**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-210XXXX**

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

**Agenda item:** 5.6.1,5.6.2

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for [98-bis-e][209]NR\_RRM\_Enh\_1

**Document for:** Information

# Introduction

The email discussion is intended to cover topics related to BWP switching on multiple CCs and UL spatial relation info switching in AI 5.6.1 in RRM enhancement core part and AI 5.6.2.2.4 (BWP switching on multiple CCs) and AI 5.6.2.2.8(UL spatial relation info switching) in RRM performance part..

# Topic #1: BWP Switching on multiple CCs (Core part)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2104842**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101633.zip) | Apple | ***Observation #4:*** *RRC based BWP switch is applicable to SCell by parameter change, as defined since Rel-15.*  **Proposal #2: No change is required to requirements for RRC based BWP switch on multiple CCs.** |
| [**R4-2106458**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106458.zip) | Intel | **Observation 1: From the reply LS of RAN2, in Rel-15 or in Rel-16, the BWP switching for SCell using RRC message is not possible.**  **Observation 2: From the reply LS of RAN2, for the reconfiguration of any parameters (with the exception of *firstActiveDownlinkBWP-Id* or *firstActiveUplinkBWP-Id*), RAN2 has not specified whether this is a BWP switch or not.**  **Proposal 1: Clarify that requirement for RRC based BWP switching on a single CC apply for SpCell only.**  **Proposal 2: There is no scenario for RRC based simultaneous BWP switching on multiple CCs. Don’t need to design test case for the scenario.**  **Proposal 3: For non-simultaneous RRC based multiple BWP switching case, clarify that the requirement apply if there is only one CC in either PCell or PSCell.**  **Proposal 4:** **Delay time for non-simultaneous RRC based BWP switch on multiple CC will be updated to:** |
| [**R4-2106524**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106524.zip) | OPPO | **Observation 1: It is only feasible to change the active BWP by changing the ID via the RRC reconfiguration for SpCell.**  **Observation 2: It is also feasible to change the parameters of the active BWP via RRC reconfigurations for either SpCell or active SCell.**  **Observation 3: Whether it is a BWP switch or not for the reconfiguration of any parameters of an already active BWP of an SPCell or an Scell, can be further discussed and confirmed by RAN4.**  **Observation 4: RRC based BWP switch is applicable to SCell, by changing the parameters of its active BWP without changing the ID for an active SCell.**  **Proposal 1: The RRM requirements apply for RRC based BWP switch on multiple CCs by changing the parameters of the active BWP of the active SCells/SpCell.** |
| [**R4-2107154**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107154.zip) | Ericsson | * **Observation 1:** RRC based BWP switching can change any BWP parameter including *firstActiveDownlinkBWP-Id* and *firstActiveUplinkBWP-Id* on the SpCell. * **Observation 2:** RRC based BWP switching can change any BWP parameter other than the *firstActiveDownlinkBWP-Id* or *firstActiveUplinkBWP-Id* on the SCell. * **Proposal 1:** RRC based BWP switch delay requirement for single CC in section 8.6.3 is applicable to only SpCell. * **Proposal 2:** Simultaneous RRC based BWP switch delay requirement for multiple CCs in section 8.6.3A.1 is removed. * **Proposal 3:** Non-simultaneous RRC based BWP switch delay requirement for multiple CCs in section 8.6.3A.2 is applicable to only PCell and PSCell in NR-DC. * **Proposal 4:** Define delay requirements for changing any BWP parameter other than the *firstActiveDownlinkBWP-Id* or *firstActiveUplinkBWP-Id* via RRC on SCel. * **Proposal 5:** The delay requirement in proposal #4 is defined by reusing the delay defined in section 8.3.2, TS 38.133. |
| [**R4-2107221**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107221.zip) | Nokia, Nokia Shanghai Bell | 1. RRC-based simultaneous BWP switch on multiple CCs shall be supported in RAN4. 2. Clarify that RRC-based BWP switch on multiple CCs are appliable for SCells with the paramter change except the modification of parameters *firstActiveDownlinkBWP-Id* and *firstActiveUplinkBWP-Id* |

## Open issues summary and companies view’s collection

### Open issues and comments collection

**Issue 1-1-1: Whether requirement for RRC based BWP switch on single CC for Rel-16 is applicable**

* Option 1 (Ericsson, Intel): RRC based BWP switch delay requirement for single CC in section 8.6.3 is applicable to only SpCell.
* Recommended WF:
  + Further discussion.

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| **Company** | **Comments** |
| Huawei | We disagree with option 1. It is already confirmed by RAN2 that changing the parameters of the active BWP on SCell is applicable. And it is already clearly defined in RAN4 that RRC BWP switch includes changing the active BWP or parameter change of active BWP since R15. We believe there is no need to exclude the requirements for SCell. And we believe there is no need to have different clauses in the spec for BWP switch and parameter change separately, as the parameter changing is already covered by BWP switch in RAN4 which is a more general concept. |
| Nokia | It is not in the scope of this WI. It should be discussed in Rel16 maintenance which will be planned in next meeting. |
| Apple | Question to moderator: Why is the applicability from Rel-16 and not from Rel-15?  We also think that this is not in the scope of this WI to discuss if single CC BWP switch is applicable to SCell. It should be discussed in Rel-15/16 maintenance.  We don’t think RRC based BWP switch for single CC is not applicable to SCell. It is applicable with parameter change, but not with BWPId change. |
| OPPO | Share the similar concerns as Apple’s. The RRM requirements apply for RRC based BWP switch on multiple CCs by changing the parameters of the active BWP of the active SCells/SpCell. |
| MediaTek | Disagree with option 1. The requirement of RRC based BWP for SCell should not be excluded because it is applicable with parameter change for SCell. |
| Ericsson | We support Option 1.   * RAN2 confirms that an RRC message carrying a *firstActive[...]BWP-Id* that is different from the UE’s current BWP ID can trigger a BWP switch, but only for spCell. It is not allowed for an SCell. * RAN2 further mentions that an RRC message can modify the parameter values of an already active BWP (with exception for the ID), even for SCell, but RAN2 currently does not recognize this as being BWP switching.   We think it is justified to restrict RRC-based BWP switching to spCell. For the case where RRC is reconfiguring parameter values of an already active BWP, we think those requirements shall be separated from RRC-based BWP switching comprising ID change. |
| vivo | We agree with nokia that this should be included in R16 maintenance WI. In addition we thinkg RRC based BWP switch is feasible through changing other parameters of a BWP instead of the BWP ID. |
| Intel | To Nokia, Apple, vivo:  Since requirement of RRC based BWP switch on multiple CCs is dependent on the issue of RRC based BWP switch on single CC. From meeting agenda of RAN4 #98bis, there is no Rel-15 maintenance discussion, but clause 5.6.1 is RRM core requirements maintenance (38.133) for RRM enhancement in Rel-16. Then we can discuss the impact of RRC based BWP switch on single CC for Rel-16 in current email thread.  Our preference is option 1, since there is no clear answer from RAN2 whether parameter change for SCell can trigger BWP switch. However, in order to move forward, we can compromise with the clarification for SCell: RRC-based BWP switch on single CC is appliable for SCells with parameter change except for the modification of firstActiveDownlinkBWP-Id and firstActiveUplinkBWP-Id. |
| Qualcomm | With Moderator’s clarification, the suggestion from Moderator (Intel) is acceptable. And it may be better to clarify that the parameter value change is for the current active BWP on the SCell. |
| NEC | Clarification from moderator is acceptable to us |

**Issue 1-1-2: Whether requirement for RRC based BWP switch on multiple CCs for Rel-16 is applicable**

* Option 1(Apple, OPPO): Yes.
* Option 2(Nokia): Yes, further clarification is needed.
* Clarify that RRC-based BWP switch on multiple CCs are appliable for SCells with the arameter change except the modification of parameters firstActiveDownlinkBWP-Id and firstActiveUplinkBWP-Id
* Option 3: No.
* Option 3a (Intel):
  + Proposal 2: There is no scenario for RRC based simultaneous BWP switching on multiple CCs. Don’t need to design test case for the scenario.
  + Proposal 3: For non-simultaneous RRC based multiple BWP switching case, clarify that the requirement apply if there is only one CC in either Pcell or PSCell.
  + Proposal 4: Delay time for non-simultaneous RRC based BWP switch on multiple CC will be updated to:
* Option 3b (Ericsson):
  + Proposal 2: Simultaneous RRC based BWP switch delay requirement for multiple CCs in section 8.6.3A.1 is removed.
  + Proposal 3: Non-simultaneous RRC based BWP switch delay requirement for multiple CCs in section 8.6.3A.2 is applicable to only Pcell and PSCell in NR-DC.
  + Proposal 4: Define delay requirements for changing any BWP parameter other than the firstActiveDownlinkBWP-Id or firstActiveUplinkBWP-Id via RRC on SCell.
  + Proposal 5: The delay requirement in proposal #4 is defined by reusing the delay defined in section 8.3.2, TS 38.133.
* Recommended WF:
  + Further discussion.

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| **Company** | **Comments** |
| Huawei | We are fine with option 1 and 2. |
| Nokia | We support option 2. RRC based BWP switch on multiple CCs for Rel16 should be supported in RAN4 and clarification should be added to exclude the modification of parameters firstActiveDownlinkBWP-Id and firstActiveUplinkBWP-Id for Scells. |
| Apple | We support option 1. In our view the applicability of BWP switch for SCell shall be captured in single CC requirements. We are also fine to add clarification in multiple CCs requirements if deemed necessary. |
| OPPO | Support option 1, and option 2 is also ok. |
| MediaTek | Support option 1 and 2. |
| Ericsson | We support Option 3b. We are also fine with Option 3a. |
| vivo | We are ok with option 1 or 2. |
| Intel | We prefer option 3a. However, in order to move forward, we can compromise to option 2, if clarification is specified for SCell, i.e. RRC-based BWP switch for Scells can be BWP parameter change except for the modification of BWP-ID. |
| Qualcomm | Option 2 with the same clarification as Issue 1-1-1 “And it may be better to clarify that the parameter value change is for the current active BWP on the SCell.” |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| [**R4-2106460**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106460.zip)  Intel | Huawei: Please find our comments in issue 1-1-1 and 1-1-2. |
| Nokia: We are not fine with the changes. From our view, RAN4 should support RRC-based BWP switch on multiple CCs. Please find our comments in issue 1-1-2. |
| Apple: We don’t support these changes based on our views |
| Ericsson: OK. Merge 6460 and 7155? |
| vivo: depending on outcome of 1-1-1 and 1-1-2. We cannot agree with this cr. |
| [**R4-2106955**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106955.zip)  Huawei, HiSilicon | Nokia: Generally OK. It will depend on the conclusion of issue 1-1-2. |
| Apple: Ok with change, but will depend on outcome of Issue 1-1-2. |
| Ericsson: This CR is depending on what gets decided regarding RRC-based BWP switching on multiple CCs (Issue 1-1-2). |
| Intel: It seems that this CR only includes interruption for simultaneous RRC based BWP switch on multiple CCs? |
| [**R4-2106956**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106955.zip)  Huawei, HiSilicon | Nokia: Generally OK. It will depend on the conclusion of issue 1-1-2. |
| Apple: Ok with change, but will depend on outcome of Issue 1-1-2. |
| Ericsson: This CR is depending on what gets decided regarding RRC-based BWP switching on multiple CCs (Issue 1-1-2). |
| Intel: similar comment as for [R4-2106955](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106955.zip). |
| [**R4-2107155**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107155.zip)  Ericsson | Huawei: We prefer not to have such differentiation. It will cause more influence on the exiting spec, and we will have to have these two kind of “switching” in mind in other discussions when referring to BWP switch. |
| Nokia: We are not fine with the changes. Firstly, the changes on single CCs is out of the WI’s scope. Secondly, for the changes on multiple CCs, we agree with Huawei, parameter changes can also be a kind of BWP switch in RAN4. |
| Apple: We don’t agree with the changes. Single CC requirements are not in the scope of this WI. We don’t agree to changes for multiple CCs BWP switch. |
| Ericsson: @Huawei: We think it makes sense to separate the requirements since one is recognized by RAN2 as RRC-based BWP switch, and the other is not. It is potentially more confusing if we use different terminology from RAN2 in this case. |
| vivo: depending on outcome of 1-1-1 and 1-1-2. We cannot agree with this cr. |
| Intel: suggest not to define separate requirement for SCell. |
| [**R4-2107222**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107155.zip)  Nokia | Huawei: The simultaneous case is not very clear to us. Does it means the simultaneous case could only happen among SCells. (what about PCell+SCell?) |
| Nokia: To Huawei, Simultaneous case will also happen among PCell + SCell. We can update the wording in our CR. |
| Apple: We understand the motivation for the change, but we think that we should have the clarification in RRC based switch for single CC section. |
| Ericsson: This CR is depending on what gets decided regarding RRC-based BWP switching on multiple CCs (Issue 1-1-2). |

## 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 1-1-1** | **Whether requirement for RRC based BWP switch on single CC for Rel-16 is applicable**  *Tentative agreement: No.*  *Moderator add more options according to the 1st round comment.*   * Option 1 (Ericsson, Intel): RRC based BWP switch delay requirement for single CC in section 8.6.3 is applicable to only SpCell. * Option 2 (Huawei, Apple, OPPO, MediaTek, vivo): Yes, * Option 2a (Intel, Qualcomm): Yes, but further clarification about SCell is preferred, i.e. RRC-based BWP switch on single CC is appliable for SCell with parameter change except for the modification of firstActiveDownlinkBWP-Id and firstActiveUplinkBWP-Id.   *Recommendations for 2nd round: further discussion.* |
| **Issue 1-1-2** | **Whether requirement for RRC based BWP switch on multiple CCs for Rel-16 is applicable**  *Tentative agreement: No.*   * Option 1(Apple, OPPO, Huawei, MediaTek, vivo): Yes. * Option 2(Nokia, Huawei, OPPO, MediaTek, vivo, Intel, Qualcomm): Yes, further clarification is needed. * Clarify that RRC-based BWP switch on multiple CCs are appliable for SCells with the paramter change except the modification of parameters firstActiveDownlinkBWP-Id and firstActiveUplinkBWP-Id * Option 3: No. * Option 3a (Intel, Ericsson):   + Proposal 2: There is no scenario for RRC based simultaneous BWP switching on multiple CCs. Don’t need to design test case for the scenario.   + Proposal 3: For non-simultaneous RRC based multiple BWP switching case, clarify that the requirement apply if there is only one CC in either PCell or PSCell.   + Proposal 4: Delay time for non-simultaneous RRC based BWP switch on multiple CC will be updated to: * Option 3b (Ericsson):   + Proposal 2: Simultaneous RRC based BWP switch delay requirement for multiple CCs in section 8.6.3A.1 is removed.   + Proposal 3: Non-simultaneous RRC based BWP switch delay requirement for multiple CCs in section 8.6.3A.2 is applicable to only PCell and PSCell in NR-DC.   + Proposal 4: Define delay requirements for changing any BWP parameter other than the firstActiveDownlinkBWP-Id or firstActiveUplinkBWP-Id via RRC on SCell.   + Proposal 5: The delay requirement in proposal #4 is defined by reusing the delay defined in section 8.3.2, TS 38.133.   *Recommendations for 2nd round: further discussion.* |
| **Issue 1-1-3** | **Whether need to update prerequisite for UE capability *bwp-SwitchingMultiCCs-r16***  *Tentative agreement: No.*  *Moderator note: In email thread[209], Qualcomm suggest to add a new discussion issue. It’s fine to collect the comments from companies, but the final decision is better to be made in thread [103].*  Background:  In the current capability spec, BWP switching on multiple CCs has this prerequisite as shown in the table.   | ***bwp-SwitchingMultiCCs-r16***  Indicates whether the UE supports incremental delay for DCI and timer based active BWP switching on multiple CCs simultaneously as specified in TS 38.133 [5]. The capability signalling comprises of the following:  -     *type1-r16* indicates the delay value for type 1 BWP switching delay and has values of {100us, 200us}  -     *type2-r16* indicates the delay value for type 2 BWP switching delay and has values of {200us, 400us, 800us, 1000us}  The UE indicating support of this feature shall also support *bwp-SwitchingDelay*, *bwp-SameNumerology* and *bwp-DiffNumerology*. | UE | No | No | No | | --- | --- | --- | --- | --- |  * Option 1(Qualcomm): * It is not logically sensible for both *bwp-SameNumerology* and *bwp-DiffNumerology* to be supported because these two are mutually exclusive. Need to update the prerequisite for *bwp-SwitchingMultiCCs-r16,* i.e.The UE indicating support of this feature shall also support *~~bwp-SwitchingDelay~~*~~,~~ *bwp-SameNumerology* or *bwp-DiffNumerology*.   *Recommendations for 2nd round: further discussion.* |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
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### CRs/TPs

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

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| **[R4-2106460](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106460.zip)**  Intel | Return to. Depend on the conclusion of issue 1-1-2. |
| **[R4-2106955](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106955.zip)**  Huawei, HiSilicon | Return to. Depend on the conclusion of issue 1-1-2. |
| **[R4-2106956](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106955.zip)**  Huawei, HiSilicon | Return to. Depend on the conclusion of issue 1-1-2. |
| **[R4-2107155](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107155.zip)**  Ericsson | Return to. Depend on the conclusion of issue 1-1-2. |
| **[R4-2107222](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107155.zip)**  Nokia | Return to. Depend on the conclusion of issue 1-1-2. |

## Discussion on 2nd round (if applicable)

**Issue 1-1-1: Whether requirement for RRC based BWP switch on single CC for Rel-16 is applicable**

* Option 1 (Ericsson, Intel): RRC based BWP switch delay requirement for single CC in section 8.6.3 is applicable to only SpCell.
* Option 2 (Huawei, Apple, OPPO, MediaTek, vivo): Yes,
* Option 2a (Intel, Qualcomm): Yes, but further clarification about SCell is preferred, i.e. RRC-based BWP switch on single CC is appliable for SCell with parameter change except for the modification of firstActiveDownlinkBWP-Id and firstActiveUplinkBWP-Id.

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| **Company** | **Comments** |
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**Issue 1-1-2: Whether requirement for RRC based BWP switch on multiple CCs for Rel-16 is applicable**

* Option 1(Apple, OPPO, Huawei, MediaTek, vivo): Yes.
* Option 2(Nokia, Huawei, OPPO, MediaTek, vivo, Intel, Qualcomm): Yes, further clarification is needed.
* Clarify that RRC-based BWP switch on multiple CCs are appliable for SCells with the paramter change except the modification of parameters firstActiveDownlinkBWP-Id and firstActiveUplinkBWP-Id
* Option 3: No.
* Option 3a (Intel, Ericsson):
  + Proposal 2: There is no scenario for RRC based simultaneous BWP switching on multiple CCs. Don’t need to design test case for the scenario.
  + Proposal 3: For non-simultaneous RRC based multiple BWP switching case, clarify that the requirement apply if there is only one CC in either PCell or PSCell.
  + Proposal 4: Delay time for non-simultaneous RRC based BWP switch on multiple CC will be updated to:
* Option 3b (Ericsson):
  + Proposal 2: Simultaneous RRC based BWP switch delay requirement for multiple CCs in section 8.6.3A.1 is removed.
  + Proposal 3: Non-simultaneous RRC based BWP switch delay requirement for multiple CCs in section 8.6.3A.2 is applicable to only PCell and PSCell in NR-DC.
  + Proposal 4: Define delay requirements for changing any BWP parameter other than the firstActiveDownlinkBWP-Id or firstActiveUplinkBWP-Id via RRC on SCell.
  + Proposal 5: The delay requirement in proposal #4 is defined by reusing the delay defined in section 8.3.2, TS 38.133.

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| **Company** | **Comments** |
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**Issue 1-1-3: Whether need to update prerequisite for UE capability *bwp-SwitchingMultiCCs-r16***

*Moderator note: In email thread[209], Qualcomm suggest to add a new discussion issue. It’s fine to collect the comments from companies, but the final decision is better to be made in thread [103].*

Background:

In the current capability spec, BWP switching on multiple CCs has this prerequisite as shown in the table.

| ***bwp-SwitchingMultiCCs-r16***  Indicates whether the UE supports incremental delay for DCI and timer based active BWP switching on multiple CCs simultaneously as specified in TS 38.133 [5]. The capability signalling comprises of the following:  -     *type1-r16* indicates the delay value for type 1 BWP switching delay and has values of {100us, 200us}  -     *type2-r16* indicates the delay value for type 2 BWP switching delay and has values of {200us, 400us, 800us, 1000us}  The UE indicating support of this feature shall also support *bwp-SwitchingDelay*, *bwp-SameNumerology* and *bwp-DiffNumerology*. | UE | No | No | No |
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* Option 1(Qualcomm):
* It is not logically sensible for both *bwp-SameNumerology* and *bwp-DiffNumerology* to be supported because these two are mutually exclusive. Need to update the prerequisite for *bwp-SwitchingMultiCCs-r16,* i.e.The UE indicating support of this feature shall also support *~~bwp-SwitchingDelay~~*~~,~~ *bwp-SameNumerology* or *bwp-DiffNumerology*.

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| **Company** | **Comments** |
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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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|  | **Status summary** |
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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
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# Topic #2: UL Spatial Relation Info Switching (Core part)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2104842**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101633.zip) | Apple | ***Observation #1:*** *Section 8.14 already has known condition and delay requirements for PL-RS specified.*  ***Observation #2:*** *With Option 1a it is unclear what the delay is when PL-RS is unknown and would also need to define PL-RS unknown condition with UL spatial relation switch.*  ***Observation #3:*** *Longer delay is expected is acceptable when the delay cannot be quantified in certain conditions. We already have delay requirements for PL-RS switch.*  **Proposal #1: Refer to section 8.14 for additional delay due to PL-RS switch in UL spatial relation switch for known PL-RS.** |
| [**R4-2106458**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106458.zip) | Intel | **Proposal 5: For Delay requirements for MAC–CE based UL spatial relation switch for PUCCH, support option 1a.** |

## Open issues summary and companies view’s collection

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Open issues and comments collection

**Issue 2-1-1: Delay requirements for MAC–CE based UL spatial relation switch**

* Option 1 (Intel): Refer to section 8.14 for additional delay due to PL-RS switch in UL spatial relation switch for known PL-RS.
* Option 2 (Apple): Refer to section 8.14 for additional delay due to PL-RS switch in UL spatial relation switch.
* Recommended WF:
  + Further discussion.

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| **Company** | **Comments** |
| Huawei | We had different views:   * If Only pucch-PathlossReferenceRS is changed in PUCCH-SpatialRelationInfo, refer to section 8.14. * If both pucch-SpatialRelation for transmission and pucch-PathlossReferenceRS are changed in PUCCH-SpatialRelationInfo, longer delay is expected.   + Option 1 or option 2 implicitly means that the uplink beam switching and PL-RS changing are performed in serial. However how UE performs uplink beam switching and power control highly depends on UE implementation. With various implementations, additional process time may be requested between two procedures, or maybe uplink spatial switching and pathloss RSRP evaluation may be performed in parallel. |
| QC | For option 1, we need to specify that the no requirement is imposed during transient period (before PL-RS switch complete).  Huawei’s proposal is good for us, too.  To Apple: 8.14 only specifies the known PL-RS requirement, then is option 2 equivalent to option 1? |
| Apple | For option 1, we will have to define what known/ unknown PL-RS means in section 8.11, hence we support option 2.  To HW: Since we specify minimum requirements in RAN4, serial processing assumption would be the worst-case assumption for UE implementation. We can cover certain cases by referring to already agreed requirements.  To QC: With option 1 we at least cover some cases where additional delay can be defined. For the case where DL-RS and PL-RS are known, but PL-RS is not maintained, we can have a delay requirement as cumulative delay, which the most common case we are trying to address. We did propose to separate out cases in our proposals in last meeting, but it was not agreeable and referring to already existing requirements was a more popular way forward. |
| MediaTek | Support Huawei’s proposal   * If Only pucch-PathlossReferenceRS is changed in PUCCH-SpatialRelationInfo, refer to section 8.14. * If both pucch-SpatialRelation for transmission and pucch-PathlossReferenceRS are changed in PUCCH-SpatialRelationInfo, longer delay is expected. |
| Ericsson | We have some concern on that spatial relation info switching will result in a significant gap in the connection. First point: How come that at most M=3 measurement occasions are required when measureing L1-RSRP for reporting (and leading to potential change of beam on both DL and UL), but in 8.14, 5 measurement occasions are required for the pathloss calculation.  Second point: If PL-RS has already been periodically measured and reported through L1-RSRP reporting (e.g. for identifying suitable DL/UL beam to switch to), how come that such measured value cannot at least reduce the number of PL-RS samples needed in 8.14?  In our view the transient period needs to be minimized. We can start with the points above. |
| Intel | Support option 1. We are fine to add clarification that there is no requirement before PL-RS switch complete. |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| [**R4-2105003**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2105003.zip)  Apple | QC: come back after issue 2-1-1 is concluded |
| Nokia: Proposal refer to 8.14.3 which in our view is too relaxed and allows 5 samples which is more than assumed for L1-RSRP. |
| [Apple] To Nokia: for pathloss measurement, the RSRP has to be L3 filtered. The delay for PL-RS switch was agreed by companies in eMIMO session. |
| Ericsson: We are fine with the CR. |
| Intel: wait for the conclusion of issue 2-1-1. |
| [**R4-2106935**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2105003.zip)  Huawei, HiSilicon | QC: DL-RS part is good, the rest should wait for issue 2-1-1 conclusion |
| Nokia: different 38.133 baseline version? Anyway, we would prefer more specific requirement as this proposal is not clear e.g. ‘Longer application time expected if switching..’ |
| Apple: Longer application time is expected very vague. |

## 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 2-1-1** | **Delay requirements for MAC–CE based UL spatial relation switch**  *Tentative agreement: No.*  *Moderator add more options according to the 1st round comment.*   * Option 1 (Intel): Refer to section 8.14 for additional delay due to PL-RS switch in UL spatial relation switch for known PL-RS. * Option 1a (Qualcomm, Intel): need to specify that the no requirement is imposed during transient period (before PL-RS switch complete). * Option 2 (Apple): Refer to section 8.14 for additional delay due to PL-RS switch in UL spatial relation switch. * Option 3(Huawei, MediaTek, Qualcomm): * If Only pucch-PathlossReferenceRS is changed in PUCCH-SpatialRelationInfo, refer to section 8.14. * If both pucch-SpatialRelation for transmission and pucch-PathlossReferenceRS are changed in PUCCH-SpatialRelationInfo, longer delay is expected.   *Recommendations for 2nd round: further discussion.* |
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*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
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### CRs/TPs

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

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| **[R4-2105003](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2105003.zip)**  Apple | Return to. Depend on the conclusion of issue 2-1-1. |
| **[R4-2106935](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2105003.zip)**  Huawei, HiSilicon | Return to. Depend on the conclusion of issue 2-1-1. |

## Discussion on 2nd round (if applicable)

**Issue 2-1-1: Delay requirements for MAC–CE based UL spatial relation switch**

* Option 1 (Intel): Refer to section 8.14 for additional delay due to PL-RS switch in UL spatial relation switch for known PL-RS.
* Option 1a (Qualcomm, Intel): need to specify that the no requirement is imposed during transient period (before PL-RS switch complete).
* Option 2 (Apple): Refer to section 8.14 for additional delay due to PL-RS switch in UL spatial relation switch.
* Option 3(Huawei, MediaTek, Qualcomm):
* If Only pucch-PathlossReferenceRS is changed in PUCCH-SpatialRelationInfo, refer to section 8.14.
* If both pucch-SpatialRelation for transmission and pucch-PathlossReferenceRS are changed in PUCCH-SpatialRelationInfo, longer delay is expected.

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| **Company** | **Comments** |
| QC | To reach agreement, we suggest the following compromised proposal:  When both pucch-SpatialRelation for transmission and pucch-PathlossReferenceRS are changed in PUCCH-SpatialRelationInfo, if both DL-RS and PL-RS are known, the additional delay is as specified in 8.14, otherwise longer delay is expected. No requirement is imposed during the transient period (before both DL-RS and PL-RS relations switch complete).  In the previous meeting, proponents of option 3 pointed out the complexity of simultaneous relation change. This compromised proposal set requirement only on the both RS are known case.  We prefer this new compromised proposal, and option 3 is acceptable, too. |
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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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|  | **Status summary** | |
| **CR/TP/LS/WF number** | | **T-doc Status update recommendation** |
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# Topic #3: BWP Switching on multiple CCs (Performance part)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2106957**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101634.zip) | Huawei, HiSilicon | **Proposal 1: RAN4 to define test cases for simultaneous RRC based BWP switch on multiple CCs and not to have test cases for partial overlapping cases.**  **Proposal 2: RAN4 to define following test cases for RRC based BWP switch on multiple CCs.**  **TC1: RRC based Active BWP Switch on multiple CCs on FR1 in EN-DC (LTE PCell + NR FR1 PSCell + NR FR1 SCell )**  **TC2: RRC based Active BWP Switch on multiple CCs on FR2 in EN-DC (LTE PCell + NR FR2 PSCell + NR FR2 SCell )**  **TC3: RRC based Active BWP Switch on multiple CCs on FR1 in SA (NR FR1 PCell + NR FR1 SCell + NR FR1 SCell)**  **TC4: RRC based Active BWP Switch on multiple CCs on FR2 in SA (NR FR2 PCell + NR FR2 SCell + NR FR2 SCell)** |
| [**R4-2107223**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101634.zip) | Nokia, Nokia Shanghai Bell | 1. RAN4 shall support RRC-based simultaneous BWP switch on multiple CCs. 2. The test case list for RRC based simultaneous BWP switch on multiple CCs shall be:  |  |  | | --- | --- | |  | **Test cases** | | RRC based simultaneous BWP switch on multiple CCs | TC1: EN-DC with NR FR1 cell (E-UTRAN PCell + NR FR1 PSCell + NR FR1 SCell)  TC2: EN-DC with NR FR2 cell (E-UTRAN PCell + NR FR2 PSCell + NR FR2 SCell)  TC3: SA with NR FR1 cell (NR FR1 PCell + NR FR1 SCell + NR FR1 SCell)  TC4: SA with NR FR2 cell (NR FR2 PCell + NR FR2 SCell + NR FR2 SCell) | |
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## Open issues summary and companies view’s collection

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Open issues and comments collection

**Issue 3-1-1: RAN4 to define test cases for simultaneous RRC based BWP switch on multiple CCs**

* Option 1 (Huawei, Nokia):
* TC1: EN-DC with NR FR1 cell (E-UTRAN PCell + NR FR1 PSCell + NR FR1 SCell)
* TC2: EN-DC with NR FR2 cell (E-UTRAN PCell + NR FR2 PSCell + NR FR2 SCell)
* TC3: SA with NR FR1 cell (NR FR1 PCell + NR FR1 SCell + NR FR1 SCell)
* TC4: SA with NR FR2 cell (NR FR2 PCell + NR FR2 SCell + NR FR2 SCell)
* Recommended WF:
  + Depending on conclusion of Issue 1-1-2. Further discussion.

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| **Company** | **Comments** |
| Huawei | We support option 1. But we agree it should base on the conclusion of core requirements applicability. |
| Apple | We support the recommended WF. We are fine with the TCs proposed in Option 1. |
| Ericsson | We think that issue 1-1-2 needs to be settled. In our view it is not correct to call the switching as RRC-based BWP switch when SCell is involved. |
| Intel | Support the recommended WF. |
| Nokia | We are fine with the recommended WF. The test cases will be decided based on the conclusion of issue 1-1-2. If RAN4 agrees the requirements for RRC based BWP switch on multiple CCs for Rel-16 is applicable, the test cases listed in option 1 should be defined. |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| [**R4-2106958**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101635.zip)  Huawei, HiSilicon | Apple: Prefer to wait for conclusion on Issue 1-1-2, 3-1-1. |
| Ericsson: We think issue 1-1-2 needs to be settled first. But apart from that detail, we think the tests are OK. |
| Intel: wait for the conclusion from 1-1-2. |
| Nokia: CR looks fine. It will depend on the conclusion of issue 3-1-1. |

## 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 3-1-1:** | **RAN4 to define test cases for simultaneous RRC based BWP switch on multiple CCs**  *Tentative agreement: No.*   * Option 1 (Huawei, Nokia, Apple): * TC1: EN-DC with NR FR1 cell (E-UTRAN PCell + NR FR1 PSCell + NR FR1 SCell) * TC2: EN-DC with NR FR2 cell (E-UTRAN PCell + NR FR2 PSCell + NR FR2 SCell) * TC3: SA with NR FR1 cell (NR FR1 PCell + NR FR1 SCell + NR FR1 SCell) * TC4: SA with NR FR2 cell (NR FR2 PCell + NR FR2 SCell + NR FR2 SCell)   *Recommendations for 2nd round: Depending on conclusion of Issue 1-1-2. Further discussion.* |
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*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
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### CRs/TPs

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

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| **[R4-2106958](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101635.zip)**  Huawei, HiSilicon | Return to. Depend on the conclusion of Issue 1-1-2, 3-1-1 |

## Discussion on 2nd round (if applicable)

**Issue 3-1-1: RAN4 to define test cases for simultaneous RRC based BWP switch on multiple CCs**

* Option 1 (Huawei, Nokia, Apple):
* TC1: EN-DC with NR FR1 cell (E-UTRAN PCell + NR FR1 PSCell + NR FR1 SCell)
* TC2: EN-DC with NR FR2 cell (E-UTRAN PCell + NR FR2 PSCell + NR FR2 SCell)
* TC3: SA with NR FR1 cell (NR FR1 PCell + NR FR1 SCell + NR FR1 SCell)
* TC4: SA with NR FR2 cell (NR FR2 PCell + NR FR2 SCell + NR FR2 SCell)

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| **Company** | **Comments** |
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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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|  | **Status summary** | |
| **CR/TP/LS/WF number** | | **T-doc Status update recommendation** |
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# Topic #4: UL Spatial Relation Info Switching (Performance part)

## Companies’ contributions summary

NA.

## Open issues summary and companies view’s collection

NA.

### Open issues and comments collection

NA.

### CRs/TPs 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** |
| [**R4-2104901**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104901.zip)  Qualcomm, Inc. | Huawei: OK |
| Apple: we suggest the following wording:  In slot *n*, which is within 1280 ms of UE reporting valid results for both SSB0 and SSB1, the UE receives a MAC-CE indicating a switch of spatial relation to PUCCH Spatial Relation Info 1. |
| Ericsson: OK |
| Intel:OK. |
| QC: We accept Apple’s wording suggestion with this correction:  which is within 1280 ms after UE reporting |
| Nokia: Not agreeable. This CR is now not according to section 8.12.2. It seems to be introducing that the MAC CE need to be received by the UE within 1280ms after having sent the report to the network. The 1280ms condition relates to when the RS used for L1-RSRP ‘Spatial relation switch command is received within 1280 ms upon the last transmission of the DL RS resource for beam reporting or measurement’. |
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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** |
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*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
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### CRs/TPs

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

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| **[R4-2104901](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104901.zip)**  Qualcomm, Inc. | Revised. Suggest companies to align the contents in 2nd round. |

## Discussion on 2nd round (if applicable)

## 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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|  | **Status summary** | |
| **CR/TP/LS/WF number** | | **T-doc Status update recommendation** |
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# Recommendations for Tdocs

## 1st round

**New tdocs**

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| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on R16 RRM enhancement part 1 – BWP switching, UL spatial relation switch | Intel |  |
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**Existing tdocs**

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| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| **[R4-2106460](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106460.zip)** | CR on RRC based BWP switching on multiple CCs | Intel | Return to | Depend on the conclusion of issue 1-1-2. |
| **[R4-2106955](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106955.zip)** | DraftCR on maintenance of BWP Switch on multiple CCs TS38.133 | Huawei, HiSilicon | Return to | Depend on the conclusion of issue 1-1-2. |
| **[R4-2106956](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106955.zip)** | DraftCR on maintenance of BWP Switch on multiple CCs TS36.133 | Huawei, HiSilicon | Return to | Depend on the conclusion of issue 1-1-2. |
| **[R4-2107155](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107155.zip)** | Correction to RRC based BWP change delay requirements | Ericsson | Return to | Depend on the conclusion of issue 1-1-2. |
| **[R4-2107222](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107155.zip)** | Correction on RRC-based BWP switch on multiple CCs requirements | Nokia | Return to | Depend on the conclusion of issue 1-1-2. |
| **[R4-2105003](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2105003.zip)** | Draft CR on UL spatial relation info switch for PUCCH | Apple | Return to | Depend on the conclusion of issue 2-1-1. |
| **[R4-2106935](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2105003.zip)** | Update on uplink spatial relation switch delay | Huawei, HiSilicon | Return to | Depend on the conclusion of issue 2-1-1. |
| **[R4-2106958](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101635.zip)** | Draft CR on RRC based BWP switch on multiple CCs | Huawei, HiSilicon | Return to | Depend on the conclusion of issue 1-1-2 and issue 3-1-1. |
| **[R4-2104901](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104901.zip)** | CR: UL spatial relation TCs | Qualcomm, Inc. | Revised | Suggest companies to align the contents in 2nd round. |
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| **[R4-2107222](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107155.zip)**  Nokia |  |  |  |  |
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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

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| **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 |  |
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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