | As clarified earlier, If we decided to go with the extension approach, it has to be extended for both Rel.16 and Rel.17, as not all UEs will be supporting both MGE releases, some UEs may support one version of the MGE (either Rel.16 or Rel.17) … to avoid this redundancy, we suggested to go with Option-2 above.  |
| CATT | See comments | Although this is not mentioned by RAN4, but we think it is reasonable to extend it to NCSG case, at least for the case of nogap-noNCSG. |
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## 3.3 LTE Solution

On the impact to LTE part, it seems easier. There is no NCSG and it is reported in static way. So, we don’t need to discuss aspect like controlling flag.

Based on the contributions, there are two options to introduce new capability on interruption information for LTE.

* **Option 1 (new R18 reporting)**: Introduce new capability IE to indicate 3 different gap requirement information, i.e. {gap, [no-gap-with-interruption], [no-gap-no-Interruption]}.
* **Option 2 (extend the R16 reporting)**: Introduce a new UE indication *interRAT-NeedForInterruptionNR-r18* to indicate whether interruption is needed (no-gap-with-interruption) or not (no-gap-no-interruption) when UE reports FALSE (i.e. no gap) in *interRAT-NeedForGapsNR-r16*.

Sample ASN.1 code for option 1

MeasGapInfoNR-r16 ::= SEQUENCE {

 interRAT-BandListNR-EN-DC-r16 InterRAT-BandListNR-r16 OPTIONAL,

 interRAT-BandListNR-SA-r16 InterRAT-BandListNR-r16 OPTIONAL

}

MeasGapInfoNR-r18 ::= SEQUENCE {

 interRAT-BandListNR-EN-DC-r18 InterRAT-BandListNR-r18 OPTIONAL,

 interRAT-BandListNR-SA-r18 InterRAT-BandListNR-r18 OPTIONAL

}

InterRAT-BandListNR-r16 ::= SEQUENCE (SIZE (1..maxBandsNR-r15)) OF InterRAT-BandInfoNR-r16

InterRAT-BandListNR-r18 ::= SEQUENCE (SIZE (1..maxBandsNR-r15)) OF InterRAT-BandInfoNR-r18

InterRAT-BandInfo ::= SEQUENCE {

 interRAT-NeedForGaps BOOLEAN

}

InterRAT-BandInfoNR-r16 ::= SEQUENCE {

 interRAT-NeedForGapsNR-r16 BOOLEAN

}

InterRAT-BandInfoNR-r18 ::= SEQUENCE {

 interRAT-NeedForInterruptionNR-r18 ENUMERATED {gap, no-gap-with-interruption, no-gap-no-interruption}

}

Sample ASN.1 code for option 2

MeasGapInfoNR-r16 ::= SEQUENCE {

 interRAT-BandListNR-EN-DC-r16 InterRAT-BandListNR-r16 OPTIONAL,

 interRAT-BandListNR-SA-r16 InterRAT-BandListNR-r16 OPTIONAL

}

MeasGapInfoNR-v18xy ::= SEQUENCE {

 interRAT-BandListNR-EN-DC-v18xy InterRAT-BandListNR-v18xy OPTIONAL,

 interRAT-BandListNR-SA-v18xy InterRAT-BandListNR-v18xy OPTIONAL

}

InterRAT-BandListNR-r16 ::= SEQUENCE (SIZE (1..maxBandsNR-r15)) OF InterRAT-BandInfoNR-r16

InterRAT-BandListNR-v18xy ::= SEQUENCE (SIZE (1..maxBandsNR-r15)) OF InterRAT-BandInfoNR-v18xy

InterRAT-BandInfo ::= SEQUENCE {

 interRAT-NeedForGaps BOOLEAN

}

InterRAT-BandInfoNR-r16 ::= SEQUENCE {

 interRAT-NeedForGapsNR-r16 BOOLEAN

}

InterRAT-BandInfoNR-v18xy ::= SEQUENCE {

 interRAT-NeedForInterruptionNR-r18 ENUMERATED {no-gap-with-interruption, no-gap-no-interruption} OPTIONAL

}

**Question 5: Which option do companies prefer to introduce new Rel-18 gap with interruption capability in LTE?**

* **Option 1 (new R18 reporting)**: Introduce new capability IE to indicate 3 different gap requirement information, i.e. {gap, [no-gap-with-interruption], [no-gap-no-Interruption]}.
* **Option 2 (extend the R16 reporting)**: Introduce a new UE indication *interRAT-NeedForInterruptionNR-r18* to indicate whether interruption is needed (no-gap-with-interruption) or not (no-gap-no-interruption) when UE reports FALSE (i.e. no gap) in *interRAT-NeedForGapsNR-r16*.

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| **Company** | **Preferred option** | **Comments** |
| MediaTek | Option 2 | In LTE, the difference between two options seems quite small. We would still prefer extending of R16. It seems more logical to extend the capability reporting rather than replace the old one.  |
| CATT | See comment | The similar option as in NR is applied. |
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## 3.4 Reply LS

Finally, there is proposal from [R2-2303071](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303071.zip) to send a Reply LS to RAN4.

* Proposal 5: Send a LS to RAN4 to inform RAN2 decisions.

Rapporteur suggests to discuss whether the LS is needed and what to be included in the LS.

**Question 6: Do companies think Reply LS to RAN4 is needed? If yes, please also briefly indicate the content and action to R4.**

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| **Company** | **Yes or No** | **Comments** |
| MediaTek | No (for now) | Reply LS not necessary in our view (for now).RAN4 send some request to RAN2 and we are doing the CR according to the requitement. Unless we want to revert RAN4 agreement or there is some action to RAN4, we don’t see the need to Reply the LS now. However, depending on the outcome of previous questions, RAN2 may have to inform RAN4 if we have some surprising conclusion.  |
| Qualcomm Inc | No | I don’t see the need to do so.  |
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| CATT | See comment | If we agree to extend it to NCSG case, we suggest notice it to RAN4. |
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## 3.5 CR

Rapporteur suggests to discuss the CR after above open issue is converged.

# 4 Conclusions

Based on the discussion in section 2, we propose the following:

**Proposal 1:**

# 5 References

[1] [R2-2302431](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2302431.zip), “LS on measurements without gap (R4-2303306; contact: Intel, CATT)”, RAN4

[2] [R2-2303103](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303103.zip), “Discussion on NeedForGaps with interruption”, Huawei, HiSilicon

[3] [R2-2302776](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2302776.zip), “Discussion on RAN4 LS for Rel-18 measurement gaps”, Nokia, Nokia Shanghai Bell

[4] [R2-2303071](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303071.zip), “Consideration on measurement without gap”, CATT

[5] [R2-2303294](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303294.zip), “Discussion on R18 no gap with interruption”, ZTE

[6] [R2-2303400](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303400.zip), “Discussion on Rel-18 gap enhancement “, Apple

[7] [R2-2303612](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303612.zip), “Introduction of measurements without gap with interruption” , MediaTek, draftCR Rel-18 36.331

[8] [R2-2303613](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303613.zip), “Introduction of measurements without gap with interruption”, MediaTek, draftCR Rel-18 36.306

[9] [R2-2303614](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303614.zip), “Introduction of measurements without gap with interruption” , MediaTek, draftCR Rel-18 38.331

[10] [R2-2303615](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2304_R2_121bis/Docs/R2-2303615.zip), “Introduction of measurements without gap with interruption”, MediaTek, draftCR Rel-18 38.306