**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 | 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 | 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 1Sub 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. Option 3 and proposals in 1524 also assume the LTE tdm-pattern. Is this the only way to support SUO? |
| 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 1Sub 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’ |

### 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 | 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**’ |
| 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** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Recommendations 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 provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **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 #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 | NTT DOCOMO | Title: RAN4 UE features list for Rel-16Index 2-20, see details below. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 UESub 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. |

### 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** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*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 | 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 | Nokia, Nokia Shanghai Bell | TS 38.101-2 CR 0236 Title: Introduction of p-Max to FR2Summary of change: TRP limit is introduced as indicated by p-Max for FR2. |
| R4-2010850 | 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 = 0Sub 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 |

### 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 0236R4-2010535 | 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. |
|  |
| 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** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*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”* |