METHOD AND APPARATUS FOR PROVIDING UPLINK SIGNAL-TO-NOISE RATIO (SNR) ESTIMATION IN A WIRELESS COMMUNICATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

Claim of Priority Under 35 U.S.C. §119 and §120

The present application for patent is a Continuation application and claims priority to patent application Ser. No. 11/619,168 filed Jan. 2, 2007 which claims priority to patent application Ser. No. 10/794,917 filed Mar. 5, 2004, now allowed, and which claims priority to U.S. Provisional Application No. 60/452,790 filed Mar. 6, 2003, now expired, all of which can be assigned to the assignee hereof and hereby expressly incorporated by reference herein.

BACKGROUND

1. Field

The present invention relates generally to communication systems, and, more specifically, to a method and apparatus for providing uplink signal-to-noise ratio (SNR) estimation in a wireless communication system.

2. Background

Wireless communication technologies have seen explosive growth over the past few years. This growth has been primarily fueled by wireless services providing freedom of movement to the communicating public as opposed to being "tethered" to a hard-wired communication system. It has also been fueled by the increasing quality and speed of voice and data communications over the wireless medium, among other factors. As a result of these enhancements in the communications field, wireless communications has had, and will continue to have, a significant impact on a growing number of the communicating public.

One type of wireless communication system includes a Wideband Code Division Multiple Access (W-CDMA) system, which is configured to support both voice and data communications. This system may have multiple base transceiver sites that communicate over a wireless link with a plurality of mobile terminals. The base transceiver site transmits data and control information to the mobile terminal over a set of forward link channels and the mobile terminal transmits data and control information to the base transceiver site over a set of reverse link channels. In particular, the reverse link channels transmitted from the mobile terminal to the base transceiver site include a pilot channel, traffic channel, and rate indicator channel, among others. The traffic channel transmits data from the mobile terminal to the base transceiver site. The rate indicator channel provides a data rate to the base transceiver site indicating the rate at which data is being transmitted over the traffic channel. The pilot channel may be used by the base transceiver site for an amplitude and phase reference for demodulating the data on the traffic channel.

The reverse link channels are typically power controlled to compensate for variations in the received signals due to variations through the communication medium between the mobile terminal and base transceiver site. This power control process is usually based on measuring the signal-to-noise ratio (SNR) of the pilot channel. For example, the base transceiver site periodically measures the SNR of the pilot channel received from the mobile terminal and compares it to a target SNR. If the measured SNR is below the target SNR, the base transceiver site transmits to the mobile terminal an "UP" command. This directs the mobile terminal to increase the power level of the pilot channel, as well as the other channels. If the measured SNR is above the target SNR, the base transceiver site sends a "DOWN" command to the mobile terminal. This directs the mobile terminal to decrease the power level of the channels. The mobile terminal increases or decreases the transmit power of the channels by a fixed upward or downward step.

Typically, as the data rate on the traffic channel increases, the signal power of the traffic channel is also increased by the mobile terminal to accommodate the increased data rate. For an efficient operation of the communication link, the pilot power typically needs to be increased to provide better phase estimation for the higher data rates. However, because the maximum total signal power at which the mobile terminal may transmit over each of the reverse link channels is limited to a finite amount of power, the signal power level of the pilot channel is set to a nominal signal power level to enable an increase in the signal power level of the traffic channel to accommodate the increased data rate and minimize the pilot channel overhead. By keeping the signal power level of the pilot channel to a nominal signal power level, the estimation of the SNR of the pilot channel may not be as precise as if it were transmitted at a higher signal power level. As a result, the inner-loop power control of the wireless communication system may be adversely impacted due to the decreased reliability in the measured SNR of a lower signal power level transmitted on the pilot channel.

The present invention is directed to overcoming, or at least reducing the effects of, one or more problems indicated above.

SUMMARY

In one aspect of the invention, a method in a wireless communication system is provided. The method comprises receiving a first signal over a first channel and a second signal over a second channel, where the second signal is received at a higher signal power level than the first signal. A signal-to-noise ratio (SNR) of the second signal is measured, and the SNR of the first signal is determined based at least in part upon the measured SNR of the second signal.

In another aspect of the invention, an apparatus is provided. The apparatus comprises at least one transmitter for transmitting a first signal over a first channel and a second signal over a second channel, where the second signal is transmitted at a higher signal power level than the first signal. The system further comprises at least one receiver for receiving the first and second signals. The receiver measures a signal-to-noise ratio (SNR) of the second signal and determines the SNR of the first signal based at least in part upon the measured SNR of the second signal.

In another aspect of the invention, a device is provided. The device comprises a receiver for receiving a first signal over a first channel and a second signal over a second channel, where the second signal is received at a higher signal power level than the first signal. The receiver device further comprises a processor for measuring a signal-to-noise ratio (SNR) of the second signal and determining the SNR of the first signal based at least in part upon the measured SNR of the second signal.

In another aspect of the invention, a mobile terminal is provided. The mobile terminal comprises a transmitter that transmits a first signal over a first channel and a second signal over a second channel to a base transceiver site, where the second signal is transmitted at a higher signal power level than the first signal. The base transceiver site receives the first