3GPP TSG-RAN WG1 Meeting #108 R1-22xxxxx

e-Meeting, February 21st – March 3rd, 2022

**Agenda Item: 5**

**Title: [Draft] FL summary #1 on CORESET#0 impact of CBW narrower than 40MHz of n79**

**Source: Moderator (Samsung)**

**Document for: Discussion, Decision**

# Introduction

This feature lead (FL) summary (FLS) concerns CORESET#0 impact of CBW narrower than 40MHz of n79 in LS [R1-2200907](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2200907.zip) from RAN4 to RAN1.

This document summarizes contributions [1] – [11] submitted to agenda item 5 Incoming LSs on Rel-17 NR\_bands\_R17\_BWs.

The issues that are in the focus of this round of the discussion are tagged FL1.

Follow the naming convention in this example:

* *NarrowerCBWn79FLS-v000.docx*
* *NarrowerCBWn79FLS-v001-CompanyA.docx*
* *NarrowerCBWn79FLS-v002-CompanyA-CompanyB.docx*
* *NarrowerCBWn79FLS-v003-CompanyB-CompanyC.docx*

If needed, you may “lock” a spreadsheet file for 30 minutes by creating a checkout file, as in this example:

* Assume CompanyC wants to update *NarrowerCBWn79FLS-v002-CompanyA-CompanyB.docx*.
* CompanyC uploads an empty file named *NarrowerCBWn79FLS-v003-CompanyB-CompanyC.checkout*
* CompanyC checks that no one else has created a checkout file simultaneously, and if there is a collision, CompanyC tries to coordinate with the company who made the other checkout (see, e.g., contact list below).
* CompanyC then has 30 minutes to upload *NarrowerCBWn79FLS-v003-CompanyB-CompanyC.docx*
* If no update is uploaded in 30 minutes, other companies can ignore the checkout file.
* Note that the file timestamps on the server are in UTC time.

In file names, please use the hyphen character (not the underline character) and include ‘v’ in front of the version number, as in the examples above and in line with the general recommendation (see slide 10 in [R1-2108693](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2108693.zip)), otherwise the sorting of the files will be messed up (which can only be fixed by the RAN1 secretary).

To avoid excessive email load on the RAN1 email reflector, please note that there is NO need to send an info email to the reflector just to inform that you have uploaded a new version of this document. Companies are invited to enter the contact info in the table below.

# CORESET#0 impact of CBW narrower than 40MHz of n79

In RAN#94-e meeting, the updated channel bandwidth support to the band n79 was approved for the new scenarios (e.g., local 5G, RedCap). Since the band n79 newly introduces {10, 20, 30, 70, 90} MHz to existing channel bandwidths {40, 50, 60, 80, 100} MHz, the minimum channel bandwidth of n79 has been changed from 40 MHz to 10MHz. Most of issues caused by minimum channel bandwidth change would be resolved for the band n79 by adding a step size for the narrower channel bandwidths. However, there’s still a backward compatibility issue.

In TS 38.213, upon detection of SS/PBCH block, UE determines CORESET#0 from MIB by looking up the table for *controlResourceSetZero*. The table is determined according to subcarrier spacing of SSB, subcarrier spacing of PDCCH, and minimum channel bandwidth of the frequency band where UE located. For example, a new UE supporting 10 MHz the minimum channel bandwidth for n79 will have a different table (table 13.4 in TS 38.213) for CORESET#0 configuration with a legacy UE still supporting 40 MHz (table 13.6 in TS 38.213). Regarding backward compatibility, how to determine the table in this scenario can be an issue that needs further clarifications.

To solve this issue, RAN4 proposed four potential solutions and sent LS to RAN1 for input.

* Alt-1: Add narrower channel bandwidth to n79, and indicate different table to legacy UE and new UE for CORESET#0 configuration.
* Alt-1a: Add narrower channel bandwidth to n79, and indicate the same table 13.6 to legacy UE and new UE for CORESET#0 configuration.
  + Rationale: Legacy UE not supporting channel bandwidth lower than 40MHz will always look at table 13.6, this table shall then be the common one.
* Alt-1b: Add narrower channel bandwidth to n79, and indicate:
  + A UE synchronizing on a GSCN with step 4 shall look at the table 13.6.
    - Rationale: This enables new and legacy to connect in band n79 using the same CORESET#0 configuration.
  + A UE synchronizing on a GSCN with step 1 but not step 4 shall look at the table 13.4.
    - Rationale: Table 3.4 offers more flexibility on CORESET#0 configuration
* Alt-2: Add narrower channel bandwidth to new band nX instead of n79.

Regarding this issue, RAN1 contributions from different companies are provided in [1-11].

* For Alt-1

Most of contributions indicate that Alt-1 is not preferred due to the big impact on configuration flexibility of CORESET#0 it brings [4, 6, 7, 8, 10, 11] or having backward compatibility issue that not feasible to implement [5]. One contribution [2] thinks Alt1/1a are acceptable from standardization effort point of view and slightly prefers Alt-1.

* For Alt-2

Most of contributions [4, 5, 6, 7, 8, 10, 11] indicate that Alt-2 is not preferred. Because it brings UE complexity to implementation to support both n79 and nX for Type0-PDCCH monitoring [4, 6, 7, 8, 11], has backward compatibility issue that not feasible to implement [5], or needs effort to revert agreement in RAN4 [2, 7, 9]. Meanwhile, one contribution [1] prefers Alt-2 comparing with other alternatives.

* For Alt-1a and Alt-1b

One contribution [1] points out that Alt-1a/1b need to introduce frequency band number and GSCN to RAN1 specification, and frequency band number and GSCN are transparent to RAN1 specification. Also, one contribution [10] indicates that typically RAN1 have avoided hard-coding band-dependencies in RAN1 specification.

Several contributions [4, 5, 6, 11] prefer Alt-1b since it has larger configuration flexibility comparing with Alt-1a. Contributions [2, 7, 11] mention the step size should be 16 instead of 4 in Alt-1b, and contribution [5] modifies Alt-1b with minor revision.

Several contributions [7, 8, 9] prefer Alt-1a, considering UE implantation complexity bring by Alt-1b. Contribution [10] thinks additional RB offsets would need to be introduced to Alt-1a. Contribution [9] introduces a new table which duplicate index 0-9 in Table13-6, and add additional configurations for CBW narrower than 40MHz.

Contribution [3] thinks it’s better to have same understanding of the alternatives and the impacts before making any agreements and exceptional handling for band n79 can be considered.

Summarize views of companies in table below.

|  |  |
| --- | --- |
| Alternatives | Support companies |
| Alt-1 | ZTE(slightly) |
| Alt-1a | MTK, SAMSUNG, NOKIA(add additional RB offset), QC (new table for n79) |
| Alt-1b | HW(assume UE complexity is negligible), ERICSSON, CMCC(slightly), INTEL, NOKIA |
| Alt-2 | vivo |

Regarding frequency band number/GSCN transparent to RAN1 specification issue from [1, 10]:

* Currently, RAN1 specification has introduced frequency band and GSCN specific procedures. For example, determination of the first symbol indexes for candidate SS/PBCH blocks in 38.213-4.1 is based on carrier frequency range. Another example, in 38.213-13, UE determine offset according Table 13-1A or Table 13-4A, ‘if frequency position of the SS/PBCH block corresponds to the GSCN of a synchronization raster entry as defined in [8-1, TS 38.101-1]’.
* Moreover, we can discuss ways to avoid mention specific frequency band number in 38.213 after we make an agreement if it is an issue.

Regarding the step size issue in Alt-1b from [2, 7, 11]:

* Correct RAN4 alternative Alt-1b’s description from step size 4 to step size 16.

Since the majority view is focus on Alt-1a and Alt-1b, the following proposal can be considered.

(Please also notice that general guideline from Chair is to make Rel-17 related outgoing LSs in RAN1#108e be finalized by February 25, 2022.)

**FL1 Proposal 2-1:** Can the following alternatives be considered for down selection? If yes, please indicate your preferred alternative(s).

* Alt-1a: Add narrower channel bandwidth to n79, and indicate the same table 13.6 to legacy UE and new UE for CORESET#0 configuration.
  + FFS additional entries for the used table(s)
  + FFS on necessity of new table(s)
* Alt-1b: Add narrower channel bandwidth to n79, and indicate:
  + A UE synchronizing on a GSCN with step 16 shall look at the table 13.6.
  + A UE synchronizing on a GSCN with step 1 but not step 16 shall look at the table 13.4.
  + Note: In RAN1’s understanding, step size of GSCN should be 16 instead of 4.

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Intel | Y | In our contribution [5], the minor modification was essentially what has been clarified in the Alt 1-b that GSCN step size should be 16 and not 4.  With this clarification, we are fully supportive of Alt 1-b.  One aspect to consider for Alt 1-a is that only 63% and 25% of the channel entries with 15 kHz and 30 kHz is supported, respectively. Compared that with Alt 1-b where all (100%) channels entries can be supported. We provide quantitative analysis of the supported channel entries in our contribution [5] |
| FUTUREWEI | Y | It is okay to focus on Alt-1a and Alt-1b for downselection (with any clarifications as needed). For instance, several companies seemed to have different understanding for Alt-1a. |
| Nokia | Y | We think that both approaches would be in principle viable, while think that from UE complexity perspective Alt-1a would be preferable.  The problem pointed by Intel would be seem to get resolved, if we introduce additional RB offset values for 24RB CORESET size (either both or at least one of ={2,3}) to Table 13-6, and for 48RB CORESET size (at least one of ={1,2,3}) to Table 13-5. |
| Ericsson | Y | Our preference is Alt-1b. |
| Qualcomm |  | Considering the potential impacts on RAN1 spec and UE implementation, our preference is Alt-1a.  Alt-2 is also acceptable to us. |
| vivo | N | We understand Alt-2 may revert RAN4’s previous agreement, but it is the cleanest solution from RAN1 perspective. Regarding the arguments made against Alt-2, we have following comments:   1. The UE blind decoding is only limited to the case where UE try to access the NW at the first time, and there are currently several precedent of overlapping bands in RAN4, which requires the similar thing. Therefore, we do not see the feasibility issue of Alt-2 from UE complexity perspective. 2. Alt- 1a or Alt-1b will introduce band specific or even GSCN specific UE behavior which is highly discouraged from RAN1 specification perspective and we do not have precedent for those. If now we agree to introduce special handling for n79, should we do the same in the future if RAN4 find another use case for special handling for other bands? Are we (RAN1) ready to break the band agnostic principle for RAN1 specification? At least for us, it would be highly discouraged to do so.   It would be good to hear the response to the above points from the proponents of Alt-1a or Alt-1b before making a down-selection. |
| SAMSUNG | Y | We prefer Alt-1a, and can further discuss the FFS.  @VIVO  We don’t think currently overlapping bands in RAN4 have the same issue with that in Alt2. Because the existing overlapping bands in RAN4 share the same minimum channel bandwidth, and map to the same CORESET#0 configuration table, UE don’t need to try both tables.  Besides, since there are already frequency band or GSCN related behavior in RAN1 specification. We don’t think it is a blocking issue for Alt1-a/Alt-1b. |
| Fujitsu | Y | Our preference is Alt-1a or Alt-1b. We think Alt-1 and Alt-2 are not practical considering the gNB implementation/backward compatibility and RAN4 workload, even though RAN1 spec impact is zero/small.  Regarding vivo’s comment, as Samsung mentioned, RAN1 specs have already defined a frequency dependent behavior in e.g. section 4.1 of 38.213 , so alt-1a or alt-1b cannot be blocked due to this reason. Also, in our understanding, there was no big support to Alt.2 in RAN4 and hence we wonder why we need to push this alternative from RAN1. |
| Huawei, HiSilicon | Y | Fine for further down selection while our preference is Alt 1-b or Alt 1-a without the FFS bullets. Our understanding is that those sub-bullets for Alt 1-a aim to provide additional flexibility conditioned by UE implementation change - if anyway such change is made then Alt 1-b should be best with full flexibility. |
| ZTE | OK | Our first preference is Alt 1 for its simplicity. We are also fine with Alt 1a.  For Alt 1b, new UE needs to distinguish different GSCNs to use the correct table, which increases the complexity of UE and more specification effort is expected. In addition, to be compatible with legacy UEs, Alt 1b also requires to apply GSCN with step 16 with table 13.6, which cannot provide additional flexibility compared to Alt 1a. |

# References

|  |  |  |  |
| --- | --- | --- | --- |
| [1] | [R1-2201059](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2201059.zip) | Discussion on RAN4 LS on CORESET#0 impact of CBW narrower than 40MHz of n79 | vivo |
| [2] | [R1-2201156](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2201156.zip) | Discussion on CORESET#0 impact of CBW narrower than 40MHz of n79 | ZTE |
| [3] | [R1-2201432](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2201432.zip) | Discussion on CORESET#0 impact of CBW narrower than 40MHz of n79 | FUTUREWEI |
| [4] | [R1-2201620](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2201620.zip) | Discussion on LS related to CORESET#0 impact of CBW narrower than 40MHz of n79 | Ericsson |
| [5] | [R1-2201677](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2201677.zip) | Discussion on LS CORESET#0 impact of CBW narrower than 40MHz of n79 | Intel Corporation |
| [6] | [R1-2201841](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2201841.zip) | Discussion on RAN4 LS on CORESET#0 impact of CBW narrower than 40MHz of n79 | CMCC |
| [7] | [R1-2201973](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2201973.zip) | Discussion on CORESET#0 impact of CBW narrower than 40MHz of n79 | Samsung |
| [8] | [R1-2202060](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2202060.zip) | Discussion on RAN4 LS on CORESET#0 configuration in n79 | MediaTek Inc |
| [9] | [R1-2202107](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2202107.zip) | Draft Reply LS on CORESET#0 Impact of CBW Narrower than 40 MHz of n79 | Qualcomm Incorporated |
| [10] | [R1-2202325](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2202325.zip) | On CORESET#0 configuration for n79 with CBW narrower than 40MHz | Nokia, Nokia Shanghai Bell |
| [11] | [R1-2202472](file:///C:\\Users\\qiqi.zhang\\AppData\\Local\\Docs\\R1-2202472.zip) | On CORESET#0 impact of smaller CBW of n79 | Huawei, HiSilicon |