

Wireless performance optimization solutions: Bluetooth® and 802.11 coexistence

Key features:

- Coexistence of 802.11 Wi-Fi® and Bluetooth® technologies in small form factors, including cell phones, PDAs, laptops and web tablets
- Simultaneous 802.11 and Bluetooth functionality
- Specifically addresses Bluetooth voice protection for mobile terminals
- Highest efficiency of 2.4-GHz band use, by time and frequency domain sharing
- Full utilization of Bluetooth specification 1.1 and 1.2 for coexistence enhancement
- Bluetooth voice simultaneous with 802.11 data communication

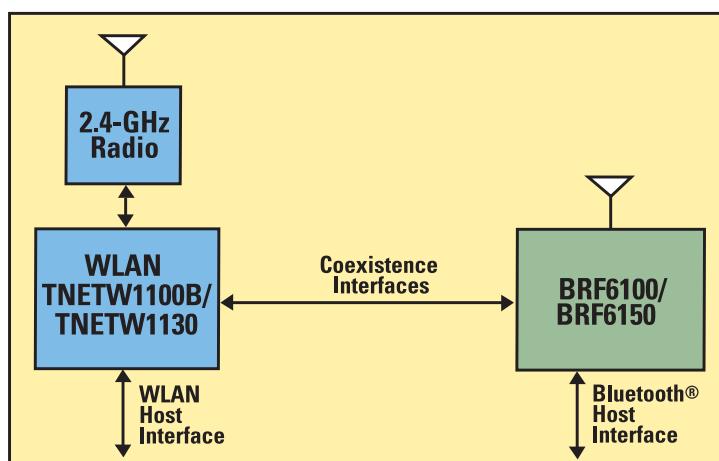
- Flexibility supported by TI's WLAN b/g PHY chips and its single-chip Bluetooth device
- Low power consumption for mobile battery-operated platforms
- No RF isolation requirements saves board space
- Small footprint ideal for compact handheld devices
- Seamlessly coordinated two-chip solution

PRODUCT BULLETIN

TI has developed a coexistence solution for simultaneous functionality of 802.11b/g wireless local area networking (WLAN) and Bluetooth® personal area networking (PAN) in small form factors, including cell phones, laptop computers, personal digital assistants (PDAs), web tablets and other new types of mobile terminals. Because 802.11b/g and Bluetooth occupy the same 2.4-GHz ISM range of wireless communications spectrum, their RF signals can cause interference for each other unless a coexistence solution is deployed.

TI's coexistence package provides intelligent and seamless coordination between TI's WLAN and Bluetooth technologies at the media access control (MAC) layer. With this level of time domain coordination, no RF isolation is needed between the 802.11 and Bluetooth antennas, simplifying designs and ensuring effective operations in small form factors.

Coexistence solution architecture



Simultaneous 802.11 and Bluetooth functions

The firmware takes advantage of the general purpose coexistence interface BUS connection between TI's 802.11 MAC processors, the TNETW1100B and TNETW1130, and TI's advanced Bluetooth system on-a-chip, the BRF6100 or BRF6150. The BRF6150 is a highly integrated Bluetooth Specification v1.2 single-chip solution. Software monitors WLAN and Bluetooth traffic patterns and, when both 802.11 and Bluetooth require bandwidth, it uses multiplexing techniques to allocate the bandwidth for simultaneous functions. In this way, RF interference between 802.11 and Bluetooth is eliminated, packet collisions are avoided and high throughput rates are maintained without requiring antenna isolation.

Unlike other possible coexistence solutions which dedicate a fixed portion of the available bandwidth to 802.11 and Bluetooth, the solution's MAC-level coordination makes efficient use of all of the bandwidth in the 2.4-GHz ISM range. At any time, all of the available bandwidth can be dedicated to either 802.11 or Bluetooth, as long as one or the other is idle. For example, when no Bluetooth communication is taking place, all of the bandwidth can support 802.11g communications at speeds up to 54 Megabits per second (Mbps). Conversely, when 802.11 is idle, all of the bandwidth in the 2.4-GHz range can be devoted to Bluetooth communications.

To ensure the quality of certain types of critical communications, the coexistence solution can intelligently set different priorities depending on the time-sensitive nature of the communication. For example, the quality of Bluetooth wireless voice communication between a cell phone or wireless PDA and a Bluetooth headset can be maintained at a high level while significant bandwidth demands are being made on the system by its 802.11 WLAN processor.

Bluetooth specification 1.2 capabilities

Utilizing Adaptive Frequency Hopping (AFH) and Extended Synchronous Connection Oriented (eSCO) features further improves the Texas Instruments coexistence performance with devices that are in close proximity to the Bluetooth/WLAN combo device. The eSCO enables better protection to the voice packets so the voice channel can tolerate uncoordinated transmissions from other devices using the 2.4-GHz band. New Bluetooth devices featuring the new specification 1.2 may utilize AFH to communicate using frequencies that do not interfere with the WLAN channel used by the Bluetooth/WLAN combo device.

Those new features present an improvement to the current implementation, while keeping same or better performance with legacy specification 1.1 compliant devices. According to leading market analysis, there will be approximately 50 million units with Bluetooth specification 1.1 in the market until the end of 2004, when first specification 1.2 devices are expected to arrive.

Low power and small footprint for mobile platforms

Taken individually, Bluetooth and WLAN devices that support the coexistence solution are among the leaders in the industry in low power consumption. Both were designed to meet the aggressive size and power requirements needed for mobile, battery-operated applications such as cell phones and PDAs. The additional power needed to process the intelligent WLAN/Bluetooth coordination algorithm is negligible.

Moreover, there is no additional space on a printed circuit board (PCB) because it operates on TI's current 802.11 and Bluetooth devices. As a firmware upgrade, no added board space is required beyond the space already devoted to the system's 802.11 and Bluetooth processors. And the combined footprint of TI's 802.11 processors, either the TNETW1100B or the TNETW1130, and the area of the BRF6100 or the BRF6150 single-chip Bluetooth subsystems are decidedly less than that of comparable devices in the industry today.

The future of 802.11 and Bluetooth coexistence

TI's coexistence solution has been designed in accordance with the recommendations of the IEEE's 802.15.2 task group on 802.11 and Bluetooth coexistence. As Bluetooth specification 1.2 features have already been implemented in the BRF6150 Bluetooth single chip device, the coexistence solution will need to tackle increasingly complex scenarios like Voice over Internet Protocol (VoIP) over WLAN while having a Bluetooth voice connection to a headset.

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