CDMA COMMUNICATION SYSTEM AND ITS TRANSMISSION POWER CONTROL METHOD

BACKGROUND OF THE INVENTION

The present invention relates to a code division multiple access mobile communication system and its transmission power control method. More particularly, the present invention relates to a packet communication system and its transmission power control method using reservation based access control.

In a CDMA method, a plurality of mobile terminals share the same frequency band to communicate with a single base station. Therefore, for example, if mobile terminals A and B transmit modulated signal waves to the base station, the signal (not desired to be received) transmitted by the mobile terminal B interferes with the signal (desired to be received) transmitted by the mobile terminal A, and the communication of the mobile terminal A with the base station is obstructed. The degree of interference depends on the received level of a signal (not desired to be received) at the base station. If the degree of interference becomes large to some level or more, communication between the mobile terminal and base station becomes impossible.

If the transmission power of each mobile terminal can be controlled to always limit the signal level received at the base station to a minimum necessary reception power, it becomes possible to maximize the number of channels capable of being communicated by the base station. The more the transmission power shifts from the minimum necessary reception power, the less the number of channels capable of being communicated by the base station.

As transmission power control techniques of CDMA mobile communication, an IS-95 transmission power control method is known described in TIA/EIA/IS-95 which is a standard system of digital cellular phones adopted in North America. The IS-95 transmission power control method will be described in the following.

Since two way communication is essential for cellular phones, a pair of an uplink traffic channel and a downlink traffic channel is used for the communication between the base station and a mobile terminal. The uplink traffic channel is a channel for transmitting data from a mobile terminal to the base station, and a downlink traffic channel is a channel for transmitting data from the base station to the mobile terminal.

The base station measures the reception power of data transmitted from each mobile terminal and generates a transmission power control signal in accordance with the measured reception power. If the reception power of data is larger than a target reception power, the base station generates a transmission power control signal "1" for this mobile station. Conversely if the reception power of data is smaller than the target reception power, the base station generates a transmission power control signal "0" for this mobile station. The generated transmission power control signal is inserted into data to be transmitted from the base station to a mobile terminal, and the transmission data with the transmission power control signal is transmitted to the mobile terminal. The mobile terminal controls to reduce the transmission power if the received transmission power control signal is "1", and to increase it if "0".

This transmission power control will be described specifically with reference to FIG. **12**. Each mobile terminal **1** to n and the base station communicate with each other by using a pair of an uplink traffic channel and a downlink traffic channel. The upper row of each pair represents transmission data of the downlink traffic channel, and the lower row represents transmission data of the uplink traffic channel. The width of transmission data, particularly uplink transmission data, is drawn to correspond to a reception power of the uplink data at the base station.

When the base station communicates with the mobile terminal **1**, it inserts transmission power control signals **132***a*, **132***b*, **132***c*, . . . into a downlink traffic channel **130***a* to the mobile terminal **1**. The mobile terminal **1** changes its transmission power of the uplink transmission data in accordance with the transmission power control signal obtained from the received channel **130***a*. As above, the transmission power control of the mobile terminal **1** is performed by using the downlink traffic channel **130***a*. Similar transmission power control is performed also for other mobile terminals **2** to n.

SUMMARY OF THE INVENTION

With advancement of mobile communication techniques, needs of not only a voice communication function (cellular phone) but also a data communication function are becoming large.

For one way communication typical to data communication, CDMA packet communication systems have been proposed from the viewpoint of efficiently using channels. One proposal of such CDMA packet communication systems is described in "Development on CDMA Packet Mobile Communication System" by Yano, Uta, Hasegawa, and Doi, Communication Society Meeting, the Institute of Electronics, Information and Communication Engineers, B-389 (1996).

Voice communication is two way communication using uplink and downlink traffic channels, whereas data communication is one way communication using only one of uplink and downlink traffic channels. In such one way communication, a conventional transmission power control method for cellular phones cannot be adopted because this method is established on the assumption that there is a pair of uplink and downlink traffic channels.

If a paired downlink channel is provided only for the transmission power control of the uplink traffic channel, one downlink traffic channel is occupied by the transmission power control of only the uplink traffic channel. The use efficiency of traffic channels is lowered.

To solve this problem, the invention provides a CDMA packet data communication system in which a base station controls the transmission power of each of a plurality of mobile terminals by using a single downlink traffic channel common for all mobile stations.

The base station measures the received level of data transmitted from each mobile terminal at each channel, and generates a transmission power control signal of each channel in accordance with the measured reception level. The generated transmission power control signals are collected together into a format predetermined for the system, and transmitted to all mobile terminals by using the common channel shared by the mobile terminals.

Each mobile terminal derives the transmission power control signal of the uplink traffic channel used by the terminal, from the collected transmission power control signals transmitted from the base station, and transmits data at the transmission power changed in accordance with the derived transmission power control signal.

These and other objects, features and advantages of the present invention will become more apparent in view of the