**3GPP TSG RAN Meeting #93-e RP-21xxxx**

**Electronic Meeting, September 13 - 17, 2021**

**Agenda item:** 9.4.1.3

**Source:** RAN Vice-Chair (AT&T)

**Title:** Moderator's summary for email discussion [93e-26-6GHz-NR-U]

**Document for:** Discussion

# Introduction

In this document, we will provide a summary for the email discussion on [93e-26-6GHz-NR-U] at RAN#92-e.

# Topic #1: Consideration of Aspects beyond ECC Decision (20)01

## Proposed objectives

Topic #1 will capture the outcome of the discussions related to aspects beyond ECC Decision (20)01 in the set of reference documents [1] to [6].

## Initial round

### Open issues

Issue 1.2-1: RAN needs to consider if the unlicensed operation in the frequency range 5945 MHz to 6425 MHz in Europe shall be based on available ECC Decision (20)01 or RAN4 shall consider other aspects as well.

The other aspects could consist of Radio Equipment Directive 2014/53/EU, receiver blocking requirements that will be necessary for coexistence with 6GHz IMT systems after WRC 2023, the technical requirements for the 6GHz band established through ETSI EN 303 687, and/or potential future regulations.

The following summarizes the options to consider for Issue 1.2-1.

* **Option 1: RAN4 to consider the unlicensed operation in the frequency range 5945 MHz to 6425 MHz in Europe shall be based on available ECC Decision (20)01.**
* **Option 2: RAN4 to consider other aspects in addition to ECC Decision (20)01 which could consist of Radio Equipment Directive 2014/53/EU, receiver blocking requirements that will be necessary for coexistence with 6GHz IMT systems after WRC 2023, the technical requirements for the 6GHz band established through ETSI EN 303 687, and/or potential future regulations.**
* **Option 3: Put** **WI (NR\_6GHz\_unlic\_EU) on hold pending potential future regulations for the upper 6 GHz range (6425 MHz to 7125 MHz).**

### Collection of company views

Issue 1.2-1: Indicate which option is preferred concerning aspects beyond ECC Decision (20)01 and impact to WI (NR\_6GHz\_unlic\_EU).

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| **Company** | **Comments** |
| OPPO | Option 2 is preferred |
| Huawei | All the applicable regulatory decision needs to be followed by default, including RED directive for EU. Therefore Option 2 to be considered as baseline.  For option 3: it would be good to clarify the timeline of the possible decision to put the WI on hold, so that it would be clear when to re-open technical discussion ,e.g. WRC 2023 outcomes? |
| Vodafone | Option 2. Article 3(2) of the directive states “Radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference”, and this must be complied with before products can be sold within the EU. If we do not define a new 6 GHz NR-U band, it is unclear how tighter requirements can be reliably specified and applied for 5945 – 6425 MHz to ensure compliance with 2014/53/EU  following the WRC23 decision. Operating with the n96 band and associated hardware within Europe would result in either unnecessary receiver blocking impacts for NR-U or a need to limit the Tx power of future licensed operation above 6425 MHz, both of which are unacceptable and not in line with the statement quoted above from 2014/53/EU. It is clear that an RF implementation targeted specifically for the 5945 – 6425 MHz range is the most effective way to ensure both licensed and unlicensed bands can coexist efficiently and avoid harmful interference. |
| BT | Option 2.  The ECC Decision is an important element of the identification of this band in Europe, however there are other elements which also need to be considered.  As previously noted, the RED requires efficient use of the radio spectrum to avoid harmful interference, and it is understood that this requires that receivers should have sufficient blocking protection. Whilst it is recognised that further clarity will be gained following the next WRC in 2023, we believe that using the band n96 receiver blocking requirements would not be appropriate in the meantime, as this would leave UEs vulnerable to interference in the future.  The figure in RP-211906 does propose a blocking mask which we believe would be appropriate, using the n96 blocking mask shifted downwards in frequency by 700 MHz, so that the UE requires the same mask at the top of the European band (i.e. above 6425 MHz) as that used at the top of the n96 band (i.e. above 7125 MHz). |
| Nokia | The three options are inter-related:  The only available quantified regulations are those of the ECC decision.  The quoted RED directive is not quantified and therefore does not help to derive any specific requirements. As implicit in BT’s response, the question is what is “sufficient”.  Consideration of 6GHz IMT systems after WRC 2023 by definition leads the conclusion towards option 3. Therefore, if it is desired to specify sufficient blocking requirements to cope fully with future 6GHz IMT systems after 2023, then option 3 is the only possible conclusion.  However, RAN4 has also agreed that “the same hardware of UE as for n96 may be reused on the frequency range 5945MHz to 6425MHz no matter whether to define a new band or define new NS for the existing n96.” This limits how much the blocking requirements may differ from those of n96. In the light of this, an alternative to option 3 could be to define the tightest blocking requirements that can be agreed to be able to be met by n96 UE hardware. The blocking mask in [4] seems to be motivated by this, and we would therefore suggest asking the question whether companies can agree to that mask, or, if not, what modification to it would be required in order to be satisfiable by n96 hardware. |
| Qualcomm | We prefer option 1. It was agreed when the work item was started to base the work on ECC Decision 20(01). In the chairmans’s minutes, it is recorded  RAN chairman clarified that 3GPP can start working on this WI based on the ECC decision already available.  WI objectives may be checked/revisited once the final EC decision becomes available (expected by March 2021)  The WI objectives were not modified based on final EC decision.  The option 2 to consider RED 2014/53/EU is not actionable since there is no requirement therein or in ETSI specification for the requested blocking. Moreover, blocking of -56 dBm and -44 dBm can be specified according to Band n96 so it is not as if no blocking is specified at all. Lastly, there was already an agreement in RAN4 that the same hardware may be used irrespective of Option 1 or Option 2. This means that the minimum requirements should NOT be specified with the assumption of filter rejection above 6425 MHz nor should it be assumed that the Rx path has higher dynamic range or linearity than that afforded by n96. Therefore, the specification of blocking for option 2 is not expected to be significantly improved compared to option 1.  As a final note, there are other non-3GPP unlicensed technologies that will be using this band. Those technologies will not be hampered by additional blocking requirements. So 3GPP is only imposing additional requirements on itself or delaying its availability of the band thereby disadvantaging itself compared to other technologies. |
| ZTE | We prefer Option 2 if regulator has imposed any restrictions, we need to fully respect that decision. based on our understandings, in-band blocking requirements and OOBB requirements for the specific frequency range or per-band are general requirements which is not purely coming from regulatory requirements. Indeed FR1 UE in-band blocking and OOBB requirements are partially originating from E-UTRA/UTRA spec, more details could be found in R4-99038 for UTRAUE RF. |
| Broadcom | We support Option 1 based the work on ECC Decision 20(01 and the final EC decision. |
| Intel | Option 1 is preferred. In our understanding Option 1 does not contradict to RED.  From our point of view Option 3 is the worst-case scenario, which would delay the adoption of NR-U 6GHz in EU for an unknown period of time. |
| Apple | Option 1 with the small clarification that it is not only the ECC Decision, but also the mandatory EC Decision that was published in June 2021. We can consider the EU RED directive, but as commented by other companies, it is not quantified in a sense that it does not provide exact blocking requirements in terms of dBm. It is also worth noting that Option 1 does provide blocking requirements, which unlike ETSI requirements for the 5GHz and 6GHz RLAN systems are more stringent and cover both lower and upper frequency ranges.  If proponents of Option 2 assume that the receiver blocking requirements should be "adequate" for the potential 6GHz IMT system after WRC 2023, then option 3 is the only possible conclusion. The matter is that we cannot predict the exact blocking requirements that EU/CEPT will end up with as a potential outcome of the WRC2023 meeting. Thus, any blocking requirements agreed now for Option 2 might be anyway inadequate. |
| Telecom Italia | Option 2 |
| Telia Company | We support Option 2 as proposed in RP-211906.  Sufficient OOBB vs. RED should be discussed and agreed as baseline. |
| Orange | We support Option 2. We are concerned that not considering sufficient protection against out of band blocking requirement will be detrimental to deployment of licensed band in the upper part of the 6 GHz band.  With this in mind we believe that a new band is necessary. |
| Telefónica | Option 2 is preferred. We need to consider further aspects in addition to ECC decision. Appropriated receiver blocking requirements compliant with 2014/53/EU need to be specified for 5945 – 6425 MHz to ensure licenced/unlicenced band coexistence |
| Skyworks | Option 1 is what granted the work to be started and option 2 does not provide any quantitative requirement for RAN4 to work with and thus from the UE prospective we do not see that it would change the agreement that a UE implementing n96 can support the European unlicensed band as is. so in our view we should stick to Option 1 or go to option 3 since there no usable information or regulation being added by option 2. Finally competing technologies are not using anything else than the EC decision and are not revisiting requirements to specifically address the >6425MHz frequency range. They only changed channelization to account for European ITS channels which is also the case for n96 |
| Ericsson | Support option 2.  Equipment compliant with the 3GPP specifications should also comply with relevant harmonized standards, that is, EN 301 908-24/25 (a transcription of relevant parts if the 3GPP specifications) and EN 303 687, to demonstrate that radio equipment both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference according to Article 3.2 of the RED 2014/53/EU.  6 GHz NR-U devices for EU should provide sufficient receiver resilience against interference in-band and in adjacent frequency bands 6425-7125 MHz consistent with the essential requirements of RED and the efficient use of radio spectrum by way of an increased resilience of receivers. |
| Telenor | Telenor supports option 2. We share the same concern as Orange and other European operators. |

### Summary and recommendation for further discussion

In this section, the summary of comments on Topic#1 and the corresponding moderator recommendations are provided.

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|  | **Summary and recommendation** |
| **Moderator (RAN Vice-Chair, AT&T)** | **Moderator Recommendation:**  The following summarizes the company views on Issue 1.2-1.  Option 1: Nokia, Qualcomm, Broadcom, Intel, Apple, Skyworks  Option 2: OPPO, Huawei, Vodafone, BT, ZTE, Telecom Italia, Telia, Orange, Telefónica, Ericsson, Telenor  Option 3: Nokia, Skyworks,  For Option 1, it is generally agreed that the mandatory EC Decision 2021/1067 that was published in June 2021 would apply in addition to ECC Decision (20)01.  The company positions do not vary much from those already expressed in the input documents.  The moderator recommends continuing discussion in the intermediate round with a goal to compromise on a solution that meets the previous RAN4 agreement that “the same hardware of UE as for n96 may be reused on the frequency range 5945MHz to 6425MHz no matter whether to define a new band or define new NS for the existing n96” while minimizing risk of future compliance issues. In absence of a compromise, Option 3 may need to be considered by RAN. |

## Intermediate round

### Open issues

Issue 1.3-1: There does not seem to be a way forward on the options presented in Issue 1.2-1 as presented due to different company views. The goal for the intermediate round will be to work towards a compromise solution that meets the previous RAN4 agreement that “the same hardware of UE as for n96 may be reused on the frequency range 5945MHz to 6425MHz no matter whether to define a new band or define new NS for the existing n96” while minimizing risk of future compliance issues.

The following summarizes the options to consider for Issue 1.3-1.

* **Option 1: Based on Nokia proposal, define the tightest blocking requirements that can be agreed in order to ensure that the requirements can be met by n96 UE hardware. Companies are encouraged to consider the blocking mask in [4] as the baseline and indicate if the mask is agreeable and, if not, what modification would be required in order for n96 hardware to be compliant.**
* **Option 2: Consider the analysis in [5] related to ETSI EN 303 687 which suggests that** **NR-U devices compliant with the existing 3GPP specifications will provide blocking protection for frequencies above 6425MHz.**
* **Option 3: Other solutions to ensure that the same n96 hardware can be reused.**

### Collection of company views

Issue 1.3-1: Indicate which option is preferred and provide reasons/justification.

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| **Company** | **Comments** |
| Nokia | From our perspective, option 1 with the blocking mask in [4] would be an acceptable compromise, as it is intended to be satisfiable by existing n96 hardware.  (The difficulty with option 2 as written above is that it does not provide a means to quantify the blocking protection. That said, option 1 with the blocking mask in [4] would provide some additional blocking protection for frequencies above 6425MHz, and thus also fulfils option 2.) |
| Qualcomm | We have a similar view as Nokia but aren’t as confident about the proposed blocking mask in [4]. We are unsure whether the proposed mask in [4] is feasible when reusing existing n96 hardware. The presumption is that the OOB Range 2 is met without filtering for n96 but since it is OOB, it does fall within the filter’s stopband. Also, the frequency at 7125 MHz is nearly a GHz higher than 6425 MHz so the gain flatness of the front-end might not be the same and therefore provide an effective attenuation. Nonetheless, it does seem like a reasonable compromise to apply a blocking somewhere between -44 dBm (IBB level known to be met w/o filtering) and -30 dBm. This evaluation probably needs to be conducted in RAN4, but at least RAN can provide guidance that the blocking is expected to be between -44 and -30 dBm. |
| Intel | We are open to discuss how proceed with band definition under assumption that n96 hardware can be reused.  For Option 1, in case of reusing the same hardware as for n96 we expect that quite limited improvement of the mask characteristics can be achieved for UEs in the 6425-7125MHz range on top of the IBB level. We are open to discuss if an improved blocking level between -44 and -30 dBm can be considered and agree with QC that discussion should take place in RAN4. We would also like to clarify that the decision on the actual achievable level should be based on the analysis of feasibility for the existing n96 hardware rather than any other factors. |
| Skyworks | The achievable UE receiver blocking level should be based on n96 hardware and may be further evaluated in RAN4 but given that there no specific value to target, the -44dBm in-band blocking level should be the starting point. |

### Summary and recommendation for further discussion

## Final round

### Open issues

### Collection of company views

### Summary and recommendation for further discussion

## Final comments

# Topic #2: Band Definition for Lower 6GHz NR Unlicensed Operation for Europe

## Proposed objectives

Topic #2 will capture the outcome of the discussions related to band definition for lower 6GHz NR unlicensed operation for Europe in the set of reference documents [1] to [4] and [6].

## Initial round

### Open issues

Issue 2.2-1: RAN needs to decide which options RAN4 shall follow to introduce unlicensed operation in the frequency range 5945 MHz to 6425 MHz in Europe.

The following summarizes the options to consider for Issue 2.2-1.

* **Option 1: Re-using already defined band n96, for the frequency range 5945 MHz to 6425 MHz.**
* **Option 2: Defining a new band n[xx], for the frequency range 5945 MHz to 6425 MHz.**
* **Option 3: Proceed with both option 1 and option 2 by specifying a new band for lower 6GHz NR unlicensed operation for Europe and amending the n96 specification with the NS values relevant for operation in Europe.**

### Collection of company views

Issue 2.2-1: Indicate which option is preferred to introduce unlicensed operation in the frequency range 5945 MHz to 6425 MHz in Europe.

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| **Company** | **Comments** |
| OPPO | Option 2 is preferred |
| Huawei | Option 2.  Regarding option 3: Option 3 was proposed during last RAN4 discussion due to lack of progress on option 1 vs 2. Considering further inputs during this RAN meeting, the option 3 is discouraged. |
| Vodafone | Option 2. |
| BT | Option 2 |
| Nokia | 1. This decision must be made by RAN plenary. It cannot be pushed back to RAN4 again, as RAN4 has repeatedly been unable to make this decision as it is not purely technical. 2. If option 2 is adopted, RAN plenary must also instruct RAN4 as to the blocking requirements to be specified, as explained in our response in section 1.2.2, since RAN4 is not able to specify option 2 without such instruction. 3. Option 1 would also be acceptable to us. 4. Option 3 is totally unacceptable. Even its own proponents state in [3] that it “is not our preference either. It is an inelegant solution, creates additional work, and leads to ambiguous standards only because RAN4 is not capable of making a decision. It does not reflect positively on RAN4.” Moreover, it is illogical: if option 1 is not acceptable, it cannot become acceptable simply by additionally specifying option 2. Similarly, if option 2 is not acceptable, it cannot become acceptable simply by additionally specifying option 1. 5. Another option, as discussed in our response in section 1.2.2, would be to put the work item on hold until sufficient regulatory detail is available to make it possible to reach consensus on the blocking requirements. |
| Qualcomm | 1. We prefer option 1. Option 2 could be considered if the specified UE blocking requirements over the range 6425 MHz and above are the same as the blocking requirements for Band n96 over that same range, but our preference is still option 1. |
| ZTE | We still support the option 2 to have new band, if we go with option 1, this will just put the potential risk and deployment restriction to regional regulators at the end, this is no good way forward for WID.  Meanwhile we think the legacy device for Europe unlicensed 6GHz should also not impact the upper 6GHz in Europe for harmonized coexistence.  If companies are not fine with option 3, then it’s also fine for us to drop it from the table. |
| Broadcom | We support Option 1. |
| Intel | Option 1 is preferred.  For Options 2 and 3 it would be good to clarify if the intention of proponents is to overturn RAN4 agreement that “*The same hardware of UE as for n96 may be reused on the frequency range 5945MHz to 6425MHz no matter whether to define a new band or define new NS for the existing n96*” or that Option 2 will be defined under assumption that same hardware can be reused? |
| Apple | We support Option 1. If it is difficult to achieve the agreement now, then we can consider putting the WI on hold and wait till more regulatory related decisions become available.  Option 3 is not totally unacceptable. As explained by Nokia, it is just illogical: if option 1 is not acceptable, it cannot become acceptable simply by additionally specifying option 2. Similarly, if option 2 is not acceptable, it cannot become acceptable simply by additionally specifying option 1. |
| Telecom Italia | Option 2  Option 3 is a non-sense |
| Telia Company | We support Option 2 as proposed in RP-211906.  Sufficient OOBB vs. RED should be discussed and agreed as baseline. |
| Orange | Option 2 |
| Telefonica | We support option 2 |
| Skyworks | RAN4 has already expressed the view that both options are feasible and whatever the way, new NS are needed to support the European unlicensed spectrum and the agreement that “*The same hardware of UE as for n96 may be reused on the frequency range 5945MHz to 6425MHz no matter whether to define a new band or define new NS for the existing n96*” shall be respected. And again this is how competing technologies are doing. We also think that some issues that are brought up only pertains to the guarantee that NRU BS will not try to operate >6425MHz which is the same issue than in n46 where BS shall not operate in UNII4 in Europe where it can be the case in the US. Also we do not see how a UE that supports the entire 6GHz spectrum cannot be supported when roaming in Europe for an unlicensed spectrum. |
| Ericsson | Support option 2.  Option 2 does not permit operation outside the allowed 5945-6425 MHz frequency range in the EU and would be endowed with at most two NS values (for LPI and VLP) both relevant for operations according to the EC Decision.  Option 2 can be specified with tighter blocking requirements for the range 6425-7125 MHz as compared to Option 1 since this range is not in-band for Option 2.  The above supported using the same hardware as for Option 1, allowing “the internal market to benefit from a spectrum resource also available worldwide, thus generating large economies of scale for equipment manufacturers” as spelled out in the EC Decision. |
| MediaTek | There is agreement in RAN4 that the same hardware may be used irrespective of Option 1 or Option 2, we think the agreement is a good solution for further discussion and should not be precluded. |
| Deutsche Telekom | Option 2.  There is a clear request from all European operators active in 3GPP RAN to progress with this option. We are the customers asking for and deploy equipment for the lower 6 GHz with NR-U.  Further as explained by Ericsson above, this is the future proof solutions making commercialization of the 5945 – 6425 MHz band possible in short term.  **We should stop this discussion here at RAN#93e and decide for this option, otherwise we should declare Working Agreement on the topic as the clear majority indicates support for this way forward.** |

### Summary and recommendation for further discussion

In this section, the summary of comments on Topic#2 and the corresponding recommendations are provided.

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|  | **Summary and recommendation** |
| **Moderator (RAN Vice-Chair, AT&T)** | **Moderator Recommendation:**  The following summarizes the company views on Issue 2.2-1. Companies shown in brackets are meant to indicate that the support of the option is predicated on additional constraints.  Option 1: Nokia, Qualcomm, Broadcom, Intel, Apple, Skyworks, MediaTek  Option 2: OPPO, Huawei, Vodafone, BT, [Nokia], [Qualcomm], ZTE, Telecom Italia, Telia, Orange, Telefónica, , Ericsson, MediaTek  Option 3: ZTE  The company positions do not vary much from those already expressed in the input documents although some companies have indicated support for an alternative option predicated on additional constraints. Option 3 can be dropped from any further discussions. Option 2 seems feasible to some companies that prefer Option 1 if the same n96 hardware can be reused.  The moderator recommends to postpone any further discussion on the decision concerning whether to re-use the existing n96 band or defining a new band until further discussion on Issue 1.3-1 is held concerning the possible compromise on a solution that meets the previous RAN4 agreement that “the same hardware of UE as for n96 may be reused on the frequency range 5945MHz to 6425MHz no matter whether to define a new band or define new NS for the existing n96” while minimizing risk of future compliance issues. |

*Skyworks: we do not understand how our company name is collected for option 2 as we have clearly a preference in option 1 and see no benefit of option 2.*

## Intermediate round

### Open issues

Postpone any further discussion on the decision concerning whether to re-use the existing n96 band or defining a new band until further discussion on Issue 1.3-1 is held concerning the possible compromise on a solution that meets the previous RAN4 agreement that “the same hardware of UE as for n96 may be reused on the frequency range 5945MHz to 6425MHz no matter whether to define a new band or define new NS for the existing n96” while minimizing risk of future compliance issues. Further discussion on this topic may be needed in the final round based on the outcome of Issue 1.3-1.

### Collection of company views

N/A.

### Summary and recommendation for further discussion

## Final round

### Open issues

### Collection of company views

### Summary and recommendation for further discussion

## Final comments

# Final Conclusions

**Moderator Recommendations:**

# References

[1] RP-211823: On Introduction of lower 6GHz NR unlicensed operation for Europe; Nokia, Nokia Shanghai Bell

[2] RP-211906: Requirements for 6GHz NR-U band plan in Europe; BT plc, Telecom Italia, Telefonica, Vodafone, Deutsche Telekom, Orange, Telia Company, Telenor, Bouygues Telecom

[3] RP-212050: On progress for WI on introduction of lower 6GHz NR unlicensed operation for Europe; Qualcomm Incorporated

[4] RP-212125: On the introduction of lower 6GHz NR unlicensed operation for Europe; Ericsson

[5] RP-212300: Summary of the regulatory requirements for in- and out-of-band blocking in the 6GHz EU/CEPT band; Apple Inc.

[6] RP-212409: Discussion on band plan for Europe unlicensed 6GHz; ZTE, Sanechips