**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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| *Company* | *View* |
| OPPO | The UE behavior of uplink power control for FR1-FR1 EN-DC has NOT been specified in current Rel-15 RAN1 specification, when p-MaxEUTRA or p-NR-FR1 is not configured nor assigned with any default value. |
| ZTE | From the current RAN1 specification itself, it seems that no UE behavior of uplink power control for FR1-FR1 EN-DC has been specified for the case where p-MaxEUTRA or p-NR-FR1 is not configured nor assigned with any default value.However, if RAN4 sees the issue of this situation and requires RAN1 to update the RAN1 spec to include the UE behavior for the case where p-MaxEUTRA or p-NR-FR1 is not configured, RAN1 can also update its spec later. |
| vivo | From current specification in RAN2 and RAN4, IEs p-MaxEUTRA and p-NR-FR1 can be optionally configured. However, from current specification in RAN1, the UE behavior was unspecified in the absence of IEs p-MaxEUTRA or p-NR-FR1 when it works in EN-DC connectivity mode. |
| Nokia, NSB | It is clear that the LTE and NR uplink PC specification works without the presence of p-MaxEUTRA and p-NR-FR1 for single-RAT configuration (LTE-only as well as NR-only config). There is no functional need for requiring these IEs to be provided with EN-DC configuration either, if there is no need to deviate from the LTE-only UL PC specification for the LTE, and NR-only UL PC specification for the NR. According to 38.213 subclause 7.6.1 the p-NR-FR1 and p-MaxEUTRA take the place of PNR and PLTE in subclauses 7.1-7.5, but nor any more in subclause 7.6, and thus the only subclause that is specific to EN-DC is not considering these parameters as inputs when determining if dynamic power sharing is to be used.Only if the UE does not support dynamic power sharing and is not configured to TDM the two RATs is there a need to configure a semi-static power sharing for the two RATs and configure the two parameters.The formulation in TS38.213 subclause 7.6.1 is somewhat unfortunate, and could be updated. |
| Qualcomm | RAN4 specifies how the UE determines max output power. For this, *p-MaxEUTRA* and *p-NR-FR1* are just one component of the equations that are configured in specific scenarios where the max output power must be limited. However, RAN1 spec is written such that they are configured for any EN-DC operations in FR1. |
| NTT DOCOMO | In current RAN1 specification, UE behavior of uplink power control for FR1-FR1 EN-DC has been specified only for the case where p-MaxEUTRA and p-NR-FR1 are configured, and no UE behavior has been specified for the case without p-MaxEUTRA and p-NR-FR1 for FR1-FR1 EN-DC. |
| Samsung | Current RAN 1 specification does not have clarification on UE behavior without *p-MaxEUTRA* or *p-NR-FR1*. So it would be read that UE is not expected to support any of introduced power sharing scheme in TS 38.213, but is expected to perform separated UL PC for LTE UL and NR UL. |
| CATT | If p-MaxEUTRA or p-NR-FR1 are not present in RRC, UE uses the maximum power for LTE in TS36.101 and for NR in TS38.101. Current power control behavior in 38.213 is clear.  |
| Ericsson1 | Uplink power control for EN-DC is specified in sub clause 7.6.1 of 38.213 including any sub clauses referenced therein. There is no additional RAN1 specification. |

### 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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| *Company* | *View* |
| OPPO | Yes. Even when dynamic power sharing or TDM sharing is used, the spec is described based on and , which can only be derived from the Ies p-MaxEUTRA and p-NR-FR1. |
| ZTE | From the current RAN1 specification itself, Ies p-MaxEUTRA and p-NR-FR1 are always required by the UE when the UE is in FR1-FR1 EN-DC connectivity mode.We assume that RAN4 will determine whether to support the case where p-MaxEUTRA or p-NR-FR1 is not configured. RAN1 can also update the spec later if RAN4 requests RAN1 to do so. |
| Vivo | Yes. |
| Nokia, NSB | The way the beginning of subclause 7.6.1 of TS38.213 is formlulated can be read so that the two Ies would need to be present always if the UE is in EN-DC. However, this may not reflect the reality in the field, and as said in answer to 2.1.1, 38.213 subclauses 7.1-7.5 are designed to work without the two Ies, and 7.6 is not considering the two Ies, so by definition 38.213 works without the two in EN-DC as well. |
| Qualcomm | Yes |
| NTT DOCOMO | Yes |
| Samsung | No. As explained by our response above, without those two IEs, current RAN1 specification would clarify that dynamic power sharing or TDM pattern based operation is not supported. |
| CATT  | No. It is clearly stated in 38.331 as follows, p-MaxMaximum transmit power allowed in this serving cell. The maximum transmit power that the UE may use on this serving cell may be additionally limited by p-NR-FR1 (configured for the cell group) and by p-UE-FR1 (configured total for all serving cells operating on FR1). If absent, the UE applies the maximum power according to TS 38.101-1 [15] in case of an FR1 cell or TS 38.101-2 [39] in case of an FR2 cell. In this release of the specification, if p-Max is present on a carrier frequency in FR2, the UE shall ignore the field and applies the maximum power according to TS 38.101-2 [39]. Value in dBm. This field is ignored by IAB-MT, the IAB-MT applies output power and emissions requirements, as specified in TS 38.174 [63]. |
| Ericsson1 | If a default configuration to apply when the fields are not present were to be included by RAN2/4, current text in 38.213 7.6.1 could still cover that case without need for additional update. |

## 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). |