**3GPP TSG-RAN WG2 Meeting #115-e R2-210xxxx**

**Online, Aug 16th – 27th, 2021**

**Agenda Item: 5.4.3**

**Source: Huawei, HiSilicon**

**Title: [Post115-e][060][NR15] Support of 100M bandwidth for band n40**

**Document for: Discussion and decision**

# Introduction

This document summarizes the following offline discussion.

* [Post115-e][060][NR15] Support of 100M bandwidth for band n40 (Huawei)

Scope: CR covering P1 in R2-2108578, as discussed in [AT115-e][016]

Intended outcome: Agreed CR(s)

Deadline: Short (for RP)

# Contact from companies

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| --- | --- |
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| Huawei, HiSilicon | Yiru Kuang, kuangyiru@huawei.com |
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# Discussion

Qualcomm summarized the understanding for the current situation:

- Mandatory or optional is defined by RAN4

- Support for the bandwidth is release-independent.

- Mandatory or optional may be different among releases.

Companies are invited to provide the views for the above understanding.

**Q1 Do companies agree with the following understanding?**

**- Mandatory or optional is defined by RAN4**

**- Support for the bandwidth is release-independent.**

**- Mandatory or optional may be different among releases.**

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| **Company** | **Yes or No** | **Comments** |
| Huawei, HiSilicon | Yes |  |
| Mediatek | Yes | In addition, we think that even if RAN4 define 100MHz channel bandwidth as mandatory, we could still have an IOT bit for it. |
| Ericsson | Partially | If RAN4 defines a new bandwidth for an existing band, the network must be able to determine which UE supports this and which UE does not. The “mandatory vs. optional” discussion is irrelevant for RAN2 and should not affect the signaling or interpretation thereof in any way. (Side note: In Rel-15 the unsuccessful attempt to make 100 MHz more mandatory than other bandwidths by not defining a corresponding bit in channelBWs-DL/UL is what causes the problem that we now try to solve) |
| ZTE | Yes |  |
| OPPO | Yes | Following Mediatek’s comment, it means UE may not set the bit to be 1. We think it is true for Rel15/R16 new UE, but not for Rel17 and on UE. |
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For now, RAN4 has introduced the 100MHz for the existing band n40 in Rel-17, the 100MHz for band n40 is mandatory, if the above “Support for the bandwidth is release-independent” is the common understanding, the Rel-15/Rel-16 UE can also implement 100MHz for band n40 but should be optional. Thus, capability signalling for 100MHz is needed and adding it in per-band bitmap, e.g. using the fourth bit in the bitmap *channelBWs-DL/UL*, is preferred based on previous discussion.

Ericsson pointed out that it is not easy to use an accurate description for a general case, and the case for n40 might be a particular case. So it should be discussed whether the introduced bit for 100MHz is restricted for n40, or a general wording can be used.

**Q2 Do companies prefer to restrict to band n40 or to use a general wording?**

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| **Company** | **“Only band n40” or “General wording”** | **Comments** |
| Huawei, HiSilicon | General wording | Based on RAN4 conclusion, it is agreed to also introduce 100MHz for band n97, and this will be added in the WID in RAN#93. So regarding adding 100MHz for the existing band(s), n40 may not be a particular case, using general wording is more forward compatible. |
| MediaTek | General wording (slightly prefer) | After further checking with our R4 colleagues, we also understand there may be more bands to support 100MHz in the future. So, general wording is preferable. We can also accept “only band n40”. |
| Ericsson | both OK | We can also accept the proposal that the 100 MHz code point is applicable for all newly introduced bands and for all existing bands for which 100 MHz is added after 17.2.0. It has indeed the benefit that RAN2 will never have to touch this field description in future. But if we go that way we would prefer to list the bands for which the bit is not applicable (instead of a difficult to digest reference to an old 38.101 version). E.g.: “The 100MHz bit is not applicable for bands n41, n48, n77, n78, n79 and n90.” |
| ZTE | General wording  | General wording is more forward compatible. |
| OPPO | comment | For R15/16 CR, if it is added occasionally we are fine with either approach. But for R17 CR, general wording is preferred definitely since existing bands are a long list. |
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If a general wording is used for introduced bit for 100MHz, to understand how the UE set this new bit for 100MHz, there are several cases can be considered which was provided by OPPO:

* Case 1: existing band mandatorily supporting 100MHz from Rel-15
* Case 2: band mandatorily supporting 100MHz from Rel-17 e.g. band n40 and optionally in previous releases i.e. Rel-15/Rel-16
* Case 3: band mandatorily supporting 100MHz from late release X we don’t know yet and optionally supporting in Rel-15~Rel-X-1

There are two ways of wording was given, and the moderator understands the one of the issue is how to handle the mandatory 100MHz for existing band before the TS 38.101-1 v17.2.0.

* *the fourth leftmost bit indicates 100MHz defined in clause 5.3.5 of TS 38.101-1 v17.2.0 and on*
* *the fourth leftmost bit indicates 100MHz defined in clause 5.3.5 of TS 38.101-1. UE shall set it to be 1 for this band from the release 100MHz bandwidth is mandatorily supported*

The following is UE and NW behaviour from moderator’s understanding:

1. For case 1, the legacy and new NW should always comprehend the existing band mandatorily supporting 100MHz based on TS 38.101-1 v17.2.0 (this logic has been implemented), since the NW cannot distinguish the UE not indicating support of 100MHz by new bit is the legacy UE (does not support new bit) or new UW (supports new bit but does not support 100MHz). Thus, no matter if the UE sets the new bit for 100MHz or not in case 1, there is no mismatch between NW and UE.
2. For case 2/3, the legacy NW cannot comprehend the new bit for 100MHz, the new NW checks the new bit for 100MHz to determine whether the UE supports 100MHz for “new introduced 100MHz” in TS 38.101-1 v17.2.0 and on.

Thus, it is moderator observation: it makes no difference for NW implementation and there is no mismatch between NW and UE no matter if the UE sets the new bit for 100MHz or not in case 1. This only influences the UE behaviour for capability reporting, i.e. whether the new UE needs to set the new bit for 100MHz for case 1.

So “*the fourth leftmost bit indicates 100MHz defined in clause 5.3.5 of TS 38.101-1 v17.2.0 and on*” may be easier. For 100MHz defined in before TS 38.101-1 v17.2.0 (mandatory), there is no signaling, both UE and NW would understand these are supported; For the 100MHz introduced from TS 38.101-1 v17.2.0, new bit for 100MHz should be used to determine whether the 100MHz is supported or not, no matter if the “new introduced 100MHz” is mandatory or optional.

For the case if the fifth bit becomes valid for another new bandwidth xxMHz, the fifth bit and the fourth bit are independent, and the NW only validates the fourth bit for the “new introduced 100MHz” from TS 38.101-1 v17.2.0, that is, there may be the case that the fifth bit is valid but the fourth bit is invalid, e.g. xxMHz is defined but 100MHz is not defined in TS 38.101-1, but this won’t lead to mis-alignment issue.

For how to reflect the 100MHz is mandatory, based on the above wording, it is clear that the fourth bit indicates 100MHz introduced from TS 38.101-1 v17.2.0, if the 100MHz is mandatory supported by later release UE, the UE should always report this new bit since the UE actually supports it. If companies prefer to explicitly capture it in the spec, “The fourth bit shall be set to 1” can be added in later release, e.g. in Rel-17 spec.

**Q3 Do companies agree to use “*the fourth leftmost bit indicates 100MHz defined in clause 5.3.5 of TS 38.101-1 v17.2.0 and on*”, or any comments to the wording?**

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| **Company** | **Yes or No** | **Comments** |
| Huawei, HiSilicon | Yes | Based on moderator observation, we understand easier way is consider the new bit for 100MHz only for “new introduced 100MHz” in TS 38.101-1 v17.2.0 and on, and no impacts on 100MHz defined before TS 38.101-1 v17.2.0.For the issue of fifth bit, maybe a NOTE can be added, e.g. the network validates the fourth bit only for the 100MHz defined in clause 5.3.5 of TS 38.101-1 v17.2.0 and on. But not sure if this is necessary as it states that the fourth leftmost bit indicates **100MHz defined in clause 5.3.5 of TS 38.101-1 v17.2.0 and on**. “*UE shall set it to be 1 for this band from the release*” is not preferred, as the release is not clear, is the RAN4 spec release or RAN2 spec release? If it is RAN4 spec release, it seems useless as the Rel-15/Rel-16 UE can implement bandwidth in Rel-17 RAN4 spec. If it is RAN2 spec, we understand this sentence can be added from the release that the signalling is considered to be mandatory to report from RAN2 spec perspective. |
| MediaTek | See Comments | We actually prefer to have a simple IOT bit for 100MHz CBW. At least, this could be done in R17. Note that the wording “**100MHz defined in clause 5.3.5 of TS 38.101-1 v17.2.0 and on**.” is quite confusing. Our reading is that this also includes the existing bands that already support 100MHz from R15/R16 (they are also **defined** in v17.2.0). I assume the intention is to say- it applies only to the bands with new 100MHz CBW introduced from v17.2.0. Suggestion below.**R15/R16** - the fourth leftmost bit indicates 100MHz defined in clause 5.3.5 of TS 38.101-1. In this version of the specification, it is only used for the bands that supporting of 100MHz is introduced in or after TS 38.101-1 v17.2.0.**R17**- the fourth leftmost bit indicates 100MHz defined in clause 5.3.5 of TS 38.101-1. The UE shall set it to be 1 if 100MHz bandwidth is mandatory according to TS 38.101-1. |
| Ericsson | See comment | As said above, if companies prefer using the new bit for all new bands and for all existing bands for which 100 MHz is defined in later versions, we request an explicit list as below. “For FR1, the leading/leftmost bit in *channelBWs-DL-v1590* indicates 70MHz, the second leftmost bit indicates 45MHz, the third leftmost bit indicates 35MHz, the fourth leftmost bit indicates 100MHz and all the remaining bits in *channelBWs-DL-v1590* shall be set to 0.The 100 MHz bit is not applicable for bands n41, n48, n77, n78, n79, n90.” |
| ZTE | See Comments | For the Rel-15/16 we are OK with MTK’s wording.For the Rel-17, we think for the case 1 there is no need to set the fourth bit to be 1. Maybe we can say “The UE shall set it to be 1 if 100MHz bandwidth is required to be mandatory from or after TS 38.101-1 v17.2.0.” |
| OPPO | No | For R15/R16 legacy UE, the 4th bit is always 0 for all bands. Now the CR change the meaning of 4th bit for R15/R16 new UE, to keep backwards compatibility, for existing bands we should not mandate R15/R16 UE to set this bit to be 1 otherwise network will be confused. So we agree with Mediatek R15/R16 CR is only applicable for bands supporting 100MHz from v17.2.0 and on. Then for Rel17 CR, the bit should apply for all bands supporting 100MHz including existing ones since there is no backwards compatibility issue to avoid discrepancy between existing band and band supporting 100MHz in future.Then for Rel15/R16 CR, this bit can be understood as optionality bit and IoT bit. But for Rel17, UE always set the bit to be 1 for relevant bands, then it should not be interpreted as IoT bit. We are fine with wording from Mediatek in general and open for improvement. |
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