402. Antenna switch **403** also directs a received signal from antenna **404** to either the 802.11 part of 802.11/Bluetooth radio **402** or the Bluetooth part of 802.11/Bluetooth radio **402**.

In the prior art, approaches of integrating and dynamically coordinating multiple wireless protocols on a single platform have focused on integration into a single integrated circuit. This control necessitates coordinating the contention for the same frequency band between the two air interfaces. If the two air interface protocols are 802.11 and Bluetooth, the control must be imposed on the two air interfaces, since there is no standardized interoperability between the two air interface protocols. When the individual wireless technologies, however, are on a rapid evolutionary path, "same chip" integration can increase cost and can cause the integrated circuit development to lag behind that of separate circuits. Also, the market demand for a dual-interface solution within a single integrated circuit can be considerably smaller than the demand for either integrated circuit supporting a single protocol only (i.e., 802.11 or Bluetooth, but not both). Furthermore, even same chip integration by itself does not inherently guarantee a tight, efficient contention control between the two air interfaces.

Therefore, the need exists for multiple radios supporting different air interface protocols, possibly on separate integrated circuits, to coordinate the use of a shared frequency band.

SUMMARY OF THE INVENTION

The present invention enables both an IEEE 802.11 radio and a Bluetooth radio to be employed in a single wireless telecommunications terminal (e.g., wireless telephone, personal digital assistant (PDA), etc.) without interference. In particular, the illustrative embodiment enables standard "off-the-shelf" 802.11 and Bluetooth radios to work in concert in a single telecommunications terminal.

In the illustrative embodiment, the Bluetooth radio distinguishes between more "time-critical" packets that have a lower latency tolerance (for example, synchronous connection-oriented [SCO] packets, as are well-known in the art), and packets with a higher latency tolerance (for example, some asynchronous connection-less [ACL] packets, as are well-known in the art). The Bluetooth radio "preempts" the operation of the 802.11 radio to transmit the former, and waits until the 802.11 radio is in power-save mode, which is an inactive "sleep" mode employed to conserve power, to transmit the latter. By coordinating the occurrence and duration of the Bluetooth preemptions, the illustrative embodiment ensures that the preemptions are not fatal to the 802.11 medium access control (MAC) error-correction mechanism, thereby enabling what appears to be concurrent operation of 802.11 and Bluetooth by the wireless telecommunications terminal.

In this specification, the illustrative embodiment is disclosed in the context of the IEEE 802.11 and Bluetooth protocols; however, it will be clear to those skilled in the art how to make and use alternative embodiments of the present invention for other combinations of competing protocols (i.e., protocols that might interfere with each other). In addition, although the illustrative embodiment is disclosed in the context of radios, it will be clear to those skilled in the art how to make and use alternative embodiments of the present invention for non-RF wireless radios and/or wireline transceivers that might interfere with each other.

The illustrative embodiment comprises: a first transmitter for transmitting a first data block through a communications band in accordance with an automatic-repeat-request error-correction mechanism; and a second transmitter for (i) preventing the first transmitter from outputting at least a portion of the first data block into the communications band while the second transmitter transmits a second data block through the communications band, and (ii) allowing the first transmitter to output into the communications band before the error-correction mechanism for the first data block fails.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** depicts a schematic diagram of wireless telecommunications system **100** in the prior art.

FIG. **2** depicts a block diagram of a dual protocol wireless terminal that uses a first technique in the prior art.

FIG. **3** depicts a block diagram of a dual protocol wireless terminal that uses a second technique in the prior art.

FIG. **4** depicts a block diagram of a dual protocol wireless terminal that uses a third technique in the prior art.

FIG. **5** depicts a block diagram of wireless terminal **500** in accordance with the first illustrative embodiment of the present invention.

FIG. **6** depicts a block diagram of multi-radio card **600** in accordance with the second illustrative embodiment of the present invention.

FIG. **7** depicts a diagram of the salient components of radio **502-1** in accordance with the third illustrative embodiment of the present invention.

FIG. **8** depicts a block diagram of wireless terminal **800** in accordance with the fourth illustrative embodiment of the present invention.

FIG. **9** depicts a graph of signals transmitted and their interrelationship in the illustrative embodiment of the present invention.

FIG. **10** depicts a diagram of the salient components of radio **502-1** in accordance with another variation of the third illustrative embodiment of the present invention.

DETAILED DESCRIPTION

FIG. **5** depicts a block diagram of wireless terminal **500** in accordance with the first illustrative embodiment of the present invention. Wireless terminal **500** is a computer that supports two distinct wireless air interface protocols concurrently for the purpose of sending and receiving data over the air on a shared frequency band. The frequency band, when used for communications purposes, is also referred to as a "communications band," comprising one or more "channels" of communication. The object referred to generically as a "data block" conveys data across a transmission medium (e.g., air, wire, etc.). A data block constitutes a message, in which the message typically comprises a header part and the data in a payload part. A data block can be also referred to as a "frame" or as a "packet." The term "frame," as is known in the art, is commonly used in an IEEE 802.11 protocol context when referring to the medium access control data blocks that are communicated across over the air. The term "packet," as is known in the art, is commonly used in a Bluetooth protocol context when referring to the data blocks that are communicated over the air.

A wireless telecommunications terminal, or "wireless terminal," as described in this specification (e.g., wireless terminal **500**, etc.), is a type of telecommunications terminal. The wireless protocols supported by wireless terminal **500** can be, for example, 802.11 and Bluetooth. Wireless terminal **500** comprises host **501**, radio **502-1**, radio **502-2**, antenna switch **503**, and antenna **504**, interconnected as shown.