**3GPP TSG-RAN WG4 Meeting # 96-e R4-20XXXXX**

**Electronic Meeting, 17 – 28 Aug., 2020**

**Agenda item:** 7.5.1, 7.5.2, 8

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [96e][111] LTE\_NR\_DC\_CA\_enh\_RF

**Document for:** Information

# Introduction

This email discussion concerns three topics

1. DC\_12-n71 and single-UL only capability (Feature group index [6-2])
2. Co-located scenario only for inter-band EN-DC (Feature group Index 2-20)
3. Cell- and UE-specific P-Max for FR2

*List of candidate target of email discussion for 1st round and 2nd round (item 1)*

* 1st round: agreement on tentative Feature group [6-2] and corresponding switching time mask

*List of candidate target of email discussion for 1st round and 2nd round (item 2)*

* 1st round: agreement on feature group 2-20

*List of candidate target of email discussion for 1st round and 2nd round (item 3)*

* 1nd round: agreement on P-Max in RAN4 Rel-16 specifications and type of limitation (cell- and/or UE-specific) if introduced
* 2nd round: Reply LS to RAN2, CR to 38.101-2 introducing P-Max if agreed

There were no contributions against agenda item 7.5.1.

# Topic #1: DC\_12-n71 and single-UL only capability

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2010932](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Docs/R4-2010932.zip) | Huawei, HiSilicon | Title: Further discussion on RF requirements about DC\_12\_n71  **Observation 1: The common understanding about the “singleUL-Transmission” is that network can choose to operate the UE in dual UL transmission even if UE report the capability “singleUL-Transmission” based on RAN plenary’s conclusion.**  **Proposal 1:** **RAN4 need to clarify the BS and UE’s behaviour when only single switched UL operation is used. The existing “singleUL-Transmission” has different meanings, compared with only single switched UL operation based on the analysis above.**  **Proposal 2: It’s proposed to specify new capability to support “only single switched UL” for specific ENDC band combinations as Annex.**  **Proposal 3:** **It’s necessary to specify the time mask for specific inter-band ENDC band combinations which is operated within “only single switched UL”. Otherwise, UE performance is unknown.**  **Proposal 4: To specify the switching time mask requirements as figure 2.2-1 and 2.2-2 when only single switched UL is supported.**  **Proposal 5: It’s proposed not to restrict the specific implementation for DC\_12\_n71 in the specification.**  **Proposal 6: It’s proposed that the** **ΔTIB,c and ΔRIB,c values are given in the tables below.** |
| [R4-2011524](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Docs/R4-2011524.zip) | Skyworks Solutions Inc. | **Proposal 1: A UE that supports an EN-DC band combination which has been defined as “Only single switched UL is supported” or also known as “SUO mandatory, does not need to transmit signaling message “*singleUL-Transmission*” and signaling message “*tdm-Pattern.*” For such Band Combinations (BC), the network implicitly knows that the BC can only be supported in a TDM scheme and it is assumed that the UE supports the “*tdm-PatternConfig*” as specified in TS 36.331.**  **Proposal 2: Adopt following text addition to sub-clause 5.5B.1**  **“In the case of EN-DC or NE-DC configurations listed in tables of this clause for which only Single Switched Uplink operation is supported, the UE does not need to indicate the capability of not supporting dual and triple uplink operation via signaling messages “*singleUL-Transmission*” and “*tdm-Pattern.*” For these band combinations, it is assumed that the UE supports “*tdm-PatternConfig*” as specified in TS 36.331, and the UE shall expect TDM operation for all RF channel combinations. Such band combinations are indicated by column “Single Uplink Allowed” with a footnote specifying “Only single switched UL is supported.”**  **Proposal 3: For inter-band EN-DC (two bands) Table 5.5B.4.1-1 adopt footnote 14**  **Note 14: “Only single switched UL is supported”**  **Proposal 4: For intra-band EN-DC where Single Switched Uplink only is specified or where Single Switched Uplink operation is allowed, MSD resulting from the intermodulation generated by the mixing products of the uplink wanted signal and its image shall be analyzed and specified. Examples can be found in [2,3].** |

## Open issues summary

### Sub-topic 1-1 New capability ‘Only supporting single switched UL’

*Sub-topic description: need for a new capability ‘Only supporting single switched UL’ (Feature group [2-20])*

*Open issues and candidate options before e-meeting:*

**Issue 1-1-1: Need for new capability ‘Only supporting single switched UL’**

* Proposals
  + Option 1: specify a new capability ‘Only supporting single switched UL’
  + Option 2: modify the capability *singleUL-Transmission*
  + Option 3: implicit indication of SUO as proposed in R4-2011524
  + Option 4: do not specify a capability ‘Only supporting single switched UL’
* Recommended WF
  + TBA (can be one of the options above or combination thereof or other)

### Sub-topic 1-2 Time-switching mask for ‘Only supporting single switched UL’

*Sub-topic description: if the capability ‘Only supporting single switched UL’ is agreed, the time-switching mask*

*Open issues and candidate options before e-meeting:*

**Issue 1-2-1: The time-switching mask for ‘Only supporting single switched UL’ (if applicable)**

* Proposals
  + Option 1: specify the mask as proposed in R4-2010932
  + Option 2: modify the mask as proposed in R4-2010932 (state how)
  + Option 3: do not specify a specific mask for ‘Only supporting single switched UL’
* Recommended WF
  + TBA

### Sub-topic 1-3 TIB,c and RIB,c values for DC\_12-n71

*Sub-topic description: discuss and possibly agree TIB,c and RIB,c values for DC\_12-n71*

*Open issues and candidate options before e-meeting:*

**Issue 1-3-1:** **TIB,c and RIB,c values for DC\_12-n71**

* Proposals
  + Option 1: as proposed in R4-2010932 (Proposal 6)
  + Option 2: other
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| T-Mobile USA | Sub topic 1-1-1: Option 3. We agree with Skyworks.  Sub topic 1-2-1: Option 1  Sub topic 1-3-1: Option 1  ….  Others: |
| Skyworks | Sub topic 1-1-1: Option 3 – see rationale & advantages in R4-2011524,  Sub topic 1-3-1: Option 2. Difficult to agree upon the proposed values as it seems the document proposes two different sets of values: Values in the main body text are different from those proposed in the summary section. Also need clarification on architecture and form factor assumptions. |
| Qualcomm | 1-1-1: Option 2 and Option 3. May need to understand more why single\_UL needs to be modified, we can use the same capability and define that for this combo, it means UE will not be capable for DU. Option 3 and proposals in 1524 also assume the LTE tdm-pattern but we would like to include also the possibility to support SUO only by scheduling only i.e. NR and LTE scheduler coordinate amongst themselves and do not schedule simultaneous TX for both. Support for tdm-pattern would then be read from its own capability.  1-2-1: Mask requirements are needed. |
| Huawei | Sub topic 1-1-1: Option 1. We need to consider the forward compatibility, so option3 and option4 can’t be considered. In the future, once UE can support dual transmission or capability is improved, how can we distinguish it? For example, the only single switched UL is supported in Rel-15 for DC\_3\_n3. However, in Rel-16, dual Tx is supported by DC\_3\_n3. As for Option2, a clarification is needed in RAN4’s spec.  Sub topic 1-2-1: Option 1  Sub topic 1-3-1: Option 1. There is a copy mistake in the sub-clause 3. The proposed values are 0.5dB for TIB,c and 0.3dB for RIB,c in both band 12 and band n71. |
| Intel | **Issue 1-1-1: Need for new capability ‘Only supporting single switched UL’**  Option 4: do not specify a capability ‘Only supporting single switched UL’  Comments:  DC\_12\_n71 is physically the same with DC\_71\_n71 from RF implementation perspective where 1PA is used.  DC\_12\_n71 is not special given that the same RF implementation is used for DC\_71\_n71, we think the existing signaling or timing mask for DC\_71\_n71 can be used.  **Issue 1-2-1: The time-switching mask for ‘Only supporting single switched UL’ (if applicable)**  Option 3: do not specify a specific mask for ‘Only supporting single switched UL’ |
| CHTTL | **Issue 1-1-1:**  Current peference on Option 4, but we are open to discuss.  Regarding the common understanding of the capability *singleUL-Transmission*, in RAN2 spec, it is mentioned that this capability indicates that the UE does not support simultaneous UL transmissions as defined in TS 38.101-3.  And then in RP-172085, it is mentioned that “UE capability indicates that the UE does not allow 2 simultaneous UL transmission for the RAN4 specified channel allocations in a given band combination. If the network chooses to operate the UE in a way that is not consistent with this capability indication then the UE behavior is not specified and the UE might not meet the performance criteria.”  🡪 We think normally the network shall not choose to operate the UE in a way that is not consistent with this capability. And note that the text above is for the inter-band EN-DC discussion, and later on the single UL is extended to the intra-band cases where emission requirements are difficult to meet . We summerized and provide our view below:  For the intra-band EN-DC combos with SUO allowed:  Currently if the UE signal *singleUL-Transmission,* it means dual uplink is not supported. If not, then dual uplink is supported. With this it can distinguish the UE.  For the inter-band EN-DC combos with SUO allowed:  Currently if the UE signal *singleUL-Transmission,* it means dual uplink is not supported if the channel arrangement is within the (IMD2/3) equation in TS 38.101-3.  For the special case DC\_12\_n71, there will be a footnote that “only single UL is supported”, so the meaning of the *singleUL-Transmission* will be close to intra-band case since it is just indicate that dual uplink is not supported, not related to the channel arrangement.  So if people think current spec is not clear, we are open to have some clarification. Regarding whether new signalling is needed, we hope not to have confusion with current signalling.  Regarding option 3, we are wondering whether it will cause some confussions in the future. For example, if the combination defined with support single switch UL only but can support dual UL in the later release, then some legacy UEs support SUO only will not indicate “*singleUL-Transmission*” , but some UE in later release but choose to support SUO only will indicate “*singleUL-Transmission*” . (In short, for the UE that support SUO only, maybe it is still better to indicate “*singleUL-Transmission*”) |
| Ericsson | Issue 1-1-1:  Option 4. SUO can be indicated by the existing capability (per BC)  *singleUL-Transmission*  Indicates that the UE does not support simultaneous UL transmissions as defined in TS 38.101-3 [4]. The UE may only include this field for certain band combinations defined in TS 38.101-3 [4]. If included for a particular band combination, the field applies to all fallback band combinations of this band combination that are defined in TS 38.101-3 [4] as being allowed to include this field and does not apply to any other fallback band combinations defined in TS 38.101-3 [4].  *tdm-Pattern*  […] Support is conditionally mandatory for UEs that do not support dynamic power sharing and for UEs that indicate single UL transmission for any BC, and optional otherwise.  with the desired property.  There should be no implicit UE capability indication by means of the specification (as proposed by Option 3) |
| OPPO | **Issue 1-1-1: Need for new capability ‘Only supporting single switched UL’**  Option 4 (do not specify a capability ‘Only supporting single switched UL’). We do not see the difference from current *singleUL-Transmission* since it also means that UE does not support simultaneous UL transmission.  **Issue 1-2-1: The time-switching mask for ‘Only supporting single switched UL’ (if applicable)**  Option 3, reuse current time mask is preferred and if new mask is to be defined the reason and difference should be clarified. |
| Apple | Issue 1-1-1: We don’t see the need for a new capability for this scenario; Option 3 or Option 4 can be useful solutions to consider.  Issue 1-3-1: Looking at the architectures proposed it seems the triplexers and the combining of two B12 and n71 duplexers are not really possible with a reasonable performance using technologies used in small form factor devices like smartphones or tablets. Therefore we do not agree to these values. |

### 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [R4-2010932](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Docs/R4-2010932.zip) | Skyworks:  **Proposal 2:**  New signalling is not needed. We propose to clarify UE and RAN behaviour in proposal 2 & 3 of R4-2011524.  **Proposal 3:**  2 Questions for clarification: 1) is there any reason why would TDM operation dynamics have a different requirement depending on the type of SUO, ie between SUO allowed vs SUO mandatory ? 2) Do we need to consider the case of intra-band dynamics vs inter-band dynamics when capturing time mask for SUO ?  **Proposal 5:** We disagree as previously discussed in previous meetings.  **Proposal 6:** Can not agree as there are two different sets of values proposed: one in main body text sub-clause 2.3 and another set in sub-clause 2.4. Could you please clarify the proposal ?  Could you also clarify the assumptions made on architecture and form factor ? |
|  | Company B |
|  | Huawei:  To Skyworks  1) If WG can reach an agreement, the switching time mask can be used for both SUO allowed and SUO mandatory.  2) The switching time mask for intra-band cases have been specified for SUO. It’s necessary to specify the time mask for inter-band cases for SUO.  3) There is a copy mistake in the sub-clause 3. The proposed values are 0.5dB for TIB,c and 0.3dB for RIB,c in both band 12 and band n71.  4) At least, we prefer Figure 2.3-1 which is not restricted by form factor. Thus, there is no need to restrict the implementation in the spec. |
|  | Intel: As commented to Issue 1-1-1 and 1-2-1, we don’t see the need to have ‘**Only supporting single switched UL**’ |
| Apple | **Proposal 5**: We do not see that this can be implemented in small form factor devices like smartphones or tablets, so we do not agree with proposal 5. There shall be a note restricting this to larger devices as it has been agreed earlier.  **Proposal 6**: Looking at the architectures proposed it seems the triplexers and the combining of two B12 and n71 duplexers are not really possible with a reasonable performance using technologies used in small form factor devices like smartphones or tablets. Therefore we do not agree to these values. |
| YYY | Company A |
|  | Company B |
|  |  |

## 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.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1-1** | *Tentative agreements:*  *Candidate options:*  *1. Do not specify a new capability ‘Only supporting single switched UL’*  *2. Reuse the existing SingleUL-Transmission*  *3. Implicit indication of SUO (according to 38.101-3)*  *Recommendations for 2nd round: decision by 2020/08/21.*  The SUO behavior should be clarified regardless of decision (doc #1) |
| **Sub-topic#1-2** | *Tentative agreements:*  *Specify a SUO time mask application inter-band EN-DC*  *Candidate options:*  *Do not specify a SUO time mask application inter-band EN-DC (one company against specification)*  *Recommendations for 2nd round:*   1. *Consider the CR in R4-2010932, possibly revised.* 2. *Discuss form-factor restriction for DC\_12-n71*   *A GTW slot may be needed.* |
| **Sub-topic#1-3** | *Tentative agreements:*  *No agreement on the values.*  *Candidate options:*  *Recommendations for 2nd round: come back at the next meeting.* |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Document for information  Clarification on the network and UE behaviors between “Only single switched UL” and “SUO/SUO allowed” | Huawei, HiSilicon |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2010932 | *To be revised.* |

## 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*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: Co-located scenario only for inter-band EN-DC (Feature group Index 2-20)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2009174](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_95_e/Docs/R4-2009174.zip) | NTT DOCOMO | Title: RAN4 UE features list for Rel-16  Index 2-20, see details below. |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 2-20 | support co-located scenario only for inter-band EN-DC | Indicates the inter-band EN-DC combination supported by the UE can only work at co-located scenario, and in this scenario the PSD difference between DL carriers and MRTD can be guaranteed.  candidate values set: {type1, type2}  type 1 UE: performance guaranteed with PSD difference between DL carriers < 6dB, and MRTD=3us (current only DC\_20\_n28 has this limitation)  type 2 UE: performance guaranteed without limitation on PSD difference between DL carriers and MRTD=33us |  | Yes | N/A | If UE does not reports this capability, the performance cannot be guaranteed under inter-band non-collocated scenario. | Per band combination | N/A | FR1 only | N/A |  | Optional |

(Use table tools to view full table)

## Open issues summary

*The Feature group 2-20 requires further discussion*

### Sub-topic 2-1 Feature group 2-20

*Sub-topic description: decide on the need for2-20, and if so, the description of this Feature group.*

*Open issues and candidate options before e-meeting:*

**Issue 2-1-1: Need for the Feature group/capability 2-20**

* Proposals
  + Option 1: Specify as proposed in R4-2009174
  + Option 2: Specify only for band combinations of a specific type (e.g. DC\_20-n28)
  + Option 3: Cover the components of 2-20 by other Feature group(s)
  + Option 4: No need for this Feature group
  + Other
* Recommended WF
  + TBA

### Sub-topic 2-2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-2: TBA**

* Proposals
  + Option 1: TBA
  + Option 2: TBA
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Sub topic 2-1-1: From RF point of view, there is no need for this capability that means we support option 4. Note that MRTD and PSD difference are BB room topics so this discussion belongs in to BB session with these assumptions.  ….  Others: |
| Huawei, HiSilicon | Option 1 with change of MRTD for type 2 UE  Sub topic 2-1-1: As discussed in previous RAN4 meetings, one implementation of DC\_20\_n28 is to use common Rx chain, under this condition, it has some limitations of PSD difference as well as synchronization, which is supposed to be scheduled for co-located scenario. However, there is no indication to network that DC\_20\_n28 cannot be used for non-collocated scenario.  On the other hand, common Rx chain is not the only possible implementation. If separate chains are utilized, there is should be no such PSD and sync limitations.  For inter-band EN-DC, by default it should support unsynchronized scenario. MRTD 3us or 33us are specific to sync scenario, thus we need to make some changes for Type 2 UE, and change the MRTD to 0.5 slot instead.  Based on indication of type 1 or type 2 UE, the network can then decide whether to configure EN-DC for 20\_n28 according to the deployment scenarios, i.e. co-located or non-collocated as well as sync or unsync. |
| Intel | We think this new capability was not discussed in any session with technical discussions.  Option 4.  Option 1 can be considered but needs to add a type 3 UE to cover asynchronous case with MRTD up to 500us. |
| Ericsson | Sub-topic 2-1-1  Option 4. This FG indication UE support of ‘co-location only’ should not be used to change the baseline for inter-band EN-DC deployment: non-collocated deployment.  What is the rationale for the 6 dB PSD requirement? UL power control is per CC.  If there is a common implementation-related timing constraint for very specific band combinations, e.g. overlapping bands, capabilities similar to the *ul-TimingAlignmentEUTRA-*NR that applies for intra-band EN-DC could possibly be considered.  In which work item was this FG discussed? |
| OPPO | **Issue 2-1-1: Need for the Feature group/capability 2-20**  Option 4, Currently the restriction of PSD and MRTD have been specified in spec, not sure what’s the benefit of this reporting. Even with the capability to distinguish two types of UE, how the BS can make sure the PSD in UE side is <6dB?   * Type 1 UE: performance guaranteed with PSD difference between DL carriers < 6dB, and MRTD=3us (current only DC\_20\_n28 has this limitation) * Type 2 UE: performance guaranteed without limitation on PSD difference between DL carriers and MRTD=33us |
| Huawei, HiSilicon | **Some feedback to the comments above**  to Intel: this capability was added in RAN4#94-e-bis meeting, and was even discussed in the feature list webinar meeting in May. MRTD in RRM spec is defined as 500us for 15 kHz SCS, but scaled with SCS, that’s the reason we propose 0.5 slot.  to Ericsson: For the baseline non-collocated deployment, we share the similar understanding. But the 6dB PSD limitation as well as 3us sync condition were already captured in the spec for DC\_20\_n28. The conditions are just based on one UE implementation, i.e. common Rx, which limited the deployment to collocated and sync only. However, the default assumption for inter-band EN-DC is unsynchronized and baseline deployment scenario is non-collocated. Without a UE capability, the non-collocated network will lose the flexibility to configure EN-DC for DC\_20\_n28 to UE implemented with separate RF chains.  to OPPO: For the question of “Even with the capability to distinguish two types of UE, how the BS can make sure the PSD in UE side is <6dB”, only collocated network can guarantee the required PSD difference in real network. The capability is to make sure the network (co-located or non-collocated) can configure properly of EN-DC based on UE capability. |

### 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *For companies against or inclusion of FG 2-20, one company supporting inclusion.*  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: do not include FG 2-20, decision needed by 2020/08/21* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## 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*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: FR1 Cell- and UE-specific P-Max for FR2

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2010534](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Docs/R4-2010534.zip) | Nokia, Nokia Shanghai Bell | Title: Discussion and draft Reply LS on power control for NR-DC  ***Proposal 1: It is proposed to introduce p-Max in FR2 for interference suppression purpose for operators to coordinate in unsynchronized network operation.***  ***Proposal 2: p-Max in FR2 is based on TRP metric.***  ***Proposal 3: The range of p-Max for FR2 is (-20..43)***  ***Proposal 4: Pcompensation shall be based on TRP metric that is compensated by p-Max.***  ***Proposal 5 The LS draft in sent to RAN2 according to the proposals above.*** |
| [R4-2010535](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Docs/R4-2010535.zip) | Nokia, Nokia Shanghai Bell | TS 38.101-2 CR 0236 Title: Introduction of p-Max to FR2  Summary of change: TRP limit is introduced as indicated by p-Max for FR2. |
| [R4-2010850](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Docs/R4-2010850.zip) | vivo | Title: On p-UE-FR2 for Rel-16  **Observation 1**: Both EIRP control and TRP control has feasibility issues.  **Observation 2**: It is EIRP control matters more, which can be even more difficult than TRP control.  Based on the current situation that the feasibility of fairly accurate UE estimation of TRP/EIRP in different blockage scenarios cannot be proved, and it is also late for rel-16, we have the following proposal:  **Proposal:** Not to introduce Pmax for FR2 in RAN4 Rel-16 spec. |

## Open issues summary

### Sub-topic 3-1 Feasibility of P-Max limitation if introduced

*Sub-topic description: need for and feasibility of P-Max limitations in the Pcmax. The feasibility of EIRP and/or TRP restrictions from a UE implementation and minimum requirement standpoints are addressed.*

*The relevant metric for Pcompensation for FR2 (see 38.304) is also discussed.*

*Open issues and candidate options before e-meeting:*

**Issue 3-1-1: Need for P-Max limitation in the configured maximum output power**

* Proposals
  + Option 1: P-Max needed as motivated in R4-2010534
  + Option 2: P-Max not needed and/or not meaningful
  + Option 3: do not introduce in RAN4 Rel-16 specifications, postpone discussion to Rel-17
* Recommended WF
  + TBA

**Issue 3-1-2: Feasibility of EIRP and TRP upper bounds if P-Max needed**

* Proposals
  + Option 1: EIRP limitation impossible (from a UE implementation standpoint)
  + Option 2: TRP restriction impossible (from a UE implementation standpoint)
* Recommended WF
  + TBA

**Issue 3-1-3: Cell-specific and UE-specific P-Max if introduced**

* Proposals
  + Option 1: Cell-specific and UE-specific
  + Option 2: Cell-specific only
  + Option 3: UE-specific only
* Recommended WF
  + TBA

**Issue 3-1-4: Metric for Pcompensation for FR2 (TS 38.304)**

* Proposals
  + Option 1: TRP
  + Option 2: other
  + Option 3: as in existing version of the specification TS 38.304
* Recommended WF
  + TBA

### Sub-topic 3-2 Reply LS to RAN2

*Sub-topic description: contents of a Reply LS to RAN2 (original LS in R4-2003363/ R2-2000294), should be sent at this meeting.*

*Open issues and candidate options before e-meeting:*

**Issue 3-2-1: Reply LS to RAN2**

* Proposals
  + Option 1: Send LS as proposed in R4-2010850, P-Max not introduced in RAN4 Rel-16 specifications
  + Option 2: Send LS as proposed in R4-2010534, including recommended range of P-Max in Rel-16 and metric for Pcompensation
  + Option 3: Revise one of the proposed draft Reply LS, state how
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei, HiSilicon | Sub topic 3-1-1: Currently, we prefer option2. If UE controls its TRP with Pmax, it is not clarified on EIRP requirement the UE is expected under such condition. It is highly possible UE lose connection since Pmax controlling on TRP in case of interference.  For the application of “local 5G” with different UL/DL configuration, it is easy to be solved by scheduling service apart between EMBB and non-MNO service.  Sub topic 3-1-2: From UE implementation perspective, both options are impossible. For EIRP, not possible to control EIRP on all directions. For TRP, we provide analysis above.  Sub topic 3-1-3: We prefer not to introduce.  Sub topic 3-1-4: Not to introduce Pmax in Rel-16, Pcompensation keep as Rel-15: Pcompensation = 0  Sub topic 3-2-1: Option 1 or option 3. We agree that Pmax will not used by RAN4 spec, but if it can be agreed, RAN2 may need to consider remove Pmax from RAN2 spec.  ….  Others: |
| Qualcomm: | 3-1-1: We would prefer option 2 but can support option 1. We need to understand if this is optional feature or mandatory for all rel-16 UE’s.  3-1-2: Option 2.  3-1-4: 38.304 is Ran2 specification. Does ran4 need to decide anything for this?  3-2-1: LS is needed according to agreements. |
| Intel | **Issue 3-1-1: Need for P-Max limitation in the configured maximum output power**  Option 3: do not introduce in RAN4 Rel-16 specifications, postpone discussion to Rel-17  **Issue 3-1-2: Feasibility of EIRP and TRP upper bounds if P-Max needed**  Both are very challenging  **Issue 3-1-3: Cell-specific and UE-specific P-Max if introduced**  Option 2: Cell-specific only  **Issue 3-1-4: Metric for Pcompensation for FR2 (TS 38.304)**  Don’t introduce P\_max. Set **Pcompensation** = 0  **Issue 3-2-1: Reply LS to RAN2**  Option 1 |
| vivo | **Issue 3-1-1:**  Prefer Option 2. We can also accept option 3 to postpone it to Rel-17.  **Issue 3-1-2:**  Both EIRP and TRP are not that feasible. (Both options.)  **Issue 3-1-4:**  Also share Qualcomm’s view that RAN4 may not need to provide this information.  **Issue 3-2-1:**  Prefer option 1. Not to reply anything is also acceptable if agreements can not be reached. |
| Ericsson | Issue 3-1-1:  Option 1.  Issue 3-1-2:  Option 1: The TRP can be controlled by means of the (conducted) input power to the antenna.  If a P-Max limitation is applied, the lower limit of the EIRP (power class) requirement should not apply.  Issue 3-1-3:  Option 1. Both. No difference between cell-specific and UE-specific P-Max limitation from a power control perspective.  Issue 3-1-4:  Option 1 (consistent with the P-Max limitation) but not trivial since the power class is in a different frame of reference. This is RAN4 scope even if 38.304 is indeed a RAN2 specification.  Issue 3-1-5:  Option 2, possibly with slight modifications. |
| OPPO | **Issue 3-1-1: Need for P-Max limitation in the configured maximum output power**  Either Option 2 or Option 3, discussion has lasted for a long time without conclusion, it is not expected conclusion can be reached suddenly. Not discuss any more or discuss in Rel-17 with something new.  **Issue 3-1-2: Feasibility of EIRP and TRP upper bounds if P-Max needed**  None of the EIRP/TRP is possible as discussed in last meeting. Further study may be needed.  **Issue 3-1-3: Cell-specific and UE-specific P-Max if introduced**  None of the options, can be discussed further once there is conclusion of introduction.  **Issue 3-1-4: Metric for Pcompensation for FR2 (TS 38.304)**  None of the options, can be discussed further once there is conclusion of introduction.  **Issue 3-2-1: Reply LS to RAN2**  Option 1. |
| Samsung | **Issue 3-1-1: Need for P-Max limitation in the configured maximum output power**  Prefer Option 2 but Option 3 is also accepted.  **Issue 3-1-2: Feasibility of EIRP and TRP upper bounds if P-Max needed**  Both are difficult, especially for EIRP considering all angles. TRP could be controlled by conduction input power, however, when beam direction changes, the TRP also has some difference even the conduction input power is the same.  **Issue 3-1-3: Cell-specific and UE-specific P-Max if introduced**  Further discussion after decision is made to introduce P-max.  **Issue 3-1-4: Metric for Pcompensation for FR2 (TS 38.304)**  Further discussion after decision is made to introduce P-max.  **Issue 3-2-1: Reply LS to RAN2**  Option 1. |
| Nokia | Issue 3-1-1: Option 1.  Issue 3-1-2: Option 1. TRP can be still controlled by controlling PA output power.  Issue 3-1-3: Option 1.  Issue 3-1-4: Option 1. Cell selection/reselection criteria is based on long term average. TRP is like an average over whole sphere, which should work better than Rel-15.  Issue 3-2-1: Option 2. |
| NTT DOCOMO, INC | **Issue 3-1-1: Need for P-Max limitation in the configured maximum output power**  Option 1.  If we take option 3, it would be better to clarify in which AI(WI) we will discuss in Rel-17.  **Issue 3-1-2: Feasibility of EIRP and TRP upper bounds if P-Max needed**  We would like to limit both TRP and EIRP. But we can compromise to apply either of metric due to feasibility issue since it would be still useful for controlling inter-cell interference while use case of P-max would be limited.  **Issue 3-1-3: Cell-specific and UE-specific P-Max if introduced**  Prefer Option 1.  **Issue 3-2-1: Reply LS to RAN2**  Option 2. |
| Apple | Issue 3-1-1: We believe there is complexity in defining and introducing UE requirements for FR2 P-Max, and this work can benefit from a dedicated objective in the Rel-17 FR2 RF work item.  Issue 3-1-2: We would propose Option 3: FFS; the reason is that in the currently defined power class requirements contain both max EIRP and max TRP limits. The question is whether the UE is capable of meeting additional requirements associated with max EIRP and/or max TRP in response to network configuration. This topic should be part of the requirement development effort in Rel-17.  Issue 3-1-3: Whether cell-specific signaling to configure the UE to limit its output power is feasible depends on whether all UEs can support the feature, and associated requirements, as a mandatory feature. If it is optional, then only UE-specific configuration is possible. We suggest handling this together with the Rel-17 discussion.  Issue 3-1-4: We suggest setting this aspect to FFS and including scope for it in the Rel-17 work scope (perhaps including RAN2 as a secondary group for the related objective).  Issue 3-2-1: We believe it is premature to send an LS to RAN2 before the UE requirements for FR2 P-Max are understood and defined. If consensus can be achieved to define scope for this effort in the Rel-17 FR2 RF enhancement work item, then we suggest the Moderator to provide the input to the relevant RAN email discussion thread on the scope of FR2 RF enhancements in Rel-17. |

### 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| TS 38.101-2 CR 0236  R4-2010535 | Huawei: TRP control on Pmax is not clear on EIRP requirement under Pmax controlling, if UE just lower down much on the transmitting power, connection can be loss and have big impact on network performance. Prefer not to introduce FR2 Pmax. |
| Intel: Limiting TRP definitely has impact on EIRP. This CR has no EIRP adjustment. Cannot agree to it. Suggest to discuss it in Rel-17. |
| vivo: Prefer not to introduce TRP control. |
| Ericsson: when the P-Max limitation applies the lower EIRP limit should apply.  Why not use a 10 dB offset and reuse the current P-Max range?  This CR also contains other relevant changes (e.g. the total TRP for CA).  Revise. |
| NTT DOCOMO, INC:  We can address concerns from Huawei and Intel if lower limit of EIRP can be decreased accordingly or ignored as proposed in Ericsson CR R4-1908715. |
| Apple: we believe it is premature to agree a CR before the requirements for FR2 P-Max are well understood and defined; there does not seem to be consensus to proceed with TRP control, and the network signaling for the configuration of P-Max is also not yet agreed. We recommend considering potential CRs for the feature in Rel-17 after the work to define the requirements yields a stable understanding of the requirement. |
| YYY | Company A |
| Company B |
|  |

## 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.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#3-1** | *No consensus, about equal support for Option 1 and Option 2, no company is against Option 3*  *Tentative agreements:*  *~~Option 3: consider specification of P-Max in Rel-17~~.*  *Option 3: Postpone the discussion of P\_Max to Rel-17*  *Candidate options:*  *Recommendations for 2nd round:*  *~~Consider specification of P-Max in Rel-17~~ Postpone the discussion of P\_Max to Rel-17, inform RAN2 that the corresponding IE are not specified/used in the RAN4 specifications.* |
| **Sub-topic #3-2** | *Tentative agreements:*  *Option 3: revise R4-2010850 (P-Max not introduced in RAN4 Rel-16 specifications)*  *Candidate options:*  *Recommendations for 2nd round:*  *Reply LS to RAN2 based on R4-2010850 (revised), doc #1* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | R4-2010850 revised  To be revised (as Reply LS)  Title: Reply LS on power control for NR-DC | vivo |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## 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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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |