**3GPP TSG-RAN WG4 Meeting # 98-e R4-20xxxxx**

**Electronic Meeting, Jan. 25th – Feb. 5th, 2021**

**Agenda item:** 9.35

**Source:** Moderator (Nokia)

**Title:** Email discussion summary for [98e][133] NR\_6GHz\_unlic\_EU

**Document for:** Information

# Introduction

In RAN#90 WID on introduction of lower 6GHz NR unlicensed operation for Europe [RP-202592]. Objectives of the WI are:

The objectives of the core part work item are:

* Depending on the details of the European regulatory requirements, determine whether they are best handled by relevant updates (if any) of band n96 or whether a new band is needed.
	+ If a new band is needed, determine the band plan for unlicensed operation in the range 5945-6425 MHz
* Define or update (if needed) system parameters such as channel bandwidths and channel arrangements
* Define or update (if needed) transmitter and receiver characteristics requirements for the UE
* Define or update (if needed) transmitter and receiver characteristics requirements for the BS

The objective of the performance part work item is:

* Define or update (if needed) conformance requirements for BS testing.

According to proposed work plan the target for this meeting is:

* 3GPP RAN4#98-e (Jan. 2021)
	+ Agree or endorse on the work plan, TR 38.849 skeleton and revised WID if any updates;
	+ Agree if the frequency range for unlicensed operation in Europe are best introduced to the specification by relevant updates (if any) of band n96 or whether a new band is needed.
	+ Agree WF or TP to TR 38.849 detailing the remaining work needed to complete the objectives of the WID
	+ Agree work split, if needed, for the WI

# Topic #1: Work plan, TR and WID

This topic is aiming to agree the TR 38.849 v0.0.0 skeleton and if needed TPs to be included in TR 38.849 v0.1.0 which have been reserved for this. Further, it is proposed to approve a work plan for the WI.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2101927 | Nokia | Skeleton TR 38.849 v0.0.0 for Agreement |
| R4-2101928 | Nokia | draft TR 38.849 v0.1.0 for Agreement |
| R4-2101929 | Nokia | Work plan for Introduction of lower 6GHz NR unlicensed operation for Europe for Approval |
| R4-2101965  | ZTE Corporation | **Proposal 4:** to discuss the 100MHz and intra-band contiguous UL CA in the corresponding WID instead of this 6GHz NR unlicensed operation for Europe WID. |

## Open issues summary

As this is the first RAN4 meeting on this WI both work plan and the allocated internal TR skeleton has to be discussed. Further, it is needed to discuss if the WID needs to be modified.

### Sub-topic 1-1

TR skeleton have been proposed by the rapporteur and how to proceed with this TR must be agreed

**Issue 1-1: Agreement of TR skeleton**

* Proposals
	+ **Option 1:** Agree the TR skeleton as in R4-2101927 and provide TPs for additions in coming meetings. TR 38.849 v0.1.0 (R4-2101928) will be updated with agreed TPs, if any, at this meeting.
	+ **Option 2:**  Modify the proposed TR skeleton by providing TPs at this meeting and based on consensus agree the modified version as TR 38.849 v0.1.0 (R4-2101928).
* Recommended WF
	+ Agree option 1

### Sub-topic 1-2

A work plan have been proposed by the rapporteur and how to proceed with this WI must be agreed

**Issue 1-2: Agreement on work plan**

* Proposals
	+ **Option 1:** Agree the work plan as in R4-2101929
	+ **Option 2:** Further discuss and if needed modify the workplan
* Recommended WF
	+ Agree option 1

### Sub-topic 1-3

To form and overview of which sections of the specifications identified in the WID will be impacted by the introduction of lower 6GHz NR unlicensed operation for Europe. Companies are invited to provide their inputs in the table below.

**Issue 1-3: Impacted Specifications**

|  |  |  |
| --- | --- | --- |
| **TS** | **Section1** | **Notes** |
| 38.101-1 | 5.2, 5.4.2.3, 5.4.3.3, 6.2F, 7.3F, 7.6F |  |
| 38.133 | 3.5.2 |  |
| 38.104 | 5.2, 5.4.2.3, 5.4.3.3, 6.6.1, 6.6.3.2, 6.6.4.2, 6.6.5.2, 7.2.2, 7.3.2, 7.4.1.2, 7.4.2.2, 7.6.2, 7.7.2, 7.8.2 |  |
| 38.141-1 |  |  |
| 38.141-2 |  |  |
| 36.104 | 6.6.4, 7.6.2 |  |
| 36.141 |  |  |
| 37.104 | 6.6.1, 7.5.2 |  |
| 37.141 |  |  |
| 37.105 | 7.5.2, 9.7.6, 10.6.2, 10.6.3, 10.6.4,  |  |
| 37.145-1 |  |  |
| 37.145-2 |  |  |
| Note 1 All listed sections might not need changes, additional notes and/or clarifications as this is dependent on how unlicensed operation in the range 5945-6425 MHz is introduced. |

* Proposals
	+ **Option 1:** Include the table of impacted TS in the TR
	+ **Option 2:** Do not include the table of impacted TS in the TR
* Recommended WF
	+ Agree one of the listed options

### Sub-topic 1-4

In the contribution R4-2101965 it is proposed that the discussion of introduction of 100MHz channels for NR-U and intra-band contiguous UL CA is conducted in the corresponding WID instead of this 6GHz NR unlicensed operation for Europe WID.

**Issue 1-4: Discussion on 100 MHz CBW and UL CA**

* Proposals
	+ **Option 1:** Leave discussion on 100MHz channels for NR-U and intra-band contiguous UL CA for other agendas (WIDs were it is/might be included) as proposed in R4-2101965
	+ **Option 2:** Further discuss and if needed modify the WID on introduction of lower 6GHz NR unlicensed operation for Europe [RP-202592] to include these topics
	+ **Option 3:** This is a RAN discussion and no further discussion is needed this RAN4 meeting.
* Recommended WF
	+ Agree one of the listed options

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc. | Sub Topic 1-4 : Discussion on 100 MHz CBW and UL CAA question for clarification, in the last Plenary meeting, RAN#90-e, there was a WF, RP-202752 WF on handling of NR-U leftovers that was noted but the conclusion endorsed which concluded the following: * *For the introduction of 100 MHz channel BW*
	+ *The NR\_bands\_R17\_BWs WID should be modified to add this new objective*
	+ *Papers and discussion related to 100 MHz NR-U shall not be treated by block approval within this work item*

Would this conclusion be in agreement with Option 1 (“Leave discussion on 100MHz channels for NR-U and intra-band contiguous UL CA for other agendas”) in Issue 1-4? If so, we agree with option 1 |
| Apple | Issue 1-4: As discussed and agreed during the RAN#90 meeting, 100MHz channel bandwidth for NR-U and UL CA will be handled in other agenda items. So, we support Option 1. |
| Skyworks | Issue 1-4: as agreed in RAN plenary, the 100MHZ BW can be handled in other agenda item but we need to make a formal request for this towards NR\_bands\_R17\_BWs WI at next RAN plenary. May be we can use this thread to decide whether such request should be made and for which bands. In our view 100MHz should at least be applicable for 6GHz band in the US and Europe. Apllying to n46 is not a priority and can be decided once 100MHz is in place for n96 |
| Nokia | Issue 1-3: Some sections have been added to the list. The added sections are based on a quick review why more impacted sections might exist. It should be noted that the list is only intended to help plan future work implementing unlicensed operation in the range 5945-6425 MHz to the specification.Issue 1-4: We are also of the understanding that this has already been agreed at RAN#90. Meaning option 1 and 3 are both fine with us. |
| ZTE | Issue 1-3: It is good to review the impact due to introduction of EU 6GHz, however we think this is not necessary to be captured in TR.Issue 1-4: option 1  |
| Huawei | Issue 1-3: if such a list is necessary then add it after the affected sections have been discussed.Issue 1-4: Option 1 follow the RAN plenary decision, new proposal should be discussed in RAN meeting. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1-1** | *Tentative agreements:* Agree draftTR skeleton (R4-2101927)*Candidate options:* No issues were raised for the draftTR skeleton (R4-2101927) hence it can be agreed. *Recommendations for 2nd round:* No further discussion is needed. draftTR update (R4-2101928) can be kept as placeholder for potential agreements. |
| **Sub-topic#1-2** | *Tentative agreements:* Agree workplan (R4-2101929)*Candidate options:* No issues were raised for the workplan (R4-2101929), hence it can be agreed. *Recommendations for 2nd round:* No further discussion is needed. |
| **Sub-topic#1-3** | *Tentative agreements:* Do not capture the table in TR (Option 2)*Candidate options:* Companies did not find the proposed table necessary to be included in the TR. It will be kept in the summary for information.*Recommendations for 2nd round:* No further discussion is needed. |
| **Sub-topic#1-4** | *Tentative agreements:* Leave discussion on 100MHz channels for NR-U and intra-band contiguous UL CA for other agendas (WIDs were it is/might be included) - (Option 1)*Candidate options:* No companies objected to option 1. One company wanted further discussion on 100MHz channels for n96 but since 100MHz channels belong to other WIs other companies wanted to keep the discussion there.*Recommendations for 2nd round:* No further discussion is needed |

### CRs/TPs/TR/Workplan

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| R4-2101927 | To be Agreed  |
| R4-2101929 | To be Agreed  |

## Discussion on 2nd round (if applicable)

None

## Summary on 2nd round (if applicable)

None

# Topic #2: Band plan

The contributions and proposals/observations related to the band plan for the introduction of lower 6GHz NR unlicensed operation for Europe is discussed under this topic and the contributions and relevant proposals/observations have been included in the Table 2.1.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100514 | Apple Inc. | **Proposal 1:** Leverage existing band n96 to support license-exempt usage of the 6GHz band in CEPT countries.**Proposal 2b:** Discuss further whether 3GPP specifications have to support CEPT VLP. |
| R4-2100546 | Skyworks Solutions Inc. | **Proposal 1:*** LPI device use case is prioritized
* VLP Narrow band use case is out of scope
* Further clarification of wideband VLP use cases may be needed, at this point we suggest it is considered

**Proposal 2 on band definition:*** Band n96 is reused for UE operation in European unlicensed band
* Operation is restricted to the 5945-6425MHz range and corresponding 20, 40, 60 and 80 MHz channels
* FSS whether a specific sub-band is introduced for the BS
* Band n96 receiver requirements are used as is
* Band n96 MPR, ACLR and spectrum mask definitions are used as is
 |
| R4-2101965  | ZTE Corporation | **Proposal 1:** to define 5925-6425MHz for Europe unlicensed operation as n99. **Proposal 2:** Applicable NR-ARFCN for band n99:for 20 MHz channel bandwidth, NREF = {797000, 798332, 799668, 801000, 802332, 803668, 805000, 806332, 807668, 809000, 810332, 811668, 813000, 814332, 815668, 817000, 818332, 819668, 821000, 822332, 823668, 825000, 826332, 827668}for 40 MHz channel bandwidth, NREF = {797668, 800332, 803000, 805668, 808332, 811000, 813668, 816332, 819000, 821668, 824332, 827000}for 60 MHz channel bandwidth, NREF = {798332, 799668, 803668, 805000, 809000, 810332, 814332, 815668, 819668, 821000, 825000, 826332}for 80 MHz channel bandwidth, NREF = {799000, 804332, 809668, 815000, 820332, 825668,}**Proposal 3:** Applicable GSCN for band n99GSCN = {9548, 9562, 9576, 9590, 9603, 9617, 9631, 9645, 9659, 9673, 9687, 9701, 9714, 9728, 9742, 9756, 9770, 9784, 9798, 9812, 9826, 9840, 9853, 9867} |
| R4-2101930 | Nokia | **Observation 1:** The same efforts for channel arrangement alignment to other technologies intended deployed in the frequency range as used for the design of n96 should be applied. **Observation 2:** There is no need to modify or add additional channel bandwidths, channel or synchronization raster points as already defined for band n96. **Proposal 1:** Introduce the 5945 MHz to 6425 MHz frequency range for unlicensed operation in Europe using already defined band n96 with relevant modifications. |

## Open issues summary

It is needed to come to an agreement if a new band should be defined or existing n96 can be updated. Further, two types of deployments are defined by ECC as described in detail in TR 37.890. It is needed to discuss if both types of deployments can be supported.

### Sub-topic 2-1

Discussion on if a new band should be defined or existing n96 can be updated.

**Issue 2-1a: Band Plan**

* Proposals
	+ **Option 1a:** Introduce unlicensed operation in the range 5945-6425 MHz by re-using band n96 (with additional notes or clarifications if needed).
	+ **Option 2a:** Introduce unlicensed operation in the range 5945-6425 MHz by a new band n[xx]
* Recommended WF
	+ Agree one of the listed options

**Issue 2-1b: ARFCN and GSCN**

* Proposals
	+ **Option 1b:** There is no need to modify or change NR-ARFCN and GSCN
	+ **Option 2b:** NR-ARFCN and GSCN should be discussed further.
* Recommended WF
	+ Agree one of the listed options

### Sub-topic 2-2

Discussion on if both LPI and VLP as define din TR 37-890 should be supported by 3GPP specification.

**Issue 2-2: Band Plan**

* Proposals
	+ **Option 1:** Introduce only LPI in 3GPP specification.
	+ **Option 2:** Prioritize LPI in 3GPP specification, VLP can be added at a later stage if found needed.
	+ **Option 3:** Introduce both LPI and VLP in 3GPP specification.
* Recommended WF
	+ Agree one of the listed options

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc | Issue 2-1a: Option 1a is agreeable with us as long as it does not change the current specs approved for n96 (US band)Issue 2-1b: We agree with option 1b as it reflects the approval reached for n96 (US band)Issue 2-2: As long as the NS values for n96 (US band) are not change then perhaps Skyworks proposal in R4-2100546 defining new NS values (55?, 56?) might be a good way forwardOthers: |
| Qualcomm | Issue 2-1a: Either is ok with a slight preference to option 1a to reduce band numbers. However, with option 1a coexistence and CA may become more cumbersome since the band is wider and more harmonic and IMD will end up falling into it.Issue 2-1b: If Band n96 is reused, the ARFCN and GSCN do not need to be changed. However, it may be helpful to include an indication that a sub-set of values corresponding to the frequency range 5945 – 6425 MHz is applicable in Europe.Issue 2-2: We support Option 3 to include both LPI and VLP into 3GPP specifications |
| Apple | Issue 2-1a: We support Option 1a, i.e. leverage existing band n96@**Charter**: At least our understanding is that by leveraging band n96 for CEPT/EU we will not impact 6GHz band for the US market. Issue 2-1b: We can re-use existing ARFCN and GSCN values. We can also add the corresponding clarifications, as proposed by Qualcomm, to indicate that certain values are applicable only to CEPT/EU.Issue 2-2: According to the CEPT regulatory framework, VLP mode is applicable only to portable battery powered devices, which to our understanding excludes the notion of the VLP NR-U base station, at least the way we know it. Nevertheless, we are open for further checking with companies whether VLP NR-U base stations would fit the CEPT regulations. Based on that our preference is to focus on LPI before all the regulatory peculiarities are clarified.  |
| Skyworks | Issue 2-1a: we support option 1 reusing n96. The channelization is already compatible with CEPT regulation by providing 10MHz guardband to rail ITS channel and no impact to US operation is expected (20MHz guard band to OOB requirement below the band)Issue 2-1b: In our paper we proposed to clarify in the spec which Channel and SSB raster points are valid for CEPT from the n95 list. We proposed to link that to the related NS but we are open to other approaches.Issue 2-2: for VLP devices only portable application seems allowed from regulation. We can start focussing on LPI mode and come back to VLP once a clear use case is identified for the UE side. We are OK to evaluate AMPR related to VLP devices as we should have the info from our measurements but would like to hold introducing in the spec before we have a clear use case (UE to UE?, outdoor UE to indoor BS….?) |
| Nokia | Issue 2-1a: Option 1a – we do not see the need for a new band as existing n96 can be utilized.Issue 2-1b: Option 1b – there should be no need to modify or change NR-ARFCN and GSCN. If an additional note is needed or the existing note for n96 should be modified to limit the available range for EU can be further discussed.Issue 2-2: Our preference is option 3 but can accept option 2 as we understand that the discussions about VLP devices have just started in ETSI BRAN (European 6 GHz Harmonized Standard), following the outcomes of the ECC Plenary meeting in December. VLP devices will be taken into account within the 6 GHz Harmonized Standard, hence we do think 3GPP support should be introduced. If we can not find consensus for option 1 we would propose to capture option 2 in an agreed WF.  |
| ZTE | Issue 2-1a: Option 1a might be feasible for UE side with additional requirement proposed by companies,However for BS side, if reusing the Fobue and Foobb of n96 for Europe 6GHz, then it will have great impacts on EU upper licensed 6GHz, therefore new band is more preferred from BS side, or at least sub band like n96a should be added. Issue 2-1b: At least we need to indicate the NR-ARFCN and GSCN for EU 6GHz, otherwise the readability is bad.Issue 2-2: Fine with option 2. |
| Ericsson | Issue 2-1a: We would prefer option 2a but will not object to option 1a (then, it should be clearly stated that n96 is restricted to 5945-6425 in Europe). See also response to Issue 2-2 regarding use of NS values.Issue 2-1b: option 1b but adding limitations on the values for Europe.Issue 2-2: Option 2 would be preferable. The proposal to manage both LPI and VLP via NS might be a good approach, nevertheless it might be problematic for EU certification: most of the minimum requirements (not only some additional limits as it’s used to be) would be based on the reception of this NS, it’s questionable if the European Commission would accept this… |
| Huawei | Issue 2-1a: option 2a, to better define the co-existence limits for BS and MSD issue for UE, it is not clear how for the BS (which takes a band centric approach) the in-band emissions for band n96 can be resolved to meet the out of band emissions for the EU spectrum, the EU restrictions would need to create a new in-band/oob split as such is this any different from a new band? If these limits can be added somehow as addition requirements then ok |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#2-1** | *Tentative agreements:* NR-ARFCN and GSCN already defined for n96 should be reused in the frequency range applicable to 6GHz NR unlicensed operation in Europe. How to make this restriction is still FFS. *Candidate options:* 5 companies preferred to introduce 6GHz NR unlicensed operation for Europe by leveraging already defined n96 (Option 1a) while 3 companies preferred a new band (Option 2a). However, one of the companies preferring Option 2a would be also Ok with re-using existing band n96 and another company would be also ok with re-using existing band if OOB limits for EU can be addressed. No companies wanted to define other NR-ARFCN and GSCN than already defined for n96. *Recommendations for 2nd round:* It seems most compagnies are okay to proceed with option 1a if some concerns can be addressed. Therefor it is suggested to further discuss how to introduce 6GHz NR unlicensed operation for Europe based on this option. A WF is requested with the ambition to capture an agreement on how to introduce 6GHz NR unlicensed operation for Europe this meeting. |
| **Sub-topic#2-2** | *Tentative agreements:* Prioritize LPI deployment introduction to 3GPP specification. VLP deployment is still FFS. *Candidate options:* Companies were either okay with introducing VLP or wanted to study further its use-case. No companies expressed concerns with LPI.*Recommendations for 2nd round:* Further discuss how to capture the tentative agreement above in requested WF. |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | WF on introduction of lower 6GHz NR unlicensed operation for Europe | Nokia |

### CRs/TPs

None

## Discussion on 2nd round (if applicable)

|  |  |
| --- | --- |
| **Company** | **Comments** |
| BT plc. | For ‘**issue 2-1a**’: we favour the introduction of a new 6 GHz NR-U band for Europe, 5945-6425 MHz ( **‘option 2A’** ).This is needed to limit mobile to mobile and base station to base station interference, from the 6 GHz NR-U band ( 5945-6425 MHz ) into the 6 GHz IMT band ( 6425-7125 MHz ).At present ECC Decision (20)01 doesn’t define out-of-band emissions above 6425 MHz.Considering f) states,*“there is no out-of-band emissions (OOBE) limit included in this ECC Decision, to protect adjacent incumbents operating above 6425 MHz, as the same incumbents will be operating co-channel with WAS/RLAN below 6425 MHz;”.*The ECC Decision has only considered existing incumbents. Hence, 3GPP RAN4 should anticipate that more stringent out-of-band emission limits will be required following WRC23; to protect 6 GHz IMT systems in Europe. **We do not believe it will be possible to protect 6 GHz IMT systems using the current NR band n96. Hence, a new 6 GHz NR-U band for Europe ( 5945-6425 MHz ) will be required after WRC23.**Our proposed **‘Way Forward’** would be to introduce a new 6 GHz NR-U band for Europe ( 5945-6425 MHz ) based on the out-of-band emissions defined by ECC Decision (20)01; assuming more stringent out-of-band emission limits may be required after WRC23. Having a specific 6 GHz NR-U band just for Europe will simplify any future modifications to introduce more stringent out-of-band emissions to the RAN4 specifications, compared to modifying NR band n96.  |
| Deutsche Telekom | Issue 2-1a: We support **option 2A** and the introduction of a new 6GHz band to address emission issues and ensure protecting upper IMT band. |
| Qualcomm | A question for BT and DT. Your proposal is to define a new band in anticipation that there might be a licensed band made available at some point in the future and therefore some emission requirement to protect this licensed band writing “assuming more stringent out-of-band emission limits may be required after WRC23.” We don’t know what those requirements are, so I don’t know how to write specifications or design a product without the benefit of a crystal ball. We have a very similar situation with VLP where the protection may change from -45 dBm/MHz to some other unknown value in the future. Qualcomm’s proposal was to go with what we know today and modify in the future if needed. Remember also that at RAN plenary, there was opposition to even start the work until regulations are available. If you are saying that regulations are not fully available today, are you suggesting to wait until they do become available after WRC23? I don’t believe that is your intention. So my proposal is to define requirements based on what is available today and only that, without prejudice about what may transpire in the future. Therefore, I am still in favor of option 1a. |
| Skyworks | We do not see the reason to introduce a new band as the regulation is clear that no specific protection is required for frequencies > 6425MHz. If any was introduced it would still be feasible to support it via NS and A-MPR on the UE side, for BS a sub-range can always be defined and supported like for n46. There is no reason to penalise NRU use in a UE in 5945-6425MHz compared to WiFi devices that will not implement filter for the 6GHz unlicensed band in Europenor are required to protect frequencies > 5425MHz. Furthermore there is already a separation as operation outdoor will only see interference from VLP devices and not LPI devices.Band n96 should be reused with restriction on usable channels and NS for A-MPR requirement linked to OOB emissions. No filter should be assumed for this. |
| Ericsson | To further clarify our comment from the 1st round: we could not agree on reusing n96 as long as the situation on the NS usage to introduce the main UE requirements for Europe is not clarified. As commented earlier, if the intention is to make conditional most of applicable UE requirements upon NS criterion (without minimum limit if no NS), as proposed in R4-2100546, the acceptance of such approach shall first be checked. This frequency range is for Europe, the way requirements are specified shall be then aligned with European rules. We don’t think then we could conclude now on reusing n96. If a quick decision is expected, the easiest and fastest way forward would be to introduce a new band. |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: UE related

Discussions related to how the introduction of unlicensed operation in the range 5945-6425 MHz for the UE specification shall be treated.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100514 | Apple Inc. | **Proposal 2a:** Introduce new NS flag(s) to support CEPT regulatory requirements on the 3GPP band n96 (6GHz band). |
| R4-2100546 | Skyworks Solutions Inc. | **Proposal 2 on band definition:*** Band n96 is reused for UE operation in European unlicensed band
* Operation is restricted to the 5945-6425MHz range and corresponding 20, 40, 60 and 80 MHz channels
* FSS whether a specific sub-band is introduced for the BS
* Band n96 receiver requirements are used as is
* Band n96 MPR, ACLR and spectrum mask definitions are used as is

**Proposal 3 for A-MPR:*** Two new Band n96 NS are introduced to cover VLP and LPI UE devices
* Band n96 PC5 definition is used to assess VLP and LPI device A-MPR
* A mechanism is needed to limit MOP to 14dBm for VLP devices
* FFS if PC3 using two PC5 power amplifiers for LPI device is introduced
 |
| R4-2101930 | Nokia | **Observation 1:** The same efforts for channel arrangement alignment to other technologies intended deployed in the frequency range as used for the design of n96 should be applied. **Observation 2:** There is no need to modify or add additional channel bandwidths, channel or synchronization raster points as already defined for band n96. **Observation 3:** The European utilization of band n96 could be restricted done by modifying the notes in 38.101-1 Table 5.4.2.3-3 and Table 5.4.3.3-1 and/or as a frequency restriction in the NS defined for European deployment. **Observation 4:** NS\_[xx] and NS\_[yy] corresponding to deployments defined in EN 303 687 shall be defined in 38.101-1. **Observation 5:** A-MPR values needs to be studied and verified for NS\_[xx] and NS\_[yy].**Observation 6:** Spurious emission requirements shall be added for NS\_[xx] and NS\_[yy] in accordance with EN 303 687. **Observation 7:** There is no need to modify or add additional receiver requirements besides the ones already defined for band n96. **Observation 8:** If band n96 is to be reused with additional NS defined Note 14 in Table 5.2-1 of TS 38.101-1 shall be modified. **Proposal 1:** Introduce the 5945 MHz to 6425 MHz frequency range for unlicensed operation in Europe using already defined band n96 with relevant modifications. |
| R4-2102416 | Qualcomm Incorporated | **Proposal 1:** It is proposed to define two NS values for the new band: NS\_XX for LPI and NS\_YY for VLP. **Proposal 2:** 0 dBi antenna gain is assumed for the purpose of deriving 3GPP specifications on MOP, PSD, and ASE.**Proposal 3:** Adopt option 1 whereby only the known requirement of -45 dBm/MHz additional spurious emission for VLP is adopted today. If the requirement is modified in the future, specification changes can be evaluated at that time after there is certainty in the requirement.**Proposal 4:** Filter rejection is not assumed in deriving A-MPR to meet the spurious emission requirement at 5935 MHz.**Proposal 5:** The same PA model and calibration setpoint from Band n96 studies is used in the evaluation of A-MPR for this band for PC5. PA model for other power classes to be further discussed. |

## Open issues summary

### Sub-topic 3-1

Discussion on how to define the assumption for antenna gain when choosing applicable power classes for VLP and/or LPI deployments.

**Issue 3-1: Antenna gain assumption**

* Proposals
	+ **Option 1**: VLP is either not considered or added at a later stage. For LPI 0 dBi antenna gain is assumed for the purpose of deriving 3GPP specifications on MOP, PSD, and ASE.
	+ **Option 2:** VLP is added by defining a new power class corresponding to the allowed 14dBm. For both VLP and LPI 0 dBi antenna gain is assumed for the purpose of deriving 3GPP specifications on MOP, PSD, and ASE.
	+ **Option 3:** Another antenna gain is to be assumed when deriving 3GPP specifications on MOP, PSD, and ASE and should be discussed further.
* Recommended WF
	+ Agree one of the listed options

### Sub-topic 3-2

Discussion on how to define NS\_[xx] and/or NS\_[yy].

**Issue 3-2: NS definition**

* Proposals
	+ **Option 1:** Define NS\_[xx] and NS\_[yy] using the TP provided in R4-2100546
	+ **Option 2:** Further discuss how to define NS\_[xx] and/or NS\_[yy] on the bases of TP provided in R4-2100546 in this RAN4 meeting.
	+ **Option 3**: Further discuss how to define NS\_[xx] and/or NS\_[yy] on the bases of TPs provided for next RAN4 meeting.
* Recommended WF
	+ Agree one of the listed options

### Sub-topic 3-3

Discussion on how to asses and define A-MPR for unlicensed operation in the range 5945-6425 MHz.

**Issue 3-3: A-MPR**

* Proposals
	+ **Option 1:** A-MPR for PC5 is assessed using band n96 PC5 definitions for VLP and LPI device A-MPR. Further, no filter rejection is assumed at 5935 MHz for spurious emissions and same PA model and calibration setpoint from Band n96 is to be used. A-MPR for other power classes are to be added at a later stage. A-MPR studies for PC5 are to be compared and decided at next RAN4 meeting.
	+ **Option 2:** Discuss how to define A-MPR for unlicensed operation in the range 5945-6425 MHz further.
* Recommended WF
	+ Agree one of the listed options

### Sub-topic 3-4

The modified additional spurious emission for VLP might be changed by ECC after January 1, 2025 from -45 dBm/MHz to -37 dBm/MHz.

**Issue 3-4: Additional spurious emission**

* Proposals
	+ **Option 1:** Define NS for the limit currently defined at -45 dBm/MHz and then later, if the new limit takes effect, modify the NS to reflect the ECC limits.
	+ **Option 2:** Already now define two different NSs for the two different spurious emission limits.
* Recommended WF
	+ Agree one of the listed options

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Charter Communications Inc | Issue 3-2: We are in agreement with option 1Issue 3-3: We are in agreement with option 1 |
| Qualcomm | Issue 3-1: We tend to support option 2, although we would appreciate more discussion before agreeing to define another power class for VLP.Issue 3-2: Option 2. One aspect we suggest further discussion on is whether NS\_XX should also indicate the maximum output power of 14 dBm. This could enable a PC5 or PC3 device to also connect to a VLP network with reduced power.Issue 3-3: Option 1 sounds good Issue 3-4: Option 1 |
| Apple | Issue 3-1: As commented for issue 2-2, the first step is to clarify whether VLP NR-U base stations fit the CEPT regulatory framework. After that we can discuss further technical details of e.g. a new power class for VLP.Issue 3-2: We are fine with either Option 1 or 2. We are also technically Ok with the principle of defining a new NS flag for VLP provided that all the regulatory aspects are clarified first.Issue 3-3: Option 1 Issue 3-4: Option 1 (provided that 3GPP concludes that VLP can be added into the 3GPP specifications) |
| Skyworks | 3-1: Aside the comments already provided for the use case for VLP devices we do not see the need for a new power class or antenna gain for VLP devices. The 14dBm/MHz can be supported via PC5 AMPR if needed as there is no need to have a separate HW whether the UE in outdoor or indoor. So if needed option 1 should be the assumption3-2: OK with option 1 or 2 and assign NS to VLP if needed3-3: Option 1 is aligned with our contribution3-4: option 1, modified MPR can be used later if regulation is changed |
| Nokia | Issue 3-1: Perhaps a missing option is “For both LPI and VLP 0 dBi antenna gain is assumed for the purpose of deriving 3GPP specifications on MOP, PSD, and ASE” If a new power class is needed for VLP can be discussed further. To respond to Apple we do not see VLP fitting a NR-U base station based on the ECC Decision quote: “The VLP device is a portable device”.Issue 3-2: Option 2 – we are fine to discuss based on TP provided in R4-2100546Issue 3-3: Option 1.Issue 3-4: Option 1. |
| Ericsson | Issue 3-1: We would prefer option 1. The 0 dBi antenna gain is fine but this should be captured somehow to avoid any ambiguity.Issue 3-2: Option 3: as mentioned in issue 2-2, we are not sure if the NS approach (most of the UE basic requirements would be determined via NS, not only the additional ones… this is new concept) would be acceptable for EU certification, this would need to be investigated…Issue 3-4: Option 1 would be ok if the NS approach is acceptable, btu that has to be confirmed. |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Sub-topic#3-1** | *Tentative agreements:* 0 dBi antenna gain is assumed for the purpose of deriving 3GPP specifications on MOP, PSD, and ASE for LPI deployments and if introduced also VLP deployments. *Candidate options:* Companies had some concerns due to the VLP use-case still being FFS but for LPI were fine with the assumptions. *Recommendations for 2nd round:* Further discuss how to capture the tentative agreement above in requested WF in Topic 2. |
| **Sub-topic#3-2** | *Tentative agreements:* None. *Candidate options:* Companies in general was okay with option 2, *Further discuss how to define NS\_[xx] and/or NS\_[yy] on the bases of TP provided in R4-2100546 in this RAN4 meeting.* The remaining company preferred to defer the NS discussion to next meeting to ensure the approach was acceptable for EU certification. *Recommendations for 2nd round:* Further discuss. |
| **Sub-topic#3-3** | *Tentative agreements:* A-MPR for PC5 is assessed using band n96 PC5 definitions for VLP and LPI device A-MPR. Further, no filter rejection is assumed at 5935 MHz for spurious emissions and same PA model and calibration setpoint from Band n96 is to be used. A-MPR for other power classes are to be added at a later stage. A-MPR studies for PC5 are to be compared and decided at next RAN4 meeting. *Candidate options:* No companies expressed concerns with option 1, the tentative agreement above. *Recommendations for 2nd round:* Capture the tentative agreement in WF requested under Topic 2. |
| **Sub-topic#3-4** | *Tentative agreements:* Define NS for the limit currently defined by ECC at -45 dBm/MHz and then later, if a new limit takes effect, modify the NS to reflect the ECC limits. *Candidate options:* No companies expressed concerns with option 1, the tentative agreement above, except one who wanted to confirm the NS approach was acceptable for EU certification. Since this is not directly related it is proposed to capture the agreement as any changes from ECC can be adopted at a later stage. *Recommendations for 2nd round:* Capture the tentative agreement in WF requested under Topic 2. |

## Discussion on 2nd round (if applicable)

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| **Company** | **Comments** |
| Qualcomm | On the draft WF for A-MPR simulations, the statement “A-MPR studies for PC5 are to be compared and decided at the next RAN4 meeting” might be too optimistic. Next meeting will be the first meeting that companies might be presenting simulation results and measurements, so companies may not be in a position to decide at that moment. |
| Skyworks | We will be able to present measurement results for back-off both LPI and VLP OOB emissions and in-band PSD. It is hard to agreed today that we will be able to decide A-MPR in the first meeting we see results from companies. |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #4: BS related

Discussions related to how the introduction of unlicensed operation in the range 5945-6425 MHz for the BS specification shall be treated.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2101931 | Nokia | **Observation 1:** The same efforts for channel arrangement alignment to other technologies intended deployed in the frequency range as used for the design of n96 should be applied. **Observation 2:** There is no need to modify or add additional channel bandwidths, channel or synchronization raster points as already defined for band n96. **Observation 3:** The European utilization of band n96 could be restricted done by modifying the notes in 38.104 Table 5.4.2.3-1 Table 5.4.3.3-1. **Observation 4:** There is no need to modify or add additional requirements for output power besides the ones already defined for band n96. **Observation 5:** There is no need to modify or add additional unwanted emission requirements besides the ones already defined for band n96. **Observation 6:** There is no need to modify or add receiver requirements besides the ones already defined for band n96. **Observation 7:** If band n96 is to be reused Note 4 in Table 5.2-1 of TS 38.104 shall be modified. **Proposal 1:** Introduce the 5945 MHz to 6425 MHz frequency range for unlicensed operation in Europe using already defined band n96 with relevant modifications. |
| R4-2101966  | ZTE Corporation | **Proposal 1:** adopt the proposals in Table 1 (below).

|  |
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| **General part** |
|  (such as BS channel bandwidth, NR-ARFCN, channel arrangement. etc) | For the operating band 5925-6425MHz, it’s different from n96, therefore new band definition is needed, the corresponding channel raster, sync raster should be defined in general section. |
| **Tx part** |
| Base station output power  | All of these requirements are defined as band or channel bandwidth agnostic except for output power dynamics. i.e. no impact with introduction of Europe unlicensed 6GHz. |
| Output power dynamics |
| Transmit ON/OFF power |
| Transmitted signal quality |
| OBW |
| Tx intermodulation |
| ACLR | The requirement of US n96 should be applied for Europe unlicensed 6GHz. |
| Operating band unwanted emissions  | UEM requirements are defined as band dependent, UEM mask of US n96 should be also reused for Europe unlicensed 6GHz, however ΔfOBUE for Europe unlicensed 6GHz should follow the legacy offset ΔfOBUE as its frequency spanning range is still within maximum frequency spanning range of n77.  |
| Transmitter spurious emissions | Spurious emission requirement for n96 could also been applied for Europe unlicensed 6GHz. |
| Rx part |
| (such as REFSEN, dynamic range, blocking, ACS, RX IMD, Rx spurious emission etc) | The Rx requirements e.g. REFSEN,dynamic range, ICS requirement, ACS, IBB, RX IMD are dependent. |
| OOBB | Similar reason of Operating band unwanted emissions could also be applied for OOBB, therefore the legacy offset ΔfOOBB could be applied for Europe unlicensed 6GHz. |

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## Open issues summary

Except for the ΔfOBUE it seems there is no disagreement on what is needed to be modified to introduce unlicensed operation in the range 5945-6425 MHz. However, whether a new band should be defined or modifications should be done to band n96 is still to be resolved.

### Sub-topic 4-1

Discussion on ΔfOBUE for unlicensed operation in the range 5945-6425 MHz should follow band n46 or band n96.

**Issue 4-1**: **ΔfOBUE/** **ΔfOOBB**

* Proposals
	+ **Option 1:** Follow n46.
	+ **Option 2:** Follow n96.
* Recommended WF
	+ Agree one of the listed options

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Issue 4-1: Option 2Sub topic 2-2:….Others: |
| Skyworks  | 4-1: option 2 follow n96 |
| Nokia | Issue 4-1: Option 2 |
| ZTE | Option 1, since Foobb and Fobue is tightly related with frequency spanning range of certain band, Now EU unlicensed 6GHz is much narrower than n96, then requirements could be discussed. |
| Ericsson | See raised comments below on BS max output power and REFSENS, those issues need to be addressed. |
| Huawei | 4-1: Here the sub-band and the full band are in conflict as the sub-band by current spec is 480MHz and hence would have a f\_OBUE value of 40MHz, but band n96 is 1200MHz so has f\_OBUE of 50MHz (the UE regulation also specifies only 10MHz) this is another reason why a new band number is preferred.We would like to further discuss when other TX and RX requirements are decided. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2101967 | Nokia: We can not agree to this draftCR. We do not think a new band should be defined for unlicensed operation in the range 5945-6425 MHz. Also, to our understand is n99 already reserved for another frequency range. |
|  Ericsson: Maximum BS output power is specified in a very open manner, the upper limits specified in ECC DEC(20)01 shall be at least captured here. Also, according to the note 5 in REFSENS tables, there would be no FRC specified, and so no REFSENS requirement specified for this 6GHz band, this issue shall be addressed. |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary**  |
| **Sub-topic#4-1** | *Tentative agreements:* Keep ΔfOBUE/ ΔfOOBB as well as other BS requirements FFS until it is decided if a new band is introduced or not.*Candidate options:* There are concerns on how to restrict/define the BS requirements based on chosen approach for introducing unlicensed operation in the range 5945-6425 MHz. It is too soon to discuss draftCRs, this is the first meeting. *Recommendations for 2nd round:* Further discuss what would need modifications in the BS specification, based on chosen approach for introducing unlicensed operation in the range 5945-6425 MHz  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2101967 | Based on 1st round of comments collection, the draftCR should be noted |

## Discussion on 2nd round (if applicable)

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | As commented on the submitted CR, on top of proposed changes, we have the following points:* Maximum BS output power is specified in a very open manner, the upper limits specified in ECC DEC(20)01 shall be at least captured here.
* According to the note 5 in REFSENS tables, there would be no FRC specified, and so no REFSENS requirement specified for this 6GHz band, this issue shall be addressed.
 |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |