3GPP TSG-RAN Meeting #89-eRP-20xxxx

Electronic Meeting, 14-18 September 2020

Agenda Item: 9.10

Source: Email discussion moderator (Intel)

Title: Report from Email Discussion [89E][15][UE\_features]

Document for: Discussion and decision

# 1 Introduction

This documents reports on the following email discussion during RAN#89-e:

**[89E][15][UE\_features]**

Goal: Find a way forward regarding the proposals on UE features.

Input contributions covered: 1525, 1768, 1877, 1878, 1879.

Note that tdoc RP-201864 was allocated to this email discussion in the kick-off email but was subsequently moved to email discussion 32.

The tdocs allocated to this discussion relate to 3 independent topics which are addressed separately by the 3 sections of this report.

## 2 UE capability differentiation for licensed and unlicensed operation

The topic is raised by tdoc [RP-201525](file:///C%3A%5CData%5C3GPP%5CExtracts%5CRP-201525%20NR%20Licensed-Unlicensed%20capability%20differentiation.docx) which makes the 3 proposals which are handled in the following sub sections. The intention of this email discussion is not to discuss individual UE capabilities, but to attempt to conclude some principles that can be applied in future discussions by the RAN WGs.

### 2.1 Proposal 1

**Proposal 1** Discuss feature by feature the applicability of the features developed for unlicensed to licensed. In general, apply to licensed, as long as it is feasible.

Companies can provide any feedback related Proposal 1.

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| **Company** | **Comments** |
| Charter Communications, Inc. | We agree with this proposal |
| Nokia | We agree with this proposal, this is already the approach taken in RAN1 for Rel-16 NR-U feature groups |
| Apple | RAN1 has already been discussing the applicability of R16 NR-U features to licensed band feature by feature. Actually, the conclusions have already been made, except ~8 of them to be further concluded. However, I am a little confused by the 2nd sentence of proposal 1, i.e., assuming we’ve already agreed to discuss the applicability feature by feature, why do we still need the 2nd sentence of the proposal?  |
| Qualcomm | Supporting the proposal |
| Futurewei | The proposal can be agreed as a principle. |
| Intel | Agree with proposal |
| vivo | We agree with the first sentence of this proposal.The second sentence has too strong implication from our perspective, many of the unlicensed band features are developed to deal with the channel access uncertainty or particular regulatory requirement for unlicensed band, these features may work in licensed band as well, but it does not bring any meaningful benefit, so no need to extend the support of such features to licensed band.  |
| NTT DOCOMO | We agree with the proposal as already do so in RAN1 NR-U UE features discussion. |
| CATT | We have similar feeling as Apple that the second sentence is not necessary. Whether a feature for unlicensed band can be applied to licensed band depends on the outcome of WG discussion.  |
| Ericsson | Support the proposal.In our view, the proposal reflects the WoW that was adopted early on in RAN1 to progress the UE features discussion. However, due to a divergence from this principle in some recent discussions, it would be valuable to re-confirm this WoW in order to help RAN1 conclude the time-consuming UE features discussion in an efficient manner.  |
| ZTE | Similar view with Apple. If we agree to discuss this issue feature by feature, then it seems the second sentence “In general, apply to licensed, as long as it is feasible.” Is not needed. |
| OPPO | Agree. For features applicable for licensed, some remark in the spec is needed so UE can signal UE capability properly because same signalling structure is shared between licensed and unlicensed. |
| Huawei, HiSilicon | Agree that we should discuss feature by feature the applicability of the features developed for unlicensed to licensed, which is what RAN1 has been doing during the UE feature discussion. However, we don't agree with the second part of the proposal “*In general, apply to licensed, as long as it is feasible*”. As agreed, we still need to discuss feature by feature for the remaining feature groups, and whether to apply a certain FG to licensed would also depend on the necessity and benefits in addition to feasibility. RP-201525 rightly starts section 2.1 with this sentence: “In general, we believe there should be a bias towards applying all features to both licensed and unlicensed where it is feasible and **beneficial**.”  |
| Samsung | We agree with the proposal, and the same principle has already been applied to the WG-level discussion. |
| LG Electronics | We agree with the first sentence of Proposal 1. For the second sentence, we share the view from Apple in the sense that a feature group can be extended to licensed band after discussion as long as consensus can be reached. |
| CMCC | We agree with the first sentence of Proposal 1. It is not needed to have the second sentence. |

### 2.2 Proposal 2

**Proposal 2** Avoid discussing feature by feature the applicability of the features developed for licensed to unlicensed. As default, apply all licensed features to unlicensed, and discuss cases on an exception basis, only if there is specific company input requesting discussion.

Companies can provide any feedback related Proposal 2.

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| **Company** | **Comments** |
| Charter Communications, Inc. | We agree with this proposal |
| Nokia | We agree with this proposal, this is already the approach taken in RAN1 for Rel-16 feature groups |
| Apple | We agree with the proposal. |
| Qualcomm | Supporting the proposal |
| Futurewei | We agree the principle, as NR for licensed should be used as the baseline of NR-U. |
| Intel | Agree with proposal |
| vivo | We agree with this proposal |
| NTT DOCOMO | We agree with the proposal as already do so in RAN1. |
| CATT | We agree with this proposal. |
| Ericsson | Support in principle.Similar comment as above. Additionally, if a company requests such a discussion for a FG, the requesting company should clarify how the functionality is affected by properties specific to unlicensed channels (e.g. channel access mechanism, power spectral density constraints, etc.), to justify the need for differentiation. Otherwise, the impact on a feature due to operation in an unlicensed band would not be different from the impact from operation in another licensed band. This criterion is needed to avoid potentially unnecessary discussions that would be impractical to manage. Therefore, we propose to update the proposal as follows:**Updated Proposal 2** :* Avoid discussing feature by feature the applicability of the features developed for licensed to unlicensed. As default, apply all licensed features to unlicensed, and discuss cases on an exception basis, only if there is specific company input requesting discussion **where the impact on the functionality of a feature due to operation in an unlicensed band is clearly identified**
 |
| ZTE | We are generally fine with the proposal. Just two minor comments, (1) Do we need to add something like a due date here? Otherwise, if company input comes too late, it may cause potential unnecessary implementation issues. For example, if companies have developed one functionality for both licensed and unlicensed by default, but other companies propose to limit this functionality to only licensed operation at a very late point, this may lead to unnecessary implementation issues.(2) To address the issue in Proposal 3, we propose to add Rel-15 and Rel-16 explicitly in this proposal. Thus, our proposal would be the following.**Proposal 2** Avoid discussing feature by feature the applicability of the Rel-15 and Rel-16 features developed for licensed to unlicensed. As default, apply all licensed features to unlicensed, and discuss cases on an exception basis, only if there is specific company input requesting discussion before RAN#XX. |
| OPPO | Agree. For features not applicable for unlicensed, some remark in the spec is needed so UE can signal UE capability properly because same signalling structure is shared between licensed and unlicensed. |
| Huawei, HiSilicon | We can accept the principle here though discussing feature by feature would be safer to identify whether it is feasible and/or necessary for a feature group developed for licensed to apply to unlicensed. However, we want to emphasize that if later there is any issue identified for a feature group due to applying it to unlicensed, we should allow the exception and cannot use the proposal 2 here as the excuse to preclude the discussion. There are always cases where two features specified separately in the same release in different WIs are not directly compatible with each other, and whether fixing this incompatibility is always discussed case-by-case in WGs. Sometimes we fix it sometimes we don’t, based on analysis of benefits and complexity.  |
| Samsung | We agree with the proposal, as the baseline of NR-U is the licensed NR. |
| LG Electronics | We agree with the proposal. |
| CMCC | Agree with Proposal 2 |

### 2.3 Proposal 3

**Proposal 3** As a baseline, for all features that apply to both licensed and unlicensed, UE capability differentiation is needed – this is already being handled in RAN1 for Rel-16 features. Capability differentiation for Rel-15 UE features is for further discussion. The differentiation is being realized by either reporting types ‘per Band’, ‘per FS’, ‘per FSPC’, or explicit differentiation for certain features.

It is not very clear from the wording of Proposal 3 what the specific proposal is. While companies are free to provide any feedback in relation to Proposal 3, it is suggested that companies should at least address the following points:

1 Should the principle to apply UE capability differentiation to all Rel-16 features that are applicable to both unlicensed and licensed also applied by RAN 2 and RAN4 (it seems it is already being applied in RAN1)

2 What should be done for Rel-15 features that are applicable to both unlicensed and licensed.

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| **Company** | **Comments** |
| Charter Communications, Inc. | We agree with this proposal |
| Nokia | For Rel-16 features this is already being considered in RAN1, where in some cases it has been identified that a feature requires licensed/unlicensed differentiation (e.g. 19-1). As for Rel-15 features, the principles of Proposal 2 should apply here, i.e. WGs should only discuss such differentiation for specific feature groups based on company requests, if any. Moreover, NBC changes need to be avoided. From Nokia point of view, we have not identified any need to modify Rel-15 capabilities due to unlicensed/licensed differentiation needs.  |
| Apple | Rel-16 UE features in NR-U session are mostly per-band already. For the remaining features, as well as Rel-15 features, proposal 2 may apply if it is agreed. |
| Qualcomm | Supporting the proposal. For Rel-16 FGs, the handling of this proposal is somewhat stabilized already, but for Rel-15 FGs, it needs to be revisited at the next RAN1 meeting. Clearly, for many features, licensed and unlicensed introduction will not happen at the same time, therefore UE capability differentiation is necessary. However, it still needs to be analysed how many of these FGs are not Type 1 or Type 2/3 already in Rel-15.  |
| Futurewei | We agree with the intention of the proposal, and think it can be handled by applying the general categories of ‘per Band’, ‘per FS’, ‘per FSPC’, etc. |
| Intel | For Rel-15 UE features, we are open to discuss in the next RAN1 meeting. |
| vivo | For Rel-15 features, all licensed features are applicable for unlicensed, and not applicability of specific feature(s) can be discussed on case by case basis.For either case above, no need to modify Rel-15 capability signalling, the need of licensed/unlicensed differentiation for Rel-15 features (if any) can be handled by introducing additional capability signalling from Rel-16 specification.  |
| NTT DOCOMO | We share similar view with Nokia that we should apply the principle of Proposal 2 (if agreed) to Rel-15 FGs as well. |
| CATT | R15 features can be discussed on a case by case basis in WG if needed. |
| Ericsson | We understand the intention behind the proposal, as it is already exercised in Rel-16.However, our observation is that licenced/unlicensed applicability of the features have been unnecessarily complicated. In our view, we should not revisit features in Rel-15 or adopt the same principle for RAN2 or RAN4. Instead, we should apply the principle in (updated) Proposal 2. If a feature is requested to be inspected by a company in a WG, the company should clearly justify the request by clarifying at least the following:* **Whether and how the functionality is affected by properties specific to unlicensed channels (e.g. channel access mechanism, power spectral density constraints, etc.).**

Otherwise, the WG would be loaded with excessive discussions without being technically justified. |
| ZTE | It seems this principle has already been considered in Rel-16 UE feature discussion. Regarding the Rel-15 UE feature, it seems it can be covered by Proposal 2 already.  |
| OPPO | Currently UE capability could be per UE, per BC, per band per BC, per FS, per FSPC. For all categories apart from per UE, signalling itself can already indicate the difference. But per UE capability RAN2 need discuss how to differentiate them in terms of IoDT. We also think Rel15 spec should not be touched i.e. any change or introduction of UE capability should be done in Rel16 and on.  |
| Huawei, HiSilicon  | For Rel-16 features, for a feature group applied to both unlicensed and licensed, we need to discuss the potential differentiation only if the reporting type for this FG is “Per UE”. We should avoid changing the agreed reporting type, and use some other way to do the differentiation if necessary, e.g. the way how we handled FG 19-1 can be considered. For Rel-15 features, share similar views as Nokia, we don't see any need to modify Rel-15 capabilities due to unlicensed/licensed differentiation either, we cannot introduce any NBC change just for this. |
| Samsung | With the proposal 2 above, we do not have to introduce a separate capability of Rel-15 features for NR-U in principle. If a company brings the issue, it may be discussed on a case-by-case basis.  |
| LG Electronics | We agree with the proposal. |
| CMCC | For Rel-15 features, it can be covered by Proposal 2.  |

### 2.4 Moderator summary from Initial Phase

**Moderator summary regarding proposal 1**: There was unanimous support to discuss feature by feature the applicability of the features developed for unlicensed to licensed. 6 companies out of the 16 that commented had some concern with regard to the second sentence. Given that the first part of the proposal is that features will be discussed case by case, and that it should already be case that we only agree to support something if it is feasible to do so and there is some benefit in doing so, it seems that the second part would add little value to the agreement.

**Moderator conclusion for proposal 1**: Discuss feature by feature the applicability of the features developed for unlicensed to licensed.

**Moderator summary regarding proposal 2**: There was unanimous support for the proposal. There was one additional proposal to add that request to discuss whether a feature is applicable to unlicensed must come with clear identification of how the feature is impacted by operation in unlicensed bands. To the moderator, this seems like a reasonable request in order to ensure a productive discussion in the WGs. There was also a proposal to set a deadline for company inputs related to Rel-15/16 features. To the moderator this seems rather difficult to enforce, as if a genuine issue is found after this date the WGs should still be open to discuss it. Of course, as with any late change the threshold to acceptance will tend to increase over time and so companies should make their proposals as soon as possible.

**Moderator conclusion for proposal 2** (note some rewording for clarity and to avoid duplication): By default all licensed features are applicable to unlicensed. Exceptions may be discussed case by case based on company input that describes how the feature is impacted by operation in unlicensed bands.

**Moderator summary regarding proposal 3**: The responses to this proposal were more varied. A number of companies commented that the Rel-15 question is handled by the conclusion from the previous discussion point that features developed for licensed are by default applicable to unlicensed. To the understanding of the moderator these are in fact distinct questions. Considering a feature develop for licenced operation in Rel-15, the second proposal says that this feature is applicable also to unlicensed operation. It is still an open question whether the signalling must include a separate capability (to be added in Rel-16) with which the UE can indicate that feature is supported in unlicensed operation. Qualcomm's explanation suggests that a separate feature may be needed for IOT purposes and as it may not be possible for a UE test to operation of that feature within an unlicensed band due to lack of a network support. A number of companies commented that the approach of proposal 2 to discuss case by case based on company input should be adopted. A number of companies also pointed out that the issue was only for the 'per UE' capabilities as for other capabilities there is already means to differentiate. While it is somewhat difficult to find a clear way forward from these comments the moderator makes the following proposal

**Moderator conclusion for proposal 3**: For per UE features (including Rel-15 features) that are applicable to both licensed and unlicensed operation, it may be discussed case by case based on company input whether to introduce licensed/unlicensed differentiation in the UE capability signalling. The company input must describe how the feature is impacted by operation in unlicensed bands, and why licensed/unlicensed differentiation is justified. If licensed/unlicensed differentiation is agreed to be applicable for Rel-15 features, the additional capability signalling is introduced from Rel-16.

Companies are invited to provide any further feedback to the moderator's proposals. In particular, moderator understands that this is intended as general guidance from RAN plenary that hould be applicable to all RAN WGs. While the discussion has mainly focussed on RAN1 aspects, the moderator requests companies to consider whether the proposals also make sense from the point of view of other WGs.

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| **Company** | **Comments** |
| Intel | Generally fine. One comment on proposal 3. In addition to per-UE, per-BC also needs to be looked at that in the context of lic/unlic applicability.<Suggestion to modification for proposal 3>**Moderator conclusion for proposal 3**: For per UE features and per BC (including Rel-15 features) that are applicable to both licensed and unlicensed operation, it may be discussed case by case based on company input whether to introduce licensed/unlicensed differentiation in the UE capability signalling. The company input must describe how the feature is impacted by operation in unlicensed bands, and why licensed/unlicensed differentiation is justified. If licensed/unlicensed differentiation is agreed to be applicable for Rel-15 features, the additional capability signalling is introduced from Rel-16. |
| vivo | We support Intel’s revision above |
| Apple | We are supportive of the moderator’s proposals (1-3). |
| OPPO | We align with moderator understanding in general. Regarding per BC UE capability we don’t think additional signalling is necessary for IoDT purpose. There are two kinds of BC w.r.t. component bands i.e. either it is purely licensed/unlicensed band combination or it is band combination mixed with licensed and unlicensed. For case 1, band combination itself can already function well by nature of band combination. For case 2, only all per BC UE capability pass IoDT test in the same time otherwise such band combination doesn’t work i.e. IoDT differentiation is not needed. Hence we don’t share intel’s view. |
| Ericsson | We support moderators Proposals 1-3. As OPPO clarified, addition of “BC” seems unnecessary. |
| Nokia, NSB | We support conclusions 1-3.  |
| ZTE | We are fine with the proposals. Just one minor editorial comment for proposal 2. Is it possible to change “licensed features” to “features developed for licensed” to keep consistency within these proposals and avoid unnecessary confusion? |
| Qualcomm | We share Intel’s view, per BC features should also be subject for discussion. Regarding OPPO’s comment, the scenario described as ‘case 2’ would result in capability underreporting. The UE, for example, could be tested in a mixed BC where the UE is configured with the particular feature in the licensed band CCs but not in the unlicensed CCs (because the unlicensed gNB has not implemented the feature). But even if the UE was tested in this scenario, the lack of capability differentiation would force the UE to signal no support of the feature, neither in licensed nor unlicensed bands in the band combination. |
| Samsung | We support moderators Proposals 1 - 3 |
| CATT | We support moderators Proposals 1 - 3 |
| Huawei | We support proposal 1. For proposal 2, we are fine with it in principle, but prefer to make it clearer on what to discuss for the exceptions. For proposal 3, based on the comments from Intel, OPPO and Qualcomm, we think it is safer to delete “per UE” from proposal 3 right now, and leave more time for companies to check if any other reporting type may need differentiation also. In addition, if a capability signalling is introduced, we think it is only for unlicensed band, thus better to clarify this in proposal 3. Therefore, we suggest to make the following modifications to proposal 2 and proposal 3:============================**Moderator conclusion for proposal 2** (note some rewording for clarity and to avoid duplication): By default all licensed features are applicable to unlicensed. Exceptions may be discussed case by case to decide whether some licensed feature(s) shall or shall not be applicable for unlicensed band, based on company input that describes how the feature is impacted by operation in unlicensed bands. **Moderator conclusion for proposal 3**: For ~~per UE~~ features that are applicable to both licensed and unlicensed operation, it may be discussed case by case based on company input whether to introduce licensed/unlicensed differentiation in the UE capability signalling. The company input must describe how the feature is impacted by operation in unlicensed bands, and why licensed/unlicensed differentiation is justified. If licensed/unlicensed differentiation is agreed to be applicable for Rel-15 features, the additional capability signalling for unlicensed may be ~~is~~ introduced from Rel-16.============================ |

### 2.5 Moderator summary from Intermediate Phase

The main topic still under discussion is whether proposal 3 should be limited to per UE features or be expanded cover per BC features. The comments from OPPO and Qualcomm show that there is some detail to be discussed in relation to band combinations that are a combination of licensed and unlicensed bands and it seems appropriate that this can be discussed case by case in the WGs. In allowing this to be discussed in the WGs it is important to remember that company proposals must still describe how the feature is impacted by operation in unlicensed bands, and why licensed/unlicensed differentiation is justified

In addition, some editorial suggestions where received which I have attempted to take into account below, although not necessarily using the exact wording.

**Moderator conclusion for proposal 1**: Discuss feature by feature the applicability of the features developed for unlicensed to licensed.

**Moderator conclusion for proposal 2** (note some rewording for clarity and to avoid duplication): By default all features developed for licensed are applicable to unlicensed. Exceptions where some features developed for licensed are proposed to be not applicable to unlicensed may be discussed case by case based on company input that describes how the feature is impacted by operation in unlicensed bands.

**Moderator conclusion for proposal 3**: For features (including Rel-15 features) that are applicable to both licensed and unlicensed operation, it may be discussed case by case based on company input whether to introduce licensed/unlicensed differentiation in the UE capability signalling. The company input must describe how the feature is impacted by operation in unlicensed bands, and why licensed/unlicensed differentiation is justified. If licensed/unlicensed differentiation is agreed to be applicable for Rel-15 features, the additional capability signalling is introduced from Rel-16.

Companies are invited to provide any further feedback to the updated moderator's proposals. No comment will be interpreted as acceptance of the proposal.

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| **Company** | **Comments** |
| Ericsson | Proposal 1 OK.Proposal 2 is not OK:We are not fine with the revised wording of the Proposal 2.The situation is as follows:* To be specific, Proposal 1 is in fact related to the features developed under Rel-16 NR-U. We have been doing the exercise as proposed here to inspect each feature whether it can be applicable to licensed or not. The exercise is almost completed, except for few features.
* The intention of Proposal 2 is to avoid this case by case exercise. Instead operate based on a default assumption but leave the room for special cases identified by companies to be addressed.
* The intention of proposal 2 is largely motivated by the design principle that is used for NR from rel-15. NR was supposed to address many use cases from day one (i.e. Rel-15), including operation in unlicensed. That was due the experience in LAA where LTE framework made enabling eLAA quite challenging. Therefore, it is misleading to have a formulation that features are design for licensed,
* Based on above, we prefer the original wording since the updated wording seems fundamentally misleading. However, since some companies requested for more clarifications, one can be more accurate to address that the intention of Proposal 2 is features not in the scope of proposal 1 as explained above. The following is an attempt for consideration:

**Moderator conclusion for proposal 2** (note some rewording for clarity and to avoid duplication): By default all ~~licensed~~ features developed ~~for licensed~~ under a WI other than Rel-16 NR-U are applicable to unlicensed. Exceptions where some of these features ~~developed for licensed~~ are proposed to be not applicable to unlicensed may be discussed case by case based on company input that describes how the feature is impacted by operation in unlicensed bandsProposal 3 is OK.We would like to comment that after further checking internally with our expert, it seems QC is in principle right that a capability bit on “per-UE” or “per-BC” level does not lead the UE to fully distinguish in which band it supports that feature. But whether it is really so that support for a feature on an unlicensed band is really so different from support on a licensed band that separate testing is justified/required, is a different story. And even if so, the second question is whether there are features which would be testable in licensed bands but not in unlicensed bands. If it turns out that NWs offer testing for those features also for unlicensed bands (when they offer testing for that band as such), there is still no need for differentiation.Therefore, it seems the updates by the moderator is a reasonable way forward. |
| Moderator | I understand the comments from Ericsson regarding proposal 2, and the proposed rewording would be acceptable from my perspective. As this is early in the 'fine tuning' phase and so far Ericsson is the only company to comment I would like to suggest that companies now comment on the wording suggestion from Ericsson. i.e:**Moderator conclusion for proposal 2**: By default all features developed under a WI other than Rel-16 NR-U are applicable to unlicensed. Exceptions where some of these features are proposed to be not applicable to unlicensed may be discussed case by case based on company input that describes how the feature is impacted by operation in unlicensed bands.If companies have concern on this rewording then my suggestion would be to return to the wording using 'licensed features'. We may not have a precise definition of what is mean by 'licensed features' but I hope it should be clear enough for the WGs to progress their work. |
| Intel | Fine with Proposal 1 and Proposal 3.Ericsson’s update on Proposal 2 is generally fine with one comment. For forward compatibility to 60GHz unlicensed operation, we want to clarify as follows:**Moderator conclusion for proposal 2**: By default all features developed for a frequency range under a WI other than Rel-16 NR-U are applicable to unlicensed for the frequency range. Exceptions where some of these features are proposed to be not applicable to unlicensed may be discussed case by case based on company input that describes how the feature is impacted by operation in unlicensed bands. |
| vivo | We are fine with the proposal 1 and 3, also fine with the revised proposal 2 from Ericsson or Intel. Regarding concern on 60GHz unlicensed operation, it will be discussed in future anyway. |
| Qualcomm | We are ok with proposals 1, 3 and with modified proposal 2.  |
| OPPO | We are fine with proposal1,3 and modified proposal2 from moderator. |
| Huawei | Fine with proposal 1. Regarding proposal 2, we are fine with the intention to avoid discussing features one by one, in order to decide whether it applies to unlicensed operation. However, if there are companies proposing some feature(s) not applicable to unlicensed operation, there should not be any default assumption on whether the feature(s) is or is not applicable to unlicensed operation.We also suggest to avoid using “Rel-16 NR-U” in the proposal as there may be other items specific for unlicensed operation in the future. On the addition of “frequency range”, our view is that this is not necessary as there are UE specific features not dependent on frequency range.**Moderator conclusion for proposal 2**: All features developed under a WI not specifically targeting unlicensed operation are assumed to be applicable to unlicensed operation. Companies shall provide contributions if some of these features are proposed to be not applicable to unlicensed operation, in which case there is no assumption on whether the feature(s) are applicable to unlicensed operation. The company contribution shall describe~~s~~ why the feature(s) shall not be applicable to unlicensed operation and/or how the feature(s) is/are impacted by operation in unlicensed bands.Regarding proposal 3, since we changed “For per UE features..” to “For features…”, features here would include some feature groups that would need licensed and unlicensed differentiation but no need to introduce new capability signalling, e.g. per band features. Therefore, we suggest to make the following change on proposal 3:**Moderator conclusion for proposal 3**: For features (including Rel-15 features) that are applicable to both licensed and unlicensed operation, it may be discussed case by case based on company input whether to introduce licensed/unlicensed differentiation in the UE capability signalling. The company input must describe how the feature is impacted by operation in unlicensed bands, and why licensed/unlicensed differentiation is justified. If licensed/unlicensed differentiation is agreed to be applicable for Rel-15 features, the additional capability signalling if needed is introduced from Rel-16. |
| ZTE | We are fine with proposal 1, 3 and the further updated proposal 2 from moderator. |

## 3 UE features for cross-carrier operation

The topic is raised by tdoc RP-201768 which makes the 3 proposals which are handled in the following sections

### 3.1 Proposal 1 and 2

**Proposal 1**: RAN discusses the remaining Rel-15 UE features with potential ambiguity issue in case of cross-carrier operation in this plenary.

**Proposal 2**: Regarding the interpretation of UE capabilities in case of cross-carrier operation, the support of the following UE capability is based on the support of this capability for the band of the scheduled/triggered/indicated cell only.

**2.1** ue-SpecificUL-DL-Assignment

**2.2** bwp-DiffNumerology / bwp-SameNumerology

These proposals are closely related and hence separate feedback for proposal 1 is not requested - if any company thinks this should not be discussed in RAN plenary then this can be indicated. Separate tables are provided in which to give feedback on 2.1 and 2.2

Companies can provide any feedback related Proposal 2.1 related to **ue-SpecificUL-DL-Assignment**

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| **Company** | **Comments** |
| Nokia | Related discussion has been started in RAN1 already and in our view it should be continued in RAN1 instead of RAN Plenary. |
| Apple | We see the need to further clarify, but would prefer to continue the discussion in RAN1 |
| Qualcomm | Our view is that the support of this feature should be conditioned on indicated support in both the scheduling and scheduled carrier. Ok to discuss it at the next RAN1 meeting. |
| Futurewei | We also think it’d be better to sort these details out in WG. |
| Intel | We appreciate the initiative, but we do not think it is something that needs to be discussed in RAN plenary. We would like to continue the discussion (as Nokia clarified) in the upcoming RAN1 meeting. |
| vivo | This is the valid issue, should be discussed in RAN1 however some guidance from RAN would be good |
| NTT DOCOMO | We think it should be discussed in RAN1 meeting. |
| CATT | We also think this topic can be further discussed in R1. |
| Ericsson | It is not clear to us the need for discussion at plenary. The corresponding discussion could continue in RAN1. |
| ZTE | We support the above proposal 2. We prefer to discuss this issue in this RAN meeting as early as possible to avoid potential backward compatibility issue. If this issue is discussed later, companies may tend to agree on the most conservative option which imposes great restrictions on testing and implementation. |
| OPPO | We think this should be discussed in RAN1 |
| Huawei, HiSilicon  | We don't see the necessity to discuss this in RAN plenary here, since it has been discussed in RAN1. Further discussion/clarification can be continued there.  |
|  Samsung | It is natural to discuss this issue in next RAN1 meeting because it was raised in RAN1. However, we are open to discuss it in this RAN-P. |
| CMCC | We do not see the need to discuss it in RAN plenary. We are open to continue discuss it in RAN1. |

Companies can provide any feedback related Proposal 2.2 related to **bwp-DiffNumerology / bwp-SameNumerology**

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| **Company** | **Comments** |
| Nokia | Related discussion has been started in RAN1 already and in our view it should be continued in RAN1 instead of RAN Plenary. |
| Apple | We see the need to further clarify, but would prefer to continue the discussion in RAN1 |
| Qualcomm | Our view is that the support of this feature should be conditioned on indicated support in both the scheduling and scheduled carrier. Ok to discuss it at the next RAN1 meeting. |
| Futurewei | We also think it’d be better to sort these details out in WG. |
| Intel | We appreciate the initiative, but we do not think it is something that needs to be discussed in RAN plenary. We would like to continue the discussion (as Nokia clarified) in the upcoming RAN1 meeting. |
| vivo | This is the valid issue, should be discussed in RAN1 however some guidance from RAN would be good |
| NTT DOCOMO | We think it should be discussed in RAN1 meeting. |
| CATT | We also think this topic can be further discussed in R1. |
| Ericsson | It is not clear to us the need for discussion at plenary. The corresponding discussion could continue in RAN1. |
| ZTE | We support the above proposal 2. We prefer to discuss this issue in this RAN meeting as early as possible to avoid potential backward compatibility issue. If this issue is discussed later, companies may tend to agree on the most conservative option which imposes great restrictions on testing and implementation. |
| OPPO | We think this should be discussed in RAN1 |
| Huawei, HiSilicon | Would be good to continue the discussion in RAN1.  |
|  Samsung | It is natural to discuss this issue in next RAN1 meeting because it was raised in RAN1. However, we are open to discuss it in this RAN-P. |
| CMCC | We do not see the need to discuss it in RAN plenary. We are open to continue discuss it in RAN1. |

### 3.2 Proposal 3

**Proposal 3**: RAN tries to resolve the ambiguity issue of Rel-16 UE features related to cross-carrier operation in RAN#89e. Otherwise, RAN tasks WG to discuss and resolve this issue in next WG meeting.

Companies can provide feedback related to Proposal 3. At this stage, feedback on the separate capabilities (approximately 15 listed in the paper) is not requested, but companies can comment on whether we try to progress these within RAN plenary. If there is support to progress them, then feedback will be requested on each separate capability in the next stage of the discussion.

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| **Company** | **Comments** |
| Nokia | RAN1 has just finalized the list of Rel-16 UE features in RAN1#102-e with focus on ASN.1 impacts, and it is natural that discussion will continue in next quarter to finalize remaining aspects. Hence, the most natural place to discuss this topic is in upcoming RAN1 meetings rather than RAN Plenary. |
| Apple | We agree with the need for further clarification, but would prefer to proceed in RAN1, as it would likely involve careful screening of all the listed features and discussions. We are OK with RAN explicitly task RAN1 to resolve the ambiguity in the coming meetings.  |
| Qualcomm | Prefer to discuss it at the next RAN1 meeting. |
| Futurewei | We prefer to sort these details out in WG. Only the controversial ones, already going through thorough discussions in WG, need to be decided in RAN plenary. |
| Intel | Okay to discuss in the upcoming RAN1 meetings |
| vivo | This is the valid issue, should be discussed in RAN1 however some guidance from RAN would be good |
| NTT DOCOMO | We think it should be discussed in RAN1 meeting. |
| CATT | We share the above view that RAN1 (and other WGs) is better place to discuss this issue. |
| Ericsson | It is not clear to us the need for discussion at plenary. The corresponding discussion could continue in RAN1. |
| ZTE | In order to facilitate the discussion, we prefer to have a general conclusion or guidance in RAN plenary and the detailed work can be carried out by working groups. One of the potential general conclusion would be the following.**Conclusion:**It is observed that ambiguity issue exists for some of the Rel-16 UE features related to cross-carrier operation. The detailed clarification work is to be carried out by working group.  |
| OPPO | We think this should be discussed in RAN1 |
| Huawei, HiSilicon | It is expected that RAN1 will do the discussion for Rel-16 UE features in the future meeting(s), therefore there is no need to discuss it in RAN plenary here.  |
|  Samsung | We share the view with Nokia and Apple. Further clarification is necessary and need more time to identify potential ambiguity. So, we prefer to continue the discussion in next RAN1 meeting. |
| CMCC | We think this should be discussed in RAN1 |

### 3.3 Moderator summary from Initial Phase

For all 3 proposals, there was a clear majority of companies that would prefer to discuss this topic within RAN1.

**Moderator conclusion**: The discussion of this topic should take place within RAN1. No further discussion will take place in RAN#89e.

## 4 New UE FG for CBG-based PUSCH retransmission with cancelled initial transmission

### 4.1 Initial Phase

Tdoc RP-201877 makes the following proposal:

**Proposal**: Add the following Rel-16 UE FG for eURLLC WI (based on Option 1a above):

In addition, tdocs RP-201878 and RP-201879 provide CRs to 38.306 and 38.331. The first phase of the email discussion should focus on the principle decision of whether to introduce the new capability. If this is agreeable then the CRs can be looked at in a second stage or tasked to RAN2 to progress in Q4.

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| **Company** | **Comments** |
| Nokia | We are OK with the principle decision of introducing the new capability proposed in RP-201878. As for the CRs, we believe it is best to task RAN2 to progress in Q4 with those. |
| Apple | This same issue has been discussed in the past 3 RAN1 meetings already. The problem has been generally acknowledged, although we failed to reach a consensus on the final solution in the last meeting. It would be very helpful that progress can be made in the current RAN meeting.  |
| Qualcomm | We support introducing the proposed UE capability for CBG-based PUSCH retransmission with cancelled initial transmission. We can also accept clearly precluding the occurrence of this scenario in the specification as an alternative.  |
| Futurewei | We are open to accommodating this UE implementation limitation. RAN may first agree the principle, i.e, option 1a) cited in RP-201877, and leave its realization to WG – whether it’d be a UE capability or a note in specification.  |
| Intel | Okay to further discuss in the next RAN1 meetings. We do not see the urgency to be discussed in RAN plenary as we would have many capabilities (not only this one) to be newly added as December version. We think the new capability signalling can be added in a backward compatible manner and thus we can discuss in the upcoming RAN1 meeting together with other UE features.  |
| vivo | We are fine with the proposal with the assumption that this will close this issue without additional RAN1 specification change.  |
| NTT DOCOMO | We are basically fine with the proposal. However, we think the proponent intends to introduce CRs (i.e., capability signaling) in Sept version of the specifications. If RAN will try to just agree the proposal but will task RAN2 to discuss CR in next WG meeting so that capability signaling will be introduced in Dec version of the specification, there may be no/less need to rush the decision in this RAN plenary meeting. Basically this is a technical discussion and hence should be discussed in WG level. |
| CATT | We are fine with the principle decision of introducing this new capability. Detailed signalling can be left to R2. |
| Ericsson | Support Option 1a in principle. The exact manner to accommodate Option 1a is to be further discussed in the WG.To accommodate the discussions in the WG, we have the following comments based on the proposals in RP-201877:First, it should be discussed if the corresponding Rel-15 UE FG 5-25 (“***cbg-TransIndication-UL***” in 38.306) should be revised. The “Note” in RP-201877 proposal changes the meaning of Rel-15 “***cbg-TransIndication-UL***” to support only in-order CBG.* The Note is “A UE supporting 5-25 shall support CBG-based retransmission(s) with cancelled initial PUSCH transmission if the following condition is satisfied: the UE is scheduled for a re-transmission of a CBG #N in a given TB only if CBG #N-1 has been transmitted before or it is scheduled in the same UL grant that includes CBG#N.”

Then, it should be discussed how to capture Option 1a as a UE feature, depending on decision of meaning of FG 5-25. * If FG 5-25 is changed to support in-order CBG only, then the new FG is introduced to support both in-order and out-of-order CBG;
* If FG 5-25 is kept as is (i.e., support both in-order and out-of-order), then the new FG is introduced to support in-order CBG only;

Also: it should be discussed if the causes should be ‘cancelled initial PUSCH transmission’ (due to Rel-16 intra-UE prioritization and inter-UE cancellation as described in RP-201877), or it can be any causes that led to the UE not transmitting the full TB at least once. |
| ZTE | We are generally fine with introducing the proposed new UE capability. The details of FG can be further discussed in RAN1/RAN2. But it should avoid further discussion on introducing explicit scheduling restrictions in the specifications. |
| OPPO | We are fine with the principle and to approve the CRs in the plenary meeting considering this feature has been discussed for quite long time in RAN1. |
| Huawei, HiSilicon | We support introducing the new UE capability for CBG-based PUSCH retransmission with cancelled initial transmission as proposed in RP-201877. As pointed out by Apple, it was discussed in several meetings in RAN1 but we still are not able to reach consensus on the final solution. Introducing a new UE capability is not the best solution in our understanding, but we are willing to compromise in order to resolve the issue.  |
|  Samsung |  We don't think it is necessary to introduce a new UE capability CBG-based PUSCH retransmission. The gNB can avoid canceling it. Even in the odd case that it needs to cancel it, re-Tx can just be TB-based.  |

### 4.2 Moderator summary from Initial Phase

The majority of companies either support the proposal or are at least willing to accept the proposal in order to resolve the issue. Majority of companies also think that details should be finalised in RAN1 and RAN2 rather than in RAN plenary.

**Moderator conclusion**: Introduce a new FG "Out-of-order CBG-based re-transmission(s) with cancelled initial PUSCH transmission". Details are to be finalised by RAN1 and RAN2.

Companies are invited to provide any further feedback to the moderator's proposal.

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| **Company** | **Comments** |
| Intel | Introducing a new FG is one out of multiple solutions. We need WG level discussion to sort out. In fact, we see this issue is similar to long-lasting relaxation for UE being allowed to skip decoding for coding rate > 0.93, but UE can actually try to decode. Thus, we think it is implementation issue who/whether to generate TB CRC for the last CBG. Generally, this corner case won’t happen as gNB will not behave as such. Though, we understand UE implementation concern and thus we won’t object to introduce a solution to relax UE, but we want RAN1 to decide final solution.Thus, we suggest RAN plenary to guide in high level (instead of exact solution) what to do in the upcoming RAN1 meeting as follows:<Proposed conclusion>RAN1 to discuss and to decide a solution for Out-of-order CBG re-transmission with cancelled initial PUSCH transmission wherein UE is scheduled for retransmission of last CBG |
| vivo | RAN1 can further discuss and if necessary add a new FG |
| Apple | We are OK with the moderator’s proposal, as based on earlier feedbacks from initial round, this seems to be a reasonable compromise to achieve.We also appreciate intel’s feedback above. However, the reason we still prefer the moderator’s proposal is that this issue has been discussed for 3 meetings in the past, e.g. there was lengthy discussions on whether to introduce CR in existing spec or simple introduce a new UE FG; if it is CR in spec, whether it is R16 or also R15 spec. etc. Finally, RAN1 proceeded with introducing a new UE FG although details were not finalized in last meeting.From Apple perspective, either way (Spec CR or new FG) is acceptable. However, we don’t want to repeat the same discussions already happened in RAN1 and back to square one again. Therefore, we think the current proposal by the moderator helps to progress faster (than Intel’s version). |
| OPPO | Support moderator’s proposal |
| Ericsson | We support moderator’s proposal. |
| Nokia, NSB | We support moderator’s proposal |
| ZTE | We are fine with moderator’s proposal. |
| Qualcomm | We support to have a principal agreement on the type of solution at the Plenary, as per the moderator’s proposal.  |
| Samsung | We do not see any need for RANP action/guidance. The issue is marginal and the understanding in RAN1 was that it could be discussed at the next RAN1 meeting. That is enough. |
| CATT | Fine with moderator’s proposal. |
| Huawei | Support the moderator’s proposal. Similar view as Apple, this issue has been discussed in RAN1 for several meetings and at the beginning the focus was to define the behaviour in the specification, unfortunately we were not able to achieve consensus. Defining UE capability is kind of compromised solution and if we can make some conclusion here, it can help avoid repeating the discussion in RAN1.  |

### 4.2 Moderator summary from Intermediate Phase

Given the clear majority in favour of the proposal in the initial round of discussion (11 companies in favour to 2 companies not in favour) and also in the Intermediate Phase (8 companies in favour to 3 companies not in favour) and also the fact that this topic has been discussed in several RAN1 meetings without conclusion, it that it would be beneficial for the RAN plenary to make a decision on the general way forward to help avoid repeat discussions in the WG. Therefore the moderators proposal from the intermediate phase is unchanged.

**Moderator conclusion**: Introduce a new FG "Out-of-order CBG-based re-transmission(s) with cancelled initial PUSCH transmission". Details are to be finalised by RAN1 and RAN2.

Following this conclusion from the intermediate phase, the moderator would like to ask if there are objections to this conclusion.

## 5 Contacts

Please provide a company contact that the email discussion moderator can contact if required.

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