3GPP TSG-RAN #93 Tdoc RP-21XXXX

Electronic meeting, 2021-09-13 - 2021-09-17

Agenda Item: X

Source: Ericsson (Moderator)

Title: Moderator Summary for [93e-30-band-n77]

Document for: Discussion, Decision

# 1 Introduction

This is a summary of the email discussion [93e-30-band-n77].

# 2 Discussion

### 2.1 Background

RAN2 and RAN4 were tasked to extend the n77 band in the US to cover the 3450-3550 MHz region, in addition to the 3700-3980 MHz region.

At RAN2#115, RAN2 discussed two solutions for this:

- A new cap signalling + new NS value

- B new frequency band replace n77 in the US including the DoD part.

RAN4 agreed that new capability signalling shall be defined, i.e., not the new frequency band solution.

For Solution A, RAN2 clarified in their LS [RP-211671](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-211671.zip) that:

RAN2 has agreed that UE’s that don’t support the DoD band need to be barred from accessing the DoD band in the US. RAN2 thinks that a new NS-value can be defined to prevent legacy UEs supporting n77 from camping on the DoD bands and as legacy UEs cannot identify the new value, the UE would not camp on that cell.

RAN2 provided technically endorsed CRs for Solution A which are adding the capability bit for Solution A, see [RP-212445](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212445.zip). RAN4 provided CRs for Solution A in [RP-211887](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-211887.zip), but these CRs are lacking the NS-value.

Nokia ([RP-212169](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212169.zip)), Ericsson ([RP-212204](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212204.zip)) and OPPO ([RP-211815](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-211815.zip)) propose to approve CRs as per Solution A defined by RAN2 (capability bit + NS-value). Company contributions for this approach from Ericsson, Nokia, Verizon, Qualcomm can be found in [RP-212513](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212513.zip), [RP-212514](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212514.zip), [RP-212515](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212515.zip), [RP-212516](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212516.zip), [RP-212517](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212517.zip), [RP-212518](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212518.zip).

Apple, MediaTek and Skyworks Solution Inc. ([RP-212305](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212305.zip)) proposes to approve CRs without the NS-value.

### 2.2 Initial Round

#### 2.2.1 Discussion Initial Round

Do you agree to approve Solution A as per RAN2's agreement, i.e. having both UE capability bit and an NS value? If no, please clarify how do you propose to ensure that UE’s that don’t support the DoD band need to be barred from accessing the DoD band in the US.

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| **Company** | **Input** |
| Nokia, Nokia Shanghai Bell | Agree: this resolves IDLE mode camping issues since barring due to unknown NS-value was introduced by Rel-15 specifications, so it works for all UEs. |
| Verizon | We agree Solution A! As what Nokia mentioned above, this soltoin is aligning on the RAN2 soltuion. Also, it is same as the RAN4 agreement.  |
| Huawei | Ok to follow the RAN2/4 agreements. As per GTW discussion, if needed, also fine to continue the NS-related technical discussion in next RAN4. |
| ZTE | Yes, to approve Solution A. RAN4 has already excluded the new band approach. |
| AT&T | Although we do not see the need for NS-value, we can accept Solution A with the assumption that the RAN4 CRs below are modified to address our comments and concerns below. |
| T-Mobile USA | We agree with Solution A, to have a new capability bit and NS value. We can live without the new NS value if that is the only way to get CRs approved at this meeting, |
| Apple | Though we are not quite convinced the new NS value is needed as when foreign UEs receive the Mobile Country Code from SIB, they should realize that they are roaming in US and should refrain themselves from accessing the cell if they are not FCC certified for the band, just like all UEs in US. Nonetheless, if the majority companies think the new NS value is needed, we can also accept that. However, in our view, we think the support of the new NS value is better paired with modifiedMPR-Behavior bits in NR rather than paired with a new capability bit. As commented in RP-212204, the new NS value is not used according to its conventional purpose. So using the modifiedMPR-Behavior bit to indicate the UE capability and the support of the new NS value would have the merit to rationalize the use of the new NS value. And in RAN4, we’ve already had similar precedent when the new NS\_203 was introduced for n258. Using modifiedMPR-Behavior bit also provides the advantage that no new UE capability in NR nor a new band number would need to be considered again if more new frequency ranges in Band n77 open up in future. To sum up our view, we would prefer to either approve the endorsed CRs only, or go with the package of (new NS value + modifiedMPR-Behavior + new LTE capability endorsed in RAN2) in this meeting. With the modifiedMPR-Behavior in RAN4 specifications, we would no longer need new UE capability bit in NR. |
| Qualcomm Incorporated | We support Solution A. The overall system behaviour is more stable with new NS value than relying on network implementations to handle UEs not indicating the new UE capability for support for 3450-3550 MHz. New NS value avoids the situation a UE not supporting the new UE capabilty camps on 3450-3550 MHz without knowing if it will be rejected by the network.We propose not to postpone the discussion. |
| Ericsson | Yes, we agree.RAN2 already defined that Solution A above is "new cap signalling + new NS value". We don't think that RAN plenary should revert this decision.The NS-value is needed for RAN2 purposes. **Not** RAN4 purposes. The NS-value should therefore not be discussed in RAN4, but it should be discussed in RAN2. And as is familiar: RAN2 already agreed (see LS [RP-211671](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-211671.zip)) that there must be a way to prevent UEs without this capability from camping on cells in the DoD-band. The way to prevent this would be using an NS-value.To understand the motivation why RAN2 agreed that the NS-value is needed, we first must understand how the network configures UEs: When a UE is served by a gNB, the gNB must find an RRC configuration for the UE. The RRC configuration must comply with the signalled UE capabilities. If the network cannot find **any** configuration which suits the UE capabilities, the network has no other choice than to reject the UE.Now: Consider a legacy UE which supports "n77". That legacy UE would camp on and connect to cells in the DoD-band since they are indicating "n77". But these legacy UEs would of course **not** include the to-be-added capability bit that says that the UE supports cells in the DoD-band. This creates the problem. This means that there will be UEs which will camp on and connect to cells in the DoD-band but based on their UE-capabilities they actually dont support cells in the DoD-band. The network cannot find **any** configuration which suits the UE capabilities and therefore has no other choice than to reject the UE. And the UE would soon return again.For information and in response to Observation 2 in Apple's contribution [RP-212305](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212305.zip): NS-value signalling works so that a UE will read system information to see what NS-values the network is broadcasting. If for a cell the network broadcast NS-values and the UE does not understand and comply to at least one of those NS-values (see 38.331 5.2.2.4.2 Actions upon reception of the SIB1), the UE will bar that cell (=not camp on or connect to that cell). This means that by adding the new NS-value for n77 band, legacy UEs which do not implement that NS-value will not camp on nor connect to a cell indicating that NS-value. In this case, cells in the DoD-band can bar legacy UEs by broadcasting the new NS value. This because those legacy UEs does not understand that NS-value. As explained above, the problem that the NS-value should address is to prevent legacy UEs from camping on and accessing cells in the DoD-band. And the goal is achieved when a network can broadcast the new NS-value in the DoD-band. So Observation 2 in [RP-212305](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212305.zip) is not correct.It was suggested to approve the capability-bit CRs now, and the NS-value CRs in December. But that also does not work. This because a UE that implements the September specification (i.e. only the capability-bit, but not the NS-value) would be barred by any network which implements the December version. This would cause a backwards compatibility issue between the September and December specifications. |
| Nokia, Nokia Shanghai Bell | For the NS-value, we agree with the Ericsson analysis above. We also shouldn't postpone this discussion to December.Finally, on Apple's comments about the *modifiedMPR*-solution: We were initially (~6 months ago) fine with that but when it was discussed in RAN2 and there wasn't enough support for it so it was excluded (e.g. due to creating a different solution for NR SA and EN-DC). As there are also no company CRs for that, we think it's best to go with the solution that has tried to take all aspects into account (i.e. the solution as shown by the company CRs from Nokia and Ericsson). |
| Intel | We agree Solution A to introduce a new capability signalling bit and NS value.After further consideration we think that it is not possible to guarantee from 3GPP specifications perspective that there will be no foreign UEs (i.e. UEs with Rel-15 version of band n77), which would attempt to access the cells in DoD band. In particular, there are no 3GPP specification requirements for UE to read the mobile country code, and even if UE reads the code (which is a typical implementation) it does not mean that UE would restrict itself not to operate in US, since there were no such requirements in Rel-15 timeframe. Therefore, a 3GPP specification solution is needed to solve the problem.We also note that other approaches to resolve the issue can be considered including a release/redirection approach, but NS signalling can be considered as a more simple solution.  |
| MediaTek | For NS-value, we are okay to follow views from US operators. Solution A is accetable to us.In addition, we prefer to make decision in this meeting. |
| OPPO | We support solution A. |
| Samsung | We support Solution A to have both UE capability bit and an NS value. |

If Solution A, as defined in the RAN2 LS (with both capability bit and NS value) should be introduced, do you agree to introduce them as per the CRs in [RP-212513](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212513.zip), [RP-212514](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212514.zip), [RP-212515](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212515.zip), [RP-212516](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212516.zip), [RP-212517](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212517.zip), [RP-212518](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN//TSGR_93e/Docs//RP-212518.zip)?

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| **Company** | **Input** |
| Nokia, Nokia Shanghai Bell | Yes (proponent). |
| Verizon | Yes, we agree with CRs! |
| Huawei | Regarding RAN4 CRs: revised versions in RP-212517, RP-212518 have corrected the identified issue of the already used NS\_52 value.Still, further text corrections needed:1. Proper reference to be added in the text to „FCC 21-32A1“ document.
2. Note 12 missing the extendedBand-n77 reference to [7].
3. Align table 5.2-1 and Table 6.2.3.1-1 for the use of “US” vs “USA” wording.
 |
| ZTE | Yes, the CRs are fine. Approving these CRs can save RAN4 time. |
| AT&T | We would like to propose the following updates to RP-212517 and RP-212518.1. Keep the RAN4 agreed table note in Table 5.2-1 as shown in R4-2115112 (R4-2112050) as it is sufficient to specify the required frequency range for n77 and this was agreed even with the fact that there was a signalling bit solution identified during the RAN4 meeting. The RAN2 CRs already adequately cover the required signalling aspects with adequate references to the RAN4 spec. There is also no need to refer to FCC 21-32A1 as we did not refer to a FCC R&O for C-Band in the core requirements and the option to include any FCC R&O reference was already determined as not needed based on previous RAN4 agreements.

NOTE 12: In the USA this band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz.2. Modify NOTE 5 in Table 6.2.3.1-1 as follows. We think that it is better to refer back to signalling specs since the requirement is defined there concerning when it needs to be used. The comment on the FCC R&O is also similar to item #1.NOTE 5: This NS value is applicable for cells in the range 3450-3550 MHz for operations in the US as indicated in clause 4.2.7.11 of 38.306 [YY] and clause 4.3.7.X of 36.306 [ZZ].3. We need to ensure that the introduction of NS\_55 does not result in any addtional RF conformance tests. Normally, we would have to test A-MPR/A-SEM for each NS value. Given that the NS value is not being used for its intended purpose, we need a clear way to indicate this in the specification. The UE shall essentially act as if NS\_01 was signalled for the purposes of RF conformance. |
| T-Mobile USA | We want to have CRs approved at this meeting. We want to see the RAN2 endorsed CR’s in RP-212445 approved at this meeting. We could accept the RAN4 agreed CRs contained in RP-211887, but we would prefer addition of NS signalling in 38.101-1 Table 6.2.3.1-1 if that is agreeable to the majority of companies. We agree with AT&T that there is no need to refer to FCC 21-32A1.  |
| Apple | We would prefer to go with the package of (new NS value + modifiedMPR-Behavior + new LTE capability endorsed in RAN2), or we only approve the endorsed RAN2 and RAN4 CRs in this meeting. |
| Qualcomm Incorporated | Yes |
| Ericsson | Yes |
| Intel | We are fine with the proposed CRs for RAN2 and RAN4. |
| MediaTek | Yes, CRs are accetable. |
| OPPO | We are fine with the set of CRs in general. RAN2 CRs also allow early implementation for Rel15. So we want to confirm that such extension of band n77 spectrum range is release independent in RAN4’s spec, otherwise R15 CR is also needed for RAN4 CR.For the issue raised by AT&T in terms of RF requirement, current RAN4 CR indicate the value of A-MPR column in the table 6.2.3.1-1 is “N/A“ which is align with NS\_01. It means NS\_55 is a normal NS value in the sense it also defines same RF requirement as NS\_01 but not just a fake NS value to prevent legacy UE to access DoD band cell only since only NS\_55 will be broadcast in SIB1 in DoD band cell. |
| Samsung | Yes |

2.2.2 Summary and conclusion Initial Round

All companies are supportive to, or can at least accept Solution A, i.e. UE capability bit and an NS value.

One company prefers to add a modifiedMPR-Behavior bit in addition. However, such proposal was discussed in RAN2 and excluded.

Most companies want to approve the CRs at this plenary.

A couple of improvements to the draft CRs were proposed.

**The moderator proposes to:**

1. agree Solution A
2. task the CR authors (Ericsson, Nokia, Verizon, and Qualcomm) to update the draft CRs considering the Huawei and AT&T proposals above
	* draft CRs to be uploaded to [.../Inbox/drafts/[93e-30-band-n77]/Intermediate Round/draft CRs/](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_93e/Inbox/Drafts/%5B93e-30-band-n77%5D/Intermediate%20Round/draft%20CRs)
3. check the updated CRs during the Intermediate Round
4. (target CR approval in Final Round)

2.3 Intermediate Round

Let’s finalize the CRs for Solution A in the Intermediate Round and target approval in the Final Round.

2.3.1 Discussion Intermediate Round

Please provide your final comments to the CRs in [.../Inbox/drafts/[93e-30-band-n77]/Intermediate Round/draft CRs/](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_93e/Inbox/Drafts/%5B93e-30-band-n77%5D/Intermediate%20Round/draft%20CRs).

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| **Company** | **Input** |
| T-Mobile USA | We have some comments: For 38.101-1 we think that that Note 5 belongs in the NR band column to be consistent with other NS values. Also, we noticed that there is a Note 5 for NS\_47 but no corresponding Note 5 in the table, so we deleted that. For definition of IE supportedBand-n77 contained in 36.306, 36.331 and in 38.306 we propose to update the text to:  Changes are proposed because:1) Replacing the use of “UE supports” to “UE restricted” aligns with the RAN2 definition with the RAN4 definition contained in 38.101 n77 note 12 “In the USA this band is **restricted** to 3450 – 3550 MHz and 3700 – 3980 MHz.2) Deleted the reference to 38.101 which is redundant now that the 3X.306 and 3X.331 definitions contain a specific frequency range. We don’t have a strong opinion on the use of “UE supports” verses “UE restricted”. If this causes a problem, we can stick with the moderators proposed wording. Revised CR’s have been uploaded to the Draft CR inbox: <https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_93e/Inbox/Drafts/%5B93e-30-band-n77%5D/Intermediate%20Round/draft%20CRs> |
| AT&T | We agree with the E/// draft revised CRs.We do not agree with the proposal from TMUS to update the RAN2 CR language as this already seemed to be agreeable during the initial round and the language in the RAN2 CR seems to be appropriate for the use of ***extendedBand-n77-r16***. |
| Intel | 1. CR to TS 38.306: The reference in the field description of extendedBand-n77-r16 in the 38.306 CR should be updated from [33] to [2].
2. CR to TS 38.101-1: Table 6.2.3.1-1 Note 5 provides a reference to TS 38.306, which is a UE capability specification. The text is related to the cells/networks operating in the range rather than to UEs. We recommend the following change:

*NOTE 5:              This NS value is applicable for cells in the range 3450-3550 MHz for operations in the USA ~~as indicated in clause 4.2.7.11 of 38.306 [X] and clause 4.3.7.X of 36.306 [Y]~~. This NS value does not indicate any additional spurious emission and maximum output power reduction requirements.* |
| Apple | In consideration that more n77 frequency ranges could become available in the future, such as 3.3 to 3.45 GHz, we would like to encourage companies to consider a solution which is more future-proof and can be sustainable in the long run. We would hate to see the same debate between a new capability and a new band indicator over and over again when a new frequency range would be introduced, or even ending up with an inconsistent implementation for different frequency ranges, such as (NS + capability) for DoD band and a new band indicator for another range.On the other hand, as commented by Ericsson, the new NS value is not used according to its conventional purpose. We also recall to hear the same comments when *modifiedMPR-Behavior* was first proposed in RAN4 #99e meeting which was further scrutinized in last RAN2 meeting and eventually was out of consideration. In fact, the concern was already anticipated in our contribution R4-2109442 where we had the following observation:***Observation 3****: If there is a preference to associate the modifiedMPR bit with A-MPR requirements (which are set to 0 dB), then as an alternative to Proposal 4, 3GPP shall define a new NS flag NS\_X corresponding to the band n77 sub-range of 3.45-3.55 GHz, 0 dB A-MPR, and one modifiedMPR bit corresponding to NS\_X, such that if the UE sets the bit, then it implies that the UE supports the new sub-range 3.45-3.55 GHz, and if the UE does not set the bit, then it implies that the UE does not support the new sub-range (i.e. it only supports 3.7-3.98 GHz).*To us it is rather strange that now the NS value can be repurposedly used while repurposing the use of *modifiedMPR-Behavior* bits could not be accepted.To help rationalize the use of both NS value and *modifiedMPR-Behavior* bits for the new frequency range, we have come up with a solution which is more consistent with the RAN4 convention. We have provided an alternative CR revision in the draft CRs folder and would like to encourage companies to have a consideration on this solution. By taking this approach, we would not have the concern as mentioned above when a new frequency range in Band n77 would be introduced in future. We only need to introduce another NS value and populate another *modifiedMPR-Behavior* bit in RAN4 NR specifications when needed.[38101-1\_CR0926r2\_(Rel-16)\_RP-21xxxx - Introduction of extended range and NS-value for n77\_v01\_Apple.docx](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_93e/Inbox/Drafts/%5B93e-30-band-n77%5D/Intermediate%20Round/draft%20CRs/38101-1_CR0926r2_%28Rel-16%29_RP-21xxxx%20-%20Introduction%20of%20extended%20range%20and%20NS-value%20for%20n77_v01_Apple.docx)  |
| T-Mobile USA | Thanks to Softbank for pointing out that in the CRs for 38.101-1 the existing NOTE 5 somehow was merged into NOTE 4, so the new note needs to be NOTE 6, and also that the Tdoc number should start with RP- not R2-. I also received feedback from another company that they preferred to keep the new note in the requirements column rather than the band column where all of the other notes are. I don’t have a strong view on that (other than a futile desire for consistency), so here is a revision of the Ericsson CR for 38.101-1 Rel-16 with the corrected tdoc number and new NOTE 6. I didn’t update the Rel-17 mirror CR. That can wait until the Rel-16 CR is agreeable. [https://www.3gpp.org/ftp/tsg\_ran/TSG\_RAN/TSGR\_93e/Inbox/Drafts/%5B93e-30-band-n77%5D/Intermediate%20Round/draft%20CRs/38101-1\_CR0926r2\_(Rel-16)\_RP-21xxxx%20-%20Introduction%20of%20extended%20range%20and%20NS-value%20for%20n77\_v02\_TMUS2.docx](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_93e/Inbox/Drafts/%5B93e-30-band-n77%5D/Intermediate%20Round/draft%20CRs/38101-1_CR0926r2_%28Rel-16%29_RP-21xxxx%20-%20Introduction%20of%20extended%20range%20and%20NS-value%20for%20n77_v02_TMUS2.docx) |
| OPPO | We are fine to rephrase “support“ to be “restricted to“ in both 306 CRs. But the the note 6 need be improved:*NOTE 6: This NS value is applicable for cells in the range 3450-3550 MHz for operations in the USA as indicated in clause 4.2.7.11 of 38.306 [X] and clause 4.3.7.X of 36.306 [Y]. This NS value does not indicate any additional spurious emission and maximum output power reduction requirements.*The wording in both 306 CRs already links the support of NS value 55 and UE capability extendedBand-n77-r16. So the reference to 306 CRs is not necessary since cell broadcast NS value 55 may have legacy UE and new UE.The 2nd sentence seems also redundant with the table because the A-MPR column already indicate “N/A“. If the intention is to show there is no additional RF requirement, we can say it is the same as NS value 01. Please find more detail in the propsoed updated CR from OPPO.For the CR from Apple, could you clarify what is the source of the table 6.5.3.3.26-1? My impression is that no new RF requirement is introduced in RAN4 for DoD band. In case it does, then we can save the argument of the need of NS value. And I guess the reference of this table is not correctly captured. |
| Apple | Thanks OPPO for the question on Table 6.5.3.3.26-1. As by convention NS value is associated with an emission requirement, this table is meant to rationalize the use of the new NS value and *modifiedMPR-Behavior* bits as we commented earlier. The requirement is simply an extension of SEM to outside of FOOB range without further tightening. Therefore, it is virtually not a new requirement and no A-MPR is needed. The selection of the protected frequency range is Band n48 which is an implication that no n77 transmission is allowed in n48 in US. |
| Qualcomm Incorporated | We suggest RAN stick to the solution A as agreed by RAN2.On the 306 text suggested by T-Mobile, we would like to keep the current principle that the UE capability signalling indicates something the UE supports. The phrase “if present, the UE is restricted…” sounds as if it is a configuration. Can we for example say, “the UE supports the restriction….as specified in TS38.101-1”? |
| ZTE | In TS 38.101-1, “NOTE 6” is placed at the second column, which is not aligned with other notes (in the third column), so we suggest to align NOTE 6 by placing it in the third column besides “n77”. And the second sentence seems redundant. |

2.3.2 Summary and conclusion Intermediate Round

TBD

# 3 Conclusion

TODO