3GPP TSG-RAN WG2 #103 Tdoc R2-18xxxxx

Gothenburg, Sweden, August 20th – 24th 2018

Agenda Item: x.x.x.x

Source: Ericsson

Title: Email discussion report: Power Class and P-max

Document for: Discussion, Decision

# 1 Introduction

In this email discussion RAN2 is supposed to “*reach a common understand of the power class related signalling as required by RAN1 and RAN4 agreements, and to progress the CR*”. The intended outcome is a report and a set of CRs to the next meeting.

The deadline for the discussion is Thursday 2018-08-02.

# 2 Discussion

## 2.1 Background

At the AH1807 meeting, the discussion was based on the following paper:

* [R2-1810384](ftp://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_AHs/2018_07_NR/Docs//R2-1810384.zip) E234/E235 Power Class and P-max Ericsson discussion Rel-15

Several agreements have been reached:

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| => The per-UE power is clarified to be just for FR1 (call it per-UE-FR1)  => Make the change backward compatible. (Changes to INMs may be non-backwards compatible)  => The change to the NR side should go into the SA CR, and the LTE side should go into the EN-DC CR.  => UE capability and INM aspects can be progressed offline |

During the AH meeting we provided corresponding CRs for LTE and NR RRC that reflect the agreements:

* [R2-1810858](ftp://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_AHs/2018_07_NR/Docs/R2-1810858.zip) Power class and P-max, CR to 38.331 Ericsson, RAN2-102-AH Montreal
* [R2-1810934](ftp://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_AHs/2018_07_NR/Docs/R2-1810934.zip) Power class and P-max, CR to 36.331 Ericsson, RAN2-102-AH Montreal

As seen above, RAN2 agreed (based on RAN4’s input) that the per-UE power class should be applicable to serving cells on FR1 only. Furthermore, the existing inter-node signalling for conveying the per-cell-group values p-NR and p-LTE stated also explicitly that it is applicable only for serving cells in FR1. We therefore adjusted also the corresponding Uu signalling by renaming p-NR to p-NR-FR1 and p-LTE to p-LTE-FR1 (change “2” in the 38.331 CR).

## 2.2 Discussion

At the presentation of the above-mentioned CRs questions were raised whether it is really intended by RAN4 to apply the power restrictions only to FR1 or whether they should also apply to FR2. And if the latter, the question was whether separate signalling parameters would be required for FR2 or whether one parameter would apply to all serving cells (irrespective whether FR1 or FR2). To resolve these open issues and to finalize the CRs we would hence appreciate companies views... **preferably after consulting their RAN4 colleagues**.

**Q1) Do the p-Max fields in dedicated signalling (p-NR, p-LTE, p-UE) and in inter-node signalling apply only to serving cells operating on FR1 or also to serving cells operating on FR2?**

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| Company | Comment |
| Sprint | RAN4 only requested p-Max for FR1. From R2-1806639:  P-Max for EN-DC and NR CA is also necessary to limit the total transmission power for some potential use cases such as 10 dBm in a hospital.   * *P-Max for EN-DC and NR CA in FR1 is introduced for some power limited use cases.*   PEMAX (which is what RAN4 calls p-Max) appears in 38.101-1:  PCMAX\_L,f,c ≤ PCMAX,f,c ≤ PCMAX\_H,f,c with  PCMAX\_L,f,c = MIN {PEMAX,c– ∆TC,c, (PPowerClass – ΔPPowerClass) – MAX(MPRc + A-MPRc+ ΔTIB,c + ∆TC,c +∆TRxSRS, P-MPRc) }  PCMAX\_H,f,c = MIN {PEMAX,c, PPowerClass – ΔPPowerClass }  But not in 38.101-2 (FR2 spec):  The configured UE maximum output power PCMAX,f,c for carrier *f* of a serving cell *c* shall be set such that the corresponding measured peak EIRP PUMAX,f,c is within the following bounds  PPowerclass – MPRf,c – P-MPRf,c – T(MPRf,c + P-MPRf,c) ≤ PUMAX,f,c ≤ EIRPmax  while the corresponding measured total radiated power PTMAX,f,c is bounded by  PTMAX,f,c ≤ TRPmax |
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**Q2) If they apply only to FR1, do we need additional parameters for FR2?**

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| Company | Comment |
| Sprint | Maybe, but that shouldn’t hold up the addition of p-Max for FR1 as requested by RAN4. |
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**Q3) Do we need an additional powerClass parameter for FR2 in the UE capability?**

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| Company | Comment |
| Ericsson | **No** - It was concluded in the RAN2 AH meeting that the additional power class value in the band combination works anyway only for 2 UL and that hence a single “powerClass” value per band combination is sufficient. The network derives the allowed split among the Uls from the per-band power class.  Hence, from signalling point of view, it does not matter whether the two ULs are for FR1 and/or FR2. In other words, the one powerClass parameter introduced in the CR should be sufficient for FR2, too. |
| Sprint | **Not at this time, but maybe Yes in the future – I**t is important to note that powerClass for FR1 and for FR2 are completely independent. Power class for FR1 is in dBm (conducted power), while PowerClass for FR2 is in EIRP (radiated power). From 38.101-3:  6.2B.1.5 Inter-band EN-DC including both FR1 and FR2  *< OTA requirements >*  <Editor’s notes: chapter numbers to be updated.>  For inter-band EN-DC of LTE and NR in both FR1 and FR2, the UE shall meet each transmitter power requirement for inter-band EN-DC of LTE and NR in FR1specified in clause 6.2B.1.3 of TS 38.101-3 and for NR in FR2 clause 6.2.1 of TS 38.101-2 independently.  For now, there are no CA or EN-DC band combinations with more than one FR2 band. So, per-band Power Class should be sufficient for FR2 bands. If and when CA or EN-DC combinations are added with more than one FR2 band in the uplink, then a UE capability for FR2 power class per band combination might be needed. |

**Q4) ....?**

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| Company | Comment |
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## 2.3 Draft CRs

The above-mentioned CRs that were briefly discussed at the RAN2-AH meeting are also in the Email discussion folder on the FTP server. We will update them based on input provided here. But other companies are also invited to provide their suggestion there directly by adding RIL-comments (like in the ASN.1 review). Please increment the version number of the file.

# Conclusion

In the previous sections we made the following observations:

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Based on the discussion in the previous sections we propose the following:

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# References

1. Tdoc Number, Title, Source, Meeting, Date
2. Spec number, Title, Source, Version, Date