**3GPP TSG-RAN WG2 Meeting #109 electronic *R2-200xxxx***

**Elbonia, 24th February – 6th March 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **36.321** | **CR** | **1461** | **rev** | **2** | **Current version:** | **15.8.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Introduction of Power headroom reporting for Additional SRS | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_DL\_MIMO\_EE-Core | | | | |  | ***Date:*** | | | 2020-02-13 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Power headroom reporting for additional SRS is introduced. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | This CR implements power headroom reporting for additional SRS for the following cells   * SpCell. * SCells without PUSCH. * SCells with PUSCH. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Power headroom reporting for additional SRS is not supported. | | | | | | | | |
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| ***Clauses affected:*** | | 6.1.3.6a, 6.1.3.6b | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

**First change**

#### 6.1.3.6a Extended Power Headroom Report MAC Control Elements

For *extendedPHR*, the Extended Power Headroom Report (PHR) MAC control element is identified by a MAC PDU subheader with LCID as specified in table 6.2.1-2. It has a variable size and is defined in Figure 6.1.3.6a-2. When Type 2 PH is reported, the octet containing the Type 2 PH field is included first after the octet indicating the presence of PH per SCell and followed by an octet containing the associated PCMAX,c field (if reported). Then follows an octet with the Type 1 PH field and an octet with the associated PCMAX,c field (if reported), for the PCell. If *addSRS-Config-r16* is configured for the PCell then follows an octet with the Type 3 PH field and an octet with the associated PCMAX,c field (if reported), for the PCell. And then follows in ascending order based on the *ServCellIndex*, as specified in TS 36.331 [8] an octet with the Type x PH field, wherein x is equal to 3 when the *ul-Configuration-r14* or *addSRS-Config-r16* is configured for this SCell, x is equal to 1 otherwise, and an octet with the associated PCMAX,c field (if reported), for each SCell indicated in the bitmap.

For *extendedPHR2*, the Extended Power Headroom Report (PHR) MAC control elements are identified by a MAC PDU subheader with LCID as specified in table 6.2.1-2. They have variable sizes and are defined in Figure 6.1.3.6a1-3, Figure 6.1.3.6a2-4 and Figure 6.1.3.6a3-5. One octet with C fields is used for indicating the presence of PH per SCell when the highest *SCellIndex* of SCell with configured uplink is less than 8, otherwise four octets are used. When Type 2 PH is reported for the PCell, the octet containing the Type 2 PH field is included first after the octet(s) indicating the presence of PH per SCell and followed by an octet containing the associated PCMAX,c field (if reported). Then follows the Type 2 PH field for the PUCCH SCell (if PUCCH on SCell is configured and Type 2 PH is reported for the PUCCH SCell), followed by an octet containing the associated PCMAX,c field (if reported). Then follows an octet with the Type 1 PH field and an octet with the associated PCMAX,c field (if reported), for the PCell. If *addSRS-Config-r16* is configured for the PCell then follows an octet with the Type 3 PH field and an octet with the associated PCMAX,c field (if reported), for the PCell. Then follows in ascending order based on the *ServCellIndex*, as specified in TS 36.331 [8] an octet with the Type x PH field, wherein, x is equal to 3 when the *ul-Configuration-r14* or *addSRS-Config-r16* is configured for this SCell, x is equal to 1 otherwise, and an octet with the associated PCMAX,c field (if reported), for each SCell indicated in the bitmap.

The Extended PHR MAC Control Elements are defined as follows:

- Ci: this field indicates the presence of a PH field for the SCell with *SCellIndex* i as specified in TS 36.331 [8]. The Ci field set to "1" indicates that a PH field for the SCell with *SCellIndex* i is reported. The Ci field set to "0" indicates that a PH field for the SCell with *SCellIndex* i is not reported;

- R: reserved bit, set to "0";

- V: this field indicates if the PH value is based on a real transmission or a reference format. For Type 1 PH, V=0 indicates real transmission on PUSCH and V=1 indicates that a PUSCH reference format is used. For Type 2 PH, V=0 indicates real transmission on PUCCH/SPUCCH and V=1 indicates that a PUCCH/SPUCCH reference format is used. For Type 3 PH, V=0 indicates real transmission on SRS and V=1 indicates that an SRS reference format is used. Furthermore, for Type 1, Type 2 and Type 3 PH, V=0 indicates the presence of the octet containing the associated PCMAX,c field, and V=1 indicates that the octet containing the associated PCMAX,c field is omitted;

- Power Headroom (PH): this field indicates the power headroom level. The length of the field is 6 bits. The reported PH and the corresponding power headroom levels are shown in Table 6.1.3.6-1 (the corresponding measured values in dB can be found in clause 9.1.8.4 of TS 36.133 [9]);

- P: this field indicates whether the MAC entity applies power backoff due to power management (as allowed by P-MPRc, see TS 36.101 [10]). The MAC entity shall set P=1 if the corresponding PCMAX,c field would have had a different value if no power backoff due to power management had been applied;

- PCMAX,c: if present, this field indicates the PCMAX,c or , as specified in TS 36.213 [2] used for calculation of the preceding PH field. The reported PCMAX,c and the corresponding nominal UE transmit power levels are shown in Table 6.1.3.6a-1 (the corresponding measured values in dBm can be found in clause 9.6.1 of TS 36.133 [9]).

Figure 6.1.3.6a-1: Void



Figure 6.1.3.6a-2: Extended PHR MAC Control Element



Figure 6.1.3.6a1-3: Extended PHR MAC Control Element supporting PUCCH on SCell



Figure 6.1.3.6a2-4: Extended PHR MAC Control Element supporting 32 serving cells with configured uplink



Figure 6.1.3.6a3-5: Extended PHR MAC Control Element supporting 32 serving cells with configured uplink and PUCCH on SCell

Table 6.1.3.6a-1: Nominal UE transmit power level for Extended PHR and for Dual Connectivity PHR

|  |  |
| --- | --- |
| PCMAX,c | Nominal UE transmit power level |
| 0 | PCMAX\_C\_00 |
| 1 | PCMAX\_C\_01 |
| 2 | PCMAX\_C\_02 |
| … | … |
| 61 | PCMAX\_C\_61 |
| 62 | PCMAX\_C\_62 |
| 63 | PCMAX\_C\_63 |

**Second change**

#### 6.1.3.6b Dual Connectivity Power Headroom Report MAC Control Element

The Dual Connectivity Power Headroom Report (PHR) MAC control element is identified by a MAC PDU subheader with LCID as specified in table 6.2.1-2. It has a variable size and is defined in Figure 6.1.3.6b-1 and Figure 6.1.3.6b-2. One octet with Ci fields is used for indicating the presence of PH per serving cell other than PCell, when the highest *SCellIndex* of SCell with configured uplink is less than 8, otherwise four octets are used. In case EN-DC, NE-DC or NGEN-DC is configured, four octets with Ci fields is always used. When Type 2 PH is reported for the PCell, the octet containing the Type 2 PH field is included first after the octet(s) indicating the presence of PH per cell (PSCell and all SCells of all MAC entities) and followed by an octet containing the associated PCMAX,c field (if reported). Then after that, when Type 2 PH is reported for the PSCell, the octet containing the Type 2 PH field is included followed by an octet containing the associated PCMAX,c field (if reported). Then follows an octet with the Type 1 PH field and an octet with the associated PCMAX,c field (if reported), for the PCell. If *addSRS-Config-r16* is configured for the PCell then follows an octet with the Type 3 PH field and an octet with the associated PCMAX,c field (if reported), for the PCell. And then follows in ascending order based on the *ServCellIndex*, as specified in TS 36.331 [8], an octet with the Type x PH field, wherein x is either 1 or 3 according to TS 36.213 [2] and TS 38.213 [18] and an octet with the associated PCMAX,c field (if reported), for all serving cells of all MAC entities indicated in the bitmap. In case of EN-DC and NGEN-DC, for a band combination in which the UE does not support dynamic power sharing, the UE may omit the octets containing Power Headroom field and PCMAX,c field for serving cells in the other MAC entity. In case of NE-DC, for a band combination in which the UE does not support dynamic power sharing, the UE may omit the octets containing Power Headroom field and PCMAX,f,c field for serving cells in the other MAC entity except for the PCell in the other MAC entity and the reported values of Power Headroom and PCMAX,f,c for the PCell are up to UE implementation.

The Dual Connectivity PHR MAC Control Element is defined as follows:

- Ci: this field indicates the presence of a PH field for the serving cell of any MAC entity, except the PCell, with *ServCellIndex* (for EN-DC, NE-DC or NGEN-DC case) or *SCellIndex* i as specified in TS 36.331 [8]. The Ci field set to "1" indicates that a PH field for the serving cell with *ServCellIndex* (for EN-DC, NE-DC or NGEN-DC case) or *SCellIndex* i is reported. The Ci field set to "0" indicates that a PH field for the serving cell with *ServCellIndex* (for EN-DC, NE-DC or NGEN-DC case) or *SCellIndex* i is not reported;

- R: reserved bit, set to "0";

- V: this field indicates if the PH value is based on a real transmission or a reference format. For Type 1 PH, V=0 indicates real transmission on PUSCH and V=1 indicates that a PUSCH reference format is used. For Type 2 PH, V=0 indicates real transmission on PUCCH and V=1 indicates that a PUCCH reference format is used. For Type 3 PH, V=0 indicates real transmission on SRS and V=1 indicates that an SRS reference format is used. Furthermore, for Type 1 ,Type 2 and Type 3 PH, V=0 indicates the presence of the octet containing the associated PCMAX,c field, and V=1 indicates that the octet containing the associated PCMAX,c field is omitted. Whether the reported PH value for an activated NR Serving Cell is based on real transmission or a reference format is determined based on UL transmissions that have been scheduled or configured until 4 ms prior to the TTI in which this PHR MAC CE is transmitted;

- Power Headroom (PH): this field indicates the power headroom level. The length of the field is 6 bits. The reported PH and the corresponding power headroom levels are shown in Table 6.1.3.6-1 (the corresponding measured values in dB for the E-UTRA Serving Cell are specified in clause 9.1.8.4 of TS 36.133 [9] while the corresponding measured values in dB for the NR Serving Cell are specified in TS 38.133 [19]);

- P: this field indicates whether power backoff due to power management is applied (as allowed by P-MPRc, see TS 36.101 [10] and TS 38.101-3 [21]). The MAC entity shall set P=1 if the corresponding PCMAX,c field would have had a different value if no power backoff due to power management had been applied;

- PCMAX,c: if present, this field indicates the PCMAX,c or , as specified in TS 36.213 [2] for the E-UTRA Serving Cell and the PCMAX,f,c or P̃CMAX,f,c, as specified in TS 38.213 [18]) for the NR Serving Cell used for calculation of the preceding PH field. The reported PCMAX,c and the corresponding nominal UE transmit power levels are shown in Table 6.1.3.6a-1 (the corresponding measured values in dBm for the E-UTRA Serving Cell can be found in TS 36.133 [9] while the corresponding measured values in dBm for the NR Serving Cell can be found in TS 38.133 [19]).



Figure 6.1.3.6b-1: Dual Connectivity PHR MAC Control Element



Figure 6.1.3.6b-2: Dual Connectivity PHR MAC Control Element supporting 32 serving cells with configured uplink