**3GPP TSG-RAN WG4 Meeting # 100-e R4-2114705**

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

**Agenda item:** 6.1.10.5

**Source:** Moderator (Apple)

**Title:** Email discussion summary for [100-e][105] US\_n77

**Document for:** Information

# Introduction

This document summarizes the email discussions on the topic of enabling US 3.45 – 3.55GHz spectrum usage in Band n77 which has been allocated to agenda item 6.1.10.5. There are total of 8 contributions in this email thread which consists of 2 discussion papers, 2 CRs for UE and 4 CRs for BS.

Since in RAN #92-e meeting, the following RAN guidance on the support of 3.45 – 3.55GHz for US Band n77 was endorsed.

* RAN4 focuses on the necessary updates to RAN4 requirements and leave signaling work, if any, to RAN2.
* RAN2 focuses on signaling aspects, with an aim to ensure the network can properly deal with legacy n77 UEs that do not support 3.45-3.55 GHz operation in US.
* RAN tasks RAN4/2 to complete the required work in Aug. and report back to RAN#93-e.

The RAN4 requirements update may be subject to the outcome of RAN2 signaling discussions. On the other hand, the BS CRs to TS 38.104 and TS 38.141-1 had been technically endorsed in last RAN4 meeting. It will only be a formality to endorse the resubmitted draft CRs if UE draft CRs could also be endorsed.

The goal for this meeting is to complete the required work in RAN4 and report back to RAN #93-e, potentially with endorsed UE draft CRs and BS draft CRs as a package.

# Topic #1: Enabling US 3.45 – 3.55GHz in Band n77

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2112048**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112048.zip)  Type: Discussion  For: Approval | Mediatek India Technology Pvt. | **Title:** Discussion of addition of 3.45-3.55 GHz in Band n77 for the US  **Observation 1**: In RAN4#99 meeting, regarding new spectrum in US band n77, many companies considered that network needs to distinguish UE devices supporting the new frequency range.  **Observation 2**: If the decision would be that NW needs to distinguish UE supporting the new frequency range by UE capabilities, to use reserved modifiedMPR-behaviour bit would not change RAN2 framework and ease RAN2 work loading.  **Observation 3**: As summarized in RAN#92 meeting, RAN2 will focus on signaling aspects, with an aim to ensure the network can properly deal with legacy n77 UEs that do not support 3.45-3.55 GHz operation in US. In addition, to our understanding, the UEs that pass DoD band certification can use optional capability to inform NW.  **Observation 4**: RAN tasks RAN4/2 to complete the required work in Aug. and report back to RAN#93-e.  **Proposal 1**: For accelerating deployment of new frequency range in US band n77 and reporting progress to RAN#93, ping-pong efforts between RAN4 and RAN2 can be avoided with considering option in 1st bullet. Once confirmation from RAN2 that optional capability may be not needed, modification of Note 12 in 2nd bullet could be adopted.  • For UE passed the DoD band certification, the Note 12 in Table 5.2-1 could be: “In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz and has optional capability for distinguishing devices”  • If optional capability is really not needed after RAN4 and RAN2 consensus, modification of Note 12: “In the USA this band is restricted to 3450 – 3550 MHz and 3700–3980 MHz” |
| [**R4-2112822**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112822.zip)  Type: Other  For: Approval | Ericsson | **Title:** Band n77 issues in the US  **Proposal 1:** Introduce a new band nXX to be used in the US to cover the same range and have the same RAN4 requirements (including CA band combinations) as the existing band n77, but restricted to the 3700 – 3980 MHz and the 3450 – 3550 MHz subparts. A UE that indicates support of nXX shall also indicate support of n77.  **Proposal 2:** If Proposal 1 cannot be agreed, Solution 1 (new per-UE capability bits) is recommended.  **Proposal 3:** Solution 3 (Use bit in modifiedMPR-Behaviour) is not recommended.  **Proposal 4:** Introduction of new n77 NS value to prevent non-supporting UE from camping/accessing on DoD cell shall not be pursued. |
| [**R4-2112049**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112049.zip)  Type: CR  For: Agreement  CAT F  Rel-16  TS 38.101-1 | Mediatek India Technology Pvt. | **Title:** CR for addition of 3.45-3.55 GHz in Band n77 for the US -r16  **Reason for change:**  As indicated in FCC 21-32A1, FCC will start an auction to grant new initial licenses subject to flexible use in the 3450-3550 MHz (3.45 GHz, DoD band) band by December 31, 2021. The range 3450-3550 MHz is covered by band n77. The new 3.45 GHz spectrum in US would lead to economies of scale, lower costs for deployment, and more rapid roll-out of new services. To enable the new frequency range within band n77 is beneficial for cellular ecosystem.  To ensure the network can properly deal with legacy n77 UEs that do not support 3.45-3.55 GHz operation in US, optional capability can handle the issues in initial access and handover between serving cell and target cell.  **Summary of change:**  FCC will add new frequency range 3450 - 3550MHz to US band n77. The US band n77 will be restricted to 3450 - 3550 MHz and 3700 – 3980 MHz. Based on US band n77 regulation, it is not allowed to access frequency outside of 3450 - 3550 MHz and 3700 – 3980 MHz. With the usage of optional capability, the network can properly deal with devices. |
| R4-2112050  Type: CR  For: Agreement  CAT A  Rel-17  TS 38.101-1 | Mediatek India Technology Pvt. | **Title:** CR for addition of 3.45-3.55 GHz in Band n77 for the US -r17  **Note:** This is the mirror CR of R4-2112049 |
| [**R4-2112271**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112271.zip)  Type: draftCR  For: Endorsement  CAT F  Rel-16  TS 38.104 | Nokia, Nokia Shanghai Bell | **Title:** Draft CR to TS 38.104: Addition of FCC emission limits on US 3.45-3.55 GHz band  **Reason for change:**  FCC emission limits in US 3.45-3.55 GHz band are not specified for Band n77.  **Summary of change:**  Specify the FCC emission limits in US 3.45-3.55 GHz band as additional regional spurious emissions requirements for Band n77. |
| R4-2112272  Type: draftCR  For: Endorsement  CAT A  Rel-17  TS 38.104 | Nokia, Nokia Shanghai Bell | **Title:** Draft CR to TS 38.104: Addition of FCC emission limits on US 3.45-3.55 GHz band  **Note:** This is the mirror CR of R4-2112271 |
| [**R4-2112273**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112273.zip)  Type: draftCR  For: Endorsement  CAT F  Rel-16  TS 38.141-1 | Nokia, Nokia Shanghai Bell | **Title:** Draft CR to TS 38.141-1: Addition of FCC emission limits on US 3.45-3.55 GHz band  **Reason for change:**  FCC emission limits in US 3.45-3.55 GHz band are not specified for Band n77.  **Summary of change:**  Specify the FCC emission limits in US 3.45-3.55 GHz band as additional regional spurious emissions requirements for Band n77. |
| R4-2112274  Type: draftCR  For: Endorsement  CAT A  Rel-17  TS 38.141-1 | Nokia, Nokia Shanghai Bell | **Title:** Draft CR to TS 38.141-1: Addition of FCC emission limits on US 3.45-3.55 GHz band  **Note:** This is the mirror CR of R4-2112273 |

## Open issues summary

Based on the discussions in the past two RAN4 meetings, the main open issue remained on this topic is whether a UE capability signaling is required in order for network to distinguish UEs supporting the new frequency range 3.45 – 3.55GHz or not. Per the RAN guidance in RAN #92-e meeting, the signaling aspects will be handled in RAN2, and RAN4 will focus on the necessary updates to RAN4 requirements. Therefore, the open issues to be discussed below will not cover the signaling options despite they are included in R4-2112822 which also has a replicate contribution in RAN2.

**Issue 1.2-1: How to modify Note 12 in Table 5.2-1 in TS 38.101-1 to include the support of 3.45 – 3.55 GHz in addition to 3.7 – 3.98 GHz in US Band n77?**

### Option 1: “In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz and has optional capability for distinguishing devices” or “In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz” if RAN2 and RAN4 conclude that capability signaling is not required. (R4-2112048)

* Option 2: “In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz” irrespective of whether the capability signaling on the support of 3450 – 3550 MHz is required or not.
* Option 3: Others

**Issue 1.2-2: Is it necessary to define a new n77 NS value to prevent non-supporting UE (without FCC certification on the new frequency range) from camping/assessing on 3.45 – 3.55GHz cell?**

### Option 1: Yes

* Option 2: No
* Option 3: Leave the decision to RAN2

## Companies’ views collection for 1st round

### Open issues

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| **Company** | **Comments** |
| OPPO | Issue 1.2-1: How to modify Note 12 in Table 5.2-1 in TS 38.101-1 to include the support of 3.45 – 3.55 GHz in addition to 3.7 – 3.98 GHz in US Band n77  Option1. And there is another proposal in paper R4-2112822 that a new band can be introduced also acceptable.  Issue 1.2-2: Is it necessary to define a new n77 NS value to prevent non-supporting UE (without FCC certification on the new frequency range) from camping/assessing on 3.45 – 3.55GHz cell  Option 3, and in our view, the NS value is designed for additional emission requirements, is there new emission requirements in this FCC certification comparing to 3GPP general requirements? |
| Qualcomm | Issue 1.2-1. Option 2. In fact, a note isn’t really needed at all. There are other bands where the entire band is not available in some countries, but there aren’t notes for those. But we can accept option 2 if companies believe a note is necessary.  Issue 1.2-2: Perhaps we don’t understand the proposal, but NS is an indication from the network to the UE. The software in the UE is either able to decode this NS or it isn’t, but the ability to decode the NS is independent of the UE’s FCC certification status. In other words, it is not as if a new version of software is loaded into the UE after FCC certification. And what would be the consequence if the network does not send the NS? Would the non-certified UE still camp? It cannot; therefore, the behavior of the UE is the same irrespective of whether the NS is sent, which means the NS might not be useful. Instead, it might be more appropriate (if needed) to have signaling from the UE to the network. That signaling would need to be based on the UE’s FCC certification status which could be set by the OEM. This would tell the network whether it should expect the UE to be able to operate on the 3450 – 3550 MHz frequency range or not. Whether this signaling is needed should be determined by RAN2. |
| Nokia | Issue 1.2-1: Option 3, include entire frequency range of n77 except for Band 48 (CBRS spectrum). Removing a note completely as proposed by Qualcomm should be also considered.  Issue 1.2-2: Option 3. While it is necessary to have UE capability, leave the decision to RAN2. |
| UScellular | Issue 1.2-1: Concur with the previous views (Nokia, Qualcomm) that a note seems to be redundant since the entire n77 spectrum range is covered, with the exclusion of the CBRS spectrum  Issue 1.2-2: Appropriate signaling to discern between UEs (previous and revised n77) seems sufficient, pending RAN2 decision. |
| Skyworks | Issue 1.2-1: It is better that the note is modified once we have a clear view from RAN2 on how to signal support of extended spectrum but we believe a note clarifying the band n48 spectrum is excluded is at minimum needed.  Issue 1.2-2: leave to RAN2 |
| ZTE | Issue 1.2-1: Option 2. As Qualcomm and other companies point out, this is not a unique situation since other countries may also cover part of n77.  Issue 1.2-2: Option 3, leave it to RAN2. |
| T-Mobile USA | Issue 1.2-1: We would also support removing the note completely as mentioned by Qualcomm, Nokia, and US Cellular. Our second choice would be Option 3 as proposed by Nokia. Our third choice would be Option 2.  Issue 1.2-2: Option 3. We don’t think NS signalling it is necessary, but can leave the decision to RAN2. |
| Apple | Issue 1.2-1: Option 2 or Option 2 together with necessary modification on signaling aspect based on the outcome of RAN2 discussions.  In general we prefer to explicitly describe the supported frequency ranges instead of only “excluding n48 range”. We understand there might be similar situation in other regions/countries but without the similar note. However, n77 is a relatively wide band. If we do not explicitly spell out the supported frequency ranges, one potential issue is that when defining the MSD test points for US band combinations, we may choose a test configuration where n77 carrier is outside of US frequency ranges and could not be verified in conformance test while there are testable configurations available but not specified.  Issue 1.2-2: Option 3  In our view, if the issue exists, it should already happen when US Band n77 was first introduced in Rel-16, meaning that some Rel-15 UEs outside of US which support the entire n77 range but without FCC certification for C band may be brought to US and potentially camp on the n77 network. It would be great if RAN4 experts in this meeting can help clarify whether this issue would happen or not, even the signaling side of decision would be left to RAN2. |
| MediaTek | Issue 1.2-1: We are okay for option1 and are also okay with Apple’s further suggestion for modified option2. We are open to Option3(new band for DoD band) due to RAN2’s consideration.  Thanks RAN4 colleagues for providing comments. The further clarification/intention for option1/2/3 is for consideration. We think it is useful to clearly indicate FCC’s new released DoD band for US n77. The intention is not to bar legacy devices.  Regarding option1, to refine the wording as follows.   * In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz. UE’s optional capability to NW is for distinguishing devices supporting 3450 – 3550 MHz.   Regarding option2,   * In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz   + To consider “UE optional capability supporting  3450 – 3550 MHz” first and pending RAN2 decision   Or   * Option 2 together with necessary modification on signaling aspect based on the outcome of RAN2 discussions   Regarding option3 (new band for DoD band): After discussion with RAN2 colleagues. We can understand Ericsson’s proposal and its discussion in RAN2 that to define new band is also one useful way. We are open about keeping the same Note 12 and defining new band for DoD band.   * In the USA this band is restricted to 3700 – 3980 MHz * To consider defining new band for US DoD band.   Issue 1.2-2: Is it necessary to define a new n77 NS value to prevent non-supporting UE (without FCC certification on the new frequency range) from camping/assessing on 3.45 – 3.55GHz cell  If possible, we courage RAN4 colleagues to sync with RAN2 colleagues. It is highly appreciated. It seems a new band for DoD band could solve the Issue 1.2-1 and issue 1.2-2 together. |
| DISH | Issue 1.2-1: Option 2. As stated out in several comments, this is not a unique situation.  Issue 1.2-2: Option 3, leave it to RAN2. |
| Ericsson | Issue 1.2-1: Option 3 pending the RAN2 decision.  Issue 1.2-2: Option 3 pending the RAN2 decision. If a UE capability is introduced for E-UTRA and NR (or with a modifiedMPRbehavior bit used as a “capability”) for indicating that the n77 UE can operate in 3450-3550 MHz and 3700-3980 MHz in a network with a US MCC without restrictions, an associated NS value will be needed for barring UEs *not* indicating this capability from the DoD band. The network would not be able to allocate resources to these UEs in the DoD part based on a UE capability, existing mechanisms for handover/CA/DC cannot be used. If a DoD cell is the only cell that provides coverage to these UEs, releasing a UE will lead to that this UE comes back to the same cell. This is indeed not the intended use of NS values or the modifiedMPRbehavior.  A new band is a cleaner solution, see also comments below to R4-2112822. |
| Samsung | Issue 1.2-1: Option 2. We don’t believe that a note that might restrict the band use or need a further change in the future is necessary as proposed by Qualcomm and other companies. However, since the option 2 is what we have discussed and supported so far, we support the option 2 to distinguish the band with n48 which is a subset band of n77 and has totally different requirements with n77.  Issue 1.2-2: Option 3. We don’t believe that the new NS for n77 is required since it is not about the additional requirements for the new range. In our understanding, given that existing case of the spectrum extension/change in the same band in a country, developing a new method to block the unexpected UE to camp on might inessential. However, we are also OK to rely on RAN2 decision. |
| MediaTek | Issue 1.2-1: After further confirmed with RAN2 colleagues. We are okay to either option1 or modified option2 (*Option 2: explicit description of supporting frequency together with necessary modification on signaling aspect based on the outcome of RAN2 discussions*).  In addition, at least in 1st round, we think Ericsson’s suggested Option 3 “*pending the RAN2 decision*” should not be precluded according to RAN-P#92 decision.    Issue 1.2-2: Option 3 pending the RAN2 decision  Regarding RAN-P#92 decision “*RAN2 focuses on signaling aspects, with an aim to ensure the network can properly deal with legacy n77 UEs that do not support 3.45-3.55 GHz operation in US*”, RAN2 are working on it now.  Regarding Ericsson’s point, it is hard for us to neglect advantage of introducing new band for DoD band as indicated by Ericsson’s comments above. It can exactly provide the clear frequency-range definition. It can also provide same capability and even more than our proposal “UE’s optional capability for 3450-3550MHz”.  It is clear and straightforward for solving issues 1.2-2 and 1.2-1. |
| AT&T | Issue 1.2-1: We support Option 2 concerning the available table note options. There is no need to mention signalling options, if necessary, in the RAN4 specification concerning supported frequency ranges. We also support the comment from Qualcomm that the note may not be necessary.  Issue 1.2-2: Option 3. Although we leave it to RAN2, we don’t think that NS signalling is necessary and does not solve the legacy UE issue. We also agree with Apple that this issue exists for the existing restricted frequency range if a non-FCC certified UE is not limiting its operation to the restricted frequency range in the US. We also believe that this would apply to other regions that use a restricted frequency range in band n77. |
| Google | Issue 1.2-1: We support Option 2. We are also not sure if the note is necessary or not since not every coutry support n77 would cover the whole frequency range of n77.  Issue 1.2-2: We support Option 3, leave the decision to RAN2. |

### Comment collection for discussion papers

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| **Tdoc number** | **Comments** |
| [**R4-2112048**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112048.zip) | **Title**: Discussion of addition of 3.45-3.55 GHz in Band n77 for the US  MediaTek: the same comments as shown in R4-2112822 |
| [**R4-2112822**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112822.zip) | **Title:** Band n77 issues in the US  Qualcomm: We do not support the proposal to define a new band. Although we are willing to consider whether signaling is needed (either overloading MPRversioning or new dedicated signaling), we don’t see the need for a new band. If additional spectrum becomes available in the future, will yet another new band be defined? We think the best way to leverage the 3.5 GHz ecosystem for US deployment and the most expeditious way to enable the spectrum is to reuse Band n77.  Verizon: RAN4 and other WGs have specified the requirements to cover the frequency range 3700 – 3980 MHz in the band n77 since Rel-16. Since then, additional band combination and different new power class items are either completed or ongoing in 3GPP.  It is too late to define a new band to cover the frequency range 3700 – 3980 MHz into a new band or define new requirement for the band at this time.  Skyworks: we do not support to define a new band. There is no justification from specific band requirement and there may be further cases of extended use of n77 in the US or different part of the world, RAN2/4 must define a mechanism by which Legacy UEs that have not been certified for an additional frequency range within a band is properly handled.  ZTE: As companies comment, this is not a unique situation for different countries and different bands. If introducing a “mirror” band in order to fulfill the change of one band for one country, then the whole list of the bands may become unnecessarily long and messy. We don’t think this is a constructive method, and we need to avoid this mirroring method.  T-Mobile USA: We don’t think a new band is needed. We also don’t understand why this situation exists only in the US. n77 is 900 MHz wide, and it is doubtful that any country has regulations for the entire 900 MHz, but we don’t put notes in the spec for other countries with partial allocations. It would be helpful to understand what is unique about the US regulations that drove RAN4 to include Note 12 to begin with.  Apple: We also prefer not to define a new band for the concerns already elaborated by companies’ comments above.  MediaTek: We can understand RAN4 colleagues’ intention. And thanks to Ericsson for bringing the Tdoc. We think a clear indication for FCC released DoD band is also useful. We are open for 2 options. The first option is to consider having clear frequency range indication with UE optional capability. Another option is to consider new band for DoD band. Regarding new band for new frequency range, I am not sure whether n78 and n77 could be 1 example for reference. We encourage RAN4 colleagues to contact RAN2 colleagues for sync-up. It is highly appreciated. There is already discussion in RAN2.  DISH: We don’t agree with new band. Also, why should the new band discussion be held in RAN2 as suggested by some comments?  Ericsson: the only difference between the new band proposed by Ericsson and n77 is the frequency band number (indicator), the rest is identical to n77 and the associated capabilities supported by the UE for n77. We would use the new band number for signaling purposes. C-band cells indicate ‘n77’ and cells in the DoD band the new band number.  n77 UEs subject to FCC certification and certified for the DoD band shall indicate support of the new band (indicator), other ‘foreign’ UE not subject to FCC certification may also indicate support if they support n77. This solves the problem. No RAN2 changes needed.  The alternative signaling solution is a new UE capability, an ASN.1 change in RAN2. The field “modifiedMPRbehaviour” could be used as “capability” instead for both E-UTRA and NR; define new bits that can be set for UE certified for the DoD band (or capable of operating in DoD part). These UEs should also support a new optional NS value that we use for access control in the DoD part barring from this part existing n77 UEs not indicating the capability (see comment above). This is not the intended use of these parameters so an “ugly” solution. The same is achieved by using a new band (number) for n77 in the DoD part -- a cleaner solution.  MediaTek: Thanks to RAN4 colleagues comments above. We think “*to define new band for DoD band*” should not be precluded since it is also useful solution to provide clear signalling capability for solving issue. The issue was already indicated in RAN-P#92 decision “*RAN2 focuses on signaling aspects, with an aim to ensure the network can properly deal with legacy n77 UEs that do not support 3.45-3.55 GHz operation in US*”.  AT&T: We do not support the definition of a new band as proposed in this paper. The situation for n77 is not entirely equivalent to n41 and n90 which shared the same exact frequency range. In the n77+DoD band case, the frequency ranges will be non-contiguous. We believe that this will create some complexities with “re-using” CA/DC combinations given that if both ranges are included in n77, intra-band CA would include both intra-band in original range as well as intra-band containing both the original range and the DoD band. For the new band definition, it is not clear how this would be handled (intra-band or inter-band? how would n77(2A) be “translated” in this case?). In addition, introducing the new band as defined in this paper would result in significant UE overhead as the UE would need to report all the band combos for both the new band and n77 to ensure backwards compatibility. This could result in having to reduce band combinations to keep within UE capability size limits.  T-Mobile USA: My RAN2 colleagues tell me that RAN2 has decided that a way to distinguish between legacy UEs that don’t support 3.45-3.55 GHz in the US and those that do. They are working on an LS, but I’m not sure of the timing. Given that they have reportedly concluded that some type of differentiation is needed, it seems like there are 3 choices 1) define a new band. 2) re-use modified MPR behavior bits, 3) Define new signalling bits (not sure if they could be available in Rel-16 or only Rel-17.) My understanding is that the RAN2 LS will ask RAN4 if we prefer a new band or signalling bits, and if so what would those bits mean.  So, it seems like there are 3 options:   1. New band. Pro: No new ASN.1, Con: Complicates RAN4 specs 2. Re-use modified MPR behavior, Pro: no new ASN.1. Con: redefining meaning of the bits 3. New signalling bit: Pro: clean solution, Con: New ASN.1. Might only be Rel-17. Would impact RAN4 and RAN2 specs.   Maybe RAN4 should just decide in round 2 if we want a new band or a signalling approach, and what the signalling would indicate. And then if we choose the signalling approach, leave the details up to RAN2, except maybe tell them a preference for release availability. |
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### CRs/draftCRs/TPs comments collection

**Moderator’s Note**: draftCR R4-2112271 and draftCR R4-2112273 are resubmissions of CR R4-2107990 and CR R4-2107991 respectively which had been technically endorsed in last RAN4 meeting but postponed as the CRs need to be agreed together with UE CR as a package. It is suggested to also endorse R4-2112271 and R4-2112273 in this meeting. Yet companies are still welcome to provide comments below if found necessary.

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| **CR/TP number** | **Comments collection** |
| [**R4-2112049**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112049.zip)  TS 38.101-1 | **Title:** CR for addition of 3.45-3.55 GHz in Band n77 for the US -r16 |
| T-Mobile USA: At a minimum a revision of the CR is needed because the original note 12 was deleted before the new note was added. Also, the text for Note 12 should not be bold. |
| [**R4-2112271**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112271.zip) | **Title:** Draft CR to TS 38.104: Addition of FCC emission limits on US 3.45-3.55 GHz band |
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| [**R4-2112273**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112273.zip) | **Title:** Draft CR to TS 38.141-1: Addition of FCC emission limits on US 3.45-3.55 GHz band |
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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 1.2-1** | **How to modify Note 12 in Table 5.2-1 in TS 38.101-1 to include the support of 3.45 – 3.55 GHz in addition to 3.7 – 3.98 GHz in US Band n77?**  Option 1: “In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz and has optional capability for distinguishing devices” or “In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz” if RAN2 and RAN4 conclude that capability signaling is not required. (R4-2112048) [**2 companies**, OPPO, MediaTek]  Option 2: “In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz” irrespective of whether the capability signaling on the support of 3450 – 3550 MHz is required or not. [**7 companies**, Qualcomm, ZTE, Apple, DISH, Samsung, AT&T, Google]  Option 3: Others. [**5 companies**, Nokia, US Cellular, Skyworks, T-Mobile USA, Ericsson]  ***Tentative Agreement (based on majority view)****: No agreement*  **Moderator’s Note**: In addition to the limited option choices, a few companies commented that the note may not be necessary [Qualcomm, Nokia, US Cellular, T-Mobile USA, Samsung, AT&T, Google]. |
| **Issue 1.2-2** | **Is it necessary to define a new n77 NS value to prevent non-supporting UE (without FCC certification on the new frequency range) from camping/assessing on 3.45 – 3.55GHz cell?**  Option 1: Yes [0 company]  Option 2: No [0 company]  Option 3: Leave the decision to RAN2 [14 companies]  ***Agreement****: Option 3: Leave the decision to RAN2* |
| **Issue 1.2-3** | **Should RAN4 consider defining a new band as an alternative to signaling to differentiate UE supporting the new frequency range or not?**  Option 1: Yes [**2 companies**, Ericsson, MediaTek]  Option 2: No [**8** **companies**, Qualcomm, Verizon, Skyworks, ZTE, T-Mobile USA, Apple, DISH, AT&T]  ***Tentative Agreement (Majority view):*** *Option 2: No*  **Moderator’s Note**: This open issue was not raised in the initial email discussion summary document but was triggered during the first round email discussions. |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | WF on Enabling US 3.45 – 3.55GHz in Band n77 | T-Mobile USA |

### CRs/TPs

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

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [**R4-2112049**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112049.zip) | Return to 2nd round |
| [**R4-2112271**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112271.zip) | Can be endorsed |
| R4-2112272 | Can be endorsed (mirror CR of R4-2112271) |
| [**R4-2112273**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112273.zip) | Can be endorsed |
| R4-2112274 | Can be endorsed (mirror CR of R4-2112273) |

### Discussion papers

**Moderator’s recommendation**: All discussion papers are recommended to be noted.

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| **Tdoc number** | **CRs/TPs Status update recommendation** |
| R4-2112048 | Noted |
| R4-2112822 | Noted |

## Discussion on 2nd round (if applicable)

Thanks T-Mobile USA’s comments on the RAN2 status in first round discussions and the suggested RAN4 discussions in 2nd round. Though in the first-round discussions, majority companies preferred not to introduce a new frequency band, let’s keep the option open and continue the discussions in 2nd round. On the UE specifications side, let’s continue the discussions on NOTE 12 for Band n77 and the necessary changes based on the RAN2’s LS. The “Return-to” UE CR R4-2112049 can be used as a template for revisions towards final CR.

**Issue 1.5-1: How to enable network to differentiate UE supporting the new frequency range or not?**

### Option 1: UE capability signaling defined by RAN2

* Option 2: Define a new frequency band

**Issue 1.5-2: How to modify NOTE 12 in Table 5.2-1 in TS 38.101-1 to include the support of 3.45 – 3.55 GHz in addition to 3.7 – 3.98 GHz in US Band n77?**

### Option 1: “In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz”

* Option 2: Remove NOTE 12 completely
* Option 3: Align the note with RAN2 decision on signaling and the note needs to indicate the exclusion of n48.
* Option 4: Others (proposals encouraged)

## Companies’ views collection for 2nd round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  | Issue 1.2-1:  Issue 1.2-2: |
| MediaTek | Thanks to RAN4 colleagues’ for valuable comments in 1st round.  We think issue 1.2-1 and issue 1.5-2 are the same question.  **Issue 1.5-2: How to modify NOTE 12 in Table 5.2-1 in TS 38.101-1 to include the support of 3.45 – 3.55 GHz in addition to 3.7 – 3.98 GHz in US Band n77?**  Regarding Issue 1.5-2’s Option 4: Others (proposals encouraged)  We would like to propose option4  Option 4: “In the USA this band is restricted to 3700 – 3980 MHz and frequency ranges in Table XY”   * 4 : Table XY : lists of each frequency range (4-1 and 4-2 are subsets of 4) * 4-1 : Table XY: lists of each frequency range with UE’s optional capability bit (irrespective new or reserved UE signalling capability) * 4-2: Table XY: lists of each frequency range with band indicator.   Option 4   |  |  |  | | --- | --- | --- | |  | Range1 | Range2 | | Frequency range (MHz) | 3450-3550 |  |   Option 4-1   |  |  |  | | --- | --- | --- | |  | Range1 | Range2 | | Frequency range1 (MHz) | 3450-3550 |  | | Note 1:  Per UE’s optional capability bits are used for each range. | | |   Option 4-2   |  |  |  | | --- | --- | --- | |  | Range1 | Range2 | | Frequency range (MHz) | 3450-3550 |  | | Band indicator1 | New band or n77a\_US |  | | Note 1: Band indicator are (only) applicable for providing signalling capability for each frequency range, respectively. n77 CA lists/tables are not changed. | | | |
| ZTE | Issue 1-5-1: **How to enable network to differentiate UE supporting the new frequency range or not?**  Option 1 would be the simpler solution, as elaborated below.  From network perspective, there are only three different operations in theory to deploy the old US n77 and the new US n77(i.e., 3700 – 3980 plus 3450 – 3550):   1. Cell “legacy” operating at 3700 – 3980: this is the same as of today, nothing changed, legacy UEs supporting 3700-3980 would work as usual 2. Cell “New” operating at 3450 – 3550: this is a new cell, and the issue is how to prevent a legacy UE which is only certificated for 3700 – 3980 from connecting to this “New” cell; 3. Cell “Wide” operating at 3450 – 3980 with a blank from 3550 – 3700: this is not possible according to the current specs, because the bandwidth exceeds the maximum channel bandwidth supported.   So the only issue to settle is to prevent a legacy UE only certificated for 3700-3980 from connecting to the “New” cell operating at 3450-3550, assuming the FCC regulation requires to do so, of course.  However, there is one thing not clear. In RAN4 specs, Note 12 indicates the range of n77 in US, but under the current signaling framework, there is no capability signaling indicating that the UE is certificated for 3700-3980, that is to say, Note 12 is not implemented in specs at all, so legacy UEs won’t tell that it only supports 3700-3980. In this case, a new capability signaling may be needed to indicate its certification of 3450-3550, and the “New” cell only accepts the connection requests from the UE with the explicit reporting of such a capability. This seems a simpler solution compared with the method of introducing a new band indicator.  **Issue 1.5-2: How to modify NOTE 12 in Table 5.2-1 in TS 38.101-1 to include the support of 3.45 – 3.55 GHz in addition to 3.7 – 3.98 GHz in US Band n77?**  Option 3 at this stage.  As elaborated above, the original Note 12 seems not implemented in the current signaling framework, so eventually it will depend on RAN2’s new signaling design, and RAN4 specs just to make sure it is aligned (most likely either Option 1 or Option 2 eventually, but at this stage, RAN4 may just hold on and wait for RAN2’s decision, i.e., Option 3).  Thanks for MTK’s new proposed option 4. It seems another way of having Note 12, and Option 4-2 proposed by MTK seems to introduce a sub-band concept, however, this is abandoned from the beginning of NR. So for the time being we may just need to wait. |
| Charter Communications Inc. | **Issue 1.5-1:** Option 1: UE capability signaling defined by RAN2  **Issue 1.5-2:** Option 3: Align the note with RAN2 decision on signaling and the note needs to indicate the exclusion of n48.  We believe this is the much clearer solution to address UE capability to support 3450-3550 MHz and differentiate from legacy UE that cannot support this frequency range |
| MediaTek | Sorry that our comment in [Summary\_105\_2nd round\_v03\_ZTE\_MTK.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Inbox/Drafts/%5B100-e%5D%5B105%5D%20US_n77/Round%202/Summary_105_2nd%20round_v03_ZTE_MTK.docx) is not included in [Summary\_105\_2nd round\_v04\_ZTE\_Chtr Comm.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Inbox/Drafts/%5B100-e%5D%5B105%5D%20US_n77/Round%202/Summary_105_2nd%20round_v04_ZTE_Chtr%20Comm.docx)  Regarding Issue 1.5-2, we thanks to ZTE for understanding our intention.  We try do our best to consider RAN4 colleagues’ concerns as possible as we can and to figuring out ways. If we miss or misinterpret RAN4 colleagues’ concerns, please help let us know.  We think that option4’s flexibility and coverage as indicated in 4 and it’s subsets 4-1 and 4-2 explicitly help us understand that no matter what would be the decision from RAN2 (capability, create a new band, or sub-band indicator), they can be the subsets of option4.  For example, 3450-3550MHz can be indicated by UE’s capability, creating a new band, or using sub-band indicator. Hope this clarify our intention. |
| T-Mobile USA | Issue 1.5-1: Option 1: UE capability signaling defined by RAN2  Issue 1.5-2: Option 4-1: We support the proposal from MediaTek. It allows the UE supported frequency range to be documented in 38.101-1 and provides for the possibility of additional frequency ranges being allocated in n77 in the US in the future. If Option 4 is not agreeable, we think Option 1 should be chosen as that received the most support in Round 1. |
| DISH | Issue 1.5-1: Option 1: UE capability signaling defined by RAN2  Issue 1.5-2: Thanks Mediatek for the additional proposal. We do not fully understand how this would be applied, nor the added flexibility with n77 vs. only the note. It is possible new spectrum would come available in the US, but does that need this type of table approach? It would be helpful to understand the benefit. Comparing option 4-1 with option 3 as it is, we do not see the benefit. Additionally, as it has been commented there is no 3700-3980 mentioned anywhere else than in 38.101-1 so why would that be left in the note, but not included in the table?  Also, does this imply that that 3450-3550 would be optional (not taking side in RAN2 discussion to which release it would be put into) and if so, then why? Capability from RAN2 perspective may be optional, but this does not mean RAN4 should treat it the same way only because it is introduced part of n77. This seems to need further discussion.  We prefer option 1 unless this option 4-1 is further discussed and its application benefit found commonly feasible.  Option 4-2 we agree with ZTE. This concept was abandoned already and should not be introduced here. |
| MediaTek | Issue 1.5-2: Thanks to DISH for comments. We are okay to option4 and are fine with option1. We are open to have further discussion about option 4/4-1/4-2 |
| Qualcomm | **Issue 1.5-1: How to enable network to differentiate UE supporting the new frequency range or not?**  We prefer option 1 for RAN2 to define a capability  **Issue 1.5-2: How to modify NOTE 12 in Table 5.2-1 in TS 38.101-1 to include the support of 3.45 – 3.55 GHz in addition to 3.7 – 3.98 GHz in US Band n77?**  We are considering option 1 or option 4-1 as proposed by MediaTek |
| Verizon | **Issue 1.5-1: How to enable network to differentiate UE supporting the new frequency range or not?**  We support option 1 and use UE capability signal defined by RAN2  **Issue 1.5-2: How to modify NOTE 12 in Table 5.2-1 in TS 38.101-1 to include the support of 3.45 – 3.55 GHz in addition to 3.7 – 3.98 GHz in US Band n77?**  We support option 4-1 as proposed by MediaTek |
| Apple | Issue 1.5-1:  Option 1 is our preference  Issue 1.5-2:  Option 1 is our preference  Option 4-1 proposed by MediaTek though assumes the merit of future extensibility, it might also create an impression that only another frequency range would be introduced in future or RAN4 already knew a new frequency range would be introduced. It might be tricky to decide how many frequency range spaces to be reserved in the specifications. |
| Ericsson | Ericsson:  1.5-1  Option 2.  Some commenters argue that a capability signaling solution is a cleaner solution. It would be useful to know in which sense.  Setting e.g. a new bit ‘modified MPR bit’ to “1” for ‘UE not restricted to 3700-3980 MHz’ is deceptively simple but is not sufficient. A NS value must be specified for n77 for barring existing UEs from the 3450-3550 MHz band, i.e. ‘this NS value indicates that UEs not supporting the new capability/modified MPR’ shall consider cells in 3450-3550 MHz barred’.  Cleaner compared to using existing band-capability signaling for initial access, NR mobility, LTE to NR mobility and configuration of Scells in the 3450-3550 MHz range?  In our view a solution based on a new band is more straightforward to implement considering both the NW and the UE, and without delay, it is based on existing band-capability signaling.  The UE does not have to copy the BC supported in its capability, only the capability for the band and it has to handle the last item below (so does the network). Repeating the key features;  -- a new band n101 introduced, a copy of n77, identical requirements  -- a UE supporting n101 must also support n77  -- band combinations (BC) are not specified for n101, no n101 requirements for neither CA nor DC  -- the UE does not include BC for n101 in its UE capability and the NW does not enquire combinations with n101  -- all band combinations that these UEs report/support with n77 can also be configured with n101 serving cells instead of n77 serving cells (supported by both the UE and the NW)  No RAN2 changes needed. The above changes to RAN4 specifications can be implemented at this meeting and a draft CR for 38.101-1 is available (a sumbset of these changes needed in 38.104 and 38.101-3)  1.5-2:  Option 4: the note should not include aspects related to n48. |
| Skyworks | Issue 1.5-1:  Option 1  **Issue 1.5-2: Moderator introduced option 3 to reflect our round 1 comment. But our position was if a frequency range note was added it rather indicates that n48 frequency range (not n48 itseft) is not supported and it may refer to the RAN2 signaling. Rather than the note, the key is the signaling to solve the issue.** |
| AT&T | **Issue 1.5-1: How to enable network to differentiate UE supporting the new frequency range or not?**  As in the first round, we prefer option 1.  **Issue 1.5-2: How to modify NOTE 12 in Table 5.2-1 in TS 38.101-1 to include the support of 3.45 – 3.55 GHz in addition to 3.7 – 3.98 GHz in US Band n77?**  We prefer option 1 but could accept option 2. Option 3 and 4 seem to add unnecessary references in the RAN4 performance requirements as these would already be defined in the RAN2 specification. We should avoid duplication. |
| MediaTek | Thanks Skyworks a lot for reminder about issue 1.5-2.  We wonder whether wordings of “Note 2: 3550-3700MHz is not supported” or “Note 2: 3550-3700MHz is excluded” could be also added in option 4/4-1/4-2 Tables to address your suggestion.  We are open to improve option4/4-1/4-2 to accommodate RAN4 colleagues’ suggestion. It is appreciated to have RAN4 colleagues’ comments.  Issue 1.5-1: We can accept majority view. |

### Way forward

Companies can provide comments to this document in the table below or to the WF directly on the reflector.

|  |  |
| --- | --- |
| R4-21xxxxx | **Title:** WF on Enabling US 3.45 – 3.55GHz in Band n77 |
| Charter Communications Inc.  With regards to enabling the network to differentiate UE supporting the new frequency range or not, we prefer RAN2 to define UE capability signaling. This solution provides the cleanest way to differentiate new UE’s to legacy UE’s.  With regards to NOTE 12 in Table 5.2-1 in TS 38.101-1, RAN4 should align this note to the RAN2 UE capability signaling decision and highlight the exclusion of band n48.  MediaTek  The WF help further understanding and discussion. Regarding “Proposal 3: Volunteers to write the CR for 38.101-1 welcome”, we can help and modify our proposed CR to accommodate RAN4 colleagues’ consideration. Regarding option 4-1 or 4-2, we think that decision from RAN2 (capability, create a new band, or sub-band indicator) can be included as subsets of option4 after RAN4 colleagues’ discussion and suggestion.  UScellular  Appropriate signaling to discern between UEs (previous and revised n77) seems sufficient, while also providing an extensible scheme for handling future changes without requiring a separate new band for each case, within the designated band range in 38.101-1  Qualcomm: The proposal summary (last page) of the WF looks agreeable. Agree with the comment from US Cellular about extensibility. The extensibility does not need to be completely general, but there is a reasonable change that other spectrum within the frequency range of n77 may become available in the future. MediaTek’s proposal 4-1 seemed to address that possibility as stated in the WF from T-Mobile.  Verizon: We slightly modified the wording of Proposal 1 to below for avoiding confusion,  Proposal 1: RAN4 to tell RAN2 that the majority of companies in RAN4 favor new signalling over a new ~~band~~ frequency range  Apple: Thanks T-Mobile USA on leading this WF.  On **Proposal 1**, RAN2 was already aware the outcome of RAN4 first round discussions based on moderator’s summary report where the majority companies in RAN4 favor new signaling over a new band. By end of 2nd round comments, RAN2 can have another update from RAN4 on the outcome of Issue 1.5-1 discussions.  On **Proposal 2**, our preference is Option 1. We are also open for Option 4-1 if most companies prefer this option.  On **Proposal 3**, MediaTek’s CR can be used as a template to capture the agreed changes for this meeting.  AT&T:  On **Proposal 1**, we agree with Apple that the outcome of Issue 1.5-1 should be identified.  On **Proposal 2**, our preference is Option 1. We do not support Option 4-1 for the reasons identified in Issue 1.5-2.  On **Proposal 3** and given our views on Proposal 2, we do not support using MediaTek’s CR as the template. We think that the table note originally proposed in Option 1 of Issue 1.5-2 is in-line with the majority view at the last RAN4 meeting and should be used for any baseline CR. |

### CR/dCR

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| Revision of R4-2112049 | **Title:** Addition of 3.45-3.55 GHz in US Band n77 |
| Charter Communications Inc. In revision R4-2112049 r-1, note 1 was change to, “UE provides information to indicate frequency range for NW distinguishing”. We do not agree with this change and rather will like to see original proposal in option 4-1, “Per UE’s optional capability bits are used for each range.”  Apple: For the UE CR/dCR, if it is not yet clear how to capture the signaling aspect into the specifications (an informative note or in Annex), we suggest to at least capture the new frequency range into the specifications like what we did for the initial introduction of US Band n77. How to introduce signaling part as defined by RAN2 into RAN4 specifications can be further discussed in next RAN4 meeting. |
| R4-21xxxxx | **Title:** Introduction of a new band (indicator) for n77 operation in 3450-3550 MHz range |
| Charter Communications Inc. We do not like the proposal of introducing a new band to enable the network to differentiate whether a UE can support 3450-3550 MHz range in n77 US. We agree with the proposal of asking RAN2 to add a new UE capability signaling instead. As we said earlier, This solution provides the cleanest way to differentiate new UE’s to legacy UE’s.  Apple: We do not prefer to introduce a new phantom band which only serves the purpose of capability signaling for the new frequency range. |

# Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

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

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

## 2nd round

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

Notes:

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

# Annex

Contact information

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