[98e-10-R18-Regional-Subsets-Bands] - Version 0.0.5

RAN

https://nwm-trial.etsi.org/#/documents/8410

3GPP TSG-RAN #98-e RP-223450

December 12th - 16th, 2022

Electronic Meeting

Agenda item: 9.2.2

Source: Moderator (Qualcomm Incorporated)

Title: Email discussion summary for [98e-10-R18-Regional-Subsets-Bands]

Document for: Information

1 Introduction

This document summarizes the email discussion on the UE support of regionally-defined subsets of an NR band. The following documents are treated in this thread.

Table 1: List of contributions

RP-223196	Text proposal for Study on UE support of regionally-defined subsets of an NR band	Apple
RP-223250	Solutions for UE support of regionally-defined bands	Nokia, Nokia Shanghai Bell
RP-223254	Generic solution for n77-like issues	Ericsson
RP-223339	Review of solutions for the study item on UE support of regionally defined subsets of an NR band	AT&T
RP-223357	Discussion on UE support of regionally-defined subsets of an NR band	Huawei, HiSilicon
RP-223358	TP for TR 38.893 to introduce the potential solutions	Huawei, HiSilicon

RP-223377	TP for TR 38.893: Solutions and recommendation	Qualcomm Incorporated

2 Initial Round

2.1 Comments

Details of solutions involving a new band or band number

Several contributions provided details on a solution with a new band or band number. Can these be merged into a single TP? The moderator suggests Ericsson to provide a merged TP.

Feedback Form 1: Details of solutions involving a new band or band number

1 – T-Mobile USA Inc.

We support a merger of proposals involving the use of a new band number.

2 – Verizon UK Ltd

We do NOT support the new band solution!

For the benefit of larger band n77 frequency range to the ecosystem, we are open to a solution of either new signaling or a new band numbering as a generic. And the solution should not impact the existing hardware.

3 – AT&T

The contributions submitted thus far to RAN#98e tend to treat the new band proposal as a simple matter of a) choosing a new number, b) defining a frequency range, and c) referring to an existing 3GPP band for all requirements. This does not adequately address the concerns raised in RP-223339, specifically:

· Expression of the association between new band numbers and parent bands in signalling requirements.

· Ensuring that UE capability signaling is not adversely impacted by the number of supported band combinations.

· Accommodations for cases where the UE subset support precludes the possibility to test some MSD exceptions.

· Ensuring that the number of new band definitions does not exhaust the range of possible band numbers.

· Management of the additional procedural work due to the need to approve a new WID for the introduction of a new band introduction.

To be considered complete, a TP for this section must address the above issues. Thus, we do not believe RAN is ready to draft a comprehensive TP for this section.

4 – T-Mobile USA Inc.

To AT&T: Thanks for the comments. I think those can be handled as follows:

· *Expression of the association between new band numbers and parent bands in signalling requirements.*

There is no association required in the signalling, only in the specs. The UE signals what bands it supports including the new band numbers. For CA and DC combinations the UE only signals the main band number. Just like n90, there would be no band combinations defined for the new band numbers.

· *Ensuring that UE capability signaling is not adversely impacted by the number of supported band combinations.*

The UE would support more bands, but the CA and DC signalling would be the same as the original band. SIgnalling should be far less impacted than if we add new capability signalling and new NS values each time there is a need for a new sub-band, or adding new signalling for sub-set of bands.

· *Accommodations for cases where the UE subset support precludes the possibility to test some MSD exceptions.*

We already have such cases in 38.101-1. If the MSD can't be tested a note is added. In other cases the configuration was changed so it is testable.

· *Ensuring that the number of new band definitions does not exhaust the range of possible band numbers.*

There are 1024 possible band numbers. We have so far only seen indication for a need for this in certain wide bands in the US and Canada, so unlikely to be a major problem.

FreqBandIndicatorNR ::= INTEGER (1..1024)

· *Management of the additional procedural work due to the need to approve a new WID for the introduction of a new band introduction.*

Adding a new band number should be less work than adding a new band, and certainly less work than adding new custom signalling and NS values as we had for n77. Adding new signalling to support sub ranges would add more work also, in our view.

We think the TP could be modified to include these aspects.

5 – Samsung Electronics Co.

New band can be considered as one possible solution.

6 – MediaTek Inc.

One concern is that carrier aggregation configurations between new bands and parent band. It can be observed that many clarifications and adjustments would be made to enable both new subset band and parent band for single band multiple carriers' operation and requirements. To use multiple bands combination definition to replace single band's (e.g., n77) multiple carriers definition causes impacts on specifications.

Regarding "to be considered completion, a TP for this section must address the issues raised in RP-223339.", currently, we agree that further detailed discussions about issues raised in RP-223339 are needed to reach consensus.

7 – ZTE Corporation

We also think (and prefer to) the solution of New band/band number solution should be included. For the band combination concern, the approach of n90/n41 might be applied.

8 – Nokia Corporation

We support having a single TP for the new band number solution. We also agree with the TMO analysis and do not see any open issues remaining here.

9 – vivo Communication Technology

We support having a single TP for the new band number solution. This should be a clean and simple enough solution and fits well for the designated scenario.

10 – Huawei Technologies Sweden AB

New band, and new band number can be captured as two separate solutions. Whether to have a single TP or not – slight preference to a single TP to reduce workload overhead.

@Verizon: we shall remember, that we are trying to investigate potential solution, which are not only n77 oriented.

We tend to agree with AT&T to clarify all the concerns before closing the SI, and capture related text in TR. There is no time pressure on related to this study.

New band number for a single carrier seems a workable solution. But we share comments on the band combinations - we would like to see more analysis on those aspects captured in the final TR. Even if this TR is supposed to be used as guide, we need to explain what the n90/n41 case was.

11 – Intel Corporation (UK) Ltd

We think it is important to distinguish the new band solution and the 'new band number' solution. The new band solution is the normal approach with which everyone is familiar with and should not need additional explanation. Our comments here relate to the 'new band number' solution.

The 'new band number' approach seems very simple at first sight, However, we share some of the concerns of others that it may not be completely straight forward to specify, and may require many clarifications to the specifications to make it clear whether text is referring to the subset band with the new band number or to the parent band.

Regarding the band combinations, we think it is important to make clear that the band number referring to the subset band would never be used within the signalling of supported band combinations (as clarified by T-Mobile above). This clarification should resolve quite a number of questions.

In summary we think that this solution is feasible.

12 – Ericsson LM

Yes, merge sounds good.

13 – Apple GmbH

As a very generic comment, a new band number is an existing solution and thus we do not see any concerns with acknowledging it as a potential option. Nevertheless, as commented by Verizon and ATT, we need to document carefully all pros and cons, especially for the case when the regulator releases sub-bands within the same frequency range covered by an existing 3GPP band. And we also agree with comments from

MediaTek that carrier aggregation features and associated band combinations definitions might become too tangled. This aspect should be studied further.

14 – CHTTL

It seems like all the contributions are proposing ”new band number” solution? at least this solution can be merged.

But we are wonder whether there exist proposals and preference for the ”new band” solution? cuz even if some contributions mention about new band solution, but they also mention to refer the requirement to the parent bands, which to me is close to ”new band number” solution if our understanding is correct.

Details of solutions not involving a new band or band number

Several contributions provided details on a solution reusing the existing bands or band numbers either with or without new signaling. Can these be merged into a single TP? The moderator suggests Apple to provide a merged TP.

Feedback Form 2: Details of solutions not involving a new band or band number

1 – AT&T

As this class of solutions does not alter the semantics associated with 3GPP Bands, we are more comfortable with the TPs presented. We feel that a TP could be drafted from a combination of the contributions to this meeting.

2 – T-Mobile USA Inc.

We don’t think the new signalling approach has been clearly defined. For example, if the UE capabilities add a new field to indicate that the UE supports a sub-allocation of the band, what would keep a roaming UE that supported the entire band from accessing the sub-allocation without the new capability signalling? And if the roaming UE did attempt to access the new sub-allocation without the new capability signalling, (as we heard with n77) the gNB might reject it over and over. So, we might need a new NS value each time like we needed for n77, to bar UEs that don’t have the new capability signalling from attempting to access the particular part of the band. Maybe there are other alternatives, but the new band number approach provides doesn’t have these problems.

3 – Samsung Electronics Co.

Signalling solution can be considered as another anternative solution including new signalling or band n77 like solution NS valule together with capability signalling.

4 – MediaTek Inc.

We are okay with moderator’s suggestion. Regarding ”solutions not involving a new band or band number”, we think to merge associated TPs into a single TP is useful.

5 – Huawei Technologies Sweden AB

There are several with possible solutions identified: therefore one TP is ok, but to capture multiple solutions proposed in tdocs (the final TR recommendation may select a single recommended solution then). Based on T-Mobile comments, we would support to have more clarifications on related open issues in the final TR.

6 – Intel Corporation (UK) Ltd

We understand that the solution not involving a new band or band number, is to define an NS value to be able to prevent a UE not supporting a subset from accessing a cell from idle/inactive, and to use a new UE capability so that the network can control handovers.

A number of companies have commented that this will require work in RAN2 and RAN4 every time a new subset band is added. In our understanding this is not correct. RAN2 could define generic signalling for a number of subsets and RAN4 can be responsible for which subsets are allowed to be used for any given band. RAN2 would only need to be involved at the introduction of the generic mechanism (in a very similar way that we do not need RAN2 to add new signalling whenever RAN4 decides a new band number or new NS value must be used).

We think that this solution is feasible.

At this meeting, we note that Huawei (3358) has proposed 2 new variants of this approach. Both variants would use similar UE capability signalling to control handovers, but have different approaches to prevent a UE not supporting a subset from accessing a cell from idle/inactive. The first approach is to rely on UE implementation and the second is to rely on new standardised UE behaviour.

We support to capture all options in the TR.

7 – Ericsson LM

Merge would be good here too.

8 – Apple GmbH

We would like to echo comments from Intel that even if we consider an approach with using network and/or UE signalling, there is no need to ask RAN2 every time a new sub-band is added. If we have a generic container, similar to what we already have for the NS values, it will be solely RAN4 decision what the corresponding bits mean. In fact, we already have such a generic container for the NS values (NW->UE signalling) and we also have modifiedMPR-behaviour (UE->NW signalling). If the latter container is only for the MPR related issues, then we can ask RAN2 to allocate a similar container only for the sub-band purposes.

And we support having a generic TP that may cover potential solutions not involving a new band number.

Other

Additional text related to roaming UE's was proposed by Huawei in the TP in RP-223358. Is this agreeable?

Feedback Form 3: Other TP additions

1 – Qualcomm Korea

We aren't ready to agree to this TP. The first proposal adds a sentence that it's also allowed for the roaming UE to not attempt to connect to the cell. But, anyways this seems to always be the case that the UE may decide not to RACH from idle state. It's not as clear for handover how the network would respond if the UE refuses. Solution X and Y seem to be a version of "Solutions not involving a new band or band number" so possibly can be merged into that and discussed as part of that rather than as a separate solution.

2 – AT&T

Our interpretation of Huawei's TP is that a UE implementation could adjust its behavior to comply with regional regulations based on information broadcast in SIB1. However, in Huawei's TP for the solutions section, they acknowledge this behavior is not specified, and should RAN decide to rely on such roaming behaviors, the behavior must be specified. If our understanding is correct, then Huawei raises a point worth considering, but the connection between the text in Section 5.1 and the text in Section 6.Y must be clarified. Otherwise, if our understanding is incorrect, we would need additional clarification from Huawei before agreeing to incorporate their TP.

3 – MediaTek Inc.

In our understanding, it is difficult to fully avoid legacy UEs already shipping on the market trying to access new sub-allocations during roaming without defining a proper way to prevent it. Solution X and Y seems within the scope of "Solutions not involving a new band or band number", we think it is necessary to have further discussion about the TP's context. Thereafter, to incorporate the TP based on consensus is feasible this meeting or later on.

4 – Huawei Technologies Sweden AB

We are ok with the proposed work-split on TPs refinements.

For the "Other" items in general, we would like to raise couple of additional items to clarify in the TR:

- Classifications of solutions: we would like to double-check on the proposal's classification proposed in Apple paper – if agreeable, the related graph may be also used in the TR.

- Duplex: so far, the whole discussion is duplex agnostic. Its ok to keep it that way, but some clarification in the general part of the TR would be also useful for clarity.

- RAT: similar to the above comment: it would be also useful to add clarification that those solutions are derived based on NR (e.g. "*new NR band number*" solution), but are expected to be equally applicable to future RATs – appropriate wording is FFS.

- RAN WGs involvement: it would be good to clarify for all the solutions captured, when RAN2 involvement is/isn't needed – this may be useful summary for future reference.

- CA/DC band combination: all solutions shall be summarized, considering their pro/cons for the new CA/DC bands definitions, related workload, etc.

- "new band number": to make it more user-friendly, it may be worth to discuss what the "new band" shall actually be. The first idea is to allocate some number which refers to the legacy/parent band number. As

example: for n77 it could be something like, e.g. n77b, or n771? RAN2 experts would need to be comment in this.

With all the above questions, we are starting to think if we shall give ourselves more time for this SI, and to extend it by one quarter…

5 – Huawei Technologies Sweden AB

Reply to Qualcomm: If your understanding is that the roaming UE not certified from the country's regulator have to attempt to access to and/or operate in the specific frequency range in specific country/region, I'm fine with it. Anyway, I expect that the industry or 3GPP standardization can provide a clear UE behavior especially for Roaming UE which is deployed in USA band n77. My mainly concern is that the following sentence is not clear for Roaming UE: *"Whether the roaming UE is allowed to operate without certification from the country's regulator is subject to each country's laws.*"

Firstly, the country's lawmay be still under discussion or the country's law didn't specify a clear UE behavior for that case. As a consequence, UE can't guarantee whether the roaming UE is allowed to operate without certification from the country's regulator, so what's the UE behavior for this case?

Secondly, can you clarify whether the roaming UE is allowed to operate without certification from the US's regulator in band n77 as we use this case as example?

6 – Huawei Technologies Sweden AB

Reply to AT&T: Yes, your understanding is correct. I think current information broadcast in SIB1 is clear enough for UE to adjust its behavior to comply with regional regulations, no matter we standardize the UE behaviors in spec or leave it to UE implementation. Once UE access to one cell, UE can indicate the sub-band capability. And network can deploy UE based on the sub-band capabilities.

The last sentence in section 5.1 is to clarify the roaming UE behavior as the previous sentence ("*Whether the roaming UE is allowed to operate without certification from the country's regulator is subject to each country's laws.")* is unclear. In my understanding, the roaming UE is not allowed to operate without certification from the US's regulator in US band n77. If companies can confirm this case, we can revise this sentence. If companies are not sure about roaming UE behavior without certification from the US's regulator, it's safer to allow roaming UE without certification from the US's regulator not to attempt to access to and/or operate in the specific frequency range in US band n77.

7 – Huawei Technologies Sweden AB

Reply to Mediatek: we are developing a general Rel-18 solution for future new sub-band frequency range. We don't think legacy UE's behavior can be an argument to exclude such general Rel-18 solution. The TR is expected to capture multiple potentail solutions (the final recommendation is another story).

Secondly, we have agreed that "*it is neither the operator nor the base station that takes responsibility for the UE meeting regulations."* If legacy UE's behavior can't comply with regulation, I think we can consider the legacy method to address this issue.

Finally, it's mentioned or implied in section 4 root cause that the UE behaviors are not clear. Thus, we should avoid such situation happen again in future releases. So, it's very important to specify or have a common understanding on the UE behaviors.

8 – Intel Corporation (UK) Ltd

We do not fully understand the intention of the roaming text proposed by Huawei. As a general comment, roaming has been an essential element of 3GPP systems since GSM and we should be very careful before allowing a UE implementation to decide not to access the network in a roaming situation. Instead, we

should rely on standardised mechanisms to control access. We also understand that today our standardised mechanisms rely on the assumption that when a UE supports a band then it supports the whole band, and that the testing/certification regime in the country where that UE originates has checked that the UE meets 3GPP requirements for that band (as those requirements existed at the time the UE was brought to market).

9 – Ericsson LM

The roaming text:

We think that support of a band means support of the whole band as defined in 3GPP. We are unsure of this addition.

The new solutions:

First: The motivation for the newly added NS-values for n77 in USA and Canada was that a legacy UE (or UE not compliant with the requirements of the new subband) should be barred from the cell.

Our understanding of the proposed added text is that it similar to the solution used for n77 in USA and Canada, but with the exception that it doesn't have the NS-value component. Is this correct?

We believe that solution must also address legacy UEs (i.e., UEs build **before** the new subband is defined). Those UEs shall not connect to cells in the new subband since they don't meet the requirements. The solutions proposed by this text seem to not work since the UE will not be aware of the new subband and hence would not be able to know that it should not connect (this applies both for the standardized and implementation-based approach). One could imagine that the UEs shall be upgraded as time passes to account for the to-be-defined subbands, but that also doesn't work since the UE cannot be conformance tested over the air. So we do not think the proposal as describe will work.

10 – CHTTL

One clarification to the proposed sentence.

It's also allowed that the roaming UE doesn't attempt to access to and/or operate in the specific frequency range in specific country/region, if UE can't guarantee whether the roaming UE is allowed to operate without certification from the country's regulator

Does the last sentence mean that the UE does not know whether the roaming UE is allowed to operate without certification from the country's regulator?

We are wonder how does the UE decide not to attempt access to the specific frequency range in specific country/region if the UE does not have any related information?

Conclusion and recommendations

Ideally, the SI could conclude with a recommendation on how regional subsets of bands could be treated in the future. Details can be left to the working groups at the time, but this SI can provide guidance. Are the conclusions and recommendations from Qualcomm RP-223377 agreeable?

Feedback Form 4: SI conclusion and recommendations

1 – T-Mobile USA Inc.

We agree with the conclusion to use new band numbers in the future. We think there is a copy and paste error in the TP, though. Solution 2 in the actual TP looks the same as Solution 1. Solution 2 in the text above is different (signalling) than Solution 2 in the TP itself (new band number).

2 – AT&T

Both the recommendation and conclusion offered by RP-223377 advocate the new band/new band number approach over a signaling based approach based on two premises: that specifying new signaling is difficult and that this is a rare situation that doesn't warrant new signaling.

We challenge both premises. First, it is not obvious that a signaling solution needs to be complicated. Second, it is not apparent that the effort required to specify a generalized signaling solution would exceed the work needed to define subset numbers combined with the complexity of defining the necessary relations between subset band numbers and parent band numbers. Finally, the rarity of this situation hasn't been quantified, so the judgement of the relative effort can't be stated with confidence.

We therefore do not agree to the conclusions and recommendations from RP-223377.

3 – Samsung Electronics Co.

We expect this RAN-P level SI shall provide clear description of the root casue of the issue and recommendation for feasible solutions.

Ideally, if RAN-P can narrow down to single solution that will save RAN4 effort. On the other hand, we also realize both new band number and signalling solutions are feasible and both of them have pros and cons as summarized in QC TP. Operators may have different preference pending on the situations in different regions, another alternative way was to include all the feasible solutions as conclusion/recommendation for this SI and the exact solution adopted can be decided in case by case manner pending on future request.

4 – ZTE Corporation

we also prefer to use new band number solution. As T-Mobile USA pointed out, there were some copy-paste errors, where the contents in solution 2 should be for signalling solution. However, the contents in both solution 1 and solution 2 are the same in the TP.

5 – MediaTek Inc.

To use new band to bar UE single band's sub region and use multiple bands combination definition to replace single band's (e.g., n77) multiple carriers definition cause impacts on specifications, which can cause specification difficult to read as well.

We can understand that solutions have pros and cons and need accompanying modification in specification.

Once RAN-P and the associated documents can clearly capture all root cause, expected issues relevant to modification from solutions, then RAN4 workload can already be dramatically reduced.

Currently, we have concern about directly choosing one solution as the conclusion. At this stage, we support the approach which is to include the feasible solutions rather than a single solution as the conclusion/recommendation of this SI and the exact solution adopted can be decided in case by case manner pending on future request.

6 – Nokia Corporation

We are fine with the direction of the recommendation but some wordings could use clarifications and some parts on the new band numbering could perhaps also be moved to the solution description.

7 – vivo Communication Technology

We are ok with the general directions and conclusions, that new band number solution is preferred. The details can be further refined.

8 – Huawei Technologies Sweden AB

As we are still working on the possible solutions, it's a little hard to draw conclusions in parallel. With relatively broad set of solution proposed, it seems to us that the SI outcome can be used as some kind of guide, listing various possible solutions.

What we shall prevent at this time, is not to exclude any of the proposed solutions (unless there are some technical issues identified).

For the conclusions in RP-223377, those shall be at lease revised to first make the "proposals" part of the TR more mature.

Based on the comments above, we tend to agree with Samsung and Mediatek. To be able to select THE solution, more detailed comparison of pros and cons of all potential solutions is missing. At the same time, we are not agains to recommend "new band number" (once open issues are well addressed in TR, e.g. CA), but other solution shall not be excluded by the TR for the future use in RAN4.

Furthermore, as 3gpp attracts more and more 3gpp newcomer companies, it would be useful to add reference to that TR for any new spectrum proposal, e.g. to be captured in the WID template, as a guidance. Aim of this would be to reassure that all proponents of the spectrum items are well aware of the study and potential solutions to such regulatory issues.

9 – Intel Corporation (UK) Ltd

We think that we can agree that both solutions are feasible, although they may have different pros and cons. We do not yet have a clear view that one should be recommended over the other, and may need more time to identify and evaluate the pros and cons.

10 – Ericsson LM

We are fine with the "conclusions and recommendation"-section in the QC paper

2.2 Summary

While it is clear to some companies, other companies raise questions on how a solution involving a new band or new band number addresses all of the identified issues. Further detail and clarification is requested. It was additionally asked to clarify the difference between a new band solution and a new band number solution and whether the two should be handled separately. Similarly, there were questions on the details of signaling for solutions not involving a new band or band number and how these solutions would manage access barring and whether new IE's would need to be defined for every instance of a new subset. Finally, a number of questions and comments were received on roaming UE's and whether a UE can autonomously choose not to connect to a

cell if it is unclear whether regulatory certification is required or whether 3GPP should define specific behavior.

3 Intermediate Round

3.1 Comments

It is recommended to provide merged TP's for further discussion and commenting in the intermediate round. Ericsson will provide a draft TP for solutions involving a new band or band number. Apple will provide a draft TP for solutions not involving a new band or band number. On roaming, either the content can be included in the Apple TP or if preferred, Huawei can prepare a separate TP (revision of RP-223358). The Recommendations and Conclusions TP should be revised accordingly if a consensus can be found, but probably best to defer that to the Final Round.

Details of solutions involving a new band or band number

A merged draft TP from Ericsson can be found in folder for this thread.

Feedback Form 5: Merged TP on Solutions involving a new band or new band number

1 – TELUS

We are generally supportive of either solution (as long it works), but would like to clarify the Canadian behaviour in the new band table provided by Qualcomm, or in the other option with subset bit indicators. A very likely scenario is that after the extend portion is added in Canada (3650 - 3900 MHz), we would like to operate in the entire 3450-3900 MHz range and not have two separate bands. Should the n109 cover the 3450 - 3900 MHz range? Also, would the new band solution be release independent, so that we can use this solution before Rel-17 devices.

2 – T-Mobile USA Inc.

To TELUS: I think you could either add a new band number that covers 3450-3900 MHz or you could add a new band number that covers 3650-3900 MHz. If the new band number covers 3450-3900 MHz then you would need to indicate both n77 and the new band number in 3450-3650 MHz so your legacy n77 UEs can still access that range. You would only broadcast the new band number in 3650-3900, unless you already have n77 UEs that support 3650-3900 MHz and extendedBand-n77-2-r17, then you would also broadcast n77 and NS_57 in 3650-3700 MHz.

If the new band number only covers 3650-3900 MHz, then only n77 would be broadcast in 3450-3650 MHz and only the new band number in 3650-3900 MHz, unless you already have n77 UEs that support 3650-3900 MHz and extendedBand-n77-2-r17, then you would also broadcast n77 and NS_57 in 3650-3700 MHz. Since these spectrum blocks are adjacent (unlike the situation with C-Band and the DoD band in the US) it might be best to have the new band cover 3450-3900 MHz in case the operator's spectrum overlaps both blocks.

If the operator's spectrum overlaps both blocks, it would probably be necessary to have a BWP that is only in 3450-3650 MHz. This would be no different than for the existing solution with extendedBand-n77-2-r17 and NS_57.

3 – TELUS

Thanks T-Mobile (Bill). The intent of extendedBand-n77-2-r17 was to enable the whole 3450-3900 MHz range, so that if an operator has 3450 - 3550 MHz channel, we don't partition it into two (BW) parts. If that is not what it accomplishes, than adding a new band number that ranges from 3450 - 3900 MHz may be the way to go.

4 – T-Mobile USA Inc.

Hi Ivo, Sorry, forget what I said about a BWP. I was thinking that if there was a carrier from 3600-3700, it might be necessary to have an initial BWP in 3600-3650 for legacy UEs that are restricted to 3450-3650 MHz in Canada. But, I'm not sure if a UE that is limited to 3450-3650 MHz in Canada will access a cell that covers 3600-3700 MHz, even if the BWP was limited to 3600-3560 MHz. I think an overlapping cell that covers 3600-3700 MHz would need to indicate only the new band number, or the new band number and n77 withextendedBand-n77-2-r17 and NS_57.

5 – T-Mobile USA Inc.

Thanks, Ericsson, for the draft TP. Please find a revision in the inbox: https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_10-R18-Regional-Subsets-Bands%5D/draft%20TP%20on%20New%20band%20number%20solution_v01_TMUS.docx

6 – MediaTek Inc.

In our understanding, there was discussion in previous RAN-Plenary meetings that other countries may also encounter the scenario of introducing new sub regions in future. Regarding draft TP's content about "*New band numbers would only be needed for countries like the US and Canada*", we think that "only" could be removed.

7 – Nokia Corporation

We have provided some comments in v3_Nokia, with some explanations below:

- Network can broadcast multiple bands in SIB1, and if UE supports any of them it can camp on the cell.

- The new band number could contain multiple sub-bands, e.g. so that it contains the entire frequency allocation defined at the time. This allows to keep track of the "largest" band allocation at a given time (even if that is non-contiguous as was the case with n77), and allows easier UL CA definitions (i.e. no inter-band CA needed, just intra-band CA)

- Some small clarifications added here and there (mainly clarifying some details)

Details on solutions not involving a new band or band number

A merged draft TP from Apple can be found in folder for this thread.

Feedback Form 6: Merged TP on Solutions not involving a new band or new band number

https://nwm-trial.etsi.org/#/documents/8410

1 – T-Mobile USA Inc.

Thanks, Ericsson, for the draft TP. Please find a revision in the inbox: https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_
10-R18-Regional-Subsets-Bands%5D/draft%20TP%20on%20New%20band%20number%20solution_v01_TMUS.docx

2 – T-Mobile USA Inc.

Sorry, I commented in the wrong box. The link above is for the solution involving a new band number.

Roaming UE's

If not included in the TP from Apple as part of solutions not involving a new band or band number, or if not satisfactorily covered within those solutions, a further TP can also be discussed. If desired, Huawei can provide a revised TP for further consideration also in the inboxfolder.

Feedback Form 7: Roaming UE behavior

1 – MediaTek Inc.

In our understanding, solutions must also address legacy UEs (i.e., UEs build before the new sub region is defined) and it is difficult to fully avoid legacy UEs already shipping on the market trying to access new sub-allocations during roaming.

Regarding the revised draft TP(Rev RP-223358 TP for TR 38.893 to introduce the potential solutions_ZP.docx)'s content of "*Because only UE know whether it has been certified based on the regional regulation and whether it's legal or illegal to access to one specific frequency range in this specific region, from 3GPP perspective, it can be up to UE implementation to choose whether to trigger a random access after receiving enough SIB1 information.*", we think that "only" can be removed.

3.2 Summary

Three TP's were provided with edits and comments received by reviewing companies during the intermediate round. It is not clear to the moderator whether all companies can agree to the TP's and included edits, nor does it appear that all of comments submitted have been reflected as edits in the TP's. Also, there appears to be new text or new interpretations in some of the TP's which deserve further review. As example, text was added to the Ericsson TP that the basestation could signal multiple band numbers and the UE should connect to the cell so long as it supports at least one of them. While this is understood, does it imply that the network could signal both the parent number and the new band number? As another example, text was added and a comment received on the behavior of legacy UE's with some drawbacks presented. However, it wasn't clear to the moderator whether those drawbacks can be addressed with one of more of the solutions; for example, a new band number so the legacy UE won't connect or a new NS so the legacy UE won't connect.

4 Final Round

The moderator suggests to use the Final Round to allow companies more opportunity to review the TP's and to finalize them for approval. Draft TP's can be found in the inbox/drafts folder for this thread.

4.1 Comments

Feedback Form 8: TP on solutions involving a new band or band number (Ericsson)

1 – AT&T

First, we support MediaTek's comment during the intermediate round regarding the TP on Solutions involving a new band or new band number. We are not being asked to predict international regulator actions in the future, and we received no indication during the study period that this is strictly a North American issue. Without such indication, we can't predict the future extent of this sort of allocation.

Secondly, a revised AT&T revision of the TP is uploaded (draft TP on New band number solution_v04_ATT.docx) to the Inbox which, in addition to several editorial changes for clarity, revises other statements which in our opinion are speculative.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-10-R18-Regional-Subsets-Bands%5D/draft%20TP%20on%20New%20band%20number%20solution_v04_ATT.docx

2 – Qualcomm Korea

Added revisions and comments to v05 in the inbox. I don't agree with using n90/n41 as an example because n90 was not used to differentiate sub-bands so I feel such an example would be confusing. On the proposal to define the sub-bands cumulatively to avoid inter-band CA within the parent band, I understand the motivation but see that it might also introduce other difficulties into the specification. The sub-band may no longer be contiguous (i.e., 3450 to 3550 + 3700 to 3980) so we would have to define two discrete frequency range for the sub-band, two disjoint sets of ARFCN, etc. It's all doable, but there may be a different way to simply indicate that these two sub-bands when aggregated together should follow intra-band – I recall this kind of approach has been used in the past. Finally, I don't think we should circumvent the need for a new WID when sub-bands are introduced. Even if the workload may be simplified, the justification should still go through an approved WID with supporting companies, etc.

3 – Verizon UK Ltd

We support Ericsson solution for few reasons!

- Frist, Ericsson has provided more considerations for both legacy UEs and new sbuband for the UEs, as well as three approaches for the RAN4 work.
- Second, this solution requires no new signaling, and it can work for any release UEs.
- Also, the solution provides three approaches applied to RAN4 work.

In our view, this solution could conclude this study.

One our suggestion is the text needs to modify the “new band or new band number” to the “new band number” to align on the content of solution.

4 – Verizon UK Ltd

Resubmission for correction of typos!

We support Ericsson’s solution for a few reasons!

- First, the proposal provides more considerations for both legacy UEs and new sub-band for the UEs.
- Second, this solution requires no new signaling, and it can work for any release UEs.
- Also, the solution provides three approaches applied to RAN4 work.

In our view, this solution could meet the conclusion of this study.

We agree with the Qualcomm comment above. One of our suggestions is that the text needs to modify the “new band or new band number” to the “new band number” to align with the content of the solution.

5 – T-Mobile USA Inc.

We added revisions if V_06 that includes the coversheet. We thought it was important to distinguish between new bands, from new band numbers. What is the difference between new bands and new band numbers?

-New bands are listed in band combinations, new band numbers are not.

-New bands have unique RF and performance requirements like REFSENS but new band numbers do not.

-n90 is an example of a new band number. n19 is an example of a regional new band (new at one time).

-UEs that support the new band number also have to support the parent band. This would not necessarily be the case with new bands.

Please find a revision in the inbox: https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-10-R18-Regional-Subsets-Bands%5D/draft%20TP%20on%20New%20band%20number%20solution_v06_QC_TMUS.

6 – Apple GmbH

We uploaded a new version of the TP with our comments for this solution. We copy/paste them below for the sake of simplicity.

It seems that the difference between new band and new band number solutions is quite marginal, if any at all. Proponents of the methods assume that a new band number can save specification work by not explicitly listing the corresponding band combinations. Firstly, this assumption is true if and only if new sub-bands do not have any specific requirements (which we cannot predict). Secondly, it will to some extent break the existing logic of the RAN4 specifications when out of sudden some band combinations will not be explicitly listed in the spec. And last but not least, at this point we are not entirely sure which impact it is going to have on the RAN2 signalling. Will a UE still be reporting band combinations with a new band? If so, and most likely it will be the case, we do not save anything because from the UE vendor perspective we still need to implement and test new band combinations.

7 – Ericsson LM

@ Apple: Yes, there is small difference between new band and new band number. I think what people have in mind is actually a new band number, not an actual band. E.g. the requirements of the parent band is reused for the subband.

The new band number-approach will not require new band combos to be included in UE capabilities, as captured in the TP. That should be captured in the spec. Preferably in a way so that RAN2 specs does not need to be updated if/when RAN4 would add a new band. I think we can leave this to the WGs to address.

8 – Nokia Corporation

We uploaded some comments based on the Apple version. Some notes also here:

Barring legacy UEs: We modified the wordings a bit since it is still network choice how to avoid legacy UEs camping on the cell. We normally avoid ”netwprk shall” even in normative text, so tried to follow the same here (without really changing the intention).

Sub-band definition: The sub-bands are defined in some chronological order, and we think the UE support should be cumulative. If we have sub-band frequencies A, B and C (in chronological order of definition), we shouldn't allow UEs to only support B and not A, or C and A but not B. That's why we thought it's important to state that once we define a sub-band, all UEs implementing the specification have to also support any previously defined sub-bands, too. From specification viewpoint we can then discuss later how exactly that is captured once some sub-bands are defined.

Avoiding duplicated band combination signalling: The Apple comment that BCs would be repeated is not correct in our understanding: UE would report the new and old band numbers in the list of supported bands, but not in the supported band combinations. To make an example:

Suppose UE supports band n900, and later a sub-band is defined for that using n901. UE will then indicate the following:

1) supported band list: n900, n901

2) support band combinations: BCs using n900 (and not repeat those for n901)

This way the band combinations (which are the large part of capability signalling) do not increase, but the information on UE support is still there.

9 – T-Mobile USA Inc.

To Apple: We already used the new band number solution for n90, although n90 had the same frequency range as n41. No additional signalling was required for n90. If there are new requirements for the regional sub-band, then a new band would be required. Or, if the new requirements are UE emissions requirements only, then a new NS value could be used (as this is the original intention of NS signalling) with a modifiedMPRBehavior bit. The new band number approach is suited for situations where the requirements other than the frequency range are the same as for the parent band.

10 – T-Mobile USA Inc.

To Mediatek: Legacy UEs will not attempt to access 3300-3450 MHz because only the new band number would be broadcast in that new frequency range. Maybe that part was not clear.

Feedback Form 9: TP on solutions not involving a new band or band number (Apple)

1 – Qualcomm Korea

Added revisions and comments in v02 in the inbox. I suggest removing Solution X since it seems to be explaining the background and the downsides from Rel-18 with Band n77 in the US and Canada. The TR already includes background and root causes so the Solutions section should focus on viable solutions that address the root causes and downsides. For the approach of implicit UE signaling, the TP suggests using the existing modifiedMPR-Behavior IE which I think would be a gross misuse of the IE. It was not intended to differentiate sub-bands at all. Then the only other implicit UE signaling is a band subset which is not implicit but rather is explicit requiring a new IE or subfield within the band identifier.

2 – Apple GmbH

The revised TP is uploaded to the server:

ftp://ftp.3gpp.org//tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-10-R18-Regional-Subsets-Bands%5D/draft_RP-22xxxx%20TP%20on%20NO%20new%20band%20number%20solution_v03_Apple.docx

Summary of changes:

- Editorial changes from ATT are accepted;

- Changes from Qualcomm are accepted;

- We added the point raised by Qualcomm that modifiedMPR-Behavior was never intended for something like sub-band signalling.

@Qualcomm: ”Explicit” versus ”implicit” UE capability is maybe not the best wording. What we tried to say is that with the ”explicit” signalling we will define an explicit capability for a new sub-band; and this is what we did for band n77. With the ”implicit” signalling, there will be a container defining the corresponding sub-band capabilities, but we will not have a separate RAN2 capability for every new sub-band.

@ATT: The band n77 example was taken from your TP, which we think could be useful as the background information. No strong preference whether to keep it or not.

3 – Nokia Corporation

We provided some comments on top of the version from Apple: mostly we noticed that the text was a bit non-neutral at points, so we made it more neutral. We also made some corrections to terminology (UE capabilities are fields, not IEs!) and explained some of the downsides in the proposals (for example, creating new interpretation to signalling may require further discussions in RAN2).

Feedback Form 10: TP on roaming and legacy UE’s and further solutions (Huawei)

1 – Qualcomm Korea

The added sentence on roaming UE's probably needs further work if it's needed at all. The added section of Legacy UE seems to be resolved by network-to-UE signaling, for example, by a new band number or by an NS. Did I understand this correctly? The Solution X and Y can be merged with Apple's TP since Apple's TP does mention signaling as network-to-UE, UE-to-network, or both. The solution X based on UE implementation seems to only have the UE-to-network capability signaling and it is implementation how to restrict connecting to a cell for which the UE is not certified. Indeed, this is a "solution" for which the legacy UE problem does exist so maybe it's not a viable solution at all?

2 – Ericsson LM

We still dont see how the UE implementaiton approach can work. A UE build today will not know that there will be a subband in some contry one year from now. If the same band number is used for a new subband which has additional requirements, the UE will anyway connect to the cell even though not certified. We think we need the new band number solution to solve the problem.

3 – Huawei Technologies Sweden AB

To Ericsson:

For example, a UE was certified in frequency range 3700MHz ~ 3980MHz in US. Then it should be aware that it can only be deployed or transmit signal in frequency range 3700MHz ~ 3980MHz in US. Later, the frequency range 3450MHz ~ 3550MHz was allocated to operators in US. If this UE detect the SSB signal in frequency range 3450MHz ~ 3550MHz, it can get all the SIB1 information. MCC code and initial BWP information will be broadcast in SIB1. If UE get the MCC code = US and initial BWP is not located in frequency range 3700MHz ~ 3980MHz, it should not trigger a RACH and transmit signal out of 3700MHz ~ 3980MHz since it was only certified in frequency range 3700MHz ~ 3980MHz in US.

So, in my understanding, SIB1 information is clear enough for UE to adjust its behavior based on the clear regional regulation or 3GPP UE behavior standardization.

In general, this TP is to propose a potential solution, which does not mean that this is THE solution for all possbile cases.

4 – Nokia Corporation

We do agree with Huawei that indeed it should be UEs task to meet the regulations, and network is not responsible if UE is misbehaving.

HOWEVER: network can not expect that all UEs are implemented in the same way. That downside seems to be completely missing from this solution so if network wants to ensure it is actively prohibiting camping of legacy UEs (as some regulations might require), such a solution simply cannot work.

So if we are to capture something on UE implementation solutions, it would be important to point out such solutions are not reliable from network perspective.

5 – MediaTek Inc.

Firstly, the added revision and comments are in "Rev RP-223358 TP for TR 38.893 to introduce the potential solutions_ZP_MTK2.docx" in the inbox. Secondly, it seems that the clauses of the Solution X and Y can be merged with Apple's TP.

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4.2 Summary

Edits were provided by reviewing companies to the three TP's under consideration. Questions were posed and responses received.

5 Extended Round

The moderator has attempted to clean up the first two TP's originally from Ericsson and Apple which had a number of edits and therefore difficult to read. The last TP from Huawei only has a few edits and therefore the moderator did not create another version of it. For the extended round, the moderator would like to see if these TP's can be agreed to be included into the TR. Perhaps there is only time for "yes" or "no" rather than further edits. If there is one sentence or one point that prevents you from indicating "yes", then perhaps you can suggest to put that one sentence or one point in square bracket so the TP can still be agreeable to you, but we cannot tolerate too many square brackets.

Also, during the extended round, the moderator will prepare a SR for review requesting a one quarter extension of the study item. The open items are "recommendations and conclusions" if the above TP's can be agreed. If they cannot be agreed, then an additional open item will be "description of potential solutions".

The TP's for possible agreement and the draft SR can be found in the inbox/drafts under the "Extended Round" sub-folder.

Feedback Form 11: Is the TP on new bands and new band numbers (Ericsson) agreeable?

1 – T-Mobile USA Inc. We think this version is agreeable.
2 – Apple GmbH We uploaded the revised TP, in which we added a NOTE saying that we need to understand better all implications behind the approach proposed by some companies that some band combinations will be omitted. ftp://ftp.3gpp.org//tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-10-R18-Regional-Subsets-Bands%5D/Extende
3 – T-Mobile USA Inc. Our understanding is that the UE would indicate support for bands n41 and n90 and would signal combinations with n41 and not any combinations with n90. The gNB would interpret supported combinations with n41 as applicable to both n41 and n90. We agree with Apple that this is not clearly documented, so it should be discussed in RAN4 and RAN2 and documented in the specs. This should probably happen as a category F CR for n90.
4 – AT&T We believe some issues were raised this week which require further discussion, e.g., configuration for MSD testing and different views about the process for introducing new bands/ new band numbers. As such, we

are not prepared to agree on this section.

5 – TELUS

We agree with this TP and details regarding the inheritance of all characteristics of the band subsets from their respective parent bands is a topic that the WGs would be in a better position to assess.

Feedback Form 12: Is the TP on reuse NR band number new signaling (Apple) agreeable?

1 – Apple GmbH

We analyzed comments from Nokia and made some changes. The revised version of the TP is uploaded here:

ftp://ftp.3gpp.org//tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-10-R18-Regional-Subsets-Bands%5D/Extende
22xxxx%20TP%20on%20NO%20new%20band%20number%20solution_v06_Apple.docx

2 – AT&T

We can agree to this section.

3 – T-Mobile USA Inc.

We cannot agree to this section. Just as concerns were raised above about now MSD testing would be handled with the new band number solution, the same MSD testing concerns would need to be addressed for the solutions with no new band number. As such. we are not prepared to agree to this TP.

Also, The TP says ”The premise for introduction of signalling from the network to the UE is to prevent legacy UEs from camping on particular sub-bands for which they are not certified, i.e., sub-bands added in later releases.” This is not correct, and we don’t want the TR to permanently document this misconception of why NS_55 was added. The reason NS_55 was added was to prevent UEs without the new UE capability signalling IE extendedBand-n77-r16 from accessing 3450-3550 MHz. As was captured in the Root Cause TP in RP-222679, ”To prevent a UE that does not indicate extendedBand-n77-r16 from accessing 3450-3550 MHz in the US, a new NS value (NS_55) was created. Where normally NS values indicate additional emissions requirements for a band, in this case NS_55 is used to bar UEs that do not support extendedBand-n77-r16 from accessing 3450-3550 MHz in the US.”

Also, 38.101-1 uses ”network signalling values” or ”NS values,” not ”NS flags” so this needs to be corrected.

A revision has been placed in the inbox, but if MSD is an open issue for the new band/new band number TP, MSD is also an open issue for the NO new band TP.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-10-R18-Regional-Subsets-Bands%5D/Extended%20Round/draft_RP-22xxxx%20TP%20on%20NO%20new%20band%20number%20solution_v0

4 – MediaTek Inc.

Regarding MSD issue, we think that the generic description for all solutions would be useful.

We wonder whether description below could be generic and applicable for all solutions.

• Consider accommodations for cases where the UE subset support precludes the possibility to test some MSD exceptions: If the UE supported subset precludes the possibility to test some MSD exceptions, just like with Note 12 for n77 either the MSD configuration can be changed so the MSD is testable in the country that uses the sub-band or a note can be added to waive the MSD.

If it would be true, then the effort of copying description above into each TP/subclause can be saved.

5 – Nokia Corporation

It seems one error that I fixed has crept back it, so I must insist: *modifiedMPR-Behaviour* is NOT an *IE* (which is a *data type*),it's a **field** (which refers to content of signalling). More precisely it is a **UE capability field.** That is why we proposed to use the word "capability" to avoid unnecessary arguments - while we understand RAN plenary is often imprecise, using "IE" is simply erroneous when talking about a specific field.

6 – T-Mobile USA Inc.

Additional questions about this TP:

Would the new signalling be per country, per region or worldwide (one bit per frequency range?)

How many bits would need to be allocated for the options that require bits?

For a given band, will we need one NS value per county, like we currently have for the US and Canada?

7 – TELUS

The solution involving a generic bitmap associated with each band developed by RAN2 which can then be further specified by RAN4 based on countries and their regulations is also a solution that merits consideration. We believe that the WGs should be given the opportunity to debate and decide as to if introducing such signalling is feasible.

Feedback Form 13: Is the TP on roaming and UE implementation based solution (Huawei) agreeable?

1 – T-Mobile USA Inc.

Sorry for the late comments, but the TP is not agreeable to us as written. we have uploaded a revision. https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-10-R18-Regional-Subsets-Bands%5D/Extended%20Round/Rev%20RP-223358%20TP%20for%20TR%2038.893%20to%20introduce%20the%20

2 – AT&T

We have reservations about including the section describing UE implementation as a solution. We feel this needs more discussion.

3 – MediaTek Inc.

Regarding MSD issue, we think that the generic description for all solutions would be useful.

We wonder whether description below could be generic and applicable for all solutions.

• Consider accommodations for cases where the UE subset support precludes the possibility to test some MSD exceptions: If the UE supported subset precludes the possibility to test some MSD exceptions, just like with Note 12 for n77 either the MSD configuration can be changed so the MSD is testable in the country that uses the sub-band or a note can be added to waive the MSD.

If it would be true, then the effort of copying description above into each TP/subclause can be saved.

Feedback Form 14: Is it agreeable to request a 1Q extension of the SI to formulate a recommendation and conclusion?

1 – T-Mobile USA Inc.

We think a 1Q extension is needed.

2 – AT&T

Yes

3 – MediaTek Inc.

Yes

4 – Huawei Technologies Sweden AB

This is a reasonable approach. Please note to mark ”Yes” in the SR for the following question ”*Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?*”

5 – Nokia Corporation

1Q extension is fine, with the intent that the remaining meeting is used to conclude on the SI recommendations.

6 – T-Mobile USA Inc.

Assuming the SI is extended, for the next meeting it would be helpful if companies could bring in information about whether there are other countries that only certify devices to operate in part of a larger band, or if countries typically certify devices for an entire band. That would help us understand if this is a USA and Canada only problem, or a larger problem that might require more bits, depending on the solution.

6 Final document status

The moderator recommends the following document status at the conclusion of the meeting.

Table 2: Final document status

RP-223196	Text proposal for Study on UE support of regionally-defined subsets of an NR band	Apple	Revised to RP-223547 to include contents from Ericsson TP also. Not pursued.
RP-223250	Solutions for UE support of regionally-defined bands	Nokia, Nokia Shanghai Bell	Noted
RP-223254	Generic solution for n77-like issues	Ericsson	Noted
RP-223339	Review of solutions for the study item on UE support of regionally defined subsets of an NR band	AT&T	Noted
RP-223357	Discussion on UE support of regionally-defined subsets of an NR band	Huawei, HiSilicon	Noted
RP-223358	TP for TR 38.893 to introduce the potential solutions	Huawei, HiSilicon	Revised to RP-223548. Not pursued.
RP-223377	TP for TR 38.893: Solutions and recommendation	Qualcomm Incorporated	Noted
New document (need a tdoc number)	TP for TR38.893 New bands and new band numbers for regional sub-bands	Ericsson	New
RP-223376	Status report for Study on UE support of regionally-defined subsets of an NR band	Qualcomm Incorporated	To be provided. Request 1Q extension.
RP-223508	Revised SID: Study on UE support of regionally-defined subsets of an NR band	Qualcomm Incorporated	To be provided. To update dates for TR for 1Q extension.

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RP-223375	TR 38.893 v0.2.0: Study on UE support of regionally-defined subsets of an NR band	Qualcomm Incorporated	Withdrawn. No TP's agreed this meeting.