**3GPP TSG-RAN WG4 Meeting #112 R4-2414277**

**Maastricht, Netherlands, 19-23 Aug, 2024**

**Title:** WF on HPUE for CA in TN

**Agenda Item:** 8.1.3

**Source:** Samsung

**Document for:** Approval

# 1. PC1.5 for intra-band contiguous and non-contiguous UL CA

## 1.1 MPR evaluation methodology and assumption

**Online Agreement:**

* MPR and CANS\_04 A-MPR studies for PC1.5 contiguous intra-band ULCA focusses on TxD architecture and may account for PSD imbalance with up to 6dB.
  + FFS on whether to define the requirements based on equal PSD or PSD imbalance with 6dB
* PC1.5 contiguous intra-band ULCA based on dualPA architecture with two LOs is not specified in R19
* MPR studies for PC1.5 non-contiguous intra-band ULCA focusses on dualPA architecture with two LOs and may account for PSD imbalance with up to 6dB.
  + FFS on whether to define the requirements based on equal PSD or PSD imbalance with 6dB
* PC1.5 non-contiguous intra-band ULCA based on TxD architecture is not specified in R19

**~~Discussion during adhoc:~~**

**~~Have some discussion which methodology is used to derive MPR requirements. Measurement? Simulation? Mathematical calculation? Then align the evaluation parameters (if measurement and/or simulation are adopted)~~**

OPPO: nothing new, all can be used

Qualcomm: all can be considered

Huawei: Contribution dirven, different methodology should be allowed. Seems average of all methodology can not be considered.

OPPO: R-IMD can not be modelled, can be considered as implementation margin.

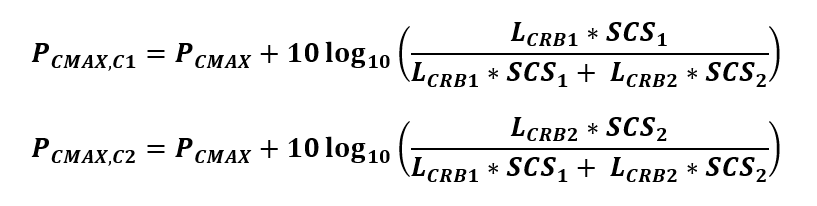
Apple: Propose to simply leverage PC2 values. Quick and simple approach

LGE: All should be allowed.

## 1.2 PCMAX,C upper bound

Proposals：

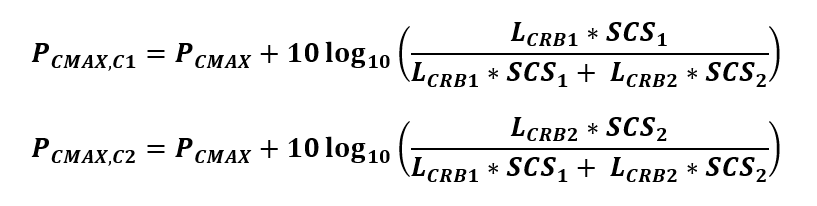
* **For dualPA-architecture****,** 
  + PCMAX,C limitation for each component carrier is 26dBm (Skyworks, Samsung, Ericsson, ZTE, Huawei, LGE, Xiaomi, vivo)
  + (Huawei)



* **For TxD (dualTx),**
  + PCMAX,CC1 = (LGE)

PCMAX,CC2 =

* + No change of current spec (Xiaomi, ZTE, Samsung, vivo, Skyworks, Ericsson)
  + (Huawei)



**Agreement:**

* **For intra-band UL NC CA with dualPA-architecture, upper bound of Pcmax,c without tolerance is 26dBm per CC**

**- Whether or how to reflect the above agreement in spec is FFS**

* **For intra-band UL contiguous CA with TxD, upper bound of Pcmax,c without tolerance is 29dBm per CC**

**- Whether or how to reflect the above agreement in spec is FFS**

Apple: For intra-band UL NCCA, only discuss dual PA

Huawei: We may should discuss upper bound for Pcmax, whether to add Pcmax equation into spec

Ericson: Prefer to introduce simple text instead of equation

OPPO: Prefer no equation

LGE: review existing spec

Huawei: Similar concern with LGE, for PC2 we assume at least one full PA

Skyworks: More offline, for PC2 we assume at least one full PA, for PC1.5 we have no full PA so have to reconsider

Ericsson: is not agasint to introduce Pcmax equation, PHR only reply on per-band power class. Pcmax per CC is at least should be limited to PC2.

Skyworks: Fallback to single CC should maintain same PC

OPPO:

## 1.3 PCMAX

* + Option 1: (Melta)
  + MOP for 2Tx architectures (TxD w/wo UL MIMO) is: *29* dBm
  + MOP for Dual-PA architectures (one PA/CC, 2LO) is:

*PCmax= 29 + 10\*log(1/2\*(1+Min(LCRB1\*SCS1,LCRB2\*SCS2)/Max(LCRB1\*SCS1,LCRB2\*SCS2)))* dBm

* + Option 2: (Huawei)
  + Option 3: No change of current spec (Ericsson, LGE, Xiaomi)
  + Option 4: 29dBm for TxD (ZTE)

**Online agreement with adhoc modification:**

* For intra-band contiguous ULCA with 2Tx-TxD, the upper bound of Pcmax is 29dBm
* For intra-band UL NC CA with dual PA architecture, the upper bound of Pcmax is 29dBm

## 1.4 Further description on the architectures for PC1.5 NC ULCA

Proposal：(Skyworks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Architecture*** | ***Implementation*** | ***Indicated***  ***capability*** | ***UL MIMO***  ***support*** | ***Power limitation*** | ***Support of 1CC PC1.5 fallback*** | ***Separation BW limitations*** |
| *#1* | *2x26 dBm PA + 2 LO with 100MHz BW* | *dualPA-Architecture* | *No* | *Each carrier is limited to 26dBm* | *Requires LO switching and thus interruption* | *No limitations other than the currently defined largest separation BW of 600MHz* |
| *#2* | *2x26 dBm PA + 1 LO with 200MHz BW* | *TxD and/or UL MIMO* | *Yes* | *One carrier can reach 29dBm* | *Can support without any switching* | *Max separation BW of 200MHz, Gap size <aggregated BW* |

* + Option 1: Agree
  + Option 2: Not agree, and further refine/modify
* Recommended WF

*(Moderator remove the “power limitation” column as it can be covered in Issue 1.2.1-2, the column can be added back if agreement reached for Issue 1.2.1-2, and a note is added to clarify the WID scope)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Architecture*** | ***Implementation*** | ***Indicated***  ***capability*** | ***UL MIMO***  ***support*** | ***Support of 1CC PC1.5 fallback*** | ***Separation BW limitations*** |
| *#1* | *2x26 dBm PA + 2 LO with 100MHz BW* | *dualPA-Architecture* | *No* | *Requires LO switching and thus interruption* | *No limitations other than the currently defined largest separation BW of 600MHz* |
| *#2* | *2x26 dBm PA + 1 LO with 200MHz BW* | *TxD and/or UL MIMO* | *Yes* | *Can support without any switching* | *Max separation BW of 200MHz, Gap size <aggregated BW* |
| *Note: PC1.5 NC ULCA+UL MIMO is out of WI scope* | | | | | |

**Agreement:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***~~Architecture~~*** | ***~~Implementation~~*** | ***~~Indicated~~***  ***~~capability~~*** | ***~~UL MIMO~~***  ***~~support~~*** | ***~~Support of 1CC PC1.5 fallback~~*** | ***~~Frequency separation~~*** |
| *~~#1~~* | *~~2x26 dBm PA + 2 LO with 100MHz BW~~* | *~~dualPA-Architecture~~* | *~~No~~* | *~~Requires LO switching and thus interruption~~* | *~~No limitations other than the currently defined largest separation BW of 600MHz~~* |
| *~~#2~~* | *~~2x26 dBm PA + 1 LO with 200MHz BW~~* | *~~TxD and/or UL MIMO~~* | *~~Yes~~* | *~~Can support without any switching~~* | *~~Max separation BW of 200MHz, Gap size <aggregated BW~~* |
|  | | | | | |

# 2. 2-band Inter-band UL NR-CA/EN-DC with 2Tx and/or 3Tx

## Configuration

Proposals：

* + Proposal 1: RAN4 to decide whether PC2 FDD bands would be considered in PC1.5 inter-band UL CA/EN-DC at the early phase of the work item. If RAN4 decides to consider PC2 FDD bands in PC1.5 inter-band UL CA/EN-DC configurations, a few exemplary band combinations would be required for companies to exercise the MSD analysis. (Apple)
  + Proposal 2: In the Rel-19 UE RF enhancement WI except PC1.5 FDD+FDD band combinations, RAN4 can focus on general RF requirements for high power inter-band CA/DC UE. (Meta)

**Agreement:**

For PC1.5 inter-band UL CA/EN-DC, the work for the case PC2 FDD band as one of the constituent band would be triggered after example combo is added in the WID.

## 2.2 Spec organization

**Agreement:** Adopt same way as in Rel-18

## 2.3 3UL CC with 3Tx

**Agreement:** Don not consider 3ULCC with 3Tx CA\_nXA-nY(2A)/ DC\_XA\_nY(2A) scenario

# 3. Increasing UE transmission power

## 3.1 The methodology

* + Proposal 1: The UE capability IEs to support increasing UE transmission high power limit for inter-band UL CA and EN-DC as defined in Rel-17, i.e., higherPowerLimit-R17 and higherPowerLimtMRDC-R17, are also applicable for any other UL power compositions with different power classes between the two UL bands. (Apple)
  + Option 2: Define Rel-19 capability of higher power limit for inter-band CA and inter-band EN-DC and Consider new duty cycle solution if Rel-19 capability of higher power limit is adopted. (LGE)
  + Option 3: For R19 increasing UE transmission power limit, to use the following existing R17/R18 methodologies: (ZTE, Samsung, Qualcomm, Nokia)
    - Use the higherPowerLimit-R17 and higherPowerLimtMRDC-R17 capability
    - No new power class is introduced
  + Option 4: To increase the transmission power limit, consider directly replacing the limit (PPowerClass,CA) set by the CA power class with the sum of the power limit per band (10 log10 ∑ pPowerClass,c) in PCMAX\_H or both PCMAX\_H and PCMAX\_L. (Huawei)
  + Option 5: For Rel-19, enable use of higherPowerLimit-r17 as the default case rather than the exception (Qualcomm, ‘there is no good justification to selectively meter out what band combinations and power class aggregations get to use this optional capability, and which do not’).

**Agreement:**

* Use higherPowerLimit-R17 and higherPowerLimtMRDC-R17 capability
* No new power class is introduced

## 3.2 The scenarios to be considered in Rel-19

* + Proposal 1: (Apple)

Use the UL power compositions in the table below to define 2UL IMD MSD requirements for the corresponding new UL configurations to support “increasing UE transmission high power limit” feature.

|  |  |  |
| --- | --- | --- |
| Power Class | UL Configuration | UL Power for 2UL IMD MSD |
| PC2 | PC2 FDD + PC5 TDD | 20dBm + 20dBm |
| PC2 | PC2 FDD + PC3 TDD | 23dBm + 23dBm |
| PC2 | PC2 FDD + PC3 FDD | 23dBm + 23dBm |
| PC1.5 | PC1.5 TDD + PC5 TDD | N/A |
| PC1.5 | PC1.5 TDD + PC3 TDD | N/A |
| PC1.5 | PC1.5 TDD + PC3 FDD | 27.8dBm + 23dBm |
| PC1.5 | PC1.5 TDD + PC2 TDD | N/A |
| PC1.5 | PC1.5 TDD + PC2 FDD | 26dBm + 26dBm |

* + Proposal 2: (Samsung)
* For 2Tx, higher power limit feature is enabled for any specified inter-band band combination.
  + - “Specified” here intends for the existing combos and the ones to be added into MOP table in future
* For 3Tx, the following scenarios may could be considered for NR-CA/EN-DC.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Indicated PC for A-B**  **(3Tx in total)** | **PC for band A of A-B**  **(1Tx)** | **PC for band B of A-B**  **(2Tx)** | **The total power**  **(dBm)** | **Note** |
| PC2 | PC3 | PC2 | 27.8 | -One CC per band  -One CC in band A, 2CC on band B (if this scenario would be introduced for 3Tx) |
| PC1.5 | PC3 | PC1.5 | 30.0 | -One CC per band; For FWA only  -One CC in band A, 2CC on band B (if this scenario would be introduced for 3Tx); For FWA only |

* + Proposal 3: (Xiaomi)

The following power class configuration could be considered in Rel 19 for UE increasing high power limit.

* PC3 (TDD/FDD) +PC1.5 indicating PC1.5 with 3Tx
* PC2 (TDD with TxD) +PC3 (TDD/FDD) indicating PC2 with 3Tx
  + Proposal 4: (Meta)

To support the accumulative power increases of inter-band CA/DC band combinations UE, RAN4 can investigate how to apply the actual increased UE transmit power based on the above CA/DC power combinations with the existing power classes in Rel-19.



* + Proposal 5: (LGE)
* Decide which inter-band CA combinations are applicable in Rel-19 from lists in Table 2-1.

Table 2-1: A list of applicable inter-band CA scenarios for increasing UE transmission power limit

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA power class** | **Power class configuration**  **Band A + Band B** | | **2Tx** | **3Tx** |
| PC2 | PC2 TDD | PC3 TDD | R18 | R18 |
| PC3 FDD | R18 | R18 |
| PC2 FDD | PC3 TDD | R19 ? | R19 ? |
| PC3 FDD | R19 ? | R19 ? |
| PC1.5 | PC1.5 TDD | PC3 TDD | N/A | R19 ? |
| PC3 FDD | N/A | R18 |
| PC2 TDD | N/A | R19 ? |
| PC2 FDD | N/A | R19 ? |

* Decide which inter-band EN-DC combinations are applicable in Rel-19 from lists in Table 2-2.

Table 2-2: A list of applicable inter-band CA scenarios for increasing UE transmission power limit

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA power class** | **Power class configuration**  **Band A(E-UTRA) + Band B(NR)** | | **2Tx** | **3Tx** |
| PC2 | PC3 TDD | PC2 TDD | R18 | R18 |
| PC3 FDD | PC2 TDD | R18 | R18 |
| PC2 FDD | R19 ? | R19 ? |
| PC2 TDD | PC3 TDD | R19 ? | R19 ? |
| PC1.5 | PC3 TDD | PC1.5 TDD | N/A | R19 ? |
| PC3 FDD | N/A | R19 ? |
| PC2 TDD | N/A | R19 ? |
| PC2 FDD | N/A | R19 ? |

* + Proposal 6 (ZTE)
* To consider the following additional eligible PC2 2Tx inter-band NR CA and ENDC to enable increasing higher power limit in Rel-19:
  + - Inter-band with intra-band UL contiguous CA in one of the NR band
* To consider the following additional eligible HPUE 3Tx inter-band NR CA and ENDC with up to 3CC in UL bands to enable increasing higher power limit in Rel-19:
  + - PC2 band combination of PC3+PC2
    - PC1.5 band combination of PC3+PC1.5
    - PC1.5 band combination of PC2+PC1.5

Note: Only PC3 is considered for LTE FDD in EN-DC

Note: For 3UL CC, only inter-band with intra-band UL contiguous CA in one of the NR band is considered.

* + Proposal 7 (Nokia)

Choose Proposal 3 [1] as a WF

* higherPowerLimit-r17 is enabled for any standardized inter-band band combination. Cases where there is concern about exceeding local regulation are treated separately as exceptions.
* RAN4 to rely on network operators (carriers) to identify if local regulatory limits are exceeded when higherPowerLimit-r17 is enabled for their band combination.
* RAN4 to evaluate best method to identify corner case UL CA configuration (band combination + power class aggregation) where higherPowerLimit-r17 may NOT be used due to local regulation. Options:
  + - Set up an NS case
    - Rely on PEMAX,CA, the value indicated by p-NR-FR1 or by p-UE-FR1
    - Maintain an exception list in 38.101-x for UL CA configurations where higherPowerLimit-r17 may NOT be used
* Remove references to power class or TR duplexing type from sections of the standard that enable use of higherPowerLimit-r17
  + Proposal 8 (vivo)
* Consider PC3+PC2 and PC3+PC1.5 for 3Tx as scenarios for increasing power limit Rel-19.
* Consider to add some restrictions of UE type such as FWA only in case the total Tx power limit beyond PC1.5**.**
* No need to discuss relationship with power boosting since already have agreements.
  + Proposal 9 (NTT Docomo)
* Both FWA and handheld UE can support PC1.5 CA/DC with increasing UE high power limit feature in Rel-19 if there are no technical issues.
  + Proposal 10 (Huawei)
* Consider the following list of scenarios for increasing UE transmission power limit as shown in Table 1 below.
* Increasing the total Tx power limit beyond PC1.5 is only for FWA UEs, not for handheld UEs.

**Table 1: A list of applicable scenarios for increasing UE transmission power limit**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CA power class** | **Power class configuration**  **Band A + Band B** | | **Power limit increase (dB)** | **2Tx** | **3Tx** |
| PC3 | PC3 | PC5 | 1.8 | Completed in R18 | N/A |
| PC2 | PC2 | PC3 | 1.8 | Completed in R17 | R19 |
| PC5 | 1.0 | R19 | R19 |
| PC1.5 | PC1.5 | PC2 | 1.8 | N/A | R19 |
| PC3 | 1.0 | N/A | R19 |
| PC5 | 0.5 | N/A | R19 |

* + Proposal 11 (Qualcomm)
* RAN4 discusses applicability of higherPowerLimit-r17 to basic inter-band ULCA configurations with single CC per band before addressing mixed inter- + intra- combinations.
* For Rel-19, the basic inter-band configurations (with no intra-band component) is enabled for all power class aggregations that are introduced into the standard. Exceptions can be accommodated on a case-by-case basis.

**Way forward:**

* For both 2Tx and 3Tx, higherPowerLimit-R17/higherPowerLimtMRDC-R17 is enabled for any specified inter-band band combination
* “Specified” here intends for the existing combos and the ones to be added into MOP table in future

# 4. General aspect

## 4.1 MSD rules

Proposals：

* + Proposal 1: (Samsung)
* RAN4 to clarify that MSD general rule discussion is within the WI scope, just the specific MSD values are left for corresponding basket WIDs to evaluate.
* For all types of MSD, RAN4 defines only the default power class inter-band CA and intra-band CA MSD requirements, and the new HPUE MSD requirements are no longer specified in the TS. The legacy agreed HPUE MSD test points are not impacted and are kept in the TS.
  + Proposal 2: (Xiaomi)
* If the supported maximum power class of the constituted band are not changed in the higher power class case for the same band combination, no new MSD case is needed compared to the existing MSD requirement in the spec when defining the harmonic, harmonic mixing and cross isolation requirements.
* A discussion is needed on whether we can agree that for a given band combination, not to reconsider additional IMD MSD requirements for higher total power class on the basis that the MSD requirement has already been defined for the same power class configuration in lower total power class.
  + Proposal 3: (Nokia)
* WID objectives preclude band combination specific MSD discussions but allow generic MSD discussion applicable to all band combinations.
* When new PC1.5 NR TDD intra-band UL contiguous and non-contiguous CA with 2Tx configuration is introduced no additional MSD test points are specified.
* When new PC1.5 UE for two band NR inter-band uplink CA with 2Tx and/or 3Tx for handheld and FWA, and PC1.5 and PC2 for two band EN-DC with 2Tx and/or 3Tx for handheld and FWA is introduced no additional MSD test points are specified.
* Framework for those new configurations which are not covered by proposals in this paper can be discussed in relevant basket WI separately unless there is a consensus to have common WF in this meeting for all HPUE power classes no matter if it is single band, CA or DC.
  + Proposal 4: (vivo)

There are some basic options for MSD derivation for HPUE BC:

* + - Re-Calculate the MSD requirements.
    - Using High Power + Default power class requirements
    - Using Default Power + Default power class requirements
  + Proposal 5: (Qualcomm)
* Instead of going directly into “PC3 MSD only” approach, companies should first consider if some simplifications e.g. by specifying just single set of requirements for HPUE FDD band combinations and/or by using some equations to derive PC2/PC1.5 MSD from respective PC3 MSD would help to bring the MSD specification framework back on track.
  + Proposal 6: (NTT docomo)

Introduce new guidelines for MSD requirements due to IM. Below are the key points.

* The default is the MSD requirement for PC3 CA/DC.
* Regarding test points for HPUE CA/DC;
  + - if there are in the default MSD requirements, they will be reused.
    - if there are not in the default MSD requirements, new test points are added to other tables.
* Regarding MSD values for HPUE CA/DC, it can be calculated using default MSD value for PC3 and new parameter.
* Regarding power configuration for test;
  + - for PC2 CA/DC, assuming both of the transmitters shall be set min(+23 dBm, PCMAX\_L,f,c).
    - for PC1.5 CA/DC, assuming both of the transmitters shall be set min(+26 dBm, PCMAX\_L,f,c).
  + Proposal 7: (CHTTL)
* Regarding the HPUE for inter-band CA/EN-DC in Rel.19, suggest to focus on the SAR solutions according to the WID at this stage.

**Way forward:**

* It is common understanding in RAN4 that MSD general rule discussion is within the WI scope, just the specific MSD values are left for corresponding basket WIDs to evaluate.
* Discussion during adhoc on the MSD general rules

## 4.2 Duty cycle solution for SAR compliance

Proposals：

* + Proposal 1: Do not introduce ΔPPowerClass related specifications changes for PC1.5 inter-band UL CA/EN-DC with 2Tx or 3Tx configuration. (Apple)
  + Proposal 2: 3GPP duty-cycle solution is not specified for any scenarios of this WI. (Samsung)
  + Proposal 3: (Xiaomi)
* If follow the similar approach as current spec, for PC1.5 UE for two band NR inter-band uplink CA with 2Tx and/or 3Tx, the existing SAR mitigation solution for PC1.5 with 3Tx in Ts 38.101-1 could be reused. For PC1.5 inter-band EN-DC with 2Tx and 3Tx case, the duty cycle approach could be defined based on the existing dutycycle approach for PC2 case with some small changes as shown in the following table 2 for TDD+TDD case and FDD+TDD case.
* A unify approach on SAR solution for all possible HP UE scenarios can be considered. The detail approach could be discussed further. For example, only P-MPR is considered (i.e., Duty-cycle solution is not considered), or SAR solution just relies on per single band manner.
  + Proposal 4: (Meta)
* RAN4 can reuse the max uplink duty cycle limitation of the single carrier SAR solution for PC 1.5 intra-band contiguous CA combinations UE.
* RAN4 can reuse the max uplink duty cycle limitation of the single carrier SAR solution for PC 1.5 intra-band non-contiguous CA combinations UE.
  + Proposal 5: (LGE)
* Modify the existing PC2 duty cycle solution if PC2 FDD/TDD + PC2 TDD with 2Tx is introduced.
* For PC3 E-UTRA FDD + PC3/PC2 NR FDD, consider A new capability, for example, maxUplinkDutyCycle-interBandENDC-FDD-PC2 which comprises of maxUplinkDutyCycle-FDD-EN-DC1 and maxUplinkDutyCycle-FDD-EN-DC2
* For PC2 E-UTRA TDD + PC3 NR TDD, consider New duty cycle solution considering the possible E-UTRA TDD uplink-downlink configurations and the percentage of maximum E-UTRA/NR uplink transmission
* For PC2 E-UTRA TDD + PC2 NR TDD, considere New duty cycle solution considering the possible E-UTRA TDD uplink-downlink configurations and the percentage of maximum E-UTRA/NR uplink transmission
* For PC3 E-UTRA FDD + PC3/PC2 NR FDD (UL-MIMO or Tx diversity), consider a new capability, for example, maxUplinkDutyCycle-interBandENDC-FDD-PC2 which comprises of maxUplinkDutyCycle-FDD-EN-DC1 and maxUplinkDutyCycle-FDD-EN-DC2
* For PC2 E-UTRA TDD + PC3 NR TDD (UL-MIMO or Tx diversity), consider New duty cycle solution considering the possible E-UTRA TDD uplink-downlink configurations and the percentage of maximum E-UTRA/NR uplink transmission
* For PC3 E-UTRA FDD/TDD + PC1.5 NR TDD (UL-MIMO or Tx diversity), consider New duty cycle solution considering the possible E-UTRA TDD uplink-downlink configurations and the percentage of maximum E-UTRA/NR uplink transmission
* For PC2 E-UTRA TDD + PC2/PC1.5 NR TDD (UL-MIMO or Tx diversity), consider New duty cycle solution considering the possible E-UTRA TDD uplink-downlink configurations and the percentage of maximum E-UTRA/NR uplink transmission
  + Proposal 6: (ZTE)
* Duty-cycle solution should be considered for limited scenarios of PC2/PC1.5 NR inter-band UL CA.
  + - Only consider P-MPR scheme for the band combination including PC2 FDD band, i.e. FDD+FDD, FDD+TDD
    - Except P-MPR, duty cycle scheme is applied to the band combination including pure TDD bands, i.e. TDD+TDD
* For duty cycle based SAR solution, reuse the PC1.5 single CC capability for PC1.5 TDD UL intra-band contiguous and non-contiguous CA
  + Proposal 7: (vivo)
* For PC1.5 of intra-band CA, the default threshold is 25% when maxUplinkDutyCycle-PC2-FR1 is absent, if 0.5\* maxUplinkDutyCycle-PC2-FR1 is exceeded, power reduction is expected.
* To compatible with PC2 of inter-band CA, for PC1.5 of inter-band CA, there is no default threshold when maxUplinkDutyCycle-interBandCA-PC2 is absent, if maxUplinkDutyCycle-PC2-FR1 is reported and 0.5\* maxUplinkDutyCycle-PC2-FR1 is exceeded, power reduction is expected.
* To compatible with PC2 of inter-band EN-DC(TDD+TDD), for PC1.5 of Inter-band EN-DC(TDD+TDD) , the default threshold is 15% when maxUplinkDutyCycle-interBandENDC-TDD-PC2-r16 is absent, if 0.5\*maxUplinkDutyCycle-interBandENDC-TDD-PC2-r16 is exceeded, power reduction is expected.
* For PC2 of inter-band EN-DC(FDD+FDD), on LTE side, there are two threshold 40% and 70% is hardcoded. On NR side, UE will report two thresholds: maxUplinkDutyCycle-FDD-FDD-EN-DC1 and maxUplinkDutyCycle-FDD-FDD-EN-DC2.
  + Proposal 8: (CHTTL)
* Regarding the SAR solutions for LTE FDD + NR TDD with 1Tx PC3 + 2Tx PC1.5 configuration
  + - At least the method that reusing PC2 LTE FDD + NR TDD signalling with 0.5 scaling is considered
    - The UE-implementation based methods (i.e. P-MPR) is still applied by default
* Regarding the SAR solutions for LTE FDD + NR FDD 2Tx/3Tx configurations
  + - The UE-implementation based methods (i.e. P-MPR) is applied by default
    - RAN4 to discuss whether other solutions (ex: duty cycle method) can be considered
  + Proposal 9: (China Telecom)
* For PC2 two band EN-DC with 2Tx and/or 3Tx, the legacy duty-cycle solution in 38.101-3 and corresponding capability and signalling shall be reused.
* For PC1.5 HPUE for intra/inter-band CA, the general SAR solution framework and the threshold of average percentage of uplink symbols should both refer to PC2 UE for CA and PC1.5 UE for single CC.
* For PC1.5 HPUE for intra/inter-band CA, if power class of one or both of the bands within the band combination is power class 1.5, the default value of maxDutyNR,x/y should be 25%.
* Start with taking half of PC2 default duty-cycle threshold and 0.5\*PC2capability as new trigger condition of SAR solution for PC1.5 of FDD+TDD/TDD+TDD.

**Way forward:** TBD