**3GPP TSG-RAN WG1 Meeting #108-e R1-220xxxx**

**e-Meeting, February 21 – March 3, 2022**

**Agenda Item: 7.1**

**Source: Huawei, HiSilicon**

**Title: Summary of [108-e-NR-CRs-16] Issue#21 on the initial BWP switching**

**Document for: Discussion and decision**

# Introduction

In [1], it is observed, perhaps also well-understood as explicitly captured in specifications that, a UE on BWP#0 with option 1 can only be used for limited manner with common configurations, e.g. random access, and can only be switched from that by RRC reconfiguration, once it is switched onto this BWP#0.

When a BWP is switched via DCI indication onto the BWP#0 with configuration option 1, if false alarm occurs and a UE switched to BWP#0 mistakenly, there could be misunderstanding between a UE and gNB when the default BWP is not configured. The above configurations can be typical in e.g. URLLC-like services thus the impact can be significant.

This contribution aims to provide summary of discussion with respect to the issue identified in [1], per the following

[108-e-NR-CRs-16] Issue#21 Clarification on the initial BWP switching – ??? (Huawei)

* Relevant tdoc: [R1-2202451](file:///D:\Docs\R1-2202451.zip)
* Check point on February 23

Some technical understanding of the issue would be helpful. Therefore, the discussion is comprised of two aspects also considering companies input from preparation phase: is there any use case to use DCI based BWP switching to switch another BWP to the BWP#0 with configuration option 1, and is it possible to mitigate/overcome the issue with minimized/no specification impact and impact on the real site implementations.

# Discussion Point 1

* **Is there any potential use case or motivation for gNB to use DCI indicating a UE to perform BWP switching onto BWP#0 configuration option 1?**

It would be up to company’s view that whether false alarm is a corner case or not. However, the configurations mentioned in the scenario could be typical in many existing networks, and when it happens for other cases than BWP#0 configuration option 1, it is obvious that gNB can use non-fallback DCI to fast resume the UE to a target BWP thus the impact on services can be minimized. When it comes to BWP#0 with option 1, since DCI based BWP switch cannot be used, it has to rely on gNB RRC reconfiguration to resume the services. It is not clear that whether there are real use cases for motivating a gNB to use DCI based fast BWP switching to BWP#0 with configuration option 1 for limited use, on the contrary that not being able to switch back to other BWPs also using DCI.

Companies are invited to share your views/considerations.

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| Company | Comment |
| ZTE | One potential use case is to configure small bandwidth for BWP#0 and larger bandwidth for BWP#1. Network may indicate the UE to BWP#0 for power saving purpose. |
| Huawei, HiSilicon | No, we do not see the motivation to have such a kind of switching, neither see it is beneficial in the real deployment.  The purpose to introduce DCI-based BWP switching is changing the BWP quickly and have a better channel condition to resume the service. However, for the BWP#0 without RRC configuration, it cannot support normal operations such as UL transmission, HARQ feedback, etc. If UE is switched to BWP#0 without RRC configuration, the service of UE might be interrupted. Thus, it seems no such a use case to switch UE from a dedicated BWP to the initial BWP without any RRC configurations via DCI signaling.  As per the false alarm in UE side, it cannot be simply regarded as a corner case, and the requirement of dedicated service should be also considered. For example, the URLLC-like service requires the reliability as high as 99.9999%. Even the probability of false alarm is only 0.1% (very likely a corner case), the requirement might not be met. |
| Qualcomm | Yes. The BWP switching by DCI provides additional flexibility in addition to RRC configured BWP switching. This applies to both switching between BWP #0 and non-zero BWP and switching between two non-zero BWPs. |
| Ericsson | Maybe the motivation is unclear, but legacy UE has already implemented the BWP switch function as it is specified. |
| vivo | We do not have strong use case in mind, but we do not see the need to disallow this case by specification at current stage as nothing broken even if gNB decide to do so. Anyway, it is up to gNB’s choice. |
| Samsung | It’s up to gNB’s implementation. As mentioned by ZTE, BWP#0 might be used for power saving purpose or other purpose. |
| Intel | This configuration is currently allowed by specs and whether to use it is up to gNB implementation. Typical use-case for DCI-based BWP switching is the obvious one – UE power savings in adaptation to traffic conditions, and is also applicable regardless of BWP#0 configuration options 1 or 2. |
| CATT | We agree with the comments above that it is not precluded and can be up to gNB implementation. |
| NTT DOCOMO | We don't see the specific use case, although the case is supported by current UEs. |
| Huawei, HiSilicon2 | @ZTE, Intel  Using DCI based BWP switching for UE power saving is one possibility in general. However, for BWP#0 with configuration option 1 since the UE cannot switch back by DCI, RRC reconfiguration is needed anyway. Then wouldn’t the UE goes into inactive state or idle state directly is a better choice for gNB, which can provide the same functions (e.g. random access) as the UE stays on BWP#0 with Opt1 but save more power? Why gNB would use DCI to indicate the BWP switch in this special case and then use RRC to further resume the UE, with limited benefits?  @Qualcomm  The response does not seem to correctly answer the question (use case) and it is even not correct to say: DCI is applicable for switching between BWP#0 and non-zero BWP, since it cannot be used for switching back from the latter to the former.  @Ericsson, vivo  Thanks. It is right and we are also seeking for an approach with minimized impact on existing devices.  @Samsung  What is exactly the other purpose? |
| MTK | No, we do not see such a use case. |
| Nokia, NSB | The question on potential use case seems irrelevant when discussing existing specifications and if there is a need to correct or clarify something. |
| Apple | The use case is not the matter. From specification perspective, switching to BWP#0 via DCI is supported, and up to gNB configure it or not. |

# Discussion Point 2

* **Is it possible to have minimized/no specification/implementation impact to avoid the issue as identified in [1]?**

During the preparation phase discussion, there are several companies mentioning that there would be gNB implementation approaches to resolve this, e.g. configuring a default BWP or using BWP#0 configuration option 2. However, it is moderator understanding that these mentioned counter-configurations will actually impose an even restricted configuration to gNB, compared with the proposal in [1] (i.e., to conclude that when *bwp-InactivityTimer* is not configured by gNB, a UE does not expect to receive a DCI format to switch from a BWP to BWP#0 with option 1). For example, mandating configuration of default BWP with BWP timer affects each of the dedicated BWPs, and mandating using BWP#0 with configuration option 2 affects the initial BWP configuration.

It is also moderator understanding that if there is no clear motivation/use case based on the discussion point 1, the proposal in [1] could be the simplest outcome without specification changes and real sites implementation impact. However, with more discussion based on the above, there could be other potential conclusion that can be drawn to mitigate the potential system impact.

Companies are invited to share your views/suggestions.

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| Company | Comment |
| ZTE | From our perspective, the current specification works well. BWP switching to BWP#0 is the same as other BWP switching. From UE perspective, it seems no further implementation complexity is required.  If network indicates the UE to switch to BWP#0 with Option1, network has to take the potential longer BWP switching time (to switch back to BWP#1 via RRC) into account. |
| Huawei, HiSilicon | We agree with moderator that leaving this up to gNB implementation will make the situation and gNB configuration more complex. To avoid the service interruption due to switching to BWP#0 with option 1, gNB has to be mandated to configure a default BWP timer or always configure RRC parameters on BWP#0, which also impact on the initial BWP configuration.  Based on the justification in section 2, there is no use case for a DCI format to switch from a BWP to BWP#0 with option 1, so precluding such a case in the spec is preferred. A conclusion in the chair’s note is also fine, but we think the issue shall be clarified. |
| Qualcomm | We agree with ZTE that the current spec is good enough. We do not think the proposed TR is necessary. First, the PDCCH false alarm is not critical due to the enhanced parity checking capability of NR PDCCH CRC bits. Second, the default BWP was specified to resolve general UE-gNB misalignment problems including the scenario in this TR and false alarm DCI based BWP switching from one non-zero BWP to another non-zero BWP. Since there is always a tool (i.e., default BWP) specified in NR, network should use this tool by configuring *bwp-InactivityTimer* sooner or later. |
| Ericsson | As it is mentioned in your contribution, a **simpler solution** could be to **configure “*bwp-InactivityTimer*” with a short value** and set the “***defaultDownlinkBWP-Id*” to BWP#1**. Then the UE should move back to BWP#1 quickly upon those false alarms. So, the issue doesn’t seem to be essential, the spec works well. We don’t see the need draw any conclusion and limiting the BWP switching behaviour. |
| vivo | If not preferable, gNB can avoid such BWP switching by its configuration or scheduling decision, this should solve the issue already. The residue issue, caused by PDCCH false alarm, is corner case, and does not motivate a special handling in the specification. |
| Samsung | We are not supportive of the proposed clarification. First, we already have several ways on this case, for example, configure *bwp-InactivityTimer* orBWP#0 withconfiguration option 2*.* Even though the proposed conclusion is not agreed, the gNB can use *RRCReconfiguration,* so that the current specification works well. Second, it is the case caused by PDCCH false alarm. Given the CRC length in NR, the false alarm rate is quite small and the specification is not needed to handle every false alarm cases. - |
| Intel | Agree with most views above that the existing specs are sufficiently clear already and there is nothing to clarify.  The false error issue is a corner case to begin with. More importantly, as mentioned by ZTE and others, it’d be the gNB’s responsibility to configure the features and any associated fallback mechanisms appropriately for a given UE’s link condition, traffic load, and QoS requirements. There are already multiple tools available to ensure fallback, and there is no need to conclude on some additional restriction on something that should be left up to gNB discretion/responsibility. |
| CATT | Agree with the comments above that no additional spec change/clarification is needed. |
| NTT DOCOMO | We see that configuring “bwp-InactivityTimer” and setting the “defaultDownlinkBWP-Id” to BWP#1” can be a potential solution with using current specification. On the other hands, we may also consider the case if these parameters are not supported by current implementation. In this case, we agree with [1] that there may be the potential issue. And if the proposed solution in [1] is specified, we think it can be generalized e.g., "When bwp-InactivityTimer is not configured by gNB, a UE does not expect to receive a DCI format to switch from a BWP to BWP without dedicated config" so that in any case with BWP without dedicated configuration the potential issue on switching can be avoided. |
| MTK | We agree with HW/DOCOMO about the benefit to avoid this issue raised in [1]. Precluding such a case in the spec is one possible way. The text suggested by DOCOMO feels good to us:   * "When *bwp-InactivityTimer* is not configured by gNB, a UE does not expect to receive a DCI format to switch from a BWP to BWP without dedicated configuration" |
| Nokia, NSB | Agree with ZTE and Qualcomm that the specification is fine and no further actions are required. |
| Apple | We also think the current spec works well. the potential issues could be solved by various gNB configurations, e.g., configuring option2, *bwp-InactivityTimer*. We don’t see the necessity to have further clarification. |

# Conclusions

TBD.

# References

1. R1-2202451.