

October 10 – 13, 2000

Agenda Item: Ad Hoc 27: Radio link performance enhancements

Source: Siemens AG, Philips

Title: Draft Work Item: Improved power control at power limits

Document for: Discussion and Approval

1. Abstract

At the last meeting in Berlin we presented [1], which proposes to improve the power control operation at maximum and minimum power limits. Corresponding to the discussion and its results in the last meeting a work item description [2] was drafted; but unfortunately this paper [2] could not be presented due to lack of time.

This paper intends to summaries the already identified problems for power control at the maximum and minimum power limits. In the appendix the drafted work item description is attached, which is proposed to be provided for the next TSG RAN#10.

2. Current power control at power limits

The problem, which should be discussed and solved in the proposed work item, occurs when a UE is operating at the power limits and the gain factors need be readjusted due to changing data rates or compressed mode. The next paragraphs of this section summarises the facts depicted in [1].

Chapter 5.1.2.6 of [3] prescribes that the total transmit power (after applying DPCCH power adjustment and gain factors) shall not exceed the maximum allowed value specified in [4]. Thus the UE is supposed to apply an additional scaling.

In the following case we consider a UE at the cell border, far away from the Node B transmitting immediately below the maximum power limit.

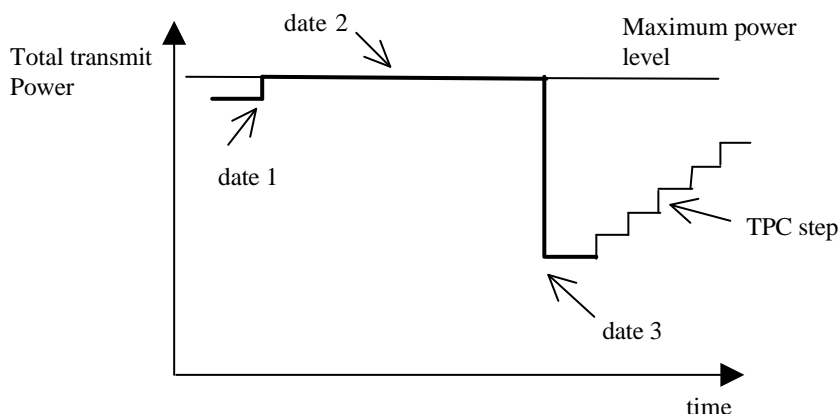


Figure 1: Power behaviour scenario at the maximum power level

In the case a higher data rate is requested the total transmit power will increase (date 1), but will also be scaled to the maximum allowed transmit power. If additionally a further data rate increase is required, the total transmit power will remain unchanged because of the performed scaling (date 2). If the high data rate is released again (date 3) and the UE

has not moved remarkably, the channel and power condition should prevail unchanged. Ideally the UE would use the same power as it used immediately before date 1. But as depicted in figure 1 the power adjustment due to gain factor readjustment is switched according to the current specification [3] to a power level, which is below the expected ideal power, since the power adjustment is done relative to the actual transmit power and not to the required transmit power.

At the minimum power level the same problem occurs (see figure 2). Looking at a UE residing immediately next to the base station, having additional a line of sight connection, the total transmit power could be very low. In the case of reducing the data rate the mobile is not to reduce the transmit power below the its minimum power level. That means the UE transmits the remaining DPCH with too much power. If the UE shall increase the total data rate again (date 3), the power adjustment due to gain factor readjustment would increase the power in the conventional way i. e. adding the power amount to the actual transmitted power and not to the required transmit power.

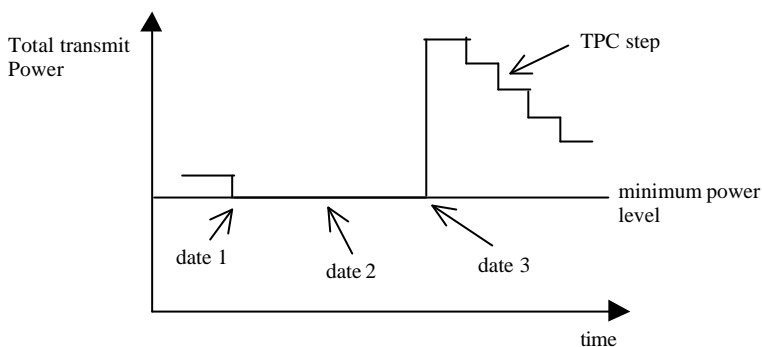


Figure 2: Power behaviour scenario at the minimum power level

This disturbed power control is similar to a UE operating at the maximum power level. But the impacts are really different. In figure 1 the UE would send with too low power and so the UE's uplink could be disturbed for a while. But the impacts caused by the example of figure 2 are devastating, since during the UE transmitting with too much power all uplink channels of the entire cell would be disturbed.

3. Conclusion

We propose to investigate the effect of inadequate power settings for R4 according to the attached WI description. A possible solution to this problem can be found in [1].

4. References

- [1] TSGR1#15(00)1056; Berlin, Germany; 8-2000; Siemens AG; Clarification of power control at maximum and minimum power
- [2] TSGR1#15(00)1125; Berlin, Germany; 8-2000; Siemens AG, Philips; Proposal for work item on improved power control at maximum and minimum power
- [3] TS 25.214 V3.4.0-DRAFT: "Physical layer procedures (FDD)"
- [4] TS 25.101 V3.3.1: "UE Radio transmission and Reception (FDD)"

Source: TSG RAN WG1

Proposed Work Item Description for improved power control at power limits

This work item description is proposed to be provided for the TSG RAN#10 for approval, sourced as TSG RAN WG1.

Work Item Description

Title

Improved power control operation at maximum and minimum transmit power.

1 3GPP Work Area

X	Radio Access
	Core Network
	Services

2 Linked work items

none

3 Justification

After consideration in TSG RAN WG1 it was identified that power control operation in case of maximum and minimum transmit power (of UE) needs improvements. This topic has been studied in TSG RAN WG1 as part of the study item "radio link performance improvements".

4 Objective

The purpose of this work item is to specify improvement for the power control operation at maximum and minimum UE transmit power.

5 Service Aspects

None

6 MMI-Aspects

None

7 Charging Aspects

None

8 Security Aspects

None

9 **Impacts**

Affects :	USIM	ME	AN	CN	Others
Yes		X			
No	X		X	X	
Don't know					

10 **Expected Output and Time scale (to be updated at each plenary)**

New specifications						
Spec No.	Title	Prime rsp. WG	2ndary rsp. WG(s)	Presented for information at plenary#	Approved at plenary#	Comments
Affected existing specifications						
Spec No.	CR	Subject		Approved at plenary#	Comments	
25.101		UE Radio transmission and Reception (FDD)		RAN #11		
25.214		Physical Layer Procedures (FDD)		RAN #11		
25.331		RRC Protocol Specification		RAN #11	Only possibly affected if parameters have to be set by higher layers	

11 **Work item rapporteurs**

12 **Work item leadership**

TSG RAN WG1

13 **Supporting Companies**

This work item has been agreed by TSG RAN WG1 for approval in TSG RAN

14 **Classification of the WI (if known)**

	Feature (go to 14a)
X	Building Block (go to 14b)
	Work Task (go to 14c)

14a The WI is a Feature: List of building blocks under this feature

(list of Work Items identified as building blocks)

14b The WI is a Building Block: parent Feature

This is a building block part of the radio interface improvement feature.

14c The WI is a Work Task: parent Building Block

(one Work Item identified as a building block)