



BlueMod+SR Hardware User Guide

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APPLICABILITY TABLE

PRODUCTS

- ■ BLUEMOD+SR/AI
- ■ BLUEMOD+SR/AP

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1. INTRODUCTION

1.1. Scope

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

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

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- TS-EMEA@telit.com
 - TS-AMERICAS@telit.com
 - TS-APAC@telit.com
- or
- TS-SRD@telit.com for global Bluetooth support

Alternatively, use:

<http://www.telit.com/support>

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

<http://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 feedback from the users of our information.

1.4. Text Conventions



Danger – This information **MUST** be followed or catastrophic equipment failure or bodily injury may occur.



Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.



Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.5. Related Documents

- [1] CD00171190.pdf Oct. 2011 Rev 14 (STM32_Reference)
- [2] CD00191185.pdf April 2011 Rev 8 (STM32_datasheet)
- [3] UICP+ UART Interface Control Protocol, 30507ST10756A
- [4] BlueMod+SR AT Command Reference, 80507ST10752A
- [5] BlueMod+SR Software User Guide, 1VV0301278

2. OVERVIEW

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



The term BlueMod+SR refers to the BlueMod+SR/AI and the BlueMod+SR/AP.

For detailed information about software interfaces refer to [4].

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

<http://www.telit.com/bluetooth/bluemod-sr/>



The integration of the BlueMod+SR module within user application shall be done according to the design rules described in this manual.

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2.1. Feature Summary

- Bluetooth specification V4.0 compliant
- Supports BR/EDR/LE
- Supports Dual Mode
- Fully qualified Bluetooth V4.0 Dual Mode BR/EDR/LE
- CE certified
- FCC, IC and KCC certified
- CSR8811 BlueCore08 and Application Processor inside
- Complete Co-location and Co-existence with 802.11 (AFH, Unity 3e+)
- Fast Connection Setup
- RF output power up to +7dBm with power control
- Supply Voltage range 2,5V to 3,6V, typical 3.3V
- Internal crystal oscillator (26 MHz and 14,7456 MHz)
- LGA Surface mount type: BlueMod+SR: 17 x 10 x 2.6 mm3
- Shielded to be compliant to FCC full modular approval
- Bluetooth enhanced data rate up to 2178kbps asymmetric
- Support for all Bluetooth power saving modes (Park, Sniff, Hold)
- Optional support for ultra-low-power mode
- Full 8- to 128-bit encryption
- High sensitivity design
- High-speed UART interface
- I2C interface
- SPI interface
- Up to 11 digital IO's for individual usage by embedded software
- Cortex-M3 STM32F103 core for embedded profiles or application software
- Manufactured in conformance with RoHS2
- Operating temperature -30 ... +85 °C
- Weight: 0,8 g

2.2. Applications

The BlueMod+SR can be used in different applications. Regardless if the application requires high throughput or low energy consumption, BlueMod+SR offers the best of both worlds. Some typical applications are described in this chapter.

Supported profiles are:

BR/EDR:

- SPP

LE:

- Terminal I/O
- GATT based LE profiles



Support for any additional profile is possible on request.

2.2.1. General Cable Replacement

The Serial Port Profile (SPP) on the BlueMod+SR can be used for UART data transfer. The connection is transparent for the user application and supports Secure Simple Pairing, making the pairing process easy and the connection secure.

2.2.2. Industry

Typical Bluetooth application include scanner, printer as well as automation controls. In the automation application area Bluetooth is mainly used for transport of I/O signals. Bluetooth low energy can be used to monitor and control motors, actuators, valves and entire processes.

2.2.3. Automotive

Modules are mainly used in aftermarket application like personal navigation devices, head units or audio applications. These applications are typically Bluetooth BR/EDR only.

2.2.4. Healthcare and Medical

The healthcare and medical market offers a lot of possible application for Bluetooth BR/EDR and Bluetooth Low Energy. 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.

2.2.5. Sports and Fitness

In the sports and fitness segment Bluetooth 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.

2.2.6. Entertainment

Bluetooth technology is already used in a wide variety of devices in the entertainment sector, namely set-top boxes / gaming consoles. Bluetooth low energy is expected to further increase the use of Bluetooth technology in devices like TV / DVD / STB / Media Player, remote controls, gaming controller, wireless mouse/keyboard.

3. BLOCK DIAGRAM

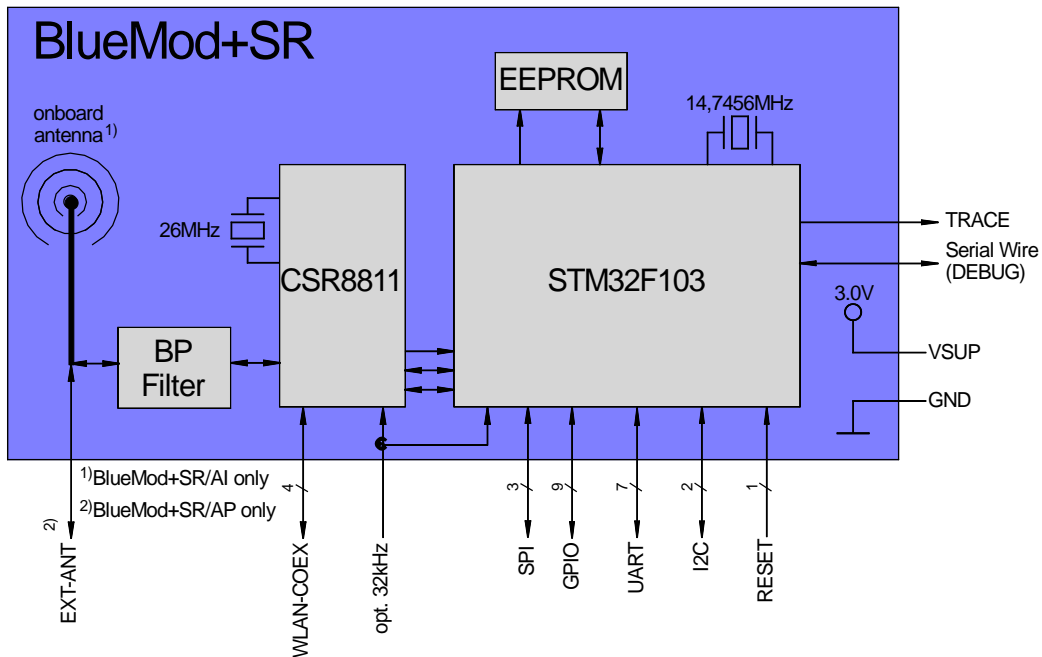


Figure 1: BlueMod+SR Block Diagram



BlueMod+SR/AI has an internal ceramic antenna whereas BlueMod+SR/AP provides for an 50Ω RF interface.

4. APPLICATION INTERFACE

4.1. Power Supply

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

Typical: 3,3V_{DC}, min.: 2,5V_{DC}, max.: 3,6V_{DC}, > 80mA peak

For optimal performance a stable supply is recommended. If a regulator is to be used, it should be a fast linear regulator placed as close as possible to the VSUP pins (E-6, F-6). Functionality has been verified with the following type: TOREX: XC6204x332xx.

If the regulator cannot be placed close to the BlueMod+SR, it is recommended to place an additional low ESR capacitor with at least 1μF as close as possible to the VSUP pins (E-6, F-6 or C-1).

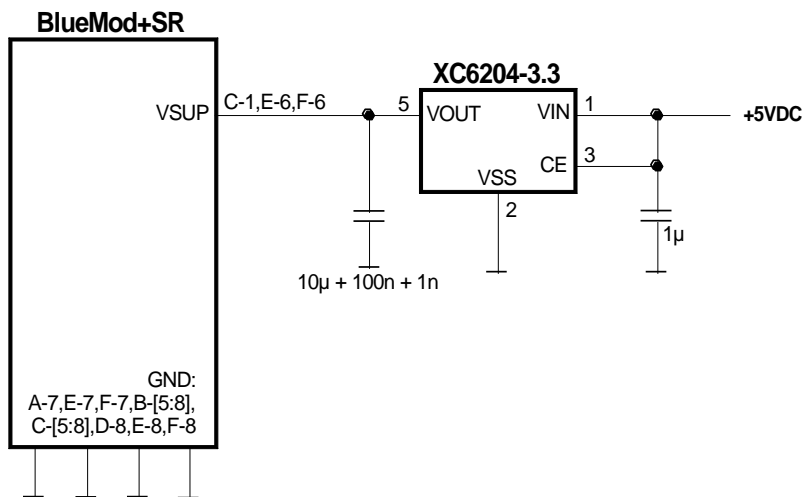


Figure 2: BlueMod+SR example power supply

4.2. Power-up/down Slew Rate

Table 1: Power up/down slew rate requirements

Parameter	Min	Max	Unit
VSUP rise time rate	1	∞	μs/V
VSUP fall time rate	20	∞	

The VSUP voltage has to rise continuously from 0V to the minimum VSUP operating voltage defined in Table 8: DC operating conditions.

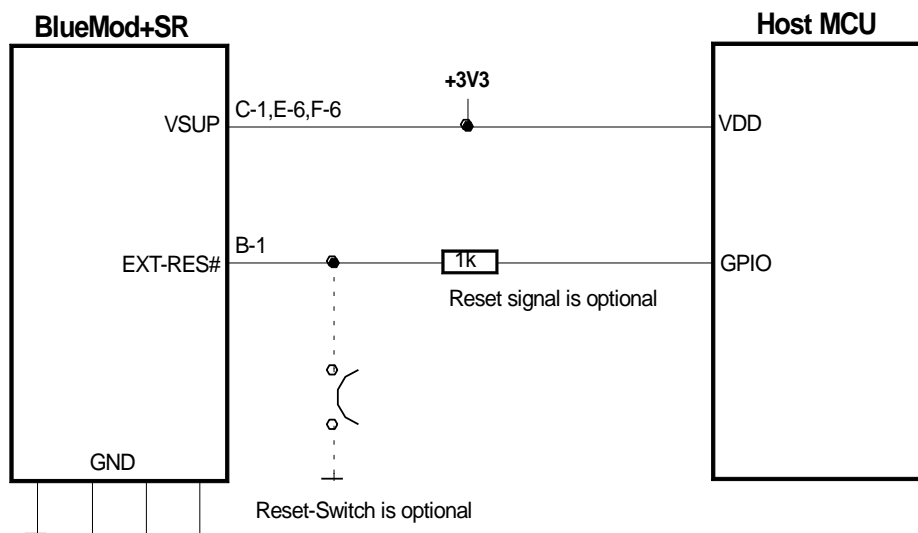
4.3. Reset

BlueMod+SR are equipped with circuitry for generating Power ON Reset from the internal core voltage. A reset is generated when the core voltage falls below typically 1,88V and is released when it rises above typically 1,92V.

By holding pin B-1 (EXT-RES#) at $\leq 0,5V$ for $\geq 5ms$, an external reset is generated. This pin has a fixed internal pull-up resistor ($R_{PU} = 30k\Omega \dots 50k\Omega$) and a capacitor to GND (100n) which acts as debounce filter. If EXT-RES# is not used, it may be left open.



EXT-RES# pin can also be output. Use an open drain device or push button to drive it low. EXT-RES# must not be connected to VSUP or driven to logic high-level directly. Provide for a 1k Ω series resistor when driving EXT-RES# from a CMOS output.



Please Note: BlueMod+SR has an open-drain output and approx. 40k internal pullup

Figure 3: BlueMod+SR example reset

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

Table 2: Pin states during reset

Pin Name	State BlueMod+SR
EXT-RES#	I/O with pull-up ⁽¹⁾ and 100n to GND – use open drain
SLCK	Input with weak pull-down ⁽²⁾
UART-TXD	Input floating
UART-RXD	Input floating
UART-RTS#	Input with pull-up resistor 470kΩ ⁽⁴⁾
UART-CTS#	Input floating
IUR-OUT#	Input with pull-up resistor 470kΩ ⁽⁴⁾
IUR-IN#	Input floating
GPIO[0:4, 6:7]	Input floating
GPIO[5]	Input with pull-up ⁽¹⁾
GPIO[8]	Output (JTDO)
BT-ACT	Input with weak pull-up ⁽²⁾
BT-STAT	Input with weak pull-up ⁽²⁾
WLAN-DNY	Input with weak pull-up ⁽²⁾
BT-PER	Input with weak pull-up ⁽²⁾
TESTMODE#	Input floating
BOOT0	Input with pull-down resistor 100kΩ ⁽⁴⁾
SWDIO	Input with pull-up ⁽¹⁾
SWCLK	Input with pull-down ⁽¹⁾

⁽¹⁾ pull-up, pull-down: R_{PU}, R_{PD} is typ. 40kΩ (30kΩ to 50kΩ)

⁽²⁾ weak pull-up, pull-down: See Table 12: DC characteristics, digital IO (CSR8811 related)

⁽³⁾ strong pull-up, pull-down: See Table 12: DC characteristics, digital IO (CSR8811 related)

⁽⁴⁾ a discrete resistor is used

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

4.4. Supply Voltage Monitor

Supply-under-voltage detection is implemented using the STM32 embedded supply voltage monitor PVD. When VSUP falls below a threshold VPVD (programmed to 2,38V ± 0,1V), a system reset will be asserted.

4.5. Serial Interface

The serial interface of BlueMod+SR 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).

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



Transmission speed may be limited by firmware. See corresponding command reference [4] for further information.

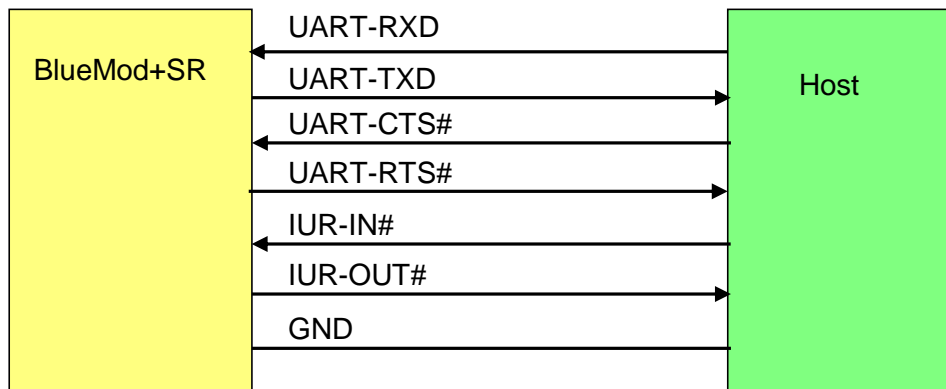


Figure 4: Serial interface signals

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 6.6.1) 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 SPP 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 [4] for a functional specification. GPIO[4] can be left unconnected if this feature is not used.

4.5.1. 3-Wire Serial Interface

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



It is strongly recommended to use hardware flow control. Not using flow control can cause a loss of data. When RTS/CTS is not used (3-wire interface) the DTE may send a limited number of Bytes (depending on buffer size) to the UART interface of the BlueMod+SR without losing data (e.g. 1 kByte by using firmware version 1.310).

4.5.2. UART Example Circuits

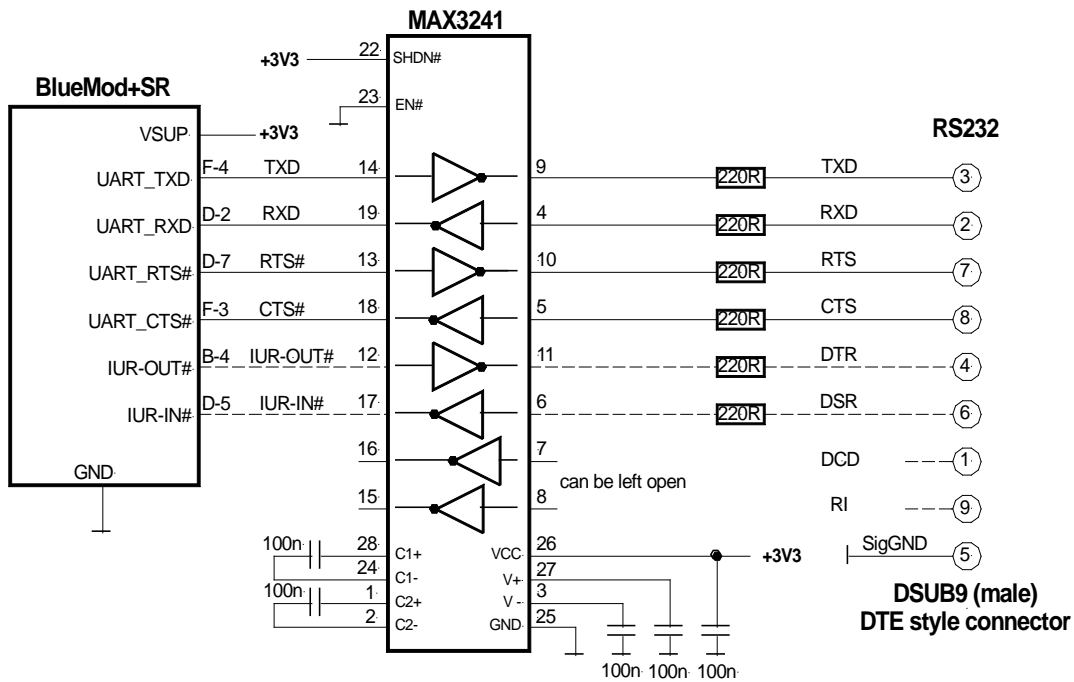


Figure 5: BlueMod+SR example serial interface (RS-232) supporting UICP

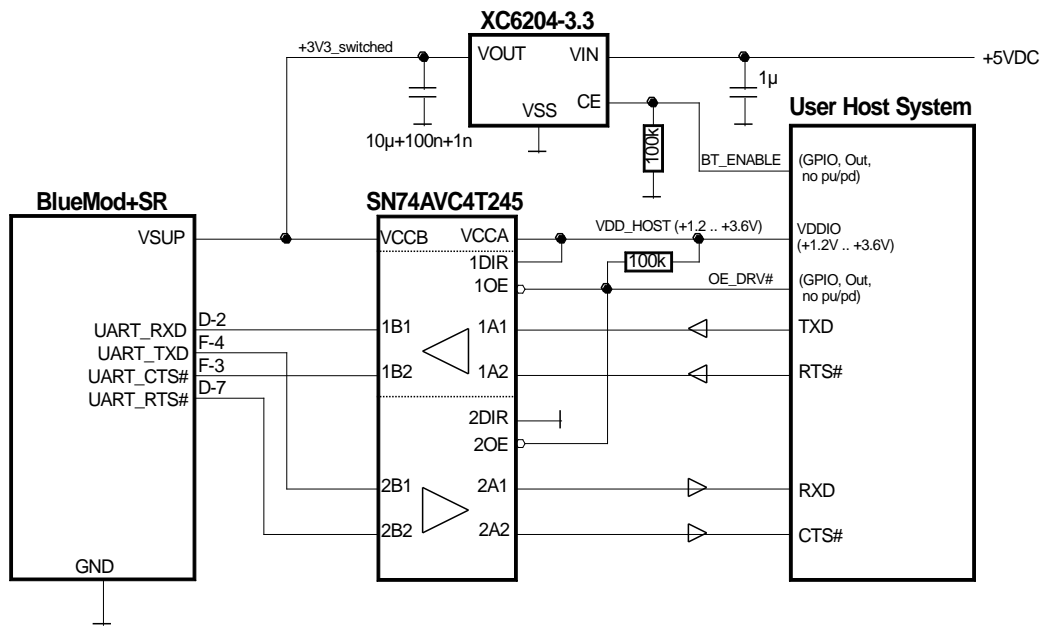


Figure 6: BlueMod+SR example serial interface (mixed signal level)

4.5.3. Baud Rate Deviation

The information on how to set standard or custom baud rates can be found in [4] BlueMod+SR AT Command Reference.

Assumed that on both sides the TX and RX baud rates are nominally equal, the total baud rate deviation is the sum of the host baud rate deviation and the BlueMod+SR baud rate deviation. The total baud rate deviation shall not exceed 2.5% to prevent loss of data. Some margin should be considered to cover deviations through the transmission line, e.g. due to asymmetry in low to high and high to low transitions.

The following table shows the BlueMod+SR baud rate deviation in percent of the standard baud rates caused by the baud rate generator granularity. Add 50ppm for the tolerance of the local oscillator over the full temperature range.

Table 3: Standard baud rates and deviations

Data rate (bit/s)	Deviation (%)
9600	0.0
19200	
38400	
57600	
115200	
230400	
460800	
921600	

Custom baud rates (CBR) are generated by a fractional divider according to the formula

$$\frac{BR}{Hz} = \frac{14.745.600}{16 \left[MANTISSA + \frac{FRACTION}{16} \right]}$$

Where data types are for MANTISSA unsigned int12 and for FRACTION unsigned int4. These values will be programmed to the fractional baud rate generator registers.

BR is the resulting baud rate which might not exactly be the targeted CBR due to the granularity error of the fractional baud rate generator.

Therefore the baud rate deviation can be calculated by the following procedure:

$$DIV = \frac{14.745.600}{16 CBR}$$

$$MANTISSA = \text{math.floor}(DIV)$$

$$FRACTION = \text{math.round}[16(DIV - MANTISSA)]$$

If FRACTION > 15

$$MANTISSA := MANTISSA + 1$$

$$FRACTION := 0$$

$$\frac{BR}{Hz} = \frac{14.745.600}{16 \left[MANTISSA + \frac{FRACTION}{16} \right]}$$

$$\frac{Deviation}{\%} = 100 \text{math.abs} \left[\frac{CBR - BR}{CBR} \right]$$

Explanation of used functions and expressions:

- `math.floor(x)` returns the largest integer less than or equal to x
- `math.round(x)` returns a number of x rounded to the nearest integer
- `math.abs(x)` returns the absolute value of x
- `DIV` floating variable
- `CBR` targeted customer baud rate
- `BR` actual resulting baud rate
- `MANTISSA` unsigned int12 baud rate register value
- `FRACTION` unsigned int4 baud rate register value

4.6. GPIO Interface

It is possible to use the programmable digital I/Os GPIO[0:8] on the BlueMod+SR. Their behavior has to be defined project specific in the firmware.

Unused GPIO pins can be left unconnected.

4.7. I²C Interface ¹

The I²C bus interface serves as an interface between the internal microcontroller and the serial I²C bus. It provides multimaster capability, and controls all I²C bus specific sequencing, protocol, arbitration and timing. It supports standard (100kHz) and fast (400kHz) speed modes.

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.

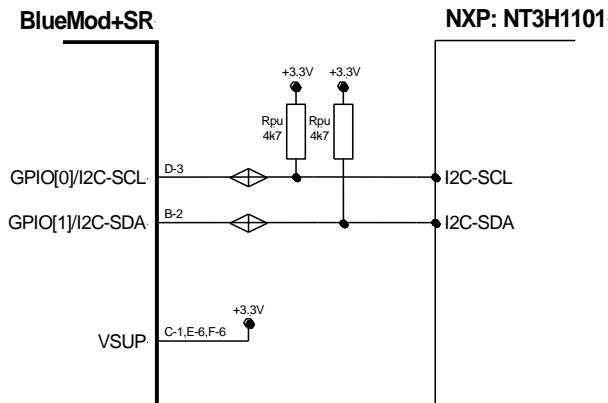


Figure 7: BlueMod+SR I²C interface

¹ subject to firmware support, contact Telit for current status
1VW0301276 Rev. 14

4.8. NFC Support ²

From SPP firmware version V1.500 on and higher the NFC TAG NXP: NT3H1101 will be supported by using the following signals:

BlueMod+SR Pin Number	BlueMod+SR Signal Name	NFC Function Signal Name	Type	Function
D-3	GPIO[0]	NFC_SCLK	O-OD	NFC TAG NXP: NT3H1101 I ² C SCLK
B-2	GPIO[1]	NFC_SDA	I/O	NFC TAG NXP: NT3H1101 I ² C SDA
C-3	GPIO[7]	NFC_FD	I-PU	NFC TAG NXP: NT3H1101 Field Detect

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

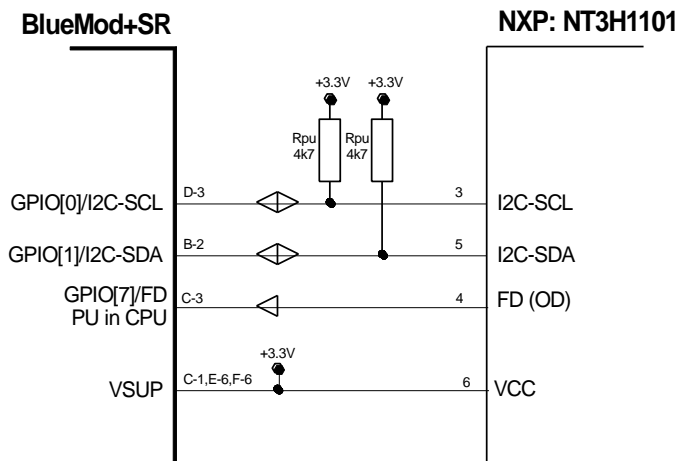


Figure 8: Connection to the NFC tag NXP: NT3H1101

The NFC TAG NXP: NT3H1101 works over the full voltage and temperature range of the BlueMod+SR.

² SPP FW version V1.500 and higher will use this interface to support NFC TAG NXP: NT3H1101 I²C interface

4.9. SPI Serial Peripheral Interface ³

The serial peripheral interface (SPI) allows half/full-duplex, synchronous, serial communication with external devices. The interface can be configured as the master and in this case it provides the communication clock (SCK) to the external slave device. The interface is also capable of operating in multi master configuration. It may be used for a variety of purposes, including simplex synchronous transfer on two lines with a possible bidirectional data line or reliable communication using CRC checking.

Module pins are used as follows:

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

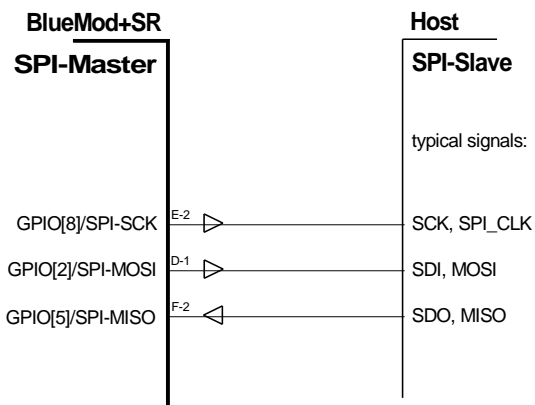


Figure 9: BlueMod+SR SPI interface (example: Master mode)

4.10. Bluetooth Radio Interface

- The BlueMod+SR/AI presents an integrated ceramic antenna.
- The BlueMod+SR/AP presents no integrated ceramic antenna whereas provides a 50Ω RF interface.

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

³ subject to firmware support, contact Telit for current status
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4.11. WLAN Coexistence Interface⁴

For implementing WLAN Coexistence with CSR's Wi-Fi solution the Unity 3e scheme could be implemented on request. Usage of signal BT_PER is not necessary at the moment.

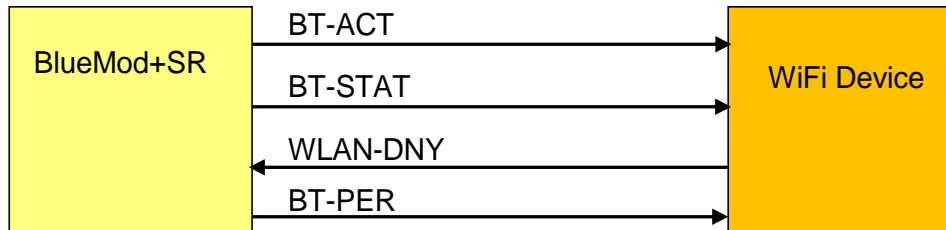


Figure 10: Unity 3e WLAN coexistence

If this interface is not used, these signals should be left unconnected.

If your application needs to use these signals, ask Telit for support.

4.12. Slow Clock Interface

Consumption of power during power-down modes can be reduced by feeding the module with an optional 32,768 kHz slow clock at pin SLCK.

SLCK specification:

- 32,768 kHz typ., 30 kHz min., 35 kHz max. Duty cycle 30...70%.
- Signal must be square wave, at VSUP-level (see note below) and present as long as VSUP is powered.

The module's firmware will detect the presence of a slow clock during the boot process and switch behavior appropriately. This check does only apply for presence of some clock; it is not checked if the clock frequency is in the valid range required by CSR8811 (30kHz ... 35kHz).

If this signal is not used, to minimize risk of erroneous pulse detection in noisy environments, Telit recommends the connection of A-6 to GND (direct connection or pull-down resistor).



Since SLCK is fed to both the STM32 and the CSR8811, the electrical characteristics as described in Table 11 (VLSEH) and Table 12 (VIH) apply both at the same time.

⁴ subject to firmware support, contact Telit for current status
1VW0301276 Rev. 14

4.13. Test Mode

This functionality is reserved. Leave pin TESTMODE# open.

4.14. Pin Strapped System Memory Boot Mode Invocation

Asserting BOOT0 “high” will invoke the system memory bootloader at start-up. This is required for firmware update. Thus, access to this signal and a means to drive it at high level should be foreseen by the customer’s hardware. While not in use, this signal can be left open or driven to logic low level.

To connect to the module during system memory boot mode, an RS232 serial interface has to be directly linked to the UART-TXD (F-4) and UART_RXD (D-2) pins.

The bootloader is stored in the internal boot ROM memory (system memory) of MCU. It is programmed during production. Its main task is to upgrade the firmware to the internal Flash memory. A communication protocol is defined with a specific command set and sequences.

The firmware upgrade will be done by either

- a Telit provided firmware update tool. This is a Windows™ program that contains the firmware and uses a PC with a serial port for the update
- implementing the system memory boot mode protocol on the host system.

If firmware update shall be performed from a host MCU, signals BOOT0 and EXT-RES# both must be controlled by that host MCU (GPIO ports). Please note that EXT-RES# must not be driven directly from a push-pull signal (see chapter 4.3).

4.15. 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 6, the voltage on any I/O pin must not exceed VSUP by more than 0,4V at any time. Otherwise some current I_{INJECT} flows through the internal protection diodes. This may damage the module.

There is no problem if the application circuit design and programming can assure that all signals directed towards BlueMod+SR 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 the 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.

4.16. Serial Wire Debug 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 it for debugging purposes, make it available and connect SWDIO via a pullup resistor 100kΩ to VSUP (refer to [1]).

4.17. Trace Interface ⁵

The Trace UART TXD interface provides firmware internal trace information and is normally not used in a customer's product. In cases where customer support by Telit is requested it may provide useful information about BlueMod+SR internal states and processes while in operation. We recommend leaving GPIO[6] unconnected but allowing access to the signal (e.g. by routing it to a via or a header).

⁵ subject to firmware support, contact Telit for current status
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5. MODULE PINS

5.1. Pin Numbering

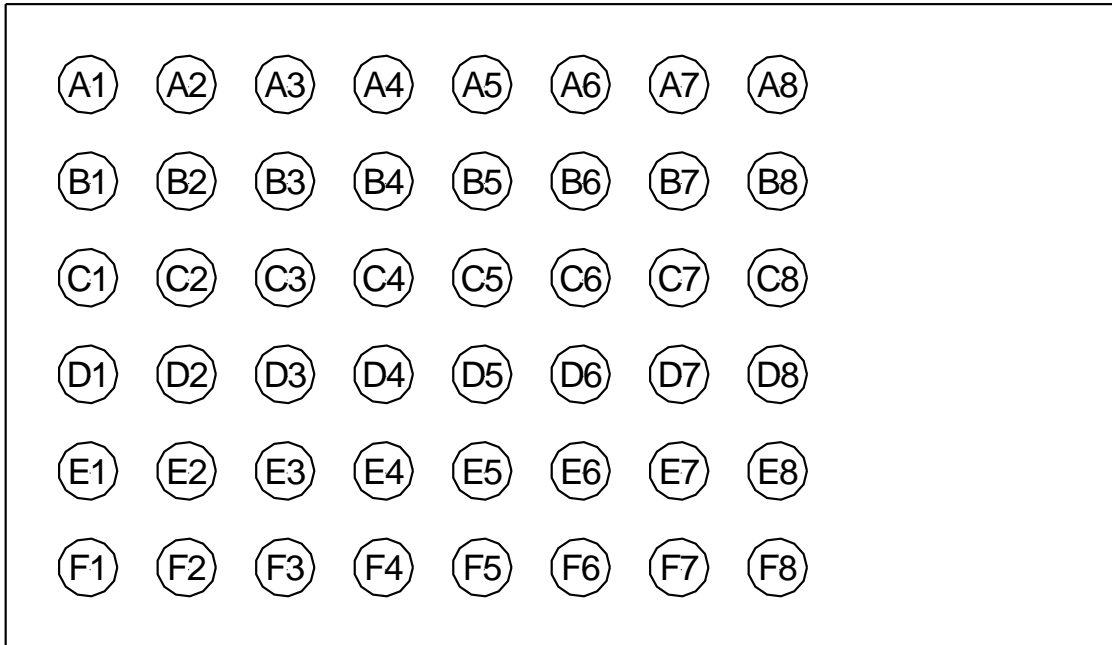


Figure 11: BlueMod+SR Pin Numbering (Top view)

5.2. General Pin Description

Table 4: General pin assignment

Pin Name	Signal	Type	Act	Function	Alternate Function
E-6	VSUP1	PWR		+3,3V nom.	
F-6	VSUP2	PWR		+3,3V nom	
C-1	VSUP3	PWR ⁽⁷⁾		+3,3V nom	
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		n.c. (AI-Variant)	RF (AP-Variant)
B-1	EXT-RES#	I/O-PU	L	User Reset	
A-6	SLCK	I-PD		32,768kHz Slow Clock	
F-4	UART-TXD	O-PP		IUR Data OUT	
D-2	UART-RXD	I-PD		IUR Data IN	
D-7	UART-RTS#	O-PU ⁽¹⁾	L	Flow Control/IUC	
F-3	UART-CTS#	I-PD	L	Flow Control/IUC	
B-4	IUR-OUT#	O-PU ⁽¹⁾	L	UICP Control	
D-5	IUR-IN#	I-PD	L	UICP Control	
D-3	GPIO[0]	I/O ⁽⁵⁾		GPIO ⁽³⁾	I2C-SCL
B-2	GPIO[1]	I/O ⁽⁵⁾		GPIO ⁽³⁾	I2C-SDA
D-1	GPIO[2]	I/O ⁽⁵⁾		GPIO ⁽³⁾	SPI-MOSI
E-4	GPIO[3]	I/O ⁽⁵⁾		GPIO ⁽³⁾	
D-4	GPIO[4]	I/O ⁽⁵⁾		GPIO ⁽³⁾	
F-2	GPIO[5]	I/O ⁽⁵⁾		GPIO ⁽³⁾	SPI-MISO
C-4	GPIO[6]	O-PP		TRACE UART TXD	
C-3	GPIO[7]	I/O ⁽⁵⁾		GPIO ⁽³⁾	
E-2	GPIO[8]	I/O ⁽⁵⁾		GPIO ⁽³⁾	SPI-SCK
A-3	BT-ACT	O		WLAN coexistence	
A-1	BT-STAT	O		WLAN coexistence	
A-4	WLAN-DNY	I-PD		WLAN coexistence	
A-2	BT-PER	O		WLAN coexistence	
F-1	TESTMODE#	I-PU	L	Testmode	
E-1	BOOT0	I-PD ⁽¹⁾		System memory bootloader	
E-3	SWDIO	I-PU ⁽⁶⁾		serial wire	
D-6	SWCLK	I-PD		serial wire	
C-2	DNU ⁽⁴⁾			reserved	
B-3	DNU ⁽⁴⁾			reserved	
A-5	DNU ⁽⁴⁾			reserved	
F-5	DNU ⁽⁴⁾			reserved	
E-5	DNU ⁽⁴⁾			reserved	

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

⁽¹⁾ a discrete pull up 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-float, i-pu, i-pd, o-pp (output push/pull), o-od (output open drain) or some alternate function; refer to [1], [2]

⁽⁶⁾ if the serial wire interface is used, a pull-up resistor 100k Ω has to be connected to VSUP. Please refer to chapter 4.16 and [1]

⁽⁷⁾ Pin C-1 VSUP3 may be left floating for footprint compatibility to other BlueMod+Sx family members

5.3. Application Specific SPP Pin Configuration

Table 5: Application specific pin assignments, SPP

Pin Name	Signal	SPP Function	Type	Act	Alternate Function
E-6	VSUP1	Power	PWR		+3,3V nom.
F-6	VSUP2	Power	PWR		+3,3V nom
C-1	VSUP3	Power	PWR		+3,3V nom ⁽⁷⁾
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	Antenna	RF		n.c. (/AI) or RF (/AP)
B-1	EXT-RES#	Reset	I/O-PU	L	User Reset
A-6	SLCK	SLCK	I-PD		32,768kHz Slow Clock (optional)
F-4	UART-TXD	TXD	O-PP		IUR Data OUT
D-2	UART-RXD	RXD	I-PD		IUR Data IN
D-7	UART-RTS#	/RTS	O-PP ⁽¹⁾	L	Flow Control/IUC; refer to
F-3	UART-CTS#	/CTS	I-PD	L	Flow Control/IUC; refer to [3]
B-4	IUR-OUT#	/IUR-OUT	O-PP ⁽¹⁾	L	UICP Control; refer to [3]
D-5	IUR-IN#	/IUR-IN	I-PD	L	UICP Control; refer to [3]
D-3	GPIO[0]	I2C_SCL	O-OD		NFC TAG NXP: NT3H1101 I ² C SCL ⁽⁶⁾ and RSSI output and generic I2C function
B-2	GPIO[1]	I2C_SDA	I/O		NFC TAG NXP: NT3H1101 I ² C SDA ⁽⁶⁾ and RSSI output and generic I2C function
D-1	GPIO[2]	IOC	I/O		User IO
E-4	GPIO[3]	IOB	I/O		User IO
D-4	GPIO[4]	HANGUP	I-PD		optional; refer to [4]
F-2	GPIO[5]	IOD	I/O		User IO
C-4	GPIO[6]	reserved	O-PP		TRACE UART TXD [4]
C-3	GPIO[7]	NFC_FD	I-PU		NFC TAG NXP: NT3H1101 Field Detect ⁽³⁾
E-2	GPIO[8]	IOA	I/O		User IO
A-3	BT-ACT	WLAN coexistence	O		
A-1	BT-STAT	WLAN coexistence	O		
A-4	WLAN-DNY	WLAN coexistence	I-PD		
A-2	BT-PER	WLAN coexistence	O		
F-1	TESTMODE#	reserved	I-PU	L	leave open
E-1	BOOT0	reserved	I-PD ⁽²⁾		system memory bootloader
E-3	DNU ⁽⁴⁾	reserved			leave open (serial wire)
D-6	DNU ⁽⁴⁾	reserved			leave open (serial wire)

Pin Name	Signal	SPP Function	Type	Act	Alternate Function
C-2	DNU ⁽⁴⁾	reserved			leave open
B-3	DNU ⁽⁴⁾	reserved			leave open
A-5	DNU ⁽⁴⁾	reserved			leave open
F-5	DNU ⁽⁴⁾	reserved			leave open
E-5	DNU ⁽⁴⁾	reserved			leave open

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

⁽¹⁾ a discrete pull up resistor is used

⁽²⁾ a discrete pull down resistor is used

⁽³⁾ function depends on firmware

⁽⁴⁾ DNU: Do not use, do not connect

⁽⁵⁾ If trace feature should be used, this signal has to be made accessible in customer hardware

⁽⁶⁾ NFC support will be available with SPP FW version V1.500 and higher. Use 4k7 PU each on signals NFC_SCLK and NFC_SDA

⁽⁷⁾ Pin C-1 can be left open for BlueMod+S footprint compatibility

5.4. Handling of Unused Signals

Depending on the application, not all signals of BlueMod+SR 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]
- SLCK If no external slow clock is provided: Leave open or tie to
- GND
- UART-RTS#, UART-CTS# If neither flow control nor UICP is used: Leave open
- IUR-OUT#, IUR-IN# If UICP is not used: leave open
- BT-ACT, BT-STAT, If there is no WLAN device on the same PCB: Leave open
- BT-PER, WLAN-DNY
- TESTMODE# Leave open
- unused GPIOs Leave open
- SWDIO, SWCLK Leave open. Only needed for debug purposes.
- GPIO⁽⁶⁾ Leave open, connect to via or header pin for getting debug
- TRACE_UART_TXD information in customer hardware

(*) for being able to update the firmware, it is strongly recommended to provide for a means to set BOOT0 temporarily to logic high level, and to reset the module; see chapter 4.14.

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.

Table 6: Absolute maximum ratings

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 +0,4	V

6.2. Electrical Requirements

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

Table 7: Electrical requirements

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	-10			dBm
	Transmit Mode to 50Ω load	-10			

6.3. Operating Conditions

T_{amb} = 25 °C

Table 8: DC operating conditions

Item	Condition	Limit			Unit
		Min	Typ	Max	
Supply voltage VSUP		2,5	3,3	3,6	V _{DC}

6.4. Environmental Requirements

Table 9: Environmental requirements

Item	Symbol	Absolute Maximum Ratings	Unit
Storage temperature range	T _{stg}	-40 to +85	°C
Operating temperature range	T _{op}	-30 to +85	°C

6.5. Digital I/O Including EXT-RES#

STM32 MCU and CSR8811 do have different electrical I/O characteristics. All Module I/O pins are connected directly to these chips without signal conditioning except for some pull-up/pull-down resistors (as indicated). Therefore the electrical characteristics are split in different tables.

STM-Related Signals:

- EXT-RES# (additional filter-C 100n to GND)
- UART-TXD, UART-RXD, UART-CTS#
- UART-RTS# (additional pull-up resistor 470k Ω)
- IUR-IN#
- IUR-OUT# (additional pull-up resistor 470k Ω)
- GPIO[0..8], TESTMODE#
- BOOT0 (additional pull-down resistor 100k Ω)

$T_{amb} = 25\text{ }^{\circ}\text{C}$

Table 10: DC characteristics, digital IO (STM32 related)

Symbol	Item	Condition	Limit			Unit
			Min	Typ	Max	
V_{IL}	Low-Level Input Voltage	$V_{SUP} = 2,5\text{ to }3,6\text{V}$	-0,3	-	0,9	V
V_{IH}	High-Level Input Voltage	$V_{SUP} = 2,5\text{ to }3,6\text{V}$	2,0	-	$V_{SUP}+0,3$	V
V_{OL}	Low-Level Output Voltage	$I_{OL} = 4\text{mA}$	-	-	0,4	V
V_{OH}	High-Level Output Voltage	$I_{OH} = -4\text{mA}$	$V_{SUP}-0,4$	-	-	V
I_{OL}	Low -Level Output Current	$V_{OL} = 0,4\text{V}$	-	-	8	mA
I_{OH}	High-Level Output Current	$2,7\text{V} < V_{SUP} < 3,6\text{V}$ $V_{OH} > 2.3\text{V}$	-	-	-8	mA
R_{PU}	weak pull-up resistor	$V_{IN} = V_{SS}$	30	40	50	k Ω
R_{PD}	weak pull-down resistor	$V_{IN} = V_{DD}$	30	40	50	k Ω
I_{ic}	I/O pad leakage current		-3	0	+3	μA
C_i	Input Capacitance			5		pF

External Slow Clock SLCK:

$T_{amb} = 25\text{ °C}$

Table 11: DC characteristics, SLCK (STM32 backup domain)

Symbol	Item	Condition	Limit			Unit
			Min	Typ	Max	
V _{LSEL}	Low-Level Input Voltage	VSUP = 2,5 to 3,6V	0,0	-	0,3	V
V _{LSEH}	High-Level Input Voltage	VSUP = 2,5 to 3,6V	0,7xVSUP	-	VSUP	V
I _{lc}	I/O pad leakage current	VSS ≤ VIN ≤ VSUP	-1	-	+1	μA
C _I	Input Capacitance			5		pF



Signal at SLCK is also fed to CSR8811 and has to comply to Table 12, too.

CSR8811 Related Signals:

- BT-ACT, BT-STAT, WLAN-DNY, BT-PER
- SLCK (caution: also connected to STM-32)

$T_{amb} = 25\text{ °C}$

Table 12: DC characteristics, digital IO (CSR8811 related)

Symbol	Item	Condition	Limit			Unit
			Min	Typ	Max	
V _{IL}	Low-Level Input Voltage	VSUP = 3,3V	- 0,4	-	0,4	V
V _{IH}	High-Level Input Voltage		0,7xVSUP	-	VSUP+0,4	V
V _{OL}	Low-Level Output Voltage	I _{OL} = 4mA	-	-	0,4	V
V _{OH}	High-Level Output Voltage	I _{OH} = -4mA	0,75xVSUP	-	-	V
I _{sp-u}	Input-current	Strong pull-up	-150	-40	-10	μA
I _{sp-d}	Input-current	Strong pull-down	+10	+40	+150	μA
I _{wp-u}	Input-current	Weak pull-up	-5,0	-1,0	-0,33	μA
I _{wp-d}	Input-current	Weak pull-down	+0,33	+1,0	+5,0	μA
I _{lc}	I/O pad leakage current			n.a.		μA
C _I	Input Capacitance		1,0	-	5,0	pF



SLCK is connected to both STM32 and CSR8811 so has to fit to STM32 and CSR8811 requirements at the same time.

6.6. Power Consumption and Power Down Modes

6.6.1. Classic Bluetooth

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

Table 13: Supply current SPP sleep modes, no radio activity

Condition	Note	Slow clock SLCK	Current Consumption	Unit
			I _{Avg}	
Sleep mode, no page scan, no inquiry scan		internal	3,6	mA
		external	3,5	
Deep sleep mode, no page scan, no inquiry scan, UICP active Interface down	(1)	internal	0,29	mA
		external	0,15	
Device in reset	(2)	(3)	2,7	mA

VSUP = 3,3V, T_{amb} = 25°C, all GPIOs and UART lines open, SLCK: 32,768 kHz

(1) IUR-IN# and UART-CTS# signals connected to CMOS high level

(2) Valid for HW V3, higher in HW Version < 3

(3) Same current consumption w. internal or external slow clock

Table 14: Supply current, SPP Bluetooth Classic

Condition	Note	Slow clock SLCK	Current Consumption	Unit
			I _{Avg}	
Standby, page scan & inquiry scan interval 1,28s		internal	4,2	mA
		external	4,0	
Standby, page scan & inquiry scan interval 1,28s,UICP active serial Interface down	(1)	internal	0,9	mA
		external	0,75	
Bluetooth connected, no data traffic (Slave)	(2)	(3)	14,4	mA
Bluetooth connected, data traffic 115 kbit/s (Slave)	(2)	(3)	22	mA
Bluetooth connected, no data traffic (Master)	(2)	(3)	9,3	mA
Bluetooth connected, no data traffic, active sniff using 250 ms sniff interval (Master)	(2)	(3)	5,0	mA
Bluetooth connected, no data traffic, active sniff using 250 ms sniff interval, UICP active (Master)	(2)	(3)	1,9	mA
Bluetooth connected, no data traffic, active sniff using 500 ms sniff interval (Master)	(2)	(3)	4,6	mA
Bluetooth connected, no data traffic, active sniff using 500 ms sniff interval, UICP active (Master)	(2)	(3)	1,6	mA
Bluetooth connected, data traffic 115 kbit/s (Master)	(2)	(3)	20	mA

VSUP = 3,3V, T_{amb} = 25°C, Tx Power = 7 dBm, all GPIO lines left open, SLCK: 32,768 kHz

(1) IUR-IN# and UART-CTS# signals connected to CMOS high level

(2) about 2 meters through the air

(3) Same current consumption w. internal or external slow clock

6.6.2. LE Configurations

6.6.2.1. LE Operating in Peripheral Device Role

The following tables show the average power consumption of BlueMod+SR in LE-mode operating in the peripheral device role.

Table 15: Supply current BLE Terminal I/O Profile, peripheral device role, standby

Item	Note	Slow clock SLCK	Current Consumption		Unit
			Tx power (dBm)		
			max (+7)	min (-23)	
			I _{Avg}	I _{Avg}	
Standby, Advertising on 3 channels, advertising interval: 1,28s	(5)	internal	3,9	3,7	mA
			external	3,8	
Standby, Advertising on 3 channels, advertising interval: 1,28s, UICP active serial Interface down	(1)	internal	0,4	0,34	mA
			external	0,25	

Table 16: Supply current BLE Terminal I/O Profile, peripheral device role, CI 7,5ms

Item	Note	Slow clock SLCK	Current Consumption		Unit
			Tx power (dBm)		
			max (+7)	min (-23)	
			I _{Avg}	I _{Avg}	
Connected, connection interval: 7,5 ms, no data traffic	(2,3)	(6)	9,6	8,8	mA
Connected, connection interval: 7,5 ms, data traffic 115 kbit/s at the serial port, central to peripheral	(2)	(6)	24	22	mA
Connected, connection interval: 7,5 ms, data traffic 115 kbit/s at the serial port, peripheral to central	(2)	(6)	27	23	mA

Table 17: Supply current BLE Terminal I/O Profile, peripheral device role, CI 37,5ms

Item	Note	Slow clock SLCK	Current Consumption		Unit
			Tx power (dBm)		
			max (+7)	min (-23)	
			I _{Avg}	I _{Avg}	
Connected, connection interval: 37,5ms, no data traffic	(2,4)	internal	5,1	4,9	mA
			external	5,0	
Connected, connection interval: 37,5ms, data traffic 115 kbit/s at the serial port, peripheral to central	(2,4)	(6)	15,5	14	mA

VSUP = 3,3V, Tamb = 25°C, all GPIO lines left open, SLCK: 32,768 kHz

- (1) UART-CTS#, IUR-IN# driven to CMOS high level, all other UART-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) All UART-lines left open
- (6) Same current consumption w. internal or external slow clock

6.6.2.2. LE Operating in Central Device Role

The following tables show the average power consumption of BlueMod+SR in LE-mode operating in the central device role.

Table 18: Supply current BLE Terminal I/O Profile, central device role, standby

Item	Note	Slow clock SLCK	Current Consumption		Unit
			Tx power (dBm)		
			max (+7)	min (-23)	
			I _{Avg}	I _{Avg}	
Standby, scanning for peripherals		(6)	50	49	mA

Table 19: Supply current BLE Terminal I/O Profile, central device role, CI 7,5ms

Item	Note	Slow clock SLCK	Current Consumption		Unit
			Tx power (dBm)		
			max (+7)	min (-23)	
			I _{Avg}	I _{Avg}	
Connected, connection interval: 7,5 ms, no data traffic	(2,3)	(6)	10,8	10,1	mA
Connected, connection interval: 7,5 ms, data traffic, data traffic 115 kbit/s at the serial port, central to peripheral	(2)	(6)	28	25	mA
Connected, connection interval: 7,5 ms, data traffic, data traffic 115 kbit/s at the serial port, peripheral to central	(2)	(6)	25	23	mA

Table 20: Supply current BLE Terminal I/O Profile, central device role, CI 37,5ms

Item	Note	Slow clock SLCK	Current Consumption		Unit
			Tx power (dBm)		
			max (+7)	min (-23)	
			I _{Avg}	I _{Avg}	
Connected, connection interval: 37,5ms, no data traffic	(2,4)	(6)	5,8	5,6	mA
Connected, connection interval: 37,5ms, data traffic 115 kbit/s at the serial port; central to peripheral	(2,4)	(6)	16,5	15	mA

VSUP = 3,3V, Tamb = 25°C, all GPIO lines left open, SLCK: 32,768 kHz

- (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 typical connection parameters used by an iPhone, iPad or iPad mini device in the central device role
- (6) Same current consumption w. internal or external slow clock

6.7. RF Performance

6.7.1. GFSK, PI/4 DQPSK, 8DPSK Receiver

VSUP = 2,5V to 3,6V, T_{amb} = +20°C

Measured conducted according to BT specification v1.2/2.0/2.0 + EDR/2.1/2.1 + EDR/3.0/3.0 + HS/4.0

Receiver	Frequency [GHz]	Limit			BT Spec	Unit
		Min	Typ	Max		
Sensitivity at 0.1% BER DH1	2.402		-84	-80	≤-70	dBm
	2.441		-88	-84		
	2.480		-88	-84		
Sensitivity at 0.1% BER DH5	2.402		-84	-80	≤-70	dBm
	2.441		-88	-84		
	2.480		-88	-84		
Sensitivity at 0.1% BER EDR2, PI/4 DQPSK	2.402		-87	-70	≤-70	dBm
	2.441		-91	-70		
	2.480		-91	-70		
Sensitivity at 0.1% BER EDR3, 8DPSK	2.402		-78	-70	≤-70	dBm
	2.441		-82	-70		
	2.480		-82	-70		
Maximum received signal at 0.1% BER with DH1		-20	0		≥-20	dBm
Maximum received signal at 0.1% BER with DH5		-20	0		≥-20	dBm
Maximum received signal at 0.1% BER with EDR2, PI/4 DQPSK		-20	0		≥-20	dBm
Maximum received signal at 0.1% BER with EDR3, 8DPSK		-20	0		≥-20	dBm
C/I co-channel GFSK			8	11	≤ 11	dB
Adjacent channel selectivity C/I f = f ₀ + 1MHz GFSK			-2	0	≤ 0	dB
Adjacent channel selectivity C/I f = f ₀ - 1MHz GFSK			-1	0	≤ 0	dB
Adjacent channel selectivity C/I f ≥ f ₀ + 2MHz GFSK			-39	-30	≤ -30	dB
Adjacent channel selectivity C/I f ≤ f ₀ - 2MHz GFSK			-30	-30	≤ -20	dB
Adjacent channel selectivity C/I f ≥ f ₀ + 3MHz GFSK			-45	-40	≤ -40	dB
Adjacent channel selectivity C/I f ≤ f ₀ - 5MHz GFSK			-46	-40	≤ -40	dB
Adjacent channel selectivity C/I f = f _{image} GFSK			-25	-9	≤ -9	dB
C/I co-channel PI/4 DQPSK			12	13	≤ 13	dB
Adj. channel selectivity C/I f = f ₀ + 1MHz π/4 DQPSK			-7	0	≤ 0	dB
Adj. channel selectivity C/I f = f ₀ - 1MHz π/4 DQPSK			-4	0	≤ 0	dB
Adj. channel selectivity C/I f ≥ f ₀ + 2MHz π/4 DQPSK			-40	-30	≤ -30	dB
Adj. channel selectivity C/I f ≤ f ₀ - 2MHz π/4 DQPSK			-36	-20	≤ -20	dB
Adj. channel selectivity C/I f ≥ f ₀ + 3MHz π/4 DQPSK			-48	-40	≤ -40	dB
Adj. channel selectivity C/I f ≤ f ₀ - 5MHz π/4 DQPSK			-50	-40	≤ -40	dB
Adj. channel selectivity C/I f = f _{image} π/4 DQPSK			-22	-7	≤ -7	dB

Receiver	Frequency [GHz]	Limit			BT Spec	Unit
		Min	Typ	Max		
C/I co-channel 8DPSK			18	21	≤ 21	dB
Adj. channel selectivity C/I $f = f_0 + 1\text{MHz}$ 8DPSK			-4	5	≤ 5	dB
Adj. channel selectivity C/I $f = f_0 - 1\text{MHz}$ 8DPSK			-1	5	≤ 5	dB
Adj. channel selectivity C/I $f \geq f_0 + 2\text{MHz}$ 8DPSK			-36	-25	≤ -25	dB
Adj. channel selectivity C/I $f \leq f_0 - 2\text{MHz}$ 8DPSK			-31	-13	≤ -13	dB
Adj. channel selectivity C/I $f \geq f_0 + 3\text{MHz}$ 8DPSK			-42	-33	≤ -33	dB
Adj. channel selectivity C/I $f \leq f_0 - 5\text{MHz}$ 8DPSK			-43	-33	≤ -33	dB
Adj. channel selectivity C/I $f = f_{\text{image}}$ 8DPSK			-14	0	≤ -0	dB

VSUP = 2,5V to 3,6V, $T_{\text{amb}} = -30^{\circ}\text{C}$

Measured conducted according to BT specification v1.2/2.0/2.0 + EDR/2.1/2.1 + EDR/3.0/3.0 + HS/4.0

Receiver	Frequency [GHz]	Limit			BT Spec	Unit
		Min	Typ	Max		
Sensitivity at 0.1% BER DH1	2.402		-84	-80	≤ -70	dBm
	2.441		-88	-84		
	2.480		-88	-84		
Sensitivity at 0.1% BER DH5	2.402		-84	-80	≤ -70	dBm
	2.441		-88	-84		
	2.480		-88	-84		
Sensitivity at 0.1% BER EDR2, PI/4 DQPSK	2.402		-88	-70	≤ -70	dBm
	2.441		-91	-70		
	2.480		-91	-70		
Sensitivity at 0.1% BER EDR3, 8DPSK	2.402		-78	-70	≤ -70	dBm
	2.441		-82	-70		
	2.480		-82	-70		
Maximum received signal at 0.1% BER DH1		-20	0		≥ -20	dBm
Maximum received signal at 0.1% BER PI/4 DQPSK		-20	0		≥ -20	dBm
Maximum received signal at 0.1% BER 8DPSK		-20	0		≥ -20	dBm

VSUP = 2,5V to 3,6V, $T_{amb} = +85^{\circ}\text{C}$

Measured conducted according to BT specification v1.2/2.0/2.0 + EDR/2.1/2.1 + EDR/3.0/3.0 + HS/4.0

Receiver	Frequency [GHz]	Limit			BT Spec	Unit
		Min	Typ	Max		
Sensitivity at 0.1% BER DH1	2.402		-84	-80	≤ -70	dBm
	2.441		-88	-84		
	2.480		-88	-84		
Sensitivity at 0.1% BER DH5	2.402		-84	-80	≤ -70	dBm
	2.441		-88	-84		
	2.480		-88	-84		
Sensitivity at 0.1% BER EDR2, PI/4 DQPSK	2.402		-87	-70	≤ -70	dBm
	2.441		-90	-70		
	2.480		-90	-70		
Sensitivity at 0.1% BER EDR3, 8DPSK	2.402		-78	-70	≤ -70	dBm
	2.441		-80	-70		
	2.480		-80	-70		
Maximum received signal at 0.1% BER DH1		-20	0		≥ -20	dBm
Maximum received signal at 0.1% BER PI/4 DQPSK		-20	0		≥ -20	dBm
Maximum received signal at 0.1% BER 8DPSK		-20	0		≥ -20	dBm



For calculating true performance add product specific antenna gain.

6.7.2. GFSK, PI/4 DQPSK, 8DPSK Transmitter

VSUP = 2,5V to 3,6V, T_{amb} = +20°C

Measured conducted according to BT specification v1.2/2.0/2.0 + EDR/2.1/2.1 + EDR/3.0/3.0 + HS/4.0

Receiver	Frequency [GHz]	Limit			BT Spec	Unit
		Min	Typ	Max		
RF transmit power 50 Ω load, at antenna Class 1 device GFSK ^{b)}	2.402	2,7	5,5		0 to 20	dBm
	2.441	4,7	7,5			
	2.480	5,7	8,5			
RF transmit power 50 Ω load, at antenna Class 1 device EDR2, π/4 DQPSK ^{b)}	2.402 GFSK		2,0		ΔTX = -4 to 1	dBm
	2.402 π/4 DQPSK		0,9			
	2.441 GFSK		4,7			
	2.441 π/4 DQPSK		3,7			
	2.480 GFSK		5,6			
	2.480 π/4 DQPSK		4,6			
RF transmit power 50 Ω load, at antenna Class 1 device EDR3, 8DPSK ^{b)}	2.402 GFSK		2,1		ΔTX = -4 to 1	dBm
	2.402 8DPSK		1,0			
	2.441 8GFSK		4,8			
	2.441 8DPSK		3,7			
	2.480 GFSK		5,6			
	2.480 8DPSK		4,6			
RF power control range		16	30		≥16	dB
RF power range control resolution		2	4	8	2 to 8	dB
20 dB bandwidth for modulated carrier			925	1000	≤1000	kHz
ICFT		-75	±25	+75	≤ ±75	kHz
Carrier frequency drift (packet DH1)			7	25	≤ 25	kHz
Drift Rate			5	20	≤ 20	kHz/ 50μs
Δf _{1avg} "Maximum Modulation"		140	164	175	≥140 to ≤175	kHz
Δf _{2max} "Minimum Modulation"		115	140		>115	kHz
Δf _{2avg} / Δf _{1avg}		0,8	0,91		≥ 0,8	

VSUP = 2,5V to 3,6V, $T_{amb} = -30^{\circ}\text{C}$

Measured conducted according to BT specification v1.2/2.0/2.0 + EDR/2.1/2.1 + EDR/3.0/3.0 + HS/4.0

Receiver	Frequency [GHz]	Limit			BT Spec	Unit
		Min	Typ	Max		
RF transmit power 50 Ω load, at antenna Class 1 device GFSK	2.402	2,7	3,5		0 to 20	dBm
	2.441	4,7	6,5			
	2.480	5,7	7,5			
RF transmit power 50 Ω load, at antenna Class 1 device EDR2, $\pi/4$ DQPSK	2.402 GFSK		-0,5		$\Delta\text{TX} =$ -4 to 1	dBm
	2.402 $\pi/4$ DQPSK		-1,9			
	2.441 GFSK		2,5			
	2.441 $\pi/4$ DQPSK		1,2			
	2.480 GFSK		4,0			
	2.480 $\pi/4$ DQPSK		2,8			
RF transmit power 50 Ω load, at antenna Class 1 device EDR3, 8DPSK	2.402 GFSK		-0,5		$\Delta\text{TX} =$ -4 to 1	dBm
	2.402 8DPSK		-1,7			
	2.441 GFSK		2,5			
	2.441 8DPSK		1,2			
	2.480 GFSK		4,0			
	2.480 8DPSK		2,8			
20 dB bandwidth for modulated carrier			925	1000	≤ 1000	kHz
Initial carrier frequency tolerance		-75	10	+75	$\leq \pm 75$	kHz
Carrier frequency drift (packet DH1)			6	25	≤ 25	kHz
Drift Rate			5	20	20	kHz/ 50 μs
$\Delta f_{1\text{avg}}$ "Maximum Modulation"		140	164	175	≥ 140 to ≤ 175	kHz
$\Delta f_{2\text{max}}$ "Minimum Modulation"		115	142		≥ 115	kHz
$\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$		0,8	0,92		$\geq 0,8$	

VSUP = 2,5V to 3,6V, $T_{amb} = +85^{\circ}\text{C}$

Measured conducted according to BT specification v1.2/2.0/2.0 + EDR/2.1/2.1 + EDR/3.0/3.0 + HS/4.0

Receiver	Frequency [GHz]	Limit			BT Spec	Unit
		Min	Typ	Max		
RF transmit power 50 Ω load, at antenna Class 1 device GFSK	2.402	1,8	4,0		0 to 20	dBm
	2.441	3,8	6,0			
	2.480	4,8	7,0			
RF transmit power 50 Ω load, at antenna Class 1 device EDR2, $\pi/4$ DQPSK	2.402 GFSK		0,3		$\Delta\text{TX} =$ -4 to 1	dBm
	2.402 $\pi/4$ DQPSK		-0,8			
	2.441 GFSK		2,8			
	2.441 $\pi/4$ DQPSK		1,7			
	2.480 GFSK		4,0			
	2.480 $\pi/4$ DQPSK		2,9			
RF transmit power 50 Ω load, at antenna Class 1 device EDR3, 8DPSK	2.402 GFSK		0,3		$\Delta\text{TX} =$ -4 to 1	dBm
	2.402 8DPSK		-0,8			
	2.441 GFSK		2,8			
	2.441 8DPSK		1,7			
	2.480 GFSK		4,0			
	2.480 8DPSK		2,9			
20 dB bandwidth for modulated carrier			925	1000	≤ 1000	
Initial carrier frequency tolerance		-75	10	+75	$\leq \pm 75$	
Carrier frequency drift (packet DH1)			7	25	≤ 25	
Drift Rate			5	20	20	
$\Delta f_{1\text{avg}}$ "Maximum Modulation"		140	164	175	≥ 140 to ≤ 175	
$\Delta f_{2\text{max}}$ "Minimum Modulation"		115	140		≥ 115	kHz
$\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$		0,8	0,91		$\geq 0,8$	



For calculating true performance add product specific antenna gain.

6.7.3. BLE Receiver

VSUP = 2,5V to 3,6V, T_{amb} = +20°C

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

Receiver	Frequency [GHz]	Min	Typ	Max	BT Spec	Unit
Sensitivity at 30,8% PER	2,402		-87	-83	≤ -70	dBm
	2,440		-90	-86		
	2,480		-90	-86		
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%PER	0,030 - 2,000	-30	> 0		-30	dBm
	2,000 - 2,400	-35	0		-35	
	2,500 -3,000	-35	0		-35	
	3,000 . 12,75	-30	>0		-30	
C/I co-channel			8	21	≤21	dB
Adjacent channel Selectivity C/I	F = F ₀ + 1 MHz		1	15	≤15	dB
	F = F ₀ - 1 MHz		-9	15	≤15	dB
	F = F ₀ + 2 MHz		-27	-17	≤-17	dB
	F = F ₀ - 2 MHz		-19	-15	≤-15	dB
	F = F ₀ + 3 MHz		-43	-27	≤-27	dB
	F = F ₀ - 5 MHz		-49	-27	≤-27	dB
	F = F _{image}		-24	-9	≤-9	dB
Maximum level of intermodulation interferers		-50	-18		≥-50	dBm

VSUP = 2,5V to 3,6V, T_{amb} = -30°C

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

Receiver	Frequency [GHz]	Min	Typ	Max	BT Spec	Unit
Sensitivity at 30,8% PER	2,402		-87	-83	≤ -70	dBm
	2,440		-90	-87		
	2,480		-90	-87		
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

VSUP = 2,5V to 3,6V, $T_{amb} = +85^{\circ}\text{C}$

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

Receiver	Frequency [GHz]	Min	Typ	Max	BT Spec	Unit
Sensitivity at 30,8% PER	2,402		-87	-83	≤ -70	dBm
	2,440		-89	-85		
	2,480		-89	-85		
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

6.7.4. BLE Transmitter

VSUP = 2,5V to 3,6V, T_{amb} = +20°C

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

Receiver	Frequency [GHz]	Min	Typ	Max	BT Spec	Unit
RF Transmit Power	2,402	2,0	5,5	10	-20 to +10	dBm
	2,440	4,0	7,5	10		
	2,480	5,0	8,5	10		
ACP	F = F ₀ ± 2MHz		-28	-20	≤ -30	dBm
	F = F ₀ ± 3MHz		-38	-30	≤ -30	
	F = F ₀ ± > 3MHz		<-60	-30	≤ -30	
Δf _{1avg} maximum modulation		225	268	275	225 < f _{1avg} < 275	kHz
Δf _{2max} minimum modulation		185	214		≥ 185	kHz
Δf _{2avg} / Δf _{1avg}		0,8	0,83		≥ 0,8	
Frequency Offset		-95	±25	+95	± 150	kHz
Carrier drift rate			4	20	≤ 20	kHz/ 50μs
Carrier drift			5	50	≤ 50	kHz

VSUP = 2,5V to 3,6V, T_{amb} = -30°C

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

Receiver	Frequency [GHz]	Min	Typ	Max	BT Spec	Unit
RF transmit Power	2,402	0,5	4,0	10	-20 to +10	dBm
	2,440	2,5	6,5	10		
	2,480	3,5	7,5	10		
ACP	F = F ₀ ± 2MHz		-28	-20	≤ -30	dBm
	F = F ₀ ± 3MHz		-35	-30	≤ -30	
	F = F ₀ ± > 3MHz		<-60	-30	≤ -30	
Δf _{1avg} maximum modulation		225	266	275	225 < f _{1avg} < 275	kHz
Δf _{2max} minimum modulation		185	225		≥ 185	kHz
Δf _{2avg} / Δf _{1avg}		0,8	0,85		≥ 0,8	
Frequency Offset		-95	±25	+95	± 150	kHz
Carrier drift rate			4	20	≤ 20	kHz/ 50μs
Carrier drift			5	50	≤ 50	kHz

VSUP = 2,5V to 3,6V, $T_{amb} = +85^{\circ}\text{C}$

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

Receiver	Frequency [GHz]	Min	Typ	Max	BT Spec	Unit
RF transmit Power	2,402	1,0	4,0	10	-20 to +10	dBm
	2,440	3,0	6,0	10		
	2,480	4,0	7,0	10		
ACP	$F = F_0 \pm 2\text{MHz}$		-30	-20	≤ -30	dBm
	$F = F_0 \pm 3\text{MHz}$		-42	-40	≤ -30	
	$F = F_0 \pm > 3\text{MHz}$		<-60	-30	≤ -30	
$\Delta f_{1\text{avg}}$ maximum modulation		225	267	275	225 < $f_{1\text{avg}}$ < 275	kHz
$\Delta f_{2\text{max}}$ minimum modulation		185	214		≥ 185	kHz
$\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$		0,8	0,83		$\geq 0,8$	
Frequency Offset		-95	± 25	+95	± 150	kHz
Carrier drift rate			5	20	≤ 20	kHz/ 50 μs
Carrier drift			5	50	≤ 50	kHz

6.7.5. Antenna Gain and Radiation Pattern

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

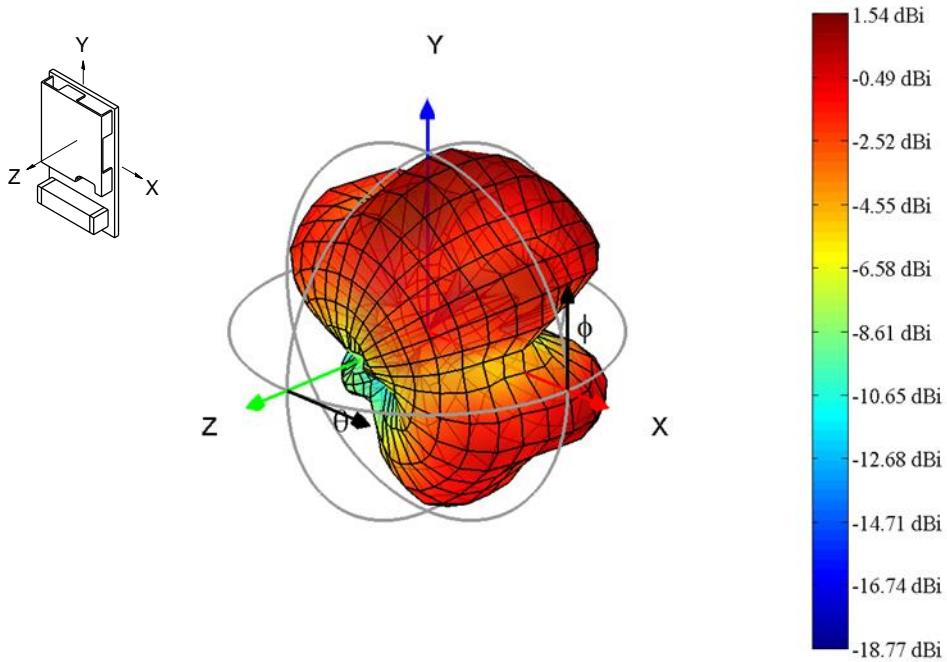


Figure 12: Typical antenna radiation pattern at 2402MHz

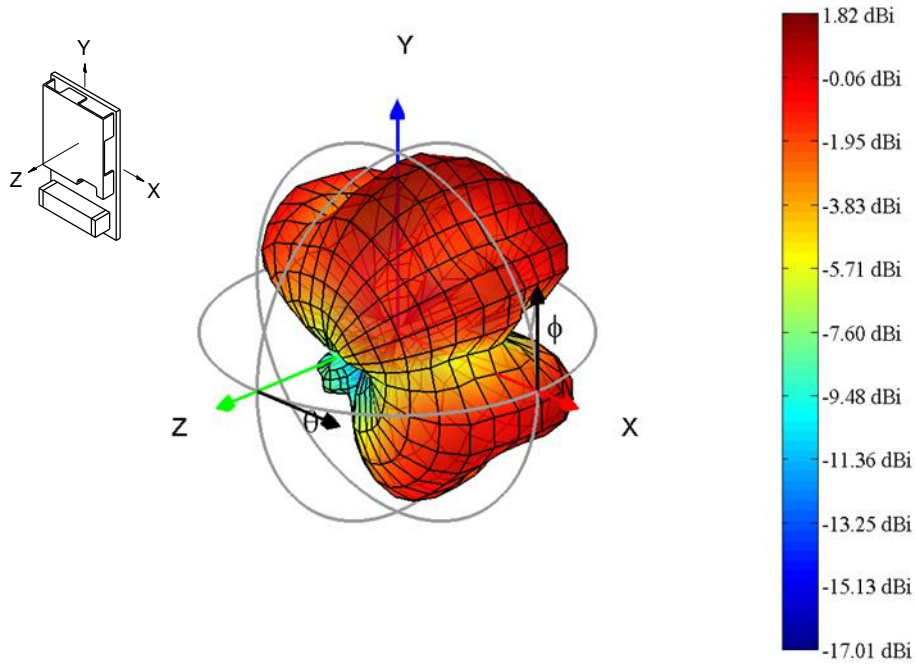


Figure 13: Typical antenna radiation pattern at 2441MHz

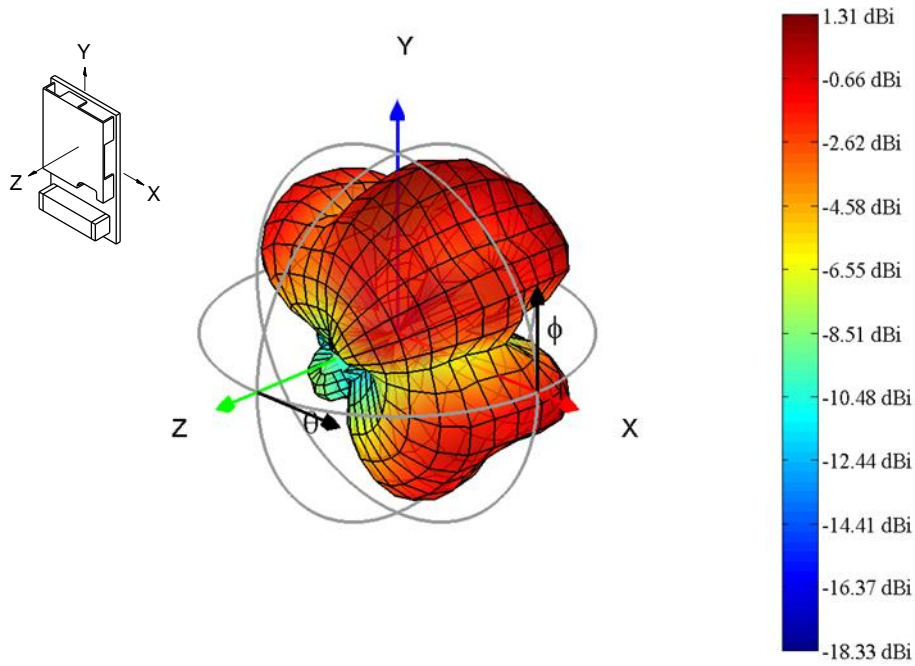


Figure 14: Typical antenna radiation pattern at 2480MHz

6.8. Power-Up Time

The time until the BlueMod+SR is able to accept link requests or serial data depends on the firmware version. In the SPP firmware the module is command ready and Bluetooth links are accepted at least 1,1 s after signal EXT-RES# is de-asserted or VSUPx is in a valid range.

7. MECHANICAL CHARACTERISTICS

7.1. Dimensions

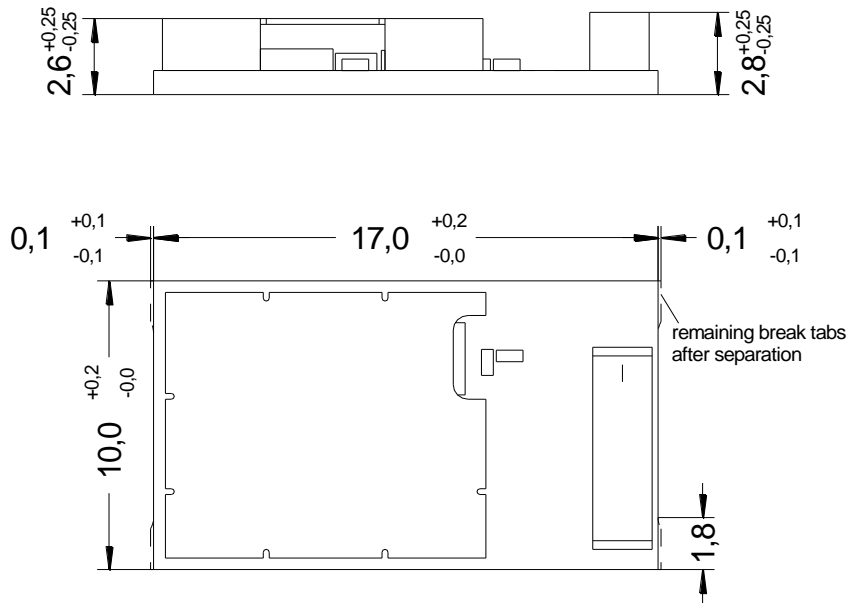


Figure 15: BlueMod+SR/AI dimensions

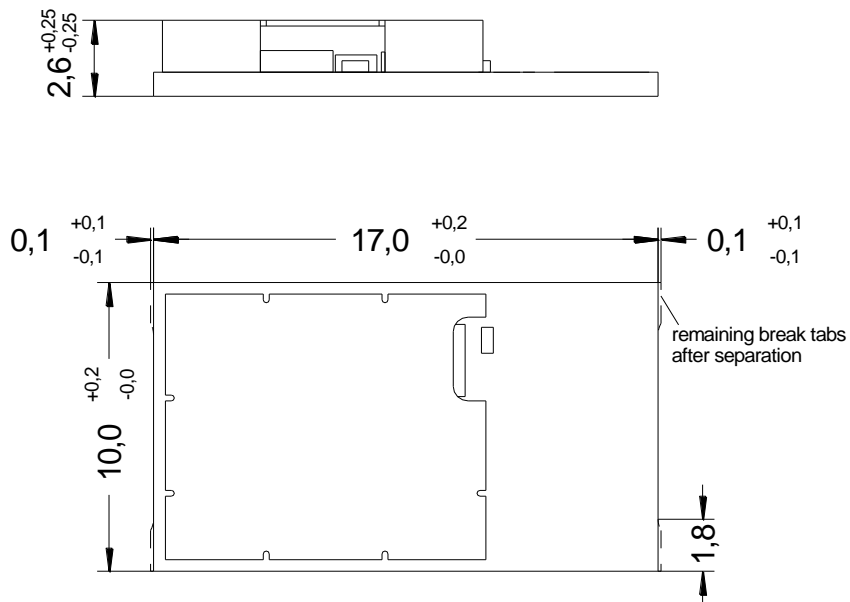


Figure 16: BlueMod+SR/AP dimensions

7.2. Recommended Land Pattern

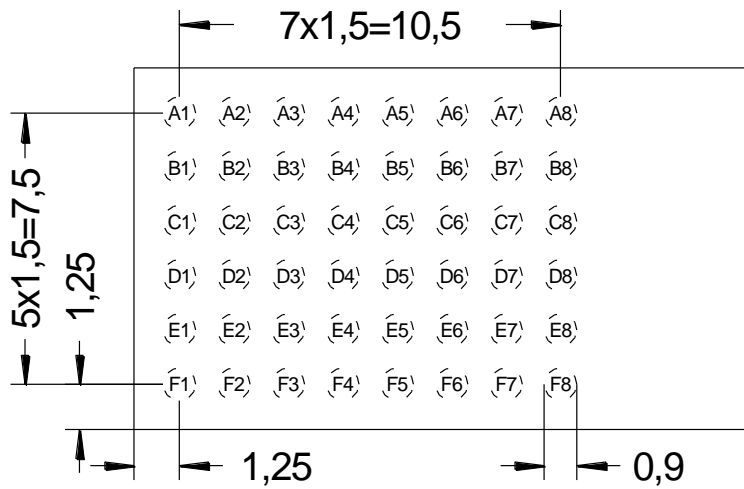


Figure 17: BlueMod+SR land pattern **TOP VIEW**



All dimensions are in mm.

7.3. 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.

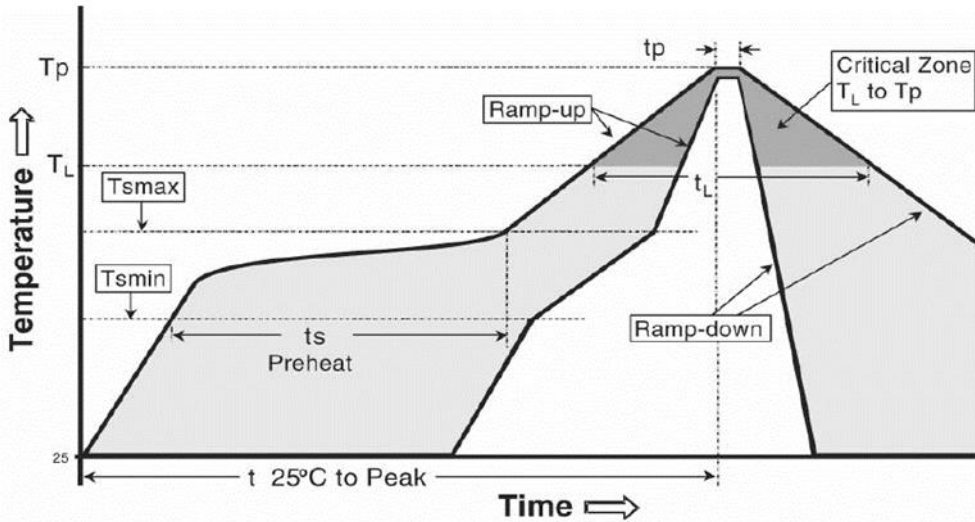


Figure 18: Soldering temperature time profile (for reflow soldering)

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+SR resides on the PCB side looking up. Heat above the solder eutectic point while the BlueMod+SR is mounted facing down may damage the module permanently.

7.4. Placement Recommendation

To achieve best radio performance for BlueMod+SR/AI, it is recommended to use the placement shown in Figure 19. This is a “corner placement” meaning the BlueMod+SR 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 7.5).

Please note that for best possible performance the antenna should be directed away from the application PCB as shown in Figure 19.

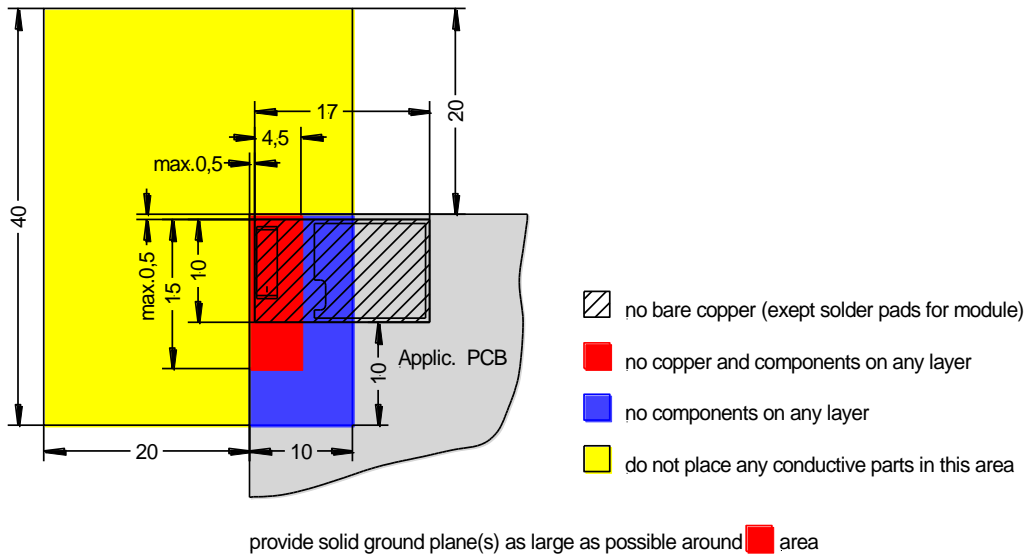


Figure 19: BlueMod+SR/AI placement recommendations

7.5. 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

7.6. Antenna Issues

BlueMod+SR is shipped with 2 different antenna designs:

- BlueMod+SR/AI comprises a ceramic antenna which as a component is soldered to the circuit board. This is functional for a BlueMod+SR/AI integrated into a plastic housing. No additional antenna is required.

For an external antenna to be set in, e.g. because the BlueMod+SR is integrated into a metal housing, the ceramic antenna is replaced.

- BlueMod+SR/AP routes the antenna signal to pin A-8.

The gain of the external antenna shall not exceed +2dBi.

When using an external Antenna the antenna must be fixed and shall not be removable or replaceable by the end user. In any case, the performance of the antenna (whether it is internal or external) 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. When the internal ceramic antenna is used, certain restrictions are to be considered.

7.7. Safety Guidelines

According to SAR regulation EN 62479:2010 the BlueMod+SR 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 EN60950-1: 2006 + A11: 2009 + A1: 2010 + AC:2011 all conductive parts of the BlueMod+SR are to be classified as SELV circuitry. OEM's implementing the BlueMod+SR in their products should follow the isolation rules given in regulation EN 60950-1: 2006.

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

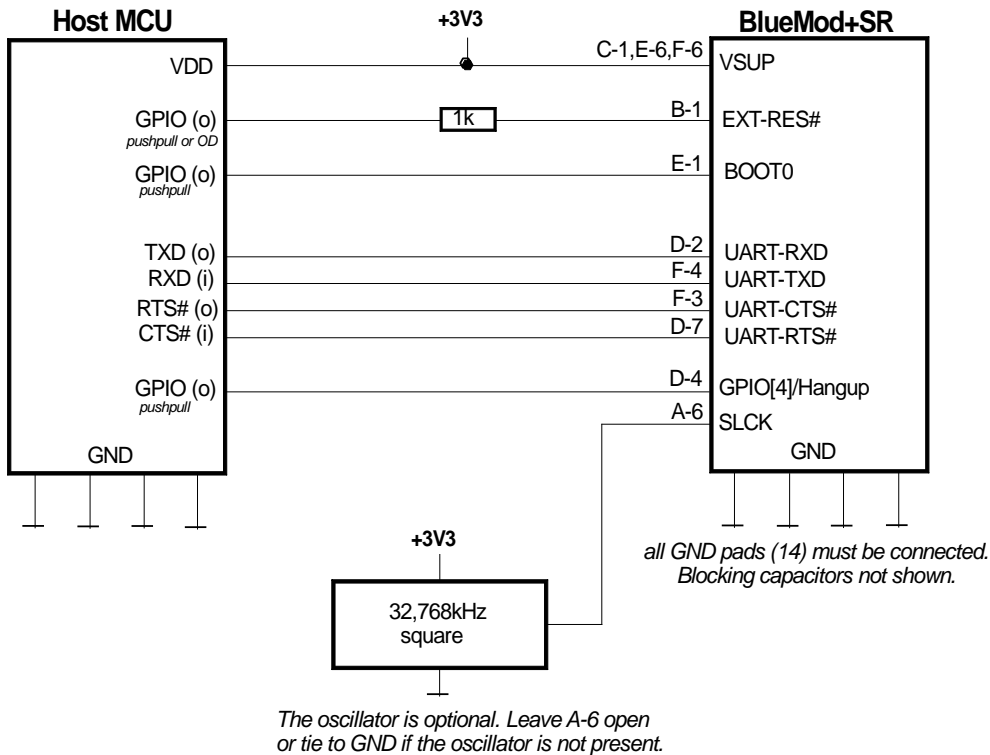
7.8. Cleaning

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

The following schematic shows a typical application of BlueMod+SR. The module is connected to some MCU running the application layer. MCU and BlueMod+SR use the same 3,3V power supply. Provisions are made for upgrading the firmware (BOOT0 and EXT-RES# are managed by the MCU). The serial interface has RTS/CTS flow control but no UICP support in this example. The 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+SR is connected to an MCU supporting RTS/CTS flow control and Hangup. Firmware update is supported (BOOT0, EXT-RES# connected). The slow clock oscillator (32,768kHz) is optional; it helps to save power during power down states.

Figure 20: Typical application schematics

9. APPROVALS/CERTIFICATIONS

The BlueMod+SR/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 Telit provides CE tested modules for customers in order to ease CE compliance assessment of end products and to minimize test effort.

9.1. Declaration of Conformity CE

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

- RED 2014/53/EU (Variant /AP for external antennas with less than +2dBi gain)
- RoHS 2011/65/EC

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

<http://www.telit.com/RED>

9.2. FCC Compliance

The BlueMod+SR/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.

BlueMod+SR/AP only:

For selling products implementing the BlueMod+SR/AP in the USA you'll have to apply for a Class II Permissive Change from the FCC authorities. Depending on antenna gain and other factors the FCC TCB will issue a reduced test plan for re-testing. Telit can assist customers with conducting this procedure on request. Especially the test plan reduction and cost optimization may be items worth to look at.

9.2.1. FCC Grant

TCB

TCB

**GRANT OF EQUIPMENT
AUTHORIZATION**
Certification
Issued Under the Authority of the
Federal Communications Commission
By:

MET Laboratories, Inc.
914 W. Patapsco Avenue
Baltimore, MD 21230-3432

Date of Grant: 07/08/2013
Application Dated: 07/08/2013

Telit Wireless Solutions GmbH
Mendelssohnstrasse 15
Hamburg, 22761
Germany

Attention: Jens Jensen

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: RFRMSR
Name of Grantee: Telit Wireless Solutions GmbH
Equipment Class: Digital Transmission System
Notes: Bluetooth Module
Modular Type: Single Modular

<u>Grant Notes</u>	<u>FCC Rule Parts</u>	<u>Frequency Range (MHZ)</u>	<u>Output Watts</u>	<u>Frequency Tolerance</u>	<u>Emission Designator</u>
CC	15C	2402.0 - 2480.0	0.006		

Output power listed is conducted. Modular Approval. This OEM module is approved for use in products operating as portable devices. The only antennas approved for use with this module is those documented in the filing.

CC: This device is certified pursuant to two different Part 15 rules sections.

TCB

**GRANT OF EQUIPMENT
AUTHORIZATION**

TCB

Certification
Issued Under the Authority of the
Federal Communications Commission
By:

MET Laboratories, Inc.
914 W. Patapsco Avenue
Baltimore, MD 21230-3432

Date of Grant: 07/08/2013
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Telit Wireless Solutions GmbH
Mendelssohnstrasse 15
Hamburg, 22761
Germany

Attention: Jens Jensen

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: RFRMSR
Name of Grantee: Telit Wireless Solutions GmbH
Equipment Class: Part 15 Spread Spectrum Transmitter
Notes: Bluetooth Module
Modular Type: Single Modular

<u>Grant Notes</u>	<u>FCC Rule Parts</u>	<u>Frequency Range (MHZ)</u>	<u>Output Watts</u>	<u>Frequency Tolerance</u>	<u>Emission Designator</u>
CC	15C	2402.0 - 2480.0	0.006		

Output power listed is conducted. Modular Approval. This OEM module is approved for use in products operating as portable devices. The only antennas approved for use with this module is those documented in the filing.

CC: This device is certified pursuant to two different Part 15 rules sections.

9.2.2. 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 may 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+SR/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 $\geq 5\text{mm}$ and if it is not used in co-locations with other antennas. If the product implementing the BlueMod+SR/AI has other

antennas in co-location or separation distances < 5mm an FCC TCB should be asked for a Class II Permissive Change.

RF exposure evaluation of devices implementing the BlueMod+SR/AP should be done with the collaboration of the FCC TCB working on the Class II Permissive Change Request.

9.2.6. FCC Labeling Requirements for the End Product

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

This device contains transmitter with	
FCC ID:	RFRMSR
IC:	4957A-MSR

9.3. IC Compliance

The BlueMod+SR/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.

For selling products implementing the BlueMod+SR/AP in Canada you'll have to apply for a Class II Permissive Change from the IC authorities. Depending on antenna gain and other factors the IC TCB will issue a reduced test plan for re-testing. Telit can assist customers with conducting this procedure on request. Especially the test plan reduction and cost optimization may be items worth to look at.

9.3.1. IC Grant



GRANT OF EQUIPMENT CERTIFICATION

THE FOLLOWING EQUIPMENT HAS BEEN TESTED
AND CERTIFIED UNDER
INDUSTRY CANADA
RSS-210, ISSUE 8, DEC. 2010
RSS-GEN, ISSUE 3, DECEMBER 2010

CB

Issued By:

CB

MET Laboratories, Inc.
914 W. Patapsco Avenue
Baltimore, Maryland 21230
Laboratory Number: 2043A

Equipment Certification is hereby issued to the Identified Certificate Holder and is VALID ONLY for the equipment identified herein.
La certification du matériel est distribuée à la Société identifiée et est VALIDE SEULEMENT pour l'équipement identifié ci-dessous.
NOT TRANSFERABLE / PAS TRANSMISSIBLE

FILE/CERTIFICATE NUMBER: 365-7-2013-39043

CERTIFICATION NUMBER: IC: 4957A-MSR

Issued to/Délivré à: Telit Wireless Solutions GmbH
Address: Mendelssohnstrasse 15 D
Hamburg, Germany D – 22761

Date Issued: 7/9/2013

Nature of Application/Nature d'Application: Original
Equipment Description/Genre de Matériel: Bluetooth module
Type of Radio Equipment: Low Power Device (2400 – 2483.5 MHz), Modular Approval, Spread Spectrum/Digital Device (2400-2483.5 MHz)
Equipment Category/Catégorie de Matériel: Category I

Model Number(s)/Modèle: BlueMod+SR

Conducted RF Power or Field Strength/Puissance H.F.: 0.007 W
Frequency Range/Bande de Fréquences: 2408-2480MHz
Bandwidth(s)/largeurs de bande: 978KHz(GFSK); 1220KHz(π /4-DQPSK); 1229KHz(8-DPSK Mode); 1063KHz(GFSK)
Emission Designations/Genre D'Émission: 978KF1D, 1M22G1D, 1M23F1D, 1M06F1D
Antenna Information/ l'information d'antenne: Integral

Test Lab: Shenzhen MORLAB Communication Technologies Co. Ltd., Fl. 3, Bldg A, FeiYang Science Park, Block 67, BoaAn District, Shenzhen, 518101 P.R. China
Tel: +86 755 36698555; Fax: +86 755 36698614
Test Lab IC Site Number: IC: 7183A-2

Notes: Output power listed is conducted. Modular Approval. This OEM module is approved for use in products operating as portable devices. The only antennas approved for use with this module is those documented in the filing.

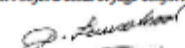
Certification of equipment means only that the equipment has met the requirements of the above-noted specification. Licence applications, where applicable to use certified equipment, are acted on accordingly by the Industry Canada issuing office and will depend on the existing radio environment, service and location of operation. This certificate is issued on condition that the holder complies and will continue to comply with the requirements and procedures issued by Industry Canada. The equipment for which this certificate is issued shall not be manufactured, imported, distributed, leased, offered for sale or sold unless the equipment complies with the applicable technical specifications and procedures issued by Industry Canada.

La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance d'Industrie Canada et dépendent des conditions radio ambiantes, du service et de l'emplacement d'exploitation. Le présent certificat est délivré à la condition que le titulaire satisfasse et continue de satisfaire aux exigences et aux procédures d'Industrie Canada. Le matériel à l'égard duquel le présent certificat est délivré ne doit pas être fabriqué, importé, distribué, loué, mis en vente ou vendu à moins d'être conforme aux procédures et aux spécifications techniques applicables publiées par Industrie Canada.

I hereby attest that the subject equipment was tested and found in compliance with the above-noted specification.

J'atteste par la présente que le matériel a fait l'objet d'essai et jugé conforme à la spécification ci-dessus.

Authorized MET Representative Signature:


Dasmitha Tennakoon

Printed: 7/9/2013

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.

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

RF exposure evaluation of devices implementing the BlueMod+SR/AP should be done with the collaboration of the IC TCB working on the Class II Permissive Change Request

9.3.5. IC Labeling Requirements for the End Product

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

This device contains transmitter with	
FCC ID:	RFRMSR
IC-ID:	4957A-MSR

9.3.6. IC Label Information BlueMod+SR

The BlueMod+SR 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+SR

The IC-ID is: 4957A-MSR

9.4. KC Certification

The BlueMod+SR/AI has been certified in Korea under the Clause 2, Article 58-2 of Radio Waves Act. Certificate is shown below with MSIP-CRM-Rfr-BlueModSR.

9.4.1. KC Certificate

2338-20607-23107-C210

방송통신기자재등의 적합인증서 <i>Certificate of Broadcasting and Communication Equipments</i>	
상호 또는 명칭 <i>Trade Name or Appellation</i>	Telit Wireless Solutions GmbH
기자재 명칭 <i>Appellation Name</i>	특정소출력 무선기기(무선데이터통신시스템용 무선기기)
기본모델명 <i>Trade Model Number</i>	BlueMod+SR
서칭모델명 <i>Search Model Number</i>	
인증번호 <i>Certification No.</i>	MSIP-CRM-Rfr-BlueModSR
제조사/제조국가 <i>Manufacturer/ Country of Origin</i>	Telit Wireless Solutions GmbH / 독일
인증연월일 <i>Date of Certification</i>	2014-02-28
기타 <i>Others</i>	

위 기자재는 「전파법」 제58조제2 제2항에 따라 인증되었음을 증명합니다.
 It is verified that foregoing equipment has been certificated under the Clause 2, Article 58-2 of Radio Waves Act.

2016년(Year) 06월(Month) 07일(Date)

국립전파연구원장 

Director General of National Radio Research Agency

* 인증 받은 방송통신기자재는 반드시 "적합심평과표시" 를 부착하여 구분하여야 합니다.
 따라서 사해된 처분 및 인증이 취소될 수 있습니다.



9.5. MIC Certification

The BlueMod+SR has been tested to fulfill the Japanese MIC requirements.



Please note that the Japanese Certificates are only valid for the variants using the internal ceramic antenna, denoted by the string “AI” in the product name.

BlueMod+SR modules designed for the use with an external antenna, denoted by the string “AP” in the product name, do need extra procedures if another antenna than in the following list of Approved External Antennas is intended to be used.

Every new antenna configuration requires an administrative Japanese Re-certification with reduced costs. For using another antenna with variant BlueMod+SR/AP, please contact Telit for starting the Japanese administrative process. Costs for re-measurements and certification should be considered.

Manufacturer	Part Number	Gain	Connector	Approval
WIMO	17010.11REV	2 dBi	Reverse SMA	MIC

Japanese Radio Law

日本の電気通信事業法と電気通信事業法の基準

This device is granted pursuant to the Japanese Radio Law (電波法)

本製品は、電波法と電気通信事業法に基づく適合証明を受けております。

This device should not be modified (otherwise the granted designation number will become invalid)

本製品の改造は禁止されています。（適合証明番号などが無効となります。）

9.5.1. MIC Certificates

Page 1(2)

CETECOM ICT Services GmbH
Untertürkheimer Strasse 8-10, D-66117 Saarbrücken, Germany

CETECOM™
CONFORMITY ASSESSMENT BODY

*Conformity Assessment Body
Recognized Certification Body for Japan*

認証書 TYPE- BASED CERTIFICATE

Approval Holder 認証を受けた者	Telit Wireless Solutions GmbH Mendelssohnstr. 15d, Hamburg, GERMANY
Manufacturer Name 製造者名	Telit Wireless Solutions GmbH Mendelssohnstr. 15d, Hamburg, GERMANY
Model Name 型式又は名称	BlueMod+SR Module approval: Each addition Host-equipment may not cause harmful interference.
Classification of Specified Radio equipment 特定無線設備の種類	Ordinance concerning Technical Regulations Conformity Certification etc. of Specified Radio Equipment 特定無線設備の技術基準適合証明等に関する規則 Article 2, clause 1, Item 13 Low power data communications system in the 2.4GHz band
- Type of emissions - Frequency -rated conducted power 電波の形式、 周波数 及び 空中線電力	See Annex 1
Certified Number 認証番号	202-LS0026
Date 認証をした年 月 日	2016-06-09


上記のとおり、電波法第 38 条の 24 第 1 項の規定に基づく認証を行ったものであることを証する。
This is to certify that the above-mentioned Type certification has been granted in accordance with the provisions of Article 38-24, Paragraph 1 of the Radio Law.

Recognized by The Ministry of Internal Affairs and Communications(MIC) via  BNetzA-CAB-03/25-51/4	Cetecom ICT Services GmbH Lothar Spitzer  Signature:
---	---

CETECOM ICT Services GmbH Untertürheimer Strasse 6-10, D-66117 Saarbrücken, Germany		
Conformity Assessment Body Recognized Certification Body for Japan		
認証書 TYPE – BASED CERTIFICATE		
Approval Holder 認証を受けた者	Telit Wireless Solutions GmbH Mendelssohnstr. 15d, Hamburg, GERMANY	
Manufacturer Name 製造者名	Telit Wireless Solutions GmbH Mendelssohnstr. 15d, Hamburg, GERMANY	
Model Name 端末機器の名称	BlueMod+SR	
Type of Equipment 端末機器の種類	Terminal equipment to be connected to leased line or digital data transmission facilities	
Certified Number 認証番号	D 15-0014 202	
Certified Date 認証年月日	2016-06-09	
<p>This certificate is issued and valid based on consent to comply with the following conditions:</p> <ul style="list-style-type: none"> • This equipment was evaluated and found to conform with the technical compliance standards for connecting with a circuit. This evaluation is based upon usage specified in the application and it does not guarantee the quality or performance of the equipment in any other type of usage. • The model name and certification label must be displayed on an external surface of the equipment. <p>端末機器の取扱については、下記事項を了承願います。</p> <ul style="list-style-type: none"> • 本品は、申込書類に基づき、回線へ接続するための技術基準に適合しているかどうか及び当該設計に合致するものとなることができるかどうか審査したもので、機器の品質、性能を保証するものではありません。 • 機器には、認定の表示、機器名を機器の外面の見易い箇所に容易に消えない方法で表示して下さい。 <p>This is to certify that the above mentioned equipment has been approved in accordance with the provisions of Article 56 of the Telecommunication Business Law.</p> <p>上記の端末機器は、電気通信事業法第 56 条の規定に基づく端末機器の設計についての認証を行ったものであることを証する。</p>		
Recognized by The Ministry of Internal Affairs and Communications (MIC) via 	CETECOM ICT Services GmbH Lothar Spitzer Signature: 	
BNetzA-CAB-03/25-51/4		

9.6. Anatel Certification

The BlueMod+SR/AI has been certified in Brazil by Anatel.



Federative Republic of Brazil
Telecommunications National Agency

Certificate of Equipment Authorization

(Not Transferable)

Nº **04343-16-02618**

Expires: **Indeterminada**
Date of Certificate: **03/05/2017**

Applicant: **TELIT WIRELESS SOLUTIONS TECNOLOGIA E SERV. LTDA.** Manufacturer: **TELIT COMMUNICATIONS S.P.A.**
ALAMEDA DA SERRA Nº420 SALA 307 **VIA STAZIONE DI PROSECCO, 5/B SGONICO (TRIESTE)**
VALE DO SERENO **ITALIA**
34000000 NOVA LIMA MG

This document approves, in accordance with the Telecommunication Rules and Regulations, the Certificate of Conformity number 5485, issued by **FUNDAÇÃO CENTRO DE PESQUISA E DESENVOLVIMENTO DE TELECOMUNICAÇÕES- CPQD**. This approval is issued on behalf of the applicant here identified and is valid only for the product described below for use under the Anatel's Rules and Regulations.

Type - Category: **Transceptor de Radiação Restrita - II**

Model - Comercial Name (s): **BlueMod+SR**

Basic technical characteristics:

Faixa de Frequências Tx (MHz)	Potência Máxima de Saída (W)	Designação de Emissões	Tecnologias	Tipo de Modulação
2.400,0 a 2.483,5	0,0014	1M10F7D	SALTO EM FREQUÊNCIA	GFSK
2.400,0 a 2.483,5	0,0014	1M13F7D	SALTO EM FREQUÊNCIA	$\pi/4$ DQPSK
2.400,0 a 2.483,5	0,0015	1M13G7D	SALTO EM FREQUÊNCIA	8DPSK
2.400,0 a 2.483,5	0,0022	717KG7D	SEQUÊNCIA DIRETA	GFSK

Ensaio de SAR não aplicável.

Comments: **Produto não acabado, de uso interno, cuja integração em outros equipamentos pode requerer nova avaliação.**
Este produto destina-se ao uso profissional, manuseado por pessoal devidamente qualificado, não sendo destinado ao uso do público em geral para acesso a serviço de telecomunicações de interesse coletivo.
Na instalação do produto devem ser observadas as condições de uso conforme estabelecido no Regulamento sobre Equipamentos de Radiocomunicação de Radiação Restrita.

Constitutes an obligation of the manufacturer or supplier of the product in Brazil to identify all approved products with Anatel's mark before its distribution to the market, as well as observe and maintain the technical characteristics which motivated the original certification.

The information in this Approval Certificate can be confirmed in the Certification and Approval Management System - SCH, available on Anatel's website. (www.anatel.gov.br).

Marcos de Souza Oliveira
Gerente de Certificação e Numeração

9.7. Bluetooth Qualification

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

The Declaration ID is: **B021281**

The Qualified Design ID is: **44784**

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.

QDL Bluetooth® Qualified Design Listing

The Bluetooth SIG Hereby Recognizes

Stollmann E+V GmbH

Member Company

BlueMod+SR

Qualified Design Name

Declaration ID: **B021281**

Qualified Design ID: **44784**

Specification Name: **4.0**

Product Type: **End Product**

Model Number: **BlueMod+SR**

Listing Date: **26 August 2013**

Assessment Date: **26 August 2013**

Hardware Version Number: **V2,V3**

Software Version Number: **V1**

This certificate acknowledges the *Bluetooth*® Specifications declared by the member were achieved in accordance with the *Bluetooth* Qualification Process as specified within the *Bluetooth* Specifications and as required within the current PRD



9.8. RoHS Declaration

The BlueMod+SR/AI and BlueMod+SR/AP do fully comply with EU RoHS directive.

- RoHS 2011/65/EC

The actual version of RoHS Declaration of Conformity (EU DoC) can be downloaded from the Telit Download Zone:

<http://www.telit.com/download-zone/>

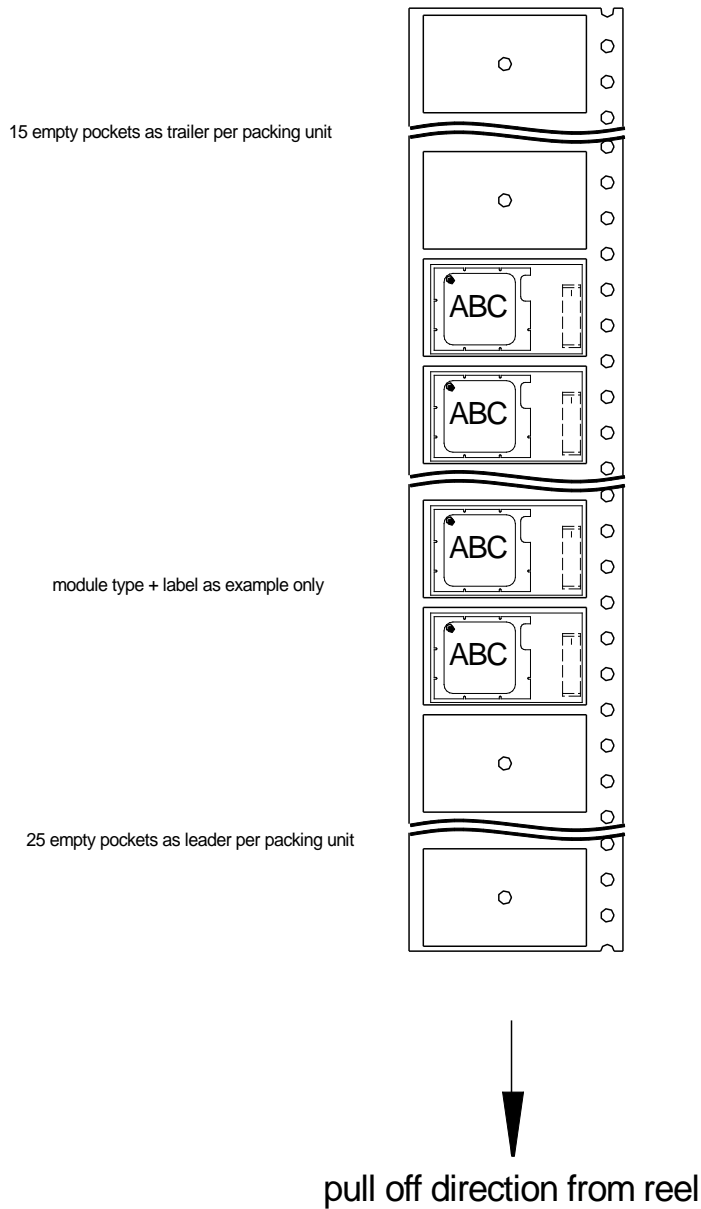
Take note that you have to register to get access to the Download Zone.

10. PACKING

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

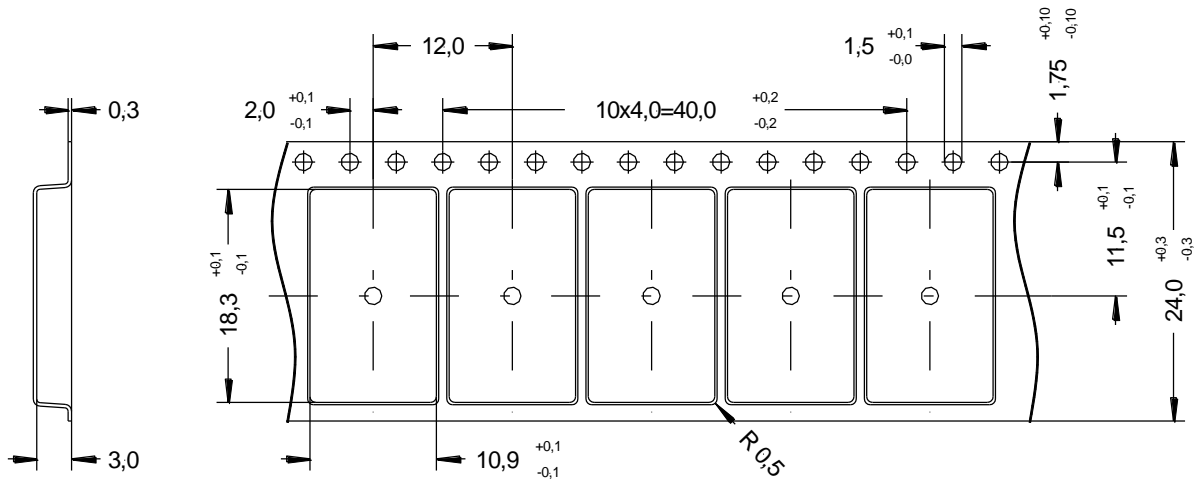
10.1. Tape&Reel Packing

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

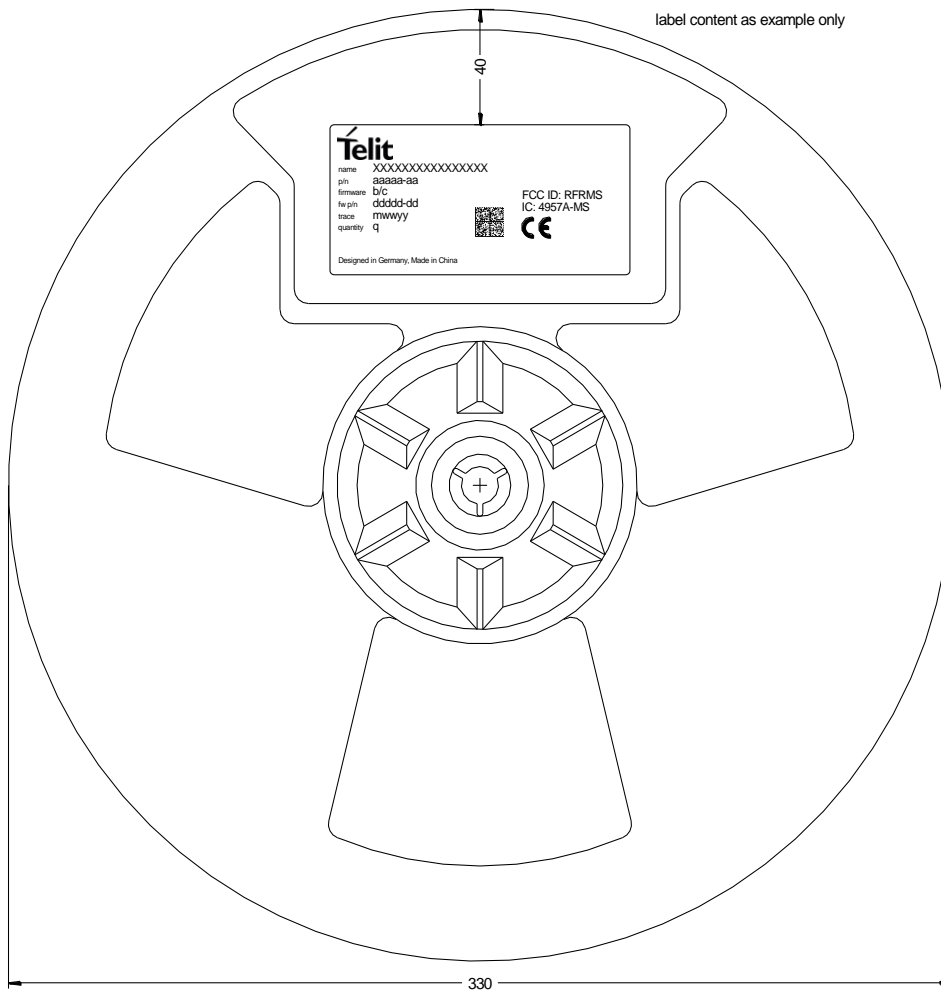


10.1.1. Tape

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

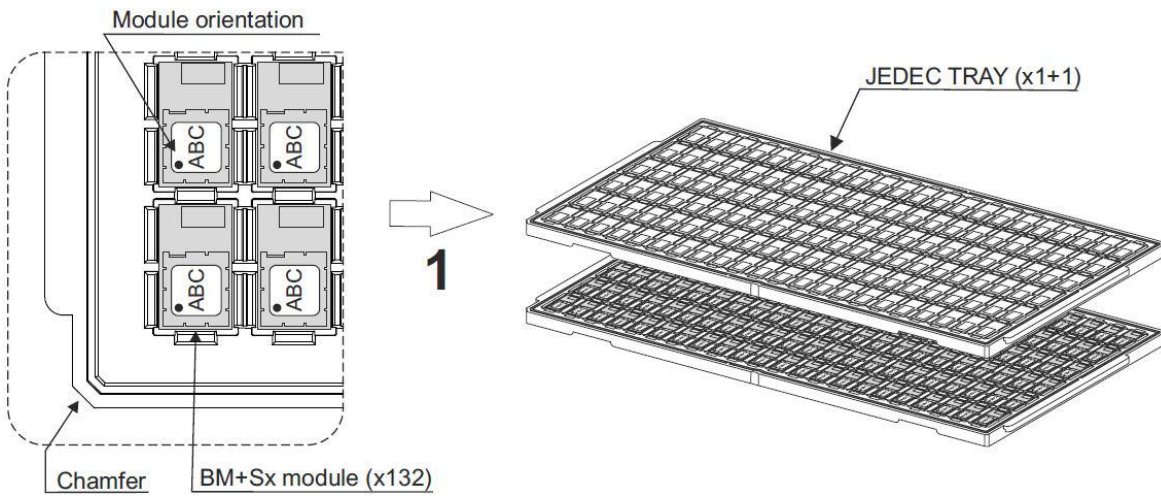


10.1.2. Reel

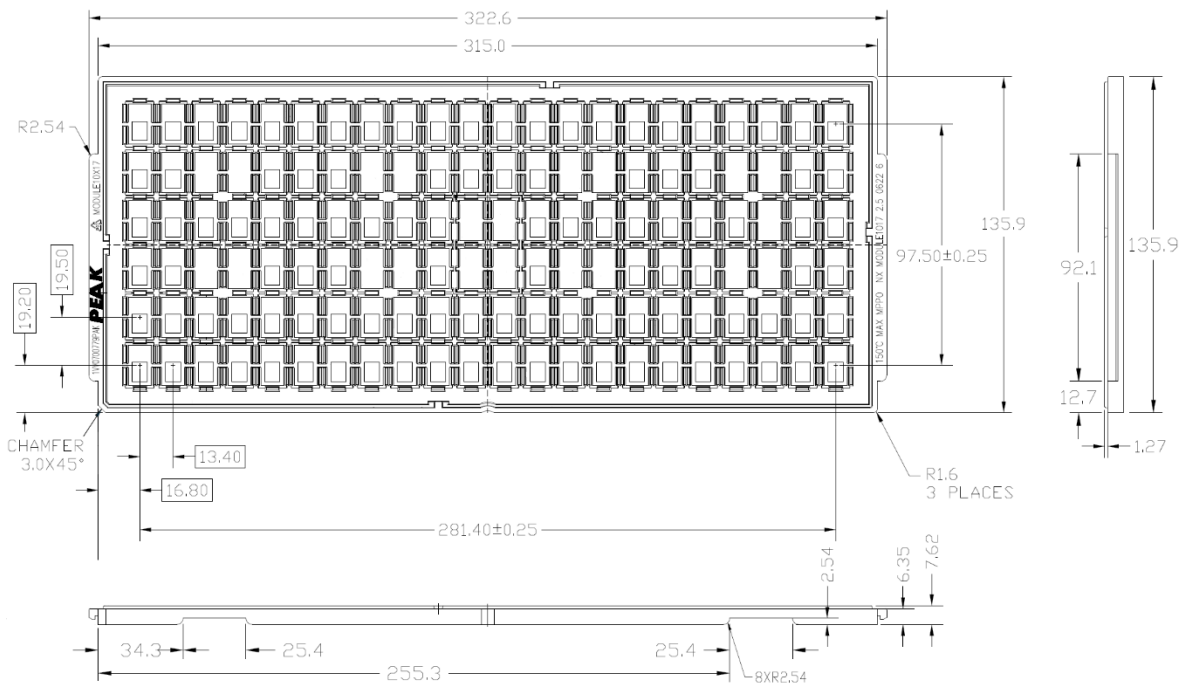


10.2. Tray Packing

10.2.1. Module Orientation



10.2.2. Tray Dimension



10.3. Moisture Sensitivity Level

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

11. EVALUATION KIT

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

12. SAFETY RECOMMENDATIONS

12.1. READ CAREFULLY

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc.
- Where there is 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 has to be supplied with a stabilized voltage source and the wiring has to be conformed to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to 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, care has to be taken to the external components of the module, as well as any project or installation issue, because the risk of disturbing the GSM network or external devices or having impact on the security. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

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

<http://ec.europa.eu/enterprise/sectors/rte/documents/>

The text of the Directive 99/05 regarding telecommunication equipment is available, while the applicable Directives (Low Voltage and EMC) are available at:

<http://ec.europa.eu/enterprise/sectors/electrical/>

13. DOCUMENT HISTORY

Revision	Date	Changes
02	2013-02-04	First issue
03	2013-02-21	<p>Signal naming conventions harmonized</p> <p>Signals in tables re-sorted</p> <p>Corrected some typos</p> <p>Updated dimension drawing (with new antenna)</p> <p>Added land pattern drawing</p> <p>Chapter “Restricted Area” renamed into “Placement Recommendation” and replaced text with drawing</p> <p>Added figure BlueMod+SR Pin Numbering (Top View)</p> <p>Added current consumption for standby mode</p> <p>Revised chapter Introduction</p>
04	2013-05-31	<p>Spelling and formatting</p> <p>Chapter Application Interface, Examples added to several sub chapters</p> <p>Chapter Power Supply, requirements lowered</p> <p>Chapter Reset, allowed to use series resistor to connect external low-active reset</p> <p>Chapter Serial Interface updated, UICP included</p> <p>Chapter PIO Interface renamed to GPIO Interface</p> <p>Chapter WLAN Coexistence, minor changes in text</p> <p>Pin Strapped System Memory Boot Mode Invocation updated</p> <p>Chapter Serial Wire DEBUG Interface added</p> <p>Chapter Pin Description, tables updated and corrected, removed signals “/BT-CONNECTED” and “STM32-WAKEUP”</p> <p>New chapter Handling of Unused Signals added</p> <p>Chapter Power Consumption and Power Down Modes, Tables updated</p> <p>Chapter RF Performance, RF parameter updated</p> <p>Chapter Antenna-Gain and Radiation Pattern updated</p> <p>Chapter Re-flow Temperature Profile updated</p> <p>Chapter Application Diagram added</p> <p>Chapter Approvals/Certifications updated</p>
05	2013-07-05	Chapter Placement Recommendation updated

Revision	Date	Changes
		<p>Chapter Classic Bluetooth, some current measurements added</p> <p>Chapter Ordering Information: MOQ and number of modules per reel changed to 400</p> <p>Chapter Approvals/Certifications updated</p>
06	2013-09-04	<p>Chapter Power Consumption and Power Down Modes some current measurements added; tables re-formatted</p> <p>Chapter Power Supply LDO recommendation updated</p> <p>Chapter Placement Recommendation updated</p> <p>Chapter Antenna Issues updated</p> <p>Chapter KCC Certification added (following chapters renumbered)</p> <p>Chapter Safety Guidelines completed</p> <p>Chapter Bluetooth Qualification updated</p> <p>Chapter Serial Wire DEBUG Interface headline changing, emphasize DEBUG in relation to chapter TRACE Interface added</p> <p>Chapter Pin Description: Debug and trace functionality in signal naming clarified and added a note on necessity of accessing sign TRACE UART TXD in customer's hardware</p> <p>Chapter Power Consumption and Power Down Modes removed "close range"</p> <p>Chapter Package Label updated to version with KCC ID and logo</p>
07	2014-12-19	<p>Chapter WLAN Coexistence Interface implementation info corrected</p> <p>Chapter NFC Support chapter added</p> <p>Chapter Standard Packing Unit 1000 pieces tape and reel added</p> <p>Chapter Recommended Land Pattern hint "TOP VIEW" added</p> <p>Chapter 3-Wire Serial Interface Note on data loss extended</p> <p>Chapter Power Consumption and Power Down Modes 2 sub-chapters SPP and BLE Tables revised Added values using sniff (without using UICP)</p>
08	2015-01-28	<p>Chapter Baud Rate Deviation revised</p> <p>Chapter Power Consumption and Power Down Modes current measurements with UICP active added</p>
09	2015-04-13	Chapter MIC Certification added

Revision	Date	Changes
		<p>Chapter Cleaning added</p> <p>Chapter Package Label MIC Certification updated</p> <p>Chapter Power-Up Time Bluetooth Link accepted time added</p>
10	2015-08-11	<p>Cover Page photo updated (label change)</p> <p>Chapter Power-up / -down Slew-Rate Values VSUP min/max rise times added</p> <p>Chapter Pin Numbering graphics enlarged for readability</p> <p>Chapter SPP Pin Configuration table format optimized</p> <p>Chapter Classic Bluetooth table format optimized</p> <p>Chapter Digital I/O Including EXT-RES# table format optimized</p>
11	2016-05-26	Telit cover page added
12	2016-12-15	<p>Chapter MSL added</p> <p>Module height changed to worst case values</p> <p>Adjusted download link in introduction</p>
13	2017-04-12	<p>Document converted to Telit template</p> <p>Chapter Declaration of Conformity CE updated, note RED pending added</p> <p>Chapter MIC Certification, updated to Telit version</p> <p>Chapter RoHS Declaration, revised, Status pending</p> <p>Chapter KC Certification, updated to Telit version</p> <p>Chapter FCC Grant, updated to Telit version</p> <p>Chapter IC Grant, updated to Telit version</p> <p>Chapter Anatel Certification added</p> <p>Chapter SPP Pin Configuration, note added Pin C-1 may be left open</p> <p>Chapter Power Supply, LinReg output capacitor value changed to 1μF</p> <p>Chapter Packing, new drawings for Tape&Reel, tray packing introduced</p> <p>Chapter Ordering Information deleted</p>
14	2017-06-07	<p>Chapter Declaration of Conformity CE updated</p> <p>Chapter Anatel Certification updated</p> <p>Chapter RoHS updated</p> <p>Chapter General Pin Description note for pin C-1 added</p>



SUPPORT INQUIRIES

Link to www.telit.com and contact our technical support team for any questions related to technical issues.

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