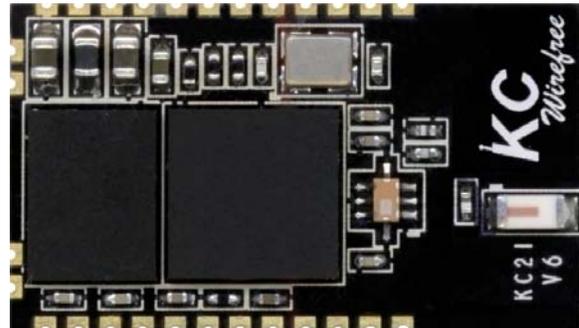


## Firmware Features

- Wireless Data Communications Subsystem
- Embedded Bluetooth Serial Port Profile (SPP)
- Easy To Use AT Command Interface Using UART
- OEM Programmable Configuration
- Remote Command And Control
- Multipoint / Piconet Capable
- Custom Firmware Available



26.9mm x 15.2mm x 2.5mm

## Hardware Features

- CSR BlueCore 4 Ext Chipset
- Bluetooth v2.1 + EDR
- 2.4GHz Class 2 Radio
- Range Typically Exceeds 20m
- High Speed Data Rate Up To 3Mbps
- 12 Digital Programmable I/O Pins
- 2 Analog Programmable I/O Pins
- UART, USB, SPI Interfaces
- Onboard Antenna
- 8Mbit Flash Memory



## Applications

- Bluetooth Serial Cable Replacement
- Bluetooth Data Cable Replacement
- Bluetooth Advertising
- Bluetooth RFID Tag Readers
- Bluetooth Digital Cameras
- Bluetooth Digital Picture Frames
- Bluetooth Hand-Held Bar Code Readers
- Bluetooth Medical Monitoring
- Bluetooth Credit Card Readers
- Many, many, more . . .

## Description

The KC-21 series data modules are pre-engineered, pre-qualified, and highly tuned surface mount PCB modules that provide fully embedded, ready to use Bluetooth wireless technology. Multi-surface pads provide both bottom pads for high volume reflow soldering and edge pads for low volume hand soldering.

The KC-21 offers reprogrammable, embedded firmware for serial cable replacement deploying the Bluetooth Serial Port Profile (SPP). OEM specific parameters and settings can be easily loaded into these modules.

Our kcSerial embedded firmware provides an easy to use AT style command interface over UART. kcSerial is capable of storing OEM default settings, and is upgradable over UART. kcSerial also provides remote control capability, where our AT commands can be issued remotely from any other Bluetooth device using SPP. Custom firmware is available.

(For Audio applications, KC Wirefree recommends our KC-5290 -- Class 2, Bluetooth Audio Module.)

## Standard Bluetooth Data Profiles

The KC Wirefree KC-21 data module comes standard with kcSerial which includes support for (DUN) Dial-up Networking Profile, and (SPP) Serial Port Profile.

### DUN - Dial-up Networking Profile

DUN provides a standard to access the Internet and other dial-up services over Bluetooth technology. The most common scenario is accessing the Internet from a laptop by using your mobile phone as a wireless dial-up modem.

### SPP - Serial Port Profile

The SPP is a very popular widely used profile for transmitting data in place of a serial cable. SPP defines how to set up virtual serial ports and connect two Bluetooth enabled devices. A scenario would be using two devices, such as PCs or laptops, as virtual serial ports and then connecting the two devices via Bluetooth technology.

## Available Bluetooth Data Profiles

KC-21 is capable of supporting each of these standard profiles. Contact KC Wirefree for customization options.

### AVRCP - Audio Video Remote Control Profile

AVRCP is designed to provide a standard interface to control TVs, hi-fi equipment, or others to allow a single remote control (or other device) to control all the A/V equipment to which a user has access. It may be used in concert with A2DP or VDP.

### BIP - Basic Imaging Profile

BIP defines how an imaging device can be remotely controlled, how an imaging device may print, as well as how an imaging device can transfer images to a storage device. BIP also includes the ability to resize and convert images to make them suitable for the receiving device.

### BPP - Basic Printing Profile

BPP allows devices to send text, emails, vCards, images or other items to printers based on print jobs. Prints emails, images, vCard, vCalendar, text messages and plain or formatted text from devices like a mobile phone or PDA to a printer.

### CTP - Cordless Telephone Profile

Used for either a dedicated cordless phone or a mobile phone that acts as a cordless phone when in proximity to a base station implementing the CTP.

### FTP - File Transfer Profile

FTP defines how folders and files on a server device can be browsed by a client device. Once a file or location is found by the client, a file can be pulled from the server to the client, or pushed from the client to the server using GOEP. A typical scenario would be transferring files wirelessly between two PCs or laptops, or browsing and retrieving files on a server.

### **GAVDP - General Audio/Video Distribution Profile**

GAVDP provides the basis for A2DP and VDP, the basis of the systems designed for distributing video and audio streams using Bluetooth technology. A typical scenario is a set of wireless stereo headphones and a music player, such as an MP3 player or Walkman. The music player sends messages to the headphones to establish a connection or adjust the stream of music, or visa versa.

### **GOEP - Generic Object Exchange Profile**

GOEP is used to transfer an object from one device to another. A simple scenario would be using Bluetooth technology to send information like files, vCards, vCalendars and images between your mobile phone or PDA and a PC.

### **HID - Human Interface Device Profile**

The HID profile defines the protocols, procedures and features to be used by Bluetooth HID such as keyboards, pointing devices, gaming devices and remote monitoring devices. The most common usage would be your wireless desktop, keyboard, mouse, etc.

### **OPP – Object Push Profile**

OPP defines the roles of push server and push client. These roles are analogous to and must interoperate with the server and client device roles that GOEP defines. An example scenario would be the exchange of a contact or appointment between two mobile phones, or a mobile phone and a PC.

### **PAN – Personal Area Networking Profile**

PAN describes how two or more Bluetooth enabled devices can form an ad-hoc network and how the same mechanism can be used to access a remote network through a network access point.

### **SDAP - Service Discovery Application Profile**

SDAP describes how an application should use SDP to discover services on a remote device. It illustrates several approaches to managing the device discovery via Inquiry and Inquiry Scan and service discovery via SDP. The ideas contained in the SDAP specification augment the basic specifications provided in GAP, SDP, and the basic processes of device discovery. The use cases for SDAP are intended to encompass the majority of service discovery scenarios associated with all profiles and devices.

### **SYNC - Synchronization Profile**

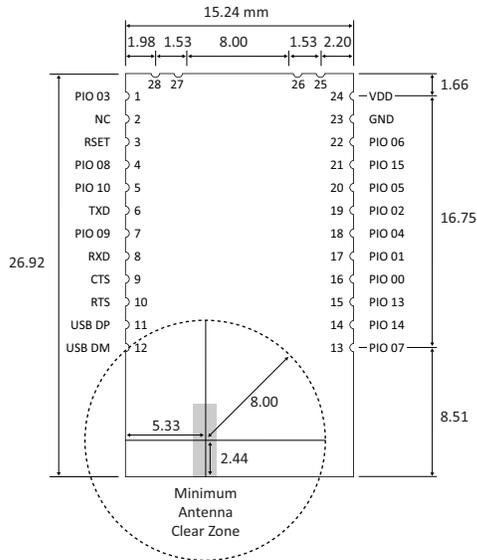
The SYNC profile is used in conjunction with GOEP to enable synchronization of calendar and address information (personal information manager [PIM] items) between Bluetooth enabled devices.

### **VDP - Video Distribution Profile**

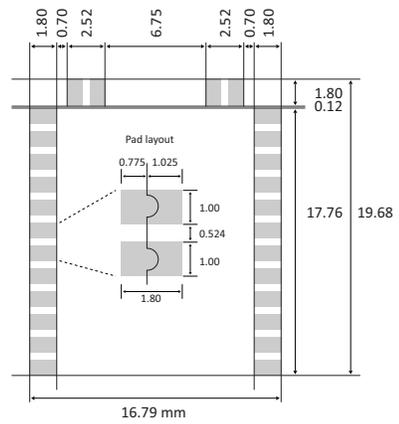
VDP defines how a Bluetooth enabled device streams video over Bluetooth wireless technology. Sample use cases include the streaming of a stored video from a PC media center to a portable player or streaming from a digital video camera to a TV.

**Physical Dimensions**

KC-21 Top View  
(dimensions in mm)



KC-21 Landing Pattern  
(dimensions in mm)



## Pin Assignment

Pin	Function	Type	Description
1	PIO_3	I/O	Programmable Input/Output
2	NC	--	Not Connected
3	RESET	Input	Hardware Reset when Low >5ms
4	PIO_8	I/O	Programmable Input/Output
5	PIO_10	I/O	Programmable Input/Output [Class 1 TX Enable]
6	UART_TXD	Output	UART Data Output
7	PIO_9	I/O	Programmable Input/Output [Class 1 RX Enable]
8	UART_RXD	Input	UART Data Input
9	UART_CTS	Input	UART Clear To Send
10	UART_RTS	Output	UART Request To Send
11	USB_DP	I/O	USB Data Positive
12	USB_DN	I/O	USB Data Negative
13	PIO_7	I/O	Programmable Input/Output [ADC, CLK]
14	PIO_14	I/O	Programmable Input/Output [ADC, CLK]
15	PIO_13	I/O	Programmable Input/Output
16	PIO_0	I/O	Programmable Input/Output [Connection Indicator]
17	PIO_1	I/O	Programmable Input/Output [Power Indicator]
18	PIO_4	I/O	Programmable Input/Output [Activity Indicator]
19	PIO_2	I/O	Programmable Input/Output [RXD Passthrough]
20	PIO_5	I/O	Programmable Input/Output [CTS Passthrough]
21	PIO_15	I/O	Programmable Input/Output [TXD Passthrough]
22	PIO_6	I/O	Programmable Input/Output [RTS Passthrough]
23	GND	--	Ground
24	VDD	Input	3V3 Regulated Input
25	SPI_MISO	I/O	SPI Master In
26	SPI_MOSI	I/O	SPI Master Out
27	SPI_CS	I/O	SPI Chip Select
28	SPI_CLK	I/O	SPI Clock

[Special/optional pin features shown in brackets]

**Electrical Characteristics**

(Conditions VDD= 3.3V and 25 °C)

<b>Absolute Maximum Ratings</b>	<b>Min</b>	<b>Max</b>	<b>Unit</b>
Storage temperature range	-40	150	°C
Supply voltage VDD	-0.4	3.7	Volts

<b>Recommended Operating Conditions</b>	<b>Min</b>	<b>Max</b>	<b>Unit</b>
Temperature Range	-40	85	°C
Supply Voltage VDD (3.3V Recommended)	3.1	3.6	Volts

<b>Digital PIO &amp; UART Pins Characteristics</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Input Voltage Low Logic	-0.4	-	0.8	Volts
Input Voltage High Logic	2.3	-	3.7	Volts
Output Voltage Low Logic	-	-	0.2	Volts
Output Voltage High Logic	3.1	-	-	Volts
Input Leakage Current	-1	-	+1	µA
Input Capacitance	1.0	-	5.0	pF
Weak Internal Pull-Up	-5.0	-1.0	-0.2	µA
Weak Internal Pull-Down	+0.2	+1.0	+5.0	µA
Strong Internal Pull-Up	-100	-40	-10	µA
Strong Internal Pull-Down	+10	+40	+100	µA

<b>Analog Programmable I/O Pins Characteristics</b>	<b>Min</b>	<b>Max</b>	<b>Unit</b>
Resolution		8	Bits
Sample Rate		50	Per Sec
Voltage	0	1.8	V

**Electrical Characteristics Cont.**

<b>Current Consumption</b>	<b>Avg</b>	<b>Unit</b>
ACL Data 115Kbps Data Transfer(Master)	11	mA
ACL Data 115Kbps Data Transfer(Slave)	25	mA
Connection, No Data Traffic (Master)	4.6	mA
Connection, No Data Traffic (Slave)	17	mA
Peak current	90	mA
Sniff Mode (40ms sniff) (Master)	2.4	mA
Sniff Mode (40ms sniff) (Slave)	2.1	mA
Sniff Mode (1.3s sniff) (Master)	0.4	mA
Sniff Mode (1.3s sniff) (Slave)	0.4	mA
Deep Sleep	40	μA

<b>Selected RF Characteristics</b>	<b>Test Conditions</b>	<b>BT Spec</b>	<b>Typical</b>	<b>Unit</b>
Maximum RF power	50 Ω load	-6 to +4	+5	dBm
Sensitivity level	0.1% BER	≤ -70	-85	dBm
Power control range		≥ 16	35	dB
Power control resolution		-	0.5	dB
Antenna load			50	Ω

## Firmware Interface

The KC-21 offers our powerful kcSerial firmware interface using the UART, which provides an easy to use AT style text command interface. The firmware interface allows persistent storage of configuration parameters such as device name, default baud rate, security PIN, and automatic connection settings. Additionally kcSerial provides operational commands such as discovery, connections, security, read/write commands for I/O pins. These commands are also available in remote command mode, so a kcSerial device will respond to these commands issued locally via UART, or wirelessly via remote command mode.

The kcSerial 2.4 firmware is compatible with kcSerial 2.2 firmware used on previous versions of KC-21 modules. Several new commands are available, offering greater control over features and settings. Please refer to our *kcSerial User Guide* for additional information. Command prefix can be either AT+KC or legacy AT+ZV.

### kcSerial v2.4 AT Command List

#### Operation Commands

AT+KC Bond  
 AT+KC Bypass  
 AT+KC DisableBond  
 AT+KC Discovery  
 AT+KC DunConnect  
 AT+KC DunDisconnect  
 AT+KC ExitSniff  
 AT+KC GPIOConfig  
 AT+KC GPIORead  
 AT+KC GPIOWrite  
 AT+KC HCImode  
 AT+KC RemoteCommand  
 AT+KC RemoteCmdDisconnect  
 AT+KC Reset  
 AT+KC Sniff  
 AT+KC SPPConnect  
 AT+KC SPPDisconnect  
 Escape Bypass Mode  
 ^#^\$^% [hex 5E235E245E25]  
 Remote Command Mode  
 ^#^\$^\* [hex 5E235E245E2A]

#### Configuration Commands

AT+KC AllowBonding  
 AT+KC Build  
 AT+KC ChangeBaud  
 AT+KC ChangeDefaultBaud  
 AT+KC COD  
 AT+KC DeepSleep  
 AT+KC DeepSleepBlocking  
 AT+KC DefaultLocalName  
 AT+KC DefaultPinCode  
 AT+KC DeleteSmartCable  
 AT+KC DisableBond  
 AT+KC DisconnectNotice  
 AT+KC EnableBond  
 AT+KC EraseBondTable  
 AT+KC FactoryReset  
 AT+KC Help  
 AT+KC HostEvent  
 AT+KC IndicatorActivity  
 AT+KC IndicatorCPU  
 AT+KC IndicatorConnection  
 AT+KC LocalName  
 AT+KC SaveSettings

AT+KC Security  
 AT+KC ShowSettings  
 AT+KC SmartCableSetup  
 AT+KC SmartCableReset  
 AT+KC UpdateInquiryScan  
 AT+KC UpdatePageScan  
 AT+KC Verbose  
 AT+KC Version

## Hardware Interfaces

### SPI Interface

The SPI pins are available for firmware loading and supported by the CSR Software Development Kit.

### UART Interface

The UART is compatible with the 16450 industry standard. Four signals are provided with the UART interface. The TXD and RXD pins are used for data while the CTS and RTS pins are used for flow control. The UART pins operate at TTL voltage level and must be translated to higher RS-232 voltage levels for communicating with PC hosts. A Maxim 3225 series or similar translator is recommend. It is highly recommended that UART pins are available for external connection (DB-9 connector or test points) to allow firmware reinstallation or updates.

### UART Bypass Interface

A UART bypass feature is available where the UART signals are passed through to PIO [2,5,6,15]. An external processor is required to issue a command that enables the bypass mode. The module will be in Deep Sleep while in bypass mode, and requires an external reset to resume normal operation.

### USB Interface

The USB interface is available for custom applications.

### Firmware Command and Control

KC-21 modules can be connected to PC or MCU hosts using the UART interface. Our kcSerial firmware provides an easy to use AT style command interface using simple text commands and parameters. Please refer to our *kcSerial User Guide* for additional information.

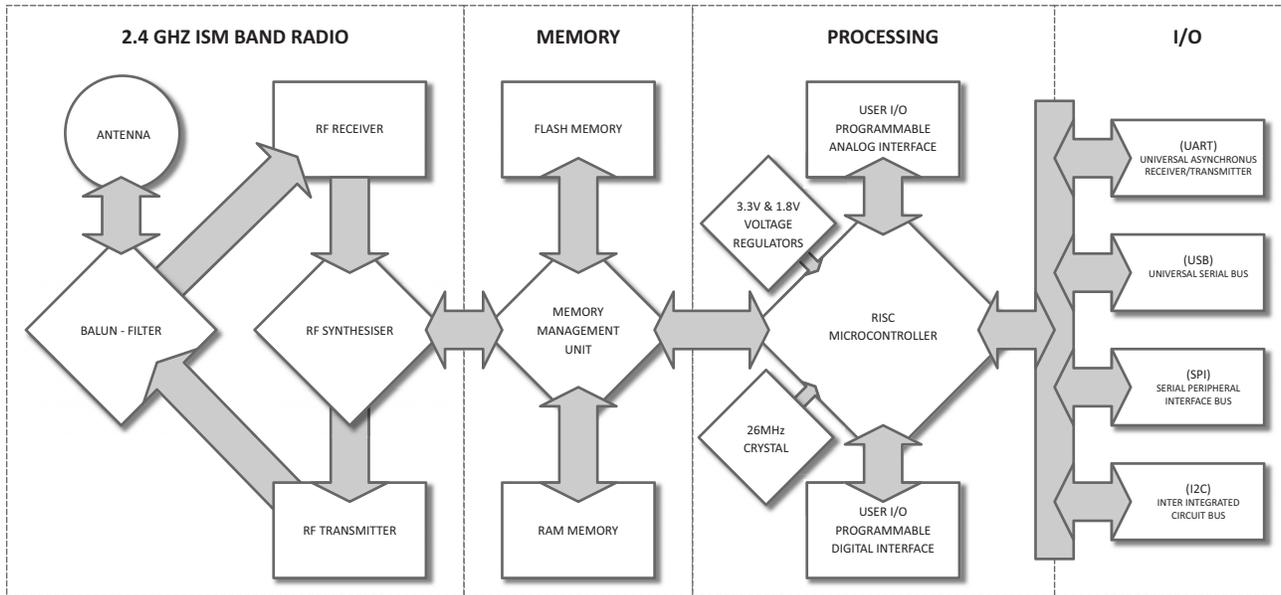
### PIO Interface Pins

PIO pins are read and write enabled via kcSerial commands. Inputs can be configured for weak pull-up, weak pull-down, strong pull-up, strong pull-down. Voltage input tolerance and output level is equal to the VDD level.

### AIO Interface Pins

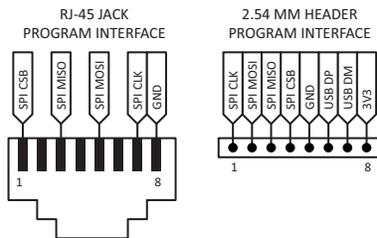
PIO 7 and PIO 14 can be enabled for analog input or output, providing 8 bit samples at rates up to 50 samples/sec. Analog pins are 1.8V logic for input mode, and 3.3V logic for output mode. AIO pins can be configured for clock output of 8, 16, 24, or 48 MHz. AIO pin usage must be custom programmed by KC Wirefree for desired operation.

**Block Diagram**



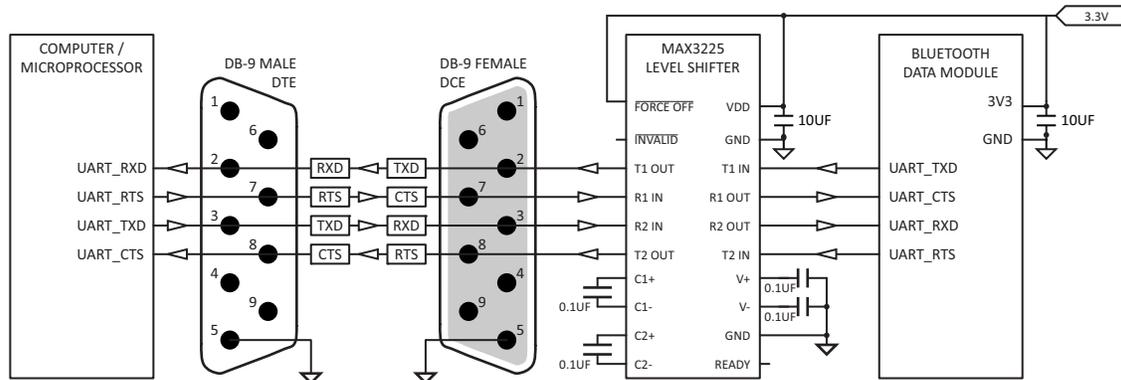
## Application Notes

- Highly recommend test points for all four SPI pins, for emergency factory debugging and firmware loading.
- UART 5-wire serial (TXD, RXD, CTS, RTS, GND). RS232 hardware flow control is enabled in firmware by default. Recommend connections to all four UART pins for RS232 connections or at least test points for firmware upgrades.
- UART optional 3-wire serial (TXD, RXD, GND). Pull up CTS pin to override hardware flow control setting. Leave RTS floating.
- UART interfaces are 3V3 TTL. A voltage level shifter is required when interfacing to PC standard RS232 ports.
- Power supply to module should have less than 10mVrms noise between 0-10MHz, and spikes should be minimal.
- Regulator should have a fast response time < 20µs. It is essential that the power rail recover quickly.
- 10µF or larger capacitor filter for VDD input.
- All unused pins should be unconnected.
- The area around the antenna should be free of any ground planes, power planes, trace routings, wire harnesses or metal. Minimum clearance is 5mm, but additional clearance allows improved range and throughput.
- Do not clean modules with Alcohol which can interact with no-clean solder flux residue.
- Do not use ultra sonic cleaning, which may cause internal interconnect damage.
- We recommend providing an RJ-45 programming adapter jack, or at least a 2.54mm programming header. The component does not need to be placed unless needed for emergency diagnostics.

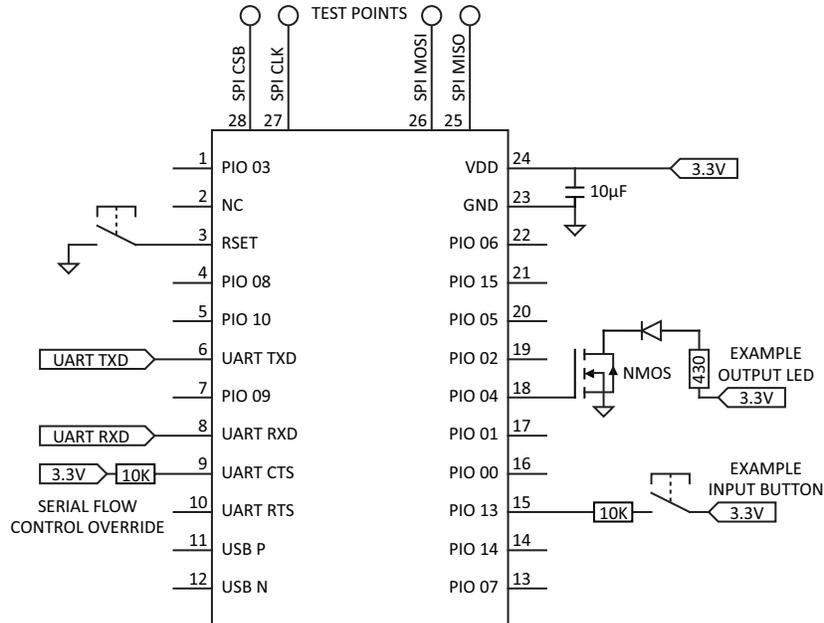


### Example Hardware Interface Connections

KC Wirefree modules provide UART, SPI, and PIO hardware interfaces. This section illustrates a typical implementation, and does not consider all cases. Our engineers are available to review designs and answer any other design questions. Contact our engineering department directly by email: support@kcwirefree.com



UART connection with level shifting



Example KC-21 module schematic using 3-wire serial interface option

## Pre Qualifications

### Bluetooth

The KC-21 is registered with and licensed by Bluetooth SIG as a qualified design.

Qualification Design ID: B015017

Bluetooth Version: 2.1 + EDR

Qualified Profiles: BB, DUN, GAP, HCI, L2CAP, LM, RFCOMM, SDP, SPP

Usage of Bluetooth registered trademarks must be licensed directly from Bluetooth SIG. A no cost membership is currently offered for trademark usage, and no cost Bluetooth product listings are currently offered for products containing our pre-qualified Bluetooth modules.

### FCC

The KC-21 is registered with and granted limited modular approval by the Federal Communications Commission. The KC-21 meets the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Bluetooth spread spectrum transmitters.

With a written agreement, Original Equipment Manufacturers may use our FCC ID transmitter license. The following FCC ID must be visible on the exterior of final the product.

FCC ID: S2242

### CE

The KC-21 complies with the following EMC Directives:

EN 300.328 V1.6.1 (2004-11) [Approval pending]

### Industry Canada

IC Warning Statement: The device's user manual does not contain the following or equivalent statement as per RSS-GEN section 7.1.5: Operation of this device is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

IC ID: 8193A-BTMODULECL2

### SAR

SAR compliant.

**Datasheet Version**

January 21, 2010

<b>Revisions</b>	<b>Changes</b>
February 11, 2009	Preliminary release
March 3, 2009	Updated image, corrected example circuit pin numbers
March 5, 2009	Updated applications, added cross-reference for KC-5290, added block diagram
March 23, 2009	Updated kcSerial commands, example schematic, hardware interfaces
April 3, 2009	Updated example schematics, corrected MOSI, MISO pin labels
June 17, 2009	Updated example schematics, and formatting
August 3, 2009	Updated profiles
January 21, 2010	Updated dimensions, example schematics, firmware description, application notes

## Ordering Information

Product Series	KC-21
Product Version	6.3
Country of Manufacture	USA
<b>Order Part Number</b>	<b>Description</b>
KC-21.6	Class 2 Bluetooth Data Module w/ kcSerial Standard Firmware
KC-21.6-FW	Class 2 Bluetooth Data Module, w/ Custom Firmware

## Contact Information

KC Wirefree  
2640 W Medtronic Way  
Tempe, Arizona 85281

(602) 386-2640      Phone

www.kcwirefree.com      Website

info@kcwirefree.com      Sales Support

tech@kcwirefree.com      Technical Support