Operational description

RF Receiver

The receiver features a near-zero Intermediate Frequency (IF) architecture that allows the channel filters to be integrated on to the die. Sufficient out-of-band blocking specification at the Low Noise Amplifier (LNA) input allows the radio to be used in close proximity to Global System for Mobile Communications (GSM) and Wideband Code Division Multiple Access (W-CDMA) cellular phone transmitters without being desensitised.

The use of a digital Frequency Shift Keying (FSK) discriminator means that no discriminator tank is needed and its excellent performance in the presence of noise allows BlueCore2-External to exceed the Bluetooth requirements for co-channel and adjacent channel rejection.

Low Noise Amplifier

The LNA can be configured to operate in single-ended or differential mode. Single-ended mode is used for Class 1 Bluetooth operation; differential mode is used for Class 2 operation.

Analogue to Digital Converter

The Analogue to Digital Converter (ADC) is used to implement fast Automatic Gain Control (AGC). The ADC samples the Received Signal Strength Indicator (RSSI) voltage on a slot-by-slot basis. The front-end LNA gain is changed according to the measured RSSI value, keeping the first mixer input signal within a limited range. This improves the dynamic range of the receiver, improving performance in interference limited environments.

RF Transmitter

IQ Modulator

The transmitter features a direct IQ modulator to minimise the frequency drift during a transmit timeslot which results in a controlled modulation index. A digital baseband transmit filter provides the required spectral shaping.

Power Amplifier

The internal Power Amplifier (PA) has a maximum output power of +6dBm allowing BlueCore2-External to be used in Class 2 and Class 3 radios without an external RF PA. Support for transmit power control allows a simple implementation for Class 1 with an external RF PA.

RF Synthesiser

The radio synthesiser is fully integrated onto the die with no requirement for an external Voltage Controlled Oscillator (VCO) screening can, varactor tuning diodes or LC resonators.

Baseband and Logic

Memory Management Unit

The Memory Management Unit (MMU) provides a number of dynamically allocated ring buffers that hold the data which is in transit between the host and the air or vice versa. The dynamic allocation of memory ensures efficient use of the available Random Access Memory (RAM) and is performed by a hardware MMU to minimise the overheads on the processor during data/voice transfers.

Burst Mode Controller

During radio transmission the Burst Mode Controller (BMC) constructs a packet from header information previously loaded into memory-mapped registers by the software and payload data/voice taken from the appropriate ring buffer in the RAM. During radio reception, the BMC stores the packet header in memory-mapped registers and the payload data in the appropriate ring buffer in RAM. This architecture minimises the intervention required by the processor during transmission and reception.

Physical Layer Hardware Engine DSP

Dedicated logic is used to perform the following:

- Forward error correction
- Header error control
- Cyclic redundancy check
- Encryption
- Data whitening
- Access code correlation
- Audio transcoding

RAM

32Kbytes of on-chip RAM is provided and is shared between the ring buffers used to hold voice/data for each active connection and the general purpose memory required by the Bluetooth stack.

External Memory Driver

The External Memory Driver interface can be used to connect to the external Flash memory and also to the optional external RAM for memory intensive applications.

USB

This is a full speed Universal Serial Bus interface for communicating with other compatible digital devices. BlueCore2-External acts as a USB peripheral, responding to requests from a Master host controller such as a PC.

Synchronous Serial Interface

This is a synchronous serial port interface for interfacing with other digital devices. The SPI port can be used for software debugging and for programming the external Flash memory.

UART

This is a standard Universal Asynchronous Receiver Transmitter (UART) interface for communicating with other serial devices.

Audio PCM Interface

The Audio Pulse Code Modulation (PCM) Interface supports continuous transmission and reception of PCM encoded audio data over Bluetooth.

Microcontroller

The microcontroller, interrupt controller and event timer run the Bluetooth software stack and control the radio and host interfaces. A 16-bit Reduced Instruction Set Computer (RISC) microcontroller is used for low power consumption and efficient use of memory.

Programmable I/O

BlueCore2-External has a total of 15 (12 digital and 3 analogue) programmable I/O terminals. These are controlled by firmware running on the device.