**3GPP TSG RAN Meeting #98-e RP-223548**

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

**Source:** Huawei, HiSilicon

**Title:** TP for TR 38.893 to introduce the potential solutions.

**Agenda Item:** 9.2.2

**Document for:** Approval

# Introduction

Referring to the discussion paper [1], text proposals for introduction of potential solutions are provided in this paper to address the issues from regionally-defined subsets of an NR band.

# References

[1] RP-223357, “Discussion on UE support of regionally-defined subsets of an NR band”, Huawei, HiSilicon

# Text proposals

## **<<Start of TP for TR 38.893>>**

# 5 Other Issues

## 5.1 Roaming UEs

In some countries it is neither the operator nor the base station that takes responsibility for the UE meeting regulations. In the USA UE vendors can only allow their devices to operate in parts of the band where there are FCC regulations at the time of device certification.

UE vendors may choose to pursue certification for some countries but not others. In view of the regional regulatory differences described above, we recognize that there may be ambiguity with regards to exactly which regulatory requirements are supported in any given UE implementation. It is important to understand how this ambiguity could affect regulatory compliance when UEs roam in countries in which they are not certified. Two scenarios are identified for clarification for feasibility of roaming:

The first scenario is if a UE is certified to operate only in part of a band (e.g. band n77 cases UE in Canada/US). In this scenario, the UE is only allowed to operate within the subset of the band for which it is certified in the country where this certification is necessary. Because the UE in addition to the above regulatory certification is also compliant to 3GPP requirements (e.g., for Band n77), it is required that the UE can support the entire band. Therefore, this UE when roaming to a country which does not have any regional regulatory requirements shall be able to operate on the entirety of the band. If this country does have regional requirements, the UE shall abide by them to operate in this country.

The second scenario is if a UE can support the frequency range of a band based on the 3GPP requirements but not certified for additional regional requirements in a subset of the band in a certain foreign country. This aspect has to be evaluated for each country based on prevailing regulation. Whether the roaming UE is allowed to operate without certification from the country’s regulator is subject to each country’s laws.

## 5.2 Legacy UE issue

UE may be designed or built before the new sub-band is defined or regional regulation is released. That may result some NBC issues due to the restriction of UE behaviour, if the existing band is reused for deployment in the specific region. For example US n77 case, the following restriction “In the USA this band is restricted to 3700 – 3980 MHz.” was introduced into the in 38.101-1-g40, and further restriction “In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz” was introduced into the in 38.101-1-g90. Thus, we can assume the following kinds of UEs.

Legacy UE2 which was designed or built between 38.101-1-g40 and 38.101-1-g90. It is required for UE to be restricted in frequency range 3700 – 3980 MHz in USA.

Current UE3 which was designed or built after 38.101-1-g90. It is required for UE to be restricted in frequency range 3700 – 3980 MHz and 3450 – 3550 MHz in USA.

For legacy UE2, due to the restriction, UE can only be deployed in frequency range 3700 – 3980 MHz in USA, so there is no risk for such UE to violate regulation.

Maybe in future release, it would be required for future UE4 to be restricted in frequency range 3700 – 3980 MHz and 3450 – 3550 MHz and AAA~BBB MHz in USA. Thus, the alternative way is to understand whether the UE behaviours can be clearly defined in current specification, and further study would be probably needed. This approach can provide similar functionality as UE capability reporting solution and assume no risks for UE2/UE3/UE4. It is likely that new capability signalling will be needed to let the gNB know that the UE supports the new frequency range AAA~BBB MHz in USA. It also assumes that there is no need to specify additional NS value or bar signalling for UE2/UE3/UE4. For roaming UE, we can still use the solutions mentioned above.

# 6 Possible solutions

## 6.1 Solution 1

## 6.2 Solution 2

## 6.X Solution X: the approach of UE implementation for accessing to cell + new capability

Since network can’t know whether UE has been certified in the specific country in specific partial frequency range once UE does not report the capability (e.g. extendedBand-n77-r16 or extendedBand-n77-2-r17 or future new capabilities) for subsets of band, it’s natural that neither the operator nor the base station can take responsibility for the UE meeting regional regulations.

In addition, in SIB1, network has broadcast the information to UE, such as MCC code and initial BWP information (frequency range and frequency location). Before UE starts to trigger a random access (transmit UL signals), new UE can make a good judgement on whether it can meet the regional regulation or not.

Because only new 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 new UE implementation to choose whether to trigger a random access after receiving enough SIB1 information.

Once UE access to this cell, network can check UE capabilities which are used to indicate the subsets of band. When the carrier frequency that UE access to is same to what UE indicate, there is no issue. When the carrier frequency that UE access to is different from what UE indicate by using the capabilities, it can also be up to network implementation to do the following behaviour.

 1) To ignore the UE capability and schedule UE in current cell or in current cell with restriction of initial BWP frequency range. but it might be difficult to track that the UE supports the frequency range in the USA and the information would be lost in handover.

 2) To do cell switching by considering UE capability indication.However, the UE might be configured to prefer n77 and might keep attempting to re-access the cell in the new frequency range and being repeatedly switched to a different cell, wasting signalling resources.

 3) To reject the UE accessing to this cell.The UE would not know why it was rejected and might continue to attempt to access the cell, wasting valuable resources.

 4) Other options are allowed.

It is assumed that the network implementations above can work well. Since network don’t need to take responsibility for the UE meeting regulations, it is assumed that there is no need to design any new SIB IE or NS values to bar UE accessing one cell. In total, this solution X has the following characteristic.

1) For UE initial access, it’s up to new UE implementation whether to access to the specific frequency range in specific region considering the information in SIB1.

 2) After accessing to the cell, UE can report the new capability which is used to indicate the subset of band. The details of this new capability can be further discussed in the potential WI phase. However, this general capability which is used to indicate the subsets of a band is only valid under the condition that it is reported by UE in the specific band and specific region.

3) New NS signalling may still be needed to avoid problems of a UE being rejected or switched to a different cell and re-attempting to access the new frequency range over and over.

## 6.Y Solution Y: the approach of UE behaviour standardization + new capability

In clause 4 root cause, it is shown that some UE behaviours are unclear and incorrect due to the ambiguity of UE behaviour. Thus, in order to address this issue and come up with a general solution, one way is to standardize the UE behaviours. It’s necessary to standardize some UE behaviours based on the common understanding from 3GPP perspective to comply with the regulation. And these UE behaviours should be aligned with the regional regulations as soon as possible. It’s very important to solve some UE behaviours’ issues from legacy UE and incorrect UE behaviours, if all the UE behaviours specified in the specification are very clear.

The solution Y was proposed with the following characteristics.

1) To standard new UE behaviour for UE whether to access to the specific frequency range in specific region considering the information in SIB1.

2) After accessing to the cell, new UE implementation can report the new capability which is used to indicate the subset of band. The details of this new capability can be further discussed in the potential WI phase. However, this general capability which is used to indicate the subsets of a band is only valid under the condition that it is reported by UE in the specific band and specific region.

3) NS signalling may still be needed to bar access by legacy UEs.

## **<<End of TP for TR 38.893>>**