BlueMod+S/AI

Hardware Reference

Release r00d01

Note

This device was developed for the purpose of communication in an office environment. It is intended solely for our industrial clients for physical integration into their own technical products after careful examination by experienced technical personnel for its suitability for the intended purpose. The device was not developed for or intended for use in any specific customer application. The firmware of the device may have to be adapted to the specific intended modalities of use or even replaced by other firmware in order to ensure flawless function in the respective areas of application. Performance data (range, power requirements, etc.) may depend on the operating environment, the area of application, the configuration, and method of control, as well as on other conditions of use; these may deviate from the technical specifications, the Design Guide specifications, or other product documentation. The actual performance characteristics can be determined only by measurements subsequent to integration. Variations in the performance data of mass-produced devices may occur due to individual differences between such devices. Device samples were tested in a reference environment for compliance with the legal requirements applicable to the reference environment. No representation is made regarding the compliance with legal, regulatory, or other requirements in other environments. No representation can be made and no warranty can be assumed regarding the suitability of the device for a specific purpose as defined by our customers. Stollmann reserves the right to make changes to the hardware or firmware or to the specifications without prior notice or to replace the device with a successor model. Of course, any changes to the hardware or firmware of any devices for which we have entered into a supply agreement with our customers will be made only if, and only to the extent that, such changes can reasonably be expected to be acceptable to our customers. No general commitment will be made regarding periods of availability; these must be subject to individual agreement. All agreements are subject to our Terms and Conditions for Deliveries and Payments, a copy of which is available from Stollmann.

Copyright © 2013 Stollmann E+V GmbH

Trademarks

The Bluetooth® word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by Stollmann E+V GmbH is under license. Other trademarks and trade names are those of their respective owners.

Table of contents

List of Figures

List of Tables

1 Introduction

This Hardware Reference documents how the BlueMod+S/AI can be integrated into customer systems. It addresses hardware specifications of the BlueMod+S/AI and requirements of the hardware environments for the BlueMod+S/AI.

Notation: The term *BlueMod+S* refers to the BlueMod+S/AI and is used as an abbreviation.

For detailed information about software interfaces refer to [5].

For the latest version of this document please check the following URL:

http://www.stollmann.de/en/support/downloads/bluetooth-adapter/bluemod-s.html

1.1 Feature Summary

- Bluetooth specification V4.0 compliant
- Supports Bluetooth low energy
- Fully qualified Bluetooth V4.0 Single Mode LE
- CE certified
- FCC and IC certified
- Nordic nRF51822 inside
- Fast Connection Setup
- RF output power -30 up to +3dBm
- RSSI
- High sensitivity design
- Supply voltage range 1,8V to 3,6V
- Internal crystal oscillator (16 MHz)
- LGA Surface Mount type. BlueMod+S: 17 x 10 x 2.6 mm^3
- Pin compatible to Stollmann BlueMod+SR dual mode module
- Shielded to be compliant to FCC full modular approval
- Flexible Power Management
- 128-bit AES encryption
- High-speed UART interface
- I^2C Master
- SPI Master/Slave interface
- Low power comparator
- Real Time Counter
- Up to 19 digital IO's for individual usage by embedded software
- Up to 6 anlog inputs for individual usage by embedded software
- 8/9/10bit ADC
- Arm® Cortex™-M0 core for embedded profiles or application software
- Manufactured in conformance with RoHS2
- Operating temperature -25 ... +75 °C
- Weight: tbd. g

1.2 Applications

The BlueMod+S is designed to be used in low power applications, like sensor devices. Some typical applications are described in this chapter.

Supported profiles are:

LE:

- Terminal IO
- any GATT based LE-profile

Support for any additional profile is possible on request.

1.2.1 General Cable Replacement

In case there is no standardized application specific profile available the BlueMod+S offers Stollmann's Terminal I/O profile, which allows transparent data transfer over UART and supports Secure Simple Pairing, making the pairing process easy and the connection secure. Terminal I/O is available for iOS and Android as well as implemented in Stollmann's dual mode module BlueMod+SR.

1.2.2 Industry

BlueMod+S can be used to monitor and control motors, actuators, values and entire processes.

1.2.3 POS/Advertising

BlueMod+S supports iBeacon or similar applications.

1.2.4 Healthcare and Medical

Usage of Bluetooth is aimed mainly at devices that are used for monitoring vital data. Typical devices are blood glucose meter, blood pressure cuffs and pulse ox meters. Bluetooth BR/EDR and low energy were chosen by the Continua Health Alliance as transports for interoperable end to end communication.

1.2.5 Sports and Fitness

In the sports and fitness segment the BlueMod+S is used in devices for positioning as well as monitoring vital data. Typical devices in this market are heart rate monitors, body temperature thermometers, pedometers, cadence meters, altimeter, positioning / GPS tracking and watches displaying information from sensors.

1.2.6 Entertainment

Bluetooth technology is already used in a wide variety of devices in the entertainment sector, namely set-top boxes / gaming consoles. BlueMod+S is especially suited for use in remote controls, gaming controller and wireless mouse/keyboard applications.

2 Block Diagram

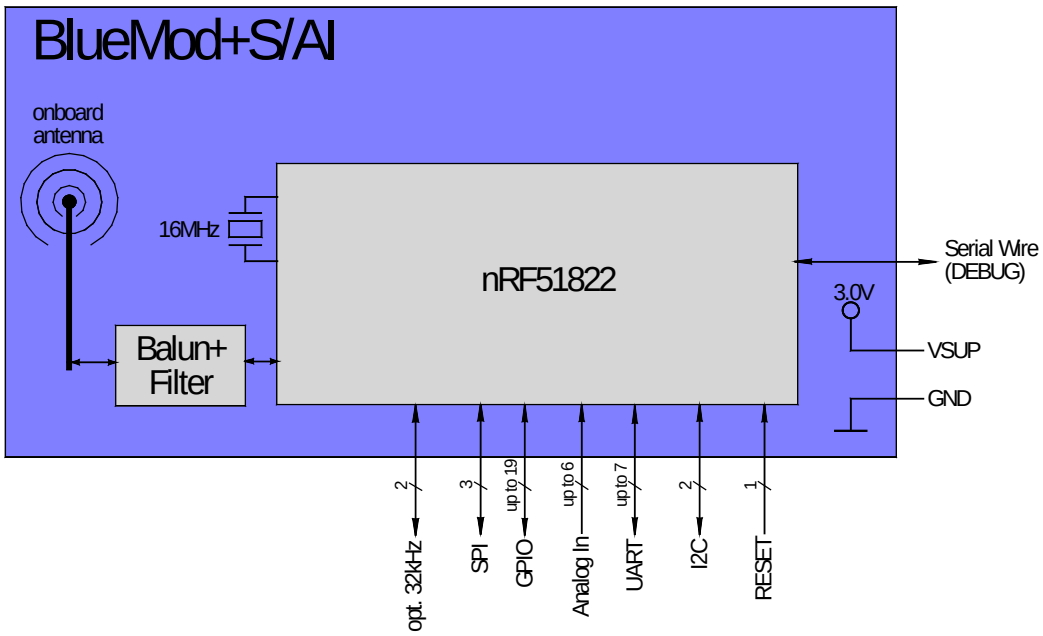


Figure 1: BlueMod+S/AI Block Diagram

3 Application Interface

3.1 Power Supply

BlueMod+S require a power supply with the following characteristics:

Typical: 3,0V_{DC}, min.: 1,8V_{DC}, max.: 3,6V_{DC}, thereby delivering > 25 mA peak

BlueMod+S is designed to be powered from 3V coin cell batteries e.g. CR2032 directly, or any other power source complying with the given requirements. For optimal performance a stable supply is recommended.

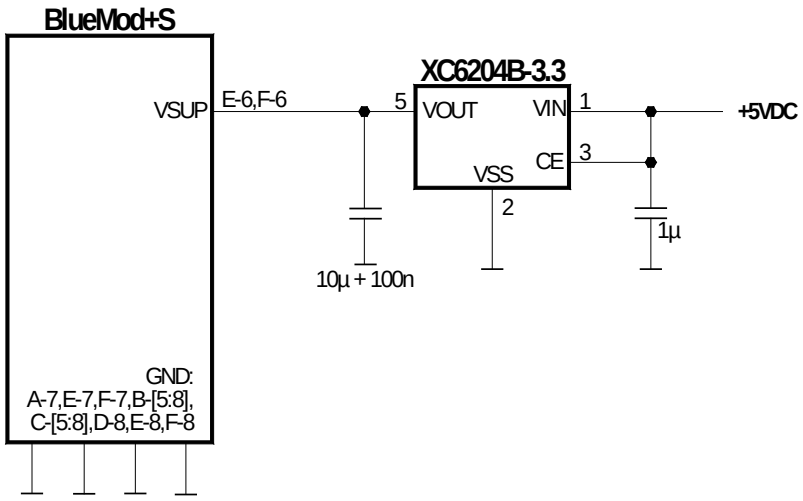


Figure 2: BlueMod+S Example Power Supply with LDO

3.2 Power-up Slew-Rate

Parameter	Min	Max	Unit
VSUP rise time rate (1), (2)	0	60	ms

(1) 0V to 1,8V
(2) The on-chip power-on reset circuitry may not function properly for rise times outside the specified interval

Table 1: Power up Rise Time Requirements

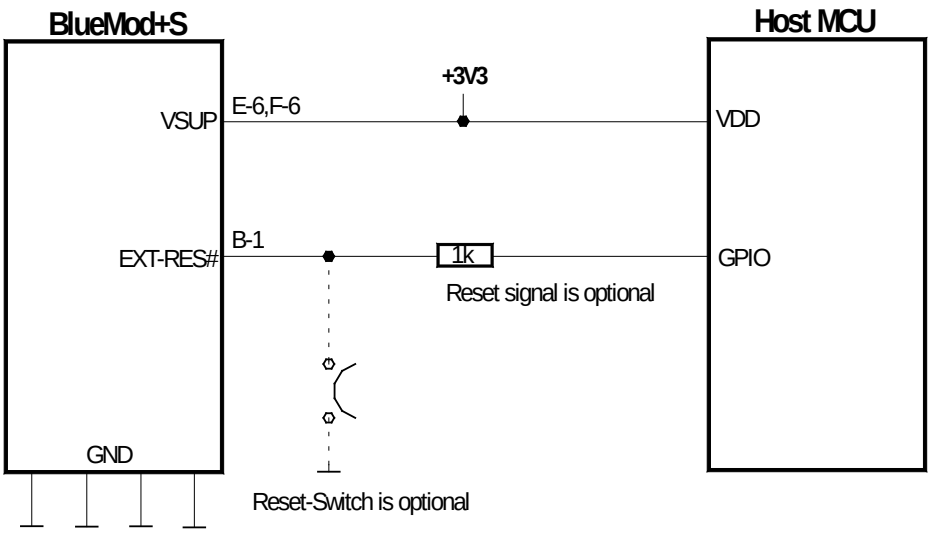
3.3 Reset

BlueMod+S are equipped with circuitry for generating power-up reset from the supply voltage VSUP, as well as brownout detection.

During power-up, reset is kept until the supply voltage VSUP has reached the minimal operating voltage. VSUP risetime has to comply with Table 1 for power-up reset to function properly. A reset is also generated when VSUP falls below the threshold of the brownout detector (1,6V .. 1,7V with a hysteresis of about 30mV), and is released when VSUP rises above that threshold.

By holding pin B-1 (EXT-RES#) at ≤ VSUP*0,3V for $t_{HOLDRESETNORMAL}$ ≥ 0,2µs, an external reset (*pin reset*) is generated. This pin has a fixed internal pull-up resistor (R_{PU} = 11kΩ ... 16kΩ). EXT-RES# may be left open if not used.

Note:
The reset-functionality associated with pin EXT-RES# is shared with the serial wire debug feature (refer to 3.12). Inside the BlueMod+S module, EXT-RES# is connected to SWDIO via a 150R resistor. During a debug session the external reset function is not available; asserting of EXT-RES# to *any* level should be avoided.



Please Note: EXT-RES# of BlueMod+S has approx. 13k internal pullup.

Figure 3: BlueMod+S Example Reset

The following table shows the pin states of BlueMod+S during reset active.

Pin Name	State: BlueMod+S
EXT-RES#	Input with pull-up (1)
XL-IN/SLCK	Input floating (disconnected)
XL-OUT	Input floating (disconnected)
UART-TXD	Input floating (disconnected)
UART-RXD	Input floating (disconnected)
UART-RTS#	Input floating (disconnected) with pull-up resistor 470kΩ (2)
UART-CTS#	Input floating (disconnected)
IUR-OUT#	Input floating (disconnected)
IUR-IN#	Input floating (disconnected)
GPIO[0:14]	Input floating (disconnected)
TESTMODE#	Input floating (disconnected)
BOOT0	Input floating (disconnected)
SWDIO	Input with pull-up (1)
SWCLK	Input with pull-down (1)

(1) pull-up, pull-down: $R_{PU,}$ R_{PD} is typ. 13kΩ (11kΩ to 16kΩ)
(2) a discrete resistor is used

Table 2: Pin States during Reset

The pin states as indicated in Table 2 are kept until hardware initialization has started.

3.4 Serial Interface

The serial interface of BlueMod+S is a high-speed UART interface supporting RTS/CTS flow control and interface-up/down mechanism according to the UICP+ protocol (refer to [3]). Electrical interfacing is at CMOS levels (defined by VSUP; see chapter 5.5.1).

- Transmission speeds are 9600 – 921600 bps and 1Mbps (asynchronous)
- Character representation: 8 Bit, no parity, 1 stop bit (8N1)
- Hardware flow-control with RTS and CTS (active low)

Note: Transmission speed may be limited by firmware. See corresponding command reference [5] for further information.

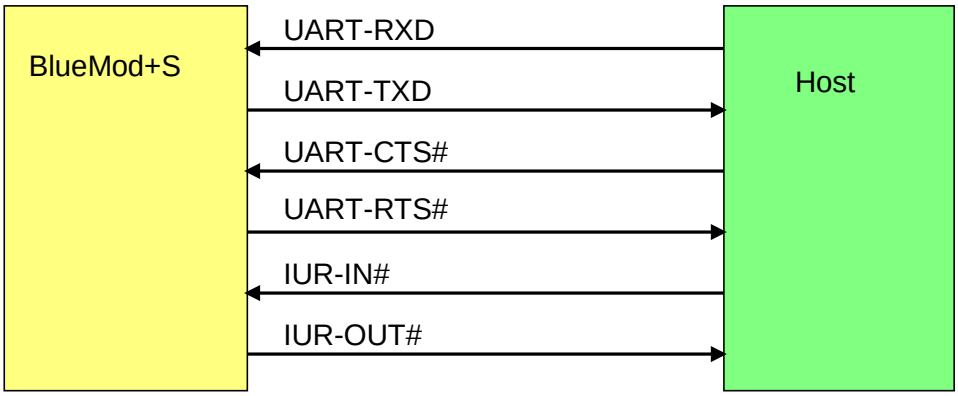


Figure 4: Serial Interface Signals

The basic serial interface (with RTS/CTS flow control) uses only four signal lines (UART-RXD, UART-TXD, UART-CTS#, UART-RTS#). IUR-IN#, IUR-OUT# and GPIO[4] (see below) can be left unconnected.

A substantially saving of power during idle phases can be achieved (see 5.6.1) when the UICP protocol is used (refer to [3]). This protocol should be implemented on the host side as well. Signals IUR-IN# and IUR-OUT# should be connected to the host and may be mapped to DSR and DTR, if an RS232-style (DTE-type) interface is used (see Figure 5).

When using the TIO firmware and applications, call control can be supported by GPIO[4]. Driving GPIO[4] to logic High level during a data transfer phase will “hang up” the connection and disconnect the Bluetooth link. This signal may be mapped to DSR, if an RS232-style (DTE-type) interface is used. Please refer to [5] for a functional specification. GPIO[4] can be left unconnected if this feature is not used.

3.4.1 3-Wire Serial Interface

When using only GND and UART-RXD, UART-TXD serial lines, leave UART-RTS# and UART-CTS# open.

Note: It is strongly recommended to use hardware flow control. Not using flow control can cause a loss of data.

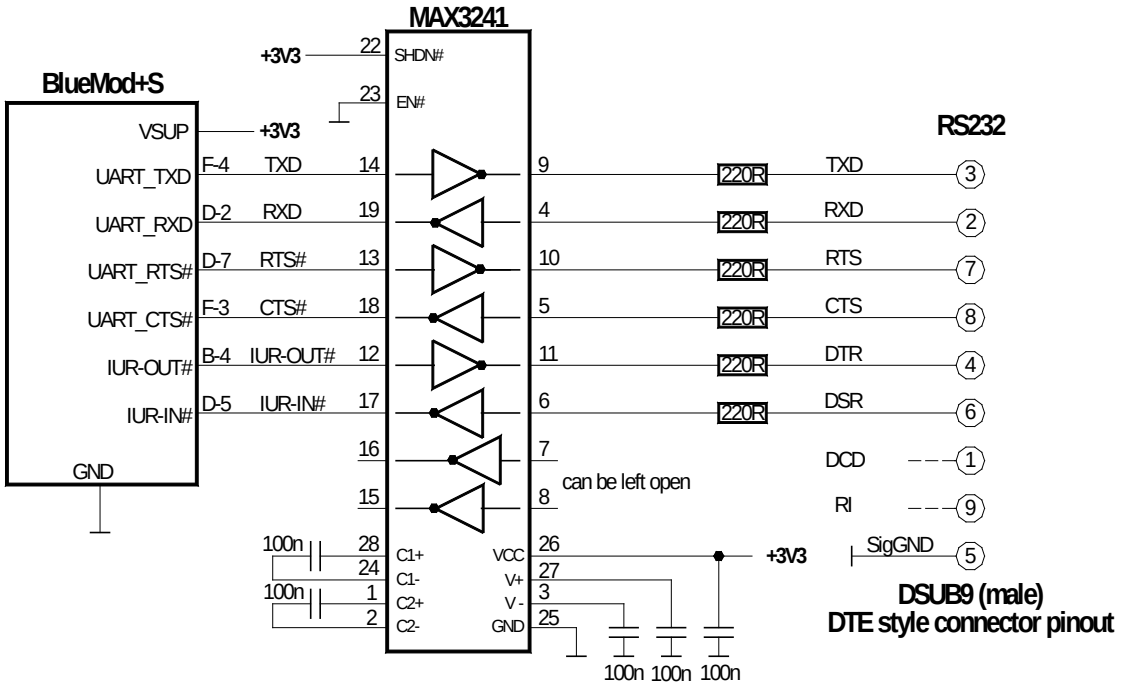


Figure 5: BlueMod+S Example Serial Interface (RS-232) Supporting UICP

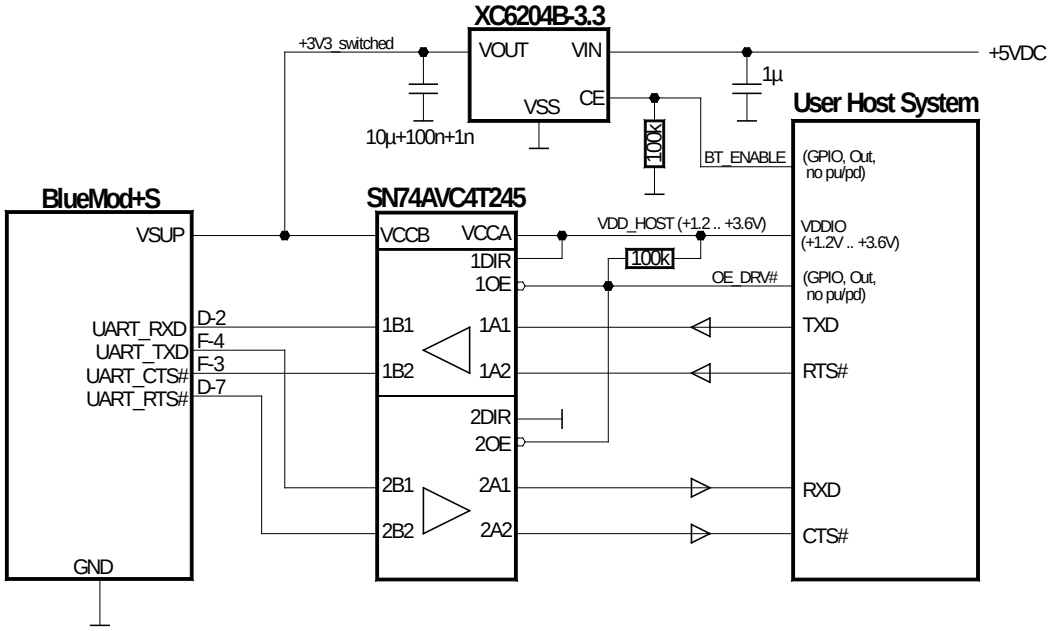


Figure 6: BlueMod+S Example Serial Interface (Mixed Signal Level)

3.4.2 Baudrate Deviation

The following table shows the deviation in percent of the standard data rates. The deviation may be caused by the inaccuracy of the crystal oscillator or granularity of the baud rate generator.

Data Rate (bits/s)	Deviation (%)
9600	±1%
19200	
38400	
57600	
115200	
230400	
460800	
921600	
1000000	

Table 3: Deviation of Baudrates

Note: The total deviation of sender and receiver shall not exceed 2,5% to prevent loss of data.

3.5 GPIO Interface

It is possible to use the programmable digital I/Os GPIO[0:14] on the BlueMod+S. Their behavior has to be defined project specific in the firmware.

Unused GPIO pins shall be left unconnected to stay compatible. There may be functions assigned to some in future versions of the firmware.

3.6 I²C Interface[1]

The I²C bus interface serves as an interface between the internal microcontroller and the serial I²C bus. BlueMod+S is the master and controls all I²C bus specific sequencing, protocol and timing. It supports standard (100kHz) and fast (400kHz) speed modes. The BlueMod+S as an I²C master must be the only master of the I²C bus (no *multimaster* capability). Clock stretching is supported.

GPIO[1]/I2C-SDA and GPIO[0]/I2C-SCL can be used to form an I²C interface. It is required to connect 4k7 pull-up resistors on I2C-SCL and I2C-SDA when this interface is used.

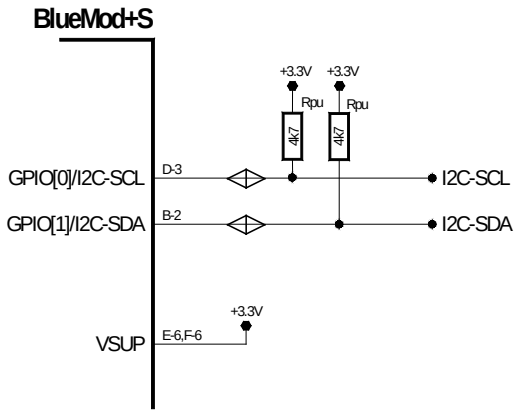


Figure 7: BlueMod+S I²C Interface

[1] subject to firmware support, contact Stollmann for current status

3.7 SPI Serial Peripheral Interface[2]

The serial peripheral interface (SPI) allows for full-duplex, synchronous, serial communication with external devices. The interface can be configured as the *master* and then provides the communication clock (SCK) to the external slave device(s), or as the *slave*. The SPI Interface supports SPI-modes 0 through 3. Module pins are used as follows:

- GPIO[2]: SPI-MOSI
- GPIO[5]: SPI-MISO
- GPIO[8]: SPI-SCK

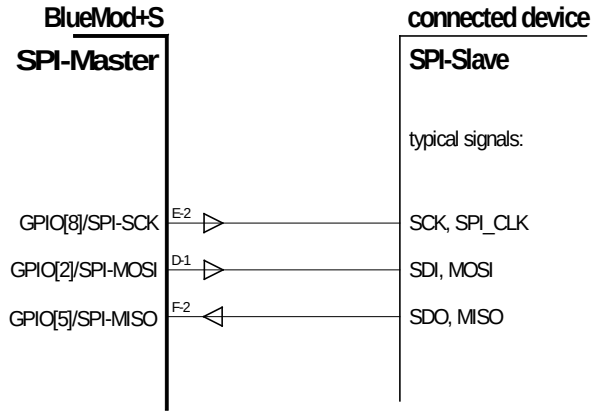


Figure 8: BlueMod+S SPI Interface (Example: Master Mode)

3.8 Bluetooth Radio Interface

The BlueMod+S/AI presents an integrated ceramic antenna.

It is highly recommended that you follow the design rule given in the Stollmann Application Note on Antenna design [4].

[2] subject to firmware support, contact Stollmann for current status

3.9 Slow Clock Interface

Even though an external slow clock is not required for BLE operation, consumption of power during power-down modes can be reduced by feeding the module with an optional 32,768 kHz slow clock at pin XL-IN/SLCK, or connecting an XTAL (32,768kHz) and two capacitors C1, C2 at pins XL-IN and XL-OUT.

3.9.1 SLCK Specification (External Supplied Signal)

- 32,768 kHz +/-250ppm; duty cycle 30...70%.
- Signal may be a sine wave, a clipped sine wave, a square wave or a rail-to-rail digital signal. The amplitude must be at least 200mV$_{pp}$. DC offset is not an issue as long as the input voltage is between VSS and VDD at all times.
- connect signal SLCK to XL-IN/SLCK (A6) and leave XL-OUT (A5) open

3.9.2 32,768 kHz Crystal Oscillator Specification (32k XOSC)

Symbol	Item	Condition	Limit			Unit
			Min	Typ	Max	
f_{NOM}	Crystal Frequency	T_{amb} = 25°C		32,768		kHz
f_{TOL}	Frequency Tolerance for BLE applications	including temperature and aging (1)			+/-250	ppm
C_L	Load Capacitance			9	12,5	pF
C0	Shunt Capacitance				2	pF
R_S	Equivalent Series Resistor			50	80	kΩ
P_D	Drive Level				1	µW
C_{pin}	Input Cap. on XL-IN and XL-OUT			4		pF

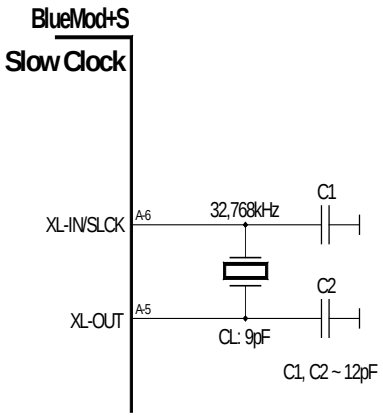
(1) adjust crystal frequency by choosing correct value for C1, C2 (value depends on C_L of crystal and layout)

Table 4: 32,768kHz Crystal Oscillator

The module's firmware will detect the presence of a slow clock during the boot process and switch behavior appropriately.

3.9.3 Connection of an External 32,768 kHz Crystal

Connect the 32,768 kHz crystal and two capacitors C1, C2 at pins A-6 (XL-IN/SLCK) and A-5 (XL-OUT). The crystal has to comply with specifications given in Table 1. The exact value of C1 and C2 depends on the crystal and the stray capacitance of the layout. Select C1, C2 such that the slow clock oscillator operates at the exact frequency at room temperature (25°C). The crystal and the capacitors shall be located close to pins A-5, A-6. Avoid long signal traces.



$C_L = (C1+C_{pin}+C_s) * (C2+C_{pin}+C_s) / (C1+C2+2*C_{pin}+2*Cs)$

C_{pin}: see Table 4

C_s: stray capacitance, depends on layout

Figure 9: BlueMod+S connection of external XTAL

3.10 Test Mode Enable

For homologation purposes the ability of testmode operation like "Direct two wire UART Testmode" is mandatory. The Direct Test Mode (as defined by the Bluetooth SIG) and additional test functions are part of the BlueMod+S TIO-Firmware. Please refer to [7] and [8].

To enter and use test modes or DTM, access to the following signals is required:

- BOOT0
- TESTMODE#
- UART-RXD
- UART-TXD
- UART-CTS#
- GND

These pins shall be routed to some test pads on an outer layer, but can be left open during normal operation when not used.
Please note the UART is required for operation of test modes. During the homologation process, UART-RXD and UART-TXD must be freely accessible and connected via some RS232 level shifter to the test equipment (like R&S CBT), whereas UART-CTS# must be set "active" (continuous low-level) to allow serial communication.

3.11 Operating in a Power-Switched Environment

A potential "back feeding" problem may arise, if the module is operated in an environment where its power supply (VSUP) is switched off by the application. This might be done to save some power in times Bluetooth is not needed.

As stated in Table 7, the voltage on any I/O pin must not exceed VSUP by more than 0,3V at any time. Otherwise some current I_{INJ} flows through the internal protection diodes. This may damage the module (please refer to chapter 5.1 for limits).

There is no problem if the application circuit design and programming can assure that all signals directed towards BlueMod+S are set to low (U < 0,3V) before and while VSUP is turned off. If this is not guaranteed, at least a series resistor (about 1k) must be inserted into each signal path. This does protect the module but obviously cannot prevent from an unwanted, additional current flow in case of such signal being at high-level. It may be necessary to use driver chips in such applications, that gate off these signals while VSUP is not present.

3.12 Serial Wire Interface

The Serial Wire interface (SWDIO, SWCLK) is normally not used in a customer's product. It is reserved for debugging purposes.

Leave SWDIO, SWCLK unconnected. Only if you intend to use them for debugging purposes, make them available. Please be aware of the nRF51822 pin sharing SWDIO/nRESET (refer to [1]). On the BlueMod+S module, pin EXT-RES# is decoupled from SWDIO by a 150 Ω resistor; SWDIO is connected directly to pin SWDIO/nRESET of the nRF51822 chip. Nevertheless, avoid *driving* EXT-RES# to any logic level while in debug mode, since EXT-RES# will also be driven by the BlueMod+S or the debugger, when SDIO is driven by either of these.

During any debugging session the external pushbutton reset functionality is not available. Please use the correct reset options of your serial wire debugger. Alternatively, power-off the system, remove the debugger and power-up again (refer to [1], Chapter 10 Debugger Interface (DIF)).

4 Module Pins

4.1 Pin Numbering

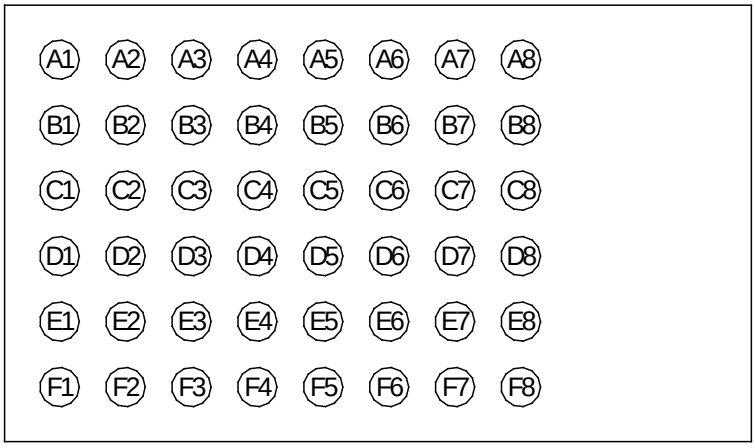


Figure 10: BlueMod+S Pin Numbering (Top View)

4.2 Pin Description

4.2.1 General Pin Description

Type: PU - pull-up; PD – pull-down; PWR – Power; I – Input; O – Output; I/O – bidir.; OD – open drain; PP – push/pull; RF: RadioFreq; I-DIS – Input Buffer Disconnected

Pin Name	Signal	Type	Act	Function	Alternate Function
E-6	VSUP1	PWR		+3,0V nom.	
F-6	VSUP2	PWR		+3,0V nom	
C-1	not connected			none	
A-7, E-7, F-7, B-[5,6,7,8], C-[5,6,7,8], D-8, E-8, F-8	GND	PWR		Ground	
A-8	ANT	RF (4)		reserved	reserved
B-1	EXT-RES#	I-PU	L	User Reset	
A-6	XL-IN/SLCK	I/O (3,5)		32,768kHz Slow Clock / XTAL	AIN1
F-4	UART-TXD	O-PP		IUR Data OUT (6)	
D-2	UART-RXD	I-PU		IUR Data IN (6)	
D-7	UART-RTS#	O-PU (1)	L	Flow Control/IUC	
F-3	UART-CTS#	I-PD	L	Flow Control/IUC (6)	
B-4	IUR-OUT#	O-PP	L	UICP Control	
D-5	IUR-IN#	I-PD	L	UICP Control	
D-3	GPIO[0]	I/O (3,5)		GPIO (3)	I2C-SCL, AIN7, AREF1
B-2	GPIO[1]	I/O (3,5)		GPIO (3)	I2C-SDA, AIN6
D-1	GPIO[2]	I/O (3,5)		GPIO (3)	SPI-MOSI
E-4	GPIO[3]	I/O (3,5)		GPIO (3)	
D-4	GPIO[4]	I/O (3,5)		GPIO (3)	
F-2	GPIO[5]	I/O (3,5)		GPIO (3)	SPI-MISO, AREF0
C-4	GPIO[6]	I/O (3,5)		GPIO (3)	
C-3	GPIO[7]	I/O (3,5)		GPIO (3)	
E-2	GPIO[8]	I/O (3,5)		GPIO (3)	SPI-SCK, AIN2
A-3	not connected			none	
A-1	GPIO[10]	I/O (3,5)		GPIO (3)	
A-4	not connected			none	
A-2	GPIO[9]	I/O (3,5)		GPIO (3)	
F-1	TESTMODE#	I-PU	L	Testmode Enable (6)	AIN3
E-1	BOOT0	I-PD		reserved (6)	AIN4
E-3	SWDIO	I/O-PU		serial wire	
D-6	SWCLK	I-PD		serial wire	
C-2	GPIO[13]	I/O (3,5)		GPIO (3)	
B-3	GPIO[11]	I/O (3,5)		GPIO (3)	AIN5
A-5	XL-OUT	I/O (3,5)		GPIO (3) / ext. XTAL 32,768kHz	AIN0
F-5	GPIO[14]	I/O (3,5)		GPIO (3)	
E-5	GPIO[12]	I/O (3,5)		GPIO (3)	

Notes:
(1) a discrete resistor is used
(3) function depends on firmware
(4) DNU: Do Not Use, Do Not Connect
(5) GPIO pin. These pins may be programmed as analog-in, i-disconnected, i-float, i-pu, i-pd, o-pp (output push/pull), o-od (output open drain), o-os (output open source) or some alternate function; refer to [1], [2]
(6) signal must be accessible for homologation purposes. Refer to 3.10 Test Mode Enable

Table 5: General Pin Assignment

4.2.2 Application Specific Pin Description

4.2.2.1 TIO Pin Configuration

Type: PU – Pull-up; PD – pull-down; PWR – Power; I – Input; O – Output; I/O – bidir.; OD – open drain: PP – push/pull; RF: RadioFreq; I-DIS – Input Buffer Disconnected

Pin Name	Signal	TIO-Function	Type	Act	Description
E-6	VSUP1	Power	PWR		+3,3V nom.
F-6	VSUP2	Power	PWR		+3,3V nom
C-1	not connected	none			
A-7,E-7,F-7, B-[5,6,7,8], C-[5,6,7,8], D-8, E-8, F-8	GND	Power	PWR		Ground
A-8	ANT	DNU (4)	RF		leave open
B-1	EXT-RES#	Reset	I-PU	L	User Reset
A-6	XL-IN/SLCK	SLCK / XTAL	I		32,768kHz Slow Clock (optional)
F-4	UART-TXD	TXD	O-PP		IUR Data OUT (6)
D-2	UART-RXD	RXD	I-PU		IUR Data IN (6)
D-7	UART-RTS#	/RTS	O-PP (1)	L	Flow Control/IUC; refer to [3]
F-3	UART-CTS#	/CTS	I-PD	L	Flow Control/IUC; refer to [3] (6)
B-4	IUR-OUT#	/IUR-OUT	O-PP (3)	L	UICP Control; refer to [3]
D-5	IUR-IN#	/IUR-IN	I (3)	L	UICP Control; refer to [3]
D-3 SCL	GPIO[0]	GPIO[0] (3)	I/O (3)		GPIO (3) [I2C-SCL]
B-2 SDA	GPIO[1]	GPIO[1] (3)	I/O (3)		GPIO (3) [I2C-SDA]
D-1 IOC	GPIO[2]	IOC (3)	I/O (3)		GPIO (3) [SPI-MOSI]
E-4 IOB	GPIO[3]	IOB (3)	I/O (3)		GPIO (3)
D-4	GPIO[4]	HANGUP	I-PD		optional; refer to [5]
F-2 IOD	GPIO[5]	IOD (3)	I/O (3)		GPIO (3) [SPI-MISO]
C-4	GPIO[6]	reserved	I-DIS		GPIO (3)
C-3	GPIO[7]	GPIO7	I-DIS		GPIO (3)
E-2 IOA	GPIO[8]	IOA (3)	I/O (3)		GPIO (3) [SPI-SCK] [DEVICE READY#]
A-3	not connected	none	none		
A-1	GPIO[10]	DNU (4)	I-DIS		leave open
A-4	not connected	none	none		
A-2	GPIO[9]	DNU (4)	I-DIS		leave open
F-1	TESTMODE#	reserved	I-PU	L	connect to test pad (6)
E-1	BOOT0	reserved	I-PD		connect to test pad (6)
E-3	SWDIO	reserved	I/O-PU		leave open (serial wire)
D-6	SWCLK	reserved	I-PD		leave open (serial wire)
C-2	GPIO[13]	DNU (4)	I-DIS		leave open
B-3	GPIO[11]	DNU (4)	I-DIS		leave open
A-5	XL-OUT	XTAL	I-DIS		leave open if no ext. XTAL is connected
F-5	GPIO[14]	DNU (4)	I-DIS		leave open
E-5	GPIO[12]	DNU (4)	I-DIS		leave open

Notes:
(1) a discrete resistor is used
(3) function depends on firmware. If function can be enabled using an AT-command, type is I-DIS when not enabled
(4) DNU: Do Not Use, Do Not Connect
(6) signal must be accessible for homologation purposes. Refer to 3.10 Test Mode Enable

Table 6: Application Specific Pin Assignments, TIO

4.3 Handling of Unused Signals

Depending on the application, not all signals of BlueMod+S may be needed. The following list gives some hints how to handle unused signals.

- EXT-RES# — If no external Reset is needed: Leave open
- BOOT0 — leave open (1)
- XL-IN/SLCK — If no external slow clock is provided: Leave open
- XL-OUT — If no external XTAL is connected: Leave open
- UART-RTS#, UART-CTS# — If neither flow control nor UICP is used: Leave open (1)
- IUR-OUT#, IUR-IN# — If UICP is not used: leave open
- TESTMODE# — Leave open (1)
- unused GPIOs — Leave open
- SWDIO, SWCLK — Leave open. Only needed for debug purposes.

Please note, to keep compatibility with future feature enhancements, unused signals shall not be connected directly to VSUP or GND. Leave open.

(1) Signals must be accessible during the homologation process, refer to 3.10 Test Mode Enable.

5 Electrical Characteristics

5.1 Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Electrical Requirements” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Item	Symbol	Absolute Maximum Ratings	Unit
Supply voltage	VSUP	-0,3 to +3,6	V
Voltage on any pin	V_{Pin}	-0,3 to VSUP+0,3	V
Injected current into any GPIO pin Max. per package	I_{INJ} $I_{INJ\_package}$	40 100	mA mA

Table 7: Absolute Maximum Ratings

5.2 Electrical Requirements

VSUP = 3,3V, T_{amb} = 25°C if nothing else stated

Item	Condition	Limit			Unit
		Min	Typ	Max	
Frequency Range		2400		2483.5	MHz
Load impedance	Measured with network analyzer in the frequency range at antenna pin		50		Ohm
Output return loss	Receive Mode to 50Ω load Transmit Mode to 50Ω load	-10 -10			dB

Table 8: Electrical Requirements

5.3 Operating Conditions

T_{amb} = 25°C

Item	Condition	Limit			Unit
		Min	Typ	Max	
Supply voltage VSUP	normal mode (DC/DC not enabled)	1,8	3,0	3,6	V_{DC}

Table 9: DC Operating Conditions

5.4 Environmental Requirements

Item	Symbol	Absolute Maximum Ratings	Unit
Storage temperature range	T_{stg}	-40 to +85	°C
Operating temperature range	T_{op}	-25 to +75	°C

Table 10: Environmental Requirements

5.5 DC Parameter

All Module I/O pins are connected directly to the Nordic nRF51822 chip without signal conditioning except for some pull-up/pull-down resistors (as indicated). Therefore the electrical characteristics are as documented in the Nordic nRF51822 data sheet [2].

5.5.1 General Purpose I/O (GPIO)

T_{amb} = 25°C

Symbol	Item	Condition	Limit			Unit
			Min	Typ	Max	
V_{IL}	Low-Level Input Voltage	VSUP = 1,8 to 3,6V	VSS	-	VSUP*0,3	V
V_{IH}	High-Level Input Voltage	VSUP = 1,8 to 3,6V	VSUP*0,7	-	VSUP	V
V_{OL}	Low-Level Output Voltage	I_{OL} = 0,5mA (1) I_{OL} = 5,0mA (2), (3)	VSS VSS	-	0,3 0,3	V
V_{OH}	High-Level Output Voltage	I_{OH} = -0,5mA (1) I_{OH} = -5,0mA (2), (3)	VSUP-0,3 VSUP-0,3	-	VSUP VSUP	V
I_{OL}	Low -Level Output Current	V_{OL} ≤ 0,3V	-	-	-0,5mA (1) -5,0mA (2), (3)	mA
I_{OH}	High-Level Output Current	VSUP-0,3V ≤ V_{OH} ≤ VSUP	-	-	0,5mA (1) 5,0mA (2), (3)	mA
R_{PU}	pull-up resistor		11	13	16	kΩ
R_{PD}	pull-down resistor		11	13	16	kΩ
I_{lc}	I/O pad leakage current		-3,5	0,01	+3,5	nA
C_I	Input Capacitance			2,5		pF

(1) drive = std
(2) drive = hi
(3) maximal number of pins (per package) with high drive is 3

Table 11: DC Characteristics, Digital IO

5.5.2 EXT-RES#

Input EXT-RES# has a Schmitt-Trigger characteristic and an internal pull-up resistor.

T_{amb} = 25°C

Symbol	Item	Condition	Limit			Unit
			Min	Typ	Max	
V_{IL}	Low-Level Threshold	VSUP = 1,8 to 3,6V		0,34*VSUP		V
V_{IH}	High-Level Threshold	VSUP = 1,8 to 3,6V		0,62*VSUP		V
V_{HYST}	Hysteresis	VSUP = 3,0V		800		mV
R_{PU}	pull-up resistor		11	13	16	kΩ
C_I	Input Capacitance			2,5		pF

Table 12: DC Characteristics, EXT-RES#

5.5.3 External Slow Clock SLCK

The following table is applicable if an external slow clock signal is fed into XL-IN/SLCK. This may be a square wave, a clipped sine wave, a sine wave or a rail-to-rail digital signal. Frequency must be 32,768kHz +/-250ppm (refer to 3.9). DC offset is not an issue as long as the input voltage is between VSS and VSUP at all times. Firmware will detect presence of external slow clock signal at startup; signal has to stay active as long as the BlueMod+S is powered.

T_{amb} = 25°C

Symbol	Item	Condition	Limit			Unit
			Min	Typ	Max	
V_{SLCKL}	Low-Level Input Voltage	VSUP = 1,8 to 3,6V	0,0	-	VSUP-V_{SLCK}	V
V_{SLCKH}	High-Level Input Voltage	VSUP = 1,8 to 3,6V	VSUP-V_{SLCK}	-	VSUP	V
V_{SLCK} (1)	Amplitude (peak_peak)	VSUP = 1,8 to 3,6V	0,2	-	VSUP	V
C_I	Input Capacitance			4		pF

(1) input voltage required between VSS and VSUP at all times

Table 13: DC Characteristics, SLCK

5.6 Power Consumption and Power Down Modes

5.6.1 Terminal I/O Configuration

The following values are typical power consumption values in the different states.

VSUP = 3,0V, T_{amb} = 25°C, all GPIOs open, UART inputs at VSUP or GND, SLCK: 32,768 kHz

Condition	Note	Slow clock SLCK	Current Consumption	Unit
			I_{Avg}	
Advertising Off, UICP not active or serial interface up		internal ext. sig. ext. XTAL	tbd. tbd. 1,1	mA
Advertising Off, UICP active, serial interface down	(1)	internal ext. sig. ext. XTAL	tbd. tbd. 4	µA
Device in reset		(2)	0,625	mA

(1) IUR-IN# and UART-CTS# signals connected to CMOS high level
(2) same current consumption w. internal or external slow clock

Table 14: Supply Current Sleep Modes, no Radio Activity

The following table shows the average power consumption of BlueMod+S operating in the peripheral device role.

VSUP = 3,0V, T_{amb} = 25°C, all GPIO lines left open, SLCK: 32,768 kHz

Condition	Note	Slow clock SLCK	Current Consumption		Unit
			Tx power (dBm) [8]		
			max (+4)	min (-30)	
			I_{Avg}	I_{Avg}	
Standby, Advertising on 3 channels, advertising interval: 1,28s, UICP not active *or* serial interface up	(5)	internal [7] ext. sig. ext. XTAL	tbd. tbd. 1,2	tbd. tbd. 1,2	mA
Standby, Advertising on 3 channels, advertising interval: 1,28s, UICP active *and* serial interface down	(1)	internal [7] ext. sig. ext. XTAL	tbd. tbd. 28	tbd. tbd. 9,5	µA
Connected, connection interval: 7,5 ms, no data traffic	(2,3)	(6)	2,2	1,95	mA
Connected, connection interval: 7,5 ms, data traffic 115 kbit/s at the serial port, central to peripheral	(2)	(6)	5,2	4,7	mA
Connected, connection interval: 7,5 ms, data traffic 115 kbit/s at the serial port, peripheral to central	(2)	(6)	3,4	3,2	mA
Connected, connection interval: 37,5ms, no data traffic	(2,4)	internal [7] ext. sig. ext. XTAL	tbd. tbd. 1,4	tbd. tbd. 1,4	mA
Connected, connection interval: 37,5ms, data traffic 115 kbit/s at the serial port, peripheral to central	(2,4)	(6)	2,0	1,9	mA

[1] UART-CTS#, IUR-IN#, UART-RXD driven to CMOS high level, all UART output lines left open
[2] connection parameters are setup by the central device when connection is established
[3] no data to be transmitted, central device sends an empty packet (80 bit) then peripheral device answers (empty packet: 80 bit)
[4] these are a typical connection parameters used by an iPhone, iPad or iPad mini device in the central device role
[5] UART-inputs connected to GND or VSUP; UART output lines left open
[6] same current consumption w. internal or external slow clock
[7] RC oscillator internal to nRF51822, periodically trimmed by S-device
[8] Tx power as set by AT command

Table 15: Supply Current BLE Terminal I/O Profile, Peripheral Device Role

5.7 RF Performance

5.7.1 BLE Receiver

VSUP = 1,8V to 3,6V, T_{amb} = +20°C

Measured conducted according to BT specification RF-PHY.TS/4.0.1

Receiver	Frequ /GHz	Min	Typ	Max	BT Spec	Unit
Sensitivity at 30,8% PER	2,402		-88,5	-70	≤ -70	dBm
	2,440		-88,5	-70		
	2,480		-88,5	-70		
Reported PER during PER report integrity test	2,426	50	50	65,4	50 < PER < 65,4	%
Maximum received signal at 30,8% PER		-10	0		≥ -10	dBm
Continuous power required to block Bluetooth reception at -67dBm with 0,1% BER	0,030 - 2,000	-30	tbd.		-30	dBm
	2,000 - 2,400	-35	tbd.		-35	
	2,500 - 3,000	-35	tbd.		-35	
	3,000 - 12,75	-30	tbd.		-30	
C/I co-channel			10	21	≤21	dB
Adjacent channel Selectivity C/I	$F = F_0 + 1$ MHz		1	15	≤15	dB
	$F = F_0 - 1$ MHz		1	15	≤15	dB
	$F = F_0 + 2$ MHz		-25	-17	≤-17	dB
	$F = F_0 - 2$ MHz		-25	-15	≤-15	dB
	$F = F_0 + 3$ MHz		-51	-27	≤-27	dB
	$F = F_0 - 5$ MHz		-51	-27	≤-27	dB
	$F = F_{image}$		-30	-9	≤-9	dB
Maximum level of intermodulation interferers		-50	-36		≥-50	dBm

VSUP = 1,8V to 3,6V, T_{amb} = -25°C

Measured conducted according to BT specification RF-PHY.TS/4.0.1

Receiver	Frequ /GHz	Min	Typ	Max	BT Spec	Unit
Sensitivity at 30,8% PER	2,402		-88,5	-70	≤ - 70	dBm
	2,440		-88,5	-70		
	2,480		-88,5	-70		
Reported PER during PER report integrity test	2,426	50	n/a	65,4	50 < PER < 65,4	%
Maximum received signal at 30,8% PER		-10	n/a		≥ -10	dBm

VSUP = 1,8V to 3,6V, T_{amb} = +75°C

Measured conducted according to BT specification RF-PHY.TS/4.0.1

Receiver	Frequ /GHz	Min	Typ	Max	BT Spec	Unit
Sensitivity at 30,8% PER	2,402		-88,5	-70	≤ . 70	dBm
	2,440		-88,5	-70		
	2,480		-88,5	-70		
Reported PER during PER report integrity test	2,426	50	n/a	65,4	50 < PER < 65,4	%
Maximum received signal at 30,8% PER		-10	n/a		≥ -10	dBm

Table 16: RF Performance BLE Receiver

5.7.2 BLE Transmitter

VSUP = 1,8V to 3,6V, T_{amb} = +20°C

Measured conducted according to BT specification RF-PHY.TS/4.0.1

Transmitter	Frequ /GHz	Min	Typ	Max	BT Spec	Unit
RF Transmit Power	2,402	-20	2,6	10	-20 to +10	dBm
	2,440	-20	3,0	10		
	2,480	-20	2,8	10		
ACP	F = F_0 ± 2MHz		-42		≤ -30	dBm
	F = F_0 ± 3MHz		-50		≤ -30	
	F = F_0 ± > 3MHz		<-55		≤ -30	
Δf_{1avg} maximum modulation		225	246	275	225 < f_{1avg} < 275	kHz
Δf_{2max} minimum modulation (test threshold 185 kHz)		99,9	100		≥ 99,9	%
Δf_{2avg} / Δf_{1avg}		0,8	0,91		≥ 0,8	
Frequency Offset		-150	±20	+150	± 150	kHz
Carrier drift rate			9	20	≤ 20	kHz/ 50µs
Carrier drift			16	50	≤ 50	kHz

VSUP = 1,8V to 3,6V, T_{amb} = -25°C
Measured conducted according to BT specification RF-PHY.TS/4.0.1

Transmitter	Frequ /GHz	Min	Typ	Max	BT Spec	Unit
RF transmit Power	2,402	-20	3,0	10	-20 to +10	dBm
	2,440	-20	3,5	10		
	2,480	-20	3,1	10		
ACP	F = F_0 ± 2MHz		-37		≤ -30	dBm
	F = F_0 ± 3MHz		-46		≤ -30	
	F = F_0 ± > 3MHz		<-51		≤ -30	
Frequency Offset		-150	±35	+150	± 150	kHz
Carrier drift rate			10	20	≤ 20	kHz/ 50µs
Carrier drift			25	50	≤ 50	kHz

VSUP = 1,8V to 3,6V, T_{amb} = +75°C
Measured conducted according to BT specification RF-PHY.TS/4.0.1

Transmitter	Frequ /GHz	Min	Typ	Max	BT Spec	Unit
RF transmit Power	2,402	-20	1,5	10	-20 to +10	dBm
	2,440	-20	1,9	10		
	2,480	-20	1,7	10		
ACP	F = F_0 ± 2MHz		-42	-20	≤ -30	dBm
	F = F_0 ± 3MHz		-50	-40	≤ -30	
	F = F_0 ± > 3MHz		<-53	-30	≤ -30	
Frequency Offset		-150	±35	+150	± 150	kHz
Carrier drift rate			10	20	≤ 20	kHz/ 50µs
Carrier drift			20	50	≤ 50	kHz

Table 17: RF Performance BLE Transmitter

5.7.3 Antenna-Gain and Radiation Pattern

If BlueMod+S/AI is integrated into an end product while the recommendations depicted in 6.4 Placement Recommendation are maintained, the following typical antenna radiation patterns can be expected.

Radiation Pattern will depend on the end products PCB size, masses in the antenna environment, housing material and geometrics.

tbd.

Figure 11: Typical Antenna Radiation Pattern at 2402MHz

tbd.

Figure 12: Typical Antenna Radiation Pattern at 2441MHz

tbd.

Figure 13: Typical Antenna Radiation Pattern at 2480MHz

5.8 Power-Up Time

The time until the BlueMod+S is able to accept link requests or serial data depends on the firmware version. In the TIO firmware version tbd. the module is command ready after at least tbd. s. Bluetooth links are accepted tbd. s after reset.

Note: For further information refer to the document BlueMod+S_Startup_Timing

6 Mechanical Characteristics

6.1 Dimensions

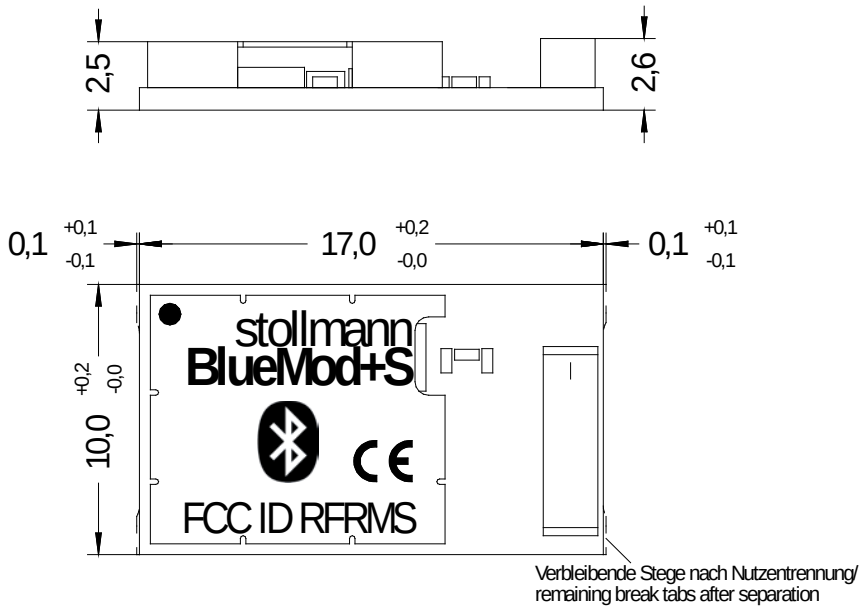


Figure 14: BlueMod+S/AI Dimensions

6.2 Recommended Land Pattern

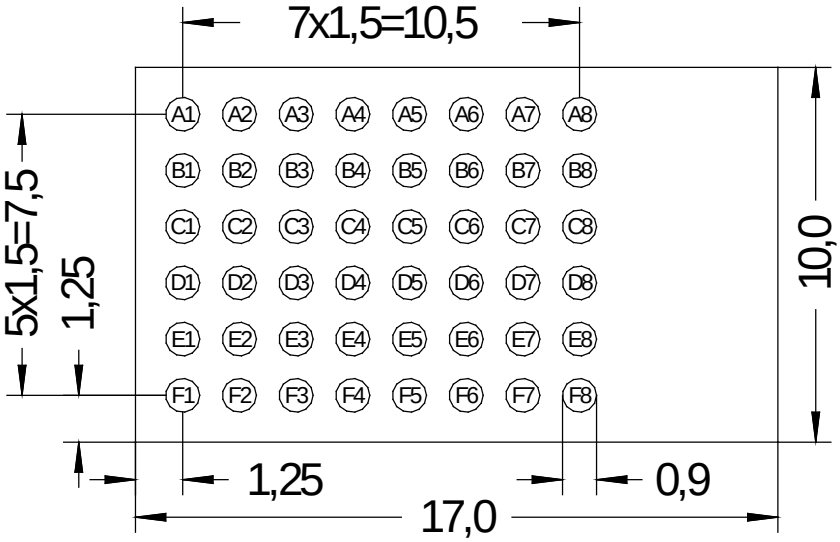


Figure 15: BlueMod+S Land Pattern

Note: *All dimensions are in mm*.

6.3 Re-flow Temperature-Time Profile

The data here is given only for guidance on solder and has to be adapted to your process and other re-flow parameters for example the used solder paste. The paste manufacturer provides a re-flow profile recommendation for his product.

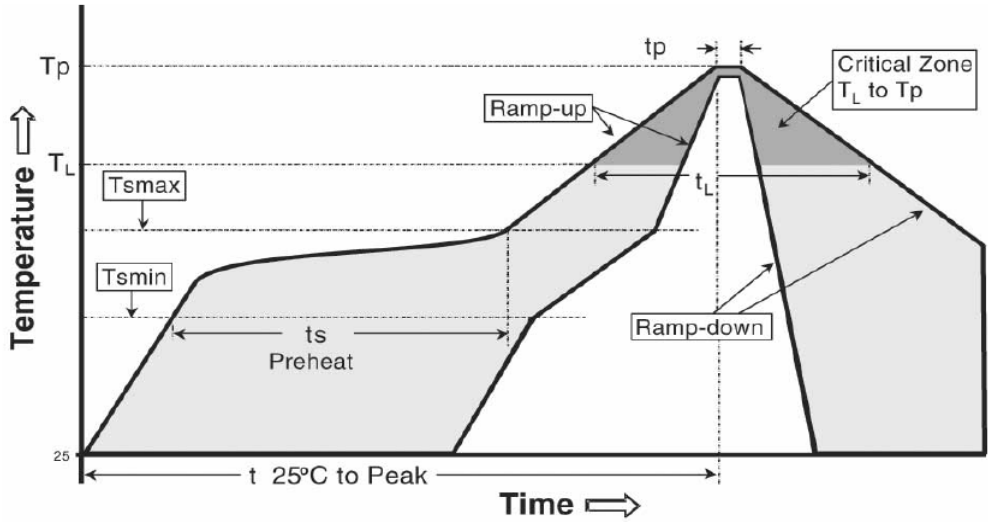


Figure 16: Soldering Temperature-Time Profile (For Reflow Soldering)

Preheat		**Main Heat**		**Peak**	
tsmax		tLmax		tpmax	
Temperature	Time	Temperature	Time	Temperature	Time
[°C]	[sec]	[°C]	[sec]	[°C]	[sec]
150	100	217	90	260	10
		230	50		
Average ramp-up rate		[°C / sec]	3		
Average ramp-down rate		[°C / sec]	6		
Max. Time 25°C to Peak Temperature		[min.]	8		

Opposite side re-flow is prohibited due to module weight.

Devices will withstand the specified profile and will withstand up to 1 re-flows to a maximum temperature of 260°C. The reflow soldering profile may only be applied if the BlueMod+S resides on the PCB side looking up. Heat above the solder eutectic point while the BlueMod+S is mounted facing down may damage the module permanently.

6.4 Placement Recommendation

To achieve best radio performance for BlueMod+S/AI, it is recommended to use the placement shown in Figure 17. This is a “corner placement” meaning the BlueMod+S/AI is placed such that the antenna comes close to the corner of the application PCB (red area). So, the yellow area is outside the PCB and regards to the housing, too (refer to 6.5).

Please note that for best possible performance the antenna should be directed away from the application PCB as shown in Figure 17.

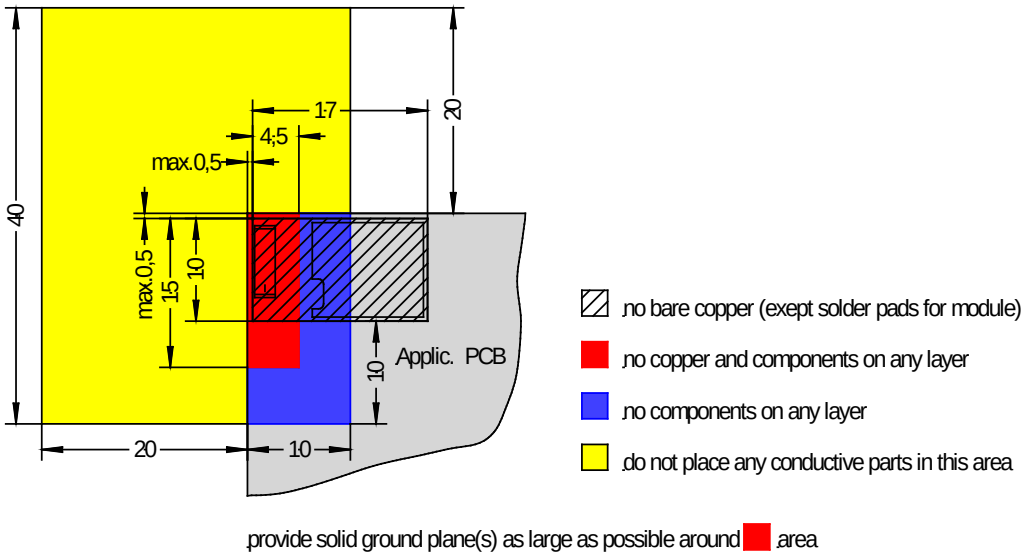


Figure 17: BlueMod+S/AI Placement Recommendation

6.5 Housing Guidelines

The individual case must be checked to decide whether a specific housing is suitable for the use of the internal antenna. A plastic housing must at least fulfill the following requirements:

- Non-conductive material, non-RF-blocking plastics
- No metallic coating
- ABS is suggested

6.6 Antenna Issues

BlueMod+S/AI comprises a ceramic antenna which as a component is soldered to the circuit board. This solution is functional for a BlueMod+S/AI integrated into a plastic housing.

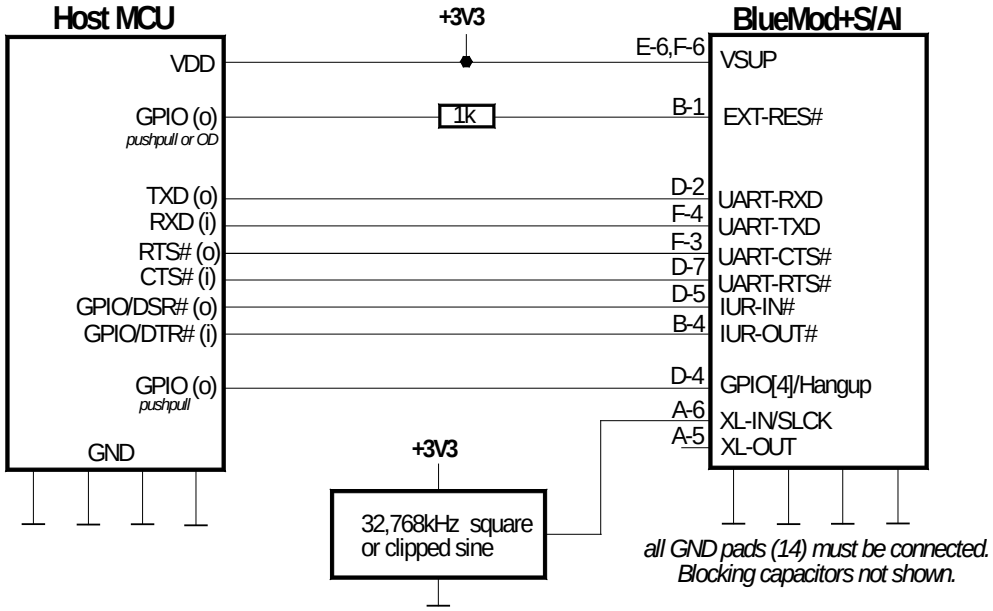
The performance of the antenna has to be checked within the final integration environment. Adjacent PCBs, components, cables, housings etc. could otherwise influence the radiation pattern or be influenced by the radio wave energy. It must be ensured that the antenna is not co-located or operating in conjunction with any other antennas, transmitters, cables or connectors.

6.7 Safety Guidelines

tbd.

7 Application Diagram

The following schematic shows a typical application of BlueMod+S. The module is connected to some MCU running the application layer. MCU and BlueMod+S use the same 3,3V power supply. The serial interface has RTS/CTS flow control and UICP support in this example. The optional hangup feature to close down the link is provided. As an option to save power, there is an external slow clock oscillator. All other module pins may be left unconnected.



In this example BlueMod+S is connected to an MCU supporting UICP, RTS/CTS flow control and Hangup.
The slow clock oscillator (32,768kHz) is optional; it helps to save power during power down states.

Figure 18: Typical Application Schematics

8 Approvals/Certifications

The BlueMod+S/AI has been tested to comply to the appropriate EU, FCC and IC directives.
CE testing is intended for end products only. Therefore CE testing is not mandatory for a Bluetooth Module sold to OEM's. However Stollmann E+V GmbH provides CE tested Modules for customers in order to ease CE compliance assessment of end products and to minimize test effort.

8.1 Declaration of Conformity CE

The BlueMod+S/AI fully complies with the essential requirements of the following EU directives:

- R&TTE 1999/5/EC
- RoHS 2011/65/EC

The actual version of EU Declaration of Conformity (EU DoC) can be downloaded from the qualification section on the product page via the following link:

http://www.stollmann.de/en/support/downloads/bluetooth-adapter/bluemod-s.html

The above link may expire, because a new version of the EU DoC is available. Please look up the EU DoC from the Stollmann web site directly then.

8.2 FCC Compliance

The BlueMod+S/AI has been tested to fulfill the FCC requirements. Test reports are available on request. Grants of the Full Modular Approval will be shown below.

8.2.1 FCC Grant

tbd

8.2.2 FCC Statement

This device complies with 47 CFR Part 2 and Part 15 of the FCC Rules and with.

Operation is subject to the following two conditions:

(1) this device my not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

8.2.3 FCC Caution

Warning: Changes or modifications made to this equipment not expressly approved by Stollmann Entwicklungs- und Vertriebs- GmbH may void the FCC authorization to operate this equipment.

8.2.4 FCC Warning

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

8.2.5 FCC RF-exposure Statement

The BlueMod+S/AI complies with the FCC/IC RF radiation exposure limits set forth for an uncontrolled environment.

The output power is < 10mW *EIRP* and therefore according to “FCC KDB 447498 D01 General RF Exposure Guidance v05” Appendix A, table “SAR Exclusion Threshold”, excluded from SAR testing for test separation distances ≥ 5mm and if it is not used in co-locations with other antennas. If the product implementing the BlueMod+S/AI has other antennas in co-location or separation distances < 5mm an FCC TCB should be asked for a Class II Permissive Change.

8.2.6 FCC Labeling Requirements for the End Product

Any End Product integrating the BlueMod+S/AI must be labeled with at least the following information:

This device contains transmitter with	
FCC ID:	RFRMS
IC:	4957A-MS

8.3 IC Compliance

The BlueMod+S/AI has been tested to fulfill the IC requirements. Test reports RSS-210 of Industry Canada are available on request. Grants of the Full Modular Approval will be shown below.

8.3.1 IC Grant

tbd

8.3.2 IC Statement

Cet appareil est conforme avec Industrie Canada RSS exemptes de licence standard(s).
Son fonctionnement est soumis aux deux conditions suivantes:
(1) cet appareil ne peut pas provoquer d'interférences, et
(2) cet appareil doit accepter toute interférence, y compris celles pouvant causer un mauvais fonctionnement de l'appareil.

This device complies with Industry Canada license-exempt RSS standard(s).
Operation 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.

NOTICE:

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

8.3.3 IC Caution

Warning: Changes or modifications made to this equipment not expressly approved by Stollmann Entwicklungs- und Vertriebs-GmbH may void the IC authorization to operate this equipment.

8.3.4 IC RF-exposure Statement

This equipment is portable device. The output power of this device is less than 20mW.
The SAR test is not required.

8.3.5 IC Labeling Requirements for the End Product

Any end product integrating the BlueMod+S/AI must be labeled with at least the following information:

This device contains transmitter with	
FCC ID:	RFRMS
IC-ID:	4957A-MS

8.3.6 IC Label Information BlueMod+S

The BlueMod+S shows no IC-ID on the product label, because there is no space available. IC allows on request to state the IC-ID in the product manual. This product has been granted to do so.

Model:	BlueMod+S
The IC-ID is:	**4957A-MS**

8.4 Bluetooth Qualification

The BlueMod+S is a qualified design according to the Bluetooth Qualification Program Reference Document (PRD) V2.1. The Qualified Design ID (QDID) is:

tbd

For further information about marking requirements of your product attention should be paid the Bluetooth Product Marking Guide at
https://www.bluetooth.org/Download/Marking_Guide_20060601.pdf

According to the Bluetooth SIG rules (Qualification Program Reference Document – PRD V2.1) you are required to perform the mandatory End Product Listing (EPL) for your product. For further information see www.Bluetooth.org or contact Stollmann.

8.5 RoHS Declaration

The actual version of RoHS Supplier Declaration according to the EU Directive 2011/65/EC can be downloaded from the qualification section on product web site via the following link:

http://www.stollmann.de/en/support/downloads/bluetooth-adapter/bluemod-s.html

9 Related Documents

[1] nordic: nRF51_Series_Reference_Manual_v2.1.pdf 2013-11-20 (nRF51822_Reference)

[2] nordic: nRF51822_PS v2.0.pdf (nRF51822_Datasheet)

[3] Stollmann: UICP_UART_Interface_Control_Protocol_r01.pdf

[4] Stollmann: AppNote_B0601_Antenna_Design_V1_0.pdf

[5] Stollmann: BlueMod+S AT Command Reference

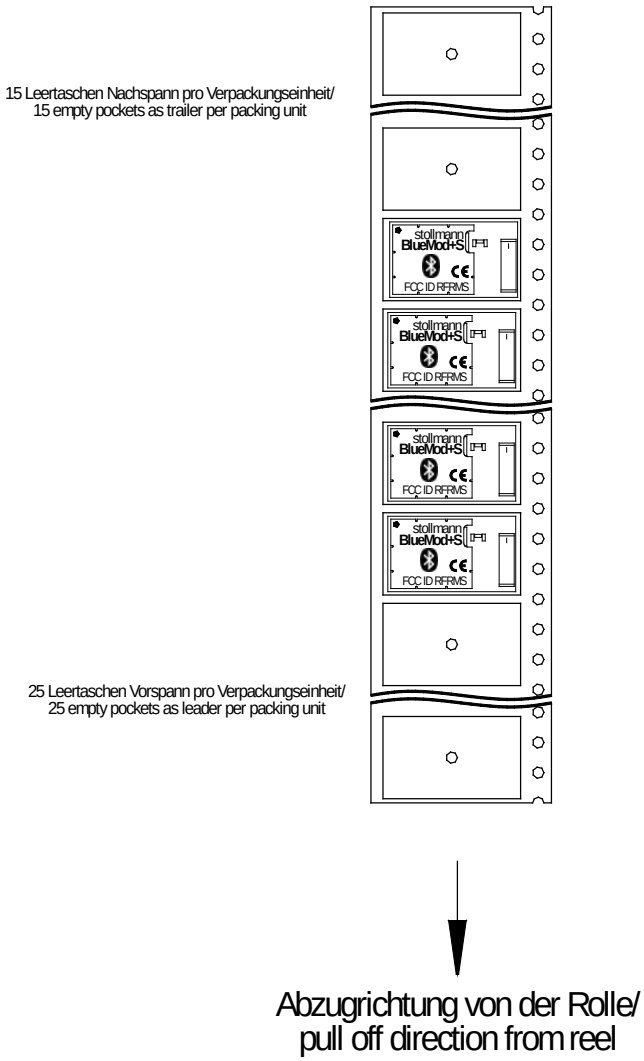
[6] Stollmann: BlueMod+S_Startup_Timing.pdf

[7] Stollmann: BlueMod+S_Testmode_Reference

[8] Bluetooth SIG: Core_v4.1.pdf

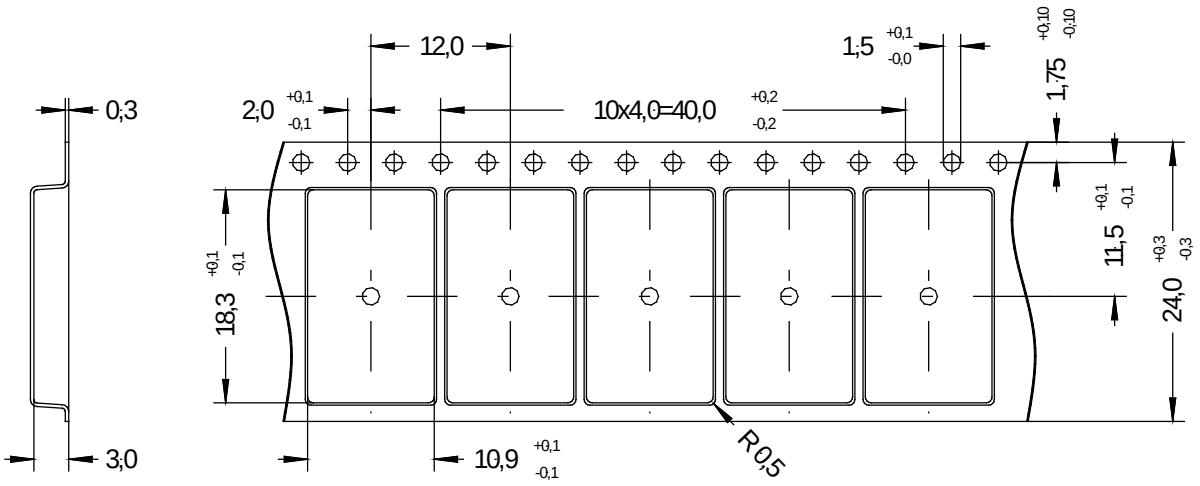
10 Packing

The BlueMod+S modules are packed using carrier tape.



10.1 Tape

The dimensions of the tape are shown in the drawing below (values in mm):

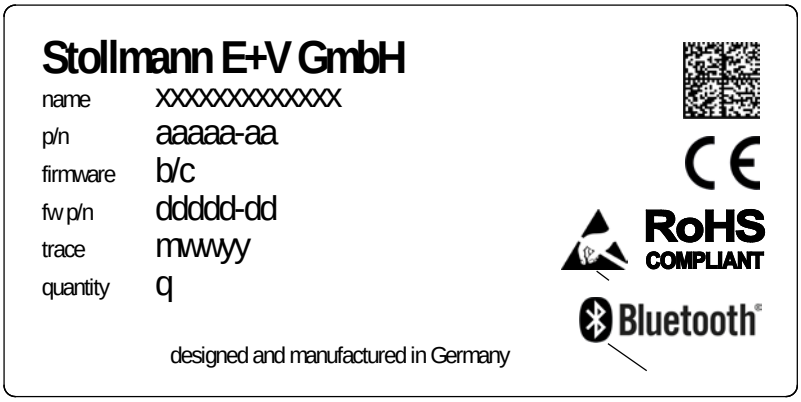


10.2 Reel

tbd

10.3 Package Label

Package box, dry shield bag and reel are each marked with the following label:



Field	Description
name	Name of product
p/n	Product number
firmware	Firmware version
fw p/n	Product number of firmware
trace	[Manufacturer m (optional)]Date (CalendarWeekYear) wwyy
quantity	Number of contained modules

If the label on the package box is different to the label described please contact Stollmann for detailed information.

11 Ordering Information

11.1 Part Numbers

BlueMod+S is available in the following variants:

Name	Antenna	Order No.	MOQ / units	Comments
BlueMod+S/AI	internal	53275-xx	50	
BlueEva+S	Internal	53276-xx	1	Evaluation Kits

Other variants on request, please contact Stollmann sales department.

11.2 Standard Packing Unit

The standard packing unit is 400 pieces Tape and Reel

11.3 Evaluation Kit

The kit BlueEva+S is available to evaluate functionality and start your firmware implementation.

12 History

Version	Release Date	By	Change description
r01	20.02.2014	MW/JW	First preliminary release

Stollmann Entwicklungs- und Vertriebs-GmbH
Mendelssohnstraße 15 D
22761 Hamburg
Germany

Phone: +49 (0)40 890 88-0
Fax: +49 (0)40 890 88-444
E-mail: info@stollmann.de
www.stollmann.de