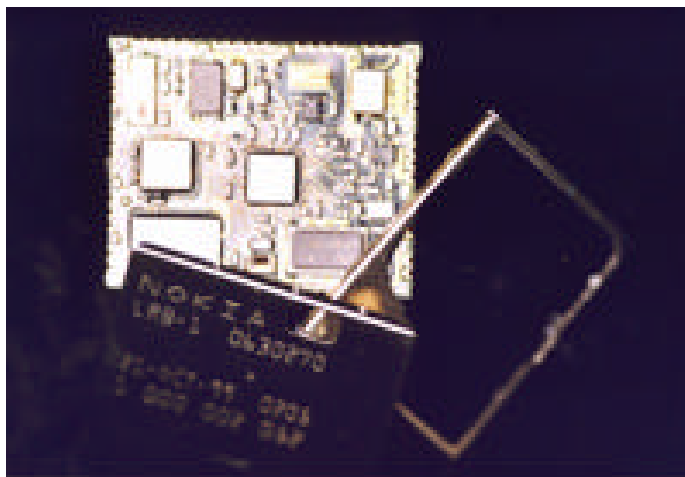# CONFIDENTIAL

INFORMATION - MANUAL

LRB-1 IS A BLUETOOTH TRANSCEIVER COMPONENT AND WILL ONLY BE USED BY NOKIA IN APPROPRIATE PRODUCTS. THESE PRODUCTS WILL HAVE TO BE TESTED AGAIN FOR COMPLIANCE.

WARNING: USERS ANS INSTALLERS MUST USE ONLY THOSE ANTENNAS SPECIFIED BY NOKIA, TO COMPLY WITH FCC'S R.F. EXPOSURE REQUIREMENTS TO AVOID EPOSING PERSONS TO HARMFUL R.F. RADIATION. DO NOT SUBSTITUTE ANY SUPPLIED ANTENNA RECOMMENDED BY THE SUPPLIER. CONTACT YOUR SUPPLIER FOR FURTHER INSTRUCTIONS.

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LRB-1   Nokia Bluetooth Transceiver Component

Product Features

❑ Complete stand-alone Class 2 Bluetooth transceiver system

❑ Including baseband controller, 2.45 GHz radio part and firmware up to HCI

❑ Bluetooth V 1.0 B compliant and pre-certified

❑ Suitable for both voice and data applications

❑ Point-to-Multipoint connection support

❑ Park, Hold and Sniff modes

❑ High speed UART and flexible PCM data interfaces

❑ Several programmable control interfaces plus ADC input

❑ Internal oscillators and power regulators

❑ Adjustable I/O voltages

❑ completely shielded and FCC approved

❑ Optimized size and form-factor: **23 x 19 x 2 mm^3**
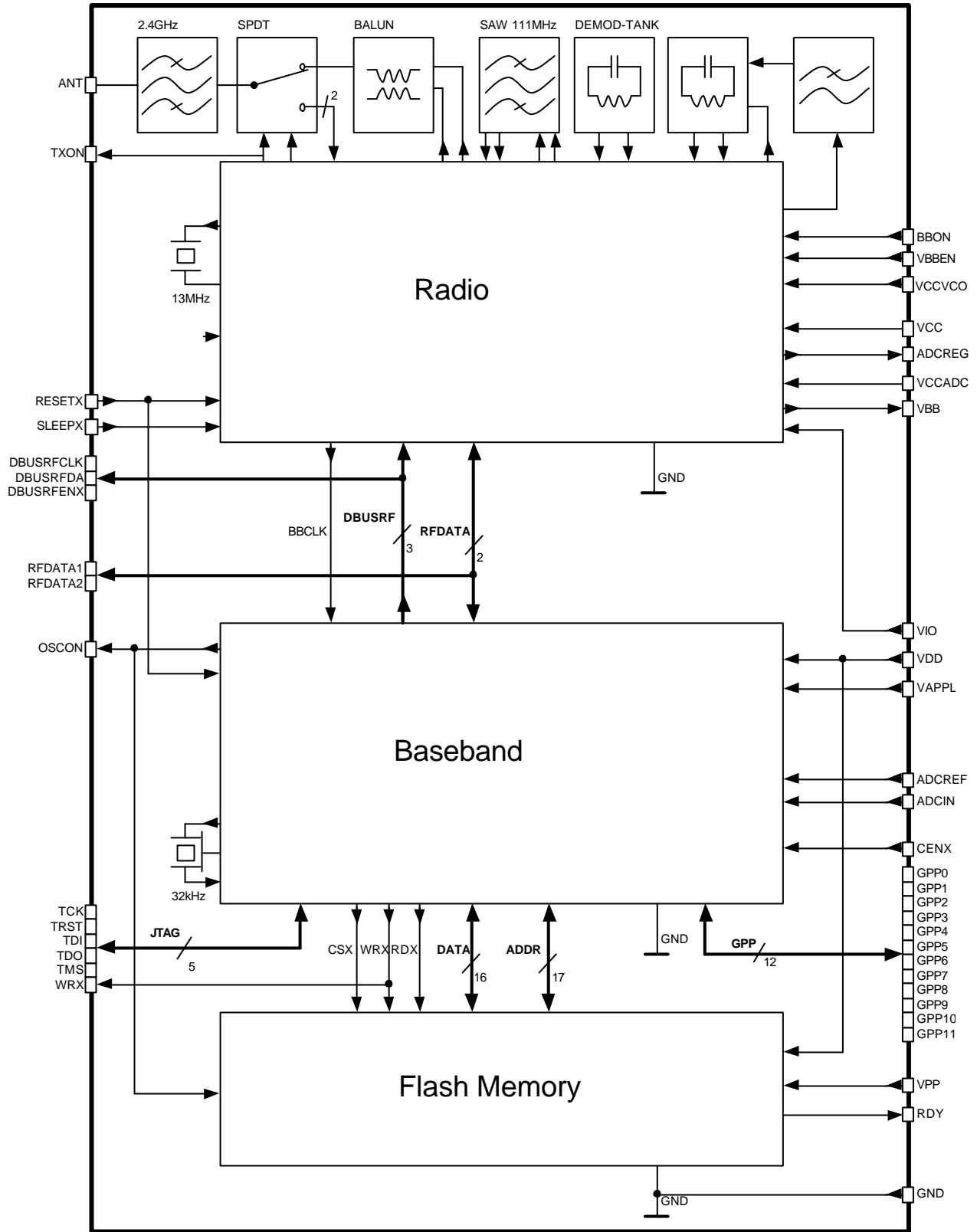

WARNING : LRB-1 IS A BLUETOOTH TRANSCEIVER COMPONENT, WHICH HAVE BEEN TESTED WITH A RECOMMENDED ANTENNA DESIGN AND SHOULD ONLY BE USED BY NOKIA IN APPROPRIATE PRODUCTS. THESE PRODUCTS WILL HAVE TO BE TESTED AGAIN FOR COMPLIANCE. USERS ANS INSTALLERS MUST USE ONLY THOSE ANTENNAS SPECIFIED BY NOKIA, TO COMPLY WITH FCC'S R.F. EXPOSURE REQUIREMENTS TO AVOID EPOSING PERSONS TO HARMFUL R.F. RADIATION. DO NOT SUBSTITUTE ANY SUPPLIED ANTENNA RECOMMENDED BY THE SUPPLIER. CONTACT YOUR SUPPLIER FOR FURTHER INSTRUCTIONS.

Overview

The LRB-1 Nokia Bluetooth Tranceiver Component is a highly integrated multi-chip component which represents a complete standalone Bluetooth transceiver system for short-range wireless applications. All necessary components including the baseband controller, the radio part for the 2.45 GHz system and a flash memory of 2 MBit are integrated on a single PCB using advanced flip chip interconnection techniques. The Bluetooth Tranceiver Component is delivered with all needed firmware of the Bluetooth protocol stack up to HCI which resides in the on-board flash memory. A traditional high-IF radio architecture providing good sensitivity has been used.

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Block Diagram

Functional Description

A. Key Components

The LRB-1 Nokia Bluetooth Transceiver Component consists of three integrated circuits plus a couple of smaller active and passive passive components. All three chips are using state-of-the-art semiconductor technologies and are mounted on the MCM substrate using flip-chip techniques:

❑ Baseband ASIC:

This chip, running at 1.8 V is a pure CMOS ASIC including the ARM7TDMIE microcontroller core, embedded RAMs and the core logic for MIPS consuming Bluetooth tasks. Due to the fact that only the MIPS consuming tasks are realized in hardware and that a central buffer RAM instead of dedicated connection buffers are used, this approach has been proven to be flexible and future-proof.

❑ Radio ASIC:

The radio chip in BiCMOS technology works as the transceiver chip for the ISM band of 2400-2483 MHz which is used for Bluetooth transmission. Implemented on-chip function blocks include the PLL, LNA, mixer and Gaussian modulator as well as 13 MHz crystal oscillator and all neded voltage regulators.

❑ Flash Memory:

An industry-standard 16-bit wide 2 MBit Flash memory running at 1.8 V with an access time of 120 ns has been implemented on the LRB-1 module. Sectoring is used to allow also the storage of non-volatile configuration information (e.g. BD address) on the device.

B. Hardware Interfaces for Data

Two different hardware interfaces for link data are supported: A high-speed UART interface for data applications and a 4-wire PCM interface for audio data. The main features of the interface implementations are as follows:

❑ UART Interface:

A full-duplex UART has been implemented on the LRB-1 module with programmable stopbit length and parity check which supports a wide range of industry-standard baud rates up to 921.6 kBaud using 7-times oversampling:

Baud Rate [bit/s]	Baud Rate [bit/s]	Baud Rate [bit/s]
7200	38400	230400
9600	57600	307200
14400	76800	460800
19200	115200	921600
28800	153600	

❑ PCM Interface:

A standard 4-wire PCM interface with 8 kHz sample rate has been implemented for voice applications using the LRB-1. This interface featuring a programmable PCMCLK frequency can be used in master or slave mode using either linear PCM, A-law or μ-law coding. Using an embedded transcoder block the voice encoding over the Bluetooth air interface can be A-law, μ-law or CVSD.

C. Hardware Interfaces for Control

In order to allow a system integration approach of the LRB-1 Bluetooth Transceiver Component into different customer applications without any overhead for interface logic, the control interface section of the module has been designed with special regard to flexibility. Three different digital control interfaces plus an embedded Analog-to-Digital converter can be used:

❑ I^2C Interface:

To allow easy interfacing to possible system extensions (e.g. by the use of port expanders) the LRB-1 features a 2-wire I^2C bus master realized in HW supporting both standard and fast mode with bit rates of up to 1.3 MBit/s. Addressing can be either 7 bit or 10 bit.

❑   MicroWire Interface:

A standard 4-wire industry-standard serial bus has been is available to support one external Micro-Wire slave (e.g. audio codec, EEPROM) with programmable word length of 1..32 bit. The clock frequency is fixed to 500 kHz, the polarity of the corresponding chip select signal can be programmed.

❑   Programmable General-Purpose Ports (GPPs):

Up to 12 user-programmable general purpose ports can be flexibly used for other application-specific hardware interfaces. Each port can be independantly programmed for input, output or bi-directional data transmission, generating an interrupt and uses switchable pull-ups/pull-downs.

In order to limit the total number of pins the functionality of the GPPs is multiplexed with that of other control and data interfaces according to the following table. Using an external application voltage of 1.8 – 3.3 V the voltage level of the module pins can be adjusted to customer needs.

❑   Analog-to-Digital Converter:

One input of the embedded ADC with a resolution of 10 bit is available for application purposes.

D. Power Supply

All needed regulators for generating the different module-internal supply voltages are embedded into the radio ASIC, therefore the LRB-1 Bluetooth Transceiver Component only needs one power supply between 2.95 V and 5.2 V.

E. Antenna

The antenna pin should be connected to a 50Ω–antenna interface.

The Bluetooth Transceiver Component is designed to use a simple antenna with a nominal gain of 0 dBi as the radiating element.

Recommended antenna design :
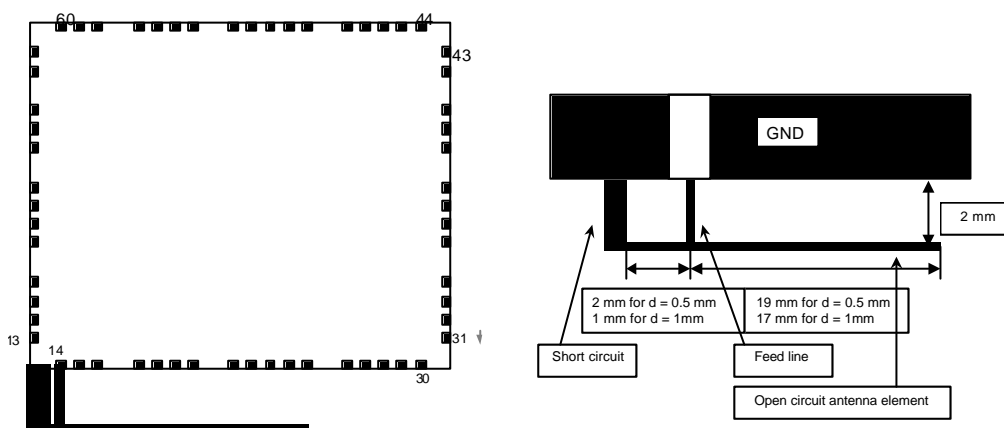
F. Software

The software which is delivered as object code together with the Bluetooth Transceiver Component includes the lower layers of the Bluetooth SW stack – Link Controller (LC), Link Manager (LM) and Host Controller Interface (HCI) together with a well-suited real-time operating system. Access from the host to the different function blocks of the module is accomplished by Nokia-specific HCI extension commands. This leads to a configurable firmware to support the customer-specific interface configurations and applications.

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Package and Mechanical Dimensions

The following figures show the bottom view of the LRB-1 Bluetooth Transceiver Component, indicating the location and dimension of the signal pads:
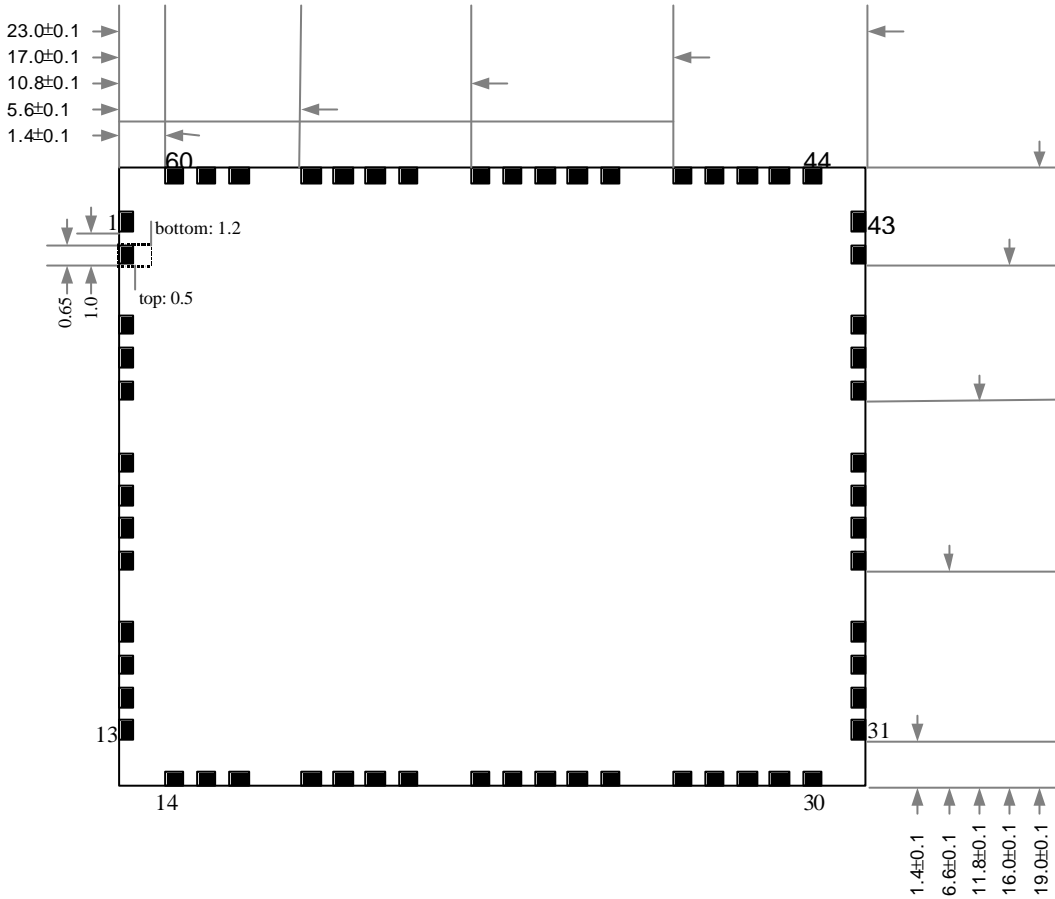
The figure on the right shows the detailed module pad dimensions. The pads include 400 μm half-vias in order to achieve proper solderability on the edge of the PCB. The total height of the MCM including shielding is **2.0mm+-0.1**. It is the sum of PCB-height (0.5mm), soldering gap (0.05mm) and assembled shielding components lid + frame (1.45mm).
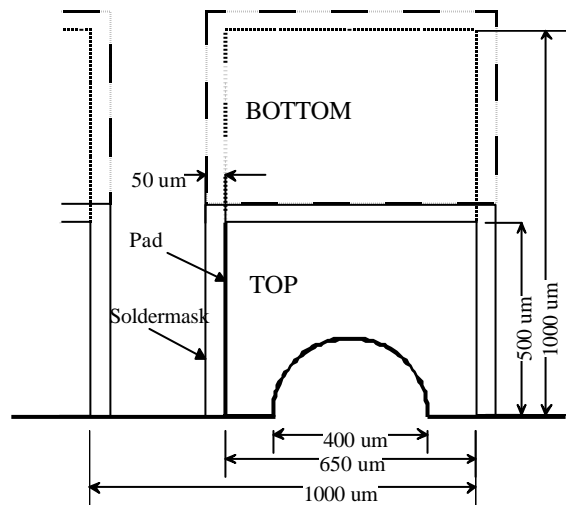
Packaging information

The Bluetooth Transceiver Component is packed after production and testing into tape&reel for delivery protecting it from electrostatic discharge and mechanical shock.

Soldering

The LRB-1 Bluetooth Transceiver Component is designed for surface mounting.

The Bluetooth Transceiver Component withstands 2 reflow cycles for assembly on top or bottom side of the host PCB.

The reflow-process should be a regular surface mount soldering profile (full convection preferred). The rampup should not be higher than 3°C/s and with a peak temperature of 210 – 235°C for a maximum of 45 seconds.

LEGAL NOTICE

The maximum RF power output from the LRB-1 Bluetooth Transceiver Component is 0 dBm or about 1 milliwatt. The Bluetooth Transceiver Component is designed to use a simple antenna with a nominal gain of 0 dBi as the radiating element.

The SAR limit would not be exceeded, even if the entire RF power output were absorbed by 1 gram of tissue, which is not possible with a typical RF circuit. With a seperating distance of 20 cm the MPE limits are well above the potential a 1 milliwatt device is capable of producing.

Depending on the product that the Bluetooth Transceiver Component is used with, the final device could be subject to routine evaluation for RF exposure, either SAR limits or MPE limits.

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Electrical Specification

Operating Conditions

Symbol	Parameter	MIN	TYP	MAX	Unit	Comments
T_{amb}	module ambient temperature range	-25	25	+75	°C	
V_{CC}	1. Main power supply with ADC regulator inside Radio ASIC in use	2.95		5.2	V	
V_{APPL}	Power supply for application interfaces	1.7		3.3	V	digital supply voltage for GPPs
V_{PP}	Flash programming supply	4.5	5.0	5.5	V	fast flash prog.
		1.7			V	default
F_{range}	Frequnecy range	2402		2483.5	MHz	
P_{in}	Rx dynamic range	-70		-20	dBm	at Antenna pad
P_{peak}	TX peak power	0.5	1	1.5	mW	at Antenna pad

Notice