

Agenda Item: 9.2.2
Source: Ericsson
Title: **Reporting events for UE internal measurements**
Document for: Decision

1 Introduction

The perhaps single most important radio resource within a CDMA radio network is the transmission power used for the communication. If too much power is used on a radio link, it creates unnecessary interference to other radio links and degrades the system capacity. Hence, it is of highest importance that the radio network functions in UTRAN are provided with sufficient knowledge of the UE transmission power to take the necessary actions.

In the Ericsson contribution TSGR2#4(99)419 "UE Measurement Concept for Intra-Frequency Measurements" [2] the general UE measurement concept and advantages of event based measurement reports are presented. In this contribution, we give some UE reporting events that are connected to the UE transmission (Tx) power and the UE received (Rx) signal level. We also propose to include the UE Tx and Rx power measurements and the related events into a new UE measurement type denoted "Internal measurements".

2 Internal measurement reporting events

In the Measurement reporting criteria field in the Measurement Control messages, the UTRAN notifies the UE which events that should trigger a measurement report. Examples of internal measurement reporting events that would provide UTRAN with useful information about the UE Tx and Rx power are given below. Note that the UEs do not necessarily need to report all these events. The listed events are the toolbox from where the UTRAN can order reporting events. As for other measurement types, UTRAN can also order periodical measurements.

All events below can be combined with hysteresis and time-to-trigger to limit the amount of event-triggered reports. That is not shown in the figures below.

[Note: The reporting events are numbered 6A, 6B, 6C,.. where 6 denotes that the event belongs to the type Internal measurements.]

2.1 Reporting event 6A: The UE Tx power becomes larger than an absolute threshold

If the UE Tx power becomes larger than a predefined threshold it is an event that could trigger a report, see figure 1. This event would be used for detecting coverage problem i.e. that high Tx power is used by the UE due to high radio link path loss. This event could also be used to detect an overloaded cell if a UE is using a high output power even when having a low radio link path loss.

The corresponding report identifies (at least) the threshold that was exceeded (in case of more than one threshold).

2.2 Reporting event 6B: The UE Tx power becomes less than an absolute threshold

If the UE Tx power becomes less than a predefined threshold it is an event that could trigger a report, see figure 1. This event would be used for detecting near-far problems i.e. that very low power is used by the UE due to very low radio link path loss.

The corresponding report identifies (at least) the threshold that the UE Tx power went below (in case of more than one threshold).

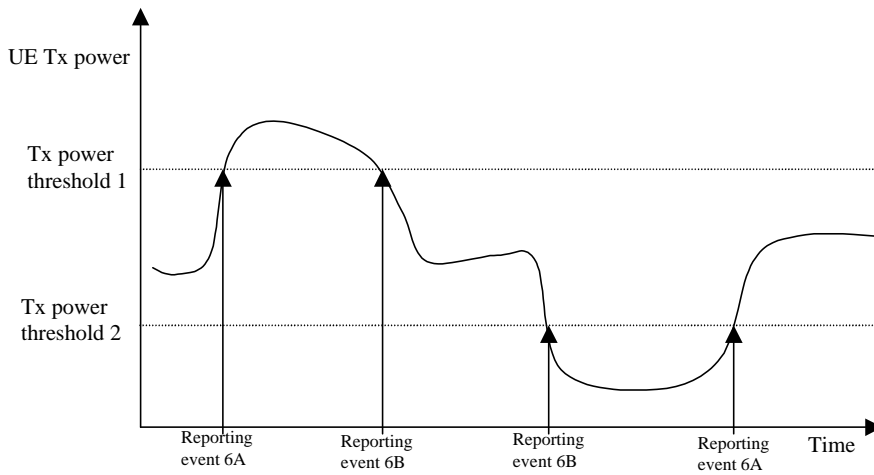


Figure 1: Event-triggered measurement reports when the UE Tx power becomes larger or less than an absolute threshold.

2.3 Reporting event 6C: UE cannot decrease the power upon demand

There is a limit for the lowest UE Tx power. Either there is a network controlled limit or a physical limit related to the UE terminal. If the uplink closed loop power control tries to order the UE to decrease its Tx power below the limit and the UE cannot do that due to the limit, it will cause interference to all other uplink transmissions in the area.

If the UE occasionally cannot decrease its Tx power, due to logical or physical limitations, the network will not experience this besides a statistical increase of the received uplink power. It is however essential that the network receives an early warning from the UE about this condition so it is possible to take appropriate actions (e.g. perform handover to another frequency).

Hence, if the UE cannot decrease its Tx power upon demand from the uplink closed loop power control, it is an event that could trigger a report, see figure 2.

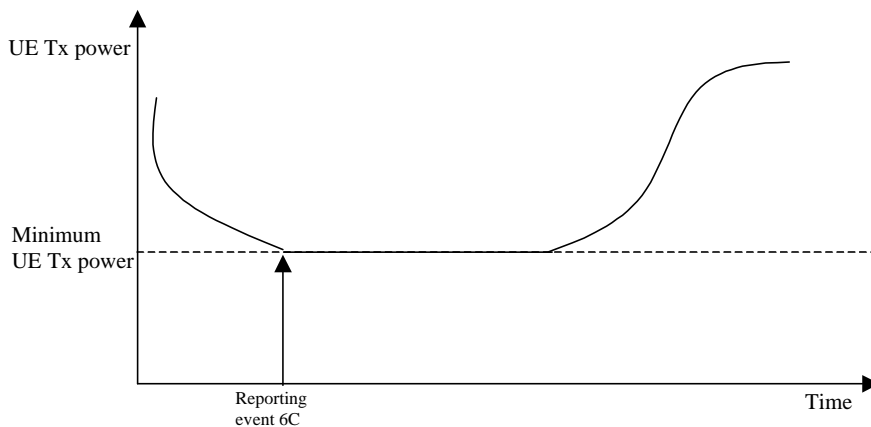


Figure 2: Event-triggered measurement report when the UE cannot decrease its power upon demand.

2.4 Reporting event 6D: UE cannot increase the power on demand

There is a limit for the highest UE Tx power. Either there is a network controlled limit or a physical limit related to the UE terminal. If the uplink closed loop power control tries to order the UE to increase its Tx power above the limit and the UE cannot do that due to the limit, it will cause poor uplink transmission quality for the UE.

If the UE occasionally cannot increase its Tx power, due to logical or physical limitations, the network will not experience this besides a statistical increase of block or bit error rate, or a decrease of SIR for this UE. It is however essential that the network receives an early warning from the UE about this condition so it is possible to take appropriate actions (e.g. lower the bitrate so the power requirements is reduced).

Hence, if the UE cannot decrease its Tx power upon demand from the uplink closed loop power control, it is an event that could trigger a report, see figure 3.

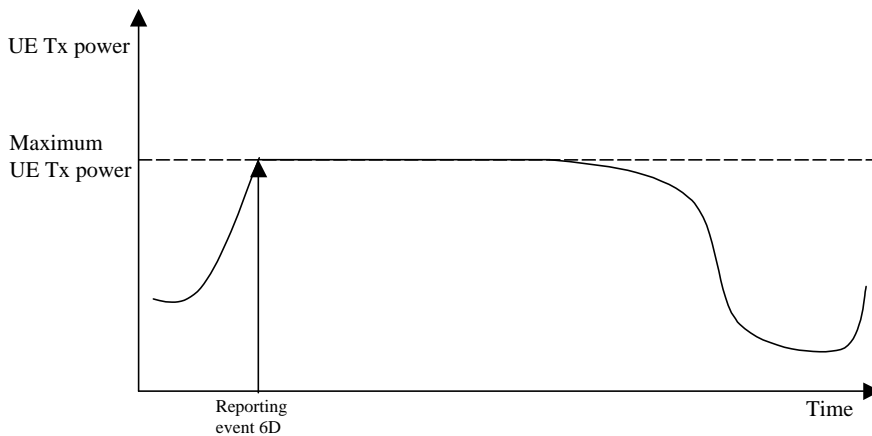


Figure 3: Event-triggered report when the UE cannot increase its power upon demand.

2.5 Reporting event 6E: The UE Rx signal level is above the dynamic range.

The UE receivers have a limited dynamic range. If the input signal to the UE is above a specific level the UE receiver becomes saturated, which results in poor downlink transmission quality. The downlink outer loop will then increase the downlink SIR-target. However, since the bad downlink performance is due to too high received signal power and not due to too low received SIR, an increase of SIR-target will not help. From the network perspective UTRAN cannot do anything about it unless the UE informs the network about its receiver problem.

Hence, if the UE received signal level is above the dynamic range, it is an event that could trigger a report. A typical action from UTRAN may be to stop compensating for bad downlink quality by increasing the downlink transmission power since the bad quality is due to too high received UE signal level.

3 Conclusions and Proposals

In this contribution, we have presented a number of UE reporting events that are triggered with respect to the UE transmission power or the UE received power. The corresponding event-triggered measurement reports would give the radio network functions in UTRAN useful information that UTRAN cannot obtain without the UE measurement reports.

We propose to introduce a new UE measurement type denoted “Internal measurements”, which includes measurements of the UE transmission power and the UE received signal level. Therefore, we propose to add this Measurement type to the bullet list in section 8.3.7 of 25.331 [1]:

- Internal measurements: Measurements of UE transmission power and UE received signal level.

Furthermore, we also propose to include the reporting events in chapter 2 of this document into chapter 15 “Specific functions” of 25.331 [1].

4 References

- [1] TS RAN 25.331 V1.0.1, “RRC protocol specification”
Source: Editor
- [2] TSGR2#4(99)419, “UE Measurement Concept for Intra-Frequency Measurements”
Source: Ericsson