97e-29-4Rx-6GHz - Version 0.0.7
RAN

3GPP TSG RAN Meeting #97-e RP-222684

Electronic Meeting, September 12 - 16, 2022

Agenda Item: 9.6.1.1

Source: RAN Vice-Chair (AT&T)

Title: Moderator's summary for discussion [97e-29-4Rx-6GHz]

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In this document, we will provide a summary for the email discussion [97e-29-4Rx-6GHz] at RAN#97-e.

1 Topic #1: 4Rx Support for licensed operation in the 6 GHz range

1.1 Proposed Objectives

Topic #1 will capture the outcome of the discussions on the following documents:

1) RP-222361 [1]

2) RP-222511 [2]

1.2 Initial Round

The initial round will be focused on collecting company views to include any opposing views and/or concerns with the proposals set forth in the documents above. Companies are also requested to provide any suggested way forward(s) to consider in future rounds of discussion.

1.2.1 Open Issues

The following covers the observation and proposal listed in [1].

Observation 1: Rel-15 4RX mandatory is just applicable to specific NR bands, but not all TDD bands above 3GHz.

Proposal 1: 4Rx support is optional for the licensed operation in 6GHz range.

The following covers the observation and proposal listed in [2].

Observation 1: The discussion on 4 Rx support for the licensed operation and unlicensed operation can be separate.

Proposal 1: It is proposed to indicate 4Rx as the baseline for band n104, i.e. 4Rx is mandatory.

The proposals are clearly different based on the performance objectives for licensed and unlicensed operation in the 6 GHz range.

In Rel-16, band n96 was introduced as the first operating band in the 6 GHz range for unlicensed operation with 2Rx as the baseline.

In the case of band n104, the licensed operation would be applicable in certain regions in an operating band that is a subset of an already defined operating band slated for unlicensed operation in a different region.

1.2.2 Collection of company views

Issue 1.2-1: Do you agree that 4Rx support can be considered as optional for licensed operation in the 6GHz range due to the impact on UE implementation which may need to support both licensed and unlicensed operation in the 6 GHz range and/or may be impacted due to the overlapping frequency ranges?

Feedback Form 1: Issue 1.2-1

1 – TELECOM ITALIA S.p.A. no. As stated in 2511, the discussion on 4 Rx support for the licensed operation and unlicensed operation can be separate (different deployment scenarios, in particular macro vs very localised coverage)
2 – Charter Communications Yes. In 6 GHz, licensed and unlicensed share some or a large frequency span. In unlicensed band, 4RX is optional as it is in 5GHz. This is primarily because in unlicensed bands you have lbt for multi carrier access plus the pSD is limited by regulation. Having 6 GHZ licensed 4 RX mandatory makes this band have better reference sensitivity and poses potential co-existence issues. IN RAN#96 meeting, WF on 4 RX RP-221869 clearly said that Applicability to other NR bands in FFS. This means that 4 RX should be discussed in a per band basis and if there are issues with 4RX mandatory at it is in 6 GHz then we can by exception have 4 RX as optional, which by the way it does not preclude for some company's and Regions to implement 4 RX as specific implementation. lastly 6 GHz licensed has not been ruled yet in WRC. It is suppose to happen in WRC23. We suggest that we hold further decisions until WRC23 rules the use of this global band
3 – Ericsson LM No. We support the proposal in RP-222511. 4Rx should be baseline for bands above 2.7 GHz as previously

agreed in RAN. The deployment scenarios, markets, use cases for licensed and unlicensed operations are different.

4 – Apple GmbH

When RAN was making an agreement to mandate 4RX for bands above 2.7GHz, we did not have licensed bands above 5GHz. And as further explained in the paper from vivo, from the UE implementation perspective 6GHz is a different frequency range with different filters, receivers, etc; not mentioning the fact that it overlaps with the unlicensed band that has different requirements. Based on that we prefer keeping 4RX as optional for band n104, whereupon we can clearly note that it is subject for further revisions once we have further decisions in the regulatory domain.

5 – Orange

No. The need for macro network in 6 GHz licensed is very different from unlicensed. 4 Rx is essential for licensed to ensure optimal coverage & capacity, and should be likened to 3.5 GHz.

6 – Spark NZ Ltd

As per RP-222511 we also support the view the 4RX is mandatory, and should be the baseline for n104.

7 – Telstra Corporation Limited

No. We agree with Telecom Italia and Orange that the relevant comparison to make regarding mandating 4RX is with 3.5 GHz. We support the proposal in RP-222511.

8 – Verizon UK Ltd

The antenna sharing of the US unlicensed band with other bands is our main concern. This is because 2Rx for the 6GHz unlicensed band was defined as mandatory. Based on this, we support keeping 4RX as optional for the US unlicensed band as what both Charter and Apple commented above.

9 – CableLabs

RAN#78 made agreement as the following:

• *For NR Bands n7, n38, n41, n77, n78, and n79 the UE shall be equipped with 4Rx ports as a baseline*

– *Applicability to other NR bands is FFS*

– *For certain UE types/categories, some exceptions to this requirement may be applicable in future*

– *RRC signalling and ASN.1 coding shall be defined in Release 15 such that supported number of UE Rx antenna ports is indicated from UE to the eNB/gNB.*

It is our understanding that RAN made agreement to mandate 4 RX for certain bands with 2 RX being mandatory for other bands.

Whether to apply 4RX ports as baseline to n104, as noted by Charter and Apple, some considerations are necessary. We agree with Charter and Apple that decision on whether to extend 4RX baseline to n104 can be delayed until it becomes clear which regions n104 would apply and how n104 may coexist with 6GHz unlicensed bands.

10 – Beijing Xiaomi Mobile Software

Yes, from UE implementation point of view, we agree with the vivo's explaination why mandating 4Rx for this 6GHz frequency range would not friendly for the UE design, taking 4Rx as an optional feature for this frequency range is our preference.

11 – E-surfing Digital

No. We agree with the comments from Telecom Italia, E///, Orange, Testra.

12 – E-surfing Digital

China Telecom: (the same comment in comment #11, and with company name added)

No. We agree with the comments from Telecom Italia, E///, Orange, Testra.

13 – Samsung Electronics Co.

We share same understanding as vivo on the previous agreements on mandating 4Rx on specific bands which is per band basis. Once new bands added, whether 4Rx can be optional or mandatory shall be discussed in case-by-case manner.

Regarding supporting 4Rx in 6GHz band (n104), it's possible to support 4Rx and on the other hand, this is ultra-high frequency range in FR1 above 5Ghz which bring implementation challenges in UE side. In previous RAN4 meetings, RAN4 already agreed 2Rx is baseline for unlicensed 6GHz band (n96) which also aligned with WIFI usage. We understand the deployment scenario can be different between licensed and unlicensed bands meanwhile from UE implementation aspect, there is commonality on the same frequency ranges. With above considerations, we prefer to take 4Rx supporting as optional in this release. For compromise, we can further check and comeback to this issue in later stage once the implementation and regional information become stable enough.

14 – Huawei Tech.(UK) Co.. Ltd

No, we don't agree. The support of 4Rx on one band is always more or less impacted by the support of other bands in the UE, but this is not specific to the 6GHz range and RAN already mandates 4Rx for IMT bands above (and including) 2.5 GHz. We deem the impact to implementation feasible in the UE, even for UEs that would support both licensed and unlicensed bands in the 6GHz range. A UE can optionally support 4Rx for unlicensed bands in 6GHz range.

15 – CHTTL

No

16 – ZTE Wistron Telecom AB

No, we support to mandate 4Rx for licensed 6GHz. The deployment scenarios and target markets for unlicensed 6GHz and licensed 6GHz are different as pointed out by other companies, thus with different demands for performance and coverage.

17 – CBN

No. We share same view with ZTE.

18 – Telia Company AB No. We also support the proposal in 2511. We see that 4-Rx should be the baseline and mandated for licensed 6GHz to ensure reliable coverage and capacity.
19 – Guangdong OPPO Mobile Telecom. 4Rx optional is our preference from implementation complexity perspective, though we understand the coverage impacts caused by this.
20 – China Unicom No. 4 Rx support for the licensed operation and unlicensed operation can be separate, and it should be mandatory to have 4Rx support for n104.
21 – VODAFONE Group Plc No. We agree with Telecom Italia, Orange, Telstra and Telia. We also support the proposal in 2511. We see that 4-Rx should be the baseline and mandated for licensed 6GHz to ensure reliable coverage and capacity.
22 – Nokia France No, we see the benefits of mandating 4Rx support for licensed operation in 6GHz bands, as outlined in RP-222511.
23 – China Mobile Com. Corporation No, 4Rx should be mandatory support for licensed 6GHz band.
24 – vivo Communication Technology Yes. We share the similar views with Apple and Samsung, from UE implementation perspective, we should consider the consistency of 2RX mandating for the same frequency ranges. We also support that further revisions can be considered once further decisions in the regulatory domain is made in the future.
25 – Facebook Yes, we support keeping 4RX as optional for the US unlicensed band as Apple. Charter and Verizon commented above.

Issue 1.2-2: Do you agree that 4Rx support for licensed and unlicensed operation can be considered separately and that 4Rx can be indicated as the baseline for band n104?

Feedback Form 2: Issue 1.2-2

1 – TELECOM ITALIA S.p.A. yes, as supporter of 2511 we agree with the statement for the reasons indicated in the paper

2 – Charter Communications

no we do not support 2511. The reasons have been stated in issue 1.2-1.

In RP-222511 observation 1 claims that 4 RX support for licensed and unlicensed can be treated separate. As I mentioned in 1.2-1, some parts of unlicensed and licensed are share in certain regions and treating them separately can cause co-existence issues. Furthermore, we need to consider that in this band, there are other technologies that co-exist and we should consider fair co-existence. Having 4 RX optional for unlicensed and mandatory for licensed causes fragmentation in the band. This can cause cost increases and supply chain problems.

There are other consideration that causes issues for 4 RX mandatory, for example Dual Rx/Tx SIM. For this application the antenna configurations are needed for checking network A and network B.

Lastly as mentioned below, WRC has still have not ruled for 6 GHZ licensed. why jumping the gun? We proposed making 4 RX optional for the 6 GHz band for both licensed and unlicensed. A possible compromise solution might be to hold the decision until WRC23. We do not understand why is the urgency for making this decision at this time.

3 – Ericsson LM

Yes. We support the statement that 4Rx should be baseline for band n104. We don't agree to delay the decision until WRC23. This will delay the roll out of n104 which is already specified and regulatory frame work is available.

4 – Apple GmbH

No. As technically explained in the previous post, mandating 4RX for band n104 impacts device implementations. Nevertheless, existing specifications do not prohibit a device to support 4RX in band n104 and there exists the corresponding signalling for that. Based on that we see no issue with keeping 4RX as optional.

@**Ericsson**: In which country do you plan to roll out band n104? Maybe you can clarify it because to our knowledge there is no Administration that has officially designated 6425-7125MHz for the IMT operation.

5 – Orange

yes, as explained at the previous question and in the submitted paper

6 – Spark NZ Ltd

We support the view that 4RX should be used for n104. We dont hold a view for other licensed/unlicensed bands. Regardless of the WRC23 outcomes on IMT designations for n104 we should proceed with specification development.

7 – Telstra Corporation Limited

Yes. 4 RX shall be mandatory for n104 UE

8 – Qualcomm CDMA Technologies

We agree that 4Rx support for licensed and unlicensed operation can be considered separately.

9 – Qualcomm CDMA Technologies

The decision for unlicensed operation (n96) was done long ago and should not be reopened.

10 – E-surfing Digital

China Telecom:

Yes, we agree.

11 – Samsung Electronics Co.

No, as explained in previous issue. Our preference is taking 4Rx supporting as optional for band n104 in current stage.

12 – Huawei Tech.(UK) Co.. Ltd

Yes, we agree. The motivation for considering separately licensed and unlicensed operation is because the coverage and capacity requirements are different, and this view is supported by a large number of operators co-sourcing RP-222511. At least from the coverage perspective, 4Rx should be mandatory in band n104, as it is mandatory for other IMT bands above (and including) 2.5 GHz.

13 – CHTTL

Yes, we agree.

14 – ZTE Wistron Telecom AB

Yes, we support 4Rx as the baseline for n104, and we disagree to postpone the decision until the WRC-2023 since this will have direct impacts on the regions where its regulatory requirement and spectrum is ready.

15 – CBN

Agree.

16 – Telia Company AB

Yes we agree. No reason to delay the decision until WRC23.

17 – Guangdong OPPO Mobile Telecom.

4Rx can be handled separately for license and unlicense, and optional feature is our preference.

18 – China Unicom

Yes. 4Rx should be the baseline for band n104.

19 – Intel Corporation (UK) Ltd We agree that as a general principle 4Rx support can be considered separately for licensed and unlicensed spectrum. The is not meant to imply that discussion on n96 can be reopened (that was concluded in Rel-16).
20 – VODAFONE Group Plc Yes. No reason to delay the decision until WRC23.
21 – Nokia France Yes, we support the statement in Issue 1.2-2.
22 – China Mobile Com. Corporation We are open to consider licensed and unlicensed seperately. 4Rx should be the baseline for band n104.
23 – CableLabs As stated in the first question, we prefer to keep 4RX optional for n104 in current stage.
24 – vivo Communication Technology No, as commented, we should consider the UE RF and antenna implementation impacts for the same frequency ranges. We support 4Rx optional for band n104.
25 – Facebook No, our view that existing specifications do not prohibit a device to support 4RX in band n104. We prefer to keep 4RX as optional for band n104.

1.2.3 Summary and recommendation for further discussion

Thanks for the input in the initial round on this topic. The moderator summary of each issue presented is as follows.

Issue 1.2-1:

- Yes (9): Charter, Apple, Verizon, CableLabs, Xiaomi, Samsung, OPPO, vivo, Facebook
- No (15): Telecom Italia, Ericsson, Orange, Spark NZ, Telstra, E-surfing Digital, Huawei, CHTTL, ZTE, CBN, Telia, China Unicom, Vodafone, Nokia, CMCC

The breakdown of supporting companies vs. non-supporting companies is favoring the case that 4Rx support should not be optional for licensed operating bands in the 6 GHz range. Although, there is still a good number of non-supporting companies to consider that there is clearly no consensus.

Some companies proposed to wait on the decision or to consider further debate on the mandatory aspects until there are further decisions on the regulatory domain are known and if band n104 will co-exist with 6GHz unlicensed operating bands.

Issue 1.2-2:

- Yes (17): Telecom Italia, Ericsson, Orange, Spark NZ, Telstra, Qualcomm, E-surfing Digital, Huawei, CHTTL, ZTE, CBN, Telia, China Unicom, Intel, Vodafone, Nokia, CMCC
- No (7): Charter, Apple, Samsung, OPPO, CableLabs, vivo, Facebook

The breakdown of supporting companies vs. non-supporting companies is favoring the case that unlicensed and licensed operating bands can be handled separately. Although, there is still a good number of non-supporting companies to consider that there is clearly no consensus.

Some companies that indicating yes for Issue 1.2-2 also mentioned that this does not imply that the discussion on band n96 will be reopened as this was concluded in Rel-16. In the moderator's view, it seems that it is commonly accepted that the decision on band n104 does not impact the core specification for band n96. The moderator will provide a feedback form in the intermediate round to confirm this.

Based on the overall input received on Issue 1.2-1 and Issue 1.2-2, it will be difficult to reach an agreement based on a binary approach on this topic. The moderator would like to collect input on the following possible options with the moderator's preference to find compromise during the intermediate round to reach consensus which would imply consideration of Option 1 or Option 2 as the preferred set of options.

- Option 1: Define band n104 performance requirements with 4Rx as baseline but allow a 2Rx exception when band n104 is supported by the UE as a roaming band (similar to the case developed for two Rx vehicular UE).
- Option 2: Define band n104 performance requirements for both 2Rx and 4Rx and consider 4Rx as optional until the regulatory situation and regions of operation are clearer.
- Option 3: Define band n104 performance requirements with 4Rx as baseline.

1.3 Intermediate Round

The intermediate round will be focused on collecting company views on the moderator proposed options for band n104. In addition, the situation concerning band n96 core requirements will be clarified.

1.3.1 Open Issues

The open issues for the intermediate round are identified below.

1.3.2 Collection of company views

Issue 1.3-1: The moderator would like to collect input on the following possible options for a way forward.

- Option 1: Define band n104 performance requirements with 4Rx as baseline but allow a 2Rx exception when band n104 is supported by the UE as a roaming band (similar to the case developed for two Rx vehicular UE).

- Option 2: Define band n104 performance requirements for both 2Rx and 4Rx and consider 4Rx as optional until the regulatory situation and regions of operation are clearer.
- Option 3: Define band n104 performance requirements with 4Rx as baseline.

Feedback Form 3: Issue 1.3-1

1 – VODAFONE Group Plc

Can someone clarify for me what a ”roaming band” is please?

2 – Spark NZ Ltd

In a view Option 1 and Option 2 end up being the same as the both allow for the BS to support both 4RX and 2RX capability. the concept of roaming should not be relevant within a 3GPP band specification (including its performance characteristics). We still feel Option 3 is the right approach, but keen to know if any other compromise could be found.

3 – Guangdong OPPO Mobile Telecom.

In our view, Option 2 is the best currently can made according to the feedback from 1st round.

4 – Samsung Electronics Co.

We support option 2

5 – Samsung Electronics Co.

We support option 2

6 – Telstra Corporation Limited

From an operator perspective, Option 3 is the acceptable way forward.

RAN decided in Rel-15 that 4 RX would be mandatory for NR UE in mid-band frequency ranges to compensate for the higher path loss at these frequency. This is clearly laid out in [2] and we have not heard sufficient motivation to go against this. Any agreements reached for unlicensed bands, based on different deployment scenarios, do not negate this long-standing principle for mandating 4 RX in licensed bands.

We see the vehicle UE case as unique and motivated by special set of reasons as laid out to 3GPP from the automotive market.

We also do not feel it is best practice to start designing 3GPP bands contingent on whether it is used in home network or roaming networks.

7 – Beijing Xiaomi Mobile Software

Option 2 is acceptable for us

8 – China Telecommunications

We support option 3.

As discussed in the basket WI for 4Rx bands in thread [97e-08-R18-RAN4-OtherSpectrumRelated], 4Rx UE are mandatory for frequency band > 2.6GHz from Rel-15. We don't see the necessity of breaking this rule for band n104.

9 – TELECOM ITALIA S.p.A.

Option 3. fully support the arguments expressed by Telstra and China Telecom. Licensed spectrum operation is quite different from local usage, since macro cells are envisaged. Two Rx severely impact the network performance, spectral efficiency and last but not least have a serious impact on energy consumption (more cells = more energy consumption), which is not acceptable

10 – Orange

Option 3 is the only option we can accept. We also fully support the arguments from Telstra & China Telecom. We also feel it should be made clear by the plenary that the proposal for 4 Rx to be only optional is breaking a previous agreement made at RAN level.

11 – Ericsson LM

We support option 3.

4Rx should be baseline for n104 regardless of which other bands the UE support.

Option 2 does not make much sense because for band n104 the regulatory framework has been completed.

12 – vivo Communication Technology

We support option 2.

13 – China Mobile Com. Corporation

We support Option 3.

Mandatory 4Rx for midband was agreed from Rel-15. We should respect the previous agreements. We do not understand how the 4Rx mandatory is related to roaming. Also 2Rx exception for vehicular UE has a reason that antenna gain of vehicular UE is larger than handheld UE. This is not relavent to n104.

14 – ZTE Wistron Telecom AB

Option 3, define band n104 performance requirements with 4Rx as baseline. We don't see any reason to revert what was agreed in the past.

15 – China Unicom

We support option 3, and share similar views with operators.

16 – CBN

Support option 3.

17 – CBN

Support option 3.

18 – Nokia France

We see option 3 as the only feasible one of these options.

19 – Apple GmbH

Option 2 is our preference. We will be open to explore further Option 1 or its variants. Hypothetically speaking, there can be a device supporting only band n104, but not n96, whereupon support of 4RX for band n104 should not cause any clashes with band n96. Nevertheless, even if we keep 4RX as fully optional, there is nothing that prevents a custom device to support 4RX for band n104.

20 – Huawei Tech.(UK) Co.. Ltd

We don't understand option 1. We also don't understand the dependency of option 2 upon the regulatory situation, whereas what we are discussion is a matter of performance especially for coverage and a matter of implementation. So at this time we continue supporting option 3 as the only acceptable option among those three options.

Regarding option 1, our understanding is that option 1 aims to refer to the first round proposal from some companies expressed as "4RX as optional for the US unlicensed band". However, we don't see how this is reflected by option 1 and how roaming could be involved in defining a capability requirement, and we have the same questions as Vodafone and Spark.

We would also like to follow-up on an earlier comment from Charter, which said that "Having 6 GHZ licensed 4 RX mandatory makes this band have better reference sensitivity and poses potential co-existence issues". First, we would like to note that even with 2Rx for n104 the reference sensitivity for n104 is already better than for n96. Perhaps the concern was for directional LBT, where 4Rx would pick-up higher interference in some directions than 2Rx. However, less interference would also be picked-up in directions where there is less interference. In general, we consider it beneficial for a device to more accurately measure directional interference, so from that perspective we don't see 4Rx as being detrimental for LBT.

Again in our view, if 4Rx can be implemented for a UE that supports n104, we think that the same 4Rx could be reused for n96 since this can be optionally supported for n96.

21 – CableLabs

We consider Option 2 is a good compromise option given feedbacks from initial round.

22 – Intel Corporation (UK) Ltd

We would like to understand option 1 better. We guess the intention is to say that 4Rx would be mandatory for UEs sold into a market where n104 is used, but optional for UEs sold into other markets. It is not clear how 3GPP specifications would be able to capture such an approach.

We understand that option 2 defers the issue until additional regions have concluded whether to use this band, and this may be an acceptable compromise for now. In general our preference is for 4Rx in this band.

23 – VODAFONE Group Plc We support option 3 (only). Same views as Orange and Telecom Italia.
24 – Telia Company AB ONLY Option 3: Define band n104 performance requirements with 4Rx as baseline.

Issue 1.3-2: Do you agree that the decision on band n104 will not re-open the core requirements for band n96?

Feedback Form 4: Issue 1.3-2

1 – Qualcomm CDMA Technologies I don't think opening core requirements for n96 is an option when this band was introduced in Rel-16 time frame.
2 – Guangdong OPPO Mobile Telecom. Yes.
3 – Telstra Corporation Limited Yes. There is no need to re-open requirements for n96.
4 – Telstra Corporation Limited Yes. There is no need to re-open requirements for n96.
5 – Samsung Electronics Co. We don't want to revert/reopen the decision on band 96. On the other hand, we shall also consider the commonality between band n104 and band n96 from UE antenna/RF front-end implementaion asspect since these two bands freqeuncy overlapped when we decide the decision on band n104. That's the reason we think it's more resonable that the decision for band n104 shall be aligned with band n96.
6 – Beijing Xiaomi Mobile Software Yes.
7 – Beijing Xiaomi Mobile Software Yes.
8 – TELECOM ITALIA S.p.A. Yes, no need to reopen discussion. The two bands have a completely different usage and therefore requirements (local coverage, low power for unlicensed vs wide area coverage for licensed)
9 – Orange yes

10 – vivo Communication Technology Yes. We share similar view with Samsung. n96 requirements should not be reopened, and n104 should consider the consistency of these similar frequency ranges. This is also one of the reasons for adopting Option 2 in Issue 1.3-1
11 – Nokia France yes
12 – Apple GmbH Yes
13 – Huawei Tech.(UK) Co.. Ltd We agree, and we think that this principle is consistent with option 3.
14 – Intel Corporation (UK) Ltd Yes
15 – Telia Company AB Yes.

1.3.3 Summary and recommendation for further discussion

Thanks for the input in the intermediate round on this topic. The moderator summary of each issue presented is as follows.

Issue 1.3-1:

- Option 1 (1): Apple (explore variant of this approach)
- Option 2 (8): OPPO, Samsung, Xiaomi, vivo, Apple, CableLabs, Intel, Charter
- Option 3 (15): Spark NZ, Telstra, China Telecom, Telecom Italia, Orange, Ericsson, CMCC, ZTE, China Unicom, CBN, Nokia, Huawei, Intel, Vodafone, Telia

Some companies expressed concern with Option 1 or needed additional clarifications as to how this would be captured in the specifications. The moderator based this option to utilize a roaming band exception to follow an approach that was suggested during the attempt to specify LTE TRP and TRS requirements. Either way, it is does not appear to have support to justify any further refinement of this option.

The breakdown of companies supporting Option 2 and companies supporting Option 3 are basically aligned with previous rounds and certainly no consensus can be concluded at this stage of the discussion.

Issue 1.3-2:

All companies confirmed that the decision on band n104 will not re-open the core requirements for band n96. There is no need to discuss this issue further. The moderator will intend to capture this understanding in any final way forward.

Based on the input received on Issue 1.3-1, it is difficult to reach an agreement based on consensus. The moderator would like to collect additional input in the final round concerning variants of Option 2 and Option 3 that could move us towards compromise.

1.4 Final Round

The final round will be focused on collecting additional input concerning variants of Option 2 and Option 3 that could move us towards compromise. Companies should not make further comments on support of Option 2 or Option 3 as written since the views are already known. The focus should be on compromise proposals only. If there is no further progress, the moderator will intend to ask for GTW time on Friday morning due to the impasse.

1.4.1 Open Issues

The open issue is listed below.

1.4.2 Collection of company views

Issue 1.4-1: Please provide suggested variants to Option 2 and/or Option 3 that could move us towards a compromise solution.

- Option 2: Define band n104 performance requirements for both 2Rx and 4Rx and consider 4Rx as optional until the regulatory situation and regions of operation are clearer.
- Option 3: Define band n104 performance requirements with 4Rx as baseline.

Feedback Form 5: Issue 1.4-1

1 – Deutsche Telekom AG

Sorry, I was not able to join this discussion earlier ..

I totally fail to understand why the definition of performance requirements should be bound to the ”regulatory situation and regions of operation” ? -> Regulators will not ask for 2Rx or 4Rx ... with this argumentation we are missing the point. They ask for ”efficient spectrum utilisation” instead, which clearly aims towars 4Rx anyway ... So for Deutsche Telekom Option 2 is totally unacceptable !

With the long standing requirement that NR devices in IMT bands > 2100 MHz SHALL support 4Rx, the way forward is totally clear: Unless there is any exception - like for the vehicular mounted UEs which allows 2Rx with compensation based on additional antenna performance requirements, the baseline is 4Rx ... hence if someone sees this differently, 3GPP shall perform a study (as we did for the 2Rx exception for

automotive) and then we might deside differently ...

So from Deutsche Telekom's point of view, Option 3 is already there and we should ONLY debate, if we like to grant any exception from this.

2 – Charter Communications

Option 2. As we mentioned in round 1, in some countries there might be part of the 6 GHz band regulated as licensed and another part(s) regulated unlicensed. Having the architecture different causes fragmentation, unnecessary complexity and potential cost and supply chain issues. Furthermore, having one band with better reference sensitivity that another and other technologies in 6 GHz can cause co-existence issues that having similar RF requirements would avoid. Once the Regulatory framework is better understood after WRC 23 then we can analyze the impact of having different performance requirements between bands.

3 – VODAFONE Group Plc

option 3

4 – VODAFONE Group Plc

option 3

5 – Ericsson LM

We support Option 3.

Option 2 does not make much sense because UE receiver configuration (2Rx, 4Rx etc) is not related to any regulatory requirements. Band n104 is specified based on RCC regulatory framework, which is completed anyway.

6 – China Telecommunications

We support option 3 as it is.

7 – Telstra Corporation Limited

Telstra still believes that there has not been enough of a justification for the deployment and operation of equipment in this licenced band to overturn a fundamental RAN agreement going back to the start of NR.

Option 3. 4 RX SHALL be mandatory for n104

8 – Spark NZ Ltd

With respect to Charter's comments about Agenda item 1.2 in WRC23 defines 6425 - 7025 MHz for IMT identification in region 1 it doesn't split in unlicensed or licensed components. If we need to wait for WRC23 (though we don't believe there is need for this) proceed with Option 3 now and develop Option 2 - 2Rx as a later CR when there is clarity.

9 – Spark NZ Ltd

With respect to Charter's comments about Agenda item 1.2 in WRC23 defines 6425 - 7025 MHz for IMT identification in region 1 it doesn't split in unlicensed or licensed components. If we need to wait for WRC23 (though we don't believe there is need for this) proceed with Option 3 now and develop Option 2 - 2Rx as a later CR when there is clarity.

10 – Spark NZ Ltd

With respect to Charter's comments about Agenda item 1.2 in WRC23 defines 6425 - 7025 MHz for IMT identification in region 1 it doesn't split in unlicensed or licensed components. If we need to wait for WRC23 (though we don't believe there is need for this) proceed with Option 3 now and develop Option 2 - 2Rx as a later CR when there is clarity.

11 – Verizon UK Ltd

We support Option 2!

12 – Facebook

We prefer Option 2. It can follow the decision in n96.

13 – vivo Communication Technology

We support option 2.

14 – TELECOM ITALIA S.p.A.

It is funny how some UE vendors are trying to ignore basic agreements achieved in Rel 15...

Outside USA there is a clear request to have an efficient use of the spectrum and considering that licensed bands are used for macro coverage (not local / low power solutions), the adoption of 4 Rx is a must to ensure efficient usage of spectrum. Therefore for us the only acceptable solution is option 3.

We really do not understand the concern of USA companies, since there could not be interference issues between unlicensed and licensed operation (being all unlicensed).

If there are concerns from USA companies, as a compromise devices could signal that 4Rx are optional in the country

15 – CBN

We support option3.

16 – Guangdong OPPO Mobile Telecom.

For clarification of Option 2, does it mean once the regulation situation is clear then 4Rx will change to mandatory, or does it mean at that time the group will re-discuss this mandatory/optional issue?

- "*consider 4Rx as optional until the regulatory situation and regions of operation are clearer*"

17 – TELEFONICA S.A.

We support Option 3 with 4Rx as baseline.

18 – Orange

We fully agree with DT and TIM's comments and can only accept option 3, which should follow the agreement made in Rel-15. The spectral efficiency of the 6 GHz licensed band is essential and as important as in 3.5 GHz. There is no other option possible from our perspective.

19 – Orange

We fully agree with DT and TIM's comments and can only accept option 3, which should follow the agreement made in Rel-15. The spectral efficiency of the 6 GHz licensed band is essential and as important as in 3.5 GHz. There is no other option possible from our perspective.

20 – Beijing Xiaomi Mobile Software

Option 2 is acceptable compromise for now

21 – Huawei Tech.(UK) Co.. Ltd

We support option 3 and can only accept option 3, as it is the only option that is consistent with past RAN plenary decisions, as already pointed out by several operators.

22 – Telia Company AB

We support ONLY Option 3: Define band n104 performance requirements with 4Rx as baseline.

23 – CHTTL

We support Option 3

24 – Samsung Electronics Co.

As commented in previous round with detailed technical reason, we can accept option 2 at current stage.

25 – China Mobile Com. Corporation

We support option 3.

26 – CKH IOD UK LIMITED

We (CK Hutchison) support 4Rx as baseline for n104 performance requirement as is important for network performance and user experience. Having some certainty on Rx performance is also useful for dimensioning of our networks. We acknowledge there me be challenges for some devices with specific form factor's but that should not preclude 4Rx as a baseline.

We support option 3.

27 – China Unicom

We support option 3 only.

28 – TELENOR ASA We support and can only accept option 3: Define band n104 performance requirements with 4Rx as baseline.
29 – TURKCELL We support Option 3 with 4Rx as a baseline. Regulatory doesn't check that it supports 2Rx or 4Rx.
30 – CATT We support option 3.
31 – Classon Consulting [for FUTUREWEI] Opt 3
32 – CableLabs We are okay with Option 2 as a compromise.
33 – Apple GmbH We prefer Option 2 as a compromise because it does not preclude anybody from making a device with 4RX before outcome of the WRC23 conference. As a reminder to everybody, there is no Administration that has allocated 6425-7125MHz for IMT, and even Ministry of Communication in Russian Federation has not allocated yet that range for IMT (meaning that the RCC recommendation is useless at this point). Once we know the outcome from WRC23, we will be more than open to re-consider optional/mandatory 4RX feature for band n104.
34 – Charter Communications To Sparz and Telecom Italia, the concerns in the US is relate to fragmentation of the band as a result of different architectures potentially affecting cost and supply chain issues. With regards to the regulatory uncertainty affecting decisions related to performance requirements as 4 RX affects, we need to be cautious as having licensed and unlicensed sharing the band can cause co-existence issues in other parts of the World. Apple has alluded to this very clearly
35 – Nokia France Option 2 does not seem like a compromise. We continue to see Option 3 as the way forward (which, we admit, is also not a compromise, but we don't see another possibility).

1.4.3 Summary and recommended conclusion

Thanks for the input in the final round on this topic. Unfortunately, the input seemed to be support/not support of Option 2 and/or Option 3 as opposed to suggested variants to work towards compromise.

There is still a wide gulf between operators/infrastructure vendors in the regions looking at licensed operation in 6GHz and UE vendors which are very concerned about the impact of mandatory 4Rx support and its UE implementation impacts on UEs that need to support both unlicensed operation in band n96 (2Rx baseline) and licensed operation in band n104 (if 4Rx is baseline).

Given the situation, the moderator does not see a way to conclude on this topic yet and will present the existing options on the table as well as one more option for the possibility of relaxation to the 4Rx baseline. Option 1 has already been excluded from further discussion.

The moderator way forward is to confirm a way forward based on one of the following options.

- **Option 2: Define band n104 performance requirements for both 2Rx and 4Rx and consider 4Rx as optional until the regulatory situation and regions of operation are clearer.**
- **Option 3: Define band n104 performance requirements with 4Rx as baseline.**
- **Option 4: Define band n104 performance requirements with 4Rx as baseline. 3GPP to perform a study on any possible 2Rx exception (as done for 2Rx exception for automotive) and, if confirmed, develop 2Rx requirement and any necessary signalling.**

The moderator will plan to update NWM once the RAN Chair confirms the extended round discussion and will kick-off those discussions. It may still be necessary for these options to be discussed on the Friday GTW based on RAN Chair decision.

Conclusion on the Tdocs will be captured in the final conclusions clause when confirmed.

16 September 2022: Update after extended round of discussion

The following was presented over email for discussion.

The moderator way forward is to confirm a way forward based on one of the following options.

- **Option 2: Define band n104 performance requirements for both 2Rx and 4Rx and consider 4Rx as optional until the regulatory situation and regions of operation are clearer.**
- **Option 3: Define band n104 performance requirements with 4Rx as baseline.**
- **Option 4: Define band n104 performance requirements with 4Rx as baseline. 3GPP to perform a study on any possible 2Rx exception (as done for 2Rx exception for automotive) and, if confirmed, develop 2Rx requirement and any necessary signalling.**

During the email discussion, there was an additional Option 5 presented which was based on Option 4 while keeping 4Rx optional or variations of the same.

- **Option 5: Define band n104 performance requirements for both 2Rx and 4Rx and consider 4Rx as optional. 3GPP to perform a study on any possible 2Rx exception (as done for 2Rx exception for automotive) and, if confirmed, develop any necessary signalling and 4Rx remains optional. If not confirmed, re-define 4Rx for band n104 as mandatory.**

The comments from each company related to acceptable options had varying degrees of support or other contingencies but, for the purpose of categorization, the moderator has listed companies in the most applicable options given that the verbiage may be further enhanced. Huawei asked to remove “performance” from the options. The moderator will remove in the recommendations. The moderator has summarized the outcome of the discussion below concerning which options could be explored further.

- Option 2 (9): HPE, Broadcom, Charter, Apple, OPPO, Samsung, Xiaomi, vivo, CableLabs
- Option 3 (25): Telecom Italia, Spark NZ, CMCC, Deutsche Telekom, Telstra, Telenor, Huawei, HiSilicon, Ericsson, Telefonica, CBN, Telia, ZTE, CHTTL, Vodafone, CATT, CK Hutchison, China Unicom, China Telecom, Turkcell, Orange, KPN, Futurewei, Nokia, Nokia Shanghai Bell
- Option 4 (17): Telecom Italia, Spark NZ, CMCC, Telstra, Huawei, HiSilicon, Telefonica, CBN, Telia, ZTE, CATT, China Unicom, China Telecom, Turkcell, Futurewei, Nokia, Nokia Shanghai Bell
- Option 5 (6): HPE, Broadcom, Charter, Apple, vivo, CableLabs

The views are similar as during earlier rounds. Additional support for Option 3 was presented by companies that had not commented previously which has led to a clear majority but there is still a wide gap between operators/infrastructure vendors and UE vendors.

For the options that proposed a study (Options 4 and 5), there were approximately two-thirds of the companies that supported the core option (Options 3 and 2, respectively) that were willing to compromise on a study to look at the alternative view. This is encouraging that a good number of companies believe that whichever choice that we take at this point can be further explored.

Certainly, we have not been able to achieve consensus. Given the clear majority view and strong support from operators, the moderator proposes to recommend Option 4 as it provides Option 3 as the baseline (majority view) and allows for further study on possible relaxation which was supported as a compromise by approximately two-thirds of the companies supporting Option 3.

Update after Friday GTW:

Some proposed text changes were requested to Option 4 for clarity which are captured in the final conclusions below.

2 Final Conclusions

The moderator recommendations for the discussion [97e-29-4Rx-6GHz] can be found below.

1) The following way forward is asked to be captured in the meeting minutes related to [2].

Moderator Way Forward:

- **Define band n104 requirements with 4Rx as baseline. RAN4 to perform a study on any possible 2Rx exception (as done for 2Rx exception for automotive) and, if confirmed, identify the necessary specification impact (e.g. requirements, signalling) for the 2Rx exception to be used.**

2) The following Tdocs can be noted.

[1] RP-222361

[2] RP-222511

3 References

[1] RP-222361: Discussion on 4Rx for 6GHz bands; vivo

[2] RP-222511: 4Rx support for band n104; Huawei, HiSilicon, China Telecom, Orange, Telecom Italia, Telefonica, Bouygues Telecom, Deutsche Telekom, Telenor, CBN, Vodafone