3GPP TSG-RAN WG2 #109bis-e R2-2004075

Electronic Meeting, April 20th – 30th 2020

Agenda Item: 6.4.2.1

Source: OPPO(Rapporteur)

Title: [AT109bis-e][704][V2X] SIB12/28 (OPPO)

Document for: Discussion, Decision

# 1 Introduction

This document is to kick off the following email discussion:

* [AT109bis-e][704][V2X] SIB12/28 (OPPO)

Scope: To discuss and conclude SIB12/28 size issues, i.e. whether the current SIB12 can work or not, if not work how to reduce the overhead (including CR R2-2002652/2653).

Expected outputs: Proposals and summary in R2-2004075 (and the updated draft 38.331 CR in R2-2004076 and 36.331 CR in R2-2004077 if needed)

Deadline: 4/24 10:00 for companies’ feedback and 4/27 10:00 for rapporteur version (UTC)

# 2 Discussion

The size of SIB12 is mainly affected by those IEs which are either too big or repeated many times or both. How many times an IE will be repeated depends on either the length of the list or how deep the IE is buried within the whole IE structures. Taking IE SL-QoS-Profile-r16 for example, it will be repeated NrofSLRB-r16\* NrofSL-QFIs-r1 times (Note1). For IE SL-Priority-TxConfigIndex-r16 it will be repeated NrofFreqSL-r16\* NrofSL-BWPs-r16\*( NrofTXPool-r16+1)\*8.

*Note1: the parameter e.g.* **NrofSLRB-r16** *in the paper is the configured length of the IE list whose maximum number is* ***max*NrofSLRB-r16***. The same assumption is taken for other similar parameters.*



Figure 2-1 IE structure of SIB12 (partial IEs)

In Figure2-1 the IEs which impacts SIB12 size mostly are listed. And the following table show the IEs, their repeated factors and estimated size:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **level 1 IE list** | **level n IE list** | **Size of IE list(bit)** | **Repeated factors** | **Minimum factors** | **Typical factors** |
| sl-FreqInfoList-r16 | IE size of sl-FreqInfoList-r16 except for below 5 IEs | 297 | 1 | 1 | 1 |
| 　 | SL-SyncConfig-r16 | 90 | NrofFreqSL-r16\*SL-SyncConfig-r16 | 1 | 4 |
|  | **SL-ResourcePool-r16(TX) except for** **sl-CBR-Priority-TxConfigList-r16** **and sl-ThresPSSCH-RSRP-List-r16** | **433** | **NrofFreqSL-r16\* NrofSL-BWPs-r16\*( NrofTXPool-r16+1)** | **2** | **5** |
|  | **sl-CBR-Priority-TxConfigList-r16** | **448** | **NrofFreqSL-r16\* NrofSL-BWPs-r16\*( NrofTXPool-r16+1)** | **2** | **5** |
|  | **sl-ThresPSSCH-RSRP-List-r16** | **496(Note2)** | **NrofFreqSL-r16\* NrofSL-BWPs-r16\*( NrofTXPool-r16+1)** | **2** | **5** |
| 　 | **SL-ResourcePool-r16(RX)** | **436** | **NrofFreqSL-r16\* NrofSL-BWPs-r16\*NrofRXPool-r16** | **1** | **1** |
| sl-UE-SelectedConfig-r16 | IE size of sl-UE-SelectedConfig-r16 except for below 3 IEs | 11 | 1 | 1 | 1 |
| 　 | sl-PSSCH-TxConfigList-r16  | 69 | PSSCH-TxConfig-r1 | 1 | 8 |
| 　 | sl-CBR-RangeConfigList-r16 | 7 | CBR-Config-r16\*CBR-Level-r16 | 1 | 64 |
| 　 | sl-CBR-PSSCH-TxConfigList-r16 | 46 | TxConfig-r16 | 1 | 16 |
| sl-NR-AnchorCarrierFreqList-r16 | 　 | 22 | FreqSL-NR-r16 | 1 | 1 |
| sl-EUTRA-AnchorCarrierFreqList-r16 | 　 | 14 | FreqSL-EUTRA-r16 | 1 | 1 |
| sl-RadioBearerConfigList-r16 | IEs except for below 2 IEs | 17 | NrofSLRB-r16 | 1 | 12 |
| 　 | **SL-QoS-Profile-r16**  | **129** | **NrofSLRB-r16\*NrofSL-QFIs-r1** | **1** | **48** |
| 　 | sl-PDCP-Config-r16  | 34 | NrofSLRB-r16 | 1 | 12 |
| SL-RLC-BearerConfig-r16 | 　 | 59 | SL-LCID-r16 | 1 | 12 |
| sl-MeasConfigCommon-r16 | 　 | 98 | NrofSL-ObjectId-r16 | 1 | 1 |
| sl-CSI-Acquisition -r16 | 　 | 1 | 1 | 1 | 1 |
| sl-ZoneConfig-r16 | 　 | 11 | 1 | 1 | 1 |
| sl-OffsetDFN-r16 | 　 | 11 | 1 | 1 | 1 |
| t400  | 　 | 4 | 1 | 1 | 1 |

Table2-1

*Note2: the size is calculated assuming CBR-Level-r16=8 (maxCBR-Level-r16=16)*

### 2.1 Minimum SIB12 size issue

In order to assess whether current SIB12 can fit a single NR SIB or LTE SIB, it is valuable to estimate a minimum size of SIB12. To do so all the parameters impacting repeated factors can be set to be 1. In this case all the IE sizes are the same as listed in table 2-1 except for IE sl-ThresPSSCH-RSRP-List-r16 which is 160 bits. Based on this assumption, the repeated factors are listed in the column” minimum factors” in table 2-1. Based on this assumption the SIB12 is **3438 bits**. Obviously the SIB12 can’t fit into a single NR or LTE SIB considering following size limitation:

* the size limitation of NR SIB **i.e. 2976bits**
* the size limitation of LTE SIB28 **i.e.2216 bits.**

**Observation1: the minimum size of SIB12 can’t fit into a single NR or LTE SIB**

**Question1: Do you agree with this observation1? If not, please give your detail reason.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Ericsson | Partially yes | The observation is not entirely true. We believe that the impact factor of whether the SIB it fits in the SIB limitation or not is given by the number of SLRB that the network configures. Now, this is not simple to understand and if we consider a worst case scenario, we agree that the V2X SIB may not fit into the NR or LTE SIB. However, in the other extreme (network configuring only 1 SLRB) there are no problem with the V2X SIB size. |
| CATT | Agree | From our perspective, the extreme case of only configuring one set of SLRB is not preferred from the perspective of flexibility. Hence, we think SIB12 cannot fit into a single NR or LTE SIB. |
| MediaTek | Yes | We disagree with Ericsson’s analysis above. Looking at the size of the IEs in the table, the size is also strongly dependent on the number of frequencies, number of BWPs, and number of resource pools, which act as multipliers for the largest individual IEs. Anyway, the minimum assumptions given by OPPO have the network configuring only 1 SLRB as suggested by Ericsson, so it seems that there is a problem also in that case.Assuming CBR-Level-r16=8 may be a bit pessimistic and reducing it (e.g. to 4) would give some gains in sl-ThresPSSCH-RSRP-List-r16, but it doesn’t seem enough to eliminate the problem. In general, we think the „typical“ case assumed in the table may be too large (12 SLRBs \* 4 QoS flows is a lot), but the problem is real even for smaller cases. |
| Intel | Agree | We agree that the analysis does imply that SIB12 does exceed the size of NR SIB assuming the worst case scenario. |
| OPPO | Agree | The assumption for the worst case actually is not a so meaningful configuration for real operation since the signaling flexibility is the least. It means SIB12 size of a basic acceptable configuration would be larger than what is indicated in the analysis part of this section. We do think there is problem otherwise SIB based mode 2 operation doesn’t work at all. |
| ZTE | Partially agree | It is not appropriate to say that even the minimum size cannot fit into a single SIB without considering some extreme cases. However, we agree that in some other cases, the size of SIB would not fit into a single SIB.  |
| Apple | Agree | The SIB size will increase significantly either when multiple SLRB configurations are included, or multiple carriers are included. We believe the multi-carrier is to be supported as a very plausible extension of NR V2X work for future releases. So, we need build a good foundation so that SIB size will not be exceeded when considering adding multi-carrier support or other features in the future. |
| Qualcomm | Agree | We agree with the analysis presented, that SIB12 can exceed the allocated size |
| Nokia | No | We share Ericsson’s view, that whether the SIB12 can fit into LTE SIB size or NR SIB size is determined by the number of configured SLRBs – the issue of oversized SIB12 mainly arises from the fact that it scales multiplicatively with #SLRBs X cast\_types X QoS profiles. However, the minimum SIB12 with a single SLRB does fit into the LTE SIB size as well as into the NR SIB size. Hence, we are treating an optimization problem here – and all companies agreed in the first V2X session of R2#109bis “we will not pursue further optimization/enhancement in Rel.16”. So optimization of SIB size e.g. SIB segmentation shall be treated in Rel.17.Note: We checked just the largest entry in the table above sl-ThresPSSCH-RSRP-List-r16 that you stated with 496bit and found that it is not correct (we think 488bit is correct value). That should only show that we rather prefer to develop a full and clean solution for SIB12 size in beginning of Rel. 17.  |

### 2.2 Solution to resolve minimum SIB12 size issue

In order to fit into either NR or LTE single SIB the straight way to tackle this issue is to introduce SIB segmentation in RRC layer as proposed in paper [2] for both NR and LTE system.

**Question2: Do you agree to introduce SIB segmentation in RRC layer for SIB12 in both NR and LTE system? If not, please give your detail reason.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Ericsson | Agree | If something needs to be done, the segmentation is the only solution to solve this. As shown in OPPO paper in R2-2002651, even optimizing the size of the SIB there is no guarantee that the V2X SIB will not exceed the NR or LTE SIB size. |
| CATT | No | From our point of view, there are two options to solve the SIB size issue.* Option 1: SIB segmentation;
* Option 2: For the SLRB configuration of RRC\_IDLE/INACTIVE UE, using pre-configuration instead of SIB configuration.

Regarding to option 1, we have below concerns:If option 1 is adopted, it will bring specification efforts, e.g., whether fixed segment, e.g., ETWS and CMAS SIBs or flexible segment, e.g., *DLDedicatedMessageSegment* should be discussed first. If fixed segment is supported, it should further discuss how to perform the fixed segment. If flexible segment is supported, different part of the SIB will be transmitted in different SI message, which will cause more reception latency. It cannot guarantee the reliability of receiving SIB12, due to UE may lose part of the SIB12.Moreover, the benefit of SIB-configured QoS flow/SLRB mapping is unclear compared with pre-configuration. Hence, option 2 is slightly preferred considering the R16 NR V2X deadline.OPPO: Yes, we agree more reception latency is inevitable. But if it help to tackle the problem, we need take it. It works for SIB6/7(ETWS) and SIB8 (CMAS) which is time critical SIB. So it should also work for SIB12 which is much less time critical.  |
| MediaTek | Agree, but | It does look like segmentation will be necessary, and we have models in the spec that can be followed (e.g. the downlink RRC segmentation). However, we’re worried that it could become a reason not to control the size of the SIBs, resulting in increased overhead and latency to acquire the V2X SIBs. So we think it’s necessary to optimise the fields as much as possible, even if we specify segmentation in addition to that. |
| Intel | Agree | We agree with Ericsson that at this late stage, the “cleanest” way to resolve this issue would be to segment the SIB in RRC. This would work even if no assumptions can be made regarding the best or worst case scenario in terms of the number of SLRBs configured by the network |
| OPPO | Agree | We need introduce segmentation solution in both NR and LTE system. And to make it simple, we can mimic what has been done for UL dedicated signaling i.e. to introduce flexible segmentation. The problem for fixed segmentation is it is very difficult to decide on what is proper fixed size for all coverage scenarios at this stage. Plus fixed size doesn’t help UE to receive the SIB since the content of the segmentation will still be variable which depends on the detail configuration like number of frequency/BWP ad SLRB etc anyway. |
| ZTE | Agree | We think it is reasonable and necessary to use SIB segmentation to solve this issue, just link previously used in LTE. |
| Apple | No | We share the concern with CATT and MediaTek, we think the segmentation is the last resort. First, RAN2 need to try to reduce the SIB size as much as possible. If we can control the SIB size to be within the NR limit in Rel-16, then segmentation can be avoided. This will make some room to use it only for future releases, if necessary. |
| Qualcomm | No | We agree with the points raised by CATT, MediaTek and Apple, in exploring other options before segmentation in this release. |
| Nokia | Comment | As stated in Q1 we believe we are discussing an optimization problem, which we agreed not to do in Rel.16 (as per statement in R2-2003519). For the issue of SIB12 size not fitting into LTE/NR SIB there are many possible solutions:* do not overload SIB12
* reduce number of SLRBs
* standardize QoS profiles
* offload SIB information content to pre-configuration
* SIB segmentation
* remove redundancy and optimize IE structure in SIB12

since the number of solutions is large and all technical solutions/optimization options have not been discussed thoroughly, the SIB12 issue should be solved in Rel.17 only. |

### 2.3 Optimization of SIB12 size issue

A big SIB12 means big signalling overhead for broadcast. Based on the analysis listed in table 2-1, it seems that the IEs marked with **bold red** can be used to evaluate the SIB12 size. In order to assess the effect following parameters affecting repeated factors are assumed:

|  |  |
| --- | --- |
| **Configured** parameters | Typical values |
| NrofFreqSL-r16 | 1 |
| NrofSL-BWPs-r16 | 1 |
| NrofTXPool-r16 | 4 |
| NrofRXPool-r16 | 1 |
| NrofSLRB-r16 | 12 |
| NrofSL-QFIs-r1 | 4 |
| SL-LCID-r16 | 12 |

The corresponding repeated factors are listed in the column “typical factors” of table 2-1. Based on this assumption SIB12 is estimated as **17413** bits. If some measures e.g. proposal 1/2/3 from paper [2] or proposal 6 from paper [4] are taken then the SIB 12 size will be reduced. Take proposal1/2/3 from paper [2] as example, the SIB size can be reduced to be **8839** based assumption that IE SL-QoS-Profile-r16 is 81bits and table+index approach is taken for IE SL-QoS-Profile-r16 where the length of the table is 16.

**Observation2: it is necessary to optimize SIB12 size to reduce signalling overhead**

**Question3: Do you agree with observation2? If not, please give your detail reason.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Ericsson | No | If something needs to be done, the segmentation is the only solution to solve this. As shown in OPPO paper in R2-2002651, even optimizing the size of the SIB there is no guarantee that the V2X SIB will not exceed the NR or LTE SIB size.Therefore, what’s the point to specify two solutions (index+table) when we know that one it may not work anyway? |
| CATT | No | Optimizing the SIB12 size cannot change the truth that the SIB12 size is oversized compared with the NR/LTE SI message size restriction. |
| MediaTek | Yes | The goal is not just to meet the SIB size limit, but to keep the overall size of the SIBs reasonable, since it affects broadcast overhead and the number of segments affects acquisition time. |
| Intel | No | We share the same view as above that once segmentation is performed, while additional enhancements might be considered, there is no pressing need to optimize the size, at least in this release. |
| OPPO | Yes | Even segmentation approach can solve the problem we believe it is also beneficial to reduce the SIB12 signaling overhead. |
| ZTE | No | Due to the limited time budget, we think segmentation is more easier to solve signaling over header problem.  |
| Apple  | Yes | Agree with OPPO and MediaTek |
| Qualcomm | Yes | We share the views expressed by Apple |
| Nokia | No | First, no optimization should be treated/discussed in Rel. 16. Secondly, the example above shows that the SIB size optimization (index-table) does not ensure that the SIB12 size with the assumptions given in the example (12SLRBs) is below the LTE-SIB size (after optimization you state that your SIB12 is 8839 which is still larger than LTE SIB size 2976bits) – just reduce the number of SLRB and you are done without any optimization. Therefor we propose to develop a solution for SIB size issue in Rel.17 that really solves the problem, rather than introducing hastily an optimization in Rel.16 that does not guarantee SIB12 size will stay below LTE SIB size. |

### 2.4 Potential solutions to optimize SIB12 size

If you agree observation2 here are alternatives to resolve the problem assuming it is there:

Option1: To introduce size optimization e.g. proposal1/2/3 from paper [2]

Option2: To pre-configure some of the heavy parameters e.g. proposal6 from paper [4]

Option3: Rely only of the SIB segmentation (no optimization of SIB12)

**Question4: which option(s) do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Ericsson | Option 3 | If something needs to be done, the segmentation is the only solution to solve this. As shown in OPPO paper in R2-2002651, even optimizing the size of the SIB there is no guarantee that the V2X SIB will not exceed the NR or LTE SIB size.Therefore, what’s the point to specify two solutions (index+table) when we know that one it may not work anyway? |
| CATT | Option 2 with comment | It is our belief that at least the heavier parameters can be preconfigured. In addition, if we do not want to introduce specification effort, the simplest way is to allow all the SLRB related parameters to be pre-configured. |
| MediaTek | Option 1 first, with comment | Relying purely on preconfiguration might not be practical as we would have to foresee in the spec the requirements of every service that could be required by idle/inactive UEs, so we have a concern that preconfigurations might not prevent large IEs from needing to be configured in SIB12. We see size optimisations as the first thing to apply here. |
| Intel | Option 3 | As commented above, the segmentation should be sufficient to handle this issue |
| OPPO | Option1 | The IEs causing oversize are core IEs within resource pool and SLRB configuration. If we put partial of them into pre-configuration it does not resolve the problem since the rest part will still grow. For example when more frequency/BWP and TX resource pools are configured the SIB12 will still larger than SIB limitation even all SLRB configuration is preconfigured. But if all the problematic IEs are all preconfigured then SIB12 itself is more or less not necessary anymore because those IEs are core configuration for V2X operation also. Hence we believe some further signaling optimization helps. |
| ZTE | Option 3 | See our previous comments. |
| Apple | Option 1 and 2 | We can start with Option 1, and if that does not provide enough reduction, then Option 2 can be considered. |
| Qualcomm | Option 1 and Option 2 at least | Our concern with option 3 (cell-specific IEs) is extensibility to future releases. This approach may benefit R16 (single-frequency), but may not benefit subsequent releases |
| Nokia | none | We do not agree with observation 2. We can agree with option 3, but think it can and should be avoid to introduce an optimization feature at such a late stage of Rel. 16. |

### 2.5 Solution details following option1 in section 2.4

Assuming you choosed option1, which options you would choose for size optimization:

Option 1: To introduce table + index approach for IE SL-QoS-Profile-r16

Option 2: To adjust the granularity for sl-GFBR-r16, sl-MFBR-r16 from linear increment to be power of 2

Option 3: sl-CBR-Priority-TxConfigList-r16 and sl-ThresPSSCH-RSRP-List-r16 is configured as cell level IEs instead of per cell per frequency per BWP per resource pool.

**Question5: which option(s) do you prefer?**

Note, these 3 options are not exclusive with each other, so you can choose more than one options.

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Ericsson | None | If something needs to be done, the segmentation is the only solution to solve this. As shown in OPPO paper in R2-2002651, even optimizing the size of the SIB there is no guarantee that the V2X SIB will not exceed the NR or LTE SIB size.Therefore, what’s the point to specify two solutions (index+table) when we know that one it may not work anyway? |
| CATT | None | Refer to our comments in Q3, from our point of view, after the above optimization, the SIB size is still exceed the NR or LTE SIB size. Thus, such optimization effort is useless. |
| MediaTek | Option 1; discuss options 2/3 | Option 1 is fairly painless and does not change the functionality. However, it could have a latency cost if the table needs to be signalled separately from the configuration (e.g. in successive segments of a SIB). If the table is specified instead of being signalled it becomes like a form of preconfiguration, with the same concern about flexibility (see next question).OPPO: if whole SIB12 is segmented we think latency should not be concern on the specific IEs.For options 2 and 3, they create some restrictions in configuration flexibility, and we should understand if these limitations are acceptable. Although time is limited, there seems no way to decide without some discussion if restricting the number of GFBR/MFBR values is acceptable from a service pov, for example.OPPO: the power of 2 approach actually mimic the value range of IE *prioritisedBitRate*. But we agree it maybe not easy to agree on.As one approach to option 3, there could be a cell-specific default value with the ability to override it per resource pool in the SIB if necessary. This would reduce the overhead from these large IEs, while still allowing the network to handle special resource pools that might require a separate configuration. Something like this could also be done for the preconfiguration approach (see next question).OPPO: We agree it works. But if we take both option1 and option2, then one instance of SL-QoS-Profile-r16 is 33 bits according to our calculation. So it should not be a big deal. |
| Intel | None | See comment to previous question |
| OPPO | Option1/2 and 3 | See comment to previous question |
| ZTE | None | See our previous comments |
| Apple | Option 1,2 and 3 | Agree with OPPO |
| Qualcomm | Option 1, 2 | See answer to Q2.4 |
| Nokia | none | We agree with Ericsson, that first of all there is no need to tackle optimization topics in Rel.16 and instead of introducing a mixed set of solutions that can not ensure that an overloaded SIB12 will stay within the LTE SIB size, we prefer a clean solution in Rel.17.  |

### 2.6 Solution details following option2 in section 2.4

**Question6: If you choose option2 in section2.4, which IE(s) do you prefer to be pre-configured?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| CATT | See comments | We think the simplest way is to allow all the SLRB related parameters to be pre-configured. |
| MediaTek | See comments | We see the potential in preconfiguration, but as noted above we think it may not cover all the needed cases, resulting in a SIB12/28 size that still explodes. One possibility would be to preconfigure some of the lower-level IEs as default values, with the ability for the SIB to override them if needed for some configurations. |
| Apple | See comments | For a variety of different options of a SL parameter, maybe we can consider that what configured in pre-configuration is a default value, and gNB only include it in SIB12 if the value is different from the default value. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# Conclusion

# References

[1] R2-2002622 Draft-CR on RRC open issues of 38.331 [N001,N002,N005] OPPO draftCR Rel-16 38.331 16.0.0 B 5G\_V2X\_NRSL-Core

[2] R2-2002651 Open issues on system information OPPO discussion Rel-16 5G\_V2X\_NRSL-Core

[3] R2-2002653 36331\_CRyyyy\_(REL-16)\_ Correct on SIB28 message for NR V2X OPPO draftCR Rel-16 36.331 16.0.0 F 5G\_V2X\_NRSL-Core

[4] R2-2002828 Further Discussion on RRC Remaining Issues CATT