

[0011] The IEEE 802.11 standard is well-established and local area networks are already implemented based on the standard, typically in office environments. As Bluetooth comes into the market, it is likely to be implemented in a domestic environment for communications within the home, for example. Thus someone with a lap-top computer may wish to connect to a IEEE 802.11 wireless local area network in the workplace, and connect to a device, such as a mobile telephone, using a Bluetooth interface outside of the workplace.

[0012] A need exists for a means which can enable a single device to interface via both an IEEE 802.11 radio system and a Bluetooth radio system.

SUMMARY OF THE INVENTION

[0013] According to one aspect of the present invention there is provided a device incorporating a first radio system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, wherein the device further includes a control means adapted to control the first and second radio systems such that only one or the other radio system may transmit at any one time. The first radio system may be a Bluetooth system and the second radio system may be an IEEE 802.11 system.

[0014] The device may be additionally controlled such that when one device is transmitting the other device cannot receive or transmit. The device may be additionally controlled such that when one device is receiving the other device cannot receive or transmit.

[0015] The control means may comprise a switching means, the switching means being adapted to switch on and off the first and second radio systems.

[0016] The control means may comprise a multiplexing means adapted to time multiplex transmissions from the first and second radio systems.

[0017] The control means may comprise a multiplexing means adapted to time multiplex transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

[0018] The Bluetooth transmissions may be through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four. The Bluetooth transmissions may be through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six. The Bluetooth transmissions may be through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

[0019] The control means may prevent transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission. The control means may prevent transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

[0020] The first and second radio systems may share a common physical layer.

[0021] According to another aspect of the present invention there is provided a method of incorporating a first radio

system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, into a single device, wherein the first and second radio systems are controlled such that only one or the other radio system may transmit at any one time. The first radio system may be a Bluetooth system and the second radio system may be an IEEE 802.11 system.

[0022] The method may further comprise controlling the radio systems such that when one radio system is transmitting the other device cannot receive or transmit.

[0023] The method may further comprise controlling the radio systems such that one device is receiving the other device cannot receive or transmit.

[0024] The radio systems may be controlled by switching on and off the first and second radio systems.

[0025] The radio systems may be controlled by time multiplexing transmissions from the first and second radio systems.

[0026] The method may comprise time multiplexing transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

[0027] The Bluetooth transmissions may be through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four. The Bluetooth transmissions may be through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six. The Bluetooth transmissions may be through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

[0028] The method may further comprising preventing transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission. The method may further comprising preventing transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

[0029] The first and second radio systems may share a common physical layer.

[0030] Therefore if both an IEEE 802.11 radio transceiver and a Bluetooth radio transceiver reside in a single device (for instance in a laptop computer) they can transmit and receive in the same radio frequency simultaneously, even though both communication standards make use of the same 85 MHz wide ISM band, at around 2.4 GHz. This is achieved by a Bluetooth device in a computer being prevented from transmitting data whilst an 802.11 device is attempting to receive data and vice versa.

[0031] Even if the RF frequency that the receiving device is tuned to is different, but still in the same band that the transmitting device is using, the emitted power will jam the receiver, rendering it unable to receive the intended signal.

[0032] The invention solves this problem by introducing an interoperability device, that is connected both to the medium access controller of the IEEE 802.11 device and to the baseband controller of the Bluetooth device.

[0033] The invention also proposes an alternative solution, called dual mode operation, where the IEEE 802.11 devices operate in a different radio frequency band than the Bluetooth system.