

Agenda Item: 8.2

Source: Nortel Networks

Title: Text Proposal for Power Control Step section of TS 25.101

Document for: Discussion and decision

1. Introduction

The current section of the TS25.101 assumed 1dB step size. This value was proposed by Working Group 4, mainly for implementation reason. However, WG 1 is mandated to evaluate the impact of this parameter on the system performances and is currently investigating the potential benefit of having step size smaller than 1dB. A liaison statement [1] was sent to WG4 on that subject.

The goal of that document is to add a note to reflect the possible recommendation coming from Working Group 1 to have a “true” power control step smaller than 1dB, as an optional requirement. It also proposes new text and takes into account the possibility of having power step equal to integer multiple of the power control step ([2], [3]).

2. Proposed modification in s25.101

- ✓ Add a note to remind the possible recommendation coming from Working Group 1 on smaller step size
- ✓ Requirement (a): requirement for a single power control command which can be integer multiple of the step size accuracy. The tolerance is defined as a function of the step value.
- ✓ Requirement (b): requirement for consecutive power control commands. The rate of power control messages is mentioned. The case where power commands are multiple of the step size is taken into account. The tolerance is defined as a function of the step size value.
- ✓ Remove the timing requirement (c): Since the envelope of the signal is not constant, this requirement is impractical to measure. It is then suggested to measure the mean power.

3. Text proposal for '6.4.3 Power control step'

6.4.3 Power control steps

The power control step is the minimum step change in the UL- transmitter output power in response to a TPC message.

6.4.3.1 Minimum requirement

The UE transmitter shall have the capability of setting the closed loop output power with a step size of 1 dB.

Note : Working Group 1 is evaluating the impacts on system performances of power control step size smaller than 1dB. The output of this evaluation could be to define power control step size smaller than 1dB as an optional requirement.

~~(a)The tolerance of the transmitter output power due to closed loop power control shall be within the range shown in Table 5.~~

(a) The power control step size accuracy is defined by the tolerance on the difference of the mean power between a slot receiving a valid power control message and the mean power measured during the next slot. The relative power control step size accuracy should be $\pm PCCmd/2$. Range of the parameters are shown in Table 5. Pmin is the minimum output power (in dBm), as defined in 6.4.4. Pmax is the UE maximum outp power (in dBm), as defined in 6.2.1. PCCmd is the power control step (in dB), as defined in 6.4.3 or p times this value ($p \leq [6]$).

(b) The average rate of change in mean power shall be greater than $[-8.0]$ dB per $[10]$ slots and less than $[-12.0]$ dB per $[10]$ slots

(b) Table 6 defines the tolerance on the difference of the power after and before N identical consecutive power control commands have been received. The N power command messages are received at the rate defined in 6.4.5 (Power Control Cycles per second). PCCmd is the power control step (in dB), as defined in 6.4.3 or p times this value ($p \leq [6]$).

(c) Following the reception of a valid power control bit, the mean output power of the UE shall be within $[0.3]$ dB of its final value in less than $[62.5]$ us from the beginning of the next slot.

Table 5: Transmitter power control tolerance

TPC Symbol in the forward-link	Transmitter power control tolerance	
	Lower	Upper
11	$+ [0.5]$ dB	$+ [1.5]$ dB
00	$- [0.5]$ dB	$- [1.5]$ dB

Table 5 : Power Control Step accuracy

Power Control Message	Mean Power	
	Slot receiving TPC command	Next slot
Single “up” command	$P_{min} \leq P \leq P_{max} - PCCmd$	$P + PCCmd \pm 0.5 * PCCmd$
Single “down” command	$P_{min} + PCCmd \leq P \leq P_{max}$	$P - PCCmd \pm 0.5 * PCCmd$

Table 6 : Transmitter Power Tolerance

Power Control Message	Number of consecutive commands	Mean Power	
		Slot receiving 1 st TPC command	Slot after N power control commands
“up” command	$[4] \leq N \leq [10]$	$P_{min} \leq P \leq P_{max} - N * PCCmd$	$P + N * PCCmd \pm [2] * PCCmd$
“down” command	$[4] \leq N \leq [10]$	$P_{min} + N * PCCmd \leq P \leq P_{max}$	$P - N * PCCmd \pm [2] * PCCmd$

4. Conclusion

Text for Power control step section of TS25.101 has been proposed:

- a note has been added to remind that a smaller step size could be optionally introduced by WG1
- Some changes have been proposed in the definition and presentation of requirements on power control step size.

5. Reference

- [1] Liaison statement to WG4 on power control minimum step sizes, source 3GPP RAN WG1 Tdoc R4-99263
- [2] Liaison from 3GPP RAN WG1, source 3GPP RAN WG1 Tdoc R4-99095
- [3] LS to WG1 WG2 on power control, source 3GPP RAN WG4 Tdoc R4-99162