**3GPP TSG-RAN WG4 Meeting #94-e R4-2002701**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 9.15

**Source:** Moderator (China Unicom)

**Title:** Email discussion summary for RAN4#94e\_#28\_ENDC\_UE\_PC2\_FDD\_TDD

**Document for:** Information

# Introduction

In RAN #86 meeting, a new WID was approved to standardize Power Class 2 high power UE for EN-DC (1 LTE FDD band + 1 NR TDD band). Two cases were included in the WI, i.e. case 1 for 23dBm LTE + 23dBm NR and case 2 for 23dBm LTE + 26dBm NR. The scope of the email discussion is to confirm the LTE reference configuration, UE-Network interaction mechanism as well as MSD values.

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

* 1st round: TBA
* 2nd round: TBA

# Topic #1: High power UE (power class 2) for EN-DC (1 LTE FDD band + 1 NR TDD band)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000121 | vivo | Proposal 1: considering characteristics of ENDC traffic, typical NR UL/DL Configuration and LTE TDD UL/DL Configuration, it is proposed that two LTE configurations are DutyLTE1=70% and DutyLTE2=40%.Proposal2: corresponding to the LTE fixed dutycycle in proposal 1, the reported UE NR ul dutycycle capabilities (maxNRDuty1, maxNRDuty2) are proposed as* Corresponding to DutyLTE1=70%, maxNRDuty1 ∈ {30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%, *Full\_duty\_supported*}, default value in case no reporting case1=30%, case2=15%
* Corresponding to DutyLTE2=40%, maxNRDuty2 ∈ {30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%, *Full\_duty\_supported*}, default value in case no reporting case1=60%, case2=30%
 |
| R4-2000122 | vivo | Draft LS on UE capability for PC2 inter-band EN-DC (LTE FDD+NR TDD) |
| R4-2000447 | Xiaomi | Observation 1: the only Rx requirement which shall be re-evaluated for DC\_3\_n78 is intermodulation interference due to dual uplink operation for both case 1 and case 2.Observation 2: IMD2 and IMD4 falling into Band 3 shall be re-evaluated for DC\_3\_n78 both case 1 and case 2.Proposal 1: the MSD value as shown in table 4 is proposed for high power UE for DC\_3\_n78 for both case 1 and case 2. |
| R4-2000878 | CHTTL | Proposal 1: For each fixed LTE reference configuration of the PC2 FDD-TDD EN-DC, consider a conditional statement for 100% UL percentage with an upper limit of the UL power setting on the LTE side. If the network configuration PLTE is not larger than the upper limit, then 100% UL percentage needs to be supported, and the UE don’t need to check the percentage of the LTE uplink symbols. - The upper limit of the PLTE corresponding to fixed LTE reference configuration (70%, 40%) can be ([21], [19]) dBm respectively. |
| R4-2000908 | CMCC | CR to TS38.101-3 - CR for adding power class 2 output power requirement for DC\_3A\_n41A |
| R4-2000968 | ZTE | Proposal 1: reuse TDD-Patternconfiguration IE specified for the single uplink transmission EN-DC. |
| R4-2001037 | China Unicom | Proposal 1: To complete the WI base on the SAR compliance scheme 2 from TR37.815 as specified in its summary part. |
| R4-2001188 | LG Electronics | Proposal 1: For PC2 DC\_3A\_n78A UE, the proposed MSD levels in Table4 shall be considered in TS38.101-3. |
| R4-2001326 | Ericsson | Proposal 1: SAR compliance is the liability of the UE; for UEs providing a duty cycle capability, the fallback behaviour is ensured by the UE by its estimates of the actual UL duty cycle on both cell groups.Proposal 2: support for EN-DC power class 2 for FDD-TDD band combination is specified by combining the methods of NR duty-cycle reporting and reduced FDD power. |
| R4-2002097 | Qualcomm | Proposal 1: The “scheme 2” feedback-based method is preferred to enable the potential for higher performance for PC2 FDD-TDD EN-DC networks.Proposal 2: The “scheme 2” feedback-based scheme shall be used if the UE signals a capability. If no capability is signaled, then a blind scheme can be used. The scheme to modify $P\_{total}^{EN-DC}$based on network configured parameters is one such blind scheme that can be considered. Another blind scheme based on actual transmitted symbols similar to SA and TDD-TDD EN-DC can also be considered. |
| R4-2002101 | Ericsson | CR to TS38.101-3 - Introduction of EN-DC power class 2 for FDD-TDD band combinations |

## Open issues summary

Main open issues identified from the contributions are the LTE reference configuration, UE-Network interaction mechanisms as well as MSD values.

### Sub-topic 1-1

Sub-topic description: LTE reference configuration

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

**Issue 1-1: LTE reference configuration**

* Proposals
	+ Option 1: DutyLTE1=70% , DutyLTE2=40%
* Recommended WF
	+ TBA

### Sub-topic 1-2

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

**Issue 1-2-1: UE-Network interaction**

* Proposals
	+ Option 1: The “scheme 2” feedback-based scheme shall be used if the UE signals a capability. If no capability is signaled, then a blind scheme can be used. (Qualcomm)
		- Option 1-a: To consider a conditional statement for 100% LTE FDD UL percentage if the network configuration PLTE is not larger than the upper limit. (CHTTL)
	+ Option 2: support for EN-DC power class 2 for FDD-TDD band combination is specified by combining the methods of NR duty-cycle reporting and reduced FDD power. (Ericsson)
* Recommended WF
	+ TBA

**Issue 1-2-2: Capability signalling**

* Proposals
	+ Option1:

Corresponding to DutyLTE1=70%, maxNRDuty1 ∈ {30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%, *Full\_duty\_supported*}, default value in case no reporting case1=30%, case2=15%

Corresponding to DutyLTE2=40%, maxNRDuty2 ∈ {30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%, *Full\_duty\_supported*}, default value in case no reporting case1=60%, case2=30%

*Full\_duty\_supported*: no restriction on uplink scheduling for both LTE and NR bands for applicability of PC2 inter-band EN-DC (FDD+TDD) requirements, i.e. SAR compliance will be fulfilled by UE based mechanisms e.g. P-MPR etc.

* Recommended WF
	+ TBA

### Sub-topic 1-3

Sub-topic description: MSD values.

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

**Issue 1-3: MSD value for high power UE for EN-DC**

* Proposals
	+ Option 1: IMD2: 31.8dB ;IMD4: 19.4dB
	+ Option 2: IMD2: 32.0dB ;IMD4: 17.5dB
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Xiaomi | Sub topic 1-1: we support option 1Sub topic 1-2: Sub topic 1-3: If MSD need to be defined in this meeting, we can compromise to accept the average approach like RAN4 usually do considering the difference is not so much. |
| LG Electronics | Sub-topic 1-1: In case of LTE (FDD) + NR(TDD), we prefer option1: Report UE NR UL duty cycles based on corresponding to the LTE fixed duty cycles. Sub topic 1-3: When RAN4 define the required MSD levels, we can merged all MSD levels as average manner like RAN4 usually considered for LTE-A CA and EN-DC basket WI.So the proposed MSD level for DC\_3A\_n78A power class 2 UE as follow- IMD2: 31.9 dB ; IMD4: 18.5dB |
| vivo | Issue 1-1: we support option1.Issue 1-2-1: we support option1. We are also fine with option1a as comprise for option2.Issue 1-2-2: we support option1 as in R4-2000121.To Ericsson: about the difference between maxNRDuty=100% and *Full\_duty\_supported*.Because we define “LTE reference configuration” (e.g. DutyLTE1=70%) for NR dutycycle capability reporting (e.g. maxNRDuty1∈ {30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%, *Full\_duty\_supported*})So the difference is that * maxNRDuty1=100% means UE supports  DutyLTE1=70% and DutyNR1=100%
* maxNRDuty1= *Full\_duty\_supported* means UE supports DutyLTE1=100% and DutyNR1=100%, I.e. further relive UL duty  restriction on LTE side compared to above one.

Regarding the indication of “UE LTE-NR duty-cycle management is not supported”, we haven’t thought about this. According to our proposal: if UE declare PC2 in an FDD+TDD ENDC band combination, then it is supposed to report maxNRDuty capabilities (default value applies if not reported). And we use this “*Full\_duty\_supported*” to activate full UE based SAR compliance solution, i.e. relieve all UL duty restriction on both LTE and NR side.We saw proposals from you, QC and CHTTL, we are certainly open for further discussion.  |
| Ericsson | Issue 1-1: we accept option 1 (from considerations in R4-2000121)Issue 1-2-1: we obviously support Option 2 but can accept Option 1 if the total EN-DC power is set as proposed in R4-2001326. Then Option 1 is almost identical to Option 2, the only difference is that the UE falls back to PC3 if the UL EN-DC scheduling does not follow capability (“no” in the decision tree in Figure 1 of R4-2002097) whereas in Option 2 the UE falls back to the higher EN-DC power if P\_LTE is set < 23 dBm (otherwise also PC3). A UE fall-back path must be specified in 38.101-1 for the feature such that compliance with SAR can be facilitated (this is already included in Option 2 and almost identically in Option 1 (with the understanding that Figure 1 of R4-2002097 provides a fallback path)We do not support option 1a.General: we will only agree a solution that ensures a performance improvement for EN-DC PC2 capable UEs also in the case in which there is no strict CG coordination (as required for joint LTE and NR duty-cycle management), e.g. the method by which a UE – even if indicating duty-cycle capability -- can fall back to an increased (minimum) fixed EN-DC power level for FDD-TDD network architectures without strict coordination. In this way the feature covers all types of network architectures and all TDD (common) configurations.Issue 1-2-2: we do not support Option 1 as is, a behaviour when both capabilities are absent must be specified. Then the network should assume that the UE LTE-NR duty-cycle management is not supported, or in case EN-DC PC2 is indicated nevertheless, that “full-duty-supported” is supported by means of P-MPR or the UE configures a total EN-DC based on (semi-static) network parameters. No need to include “full-duty-supported” as a value for the capability field (100% enough).Issue 1-3: our understanding is that only IMD2 allows single-TX transmissions (possibly with HARQ timing Case 2).Note that the R4-2002102 is a draft CR covering the configured EN-DC power and the fallback path (not a complete CR for the feature). |
| OPPO | Issue 1-2-1: The solutions introduced actually are optional solutions, UEs which do not need support from NW side to do restriction no matter power or UL duty cycle shall be allowed. Therefore, we have concern on mandating UE to choose between reporting UL duty cycle and reduce power. When no capability is signalled BS shall not restrict UE scheduling. |
| CMCC | Issue 1-2-1: Considering that the UE behaviour of EN-DC PC2 FDD+TDD and TDD+TDD could be as consistent as possible. We prefer option1. |
| ZTE | Sub topic 1-1: fine for option 1Sub topic 1-2-1: Support to have combination methods of NR duty cycle reporting and reduced FDD power. We think option 3 also include the reduced FDD power which is names as blind method, We think if eNB don’t follow the UE NR UL duty report, whether directly fallback to PC3 or with modified configured power could be further discussed.Sub-topic 1-3: No strong view on this value and it seems that only single uplink transmission is allowed as MSD is as large as 31dB |
| Huawei | Issue 1-1: support option1Issue 1-2-1: support option 1Issue 1-3: MSD should be further studied with more inputs from companies |
| CHTTL | Sub topic 1-1: we are fine with option 1.Sub topic 1-2: (for both Issue 1-2-1 and 1-2-2)Before discussing which option is preferred by the companies, we think some general discussion and clarifications are needed.Option 1 just mentions that a “blind” scheme can be considered when no capability is signaled, however which “blind” scheme will be chosen needs to be further discussed. So whether it is consistent as the TDD-TDD scheme will depened on which “blind” scheme is decided.The option 1 of the issue 1-2-2 and option 1-a are provided based on the assumption that when no capability is signaled, same UE behaviors are applied with the default value of the capability.We propose option 1-a is also to consider another way to reduce LTE FDD power to achieve higher power on NR TDD side, however, we are kind that we are open to discuss option 2.Compare option 1 with option 2:In Option 1, if UL EN-DC scheduling exceeds the UE capability, the UE fallbacks to PC3, the UL EN-DC scheduling includes LTE UL scheduling and the NR UL scheduling.In Option 2 (the draft CR content in R4-2002101), if my understanding is correct, if UL EN-DC scheduling (including LTE UL and NR UL) exceeds the UE capability, the UE will apply the reducing Tx power “permanently” scheme. But on the cover page of R4-2002101, it is mentioned that “The second item is used as a fall-back when the actual **NR duty cycle** exceeds the indicated capability or when the UE is not providing the capabilties.”, which only consider the NR UL only. We are not sure if the above understanding of the option 2 is right or not.We think that for sure we need to define the UE behavior or we call it as “blind” scheme when no capability is signaled, so here we think we first we can discuss whether a “blind” scheme can also be considered when the scheduling exceeds the reported capability. Then we can further discuss what the “blind” scheme is, and also option 1-a.Sub topic 1-3: We think we can go with the average approach suggested by LGE. |
| XXX | Sub topic 1-1: Sub topic 1-2:….Others: |

### 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#1-1:** **LTE reference configuration** | *Tentative agreements: two fixed LTE reference configurations of the PC2 FDD-TDD EN-DC, DutyLTE1=70% , DutyLTE2=40% are agreed**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic#1-2: UE-Network interaction and Capability signaling** | *Tentative agreements: The following capability set can be considered, corresponding to DutyLTE1 and DutyLTE2.* *maxNRDuty1 ∈ {30%, 40%, 50%, 60%, 70%, 80%, 90%, 100% }* *maxNRDuty2 ∈ {30%, 40%, 50%, 60%, 70%, 80%, 90%, 100% }**Candidate options:**Recommendations for 2nd round:** *The "Full\_duty\_supported" indication needs further discussion.*
* *what "blind" scheme can be applied when no report case needs further discussion..*
* *whether the UE fallbacks to PC3 or a "blind scheme" can be considered when the UL EN-DC scheduling exceeds the UE capability needs further discussion.*
 |
| **Sub-topic#1-3:** **MSD values** | *Tentative agreements: Average of two proposed options i.e. IMD2: 31.9 dB ; IMD4: 18.5dB for DC\_3A\_n78 combination**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)

|  |  |
| --- | --- |
| **Open issue 1** | **Issue on "Full\_duty\_supported" indication** |
| Qualcomm | ”Full duy supported” is defined in R4-2000121 as ” no restriction on uplink scheduling for both LTE and NR bands for applicability of PC2 inter-band EN-DC (FDD+TDD) requirements, i.e. SAR compliance will be fulfilled by UE based mechanisms e.g. P-MPR etc.”. We think this is a good option, especially for those architectures where there is limited coordination in schedulers between eNB/gNB. When “full duty supported” is signalled as the capability, the basestation has complete flexibility to schedule without constraint. We support including this as an option in the signalling capability. |
|  | Company B: |

|  |  |
| --- | --- |
| **Open issue 2** | **Issue on mechanism for "blind" scheme when capability parameters are absent** |
|  | Company A:  |
|  | Company B: |

|  |  |
| --- | --- |
| **Open issue 3** | **Issue on whether PC fallback or following ”blind” scheme when the UL EN-DC scheduling** |
| Qualcomm | We think when the scheduling exceeds the capability, the UE should fallback to PC3. The ”blind” scheme is optimized when the basestation signal a lowered P\_LTE, but this may not have been the case for the UE that needs to fallback. Therefore, the simplest and preferred solution that is consistent with fallback for SA and TDD-TDD is to simply fallback to PC3. |
|  | Company B: |

## 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: Title

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-20xxxxx | Company A | Proposal 1:Observation 1: |

## Open issues summary

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

### Sub-topic 2-1

*Sub-topic description:*

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

**Issue 2-1: TBA**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* 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** |
| XXX | Sub topic 2-1: Sub topic 2-2:….Others: |

### 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”* |