**3GPP TSG RAN WG1 Meeting #108-e R1-22xxxxx**

**e-Meeting, February 21st - March 3rd, 2022**

**Agenda Item: 5**

**Source: Moderator (Huawei)**

**Title: [Draft] Summary of email discussion [108-e-AI5-LSs-01] on reply LS to R1-2200873**

**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. |

As per chair’s guidance, a reply LS is discussed and is expected to complete by February 25.

 [108-e-AI5-LSs-01] Email discussion for incoming LS on configuration of p-MaxEUTRA and p-NR-FR1 (R1-2200873) by February 25 – Frank (Huawei)

# Phase I of Discussions

## Q1: whether the RAN1 specifications require that the IEs p-MaxEUTRA and p-NR-FR1 are always configured by the network when the UE is in EN-DC connectivity mode.

Based on the contribution papers [2-8] this meeting, companies have different views on the answer to the question.

In [2-5], 5 companies (OPPO, ZTE, vivo, Huawei, HiSilicon) think that the IEs *p-MaxEUTRA* and *p-NR-FR1* should always be configured by the network when UE works in EN-DC connectivity mode. Without these parameters, the power control for EN-DC is not specified at all.

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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. |

In [6-7], 2 companies (Nokia, Samsung) think that IEs *p-MaxEUTRA* and *p-NR-FR1* do not have to be always configured.

In [6], Nokia thinks that there is no functional need to configure the p-MaxEUTRA and p-NR-FR1 when dynamic power sharing or TDM sharing is used. The p-MaxEUTRA and p-NR-FR1 need to be configured when LTE and NR transmissions can take place at the same time and semi-static power sharing is used, e.g. because the UE doesn’t support dynamic power sharing, or if there is some other reason why the network wants to cap the max Tx power of each RAT individually.

In [7], Samsung thinks that the RAN1 agreement below does not request p-MaxEUTRA or p-NR-FR1 to be always configured and UE supports EN-DC operation without configured with either or both of p-MaxEUTRA or p-NR-FR1. The signaling details of p-MaxEUTRA or p-NR-FR1 is up to RAN2, RAN4. If either or both of p-MaxEUTRA and p-NR-FR1 are not configured, Dynamic power sharing or TDM-pattern based power sharing would not be supported.

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| RAN1#90Agreements:* At least for LTE-NR NSA operation
	+ Maximum allowed power values for LTE (P\_LTE) and NR (P\_NR) are set separately
		- i.e., when UE is configured for NR, P\_LTE can be configured up to P\_cmax and  P\_NR can be configured up to P\_cmax.
		- e.g. P\_LTE + P\_NR > P\_cmax or P\_LTE + P\_NR = P\_cmax
	+ Signaling details for P\_LTE, P\_NR are left to RAN2, RAN4.
	+ Note: ‘P\_cmax’ is a limit that is similar to ‘The configured maximum UE output power’ that was specified for LTE.
	+ Note: The network will still have flexibility to prioritize or reserve certain NR transmission power depending on network implementation
	+ All UEs are mandated to handle P\_LTE + P\_NR = P\_cmax while handling of P\_LTE + P\_NR > P\_cmax depends on UE capability
	+ At least, when DL/UL LTE sTTI/reduced UE processing time based operation is not configured for the UE, if total transmit power exceeds P\_cmax when there is simultaneous NR and LTE UL tx,
		- For NR, UE scales down/drops NR transmission and NR power scaling details are left to UE implementation (note: it is not intended to have RAN4 test from RAN1 perspective)
			* If there are two or more UL carriers, the power scaling or tx dropping can be performed for each of the UL carriers separately or jointly up to UE implementation
		- For LTE, no change in power control procedure
	+ FFS the case when DL/UL LTE sTTI/reduced UE processing time based operation is configured for the UE
	+ The following is FFS
		- The case when P\_NR is configured such that P\_NR < P\_cmax, and UE can use power up to P\_cmax in NR when it knows that there will be no UL transmission in LTE by semi-static configuration (e.g., measurement gap, DL/UL configuration)

Send an LS to RAN2 and RAN4 to be drafted in [R1-1715237](file:///C%3A%5CUsers%5Cdan77.park%5CAppData%5CRoaming%5CMicrosoft%5CDocs%5CR1-1715237.zip) |

In [8], Qualcomm think that RAN1 does not see an issue on this and expects that RAN4 will discuss whether and how to determine the maximum power for transmissions on MCG and/or for transmissions on SCG when *p-MaxEUTRA* and/or *p-NR-FR1* is/are not provided for EN-DC.

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*.**

### Question 1-1: For the case where p-MaxEUTRA or p-NR-FR1 is not configured nor assigned with any default value, whether any UE behavior of uplink power control for FR1-FR1 EN-DC has been specified in current Rel-15 RAN1 specification? If yes, please elaborate a bit its source.

Companies’ views are very welcome.

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### Question 1-2: whether the current RAN1 specifications require that the IEs p-MaxEUTRA and p-NR-FR1 are always configured by the network when the UE is in FR1-FR1 EN-DC connectivity mode? If no, please elaborate a bit your interpretation on the excerpt of TS 38.213 above.

Companies’ views are very welcome.

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## Draft Text for reply LS

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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**: TBD**2. Actions:****To:** RAN5**ACTION:** RAN1 respectfully asks RAN5 to take the above answer into account in their future work. |

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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# Conclusions

TBD

# References

1. R1-2200873 LS on configuration of p-MaxEUTRA and p-NR-FR1, RAN5
2. R1-2201233 Discussion on LS on configuration of p-MaxEUTRA and p-NR-FR1 OPPO
3. R1-2201150 [Draft] Reply LS on configuration of p-MaxEUTRA and p-NR-FR1 ZTE
4. R1-2201045 [DRAFT] Reply LS on configuration of p-MaxEUTRA and p-NR-FR1 vivo
5. R1-2201213 Draft reply LS on configuration of p-MaxEUTRA and p-NR-FR1 Huawei, HiSilicon
6. R1-2202269 On configuration of p-MaxEUTRA and p-NR-FR1 Nokia, Nokia Shanghai Bell
7. R1-2201984 Discussion for rely LS on configuration of p-MaxEUTRA and p-NR-FR1 Samsung
8. R1-2202102 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). |