# BlueMod+S50

## HW User Guide

1VV0301505 Rev. 4 – 2021-07-19

Telit Technical Documentation

# APPLICABILITY TABLE

| PRODUCTS |
| --- |
| BLUEMOD+S50/AI/CEN |
| BLUEMOD+S50/AP/CEN |

# CONTENTS

# 1. INTRODUCTION

## 1.1. Scope

This document provides information how the BlueMod+S50 can be integrated into customer systems. It addresses hardware specifications of the BlueMod+S50 and requirements of the hardware environments for the BlueMod+S50.

**Note/Tip:** The description text "BlueMod+S50" refers to all modules listed in the Applicability Table.

## 1.2. Audience

This document is intended for Telit customers, especially system integrators, about to implement Bluetooth modules in their application.

## 1.3. Contact Information, Support

For general contact, technical support services, technical questions and report of documentation errors contact Telit Technical Support at:

- *TS-EMEA@telit.com*
- *TS-AMERICAS@telit.com*
- *TS-APAC@telit.com*
- *TS-SRD@telit.com*
- *TS-ONEEDGE@telit.com*

Alternatively, use:

*https://www.telit.com/contact-us/*

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

*https://www.telit.com*

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates the user feedback on our information.

## 1.4. Symbol Conventions

| | |
|---|---|
|  | **Danger:** This information MUST be followed or catastrophic equipment failure or personal injury may occur. |
|  | **Warning:** Alerts the user on important steps about the module integration. |
|  | **Note/Tip:** Provides advice and suggestions that may be useful when integrating the module. |
|  | **Electro-static Discharge:** Notifies the user to take proper grounding precautions before handling the product. |

*Table 1: Symbol Conventions*

All dates are in ISO 8601 format, that is YYYY-MM-DD.

## 1.5. Related Documents

- [1] Bluetooth SIG Core SpecificationV5.0
- [2] UICP_UART_Interface_Control_Protocol, 30507ST10756A
- [3] BlueMod+S50 AT Command Reference, 80578ST10890A
- [4] BlueMod+S50 Software User Guide, 1VV0301506
- [5] BlueEva+S50 Evaluation Kit User Guide, 1VV0301519
- [6] OTA Measurement User Guide, 1VV03xxxxx
- [7] Nordic: nRF52_Series_Reference_Manual
- [8] Nordic: nRF52832_PS v1.x.pdf (Product Specification)

# 2. OVERVIEW

This document provides information on how BlueMod+S50 can be integrated into customer systems. It addresses hardware specifications of the BlueMod+S50 and requirements of the hardware environments for the BlueMod+S50.

**Note/Tip:** The term BlueMod+S50 is used as an abbreviation and refers to both, the BlueMod+S50/AI and the BlueMod+S50/AP.

If information is related to dedicated versions, the whole product name is used.

The BlueMod+S50 is delivered in two different hardware versions:

- **BlueMod+S50/AI:** with integrated Bluetooth antenna
- **BlueMod+S50/AP:** without integrated Bluetooth antenna and with a 50Ω rf connection on pin.

**Note/Tip:** The integration of the BlueMod+S50 Bluetooth module within user application shall be done according to the design rules described in this manual.

# 3. GENERAL PRODUCT DESCRIPTION

## 3.1. Feature Summary

- Supports Bluetooth low energy
- Qualified Bluetooth V5.0 Single Mode LE
- Supports 2 Msym/s PHY for LE
- Arm® CortexTM-M4F core for embedded profiles or application software
- RF output power -20 up to +4dBm
- RF output power -40dBm in Whisper Mode
- Supply voltage range 1,7V to 3,6V
- Internal crystal oscillator (32 MHz)
- LGA Surface Mount type. BlueMod+S50: 17 x 10 x 2.6 $mm^3$
- Pin compatible to Telit BlueMod family +S, +S42, +S42M and +SR
- Flexible Power Management
- NFC peripheral communication signal interface type A with 106 kbps bit rate
- High-speed UART interface
- I2C Master
- SPI Master/Slave interface
- Up to 19 digital IO's for individual usage by embedded software
- Up to 8 analog inputs for individual usage by embedded software
- 8/9/10/12bit ADC
- Low power comparator
- Real Time Counter
- 128-bit AES encryption
- CE certified
- Shielded to be compliant to optional FCC full modular approval
- Manufactured in conformance with RoHS2
- Operating temperature -40 ... +85 °C
- Weight: 0,7 g

## 3.2. Applications

The BlueMod+S50 is designed to be used in low power applications, like sensor devices. Some typical applications are described in this chapter.

Supported profiles are:

- Terminal I/O
- GATT based LE-profiles

**Note/Tip:** Support for any additional profile is possible on request.

### 3.2.1. General Cable Replacement

In case there is no standardized application specific profile available the BlueMod+S50 offers Telit'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 Telit's dual mode module BlueMod+SR.

### 3.2.2. Industry

BlueMod+S50 can be used to monitor and control motors, actuators, values, and entire processes.

### 3.2.3. POS/Advertising

BlueMod+S50 supports iBeacon or similar applications.

### 3.2.4. 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.

### 3.2.5. Sports and Fitness

In the sports and fitness segment the BlueMod+S50 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.

### 3.2.6. Entertainment

Bluetooth technology is already used in a wide variety of devices in the entertainment sector, namely set-top boxes / gaming consoles. BlueMod+S50 is especially suited for use in remote controls, gaming controller and wireless mouse/keyboard applications.

## 3.3. Block Diagram

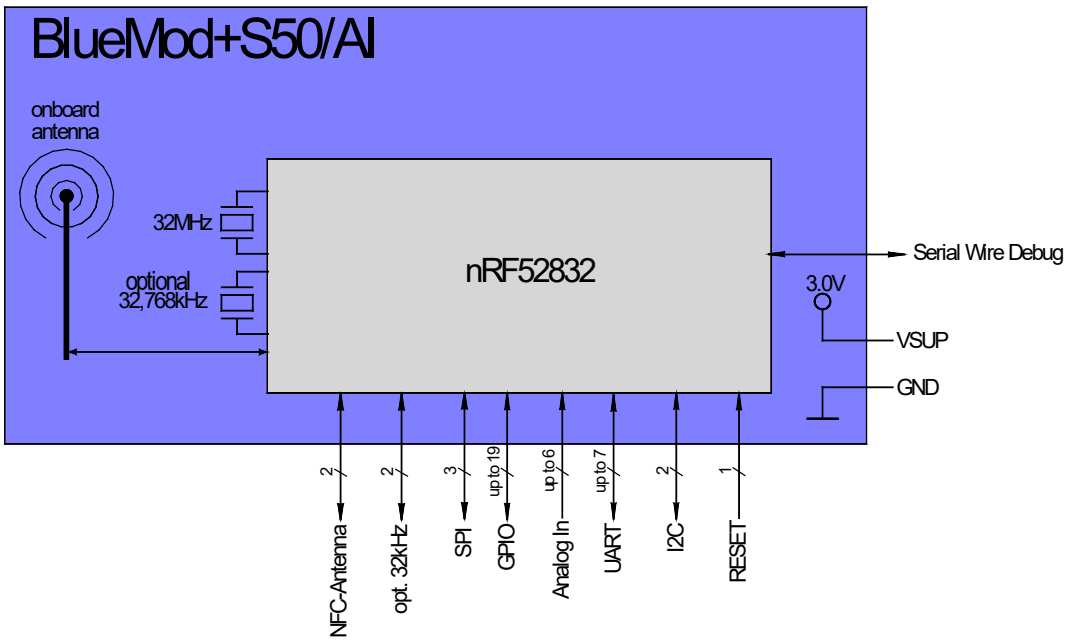


*Figure 1: BlueMod+S50/AI Block Diagram*

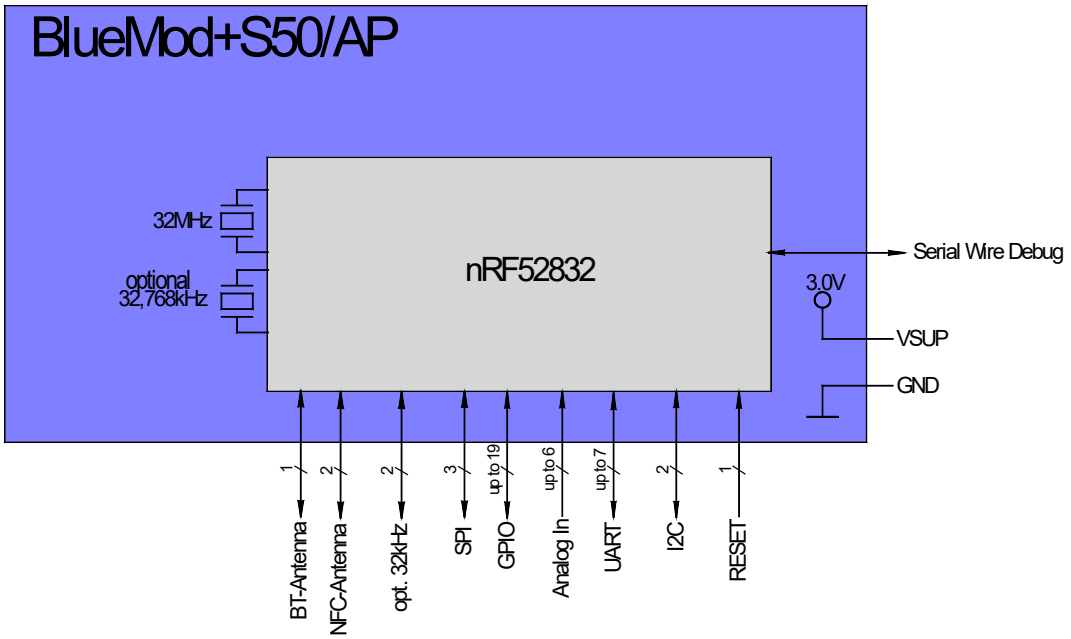


*Figure 2: BlueMod+S50/AP Block Diagram*

# 4. APPLICATION INTERFACE

## 4.1. Power Supply

BlueMod+S50 require a power supply with the following characteristics:

Typical: 3,0$V_{DC}$, min.: 1,7$V_{DC}$, max.: 3,6$V_{DC}$, thereby delivering > 25 mA peak

BlueMod+S50 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. Furthermore, it is recommended to place a capacitor in parallel to the CR2032 3V coin cell battery to prolong battery lifetime, by compensating the effects of the rising source resistance of the battery to pulsed loads. Since the isolation resistance of this capacitor will discharge the battery in a not insignificant scale, the capacitor should be chosen under consideration of the following rules:

- Capacitance as small as necessary
- Nominal voltage as high as possible
- Case size as large as possible
- Use X7R instead of X5R

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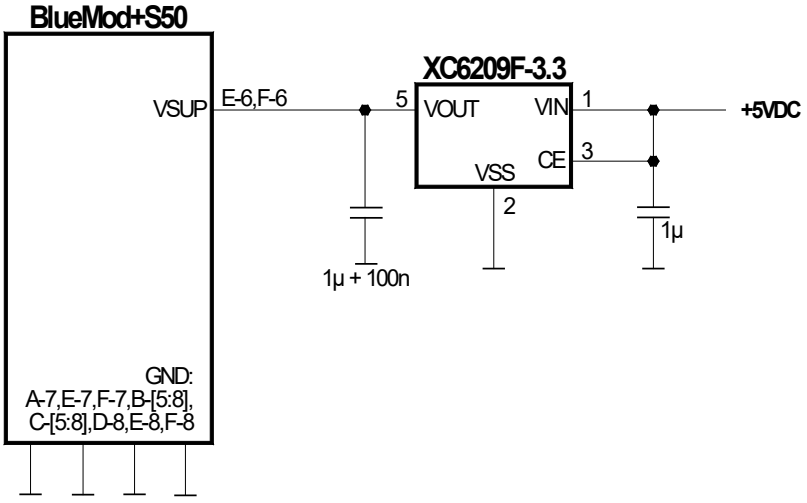


*Figure 3: BlueMod+S50 Example Power Supply with LDO*

It is strongly recommended NOT to switch the module power supply on/off while other parts of the circuitry stay powered. This mostly leads to hardly controllable back-feeding issues.

Due to the ultra-low power design a few µAmps are enough to raise VSUP to an undefined state, which may cause a hang-up deadlock if power is switched on again.

Any I/O pin at a voltage > 0,3V while the supply VSUP is at 0V violates the abs. max. ratings given in chapter 5.1 Absolute Maximum Ratings.

It is instead recommended to use the advanced power management features, which may reduce the supply current to 300nA.

## 4.2. Reset

BlueMod+S50 are equipped with circuitry for generating reset from two sources:

- A reset is held active, when VSUP falls below the threshold of the brownout detector ($V_{BOR}$ = 1,2V ... 1,7V), and is released when VSUP rises above $V_{BOR}$ + $V_{HYST}$. The brownout detector also holds the reset active during power up, until VSUP > $V_{BOR}$.
- A reset is generated, when VSUP is > $V_{BOR}$ and increases 300 mV or more, within 300 ms or less.
- By holding pin B-1 (EXT-RES#) at ≤ VSUP*0,25V 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.

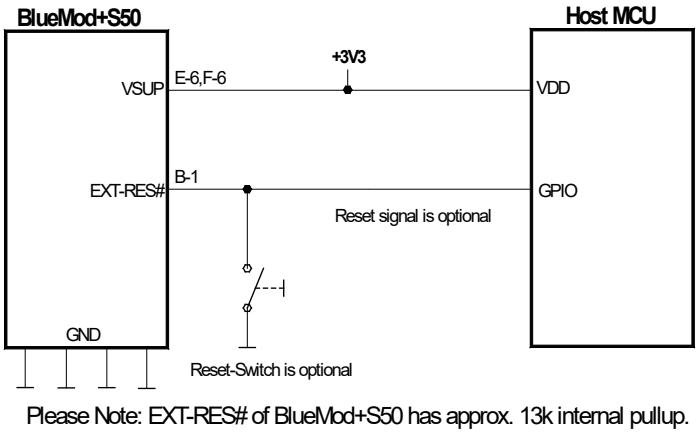


*Figure 4: BlueMod+S50 Example Reset*

The following table shows the pin states of BlueMod+S50 during reset active. This pin states are kept until hardware initialization has started.

| Pin Name | State: BlueMod+S50 |
|---|---|
| EXT-RES# | Input with pull-up [1] |
| XL-IN | 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) |

| Pin Name | State: BlueMod+S50 |
|---|---|
| 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. 10kΩ*

*Table 2: Pin States during Reset*

## 4.3. Serial Interface

The serial interface of BlueMod+S50 is a high-speed UART interface supporting RTS/CTS flow control and interface-up/down mechanism according to the UICP protocol (refer to [2]).

- Electrical interfacing is at CMOS levels (defined by VSUP; see chapter 0)
- 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/Tip:** Transmission speed may be limited by firmware. See corresponding AT command reference [3] for further information.

### 4.3.1. Basic Serial Interface

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

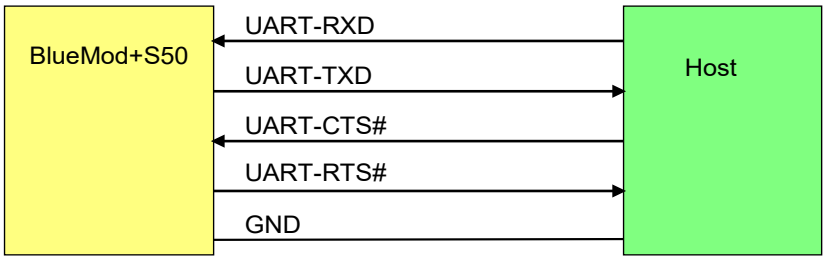


*Figure 5: Basic Serial Interface*

**Warning:** A pulldown resistor is programmed to CTS# if UICP is disabled.

If AT+SYSTEMOFF is issued while UICP is disabled, it is necessary that the host keeps CTS# at logic low or leaves this pin floating.

Otherwise the supply current drawn in the deep sleep mode increases by VSUP/13kΩ, which would be at 3V 231µA, 770 times the expected 0,3µA. This would reduce the lifetime of a coin cell significantly.

### 4.3.2. 4-Wire Serial Interface

If the host in question is sufficiently fast, a four-wire scheme may be successful. Connect the serial lines UART-RXD, UART-TXD as well as UART-RTS# and GND; leave UART-CTS# open. The host is required to stop sending data within a short time after de-assertion of UART-RTS# (there is room for up to 4 more characters at the time RTS# drops).

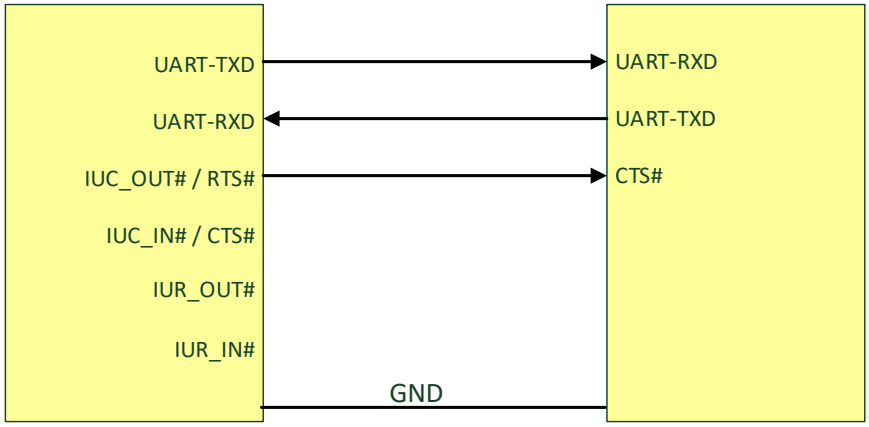


*Figure 6: UART Interface without UICP Signals 4-wire (incl. GND)*

**Warning:** UICP must be deactivated permanently in this configuration, because signal UART-CTS# and IUR-IN# become inputs with no PU or PD if UICP is active. This would cause floating CMOS inputs.

**Note/Tip:** It is strongly recommended to use hardware flow control in both directions. Not using flow control can cause a loss of data.

### 4.3.3. Serial Interface with UICP

A substantially saving of power during idle phases can be achieved (see when the UICP protocol is used (refer to [2]). 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 7).

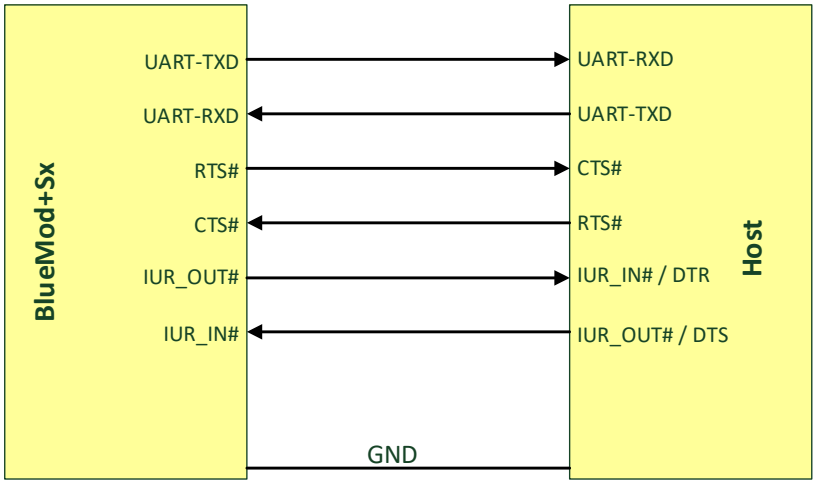


*Figure 7: BlueMod+S50 Serial Interface Supporting UICP*

If I/O line availability at the host side is extremely tight, 2 I/O lines could be saved by using the following scheme. This would come at the cost of:

- The host is not allowed to enter sleep mode.
- The host must accept incoming data at all times and is not able to stop the BlueMod+Sx sending data. This may be difficult to control for all scenarios and adds the risk that data gets lost.
- The host does not implement UICP, but wake-up BT via GPIO.

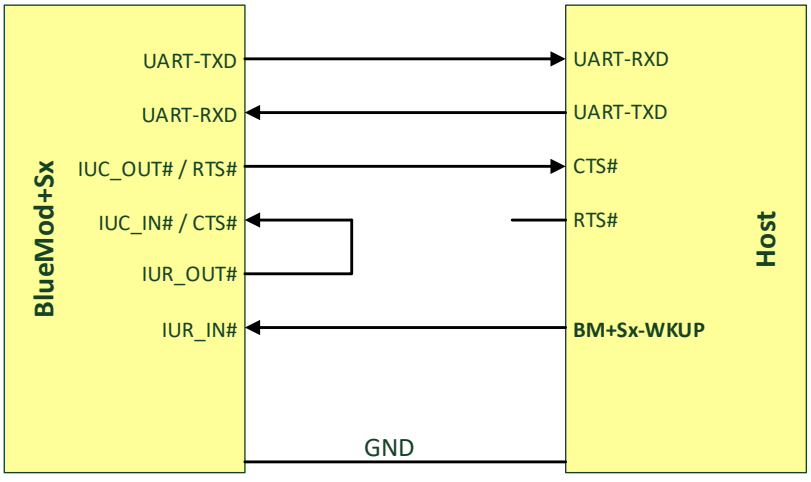


*Figure 8: Five Wire Interface Supporting UICP*

### 4.3.4. Dynamic I/O Signal Type Changes Depending on UICP Status

To reduce current consumption when using UICP, the BlueMod+S50 FW supports the following dynamic I/O signal type changes depending on the UICP activated resp. deactivated status.

| Signal | UICP deactivated | UICP activated |
|---|---|---|
| UART-CTS# | I-PD | I-FLOAT |
| IUR-IN# | I-DIS | I-FLOAT |
| IUR-OUT# | I-DIS | O-PP |

(1) I-PU: input pull-up; I-PD: input pull-down; I-FLOAT: input floating; I-DIS: input disconnected; O-PP: output push-pull

*Table 3: Pin Assignments*

Signal types I-PD, I-DIS, and O-PP may be left open. I-FLOAT must be driven to GND or VCC to avoid open CMOS input oscillation.

If UICP is deactivated the pull-down resistor on UART-CTS# helps to keep the serial interface active if UART-CTS# is open.

If UICP is active and the serial interface is down, UART-CTS# must be held at VCC and thus the pull-down would cause an unwanted permanent current drain. Therefore, the pull-down is switched off in this mode.

### 4.3.5. UART Example Circuits

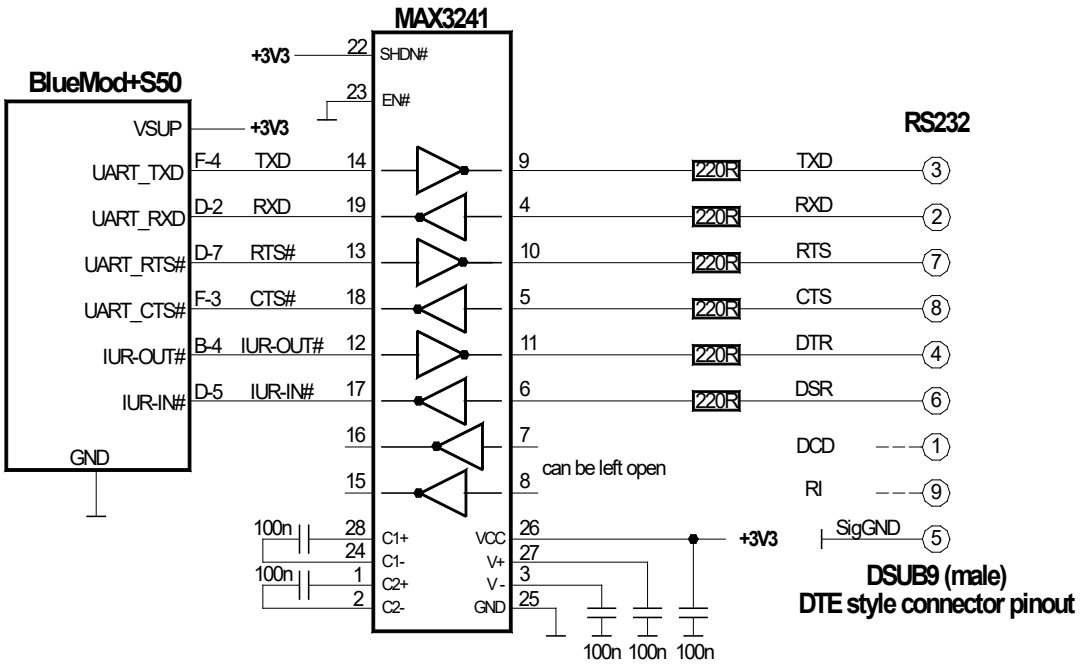


*Figure 9: BlueMod+S50 Serial Interface (RS-232 COM Port) Supporting UICP*

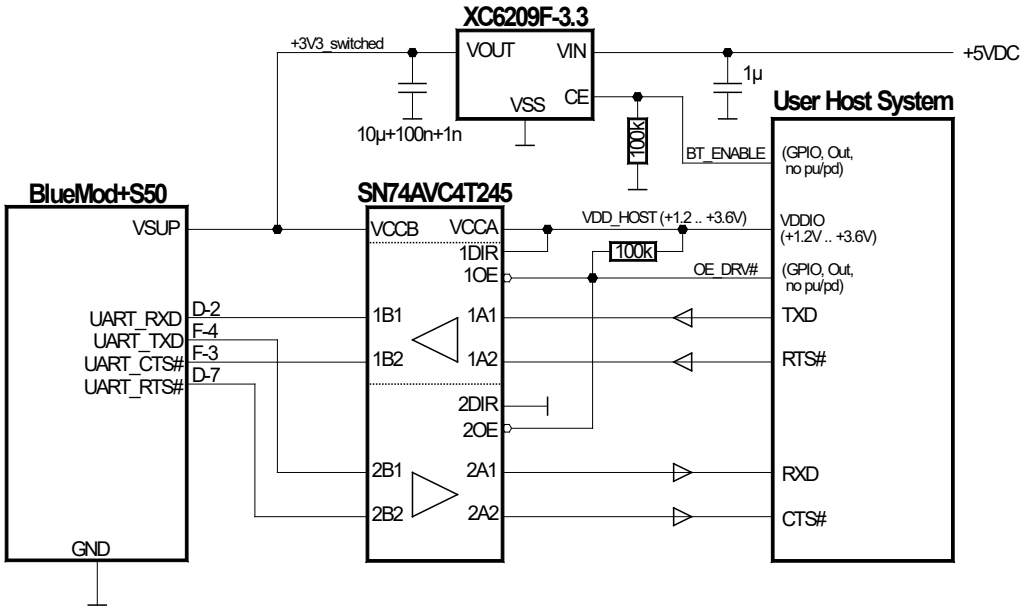


*Figure 10: BlueMod+S50 Example Serial Interface (Mixed Signal Level)*

## 4.4. General Purpose I/O (GPIO)

Functionality is defined project specific in the firmware used.

It is possible to use the programmable digital I/Os GPIO[0:14] on the BlueMod+S50. Unused GPIO pins shall be left unconnected to stay compatible. There may be functions assigned to some in future versions of the firmware. Refer to 5.3

## 4.5. I²C Interface

Functionality is defined project specific in the firmware used.

The I²C bus interface serves as an interface between the internal microcontroller and the serial I²C bus. BlueMod+S50 is the master and controls all I²C bus specific sequencing, protocol, and timing. It supports standard (100kHz) and fast (400kHz) speed modes. The BlueMod+S50 as an I²C master must be the only master of the I²C bus (no multimaster capability). Clock stretching is supported.

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

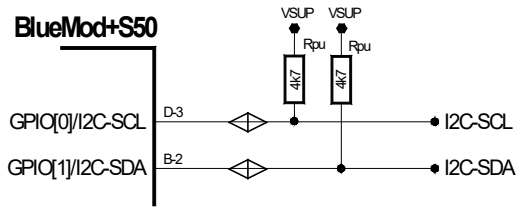


*Figure 11: BlueMod+S50 I²C Interface*

## 4.6. SPI Serial Peripheral Interface

Functionality is defined project specific in the firmware used.

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

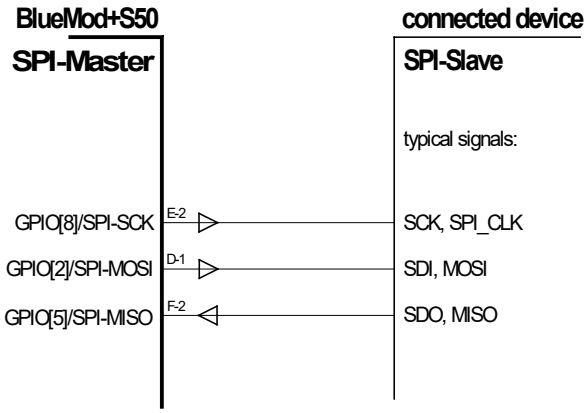


*Figure 12: BlueMod+S50 SPI Interface (Example: Master Mode)*

## 4.7. Serial Wire Debug Interface

The Serial Wire Debug (SWD) interface (signals 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.

## 4.8. Test Mode

For regulatory approval purposes, the ability of test mode operation like "BlueMod+S50 Testmode" or "Direct two wire UART Testmode" (DTM) is mandatory. The Direct Test Mode (as defined by the Bluetooth SIG) and BlueMod+S50 Testmode are part of the BlueMod+S50 firmware. Please refer to [6].

For enabling the different test modes, the BlueMod+S50 provides two IO pins.

- The pin Testmode is low active. Active means connect to GND.
- The pin Boot0 is high active. Active means connect to VSUP.

- The other two combinations start the bootloader for firmware update of the programmed firmware. These two modes are not scope of this document.

The following table shows the possible combinations:

| Testmode# | Boot0 | Mode |
|---|---|---|
| Active | Inactive | Testmode(38400, 8N1) |
| Active | Active | DTM (19200, 8N1) |
| Inactive | Active | Bootloader (15200, 8N1) |
| Inactive | Inactive | Firmware |

*Table 4: Testmode# / Boot0 Logic*

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

- BOOT0
- TESTMODE#
- UART-RXD
- UART-TXD
- UART-RTS#
- 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.

**Warning:** Please note the UART is required for operation of DTM. For any regulatory approval, UART-RXD, UART-TXD, UART-RTS# and UART-CTS# must be freely accessible.

## 4.9. NFC Function

Functionality is defined project specific in the firmware used.

The NFCT peripheral supports communication signal interface type A and 106 kbps bit rate from the NFC Forum. With appropriate software, the NFC peripheral can be used to emulate the listening device NFC-A as specified by the NFC Forum.

Main features for the NFC peripheral:

- NFC-A listen mode operation
- 13.56 MHz input frequency
- Bit rate 106 kbps

- Wake-on-field low power field detection (SENSE) mode
- Frame assemble and disassemble for the NFC-A frames
- Programmable frame timing controller
- Integrated automatic collision resolution, CRC, and parity functions

### 4.9.1. NFCT Antenna Recommendations

The NFCT antenna coil must be connected differential between NFCANT1 and NFCANT2 pins of BlueMod+S50.

Two external capacitors Ctune1/2 connected between the NFCANTx pins and GND should be used to tune the resonance of the antenna circuit to 13.56 MHz.

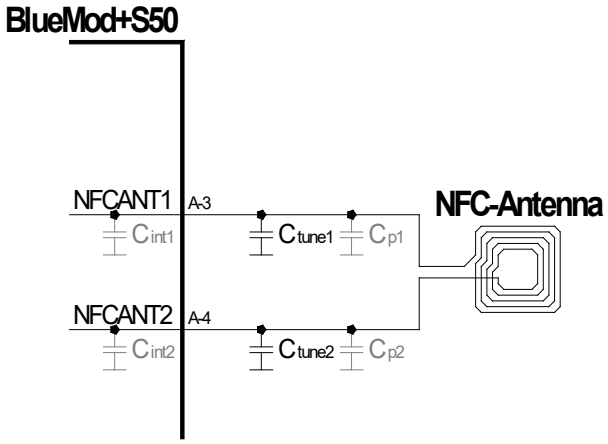


*Figure 13: BlueMod+S50 NFC Antenna Tuning*

$$C_{tune} = \frac{2}{(2\pi \times 13{,}56MHz)^2 \times L_{ant}} - C_p - C_{int}$$

$$C_{tune} = C_{tune1} = C_{tune2}$$

$$C_p = C_{p1} = C_{p2}\ (antenna\ track\ capacitance)$$

$$C_{int} = C_{int1} = C_{int2} = 4pF$$

### 4.9.2. Power Back Feeding

If the NFC antenna is exposed to a strong NFC field, power back feeding may occur. That means, current may flow in the opposite direction on the supply due to parasitic diodes and ESD structures.

If a battery is used that does not tolerate return current, a series diode must be placed between the battery and the BlueMod+S50 to protect the battery. An ultra-low forward voltage Schottky diode should be chosen to keep the battery life reduction as small as possible.

## 4.10. 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 connecting an XTAL (32,768kHz) and two capacitors C1, C2 at pins XL-IN and XL-OUT.

| 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 | | | | 12,5 | pF |
| C0 | Shunt Capacitance | | | | 2 | pF |
| $R_S$ | Equivalent Series Resistance | | | | 100 | 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 CL of crystal and layout)

*Table 5: 32,768kHz Crystal Oscillator*

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

### 4.10.1. 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) and A-5 (XL-OUT). 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). C1 and C2 shall be of equal capacity. The crystal and the capacitors shall be located as close as possible to pins A-5, A-6.

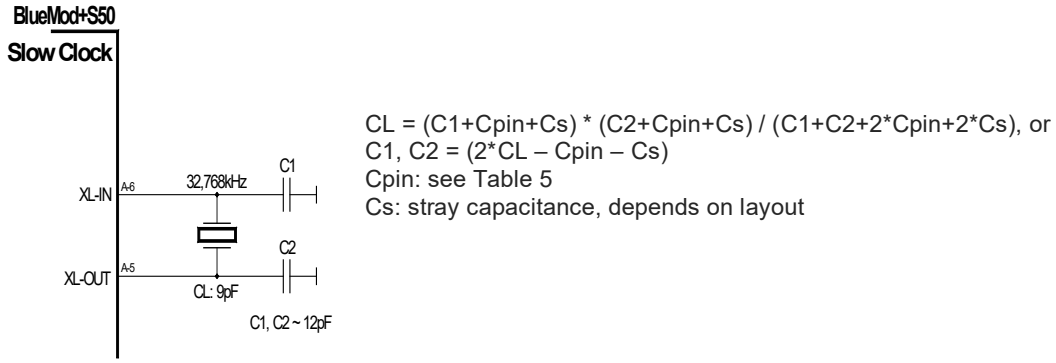


*Figure 14: BlueMod+S50 connection of external XTAL*

## 4.11. Analog/Digital Converter (ADC)

Functionality is defined project specific in the firmware used.

The ADC supports:

- 8/10/12-bit resolution, 14-bit resolution with oversampling
- Full swing operation 0V to VSUP
- Up to 200kHz sample rate
- Limit event monitoring
- 2 sources for ADC reference voltage 600mV REF or VSUP/4
- Prescaler [1/6, 1/5, 1/4, 1/3, 1/2, 1, 2, 4]

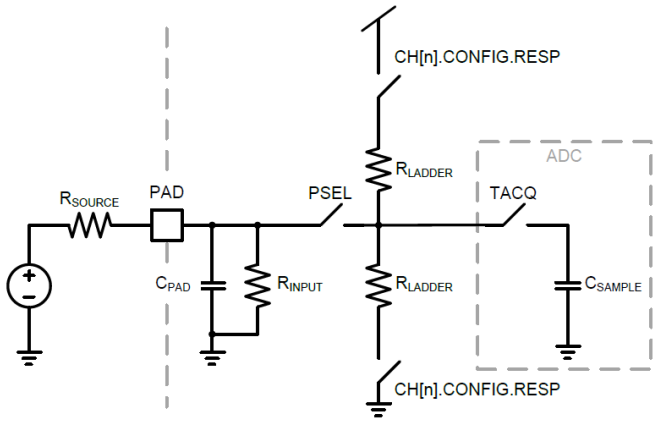


*Figure 15: ADC Signal Input Structure*

The ADC signal conversion is splitted into 2 phases, sample and convert. In the sampling phase the capacitor CSAMPLE is charges to the analog source voltage for tACQ, by closing the TACQ switch for the acquisition time. In the conversion phase the TACQ is opened again and the voltage on CSAMPLE is converted to a digital value. Therefore,

FSAMPLE < 1/ (tACQ + tCONV) must be maintained.

The time necessary to load CSAMPLE with sufficient preciseness to VSOURCE depends on the values of CSAMPLE, known 2,5pF typ., and the source resistance of VSOURCE, e.g. a potentiometer.

Therefore, the max. allowed source resistance of VSOURCE depends on the programmed acquisition time.

| TACQ /µs | Max. resistance VSOURCE /kΩ |
|---|---|
| 3 | 10 |
| 5 | 40 |

| TACQ /µs | Max. resistance VSOURCE /kΩ |
|---|---|
| **10** | 100 |
| **15** | 200 |
| **20** | 400 |
| **40** | 800 |

*Table 6 TACQ versus R(VSOURCE) max.*

# 5. MODULE PINS

## 5.1. Pin Numbering

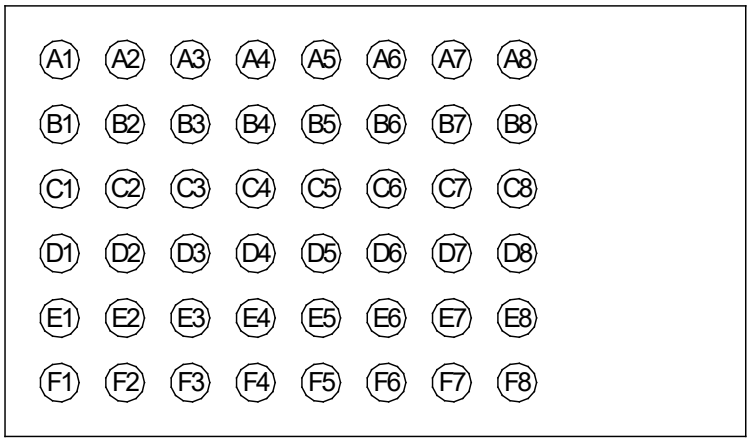


*Figure 16: BlueMod+S50 Pin Numbering (Top View)*

## 5.2. Pin Description

| Pin Name | Signal | Alternate | Type[1] | Act | nRF52 | Description |
|---|---|---|---|---|---|---|
| E6<br>F6 | VSUP1 | | PWR | | VDD | +3,0V nom. |
| A7<br>B[5-8]<br>C[5-8]<br>D8<br>E7<br>E8<br>F7<br>F8 | GND | | PWR | | VSS | Ground<br>All GND pins must be connected |
| A8 | ANT PIN | | RF | | RF | AI: not connected<br>AP: RF output (50Ω) |
| A3 | NFCANT1 | | RF | | P0.09 | NFC-Antenna |
| A4 | NFCANT2 | | RF | | P0.10 | NFC-Antenna |
| F1 | TESTMODE# | | I-PU[3] | L | P0.08 | Enable Testmode |
| E1 | BOOT0 | | I-PD[3] | | P0.25 | Startup with Bootloader |
| E3 | SWDIO | | I/O-PU | | SWDIO | Serial Wire Debug (data) |
| D6 | SWCLK | | I-PD | | SWCLK | Serial Wire Debug (clock) |
| B1 | EXT-RES# | | I-PU | L | P0.21 | User Reset |
| A6 | XL-IN | | I/O | | P0.00 | XTAL 32,768kHz input |
| A5 | XL-OUT | | I/O | | P0.01 | XTAL 32,768kHz output |
| F4 | UART-TXD | | O-PP | | P0.17 | Serial Data OUT |
| D2 | UART-RXD | | I | | P0.11<br>P0.13 | Serial Data IN |
| D7 | UART-RTS# | | O-PU | L | P0.07 | Flow Control/IUC<br>(internally connected to a 470k pull up) |
| F3 | UART-CTS# | | I-PD[4] | L | P0.12 | Flow Control/IUC |
| B4 | IUR-OUT# | | O-PP[4] | L | P0.04 | UICP Control |
| D5 | IUR-IN# | | I-DIS[4] | L | P0.29 | UICP Control |
| D3 | GPIO[0] | I2C-SCL | I/O | | P0.27 | GPIO [2] |
| B2 | GPIO[1] | AIN,<br>I2C-SDA | I/O | | P0.31 | GPIO [2] |
| D1 | GPIO[2] | SPI-MOSI | I/O | | P0.14 | GPIO [2] |
| E4 | GPIO[3] | AIN | I/O | | P0.02 | GPIO [2] |
| D4 | GPIO[4] | AIN | I/O | | P0.30 | GPIO [2] |
| F2 | GPIO[5] | AIN,<br>SPI-MISO | I/O | | P0.05 | GPIO [2] |
| C4 | GPIO[6] | AIN | I/O | | P0.03 | GPIO [2] |
| C3 | GPIO[7] | AIN | I/O | | P0.28 | GPIO [2] |
| E2 | GPIO[8] | SPI-SCK | I/O | | P0.06 | GPIO [2] |
| A2 | GPIO[9] | | I/O | | P0.18 | GPIO [2] |
| A1 | GPIO[10] | | I/O | | P0.22 | GPIO [2] |
| B3 | GPIO[11] | | I/O | | P0.20 | GPIO [2] |
| E5 | GPIO[12] | | I/O | | P0.16 | GPIO [2] |
| C2 | GPIO[13] | | I/O | | P0.15 | GPIO [2] |
| F5 | GPIO[14] | | I/O | | P0.26 | GPIO [2] |
| C1 | NC | | | | | not connected |

[1] PWR: Power; I: Input; O: Output; I/O: bidir; PU: pull-up; PD: pull-down; DIS: disconnected; PP: push-pull; RF: RadioFreq

[2] Pin function depends used firmware, refer to 5.3

[3] signals sampled only at startup time, I-DIS otherwise
[4] Pin Type depends on UICP status. Refer to 4.3.4

*Table 7: Pin Assignments*

## 5.3. Firmware depend Functions

| Signal | CEN | |
|---|---|---|
| | Type[1] | Function |
| GPIO[0] | DIS | none |
| GPIO[1] | DIS | none |
| GPIO[2] | DIS | none |
| GPIO[3] | O | IOB |
| GPIO[4] | I-PU | HANGUP |
| GPIO[5] | DIS | none |
| GPIO[6] | DIS | none |
| GPIO[7] | DIS | none |
| GPIO[8] | O | IOA |
| GPIO[9] | DIS | none |
| GPIO[10] | DIS | none |
| GPIO[11] | DIS | none |
| GPIO[12] | DIS | none |
| GPIO[13] | DIS | none |
| GPIO[14] | DIS | none |

[1] I: Input; O: Output; I/O: bidir; PU: pull-up; PD: pull-down; DIS: disconnected; PP: push-pull.

*Table 8: Firmware depend GPIO function*

## 5.4. Handling of Unused Signals

Depending on the application, not all signals of BlueMod+S50 may be needed. The following list gives some hints how to handle unused signals.

| Signal | Handling |
|---|---|
| EXT-RES# | If no external Reset is needed: Leave open |
| UART-RXD | Add a pullup (e.g.100kΩ) to VSUP [1] |
| UART-TXD | Leave UART-TXD open [1] |
| UART-RTS#, UART-CTS# | If neither flow control nor UICP is used: Leave open [1][2] |
| IUR-OUT#, IUR-IN# | If UICP is not used: leave open |

| Signal | Handling |
|---|---|
| **TESTMODE#** | Leave open [1] |
| **unused GPIOs** | Leave open |
| **SWDIO, SWCLK** | Leave open. Only needed for debug purposes |

[1] Signals must be accessible for regulatory approving
[2] It is strongly recommended to use hardware flow control in both directions. Not using flow control can cause loss of data.

*Table 9: Handling of Unused Signals*

# 6. ELECTRICAL CHARACTERISTICS

## 6.1. 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.

| Symbol | Item | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| **VSUP** | Supply voltage | | -0,3 | | 3,6 | V |
| **$V_{Pin}$** | Voltage on any pin | | -0,3 | | VSUP+0,3 ≤ 3,6 | V |
| **$P_{RFin}$** | RF input level | | | | 10 | dBm |
| **$I_{NFC1/2}$** | NFC antenna pin current | | | | 80 | mA |
| **$T_{stg}$** | Storage temperature range | | -40 | | +125 | °C |

*Table 10: Absolute Maximum Ratings*

## 6.2. Operating Conditions

| Symbol | Item | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| **VSUP** | Supply voltage | DC/DC not enabled | 1,7 | 3,0 | 3,6 | $V_{DC}$ |
| | | DC/DC enabled | 1,7 | 3,0 | 3,6 | $V_{DC}$ |
| **$t_{Vrise}$** | Supply rise time | 0V to 1,7V | | | 60 | ms |
| **$T_{op}$** | Operating temperature range | | -40 | | +85 | °C |

*Table 11 Operating Conditions*

## 6.3. DC Parameter

All Module I/O pins are connected directly to the Nordic nRF52832 chip without signal conditioning except for some pull-up/pull-down resistors (as indicated). Therefore, the electrical characteristics are as documented in the Nordic nRF52832 data sheet [7].

### 6.3.1. General Purpose I/O (GPIO)

$T_{amb}$ = 25°C VSUP = 1,7 to 3,6V

| Symbol | Item | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $V_{IL}$ | Input Low Voltage | | | | 0,3*VSUP | V |
| $V_{IH}$ | Input High Voltage | | 0,7*VSUP | | | V |
| $V_{OL}$ | Output Low Voltage | | | | VSS + 0,4 | V |
| $V_{OH}$ | High-Level Output Voltage | | VSUP-0,4 | | | V |
| $I_{OL}/I_{OH}$ | Low and High Level Output Current | drive = std | | | 0,5 | mA |
| | | drive = hi (1) | | | 5 | mA |
| $R_{PU}/R_{PD}$ | pull-up/down resistor | | 11 | 13 | 16 | kΩ |
| $C_I$ | Pad Capacitance | | | 3,0 | | pF |

(1) maximal number of pins (per package) with high drive is 3

*Table 12: DC Characteristics, Digital IO*

### 6.3.2. Reset

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

$T_{amb}$ = 25°C VSUP = 1,7 to 3,6V

| Symbol | Item | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $V_{IL}$ | Low-Level Threshold | | | 0,25* VSUP | | V |
| $V_{IH}$ | High-Level Threshold | | | 0,75* VSUP | | V |
| $R_{PU}$ | pull-up resistor | | 11 | 13 | 16 | kΩ |
| $C_I$ | Input Capacitance | | | 3 | | pF |

*Table 13 Reset Characteristics*

## 6.4. Power Consumption and Power-Down Modes

### 6.4.1. BlueMod+S50/AI CEN FW

The following values are typical power consumption values in different states of operation. BlueMod+S50 configured as a peripheral device.

VSUP = 3,0V, $T_{amb}$ = 25°C, all GPIO lines left open

| Mode | Condition | Note | Current Consumption ($I_{Avg}$) Tx power: +4dBm (max) | | Unit |
|---|---|---|---|---|---|
| | | | AI | | |
| **System off** | CPU off, Radio inactive, 32k clock off, SRAM Retention off, wakeup by RESET | | 0,3 | | µA |
| **Reset** | Device hold in Reset | | 0,4 | | mA |
| **UICP active *and* serial interface down** | Standby, Advertising Off (Radio inactive) | | 11,1 | | µA |
| | Standby, Advertising, 3 channels advertising interval: 1.28s | | 22,1 | | µA |
| | Connected, connection interval: 1.28s | (1) | 15,6 | | µA |
| **UICP not active *or* serial interface up** | Idle, Advertising Off (Radio inactive) | | 1,3 | | mA |
| | Advertising, 3 channels advertising interval: 1.28s | | 1,3 | | mA |
| | Connected, connection interval: 1.28s | (1) | 1,3 | | mA |
| | Connected, connection interval: 40ms | (1,2) | 1,4 | | mA |
| | Connected, connection interval: 7,5ms | (1) | 1,7 | | mA |
| | Connected, connection interval: 7,5ms, data traffic 115 kbit/s at the serial port | (1) | 2,6 | | mA |

(1) connection parameters are setup by the central device when connection is established
(2) these are a typical connection parameter used by an iPhone, iPad, or iPad mini device in the central device role

*Table 14: Supply Current BLE Terminal I/O Profile, Peripheral Device Role*

## 6.5. RF Performance

### 6.5.1. BLE Receiver

VSUP = 3,0V, $T_{amb}$ = +25°C, PHY type: LE 1Msps

| Receiver | Conditions | Min | Typ | Max | BT Spec | Unit |
|---|---|---|---|---|---|---|
| Sensitivity | PER ≤ 30,8% | -93,0 | | | ≤ -70 | dBm |
| max received input level | PER ≤ 30,8% | | 0 | | ≥ -10 | dBm |
| max PER report integrity Wanted signal level -30dBm | 2,426 Ghz | | 50 | | 50 < PER < 65,4 | % |
| Blocker Power Wanted signal level -67dBm | 0,030 – 2,000 | -30 | | | -30 | dBm |
| | 2,000 – 2,400 | -35 | | | -35 | |
| | 2,500 – 3,000 | -35 | | | -35 | |
| | 3,000 – 12,75 | -30 | | | -30 | |
| Adjacent channel Selectivity C/I | co-channel | | 10 | | ≤21 | dB |
| | F = F0 + 1 MHz | | 1 | | ≤15 | dB |
| | F = F0 - 1 MHz | | 1 | | ≤15 | dB |
| | F = F0 + 2 MHz | | -25 | | ≤-17 | dB |
| | F = F0 - 2 MHz | | -25 | | ≤-15 | dB |
| | F = F0 + 3 MHz | | -51 | | ≤-27 | dB |
| | F = Fimage | | -30 | | ≤-9 | dB |
| max intermodulation level | | | -36 | | ≥-50 | dBm |

*Table 15: RF Performance BLE Receiver @1Msps*

### 6.5.2. BLE Transmitter

VSUP = 1,7V to 3,6V, $T_{amb}$ = +25°C, PHY type: LE 1Msps

| Transmitter | Conditions | Min | Typ | Max | BT Spec | Unit |
|---|---|---|---|---|---|---|
| RF Transmit Power | - | | 4 | | -20 to +10 | dBm |
| Programmable RF Transmit Power Range | - | -20 | | +4 | | dBm |
| RF Transmit Power "Whisper Mode" | - | | -40 | | N/A | dBm |
| Adjacent Channel Power ACP | F = F0 ± 2MHz | | -48 | | ≤ -20 | dBm |
| | F = F0 ± 3MHz | | -55 | | ≤ -30 | |
| | F = F0 ± > 3MHz | | <-60 | | ≤ -30 | |
| Modulation Characteristics | Δf1avg | | 255 | | 225 ... 275 | kHz |
| | Δf2max *Thrsh. 185kHz* | | 100 | | ≥ 99,9 | % |
| | Δf2avg / Δf1avg | | 1,0 | | ≥ 0,8 | |
| Carrier Frequency Offset and drift | Avg Fn | | ±20 | | ± 150 | kHz |
| | avg drift | | 5 | | ≤ 50 | kHz |
| | max drift rate | | 5 | | ≤ 20 | kHz/50µs |

*Table 16: RF Performance BLE Transmitter @1Msps*

## 6.6. Antenna-Gain and Radiation Pattern for BlueMod+S50/AI

If BlueMod+S50/AI is integrated into an end product while the recommendations depicted in chapter 7.4 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.

Typical antenna gain is about 2 dBi.

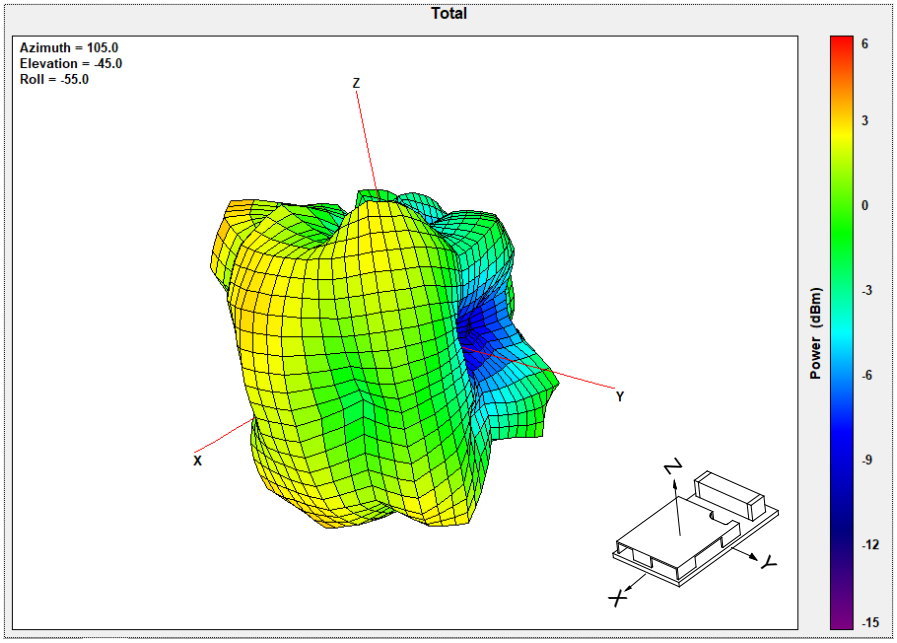


*Figure 17: Typical Antenna Radiation Pattern at 2402MHz*

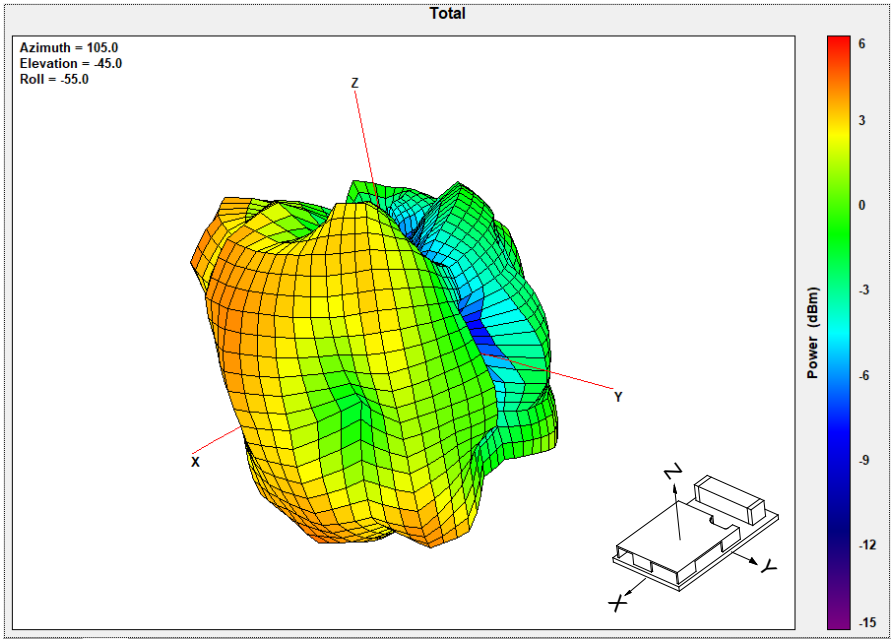


*Figure 18: Typical Antenna Radiation Pattern at 2440MHz*

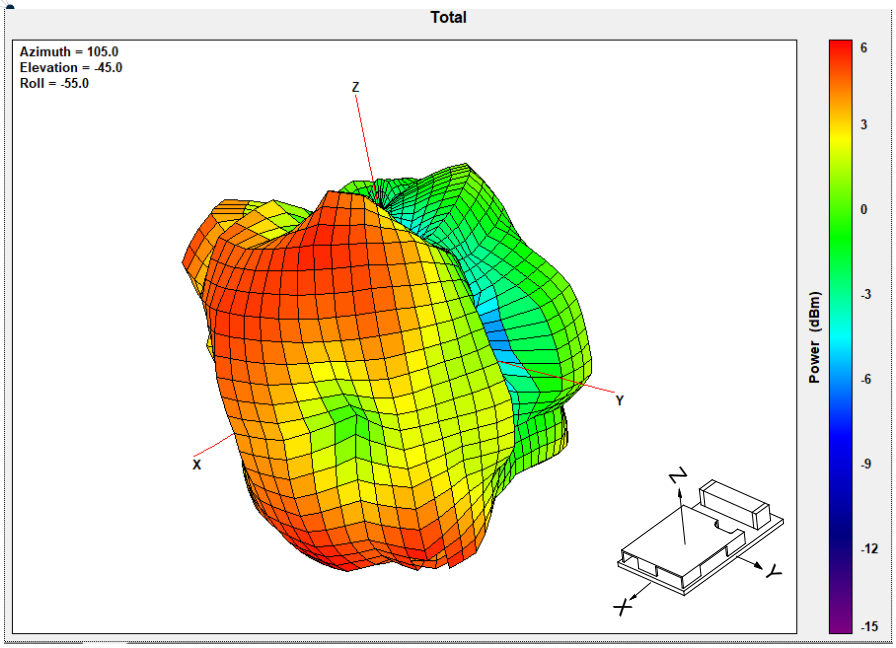


*Figure 19: Typical Antenna Radiation Pattern at 2480MHz*

# 7. MECHANICAL CHARACTERISTICS

**Note/Tip:** All dimensions are in millimeters.

## 7.1. Dimensions

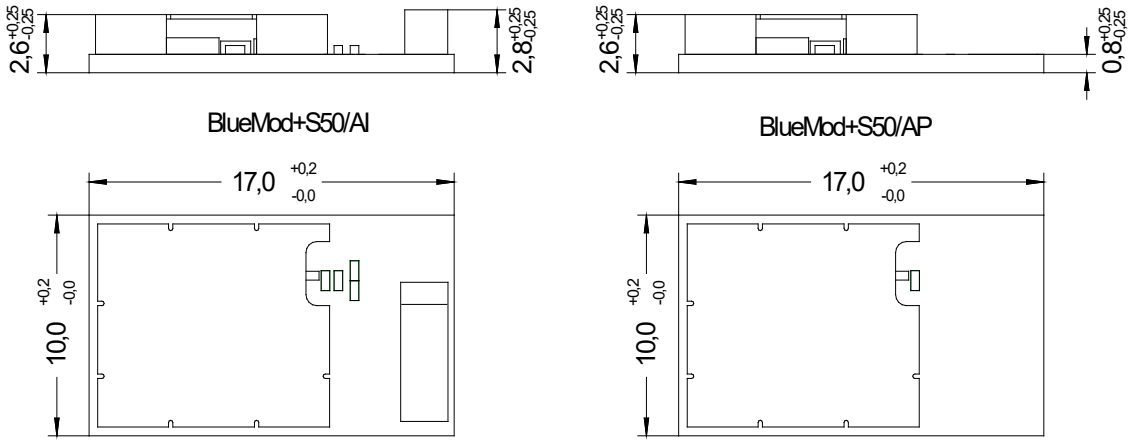


*Figure 20: BlueMod+S50/AI an /AP Dimensions*

## 7.2. Recommended Land Pattern

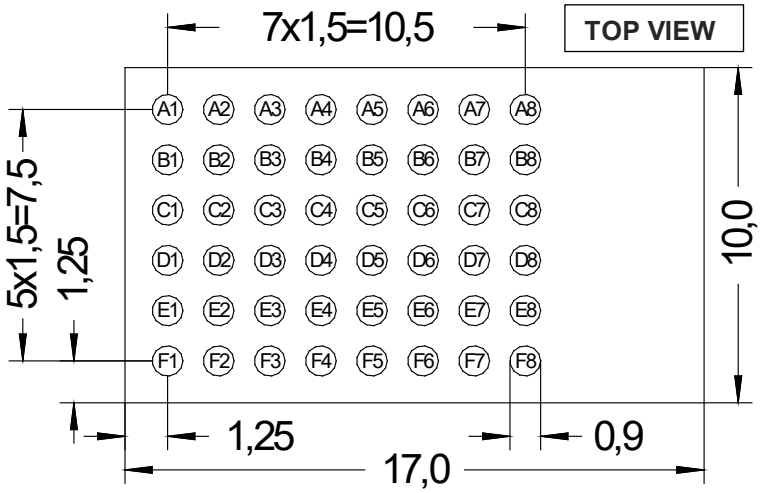


*Figure 21: BlueMod+S50 Land Pattern*

## 7.3. Re-flow Temperature-Time Profile

The data here is given only for guidance on solder and must 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.

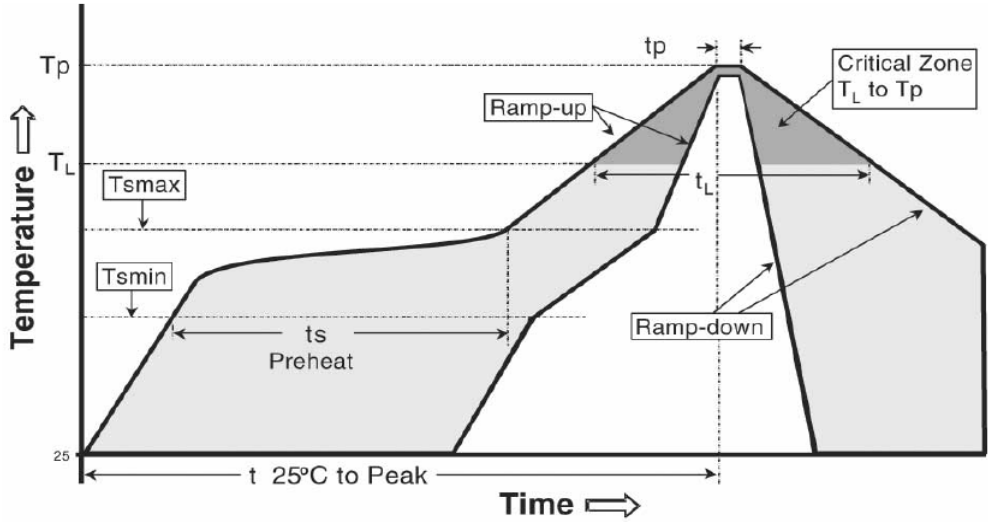


*Figure 22: Soldering Temperature-Time Profile (For Reflow Soldering)*

| 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 reflow is prohibited due to module weight.

Devices will withstand the specified profile and will withstand up to one re-flows to a maximum temperature of 260°C. The reflow soldering profile may only be applied if the BlueMod+S50 resides on the PCB side looking up. Heat above the solder eutectic point while the BlueMod+S50 is mounted facing down may damage the module permanently.

## 7.4. AI Layout and Placement Recommendation

BlueMod+S50/AI comprises a ceramic antenna, which as a component is soldered to the circuit board. The performance of the antenna must 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.

To achieve best radio performance for BlueMod+S50/AI, it is recommended to use the placement and layout shown in Figure 23 and Figure 24. This is a "corner placement" meaning the module 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 7.6).

Please note that for best possible performance the antenna should be directed away from the application PCB as shown in Figure 23.

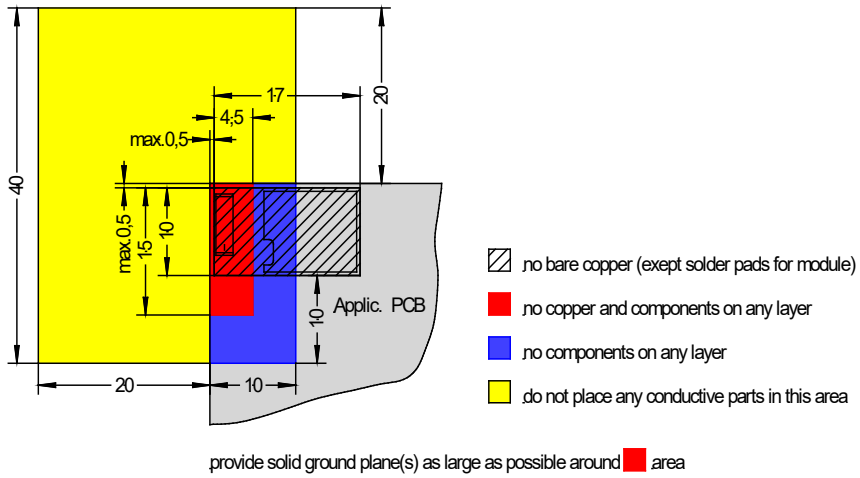


*Figure 23: AI Placement Recommendation*

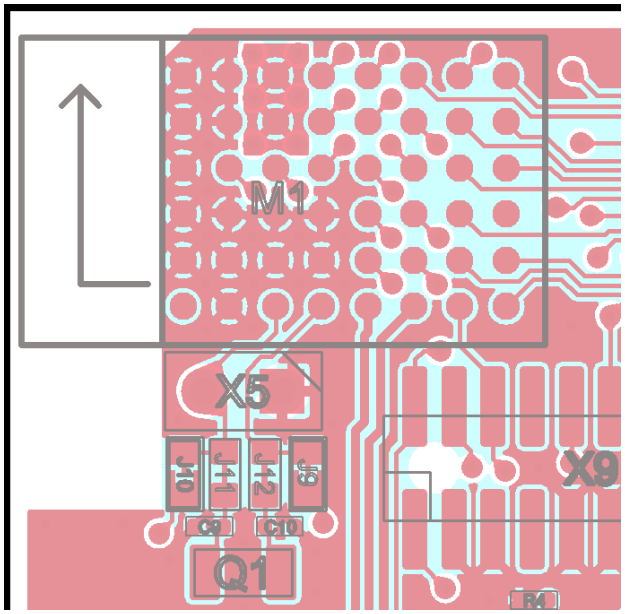


*Figure 24: AI Layout Recommendation*

## 7.5. OEM Layout and Antenna Selection in Respect to RED/FCC/IC Certification

Placement for BlueMod+S50/AP, is not restricted. For antenna port connection it is recommended to use a layout like shown in Figure 26.

To keep specified radio power values the impedance of the RF trace connected to the antenna port shall be 50 Ohms. Impedance of the RF trace depends on customer pcb. Use a calculator for coplanar waveguides e.g. "TXline" to determine track width and gap between ground and RF track.

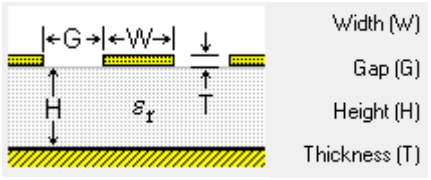


*Figure 25: Coplanar Waveguide Sample*

*Figure 26: AP Antenna Port Layout Recommendation*

OEM integrators are free with choosing a trace design suitable for their end product and selecting an antenna according to their needs. Only if it is desired to re-use the RED/FCC and IC certification of the BlueMod+S50/AP the following restrictions apply.

1. Use External Antenna: antenova part no B4844-R
   Please note that for FCC Certification it is mandatory to use a reverse SMA connector instead of using a standard SMA male connector on the antenna side.
2. Exactly follow the Trace Design with below given parameters
   The RF trace on the Telit standalone test board used for homologation lab testing is placed on the top side of a standard FR4 4 layer PCB with $\varepsilon_r \approx 4,7$ and designed as microstrip transmission line with the below given parameters.
   In many cases the antenna is required to be mounted in another position on the end product. This could be achieved by using SMA/SMA coax cables.
   a. Trace Design Impedance 50R Calculation

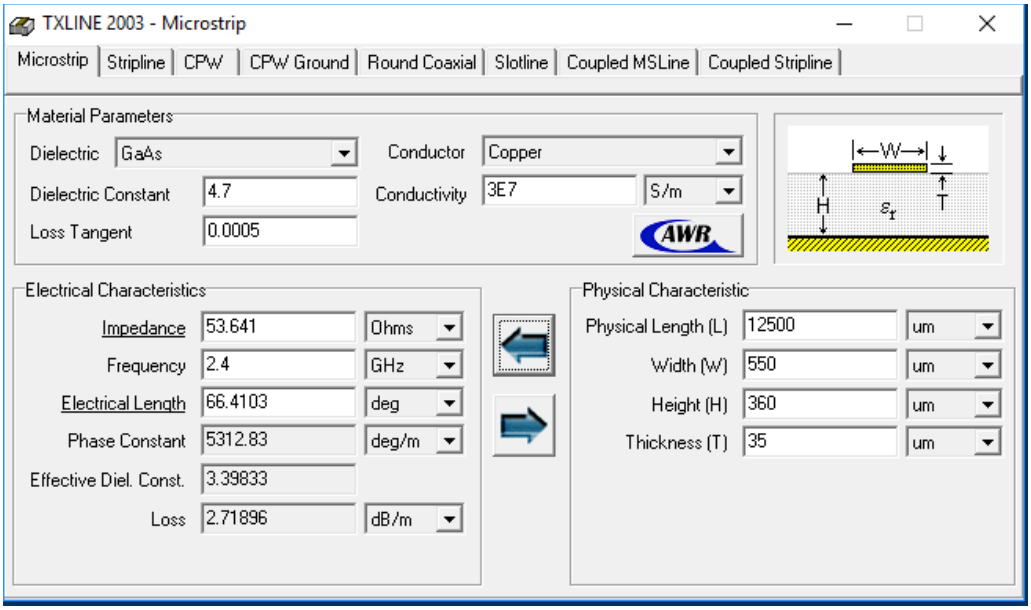


*Figure 27: RF Trace Impedance Calculation Parameters*

b. Trace Design Geometry

It is important to avoid coupling of noise from digital lines to the RF trace and also to avoid RF signal coupling into power supply or analogue lines. Therefore, the following RF trace design geometry has been successfully used on the Telit standalone test board and should be followed by OEM's re-using BlueMod+S50/AP RED/FCC or IC Certifications.

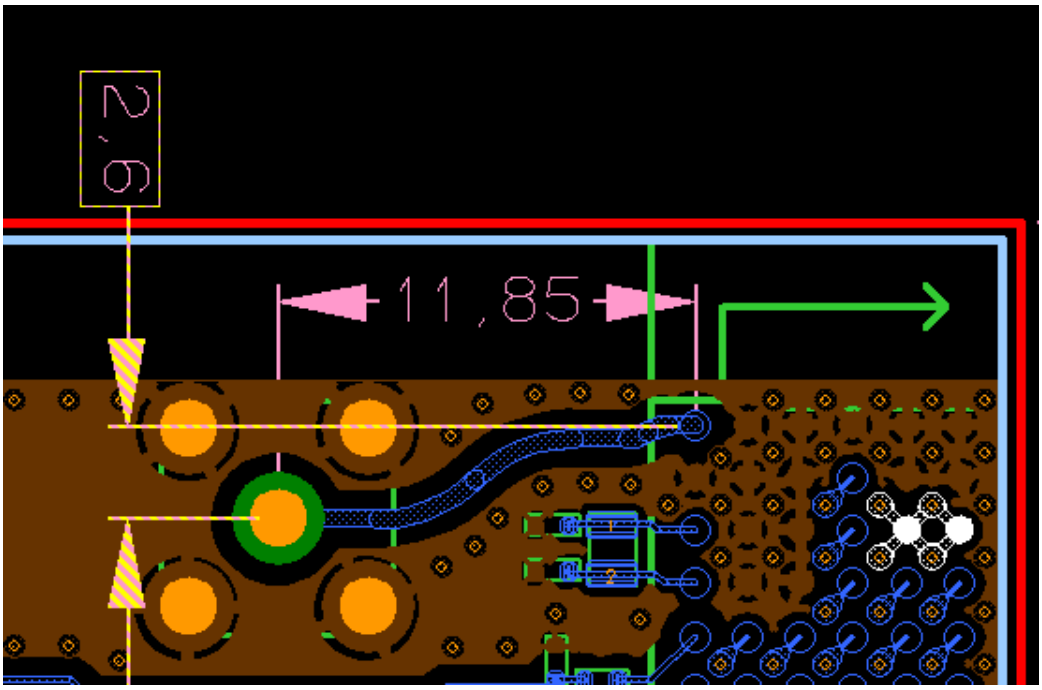


*Figure 28: RF Trace Design Geometry*

## 7.6. 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

## 7.7. Safety Guidelines

According to SAR regulation EN 62479:2010 the BlueMod+S50/AI is not intended to be used in close proximity to the human body. Please refer to above-mentioned regulation for more specific information.

In respect to the safety regulation EN 62368-1:2014 + AC:2015 all conductive parts of the BlueMod+S50 are to be classified as SELV circuitry. OEM's implementing the BlueMod+S50 in their products should follow the isolation rules given in regulation EN 62368-1:2014.

The PCB material of the BlueMod+S50 is classified UL-94V0.

## 7.8. Cleaning

In general, cleaning the modules mounted on the host board is strongly discouraged. Residues between module and host board cannot be easily removed with any cleaning method.

- Cleaning with water or any organic solvent can lead to capillary effects where the cleaning solvent is absorbed into the gap between the module and the host board. The combination of soldering flux residues and encapsulated solvent could lead to short circuits between conductive parts. The solvent could also damage any labels.
- Ultrasonic cleaning could damage the module permanently. Especially for crystal oscillators the risk of damaging is very high.

# 8. APPLICATION DIAGRAM

Figure 29 shows a typical application of BlueMod+S50. The module is connected to some MCU running the application layer. MCU and BlueMod+S50 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.

All other module pins may be left unconnected.

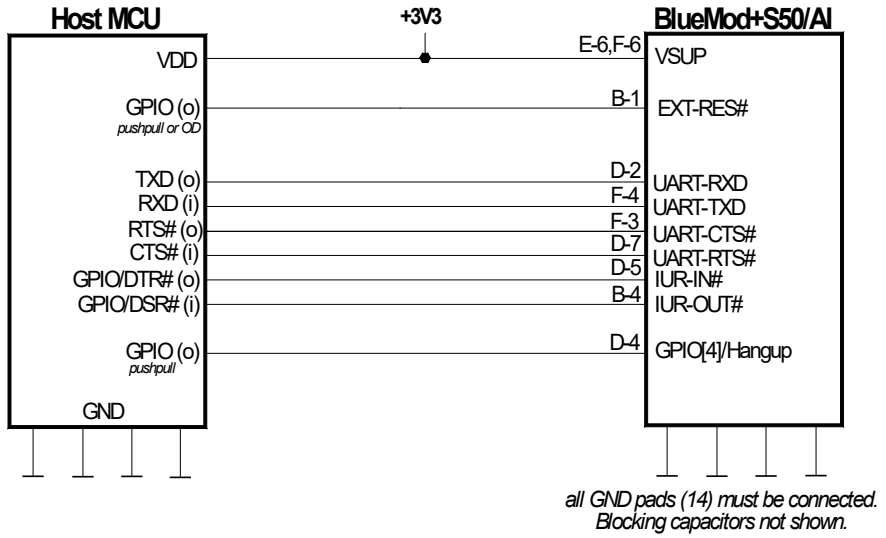


*Figure 29: Typical Application Schematics*

# 9. COMPLIANCES

The BlueMod+S50/AI and BlueMod+S50/AP have been tested to fully comply with 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 an OEM end product. However, Telit provides CE tested modules for customers to ease CE compliance assessment of end products and to minimize test effort.

OEM end product compliance assessment must be done for every end product by the OEM's certification manager. It should be noted that compliance assessment doesn't necessarily mean re-testing in the test lab. Telit test reports are available on request and can be used to drastically reduce the test plan and compliance testing costs.

**Note/Tip:** All certifications and declarations, except RoHS and ReacH, are only valid for the BlueMod+S50 running with Telit FW. If the FLASH is erased and a customer specific FW is loaded all certifications must be re-evaluated or renewed.

**Note/Tip:** All measurements and certifications have been done for the BlueMod+S50/AI with internal ceramic antenna and with a specific external antenna for the BlueMod+S50/AP, which offers the RF signal on a module pin. For the BlueMod+S50/AP the RED; FCC and IC certifications stay valid if the OEM design follows exactly the standalone test board trace design and uses exactly the same antenna given in chapter 7.5 OEM Layout and Antenna Selection in Respect to RED/FCC/IC Certification.

If this trace design is not the same or this specific antenna is not used the following actions should be done.

- RED Re-assess RED compliance
- FCC Class II Permissive Change
- IC Class II Permissive Change

## 9.1. Declaration of Conformity CE

The BlueMod+S50/AI and the BlueMod+S50/AP do fully comply with the essential requirements of the following EU directives:

- RED 2014/53/EU

- RoHS 2011/65/EC

The actual version of EU Declaration of Conformity (EU DoC) can be downloaded from

*https://www.telit.com/RED*

## 9.2. FCC Compliance

The BlueMod+S50/AI and the BlueMod+S50/AP have been tested to fulfill the FCC requirements. Test reports are available on request.

### 9.2.1. FCC Grant

The actual version of the FCC Grant can be downloaded from the Telit Download Zone:

*https://www.telit.com/support-training/download-zone/*

Take note that you must register to get access to the Download Zone.

### 9.2.2. FCC Statement

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

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.

### 9.2.3. FCC Caution

**Warning:** Changes or modifications made to this equipment not expressly approved by Telit may void the FCC authorization to operate this equipment.

### 9.2.4. 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.

#### 9.2.5. FCC RF-exposure Statement

The BlueMod+S50/AI and BlueMod+S50/AP, if used with the antenna described in chapter 7.5 OEM Layout and Antenna Selection in Respect to RED/FCC/IC Certification, do comply with the FCC/IC RF radiation exposure limits set forth for an uncontrolled environment.

According to table 1B of 47 CFR 1.11310 "Limits for Maximum Permissible Exposure (MPE), Limits for General Population / Uncontrolled Exposure" the power density at 20 cm distance to the human body is well below the limit of 1mW/cm2.

**Note/Tip:** For the BlueMod+S50/AI the distance to the human body may be 0cm. The same applies for the BlueMod+S50/AP if the specific antenna stated in 7.5 OEM Layout and Antenna Selection in Respect to RED/FCC/IC Certification is used. But if a different antenna is used, MPE must be re-evaluated.

#### 9.2.6. FCC Labeling Requirements for the End Product

Any End Product integrating the BlueMod+S50/AI or BlueMod+S50/AP must be labeled with at least the following information:

This device contains transmitter with:

FCC ID: RFR-S50

IC: 4957A-S50

### 9.3. IC Compliance

The BlueMod+S50/AI and BlueMod+S50/AP have been tested to fulfill the IC requirements. Test reports RSS-210 of Industry Canada are available on request.

#### 9.3.1. IC Grant

The actual version of the IC Grants can be downloaded from the Telit Download Zone:

*https://www.telit.com/support-training/download-zone/*

Take note that you must register to get access to the Download Zone.

### 9.3.2. IC Statement

(i) Ce dispositif doit être installé et exploité dans une enceinte entièrement fermée afin de prévenir les rayonnements RF qui pourraient autrement perturber la navigation aéronautique. L'installation doit être effectuée par des installateurs qualifiés, en pleine conformité avec les instructions du fabricant.

(ii) Ce dispositif ne peut être exploité qu'en régime de non-brouillage et de non-protection, c'est-à-dire que l'utilisateur doit accepter que des radars de haute puissance de la même bande de fréquences puissent brouiller ce dispositif ou même l'endommager. D'autre part, les capteurs de niveau à propos desquels il est démontré qu'ils perturbent une exploitation autorisée par licence de fonctionnement principal doivent être enlevés aux frais de leur utilisateur.

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.

Cet appareil est conforme aux normes RSS exemptes de licence d'Industrie Canada. L'utilisation est soumise aux deux conditions suivantes:

(1) cet appareil ne doit pas causer d'interférences, et

(2) cet appareil doit accepter toute interférence, y compris les interférences susceptibles de provoquer un fonctionnement indésirable de l'appareil.

***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.

### 9.3.3. IC Caution

**Warning:** Changes or modifications made to this equipment not expressly approved by Telit may void the IC authorization to operate this equipment.

### 9.3.4. IC RF-exposure Statement

This equipment is portable device. According to RSS-102 Issue 5 §2.5.1 Exemption Limits for Routine Evaluation – SAR Evaluation Table 1, the allowed distances to the human body for products implementing the BlueMod+S50/AI or BlueMod+S50/AP can be calculated

as follows. If the intended use of the end product asks for smaller distances a SAR evaluation must be repeated with the end product.

- Max. RF output power is +3.5dBm
- Antenna peak Gain is +3dBi
- Resulting max. RF output power is +6.5dBm = 4.5mW < 7mW
- Table 1 of RSS-102 Issue 5 §2.5.1 shows that for 2450MHz the distance at 7mW should be ≥ 1cm

If the BlueMod+S50/AP is used with a different antenna as stated in 7.5OEM Layout and Antenna Selection in Respect to RED/FCC/IC Certification, SAR evaluation has to be re-newed.

### 9.3.5. IC Labeling Requirements for the End Product

Any end product integrating the BlueMod+S50/AI or BlueMod+S50/AP must be labeled with at least the following information:

This device contains transmitter with

FCC ID: RFR-S50

IC-ID: 4957A-S50

### 9.3.6. IC Label Information BlueMod+S50

The BlueMod+S50/AI and the BlueMod+S50/AP show the IC-ID on the product label.

Model: BlueMod+S50

**The IC-ID is: 4957A-S50**

## 9.4. Bluetooth Qualification

The BlueMod+S50 is a qualified design according to the Bluetooth Qualification Program Reference Document (PRD) V2.3.

The Declaration ID is:

**D036717**

The Qualified Design ID is:

**108346**

For further information about marking requirements of your product attention should be paid the Bluetooth Brand Usage Guide at

*https://www.bluetooth.org/en-us/bluetooth-brand/bluetooth-brand*

According to the Bluetooth SIG rules (Bluetooth Declaration Process Document – DPD) you must complete a Product Listing and Declaration of Compliance (DoC) referencing the Qualified Design (QDID) for your product. For further information see www.Bluetooth.org or contact Telit.

## 9.5. RoHS Declaration

RoHS evaluation is in progress.

## 9.6. Anatel Certification

The BlueMod+S50 has been certified in Brazil by Anatel.


"Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados"

"This equipment is not entitled to protection against harmful interference and must not cause interference in duly authorized systems"

BlueMod+S50 Homologation # 05455-19-02618

# 10. PACKING

The BlueMod+S50 modules are packed either as Tape&Reel or as tray packing.

## 10.1. Tape&Reel Packing

The BlueMod+S50 modules are packed using carrier tape in this orientation.

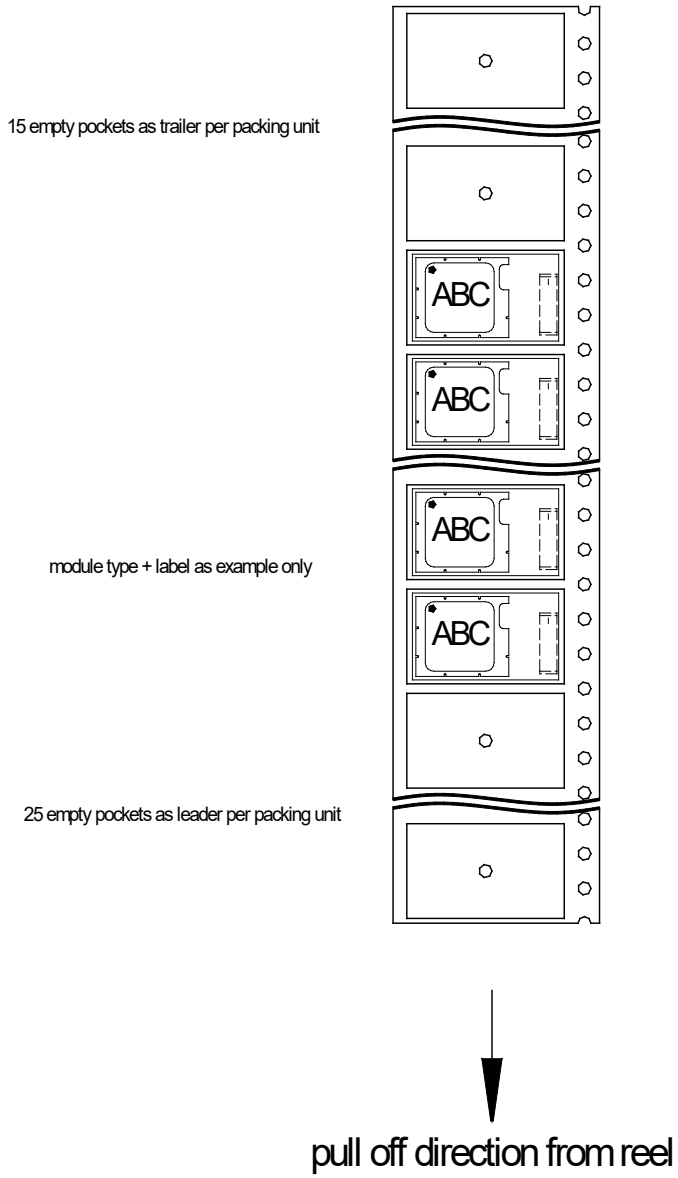


*Figure 30: Module Orientation in Carrier Tape*

### 10.1.1. Tape

The dimensions of the tape are shown in Figure 31 (values in mm):

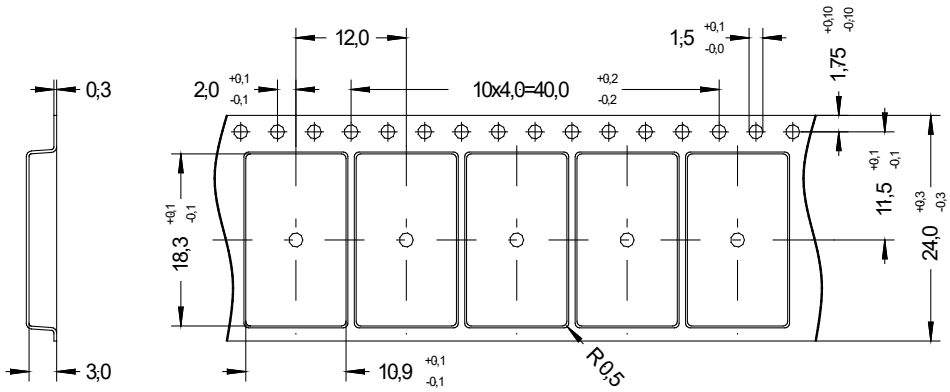


*Figure 31: Carrier Tape Dimensions*

### 10.1.2. Reel

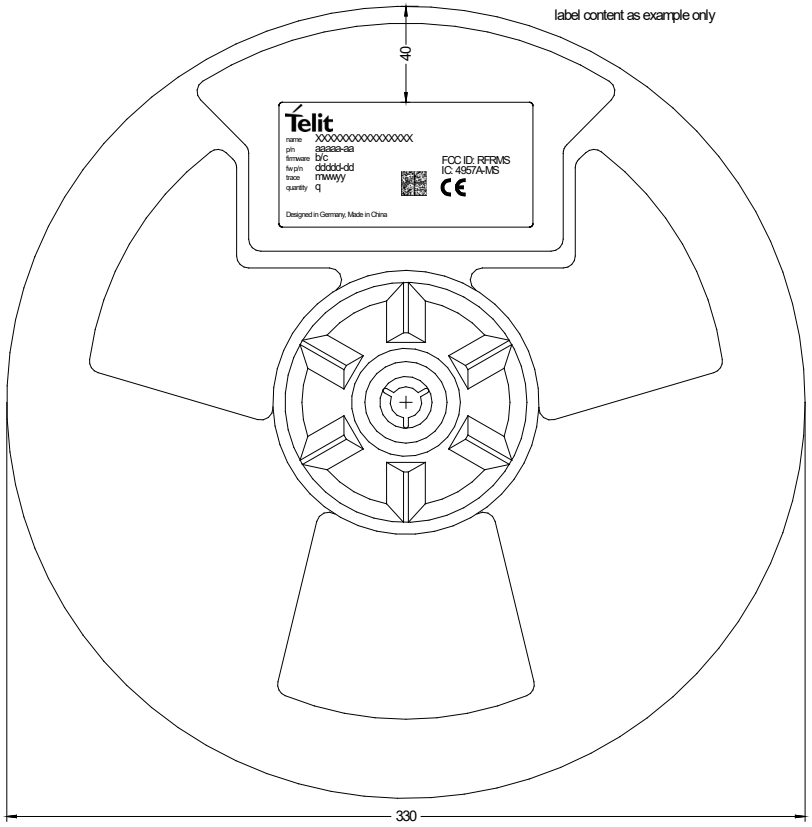


*Figure 32: Reel Dimensions*

## 10.2. Tray Packing

### 10.2.1. Module Orientation

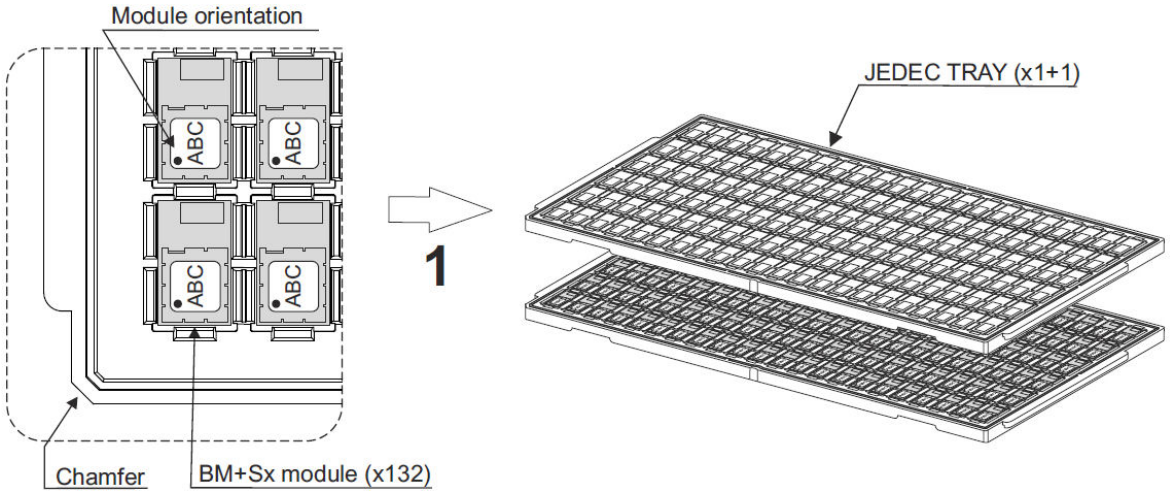


*Figure 33: Module Orientation on Tray*

### 10.2.2. Tray Dimensions

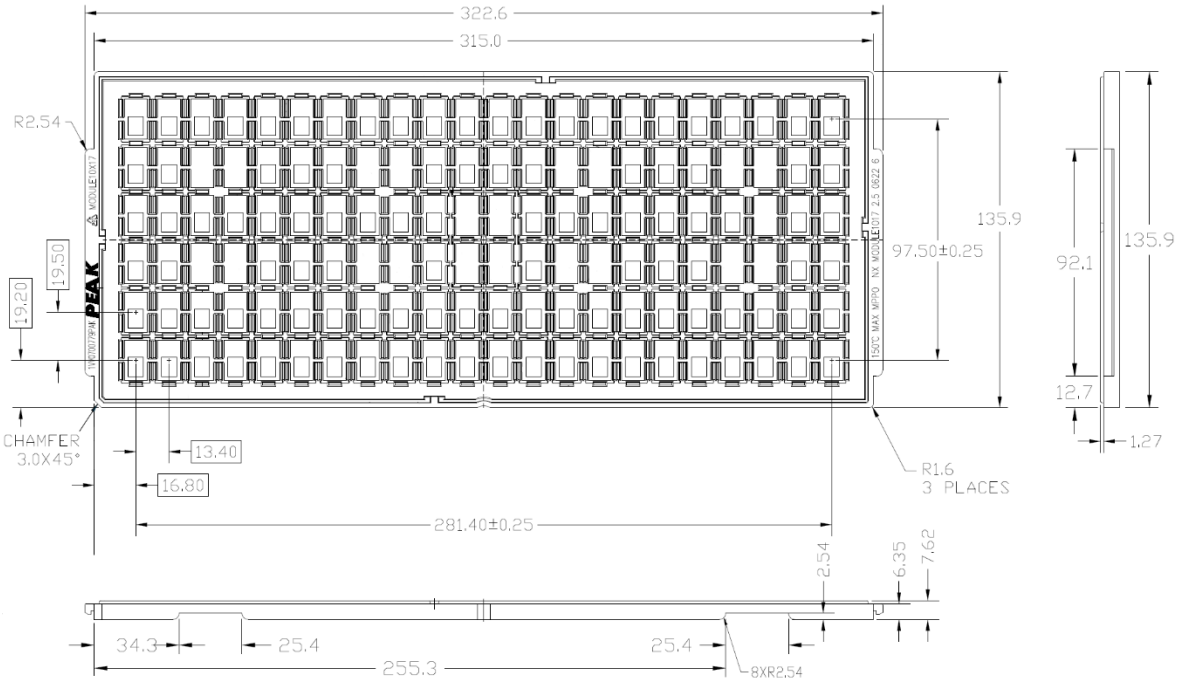


*Figure 34: Tray Dimensions*

## 10.3. Moisture Sensitivity Level

Moisture Sensitivity Level (MSL) for BlueMod+S50 is 3.

# 11. EVALUATION KIT

Following evaluation kits are available:

- BLUEEVA+S50/AI

Please refer to [5] for additional information's.

# 12. PRODUCT AND SAFETY INFORMATION

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## 12.3. Safety Recommendations

Make sure the use of this product is allowed in your country and in the environment required. The use of this product may be dangerous and must be avoided in areas where:

- it can interfere with other electronic devices, particularly in environments such as hospitals, airports, aircrafts, etc.
- there is a risk of explosion such as gasoline stations, oil refineries, etc. It is the responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for correct wiring of the product. The product must be supplied with a stabilized voltage source and the wiring must be conformed to the security and fire prevention regulations. The product must be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions must be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible for the functioning of the final product. Therefore, the external components of the module, as well as any project or installation issue, must be handled with care. Any interference may cause the risk of disturbing the GSM network or external devices or having an impact on the security system. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module must be equipped with a proper antenna with specific characteristics. The antenna must be installed carefully to avoid any interference with other electronic devices and must guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator must assess the final product against the SAR regulation.

The equipment is intended to be installed in a restricted area location.

The equipment must be supplied by an external specific limited power source in compliance with the standard EN 62368-1:2014.

The European Community provides some Directives for the electronic equipment introduced on the market. All the relevant information is available on the European Community website:

https://ec.europa.eu/growth/sectors/electrical-engineering_en

# 13. GLOSSARY

| | |
|---|---|
| **CLK** | Clock |
| **CMOS** | Complementary Metal – Oxide Semiconductor |
| **CS** | Chip Select |
| **DTE** | Data Terminal Equipment |
| **ESR** | Equivalent Series Resistance |
| **GPIO** | General Purpose Input Output |
| **I/O** | Input Output |
| **MISO** | Master Input – Slave Output |
| **MOSI** | Master Output – Slave Input |
| **PCB** | Printed Circuit Board |
| **SPI** | Serial Peripheral Interface |
| **TTSC** | Telit Technical Support Centre |
| **UART** | Universal Asynchronous Receiver Transmitter |
| **USB** | Universal Serial Bus |
| **VNA** | Vector Network Analyzer |

# 14. DOCUMENT HISTORY

| Revision | Date | Changes |
|---|---|---|
| 4 | 2021-07-19 | Added Anatel Certification |
| 3 | 2021-05-05 | Updated Table 4: Testmode# / Boot0 Logic<br>Updated document to new Telit Template standards |
| 2 | 2018-07-31 | Added final power consumption values |
| 1 | 2018-03-26 | FCC and IC compliance updated<br>Added Bluetooth qualification |
| 0 | 2018-03-02 | Initial release |

From Mod.0818 rev.3

Connect to our site and contact our technical support team for any question

www.telit.com