DATA BURST RANDOMIZER

The present application is a continuation application of U.S. patent application Ser. No. 08/194,823, filed Feb. 14, 1994, which is a continuation application of U.S. patent application Ser. No. 07/846,312, filed Mar. 5, 1992, now abandoned, entitled "DATA BURST RANDOMIZER", which is a continuation-in-part application of U.S. patent application Ser. No. 07/543,496, filed Jun. 25, 1990, entitled "SYSTEM AND METHOD FOR GENERATING SIGNAL WAVEFORMS IN A CDMA CELLULAR TELEPHONE SYSTEM", now U.S. Pat. No. 5,103,459 and as such relates to data transmission. More particularly, the present invention relates to a novel and improved method and apparatus for the random positioning of data within transmission data frames.

BACKGROUND OF THE INVENTION

1. Field of the Invention

2. General Background of the Invention

In the field of digital communications it is well known that data may be transmitted in frames of a constant time duration and number of data bits. However in certain types of digital communication systems, it is desirable to transmit less data than is contained in a full frame of data. One such digital communication system is a Code Division Multiple Access (CDMA) communication system which uses direct sequence spectrum spreading techniques.

In a CDMA system, system capacity is limited by the total interference within the transmission frequency band. Within the frequency band of interest transmitted signals intended for one user interfere with the signals of other users. It is this mutual interference which limits the capacity of the system to support an increased number of system users, as compared to conventional analog systems. In using fixed length data frames which are completely filled with data a constant level of interference is caused by the transmission. Although the level of transmission power for a user may be adjusted to control the interference this user's signal causes to other users, a reduction in transmitter power below a certain point can degrade the quality of this user's communication link. It is therefore desirable to provide for the CDMA system techniques which can reduce the user interference levels even further, thereby increasing system capacity.

The use of variable rate vocoding techniques provides the ability to reduce the amount of information representative of the speech as compared to fixed rate vocoding techniques. Thus by using variable rate vocoding techniques less data need be transmitted. Variable rate vocoded data may be adapted to be transmitted using data frames of a fixed time duration. For vocoding rates which provide data at lower data rates for a data frame that is of a time duration designed for higher rate data, redundancy in the frame data may be provided to support a transmission of data throughout the entire frame. Thus for a frame in which the data rate is less than full, the data bits and repeats thereof may be transmitted within the frame. Like before, the constant transmission of data frames containing redundant data provides a constant level of interference even though these frames contain lesser amounts of useful information, i.e. information in a lower data rate frame. However depending upon the amount of redundancy in the frame, the power in the transmitted data may be reduced accordingly. For data frames in which the data is repeated the power used to transmit the data may be reduced. This technique provides for a reduction in the level of interference caused by this system user, so as to realize an increase in system user capacity.

As mentioned previously, variable rate vocoding provides a communication system with the ability to transmit lesser amounts of data representative of the voice information as compared to one which uses fixed rate vocoding. In transmitting less data a reduction in transmitted energy is realized. Variable rate vocoding as implemented in a CDMA communication system can therefore result in a reduction in the level of interference caused by a system user. In order to take full advantage of variable rate vocoding in a transmission scheme in which data frames are of a fixed time duration, data without any redundancy may be transmitted for the frame. In addition, power control techniques may be implemented to attenuate the transmitted signal to further reduce system interference and still maintain quality communications.

In such a communication system, variable rate vocoder data, or non-vocoder data, or a combination thereof may be transmitted on a frame by frame basis. For the less than full rate data frames, the one set of data to be transmitted for a frame may be simply placed at the beginning of a frame or another predetermined fixed position within the frame. However in a system where user transmission frames are synchronized to system timing, disregarding propagation delays, the use of such a simple positioning scheme may still result in unnecessary overlap in the transmission of data by the various users. The unnecessary overlap in transmission effectively increases the level of system interference as compared to the case where no overlap occurs.

It is therefore an object of the present invention to reduce in a CDMA communication system user mutual interference so as to provide an increase in user capacity.

It is yet another object of the present invention to provide for the transmission of frames of data so as to reduce, on a frame by frame basis, systemwide traffic load.

It is still a further object of the present invention to provide a novel and improved method and apparatus for pseudorandomly positioning data within a data frame for transmission.

SUMMARY OF THE INVENTION

The present invention is a novel and improved method and system for the communication of frames of data in a manner which reduces within transmission data frames of various users the occurrence of unnecessary instances of contemporaneous transmission of data so as to reduce systemwide traffic loading in data transmission.

In accordance with the present invention, data is transmitted in data frames of a fixed time duration. When data is provided for transmission at a data rate less than the data frames are capable of supporting, the data is pseudorandomly distributed throughout the data frame. The distribution of the data throughout the frame reduces the possibility of concurrent transmission by other users whose frame timing is approximately the same. In an alternative implementation, where less than full rate data is provided for a frame, data is repeated within the frame to provide a full frame of data. When the frame contains repeated data the frame is transmitted at a lower power level according to the amount of data redundancy employed for the frame.

The present invention is thus a method and system, for use in a communication system in which data is transmitted in data frames of a predetermined time duration which allows for the positioning of data within the data frames for transmission. A computation circuit computes according to a deterministic code a pseudorandom position for the data