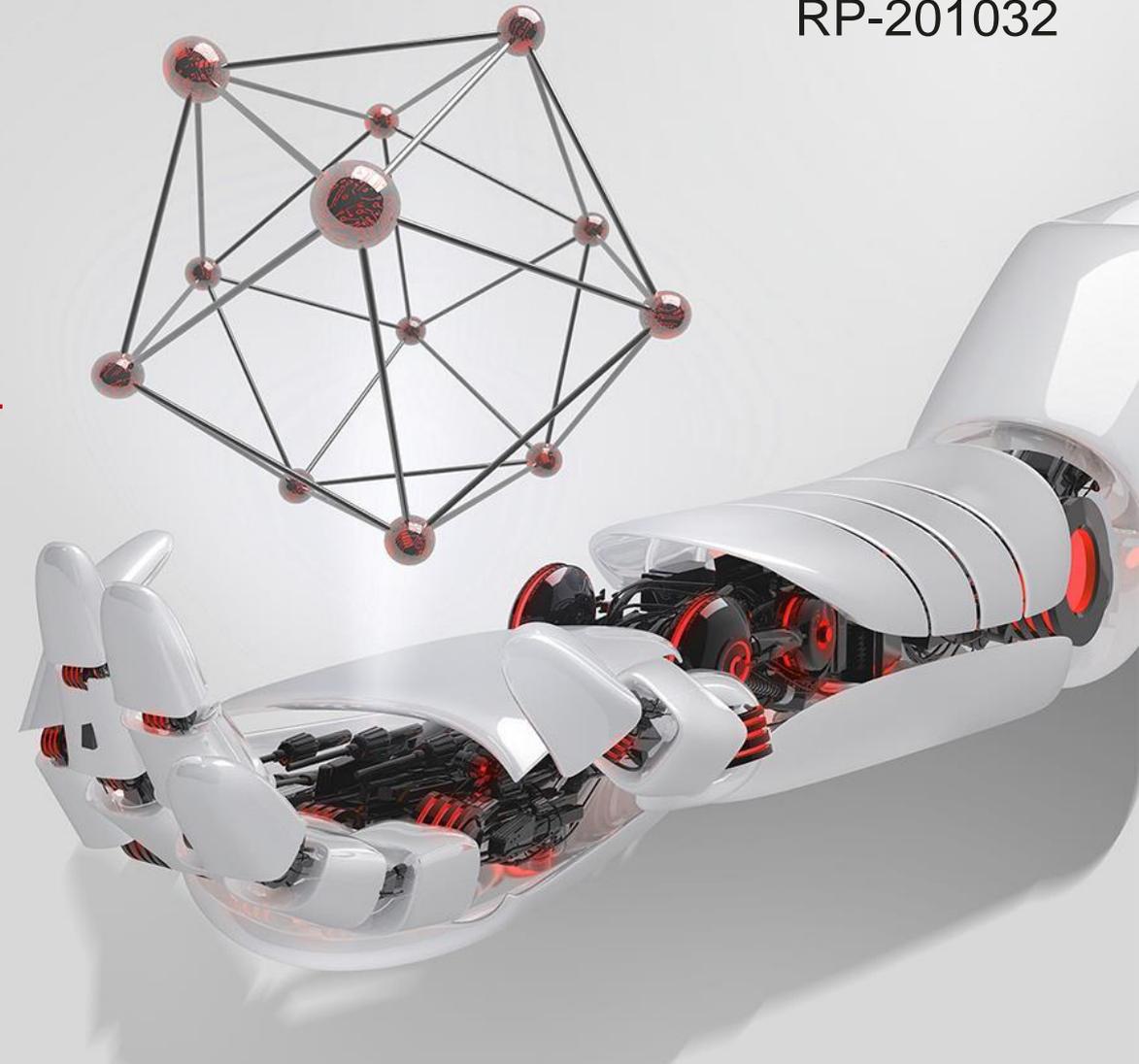


Document for: Approval
Agenda Item: 9.8

On Rel-16 EN-DC power class

Huawei, HiSilicon



Background

- LS on Rel-15 EN-DC power class was sent in [1] based on WF [2], and RAN2 designed the signaling accordingly
- For Rel-15 EN-DC power class, clarification was initially discussed in [3]. Companies thought it was a bit late to introduce new signalling for Rel-15, and in the end some clarifications were made in the 38.101-3 only [4].
- For Rel-16 EN-DC power class, no conclusion on whether similar clarification as that for Rel-15 or a new power class is introduced for the NR band in the band combination [5][6].

RAN2 spec is not aligned with RAN4 WF

```
BandNR ::=
    bandNR                FreqBandIndicatorNR,
    modifiedMPR-Behaviour BIT STRING (SIZE (8))                OPTIONAL,
    mimo-ParametersPerBand MIMO-ParametersPerBand            OPTIONAL,
    extendedCP             ENUMERATED {supported}             OPTIONAL,
    multipleTCI           ENUMERATED {supported}             OPTIONAL,
    bwp-WithoutRestriction ENUMERATED {supported}            OPTIONAL,
    bwp-SameNumerology    ENUMERATED {upto2, upto4}           OPTIONAL,
    bwp-DiffNumerology    ENUMERATED {upto4}                 OPTIONAL,
    crossCarrierScheduling-SameSCS ENUMERATED {supported}    OPTIONAL,
    pdsch-256QAM-FR2     ENUMERATED {supported}             OPTIONAL,
    pusch-256QAM         ENUMERATED {supported}             OPTIONAL,
    ue-PowerClass         ENUMERATED {pc1, pc2, pc3, pc4}     OPTIONAL,
    ...

BandCombinationList-v1540 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1540

BandCombination ::= SEQUENCE {
    bandList                SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParameters,
    featureSetCombination   FeatureSetCombinationId,

    ca-ParametersEUTRA      CA-ParametersEUTRA                OPTIONAL,
    ca-ParametersNR         CA-ParametersNR                   OPTIONAL,
    mrdc-Parameters        MRDC-Parameters                  OPTIONAL,
    supportedBandwidthCombinationSet BIT STRING (SIZE (1..32)) OPTIONAL,
    powerClass-v1530        ENUMERATED {pc2}                  OPTIONAL,

    CA-ParametersEUTRA ::= SEQUENCE {
        multipleTimingAdvance    ENUMERATED {supported}    OPTIONAL,
        simultaneousRx-Tx        ENUMERATED {supported}    OPTIONAL,
        supportedNAICS-2CRS-AP    BIT STRING (SIZE (1..8))  OPTIONAL,
        additionalRx-Tx-PerformanceReq ENUMERATED {supported} OPTIONAL,
        ue-CA-PowerClass-N        ENUMERATED {class2}        OPTIONAL,
        supportedBandwidthCombinationSetEUTRA-v1530 BIT STRING (SIZE (1..32)) OPTIONAL,
        ...
    }
}
```

powerClass

Power class that the UE supports when operating according to this band combination. If the field is absent, the UE supports the default power class. If this power class is higher than the power class that the UE supports on the individual bands of this band combination (ue-PowerClass in BandNR), the latter determines maximum TX power available in each band. The UE sets the new power class parameter only in band combinations with two FR1 uplink serving cells.

It can be seen from the current signalling design that

- The power class for NR is indicated per band, which is used for standalone mode rather than EN-DC mode
- For EN-DC, power class is indicated per band combination, which the total power of LTE and NR.
- For EN-DC, the maximum transmit power for LTE is indicated separately by ue-CA-PowerClass-N for UE operating in EN-DC mode, while there is no capability to signal the maximum transmit power of NR for UE operating in EN-DC mode.

Essential issue identified for EN-DC power class

- An example is utilized to explain the essential issue identified for Rel-15 signaling design

	EN-DC power class (supported in RAN2 spec)	LTE power class in EN-DC (supported in RAN2 spec)	NR Power class in EN-DC (not supported in RAN2 spec)	NR Power class in SA mode (supported in RAN2 spec)
Case 1	PC2	PC3	PC3	PC3
Case 2	PC2	PC2	PC2?	PC2 with 2Tx

- Both power class cases in above table can be supported from Rel-15
 - For case 2, if UE supports PC2 for NR SA mode, and 2Tx is supported to enable PC2 for the NR band
 - For EN-DC band combination case 2, so far 3Tx is not supported, which means NR can only support 1x23dBm in EN-DC mode. Then the power class for NR band would be different for NR SA and NSA modes.

Rel-16 EN-DC power class

Agreement for Rel-15 EN-DC power class (clarification in TS 38.101-3 clause 6.1)

- Unless otherwise stated, requirements for NR transmitter written in TS 38.101-1 [2] and TS 38.101-2 [3] apply and are assumed anchor agnostic. Unless otherwise stated, if UE indicates IE `maxNumberSRS-Ports-PerResource = n2` in NR standalone operation mode, the said UE shall meet the NR requirements for either power class 2 or power class 3 in EN-DC within FR1 if UE indicates IE `maxNumberSRS-Ports-PerResource = n1` for EN-DC on this NR band. Requirements are verified under conditions where anchor resources do not interfere NR operation.
- **Options for Rel-16 EN-DC power class**
 - Option 1: Similar clarification as that for Rel-15 in TS 38.101-3 (see above)
 - Option 2: Introduce a new power class for NR band in MR-DC combination

Proposals

- **Proposal 1:** Similar to E-UTRA power class capability for the EN-DC band combination, Power Class for NR band in the MR-DC band combination needs to be signaled as a Rel-16 UE capability
- **Proposal 2:** Send LS to RAN2 to inform the RAN decision to introduce additional power class capability for NR band in an MR-DC band combination

Reference

- [1] R4-1805929, LS on power class for FR1 EN-DC and NR CA, NTT DOCOMO
- [2] R4-1803373, WF on Power Class EN-DC, Qualcomm
- [3] R4-1909911, On EN-DC power class, Huawei, HiSilicon
- [4] R4-1916137, CR to 38.101-3: clarification of ENDC power class in R15, vivo
- [5] R4-2008259, CR to 38.101-3: clarification of ENDC power class in R16, vivo
- [6] R4-2008935, Email discussion summary for [95e][104] NR_NewRAT_UE_RF_Part_3

Thank you.

Bring digital to every person, home and organization for a fully connected, intelligent world.

**Copyright©2018 Huawei Technologies Co., Ltd.
All Rights Reserved.**

The information in this document may contain predictive statements including, without limitation, statements regarding the future financial and operating results, future product portfolio, new technology, etc. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied in the predictive statements. Therefore, such information is provided for reference purpose only and constitutes neither an offer nor an acceptance. Huawei may change the information at any time without notice.

