3GPP TSG-RAN WG4 Meeting #101-e R4-2118896
Electronic Meeting, 1-12 Nov, 2021

# Discussion on lower UE power class in Rel-18

OPPO

# Background

- Lower UE power classes with max power 20dBm or 14dBm were proposed for Rel-18 NR IoT device, Indoor device and wearable devices in RAN#93e [1] with statements as below, however, no justifications provided.
- This paper share some views on the necessity and issues of introducing lower UE power class.

- With lower UE power class (e.g. 14dBm, 20dBm), CMOS PA is feasible instead of GaAs
  - Reduced device cost
  - Improved PAE in low Tx power range, compared with 23dBm capable devices by GaAs PA
  - Applicable for UE types with shorter communication range
- Proposal:
  - Support lower UE power class(s) for Uu and sidelink in Rel-18
  - Both PC5 (20dBm) and PC6 (14dBm) can be considered
  - Consider new device type, e.g. NR IoT device, Indoor devices, wearable devices

# Max Tx power is highly rely on NW deployments

- It was claimed in [1] that 10dBm Tx power level is sufficient for 100% UEs under InH scenario, and 15dBm Tx power is sufficient for 100% UEs with 5MHz BW or 90% UEs with 20MHz BW in dense urban scenario.
- This is a daring and misleading statement. UE Tx power is always a key factor to the UL coverage, and whether 10/15dBm Tx power is enough is highly rely on the NW deployment. Therefore, we don't think it is correct to take 10/15dBm as the conclusion to say in the real NW higher than 15dBm is not needed at all.

**Observation 1:** It is misleading statement to say 10/15dBm is enough for 100% UEs in the NW with InH or dense urban scenario, since Tx power is highly rely on NW deployment and poor NW deployment will cause high UE Tx power no matter indoor or dense urban.

# Tx power shall be guaranteed in real NW

- Mobility impact needs to be carefully considered in NW, and low Tx power will cause big problems since the NW is deployed according to normal power class.
- It was further claimed to introduce new device type in [1], e.g. NR IoT device, Indoor devices, wearable devices in Rel-18, however, these device types are not new, and it is not clear of what kind of IoT device/indoor device can only exist in good coverage NW and never goes to poor coverage area or move to outdoor. If exist, they are corner cases and not deserved to introduce new low power classes in RAN4.

**Observation 2:** Low Tx power will cause big problems in the NW if consider mobility.

**Observation 3:** It is not clear what kind of IoT device/indoor device only exists in good coverage NW and never goes to poor coverage or outdoor. For corner cases, they are not deserved to define new low power classes.

# UE requirements and Implementation choices

- RAN4 power classes are defined based on the Tx power demands in the whole system and be used to do NW planning like cell coverage.
- PA choices are purely up to UE implementation as long as it can meet 3GPP RAN4 requirements for the targeted power class. It is unusual to introduce new power classes just because of enabling UE to implement one specific kind of PA.

**Observation 4:** PA efficiency and costs are not proper to be used as the reason to introduce new power classes in RAN4, it is implementation specific issue.

# PA efficiency and costs are not problem for GaAs

- It was claimed in [1] that GaAs PA has low efficiency and high costs comparing to CMOS PA in low Tx power, and is not suitable for wearable and indoor devices, however, currently GaAs PA is widely used for smart phone and wearable devices and no problem is found.
- GaAs PA is more mature and better performance. We don't see the obvious advantage in efficiencies that CMOS PA can provide in 20dBm Tx power.
- Regarding cost, actually it is different from company to company, and we don't see there is problem for GaAs PA especially considering the performance, industry mature status and product choices on the market.

**Observation 5:** It is not obvious to say CMOS PA has higher efficiency and lower costs than GaAs PA.

**Observation 6:** GaAs PA now is widely used in smartphone and wearable devices, and no cost or efficiency problems are found in real implementation.

# Conclusion

- It is not justified the necessity of introducing new lower UE power classes.
- It will cause problems in the real NW if introduce lower UE power classes, especially for NWs which are deployed according to the normal UE power class.
- It is proposed not to consider lower UE power class in RAN4 Rel-18.

# Reference

[1] RP-212019, Views on RAN4 UE RF in Rel-18, vivo, RAN #93-e, Sep. 2021