**3GPP TSG-RAN Meeting #98-e R4-22xxxx**

**Electronic Meeting, 12-16 December, 2022**

**Title:** TP for TR38.893 New bands and new band numbers for regional sub-bands

**Agenda Item:** 9.2.2

**Source: Ericsson, T-Mobile USA, AT&T, Qualcomm, Nokia, Huawei**

**Document for:** Approval

1. Introduction

This is a text proposal for the TR for Study on UE support of regionally-defined subsets of an NR band, (new RAN SI: FS\_NR\_subset\_band\_support). This TP proposes text for Clause 5 Solution x: New Band number.

1. Text Proposal

<First change>

## 6.x Solution x: New Band

Introducing a new band is a well-known technique for RAN4, which has been used to differentiate between different (sub-)bands or portions thereof in 3GPP specifications. For instance, B26/n26 are supersets of Band 5/n5, and Band 25/n25 are supersets of Band 2/n2. Also, Band 19/n19 are regional subsets of band 5/n5. These new bands have separate band combinations and separate RF requirments, including different refsens and MSD. However, in the case of B26 B25, the superset bands were introduced in 3GPP after the smaller B5 and B2 were in the specs, so it is not quite the same situation as with n77, where there is an existing wider band, but a need for a regional sub-band.

One downside of introducing a new band for a regional sub-band is that new band combinations are required for the new bands. This can create significant workload for RAN4 because of the redundant effort. Also, RAN4 would need to specify all of the requirements for the sub-band including rf and performance requirments.

The use of new bands for regional sub-bands would provide a means to limit access to spectrum in a region that only has regulations for the sub-band, but it could lead market fragmentation if vendors introduce UEs that only support the new regional band, and not the wider full band.

6.y Solution y: New Band Number

Another potential solution is to introduce a new band number, which is not really a new band. The difference between a new band and a new band number is that all the requirements of the original band would apply to the new band-number, but the new band number would allow for differentiation of which part of the spectrum a UE is certified to operate in in the region. All the band combinations that applied to the parent band would also apply to the new band number.

One example of a new band number is n90, which is identical to n41 except that n90 also supports the 100 kHz raster and the 7.5 kHz uplink shift. There are no band combinations defined for n90 because all the n41 combinations apply to n90 also. In the case of n90, the new band number was more of a capability signalling mechanism to allow the network to identify UEs that support the 100 kHz raster and 7.5 kHz shift, and bar n41 only UEs that don’t support those features.

For regional sub-bands, the new band number can be thought of more as a signalling mechanism used to allow or bar devices based on support for a particular part of the band. It is similar to the extendedBand-n77-r16 / NS\_55 solution, except that it uses existing UE capability signalling and barring and does not require any new network signalling.

An example of how this would work is that at some point in time 3300-3450 MHz might become available in the USA for Mobile use. If this spectrum does become available, then a new band number could be allocated to indicate that a UE supports 3300-3450 MHz, as well as 3450-3550 and 3700-3980 MHz, in the US. Only the new band number would be reported in the new frequency range in the US so that only UEs that support the new band number would attempt to access 3300-3450 MHz in the US. Also, when the gNB examines the UE capabilities, it would know if the UE supports 3300-3450 MHz in the US based on if it reports support for the new band number or not in its UE capabilities.

The benefits of the new band number approach are:

* No new RAN2 signalling needed as new parts of the band become available.
* No new NS values required for barring UEs
* There are many available band numbers (107 of 1024 have been used so far for NR)

3GPP would pro-forma select a new band number based on regional frequency allocations within an existing 3GPP band, the existing band being referred to as the parent band.

If the network wants to avoid that a legacy device supporting only the parent band (but not indicating support for the new band number) will camp on a cell in the new sub-band, the network can indicate only the new band number on cells in the new sub-band. In this manner the technique of a new band number should prevent UEs which are not compliant to the requirements of the new sub-band from camping on or accessing the cell in such a sub-band. And the gNB sees from UE capabilities the bands and band numbers that the UE supports and hence the gNB knows if the UE can be handed over to a cell in the new sub-band.

For this technique, the new band number would reference the parent band for RF requirements. Dedicated sub-band hardware for the UE such as RF filters is not assumed to be utilized for the new band number. In addition, the new band number should be a collection of a new sub-band and previously introduced sub-band(s) (chronologically) to avoid having inter-band CA within the parent band. To avoid market fragmentation and to support roaming, it should be mandated that the new band number can only be supported by a UE which also supports the associated parent band. If a UE including roaming UE is not certified to operate in new band number based on regional regulatory certification, the UE shall not advertise the new band number in its capabilities nor shall it attempt to connect to a cell broadcasting this new band number.

In current practice, adding a new band triggers introduction of new band combinations, which would add many new band combinations to the specification and UE capability signalling. By contrast, adding a new band number, such as when n90 was added, does not require new band combinations, but rather text stating that combinations for the parent band apply to the new band number. To ensure that UE capability signalling is not adversely impacted by the number of supported band combinations, this technique requires that the new band number corresponding to the new sub-band has a reference to the parent band for signalling carrier aggregation (CA) and dual-connectivity (DC) band combinations.

NOTE: It should be studied further whether a UE shall report band combinations for the parent and sub-bands, and if not, which specification impact it will have.

This technique requires no new signalling and can work for any release UEs, but it does change the semantics of 3GPP frequency bands and 3GPP should clarify the association between a new band number and their parent band in signalling requirements. If the new band number approach is applied, 3GPP RAN4 should:

• 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.

• Ensure that the number of new band number definitions does not exhaust the range of possible band numbers: Rel-17 signaling supports 1024 NR band numbers, or which 104 are assigned in Rel-17. Exhaustion of the range of band numbers is not anticipated to be an issue.

<End of changes>