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 FL3.

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 implementation 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.  FL2: It is FL’s understanding of your contribution as well.  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]  FL2: Consider configuration flexibility you mentioned, Alt-1a with new added entries may also solve the issue. Please consider to add your answer in Question 2-1. |
| 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.  FL2: with the impact on UE implementation and effort to revert agreement in RAN4, we’ll take the majority view to down select Alt-1a and Alt-1b. |
| 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. |
| NTT DOCOMO | Y | We support to down-select from Alt.1a or Alt.1b. Also we share the same view with Qualcomm that Alt.1a is preferable considering potential RAN1 impact. |
| vivo2 |  | Thanks a lot for the responses to our comments.  We do not see a particular band number nXX captured in anywhere in the current RAN1 specification. Currently it only distinguishes among different frequency ranges, e.g. licensed/unlicensed, FR1/FR2, or <3GHz, etc. and we would like to avoid mentioning specific band number in RAN1 specification. We also did not see particular GSCN or GSCN step captured in the RAN1 specification, we also would like to avoid that.  Regarding Alt-2, our understanding of the discussion was that RAN4 did not realize the significant RAN1 specification when excluding Alt-2 at the early stage of the discussion, RAN1 should have been involved at that time.  If there is clear majority to go with Alt-1a or Alt-1b, we strongly prefer to keep RAN1 specification transparent to particular band number and GSCN number and having those captured in RAN4 specification.  FL2: Regarding the RAN1 specification issue you pointed out, please consider to further comment on potential test in Proposal 3-1/3-2/3-3. |
| MediaTek | Y | From the UE implementation perspective, we prefer Alt1-a without FFS point. For the FFS points under it, if new entries or tables are to be added, we need to make sure legacy UE will not impacted. |

Based on replies above, the majority view is to down select from Alt-1a and Alt-1b as below.

* 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.

Update companies’ view on two alternatives as table below.

|  |  |
| --- | --- |
| Alternatives | Support companies |
| Alt-1a | MTK (without additional entries), SAMSUNG, NOKIA(add additional RB offset), QC (new table for n79), NTT DOCOMO,ZTE, HW(without additional entries), Fujitsu, FUTUREWEI |
| Alt-1b | HW, ERICSSON, INTEL, Fujitsu, FUTUREWEI |

In FL’s understanding, adding new entries to existing tables can provide similar flexibility as introducing new tables for n79. Considering the concern from vivo to introduce special handling of particular band, FL suggest to focus the discussion on the new entries.

**FL2 Question 2-1: Please provide answers of the following questions with technical reasons:**

**(Q1) Which option(s) is preferred?**

**(Q2) Which option(s) can be accepted?**

**(Q3) Which option(s) is not acceptable?**

* 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.
* Alt-1a’: Add narrower channel bandwidth to n79, and indicate table 13.6 with additional entries to legacy UE and new UE for CORESET#0 configuration.
* 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** | **Comments** |
| Ericsson | Preference is Alt-1b considering it is the only way to provide additional flexibility in CORESET#0 configuration that we see needed in deployments. We do not see how Alt-1a’ can work with legacy UEs and then it should be ruled out. In Alt-1a one is then limited to the existing in tables 13-5 and 13-6. Hence:  Q1: Alt-1b  Q2: We have concerns with the lack of flexibility in Alt-1a  Q3: Alt-1a’ since it cannot support legacy UEs |
| vivo | Q1: Alt-1a.  Q3: Alt-1a' would require further RAN1 spec efforts for determine the appropriate values for the reserved entries and it may have impacts on the legacy UEs. Alt-1b would increase UE implementation complexity. |
| Qualcomm | Q1: Alt-1a’. To mitigate the impacts of Alt-1a’ on legacy UE (if any), NW has the flexibility to signal the existing entries (index 0 to 9) of Table 13-6 only for a cell that allows legacy UE to access.  Q2: Alt-1a  Q3: For Alt-1b, we have concerns for its potential impacts on RAN1 specs and UE implementation. Moreover, it prohibits the cells with CBW of {10, 20, 30} MHz to be deployed on the GSCN range of 8460:16:8880, and this seems inconsistent with the RAN4 agreements (which allows new CBW of {10, 20, 30} MHz to be deployed on the GSCN range of 8475:1:8884). |
| FUTUREWEI | Note to moderator: our preferences were not captured in the table. We updated the table in red.  Q1: Alt-1b – in our understanding, when GSCN is a multiple of 16, during initial access CBW of 10 and 20 MHz are used. For the connected mode, CBW of 10, 20, 30 can be configured. So there is no issue or inconsistency with RAN4.  Q2: Alt-1a  Q3: Alt-1a′ - it is unclear how a legacy UE interprets such reserved entries. |
| Nokia | Q1: Our preference would be Alt-1a’.  Q2/Q3: In principle we can consider any of the listed alternatives. For Alt-1b, if agreed, we would prefer to leave the GSCN based selection procedure to RAN4, as suggested in FL proposals below. |
| MediaTek | Q1: We still prefer Alt-1a to minimize UE changes.  Q2: However, we can accept Alt-1b and Alt-1a’ with a *condition*.   * Between Alt-1b and Alt1-a’ with a condition, we prefer Alt-1b. * The *condition* for us to accept Alt-1a’ is that new entries can be only configured in cells that are not deployed on legacy sync raster entries. In this way, a legacy UE won’t camp on such a cell and won’t try and fail to decode CORESET#0 configured by new entries.   Q3: We cannot accept Alt1-a’ without any conditions applied, for example the *condition* we described in our reply to Q2. |
| SAMSUNG | Q1:Alt-1a has no impact on legacy UE, less impact on RAN1 specification and simple to implement with good enough flexibility.  Q2:Alt-1a’. It is up to UE implementation that how to interpret the reserved row of table 13-6. Thus, we also have concern on the behavior of legacy UE when it co-exist with new UE.  To solve this problem, one way is as QC mentioned to depend on NW configuration. However, NW still have the possibility to configure index 10-15. And if there is legacy UE, then it may cause unknown UE behavior. Another way is to add restriction on the usage of the new entries in RAN1 specification, for example: new entries only applicable for GSCN with step size 1 but not step size 16.  Comparing with Alt-1a, it has larger impact on RAN1 specification.  Q3: Alt-1b. We have concerns on UE implementation complexity it brings. UE need to identify its located GSCN firstly, then map the corresponding table for CORESET#0 configuration determination. Moreover, Alt-1a’ can bring same configuration flexibility without impact on UE implementation. |
| NTT DOCOMO | Q1: Alt-1a  Q2: Alt-1a’, Alt-1b  Our preference is Alt-1a which can minimize RAN1 specification impacts or standardization effort. We can also accept Alt-1a’ and Alt-1b which can provide configuration flexibility compared to Alt-1a. If Alt-1a’ is supported, it may be necessary to discuss how to ensure backward compatibility for legacy UE. |
| CMCC | Comparing these three alternatives, when there are legacy UEs in the cell, only entries 0~9 in table 13-6 can be configured for common CORESET#0. When there are no legacy UEs, both Alt-1a’ and Alt-1b can provide additional CORESET#configurations. While Alt-1b allow more flexible configuration candidates, that’s because when SSB is transmitted on a GSCN with step 1 but not step 16, even with the same 24RB\*2symbol, offset 2RB configuration, the CORESET#0 location will be different from the case that SSB is transmitted on a GSCN with step 16. And Alt-1b desn’t require no new design for the table.  Q1: Alt-1b  Q2: Alt-1a  Q3: Alt-1a’, it is not preferred, since it requires more spec changes. |
| Fujitsu | Q1. Either Alt-1a or Alt-1b is fine.  In our view, the necessity of the flexibility depends on the potential spectrum allocation. We think the most flexible solution should be prepared by RAN1, but we are OK to leave the final decision (Alt-1a or -1b) up to RAN4.  Q2. Alt-1a’  We understand that Alt-1a’ will not bring any legacy UE issue if the new entries are properly used. However, we don’t think this approach is a safe way to go. More discussion and a solution to ensure backward compatibility would be needed, then. |
| ZTE | Q1: Alt-1a.  Q2: Alt-1a’. It can provide better flexibility and avoid dependency on GSCN number in RAN1 specification. So, this is acceptable for us.  Q3: Alt-1b. More UE complexity is expected. |

**FL3:** According to discussion above, summary companies’ view as below.

**Alt-1a:**

* Prefer or acceptable companies(11):
  + ERICSSON, vivo, QC, FUTUREWEI, Nokia, MediaTek, SAMSUNG, CMCC, NTT DOCOMO, Fujitsu, ZTE,[Huawei, HiSilicon]??
* Unacceptable companies: -

One company raises their concern on the lack of configuration flexibility. However, no companies think it is unacceptable comparing with other alternatives.

**Alt-1a’:**

* Prefer or acceptable companies(7):
  + QC, Nokia, MediaTek (new added entries only for new sync raster entries), SAMSUNG, NTT DOCOMO, Fujitsu, ZTE
* Unacceptable companies(4):
  + ERICSSON, vivo, FUTUREWEI, CMCC, Intel

Several companies raise the issue of supporting legacy UE if new entries are applied to legacy SS sync raster entries. For this issue, some companies suggest to leave it to NW configuration or add restriction on new entries to RAN1 or RAN4 specification. However, there are companies suggest more discussion on this.

Several companies mentioned that this alternative requires further RAN1 spec efforts to design the new entries for the table or more specification changes.

**Alt-1b:**

* Prefer or acceptable companies(7): ERICSSON, FUTUREWEI, Nokia, MediaTek, CMCC, NTT DOCOMO, Fujitsu, ~~[~~Intel~~]??~~, [Huawei, HiSilicon]??
* Unacceptable companies(4): QC, vivo, SAMSUNG, ZTE

Several companies have concern on the impact on UE implementation complexity and/or RAN1 specification.

Update companies’ view on alternatives as table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Alternatives** | **Support companies (prefer or acceptable)** | **Count** | **Unacceptable companies** | **Count** |
| **Alt-1a** | ERICSSON, vivo, QC, FUTUREWEI, Nokia, MediaTek, SAMSUNG, CMCC, NTT DOCOMO, Fujitsu, ZTE, ~~[~~Huawei, HiSilicon~~]??~~ | 11 | - | 0 |
| **Alt-1a’** | QC, Nokia, MediaTek (new added entries only for new sync raster entries), SAMSUNG, NTT DOCOMO, Fujitsu, ZTE | 7 | ERICSSON, vivo, FUTUREWEI, CMCC | 4 |
| **Alt-1b** | ERICSSON, FUTUREWEI, Nokia, MediaTek, CMCC, NTT DOCOMO, Fujitsu, ~~[~~Intel~~]??~~, ~~[~~Huawei, HiSilicon~~]??~~ | 7 | QC, vivo, SAMSUNG, ZTE | 4 |

According to the discussions, all companies can accept Alt-1a, and companies have very different views on Alt-1a’ and Alt-1b. For the issue raised in Alt-1a’, more discussions are needed.

**FL3:** Can you support or accept Proposal 2-2? If no,please provide detail technical reason.

**Proposal 2-2:**

* **Alt-1a: Add narrower channel bandwidth to n79, and indicate the same table 13-5/13-6 to legacy UE and new UE for CORESET#0 configuration.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MediaTek | Y |  |
| Huawei, HiSilicon | Y and | We confirm our preference/opinion in the above table by revisions.  Although we can accept the proposal, a bit following up is that the concern from other companies on Alt 1-b is not valid in our view: where to deploy the sync raster could be a network choice who will know the consequence that legacy UE cannot access the carrier with smaller CBW, but it still provide operators more chance to use its small spectrum for new UEs. Alt 1-a’ has the same issue in this sense, i.e., when the carrier is smaller than 40Mhz, even if a legacy UE can read the same table referring to 40Mhz BW for SSB, it will fail to access when reading SIB since the indicated carrier BW is smaller than UE CBW. As a consequence as MTK pointed out, legacy UE cannot work on new carrier deployed in the overlapping GSCN. |
| Nokia | Y |  |
| FUTUREWEI | Y |  |
| Qualcomm | Y |  |
| vivo | Y |  |
| Intel | - | While we can accept the conclusion. RAN1 should also provide information that with Alt 1-1a, this basically means for only 63% of all possible channels for 10 MHz using 15kHz can be utilized, and only 25% of all possible channels for 10 MHz using 30 kHz can be utilized. Resulting in limitations on where the 10 MHz can be deployed within n79.  We should avoid the impression that Alt 1-1a will solve the channelization limitation issue to RAN4. So we would be ok to accept this is information about the channelization limitation is sent along with the reply LS.  From our opinion, we can actually provide both information of Alt 1-a and Alt 1-b to RAN4 and let RAN4 determine the final outcome.  From RAN1 perspective, both Alt 1-a and Alt 1-b are feasible from physical layer perspective as both do not cause backwards compatibility issue. I think we should focus the discussion on identifying solutions that are feasible from specification. If there are other consideration that need to be made, e.g. channelization deployment restriction vs UE configuration simplicity, I think this decision is best suitable for RAN4 to decide. Not sure why RAN1 can decide this when deployment flexibility and channel definition is completely in RAN4 domain. |
| SAMSUNG | Y |  |
| NTT DOCOMO | Y |  |

# Potential Text proposal

As commented by vivo, specific frequency band number or GSCN number shall be transparent to RAN1 specification. Please comment on the potential text proposals for each alternative:

**Text proposal For Alt-1a:**

Table 13-3: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the frequency bands given in [5, TS38.101-1] <Table omitted>

Table 13-4: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the frequency bands given in [5, TS38.101-1] <Table omitted>

Table 13-5: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 40MHz or for the frequency bands given in [5, TS38.101-1] <Table omitted>

Table 13-6: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 40MHz or for the frequency bands given in [5, TS38.101-1] <Table omitted>

**FL2 Proposal 3-1:**

* **If Alt-1a is supported, whether the above changes are sufficient for RAN 1?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Ericsson | Y |  |
| vivo |  | We are fine generally with the text proposal. But we would like to clarify whether the {SS/PBCH block, PDCCH} SCS of {30, 15}, i.e., modification on Table 13-3 and Table 13-5 is in the scope since from RAN4 LS description, only {SS/PBCH block, PDCCH} SCS of {30, 30}, i.e., Table 13-4 and Table 13-6 in TS 38.213 is discussed.  FL3:Please check the comment from Samsung |
| Qualcomm | Y | Agree with the comments of Vivo  FL3:Please check the comment from Samsung |
| FUTUREWEI |  | Similar comment as vivo. In addition, the minimum channel bandwidth needs to be added to Table 13-6. Example  Table 13-6: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 40MHz or for the frequency bands given in [5, TS38.101-1] when the minimum channel bandwidth is 10 MHz  FL3: RAN4 can add note to indicate the specific frequency band (i.e., n79) for this table, thus there is no need to mention minimum channel bandwidth for the frequency band. |
| Nokia | Y |  |
| MediaTek | Y |  |
| SAMSUNG | Y | @vivo  According to RAN4 CR R4-2117846, n79 supports new narrower CBW for both SCs 15KHz and 30KHz. Thus, for SCs {30, 15} kHz of {SS/PBCH block, PDCCH}, it has the exactly same problem as SCs {30, 30} kHz of {SS/PBCH block, PDCCH}. Even only table 13-6 is mentioned in alternatives, for table 13-5, it is the exactly same solution. And RAN1 shall include both scenarios for potential text proposal.  [vivo]: Thanks for your explanation. |
| NTT DOCOMO | Y |  |
| CMCC | Y |  |
| Fujitsu | Y |  |
| ZTE | Y |  |
| Huawei, HiSilicon |  | Our understanding of vivo’s comment is that the table is just mentioned by RAN4 as an example. Others table may have the same issue and we are fine to address those. |
| Intel | Y |  |

**Text proposal For Alt-1a’:**

**Table 13-3: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the frequency bands given in [5, TS38.101-1]** <Table omitted>

**Table 13-4: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the frequency bands given in [5, TS38.101-1]** <Table omitted>

**Table 13-5: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 40MHz or for the frequency bands given in [5, TS38.101-1]**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Index | SS/PBCH block and CORESET multiplexing pattern | Number of RBs | Number of Symbols | Offset (RBs) |
| 0 | 1 | 48 | 1 | 4 |
| 1 | 1 | 48 | 2 | 4 |
| 2 | 1 | 48 | 3 | 4 |
| 3 | 1 | 96 | 1 | 0 |
| 4 | 1 | 96 | 1 | 56 |
| 5 | 1 | 96 | 2 | 0 |
| 6 | 1 | 96 | 2 | 56 |
| 7 | 1 | 96 | 3 | 0 |
| 8 | 1 | 96 | 3 | 56 |
| 9 | 1 | 48 | [1] | [6] |
| 10 | 1 | 48 | [2] | [6] |
| 11 | 1 | 48 | [3] | [6] |
| 12 | [Reserved] | | | |
| 13 | [Reserved] | | | |
| 14 | Reserved | | | |
| 15 | Reserved | | | |

Table 13-6: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 40MHz or for the frequency bands given in [5, TS38.101-1]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Index | SS/PBCH block and CORESET multiplexing pattern | Number of RBs | Number of Symbols | Offset (RBs) |
| 0 | 1 | 24 | 2 | 0 |
| 1 | 1 | 24 | 2 | 4 |
| 2 | 1 | 24 | 3 | 0 |
| 3 | 1 | 24 | 3 | 4 |
| 4 | 1 | 48 | 1 | 0 |
| 5 | 1 | 48 | 1 | 28 |
| 6 | 1 | 48 | 2 | 0 |
| 7 | 1 | 48 | 2 | 28 |
| 8 | 1 | 48 | 3 | 0 |
| 9 | 1 | 48 | 3 | 28 |
| 10 | 1 | 24 | [2 or 3] | [1] |
| 11 | 1 | 24 | [2 or 3] | [2] |
| 12 | 1 | 24 | [2 or 3] | [3] |
| 13 | Reserved | | | |
| 14 | Reserved | | | |
| 15 | Reserved | | | |

**FL2 Proposal 3-2:**

* **If Alt-1a’ is supported,**

**(Q1) whether the above changes are sufficient for RAN 1?**

**(Q2) what are the new entries needed?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Ericsson | N | We consider this change NBC and hence breaking the specification |
| Qualcomm | Y | As recognized by RAN4 in the LS to RAN1 (R4-2202286), introduction of new/narrower CBW and new GSCN configurations (range, step size) to n79 band is a NBC issue.  Q1/Q2: it is desirable to add new entire for 24 RB/48 RB, which support max CCE AL of 16. |
| FUTUREWEI |  | Similar comment as above for the minimum channel bandwidth in the table title. It is unclear how a legacy UE would interpret the new values when it receives them in the MIB |
| Nokia | Y | Q1: Yes  Q2: For Table 13-6, as noted earlier we could have the offsets={1,2,3} RB added either both or at least one of ={2,3} values. For Table 13-5, we could check if both the offsets={2,6} RB would be added to all or some of ={1,2,3} values. |
| MediaTek |  | To avoid any impact on legacy UE, if Alt-1a’ is agreed, we should notify RAN4 that new entries are only applicable to cells that allow new UEs ***but not legacy UEs*** to access. This condition should be clearly stated in RAN4’s specification and NW should strictly follow this rule for its cell planning and configuration. |
| SAMSUNG |  | Q1: For the concern from Ericsson and FUTUREWEI, notes can be added for the new entries. For example, index 10-15 of table 13-6 are only applicable for GSCNs of synchronization raster entries as defined in [5.4.3.3, TS38.101-1]. And inform RAN4 to restrict the applicable GSCNs only to new UEs which with GSCN step size 1 but not step size 16.  Q2: Number of RB 48 for table 13-5, and Number of RB 24 for table 13-6 |
| NTT DOCOMO |  | We share similar the concern as Ericsson and FUTUREWEI that a legacy UE behavior when it is configured with a new entry is unclear, hence, it needs to be clarified before we discuss the exact values of new entries. |
| CMCC |  | When only 3 additional entries are designed, the additional flexibility may be limited. |
| ZTE |  | We prefer the following changes for the new entries of Table 13-5 and Table 13-6, i.e., directly change the reserved row into an index referring to Table 13-3 and Table 13-4 respectively. Because it can clearly reflect our intention to use the index from a narrow band table and is more understandable. In addition, it also borrow some spirit of Alt 1 b (in terms of referring a new Table) and therefore may also address some of concerns from proponents of Alt 1b.  For Table 13-5:  ~~Reserved~~ Index 1 of Table 13-3  ~~Reserved~~ Index 3 of Table 13-3  ~~Reserved~~ Index 5 of Table 13-3  For Table 13-6:  ~~Reserved~~ Index 1 of Table 13-4  ~~Reserved~~ Index 2 of Table 13-4  ~~Reserved~~ Index 3 of Table 13-4 |
| Intel | N | Q1: Whether the changes are sufficient are not depends on the goal. From our understanding Table 13-6 may not fully cover all channel deployment cases, therefore in our opinion not sufficient.  Q2:would require RB offset of {1,2,3} for both 2 symbol and 3 symbol cases. |

**Text proposal For Alt-1b:**

Table 13-3: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the GSCNs of synchronization raster entries as defined in [5.4.3.3, TS 38.101-1] <Table omitted>

Table 13-4: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the GSCNs of synchronization raster entries as defined in [5.4.3.3, TS 38.101-1] <Table omitted>

Table 13-5: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 40MHz or for the GSCNs of synchronization raster entries as defined in [5.4.3.3, TS 38.101-1] <Table omitted>

Table 13-6: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 40MHz or for the GSCNs of synchronization raster entries as defined in [5.4.3.3, TS 38.101-1] <Table omitted>

**FL2 Proposal 3-3:**

* **If Alt-1b is supported, whether the above changes are sufficient for RAN 1?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Ericsson | Y |  |
| Qualcomm |  | In addition to the updates above, at least Clause 4.1 of TS 38.213 needs to be revised to accommodate the new cell search procedures associated with Alt-1b.  Moreover, it prohibits the cells with CBW of {10, 20, 30} MHz to be deployed on the GSCN range of 8460:16:8880, and this seems inconsistent with the RAN4 agreements (which allows new CBW of {10, 20, 30} MHz to be deployed on the GSCN range of 8475:1:8884). |
| FUTUREWEI | Y | Similar changes to the table title to account for the minimum channel bandwidth needed |
| Nokia | Y |  |
| MediaTek | Y |  |
| SAMSUNG | Y |  |
| NTT DOCOMO | Y |  |
| CMCC | Y |  |
| Fujitsu | Y |  |
| Intel | Y |  |

**FL3:** Most of companies agree on the proposed text proposal for Alt-1a. @vivo @FUTUREWEI,please check FL3’s comment in **FL2 Proposal 3-1** to see whether the replies can address your concerns.

**FL3 Proposal 3-4: Endorse the following text proposal for TS 38.213**

==========Text proposal for 38.213=================

<Unchanged part omitted>

Table 13-3: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the frequency bands given in [5, TS38.101-1]

<Unchanged part omitted>

Table 13-4: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the frequency bands given in [5, TS38.101-1]

<Unchanged part omitted>

Table 13-5: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 40MHz or for the frequency bands given in [5, TS38.101-1]

<Unchanged part omitted>

Table 13-6: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 40MHz or for the frequency bands given in [5, TS38.101-1]

<Unchanged part omitted>

==========End of Text proposal =================

**FL3:** Can you support or accept **Proposal 3-4**? If no,please provide detail technical reason and suggested changes.

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MediaTek | Y |  |
| Huawei, HiSilicon | Y |  |
| Nokia | Reservations | Like expressed earlier we see merit in Alt1a combined with new entries to the aforementioned tables, so that we can obtain simple UE implementation and deployment flexibility. Hence we would like to consider that RAN1 agrees that we introduce new values for the reserved entries (e.g. in next meeting) to achieve the deployment flexibility. Detailed values for the offsets could be still worked on in this meeting, or confirmed in next meeting.  For the use of the new entries, in order to avoid any implications with legacy terminals, these entries could be used only in the new SS-raster locations, and in the legacy raster locations it would be preferable to restrict to legacy entries. From this perspective Alt1a with new entries and Alt1b do not differ. |
| Qualcomm | Y |  |
| vivo | Y |  |
| SAMSUNG | Y |  |
| NTT DOCOMO | Y |  |
| Intel | Only if additional information is sent along with LS | As mentioned above, while we can accept the conclusion. RAN1 should also provide information that with Alt 1-1a, this basically means for only 63% of all possible channels for 10 MHz using 15kHz can be utilized, and only 25% of all possible channels for 10 MHz using 30 kHz can be utilized. Resulting in limitations on where the 10 MHz can be deployed within n79.  We should avoid the impression that Alt 1-1a will solve the channelization limitation issue to RAN4. So we would be ok to accept this is information about the channelization limitation is sent along with the reply LS.  We believe a better approach is providing both information of Alt 1a and Alt 1b to RAN4 and let RAN4 determine the final outcome.  From RAN1 perspective, both Alt 1a and Alt 1b are feasible from physical layer perspective as both do not cause backwards compatibility issue. I think we should focus the discussion on identifying solutions that are feasible from specification. If there are other consideration that need to be made, e.g. channelization deployment restriction vs UE configuration simplicity, I think this decision is best suitable for RAN4 to decide. We can simply provide additional information to RAN4. Not sure why RAN1 can decide this when deployment flexibility and channel definition is completely in RAN4 domain. |

# Reply LS

Please consider the following proposal for reply LS.

**FL3: Proposal 4-1:**  **If Alt-1a and the corresponding Text proposal are agreed, can we agree on the following text as reply LS to RAN 4?**

RAN1 would like to thank RAN4 for the LS (R1-2200907/R4-2202286) on CORESET#0 impact of CBW narrower than 40 MHz of band n79.

RAN1 has discussed the four alternatives (Alt-1, Alt-1a, Alt-1b, Alt-2) provided by RAN4, and also Alt-1a’ which adds new entries to table 13-5/13-6 based on Alt-1a, and the following agreements were made:

* [Alt-1a: Add narrower channel bandwidth to n79, and indicate the same table 13-5/13-6 to legacy UE and new UE for CORESET#0 configuration.]
* [RAN1 agree on following potential text proposal in 38.213

==========Text proposal for 38.213=================

<Unchanged part omitted>

Table 13-3: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the frequency bands given in [5, TS38.101-1]

<Unchanged part omitted>

Table 13-4: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz except for the frequency bands given in [5, TS38.101-1]

<Unchanged part omitted>

Table 13-5: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 40MHz or for the frequency bands given in [5, TS38.101-1]

<Unchanged part omitted>

Table 13-6: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 40MHz or for the frequency bands given in [5, TS38.101-1]

<Unchanged part omitted>

==========End of Text proposal =================]

RAN1 suggest RAN4 to add specific frequency band restriction (i.e., n79) to RAN4 specification to support Alt-1a.

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Huawei, HiSilicon | Y |  |
| Nokia | Reservations | As noted/proposed above, we could indicate to RAN4 also that RAN1 is considering to introduce new entries to the tables (13-5/6) for deployment flexibility. |
| Qualcomm | Y |  |
| vivo | Y |  |
| SAMSUNG | Y |  |
| NTT DOCOMO | Y |  |
| Intel | conditional | As mentioned above, if RAN1 were to provide information for Alt 1a, we should also provide information on limitation of supported channels to RAN4.  We suggest adding the following text.  RAN1 notes that only 24595 out of 39335 (63%) or only 4916 out of 19668 (25%) potential 10 MHz channels using 15kHz or 30 kHz, respectively, can be supported with RB offsets defined by Table 13-5/6 for n79. For channel bandwidths 20 MHz and above, 100% cases can be supported with RB offsets defined by Table 13-5/6 for n79. |

# 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 |