**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-2105225**

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

**Agenda item:** 14

**Source:** Moderator (Apple)

**Title:** Email discussion summary for [98-bis-e][152] 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 in agenda item 14. There are five contributions in this email thread which consists of two discussion papers, one draft CR for UE and two draft CRs for BS.

The goal in this meeting is to decide whether any new RF requirements other than the existing Band n77 requirements in US need to be introduced in order to enable 3.45 – 3.55GHz spectrum usage in US Band n77 and conclude whether the proposed UE and BS draft CRs can be technically endorsed.

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2107109**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107109.zip)  Type: Discussion  For: Approval | Apple | **Title:** Band n77 usage in the US for 3.45 to 3.55 GHz  **Observation 1:** A UE using band n77 fulfilling the 3GPP general emissions mask, also fulfills the emissions limits in §27.53 of the new FCC rules for 3450-3550MHz  **Proposal 1:** No modification to the general emissions mask in 38.101-1 is needed.  **Proposal 2:** No modification to the co-existence for US bands for n77 in 38.101-1 is needed.  **Proposal 3:** Modify the frequency restriction in the Operating Bands table for the US to restrict n77 usage to outside the n48 frequency range.  **Proposal 4:** Companies are encouraged to propose a solution, how the network can distinguish devices supporting the new frequency range or not within the same release. If no reasonable solution is found, the best way would be to specify the new frequency range from Rel. 17 onwards. |
| [**R4-2107349**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107349.zip)  Type: Discussion  For: Approval | Qualcomm Incorporated, AT&T | **Title:** Enabling US 3.45 – 3.55 GHz with Band n77  **Observation 1:** PC3 and PC2 power classes for Band n77 and future PC1.5 power class are suitable for US 3.45 – 3.55 GHz operation for conducted power. The equipment manufacturer is further obligated to ensure that maximum EIRP limits are not exceeded with the power class and antenna design of the device.  **Observation 2:** Coexistence between Band n77 and other US bands is already captured in the specifications.  **Proposal 1:** 3GPP SEM for Band n77 is compatible with the FCC emission mask. No modification is needed for SEM.  **Proposal 2:** Similar to introduction of 3700 – 3980 MHz, it is proposed that no additional spurious or UE coexistence emission requirements are specified between Band 48 (n48), Band 49, and Band n77.  **Proposal 3:** Decide which of two notes should be included into the specification to describe the frequency range applicability for US Band n77. |
| [**R4-2107350**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107350.zip)  Type: draftCR  For: Endorsement  CAT: F  Rel-16  TS 38.101-1 | Qualcomm Incorporated, AT&T, Nokia | **Title:** Addition of new spectrum in Band n77 for US  **Reason for change:**  Band n77 requirements apply only over the frequency range 3700 – 3980 MHz in the US.  **Summary of change:**  The frequency range applicability note for Band n77 is changed to exclude CBRS for the US rather than to apply only to 3700 – 3980 MHz.”. |
| [**R4-2104496**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104496.zip)  Type: draftCR  For: Endorsement  CAT: F  Rel-16  TS 38.104 | Nokia, Nokia Shanghai Bell | **Title:** Draft CR to TS 38.104: Additional 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 operating band unwanted emissions requirements for Band n77. |
| [**R4-2104497**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104497.zip)  Type: draftCR  For: Endorsement  CAT: F  Rel-16  TS 38.141-1 | Nokia, Nokia Shanghai Bell | **Title:** CR to TS 38.141-1: Additional 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 operating band unwanted emissions requirements for Band n77. |

## Open issues summary

**Issue 1.2-1: Is it agreeable that no UE SEM modification is needed for adding 3.45 – 3.55 GHz in US Band n77?**

### Option 1: Yes

### Option 2: No

**Issue 1.2-2: Is it agreeable that no modification to UE coexistence bands is needed for adding 3.45 – 3.55 GHz in US Band n77?**

### Option 1: Yes

### Option 2: No

**Issue 1.2-3: 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: “In the USA the Band n77 requirements do not apply over the 3550 – 3700 MHz frequency range”

* Option 3: “In the USA the Band n77 usage is restricted to outside the Band n48 frequency range”

**Issue 1.2-4: Should the issue on how the network can distinguish devices supporting the new frequency or not within the same release be resolved before the Rel-16 draft CRs can be technically endorsed?**

### Option 1: Yes

* Option 2: No

**Issue 1.2-5: Are changes needed in BS specifications to enable 3.45 – 3.55 GHz in US Band n77?**

### Option 1: Yes (as proposed in draft CRs R4-2104496 and R4-2104497)

* Option 2: No (as stated in R4-2107349)

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| T-Mobile USA | Issue 1.2-1: Option 1: Yes  Issue 1.2-2: Option 1: Yes  Issue 1.2-3: Option 3. We could also accept ““In the USA the Band n77 usage is restricted to outside the 3550 – 3700 MHz frequency range” We cannot accept the wording in Option 2 because having “no requirements” isn’t the same as preventing operation in the CBRS band, like the current note does. In fact, the behavior may be unpredictable if there are “no requirements.”  Issue 1.2-4: Option 1: Yes. We can wait another meeting to see how the issue may be resolved before agreeing draft CRs or CRs.  Issue 1.2-5: Option 2: We don’t have a strong view, but we don’t think that changes in the BS spec are needed because the spec already allow for additional regulatory requirements outside of the 3GPP specs. |
| CableLabs | Issue 1.2-2: Option 2: no, not agreeable. Band 48/n48 is a legacy band that should be protected from impact from new bands. The -50 dBm/MHz UE coexistence limit should apply to the 3.45-3.55 GHz frequency range in US band n77 to protect band 48/n48. Using combination of filter, A-MPR and RB blanking inside the 3.45-3.55 GHz band, this limit is achievable.  Issue 1.2-3: we support Option 1.  Issue 1.2-5: we support Option 1. |
| Skyworks | Issue 1.2-1: Option 1: Yes  Issue 1.2-2: Option 1: Yes, band 48 being an overlapping band it needs to be synchronized, there is no difference whether the spectrum is above or below band 48 so the additional spectrum below band 48 has the same coexistence requirement than the spectrum above.  Issue 1.2-3: Option 3, this is the most future proof and can only be modified if specific band 48 emission requirements are modified.  Regarding the addition of the lower n77 range, we do support this addition for band n77 operation in north-America but we want to mention here that some band combinations had made use of the spectrum being restricted to the 280MHz above band 48 to simplify/omit MSD cases. Such cases will have to be re-exanimated and for upcoming combinations including n77(2A) UL CA we suggested that the entire 3450MHz-3980MHz (-band 48) is considered (i.e an IMD BW of up to 530MHz).  Issue 1.2-4: yes it is worth having a common understanding how legacy UEs will be supported from the network. |
| Nokia | Issue 1.2-1: Option 1.  Issue 1.2-2: Option 1.  Issue 1.2-3: Option 3.  Issue 1.2-5: Option 1 since similar conducted requirements exist already for other US bands in TS 38.104 clause 6.6.4.2.5 and TS 38.141-1 clause 6.6.4.5.6, omitting band n77 would create unnecessary ambiguity. |
| Qualcomm | Issue 1.2-1: Option 1  Issue 1.2-2: Option 1  Issue 1.2-3: Any of these options is acceptable to us  Issue 1.2-4: Option 2. The UE will not connect to the cell if it has not be FCC certified to operate within the frequency range. What would the network do if it had this information because anyways the UE cannot connect? For initial access, there is nothing the network would do. For handover, the network would try to handover to a different band, which is the same behavior even if the network knows that the UE cannot support this spectrum. So we don’t see this as a major problem, certaintly not one that merits new signaling or delaying introduction to the next release. Moreover, delaying the draft CR or even deferring to Rel-17 only makes the problem worse; the earlier the spec is completed, the sooner devices can adopt it, and the fewer devices will need to be upgraded.  Issue 1.2-5: Option 1 is ok for us. |
| DISH Network | Issue 1.2-1: Option 1  Issue 1.2-2: Option 1  Issue 1.2-3: Option 1  Issue 1.2-4: Option 1. This is an important aspect to clarify, but in addition to resolving NW’s ability/need to distinguish devices supporting new frequency range or not, we need to clarify clearly if/how UE’s in the field currently not supporting new frequency range can be SW upgraded to support the new frequency range  Issue 1.2-5: Option 1 |
| AT&T | Issue 1.2-1: Option 1  Issue 1.2-2: Option 1  Issue 1.2-3: Any of these options are OK with us. Concerning some of the comments on Option 2, we can consider revised text to make this clearer if this option is preferred.  Issue 1.2-4: Option 1 is OK as long as we can decide on the CRs in the May meeting to keep the specification release as June.  Issue 1.2-5: Either option is OK with us as, in the end, the BS needs to meet the regulatory requirements. |
| Apple | Issue 1.2-1: Option 1: Yes  Issue 1.2-2: Option 1: Yes  Issue 1.2-3: Option 3: “In the USA the Band n77 usage is restricted to outside the Band n48 frequency range”  Issue 1.2-4: Option 4: Yes |
| CableLabs | Issue 1.2-2: Option 2. R4-2107349 discussed TDD sync between 3.45-3.55 GHz band and CBRS band. We would encourage TDD sync, but it is not mandated by FCC. The UE coexistence would be a much less concern if we have inter-band TDD sync. However, given the fact that there is no mandated TDD sync, the UE coexistence is needed to protect the legacy CBRS band.  @Skyworks: it is true that the upper edge (3.7-3.98 GHz) does not have UE coexistence defined in 3GPP specs. The upper edge and lower edge of CBRS band are different. 3.65-3.7 GHz spectrum are allocated for unlicensed use (GAA only), but 3.55-3.65 GHz band is for PAL licensed use. The UE spurious emission from 3.45-3.55 GHz band to CBRS band needs to be limited, regardless of the specs for 3.7-3.98 GHz portion of US band n77. |
| Samsung | Issue 1.2-1: Option 1  Issue 1.2-2: Option 1  Issue 1.2-3: Prefer Option 3. But other options are also acceptable for us if they all have the same result  Issue 1.2-4: Option 1  Issue 1.2-5: Option 1 |
| T-Mobile USA | To Cable Labs: RAN4 never defines -50 dBm/MHz protection for adjacent TDD bands. Instead, RAN4 always assumes that the neighbors coordinate their UL/DL ratios and synchronize. That has worked very well in the 2.5 GHz band, despite there being no mandate from the FCC for synchronizing. Likewise, there are multiple licensees in 3.7-3.98 GHz in the US and although there is no FCC mandate, it will be in their best interest to coordinate and synchronize with each other.  Even if RAN4 did define NS signalling with A-MPR and RB blanking to protect the CBRS band, if there is no FCC mandate to use the NS signalling and RB blanking, why does Cable Labs think that will be a better solution than coordination and synchronization? |
| Ericsson | Issue 1-2-1: Option 1  Issue 1-2-2: Option 1, 3450-3550 MHz same as the C-band from a band coexistence standpoint, there are no additional emission requirements stated in the FCC NPRM  Issue 1-2-4: Option 1, handling of non-certified devices may require further consideration. But how to prevent inbound-roaming n77 capable UEs that are not certified from attempting to access 3.45-3.55 GHz or the C-band for that matter?  Issue 1-2-5: While the general UE SEM would be compliant with the emission limits in the FCC NPRM on 3.45-3.55 GHz, the emission limits for the BS are more stringent below 3440 MHz and 3560 MHz. How to capture these in the 38.104 may require further consideration before agreeing CRs. |
| Google | Issue 1.2-1: Option 1  Issue 1.2-2: Option 1  Issue 1.2-3: Option 3 is preferred. We are also fine with Option 1 and Option 2.  Issue 1.2-4: Option 1 |

### Comment collection for discussion papers

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| **Tdoc number** | **Comments** |
| [**R4-2107109**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107109.zip) | **Title**: Band n77 usage in the US for 3.45 to 3.55 GHz |
| [**R4-2107349**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107349.zip) | **Title:** Enabling US 3.45 – 3.55 GHz with Band n77 |

### CRs/TPs/LSs comments collection

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

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| **CR/TP number** | **Comments collection** |
| [**R4-2107350**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107350.zip) | **Title:** Addition of new spectrum in Band n77 for US |
| Apple:   1. We prefer the wording of Option 3 in Issue 1.2-3 above for the modification of 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. 2. A solution for network to distinguish devices supporting the new frequency range or not within the same release needs to be identified if the new frequency range would be introduced in Rel-16, or it is better to introduce the new frequency range from Rel-17 onwards.   Ericsson: not agreed (the UE specification should be treated together with the BS specification as a package). |
| [**R4-2104496**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104496.zip) | **Title:** Draft CR to TS 38.104: Additional of FCC emission limits on US 3.45-3.55 GHz band |
| Apple: We do not have a strong view on whether the changes in BS specifications are needed or not. If the changes are found necessary, we suggest the BS draft CR to be endorsed together with UE draft CR as a package.  Ericsson: not agreed, how to capture the BS emissions limits in the FCC NPRM on 3.45-3.55 GHz requires further consideration. We propose to revisit this at the next RAN4. |
| [**R4-2104497**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104497.zip) | **Title:** CR to TS 38.141-1: Additional of FCC emission limits on US 3.45-3.55 GHz band |
| Apple: We do not have a strong view on whether the changes in BS specifications are needed or not. If the changes are found necessary, we suggest the BS draft CR to be endorsed together with UE draft CR as a package. |

## 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** | **Is it agreeable that no UE SEM modification is needed for adding 3.45 – 3.55 GHz in US Band n77?**  Option 1: Yes (10 companies, T-Mobile USA, Skyworks, Nokia, Qualcomm, Dish Network, AT&T, Apple, Samsung, Ericsson, Google)  Option 2: No (0 company)  ***Agreement****: No UE SEM modification is needed for adding 3.45 – 3.55 GHz in US Band n77.* |
| **Issue 1.2-2** | **Is it agreeable that no modification to UE coexistence bands is needed for adding 3.45 – 3.55 GHz in US Band n77?**  Option 1: Yes (10 companies, T-Mobile USA, Skyworks, Nokia, Qualcomm, Dish Network, AT&T, Apple, Samsung, Ericsson, Google)  Option 2: No (1 company, CableLabs)  ***Tentative Agreement (based on majority view)****: No modification to UE coexistence bands is needed for adding 3.45 – 3.55 GHz in US Band n77.* |
| **Issue 1.2-3** | **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” (6 companies, CableLabs, Qualcomm, Dish Network, AT&T, Samsung, Google)  Option 2: “In the USA the Band n77 requirements do not apply over the 3550 – 3700 MHz frequency range” (4 companies, Qualcomm, AT&T, Samsung, Google)  Option 3: “In the USA the Band n77 usage is restricted to outside the Band n48 frequency range” (8 companies, T-Mobile USA, Skyworks, Nokia, Qualcomm, AT&T, Apple, Samsung, Google)  ***Tentative Agreement (based on slight majority view):*** *“In the USA the Band n77 usage is restricted to outside the Band n48 frequency range”* |
| **Issue 1.2-4** | **Should the issue on how the network can distinguish devices supporting the new frequency or not within the same release be resolved before the Rel-16 draft CRs can be technically endorsed?**  Option 1: Yes (8 companies, T-Mobile USA, Skyworks, Dish Network, AT&T, Apple, Samsung, Ericsson, Google)  Option 2: No (1 company, Qualcomm)  ***Tentative Agreement (based on majority view)****: The issue on how the network can distinguish devices supporting the new frequency or not within the same release needs to be resolved before the Rel-16 draft CRs can be technically endorsed.* |
| **Issue 1.2-5** | **Are changes needed in BS specifications to enable 3.45 – 3.55 GHz in US Band n77?**  Option 1: Yes (7 companies, CableLabs, Nokia, Qualcomm, Dish Network, AT&T, Samsung, Ericsson)  Option 2: No (2 companies, T-Mobile USA, AT&T)  ***Tentative Agreement (based on majority view)****: Changes (in emission limits) are needed in BS specifications to enable 3.45 – 3.55 GHz in US Band n77.* |

*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 | Apple |

### CRs/TPs

Based on the outcome of the first-round discussions and the shortened e-meeting duration, it does not seem that we would be able to technically endorse the proposed UE and BS draft CRs. The moderator’s suggestion is to note all the contributions and focus on the WF with the aim to conclude the support of US 3.45 – 3.55GHz in Band n77 in May meeting.

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2107350 | Noted |
| R4-2104496 | Noted |
| R4-2104497 | Noted |

### Discussion papers

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

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| **Tdoc number** | **CRs/TPs Status update recommendation** |
| R4-2107109 | Noted |
| R4-2107349 | Noted |

## Discussion on 2nd round (if applicable)

The 2nd round discussions will be focused on the following WF. Companies can provide the comments to this document or to the WF directly on the reflector.

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|  | **Title:** WF on Enabling US 3.45 – 3.55GHz in Band n77 |
|  |
|  | **Title:** |
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## Summary on 2nd round (if applicable)

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

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
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