KC-11 Datasheet — Bluetooth OEM Amplified Module
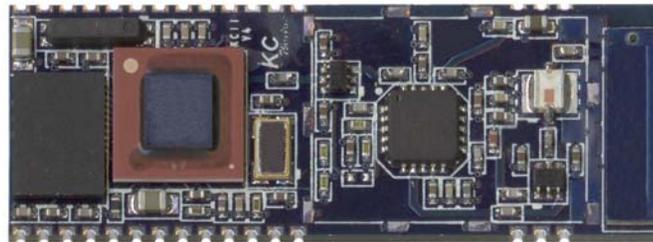
KC11
Bluetooth OEM Amplified Module

15mm x 43mm

Features

- FCC & Bluetooth licensed radio
- Complete RF ready module
- Fully embedded serial profile (SPP)
- Class 1 radio
- Bluetooth v1.2
- Wireless data communications
- ARM7 microprocessor up to 48MHz
- 8Mb flash memory
- 921K baud data throughput
- Integrated chip antenna
- 128-bit encryption security
- Amplified transmission and reception
- Range up to 100m LOS
- SPI interface, up to 24MHz
- 14 general purpose I/O
- AT command set
- Multipoint capability

Additional Documentation

- Getting Started Guide
- kcSerial 2.2 User Guide
- kcSerial 2.2 Reference Guide

Description

One of the most powerful Bluetooth modules available, the KC11 Bluetooth OEM Amplified Module is designed for maximum wireless range and penetration. The powerful onboard amplifier boosts both the transmission and reception signals – typically exceeding Bluetooth minimum specifications for a class 1 rated device.

The KC11 is a surface mount PCB module that provides fully embedded, ready to use Bluetooth wireless technology. The conveniently pre-programmed flash device contains embedded firmware for serial cable replacement using the Bluetooth SPP profile.

We are able to quickly customize the firmware for external device interaction, or for optimizations such as minimal power consumption, high speed response, and other proprietary features. Custom firmware is easily pre-loaded into these highly tuned and tested modules so that they are ready to install without additional procedures.

Typical Cable Replacement Applications

Serial communications

Machine diagnostics and control

Mobile financial transactions

Remote sensing

Medical device communications

Industrial control

Home automation
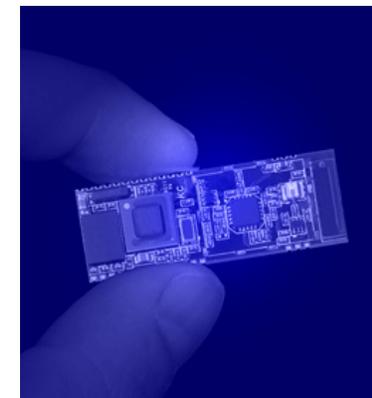
Software Architecture

Lower Layer Stack

- Full Bluetooth data rate (723.3kbps maximum)
- Device power modes—active, sleep and deep sleep
- Wake on Bluetooth feature—optimized power consumption of host CPU
- Authentication and encryption
- Encryption key length from 8-bits to 128-bits maximum
- Persistent FLASH memory—for BD Address and radio parameter storage
- All ACL (Asynchronous Connection Less) packet types (DM1, DH1, DM3, DH3, DM5, DH5, AUX1)
- SCO (Synchronous Connection Oriented) packet types (HV1, HV2, HV3)
- Point to multipoint and scatternet support—3 master and 7 slave links allowed (10 active links simultaneously)
- Park, sniff, and hold modes—fully supported to maximum allowed intervals
- Master slave switch—supported during connection and post connection
- Dedicated Inquiry Access Code—for improved inquiry scan performance
- Dynamic packet selection—channel quality driven data rate to optimize link performance
- Dynamic power control—interference reduction and link performance
- Bluetooth test modes—per Bluetooth 1.2 specification
- 802.11b co-existence—AWMA and AFH
- SCO over UART, PCM, or SPI interface—application flexibility for host CPU
- Vendor specific HCI commands—to support device configuration and certification test modes

Upper Layer Stack

- SPP, SDAP, GAP, and DUN protocols
- RFComm, SDP, and L2CAP supported

HCI Interface

- Bluetooth 1.2 specification compliant
- HCI USB transport layer (H2)
- HCI UART transport layer (H4)
- Firmware upgrade over UART

HCI STACK

KC-11 Datasheet　　　*Bluetooth OEM Amplified Module*
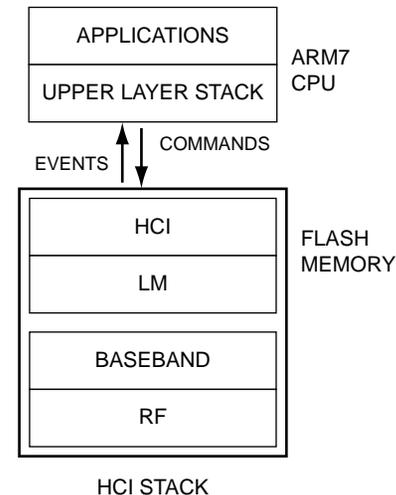
Hardware Specifications

General Conditions (V_{DD}= 3.3V and 25°C)

Recommended Operating Conditions

Rating	Min	Typical	Max	Unit
Temperature Range 3.0v – 3.3v	-30	-	85	°C
Temperature Range 2.7v – 3.6v	-20	-	80	°C
Supply Voltage V_{DD}	2.7	3.3	3.6	Volts
Signal Pin Voltage	-	3.3	-	Volts
RF Frequency	2400	-	2483.5	MHz

Absolute Maximum Ratings

Rating	Min	Typical	Max	Unit
Storage temperature range	-40	-	+150	°C
Supply voltage, V_{DD}	-0.3	-	+ 3.6	Volts
RF input power	-	-	-5	dBm

Current Consumption

Modes	Avg	Unit
Typical Power Consumption		
ACL data 115K Baud UART at max throughput (Master)	98.0	mA
ACL data 115K Baud UART at max throughput (Slave)	95.0	mA
Connection, no data traffic, master	18.0	mA
Connection, no data traffic, slave	28.0	mA
Connection in sniff (Tsniff=100ms), no data traffic, master	10.2	mA
Connection in sniff (Tsniff=100ms), no data traffic, slave	10.8	mA
Connection in sniff (Tsniff=375ms), no data traffic, master	2.75	mA
Connection in sniff (Tsniff=375ms), no data traffic, slave	3.50	mA
Standby, without deep sleep	16.5	mA
Standby, with deep sleep	1.2	mA
Page/Inquiry scan, deep sleep	6.1	mA
Peak current	210	mA

I/O Operating Characteristics

Symbol	Parameter	Min	Max	Unit	Conditions
V_{IL}	Low-Level Input Voltage	-	0.8	Volts	
V_{IH}	High-Level Input Voltage	2.0	-	Volts	
V_{OL}	Low-Level Output Voltage	-	0.4	Volts	I_{OL} = 2mA
V_{OH}	High-Level Output Voltage	2.4	-	Volts	I_{OH} = 2mA
I_{OL}	Low -Level Output Current	-	2.2	mA	V_{OL} = 0.4 V
I_{OH}	High-Level Output Current	-	3.1	mA	V_{OH} = 2.4 V
I_I	Input Leakage Current	-1	+1	µA	@V_I = 3.3V or 0V
V_{T+}	Schmitt Trigger Low-High	1.47	1.50	Volts	
V_{T-}	Schmitt Trigger High-Low	0.89	0.95	Volts	
R_{PU}	Pull-up Resistor	53	113	KΩ	Resistor Turned On
R_{PD}	Pull-down Resistor	43	118	KΩ	Resistor Turned On
C_I	Input Capacitance		7.5	pF	

Selected RF Characteristics

Parameters	Conditions	BT Spec	Typical	Unit
Antenna load			50	ohm
Radio Receiver				
Sensitivity level	BER < .001 with DH5	≤ -70	-89	dBm
Maximum usable level	BER < .001 with DH1	≥ -20	-5	dBm
Input VSWR			2.5:1	
Radio Transmitter				
Maximum output power	50 Ω load	+4 to +20	+18	dBm
Power control range		≥ 16	30	dB
Power control resolution		2 to 8	4	dB
Initial Carrier Frequency Tolerance		± 75	18	kHz
20 dB Bandwidth for modulated carrier		≤ 1000	930	kHz

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Pin Assignment

Name	Type	Pin #	Description
UART Interface			
RXD	I	8	Receive data
TXD	O	7	Transmit data
CTS	I	9	Clear to send (active low)
RTS	O	11	Request to send (active low)
Reserved			
MODE	I	2	Reserved
USB DP	I/O	12	Reserved
USB DM	I/O	13	Reserved
Power and Ground			
V_{DD}		32	V_{DD}
GND		14-19,31	GND
Reset			
RESET	I	3	Reset input (active low for 5 ms) Schmidt triggered
GPIO – General Purpose Input/Output			
GPIO [0]	I/O	25	General Purpose or SPI Dout
GPIO [1]	I/O	26	General Purpose or SPI Din
GPIO [2]	I/O	28	General Purpose or SPI CS
GPIO [3]	I/O	1	General Purpose or SPI CLK
GPIO [4]	I/O	27	General Purpose
GPIO [5]	I/O	29	General Purpose
GPIO [6]	I/O	10	General Purpose
GPIO [7]	I/O	5	General Purpose or PCM SYNC
GPIO [8]	I/O	23	General Purpose or PCM IN
GPIO [9]	I/O	22	General Purpose or PCM CLK
GPIO [10]	I/O	24	General Purpose or PCM OUT
GPIO [11]			Not Available - Internal Use
GPIO [12]			Not Available - Internal Use
GPIO [13]	I/O	4	General Purpose
GPIO [14]	I/O	6	General Purpose
GPIO [15]	I/O	30	General Purpose

Module dimensions and suggested landing pattern.

Top View
600 mil

Pin	Name	Name	Pin
1	GPIO 3	+3.3V	32
2	MODE	GND	31
3	RESET	GPIO 15	30
4	GPIO 13	GPIO 5	29
5	GPIO 7	GPIO 2	28
6	GPIO 14	GPIO 4	27
7	TXD	GPIO 1	26
8	RXD	GPIO 0	25
9	CTS	GPIO 10	24
10	GPIO 6	GPIO 8	23
11	RTS	GPIO 9	22
12	RESV	NC	21
13	RESV	NC	20
14	GND	GND	19
15	GND	GND	18
16	GND	GND	17

30   60
720
1708
570
120   40
268

55   520   55
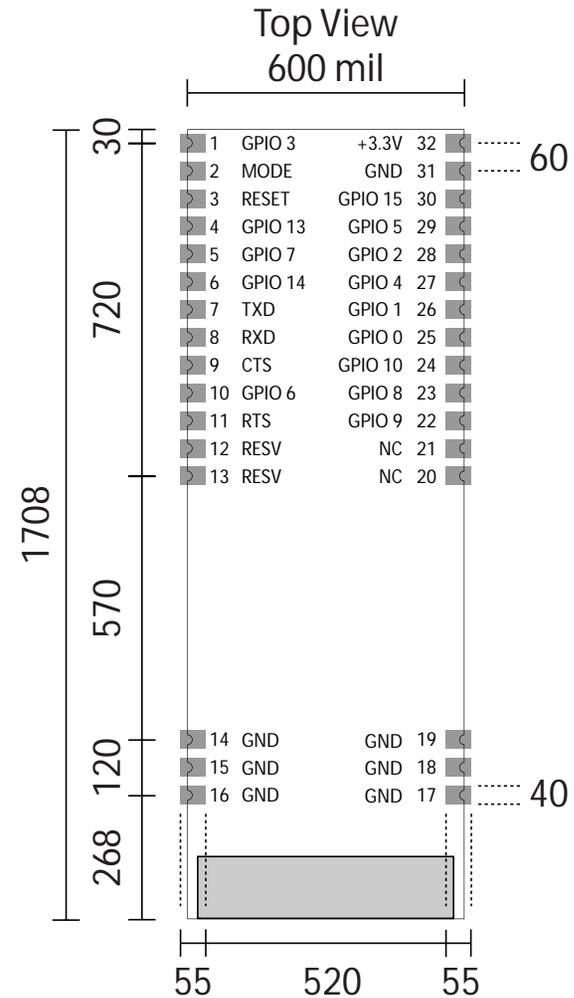
Hardware Design

KC Wirefree modules support UART, SPI, and GPIO hardware interfaces. This section details typical usage models for these features. Please note that the usage of these interfaces is dependant upon the firmware that is loaded into the module, and is beyond the scope of this document.

Notes

- RESET pin must be held high. 3.0v recommended.
- All unused pins should be left floating; do not ground.
- All GND pins must be well grounded.
- The area around the module should be free of any ground planes, power planes, trace routings, or metal for at least 8 mm from the antenna in all directions.
- Traces should not be routed underneath the module.
- The RXD pin is floating in this UART implementation. If the RXD pin is not connected, it must be pulled high using a 50K ohm resistor.

Module Reflow Installation

The KC-11 is a surface mount Bluetooth module supplied on a 32 pin, 6-layer PCB.

For non Pb-free applications, Sn63/Pb37 solder is recommended.

- Maximum peak temperature of 208° - 210°C (below 220°C).
- Maximum rise and fall slope after liquidous of < 2°C/second.
- Maximum time at liquidous of 50 – 90 seconds.

For RoHS/Pb-free applications, Sn96.5/Ag3.0/Cu0.5 solder is recommended.

- Maximum peak temperature of 230° - 240°C (below 250°C).
- Maximum rise and fall slope after liquidous of < 3°C/second.
- Maximum time at liquidous of 40 – 80 seconds.

GPIO Interface

All GPIOs are capable of sinking and sourcing 2mA of I/O current. These terminals are 5V input tolerant. GPIO [0] to GPIO [7] are internally pulled down with 50KΩ (nominal) resistors GPIO [8] to GPIO [15] are internally pulled up with 50KΩ (nominal) resistors.

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.
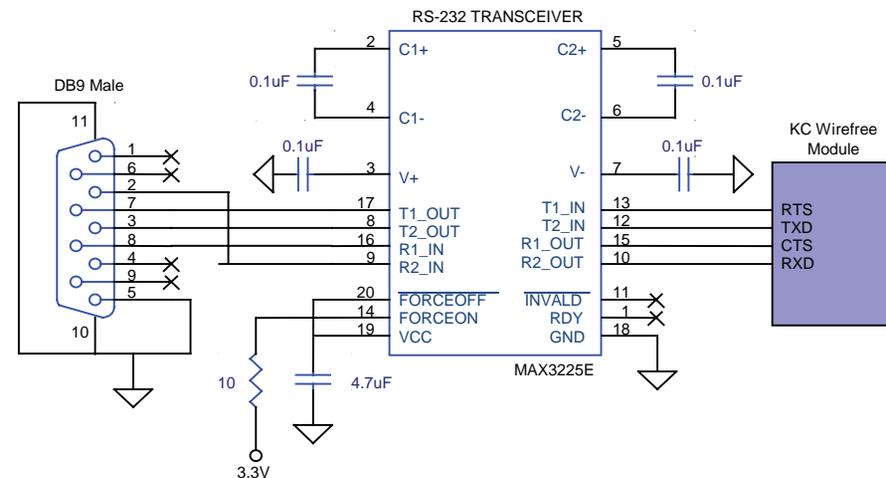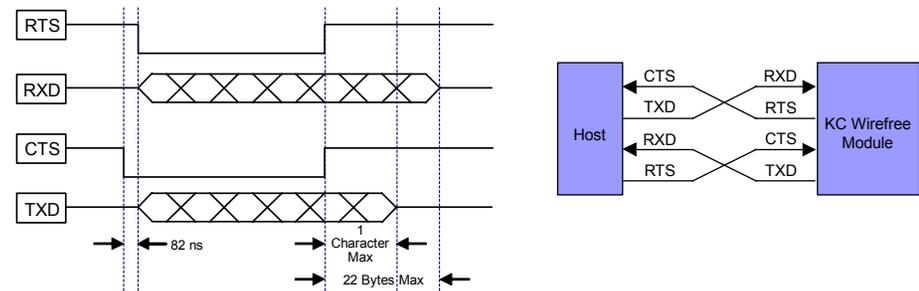
FCC Regulatory Compliance

This module has been tested and found to comply with the FCC Part15 Rules. These limits are designed to provide reasonable protection against harmful interference in approved installations. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Modifications or changes to this equipment not expressly approved by KC Wirefree may void the user's authority to operate this equipment.

Modular Approval

FCC ID: S22BTMODULE-CL1

In accordance with FCC Part 15, the KC-11 is listed above as a Modular Transmitter device.

In support of the Modular Transmitter Approval, the following is stated:

- The module does have it's own RF shielding.
- The module does have buffered modulation / data inputs.
- The module does regulate its own power supply.
- The module does have a permanently attached antenna.
- The module can be tested as a stand-alone device.
- The module is labeled with the proper FCC ID, and labeling instructions are provided to OEM end users for external product labels.
- The module does have instruction for proper use.
- The module does meet the FCC RF regulations.

In accordance with FCC document, DA 00-1407, all final usage by OEMs of this device, (1) Must be approved by the module's manufacturer, KC Wirefree, (2) final installation must follow the instructions in this user's manual, (3) a written agreement with the OEM will detail which products are approved for this module's final installation to control its end usage and ensure FCC Part 15 compliance.

FCC Label Instructions

The outside of final products that contain a KC-11 device must display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: S22BTMODULE-CL1" or "Contains FCC ID: S22BTMODULE-CL1". Any similar wording that expresses the same meaning may be used.

Firmware Reprogramming Notes

KC Wirefree modules and adaptors may be reprogrammed using the procedure detailed in this document. Normally, KC Wirefree will deliver devices with the final firmware already pre-loaded, so this should not need to be part of a product's normal production.

Typically, the following tools and equipment are necessary:

- New flash image and KC Wirefree Flash Tool.
- Null modem serial cable to PC serial port (available from KC Wirefree).
- TTL to RS232 level shifter; when programming modules.

UART Connections

The new firmware must be loaded using the UART interface. Access to this interface depends on the product type.

The minimum UART pins that are needed are the Rx and Tx pins. The RTS and CTS flow control pins are not necessary for programming devices at 115K baud (standard), but are required at 921K baud.

Serial Adaptors

KC-111 and KC-121 serial adaptors already have a DB9 serial connector and RS232 level output, so no additional hardware modifications or connections are necessary.

Modules

KC-11, KC-20, KC-21, and KC-22 modules support TTL level UART communications, but a PC requires RS232 voltage levels. Therefore, a TTL to RS232 level shifter is required.

Flash Tool

KC Wirefree will deliver the appropriate firmware in a directory structure that includes the flash tool batch (.bat) files and firmware image. The following procedure must be carefully followed to program the device:

1. Make the necessary serial connections to the PC.
2. Start with the device powered OFF.
3. Run the BurnFirmware_pX.bat file, where X represents the COM port, 1-4, of the PC connection.
4. A DOS shell will appear, and prompt the user to reset the device.
5. Turn on power to the device.
6. The program will automatically establish communication and loads the new firmware in about one minute.

Bluetooth OEM Amplified Module
Version: KC-11.4

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