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System performance impact of power control interval

1 Introduction

Power control is currently available in GSM speech through the SACCH which enables a control interval of 480 ms.

ECSD uses inband signalling bits to enable fast power control (FPC) at a control interval of 20 ms. It has recently been proposed to reuse the FPC mechanism for the 8-PSK voice bearer that is currently being standardized [2].

This document present some system performance results with different interval of power control in order to determine if there would be a gain of decreasing the power control interval.

2 Simulation Results

The system performance is measured as the amount of speech users having Class 1a FER less than 1%. The power control is either turned off (nopc) or on at an interval of 480, 240 or 120 ms. The delay from measurement to actual change of power is either three or two times the power control interval, as indicated in the figures.

In Figure 1 results are shown when all users are moving at a speed of 3 km/h. As seen, all gain of power control for the slow moving users is achieved already at 480 ms control interval. Therefore, for low speed, there is no further gain of decreasing the power control interval.

Figure 2 shows the same simulations, but for users moving at 50 km/h. It can be seen that there is more gain of decreasing the power control interval below 480 ms. Note however that the largest gain is when going from 480 to 240 ms. The difference in fractional load between 240 and 120 ms is not very large. Decreasing the power control interval below 120 ms may therefore not improve system performance for users moving at 50 km/h or less.

Another aspect is the total delay from the measurement is started to the power is changed. If the delay is large with respect to the control interval there is a risk that the power commands are too old when they arrive to the transmitter. A shorter power control interval also implies shorter measurement intervals, which could affect the accuracy. Any significant performance gain is therefore not expected by decreasing the power control interval below 120 ms.

Figure 1: System performance for slow mobiles, 3 km/h

Figure 2: System performance for fast mobiles, 50 km/h.

3 Conclusion

The power control interval of 480 ms that exists today is adequate for slow users. However, at 50 km/h there is a gain of decreasing the interval to 120 ms. A power control interval as low as 20 ms is probably not necessary. The effect of power control on a very fast user, e.g. 100 km/h or more, is for further study.

4 References

[1] GSM 05.08, Radio Subsystem Link Control, V8.3.0, 2000-02.

[2] ETSI SMG2, Tdoc 1105/00, Fast Adaptation Mechanisms for 8PSK Speech Bearer, Nokia

Annex A Simulation assumptions

- Downlink
- TU3iFH
- Frequency reuse is 1/1.
- Random frequency hopping is used.
- AMR Full Rate, 5.9 kbps vocoder is used.
- Power control step size is 2 dB.
- Delay from start of measurement to execution of power control order is either 2 or 3 times the power control interval as indicated in the figures.