3GPP TSG-RAN WG2 #119bis-e R2-22xxxxx

Online, 10th – 19th Oct, 2022

Agenda Item: 8.18

Source: ZTE Corporation

Title: Report of [AT119bis-e][016][NR18] DSS enhancement (ZTE)

Document for: Discussion, Decision

# Introduction

This document is the report of the following offline discussion:

* [AT119bis-e][016][NR18] DSS enhancement (ZTE)

 Scope: Treat R2-2209314, R2-2210636, R2-2210133, R2-2210297, R2-2210586, R2-2210587, Determine agreeable parts, Open points etc

 Intended outcome: Report, Agreeable CRs if applicable.

 Deadline: For CB W1 Fri

# Contact Information

|  |  |  |
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# Discussion

For reference, the objectives of Rel-18 DSS WID (in RP-213575) are shown below:

|  |
| --- |
| The following objectives shall be included for improvement of NR spectrum efficiency for LTE-NR co-existence (RAN1):* Study and if needed specify NR PDCCH reception in symbols with LTE CRS REs. [RAN1]
	+ Investigate enabling LTE CRS to puncture NR PDCCH, including the impact to NR PDCCH DMRS if there is the performance gain from the additional PDCCH resources.
* Allow a UE to support, and be configured with, two overlapping CRS rate matching patterns regardless of support or configuration of multi-TRP [RAN1, RAN2]
 |

## Work plan for Rel-18 DSS

[R2-2210636](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_119bis-e%5CDocs%5CR2-2210636.zip) Work plan for Rel18 WI on Enhancement of NR Dynamic spectrum sharing (DSS) Ericsson discussion

The rapporteur of WI (Ericsson) has provided the work plan for Rel-18 DSS, the RAN2 work plan is copied/pasted below:

*#extracted from R2-2210636*

|  |  |
| --- | --- |
| **RAN2 meeting** | **Work plan** |
| RAN2#119bis-e,October 2022 | Support for two overlapping CRS rate matching patterns* Identify spec impact and endorse draft CRs/TPs to introduce support for two overlapping CRS rate matching patterns.
 |
| RAN2#120,November 2022 | Support for two overlapping CRS rate matching patterns* Finalize any remaining issues with draft CRs/TPs to introduce support for two overlapping CRS rate matching patterns and agree on final CRs.

Note: RAN2 may eventually also handle additional RAN2 impacts at a later stage e.g. RRC parameters provided by RAN1 for this WI towards the end of the release, as usual.  |

Companies are invited to show your views to the RAN2 work plan.

**Q1: Do companies agree with RAN2 work plan in R2-2210636?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| ZTE | Yes |  |
| Huawei, HiSilicon | See comments | We are in general fine with the work plan, but it is worthy indicating that, considering RAN1 has finished this WI, RAN2 discussion should be triggered by RAN1 (either by LS/RRC parameter inputs) and hence any potential RAN1 impact should be avoided, i.e. restrained in RAN2 scope. |
| vivo | Yes | Agree with Huawei that RAN2 should not trigger discussion that may cause potential RAN1 impact, unless triggered by RAN1 LS. |
| Xiaomi | Yes |  |
| Nokia | Yes | This looks quite good. We should not though that although RAN1 has no more TU on this they still have some work to be done e.g. about signaling parameters as well as capabilities. We should expect some more inputs on those from RAN1 in coming meeting(s). |
| Intel | Yes |  |
| CATT | Yes |  |
| OPPO | Yes  |  |

Summary:

8 companies provide inputs, 7 companies agree with the RAN2 work plan in R2-2210636, 1 company thinks RAN2 discussion should be triggered by RAN1. RAN2 should avoid discussing things that impact RAN1. Rapporteur agrees that this should be the common understanding in RAN2.

**Proposal 1 The RAN2 work plan in R2-2210636 is noted as it is.**

## Two overlapping LTE-CRS patterns

Regarding the objective on two overlapping LTE-CRS patterns, RAN2 receives the following LS from RAN1.

[R2-2209314](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_119bis-e%5CDocs%5CR2-2209314.zip) LS to RAN2 on two overlapping LTE-CRS patterns in Rel-18 DSS (R1-2208194; contact: ZTE) RAN1 LS in Rel-18 NR\_DSS\_enh To:RAN2

This LS includes the RAN1 agreements made on two overlapping LTE-CRS patterns and their expected RAN2 spec changes, based on the LS, companies provided draft CRs/TPs.

[R2-2210297](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_119bis-e%5CDocs%5CR2-2210297.zip) Discussion on two overlapping LTE-CRS patterns in Rel-18 DSS ZTE Corporation, Sanechips, Ericsson discussion Rel-18 NR\_DSS\_enh-Core

[R2-2210586](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_119bis-e%5CDocs%5CR2-2210586.zip) Clarification on the DSS UE capability Xiaomi CR Rel-16 38.306 16.10.0 0818 - F TEI16

[R2-2210587](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_119bis-e%5CDocs%5CR2-2210587.zip) Clarification on the DSS UE capability Xiaomi CR Rel-17 38.306 17.2.0 0819 - A TEI16

### TS 38.331 CR

In R2-2210297, it proposes the following changes to Rel-18 TS 38.331:

#Change 1: Introduce *lte-CRS-PatternList3-r18* and *lte-CRS-PatternList4-r18* to *ServingCellConfig,* add corresponding field description.

ServingCellConfig ::= SEQUENCE {

\*\*\* skip non-related part\*\*\*

 lte-CRS-PatternList1-r16 SetupRelease { LTE-CRS-PatternList-r16 } OPTIONAL, -- Need M

 lte-CRS-PatternList2-r16 SetupRelease { LTE-CRS-PatternList-r16 } OPTIONAL, -- Need M

\*\*\* skip non-related part\*\*\*

 [[,

 lte-CRS-PatternList3-r18 SetupRelease { LTE-CRS-PatternList-r16 } OPTIONAL, -- Need M

 lte-CRS-PatternList4-r18 SetupRelease { LTE-CRS-PatternList-r16 } OPTIONAL, -- Need M

 ]]

}

|  |
| --- |
| ***lte-CRS-PatternList3***A list of LTE CRS patterns around which the UE shall do rate matching for PDSCH. The LTE CRS patterns in this list shall be non-overlapping in frequency. The network does not configure this field and *lte-CRS-ToMatchAround,* or this field and *lte-CRS-PatternList1*, or this field and *lte-CRS-PatternList2* simultaneously. |
| ***lte-CRS-PatternList4***A list of LTE CRS patterns around which the UE shall do rate matching for PDSCH. The LTE CRS patterns in this list shall be non-overlapping in frequency. The first LTE CRS pattern in this list shall be fully overlapping in frequency with the first LTE CRS pattern in *lte-CRS-PatternList3*. The second LTE CRS pattern in this list shall be fully overlapping in frequency with the second LTE CRS pattern in *lte-CRS-PatternList3*, and so on. Network configures this field only if the field *lte-CRS-ToMatchAround* is not configured and the field *lte-CRS-PatternList3* is configured. |

#Change 2: Update the field description of crs-RateMatch-PerCORESETPoolIndex based on RAN1 LS.

|  |
| --- |
| ***crs-RateMatch-PerCORESETPoolIndex***Indicates how UE performs rate matching when both *lte-CRS-PatternList1-r16* and *lte-CRS-PatternList2-r16* are configured or when both *lte-CRS-PatternList3-r18* and *lte-CRS-PatternList4-r18* are configured as specified in TS 38.214 [19], clause 5.1.4.2. |

**Q2: Do companies agree with above change 1 and 2 in R2-2210297?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| ZTE | Yes | Proponent |
| Huawei, HiSilicon | Yes | It is aligned with RAN1 LS |
| vivo | Yes | It is aligned with RAN1 LS |
| Xiaomi | Yes |  |
| Apple | Yes |  |
| Nokia | Partly | This is aligned with RAN1 LS, but it’s a little bit strange why RAN1 defined pattern3/4: * pattern3 is just the same as pattern1
* pattern4 is always overlapping with pattern3.

So why not introduce only pattern3 and indicate that is only used if (only) pattern1 is configured? That would require less signalling, and still work to fulfil the RAN1 intent. Or was there some technical reason why such signalling wouldn’t work?[Rapp-ZTE] RAN1 has discussed the issue before, i.e. whether to introduce one new RRC list or two new RRC lists, and RAN1 concluded with two lists. We understand that RAN1 prefers to have a cleaner solution to avoid too much coupling between single TRP and M-TRP operation, and the specification text in RAN1 is more straightforward by simply extending the approach of M-TRP to single TRP.From RAN2 perspective, we suggest to respect to RAN1’s decision unless problem is found. |
| Intel  | Yes with comment   | It seems missed to indicate “Lte-CRS-PatternList4-r18 is configured only if lte-CRS-PatternList3-r18 is configured in ServingCellConfig.”[Rapp-ZTE] Seems this is already covered by the last sentence in field description: “Network configures this field only if the field *lte-CRS-ToMatchAround* is not configured and the field *lte-CRS-PatternList3* is configured.”Please let me know if I misunderstood. We assume that based on description, the entry number of two lists should be the same. Regarding Nokia’s comment, our understanding is that pattern3 and pattern 4 are fully overlapped, but pattern 3 is not configured with pattern 1.We might think to merge pattern 3 and pattern 4 but it is not clear what “fully overlapped” in frequency really means, e.g. whether it is the same frequency carrier/bandwidth or not. In addition, two patterns are used to associate two coreset pool for mTRP PDCCH case. So, it might be safe to follow what RAN1 requested e.g. having two patterns separately. [Rapp-ZTE] We think “fully overlapped” means the frequency carrier, e.g. the PRBs that contain CRS are overlapped. But the detailed position (e.g. RE level position of CRS) may be different in pattern 3 and pattern 4. |
| CATT | Yes | aligned with RAN1 LS |
| OPPO | Yes  |  |

Summary:

9 companies provide inputs, 8 companies agree with TS 38.331 changes, 1 company asks why 2 new LTE-CRS pattern lists are needed and thinks it can be done by pattern 1+ pattern 3. Based on the discussion in RAN1, they have discussed all possible signalling solutions and finally concluded with two new separate pattern lists.

From RAN2 perspective, we’d better respect to RAN1’s conclusion, so rapporteur suggests to agree the changes which are aligned with RAN1 LS.

**Proposal 2 Endorse the Rel-18 TS 38.331 CR, the modification is the same as the TS 38.331 TP in R2-2210297.**

### TS 38.306 CR

For TS 38.306 CR, companies provided CR of different spec versions, the CR provided in R2-2210297 is intended to correct only Rel-18 spec, while the CR provided in R2-2210586/R2-2210587 are based on Rel-16/17 specs.

Based the RAN1 LS (see below) and RAN1 discussion, rapporteur understands the intention is to add the pre-requisite from Rel-18, so it does not impact Rel-16 and Rel-17 specs.

* Clarify that the Rel-16 UE capability *overlapRateMatchingEUTRA-CRS-r16* is subject to support of *multiDCI-Multi-TRP-r16* in Rel-18 ASN.1.

Companies are invited to show your views.

**Q3: Do companies agree the condition needs to be added to Rel-18 spec, no need to change Rel-16/Rel-17 specs?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| ZTE | Yes | Based on the information we got from our RAN1 colleagues, RAN1 agree to add the condition starting with Rel-18 version, they do not intend to update Rel-16/Rel-17 specs so that legacy UEs are not impacted.  |
| Huawei, HiSilicon | Yes | Agree with the moderator, no need to change legacy spec. |
| vivo | Yes | Receive same input from our RAN1 colleagues as ZTE comments. |
| Xiaomi | No | The new Rel-18 DSS feature would anyway require a new UE capability bit which shall not be mixed up with the Rel-16 UE capability overlapRateMatchingEUTRA-CRS-r16. The RAN1 LS is to clarify the legacy UE feature *overlapRateMatchingEUTRA-CRS-r16* which was not clearly reflected in the RAN2 specification, without changing any legacy function. To reflect the correction understanding of the legacy UE feature *overlapRateMatchingEUTRA-CRS-r16* in Rel-18 ASN.1, the change should start from Rel-16.Otherwise we might have Rel-16 UE supporting *overlapRateMatchingEUTRA-CRS-r16,* but not supporting *multiDCI-MultiTRP-r16*. The implementation team will not look into the Rel-18 specification (Note that this will not be provided before the Rel-18 ASN.1 frozen.) to implement a Rel-16 feature.[Rapp-ZTE] The point is that in Rel-16, LTE CRS pattern can only be configured in multi-TRP scenario, single TRP is not supported, so **there is no ambiguity issue** in Rel-16 and the UEs are assumed to support multiDCI-MultiTRP-r16 when indicating the support of overlapRateMatchingEUTRA-CRS-r16, this is already captured in RAN1 spec, even if the condition in TS38.306 did not mention it. However, for Rel-18, LTE CRS pattern for single TRP is introduced, that is why ambiguity issue occurs and RAN1 suggests to clarify in 38.306 that overlapRateMatchingEUTRA-CRS-r16 is only applicable to multi-TRP. We think the correction on Rel-18 is essential to eliminate the ambiguity issue. However, for Rel-16/17 specs, there is no ambiguity issue at all, and the bar for Rel-16/17 correction is quite high (only essential corrections are considered). Rapporteur suggests to focus on Rel-18 correction, if companies do think Rel-16/17 specs need to be corrected, it can be discussed under the agenda item of Rel-16/17 CR.But to avoid misunderstanding, it is fine to make the change more general, see response to Q4. |
| Apple | Yes | According to our RAN1 colleague, RAN1 spec is clear that UE should be able with multiDCI-Multi-TRP-r16. So we are fine to not change Rel-16 spec. |
| Nokia | Yes |  |
| Intel | See comments | If it is simple clarification given that the pre-requisite is already assumed in the PHY spec, we would be ok to introduce the pre-requisite from Rel-18. The LS doesn’t seem to be 100% clear on that assumption, [Rapp-ZTE] See above response to Xiaomi. |
| CATT | Yes |  |
| OPPO | Yes  |  |

Summary:

9 companies provide inputs, 8 companies agree to only add the pre-requisite to Rel-18 spec, 1 company thinks Rel-16/17 specs should be updated accordingly, otherwise, Rel-16/17 specs are incomplete.

As clarified, there is ambiguity issue in Rel-16/17 specs because only multi-TRP scenario is supported, and it is captured in RAN1 spec that UE supports overlapRateMatchingEUTRA-CRS-r16 also supports multiDCI-MultiTRP-r16. But for Rel-18, since single TRP scenario is introduced, to avoid misleading, it is worth to clarify Rel-16 capabilities, so we can limit the change to Rel-18 spec.

Proposal of Q4 is merged with Q5.

For the detailed wording of the condition, companies proposed different changes.

Option 1: proposed in R2-2210297:

| ***overlapRateMatchingEUTRA-CRS-r16***Indicates whether the UE supports two LTE-CRS overlapping rate matching patterns within a part of NR carrier using 15 kHz SCS overlapping with a LTE carrier. If the UE supports this feature, the UE needs to report *multipleRateMatchingEUTRA-CRS-r16*. In this release of the specification, the UE indicating support of this feature shall indicate support of *multiDCI-MultiTRP-r16*. | Band | No | N/A | FR1 only |
| --- | --- | --- | --- | --- |

Option 2: proposed in R2-2210586/R2-2210587:

| ***overlapRateMatchingEUTRA-CRS-r16***Indicates whether the UE supports two LTE-CRS overlapping rate matching patterns within a part of NR carrier using 15 kHz SCS overlapping with a LTE carrier. If the UE supports this feature, the UE needs to report *multipleRateMatchingEUTRA-CRS-r16* and *multiDCI-MultiTRP-r16*. | Band | No | N/A | FR1 only |
| --- | --- | --- | --- | --- |

Rapporteur thinks there is no big difference between Option1 and Option 2, but if answers “Yes” to Q3, then Option 1 is preferred, because it is aligned with other pre-requisites which are only applicable from a specific release.

**Q4: Which wording change (Option1 or Option2) do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Opt1 or Opt2 | Comments |
| ZTE | Option 1 | Proponent.We think the condition is only needed for Rel-18 and future release of UEs, so it is better to make the spec clear by highlighting “in this release of the specification”.  |
| Huawei, HiSilicon | Opt 1 |  |
| vivo | Opt 1 |  |
| Xiaomi | Option 2 | Option 1 does not work at all. See reasons provided above.  |
| Apple | Option 1 |  |
| Nokia | Option 1 |  |
| Intel | Option 2 | If it is already clear from Rel-16 PHY spec, option 1 seems to make potential misleading such that this is a new requirement from Rel-18.[Rapp-ZTE] Ok, I see your point, thanks. |
| CATT | Option 1 |  |
| OPPO | Option 1 |  |
| Rapp-ZTE | Let’s go for Option 2 | See the response to Xiaomi’s comments in Q3, to avoid the potential misleading that only Rel-18 UEs shall report overlapRateMatchingEUTRA-CRS-r16 together with multiDCI-MultiTRP-r16, rapporteur suggests to adopt Option 2, but still only Rel-18 CR is needed. |
|  |  |  |

Note: based on the feedbacks from companies, proponent company can provide ‘real’ draft CRs for endorsement.

Summary:

9 companies provide inputs, 7 companies support Option 1, 2 companies support Option 2.
To avoid misleading, rapporteur suggests to go for Option 2.

**Proposal 3 Endorse the Rel-18 TS 38.306 CR, the modification is same as in R2-2210586, no need to update Rel-16/17 specs with the assumption that the same condition is already applicable to Rel-16/17 UEs based on RAN1 spec.**

## PDCCH on CRS

Regarding the following objective, one company provides cont ribution with proposals.

* Study and if needed specify NR PDCCH reception in symbols with LTE CRS Res. [RAN1]
	+ Investigate enabling LTE CRS to puncture NR PDCCH, including the impact to NR PDCCH DMRS if there is the performance gain from the additional PDCCH resources.

[R2-2210133](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_119bis-e%5CDocs%5CR2-2210133.zip) RRC configuration and UE capability for PDCCH on CRS Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_DSS\_enh

**Proposal 1:** A PDCCH candidate with Res overlapping with LTE CRS Res as configured to the UE is either monitored or dropped according to explicit RRC configuration or a determination based on the transition to RRC Connected state:

* Different PDCCH candidates / aggregation levels of a search space can be configured to be processed/dropped when they collide with LTE CRS
* Any PDCCH aggregagtion levels employed or higher than the aggregationlevels employed in the CCS during the transition from RRC Idle to RRC connected state are assumed to be monitored

**Proposal 2:** A PDCCH candidate with Res overlapping with LTE CRS Res as configured to the UE (and configured to be monitored) is tagged with information on what the Gnb does to the PDCCH Res colliding with the LTE CRS Res

* Different PDCCH candidates / aggregation levels of a search space can be configured differently
* The configuration is either a relative power differentce of CRS RE and PDCCH RE (inf and –inf indicating that one is present and the other is punctured), or as binary (overlapping PDCCH RE present / not present)

Based on the RAN1 discussion, rapporteur thinks this objective (together with above two proposals) are under RAN1’s discussion. From RAN2 perspective, we can wait for RAN1’s conclusion first and update our spec if needed.

**Q5: Do companies agree to wait for RAN1 about the RRC configuration and UE capability for PDCCH on CRS (Objective 1 in WID)?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| ZTE | Yes(wait for RAN1) | Based on the information we got from our RAN1, these proposals are now discussed in RAN1 this meeting, under [110bis-e-R18-Others-01].We think RAN2 can wait for RAN1, if there is RAN2 impact, RAN1 will inform RAN2 as usual. |
| Huawei, HiSilicon | Yes | It is RAN1 issue, which should be discussed first in RAN1. If RAN1 cannot conclude anything, RAN2 has no point to specify anything relevant. |
| Vivo | Yes | As commented in Q1, we prefer it being discussed in RAN1 first. |
| Xiaomi | Yes | Agree with ZTE that RAN1 is discussing the same proposals. |
| Apple | Yes | Agree with Rapporteur. |
| Nokia | Yes (although proponent) | We would also think it is important that this is discussed in RAN1 as well. So we could wait their progress. |
| Intel | Yes |  |
| CATT | Yes  | Wait for RAN1 progress. |
| OPPO | Yes  | Wait for RAN1. |

Summary:

All companies agree we can wait for RAN1.

**Proposal 4 RAN2 waits for RAN1 regarding the RRC configuration and UE capability for PDCCH on CRS.**

If answers “No” to above question, then companies are invited to show your views to the proposals.

**Q6: If answers “No” to Q5, do companies agree with Proposal 1 and Proposal 2?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
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|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# Conclusion

Based on companies’ input, proposals are listed as follows.

**Proposal 1 The RAN2 work plan in R2-2210636 is noted as it is.**

**Proposal 2 Endorse the Rel-18 TS 38.331 CR, the modification is the same as the TS 38.331 TP in R2-2210297.**

**Proposal 3 Endorse the Rel-18 TS 38.306 CR, the modification is same as in R2-2210586, no need to update Rel-16/17 specs with the assumption that the same condition is already applicable to Rel-16/17 UEs based on RAN1 spec.**

**Proposal 4 RAN2 waits for RAN1 regarding the RRC configuration and UE capability for PDCCH on CRS.**

# References

1. R2-2209314 LS to RAN2 on two overlapping LTE-CRS patterns in Rel-18 DSS (R1-2208194; contact: ZTE) RAN1 LS in Rel-18 NR\_DSS\_enh To:RAN2
2. R2-2210636 Work plan for Rel18 WI on Enhancement of NR Dynamic spectrum sharing (DSS) Ericsson discussion
3. R2-2210133 RRC configuration and UE capability for PDCCH on CRS Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_DSS\_enh
4. R2-2210297 Discussion on two overlapping LTE-CRS patterns in Rel-18 DSS ZTE Corporation, Sanechips, Ericsson discussion Rel-18 NR\_DSS\_enh-Core
5. R2-2210586 Clarification on the DSS UE capability Xiaomi CR Rel-16 38.306 16.10.0 0818 - F TEI16
6. R2-2210587 Clarification on the DSS UE capability Xiaomi CR Rel-17 38.306 17.2.0 0819 - A TEI16