**3GPP TSG-RAN WG4 Meeting # 109 R4-2318146**

**Chicago, USA, November 13 – 17, 2023**

**Agenda item:** 8.27.3

**Source:** Moderator (Huawei, HiSilicon)

**Title:** Topic summary for [109][140] NR\_cov\_enh2\_part1

**Document for:** Information

# Introduction

This contribution summarizes the documents that are submitted to agenda 8.27.1.1 for RAN4#109 and it concentrates on the following aspects.

* Topic #1: CRs to introduce *higherPowerLimit-r17* for eligible PC3+PC5 CA/DC combinations respectively, including UL intra-band CA
* Topic #2: Remaining clarifications on ΔPPowerClass report and full power transmission mode capability indication

# Topic #1: CRs to introduce *higherPowerLimit-r17* for eligible PC3+PC5 inter-band includin CA/DC combinations respectively, including UL intra-band CA

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2318030 | Nokia, Nokia Shanghai Bell, Samsung | **Rel-18 CR for TS 38.101-1 to enable higherpowerlimit feature to deal with PC3 uplink inter band CA whose respective power classes are PC3 and PC5 and one of the bands may include intra band UL CA.** |
| R4-2318031 | Nokia, Nokia Shanghai Bell, Samsung | **Rel-18 CR for TS 38.101-3 to enable higherpowerlimit feature to deal with PC3 uplink inter band EN-DC whose respective power classes are PC3 and PC5 and one of the bands may include intra band UL CA.** |
| R4-2318959 | vivo, ZTE, Huawei, CHTTL, Samsung, Xiaomi | **Resubmission of the endorsed draft CR R4-2315848.****Rel-18 CR for TS 38.101-1 to enable higherpowerlimit feature to deal with PC3+PC5 uplink inter band CA. This is to incorporate previous endorsed ones and also consider latest status, to have a unified version as a baseline for formal CR.** |
| R4-2320094 | , vivo, Huawei, CHTTL, Xiaomi, Samsung | **Resubmission of the endorsed draft CR R4-2316336.****Rel-18 CR for TS 38.101-3 to enable higherpowerlimit feature to deal with PC3+PC5 uplink inter band EN-DC. This is to incorporate previous endorsed ones and also consider latest status, to have a unified version as a baseline for formal CR.** |

## Open issues summary

### Sub-topic 1-1: CRs to enable higherpowerlimit-r17 for eligible PC3+PC5 combinations of uplink inter-band CA/DC with intra-band UL CA component

*Sub-topic description:*

*Discussions on the CRs to enable higherpowerlimit-r17 for eligible PC3+PC5 combinations of uplink inter-band CA/DC with intra-band UL CA component are still expected. The controversial parts are excerpted as below.*

*#1 for sub-clause 6.2A.4.1.3* *Configured transmitted power for Inter-band CA:*

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*For the same issue under EN-DC scenario, following modifications need further discussion:*

*#1 for sub-clause 6.2B.4.1.3 Inter-band EN-DC within FR1:*

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*Open issues and candidate options before meeting:*

**Issue 1-1: Whether to adopt the changes in CR R4-2318030 which is to clarify that the total power under higherpowerlimit feature for PC3+PC5 inter-band UL CA with intra-band UL CA component is determined by the sum of configured power of each band but not by that of each CCs.**

* Proposals
	+ Option 1: Yes. (Nokia)
	+ Option 2: Others, in case the CR may need further revision/merge.
* Recommended WF
	+ TBA

**Issue 1-2: Whether to adopt the changes in CR R4-2318031 which is to clarify the configured power related signalling reference for enabling higherpowerlimit feature for PC3+PC5 inter-band EN-DC with intra-band UL CA component.**

* Proposals
	+ Option 1: Yes. (Nokia)
	+ Option 2: Others, in case the CR may need further revision/merge.
* Recommended WF
	+ TBA

# Topic #2: Remaining issues on ΔPPowerClass report and full power transmission mode capability indication

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2318032 | Nokia, Nokia Shanghai Bell | **Proposal:**  Clarify if the agreement about applicability of ΔPPowerClass to CA/DC. 1. Reporting ΔPPowerClass is available during single band with single CC operation as well as CA/DC operation, i.e., ΔPPowerClass,CA andΔPPowerClass,EN-DC are out of scope.
2. ΔPPowerClass as well as ΔPPowerClass,CA andΔPPowerClass,EN-DC are reported.

It is noted that our understanding is A), but the below answers are provided based on B) which can anyway include answers based on A).**Observation 1:** RAN4#108bis agreed that ΔPPowerClass,CA and ΔPPowerClass,EN-DC for CA/DC with *higherPowerLimit-r17* is not considered at least in Rel-18. Hence, possible values for ΔPPowerClass(s) in Rel-18 is 0, 3 and 6 dB at most. Thus, at least 2 bits are needed. **Observation 2:** The granularity is per cell for ΔPPowerClass and per aggreagated cells for ΔPPowerClass,CA and ΔPPowerClass,EN-DC, respectively. This is because ΔPPowerClass(s) is a difference from the advertised power class whose granularity is per band for single band operation or per band combination for CA or DC operation. These are utilized to determine a range of PCMAX,f,c or PCMAX, respectively, whose granularity is per cell or per aggregated cells in PHR. **Observation 3:** RAN4 specifications already have specified conditions that ΔPPowerClass(s) should change, while some relevant parameters like uplink duty cycle evaluation period, start and end timing of the evaluation, are not clearly defined. Values of these undefined parameters would be different from UE to UE so that the final decision on the report timing depends on UE implementation**.****Observation 4:**  Networks which can utilize the reported value should have authority to configure a UE supporting a corresponding capability with the reporting via PHR-Config like *tdd-MPE-P-MPR-Reporting-r16*. Otherwise, the UE needs to keep usefulness reporting when it is under the network which cannot deal with the reported value(s). Accordingly, RAN4 specifications would add a similar note for MPE P-MPR Reporting capability with a following additional side condition (the example is for single carrier operation).**Answer for Q1:** At least two bits.**Answer for Q2:** Per cell [for single band with single CC operation and per aggregated cells for band combination for CA or DC operation] “Editor comment: The latter part is omitted once clarified that only ΔPPowerClass is reported”.**Answer for Q3:** RAN4 specifications would specify a following or similar note. [It is noted that ΔPPowerClass can beΔPPowerClass, CA orΔPPowerClass, EN-DC depending on where the note is included] “Editor comment: The latter part is omitted once clarified that only ΔPPowerClass is reported. |
| R4-2318100 | Nokia, Nokia Shanghai Bell | **Rel-18 CR for TS 38.101-1 to introduce UE report on ∆PPowerClass and/or∆PPowerClass,CA.**Introduce a note to explain a following side-condition to limit this feature not to be used by the other triggering conditions.* ∆PPowerClass reporting capability XXX-r18, as defined in TS 38.306, is used to report ∆PPowerClass when the network configures the UE with the reporting and the reporting is triggered only by uplink duty cycle exceedance or by return to the *ue-PowerClass* after the duty cycle exceedance.
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| R4-2318101 | Nokia, Nokia Shanghai Bell | **Rel-18 CR for TS 38.101-3 to introduce UE report on ∆PPowerClass,EN-DC.**Introduce a note to explain a following side-condition to limit this feature not to be used by the other triggering conditions.* ∆PPowerClass,EN-DC reporting capability XXX-r18, as defined in TS 38.306, is used to report ∆PPowerClass,EN-DC when the network configures the UE with the reporting and the reporting is triggered only by uplink duty cycle exceedance or by return to the *powerClass* after the duty cycle exceedance.
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| R4-2318437 | Apple | **Observation 1:** RAN4 has concluded that ∆PPowerClass is not applicable to CA/DC with high-power limit feature for which only P-MPR is used for SAR mitigation.**Observation 2**: ULFPTx capability is an indication of UE’s power amplifier (PA) configuration in conjunction with the corresponding power class handling capability. **Observation 3**: UE’s fundamental ULFPTx capability shall not be altered by ΔPPowerClass nor with other power limiting mechanisms, such as P-Max and P-MPR.**Observation 4**: There has been a misconception in RAN4 that when ΔPPowerClass is applied, the UE power class would be changed (also being considered as power class “fallback”).**Observation 5**: The UE power class should have never fell back as it is the UE PA power handing capability which does not change because of any power back-off.**Observation 6**: If UE supports ULFPTx, irrespective of any mode, as long as ΔPPowerClass = 3dB or 6dB is applied, each of the PAs shall be able to support PCMAX individually, or equivalently the UE can always support full-power mode (or mode 0).**Observation 7**: Since network is already aware of UE’s ULFPTx capability based on the RRC indication, it should be able to derive the equivalent full-power mode when PCMAX is constrained by ΔPPowerClass.**Observation 8**: If the ΔPPowerClass status change would occur rather frequently, the redundant additional ULFPTx capability indication could potentially impact the network efficiency.**Proposal 1**: RAN4 should cease using “Increasing UE power high limit for CA and DC” feature as a vehicle for future ∆PPowerClass reporting discussions to avoid the confusion.**Proposal 2**: If ∆PPowerClass reporting would be developed, do not combine with additional ULFPTx capability indication.  |
| R4-2318718 | MediaTek | **Answer for Q1:** From RAN4 perspective, delta power class has 5 values, 0/±3/±6, therefore at least 3 bits are required to support the reporting of this information.**Answer for Q2:** The granularity of the information to be reported is per cell.**Answer for Q3:** It is clear to RAN4 under which condition(s) a UE is allowed to report delta power class, i.e., either when the scheduled duty cycle exceeds the UE maximum duty cycle capability or reduces to equal to or below the UE maximum duty cycle capability after exceedance. RAN4 will specify these conditions in RAN4 specs, and RAN2 specs TS 38.331 could refer to this when writing the reporting procedure. |
| R4-2318773 | Qualcomm | **Observation 1:** When a UE takes on ∆Ppowerclass > 0 (i.e. ‘power class fallback’), it may elect to support any one of the available ULFPTX modes during fallback.**Answer for Q1:** As background, the UE can assume multiple positive values for the parameter ∆Ppowerclass instead of the default 0 value case, and these correspond to multiple fallback levels. For each fallback level, the UE needs to optionally convey to the network an applicable *ul-FullPower* capability. The choices correspond to *ul-FullPower*, *ul-FullPowerMode1* and *ul-FullPowerMode2* [38.306]. Not reporting an *ul-FullPower* capability for a new fallback level implies no change from declared ULFPTx mode for the declared power class. RAN4 has UEs with 2 levels of fallback as of Rel-18, but RAN4 defer to RAN2 choice on instituting additional levels for future flexibility. RAN4 is aware that the first two options (*ul-FullPower*, *ul-FullPowerMode1*) only require a bit each, so special care is needed only for *ul-FullPowerMode2* parameters. To support this goal in an efficient way, the signaling can be divided into a static ‘pre-conveyed’ part and a dynamic pointing. Specifically, the UE would additionally report as part of initial access, sets of *ul-FullPowerMode2* parameters for each foreseen fallback level. The UE is then only required to dynamically point to one of the three options for each fallback level.Since every level of fall back has 3 options for *ul-FullPower*, a 2-bit field is sufficient. When the new ∆Ppowerclass is 0, the original capability set for the declared power class applies.In summary:1. For every instance when ∆Ppowerclass is changed, a UE shall 2 bits to indicate the new value of ∆Ppowerclass . Additionally, a UE can optionally report a 2-bit pointer to the applicable set of *ul-FullPower* capabilities corresponding to the new value of ∆Ppowerclass.
2. New capabilities are required to be defined so a UE can pre-convey to the network for each positive value of ∆Ppowerclass, the potential *ul-FullPowerMode2* parameters that could apply

**Answer for Q2:** Since ∆Ppowerclass is tied to PHR, the granularity would be similar: ∆Ppowerclass is per cell and ∆Ppowerclass,CA is per UE.**Answer for Q3:** The triggering events for ∆Ppowerclass change, and consequently, reporting thereof are documented in section 6.2x.4 of TS38.101-1 and TS38.101-3. |
| R4-2318892 | Xiaomi | **Observation 1:** there are no other values other than 0/3/6 dB for delta power class. But, it also allow UE to report ΔPPowerClass when it returns to the advertised power class or an intermediate power class.**Observation 2:** the delta power class could apply to both single band scenario and CA/DC scenario.**Observation 3:** the delta power class definition and triggering condition(s) has been somehow already reflected in the current RAN4 spec, but some more modifications is needed in RAN4 spec regarding the power class return triggering condition(s).**Proposal 1:** For single band, the granularity of the reporting is per band; for band combination, the granularity of the reporting is per band combination.**Proposal 2:** the answers in the annex is proposed for the reply LS.**Answer for Q1:** delta power class can be 0dB, 3dB or 6dB. But it also allow UE to report ΔPPowerClass when it returns to the advertised power class or an intermediate power class.Answer for Q2: For single band, the granularity of the reporting is per band; for band combination, the granularity of the reporting is per band combination.**Answer for Q3:** Yes. |
| R4-2318957 | vivo | **Proposal 1:** 2 Bits is suggested for the information, considering the current need (three cases: 0/3/6dB) and future extension.**Proposal 2:** Choose per FS as granularity, or postpone the reply of this topic to next meeting.**Proposal 3:** Leave the case description for different values of ΔPPowerClass (and other related concepts) in RAN4 as current it is, and RAN2 can define the triggering condition of value changes of ΔPPowerClass because of the duty cycle changes (i.e. change of the percentage of uplink symbols transmitted in a certain evaluation period) as in previous multiple LSs. |
| R4-2318958 | vivo | **Answer for Q1:** 2 Bits is suggested for the information report, considering the current need (three cases: 0/3/6dB) and future extension.Answer for Q2: RAN4 would need further study on this issue.**Answer for Q3:** RAN4 would keep the current description for different values of ΔPPowerClass and other related concepts such as ΔPPowerClass,CA, ΔPPowerClass,EN\_DC which used for CA and EN-DC as current they are. RAN2 can define the triggering conditions of value changes of those parameters because of the duty cycle changes (i.e. change of the percentage of uplink symbols transmitted in a certain evaluation period) based on the descriptions in previous multiple LSs |
| R4-2319406 | Samsung | **Proposal 1:** Neither ΔPPowerClass reporting nor PHR reporting triggered by the change of physical UL resources availability at the UE side is considered in Rel-18.**Proposal 2:** In principle, the applicable/suitable ULFPTx mode reporting (along with ΔPPowerClass reporting) is supposed to be semi-static reporting(RRC), to maximize the benefit. **Proposal 3:** ULFPTx mode reporting (along with ΔPPowerClass reporting) should be optional.**Observation 1:** It is also acceptable to us if unfortunately RAN2 is not able to introduce semi-static reporting (RRC) for suitable ULFPTx mode within Rel-18, which can be left for future releases.**Observation 2:** For CA/DC, ΔPPowerClass,CA/ΔPPowerClass,EN-DC are considered, so the reporting is for the whole band combination, rather than for the constituent(s) band or constituent CC(s) within the band combination.**Proposal 4:** For Q1/Q2, in terms of single band single CC, our understanding is at least 2bits are needed for the reported values if reusing the existing single entry PHR mechanism for ΔPPowerClass reporting, and the granularity is expected as per CC.**Proposal 5:** For Q1/Q2, in terms of inter-band or intra-band CA/DC, our understanding is at least 2bits are needed for the reported values, if reusing the existing multi entry PHR mechanism for ΔPPowerClass,CA/ΔPPowerClass,EN-DC reporting. In addition, the granularity for ΔPPowerClass,CA/ΔPPowerClass,EN-DC reporting is expected as per BC. **Proposal 6:** An optional “per UE” capability is needed. If indicated, both ΔPPowerClass reporting for single band single CC and ΔPPowerClass,CA/ΔPPowerClass,EN-DC reporting for CA/DC are supported by the UE.**Proposal 7:** A paired NW control indication (signalling) is needed to allow UE to report ΔPPowerClass/ΔPPowerClass,CA/ΔPPowerClass,EN-DC(in other words, NW can choose to not utilize this UE capability, and just use legacy PHR reporting mechanism).**Proposal 8:** The reporting conditions at UE side for ΔPPowerClass reporting for single band single CC and ΔPPowerClass,CA/ΔPPowerClass,EN-DC reporting for CA/DC should be clearly defined in RAN4. Further, at least new UE capability, new NW control signaling and trigger condition (duty cycle-based) are supposed to be clearly described. |
| R4-2319437 | Ericsson | **Answer for Q1:** in the current versions of the 38.101-1, the Ppowerclass for a serving cell can take the values 0, 3 or 6 dB so at least two bits needed. The Ppowerclass,CA for a band combination can take the values 0 or 3 dB.Answer for Q2: per UE, reported for both serving cell(s) and also for a band combination when configured to report for the band combination.**Answer for Q3:** trigger conditions for power capability changes are defined in 38.101-1, but not the timing of the events. Application of a Ppowerclass can be due to excessive UL duty cycles, although the network is not aware of the duty cycle management in the UE and the timing of the power capability change. The Ppowerclass can also be set when the UE is configured with a P-Max power limit; RAN4 expects that this is not frequent but should be included in reporting nevertheless. RAN4 suggests that the Ppowerclass for a serving cell and the Ppowerclass,CA for a band combination is triggered similarly to the existing trigger mechanisms for path loss changes specified for aperiodic PHR reporting. |
| R4-2319911 | OPPO | **Proposal 1: For Q1, reply RAN2:**The reporting includes two aspects, one is the applied Tx power capability of UE when the duty cycle is exceeded or returned, and the other is the applied ULFPTx capability along with it. The reported ΔPPowerClass values are {0dB, 3dB, 6dB}, and meanwhile mapping the applied ΔPPowerClass to the ULFPTx capabilities {fullpower, fullpowerMode1, fullpowerMode2}. When UE indicate the ΔPPowerClass values, the corresponding ULFPTx capabilities will also be applied. The exact bits can be decided by RAN2 based on the final reporting signalling design.**Proposal 2: For Q2, reply RAN2:** The granularity is per band per BC.**Proposal 3: For Q3, reply RAN2:** The ΔPPowerClass reporting can be triggered by the condition of either when the scheduled duty cycle exceeds the UE maximum duty cycle capability or reduces to equal to or below the UE maximum duty cycle capability after exceedance. The relation among ΔPPowerClass, scheduled duty cycle and maximum duty cycle capabilities are defined in clause 6.2.4 of 38.101-1 for single band, and clause 6.2A.4 of 38.101-1 for CA band combinations, and 6.2B.4 of 38.101-3 for EN-DC in these cases.  |
| R4-2320079 | Huawei, HiSilicon | **Observation 1:** Regarding triggering condition of ΔPPowerClass reporting, RAN1 have concluded that no spec impact will be introduced, while RAN4 have made the draft CR in R4-2313097 as ‘not pursued’ with the understanding that RAN4 spec impact is unnecessary either.**Observation 2:** For static reporting, at least some clarifications in RAN2 specification are necessary in order to make sure the mapping between full power transmission mode capability and each reference power class can be aware of by network.**Observation 3:** For dynamic reporting, at least concomitant signalling design in RAN2 domain can be expected.**Proposal 1:** Regarding ΔPPowerClass reporting, the current value (i.e. 0dB, 3dB or 6dB) of it is required to be reported when exceedance/return from exceedance of max duty cycle happens and causing the UE applies different ΔPPowerClass. **Proposal 2:** Per band per band combination is RAN4 recommendation for ΔPPowerClass reporting granularity in order to cover both single band operation and CA/DC (only NR band).**Proposal 3:** Both static and dynamic indication on full power transmission mode capability should be considered: * “Static” – In addition to the full power transmission mode capability indication for the advertised power class, indicate all capabilities for each reference power class as well.
* “Dynamic” – Indicate the capability once max duty cycle exceedance or return from exceedance happens, which means such UE may change its capability for the advertised/reference power class.
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| R4-2320080 | Huawei, HiSilicon | **Answer for Q1:** The current value (i.e. 0dB, 3dB or 6dB) of ΔPPowerClass is required to be reported when exceedance/return from exceedance of max duty cycle happens and causing the UE applies different ΔPPowerClass. By this sense, two bits can be enough to cover all status (to indicate 0dB, 3dB or 6dB).Answer for Q2: Per band per band combination is RAN4 recommendation for ΔPPowerClass reporting granularity in order to cover both single band operation and CA/DC (only NR band).**Answer for Q3:** RAN4 will discuss the triggering condition(s) for ΔPPowerClass reporting as input to RAN2.As for full power transmission mode capability indication, following two types of it should be considered:* “Static” – In addition to the full power transmission mode capability indication for the advertised power class, indicate all capabilities for each reference power class as well.
* “Dynamic” – Indicate the capability once max duty cycle exceedance or return from exceedance happens, which means such UE may change its capability for the advertised/reference power class.
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| R4-2320093 | ZTE | **Observation 1**: UL full-power mode may or may not be changed due to ΔPPowerClass reporting.**Observation 2**: To enable the flexible changes of UL FP mode switching when ΔPPowerClass reporting, there are impacts on both RAN1 and RAN2. **Proposal 1**: 2-bit is needed for a UE to report on the ΔPPowerClass.**Proposal 2**: 2-bit MPE field used for FR2 in PHR MAC CE can be reused to report ΔPPowerClass for FR1.**Proposal 3.** To introduce an optional UE signalling to indicate the additional ul-FullPwrMode-r16 capabilities for this UE when the UE reports 3dB or 6dB ΔPPowerClass. **Proposal 4.**  Dynamic indication of the ULFPTx capability(s) for positive values of ΔPPowerClass should be semi-static. **Answer for Q1:** 2-bits are required to support the reporting ΔPPowerClass. In addition, introduce an optional UE signalling to indicate the additional *ul-FullPwrMode-r16* capabilities for this UE when the UE reports 3dB or 6dB ΔPPowerClass.Answer for Q2: The granularity for ΔPPowerClass reporting is per UE.Answer for Q3: The only triggering condition(s) for ΔPPowerClass reporting is the duty cycle mechanism, which have already been included in the clause 6.2.4 for single carrier, and clause 6.2A.4 for NR CA in TS38.101-1, and clause 6.2B.4 for DC in TS38.101-3. |

## Open issues summary

### Sub-topic 2-1: Further clarifications on ΔPPowerClass report

*Sub-topic description:*

*By those questions in the LS R2-2311611, RAN2 call on RAN4 to fulfill duties on providing necessary clarifications on the details of ΔPPowerClass report for the sake of facilitating RAN2 signaling designing work considering it is coming to the end of Rel-18.*

**Issue 2-1: What exact information is required to be reported byΔPPowerClass reporting**

* Proposals
	+ **Option 1**: Only ΔPPowerClass is available during single band with single CC operation as well as CA/DC operation.
		- **Option 1a**: 2 bits are needed due to the fact that the reported ΔPPowerClass can be 0, 3 and 6 dB. (Nokia)
		- **Option 1b**: 3 bits are needed because the reported ΔPPowerClass can be 0/±3/±6 dB. (MediaTek)
	+ **Option 2**: Both ΔPPowerClass, ΔPPowerClass, CA/ΔPPowerClass, EN-DC should be considered.
		- For single band operation, 2 bits are needed to cover 0, 3 and 6 dB for ΔPPowerClass; For CA/DC case, 2 bits are needed to cover 0, 3 dB for ΔPPowerClass, CA/ΔPPowerClass, EN-DC. (Samsung, Huawei, [Ericsson])
	+ **Option 3**: Others.
* Recommended WF
	+ TBD.

**Issue 2-2: What is the granularity of ΔPPowerClass reporting**

* Proposals
	+ **Option 1**: Per cell for single band operation (ΔPPowerClass) and per band combination for CA/DC (ΔPPowerClass, CA/ΔPPowerClass, EN-DC). (Nokia, Samsung, Xiaomi)
	+ **Option 2**: Per Cell. (MediaTek)
	+ **Option 3**: Per FS. (vivo)
	+ **Option 4**: Per band per band combination. (OPPO, Huawei)
	+ **Option 5**: Per UE. (Ericsson, Qualcomm, ZTE)
	+ **Option 6**: Others.
* Recommended WF
	+ TBD.

**Issue 2-3: Whether RAN4 spec modification would be needed to clarify the triggering condition(s)**

* Proposals
	+ **Option 1**: Yes. (Xiaomi, Samsung)
		- **Option 1a**: CR R4-2318100/8101 can be considered. (Nokia)
			* [Moderator: reproduce part of R4-2318100 here as an example]
				+ NOTE: ∆PPowerClass reporting capability XXX-r18, as defined in TS 38.306, is used to report ∆PPowerClass when the network configures the UE with the reporting and the reporting is triggered only by uplink duty cycle exceedance or by return to the ue-PowerClass after the duty cycle exceedance.
	+ **Option 2**: No need for spec change, but just further clarifications by LS reply to RAN2. (Ericsson, MediaTek, Qualcomm, vivo, OPPO, ZTE)
		- **Option 2a**: trigger conditions for power capability changes are defined in 38.101-1, but not the timing of the events... (More details in R4-2319437 from Ericsson)
		- **Option 2b**: The ΔPPowerClass reporting can be triggered by the condition of either when the scheduled duty cycle exceeds the UE maximum duty cycle capability or reduces to equal to or below the UE maximum duty cycle capability after exceedance. The relation among ΔPPowerClass, scheduled duty cycle and maximum duty cycle capabilities are defined in clause 6.2.4 of 38.101-1 for single band, and clause 6.2A.4 of 38.101-1 for CA band combinations, and 6.2B.4 of 38.101-3 for EN-DC in these cases. (More details in R4-2319911 from OPPO)
* Recommended WF
	+ TBD.

**Issue 2-4: Whether the network should have the authority to configure ΔPPowerClass reporting**

* Proposals
	+ **Option 1**: Yes, the network control signalling is needed. (Nokia, Samsung)
	+ **Option 2**: Others.
* Recommended WF
	+ Option 1.

### Sub-topic 2-2: Further clarifications on full power transmission mode capability indication due to ”power back-off”

*Sub-topic description:*

*In previous meeting, whether to consider static or dynamic for such indication was left for further study.*

**Issue 2-5: What exact information should be provided from UE by full power transmission mode capability indication due to ”power back-off”**

* Proposals
	+ **Option 1**: Optional and dynamic indication with the following details. (Qualcomm)
		- For every instance when ΔPPowerclass is changed, the UE can report a pointer to the applicable capability from one of {*ul-FullPower*, *ul-FullPowerMode1, ul-FullPowerMode2*}.
			* The specific parameters of *ul-FullPowerMode2* can be pre-conveyed to the network for each positive ΔPPowerclass.



* + **Option 2**: Optional semi-static indication. (Samsung, ZTE)
		- The mapping between ΔPPowerclass and full power transmission mode capabilities {*ul-FullPower*, *ul-FullPowerMode1, ul-FullPowerMode2*}. (OPPO)
	+ **Option 3**: Both static and dynamic indication should be considered. (Huawei)
		- “Static” – In addition to the full power transmission mode capability indication for the advertised power class, indicate all capabilities for each reference power class as well.
		- “Dynamic” – Indicate the capability once max duty cycle exceedance or return from exceedance happens, which means such UE may change its capability for the advertised/reference power class.
	+ **Option 4**: Do not consider such indication. (Apple)
* Recommended WF
	+ TBA