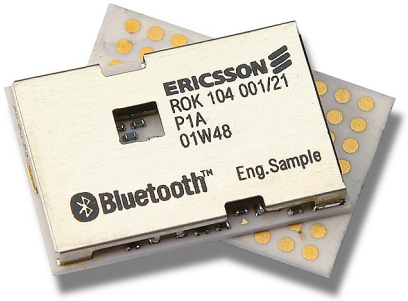
Bluetooth™ System Module

Key features

- A small and complete class 2 Bluetooth System
- Forms full Bluetooth functionality with only the addition of an antenna
- Point to Multipoint, 7 slaves
- Power management: PARK, SNIFF & HOLD as well as system power saving
- Excellent high signal level performance in-band
- Exceptional out-band blocking in all GSM bands.
- Multiple interfaces USB, UART, PCM, Bidirectional serial interface/GPIO
- Capability of embedded solutions
- Pre-qualified to Bluetooth spec. 1.1
- FCC & ETSI type approved



Description

The Bluetooth System Module ROK 104 001 is a complete FCC & ETSI type approved product for fast implementation, cutting your time-to-market. It is a compact and cost effective radio/baseband module that can be implemented in any kind of electronic device. In standard configuration the module includes a baseband processor with 4-8 MBit Flash memory, a radio solution, interfaces to antenna and application, supporting circuitry, together with basic Bluetooth software for signaling at HCI level (Host Controller Interface).

The antenna filter is specially designed for application in GSM environment such as inside a mobile phone. The ROK 104 001 also has a very high threshold for high signal levels in-band, which makes it very suitable to be in an IEEE 802.11b environment.

As the ROK 104 001 is a generic product, it can be used for many different types of application that require Bluetooth capability such as

- Computers and peripherals
- Handheld devices and accessories
- Access points and Home base stations
- Applications where short time-to-market is required

Supported Bluetooth profiles

- Generic Access Profile
- Service Discovery Application Profile
- Serial Port Profiles
  - Dial-up networking, Fax, Headset
- Generic Object Exchange Profiles
  - File transfer, Object Push, Synchronization

ERICSSON

Block diagram

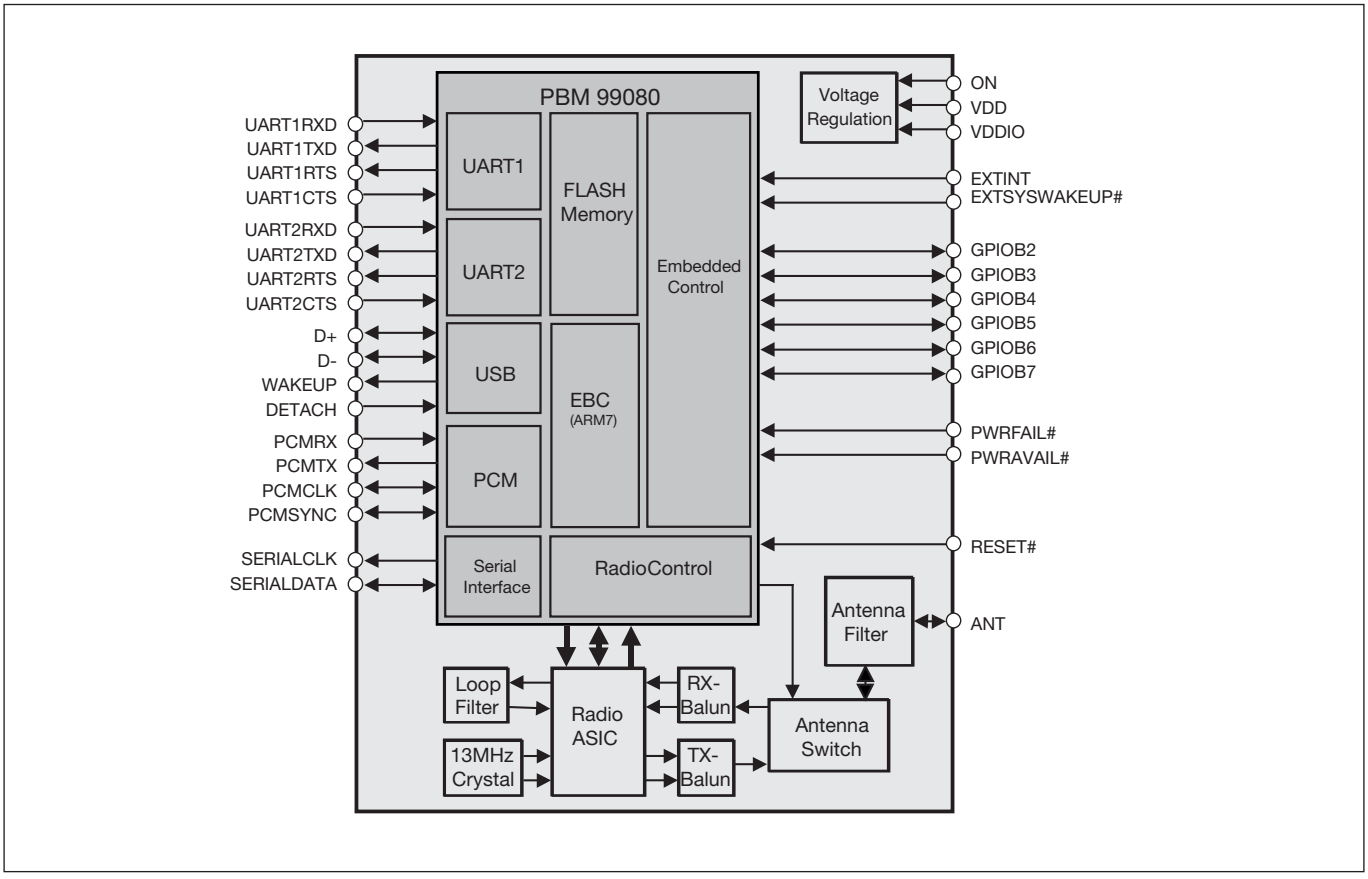


Figure 1. Block diagram.

Absolute maximum ratings

Parameter	Symbol	Min	Typ	Max	Unit
Temperature					
Storage temperature	T_{Stg}	-40		+100	°C
Operating temperature	T_{Amb}	-20		+75	°C
Power supply					
V_{DD} with respect to GND	V_{DD}	-0.3		6.5	V
V_{DD_IO} with respect to GND	V_{DD_IO}	-0.8		3.6	V
Digital inputs					
Input low voltage	V_{IL}	-0.5			V
Input high voltage	V_{IH}			V_{DD_IO} +0.3	V
Antenna port					
Input RF power	In-band			15	dBm
	Out of band			15	dBm

Electrical characteristics

DC specifications

Unless otherwise noted, the specification applies for T_{Amb} = 0 to +75°C, V_{DD} = 3.3 V, VSWR ≤ 2:1

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Power supply						
Supply voltage		V_{DD}	2.8	3.3	6.5	V
I/O ports supply voltage		V_{DD_IO}	2.8	3.3	3.6	V
Digital inputs						
Logical input high [1]		V_{IH1}	0.7 × V_{DD_IO}		V_{DD_IO}	V
Logical input low [1]		V_{IL1}	0		0.3 × V_{DD_IO}	V
Logical input high	ON signal only	V_{IH2}	2.0		V_{DD}	V
Logical input low	ON signal only	V_{IL2}	0		0.4	V
Digital outputs						
Logical output high		V_{OH}	0.9 × V_{DD_IO}		V_{DD_IO}	V
Logical output low		V_{OL}	0		0.1 × V_{DD_IO}	V
Current consumption I_{DD} + I_{DD_IO}						
Stop	After HCI - reset	I_{Idle}		180	300	µA
HV3				43	TBD	mA
Symmetric DM1	50% load	I_{DM1}		48	TBD	mA
Asymmetric DM1		I_{DM1}		40	TBD	mA
Hold mode		I_{Hold}		1	TBD	mA
Park mode	Beacon interval 1.28 s	I_{Park}		1	TBD	mA
Sniff mode	Sniff interval 1.28 s	I_{Sniff}		1	TBD	mA
Page scan	Mandatory page scan mode	I_{PSM}		5	TBD	mA
Inquiry mode		I_{ISM}		5	TBD	mA

[1] All inputs except ON

RF specifications

Parameter	Condition	Symbol	Min	Typ	Max	Unit
General						
Frequency Range			2.402		2.480	GHz
Double Sided IF Bandwidth				1		MHz
Antenna load				50		Ω
VSWR	RX mode			2:1		
VSWR	TX mode [2]			2:1		
Receive Performance	**(0.1 % BER)**					
Sensitivity Level				-80		dBm
Maximum input			5	15		dBm
$C/I_{co\text{-}channel}$			11			dB
C/I_{1MHz}			0			dB
C/I_{2MHz}			-30			dB
Out of band blocking	30-1980 MHz		0	+11		dBm
	1980-2000 MHz		-10	+11		dBm
	2000-2100 MHz		-27	0		dBm
	2100-2200 MHz		-27	-10		dBm
	2200-2300 MHz		-27	-13		dBm
	2500-3000 MHz		-27	-20		dBm
	3000-5000 MHz		-10	0		dBm
	5000-12750 MHz		-10	+10		dBm
Spurious Emissions	30 MHz to 1 GHz				-57	dBm
Spurious Emissions	1 GHz to 12.75 GHz				-47	dBm

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Transmitter Performance						
TX power			-2	1.5	+4	dBm
TX carrier drift	1 slot (366 µs)			3	25	kHz
TX carrier drift	3 slots (1598 µs)			3	40	kHz
TX carrier drift	5 slots (2862 µs),			3	40	kHz
Out of band spurious emissions	30 MHz – 1 GHz				-36	dBm
Out of band spurious emissions	1 GHz – 12.75 GHz				-30	dBm
Out of band spurious emissions	1.8 GHz – 1.9 GHz				-47	dBm
Out of band spurious emissions	5.15 GHz – 5.3 GHz				-47	dBm

2) During the TX mode, the VSWR specification states the limits that are acceptable before any other RF parameters are strongly affected, i.e. frequency deviation and drift.

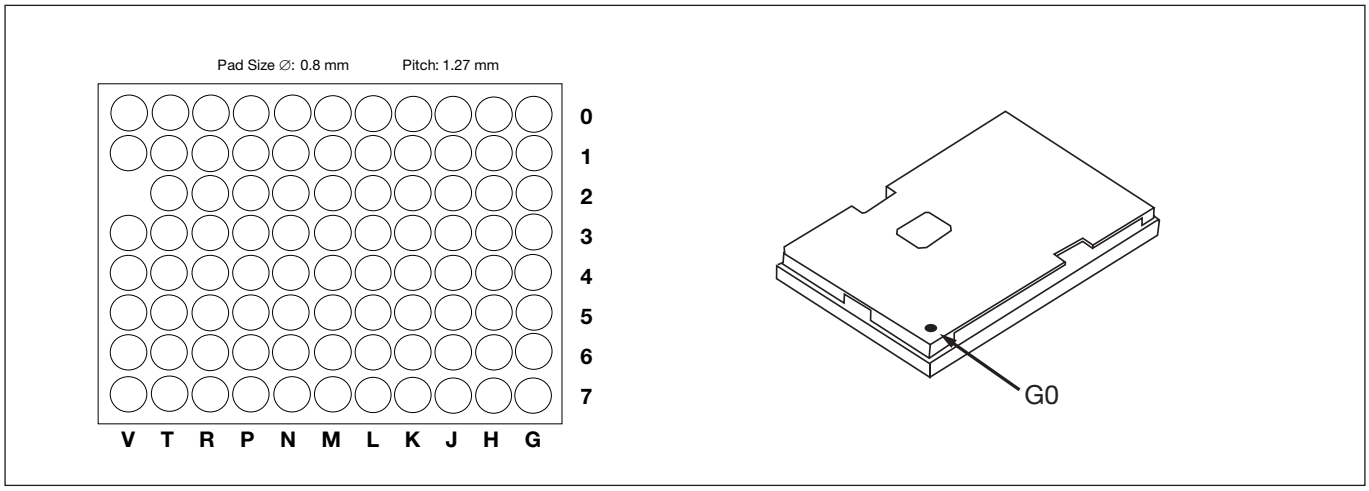


Figure 2. Mechanical dimensions of footprint, land view.

Pinout (bottom view)

Please refer to figure 2 for the positioning of each pad.

7	GND	NC	NC	NC	NC	GND	NC	NC	NC	NC	GND
6	GND	SERIALDATA	GPIOB7	GPIOB6	NC - VTP3	NC - VTP4	GND	GND	GND	GND	GND
5	GND	NC - VTP1	POWERFAIL#	NC - VTP2	UART2RTS	PWRAVAIL#	NC	NC	VDD	GND	GND
4	GND	NC	GPIOB2	DETACH	GPIOB4	NC	GND	UART1TX	VDDIO	ON	NC
3	GND	GND	RESET#	SERIALCLK	GPIOB5	UART1RX	WAKEUP	UART1RTS	UART1CTS	D+	NC
2		ANT	GND	EXTSYSWAKEUP#	UART2RX	EXTINT	PCMSYNC	NC	UART2CTS	D-	GND
1	GND	GND	GND	GPIOB3	PCMTX	PCMCLK	PCMRX	NC	UART2TX	GND	GND
0	GND	NC	NC - VTP5	NC	NC	GND	NC	NC	NC	NC	GND
	V	**T**	**R**	**P**	**N**	**M**	**L**	**K**	**J**	**H**	**G**

Pin description

Pin	Pin Name	Type	Direction	Description
G0 - 2	GND	Power	-	Mechanical connection to ground
G3 - 4	NC	-	-	Mechanical connection - treat as no connect. Pad required.
G5 - 7	GND	Power	-	Mechanical connection to ground
H0	NC	-	-	Mechanical connection - treat as no connect. Pad required.
H1	GND	Power	-	Mechanical connection to ground
H2	D-	CMOS	Bidirectional	USB data pin
H3	D+	CMOS	Bidirectional	USB data pin
H4	ON	Power	Input	When tied to V_{DD}, the module is HW enabled
H5	GND	Power	-	Ground
H6	GND	Power	-	Mechanical connection to ground
H7	NC	-	-	Mechanical connection - treat as no connect. Pad required.
J0	NC	-	-	Mechanical connection - treat as no connect. Pad required.
J1	UART2TX	CMOS	Output	TX data from UART 2
J2	UART2CTS	CMOS	Input	Flow control signal, Clear To Send data to UART 2
J3	UART1CTS	CMOS	Input	Flow control signal, Clear To Send data to UART 1
J4	VDDIO	Power	-	External supply rail to the Input / Output ports
J5	VDD	Power	-	Supply Voltage
J6	GND	Power	-	Ground
J7	NC	-	-	Mechanical connection - treat as no connect. Pad required.
K0	NC	-	-	Mechanical connection - treat as no connect. Pad required.
K1-2	NC	-	-	Not connected
K3	UART1RTS	CMOS	Output	Flow control signal, Request To Send data from UART 1
K4	UART1TX	CMOS	Output	TX data from UART 1
K5	NC	-	-	Not connected
K6	GND	Power	-	Signal ground
K7	NC	-	-	Mechanical connection - treat as no connect. Pad required.
L0	NC	-	-	Mechanical connection - treat as no connect. Pad required.
L1	PCMRX	CMOS	Input	PCM receive data (default)
L2	PCMSYNC	CMOS	Bidirectional	PCM data sampling rate
L3	WAKEUP	CMOS	Output	Indicates that the module wants to be attached
L4	GND	Power	-	Ground
L5	NC	-	-	Not connected
L6	GND	Power	-	Ground
L7	NC	-	-	Mechanical connection - treat as no connect. Pad required.
M0	GND	Power	-	Mechanical connection to ground
M1	PCMCLK	CMOS	Bidirectional	PCM clock that sets the PCM data rate
M2	EXTINT	CMOS	Input	External interrupt for embedded purposes
M3	UART1RX	CMOS	Input	Receive data to UART 1
M4	NC	-	-	Not connected
M5	PWRAVAIL#	CMOS	Input	Indicates whether external power is available; used in conjunction with PWRFAIL#. -Not supported by Firmware R1A
M6	NC-VTP4	-	-	Not connected - Vendor test point #4
M7	GND	Power	-	Mechanical connection to ground

Pin	Pin Name	Type	Direction	Description
N0	NC	-	-	Mechanical connection - do not connect
N1	PCMTX	CMOS	Output	PCM transmit data (default)
N2	UART2RX	CMOS	Input	Receive data to UART 2
N3	GPIOB5	CMOS	Bidirectional	General purpose signal #5 Input / Output (default) for embedded purposes
N4	GPIOB4	CMOS	Bidirectional	General purpose signal #4 Input / Output (default) for embedded purposes
N5	UART2RTS	CMOS	Output	Flow control signal, Request To Send data from UART 2
N6	NC-VTP3	-	-	Not connected - Vendor test point #3
N7	NC	-	-	Mechanical connection - treat as no connect. Pad required.
P0	NC	-	-	Mechanical connection - treat as no connect. Pad required.
P1	GPIOB3	CMOS	Bidirectional	General purpose signal #3 Input / Output (default) for embedded purposes
P2	EXTSYSWAKEUP#	CMOS	Input	Can be used as an external interrupt to control the EBC - for embedded purposes
P3	SERIALCLK	CMOS	Output	Bidirectional serial interface/GPIO clock signal
P4	DETACH	CMOS	Input	Indicates that the USB host wants to detach the module
P5	NC-VTP2	-	-	Not connected - Vendor test point #2
P6	GPIOB6	CMOS	Bidirectional	General purpose signal #6 Input / Output (default) for embedded purposes
P7	NC	-	-	Mechanical connection - treat as no connect. Pad required.
R0	NC-VTP5	-	-	Not connected - Vendor test point #5
R1 - 2	GND	Power	-	Ground
R3	RESET#	CMOS	Input	Reset signal, Active low
R4	GPIOB2	CMOS	Bidirectional	General purpose signal #2 Input / Output (default) for embedded purposes
R5	PWRFAIL#	CMOS	Input	Indicates a power fail condition; used in conjunction with PWRAVAIL#. -Not supported by Firmware R1A
R6	GPIOB7	CMOS	Bidirectional	General purpose signal #7 Input / Output (default) for embedded purposes
R7	NC	-	-	Mechanical connection - treat as no connect. Pad required.
T0	NC	-	-	Mechanical connection - treat as no connect. Pad required.
T1	GND	Power	-	Ground
T2	ANT	RF	Bidirectional	50Ω antenna connection
T3	GND	Power	-	Ground
T4	NC	-	-	Not connected
T5	NC-VTP1	-	-	Not connected - Vendor test point #1
T6	SERIALDATA	CMOS	Bidirectional	Serial interface - data signal
T7	NC	-	-	Mechanical connection - treat as no connect. Pad required.
V0 - 1	GND	Power	-	Mechanical connection to ground
(V2)	-	-	-	(No pad)
V3 - 7	GND	Power	-	Mechanical connection to ground

Functional description

The ROK 104 001 is a complete Bluetooth module that has been specified and designed according to the Bluetooth System v1.1. Its implementation is based on a high-performance integrated radio IC working with the baseband controller PBM 990 80 that has an integrated flash memory.

ROK 104 001 consists of three major parts; a baseband controller, firmware, and a radio. Multi slot data and voice packets are supported. Communication between the module and the host controller is carried out on UART, USB and PCM interfaces. ROK 104 001 is compliant with BT version 1.1 and is a Class 2 BT Module. ROK 104 001 is tested according to ETSI & FCC type approval requirements.

Design sections

ROK 104 001 has five major design sections. Figure 3 illustrates the interaction of the various sections. The functionality of each section will be explained in detail.

Radio

The radio functionality is achieved by an Ericsson Microelectronics Radio IC, based on the same RF design as PBA 313 05, a short-range microwave frequency radio transceiver for Bluetooth communication links based on RFCMOS technology.

Baseband

The baseband functionality is achieved by using Ericsson Microelectronics PBM 990 80. The baseband is a multi stacked die package consisting of the baseband PBM 990 90 and a Flash. The baseband contains the EBC core; an ARM 7 processor, I/O ports (PCM, UART and USB) and RAM memory. Firmware is downloaded into the flash memory. The interfaces that are implemented on the baseband chip are UART, USB, PCM and serial clock interface (Bidirectional serial interface/GPIO).

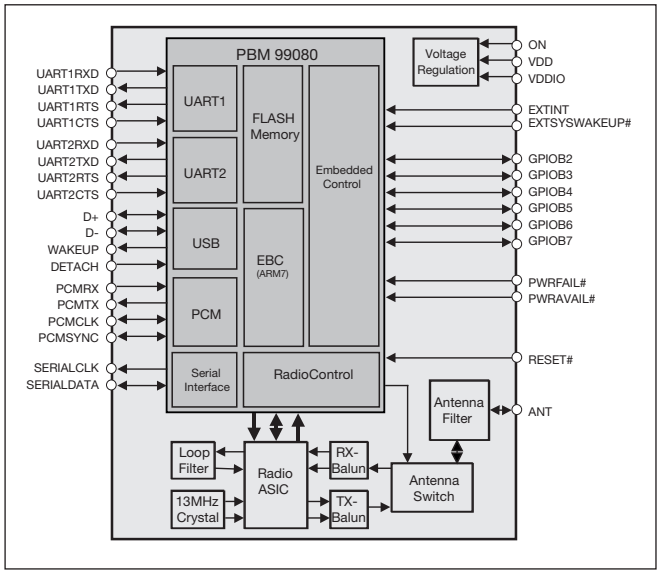


Figure 3. Block diagram.

PBM 990 80 provides the link-setup and control routines for the layers above. Furthermore, PBM 990 80 also provides Bluetooth security like encryption, authentication and key management.

Please refer to the PBM 990 80 data sheet for further information regarding baseband functionallity.

Voltage regulation section

There are three inputs to the voltage regulation section (V_{DD}, V_{DD_IO}, ON). V_{DD} can be fed with 2.8 V to 6.0 V. The power regulator on the module creates 2.6 V regulated supply.

A separate power supply rail (V_{DD_IO}) is provided for the I/O ports, UART, USB and PCM. V_{DD_IO} can either be connected to V_{DD} or to a dedicated supply rail, which is the same as the logical interface of the host.

The ON input is the only signal that is required to activate the module.

Crystal oscillator

An internal crystal oscillator supplies radio IC and Baseband with a stable frequency. No external oscillator or crystal is required.

Flash memory

ROK 104 001 is delivered with either 4M or 8M bit flash memory. Firmware (F/W) for the host controller interface and the link manager resides in the flash and is available as an image file format.

Module HW interfaces

Host interfaces

To enable a host system to access the Bluetooth radio link, a Host Controller Interface (HCI) has been defined. The host system controls and distributes data to and from the Bluetooth Link Manager with a set of commands. These commands are carried physically on either the USB or UART interface.

USB 2.0 Full-speed

The module is a USB 2.0 full-speed class device (12 Mbit/s) that has the full functionality of a USB device and is compliant to the USB 2.0 specification (If $V_{DD\_IO} > 3.11$ V).

Data transfer occurs on the Bidirectional ports, D+ & D-. Additionally, there are two side band signals for a notebook application.

Two side band signals Wake_up and Detach are used to control the state from which the notebook resumes. When the host is in a power down mode, Wake_up wakes the host up when the Bluetooth system receives an incoming connection. The host indicates that it is in Suspend mode by using the Detach signal.

USB is a serial interface. The interface is “Plug and Play” and is therefore easy to use for equipment that is constantly moved around.

The USB interface implemented in ROK 104 001 is based on the 2.0 Full-speed version of the USB standard and is configured for 6 endpoints:

- Control endpoint with 8 bytes buffer.
- 2 Isochronous endpoints (Rx/Tx) – Double buffered with 64 bytes in each buffer.
- 2 Bulk transfer endpoints (Rx/Tx) – Double buffered with 64 bytes in each buffer.
- Interrupt endpoint with 16 bytes buffer.

The USB is divided into three parts, USB PHY, USB core, and USB driver software integrated in the firmware.

ROK 104 001 has an integrated PHY, the necessary analog line driver for USB signalling, thus avoiding an external component. The simplified USB pin configuration where only D+ and D- are used, means that the interface does not require to be fed power from the USB host.

The USB core is the digital hardware part handling packet transmission and reception. It also handles low level control. The USB software driver is integrated in the firmware delivered with the module.

UARTs

The UART implemented on the baseband is an industry standard and supports the following baud rates: 300, 600, 900, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800 and 921600 bits/s. 128 byte FIFOs are associated with the UART.

Four signals will be provided for the UART interface. TxD & RxD are used for data flow, and RTS & CTS shall be used for flow control. The module is a DCE.

There are two on-chip UART interfaces, UART1 and UART2. UART1 has 128 byte FIFOs and full modem control support and is used for data transmission at bit rates up to 921 kbit/s. UART1 is setup to a DTE configuration. UART2 has 16 byte FIFOs and is used for control and/or boot.

Start-detect and Auto-baud functionality is available for both UARTs.

Default Settings UART1, UART2	
Speed	57600 bit/s
Data bit	8 bit
Stop bit	One
Parity	None
Flow	CTS/RTS

Note: These settings can be changed from the HCI level using Ericsson specific commands.

Other interfaces

Serial interface

The Bidirectional serial interface/GPIO interface function is based on software using two GPIO's. The interface has a capacity of handling approximately 100 kbit/s.

A master serial I/F is available on the module. This is used to control external serial interface devices. The controls of the serial interface pins are performed by Ericsson specific HCI commands available in the FW implementation. See Application Note. This enables application in a stand-alone ROK 104 001 module to also control other devices via the serial interface.

General purpose I/O

The ROK 104 001 architecture supports up to 8 General Purpose I/O's. 2 GPIO's are default, that is used as the serial interface.

PCM voice interface

Uses the standard PCM interface, which has a sample rate of 8 kHz (PCMSYNC). The PCM I/F can be set in master or slave mode (providing or receiving the PCMSYNC and PCMCLK).

PCM clock (PCMCLK) is variable between 200 kHz and 2.0 MHz in slave mode. During the master mode, the PCMCLK is set at 2.0 MHz. PCM data can be linear PCM (13-16 bit), µ-Law (8 bit) or A-Law (8 bit). Over the air the encoding is programmable to be CVSD, A-Law or µ-Law.

The PCM Interface (PIF) in the EBC block provides an interface between the serial PCM transfer lines and the Receive and Transmit voice blocks inside the EBC. This interfacing task involves:

- Synchronization between two asynchronous clock domains
- Direction switching of the Bidirectional PCM data and control signals
- Synchronous serial data to parallel data conversion.

The EBC supports one PCM channel on the PCM interface.

The PCM line interface can act either as slave or master. When the PCM line interface is slave the frequency range of PCMCLK (in) is 200 kHz to 2 MHz. When the PCM line interface is master PCMCLK (out) is always 2 MHz.

Each PCM symbol received on the PCMA or PCMB in line is organized as an 8 or 16-bit sequence of bits, arriving synchronous to PCMCLK in (if the PCM line interface is slave) or PCMCLK out (if the PCM line interface is master). The symbol starts with its most significant bit arriving after a positive edge on the PCMCLK in (or out), one clock cycle after a PCMSYNC in (or out) positive transition. The symbol is then transferred by one bit each PCMCLK in (or out) clock cycle until the least significant bit is transferred. The EBC then samples the arriving bit at falling edges of PCMCLK in (or out).

The PCM symbols are transmitted bit by bit starting with the MSB, one clock cycle after a positive edge on the PCMCLK in (if the PCM line interface is slave) or PCMCLK out (if the PCM line interface is master), one clock cycle after a PCMSYNC (in or out) positive transition. The rest of the bits are then transferred by one bit each PCMCLK (in or out) cycle, and are synchronized with the rising edge of this clock.

Low power operation (LPO) clock support

This function is essential for the wake up function. When the radio link is unused, the circuit will go into a power saving mode inactivating other blocks including the PLL. At this time the LPO clock and a small number of gates are the only active logic in the circuit. The LPO associated logic activates the processor periodically for page- and inquiry-scan.

Antenna

The ANT pin should be connected to a 50 Ω antenna interface, thereby supporting the best signal strength performance, VSWR should not be higher than 2:1. Ericsson Microelectronics can recommend application specific antennas.

Software

The Bluetooth link is partitioned into a hardware part and a software part. The software relates to the Bluetooth protocol stack. Depending on the level of integration, there will be two different firmware models available, including hardware specific drivers for the Bluetooth core, USB, UARTs, GPIO and Bidirectional serial interface/GPIO. The level of integration follows the two scenarios:

- LM & HCI firmware
- Embedded Bluetooth stack firmware

Firmware

The module includes firmware for the host controller interface, HCI, and the link manager, LM. The FW resides in the Flash and is available in load format (*.mfl) and in binary format (*.bin).

Bluetooth module stack

The Host Controller Interface (HCI) handles the communication by the transport layer through the UART or USB interface with the host. The Baseband and radio provide a secure and reliable radio link for higher layers.

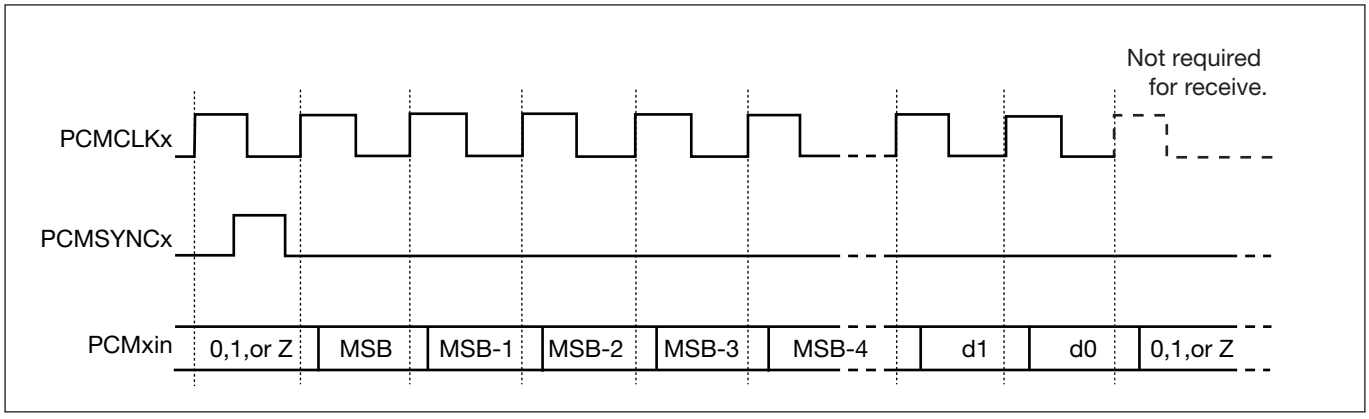


Figure 4. PCM interface receive timing diagram.

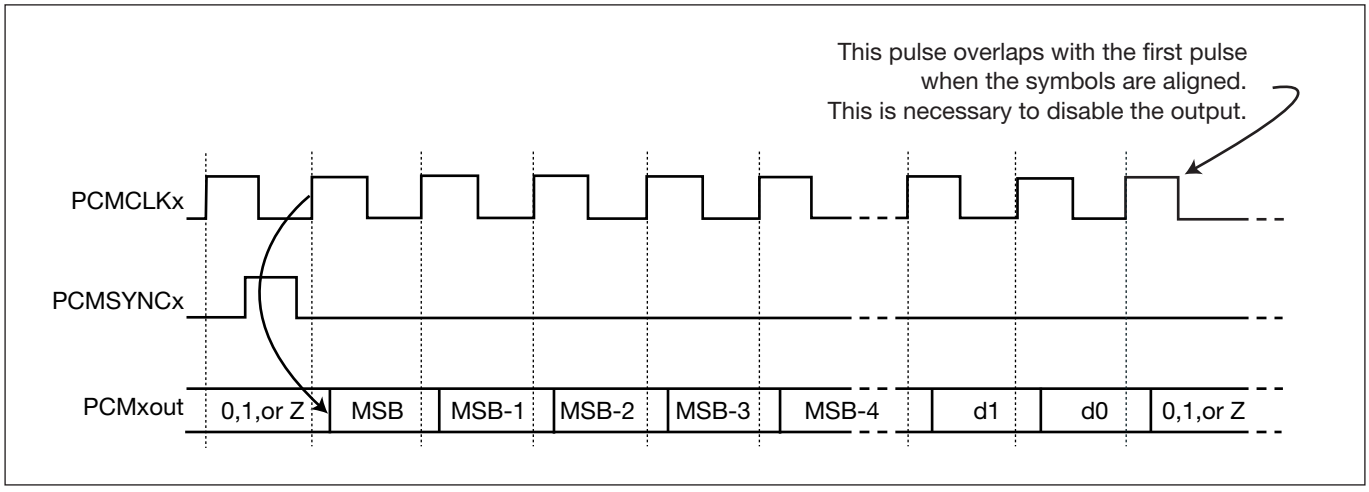


Figure 5. PCM interface transmit timing diagram.

The following sections describe the Bluetooth module stack in more detail, see also figure 6. It is implemented in accordance with and complies with the Specification of the Bluetooth System v1.1.

LM & HCI firmware

In this configuration the customer will access the LM through a Host Controller Interface (HCI) protocol distributed over USB or UART.

Host Controller Interface (HCI)

The HCI provides a uniform command I/F to the Baseband and Link Manager and also to HW status registers. The HCI I/F is accessed through UART or USB. There are three different types of HCI packets:

- HCI command packet – from host to Bluetooth module HCI.
- HCI event packets – from Bluetooth module HCI to host.
- HCI data packets – going both ways.

It is not necessary to make use of all different commands and events for an application. If the application is aimed at a pre-specified profile, the capabilities of such a profile are necessary to adjust to – see Specification of the Bluetooth System v1.1 Profiles and Application Note TBD.

a) With the HCI UART Transport Layer on top of HCI, the module will communicate with a host through the UART I/F. The PCM I/F is also available for communicating voice.

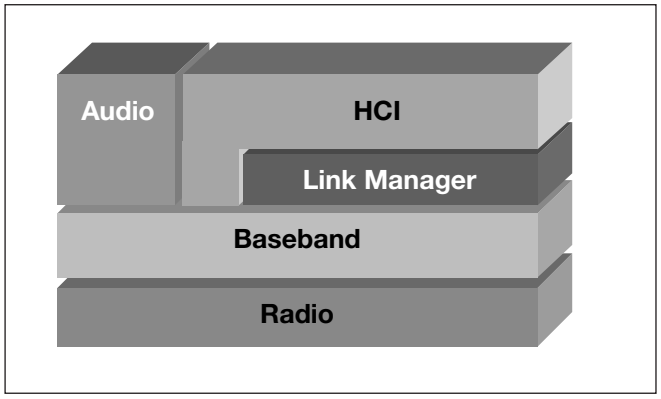


Figure 6. HW/FW parts included in the Bluetooth module from Ericsson Microelectronics.

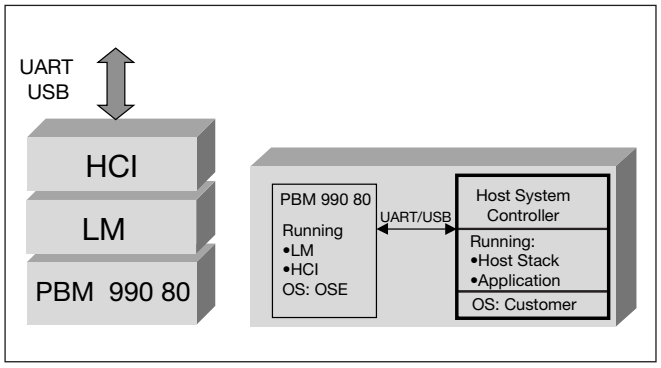


Figure 7. Host Controller Interface.

b) With the HCI USB Transport Layer on top of the HCI, the module will communicate with a host through the USB. Detach and Wake_up signals are also available for notebook implementations.

Please refer to the Specification of the Bluetooth System v1.1 part H: 1-4 for in-depth information regarding the HCI and different transport layers.

Link Manager (LM)

The Link Manager in each Bluetooth module can communicate with another Link Manager by using the Link Manager Protocol (LMP) which is a peer to peer protocol, see figure 8. The LMP messages have the highest priority and are used for link-setup, security, control and power saving modes. The receiving Link Manager filters out the message and does not need to acknowledge the message to the transmitting LM due to the reliable link provided by the Baseband and radio. LM to LM communication can take place without actions taken by the host. Discovery of features at other Bluetooth enabled devices nearby can be found and saved for later use by the host. Please refer to the Specification of the Bluetooth System v1.1 part C for in-depth information regarding the LMP.

Design guidelines

Power-up sequence

There is no need for a power up sequence if V_{DD}, ON and V_{DD_IO} are tied together. A power up sequence, if used, shall be applied accordingly: connection of the supply rails, GND and then V_{DD}; then the ON signal should be applied in order to initiate the internal regulators; and finally, the V_{DD_IO} supply rail can be activated.

The power-down sequence is similar to the power-up procedure but in the reverse format. Therefore, the disconnection of the signals shall be as follows: V_{DD_IO}, ON, V_{DD} and finally GND.

RESET

The assignment of the RESET# input is to generate a reset signal to ROK 104 001. During power-up the reset signal is set 'low' so that power supply glitches are avoided. Therefore, no reset input is required after power-up.

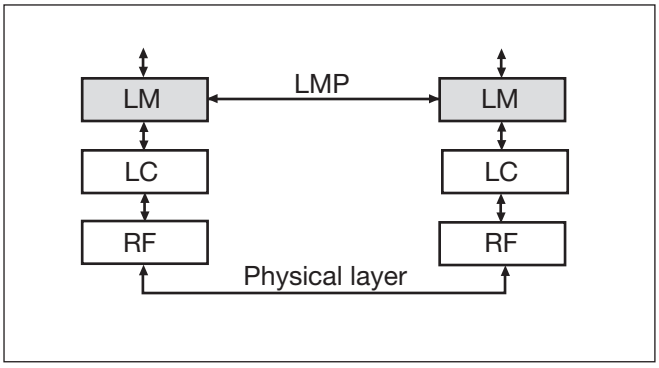


Figure 8. Link manager.

Power

There are three inputs to the Voltage Management section (V_{DD}, V_{DD_IO}, ON). V_{DD} is the supply voltage that is typically 3.3 V. A separate power supply rail (V_{DD_IO}) is provided for the I/O ports, UART, PCM and USB. V_{DD_IO} can either be connected to V_{DD} or to a dedicated supply rail, which is the same as the logical interface of the host. The ON signal is controlling the internal regulators on or off.

An input capacitor whose capacitance is $\geq$ 1 µF is required between the V_{DD} supply and ground (the amount of capacitance may be increased without limit). This capacitor must be located as close as possible to the V_{DD} pad returned to a clean analogue ground. Any good quality ceramic, tantalum, or film capacitor may be used at the input.

Important: Tantalum capacitors can suffer catastrophic failure due to surge current when connected to a low-impedance source of power (like a battery or very large capacitor). If a Tantalum capacitor is used at the input, it must be guaranteed by the manufacturer to have a surge current rating sufficient for the application.

There are no requirements for ESR on the input capacitor, but tolerance and temperature coefficient must be considered when selecting the capacitor to ensure that the capacitance will be $\geq$ 1 µF over the entire operating temperature range.

Antenna

It is very important to keep the antenna output routing 50 Ω (VSWR ≤ 2:1) all the way to the antenna in order to maintain the radio performance listed in this data sheet and thereby the FCC and ETSI approvals. For the routing underneath the module, the modules ground plane should be considered.

Shielding / EMC requirements

The module has its own RF shielding and is approved according to the standards by FCC and ETSI. If the approval number is not visible on the outside when the module is utilised in the final product, an exterior label must state that there is a transmitter module inside the product.

Ground

Ground should be distributed with very low impedance as a ground plane. Connect all GND pins to the ground plane.

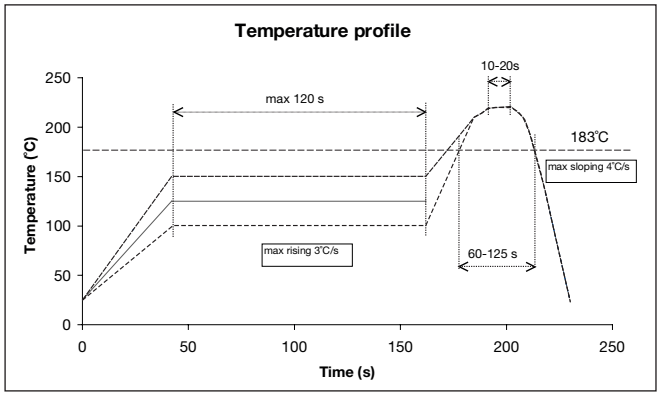


Figure 9. Eutectic SnPb-solder profile.

Assembly guidelines

Solder paste

The ROK 104 001 module is made for surface mounting with land grid array (LGA) solder joints. To assemble the module, solder paste (eutectic Tin/Lead) must be printed at the target surface. Preferred solder paste height is 100-127µm (4-5 mil).

Soldering profile

It must be noted that the module should not be allowed to be hanging upside down in the reflow operation. This means that the module has to be assembled on the side of the PCB that is soldered last. The reflow process should be a regular surface mount soldering profile (full convection strongly preferred), the ramp-up should not be higher than 3°C/s and with a peak temperature of 210-225°C during 10-20 seconds. Max sloping rate should not be higher than 4°C/s (see example of reflow profile in Figure 9).

Pad size

It is recommended that the pads on the PCB should have a diameter of 0.7-0.9 mm. The surface finish on the PCB pads should be Nickel/Gold or a flat Tin/Lead surface or OSP (Organic Surface Protection).

Placement

The recommended pickup coordinates for the ROK 104 001 shield is based on a nozzle with inner diameter 2 mm and outer diameter 3.17 mm. The center of the shield is the origin of coordinates, (0,0) for (x,y), giving the pickup coordinates (1mm,0) for (x,y).

Storage

Keep the component in its dry pack when not yet using the reel. After removal from the dry pack ensure that the modules are soldered onto the PCB within 48 hours.

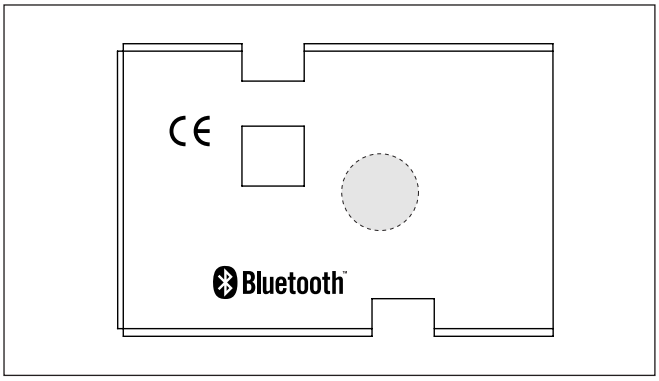


Figure 10. Pickup coordinates.

Module marking

Each module is marked on the shield with the following information:

Ericsson logotype
Product No with index
Revision state
Manufacturing unit code
Production year and week
Bluetooth trademark
FCC product code
CE marking

Reel marking

The reel, reel box and dry pack has a label with the following information:

- Ericsson product number with revision
- Customer product number with revision
- Quantity
- Reel-ID. (Batch No)
- Factory code
- Manufacturing date
- Country of origin
- Ericsson logotype

1-6 above is also printed in BAR-code format

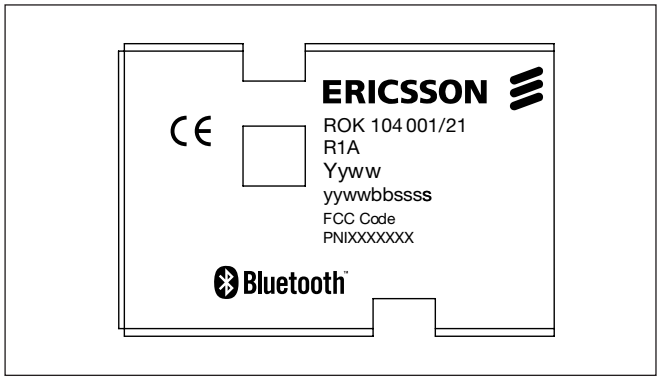


Figure 11. Module marking.

Ordering information

Please contact Ericsson Microelectronics for further information.

Packaging

The modules will be delivered in a tape & reel and dry pack, protecting them from ESD and mechanical shock.

The tape width is TBD mm and the pitch is TBD mm. The diameter of the reel is TBD inches and it contains 1500 modules.

Abbreviations

ASIC	- Application Specific Integrated Circuit
BER	- Bit Error Rate
CMOS	- Complementary Metal Oxide Semiconductor
DCE	- Data Circuit terminating Equipment
HCI	- Host Controller Interface
IC	- Integrated Circuit
ISM	- Industrial Scientific and Medical
LGA	- Land Grid Array
PCB	- Printed Circuit Board
PCM	- Pulse Code Modulation
RX	- Receive
SIG	- Special Interest Group
TX	- Transmit
UART	- Universal Asynchronous Receiver Transmitter
USB	- Universal Serial Bus

Mechanical specifications

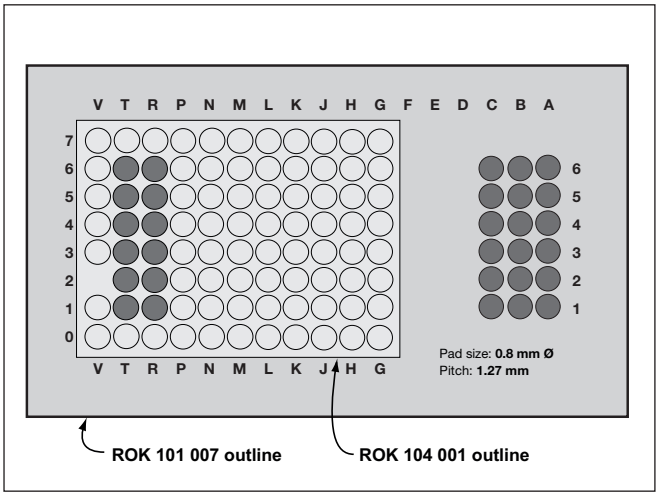


Figure 12. ROK 104 001 and ROK 101 007, bottom view.

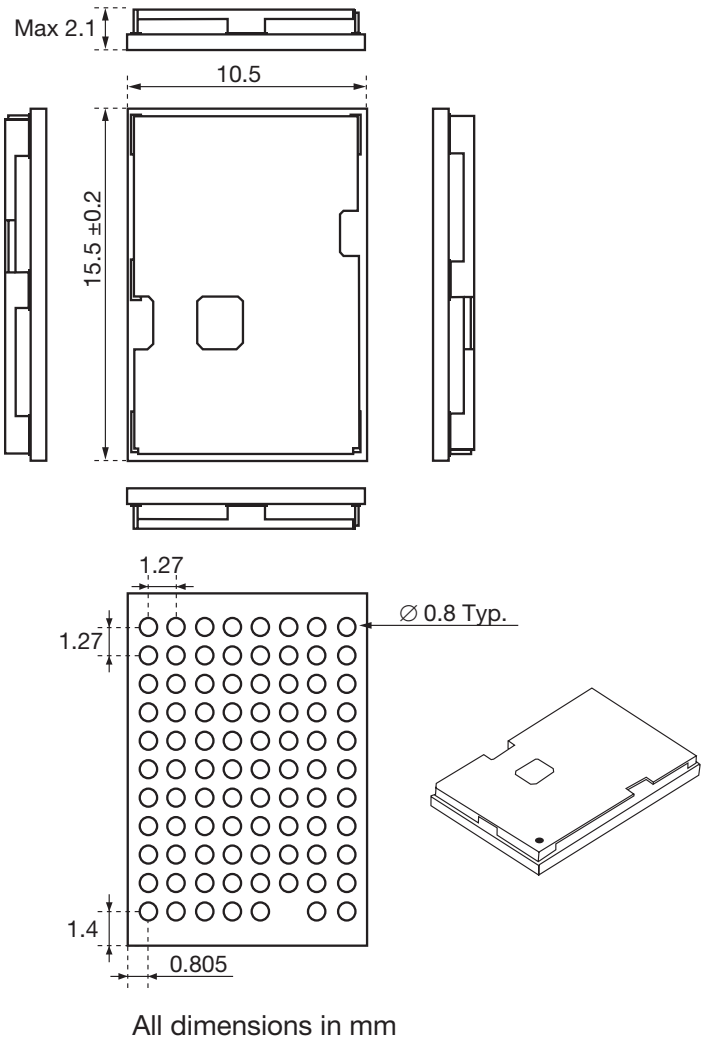


Figure 13. Mechanical dimensions and footprint, bottom view.

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Preliminary Data Sheet

EN/LZT 146 130 R1C