**3GPP TSG-RAN WG4 Meeting #100-e R4-2115785**

**Electronic Meeting, 16th – 27th August, 2021**

**Agenda item:** 9.13.2

**Source:** Moderator (Samsung)

**Title:** Email discussion summary for [100-e][313] NTN\_Solutions\_Part2

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

This summary document captures issues related to NR-NTN coexistence aspects. It contains a summary of the contributions under Agenda Item 9.13.2 at TSG-RAN WG4 #100-e, together with identified key open issues, and recommends topics/questions to be handled via email discussions. The goal of this document is also to provide recommendations on prioritization of discussion and whether any issues should be postponed.

A total of 28 TDOCs have been received for this agenda (See Annex 2) and 5 topics are listed as below to cover proposals and contents in these documents as appropriate.

* Topic #1: Coexistence scenarios
* Topic #2: Network layout model & methodology
* Topic #3: Other simulation assumptions
* Topic #4: HAPS
* Topic #5: Calibration and alignment

To progress the discussion, it is proposed that the meeting could:

* 1st round: Focus on Topic #1, 2 and 3, 5 targeting on narrowing down co-existence scenarios, agreeing on assumptions of NTN & TN systems and aligning calibration assumptions.
* 2nd round: Focus on Topic #4 and remaining issues of Topic #1, 2 and 3, targeting on the finalization of simulation assumptions to facilitate co-existence studies in time. The agreed simulation assumptions will be captured in one or two separate document(s) as appropriate.
* For Topic #5, calibration results proposed by companies will be incorporated into the summary of offline calibration activities which will be handled in accordance with the meeting guideline as appropriate.

# Topic #1: Coexistence scenarios

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112247 | Qualcomm Incorporated | **Observation 1:** It is noted from Table 3 that, it is very difficult to coexist between TN and NTN in urban and rural scenarios with the assumption that NTN UEs are in the coverage of TN.  **Observation 2:** The results of NTN UE at TN cluster edge assumption in Table 4 show about 5 to 16 dB lower required ACIR compared to the random NTN UE deployment in Table 3. The use cases of deploying NTN in urban areas and rural areas should be further discussed. |
| R4-2112248 | Qualcomm Incorporated | **Proposal 1:** RAN4 to only consider urban and rural scenarios. For the rural case, shorter ISD (5km) or a revision of the propagation model should be considered.  **Proposal 2:** RAN4 to further clarify the use cases of NTN and check if it is possible to focus only on coexistence in rural environment. |
| R4-2112588 | Samsung | **Proposal 1:** It is proposed to de-prioritize the ‘Dense Urban’ scenario in this co-ex study for FR1. |
| R4-2113427 | Huawei, HiSilicon | **Proposal 1:** To remove GEO scenario since PC3 handheld UE has no UL throughput.  **Proposal 2:** One satellite with FRF=3 can be considered as candidate NTN-NTN co-existence scenario. |
| R4-2113742 | Ericsson | **Proposal 1:** Without any evidence that NTN-NTN coexistence has already been studied and any related issue was addressed, NTN-NTN scenarios should not be de-scoped. |
| R4-2114232 | Hughes/EchoStar, Inmarsat, Sateliot, Thales | **Proposal 3**: RAN4 to consider analysis of co-existence with N1 and N34 as adjacent bands to MSS S-Band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)].  **Observation 4**: As demonstrated in Figure 1, there are no NTN (satellite) bands adjacent to MSS S-band range of 1980-2010 and 2070–2200 MHz.  **Proposal 4**: RAN4 shall consider this as the input from operators that NTN-NTN (satellite) adjacent band co-existence for MSS S-band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] is not applicable and out of scope. |
| R4-2114424 | THALES | **Proposal 1:** RAN4 should remove coexistence with n41 (2496-2690 MHz) (identified as Item 7 & 8 in the scenario table of R4-2108645)  **Proposal 2.** RAN4 should remove NTN-NTN coexistence for LEO-LEO, LEO-GEO and GEO-GEO scenarios in S-band |

## 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

*Open issues and candidate options before e-meeting:*

**Issue 1-1: Dense Urban scenario of NR/NB-IoT**

* Proposals
  + Option 1(Qualcomm, Samsung): Remove “Dense Urban” scenario of NR/NB-IoT
* Recommended WF
  + Agree on Option 1 to remove “Dense Urban” scenario of NR/NB-IoT

**Issue 1-2: Rural scenario of NR/NB-IoT**

* Proposals
  + Option 1(Qualcomm): Focus only on “Rural” scenario of NR/NB-IoT.
* Recommended WF
  + Satellite operators, as well as vendors are invited to further clarify the use cases of NTN, esp. whether Urban scenario is considered
  + Further discuss if it is possible to focus only on coexistence in rural environment.

**Issue 1-3: GEO scenario of NTN**

* Proposals
  + Option 1(Huawei, HiSilicon): Remove “GEO” scenario since PC3 handheld UE has no UL throughput.
* Recommended WF
  + Further discuss Option 1

### Sub-topic 1-2

*This sub-topic focus on NTN part.*

*Open issues and candidate options before e-meeting:*

**Issue 1-4: NTN-TN co-existence scenarios**

* Proposals
  + Option 1(Thales): Remove NTN coexistence cases with n41 (2496-2690 MHz) which are identified as Item 7 & 8 in the scenario table of R4-2108645.
* Recommended WF
  + Agree on Option 1 as S-band extension (e.g. S-band 2483.5 – 2500 MHz DL) is not considered at this stage.

**Issue 1-5: NTN-NTN co-existence scenarios**

* Proposals
  + Option 1:
* (Thales): Remove LEO-LEO, LEO-GEO and GEO-GEO scenarios in S-band of [1980-2010 MHz (UL) and 2170-2200 MHz (DL)]
* Hughes/Inmarsat/Thales/Sateliot): RAN4 shall consider this as the input from operators that NTN-NTN (satellite) adjacent band co-existence for MSS S-band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] is not applicable and out of scope.
  + Option 2(Ericsson): NTN-NTN scenarios should not be de-scoped. One satellite with FRF=3 can be considered as candidate NTN-NTN co-existence scenario.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Issue 1-1: Dense Urban scenario of NR/NB-IoT**

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| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | ‘Dense urban’ scenario does not fit in the exemplary 2GHz band for NR/NB-IoT. |
| Ericsson | Need further discussion | “Dense urban” is commonly used in RAN4 to describe scenarios with micro BS deployed in Urban area and so UMi channel model should be used. You could check with NR TR 38.803.  If we remove “dense urban” from the list of scenario, that means NTN operation should also be forbid in such environment. |
| ZTE | Agree | For legacy NR coexistence study, it was found out that Dense urban scenario is least demanding ACIR than other cases, therefore it was also down -prioritized in ITU-R 6-10GHz. For NTN and TN network, we think that from NTN interfering TN DL perspective, since TN UE SINR cdf of dense urban scenario should be relatively higher than that of urban macro, therefore ACIR requirement is also less demanding from our understanding. This similar for NTN DL interfering TN UL.  Anyway NTN simulation workload is already very high, we need to have some focus/ |
| CATT | Need further discussion | If there is evidence that dense urban is less stringent, then it can be omitted. Otherwise, all the outdoor scenarios should be in the scope. |
| Qualcomm | Agree | Per our simulation results, NTN and TN could not co-ex in the Dense urban scenario due to the low SINR for NTN system. Besides, from deployment point of view, most likely NTN should provide the service for the area of lack of coverage such as Rural rather than Dense urban. |
| THALES | Agree |  |
| MediaTek |  | Not the most critical deployment scenario in our view, but we do not see this as forbidding operation of NTN geographically close to a dense urban network. Here we specifically talk about immediately adjacent channels. |
| Nokia | Agree | We are okay not to focus on this deployment scenario at present time |
| Hughes/EchoStar | Agree |  |
| ESA | Agree | Dense Urban not necessary. |

**Issue 1-2: Rural scenario of NR/NB-IoT**

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| **Company** | **Agree with Option1 or not?** | **Comments** |
| Samsung | Not yet. | We cannot agree on Option 1 at this stage, but we are open to discuss it further.  Our initial results in R4-2112715 reflects that, for some scenario Urban case actually dominates the ACIR. And we have not yet explored all the co-ex scenarios. So it’s hard to conclude to only focus on ‘Rural’ than ‘Urban’ at this time. |
| Ericsson | Don’t agree for the time being, it would need further alignment. | Again, this would have some major consequence as it would only allow NTN deployment in rural scenarios… |
| ZTE | Don’t agree | This will bring some risk for NTN deployment in other scenarios. |
| CATT | Don’t agree | Similar comments as issue 1-1. All outdoor scenarios should be well evaluated if we don’t have evidence that a specific scenario can be omitted. |
| Huawei | Don’t agree |  |
| Qualcomm | Agree | Per our simulation results, only Rural is feasible for NTN and TN co-ex. In case, we could confirm this conclusion. We can restrict the NTN deployment scenarios in the specification. We’d like to hear the views from satellite operators. |
| THALES |  | Interesting proposal. Some views from satellite operators could be required with respect to possible deployment scenarios. |
| MediaTek |  | The analysis from Qualcomm seems to be based on TN BS Tx aggressing NTN UE Rx. It is a bit strong to say that if 3GPP simulations show some degradation to the NTN performance then an NTN UE will never be able to operate the NTN UE in an urban area, and NTN operation in such an area is barred. Here we only talk about adjacent channels, and just means that NTN downlink performance may not be guaranteed. |
| Xiaomi |  | We prefer to keep both Rural and Urban cases be considered at this stage. |
| Nokia |  | While we are fine to focus on Rural deployments we do believe that some Urban cases also should be considered. |
| Hughes/EchoStar | Agree | Cellular operators/industry view that satellite solutions to complement services in unserved and underserved areas. For the purpose of analysis it may be useful to primarily refer to rural scenario. |
| ESA | Agree |  |
| Inmarsat | Agree |  |

**Issue 1-3: GEO scenario of NTN**

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| **Company** | **Comments** |
| Samsung | We cannot agree on Option 1 at this stage, but we are open to discuss it further.  Our initial results in R4-2112715 also indicates the GEO has less co-ex interference to TN compared to LEO-600 or 1200. But since the co-ex assumptions (esp. channel BW) are not agreed yet, we are lack of agreed numerical analysis to support such proposal at this moment. |
| Ericsson | Don’t agree for the time being.  Similar comment as before: if we remove GEO from the study, that means NTN is not supporting any GEO deployment… Would that be agreeable? |
| ZTE | To remove GEO deployment might be big decision which should be done in RAN-P level  In addition, low UL SINR is mainly caused by larger scheduled PRB numbers with limited output power, if to reduce the scheduled PRBs down to 5PRBs or 2PRBs, then UL SINR could be improved. Initial simulation results indicate us that the existing simulation assumption for uplink scheduling for GEO is not appropriate instead of to support. |
| CATT | We should be cautious to remove any satellite scenario which is captured in TR 38.821.  Is there any simulation to show that PC3 UE in this scenario is not workable? |
| Huawei | We may need more input from satellite companies. Are 23dBm handheld UE being deployed by GEO satellite in the field network? Is it the real deployment scenario? Companies can check the simulation results. In this scenario, the UL SINR is limited by UL receiver signal because of the large pathloss. |
| Qualcomm | We have concerns on option 1. GEO is one of important deployment scenario for NTN. In addition, the feasibility of GEO deployment has been verified in RAN1 discussion (TR38821). Reducing UL channel bandwidth to 2RB or considering FRF of 3 could help on the UL SINR in GEO which was used in RAN1 study. |
| THALES | We confirm that GEO is an important scenario and should not be removed. Agree that FRF=3 could help, is what we are suggesting from the beginning. There might be also other techniques as already discussed e.g. in TR 38.821. |
| MediaTek | Limiting simulations to FRF=3 may be fine if ok to satellite operators, but do not agree to remove completely. |
| Xiaomi | We agree with Qualcomm, the feasibility of GEO deployment with PC3 handheld UE has been verified in TR38821 (i.e SC4, SC5 ,SC19 and SC20 cases). And it is very important satellite scenario for actual deployment. |
| Hughes/EchoStar | Disagree with removing GEO. This is a very important scenario. It has been proven that PC3 can work with GEO in FR1 range. Additionally, there are techniques that can be used to improve SINR for PC3 with GEO.  Please also refer to NGMN position paper on NTN <https://www.ngmn.org/wp-content/uploads/191209-NGMN-Non-Terrestrial-Networks-Position-Paper-r1-1.pdf>, page 31-33 for Use case 4 and 8: GEO S Band direct access. |
| ESA | Disagree with the GEO removal. |
| Inmarsat | Disagree with GEO removal |

**Issue 1-4: NTN-TN co-existence scenarios**

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| **Company** | **Agree with W/F or not?** | **Comments** |
| Ericsson | Agree | That could be done when introducing the 2483.5-2500 MHz range as new NTN band. |
| ZTE | Agree | The approved S band don’t have the coexistence issue with n41. |
| CATT | Agree | Same view as Ericsson. |
| Huawei |  | If we remove this scenario in Rel-17, that means we can’t introduce 2483.5-2500 MHz range as new NTN band in Rel-17.  If companies want to introduce 2483.5-2500 MHz range as new NTN band in the future release, the ACIR should be reviewed. It may have an impact on the legacy satellite network |
| Qualcomm | Agree |  |
| THALES | Agree | Agree with Ericsson, it makes sense. |
| MediaTek | Agree |  |
| Xiaomi | Agree |  |
| Nokia | Agree |  |
| Hughes/EchoStar | Agree |  |
| ESA | Agree |  |

**Issue 1-5: NTN-NTN co-existence scenarios**

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| **Company** | **Which Option do you support?** | **Comments** |
| Ericsson | Option 2 for the time being | Adjacent channels coexistence studies have always been done in RAN4, why shouldn’t we do this for NTN? There should be strong motivation (e.g. any ITU study report) to not do this in RAN4. |
| ZTE | Option 2 for the time being | Based on the legacy practice in RAN4, coexistence with 3GPP RAT should be done publicly in 3GPP RAN4 instead of by bi-lateral agreement between operators. |
| CATT | Option 2 for the time being. | Refer to the discussion in thread 3. Several requirements need to be derived based NTN-NTN co-existence. We should be cautious to remove these scenarios. |
| Huawei | Option 2 |  |
| Qualcomm | Option 2 with clarification | Does option 2 mean FRF of 1 would not be considered? Only consider FRF of 3? |
| THALES | Option 1 for the time being | Please also see Proposal 2 from R4-2114424. |
| MediaTek |  | This would mean that RAN4 adjacent channel requirements are driven from NTN-TN studies only. May need further discussion on potential consequences. |
| Xiaomi | Option 2 |  |
| Nokia | Option 2 |  |
| Hughes/EchoStar | Option 1 | The process for S band MSS co-existence among systems, unlike the terrestrial mobile service, is subject to a formal process dictated by the ITU Radio Regulations. Pursuant to the ITU Radio Regulations, multiple satellite systems can co-exist in the same frequency band but must follow the ITU Radio Regulations on coordination (or operate on a non-interference basis with no protection). Satellite network operators (through their filing Administration) are required to coordinate their satellite networks under Article 9 of the ITU Radio Regulations. All coordination agreements must be agreed to by the Administrations of the satellite network operators involved and notified to the ITU. NTN-NTN coexistence analysis is not needed in 3GPP since the UE and BS RF requirements will be assumed for the ITU process in ensuring NTN-NTN coexistence. Therefore, 3GPP should defer to the ITU regulatory process which satellite operators and their Administrations are required to abide by. |
| Hughes/EchoStar | **Correction to the Moderator’s proposals to Issue 1-5: NTN-NTN co-existence scenarios.** The proposal to remove LEO-LEO, LEO-GEO and GEO-GEO scenarios in S-band of [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] **came from Thales**   * Option 1: * (~~Hughes~~ Thales): Remove LEO-LEO, LEO-GEO and GEO-GEO scenarios in S-band of [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] * Hughes/Inmarsat/Thales/Sateliot): RAN4 shall consider this as the input from operators that NTN-NTN (satellite) adjacent band co-existence for MSS S-band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] is not applicable and out of scope. | |
| Inmarsat | Option 1, with observations given by Thales and Hughes/EchoStar above. | |
| Sateliot | Option 1 for the time being |  |
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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** |
| **Issue 1-1: Dense Urban scenario of NR/NB-IoT** | 6 companies are fine to remove Dense Urban scenario of NR/NB-IoT and 2 companies suggest further discussion.  *Tentative agreements:* N/A  *Candidate options:*   * Option 1: Remove Dense Urban scenario * Option 2: Keep Dense Urban scenario   *Recommendations for 2nd round:* Further discuss Option 1 & 2. |
| **Issue 1-2: Rural scenario of NR/NB-IoT** | 8 companies do not agree to only focus on Rural scenario of NR/NB-IoT and 4 support.  *Tentative agreements:* N/A  *Candidate options:*   * Option 1: Focus only on “Rural” scenario of NR/NB-IoT. * Option 2: Keep both “Rural” and “Urban” scenarios of NR/NB-IoT.   *Recommendations for 2nd round:* Further discuss Option 1 & 2. |
| **Issue 1-3: GEO scenario of NTN** | Most companies do not agree to remove GEO scenario of NTN  *Tentative agreements:* Keep GEO scenario of NTN.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 1-4: NTN-TN co-existence scenarios** | Most company agree to remove NTN coexistence cases with n41 (2496-2690 MHz), and 1 company expressed the concern that the frequency band 2483.5-2500MHz may be introduced later and consequently such cases will be needed and may impact legacy satellite network.  *Tentative agreements:* Remove NTN coexistence cases with n41 (2496-2690 MHz) which are identified as Item 7 & 8 in the scenario table of R4-2108645.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 1-5: NTN-NTN co-existence scenarios** | Several companies expressed the same concern that omitting NTN-NTN co-existence study is in contradiction with 3GPP usual/legacy practice. However, as elaborated by satellite operator, the co-existence of satellite networks subject to a formal procedure dictated by the ITU Radio Regulations, in which administrations are involved and usually are international/multi/bi-lateral treaties. Therefore, 3GPP should defer to the ITU regulatory process which satellite operators and their Administrations are required to abide by.  *Tentative agreements:* N/A  *Candidate options:*   * Option 1: * (Thales): Remove LEO-LEO, LEO-GEO and GEO-GEO scenarios in S-band of [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] * (Hughes/Inmarsat/Thales/Sateliot): RAN4 shall consider this as the input from operators that NTN-NTN (satellite) adjacent band co-existence for MSS S-band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] is not applicable and out of scope. * Option 2(Ericsson): NTN-NTN scenarios should not be de-scoped. One satellite with FRF=3 can be considered as candidate NTN-NTN co-existence scenario. * Option 3(Moderator): “One satellite with FRF=3” case can be first studied as NTN-NTN co-existence scenario. Other cases can be further discussed.   *Recommendations for 2nd round:* Further discussion Option 1, 2 & 3. |

## Discussion on 2nd round

### Open Issues and view collection

**Issue 1-1: Dense Urban scenario of NR/NB-IoT**

* Proposals
  + Option 1: Remove Dense Urban scenario
  + Option 2: Keep Dense Urban scenario
* Recommended WF:
  + Agree on Option 1.

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| **Company** | **Agree with W/F or not?** | **Comments** |
| Moderator |  | It has been indicated by satellite operators for several times that Dense urban case is not the targeting case for NTN. And it is also supported by several companies with analysis.  Taking into account the workload of NTN co-existence, it is recommended not to consider Dense Urban scenario. |
| Samsung | Agree | We propose to agree on removing the ‘Dense Urban’ case considering the following reasons:   1. In the TN parameters reference that this meeting agreed to use, there’s no ‘Dense Urban’ or Urban-Micro system parameters for TN in this 2GHz exemplary band. 2. For NTN DL to TN DL case, dense urban would results in higher SNR for TN, with same interference level from NTN, the impacted SINR would be smaller than Urban Macro or Rural Macro cases. 3. For NTN UL to TN UL case, if the NTN UE density per beam coverage is similar, then the averaged distance from NTN UE to TN stations are the same. Then it’s similar case as DL, the Dense Urban would have less impact than macro urban or rural scenarios. 4. TR 38.803 intended to study the mmWave band NR, 30GHz and 70GHz. Though it indeed covered Dense Urban (or called Urban-Micro) case, but it was targeting a very different frequency band. So it may not be a good reference for our case. |
| Huawei | Agree | However, RAN4 is driven by contributions. I suppose it’s also welcomed that proponent can provide corresponding analysis in the specific scenario. |
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**Issue 1-2: Rural scenario of NR/NB-IoT**

* Proposals
  + Option 1: Focus only on “Rural” scenario of NR/NB-IoT.
  + Option 2: Keep both “Rural” and “Urban” scenarios of NR/NB-IoT.
* Recommended WF:
  + Further discuss Option 1 & 2.

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| **Company** | **Which Option do you agree with?** | **Comments** |
| Samsung | Option 2. | The Rural and Urban results could be different from co-ex interference cases of NTN to TN and TN to NTN. Thus, there’s still lack of evidence for us to be confidently remove one of these two TN scenarios for the whole study. |
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**Issue 1-5: NTN-NTN co-existence scenarios**

* Proposals
  + Option 1:
* (Thales): Remove LEO-LEO, LEO-GEO and GEO-GEO scenarios in S-band of [1980-2010 MHz (UL) and 2170-2200 MHz (DL)]
* (Hughes/Inmarsat/Thales/Sateliot): RAN4 shall consider this as the input from operators that NTN-NTN (satellite) adjacent band co-existence for MSS S-band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] is not applicable and out of scope.
  + Option 2(Ericsson): NTN-NTN scenarios should not be de-scoped. One satellite with FRF=3 can be considered as candidate NTN-NTN co-existence scenario.
  + Option 3(Moderator): “One satellite with FRF=3” case can be first studied as NTN-NTN co-existence scenario. Other cases can be further discussed. This does not apply to HAPS.
* Recommended WF:
  + Further discussion Option 1, 2 & 3

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| **Company** | **Which Option do you agree with?** | **Comments** |
| Moderator |  | In the summary of 1st round discussion, the differences between 3GPP and ITU working procedure can be spotted and it is worth our further consideration on how to handle these differences taking into account that satellite systems do fall under the regime of and are relatively more impacted by the international regulatory framework. The comment of Hughes/EchoStar has been copied here and I encourage all to give a second thought about it.  *Hughes/EchoStar: The process for S band MSS co-existence among systems, unlike the terrestrial mobile service, is subject to a formal process dictated by the ITU Radio Regulations. Pursuant to the ITU Radio Regulations, multiple satellite systems can co-exist in the same frequency band but must follow the ITU Radio Regulations on coordination (or operate on a non-interference basis with no protection). Satellite network operators (through their filing Administration) are required to coordinate their satellite networks under Article 9 of the ITU Radio Regulations. All coordination agreements must be agreed to by the Administrations of the satellite network operators involved and notified to the ITU. NTN-NTN coexistence analysis is not needed in 3GPP since the UE and BS RF requirements will be assumed for the ITU process in ensuring NTN-NTN coexistence. Therefore, 3GPP should defer to the ITU regulatory process which satellite operators and their Administrations are required to abide by.* |
| Samsung | Option 3 or 1. | We support Moderator’s Option 3 as a compromise between Option 1 and 2.  We understand there exists the International regulatory framework for the technical and operation of satellite services. But the studies we carried out here is for adjacent channel co-ex deployment purpose, and it is quite different to the cross-border co-frequency or out-of-band sharing that the RR Articles dealt with. |
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## Summary for 2nd round

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|  | **Status summary** |
| **Issue 1-1: Dense Urban scenario of NR/NB-IoT** |  |
| **Issue 1-2: Rural scenario of NR/NB-IoT** |  |
| **Issue 1-5: NTN-NTN co-existence scenarios** |  |

# Topic #2: Network layout model & methodology

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112247 | Qualcomm Incorporated | **Observation 1:** It is noted from Table 3 that, it is very difficult to coexist between TN and NTN in urban and rural scenarios with the assumption that NTN UEs are in the coverage of TN.  **Observation 2:** The results of NTN UE at TN cluster edge assumption in Table 4 show about 5 to 16 dB lower required ACIR compared to the random NTN UE deployment in Table 3. The use cases of deploying NTN in urban areas and rural areas should be further discussed. |
| R4-2112248 | Qualcomm Incorporated | **Proposal 3:** RAN4 to only consider NTN UEs dropped outside the coverage area or at the TN cluster edge in rural areas. (For cases of TN and NTN in the DL direction) |
| R4-2112588 | Samsung | **Proposal 8:** It is proposed to consider the below network deployment methodology as one of the options for co-ex study for NTN DL to TN DL and NTN UL to TN UL.  For NTN DL to TN DL, and NTN UL to TN UL scenario:   1. Generate NTN beams on the ground with earth curvature, as the figure below.      1. Randomly select one point of reference inside the NTN central beam, as the red point shown in figure below.      1. Generate the 19-cell with warp-around TN networks with the centre at this reference point. The TN BS, UEs are deployed with the agreed deployment parameters and characteristics. 2. Generate NTN UE (for uplink scenario) randomly inside the TN 19-cell area. In the figure below, red triangle represents the 3 active NTN UL UE randomly dropped inside the red-circle (TN 19-cell) area. |
| R4-2113742 | Ericsson | **Proposal 2:** Adopt the following Table 1 describing which NTN cells, TN and TN cells to be observed for each scenarios |
| R4-2113930 | ZTE | **Proposal 4:** to adopt the simulation methodology to calculate the interference from TN for NTN UL.  **Step 1**: to drop NTN UE per beamprint randomly ;  **Step 2**: to drop N of 57 sites per beamprint randomly which should be larger than the active TN cells    **Step 3**: calculate the total ACI per beam for NTN by scaling factor:    **Step 4**: calculate the total ACI from all beams (e.g. M=7 ) for NTN:    Regarding active factors for terrestrial network to simulate the adjacent channel interference for NTN, to follow the ITU-R recommendation e.g. 20% for both urban macro and rural scenarios;  **Proposal 5:** to set the active factor for terrestrial network similar as ITU-R recommendation; |

## 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 2-1

*Open issues and candidate options before e-meeting:*

**Issue 2-1: Considerations of all scenarios**

* Proposals
  + Check following table describing which NTN cells, TN and TN cells to be observed for each scenarios incorporating proposals from Ericsson, Qualcomm, Samsung and ZTE.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Combination** | **Aggressor** | **Victim** | **Which NTN cell to observe?** | **Which TN to observe?** | **Which TN cells in a TN to observe?** |
| 1 | TN with NTN | TN DL | NTN DL | Option 1(Ericsson): All 7 NTN cells  Option 2(Samsung): Observe NTN central beam for SINR, 6 adjacent beams for inter-beam interference. | Option 1 (Ericsson): Consider an active rate of TN. | Option 1 (Ericsson): All active TN cells.  Option 2 (Samsung): All active TN cells which co-located with NTN UEs |
| 2 | TN with NTN | TN UL | NTN UL | Option 1 (Ericsson and ZTE): All 7 NTN cells  Option 2(Samsung): Observe NTN central beam for SINR, 6 adjacent beams for inter-beam interference. | Option 1 (Ericsson and ZTE): Consider an active rate of 20% for Rural and Urban of TN. | Option 1 (Ericsson and ZTE): All active TN cells. |
| 3 | TN with NTN | NTN DL | TN DL | NTN cell:  Option 1(Ericsson and Samsung): Nadir point. | Option 1(Ericsson):  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Option 1 (Ericsson and Samsung):  All |
| Option 1(Ericsson):  NTN cell with satellite at low elevation (additional case) | Option 1(Ericsson):  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam |
| 4 | TN with NTN | NTN UL | TN UL | NTN cell:  Option 1(Ericsson and Samsung): Nadir point.  NTN UE:  Option 1(Samsung): NTN UEs dropped inside the TN clusters (19-cell with wrap-around).  Option 2(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters. | Option 1 (Ericsson and Samsung):  TN randomly placed in this NTN beam | Option 1 (Ericsson):  Only the TN cells (sectors) hosting NTN UE(s)  Option 2(Samsung): The TN cluster (19-cells) where co-located with NTN UEs. |
| 5 | TN with NTN | NTN UL | TN DL | NTN cell:  Option 1 (Ericsson): nadir point | Option 1(Ericsson):  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Option 1(Ericsson):  All  Option 2(Samsung): All TN cells which co-located with NTN UEs. |
| Option 1(Ericsson):  NTN cell with satellite at low elevation (additional case) | Option 1(Ericsson)  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Option 1(Samsung): All TN cells which co-located with NTN UEs |
| 6 | TN with NTN | TN DL | NTN UL | Option 1 (Ericsson and ZTE): All 7 NTN cells  Option 2(Samsung): Observe NTN central beam for SINR, 6 adjacent beams for inter-beam interference. | Option 1(Ericsson and ZTE): Consider the active rate of 20% for Rural and Urban of TN. | Option 1 (Ericsson and ZTE): All active TN cells. |
| 7 | TN with NTN | TN UL | NTN DL | TBD | TBD |  |
| 8 | TN with NTN | NTN DL | TN UL | NTN cell:  Option 1 (Ericsson): nadir point | Option 1(Ericsson):  TN randomly placed in this NTN beam | Option 1(Ericsson):  Only the TN cells hosting NTN UE(s)  Option 2(Samsung): The TN cluster (19-cells) where co-located with NTN UEs |
| 9 | NTN with NTN | NTN DL | NTN DL | TBD | TBD | NA |
| NTN UL | NTN UL | TBD | TBD | NA |

* Recommended WF
  + Further discuss the table in Annex 3.

## Companies views’ collection for 1st round

### Open issues

**Issue 2-1 Considerations of all scenarios**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Moderator | Please provide your comments in Annex 3 rather than here. Thank you! |

## 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** |
| **Considerations of all scenarios** | *Tentative agreements: See Annex 3*  *Candidate options: See Annex 3*  *Recommendations for 2nd round: See Annex 3* |

## Discussion on 2nd round

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

### Open Issues and view collection

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Moderator | Please provide your comments in Annex 4 rather than here. Thank you! |

## Summary for 2nd round

|  |  |
| --- | --- |
|  | **Status summary** |
| **Considerations of all scenarios** |  |

# Topic #3: Other simulation assumptions

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112247 | Qualcomm Incorporated | **Observation 3:** The rural scenario uses the propagation model from TR 38.901 which is only valid till 5 km. In the simulation assumptions the ISD is 7.5 km in rural scenario which exceeds the limits of the path loss model. This should be revised and further discussed in RAN4. |
| R4-2112248 | Qualcomm Incorporated | **Proposal 1:** RAN4 to only consider urban and rural scenarios. For the rural case, shorter ISD (5km) or a revision of the propagation model should be considered.  **Proposal 4:** RAN4 to reuse the same assumption as RAN1 with 2 RBs per UE for the NTN UL scenario. The number of active UL UE is 3.  **Proposal 5:** RAN4 to consider the satellite receiver off angle in the satellite receiver gain calculation.  **Proposal 6:** RAN4 to consider the usage of other elevation angles e.g., 45 degrees for the GEO or LEO satellites to reflect the real case scenario. |
| R4-2112588 | Samsung | **Proposal 2:** It is proposed to change the ‘BS-MS min couple loss in dB’ to ‘BS-UE min distance in meter’, and adopt 35 meters for NR and NB-IoT, for clarification purpose.  **Proposal 3:** It is proposed to remove all the ‘Suburban Macro’ related parameters, because it is not one of the agreed scenarios for this coexistence study. In addition, ‘Suburban Macro’ does not have any related propagation model or AAS parameters described in TR 38.901 and TR 38.921.  **Proposal 4:** It is proposed to agree on the AAS parameters based on RP-200559 above, and amend it to the AAS parameter section, because there’s lack of AAS parameters and TR 38.921 does not provide AAS parameters for ‘Rural’.  **Proposal 5:** It is proposed to adopt 46 dBm as conducted power for non-AAS BS referring to TR 36.942.  **Proposal 6:** It is proposed to clarify the NR-NTN SINR should not be calculated following the TR 38.821 section 6.1.3 equations for co-ex study purpose, but follow the NR-TN methods to reflect the actual wanted or interference power level that a station received.  **Proposal 7:** It is proposed to consider to adopt a similar ACIR models for NR-NTN from TR 36.942 for the same frequency bands, as shown in figure below. |
| R4-2113427 | Huawei, HiSilicon | **Proposal 3:** the satellite max Tx power in dBm for 20MHz can be assumed as below.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Satellite orbit | | | GEO | | LEO-1200 | | LEO-600 | | | Satellite altitude | | | 35786 km | | 1200 km | | 600 km | | | Payload characteristics for DL transmissions | | | | | | | | | | Satellite EIRP density | | 2GHz | 59 dBW/MHz | | 40 dBW/MHz | | 34 dBW/MHz | | | Satellite max TX power in dBm | BW (MHz) |  | 20 |  | 20 |  | 20 | | SCS 15kHz | 50.71 | 52.71 | 46.71 | | SCS 30kHz | 50.37 | 52.37 | 46.37 |   **Proposal 4:** the handover margin can be 3dB for NTN.  In table 2.3-6, the “cell radius” should be replaced by “cell range” because of the different concepts for “cell radius” between ITU-R and 3GPP.  In table 2.3-6, the suburban macro can be removed since the agreed scenarios didn’t include suburban macro.  In table 2.3-7, the ACS requirements for BS is 46dB instead of 45dB.  **Proposal 5:** to correct the above errors in table 2.3-6 and 2.3-7.  **Proposal 6:** to assume specific Antenna parameters for AAS antenna pattern.   |  |  |  |  | | --- | --- | --- | --- | |  |  | **Rural** | **Macro urban** | | 1.1 | Antenna pattern | TS 38.921 | | | 1.2 | Element gain (dBi) (Note 2) | 7.1 | 6.4 | | 1.3 | Horizontal/vertical 3 dB beam width of single element (degree) | 90º for H 54º for V | 90º for H 65º for V | | 1.4 | Horizontal/vertical front‑to‑back ratio (dB) | 30 for both H/V | 30 for both H/V | | 1.5 | Antenna polarization | Linear ±45º | Linear ±45º | | 1.6 | Antenna array configuration (Row × Column) (Note 4) | 8 × 8 elements | 8 × 8 elements | | 1.7 | Horizontal/Vertical radiating element spacing | 0.5 of wavelength for H, 0.9 of wavelength for V | 0.5 of wavelength for H, 0.7 of wavelength for V | | 1.8 | Array Ohmic loss (dB) (Note 2) | 2 | 2 | | 1.9 | Conducted power (before Ohmic loss) per antenna element (dBm) (Note 3) | 25 | 25 | | 1.10 | Base station maximum coverage angle in the horizontal plane (degrees) | 120 | 120 | | 1.11 | Base station vertical coverage range (degrees) (Note 1) | 90-100 | 90-120 | | 1.12 | Mechanical downtilt (degrees) | 3 | 10 |   **Proposal 7:** to assume 20% indoor UE for TN in HAPS coexistence simulation. Urban macro channel model can refer to TR 38.901. |
| R4-2113742 | Ericsson | **Proposal 3:** From TR 38.811 NTN shadow fading values:  - Use table 6.6.2-3 for urban scenario (and not table 6.6.2-2).  - For BS LOS values in S-band, reuse LOS values from Ka-band in table 6.6.2-3. |
| R4-2113930 | ZTE | **Proposal 1:** to use the antenna pattern in Figure 2 and Figure 3 as LEO and GEO antenna pattern.    Figure 2. antenna pattern for LEO 600KM and 1200KM [4.4127 deg for 3dB beamwidth]    Figure 3. antenna pattern for antenna aperture of GEO [0.4011 deg for 3dB beamwidth]  Proposal 2: for the baseline of central beam center elevation angle target of GEO, propose to keep the alignment between coexistence simulation and TR 38.821. (Baseline: 45 deg.)  **Proposal 3:** propose more UEs to be scheduled in GEO scenario e.g. 12 or 15 or more.  **Proposal 6:** to adopt the step wise ACIR model for uplink coexistence study.    Figure 1. ACIR model  Table 1. Uplink ACIR value   |  |  | | --- | --- | | Frequency offset between aggressor (105 RBs) and victim (105 RBs) | ACIR value | | 0-[34] RBs | 30 + X | | [35-69] RBs | 43 + X | | >[69] RBs | 43+ X | |
| R4-2114424 | THALES | **Proposal 3.** The satellite max Tx power can be calculated by the equation as below:   |  |  | | --- | --- | |  | **NRB** (**20MHz BW)** | | SCS 15kHz | 106 | | SCS 30kHz | 51 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Satellite orbit | | GEO | LEO-1200 | LEO-600 | | Satellite EIRP density | | 59 dBW/MHz | 40 dBW/MHz | 34 dBW/MHz | | Satellite max TX power in dBm | BW (MHz) | 20 | 20 | 20 | | SCS 15kHz | 50.81 | 52.81 | 46.81 | | SCS 30kHz | 50.64 | 52.64 | 46.64 | | 3dB beamwidth or HPBW (Half-Power BandWidth) of main central beam | | 0.4011 deg | 4.4127 deg | 4.4127 deg | | ABS (Adjacent Beam Spacing) of adjacent beams from the central beam | | 0.3474 deg | 3.8206 deg | 3.8206 deg | | Satellite (central) beam diameter | | 250 km | 90 km | 50 m |   **Proposal 4.** The satellite Adjacent Beam Spacing or ABS can be computed using the following equations:  ABS**[rad]** = sqrt(3) x sin(HPBW**[degrees]**/2) or ABS**[rad]** = sqrt(3) x sin**r**(HPBW**[rad]**/2)  with ABS [degree]=180/pi x ABS[rad] and  with HPBW the Half-Power BandWidth of the main lobe from the satellite antenna pattern.  **Proposal 5.** The following ABS values shall be used for RAN4 NTN simulator calibration and coexistence purposes:   * Adjacent Beam Spacing value for **GEO** of **0.3474 degrees**; * Adjacent Beam Spacing value for **LEO** of **3.8206 degrees**.   **Proposal 6.** RAN4 shall be aware that current satellite ABS (Adjacent Beam Spacing) used to generate satellite adjacent beams for RAN4 coexistence simulation purposes are lower than HPBW (Half-Power BandWidth) of the main lobe of the antenna pattern used to generate the satellite central beam. Therefore, ABS≠HPBW with ABS<HPBW. |
| R4-2114425 | THALES | **Proposal 1.** RAN4 confirms using the agreed NTN propagation model from TR 38.811 as starting point for NTN coexistence work with respect to both calibration and simulation purpose.  **Proposal 2.** New proposals for NTN propagation model optimizations are potentially acceptable, but only if they would change the result to an extend where that work is justified. |

## 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 3-1

This sub-topic focus on NTN parameters

*Open issues and candidate options before e-meeting:*

**Issue 3-1: Satellite max TX power for 20MHz BW**

* Proposals
  + Option 1(Thales): NRB=106 (SCS 15kHz), 51(SCS 30kHz)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Satellite orbit | | GEO | LEO-1200 | LEO-600 |
| Satellite EIRP density | | 59 dBW/MHz | 40 dBW/MHz | 34 dBW/MHz |
| Satellite max TX power in dBm | BW (MHz) | 20 | 20 | 20 |
| SCS 15kHz | 50.81 | 52.81 | 46.81 |
| SCS 30kHz | 50.64 | 52.64 | 46.64 |

* + Option 2(Huawei, HiSilicon):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Satellite orbit | | GEO | LEO-1200 | LEO-600 |
| Satellite EIRP density | | 59 dBW/MHz | 40 dBW/MHz | 34 dBW/MHz |
| Satellite max TX power in dBm | BW (MHz) | 20 | 20 | 20 |
| SCS 15kHz | 50.71 | 52.71 | 46.71 |
| SCS 30kHz | 50.37 | 52.37 | 46.37 |

* Recommended WF
  + Proponents align their NRB values and derive power based on following equation

**Issue 3-2: Adjacent Beam Spacing**

* Proposals
  + Option 1(Thales):

Add Adjacent Beam Spacing related contents marked in Yellow in Set 1 Satellite table (Table 2.3-1 of [1]) and following ABS values should be used for RAN4 NTN simulator calibration and coexistence purposes, as current satellite ABS (Adjacent Beam Spacing) used to generate satellite adjacent beams for RAN4 coexistence simulation purposes are lower than HPBW (Half-Power BandWidth) of the main lobe of the antenna pattern used to generate the satellite central beam. Therefore, ABS≠HPBW with ABS<HPBW.

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite orbit | GEO | LEO-1200 | LEO-600 |
| Satellite EIRP density | 59 dBW/MHz | 40 dBW/MHz | 34 dBW/MHz |
| 3dB beamwidth or HPBW (Half-Power BandWidth) of main central beam | 0.4011 deg | 4.4127 deg | 4.4127 deg |
| ABS (Adjacent Beam Spacing) of adjacent beams from the central beam | 0.3474 deg | 3.8206 deg | 3.8206 deg |
| Satellite (central) beam diameter | 250 km | 90 km | 50 m |

The satellite Adjacent Beam Spacing or ABS can be computed using the following equations:

ABS[rad] = sqrt(3) x sin(HPBW[degrees]/2) or ABS[rad] = sqrt(3) x sinr(HPBW[rad]/2)

with ABS [degree]=180/pi x ABS[rad] and

with HPBW the Half-Power BandWidth of the main lobe from the satellite antenna pattern.

* Recommended WF
  + Further discuss Option 1.

**Issue 3-3: Handover margin for NTN**

* Proposals
  + Option 1(Huawei, HiSilicon): 3dB
* Recommended WF
  + Agree on Option 1

**Issue 3-4: Central beam elevation angle**

* Proposals
  + Option 1(Qualcomm, ZTE): Add 45° (Note that is assumed 90°now.)
* Recommended WF
  + Agree on Option 1

**Issue 3-5: Satellite antenna pattern**

* Proposals
  + Option 1(ZTE): Update the Fig 2.4.1-1 in [1] with new satellite antenna patterns.

|  |  |
| --- | --- |
| As is in [1] | To be |
| **A close up of a logo  Description generated with very high confidence**  **Figure 2.4.1-1:** **Satellite antenna gain pattern for aperture radius 10 wavelengths, *a*=10 *c*/*f*** | **Figure 2.4.1-1. antenna pattern for LEO 600KM and 1200KM [4.4127 deg for 3dB beamwidth]**    **Figure 2.4.1-2 antenna pattern for antenna aperture of GEO [0.4011 deg for 3dB beamwidth]** |

* Recommended WF
  + Agree on Option 1.

**Issue 3-6: NTN UE deployment**

* Proposals
  + Option 1(Qualcomm): Reuse the same assumption as RAN1 with 2 RBs per UE for the NTN UL scenario. The number of active UL UE is 3.
  + Option 2 (ZTE): More UEs to be scheduled in GEO scenario e.g. 12 or 15 or more.
* Recommended WF
  + Further discuss Option 1 & 2.

**Issue 3-7: NTN UL TPC**

* Proposals
  + Option 1(remaining in [1]): Adopt the same TPC model of TN for NTN UL scenarios but needs to revise CLx-ile to align with UE UL power control parameters used in TR38.821. The CLx-ile value should be adapted for rural, dense urban and indoor scenarios.
  + Option 2(remaining in [1]): The CLx-ile value should be adapted for rural, dense urban and indoor scenarios.
  + Option 3(Observation of calibration): Do not use UL TPC as indicated by the calibration that UE is always working at maximum power level (23dBm) to ensure the throughput.
* Recommended WF
  + Agree on Option 3.

### Sub-topic 3-2

This sub-topic focus on TN parameters.

*Open issues and candidate options before e-meeting:*

**Issue 3-8: Changes to Table 2.3-5 in [1]**

* Proposals
  + Option 1(Samsung): Replace “BS-MS min couple loss in dB” with “BS-UE min distance in meter” and set it as 35m.

|  | NB-IoT  Standalone | NR | | NR |
| --- | --- | --- | --- | --- |
|  |  | Option 1  (R4-2106476 CATT) | Option 2  (R4-2105045 Samsung) | Agreed values |
| ~~BS-MS min couple loss in dB~~ | ~~70~~ |  |  | ~~70 for outdoor scenario in Table 2.1-1.~~ |
| BS-UE min distance in meter | 35 |  |  | 35 |

* Recommended WF
  + Agree on Option 1.

**Issue 3-9: Changes to Table 2.3-6 in [1]**

* Proposals
  + Option 1(Huawei, HiSilicon, Samsung): See changes marked in Yellow below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Urban Macro | ~~Suburban Macro~~ | Rural Macro | Remarks |
| Cell ~~radius~~ range in meters | 500 | ~~1000~~ | 5000 | ITU-R Report M.2292 |
| BS Antenna height in meters | 25 | ~~30~~ | 30 |
| **UE Parameters** | | | | |
| UE Outdoor/indoor | 100% Outdoor | | |  |
| UE height in meter | 1.5 | ~~1.5~~ | 1.5 | 3GPP LS to ITU-R WP5D RP-200559  and  ITU-R WP5D  [IMT\_Parameters] |
| Minimum BS-UE distance in meter | 35 | ~~35~~ | 35 |

* Recommended WF
  + Agree on Option 1.

**Issue 3-10: Change to Table 2.3-7 in [1]**

* Proposals
  + Option 1(Huawei, HiSilicon): See changes marked in Yellow below

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **NR** | **NB-IOT** |
| BS | ACLR | 45 dB | 40 dB |
| ACS | ~~45~~ 46 dB | ~~45~~ 46 dB |
| UE | ACLR | 30dB (ACLR1)  43dB (ACLR2) | 37 |
| ACS | 33 | 28 |

* Recommended WF
  + Agree on Option 1

**Issue 3-11: AAS Antenna Pattern**

* Proposals
  + Option 1(Huawei, HiSilicon, Samsung): Adopt specific antenna parameters for AAS antenna pattern, shown as below.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Rural** | **Macro urban** |
| **1** | **Base Station Antenna Characteristics** | | |
| 1.1 | Antenna pattern | TR 38.921 | |
| 1.2 | Element gain (dBi) (Note 2) | 7.1 | 6.4 |
| 1.3 | Horizontal/vertical 3 dB beam width of single element (degree) | 90º for H  54º for V | 90º for H  65º for V |
| 1.4 | Horizontal/vertical front‑to‑back ratio (dB) | 30 for both H/V | 30 for both H/V |
| 1.5 | Antenna polarization | Linear ±45º | Linear ±45º |
| 1.6 | Antenna array configuration (Row × Column)  (Note 4) | 8 × 8 elements | 8 × 8 elements |
| 1.7 | Horizontal/Vertical radiating element spacing | 0.5 of wavelength for H, 0.9 of wavelength for V | 0.5 of wavelength for H, 0.7 of wavelength for V |
| 1.8 | Array Ohmic loss (dB) (Note 2) | 2 | 2 |
| 1.9 | Conducted power (before Ohmic loss) per antenna element (dBm) (Note 3) | 25 | 25 |
| 1.10 | Base station maximum coverage angle in the horizontal plane (degrees) | 120 | 120 |
| 1.11 | Base station vertical coverage range (degrees) (Note 1) | 90-100 | 90-120 |
| 1.12 | Mechanical downtilt (degrees) | 3 | 10 |

* Recommended WF
  + Agree on Option 1.

**Issue 3-12: Non-AAS BS conducted power**

* Proposals
  + Option 1(Samsung): 46 dBm (referring to TR 36.942)
* Recommended WF
  + Agree on Option 1.

### Sub-topic 3-3

This sub-topic focus on other assumptions.

*Open issues and candidate options before e-meeting:*

**Issue 3-13: General consideration of propagation model**

* Proposals
  + Option 1(Thales): RAN4 confirms using the agreed NTN propagation model from TR 38.811 as starting point for NTN coexistence work with respect to both calibration and simulation purpose. New proposals for NTN propagation model optimizations are potentially acceptable, but only if they would change the result to an extent where that work is justified.
* Recommended WF
  + Agree on Option 1.

**Issue 3-14: Propagation model between NTN and UE**

* Proposals
  + Option 1(Ericsson): From TR 38.811 NTN shadow fading values:

- Use table 6.6.2-3 for urban scenario (and not table 6.6.2-2).

- For BS LOS values in S-band, reuse LOS values from Ka-band in table 6.6.2-3.

* Recommended WF
  + Agree on Option 1.

**Issue 3-15: Propagation model between TN BS and UE**

* Proposals
  + Option 1(Qualcomm): For rural scenario, the maximum ISD is 5km.
* Recommended WF
  + Agree on Option 1.

**Issue 3-16: TN-NTN SINR**

* Proposals
  + Option 1(Qualcomm, Samsung): The satellite receiver off angle should be considered in the satellite receiver gain calculation when calculating SINR. Note that such angle is not considered in TR 38.821 section 6.1.3 equations. Thus those equations should be used for SINR calculation.
* Recommended WF
  + Agree Option 1.

**Issue 3-17: ACIR model for uplink cases**

* Proposals
  + Option 1(ZTE): Adopt the step wise ACIR model for uplink coexistence study.



Figure 1. ACIR model

Table 1. Uplink ACIR value

|  |  |
| --- | --- |
| Frequency offset between aggressor (105 RBs) and victim (105 RBs) | ACIR value |
| 0-[34] RBs | 30 + X |
| [35-69] RBs | 43 + X |
| >[69] RBs | 43+ X |

* + Option 2(Samsung): It is proposed to consider to adopt a similar ACIR models for NR-NTN from TR 36.942 for the same frequency bands, as shown in figure below.



* Recommended WF
  + Further discuss Option 1 & 2.

## Companies views’ collection for 1st round

### Open issues

Sub topic 3-1 NTN parameters

**Issue 3-1: Satellite max TX power for 20MHz BW**

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Moderator |  | Companies are encouraged to provide their NRB numbers and max TX power for 20MHz BW. |
| Samsung | Option 1 | We used the agreed equation and resulted in same numbers as provided by Option 1. |
| Ericsson | Option 1 | For 20 MHz, according to NR SU, NRB=106, option 1 looks correct then |
| ZTE | Option 1 |  |
| Qualcomm | Option 1 |  |
| THALES | Option 1 |  |
| Xiaomi | Option 1 |  |
| Nokia | Option 1 |  |
| Hughes/EchoStar | Option 1 |  |

**Issue 3-2: Adjacent Beam Spacing**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with Option 1 or not?** | **Comments** |
| Samsung | Agree with typo fixed. | We support the ABS equation and numbers, which aligned with 38.821.  We propose to editorially fix a typo in equation if THALES agrees:  ABS[degrees] = sqrt(3) x sin(HPBW[degrees]/2) or ABS[rad] = sqrt(3) x sinr(HPBW[rad]/2) |
| Ericsson | Option 1 | Looks correct |
| ZTE | Option 1 |  |
| THALES | Option 1 | Equation from Option 1 is correct.  The first sin function uses [degrees] (“sin”) and the second one uses [rad] (“sinr”) but the result is the same. The ABS for both equations is expressed in [rad] and requires conversion for [degrees]. |
| Nokia | Option 1 |  |
| Hughes/EchoStar | Option1 |  |

**Issue 3-3: Handover margin for NTN**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Ericsson | Agree |  |
| ZTE | Agree | This is legacy value used in TN system simulation |
| Qualcomm | Agree |  |
| THALES | Agree |  |
| Nokia | Agree |  |
| Hughes/EchoStar | Partial | If for co-existence OK, but it will vary in actual implementation |

**Issue 3-4: Central beam elevation angle**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung |  | We are neutral. If agreed, then some parameters like beam coverage needs to have additional note to indicate if it described nadir beam or lower angle beam. |
| Ericsson | Option 1 for the calibration only | We have other proposals depending on the scenarios for the final coex simu results, see annex 3. |
| ZTE | Option 1 | We prefer to keep aligned with TR 38.821 where GEO elevation angle is 45’ |
| Huawei |  | Satellite antenna gain at 45°is less than -40dB comparing to 90°. Not sure this scenario will achieve a lower couple loss. If RAN4 agree this scenario, network layout should be assumed as well. |
| Qualcomm | Option 1 | Considering low elevation angle is more realistic for NTN deployment. |
| THALES |  | We are neutral, but we agree that for GEO is better 45⁰ and is consistent with TR 38.821.  However, it should be clarified if proposed Option 1 is for both GEO or LEO, or only for GEO.  On the other hand, we can consider calibration as it is, and consider Option 1 for simulation purpose only. |
| Nokia | Option 1 |  |
| Hughes/EchoStar |  | To be discussed |

**Issue 3-5: Satellite antenna pattern**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree with editorial changes | It’s helpful to have direct related figures in the document. But we would like to ask the proponent and moderator to: 1) add title of each figure to indicate it’s for set-1; 2) remove the data-tips in zoomed figures or simply remove the zoomed figures, as the data-tips are not exactly match the 3dB beamwidth values due to MATLAB resolution issue. |
| Ericsson | Need clarification | Our understanding of this proposal is that, we don’t change the antenna pattern itself (still Bessel function) but we make sure the 3dB beamwidth is according to the agreed parameters. If so, we don’t think there is any change with the current assumptions. If needed, some clarification could be added to the NTN antenna pattern/parameters captured in the simulation assumptions then. |
| ZTE | Agree | To samsung; it’s fine for me to update the figure and title.;  To Ericsson, Beeesel function is used to generate the antenna, the purpose of this proposal is to show the correct antenna pattern for each scenario, otherwise example antenna pattern in TR38.811 is confusing at least based on our simulation practice. |
| Huawei | Need clarification | My question is how we can achieve the antenna patterns proposed by ZTE. I suppose the Bessel function is unchanged. Do we need to change the parameter a = 10 c/f or k = 2f/c? |
| Qualcomm | Need clarifications | We are OK if the figures are to show more details for the antenna pattern. To make sure it is consistent with antenna pattern defined TR38.811. |
| THALES | Need clarifications | It may result in multiple extra simulations. |
| ZTE |  | To Huawei: Yes, Bessel function is not changed, however a should be updated based on be aperture radius of [N] wavelengths, where N could based on Equivalent satellite antenna aperture /2/wavelength; |
| Nokia |  | We are fine to add further information to the figures. But don’t see any change in the assumptions used so far. |

**Issue 3-6: NTN UE deployment**

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Samsung | Option 2 | We shared the same view with both options, the UL SNR is too low to achieve usable throughput. We support option 2 other option 1, simply because it is not fixed number. And we would like to see more views on this topic especially from Satellite companies and operators. |
| Ericsson | Other | It might be reasonable indeed to assume less than 106/3 RBs in UL indeed, but 2 RBs look very small number, throughput would be very low… And then we should most likely increase to number of UEs (10 or more). |
| ZTE | Option 2 | To Ericsson, based on our initial simulation results, even 12/15 users might be still not enough, indeed we would like to open the discussion for further discussion instead of agreed some fixed value right now. |
| Huawei | Other | If 12/15 users might be still not enough, it means that the couple loss is too high and UE tx power is too low. Alternatively, we have to abandon this scenario. Generally we need to consider the full buffer scenario. Using the minimum RB numbers is not realistic. We can check the UL traffic mode with other working group, if we have to narrow the RB numbers. |
| Qualcomm | Option 1 with clarification. | Option 1 and option 2 are not exclusive. Our understanding is both option 1 and option 2 are saying we need to reduce the RBs number for UL considering the low UL SINR. In RAN1 study, 2RBs for UL is considered and it should be for small data service. So we prefer to reuse 2RBs assumption for UL in RAN4.  Regarding the UL UE number, we prefer to consider 3UEs to simply the simulation. But we are open to discuss the exact number. |
| THALES | Option 1 or 2 | Small preference for Option 1, it might be useful to consider a smaller number of RBs. Also, it makes sense to reuse 38.821 assumptions. |
| Nokia | Option 1 and 2 | It is of interest to study reduced RBs number in UL while is also make sense to consider more than one UE scheduled. |
| Hughes/EchoStar | Option 1 |  |

**Issue 3-7: NTN UL TPC**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Moderator |  | As agreed in RAN4#99e, same TN TPC for NTN with SNR target 15dB has been applied during the calibration. The calibration shows that to achieve such SNR, US is always working on maximum power level which is 23dBm. |
| Samsung | Agree |  |
| ZTE |  | We think that based on the current simulation assumption for uplink scheduled PRBs, then UE is always transmitting with maximum output power, however since this is also under discussion in this meeting, we would like to postpone the discussion a bit.  In addition, based on our internal discussion with RAN1 team, it was said that UL PC for NTN UE is disabled, however i still need some time to find out that agreement. |
| Huawei |  | It seems that UL PC for NTN UE is allowed. Company can further check. At least, for LEO600/1200, the targeted SNR can be reduced. |
| Qualcomm |  | Agree with ZTE’s view.  We will check with RAN1 colleagues. If it was agreed in RAN1 that UL PC is disabled, we could remove the NTN UL TPC in RAN4 simulation. |
| THALES | Agree | At least for NTN calibration phase, all companies used maximum transmission power. |

Sub-topic 3-2 TN parameters

**Issue 3-8: Changes to Table 2.3-5 in [1]**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | We have offline discussed with several companies, and we believe the previous ‘minimum coupling loss’ is actually referring to ‘minimum path loss’ for 35 meters. It’s confusing people. So we would like to change it to ‘BS-UE min distance 35 meters’, which is also aligned with 3GPP LS to ITU-R. |
| Ericsson | Agree |  |
| ZTE | Agree |  |
| Huawei | Agree |  |
| THALES | Agree |  |
| Nokia | Agree |  |

**Issue 3-9: Changes to Table 2.3-6 in [1]**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | Sub-urban Macro does not have corresponding propagation loss model in 38.901, and so as some other parameters. Considering the work load, and the fact of missing parameters, we propose to remove ‘Sub-urban Macro’ case. |
| Ericsson | Agree | Ok to remove suburban which is more an ITU scenario, not listed in our coex scenarios list. |
| ZTE | Agree | Since there are no propagation channel model defined, therefore it’s not possible for further work. |
| Huawei | Agree |  |
| Qualcomm | Agree |  |
| THALES | Agree |  |
| Nokia | Agree |  |

**Issue 3-10: Change to Table 2.3-7 in [1]**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Ericsson | Agree |  |
| ZTE | Agree |  |
| Huawei | Agree |  |
| Qualcomm | Agree |  |
| THALES | Agree |  |
| Nokia | Agree |  |

**Issue 3-11: AAS Antenna Pattern**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | We would like to support our option. But we are open to other options as well, as long as they can be agreed by the meeting. |
| Ericsson | Agree | We shall align with the LS reply we sent to ITU-R. This was also our proposal for HAPS TN antenna parameters assumptions. |
| ZTE | Agree | For TN BS with AAS, referring to LS reply to ITU-R.  For TN BS with non-AAS, referring to TR 36.942. |
| Huawei | Agree |  |
| Qualcomm | Agree |  |
| THALES | Agree |  |

**Issue 3-12: Non-AAS BS conducted power**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | The conducted Tx power is missing in previous document. |
| Ericsson | Agree |  |
| ZTE | Agree |  |
| Qualcomm | Agree |  |
| THALES | Agree |  |

Sub-topic 3-3 Other assumptions

**Issue 3-13: General consideration of propagation model**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree |  |
| Ericsson | Agree |  |
| ZTE | Agree |  |
| Huawei | Agree |  |
| THALES | Agree |  |
| Nokia | Agree |  |

**Issue 3-14: Propagation model between NTN and UE**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung |  | We are OK to adopt and implement different numbers. But should we contact 38.811 rapporteur for some clarification first? |
| Erisson | Agree |  |
| ZTE | Netural | This should be done in RAN1 i guess. |
| Huawei |  | Since TR 38.811 is a REL-16 TR, I’m not sure companies can correct it at this stage. If these values in TR 38.811 can’t be changed, we should follow it. |
| THALES |  | Agree with Samsung and Huawei. |
| Nokia |  | We are not sure why this change is needed. |

**Issue 3-15: Propagation model between TN BS and UE**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | No | We are OK with Rural ISD has upper limit of 5 km. We prefer the meeting to agree on a fixed value and update the TN parameter table. |
| Erisson | To be further discussed. | Before any decision:   * The PL model in TR 38.901 is up to 10km, there is no limitation due to this.   We made simulations with ISD up to 8km in the past (e.g. HPUE for band 41), why do have any issue now? |
| ZTE | To be further discussed. |  |
| Huawei | To be further discussed. |  |
| Qualcomm |  | Our proposal is to limit Rural ISD as 5km per the since as described in 38901, the distance is less then 5km. |
| THALES |  | Why maximum ISD and not fixed ISD value? If might be confusing if choice related to coexistence simulations. |

**Issue 3-16: TN-NTN SINR**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Yes |  |
| Ericsson | Agree |  |
| ZTE | Agree |  |
| Qualcomm | Agree |  |

**Issue 3-17: ACIR model for uplink cases**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | We are pleased to combine our Option 2 with ZTE’s Option 1. Even the figure is different, I think they both refer to same ACIR model. |
| Ericsson | Both options are identic, right? |
| ZTE | To Ericsson, it’s similar. |
| Qualcomm | We agree to reuse the ACIR model from TR36.942. But the table in option 1 is based on the assumption of 3UEs in UL that need to be further discussed. |

## 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** |
| **Issue 3-1: Satellite max TX power for 20MHz BW** | All companies agree with Option 1  *Tentative agreements:* Adopt Option 1 values.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-2: Adjacent Beam Spacing** | All companies agree with Option 1  *Tentative agreements:* Add Adjacent Beam Spacing related contents marked in Yellow in Option into Set 1 Satellite table. ABS values should be used for calibration and co-existence.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-3: Handover margin for NTN** | All companies agree with 3dB handover margin for NTN co-existence study.  *Tentative agreements:* For co-existence study, NTN handover margin is 3dB.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-4: Central beam elevation angle** | 5 companies are OK with Option 1 (45°). But several companies request further discussion.  *Tentative agreements:* N/A  *Candidate options:*   * Option1: Add 45° for GEO only which is consistent with TR 38.821   *Recommendations for 2nd round:* Further discuss Option 1. |
| **Issue 3-5: Satellite antenna pattern** | As explained by the proponent, the intension is just to show the correct figure and there’s no change to the parameters agreed in previous meeting.  *Tentative agreements:* Update the Fig 2.4.1-1 in [1] with new figures.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-6: NTN UE deployment** | It seems that reducing RB numbers for UL is acceptable to most companies. However, the UL UE number needs further discussion.  *Tentative agreements:* Reuse the same assumption as RAN1 with 2 RBs per UE for the NTN UL scenario.  *Candidate options:*   * Option 1: 3 UEs * Option 2: 10/12/15 or other numbers UEs   *Recommendations for 2nd round:* Further discuss Option 1 & 2 |
| **Issue 3-7: NTN UL TPC** | 2 companies agree not to use NTN UL TPC but just make the UE working at maximum power level. There are requests to postpone the discussion to 2nd round so that some internal checks on RAN 1 discussion can be conducted.  *Tentative agreements:* N/A  *Candidate options:*   * Option 1(remaining in [1]): Adopt the same TPC model of TN for NTN UL scenarios but needs to revise CLx-ile to align with UE UL power control parameters used in TR38.821. The CLx-ile value should be adapted for rural, dense urban and indoor scenarios. * Option 2(remaining in [1]): The CLx-ile value should be adapted for rural, dense urban and indoor scenarios. * Option 3(Observation of calibration): Do not use UL TPC as indicated by the calibration that UE is always working at maximum power level (23dBm) to ensure the throughput.   *Recommendations for 2nd round:* Further discuss 3 options taking into account RAN1 status. |
| **Issue 3-8: Changes to Table 2.3-5 in [1]** | All agree with Option 1  *Tentative agreements:* Adopt Option 1 to replace “BS-MS min couple loss in dB” with “BS-UE min distance in meter” and set it as 35m.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-9: Changes to Table 2.3-6 in [1]** | All agree with Option 1  *Tentative agreements:* Adopt changes in Option 1  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-10: Change to Table 2.3-7 in [1]** | All agree with Option 1  *Tentative agreements:* Adopt Option 1 to change ACS of BS to 46dB  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-11: AAS Antenna Pattern** | All agree with Option 1  *Tentative agreements:* Adopt Option 1 to use specific antenna parameters for AAS antenna pattern.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-12: Non-AAS BS conducted power** | All agree with Option 1  *Tentative agreements:* Non-AAS BS conducted power is 46dBm.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-13: General consideration of propagation model** | All agree with Option 1  *Tentative agreements:*  RAN4 confirms using the agreed NTN propagation model from TR 38.811 as starting point for NTN coexistence work with respect to both calibration and simulation purpose. New proposals for NTN propagation model optimizations are potentially acceptable, but only if they would change the result to an extent where that work is justified.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-14: Propagation model between NTN and UE** | No agreement can be made so far.  *Tentative agreements:* N/A  *Candidate options:*   * Option 1(Ericsson): From TR 38.811 NTN shadow fading values:   - Use table 6.6.2-3 for urban scenario (and not table 6.6.2-2).  - For BS LOS values in S-band, reuse LOS values from Ka-band in table 6.6.2-3.   * Option 2: Follow TR 38.811 values at current stage and send a LS to RAN 1 seeking for clarifications. * Option 3: TBA   *Recommendations for 2nd round:* Further discuss Option 1, 2 & 3 |
| **Issue 3-15: Propagation model between TN BS and UE** | No agreement can be made so far.  *Tentative agreements:* N/A  *Candidate options:*   * Option 1: limit Rural ISD as 5km.   Note: as described in 38901, the distance is less then 5km.    *Recommendations for 2nd round:* Further discuss Option 1. |
| **Issue 3-16: TN-NTN SINR** | All agree with Option 1  *Tentative agreements:* Adopt Option 1 for TN-NTN SINR calculation  The satellite receiver off angle should be considered in the satellite receiver gain calculation when calculating SINR. Note that such angle is not considered in TR 38.821 section 6.1.3 equations. Thus those equations should be used for SINR calculation.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 3-17: ACIR model for uplink cases** | All agree to reuse the ACIR model from TR 36.942. The UE numbers needs further discussion.  *Tentative agreements:* Adopt the step wise ACIR model from TR 36.942 for uplink coexistence study.  *Candidate options:*   * Option 1: 3UEs * Option 2: Other numbers (this may be related to Issue 3-6)   *Recommendations for 2nd round:* Further discuss Option 1 & 2 |

## Discussion on 2nd round

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

### Open Issues and view collection

**Issue 3-4: Central beam elevation angle**

* Proposals
  + Option1: Add 45° for GEO only which is consistent with TR 38.821
* Recommended WF
  + Agree on Option 1.

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | We are OK to take additional case if it is agreed by the meeting. |
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**Issue 3-6: NTN UE deployment**

* Proposals
  + Option 1: 3 UEs
  + Option 2: 10/12/15 or other numbers
* Recommended WF
  + Further discuss Option 1 & 2.

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you agree with?** | **Comments** |
| Samsung | Option 1 or 2 | We are OK with either options whichever is agreed by the meeting.  We believe larger number of UEs would make it more practical for NTN UL throughput. But it should also be noted that more active UEs would result in higher complexity of simulation and ACIR. |
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**Issue 3-7: NTN UL TPC**

* Proposals
  + Option 1(remaining in [1]): Adopt the same TPC model of TN for NTN UL scenarios but needs to revise CLx-ile to align with UE UL power control parameters used in TR38.821. The CLx-ile value should be adapted for rural, dense urban and indoor scenarios.
  + Option 2(remaining in [1]): The CLx-ile value should be adapted for rural, dense urban and indoor scenarios.
  + Option 3(Observation of calibration): Do not use UL TPC as indicated by the calibration that UE is always working at maximum power level (23dBm) to ensure the throughput
* Recommended WF
  + Further discuss 3 options taking into account RAN1 status.

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you agree with?** | **Comments** |
| Samsung | Option 3 | We support Option 3 if RAN1 agreed to disable UL TPC for NR-NTN. |
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**3-14: Propagation model between NTN and UE**

* Proposals
  + Option 1(Ericsson): From TR 38.811 NTN shadow fading values:

- Use table 6.6.2-3 for urban scenario (and not table 6.6.2-2).

- For BS LOS values in S-band, reuse LOS values from Ka-band in table 6.6.2-3.

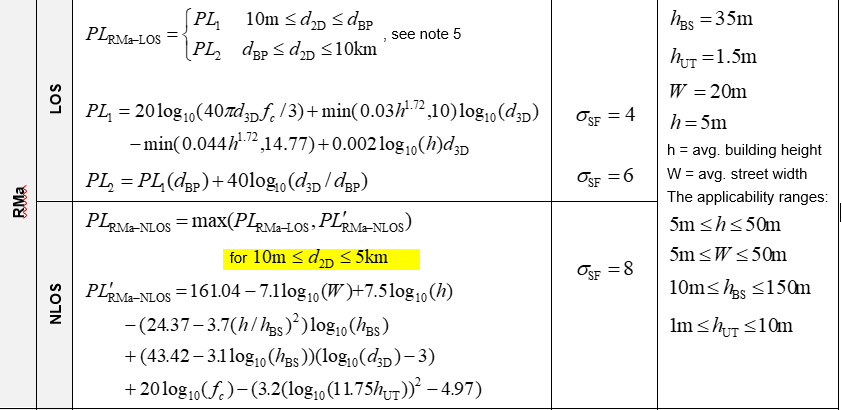
* + Option 2: Follow TR 38.811 values at current stage and send a LS to RAN 1 seeking for clarifications.
  + Option 3: other solutions.
* Recommended WF
  + Further discuss Option 1, 2 & 3.

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you agree with?** | **Comments** |
| Samsung | Option 2 | We support to follow the values in existing TR 38.811 for the time being. |
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**Issue 3-15: Propagation model between TN BS and UE**

* Proposals
  + Option 1(Qualcomm): limit Rural ISD as 5km.

Note: as described in 38901, the distance is less then 5km.



* + Option 2(Moderator): Use ISD derived from Cell range.

|  |  |  |
| --- | --- | --- |
|  | Urban Macro | Rural Macro |
| Cell range in meters | 500 | 5000 |
| ISD in meters | 750 | 7500 |

* Recommended WF
  + Further discuss Option 1 & 2.

|  |  |  |
| --- | --- | --- |
| **Company** | **Which option do you agree with?** | **Comments** |
| Samsung | Option 2 with agreed ISD number | We are open to limit the ISD within 5 km to make us more confidence in using the equations from 38.901. We propose to only use an agreed ISD number instead of cell range/radius for clarification purpose.  We can go with either of the options below, or any other number that eventually can be agreed in this meeting.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | | Option 1  (Moderator) | Option 2  (Issue 5-10) | Option 3  (Issue 5-10) | | Inter-site distance  (m) | Rural | 7500 | 2000 | 2500 | | Urban | 750 | 1000 | 500 | |
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**Issue 3-17: ACIR model for uplink cases**

* Proposal: for uplink ACIR model, how many UE numbers should be considered?
  + Option 1: 3
  + Option 2: Other numbers
* Recommended WF
  + Companies are requested to give a number if Option 1 cannot be agreed with.

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree with Option 1?** | **Comments** |
| Samsung | Option 2 | For TN, use 3 as agreed.  For NTN, use same number as what will be agreed in Issue 3-6. |
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**Issue 3-18: Non AAS BS mechanical downtilt angles**

* Proposal (Samsung): Consider Rural 3 degree and Urban 10 degree for non-AAS as mechanical downtilt angles, same as Issue 5-11 agreements.

|  |  |
| --- | --- |
| Parameter for BS | Values |
| Antenna vertical radiation pattern (dB) |  |
| Antenna horizontal radiation pattern (dB) |  |
| Combining method for 3D antenna pattern (dB) |  |
| Maximum directional gain of an antenna *GE,max* | 17 dBi |
| Conducted power | 46 dBm (Issue 3-12 agreements) |
| Mechanical Downtilt | Rural 3 / Urban 10 degrees |

* Recommended WF
  + Agree on Option 1.

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | It is missing in the non-AAS BS table, we propose to amend it. |
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## Summary for 2nd round

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| --- | --- |
|  | **Status summary** |
| **Issue 3-4: Central beam elevation angle** |  |
| **Issue 3-6: NTN UE deployment** |  |
| **Issue 3-7: NTN UL TPC** |  |
| **Issue 3-14: Propagation model between NTN and UE** |  |
| **Issue 3-15: Propagation model between TN BS and UE** |  |
| **Issue 3-17: ACIR model for uplink cases** |  |
| **Issue 3-18: Non AAS BS mechanical downtilt angles** |  |

# Topic #4: HAPS

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2113310 | Qualcomm Incorporated | **Observation 1:** The impact of the interference coming from co-channel interference within HAPS is obvious, which leads to about 10dB performance degradation at 50% CDF.  **Proposal 1:** The HAPS antenna gain CDF and pathloss CDF should be further calibrated to find the root cause of performance difference in HAPS.  **Observation 2:** When the HAPS UE UL bandwidth is 1MHz, the target SINR of 15dB still can be achieved. The UL CBW for HAPS needs to be further discussed. |
| R4-2113310 | Qualcomm Incorporated | **Proposal 1:** The HAPS UE UL bandwidth could be larger than 0.36 MHz since the link budget of HAPS is much better than LEO and GEO. The feasibility of wrap-around network for HAPS can be discussed. While current HAPS performance is still not quite aligned, this could be discussed later when the performance is comparable.  **Proposal 2:** Since the carrier frequency is 2GHz for both HAPS and NTN, the TN network parameters for HAPS can use the same value with NTN agreements, such as antenna array setting, conducted power, ISD, indoor UE percentage, etc. |
| R4-2113427 | Huawei, HiSilicon | **Proposal 7:** to assume 20% indoor UE for TN in HAPS coexistence simulation. Urban macro channel model can refer to TR 38.901 (because channel model in 38.803 was not updated). |
| R4-2113690 | Nokia | **Observation 1:** HAPS networks have much higher path loss than terrestrial networks.  **Proposal 1:** Align the terrestrial network assumption with NTN simulation assumptions for HAPS coexistence scenarios.  **Proposal 2:** For the HAPS network, UL scheduled bandwidth is 2 RBs per UE and 10 UEs are scheduled per cell. Scheduled UE resources are randomly distributed across the bandwidth.  **Proposal 3:** Use the following parameters to set the UE’s UL transmit power in the agreed UL power control model:   |  |  |  | | --- | --- | --- | | UL power control parameter | TN | HAPS | | Pmax (dBm) | 23 | 23 | | Rmin (dB) | -54 | -54 | | γ | 1 | 1 | | X, transmission bandwidth (MHz) | 5.94 | 0.36 | | Y, BS noise figure (dB) | 5 | 5 |   **Observation A1:** The assumption of 8 dBi element antenna gain and 65⁰ horizontal/vertical HPBW for HAPS coexistence simulations is a realistic assumption.  **Observation A2:** The loss of directivity has been accounted for in the antenna element gain assumption and should not be double counted in simulations.  **Observation A3:** A reasonable separation distance between adjacent elements with 65⁰ beamwidth may be 0.7 wavelength.  **Proposal A1:** In light of the latest input and analysis regarding HAPS antenna parameters, revise the HAPS assumption from R4-2106106 as follows:   |  |  | | --- | --- | | Number of cells | 7 | | Antenna array configuration (row x column) | 2 x 2 for 1st layer cell  4 x 2 for 2nd layer cell | | Antenna polarization | Linear | | Element gain | 7.8 dBi | | Element HPBW horizontal/vertical | for both H/V | | Element front-to-back ratio horizontal/vertical | 30 dB for both H/V | | Element spacing horizontal/vertical | 0.7 wavelength for both H/V | | Antenna panel tilt (from the horizon) | for 1st layer cell  for 2nd layer cell | | EIPR/cell | 56.8 dBm (1st layer cell),  59.8 dBm (2nd layer cell) | | EIRP spectral density/cell | 43.8 dBm/MHz (1st layer cell),  46.8 dBm/MHz (2nd layer cell) | | Tx power per antenna panel | 43 dBm | | Noise figure | 5 dB | | Indoor UE percentage | 0% | | Coverage area (7 cells combined) | A 100 Km radius circular area centered by the serving HAPS | | UE distribution | Uniformly distributed in the coverage area | |
| R4-2113691 | Nokia | Preliminary results indicate HAPS adjacent channel impact on terrestrial networks is minor in the DL. |
| R4-2113742 | Ericsson | **Proposal 4:** Agree on HAPS network parameters as mentioned in Table 2.   |  |  | | --- | --- | | Number of cells | 7 | | Antenna array configuration (row x column) | 2 x 2 for 1st layer cell  4 x 2 for 2nd layer cell | | Antenna polarization | Linear | | Element gain | 7.8 dBi | | Element HPBW horizontal/vertical | for both H/V | | Element front-to-back ratio horizontal/vertical | 30 dB for both H/V | | Element spacing horizontal/vertical | 0.7 wavelength for both H/V | | Antenna panel tilt (from the horizon) | for 1st layer cell  for 2nd layer cell | | EIPR/cell | 56.8 dBm (1st layer cell),  59.8 dBm (2nd layer cell) | | EIRP spectral density/cell | 43.8 dBm/MHz (1st layer cell),  46.8 dBm/MHz (2nd layer cell) | | ~~Tx power per antenna panel~~ | ~~43 dBm~~ | | Conducted power (before ohmic loss) per antenna element (dBm) | 34 dBm for 2 x 2 (x 2 polarizations)  21 dBm for 4 x 2 (x 2 polarizations) | | Noise figure | 5 dB | | Indoor UE percentage | 0% | | Coverage area (7 cells combined) | A 100 Km radius circular area centered by the serving HAPS | | UE distribution | Uniformly distributed in the coverage area |   **Proposal 5:** Agree on TN network and parameters for HAPS as mentioned in Table 3 and Table 4.   |  |  |  | | --- | --- | --- | | Terrestrial environment | Urban macro | Rural macro | | Network layout | 19 sites (57 cells) wrap-around | 19 sites (57 cells) wrap-around | | Inter-site distance | 500m ~~1 Km~~ | 5 ~~2~~ Km | | BS antenna height | 25 m | 30 ~~35~~ m | | ~~BS transmit power~~ | ~~46 dBm~~ | ~~46 dBm~~ | | Conducted power (before Ohmic loss) per antenna element (Note 3) | 25 dBm | 25 dBm | | BS antenna array (M, N, P) | (8, 8, 2) | (8, 8, 2) | | BS antenna Element spacing horizontal/vertical | 0.5 ʎ for H  0.7 ʎ for V | 0.5 ʎ for H  0.9 ʎ for V | | BS antenna downtilt | 10⁰ | 3 ~~6~~⁰ | | BS antenna element gain pattern | **Table 4** | **Table 4** | | BS noise figure | 5 dB | 5 dB | | Indoor UE percentage | ~~7~~ 0% | ~~5~~ 0% |  |  |  |  | | --- | --- | --- | | Parameter | Urban macro | Rural macro | |  | 90 | 90 | |  | 65 | 54 | |  | 30 | 30 | |  | 30 | 30 | |  | 6.4 | 7.1 |   **Proposal 6:** For HAPS simulations in UL, consider 3 UEs for both HAPS and TN networks. |

## 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 4-1

This sub-topic focus on network side.

*Open issues and candidate options before e-meeting:*

**Issue 4-1: HAPS network layout**

* Proposals
  + Option 1(Qualcomm): The feasibility of wrap-around network for HAPS can be discussed
* Recommended WF
  + Further discuss Option 1 and possible layouts for HAPS.

**Issue 4-2: HAPS network parameters**

* Proposals
  + See proposed changes in Option 1 marked in Yellow and Option 2 marked in Green below.

|  |  |  |
| --- | --- | --- |
|  | Option 1 (Nokia) | Option 2 (Ericsson) |
| Number of cells | 7 |  |
| Antenna array configuration (row x column) | 2 x 2 for 1st layer cell  4 x 2 for 2nd layer cell |  |
| Antenna polarization | Linear |  |
| Element gain | 7.8 dBi | 7.8 dBi |
| Element HPBW horizontal/vertical | for both H/V |  |
| Element front-to-back ratio horizontal/vertical | 30 dB for both H/V |  |
| Element spacing horizontal/vertical | 0.7 wavelength for both H/V | 0.7 wavelength for both H/V |
| Antenna panel tilt (from the horizon) | for 1st layer cell  for 2nd layer cell |  |
| EIPR/cell | 56.8 dBm (1st layer cell),  59.8 dBm (2nd layer cell) | 56.8 dBm (1st layer cell),  59.8 dBm (2nd layer cell) |
| EIRP spectral density/cell | 43.8 dBm/MHz (1st layer cell),  46.8 dBm/MHz (2nd layer cell) | 43.8 dBm/MHz (1st layer cell),  46.8 dBm/MHz (2nd layer cell) |
| Tx power per antenna panel | 43 dBm | ~~43 dBm~~ |
| Conducted power (before ohmic loss) per antenna element (dBm) |  | 34 dBm for 2 x 2 (x 2 polarizations)  21 dBm for 4 x 2 (x 2 polarizations) |
| Noise figure | 5 dB |  |
| Indoor UE percentage | 0% |  |
| Coverage area (7 cells combined) | A 100 Km radius circular area centered by the serving HAPS |  |
| UE distribution | Uniformly distributed in the coverage area |  |

* Recommended WF
  + Agree on Option 1 & Option 2 and incorporate them in one table.

**Issue 4-3: General consideration of TN network parameters**

* Proposals
  + Option 1(Qualcomm, Nokia): Align the terrestrial network assumption with NTN simulation assumptions for HAPS coexistence scenarios.
* Recommended WF
  + Agree on Option 1 but specific parameters may be changed to meet the unique requirements for HAPS co-existence study.

**Issue 4-4: Specific TN network parameters**

* Proposals
  + Option 1(Ericsson): Agree on TN network and parameters for HAPS as mentioned in Table 3 and Table 4 of [2].

Table 3

|  |  |  |
| --- | --- | --- |
| Terrestrial environment | Urban macro | Rural macro |
| Network layout | 19 sites (57 cells) wrap-around | 19 sites (57 cells) wrap-around |
| Inter-site distance | 500m ~~1 Km~~ | 5 ~~2~~ Km |
| BS antenna height | 25 m | 30 ~~35~~ m |
| ~~BS transmit power~~ | ~~46 dBm~~ | ~~46 dBm~~ |
| Conducted power (before Ohmic loss) per antenna element (Note 3) | 25 dBm | 25 dBm |
| BS antenna array (M, N, P) | (8, 8, 2) | (8, 8, 2) |
| BS antenna Element spacing horizontal/vertical | 0.5 ʎ for H  0.7 ʎ for V | 0.5 ʎ for H  0.9 ʎ for V |
| BS antenna downtilt | 10⁰ | 3 ~~6~~⁰ |
| BS antenna element gain pattern | **Table 4** | **Table 4** |
| BS noise figure | 5 dB | 5 dB |
| Indoor UE percentage | ~~7~~ 0% | ~~5~~ 0% |

Table 4

|  |  |  |
| --- | --- | --- |
| Parameter | Urban macro | Rural macro |
|  | 90 | 90 |
|  | 65 | 54 |
|  | 30 | 30 |
|  | 30 | 30 |
|  | 6.4 | 7.1 |

* + Option 2(Huawei): 20% Indoor UE
* Recommended WF
  + Further discuss Option 1 & Option 2, noting that Option 2 is part of Option 1.

### Sub-topic 4-2

This sub-topic focus on UE side and propagation model.

*Open issues and candidate options before e-meeting:*

**Issue 4-5: HAPS UL Scheduled BW**

* Proposals
  + Option 1(Nokia): 2RBs per UE and 10 UEs per cell. Scheduled UE resources are randomly distributed across the bandwidth.
  + Option 2(Ericsson): 3 UEs
* Recommended WF
  + Further discuss Option 1 & 2.

**Issue 4-6: TN UL Scheduled BW**

* Proposals
  + Option 1(Ericsson): 3 UEs
* Recommended WF
  + Agree on Option 1.

**Issue 4-7: UE uplink power control**

* Proposals
  + Option 1(Nokia): Use the following parameters to set the UE’s UL transmit power in the agreed UL power control model.

|  |  |  |
| --- | --- | --- |
| UL power control parameter | TN | HAPS |
| Pmax (dBm) | 23 | 23 |
| Rmin (dB) | -54 | -54 |
| Γ | 1 | 1 |
| X, transmission bandwidth (MHz) | 5.94 | 0.36 |
| Y, BS noise figure (dB) | 5 | 5 |

* + Option 2: The HAPS UE UL bandwidth could be larger than 0.36 MHz since the link budget of HAPS is much better than LEO and GEO
* Recommended WF
  + Further discuss Option 1 & 2, noting that Option 2 is part of Option 1.

**Issue 4-8: Propagation model**

* Proposals
  + Option 1(Huawei, HiSilicon): Urban macro channel model can refer to TR 38.901 (because channel model in 38.803 was not updated).

Table 5 in [2]

|  |  |  |  |
| --- | --- | --- | --- |
| Scenario | Radio Link | Channel model | Reference |
| TN+HAPS (UMa) | TN BS to TN UE | Urban Macro | ~~TR 38.803 [6]~~  TR 38.901 |
| TN+HAPS (UMa) | HAPS to TN UE | NTN Urban + penetration loss1 | TR 38.811 [7] |
| TN+HAPS (UMa) | HAPS to HAPS UE | NTN Urban | TR 38.811 [7] |
| TN+HAPS (RMa) | TN BS to TN UE | Rural Macro | TR 38.901 [8] |
| TN+HAPS (RMa) | HAPS to TN UE | NTN Rural+ penetration loss1 | TR 38.811 [7] |
| TN+HAPS (RMa) | HAPS to HAPS UE | NTN Rural | TR 38.811 [7] |
| HAPS+HAPS (RMa) | HAPS to HAPS UE | NTN Rural | TR 38.811 [7] |
| Note 1: Penetration loss model is specified in TR 38.803, assuming 50% low-loss model and 50% high-loss model. It only applies to indoor UEs. | | | |

* Recommended WF
  + Further discuss Option 1.

## Companies views’ collection for 1st round

### Open issues

Sub topic 4-1

**Issue 4-1: HAPS network layout**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | The antenna pattern for HAPS is different for 1st and 2nd layers which is different from NTN. Warp-around could solve this issue but it will increase the simulation complexity. We are open to discuss it. |
| Nokia | For ACI analysis, we think it is sufficient to study HAPS impact on TN when the two networks are separated by various distances (from 0 up to HAPS coverage radius) without HAPS wrap-around. The requirement can be derived from the worst case of various separations. Doing wrap-around for HAPS needs to make assumption of multiple HAPS deployment which is not clear at this moment. HIBS study in ITU does not use wrap-around for HIBS either. We would rather avoid this complication. |

**Issue 4-2: HAPS network parameters**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Ericsson | Agree | The option is aligned with NTN parameters and LS Replyt with ITU where we only provide the conducted power per antenna element, not the Tx power per panel. |
| Qualcomm | No | For option 2, for conduct power: shouldn’t be 31 dBm for 4 x 2 (x 2 polarizations)? |
| Nokia | Agree. | We can add an additional row for “conducted power per antenna element” but still keep “Tx power per antenna panel”. |

**Issue 4-3: General consideration of TN network parameters**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Ericsson | Agree | This is also our proposal |
| Qualcomm | Agree |  |
| Nokia | Agree | Our view is that TN assumption for HAPS coexistence simulations should reuse the TN assumption for NTN (satellites) whenever possible. |

**Issue 4-4: Specific TN network parameters**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | The idea here is to align TN parameters used for HAPS with the ones used for NTN. Why should we have 20% indoor UEs with HAPS while we agree to have 0% with NTN? |
| Huawei | These indoor UE radio is for the TN network. Generally, we assume 20% indoor UE for urban macro scenario. Anyway, 70%/50% isn’t reasonable. |
| Qualcomm | We agree to align with NTN parameters. 0% indoor UE should be considered for HAPS. |
| Nokia | In principle, we agree to adopt the TN parameters for NTN coexistence. Two comments here: (1) the Inter-site distance should be 750 m and 7.5 km for UMa and Rural respectively (corresponding to 500 m and 5 km cell radius in the NTN assumption tdoc). (2) Indoor UE percentage in the channel model according to 38.901 (section 7.2) is 80% for UMa and 50% for rural. Why not use that assumption? 0% indoor UE for TN is not realistic. |

Sub topic 4-2

**Issue 4-5: HAPS UL Scheduled BW**

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Ericsson |  | We understand 106/3 RBs would be to large number for HAPS, but 2 RBs might be very small, UL troughput would be very low, shouldn’t we consider higher value still? 10 UEs would be ok. |
| Huawei |  | We should consider the UL traffic mode. 2RB is not realistic. |
| Qualcomm |  | We are OK to have 3UEs but the number of ULRBs could be larger than 2RBs considering the link budget for HAPS is much better than NTN. |
| Nokia | Option 1 | We think limiting scheduled BW to 2 RBs is needed to ensure sufficient power spectral density for UL cell edge (5%-tile) throughput to be >0. If only 3 UEs are scheduled, then the used BW in UL will only be 6 RBs, which is a tiny fraction of 20 MHz system bandwidth.  However, we are open for suggestions. Perhaps using the same 6 RBs in all of the 7 cells? |

**Issue 4-6: TN UL Scheduled BW**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Ericsson | Agree | Again, this is to aligned with NTN |
| Qualcomm | Agree |  |
| Nokia | Agree. | The same assumption for NTN coexistence can be used here. |

**Issue 4-7: UE uplink power control**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | The transmission BW depends on the number fo RBs we will scheduled, so this is related to issues 4-5 and 4-6. |
| Huawei | Share views with Ericsson. It depends on the issue 4-5 and 4-6. |
| Qualcomm | Agree with Ericsson. |
| Nokia | Support Option 1. Using a scheduled BW > 2 RBs for HAPS UE may result in zero cell edge throughput using the NTN propagation model 38.811. That would make it impossible to evaluate ACI impact on HAPS cell edge throughput. |

**Issue 4-8: Propagation model**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with Option 1 or not?** | **Comments** |
| Ericsson | Agree |  |
| Huawei | Agree |  |
| Qualcomm | Agree |  |
| Nokia | Agree. |  |

## 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** |
| **Issue 4-1: HAPS network layout** | Based on the comments, wrap-around network for HAPS is not needed.  *Tentative agreements:* Do not use wrap-around network for HAPS.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 4-2: HAPS network parameters** | Most parameters look acceptable except “Tx power per antenna panel” and “Conducted power per antenna element”  *Tentative agreements:* Accept proposed parameters except “Tx power per antenna panel” and “Conducted power per antenna element”.  *Candidate options:*  Tx power per antenna panel:   * Option 1: Remove this item * Option 2: Keep this item   Conducted power per antenna element:   * Option 1: 21 dBm for 4 x 2 (x 2 polarizations) * Option 2: 31dBm for 4 x 2 (x 2 polarizations)   *Recommendations for 2nd round:* Further discuss options above. |
| **Issue 4-3: General consideration of TN network parameters** | All agree with the WF  *Tentative agreements:*  Align the terrestrial network assumption with NTN simulation assumptions for HAPS coexistence scenarios, but specific parameters may be changed to meet the unique requirements for HAPS co-existence study.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 4-4: Specific TN network parameters** | Most changes are acceptable but there’re different views on ISD and Indoor UE percentage.  *Tentative agreements:* Adopt changes except Indoor UE percentage.  *Candidate options:*  Indoor UE percentage   * Option 1: 0% * Option 2: 20% * Option 3: 80% (Uma) & 50%(Rural)   ISD   * Option 1: 750m (UMa) & 7.5km (Rural) * Option 2: 500m (Uma) & 5km (Rural)   *Recommendations for 2nd round:* Further discuss options above |
| **Issue 4-5: HAPS UL Scheduled BW** | No agreement can be made so far.  *Tentative agreements:* N/A  *Candidate options:*  Option 1: 3UEs with []RBs  Option 2: 10UEs with 2RBs  Option 3: Traffic mode needs to be considered when discussing Option 1&2  *Recommendations for 2nd round:* Further discuss Option 1, 2&3. |
| **Issue 4-6: TN UL Scheduled BW** | All agree with Option 1 3UEs  *Tentative agreements:* Adopt Option 1 3UEs  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |
| **Issue 4-7: UE uplink power control** | This issue depends on the outcome of Issue 4-5&4-6  *Tentative agreements:* N/A  *Candidate options:* N/A  *Recommendations for 2nd round:* Determine TN & HAPS transmission BW based on agreements of Issue 4-5 & Issue 4-6 |
| **Issue 4-8: Propagation model** | All agree with Option 1  *Tentative agreements:* Urban macro channel model can refer to TR 38.901.  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A |

## Discussion on 2nd round

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

### Open Issues and view collection

**Issue 4-2-1: HAPS network parameters-Tx power per antenna pannel**

* Proposals
  + Option 1(Ericsson): Remove “**Tx power per antenna pannel**”;
  + Option 2(Nokia): Keep “**Tx power per antenna pannel**”
* Recommended WF
  + Further discussion Option 1 & 2

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Huawei | Option 1 | We can follow the general assumption for Base station. |
| Nokia | Option 2 | It does not hurt to keep this parameter. It adds to the clarity of HAPS transmit power. |
|  |  |  |
|  |  |  |

**Issue 4-2-2: HAPS network parameters - Conducted power per antenna element**

* Proposals
  + Option 1(Ericsson): 21 dBm for 4 x 2 (x 2 polarizations)
  + Option 2(Nokia): 31dBm for 4 x 2 (x 2 polarizations)
* Recommended WF
  + Further discussion Option 1 & 2

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Huawei |  | One question for clarification: why these two options are so different? |
| Nokia | Option 2 | Probably “21 dBm” is a typo? With 4x2x2, the conducted power per element should be 31 dBm for the total transmit power per panel to be 43 dBm. |
|  |  |  |
|  |  |  |

**Issue 4-4-1: Specific TN network parameters – Indoor UE percentage**

* Proposals
  + Option 1(Ericsson, Qualcomm): 0%
  + Option 2(Huawei): 20%
  + Option 3(Nokia): 80% (Uma) & 50%(Rural)
* Recommended WF
  + Further discussion Option 1 & 2

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Huawei | Option 1 or 2 | I’m OK if majority view is option 1. |
| Nokia | Option 3 | The indoor UE percentage in Option 3 is consistent with the channel model scenarios for TN. |
|  |  |  |
|  |  |  |

**Issue 4-4-2: Specific TN network parameters – ISD**

* Proposals
  + Option 1: 750m (UMa) & 7.5km (Rural)
  + Option 2: 500m (Uma) & 5km (Rural)
* Recommended WF
  + Further discussion Option 1 & 2

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Huawei |  | The proposal is not related to ISD. |
| Nokia | Option 1 | To be consistent with NTN assumption, TN network ISD should be 750 m for Urban macro and 7.5 km for rural. |
|  |  |  |
|  |  |  |

**Issue 4-5: HAPS UL Scheduled BW**

* Proposals
  + Option 1: 3UEs with []RBs
  + Option 2: 10UEs with 2RBs
  + Option 3: Traffic mode needs to be considered when discussing Option 1&2
* Recommended WF
  + Further discussion Option 1, 2 &3.

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Huawei | Option 3 | I think the UL throughput is very low if we assume 2 RBs. It’s just like NB-IoT. |
| Nokia | Option 2, but open to other alternatives. | Not all the UEs can be allocated a wide bandwidth for UL. If the UE is in NLOS with HAPS, the 38.811 propagation model can add a 17-19 dB clutter loss for the link. The 2 RB allocation in Option 2 considers those UEs in a bad channel condition. However, much more transmission BW is feasible for UEs in a favorable channel condition. Does it make sense to classify UEs as “high BW UE” (those in good channel condition) and “low BW UE” (those in bad channel condition) and assign BW accordingly? We are open to suggestions.  If we want to use the same BW for all UEs, Option 2 is probably the simplest model. |
|  |  |  |
|  |  |  |

**Issue 4-7: UE uplink power control**

* Proposals
  + Option 1(Nokia):

|  |  |  |
| --- | --- | --- |
| UL power control parameter | TN | HAPS |
| X, transmission bandwidth (MHz) | 5.94 | 0.36 |

* + Option 2: The HAPS UE UL bandwidth could be larger than 0.36 MHz since the link budget of HAPS is much better than LEO and GEO
* Recommended WF
  + Determine TN & HAPS transmission BW based on agreements of Issue 4-5 & Issue 4-6

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Moderator |  | Agreement of Issue 4-6: 3UE for TN UL |
| Nokia | Agree. | For TN, assuming 3 UEs sharing 20 MHz bandwidth, each UE will be allocated 33 RBs or 5.94 MHz. For HAPS, the parameter value is the result of agreement for Issue 4-5. |
|  |  |  |
|  |  |  |

## Summary for 2nd round

|  |  |
| --- | --- |
|  | **Status summary** |
| **Issue 4-2: HAPS network parameters** |  |
| **Issue 4-4: Specific TN network parameters** |  |
| **Issue 4-5: HAPS UL Scheduled BW** |  |
| **Issue 4-7: UE uplink power control** |  |

# Topic #5: Calibration and alignment

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112012 | CATT | Further consideration on simulation assumption |
| R4-2112013 | CATT | Simulation results for NTN |
| R4-2112716 | Samsung | NR-NTN calibration summary and observations |
| R4-2113296 | Xiaomi | Coexistence study assumptions on NR to support non-terrestrial networks |
| R4-2113394 | HHI | In this document, we provided our calibration results based on the simulation assumptions that were agreed during the offline E-mail discussion between RAN4#99-e and #100-e. Additional assumptions are introduced in Section 2. Preliminary results for DL and UL coupling loss and SINR were also shared in the E-mail discussion and the results presented in Section 3 are an update of the preliminary results. |
| R4-2113691 | Nokia | We presented SINR distributions in HAPS and LEO coexistence scenarios for simulation alignment, as well as HAPS DL coexistence simulation results using the updated assumption. Preliminary results indicate HAPS adjacent channel impact on terrestrial networks is minor in the DL. |
| R4-2113743 | Ericsson | In this contribution, we provided again our simulations results, with some additional figures. We have also made some first observations from the results shared so far by all companies. |
| R4-2113931 | ZTE | In this contribution, we shared some initial simulation results for NTN and TN simulation calibration. Regarding the ACIR result for NTN and TN coexistence study, these simulation results could be provided later on. |
| R4-2114486 | THALES | NTN co-existence calibration with THALES updated values |

## 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 5-1

*Open issues and candidate options before e-meeting:*

**Issue 5-1: NTN propagation model considerations**

* Proposals
  + Option 1(Samsung, Qualcomm, ZTE, Xiaomi, Huawei, THALES, FhG, Ericsson, CATT): Follow propagation model in 38.811, and do not consider atmospheric loss, ionosphere/scintillation loss or O2I/building-entry loss.
* Recommended WF
  + Adopt Option 1 for calibration assumption alignment.

**Issue 5-2: NTN adjacent beam ACI consideration in SINR**

* Proposals
  + Option 1(Samsung, Qualcomm, ZTE, Xiaomi, THALES, FhG, Ericsson, CATT): Consider 6 adjacent beams’ ACI for centre beam SINR;
  + Option 2(Huawei): Not consider adjacent beams’ ACI.
* Recommended WF
  + Adopt Option 1 for calibration assumption alignment.

**Issue 5-3: Number of NTN UL UE considered**

* Proposals
  + Option 1(Samsung, Qualcomm, ZTE, Xiaomi, THALES, FhG, Ericsson, CATT): 3 (Referring to R4-2108645 Table 2.3-3, Row ‘The number of active UE (UL)’);
  + Option 2(Huawei): 1.
* Recommended WF
  + Adopt Option 1 for calibration assumption alignment.

**Issue 5-4: NTN elevation angle considered**

* Proposals
  + Option 1(Samsung, Qualcomm, Xiaomi, THALES, FhG, Ericsson, CATT): 90 degrees for GEO and LEO (Referring to R4-2108645 Table 2.4.1-1, Row ‘Central beam bore sight direction’);
  + Option 2(ZTE): 45 degrees for GEO, 90 degrees for LEO;
  + Option 3(Huawei): 91 degrees for GEO and LEO.
* Recommended WF
  + Adopt Option 1 for calibration assumption alignment.

### Sub-topic 5-2

**Issue 5-5: TN Rural AAS parameters**

* Proposals
  + Two Options as below

|  |  |  |
| --- | --- | --- |
|  | Option 1  (Samsung, Qualcomm, ZTE, Xioami, Huawei, Ericsson, CATT) | Option 2  (Nokia) |
| Reference | Referring to RP-200559\_R4-2008924 | - |
| Element gain (dBi) | 7.1 | 6.4 |
| 3dB | H 90 / V 54 | H 90 / V 65 |
| Front-back | 30 H/V | 30 H/V |
| Array | 8x8 | 16x8 |
| Element spacing | H 0.5/V 0.9 | H 0.5/V 0.7 |
| Conducted Tx power (dBm) | 25 | 22 |
| Ohmic loss (dB) | 2 | 2 |
| Mechanical downtilt (degrees) | 3 | 6 |

* Recommended WF
  + Adopt Option 1 for calibration assumption alignment.

**Issue 5-6: TN Urban AAS parameters**

* Proposals
  + Two Options as below

|  |  |  |
| --- | --- | --- |
|  | Option 1  (Samsung, Qualcomm, ZTE, Xioami, Huawei, Ericsson, CATT) | Option 2  (Nokia) |
| Reference | Referring to RP-200559\_R4-2008924 | - |
| Element gain (dBi) | 6.4 | 5.5 |
| 3dB | H 90 / V 65 | H 90 / V 90 |
| Front-back | 30 H/V | 30 H/V |
| Array | 8x8 | 16x8 |
| Element spacing | H 0.5/V 0.7 | H 0.5/V 0.5 |
| Conducted Tx power (dBm) | 25 | 22 |
| Ohmic loss (dB) | 2 | 2 |
| Mechanical downtilt (degrees) | 10 | 10 |

* Recommended WF
  + Adopt Option 1 for calibration assumption alignment.

**Issue 5-7: TN polarization gain consideration**

* Proposals
  + Option 1(Samsung, Xiaomi, CATT): polarization gain not considered;
  + Option 2(Qualcomm, Nokia, Huawei): 3dB polarization gain considered
* Recommended WF
  + TBA.

**Issue 5-8: TN UL UE number**

* Proposals
  + Option 1(Samsung, Qualcomm, ZTE, Xiaomi, Nokia, Huawei, CATT): 3 (Referring to R4-2108645 Table 2.3-5, Row ‘Number of scheduled UE per cell (UL)’);
  + Option 2(Ericsson): 1
* Recommended WF
  + Adopt Option 1 for calibration assumption alignment.

**Issue 5-9: TN UE Outdoor/Indoor distribution**

* Proposals
  + Option 1(Samsung, CATT): 100% Outdoor (Referring to R4-2108645 Table 2.3-6, Row ‘UE Outdoor/indoor’);
  + Option 2(Nokia): Rural: 50% Indoor, Urban 70% Indoor.
* Recommended WF
  + Adopt Option 1 for calibration assumption alignment.

**Issue 5-10: Cell radius/Inter-site distance**

* Proposals
  + Three options as bleow.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | Option 1  (Samsung) | Option 2  (Nokia) | Option 3  (CATT) |
| Cell radius  (m) | Rural | 5000\* | - | - |
| Urban | 500\* | - | - |
| Inter-site distance  (m) | Rural | 7500 | 2000 | 2500 |
| Urban | 750 | 1000 | 500 |

\* Referring to R4-2108645 Table 2.3-6, Row ‘Cell radius in meters’

* Recommended WF
  + Adopt Option 1 for calibration assumption alignment.

**Issue 5-11: TN non-AAS BS parameters**

* Proposals
  + Option 1(Samsung): Referring to R4-2108645 Table 2.4.3-1

|  |  |
| --- | --- |
| **Parameter for BS** | **Values** |
| Antenna vertical radiation pattern (dB) |  |
| Antenna horizontal radiation pattern (dB) |  |
| Combining method for 3D antenna pattern (dB) |  |
| Maximum directional gain of an antenna *GE,max* | 17 dBi |
| Conducted power | 46 dBm |
| Mechanical Downtilt | Rural 3 / Urban 10 |

* + Option 2(Xiaomi, Huawei):
    - Antenna Gain: 17 dBi
    - Conducted power: 46 dBm
    - 3dB: H 65 / V 10
    - Front-back: H 30 / V 30
    - Mechanical downtilt: Rural 3 / Urban 10
* Recommended WF
  + Further discuss Option 1 & 2.

### Sub-topic 5-3

**Issue 5-12: Calibration and alignment**

* Proposals
  + Option 1: N/A
* Recommended WF
  + The updated summary of calibration results and assumptions will be captured in the new TR 38.863. With results collected and analysed, the calibration phase is done.

## Companies views’ collection for 1st round

### Open issues

Sub topic 5-1

**Issue 5-1: NTN propagation model considerations:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | Most companies are using this assumption. |
| Ericsson | Agree |  |
| ZTE | Agree |  |
| THALES | Agree |  |

**Issue 5-2: NTN adjacent beam ACI consideration in SINR**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | Most companies are using this assumption, and Option 2 can only derive SNR not SINR. |
| Ericsson | Agree | Option 1 makes sense |
| ZTE | Agree |  |
| THALES | Agree | Option 1, as we decided to represent CDF=f(SINR) |

**Issue 5-3: Number of NTN UL UE considered**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | It’s agreed in last meeting, and most companies are using this assumption. |
| Ericsson | Agree |  |
| ZTE | Agree |  |
| THALES | Agree |  |

**Issue 5-4: NTN elevation angle considered**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | It’s agreed in last meeting, and most companies are using this assumption. |
| Ericsson | Agree for calibration | We have different proposals depending on the scenarios, see issue 2-1 / annex 3 |
| ZTE | Agree for calibration | However for final coexistence study, we would like to use elevation angle as 45; |
| Huawei |  | We also use 90 degree. It’s a typo. |
| THALES | Agree |  |

Sub-topic 5-2

**Issue 5-5: TN Rural AAS parameters**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | Most companies are using this assumption. |
| Ericsson | Agree | We shall align with NTN and the LS Reply to ITU. |
| ZTE | Agree | To align with the LS Reply to ITU. |
| THALES | Agree |  |
| Nokia | Agree | We will update our calibration data with this assumption. |

**Issue 5-6: TN Urban AAS parameters**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | Most companies are using this assumption. |
| Ericsson | Agree | We shall align with NTN and the LS Reply to ITU. |
| ZTE | Agree | To align with the LS Reply to ITU. |
| THALES | Agree |  |
| Nokia | Agree | We will update our calibration data with this assumption. |

**Issue 5-7: TN polarization gain consideration**

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Samsung | Option 1 | We support our option, but we are also open to see what the other calibration participating companies’ views are. We can agree on the options implemented by the majorities. |
| Ericsson | Option 2 |  |
| ZTE | Option 2 |  |
| Huawei | Option 2 |  |
| THALES |  | Option 1 or Option 2. For calibration we could consider Option 1 and for further simulations Option 2. |
| Samsung | Seek clarification on Option 2. | Can Option 2 proponent (Ericsson, ZTE or Huawei) clarify 1) if polarization loss is compatible with TN parameters we used 2) polarization gain 3dB applied additionally to wanted signal or 3dB loss applied to other signals. |
| Ericsson | Some clarification on option 2 | The term “polarization gain” might be RAN4 internal language actually and could not be accurate naming…  Even if there is no dedicated row in the table 2, the LS to ITU-R (R4-2103104) is considering this “polarization gain”: the note 3 (related to conducted power) is mentioning:  *The conducted power per element assumes 8x8****x2*** *elements (i.e. power per H/V polarized element).*  There is so one element per polarization, and the “x2” indicates 2 polarizations. That gives then a “polarization gain” of 3dB (=10 Log(2)).  This “gain” is applicable to the TN AAS BS total output power. |

**Issue 5-8: TN UL UE number**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | It’s agreed in last meeting, and most companies are using this assumption. |
| Ericsson | Option 1 | We should update our simu with 3 UEs. |
| ZTE | Agree |  |
| THALES | Agree |  |
| Nokia | Agree. |  |

**Issue 5-9: TN UE Outdoor/Indoor distribution**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | It’s agreed in last meeting, and most companies are using this assumption. |
| Ericsson | Agree with option 1 |  |
| ZTE | Agree |  |
| Huawei | Agree with option 1 |  |
| Qualcomm | Agree |  |
| THALES | Agree |  |
| Nokia | Agree | We will update our calibration data with this assumption. |

**Issue 5-10: Cell radius / Inter-site distance**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | It’s agreed in last meeting, and most companies are using this assumption. |
| Ericsson | Agree with opt 1 | We shall align TN parameters with the ones we took for NTN. |
| ZTE | Agree |  |
| Huawei |  | In 3GPP language, 5000/500 is called cell range. We can only use the ISD which will not cause confusion. |
| Qualcomm | No | We should make sure the pathloss equation in TR38901 is feasible for the distance larger than 5000m |
| THALES |  | The table does not seem to be correct because there is no direct correspondence between cell radius and ISD. |
| Nokia | Agree | We will update our calibration data with this assumption. |

**Issue 5-11: TN non-AAS BS parameters**

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Samsung | Option 1 | It is agreed model in last RAN4 meeting. |
| Ericsson | Option 1 | The only difference between the 2 proposals seems to be the front back ratio, right? |
| ZTE | Option 1 | To Ericsson, yes. |
| Huawei |  | We will further check our parametes. |

Sub-topic 5-3

**Issue 5-12: Calibration and alignment**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree | We have 10 contributors, and we have seen a common set of assumptions and calibration data from the majority. |
| Ericsson | Partially agree | Results should be captured in the TR, but I don’t think we could consider the calibration is done as we have still many differences in companies’ results, further discussion/alignment is needed. |
| ZTE | Agree |  |

## 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** |
| **Issue 5-1: NTN propagation model considerations** | All agree with Option 1.  *Tentative agreements:* The atmospheric loss, ionosphere/scintillation loss, O2I/building entry loss are considered as 0 when implementing 38.811 propagation model in calibration.  *Candidate options: N/A*  *Recommendations for 2nd round: N/A* |
| **Issue 5-2: NTN adjacent beam ACI consideration in SINR** | All agree with Option 1.  *Tentative agreements:* Consider 6 adjacent beams as intra-system interference for NTN central beam SINR calibration.  *Candidate options: N/A*  *Recommendations for 2nd round: N/A* |
| **Issue 5-3: Number of NTN UL UE considered** | All agree with Option 1.  *Tentative agreements:* 3 NTN UL UEs for NTN calibration.  *Candidate options: N/A*  *Recommendations for 2nd round: N/A* |
| **Issue 5-4: NTN elevation angle considered** | All agree with Option 1.  *Tentative agreements:* Use 90 degrees for both GEO and LEO600, LEO1200 as NTN central beam elevation angle in NTN calibration.  *Candidate options: N/A*  *Recommendations for 2nd round: N/A* |
| **Issue 5-5: TN Rural AAS parameters** | All agree with Option 1.  *Tentative agreements:* Adopts Option 1 as TN Rural BS AAS parameters in TN calibration.  *Candidate options: N/A*  *Recommendations for 2nd round: N/A* |
| **Issue 5-6: TN Urban AAS parameters** | All agree with Option 1.  *Tentative agreements:* Adopts Option 1 as TN Urban BS AAS parameters in TN calibration.  *Candidate options: N/A*  *Recommendations for 2nd round: N/A* |
| **Issue 5-7: TN polarization gain consideration** | 3 companies support Option 2 and 1 company supports Option 1.  *Tentative agreements: N/A*  *Candidate options:*   * Option 1(Samsung, Xiaomi, CATT): polarization gain not considered; * Option 2(Qualcomm, Nokia, Huawei): 3dB polarization gain considered   *Recommendations for 2nd round:* Try to agree on Option 2. |
| **Issue 5-8: TN UL UE number** | All agree with Option 1.  *Tentative agreements:* 3 UL UEs in TN calibration.  *Candidate options: N/A*  *Recommendations for 2nd round: N/A* |
| **Issue 5-9: TN UE Outdoor/Indoor distribution** | All agree with Option 1.  *Tentative agreements:* UEs are distributed 100% Outdoor in TN calibration.  *Candidate options: N/A*  *Recommendations for 2nd round: N/A* |
| **Issue 5-10: Cell radius / Inter-site distance** | 3 companies support Option 1, 1 company opposed Option 1.  2 Companies propose to directly use ISD to avoid confusion.  *Tentative agreements:* Adopt ISD rather than Cell radius.  *Candidate options:*   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | | Option 1  (Samsung) | Option 2  (Nokia) | Option 3  (CATT) | | Inter-site distance  (m) | Rural | 7500 | 2000 | 2500 | | Urban | 750 | 1000 | 500 |   *Recommendations for 2nd round:* Further discuss Option 1, 2 &3. |
| **Issue 5-11: TN non-AAS BS parameters** | All agree with Option 1.  *Tentative agreements:* Adopt Option 1 as TN non-AAS BS antenna parameters in TN calibration.  *Candidate options: N/A*  *Recommendations for 2nd round: N/A* |
| **Issue 5-12: Calibration and alignment** | 2 companies support recommended WF, 1 company agreed to capture assumptions and results in new TR 38.863, but concerned calibration required further work.  *Tentative agreements:* N/A  *Candidate options:* N/A  *Recommendations for 2nd round:* N/A  Agreement of GTW session on Aug. 20  The updated summary of calibration results and assumptions will be captured in the new TR 38.863  The calibration results indicate the consistency of most companies’ simulations. Therefore, calibration work has mostly been done for NTN coexistence. Companies can continue to contribute on calibration aspect over emails till Sep 30th.  For HAPS calibration, companies will continue the effort for calibration. It’s encouraged interested companies can provide results for HAPS, RAN4 will check the status till Nov 2021 RAN4 meeting.  RAN4 start to discuss the simulation assumption and co-existence results for phase 1 as agreed in previous work plan, RAN4 will check the status in Nov 2021 RAN4 meeting with the target to conclude phase 1 co-existence study by Nov 2021. |

## Discussion on 2nd round

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

### Open Issues and view collection

**Issue 5-7: TN polarization gain consideration**

* Proposals
  + Option 1(Samsung, Xiaomi, CATT): polarization gain not considered;
  + Option 2(Qualcomm, Nokia, Huawei): 3dB polarization gain considered
* Recommended WF
  + Agree on Option 2

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree with W/F or not?** | **Comments** |
| Samsung | Agree |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Issue 5-10: Cell radius / Inter-site distance**

* Proposals

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | Option 1  (Samsung) | Option 2  (Nokia) | Option 3  (CATT) |
| Inter-site distance  (m) | Rural | 7500 | 2000 | 2500 |
| Urban | 750 | 1000 | 500 |

* Recommended WF
  + Further discuss Option 1, 2 & 3

|  |  |  |
| --- | --- | --- |
| **Company** | **Which Option do you support?** | **Comments** |
| Samsung | Option 1, 2 or 3. | We are OK to go with either option.  We propose the moderator to agree on the most-voted/supported option in this meeting for calibration purpose. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## Summary for 2nd round

|  |  |
| --- | --- |
|  | **Status summary** |
| **Issue 5-7: TN polarization gain consideration** |  |
| **Issue 5-10: Cell radius / Inter-site distance** |  |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on [313] NTN\_Solutions\_Part2 | Samsung |  |
| Simulation assumptions for NTN co-existence | Samsung, CATT |  |
| Simulation assumptions for HAPS co-existence | Nokia |  |

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** |
| R4-2115749 | WF on [313] NTN\_Solutions\_Part2 | Samsung |  |  |
| R4-2115750 | Simulation assumptions for NTN co-existence | Samsung, CATT |  |  |
| R4-2115751 | Simulation assumptions for HAPS co-existence | Nokia |  |  |
|  |  |  |  |  |

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

# Reference

[1] R4-2108645 Simulation assumptions for NTN co-existence study, Samsung, CATT

[2] R4-2108646 Simulation assumptions for HAPS co-existence, Nokia, Nokia Shanghai Bell

# Annex 1 Contact information

|  |  |  |
| --- | --- | --- |
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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)

# Annex 2. TDOC list for Agenda Item 9.13.2

A total of 28 TDOCs have been received (3 withdrawn, 1 update during the meeting) for this agenda and listed as below. It should be noted that R4-2112517 has been re-assigned under Agenda Item 9.13.1 and a portion of R4-2114232 is out of the scope of this Agenda Item 9.13.2.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***TDoc No.*** | ***Title*** | ***Source*** | ***Type*** | ***For*** | ***Agenda Item*** | ***Status*** |
| [R4-2112012](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112012.zip) | Further consideration on simulation assumption | CATT | discussion | Discussion | 9.13.2.1 | available |
| [R4-2112013](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112013.zip) | Simulation results for NTN | CATT | discussion | Discussion | 9.13.2.2 | available |
| [R4-2112014](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112014.zip) | Proposed methodologies and assumptions for NTN co-ex study | Samsung | agenda | Approval | 9.13.2.1 | withdrawn |
| [R4-2112015](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112015.zip) | Initial NR-NTN co-ex study ACIR results | Samsung | agenda | Discussion | 9.13.2.2 | withdrawn |
| [R4-2112016](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112016.zip) | NR-NTN calibration summary and observations | Samsung | agenda | Discussion | 9.13.2 | withdrawn |
| [R4-2112247](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112247.zip) | Coexistence simulation restuls for TN-NTN | Qualcomm Incorporated | discussion |  | 9.13.2.2 | available |
| [R4-2112248](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112248.zip) | Simulation assumptions for NTN co-existence | Qualcomm Incorporated | discussion |  | 9.13.2.1 | available |
| [R4-2112517](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112517.zip) | Skeleton of TR 38.863 for NTN related RF and co-existence aspects | Samsung | draft TR | Approval | 9.13.2 | available |
| [R4-2112588](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112588.zip) | Proposed methodologies and assumptions for NTN co-ex study | Samsung | discussion | Approval | 9.13.2.1 | available |
| [R4-2112715](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112715.zip) | Initial NR-NTN co-ex study ACIR results | Samsung | discussion | Discussion | 9.13.2.2 | available |
| [R4-2112716](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112716.zip) | NR-NTN calibration summary and observations | Samsung | discussion | Discussion | 9.13.2 | available |
| [R4-2113296](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113296.zip) | Coexistence study assumptions on NR to support non-terrestrial networks | Xiaomi | discussion | Information | 9.13.2.2 | available |
| [R4-2113310](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113310.zip) | Simulation restuls for HAPS | Qualcomm Incorporated | discussion |  | 9.13.2.2 | available |
| [R4-2113311](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113311.zip) | Simulation assumptions for HAPS co-existence | Qualcomm Incorporated | discussion |  | 9.13.2.1 | available |
| [R4-2113394](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113394.zip) | Simulation assumptions and results for NTN co-existence calibration | Fraunhofer HHI, Fraunhofer IIS | other | Information | 9.13.2 | available |
| [R4-2113427](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113427.zip) | Further discussion on NTN simulation assumptions | Huawei, HiSilicon | other | Approval | 9.13.2.1 | available |
| [R4-2113428](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113428.zip) | Initial NTN simulation Results | Huawei, HiSilicon | other | Approval | 9.13.2.2 | available |
| [R4-2113690](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113690.zip) | NTN simulation assumptions for coexistence study | Nokia, Nokia Shanghai Bell | discussion | Approval | 9.13.2.1 | available |
| [R4-2113691](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113691.zip) | NTN adjacent channel coexistence simulation results | Nokia, Nokia Shanghai Bell | discussion | Approval | 9.13.2.2 | available |
| [R4-2113742](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113742.zip) | NTN - Simulation assumptions | Ericsson | other | Approval | 9.13.2.1 | available |
| [R4-2113743](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113743.zip) | NTN - Simulation results for alignment | Ericsson | discussion | Discussion | 9.13.2.2 | available |
| [R4-2113930](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113930.zip) | Further discussion on simulation assumptions for NTN | ZTE Corporation | other | Approval | 9.13.2.1 | available |
| [R4-2113931](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113931.zip) | Initial simulation results for NTN coexistence study | ZTE Corporation | other | Approval | 9.13.2.2 | available |
| [R4-2114232](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114232.zip) | MSS S-Band range (1980-2010 and 2170-2200 MHz) for NTN-FR1 and its adjacent bands | Hughes/EchoStar, Inmarsat, Sateliot, Thales | discussion | Agreement | 9.13.2.1 | available |
| [R4-2114424](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114424.zip) | On the S-band NTN Scenarios and Parameters for Calibration and Coexistence Simulations | THALES | discussion | Discussion | 9.13.2.1 | available |
| [R4-2114425](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114425.zip) | On the NTN Propagation Model | THALES | discussion | Discussion | 9.13.2.1 | available |
| [R4-2114486](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114486.zip) | NTN co-existence calibration with THALES updated values | THALES | discussion | Information | 9.13.2.2 | available |
| R4-2115628 | NR-NTN calibration summary and observations | Samsung | discussion | Discussion | 9.13.2 |  |

# Annex 3. Comments on Issue 2-1 in 1st round

Please use ‘split’ function and add your company name and comments to make sure your comments are in line with each item.

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| **No.** | **Combination** | **Aggressor** | **Victim** | **Which NTN cell/UE to observe?** | | **Which TN/UE to observe?** | | **Which TN cells in a TN to observe?** | |
| 1 | TN with NTN | TN DL | NTN DL | NTN cell:  Option 1(Ericsson): All 7 NTN cells  Option 2(Samsung): Observe NTN central beam for SINR, 6 adjacent beams for inter-beam interference.  NTN UE:  Option 3(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Support Option 2 and 3.  Because NTN do not have wrap-around assumption, then only central beam SINR can be evaluated.  We are OK to either drop NTN UEs inside the TN cluster or at the edge of TN cluster. | Option 1 (Ericsson): Consider an active rate of TN.  Option 2 (Qualcomm): One cluster with 19 TN cells (57 sectors) randomly placed in the central NTN beam | Samsung: Support Option 1, the active rate can be aligned with 20% or any other agreed number. | Option 1 (Ericsson): All active TN cells.  Option 2 (Samsung): All active TN cells which host NTN UEs | Samsung: Support Option 2.  Because the massive number of TN cells that are far from NTN UEs will only consume calculation time but not very meaningful. |
| Ericsson: we would prefer opt 1, but could compromise on opt 2. | Ericsson: option 1 | Ericsson: we would prefer option 1, but could compromise on option 2. |
| ZTE: option 2 for NTN cell,  regarding whether NTN ue could be dropped within TN network, this should be checked with practical deployment, if this is requested in the practical deployment, then stringent requirement should be defined, this might out scope of coexistence simulation assumption i think. | ZTE: option 1 | ZTE: Option 1, this is more aligned how to consider interference for TN UE. |
| Qualcomm: Option 2 and Option 3. Deploying NTN UE in TN coverage will lead to very stringent required ACIR with is not feasible. | Qualcomm: Need clarification. For DL, we already agreed to only consider one TN with 19 TN cells (57 sectors), UEs randomly distributed in the TN cells. What does the active rate of TN here? | Qualcomm: None of two options. We should consider all the 19 TN cells (57 sectors) for DL co-ex scenario. |
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| ***Summary:***  ***NTN Cell:***  ***Agreed on Option 2***  ***NTN UE:***  ***Further discuss Option 3*** | ***Summary:***  ***Further discuss option 1 & 2***  ***Option 1 (Ericsson): Consider an active rate of TN.***  ***Option 2: One cluster with 19 TN cells (57 sectors) randomly placed in the central NTN beam***  ***Response to Qualcomm’s question is encouraged.*** | ***Summary:***  ***2 support Option 1***  ***1 support Option 2***  ***1 for other option***  ***Further discuss Option 1 & 2.***  ***Note: Qualcomm’s comment may be related to the understanding of active rage of TN.*** |

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| 2 | TN with NTN | TN UL | NTN UL | NTN cell:  Option 1 (Ericsson, ZTE): All 7 NTN cells  Option 2(Samsung): Observe NTN central beam for SINR, 6 adjacent beams for inter-beam interference.  NTN UE:  Option 3(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Support Option 2 and 3.  Because NTN do not have wrap-around assumption, then only central beam SINR can be evaluated.  We are OK to either drop NTN UEs inside the TN cluster or at the edge of TN cluster. | Option 1 (Ericsson, ZTE): Consider an active rate of 20% for Rural and Urban of TN. | Samsung: Support Option 1. | ~~Option 1 (Ericsson, ZTE): All active TN cells.~~  ***Option 1: All active TN cells in central NTN beam***  ***Option 2: All active TN cells in all 7 NTN beams*** | Samsung: Support Option 1.  Clarification is needed – All active TN cells in central NTN beam or in all 7 NTN beams? |
| Ericsson: we would prefer option 1, but could compromise on option 2. | Ericsson: option 1 | Ericsson: option 1 |
| ZTE:  For NTN cell:  we are fine to only consider the centre beam  For NTN UE:  regarding whether NTN ue could be dropped within TN network, this should be checked with practical deployment, if this is requested in the practical deployment, then stringent requirement should be defined, this might out scope of coexistence simulation assumption i think. | ZTE: option 1 | ZTE: option 1, in all 7 NTN beams |
| Qualcomm: Option 2 and Option 3. Deploying NTN UE in TN coverage will lead to very stringent required ACIR with is not feasible. | Qualcomm: option 1 | Qualcomm: All achieve TN cells in central beam. |
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| ***Summary:***  ***NTN Cell:***  ***Agreed on Option 2***  ***NTN UE***  ***Further discuss Option 3*** | ***Summary:***  ***Agreed on Option 1*** | ***Summary:***  ***Further discuss***  ***Option 1: All active TN cells in central NTN beam***  ***Option 2: All active TN cells in all 7 NTN beams*** |

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| 3 | TN with NTN | NTN DL | TN DL | NTN cell:  Option 1(Ericsson, Samsung): Nadir point.  NTN UE:  Option 2(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Support Option 1 and 2.  We are OK to either drop NTN UEs inside the TN cluster or at the edge of TN cluster. | Option 1(Ericsson):  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Samsung: Support Option 2. | Option 1 (Ericsson, Samsung):  All in central NTN beam | Samsung: Support Option 1.  Clarification is needed – All active TN cells in central NTN beam or in all 7 NTN beams? |
| Ericsson: option 1 | Ericsson: option 1 | Ericsson: option 1 |
| ZTE: option 1 | ZTE: option 2, not clear why TN cells at the NTN cell edge will experience more interference from NTN side. | ZTE: option 1 with cells in center beam |
| Qualcomm: Option 1 and Option 2. Deploying NTN UE in TN coverage will lead to very stringent required ACIR with is not feasible. | Qualcomm: Option 2. One cluster with 19 TN cells (57 sectors) randomly placed in the central NTN beam | Qualcomm: All achieve TN cells in central beam. |
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| ***Summary:***  ***NTN cell:***  ***Agreed on Option 1***  ***NTN UE:***  ***Agreed on Option 2*** | ***Summary:***  ***3 support Option 2***  ***1 support Option 1***  ***Further discuss Option 1 & 2*** | ***Summary:***  ***Agreed on Option 1 active TN cells in central NTN beam*** |
| NTN cell:  Option 1(Ericsson)  NTN cell with satellite at low elevation (additional case)  NTN UE:  Option 2(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Moderator: Value of low elevation will be discussed in Session 3. | Option 1(Ericsson):  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Samsung: Support Option 2.  Clarification is required on Option 1 why only consider TN at NTN cell edge when FRF = 1 other than in NTN coverage. | Samsung: Support Option 1. |
| Samsung: We are neutral. This required discussion and numerical analysis on: 1) if additional case is needed and 2) what additional angle to study. | Ericsson: option 1 | Ericsson: option 1 |
| Ericsson: option 1. Note that we are not proposing to do simulations for both Nadir and low elevation for all deployment scenarios, we can focus on one (e.g. rural) to check which one is the worst case scenario. Also, we think this option (low satelltie elevation) is particularly relevant for AAS BS, where antenna gain is high when pointing to the horizon. | ZTE:option 2, not clear why TN cells at the NTN cell edge will experience more interference from NTN side. | ZTE: option 1 with cells in center beam: |
| ZTE: Option 1 similar as Ericsson, this is only for GEO case, right? | Qualcomm: option 2. Clarification for option 1 is needed | Qualcomm: Option 1 |
| Qualcomm: Option 1 and option 2 |  |  |
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| ***Summary:***  ***NTN cell:***  ***Agreed on Option 1***  ***Tentatively 45 for GEO only***  ***NTN UE:***  ***Agreed on Option 2*** | ***Summary:***  ***3 support Option 2***  ***1 support Option 1***  ***Further discuss Option 1 & 2*** | ***Summary:***  ***Agreed on Option 1 active TN cells in central NTN beam.*** |

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| 4 | TN with NTN | NTN UL | TN UL | NTN cell:  Option 1(Ericsson and Samsung): Nadir point.  NTN UE:  Option 2(Samsung): NTN UEs dropped inside the TN clusters (19-cell with wrap-around).  Option 3(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Support Option 1, 2&3.  For Option 2 and 3, we are OK to either drop NTN UEs inside the TN cluster or at the edge of TN cluster. | Option 1 (Ericsson, Samsung):  TN randomly placed in this NTN beam | Samsung: Support Option 1. | Option 1 (Ericsson):  Only the TN cells (sectors) hosting NTN UE(s)  ~~Option 2(Samsung): The TN cluster (19-cells) where hosts NTN UEs.~~  New Option 2 (Qualcomm): All 19 TN cells (57 sectors) | Samsung: We support both Option 1 and 2.  We need to point out that Option 1 would results in higher interference because it always observes the worst sector. |
| Ericsson: option 1 for NTN cell. If NTN UEs are dropped outside the TN clusters, interference would be very limited… | Ericsson: option 1 | Ericsson: option 1. Due to NTN UE density, which would be very low in a TN, impact might be too minimized while it might be huge in the vicinity of a NTN UE… |
| ZTE:  Option 1 for NTN cell,  FFS for NTN UE since this might be big decision for NTN deployment. | ZTE: option 1 | ZTE: Fine with option 1. |
| Qualcomm  NTN cell: Option 1.  NTN UEs: Option 3 | Qualcomm: option 1 | Qualcomm: None of two options. We need to be careful here since NTN UE is using max power 23 dBm. All The 3 NTN UEs will affect the 57 TN sectors. So we should consider all the 19 TN cells (57 sectors) |
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| ***Summary:***  ***NTN cell:***  ***Agreed on Option 1***  ***NTN UE:***  ***Further discuss Option 2 & 3*** | ***Summary:***  ***Agreed on Option 1*** | ***Summary:***  ***Further discuss***  ***Option 1(Ericsson):***  ***Only the TN cells (sectors) hosting NTN UE(s)***  ***Option 2 (Qualcomm): All 19 TN cells (57 sectors)*** |

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| 5 | TN with NTN | NTN UL | TN DL | NTN cell:  Option 1 (Ericsson): nadir point  NTN UE:  Option 2(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Support Option 1 and 2.  We are OK to either drop NTN UEs inside the TN cluster or at the edge of TN cluster. | Option 1(Ericsson):  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Samsung: Support Option 2.  Clarification is required on Option 1 why only consider TN at NTN cell edge when FRF = 1 other than in NTN coverage. | Option 1(Ericsson):  All  Option 2(Samsung): All TN cells which host NTN UEs. | Samsung: We support both Option 1 and 2. |
| Ericsson: option 1 | Ericsson: option 1  To Samsung: For FRF=1, the TN at cell edge would also suffer from interference from the NTN adjacent cell, this should then be worst case scenario. | Ericsson: option 1 but option 2 could be an acceptable compromise |
| ZTE:option 1, this is cross link interference from UE side. | ZTE: Option 2. this is not related with where NTN UE is dropped since UE is always transmitting with maximum output power. | ZTE: Option 2 |
| Qualcomm: option 1 and option 2 | Qualcomm: Option 2. One cluster with 19 TN cells (57 sectors) randomly placed in the NTN beam | Qualcomm: Option 1, i.e., all the 19 TN cells (57 sectors) |
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| ***Summary:***  ***NTN cell***  ***Agreed on Option 1***  ***NTN UE***  ***Further discuss Option 2***  Note that this is a UE-UE case. | ***Summary:***  ***1 support Option 1***  ***3 support Option 2***  ***Further discuss Option 1 & 2***  *Clarification on Option 2 is needed with regard to Qualcomm’s addition “*One cluster with 19 TN cells (57 sectors) randomly placed in the NTN beam*”.* | ***Summary:***  ***1 support Option 1***  ***1 Support Option 2***  ***2 can live with both Option 1 & 2***  ***Further discuss Option 1 & 2***  Note that this is a UE-UE case, |
| NTN cell:  Option 1(Ericsson):  NTN cell with satellite at low elevation (additional case)  NTN UE:  Option 2(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: We are neutral. This required discussion and numerical analysis on 1) if additional case is needed and 2) what additional angle to study. | Option 1(Ericsson)  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Samsung: Support Option 2.  Clarification is required on Option 1 why only consider TN at NTN cell edge when FRF = 1 other than in NTN coverage. | Option 1(Samsung): All TN cells which host NTN UEs | Samsung: Support Option 1. But if Option 2 of above row is agreed, then we can align this row to above agreement. |
| Ericsson: option 1, see our comment to number #3 above | Ericsson: option 1  To Samsung: For FRF=1, the TN at cell edge would also suffer from interference from the NTN adjacent cell, this should then be worst case scenario. | Ericsson: option 1 |
| ZTE: this case is not related with how NTN BS elevation angle, this NTN UE uplink interfering TN UE DL | ZTE: support Option 2. | ZTE:option 1 |
| Qualcomm: Option 1 and Option 2. But agree with ZTE, low elevation would not have much impact in this scenario. | Qualcomm: Option 2. One cluster with 19 TN cells (57 sectors) randomly placed in the NTN beam | Qualcomm: All the 19 TN cells (57 sectors) |
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| ***Summary:***  ***NTN cell:***  ***Agreed on Option 1***  ***NTN UE***  ***Further discuss Option 2***  Note that this is a UE-UE case. | ***Summary:***  ***3 support Option 2***  ***1 support Option 1***  ***Further discuss Option 1 & 2.***  *Clarification on Option 2 is needed with regard to Qualcomm’s addition “*One cluster with 19 TN cells (57 sectors) randomly placed in the NTN beam*”.* | ***Summary:***  ***3 support Option 1***  ***1 support All 19 TN cells.***  ***Try to agree on Option 1*** |

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| 6 | TN with NTN | TN DL | NTN UL | NTN cell:  Option 1 (Ericsson and ZTE): All 7 NTN cells  Option 2(Samsung): Observe NTN central beam for SINR, 6 adjacent beams for inter-beam interference.  NTN UE:  Option 3(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Support Option 2 and 3.  Because NTN do not have wrap-around assumption, then only central beam SINR can be evaluated.  We are OK to either drop NTN UEs inside the TN cluster or at the edge of TN cluster. | Option 1(Ericsson, ZTE): Consider the active rate of 20% for Rural and Urban of TN. | Samsung: Support Option 1. | ~~Option 1 (Ericsson, ZTE): All active TN cells.~~  Option 1: All active TN cells in central NTN beam  Option 2: All active TN cells in all 7 NTN beams | Samsung: Support Option 1.  Clarification is needed – All active TN cells in central NTN beam or in all 7 NTN beams? |
| Ericsson: we would prefer option 1, but could compromise on option 2. | Ericsson: option 1 | Ericsson: option 1 |
| ZTE: we would prefer option 1, but could compromise on option 2. | ZTE: option 1 | ZTE: option 1  To samsung, for all 7 NTN beams |
| Qualcomm: Option 2 and Option 3.  In addition, we need to consider the low elevation case which will have impact for TN DL to NTN UL interference. | Qualcomm: Option 1 | Qualcomm: Option 1 for central beam. |
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| ***Summary:***  ***NTN cell:***  ***Agreed on Option 2***  ***NTN UE***  ***Agreed on Option 3*** | ***Summary:***  ***Agreed on Option 1*** | ***Summary:***  ***Further discuss***  ***Option 1: All active TN cells in central NTN beam***  ***Option 2: All active TN cells in all 7 NTN beams*** |

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| 7 | TN with NTN | TN UL | NTN DL | TBD | Qualcomm: No need to consider this scenario for S-band at this stage. | TBD |  |  |  |
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| ***Summary:***  ***Given the tentative agreement of Issue 1-4, do not consider this scenario at this stage*** | | | | | | | | | |

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| 8 | TN with NTN | NTN DL | TN UL | NTN cell:  Option 1 (Ericsson): nadir point | Samsung: Support Option 1. | Option 1(Ericsson):  TN randomly placed in this NTN beam | Samsung: Support Option 1. | Option 1(Ericsson):  Only the TN cells hosting NTN UE(s)  Option 2(Samsung): ~~The TN cluster (19-cells) where hosts NTN UEs~~ All active TN cells in this beam | Samsung: Both options seem not very fit in this row. We propose to modify Option 2 to ‘All active TN cells in this beam’ |
| Ericsson: option 1 | Ericsson: option 1 | Ericsson: option 1. Due to NTN UE density, which would be very low in a TN, impact might be too minimized while it might be huge in the vicinity of a NTN UE… |
| ZTE:option 1 | ZTE: option 1 | ZTE: all active TN cells should be defined.s |
| Qualcomm: No need to consider this scenario per S-band frequency allocation at this stage. Low elevation needs to be considered if it applies for other NTN bands. |  |  |
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| Summary:  3 support Option 1 | Summary:  3 support Option 1 | Summary:  Further discuss Option 1 & new Option 2 |
| ***Summary:***  ***Given the tentative agreement of Issue 1-4, do not consider this scenario at this stage*** | | | | | | | | | |

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| 9 | NTN with NTN | NTN DL | NTN DL | TBD |  | TBD |  | NA |  |
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| NTN UL | NTN UL | TBD |  | TBD |  | NA |  |
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# Annex 4. Comments on Issue 2-1 in 2nd round

Please use ‘split’ function and add your company name and comments to make sure your comments are in line with each item.

**Bold fonts marked in green are options Agreed in 1st round**

Fonts marked in yellow are options for discussion in 2nd round

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| **No.** | **Combination** | **Aggressor** | **Victim** | **Which NTN cell/UE to observe?** | | **Which TN/UE to observe?** | | **Which TN cells in a TN to observe?** | |
| 1 | TN with NTN | TN DL | NTN DL | **NTN cell:**  **Observe NTN central beam for SINR, 6 adjacent beams for inter-beam interference.**  NTN UE:  Option 3(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Part of Option 3.  For NTN UE, we can agree on UEs to be dropped at the edge of TN clusters or randomly inside the TN clusters. But we cannot agree on ‘out of TN clusters’ without limitation.  It should be clear and workable. | Option 1 (Ericsson): Consider an active rate of TN.  Option 2 (Qualcomm): One cluster with 19 TN cells (57 sectors) randomly placed in the central NTN beam | Qualcomm: Need clarification. For DL, we already agreed to only consider one TN with 19 TN cells (57 sectors), UEs randomly distributed in the TN cells. What does the active rate of TN here? | Option 1 (Ericsson): All active TN cells.  Option 2 (Samsung): All active TN cells which host NTN UEs | Samsung: Option 2.  In left columns, we said we consider the TN cluster that host the NTN UE inside or at the edge.  Then for different interfered NTN UE, its corresponding TN cluster should be considered whether it’s active or in-active with the agreed active rate. |
|  | Samsung: Option 2.  In this case, the NTN UE is suffering interference from TN BS, Consider the TN stations that far from the interfered NTN UE is resource consuming and meaningless. |  |
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| 2 | TN with NTN | TN UL | NTN UL | **NTN cell:**  **Observe NTN central beam for SINR, 6 adjacent beams for inter-beam interference.**  NTN UE:  Option 3(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: NTN UE drop can be skipped in this case. | **Consider an active rate of 20% for Rural and Urban of TN.** |  | Option 1: All active TN cells in central NTN beam  Option 2: All active TN cells in all 7 NTN beams | Samsung: Option 1 or 2. |
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| ***Summary:*** |  | ***Summary:*** |

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| 3 | TN with NTN | NTN DL | TN DL | **NTN cell:**  **Nadir point.**  **NTN UE:**  **NTN UEs dropped outside or at the edge of TN clusters** |  | Option 1(Ericsson):  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Samsung: Option 2 or 2+1  We support Option 2, but we also notice Option 1 is actually proposing a corner case that for FRF=1, the TN placed at NTN cell edge could possibly receive aggregated interference from multiple side-lobes than the one main-lobe.  We are also OK to consider that case if the proponent persist and meeting agrees. | **All in central NTN beam** |  |
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|  | ***Summary:*** |  |
| **NTN cell:**  **NTN cell with satellite at low elevation (additional case)**  **NTN UE:**  **NTN UEs dropped outside or at the edge of TN clusters** | Elevation angle TBD | Option 1(Ericsson):  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Samsung: Option 2 or 2+1  Same reason as above. |  |
| Samsung: elevation angle should refer to discussion result of Issue 3-4. |  |  |
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| 4 | TN with NTN | NTN UL | TN UL | **NTN cell:**  **Option 1(Ericsson and Samsung): Nadir point.**  NTN UE:  Option 2(Samsung): NTN UEs dropped inside the TN clusters (19-cell with wrap-around).  Option 3(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Option 2 or 3.  We are OK to take either option which can be agreed by the meeting. For Option 3, we cannot agree to drop NTN UE outside the TN cluster without limitation.  Whatever is to be agreed should be clear and workable. | **N randomly placed in this NTN beam** |  | Option 1 (Ericsson):  Only the TN cells (sectors) hosting NTN UE(s)  Option 2 (Qualcomm): All 19 TN cells (57 sectors) | Samsung: Option 2 or 1.  We prefer Option 2 but can go with Option 1. |
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| ***Summary:*** |  | ***Summary:*** |

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| 5 | TN with NTN | NTN UL | TN DL | **NTN cell:**  **Option 1 (Ericsson): nadir point**  NTN UE:  Option 2(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Part of Option 2.  For NTN UE, we can agree on UEs to be dropped at the edge of TN clusters or randomly inside the TN clusters. But we cannot agree on ‘out of TN clusters’ without limitation.  It should be clear and workable. | Option 1(Ericsson):  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Clarification on Option 2 is needed with regard to Qualcomm’s addition “One cluster with 19 TN cells (57 sectors) randomly placed in the NTN beam”*.* | Option 1 (Ericsson):  All  Option 2 (Samsung): All TN cells which host NTN UEs. | Samsung: Option 2.  It’s not meaningful to consider all TN cells which are far away from those interfering NTN UEs. |
|  | Samsung: Option 2  When NTN UE is interferer, it is not meaningful to consider TN at NTN cell edge, because there’s no NTN DL aggregated interference in this case.  .  Clarification on Option 2, we mean ‘One Cluster’ randomly palced in NTN beam. |  |
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| ***Summary:*** | ***Summary:*** | ***Summary:***  Note that this is a UE-UE case, |
| NTN cell:  Option 1(Ericsson):  NTN cell with satellite at low elevation (additional case)  NTN UE:  Option 2(Qualcomm): NTN UEs dropped outside or at the edge of TN clusters | Samsung: Part of Option 2.  Same as above. | Option 1(Ericsson)  FRF≠1: TN randomly placed in the NTN cell.  FRF=1: TN at NTN cell edge  Option 2(Samsung):  TN clusters randomly placed in this NTN beam | Clarification on Option 2 is needed with regard to Qualcomm’s addition “One cluster with 19 TN cells (57 sectors) randomly placed in the NTN beam”. | Option 1 (Samsung): All TN cells which host NTN UEs  Option 2 (Qualcomm): All the 19 TN cells (57 sectors) | ***Try to agree on Option 1*** |
|  | Samsung: Option 2  Same as above. | Samsung: Option 1 and 2 (Combine)  Clarifications on Option1, we mean one TN cluster (19-cell, 57 sectors) that either host NTN UEs, or has the NTN UE at its edge, depending on the discussion on NTN UE location. |
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| ***Summary:***  Note that this is a UE-UE case. | ***Summary:*** | ***Summary:*** |

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| 6 | TN with NTN | TN DL | NTN UL | **NTN cell:**  **Observe NTN central beam for SINR, 6 adjacent beams for inter-beam interference.**  **NTN UE:**  **NTN UEs dropped outside or at the edge of TN clusters** |  | **Consider the active rate of 20% for Rural and Urban of TN.** |  | Option 1: All active TN cells in central NTN beam  Option 2: All active TN cells in all 7 NTN beams | Samsung: Option 1 or 2. |
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|  |  | ***Summary:*** |

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| 7 | TN with NTN | TN UL | NTN DL | TBD | Qualcomm: No need to consider this scenario for S-band at this stage. | TBD |  |  |  |
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| ***Summary:***  ***Given the tentative agreement of Issue 1-4, do not consider this scenario at this stage*** | | | | | | | | | |

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| 8 | TN with NTN | NTN DL | TN UL | NTN cell:  Option 1 (Ericsson): nadir point | Samsung: Support Option 1. | Option 1(Ericsson):  TN randomly placed in this NTN beam | Samsung: Support Option 1. | Option 1(Ericsson):  Only the TN cells hosting NTN UE(s)  Option 2(Samsung)All active TN cells in this beam | Samsung: Both options seem not very fit in this row. We propose to modify Option 2 to ‘All active TN cells in this beam’ |
| Ericsson: option 1 | Ericsson: option 1 | Ericsson: option 1. Due to NTN UE density, which would be very low in a TN, impact might be too minimized while it might be huge in the vicinity of a NTN UE… |
| ZTE:option 1 | ZTE: option 1 | ZTE: all active TN cells should be defined.s |
| Qualcomm: No need to consider this scenario per S-band frequency allocation at this stage. Low elevation needs to be considered if it applies for other NTN bands. |  |  |
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| Summary:  3 support Option 1 | Summary:  3 support Option 1 | Summary:  Further discuss Option 1 & new Option 2 |
| ***Summary:***  ***Given the tentative agreement of Issue 1-4, do not consider this scenario at this stage*** | | | | | | | | | |

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| 9 | NTN with NTN | NTN DL | NTN DL | TBD |  | TBD |  | NA |  |
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| NTN UL | NTN UL | TBD |  | TBD |  | NA |  |
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