3GPP RAN TSG Meeting #98 RP-22xxxx

Electronic meeting, December 12 – 16, 2022 (revision of RP-223196)

Agenda item: 9.2.2

Source: Apple Inc

Title: Text proposal for Study on UE support of regionally-defined subsets of an NR band

WI/SI: FS\_NR\_subset\_band\_support

Release: Rel-18

Document for: Approval

# 1 Introduction

During the RAN#95 meeting an issue of so-called phased introduction of frequency ranges was raised and discussed. And as further discussed in [1-3], this issue comes from the fact that while 3GPP tends to define, when possible, large bands covering large contiguous chunk of spectrum, it is not necessarily the case that all countries or geographical areas will have the same allocation. Some countries or regions might have only a sub-range within an NR band, and the UEs will support this sub-range and will be tested for it. However, if a particular country/region extends further available frequencies within the same band – effectively resulting in phased introduction of frequency (sub-)ranges within the same NR band – there will be two types of UEs supporting only the initial set of frequency sub-ranges and supporting an extended set of frequencies.

While 3GPP resolved this issue for US and Canada, several companies expressed the preference to have a common solution or framework for similar cases. As a result, RAN#96 agreed a new RAN SI [5], which aims at studying further general solutions for this problem.

This paper presents a text proposal for potential solutions that do not require a new band number. The content of the text proposal is based on input from the following documents:

- RP-223196 (Apple Inc.)

- RP-223339 (AT&T)

- RP-223357 (Huawei, HiSilicon)

# 2 Text proposal for TR 38.893

-------------------- TEXT PROPOSAL (BEGIN) --------------------

# 6 Possible solutions

### 6.x Solution X (reuse NR band number, no signalling)

One way to handle regionally-defined sub-bands is to add the corresponding notes and clarifications, similar to the way it was done for band n77 in US. The main principle is that a special NOTE is added to a particular band indicating that only portion of it can be used for a particular region/country with other restrictions if needed.

While this approach works as a one-time modification, it becomes too cumbersome when later yet another sub-band is added for the same country/region, as in fact it happened for the DOD-band in US. The biggest problem in this case is how to differentiate between UEs supporting different sub-bands, which can be even added in different releases. And the specification wise it might become somewhat unclear how to interpret these NOTEs because band definitions are release-independent, whereas NOTEs are added in different releases causing potential misinterpretations on potential restrictions as perceived by the UE implementing a particular version of the specification.

Another limitation of this solution is that the network only knows which "large" NR band a UE supports, but it does not know anything about supported sub-bands, which can cause later issues with re-direction and handover procedures.

### 6.y Solution Y (reuse NR band number, new signalling)

With this solution, the existing NR band is also re-used, but there is also an explicit signalling – either from the UE to the network, or from the network to the UE, or both – providing further information to the communicating entities on which sub-bands are supported. Hence for the sake of clarity we will focus separately on potential options for signalling for both communication sides.

The premise idea for introduction of signalling from the network to the UE is to prevent legacy UEs from camping on particular sub-bands, which could be added in later releases. The easiest way to accomplish this is to have new NS flag(s) associated with the corresponding band. Thus, with this approach the network broadcasting new NS flag(s) can be always sure that a legacy UE will not camp on a particular sub-band. And it does not matter how many sub-bands are added and in which release – as long as every sub-band is associated with a particular NS flag, the network can always control which UEs can camp on them.

As for the UE to the network signalling, one of the main reasons to have it is to provide the network with additional information on which sub-bands a UE supports so that the network can decide later which sub-bands can be used in the re-direction and handover procedures. Fundamentally, this is just information on supported sub-bands, but it can be implemented in several different ways:

- **Explicit UE capability**. As follows from its name, the UE capability is implemented as an explicit IE in the UE capability container, whereupon it can be as simple as one bit or something more versatile as a bitmap container. The only downside of this approach is that since such a generic UE capability does not exist, RAN WG4 will need to contact RAN WG2 every time such a capability is needed (as it already happened with the DOD-band). Thus, a generic approach would be preferred when RAN WG2 introduces a generic capability (or a bitmap), which can be signalled for every band indicating further which sub-bands are supported. And for the sake of simplicity the content of this capability/bitmap should be defined by RAN WG4 (following the same logic as what we already have for RAN WG4).

- **Implicit UE capability (via e.g. modifiedMPR-Behaviour field bitmap or a new bitmap)**. This approach is identical to the previous one with the only difference is that instead of the asking RAN WG2 to define a new capability for a new sub-band, a more generic signalling is used.

- One option is that the existing IE modifiedMPR-Behaviour can be leveraged for this purpose. The IE modifiedMPR-Behaviour can already be signalled for every band not requiring any RAN WG2 changes. And since it is up to RAN WG4 to define purpose and meaning of every value of that field, RAN WG4 can use this IE to indicate supported sub-bands.

- Another option is to include a band subset indication. In this proposal, the parent band designation may be followed by an indicator which identifies which sub-allocation of the band applies to the region in question. This proposal avoids the issue of parent-band association, but at the cost of defining new signalling.

As an example, the solution adopted for band n77 was a combination of the following elements:

- UE-to-NW signalling: defining the explicit UE capability indications (extendedBand-n77-r16 and extendedBand-n77-2-r17); and

- NW-to-UE signalling: defining new flags NS\_55 and NS\_57 for barring UE access.

-------------------- TEXT PROPOSAL (END) --------------------

# 3 Conclusions

# 4 References

1. RP-220457, "Views on phased introduction of operation frequency ranges in an NR Band", Apple
2. RP-220545, "Regulatory Issues with wide global bands", T-Mobile USA
3. RP-220762, "Handling of Canada n77 band", MediaTek Inc.
4. RP-220899, "Moderator’s summary of discussion [95e-39-R17-TEIs]", Moderator (RAN4 Chair)
5. RP-221872, "New SI on generalizing the specification for subsets of NR band support", Qualcomm Inc.
6. RP-222210, "TP for TR38.xxx Band Subsets; Root cause and New band number", T-Mobile USA Inc.
7. RP-222223, "TP for TR 38.893: Views on UE support of regionally-defined subsets of an NR band", Qualcomm Inc.
8. RP-222365, "On UE support of regionally-defined bands", Nokia, Nokia Shanghai Bell
9. RP-222368, "Generic solution for n77-like issues", Ericsson
10. RP-222510, "Discussion on UE support of regionally-defined subsets of an NR band", Huawei, HiSilicon