**3GPP TSG RAN Meeting #88-e RP-20XXXX**

**e-meeting, 29 June - 3rd July 2020**

Source: Thales (Email discussion moderator)

Title: Way forward on satellite-NTN spectrum

TDOC Type: discussion

Agenda Item: 9.10.6 Solutions for NR to support non-terrestrial networks (NTN) [RAN2 WI: NR\_NTN\_solutions]

Document for: discussion

Release: Rel-17

# Introduction

The following TDOC is submitted to the email discussion decided during RAN#88-E and referenced as follow :

* [Satellite\_bands] (Thales)

Goal: Determine a way forward for addressing spectrum bands for NTN/Satellite.

Input contributions covered: 638, 838, 843, 789

Moderator: Nicolas Chuberre

# Discussion

The referred documents:

* RP-200838: “Possible bands for NR based satellite networks” , Thales, document for information
	+ It entails a list of all frequency bands that are allocated to Satellite networks in the different ITU regions that may be proposed in the future to be specified as NR bands for the operation of NR based satellite network

As example, the following documents entail example of two work item descriptions proposing to specify the “Ka band” and “Ku band” allocated to satellite service as a new NR frequency band in FR2 for Satellite Networks.

* RP-200638: “FR2 for NR based Satellite networks”, Hughes Network Systems Ltd, document for information
	+ This contains a proposal to specify the “Ka band” allocated to satellite service as a new NR frequency band in FR2 for Satellite Networks
* RP-200843 “FR2 for NR based Satellite networks”, Intelsat, document for information
	+ This contains a proposal to specify the “Ku band” allocated to satellite service as a new NR frequency band in FR2 for Satellite Networks

Last the following document provides additional considerations

* RP-200789: “Regarding possible bands for NR based satellite networks”, Eutelsat, document for information
	+ It suggests to use the ITU-R documentation at its latest issue as the definitive source of information concerning spectrum allocated for satellite use and to prioritize work on a sub-set of the allocated mobile-satellite services bands

Based on the above, the following questions are proposed:

**Question 1: What should be the primary source of information concerning spectrum allocated for satellite services ?**

| **Organization** | **Views** | **Comments** |
| --- | --- | --- |
| Thales | ITU-R documents on spectrum allocation to satellite services should be at least considered |  |
| Hughes Network Systems Ltd | The primary source of information concerning spectrum allocated for satellite services should be the ITU-R Radio Regulations - on the assignment and use of frequencies for satellite services in all bands. |  |
| Intelsat | ITU-R Radio Regulation is the prime reference of information to address spectrum allocation for satellite services. |  |
| Qualcomm | Traditionally in 3GPP the operators would propose the bands and the requirements are defined based on regulations from each country/region. We think it would be useful to follow a similar model in which the companies interested in using that spectrum will propose the bands and also contribute on the requirements that should be met. |  |
| Ericsson | To be specific, ITU Radio Regulations and WRC final acts decisions are most relevant.  |  |
| Apple | As commented by other companies, 3GPP follows regulatory rules from each particular country/region while defining bands and additional requirements that could be specific to a specific region. And we naturally account for decisions made by various bodies, such as FCC, ECC, etc. |  |
| ZTE | It’s up to the target of corresponding study. If the spectrum is only considered for general survey globally, then ITU-R regulation can be one reference. For specifying the dedicated performance/RF requirements, restriction from commercial deployment (e.g., proposed by each operator) and regional limits (e.g., band allocation for different system) on frequency usage should be considered for coexistence evaluation. | Clarify on the motivation/target is needed. |
| Fraunhofer | We agree that the ITU-R Radio Regulations could be used as the primary source of information as it declares the minimum requirements to be met. In case there are higher requirements desired by individual 3GPP partners, this should be of course discussed. |  |
| Panasonic | ITU-R radio regulation document should be the primary source. |  |
| Eutelsat | The primary source of information concerning spectrum allocated for satellite services is the ITU-R Radio Regulations |  |
| Huawei, HiSilicon | Regional and/or national frequency allocation regulations have same priority as ITU-R documents when consider a band in 3GPP. Specific requirements for NR technology to be used in satellite spectrum (e.g. confirmation from ITU-R or regional/national regulatory bodies) should be made available before band definition work.Conclusions from co-existence study are usually needed for spectrum which could be used by different services (agree with the view in RP-200838 that the use of some frequency bands may require coexistence studies if not already concluded in ITU-R) |  |
| Novamint | ITU-R radio regulations documentation is the most relevant source |  |
| Vodafone | Not sure what we mean as “primary”. Typically we consider whatever information is relevant for defining specification requirements. This info may be from ITU-R or may be from regional regulatory bodies for example, or even national administrations.  |  |
| Ligado | We think we should follow the traditional 3GPP approach for introducing bands and the rationale/justification can provide additional information on both ITU-R and regional aspects regarding the allocation/authorization/use of the spectrum. |  |

**Question 2: Should other source of information be considered for the RAN4 satellite band specific work items ?**

| **Organization** | **Views** | **Comments** |
| --- | --- | --- |
| Thales | Harmonized standard developed by ETSI for satellite services should also be considered | However they don’t necessarily address all the parameters required in 3GPP  |
| Hughes Network Systems Ltd | * Pre-existing Harmonized Standards developed in ETSI for satellite services in specific bands
* The United States Table of Frequency allocations and its rules
* CEPT or ECC frequency allocations/decisions
 |  |
| Intelsat | * Harmonized Standard developed by ETSI for satellite services.
 |  |
| Ericsson | * Also regional regulations; FCC, ECC, EC, MIC, … could be relevant, and 3GPP specs
 |  |
| SoftBank | * Regulatory of interested regions/countries (this is very fundamental information for defining a band in 3GPP)
 |  |
| ZTE | * Regulation related should be followed. But w.r.t the others, all requirements for specific band should be well investigated in RAN4 with assumption on the usage of NR standard as well as impacts of terrestrial network. Standards from other source can be considered as reference to justify the individual proposal and final decision is up to discussion case by case.
 | Global requirements should be defined based on well study, otherwise, it will lead to the regional requirements by simple reusing of other sources.  |
| Fraunhofer | We believe that the sources of information should not be limited in advance. |  |
| Panasonic | ETSI and FCC document as mentioned above |  |
| Eutelsat | Scope of 3GPP/RAN4, agreements between 3GPP and ITU. Also relevant regional/national authorities (CEPT, ECC, FCC etc.) |  |
| Novamint | We should consider harmonized standard developed by ETSI for satellite services |  |
| Vodafone | * See comment to Question 1. We don’t see a need to differentiate between primary and other.
 |  |
| Ligado | WID submitter can reference all necessary sources including regional/national authorities for its justification. |  |

**Question 3: Are there any specific recommendation for the “satellite” band specific WI during Rel-17?**

| **Organization** | **Views** | **Comments** |
| --- | --- | --- |
| Thales | No specific recommendations |  |
| Hughes Network Systems Ltd | Satellite stakeholders may consider for Rel-17 any specific satellite band(s) of interest accessible to them for deploying NR-based satellite services. Please also refer to Note 1 of the NTN approved WID-RP-201256, a revision from RP-200600 & 193234: **Note 1**: It is assumed that this work item will be frequency agnostic and therefore we can consider that NTN can operate in FR1 or FR2 ranges. Defining NR bands for NTN should be included as part of dedicated Rel-17 RAN4 led work items including an analysis of regulations in spectrum considered, which bands 3GPP should specify, as well as potential co-existence between NR terrestrial and satellite. |  |
| Intelsat | Satellite stakeholders woud like to consider satellite networks for Rel-17 allocated in the FR1 and FR2 frequency bands as part of the NR based 5G services and applications via satellite.  |  |
| Qualcomm | The current proposals assume that all the RAN4 requirements should be done in the WI with the band proposals(or at least they seem to assume this). The generic requirements should be first finalized and then band specific requirements can be worked on. What was normally done before was pick one band as example and then declare the WI complete when the band is also complete. If the WI is “NR-NTN-solutions” then a single band should be included there and requirements should be worked on. What is the plan for generic requirements such as ACLR/ACS that normally require a co-existence study?Another question is whether there should be separate specs for these devices or 101, 104 and 133 should be used. |  |
| Ericsson | For specifying the bands, we should consider the target use cases and architectures and how those map to the radio regulations. |  |
| SoftBank | Our understanding is that the latest WID for NTN allows the work for band related generic topics. After that, if companies (NTN operators) identify the necessity of specific band(s) for NTN/satellite, they can always bring a new WID, which satisfies their regulatory requirements. In addition, release independent manner is basically applicable to the support of new bands. Therefore, the normal 3GPP procedure above is satisfactory for NTN, and we don’t see strong necessity to have a common view among companies for this question. |  |
| Apple | To complete for the core NTN WI with generic requirements it is enough to have one exemplary satellite band; same approach has been followed for all WIs. Once the core functionality is completed, additional bands can be introduced through dedicated WIs.  |  |
| ZTE | No specific recommendation for the “satellite” band specific WI. Detailed discussion on both generic and dedicated requirement is up to the normal procedure of WG groups. | Criteria for band selection and principle for discussion can be found in the response for other questions. |
| Fraunhofer | We believe that at least two exemplary bands need to be considered for the core NTN WI with generic requirements, one in FR1 and one in FR2. |  |
| Eutelsat | Considering the high workload in 3GPP/RAN4, RAN4 should prioritize its work. It should only study frequency bands which are identified by ITU-R for IMT. It should only study co-existence between 3GPP RATs in frequency band identified for IMT. It is not the appropriate body to decide rules/parameters for co-existence between 3GPP systems and other radio systems in licensed bands |  |
| DISH | Before agreeing band specific work item(s), RAN needs to clarify several topics, e.g:* How to address frequencies between current FR1 and FR2 in specifications, including RAN1/RAN2/RAN3
* How satellite bands shall be included in RAN4, among the terrestrial bands, in new “Satellite” suffix, or even in separate specification?
* Is co-existence between satellite bands and terrestrial bands included in the work, and if so to which extent?

The WI’s should provide more clarity on at least the following topics:* What does “FR2 band” in WI proposals refer to?
* Are the FR2 satellite bands planned to use FD-FDD or HD-FDD?
* What would be the intended TRP/TRS and EIRP/EIS levels?
* For which UE type/form factor (Powerclass) are the proposed bands intended for?
 |  |
| Novamint | Agree with Eutelsat |  |
| Vodafone | The comment from Apple is how things are normally done. So far unclear if anything needs to change wrt to that approach. |  |
| Ligado | Coexistence should be limited coexistence from a device perspective and not at the system level. ITU-R normally performs sharing studies across countries. |  |

**Question 4: When NTN/Satellite band specific WI should start during Rel-17 ?**

| **Organization** | **Views** | **Comments** |
| --- | --- | --- |
| Thales | Such work item proposal may be submitted for approval once RAN4 activities on the WID “NR-NTN-solutions” (see RP-200600) have progressed on the generic requirements and once the regulatory context and targeted architecture associated to each of the proposed spectrum are clarified. |  |
| Hughes Network Systems Ltd | Due to time needed in adding new frequency bands to NR-band, and satellite characteristics being quite challenging, it is imperative that such work items be introduced early. The work item proposals should be submitted for approval once RAN4 activities on the WID “NR-NTN-solutions” have progressed onto the generic requirements. |  |
| Intelsat | The objective for the WI to be submitted for approval as part of the RAN4 activities on the WID “NR-NTN-solutions” once generic requirements have progressed. |  |
| Qualcomm | We think one band could be done as an example during the WI with all the requirements. More bands can be added afterwards in separate WIs. |  |
| Ericsson | the first thing is to progress the generic considerations and requirements. Then further bands can be added with WI. Note that example bands should be identified as part of the generic work in the NTN WI. |  |
| Apple | The most important thing is to progress further with the core functionality and requirements; and the NTN WI can be completed with one exemplary band. Then, additional bands can be identified and added. |  |
| ZTE | No need to have a dedicated RAN4 WI for NTN band discussion. NTN band issues should be discussed within the approved NTN WI as part of RAN4 objective. More specifically, w.r.t the interested band, it can be considered as examples in corresponding discussion as described in RAN4 objective of approved NTN WI (RP-193234): *“Considering the potential bands to be used as example for the WID”* | For well capturing the related discussion, maybe some dedicated TR could be requested to record the progress of study. |
| Fraunhofer | The NTN band specific WI should not start before the generic requirements are identified in RAN4 activities on NR-NTN-solutions.  |  |
| Panasonic | WI proposal should be submitted once RAN4 work on WID "NR-NTN-solutions" has progressed on generic requirement. |  |
| Eutelsat | Each band studied will take up considerable resources in RAN4, so careful consideration should be given to bands which are already defined by the appropriate authorities. |  |
| Huawei, HiSilicon | Example band could be considered in existing Rel-17 NTN WI (NR\_NTN\_solutions) as described in the WID. Band specific WI can be considered after completion of the NR-NTN-solutions WI. |  |
| Novamint | Agree with Thales and Fraunhofer |  |
| Vodafone | We should progress generic and core requirements first. |  |
| Ligado | Agree with HNS and Thales |  |

**Question 5: Any other aspects to be considered for Rel-17 satellite band specific WI ?**

| **Organization** | **Views** | **Comments** |
| --- | --- | --- |
| Hughes Network Systems Ltd | Satellite stakeholders may consider for Rel-17 any specific band(s) of interest accessible to them for deploying NR-based or LTE-based satellite services, irrespective of type of services – e.g broadband, NB-IoT or any FSS services. Note that ITU-R Radio Regulations do not mandate the technology of choice. Matters concerning sharing or co-primary decisions on certain satellite bands should follow Radio Regulations (International and Regional) Regulatory Framework. |  |
| Ericsson | The RR allocates frequency bands to different services: MSS (Mobile Satellite Service); FSS (Fixed Satellite Service), etc. Understanding the architecture is critical for 3GPPRR also sets rules for international co-existence/sharing among services, while national coordination is considered to be a national issue. This can be an starting point for the 3GPP discussions on co-existenceWe should also consider how the satellite related requirements are best added into the 3GPP framework (in terms of specs etc.) |  |
| ZTE | For balancing the workload in RAN4, all interested band should be based on the commercial usage and regulation (i.e., clear clarification on the regulation for satellite is preferred to accelerate the discussion). Requirements on the both BS and UE side should be defined .e.g. consideration on potential impact for TN, whether the UE is capable to access the TN and NTN. |  |
| Eutelsat | The WI should consider NR-based or LTE-based mobile services by satellite, irrespective of type of mobile services – e.g broadband, NB-IoT. Satellite feeder links are considered out of scope for RAN4 |  |
| Novamint  | Agree with HNS and Eutesat |  |
| Ligado | Agree with Ericsson; 3GPP needs more discussion on what should be within the scope of 3GPP band specification and what should be out of scope and how the requirements are added to the 3GPP specifications. |  |

# Proposed way forward

**Proposal 1: In RAN4, the WID “NR-NTN-solutions” will define the generic and core requirements and consider at least one example satellite band in FR1 (e.g. band 65) and one in FR2 (TBD).**

**Proposal 2: More satellite bands can be added in RAN4 via separate satellite band specific WIs once progress on generic and core requirements is sufficient and targeted use case and architecture are clarified (e.g. Duplex mode, UE types, ..).**

**Proposal 3: RAN4 led “satellite” band specific WI should take into account ITU-R Radio Regulations as well as relevant national regulations, pre-existing Harmonized Standards developed for example in ETSI or coexistence study from device perspective. The proponents of the WI are expected to reference all the the necessary sources and contribute to the definition of the requirements that should be met.**

**Proposal 4: Any specific satellite band(s) may be proposed as part of “satellite” band specific WI to allow the deployment of NR-based satellite network.**

# Discussion on proposed way forward

# Conclusion

***END***