BlueMod™
FCC Operational Description

Version 1.00

	Name	Signature
Author	Alex Busteed	
Approved		
Agreed		

ACN 085 659 963
www.hcvwireless.com

CONTENTS

MODIFICATION HISTORY

Version	Date	Author	Changes
1.00	10/05/02	Alex Busteed	First Release

1. ABOUT THIS DOCUMENT

1.1 Purpose and Scope

This document provides an operational overview of the BlueMod^{TM} Bluetooth Development Kit. The target audience for this document is the Federal Communications Commission and, as such, it mainly discusses the operation of the built-in Bluetooth radio transceiver. The overview consists of two parts, a general overview of BlueMod^{TM} and a technical description of the radio technology used in the product.

Please note references to other documents in the application are by FCC exhibit type and file name. References to FCC 47 CFR part 15 are abbreviated to paragraph 15 section only.

1.2 Acknowledgements

1.3 Disclaimers

- Draft versions of this document are intended for HCV internal use only.

1.4 Contact Details

For any queries or suggestions regarding this document, please contact:

HCV Wireless,
Level 1, 80 Jephson Street,
Toowong, Queensland 4066, Australia
Tel: +61 7 3327 9893
Fax: +61 7 3217 8737
www.hcvwireless.com

2. OPERATIONAL DESCRIPTION

2.1 Product Description

BlueMod™ is both a pre-qualified Bluetooth sub-system for OEMs and a rapid Bluetooth prototyping platform for system integrators and application developers. It features multiple connectivity accessories, a powerful 32-bit onboard microprocessor running a Linux based operating system and Bluetooth host side protocol stack and profiles.

BlueMod™ is designed to help application developers integrate Bluetooth technology into their products and develop high-level software applications without requiring an in-depth understanding of the Bluetooth specification. BlueMod™ will be sold to people wanting to develop applications using Bluetooth technology, for example Original Equipment Manufacturers, educational institutions and application developers. Manufacturers producing Bluetooth hardware will be responsible for making applications to the FCC for any such equipment that they may produce. No form of modular approval is being sought for BlueMod™.

2.1.1 Computer Subsystem

The SBC subsystem core is a 32-bit Motorola processor running at 48MHz. This device controls all aspects of the device operation, apart from the Bluetooth radio and baseband, which is controlled by the Cambridge Silicon Radio BC01b. Connected to the main processor, is 8MB of SDRAM and 2MB of Flash memory. The Flash memory device stores the operating system binary code, Bluetooth protocol stack binary code and user application binary code.

2.1.2 BlueMod™ Interfaces

BlueMod™ provides a High Speed RS232 Serial interface, a USB Slave port, a DC power Jack and an Accessory expansion interface. The high-speed RS232 interface allows connection of BlueMod™ to a standard PC serial port or external modem. The USB 1.0 Slave interface allows connection of BlueMod™ to any USB Host device, thus facilitating a high-speed serial connection. The DC power interface is a simple power socket used to obtain +5V DC from the BlueMod™ AC/DC power adapter.

The Accessory Connector expansion interface is a set of two 64-pin surface mount connectors that allow the system functionality to be expanded and varied via the connection of a second circuit board. The Accessory Connector interface has a proprietary pin configuration and thus only approved BlueMod™ accessories can interface with the SBC using these connectors. One such circuit board is an Ethernet Accessory, which is qualified as part of the BlueMod™ system.

2.1.3 BlueMod™ Power Supply

The power input to BlueMod™ is a regulated +5V. This can be supplied from an external AC/DC plug pack or via the USB Slave connector. BlueMod™ houses an on-board linear voltage regulator that supplies the electronic circuits with +3.3V. The maximum permissible current drain for this regulator is 800mA, yet the maximum current consumption of BlueMod™ is only 500mA, including the consumption of the Ethernet Accessory.

2.1.4 BlueMod™ Radio Subsystem

The BlueMod™ radio subsystem is implemented using a pre-qualified Bluetooth module from ALPS Electric Pty Ltd. This module is a Class 1 Bluetooth device based on the BC01b chip from Cambridge Silicon Radio (CSR). The BC01b is a spread spectrum transmitter using a frequency hopping technique operating in the unlicensed 2.4 GHz ISM band. Section 3 discusses the operation of the Bluetooth radio and its conformance with Part 15.247.

2.1.5 BlueMod™ System Operation

When powered up, BlueMod™ performs the following procedures:

- Initialises all system hardware,
- Loads the µClinux operating system and associated system drivers such as the Ethernet controller, Bluetooth protocol stack and other networking tools,
- Launches any startup user applications.

The actual system operation of BlueMod™ is dependant upon the application for which it has been programmed. Typical applications are:

- Cable replacement of serial based communications
- Bluetooth access point for Internet based applications

Since BlueMod™ is designed to be primarily for development purposes, the tasks the device performs will vary from one implementation to another. However, it is important to note that developers cannot modify the firmware that controls the operation of the Bluetooth radio. As such, the electromagnetic characteristics of BlueMod™ will remain constant regardless of the high-level application software which runs on the main processing device.

2.2 The BlueMod™ Radio Implementation

The BlueMod™ radio interface is a 2.4GHz Frequency Hopping Spread Spectrum (FHSS) transceiver that conforms to the Bluetooth V1.1 specification. The module used to implement the radio interface in BlueMod™ is based on the Cambridge Silicon Radio BC01b single chip transceiver, a single chip radio and baseband IC for Bluetooth 2.4GHz radios implemented in CMOS technology. This device solely determines the Bluetooth operation of BlueMod™.

2.2.1 The Frequency Hopping Spread Spectrum System

The Bluetooth standard describes a frequency hopping spread spectrum system (FHSS). The frequency hopping sequence is governed by one unit known as the master in any group of units communicating together. Such a group is known as a piconet, and all units other than the master are known as slaves. The master determines the pseudo random hopping sequence and slave devices follow this sequence. As the master unit generates the hopping sequence internally and without reference to any external information, there is no co-ordination with any other Bluetooth or other FHSS systems so as to avoid simultaneous occupancy of hopping channels. Bluetooth uses re-transmission, interleaving and coding techniques to mitigate against lost transmissions when simultaneous occupancy of a channel causes loss of data. The pseudo random hopping sequence is initialised at the start of a new connection between master and slave to a random frequency (hopping channel), and the hopping sequence is generated such that an equal time is spent in each of 79 channels throughout the duration of the connection.

During the normal connection state in the Bluetooth protocol, as described above, the operation meets the description of a FHSS system under 15.247(a)(1) as the number of hopping frequencies is greater than 75. However, in two specific modes (inquiry and page) of the Bluetooth protocol, only 32 frequencies are used. These two modes are used for short periods only to search for and connect to other devices in range. However during these modes fixed access codes are used in the header part of the transmitted packet, and other devices that are available for connection (in modes inquiry scan and page scan) search for these codes using correlation techniques. Therefore, during inquiry and page modes the system operation can be viewed as part Direct Sequence Spread Spectrum (DSSS) and part FHSS (as hopping is still occurring over 32 hops). These modes meet the description of a Hybrid system under 15.247(f).

2.2.2 Demonstration of Compliance with Part 15.247

A detailed description of the frequency bands, frequency-hopping system, and modulation scheme are included in FCC exhibit type Operational Description, file BlueMod_OpDes2.pdf which contains extracts from Bluetooth Core Specification 1.0B. FCC exhibit type Operational Description, file BlueMod_OpDes3.pdf discusses how devices based on the BC01b chip conform to the FCC requirements of a FHSS device operating in the 2.4GHz unlicensed ISM band. All other measurements required to demonstrate conformance with Part 15.247 can be found in FCC exhibit type Test Report, file BlueMod_TestRpt.pdf.

2.2.3 Processing Gain Measurements

There is an additional requirement for hybrid systems, to establish a minimum processing gain for the combined DSSS and FHSS operation as described in 15.247(e). The Bluetooth

function in BlueMod™ is determined completely by CSR's BC01b chip which features an integral transmitter, receiver and processing gain filters. As discussed and agreed between the FCC and CSR, all BC01b based modules therefore have identical processing gains. Thus the processing gain of BlueMod™ when in its hybrid mode of operation has not been tested. FCC Exhibit, type Test Report, file BlueMod_TestRpt3.pdf outlines the test method and results for measurement of the Processing Gain of the product FCC ID O2Z-BT2.