SYSTEM AND METHOD FOR COORDINATION OF WIRELESS MAINTENANCE CHANNEL POWER CONTROL

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a divisional of U.S. patent application Ser. No. 12/938,864 filed on Nov. 3, 2010, which is a divisional of U.S. patent application Ser. No. 10/170,015, filed on Jun. 11, 2002 which claims the benefit of U.S. provisional application No. 60/297,839 filed on Jun. 13, 2001, which is incorporated by reference as if fully set forth.

BACKGROUND

In a wireless communication system, a number of radio channels provide a connection between users and a central location, such as a base station or access point. In such a system, the wireless channels are a scarce resource which must typically be shared. In a Code Division Multiple Access (CDMA) system, a number of different channels can be transmitted on a single radio frequency carrier by applying different codes to each signal. However, even in a CDMA system, demand for access to channels is so great that the base station must allocate and switch the channels among multiple users.

Often, a wireless user may be switched on, but not actively sending or receiving data. Accordingly, wireless users may be in an "active" mode, and currently allocated a wireless data traffic channel for sending or receiving data, or in an "idle" mode, and not currently sending or receiving data. An idle user may, for example, have just sent or received a data traffic transmission and is therefore deemed likely to soon request a data traffic channel for further transmissions. A maintenance message may therefore be employed to maintain a user in a synchronized but idle state to facilitate allocation of a wireless traffic channel when needed. When a user requests a channel, the idle state allows the user to be allocated a wireless traffic channel more quickly than for a user who was not being maintained in a synchronized idle state. For more information concerning one way to implement a system, please refer to U.S. Pat. No. 6,222,832, entitled "Fast Acquisition of Traffic Channels for a Highly Variable Data Rate Reverse Link of a CDMA Wireless Communication System," assigned to Tantivy Communications, Inc., assignee of the present application.

A number of users, therefore, may be maintained in an idle state through a periodic sequence of maintenance messages. In the idle state, the maintenance messages typically provide time tracking and power control, and do not require phase reference information employed when in the active state. Time tracking and power control signaling requires less power than the maintenance messages sent during active data payload transmission. The maintenance messages, however, are typically sent at a similar power level during both the idle and active states. Accordingly, the maintenance messages can increase interference and battery power drain during the idle state.

SUMMARY

In a wireless communications system, synchronization maintenance messages are often employed to maintain a user in an idle state by providing time tracking and power control. According to the present invention, a method for controlling the power level of a wireless message which defines a maintenance channel operable to transmit synchronization maintenance messages (synchronization messages) includes determining the presence of data to be transmitted from a wireless access terminal to a base station. The power level of the synchronization message sent from the access terminal via the maintenance channel is adjusted depending on the presence of data to be sent. Synchronization messages for idle state synchronization provide time tracking and power control signaling, while synchronization messages corresponding to active data traffic transmissions also provide phase reference for the data traffic transmissions. The synchronization messages corresponding to the idle state employ a lower power level than the active state transmissions which employ a higher power level.

In this manner, the system monitors the presence of data and controls the power level accordingly such that synchronization messages are sent at a lower power level in the idle state, when no data is present, thereby reducing power consumption and interference.

More specifically, a data transmission state is maintained at the wireless access terminal to indicate the presence of data to transmit via a data traffic channel on a reverse link. The power level of a synchronization message is computed in response to the data transmission state. Target power levels are maintained for the idle state and the active state. The synchronization messages are sent from the access terminal to the base station at the corresponding power level. Power control messages (return messages) sent in response from the base station manage the power level towards the applicable target power level.

A maintenance channel connection is maintained for transmission of the synchronization messages. The maintenance channel typically transmits unmodulated, or pilot, signals for maintaining synchronization. Since the maintenance channel is not a dedicated data traffic channel, a plurality of access terminals may be maintained over a single maintenance channel using a plurality of time slots.

The synchronization messages are typically sent at predetermined intervals from each of the access terminals. In the idle state, synchronization messages are sent according to a gating rate. In the active state, synchronization messages are sent continuously in order to maintain a phase reference for a corresponding data traffic transmission. Return power control messages are sent in response to the synchronization messages including power control and time tracking information according to a power control group.

The access terminal determines the data transmission state, either ON (active) or OFF (idle), and adjusts transmission power accordingly. The base station, in turn, determines the data transmission state and adjusts information in the return messages accordingly to control the power level toward one of an active power control target and an idle power control target. Further, the access terminal disregards return messages for a predetermined interval after a change in the data transmission state to allow for recognition and adjustment of the data transmission state change by the base station. The target power level is determined by the base station using factors including the received signal strength, received signal quality, Carrier-to-Interference (C/I) ratio, and the Signal to Noise Ratio (SNR).

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the