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TITLE

MULTI-RATE RADIOCOMMUNICATION SYSTEMS AND TERMINALS

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ABSTRACT

Variances in bandwidth used by a radiocommunication connection are adapted to by changing the type of information being transmitted. For example, in a TDMA environment, a first downlink time slot associated with a double- or triple-rate connection may have a first format, while a second time slot associated with the same connection may have a second format different from the first format. Bandwidth in the second (or third) time slot can be used to carry information in a fast out-of-band channel (FOC). The FOC may provide information relating to the same connection as the payload or data field in that time slot, e.g., a service type identifier which informs the mobile or base station of the type of information (e.g., voice, video or data) being conveyed in the payload. Alternatively, the FOC information may be associated with a connection or connections which are different from that supported by the payload or data field containing the FOC.

APPLICATION FOR UNITED STATES LETTERS PATENT

by

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for

MULTI-RATE RADIOCOMMUNICATION SYSTEMS AND TERMINALS

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MULTI-RATE RADIOCOMMUNICATION SYSTEMS AND TERMINALS

RELATED APPLICATION

This application is related to U.S. Patent Application Serial No. 08/730,360, entitled "Radiocommunication Systems and Terminals with Increased Payload Bandwidth", which application was filed on the same date as this application.

BACKGROUND

Applicant's invention relates generally to radiocommunication systems, e.g., cellular or satellite systems, that use digital traffic channels in a multiple access scheme, e.g., time division multiple access (TDMA) or code division multiple access (CDMA).

The growth of commercial radiocommunications and, in particular, the explosive growth of cellular radiotelephone systems have compelled system designers to search for ways to increase system capacity without reducing communication quality beyond consumer tolerance thresholds. One way to increase capacity is to use digital communication and multiple access techniques such as TDMA, in which several users are assigned respective time slots on a single radio carrier frequency.

In North America, these features are currently provided by a digital cellular radiotelephone system called the digital advanced mobile phone service (D-AMPS), some of the characteristics of which are specified in the interim standard IS-54B, "Dual-Mode Mobile Station-Base Station Compatibility Standard", published by the Electronic Industries Association and Telecommunications Industry Association (EIA/TIA). Because of a large existing consumer base of equipment operating only in the analog domain with frequency-division multiple access (FDMA), IS-54B is a dual-mode (analog and digital) standard, providing for analog compatibility in tandem with digital communication capability. For example, the IS-54B standard provides for both

FDMA analog voice channels (AVC) and TDMA digital traffic channels (DTC), and the system operator can dynamically replace one type with the other to accommodate fluctuating traffic patterns among analog and digital users. The AVCs and DTCs are implemented by frequency modulating radio carrier signals, which have frequencies near 800 megahertz (MHz) such that each radio channel has a spectral width of 30 kilohertz (KHz). A subsequent standard, referred to as IS-136, adds specifications for digital control channels. This standard document, in particular the version identified as PN-3474.1, dated December 15, 1995 and published by EIA/TIA, is incorporated here by reference.

In a TDMA cellular radiotelephone system, each radio channel is divided into a series of time slots, each of which contains a burst of information from a data source, e.g., a digitally encoded portion of a voice conversation. The time slots are grouped into successive TDMA frames having a predetermined duration. According to IS-54B and IS-136, each TDMA frame consists of six consecutive time slots and has a duration of 40 milliseconds (msec). Thus, each frame can carry from one to six traffic channels (e.g., one to six radio connections). The number of connections which can be supported by each TDMA frame depends on the desired information transmission rate. For example, if the connections are used to support the transmission of voice information, the number of slots used per channel depends on the source rates of the speech coder/decoders (codecs) used to digitally encode the conversations. Such speech codecs can operate at either full-rate or half-rate, with full-rate codecs being expected to be used until half-rate codecs that produce acceptable speech quality are developed.

Thus, a full-rate DTC requires twice as many time slots in a given time period as a half-rate DTC, and in IS-54B, each radio channel can carry up to three full-rate DTCs or up to six half-rate DTCs. Each full-rate DTC uses two slots of each TDMA frame, i.e., the first and fourth, second and fifth, or third and sixth of a TDMA frame's six slots. Each half-rate DTC uses one time slot of each TDMA frame. During each DTC time slot, 324 bits are transmitted, of

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