**3GPP TSG RAN WG1 Meeting #109-e R1-220xxxx**

**e-Meeting, May 9th – 20th, 2022**

**Agenda Item: 5**

**Source: Moderator (Huawei)**

**Title: Draft Summary of email discussion [109-e-AI5-LSs-03] on reply LS to R1-2200873 and R1-2203038**

**Document for: Discussion and Decision**

# Introduction

A RAN5 LS [1] asks RAN1 one question on configuration of p-MaxEUTRA and p-NR-FR1, as copied below.

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| **Overall Description:**RAN5 is working on RF test cases of power transmission for EN-DC configurations with power class 1.5 (29dBm). There are different opinions on whether the IEs p-MaxEUTRA and p-NR-FR1 shall be configured by the network when UE works in EN-DC connectivity mode. According to clause 7.6.1 of TS 38.213, the IEs p-MaxEUTRA and p-NR-FR1 shall be configured to UE so that UE could determine the power transmission behaviour in the SCG, such as scaling down or dropping the transmission.However there is an opinion that those IEs are indicated as optional in TS 36.331 and TS 38.331 and that UE operation for the PC 1.5 UE is specified by the normative text in TS 38.101-3 clauses 6.2B.1.1 and 6.2B.4.1.1. In addition some company believes if IEs p-MaxEUTRA and p-NR-FR1 are absent, value of 26dBm should be assumed and used as the default, although no default value is specified in TS 36.331 and TS 38.331.RAN5 kindly request RAN1, RAN2 and RAN4 to clarify the power configuration scheme and associated signalling for EN-DC mode.**Actions:****To:** RAN1:**ACTION:** RAN5 kindly request RAN1 feedback on whether the RAN1 specifications require that the IEs p-MaxEUTRA and p-NR-FR1 are always configured by the network when UE works in EN-DC connectivity mode.**To:** RAN2:**ACTION:** RAN5 kindly request RAN2 feedback on whether the RAN2 specifications require that the IEs p-MaxEUTRA and p-NR-FR1 are always configured by the network when UE works in EN-DC connectivity mode and also consider updating the core specification to clarify the same.**To:** RAN4:**ACTION:** RAN5 kindly request RAN4 feedback on whether the RAN4 specifications require that the IEs p-MaxEUTRA and p-NR-FR1 are always configured by the network when UE works in EN-DC connectivity mode for UEs of power class 1.5 and other power classes. |

It has been replied by RAN1 in [2] and by RAN4 in [3], as copied below,

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| **1. Overall Description:**RAN1 thanks RAN5 for the LS on configuration of p-MaxEUTRA and p-NR-FR1. RAN1 answers are as follows.**Q1:** Whether the RAN1 specifications require that the IEs p-MaxEUTRA and p-NR-FR1 are always configured by the network when UE works in EN-DC connectivity mode.**Answer**: there is no specified UE behavior in existing RAN1 specifications for the case where FR1-FR1 EN-DC is configured but p-MaxEUTRA or p-NR-FR1 is not configured. RAN1 may discuss potential action, if any, after RAN2/4 responses are received.**2. Actions:****To:** RAN5**ACTION:** RAN1 respectfully asks RAN5 to take the above answer into account in their future work. |

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| 1 Overall descriptionRAN4 thanks RAN5 LS on configuration of p-MaxEUTRA and p-NR-FR1. RAN4 has discussed it and made the following response.For UEs supporting dynamic power sharing, RAN4 understanding is there is no specified UE behavior when the network does not configure p-MaxEUTRA or p-NR-FR1. It is up to RAN1 to confirm if this is a valid configuration. RAN4 will further discuss whether ‘infinity’ could be used as default value if these two parameters are not configured, and whether and how to capture this in the specification.For UEs not supporting dynamic power sharing, RAN4 understanding is the UE’s transmitted power is not fully specified by RAN4. It is up to RAN1 to decide if p-MaxEUTRA or p-NR-FR1 should be configured by the network or if default values are needed.2 Actions**To TSG RAN WG5** **ACTION:** RAN4 respectfully asks RAN5 to take into account the above information in the conformance testing work. |

In [4], a reply LS is proposed as,

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| …From RAN1 specification perspective, if a UE is configured with a MCG using E-UTRA radio access and with a SCG using NR radio access, the UE is configured a maximum power  for transmissions on the MCG by p-MaxEUTRA and a maximum power  for transmissions in FR1 on the SCG by p-NR-FR1. No new RAN1 specification impact with respect to p-MaxEUTRA and p-NR-FR1 is expected.**2. Actions:****To:** RAN4 and RAN5**ACTION:** RAN1 respectfully asks RAN4 and RAN5 to take the above answer into account. |

In [5], a reply LS is proposed as

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| **Proposal**: Respond to RAN5, RAN4 and RAN2 that 1. The *p-MaxEUTRA* and *p-NR-FR1* parameters can be used to cap a cell groups’ maximum Tx powers, when configured, this can be either due to the need
	1. to semi-statically split the total Tx power budget between the cell groups (some power sharing modes), or
	2. to limit individual cell groups Tx power due emission caps related to the network’s operations
2. If neither of the two reasons exist for capping one or the other (or both) cell group’s Tx power, there is no need to configure the two parameters either.
3. It is up to RAN4 to discuss the need for default setting for the parametes when not configured
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In [6], a reply LS is proposed as,

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| …To conclude the discussions, RAN1 can confirm the following:* *p-MaxEUTRA* and *p-NR-FR1* are not mandatory parameters
	+ RAN1’s understanding is that maximum transmission power of each cell-group is defined in TS 38.101-3, and *p-MaxEUTRA* and *p-NR-FR1* are the parameters that may cap the maximum transmission power for the corresponding cell-group, if configured
	+ The default value when *p-MaxEUTRA* or *p-NR-FR1* is not configured is up to RAN4

2 Actions**To 3GPP RAN5, RAN4****ACTION:** To take into account the RAN1’s feedback on configuration of *p-MaxEUTRA* and *p-NR-FR1* for EN-DC operation for the specification work. |

In TS 38.213, the relevant text is,

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| 7.6.1 EN-DCIf a UE is configured with a MCG using E-UTRA radio access and with a SCG using NR radio access, the UE is configured a maximum power  for transmissions on the MCG by *p-MaxEUTRA* and a maximum power  for transmissions in FR1 on the SCG by *p-NR-FR1*. The UE determines a transmission power for the MCG as described in [13, TS 36.213] using  as the maximum transmission power. The UE determines transmission power for the SCG in FR1 as described Clauses 7.1 through 7.5 using  as the maximum transmission power. The UE determines transmission power for the SCG in FR2 as described Clauses 7.1 through 7.5.… |

Furthermore, according to the excerpt of TS 38.331 in Appendix, **there is no default value specified for *p-NR-FR1* if the parameter is absent. Neither is for *p-MaxEUTRA*.**

As per chair’s guidance, a reply LS is discussed and is expected to complete by May 13.

[109-e-AI5-LSs-03] Email discussion for incoming LS on configuration of p-MaxEUTRA and p-NR-FR1 ([R1-2203038](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_109-e%5CDocs%5CR1-2203038.zip)) by May 13 – TBD (Huawei)

# Phase I of Discussions

According to reply LS [2] and [3], an observation is

***Observation****:*

*In the case that FR1-FR1 EN-DC is configured but p-MaxEUTRA or p-NR-FR1 is not configured,*

* *For a UE capable of dynamic power sharing, no UE behavior has been specified yet in either RAN1 or RAN4 now.*
* *For a UE incapable of dynamic power sharing, no UE behavior has been specified in RAN1 while the UE’s transmitted power is not fully specified by RAN4.*

According to the submitted tdoc [4-6], there seems only two options to move forward

* Opt1: No RAN1 specification change and no default value is required to be specified [4]
* Opt2: No RAN1 specification change and default value is required to be specified in RAN4 [5][6]

Both Options suggest no RAN1 specification change on this issue.

## Any RAN1 specification impact or reply LS with respect to p-MaxEUTRA and p-NR-FR1?

### Question 1-1: For the case where p-MaxEUTRA or p-NR-FR1 is not configured for EN-DC, whether it is agreeable that no new RAN1 specification impact with respect to p-MaxEUTRA and p-NR-FR1 is expected?

Companies’ views are very welcome.

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| *Company* | *View* |
| Intel | Whether changes are included in RAN1 specification, or RAN2 or RAN4 specification, in the end there is going to be specification impact.Therefore, in which specification the changes are made is not really important. Changes to RAN2 or RAN4 are equally as impactful as changes to RAN1 specification.So, we don’t have a strong view on no RAN1 spec change, with the understanding something will be updated in 3GPP specification. |
| Qualcomm | Perhaps, our step 0 (before answering question 1-1) is to make a common understanding on whether or not *p-MaxEUTRA* and *p-NR-FR1* are mandatory, from technical point of view. We think they are not mandatory, since these are just parameters that can cap the max power per cell-group if/when configured, as specified in RAN4 spec as follows (copied from TS38.101-3 6.2B.4.1.3 for inter-band EN-DC).

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| The configured maximum output power PCMAX\_E-UTRA,*c* (*p*) in sub-frame *p* for the configured E-UTRA uplink carrier(s) shall be set within the bounds:PCMAX\_L\_E-UTRA,*c* (*p*) ≤ PCMAX\_E-UTRA,*c* (*p*) ≤ PCMAX H \_E-UTRA,*c* (*p*)where PCMAX\_L\_E-UTRA,*c* andPCMAX H \_E-UTRA,*c* are the limits for a serving cell *c* as specified in TS 36.101 [4] clause 6.2.5 modified by PLTE as follows:PCMAX\_L\_E-UTRA,*c* = MIN { PEMAX, EN-DC , (PPowerClass, EN-DC – ΔPPowerClass,EN-DC ), MIN(PEMAX,*c*, PLTE) – tC\_ E-UTRA, *c*, (PPowerClass,E-UTRA – ΔPPowerClass,E-UTRA) – MAX(MPR*c* + A-MPR*c* + ΔTIB,c + tC\_ E-UTRA, *c* + TProSe, P-MPR*c*)}PCMAX H \_E-UTRA,*c* = MIN {PEMAX,*c*, PEMAX, EN-DC , (PPowerClass, EN-DC – ΔPPowerClass,EN-DC ), PLTE, PPowerClass,E-UTRA – ΔPPowerClass,E-UTRA}[…]The configured maximum output power PCMAX,f,*c,NR* (*q*) in physical-channel *q* for the configured NR carrier shall be set within the bounds:PCMAX\_L,f,*c,NR* (*q*) ≤ PCMAX,f,*c,NR* (*q*) ≤ PCMAX\_H,f,*c,NR* (*q*)where PCMAX\_L,f,*c,NR* andPCMAX\_H,f,*c,NR* are the limits for a serving cell c as specified in clause 6.2.4 of TS 38.101-1 [2] modified as follows:PCMAX\_L,f,*c,NR* = MIN { PEMAX, EN-DC , (PPowerClass, EN-DC – ΔPPowerClass,EN-DC ), MIN(PEMAX,c , PNR ) - TC\_NR, *c*, (PPowerClass,NR – ΔPPowerClass,NR) – MAX(MAX(MPRc, A-MPRc)+ ΔTIB,c + TC\_NR, *c* + ∆TRxSRS, P-MPRc) }PCMAX\_H,f,*c,NR* = MIN {PEMAX,c, PEMAX, EN-DC , (PPowerClass, EN-DC – ΔPPowerClass,EN-DC ), PNR , PPowerClass,NR – ΔPPowerClass,NR } |

Once it is agreeable that these parameters are not mandatory but just components of max power for MCG and SCG, then the next step is to conclude whether RAN1 spec change is necessary. We tend to agree with Intel – as long as the above is clarified, RAN1 spec description is not a significant matter. |
| ZTE | The most straightforward way to conclude this issue is to always configure p-MaxEUTRA and p-NR-FR1 considering Rel-15 has been finished years ago. If companies don’t want to change RAN1 specs, we can leave this issue totally to RAN4. |
| vivo | If the UE does not support dynamic power sharing, there is no need for the NW to configure *p-MaxEUTRA* and *p-NR-FR1*. Therefore, the two parameters are optionally configured.If the UE supports dynamic power sharing, and the NW wants the UE to work in EN-DC mode, we are not sure why the network does not configure the two parameters? In our understanding, the current RAN1 specification is clearly, we do not see the need to change it.In addition, it is not a valid configuration for the case of the UE supports dynamic power sharing, and the NW wants the UE to work in EN-DC mode but does not configure *p-MaxEUTRA* and *p-NR-FR1*. |
| CATT | If *p-MaxEUTRA* and *p-NR-FR1* are not configured, the default assumption is that UE would use its max power of the respective carrier for the power control. The power scaling would be performed when the total power exceeds the power limit of the UE in EN-DC. Thus, we don’t see any impact to current RAN1 spec.  |
| Samsung | Agree to Qualcom’s view. Since these parameters bring additional restriction on peak power, when configured, configuration of theses parameters are not mandatory.  |
| NTT DOCOMO | We tend to agree with Intel’s comment that we don’t have strong view on no RAN1 spec change as there would be spec change in somewhere to solve this issue. |
| Nokia, NSB | Agree with Qualcomm and Samsung that the parameters are useful when there is a need to provider an additional power cap. When this is not needed, then the parameter config is not necessary either and they should be optional. |

### Question 1-2: For the concerned case, which the alternative below is preferred with respect to potential default values?

**Alt 1:** Default values can be introduced

**Alt 2:** Default values are not introduced. (No UE behavior will be specified for the concerned case.)

**Alt 3:** No need to discuss any default value in RAN1. Whether default values can be introduced or not is being discussed in RAN4 and RAN2.

**Alt 4:** Those two RRC parameters are mandatory configuration.

Based on [5] and [6], Alt 4 seems not agreeable at this stage. **For any company preferring Alt 4, it is encouraged to also feedback your choice with your second preference, if any.**

Companies’ views are very welcome.

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| *Company* | *View* |
| Intel | Either Alt 1 or 3 is ok. |
| Qualcomm | Alt.3. RAN1 should inform RAN4 that these parameters are not mandatory and ask to progress on “*RAN4 will further discuss whether ‘infinity’ could be used as default value if these two parameters are not configured, and whether and how to capture this in the specification*”. |
| ZTE | We are ok with Alt.3 or Alt.4. |
| vivo | Support Alt2. |
| CATT | Alt 1: The Pcmax value is the default value used for power control if there is no additional configured *p-MaxEUTRA* and *p-NR-FR1* values.  |
| Samsung | Alt 3. |
| NTT DOCOMO | Our original preference was Alt.4, but we are ok with Alt.2 or 3. |
| Nokia | Alt.3 |

## Draft Text for reply LS

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| **1. Overall Description:**RAN1 thanks RAN4 and RAN5 for the LS on configuration of p-MaxEUTRA and p-NR-FR1. Regarding the question raised in the LS, RAN1 provides further answer as follows:**Answer**: TBD**2. Actions:****To:** RAN4 and RAN5**ACTION:** RAN1 respectfully asks RAN4 and RAN5 to take the above answer into account. |

Comments are welcome only after more progress in Section 2.1.

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| No comment needed yet |  |
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## Other Issues

Issues or comments that do not fit in any of the previous sections of this document can be provided in this section.

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# Phase II of Discussions

TBD

# Conclusions

TBD

# References

1. R1-2200873 LS on configuration of p-MaxEUTRA and p-NR-FR1, RAN5, Huawei
2. R1-2202769 Reply LS on configuration of p-MaxEUTRA and p-NR-FR1, RAN1, Huawei
3. R1-2203038 Reply LS on configuration of p-MaxEUTRA and p-NR-FR1, RAN4, Huawei
4. R1-2203098 Draft reply LS on configuration of p-MaxEUTRA and p-NR-FR1 Huawei, HiSilicon
5. R1-2204880 On configuration of p-MaxEUTRA and p-NR-FR1 Nokia, Nokia Shanghai Bell
6. R1-2204967 Draft reply LS on configuration of p-MaxEUTRA and p-NR-FR1 Qualcomm Incorporated

# Appendix:

**RRC parameter p-NR-FR1 in TS 38.331:** No default value is specified for the case where the parameter is absent.

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| PhysicalCellGroupConfig ::= SEQUENCE { harq-ACK-SpatialBundlingPUCCH ENUMERATED {true} OPTIONAL, -- Need S harq-ACK-SpatialBundlingPUSCH ENUMERATED {true} OPTIONAL, -- Need S p-NR-FR1 P-Max OPTIONAL, -- Need R pdsch-HARQ-ACK-Codebook ENUMERATED {semiStatic, dynamic}, tpc-SRS-RNTI RNTI-Value OPTIONAL, -- Need R tpc-PUCCH-RNTI RNTI-Value OPTIONAL, -- Need R tpc-PUSCH-RNTI RNTI-Value OPTIONAL, -- Need R sp-CSI-RNTI RNTI-Value OPTIONAL, -- Need R cs-RNTI SetupRelease { RNTI-Value } OPTIONAL, -- Need M ..., [[ mcs-C-RNTI RNTI-Value OPTIONAL, -- Need R p-UE-FR1 P-Max OPTIONAL -- Cond MCG-Only ]], [[ xScale ENUMERATED {dB0, dB6, spare2, spare1} OPTIONAL -- Cond SCG-Only ]], [[ pdcch-BlindDetection SetupRelease { PDCCH-BlindDetection } OPTIONAL -- Need M ]]} |

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| ***p-NR-FR1***The maximum total transmit power to be used by the UE in this NR cell group across all serving cells in frequency range 1 (FR1). The maximum transmit power that the UE may use may be additionally limited by *p-Max* (configured in *FrequencyInfoUL*) and by *p-UE-FR1* (configured total for all serving cells operating on FR1). |
| ***p-UE-FR1***The maximum total transmit power to be used by the UE across all serving cells in frequency range 1 (FR1) across all cell groups. The maximum transmit power that the UE may use may be additionally limited by *p-Max* (configured in *FrequencyInfoUL*) and by *p-NR-FR1* (configured for the cell group). |

**RRC parameter p-maxEUTRA in TS 38.331:** No default value is specified for the case where the parameter is absent.

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| ConfigRestrictInfoSCG ::= SEQUENCE { allowedBC-ListMRDC BandCombinationInfoList OPTIONAL, powerCoordination-FR1 SEQUENCE { p-maxNR-FR1 P-Max OPTIONAL, p-maxEUTRA P-Max OPTIONAL, p-maxUE-FR1 P-Max OPTIONAL } OPTIONAL, servCellIndexRangeSCG SEQUENCE { lowBound ServCellIndex, upBound ServCellIndex } OPTIONAL, -- Cond SN-AddMod maxMeasFreqsSCG INTEGER(1..maxMeasFreqsMN) OPTIONAL, dummy INTEGER(1..maxMeasIdentitiesMN) OPTIONAL, ..., [[ selectedBandEntriesMNList SEQUENCE (SIZE (1..maxBandComb)) OF SelectedBandEntriesMN OPTIONAL, pdcch-BlindDetectionSCG INTEGER (1..15) OPTIONAL, maxNumberROHC-ContextSessionsSN INTEGER(0.. 16384) OPTIONAL ]], [[ maxIntraFreqMeasIdentitiesSCG INTEGER(1..maxMeasIdentitiesMN) OPTIONAL, maxInterFreqMeasIdentitiesSCG INTEGER(1..maxMeasIdentitiesMN) OPTIONAL ]]} |

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| ***p-maxEUTRA***Indicates the maximum total transmit power to be used by the UE in the E-UTRA cell group (see TS 36.104 [33]). This field is used in (NG)EN-DC and NE-DC. |
| ***p-maxNR-FR1***Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 1 (FR1) (see TS 38.104 [12]). The field is used in (NG)EN-DC and NE-DC. |
| ***p-maxUE-FR1***Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 1 (FR1). |