**3GPP TSG-WG RAN4 Meeting #100-e R4-2114931**

**Electronic meeting, August 16-27, 2021**

WF on UE PC2 dutycycle SAR solutions and UE maximum power

China Telecom

# Background

The contributions submitted in RAN4 #100e meeting for SAR solutions and UE maximum power:

* R4-2111766, A way to increase UE maximum power for NR uplink inter band CA, Nokia, Nokia Shanghai Bell
* R4-2112047, Discussion on increasing maximum output power for UE PC2 CA, Mediatek India Technology Pvt.
* R4-2112382, Clarifications on NR FR1 inter-band UL CA power class, Apple
* R4-2112490, Discussion on how to introduce SAR schemes for UE power class 2 NR inter-band CA and SUL configurations, China Telecom
* R4-2112491, CR to 38.101-1 Introduce SAR solution for UE power class 2 NR inter-band CA and SUL configurations, China Telecom
* R4-2112492, LS on UE capability for UE power class 2 NR inter-band CA and SUL configurations, China Telecom
* R4-2112998, Further discussion on the dutycycle threshold calculation for HPUE with 2UL inter-band CA, vivo
* R4-2113305, Discussion on increasing UE maximum power high limit, Xiaomi
* R4-2113903, R17 Discussion on UE power class high limit, OPPO
* R4-2113904, R17 Inter band CA HPUE SAR, OPPO
* R4-2114209, Further Discussion on Higher UE Power Limits for Inter-band CA/DC, Huawei, HiSilicon

# Agreement on dutycycle SAR solution

* Agreement on dutycycle SAR solution
	+ Agree the CR R4-2114932 CR to 38.101-1 Introduce SAR solution for UE power class 2 NR inter-band CA and SUL configurations
* Agreement on dutycycle capability reporting
	+ For inter-band CA, the maxUplinkDutyCycle-interBandCA-PC2 capability is reported by UE as per band combination capability
	+ For SUL combination, the maxUplinkDutyCycle-SULcombination-PC2 capability is reported by UE as per band combination capability.
	+ The values and range is listed as below
		- Option 1: {n50, n60, n70, n80, n90, n100, full\_duty}, 50% is proposed as default when the dutycycle signalling is absent
		- Option 2: {50%, 60%, 70%, 80%, 90%, 100%}. PC2 is supported without duty cycle restriction when the dutycycle signalling is absent
		- Option 3: {50%, 60%, 70%, 80%, 90%, 100%}. full\_duty is proposed as default when the dutycycle signalling is absent, full\_duty means UE will adopt P-MPR solution for supported power class 2.
		- Option 4: {60%, 70%, 80%, 90%, 100%}. 50% is proposed as default when the dutycycle signalling is absent
		- Agreement: option 4
	+ Agree the LS R4-2114933 LS on UE capability for UE power class 2 NR inter-band CA and SUL configurations

Ericsson: we have concern on duty cycle. What is the fall-back behaviour of UE if there is no duty cycle reported, or if the network does not account? It should be clearly specified in the spec. This is release-17 work item. We have time to ensure that the issue is properly addressed.

CTC: Regarding the feasibility of reporting, option 2 has cover your concern, because option 2 says if the duty cycle is absent then other solution applies. Regarding WI target date, we have extended WI by two quarters. We expected no further extension.

Verizon: we share the comment as Ericsson. This is issue that we need consider.

OPPO: Ericsson pointed out the issue what UE should do if it does not report capability. There is difference between Option 2 and Option 4. We propose Option 2.

Huawei: we have concern on option 2. The current solution has already assumed 50%. If we choose option 2, it will create the consistency problem. Option 2 and option 4 are acceptable.

Nokia: we have similar view as Huawei. Option 2 is confusing. We do not see the different between 100% reported and absent. Option 4 is clear. We do not see the reason to go with Option 2.

OPPO: it is new UE capability which does not cause NBC issue. From network perspective they would be same but for UE there are difference. The main issue of Option 4 is that UE only rely on PMRP if there is no reporting and then 50% is restriction.

Ericsson: We agree with OPPO. We would like not to accept 50%.

InterDigital: want to ask question if device reports duty cycle, it preclude P-MPR. How does network know how to react to capability? It is scheduler issue. For any option suggesting reporting, do those options preclude P-MPR?

CTC: we think all duty cycle solutions do not preclude P-MPR.

VIVO: PC2 for CA/SUL is not aligned with EN-DC case.

InterDigital: does the signalling have impact on the test.

OPPO: it has been solved in Rel-16 when we discuss the single carrier case. We consider it by DL-UL configuration. It will impact GCF.

* Agreement: for duty cycle capability reporting,
	+ The values and range is listed as below
		- {50%, 60%, 70%, 80%, 90%,100%}.
	+ From network perspective, PC2 is supported without duty cycle restriction when the duty cycle signalling is absent.
	+ From UE perspective,
		- UE does not falls back to PC3 when the duty cycle signalling is absent
		- UE will use P-MPR to meet SAR requirement when the duty cycle signalling is absent

# WF on UE maximum power (1/2)

* How to increase UE maximum power high limit
	+ Option 1: Replace PPowerClass with sum or modified sum in both PCMAX\_H and PCMAX\_L
	+ Option 2: Define a new power class per band-combination
	+ Agreement: xxx

Huawei: it seems that this issue will be discussed in the new WI or SI. Most options can be explored in future. We prefer Option 2. We are open to discuss is further.

Skyworks: it is important to make it superset of PC1.5 and PC2. We should make clear what duty cycle is supported.

OPPO: Neither options are easy agreement. Option 2 would be feasible solution now. Option 1 cannot be applied to UE. Option 2 is not easy task. We are not sure if the current requirement will be adjusted. This issue is not included in WID. We can address it in the next release.

Ericsson: new power exists for PC1.5. That can be reported by UE for band combination. The UE will indicate and report capability per band. PC1.5 has already exist. The missing is between 23+26, which could be called as PC1.75. We recognize the issue replying on duty cycle.

Nokia: support option 1. I understand concern from companies and discuss the potential issue. We would like to avoid the situation to discuss what options we like. It is better to list the issue to be addressed and help we identify the issue to be discussed in furture meeting.

Apple: the idea is to increase the maximum power. We should maximize the power for each band. The combined power is not important. The power class per band is important. UE needs to refer to per band power class. My idea is to define the new power class, which is not related to particular value rather refereeing to power class per band.

Qualcomm: we support comment made by Nokia. We repeat the argument. We do not see the effort to find solution. For option 1, we do not fully understand. To Oppo comment about Huawei paper, I think that could be solved by not applying sum to PcmaxL rather to PcmaxH.

Vivo: UE maximum power for inter-band CA should be based on band combination.

Apple: We can use the existing solution. For this type of operation, each band is maximized, which is similar to case of FR1+FR2.

# WF on UE maximum power (2/2)

* WI scope for increasing UE maximum power high limit
	+ Option 1: Focus on increasing UE maximum power high limit for NR uplink inter band CA under this WI and revise the WID to accommodate this topic in the objective accordingly.
	+ Option 2: Discuss the topic in a dedicated SI in Rel-18.
	+ Agreement: xxx