**3GPP TSG-RAN WG4 Meeting #100-e R4-21xxxxx**

**Electronic Meeting, 12th – 20th April, 2021**

**Agenda item:** 8.2

**Source:** Moderator (Apple Inc)

**Title:** Email discussion summary for [100-e][109] NR\_6GHz\_unlic\_full

**Document for:** Information

# Introduction

3GPP Rel-16 NR-U WI specified how the NR technology can be used on the unlicensed spectrum thus offering more resources in frequency bands, such as 5GHz and 6GHz. 5GHz is a well-known band for the unlicensed operation, but 6GHz is a relative new band usage of which was approved recently in different regulatory regions. While the 6GHz band for the US is already part of the Rel-16 core functionality, current 3GPP specifications do not support it for other countries, such as South Korea and Canada, which have finalised their regulatory requirements only recently. Thus, RAN#92 meeting approved a new WI aim of which is to enable support of the 6GHz unlicensed band for those countries and regions that have finalised recently the corresponding regulatory requirements.

The scope of this email discussion will cover three major areas:

- WI work plan and related aspects.

- Summary of the current regulatory status, i.e. which country requirements are common and which ones are completely new.

- System related aspects, such as band plan, required NS values, A-MPR values, etc.

# Topic #1: Introduction of operation in full unlicensed band 5925-7125MHz for NR

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112343 | Apple  | - RAN4#100:- analyse the band plan for the countries, which are in the scope of the WI, to conclude whether band n96 can be re-used;- analyse regulatory requirements for the countries, which are in the scope of the WI, to conclude which existing NS values can be re-used and how many new NS values might be needed;- start working on the required A-MPR values; - RAN4#101:- continue technical work on the required NS values and associated A-MPR requirements;- agree on preliminary A-MPR values;- introduce running CRs for required NS values and associated A-MPR requirements.- RAN4#102:- agree the final CRs implemented all necessary NS values and A-MPR requirements.**Proposal: Agree the proposed work plan for this WI** |
| R4-2113065 | Huawei, HiSilicon | **Proposal: The introduction of VLP should be addressed in the WI in term of power class and regulatory requirements for Canada, Brazil and South Korea.** |
| R4-2112344 | Apple | a) All countries, which are in the scope of this WI, allow the full range of 5925-7125MHz for the unlicensed operation. b) Latin America countries Brazil, Peru and Chile share same parameters for the low power indoor (LPI) mode, which in turn is identical to the US FCC LPI mode for the 6GHz band. c) Unlike Brazil, outdoor operation for the unlicensed 6GHz band is not allowed in Peru and Chile. d) Canada allows three different modes for the 6GHz band: standard power (with AFC), low power indoor and very low power. And it is worth noting that Canadian SP and LPI mode parameters are slightly different when compared to US FCC. e) Even though both Brazil and Canada have the VLP mode defined by the local regulators, they have different parameters (and are different when compared to e.g. EU/CEPT VLP).f) South Korea allows both LPI and VLP modes, whereupon the VLP mode parameters are identical to the EU/CEPT regulations, but the LPI mode parameters are not the same as in e.g. US or EU/CEPT.**Proposal 1: Re-use 3GPP band n96 for Canada, Peru, Chile, Brazil and South Korea.****Proposal 2: Since Peru, Chile and Brazil have the same requirements for the LPI mode, which in turn is identical to the US LPI mode, re-use existing NS\_53 for those countries.** **Proposal 3: Since Canada and South Korea have different LPI mode requirements, two new NS values are needed.****Proposal 4: Defer introduction of the VLP mode for Brazil, Canada and South Korea.** |
| R4-2113066 | Huawei, HiSilion | For Canada LPI operation, new NS may be needed to address in-band 5 dBm/MHz PSD limit for PC5 UEFor Canada VLP operation, new power class and new NS may be needed to address in-band 5 dBm/MHz PSD limit.For Brazil LPI operation, NS\_53 may be reused.For Brazil VLP operation, new power class and new NS may be needed to address in-band -5 dBm/MHz PSD limit and out of band -27 dBm/MHz limit.For Peru and Chile LPI operation, new NS may be needed to address in-band -1 dBm/MHz PSD limit for PC5 UEFor South Korea LPI operation, new NS may be needed to address in-band 2 dBm/MHz PSD limit and out of band limits for PC5 UE.For South Korea VLP operation, new power class and new NS may be needed to address in-band 1 dBm/MHz PSD limit and out of band limits. |
| R4-2112972 | LG Electronics | Observation 1: In the case of South Korea, the legacy RF requirements for n96 UE can be reused, however, there are differences for the in-band emissions requirements between Korea’s technical standards and the 3GPP standards.Observation 2: The following 2 options are available for NS value for LPI UE in Korea 5925-7125MHz. Option 1: RAN4 can reuse NS\_53 for Korea NR-U operation in 5925~7125MHz. Option 2: For the NR-U operation in Korea, RAN4 can define New NS value (NS\_xx) to optimize the A-MPR requirements.**Proposal 1: To comply Korea regulatory requirements, RAN4 needs to specify the new NS value (NS\_xx) to optimize the A-MPR requirements.****Proposal 2: The operating band perspective for NR-U operation in Korea, n96 NR band will be reused.**Observation 3: To support VLP operating mode, new power class in n96 is needed to specify in TS38.101-1. Also, VLP operating mode with +14/+17dBm Power class were requested in EU/UK/Canada/Brazil. The power class 6(+14dBm) was already specified in TS36.101 to support NB-IoT UE.Observation 4: For VLP operating mode, RAN4 needs to specify the A-MPR requirements with new NS\_xy to meet the additional emission requirements (in-band emission and out-of-band emission).**Proposal 3: To support VLP operating mode, RAN4 shall specify the new power class (Power class6: +14dBm) in n96 and specify the A-MPR requirements with New NS\_xy to meet the additional emission requirements.** |
| R4-2112345 | Apple | **Proposal 1: Define A-MPR for NR-U PC5 LPI in Canada as provided in Table 2.1-1.****Proposal 2: Define A-MPR for NR-U PC5 LPI in South Korea as provided in Table 2.2-1.** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1 (WI work plan and scope)

Only one contribution (R4-2112343) was submitted proposing the work plan for this WI.

**Issue 1-1-1: Workplan**

* Proposals
	+ Option 1: WI work plan as proposed in R4-2112343.
* Recommended WF
	+ Agree the WI work plan proposed in R4-2112343.

### Sub-topic 1-2 (Overview of regulatory requirements)

In this sub-topic the general regulatory related aspects are handled. Since not all the countries share same regulatory parameters for the 6GHz unlicensed band, this sub-topic aims at analyzing which countries have same parameters and which parameters are different.

The following paper, submitted to this WI, make a summary of the regulatory related parameters: R4-2113065, R4-2112344, R4-2113066, R4-2112972.

**Issue 1-2-1: Summary of regulatory parameters**

* Recommended WF
	+ Based on the presented information, it is suggested to endorse the following table which summarises which countries have or share the same parameters (max EIRP, PSD, OOBE) and which countries have new ones.

|  |  |
| --- | --- |
| Country | Mode |
| SP | LPI | VLP |
| Canada | (new) | (new) | (new) |
| Brazil | N/A | same as US LPI  | (new) |
| Peru | N/A | same as US LPI | N/A |
| Chile | N/A | same as US LPI | N/A |
| South Korea | N/A | (new) | same as EU/CEPT VLP |
| NOTE 1: Peru and Chile LPI regulatory parameters are the same as US LPI, but there is no -27dBm/MHz out-of-band emission requirement.NOTE 2: South Korea VLP parameters are the same as in EU/CEPT, but out-of-band emission requirement is set to -34dBm/MHz outside the operational range.  |

### Sub-topic 1-3 (System related aspects)

In this sub-topic the regulatory requirements are “translated” into specific 3GPP system parameters. The following issues are considered: band plan, LPI and VLP, required NS values, A-MPR values.

Input from the following papers is considered: R4-2113065, R4-2112344, R4-2112972, R4-2112345.

**Issue 1-3-1: Band plan**

* Proposals
	+ Option 1: Band n96 is used for South Korea (R4-2112972), Canada, Brazil, Chile and Peru (R4-2112344).
	+ *(no other options were proposed)*
* Recommended WF
	+ Agree that existing 3GPP band n96 is used for South Korea, Canada, Brazil, Chile and Peru.

**Issue 1-3-2: Canada**

* Proposals
	+ SP mode: no need for a new NS flag for NR-U PC5 (R4-2113066 and R4-2112344).
	+ LPI mode: a new NS flag is needed (R4-2113066 and R4-2112344)
	+ VLP mode: different views expressed on whether VLP should be added now (R4-2113066 and R4-2112344)
* Recommended WF
	+ Agree that no NS flag is needed for the SP mode in Canada (NOTE: can be confirmed further by simulations).
	+ Agree that a new NS flag is needed for the LPI mode in Canada
	+ VLP should be discussed further.

**Issue 1-3-3: Brazil**

* Proposals
	+ LPI mode: re-use NS\_53 (US LPI) for Brazil (R4-2113066 and R4-2112344).
	+ VLP mode: different views expressed on whether VLP should be added now (R4-2113066 and R4-2112344)
* Recommended WF
	+ Agree that NS\_53 can be re-used for LPI in Brazil.
	+ VLP should be discussed further.

**Issue 1-3-4: Peru and Chile**

* Proposals
	+ LPI mode: while R4-2112344 states that no NS flag is needed because the requirements are the same as in Brazil and US, R4-2113066 mentions that a new NS flag may be needed.
* Recommended WF
	+ Check further whether Peru and Chile can re-use NS\_53 (similar to Brazil LPI).

**Issue 1-3-5: South Korea**

* Proposals
	+ LPI mode: a new NS value is needed (R4-2112344 and R4-2112972).
	+ VLP mode: different views expressed on whether VLP should be added now (R4-2112344 and R4-2112972)
* Recommended WF
	+ A new NS value is needed for LPI in South Korea.
	+ VLP should be discussed further.

**Issue 1-3-6: A-MPR values**

* Proposals
	+ Option 1: A-MPR values for the LPI mode in Canada and South Korea (R4-2112345).
	+ *(no other A-MPR simulations are submitted)*
* Recommended WF
	+ Agree tentatively proposed A-MPR values, subject for further checking and corrections.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | THIS IS A TEMPLATE, DO NOT CHANGE IT, ADD A NEW ROW BELOWIssue 1-1-1 (Work plan): Issue 1-2-1 (Summary of the regulatory requirements):Issue 1-3-1 (Band plan)Issue 1-3-2 (Canada)Issue 1-3-3 (Brazil)Issue 1-3-4 (Peru and Chile)Issue 1-3-5 (South Korea)Issue 1-3-6 (A-MPR values) |
| Skyworks | Issue 1-1-1 (Work plan): Agree with proposed WFIssue 1-2-1 (Summary of the regulatory requirements): Agree with proposed WFIssue 1-3-1 (Band plan): Agree with proposed WFIssue 1-3-2 (Canada): Agree with proposed WF. On VLP we need to understand the fall back mechanism between indoor to outdoor operation. In any case we do not see that a specific power class should be defined as a PC5 UE may have to support VLP mode when being outdoors and connected to an indoor BS.Issue 1-3-3 (Brazil): Agree with proposed WF. On VLP we need to understand the fall back mechanism between indoor to outdoor operation. In any case we do not see that a specific power class should be defined as a PC5 UE may have to support VLP mode when being outdoors and connected to an indoor BS.Issue 1-3-4 (Peru and Chile): can reuse same NS that US LPIIssue 1-3-5 (South Korea): Agree with proposed WF. On VLP we need to understand the fall back mechanism between indoor to outdoor operation. In any case we do not see that a specific power class should be defined as a PC5 UE may have to support VLP mode when being outdoors and connected to an indoor BS.Issue 1-3-6 (A-MPR values): values are consistent with n96 US numbers and the higher in band PSD, since only 20MHz needs A-MPR it may be worth clarifying that only when there is one sub-band transmitted wideband operation needs to use the respective (full/partial) A-MPR. |
| Huawei | Issue 1-1-1 (Work plan): in general it is ok, but the introduction of VLP should be addressed in the WI in term of power class and regulatory requirements for Canada, Brazil and South Korea, which should be include in the work plan.Issue 1-2-1 (Summary of the regulatory requirements):For Peru and Chile, there is no OOB emission is required which is not the same as UP LPIIssue 1-3-1 (Band plan)Issue 1-3-2 (Canada)OK with proposed WFIssue 1-3-3 (Brazil)OK with proposed WFIssue 1-3-4 (Peru and Chile)Need further checkIssue 1-3-5 (South Korea)OK with proposed WF |
| Nokia | Issue 1-1-1 (Work plan) - Fine with the proposed Work plan, just wondering if it is a bit optimistic. Issue 1-2-1 (Summary of the regulatory requirements): - We are fine to tentatively captured the table, but it seems some further checking is needed. Issue 1-3-1 (Band plan) – Ok with proposed WFIssue 1-3-2 (Canada) – Ok with proposed WFIssue 1-3-3 (Brazil) – Ok with proposed WFIssue 1-3-4 (Peru and Chile) – Ok with proposed WF to further checkIssue 1-3-5 (South Korea) – Ok with proposed WFIssue 1-3-6 (A-MPR values) – Ok with proposed WF |

### CRs/TPs comments collection

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

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

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

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Skyworks Solutions Inc. | Dominique Brunel | Doinique.brunel@skyworksinc.com |
| Huawei | Liehai Liu | liuliehai@huawei.com |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)