3GPP TSG-RAN WG2 #117 R2-220xxxx

eMeeting, 21st February - 3rd March, 2022

Agenda Item: 8.22.3.1

Source: MediaTek Inc.

**Title: Report of [Pre117-e][010][MGE] MGE Open Issues Input (MediaTek)**

Document for: Discussion and decision

# 1 Introduction

This is report for pre-meeting discussion [Pre117-e][010][MGE] MGE Open Issues Input (MediaTek). We will discuss open issue from R2-2202054.

Deadline for comment – Feb 14th, 2359 UTC

# 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 |
| Intel (Rapp) | Candy Yiu | Candy.yiu@intel.com |
| Qualcomm  | Mouaffac Ambriss | mambriss@qti.qualcomm.com  |
| vivo | Xiaodong Yang | Yangxiaodong5g@vivo.com |
| DENSO | Tomoyuki Yamamoto | tomoyuki.yamamoto.j5c@jp.denso.com |
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| **OI Index** | **Open issue** | **Rapporteur comment** |
| **N1-1** | It is FFS whether to support reporting of NCSG for E-UTRA target bands |  |
| **N1-4** | Whether the NCSG could be configured as per FR gap |  |
| **N1-5** | Whether to add a new IE for NCSG gap configuration or reuse the legacy *GapConfig* with some extension |  |

# 3 Discussion

## 3.1 C1-1 How to add multiple concurrent gap

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| **OI Index** | **Open issue** | **Rapporteur comment** |
| **C1-1** | Whether to use *ToAddModList* and *ToReleaseList* structure |  |

The open issue C1-1 comes from the discussion that how to add additional concurrent gap. Some companies propose to use *ToAddMod* list structure to be more future proof while some companies think just duplicating the *GapConfig* for per UE gap, FR1 gap, and FR2 gap respectively would be enough.

There are basically two options for this

* **Option 1**: Duplicate the *GapConfig* for per UE gap, FR1 gap, and FR2 gap (only one more gap configuration for each gap type, as in current running CR)
* **Option 2**: Use *ToAddModList* and *ToReleaseList* structure for each gap type. FFS maximum number of additional gap configuration for each gap type)

**Sample ASN.1 code for Option 1**

MeasGapConfig ::= SEQUENCE {

 gapFR2 SetupRelease { GapConfig } OPTIONAL, -- Need M

 ...,

 [[

 gapFR1 SetupRelease { GapConfig } OPTIONAL, -- Need M

 gapUE SetupRelease { GapConfig } OPTIONAL -- Need M

 ]], [[

 gapTwoFR2-r17 SetupRelease { GapConfig } OPTIONAL, -- Need M

 gapTwoFR1-r17 SetupRelease { GapConfig } OPTIONAL, -- Need M

 gapTwoUE-r17 SetupRelease { GapConfig } OPTIONAL -- Need M

 ]]

}

**Sample ASN.1 code for Option 2**

MeasGapConfig ::= SEQUENCE {

 gapFR2 SetupRelease { GapConfig } OPTIONAL, -- Need M

 ...,

 [[

 gapFR1 SetupRelease { GapConfig } OPTIONAL, -- Need M

 gapUE SetupRelease { GapConfig } OPTIONAL -- Need M

 ]], [[

 gapUEToAddModList-r17 SEQUENCE (SIZE (1..TBD)) OF GapConfig OPTIONAL, -- Need N

 gapUEToReleaseList-r17 SEQUENCE (SIZE (1..TBD)) OF MeasGapId-r17 OPTIONAL, -- Need N

 gapFR1ToAddModList-r17 SEQUENCE (SIZE (1..TBD)) OF GapConfig OPTIONAL, -- Need N

 gapFR1ToReleaseList-r17 SEQUENCE (SIZE (1..TBD)) OF MeasGapId-r17 OPTIONAL, -- Need N

 gapFR2ToAddModList-r17 SEQUENCE (SIZE (1..TBD)) OF GapConfig OPTIONAL, -- Need N

 gapFR2ToReleaseList-r17 SEQUENCE (SIZE (1..TBD)) OF MeasGapId-r17 OPTIONAL -- Need N

 ]]

}

The latest R4 agreement on concurrent gap configuration is shown in below (from R4 LS R2-2202604)

|  |
| --- |
| Combinations of different gap types for per-FR gap capable UE |
| Index | # of simultaneous MG | RAN4 conclusion |
| Per-FR1 | Per-FR2 | Per-UE |
| 0 | 2 | 1 | 0 | Supported |
| 1 | 1 | 2 | 0 | Supported |
| 2 | 0 | 0 | 2 | Supported |
| 3 | 1 | 0 | 1 | Supported when per-UE gap is associated to PRS measurement |
| 4 | 0 | 1 | 1 |
| 5 | 1 | 1 | 1 |
| 6 | 0 | 0 | 1 | Supported |
| 7 | 1 | 1 | 0 | Supported |
| 8 | 1 | 0 | 0 | Supported |
| 9 | 0 | 1 | 0 | Supported |
| 10 | 2 | 0 | 0 | Supported |
| 11 | 0 | 2 | 0 | Supported |

In the open issue discussion, some company also mentioned that this should be discussed in general gap coordination section. However, based on the following agreement, the rapporteur suggests to discuss this first from MGE perspectives. It can be re-discussed in general section if needed.

* Continue to discuss each gap feature in individual WI with the following understandings.

- Whether to support MAC CE activation/deactivation of the gap is discussed independently in each WI. There is no need to have common MAC CE framework.

- RRC configuration for gap feature could be progressed separately in each WI. However, RAN2 may use common RRC configuration structures for different gaps once the relation between each gap feature is clear.

Companies are invited to provide their comment on MGE open issue C1-1.

**Question 1: Companies are invited to provide their comment on MGE open issue C1-1. Which option is preferred and why? For option 2, please also provide the maximum number of additional gap configuration for each gap type.**

* **Option 1: Duplicate the *GapConfig* for per UE gap, FR1 gap, and FR2 gap**
* **Option 2: Use *ToAddModList* and *ToReleaseList* structure for each gap type.**

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| **Company** | **Preferred option** | **Comments** |
| MediaTek | Option 1 | One can easily find option 1 could fulfil the requirement from RAN4. We consider that option 2 bring unnecessary complexity in both ASN.1 and procedure text. Unless there is a need to merge the MGE additional gap configurations with other newly introduced gap in REl-17, we think option 1 is enough. Whether to have better ASN.1 code could be discussed in gap coordination section. But we don’t think there is much time for ASN.1 beautification. Purely based on MGE aspects, we prefer option 1. |
| Intel | Option 2 | As we agree with Media Tek that option 1 can fulfil RAN4 requirement. However, with different WI requirement, it will be more future compatible with a list. In addition, pre-configured gap now is also merge with concurrent gaps because of the simultaneously support of legacy gap. Therefore, we think that list is a more preferable structure.  |
| QCOM | Option-1 | Simpler from ASN.1 perspective, and procedural text can be aligned accordingly. in addition, we don’t anticipate further gaps to be added to the spec, and in case there was, a 3rd GapConfig IE can be added in a similar manner.  |
| vivo | Option2  | We still think more gap features can be configured together. Add Use ToAddModList and ToReleaseList structure allow the same ASN.1 structure.  |
| DENSO | Option 2 | As Intel mentioned, other WI may also require additional gap configuration. From the point of view, we think Option 2 has better flexibility and extendibility. |
| Huawei, HiSilicon | Option 1 | Both are feasible, Option 1 is simpler. |
| OPPO | Option 1 | Both are feasible, Option 1 is simpler. |
| Xiaomi | Option 1 | Option 1 is simpler. |
| ZTE | Option 2 | Option 1 is sufficient for Rel-17 MGE, but considering gap from other WIs will also be added to *MeasGapConfig*, we would prefer a unified ASN.1 structure (Option 2), but we agree this can be discussed in gap coordination session. For Option 1, if RAN4 finally defines a maximum total number of gaps across multiple features, then it will be hard to capture it in specification because several individual IEs are involved. For Option 2, the main difficulty is to define the “maximum value” of the list, waiting for RAN4 will delay our progress, so one way is to define a relaxed value in ASN.1 and further restrict it in field description (based on RAN4 inputs later). The “relax value” can be sum of needed gap number across multiple features. (e.g. 2 MGE+ 2 MUSIM+N Pos -1 legacy). |
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## 3.2 C1-2 Whether to support use case association

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| **OI Index** | **Open issue** | **Rapporteur comment** |
| **C1-2** | In addition to the per frequency layer association, define ASN.1 for per use case (e.g. ~~PRS,~~ SSB, CSI-RS, EUTRA) association with concurrent gaps. | Please indicate all use case or purpose company would like to support for detail discussion |

Issue C1-2 has been discussed in two meeting but no conclusion to support it.

In last meeting, we agree to have per frequency layer association as below.

* For association between concurrent MG and measured frequencies: Indicate the associated gaps (via “gap ID”) in MO; (for PRS measurement, indicating in the association in MG configuration).

The discussion point now is that whether add **simpler** indicator to indicate per use case association (e.g. one indicator to indicate one MG is associate with all SSB measurement). The kind of coarse granularity could reduce the signaling overhead.

**Question 2: Companies are invited to provide their comment on MGE open issue C1-2. In addition to the per frequency layer association, do you support to define per use case (e.g. SSB, CSI-RS, EUTRA) association with concurrent gaps and why ? If support, please also indicate the use case(s) to be configured.**

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| **Company** | **Yes or No** | **Comments** |
| MediaTek | Prefer No | No strong view.The current ASN.1 define in the running CR has finer granularity on gap association. The use case association (coarse granularity) could be considered as a signal optimization but not a must.We do understand that this is simple solution and easier to be extended to MR-DC case. However, it seems not essential to have this.If supported, we think that 3 additional use cases (i.e. SSB measurement, CSI-RS measurement, and E-UTRAN measurement) is enough |
| Intel | Yes | In order to allow gap to associate to SSB or CSI-RS within the same MO, this indication may be needed. In addition, MUSIM and PRS may also be able to reuse this per use case. |
| QCOM | No | It seems too much of a restriction to the UE. The association at the Frequency layer level is good enough.  |
| vivo | No | Agree with QC. |
| DENSO | Yes | To associate a gap for each use case (SSB/CSI-RS) separately within the same MO, use case level association may be needed. |
| Huawei, HiSilicon | Yes | The use case can be RS type (SSB, CSI-RS, PRS), RAT (NR, inter-RAT), and MUSIM (depending on the conclusion of gaps coordination). |
| OPPO | Yes  | Agree with Huawei  |
| Xiaomi | No | Agree with QC. |
| ZTE | No | We originally thought coarse granularity should be supported because it is helpful for MR-DC (to avoid complex MN-SN coordination), but since MR-DC is deprioritized, and per-MO indication is adopted for SA, we think per use case association is not needed in Rel-17, it can be considered in future when MR-DC is supported. In our view, the typical use case of Rel-17 concurrent gap is to configure a gap specifically for PRS, and the current signalling design can already achieve this. |
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## 3.3 C1-3 Maximum support of concurrent gaps

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| **OI Index** | **Open issue** | **Rapporteur comment** |
| **C1-3** | Maximum support of concurrent gaps | RAN4 latest agreement:* The maximum number of concurrent gaps across all FRs for per-FR gap capable UEs is 3 for SA case
 |

From functional point of view, the maximum number of concurrent gaps is quite clear from RAN4 latest LS R2-2202604. See also the table in section 3.1.

From RRC signaling point of view, the rapporteur considers there are two FFS issues

* (Discussed in Q1 if preferred option 2) maximum number of additional gap configuration for each gap type
* Maximum number of measurement gap ID

As the first issue is already discussed in Q1, we only have to discuss the second one. Note this may related to general gap coordination discussion once we decide to merge the configuration. However, let’s discuss first from MGE perspectives.

**Question 3: Companies are invited to provide their comment on MGE open issue C1-3. What should the maximum number of measurement gap ID ? Any other comment related to this issue ?**

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| **Company** | **Comments** |
| MediaTek | According to R4 agreement. It seems that gap ID up to 3 is enough. We can also use 4 to make it power of 2. We understand that this could be re-discussed in gap coordination section if needed. |
| Intel | There may be multiple pre-configured gap but activate only one. PRS may also configure multiple gaps and activate only one. We may want to have a bigger number to allow other WI to reuse the same gap ID. |
| vivo | May be 8, it depends on how many gap features can be configured together.  |
| DENSO | Agree with Intel. Bigger number of maximum gap number may be needed for “inactive” gap configurations, and other WI requirements such as MUSIM. |
| Huawei, HiSilicon | Agree that this also relies on the coordination with gap features from other WIs. For MGE WI, 3 is enough. |
| OPPO | It is fine to follow RAN4, i.e. 3. |
| Xiaomi | Follow RAN4, the maximum number is 3.  |
| ZTE | See our response to Q1, from signalling point of view, a larger number can be defined, configuration restrictions can be specified in field description. |
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## 3.4 C1-7 Potential Configuration restriction on gap association

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| **OI Index** | **Open issue** | **Rapporteur comment** |
| **C1-7** | Potential Configuration restriction for associated gap ID configuration in measObjectNR.Based on current spec, network can configure multiple measObjectNR associated with the same SSB frequency (one for SSB based measurement, the others for providing timing reference for CSI-RS based measurement). So when multiple SSB MOs (with the same SSB freq) are configured, how to indicate the “associatedMeasGapSSB-r17” field in each MO? Either network can only set the field in the MO that used for SSB-based measurement; Or network can configure associatedMeasGapSSB-r17 in each MO with a restriction that all must be set to the same value. Similar issue also applies to CSI-RS based measurements, e.g. when multiple MOs are configured with the same CSI-RS centre frequency. |  |

Issue C1-7 is raised by company during open issue discussion. Please check the issue description above and provide your comment.

**Question 4: Companies are invited to provide their comment on MGE open issue C1-7.**

* **when multiple SSB MOs (with the same SSB freq) are configured, how to indicate the “*associatedMeasGapSSB-r17*” field in each MO?**
* **when multiple MOs are configured with the same CSI-RS centre frequency, how to indicate the “*associatedMeasGapCSIRS-r17*” field in each MO?**

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| **Company** | **Comments** |
| MediaTek | If same SSB or CSI-RS measured frequency is for some reason configured in different MO, our preference is that the NW will indicate the **same** associated MG Id in all MOs. This will make the association clear without ambiguity. |
| Intel | We share the same view as MT. NW should indicate the same associated MG Id in all Mos. |
| vivo |  Can use the same MG id.  |
| DENSO | Same view with other companies. The same MG Id should be indicated for all MOs configured with same SSB/CSI-RS frequency.. |
| Huawei, HiSilicon | If same SSB is configured in different MOs, agree with other companies that NW should associate the MOs with the same gap ID.However, for CSI-RSs with the same centre frequency but configured in different MOs, according to the latest LS from RAN4 (R4-2202604), they are considered as different frequency layers, so it’s allowed to associated them with different gap IDs.* RAN4 response: RAN4 confirms all above understanding is correct, but different MOs with CSI-RS resources are considered as different frequency layers from RAN4 requirement’s viewpoint, no matter if the CSI-RS resources are with same or different centre frequencies.
 |
| OPPO | Same via as MediaTek. |
| Xiaomi | Agree with MTK. |
| ZTE | We are fine to configure the same MG ID in all MOs associated with the same SSB. To avoid misinterpretation in future, it is better to make it clear in specification.Regarding the comment from HW, multiple CSI-RS MOs with the same centre frequency are treated as separate frequency layers, occupies UE capability (number of measured layers), so we agree that network should be allowed to configure different gap IDs (*associatedMeasGapCSIRS-r17*) in different CSI-RS MOs (no matter the same of different centre frequencies). |
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## 3.5 N1-1 Reporting of NCSG for E-UTRA target bands

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| **OI Index** | **Open issue** | **Rapporteur comment** |
| **N1-1** | It is FFS whether to support reporting of NCSG for E-UTRA target bands |  |

This open issue is related to the following FFS point

[R2-2201678](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2201_R2_116bis-e/Docs/R2-2201678.zip) Summary of AI 8.22.4 Network Controlled Small Gap (Apple) Apple

DISCUSSION

* Detailed design Same as Rel-16 NeedForGap, support NCSG reporting for both intra-frequency and inter-frequency. FFS Inter RAT

On this issue, rapporteur understand it is already concluded by RAN4 and informed RAN2 in the LS R2-2200127 / R4-2120306 as below.

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| --- |
| 1. **Scenarios and use cases**
2. For different types of measurement with NCSG:

Agreements: * NCSG can be used for:
	+ SSB based intra-frequency measurement with gap
	+ SSB based inter-frequency measurement with gap
	+ Inter-RAT E-UTRAN measurement
	+ Measurement on de-activated SCell
* NCSG will NOT be used for:
	+ 2G/3G measurements
	+ PRS measurements
* It is still FFS whether NCSG can be used for:
	+ RRM measurement for dormant SCell.
	+ CSI-RS based inter-frequency measurement
 |

So, it is suggested to confirm that reporting of NCSG for E-UTRA target bands is supported.

**Question 5: Companies are invited to provide their comment on MGE open issue N1-1. Do companies agree to support reporting of NCSG requirement information for E-UTRA target bands ? If no, please explain why.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| MediaTek | Yes | As agreed by RAN4. |
| Intel | Yes |  |
| QCOM | Yes | Already agreed in RAN4 … We should have it with a separate capability |
| vivo | Yes  |  |
| Huawei, HiSilicon | Yes | Agreed by RAN4. |
| OPPO | Yes  | Follow RAN4. |
| Xiaomi | Yes |  |
| ZTE | Yes |  |
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## 3.6 N1-4 Whether the NCSG could be configured as per FR gap

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| **OI Index** | **Open issue** | **Rapporteur comment** |
| **N1-4** | Whether the NCSG could be configured as per FR gap |  |

This issue is also discussed briefly in R2-2201934 [3] while RAN2 drafting the replied LS on NCSG to RAN4. It was pointed out by several companies that RAN4 already agree to support configuring NCSG as per FR gap. In the RAN4 WF R4-2105792, there is clear indicate that *Support both per FR and per UE NCSG patterns in Rel17*. So, R2 does not send LS to ask this question.

Some companies have concern on this since RAN4 mentioned that “*Feasibility in FR2 is still being discussed in RAN4*” in LS R2-2200127 / R4-2120306. However, in the latest update of NCSG LS R4-2202626, it was concluded that NCSG is feasible in FR2. Therefore, rapporteur believe that RAN2 can conclude that NCSG could be configured as per FR gap.

**Question 6: Companies are invited to provide their comment on MGE open issue N1-4. Do companies agree that NCSG could be configured as per FR gap? If no, please explain why.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| MediaTek | Yes | As agreed by RAN4. |
| Intel | Yes |  |
| QCOM |  | Already agreed in RAN4 |
| vivo | Yes  |  |
| Huawei, HiSilicon | Yes | Agreed by RAN4. |
| OPPO | Yes  |  |
| Xiaomi | Yes |  |
| ZTE | Yes |  |
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## 3.7 N1-5 NCSG gap configuration

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| **OI Index** | **Open issue** | **Rapporteur comment** |
| **N1-5** | Whether to add a new IE for NCSG gap configuration or reuse the legacy *GapConfig* with some extension |  |

This open issue is related to ASN.1 configuration on NCSG pattern. At high level, there are two approach on how to configure the NCSG gap.

* Option 1 – Reuse the legacy *GapConfig* with some extension
* Option 2 – Add a new IE for NCSG gap configuration

Option 1 will also request to modify the field description of original field in *GapConfig* to clarify how they are applied to NCSG gap. However, it seems that NCSG gap does use very similar parameters as legacy gap. Option 2 is more clean approach but request more change in ASN.1. Sample code for both options is shown below.

**Sample ASN.1 code for Option 1**

MeasGapConfig ::= SEQUENCE {

 gapFR2 SetupRelease { GapConfig } OPTIONAL, -- Need M

 ...,

 [[

 gapFR1 SetupRelease { GapConfig } OPTIONAL, -- Need M

 gapUE SetupRelease { GapConfig } OPTIONAL -- Need M

 ]]

}

GapConfig ::= SEQUENCE {

 gapOffset INTEGER (0..159),

 mgl ENUMERATED {ms1dot5, ms3, ms3dot5, ms4, ms5dot5, ms6},

 mgrp ENUMERATED {ms20, ms40, ms80, ms160},

 mgta ENUMERATED {ms0, ms0dot25, ms0dot5},

 ...,

 [[

 refServCellIndicator ENUMERATED {pCell, pSCell, mcg-FR2} OPTIONAL -- Cond NEDCorNRDC

 ]],

 [[

 refFR2ServCellAsyncCA-r16 ServCellIndex OPTIONAL, -- Cond AsyncCA

 mgl-r16 ENUMERATED {ms10, ms20} OPTIONAL -- Cond PRS

  ]],

 [[

 nscgInd-r17 ENUMERATED {true} OPTIONAL, -- Need R

 mgta-r17 ENUMERATED {ms0dot75} OPTIONAL -- Cond FFS

 ]]

}

**Sample ASN.1 code for Option 2**

MeasGapConfig ::= SEQUENCE {

 gapFR2 SetupRelease { GapConfig } OPTIONAL, -- Need M

 ...,

 [[

 gapFR1 SetupRelease { GapConfig } OPTIONAL, -- Need M

 gapUE SetupRelease { GapConfig } OPTIONAL -- Need M

 ]], [[

 ncsg-FR1-r17 SetupRelease { NCSG-Config-r17 } OPTIONAL, -- Need M

 ncsg-FR2-r17 SetupRelease { NCSG-Config-r17 } OPTIONAL, -- Need M

 ncsg-UE-r17 SetupRelease { NCSG-Config-r17 } OPTIONAL -- Need M

 ]]

}

NCSG-Config-r17 ::= SEQUENCE {

 ncsg-Offset-r17 INTEGER (0..159),

 ml-r17 ENUMERATED {FFS1, FFS2, FFS3, FFS4, FFS5, FFS6},

 virp-r17 ENUMERATED {ms20, ms40, ms80, ms160},

 ncsg-TA-r17 ENUMERATED {ms0, ms0dot25, ms0dot5, ms0dot75}

 refFR2ServCellAsyncCA-r17 ServCellIndex OPTIONAL, -- Cond AsyncCA

}

**Question 7: Companies are invited to provide their comment on MGE open issue N1-5. Which option is preferred for NCSG gap configuration ?**

* Option 1 – Reuse the legacy *GapConfig* with some extension
* Option 2 – Add a new IE for NCSG gap configuration

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| **Company** | **Preferred option** | **Comments** |
| MediaTek | Option 1 | Both options are okay but we would prefer to use option 1 as it results in simpler ASN.1 code. Also, we consider option 1 as a easier way to combine the concept of concurrent gap and NCSG gap. |
| Intel | Option 1 | Prefer to reuse the legacy structure  |
| QCOM | Option 1 |  |
| vivo | Option 1 |  |
| Huawei, HiSilicon | Option 1 |  |
| OPPO | Option 1 |  |
| Xiaomi | Option 1 |  |
| ZTE | Option 1 |  |
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# 4 Conclusions

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

# 5 References

[1] R2-2202054, “[Post116bis-e][085][MGE] Open Issues (Intel)”, Intel

[2] R2-2201903, “RRC signaling for measurement gap enhancement”, MediaTek

[3] R2-2201934, “Summary of [AT116bis-e][061][MGE] LS out (Apple)”, Apple