BlueMod+C11/G2

Hardware reference

Note

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

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Table of contents

1 Introduction

This Hardware Reference Guide documents how BlueMod+C11/G2 can be integrated into customer systems.

It addresses developers of hardware environments for BlueMod+C11/G2.

For detailed information about software interfaces refer to the software reference manual.

The BlueMod+C11/G2 is available with EDR functionality disabled and enabled. For the product with EDR disabled all information given in the following chapters regarding EDR performance and functionality is not valid. Information regarding EDR performance and functionality applies only to the BlueMod+C11/G2 with EDR functionality enabled.

1.1 Feature Summary

- Bluetooth specification V2.0+EDR
- EDR compliant with V2.0.E.2 of specification for 2Mbps and 3Mbps modulation modes
- Full Speed Bluetooth Operation with Full Piconet Support
- Scatternet Support
- Complete Co-location and Co-existence with 802.11 (AWMA, AFH and SFH)
- Fast Connection Setup
- RF output power class 1 with power control
- Supply Voltage 3.3V range 3.0V to 3.6V
- Internal crystal oscillator (26 MHz BC04 and 14,7456MHz for ARM7)
- Full Bluetooth data rate up to tbd kbps asymmetric
- Support for very low-power modes (sleep and deep sleep)
- Full 8- to 128-bit encryption
- High sensitivity design (-87 dBm typ.)
- Extra ARM7TDMI CPU for embedded profiles and/or application software
- Up to 17 GPIO lines
- USB 2.0 Full Speed Device Interface
- Master/Slave SPI
- Synchronous Serial Controller
- PWM Controller
- PCM Interface
- 10 bit A/D Converter
- Power control
- 5V tolerant I/Os
- -40℃ to +85℃ industrial operating temperature ran ge
- RoHS Compliant

1.2 Applications

BlueMod+C11/G2 can be used in different applications. Some typical applications are described in this chapter. For applications requiring an external adapter please refer to other BlueRS+ versions from Stollmann

BG/JW: Bitte Kapitel nach Wunsch einfügen

2 Block Diagram

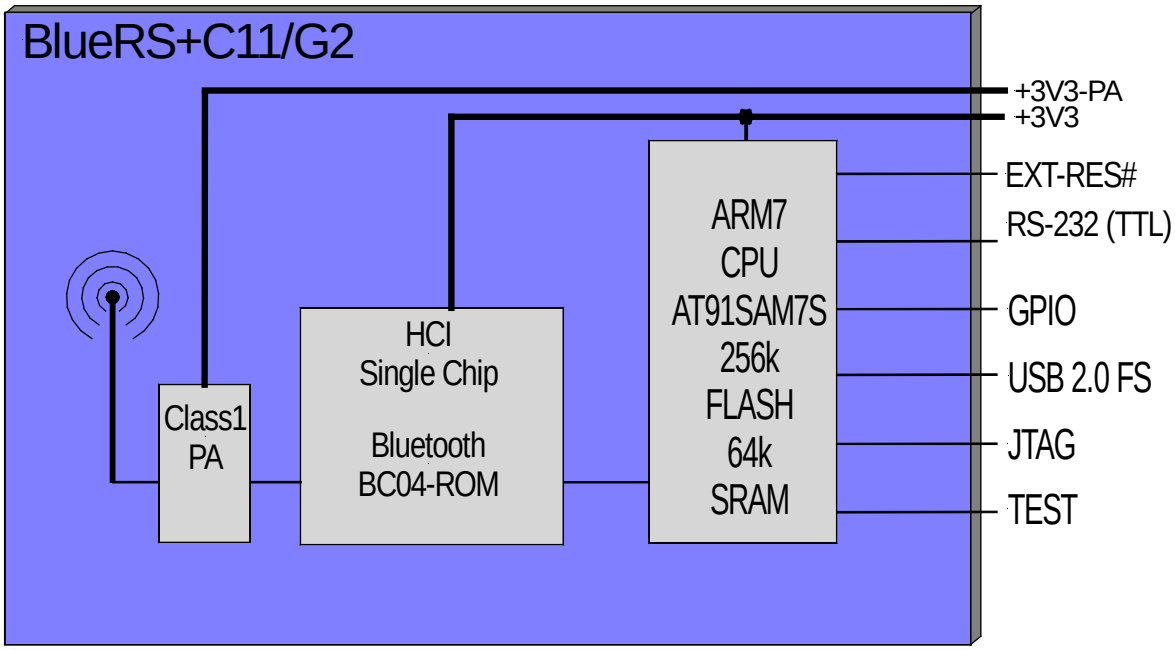


Fig. 1 Block Diagram

3 Application Interface

3.1 Power Supply

The BlueMod+C11/G2 has 2 power supply rails, which always should be kept on the same voltage level.

Pin	Signal	Usage
C-13	3V3	Supply for digital and low power RF circuitry,
C-16	3V3-PA	Supply for RF Amplifier
C-14	GND	Reference Supply
C-15	GND	Reference Supply

The pin order is made such that on the customer hardware directly at the pins of each supply pair pins (C-13/C14) and pins (C-16/C-15) a 10uF X5R ceramic capacitor with for example a 1206 footprint can be placed for decoupling. It is recommended to add further smaller value ceramic capacitors. These values depend on noise frequencies on the supply rail. The following picture shows a sample layout with 2 linear regulators in SOT23-5 housings and various capacitors in SMT shapes 0402, 0805 and 1206.

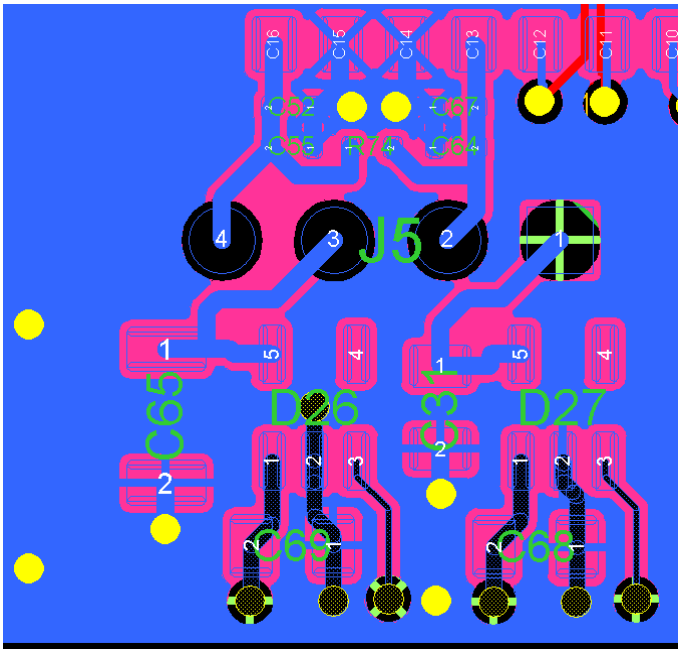


Fig. 2 Sample Layout Power Supply

Each supply rail should be fed with 3,3V, Range 3,0V to 3,6V incl. Noise, low noise from a linear regulator with fast transient response. Stollmann suggest using 2 pcs.

TOREX: XC6204B332MR

regulators, so that the fast current transients of the class1 RF power amplifier do not interfere with sensitive PLL circuitry of the low power RF circuitry.

For layout guidelines please see sample implementation Stollmann reference design BlueMod+Eval/C11/G2.

Excessive noise or too slow current transient response on the supply rails may have an impact on the RF performance.

3.2 Power-On-Reset

The BlueMod+C11/G2 is equipped with circuitry for generating Power On Reset and to provide under-voltage supervision. An integrated circuit type Maxim DS1818R provides this functionality.

A reset is generated if the 3.3V supply rail including noise falls below 2,8V to 2,97V.

Via Pin A-1 an external reset can be generated by holding EXT-RES# at ≤ 0.3V for ≥ 10ms. A 74LVC14 Schmitt Trigger gate with a 1kR5/10nF low-pass filter at the input is implemented to avoid false reset pulse recognition due to EMC effects.

If EXR-RES# is not used, it may be left open or tied to VCC.

3.3 Serial Interface

The interface functionally corresponds to the norm V.24 / RS-232 but has TTL-level.

- Transmission speeds 300 bps – 1,843200 Mbps (asynchronous)
- Character representation: 7 to 9 Bit, even, odd, mark, space or no Parity, 1, 1.5 or 2 stop bits
- Half duplex or full duplex
- Hardware flow-control (RTS/CTS)

Note: All signals of the serial interface are named according to the EIA232 DTE definition.

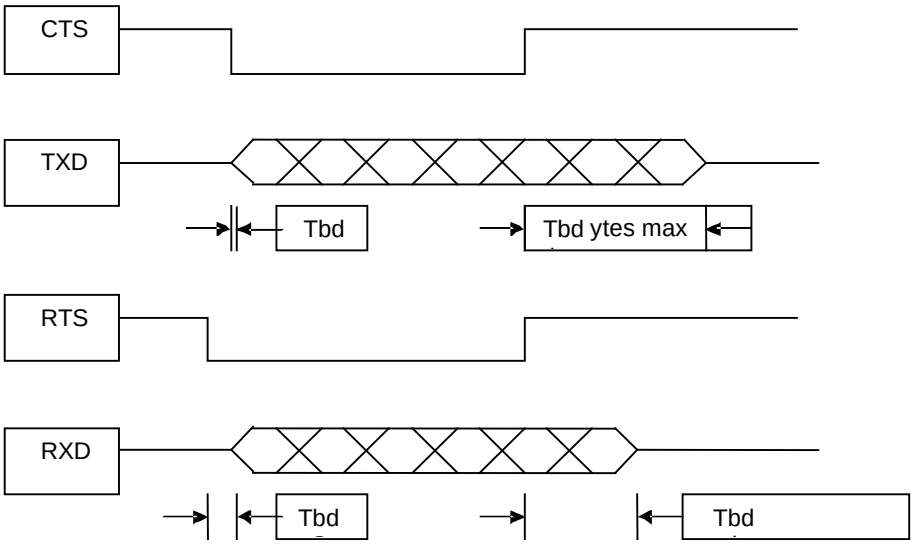


Figure 1. UART Timing Diagram

3.4 GPIO Interface

All user signals, except for EXT-RES#, which is routed via a Schmitt Trigger gate, are connected directly to port pins of the ATMEL AT91SAM7S256 CPU. Except for USB signals DP, DM and GPIO(4), no pull-up or down resistors are implemented, so that the I/O characteristics of the ATMEL CPU apply. These are

- 3V3 logic 5V tolerant
- V_{IL} max = 0.8V, V_{IH} min = 2.0V, V_{IH} max = 5.5V
- V_{OH} min = VCC – 0.4V @ I_O = 8mA, V_{OL} < 0.4V @ I_O = 8mA

- LED's can be driven directly on specific GPIO lines when I_o stays below 8mA
  All current consumption data in this document are given with I_O(GPIO) = 0mA
  See chapter 5 Electrical Characteristics for detailed information.
- All I/O signals except USB, GPIO(4) and JTAG are connected directly from the AT91SAM7S pins to the user accessible stamp pins. Therefore the electrical characteristics of the I/O pins are programmable in regard to direction, pull-up resistor, function, push-pull or open drain. Please see specific application software documentation for details. After reset all GPIO's have pull-ups avtivated. GPIO10, GPIO8 and TXD have 50kR to 300kR pull-ups, all other I/Os have 5kR to 20kR pull-ups

3.5 Alternate GPIO/IO Functions

Application specificly dedicated GPIO or IO pins can be programmed to alternative functionalities. Then pin functionality and direction are fixed for the activated function block. Many GPIO's or IO's are used by the SPP application. See chapter SPP Configuration. Probably some of them can be released for use by other function blocks. Co-functionality of blocks has to be carefully considered, because pin multiplexing possibilities are fixed by the ATMEL AT91SAM7S CPU and using a function block often causes that other function blocks can't be used at the same time. Please refer to the ATMEL data sheet AT91SAM7Sxxx Rev. F for complete information. The possibilities depicted in the following chapters are an subset only.

The following function blocks may be usable on the BlueMod+C11/G2:

3.5.1 Master/Slave SPI Interface

Pin #	GPIO# IO Name	Alternative Signal Name	Description	Direction	
				Master	Slave
A5	GPIO1	MISO	Master In Slave Out	IN	OUT
A4	GPIO0	MOSI	Master Out Slave In	OUT	IN
A3	GPIO3	SPCK	Serial Clock	OUT	IN
A6	GPIO2	NPCS0	Peripheral. Chip Select	OUT	IN

Clock polarity and phase are programmable. The chip select signal is low active.

3.5.2 Synchronous Serial Interface

The Synchonous Serial Interface is capable of handling the protocols I2S, Short Frame Sync, Long Frame Sync and other Telecom protocols. Receiver and transmitter do act independently. Due to multiplexing interdependencies the SSC is only available with the Transmitter clock signal TK used for both directions if the UART IF is enabled. JTAG reset, signal /ATRST, is also not available, if the SSC signal RF, Receiver Frame Sync is used.

Pin #	GPIO# IO Name	Alternative Signal Name	Description	Direction	
				Case 1	Case 2
A16	/ATRST	RF	Receiver Frame Sync	IN	OUT
A12	GPIO10	RD	Receiver Data	IN	IN
C7	TXD	RK	Receiver Clock	IN	OUT
A13	GPIO7	TF	Transmitter Frame Sync	IN	OUT
A11	GPIO8	TD	Transmitter Data	OUT	OUT
A14	GPIO9	TK	Transmitter Clock	IN	OUT

3.5.3 Multi Channel PWM Controller

Each PWM channel can be programmed individually in regard to IO pin assignment and PWM functionality. Therefore PWM application designers can choose a proper channel and pin for their application with the chance not to interfere with other necessary interfaces.

Pin #	GPIO# IO Name	Alternative Signal Name	Description	Direction
A6	GPIO2	PWM0	PWM Waveform Out CH0	OUT
C9	GPIO5	PWM0	PWM Waveform Out CH0	OUT
C5	/CTS	PWM1	PWM Waveform Out CH1	OUT
A5	GPIO1	PWM1	PWM Waveform Out CH1	OUT
A5	GPIO1	PWM1	PWM Waveform Out CH1	OUT
C2	GPIO15	PWM1	PWM Waveform Out CH1	OUT
C4	/RTS	PWM2	PWM Waveform Out CH2	OUT
A4	GPIO1	PWM2	PWM Waveform Out CH2	OUT
C8	GPIO6	PWM2	PWM Waveform Out CH2	OUT
A3	GPIO3	PWM3	PWM Waveform Out CH3	OUT

3.5.4 PCM interface

XXX (JW)

For being able to use the PCM interface the HW needs to be altered. At the moment no version with this alteration can be ordered. The PCB layout allows the use of the Bluetooth HCI chips PCM interface at certain GPIO pins for future enhancements by population changes. Then also the electrical characteristics of these pins do change, because the characteristics of the CSR BC04 Bluetooth HCI chip apply. Especially the 5V IO tolerance is not applicable anymore.

Pin #	GPIO# IO Name	Alternative Signal Name	Description	Direction
A12	GPIO10	PCM-OUT	PCM Data Out	OUT
A11	GPIO8	PCM-IN	PCM Data In	IN
A14	GPIO9	PCM-CLK	PCM Clock	OUT ???
A13	GPIO7	PCM-SYNC	PCM Frame Sync	OUT ???

PCM-Out has a 10k pull-up to +3V3 and is driven OC only.

The following electrical characteristics apply:

Input Voltage Levels	Min	Max
V_{IL}	- 0.4V	+0.8V
V_{IH}	0.7 VCC	VCC + 0.4V
Output Voltage Level		
V_{OL} (I_O < 4mA sunk)		0.2V
V_{OH} (I_O < 4mA sourced)	VDD-0.2V	

3.5.5 Analog to Digital Converter

3 ADC channels with 8 to 10bit resolution in reference to 1.8V are available. A wide range of trigger sources and programmable S&H timing are available.

Pin #	GPIO# IO Name	Alternative Signal Name	Description	Direction
A16	JTAG-RES#	AD3	ADC channel 3	In analogue
A12	GPIO10	AD0	ADC channel 0	In analogue
A11	GPIO8	AD1	ADC channel 1	In analogue

3.6 Bluetooth radio Interface

The BlueMod+C11/G2 offers 3 population variants for the antenna

1) The BlueMod+C11/G2/-AE variant presents a 50Ω impedance antenna interface on a Radiall UMP connector, type R107103020. See http://www.radiall.com/

2) The BlueMod+C11/G2/-AI variant presents an integrated ceramic antenna.

3) The BlueMod+C11/G2/-AP variant presents a 50Ω impedance antenna interface on pin A-27 with adjacent GND pins A-26 and A-28. Signal routing of the RF signal on customer PCB has to be implemented with 50R micro-strip line technique.

Pins A-26 and A-28 should be connected directly to the reference GND plane.

If the antenna performance does not meet your requirements or you need antenna support, please contact Stollmann.

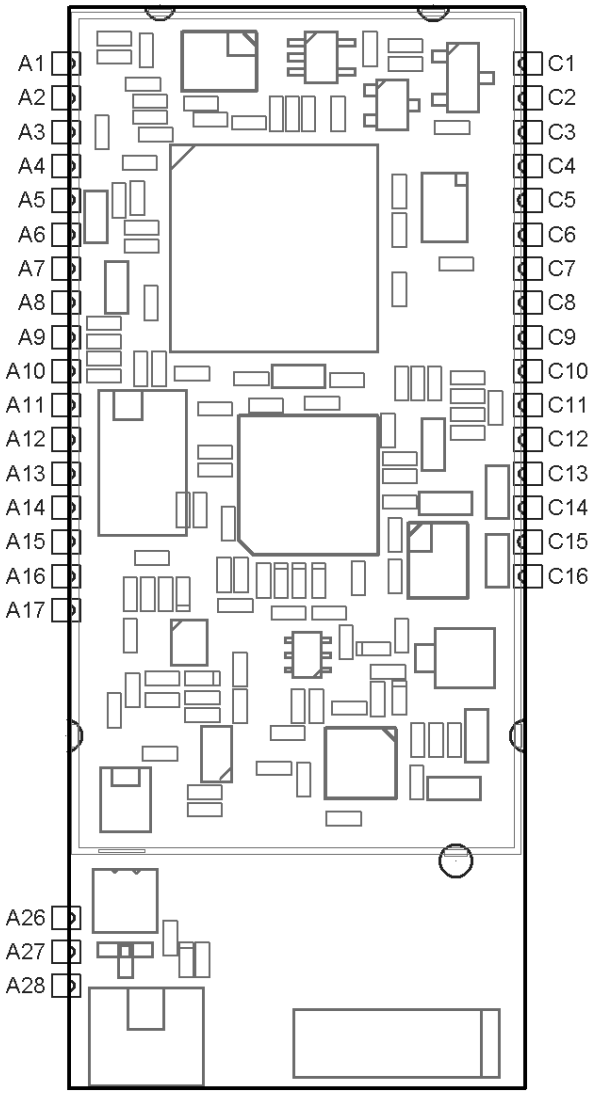
3.7 Etc.

For SW development purposes on the module pins a full JTAG interface connected to the ATMEL CPU is implemented.

4 Pin Description

The BlueMod+C11/G2 module is soldered on customers PCB via stamp pins located on the module PCB edges.

4.1 Pin Numbering



Top View

4.2 Pin Description

4.2.1 General Pin Description

Pin	Signal	Dir.	Activ	Description
A1	/EXT_RES	I	L	Reset low active
A2	M0-DTXD	I		Test pin – do not connect
A3	GPIO3 ()	I/O		General Purpose IO
A4	GPIO0 ()	I/O		General Purpose IO
A5	GPIO1 ()	I/O		General Purpose IO
A6	GPIO2 ()	I/O		General Purpose IO
A7	ATDO	O		JTAG test data output
A8	ATCK	I		JTAG clock
A9	ATMS	I		JTAG mode select
A10	ATDI	I		JTAG test data input
A11	GPIO8 (PCM_IN)	I		General Purpose IO
A12	GPIO10 (PCM_OUT)	O		General Purpose IO
A13	GPIO7 (PCM_SYNC)	O		General Purpose IO
A14	GPIO9 (PCM_CLK)	O		General Purpose IO
A15	M1-DRXD	I		Test pin – do not connect
A16	/ATRST	I	L	GPIO or JTAG reset (Pop Change nec.)
A17	TST	I		Test pin – do not connect (SAMBA = HIGH)
A26	ANT_GND			Antenna ground, connect directly to plane
A27	ANT			50 Ohm Rx/Tx connection to antenna
A28	ANT_GND			Antenna ground, connect directly to plane
C1	GPIO14	I/O		General Purpose IO
C2	GPIO15	I/O		General Purpose IO (SAMBA = HIGH)
C3	GPIO13	I/O		General Purpose IO
C4	/RTS	I	L	Request to send
C5	/CTS	O	L	Clear to send
C6	RXD	O		Receive Data
C7	TXD	I		Transmit Data
C8	GPIO6	I/O		General Purpose IO (SAMBA = HIGH)
C9	GPIO5	I/O		General Purpose IO (SAMBA = HIGH)
C10	GPIO4	I/O		General Purpose IO
C11	USB_DM	I/O		USB D-, Data pin
C12	USB_DP	I/O		USB D+, Data pin
C13	VCC	P		+3.3V Power digital and low power RF
C14	GND	P		GND
C15	GND	P		GND
C16	VCC	P		+3.3V Power RF amplifier

4.2.2 Application Specific Pin Description

4.2.3 SPP Configuration

Pin	Pin Name	SPP function	Dir.	Active	Description
A3	GPIO3	Break out	O	tbd	generate break
A4	GPIO0		I/O		
A5	GPIO1	Break detect	I		Optional, connect external to RXD special firmware required
A6	GPIO2		I/O		General Purpose IO
A11	GPIO8	ID1	O		Identification signal 1
A12	GPIO10	UA2	O		User Output 2
A13	GPIO7	/LED1	O	L	Device ready
A14	GPIO9	/LED2	O	L	Bluetooth connected. Active if a Bluetooth connection exists. Inactive in idle state. Flashes during startup.
C1	GPIO14	/RTC-OUT	O	L	DSR in DCE mode DTR in DTE mode
C2	GPIO15	/DCD	I/O	L	Data Carrier Detect input in DTE mode, output in DCE mode
C3	GPIO13	/RTC-IN	I	L	DTR in DCE mode DSR in DTE mode
C4	/RTS		I	L	Request to send
C5	/CTS		O	L	Clear to send
C6	RXD		O		Receive Data
C7	TXD		I		Transmit Data
C8	GPIO6	/RI	I/O		Ring Indicator input in DTE mode, output in DCE mode
C9	GPIO5	ID2	O		Identification signal 2
C10	GPIO4	DTE-/DCE	I	10k PD	DTE DCE mode selector
C13	VCC	VCC	P		+3.3V Power
C14	GND	GND	P		GND
C15	GND	GND	P		GND
C16	VCC	VCC	P		+3.3V Power
A1	/EXT_RES	/EXT_RES	I	L	Reset low active
C11	USB_DM				Do not connect
C12	USB_DP				Do not connect

5 Electrical Characteristics

5.1 Absolute Maximum Ratings

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

Item	Symbol	Absolute Maximum Ratings	Unit
Supply voltage	V_{cc}	3,7V with respect to GND to - 0,4V with respect to GND	V
Voltage on any pin	V_{Pin}	VCC + 0,4V with respect to GND to - 0,4V with respect to GND	V
Input RF level	P_{max}	0	dBm
ESD on any pin	V_{ESD}	This device is ESD sensitive. Handling and assembly of this device should be at ESD protected workstations.	

5.2 Operating Conditions

5.2.1 RF and Supply Connections

Vcc = 3.0V to 3.6V, T_{amb} = - 40℃ to +85℃

Item	Condition	Limit			Unit
		Min	Typ	Max	
Frequency Range Pin A-27		2400		2483.5	MHz
Load impedance Pin A-27 or UMP connector	Measured with network analyzer in the frequency range at antenna pin		50		Ω
Output return loss Pin A-27 or UMP connector	Receive Mode to 50Ω load Transmit Mode to 50Ω load	-10 -10			dBm
Supply voltage Pin C-13 and Pin C-16	The typical voltage is recommended Vcc at voltage pin (incl. ripple)	3.0	3.3	3.6	Vdc
Ripple on Vcc	Ripple frequency ≥200kHz Ripple frequency <200kHz			20 20	mVrms

5.2.2 GPIO, JTAG; Serial IF and Test Pins

Vcc = 3.3V, T_{amb} = - 40℃ to +85℃

Symbol	Item	Condition	Limit		Unit
			Min	Max	
V_{IL}	Low-Level Input Voltage		-0.3	0.8	V
V_{IH}	High-Level Input Voltage		2.0	5.5	V
V_{OL}	Low-Level Output Voltage	I_{OL} < 8mA	-	0.4	V
V_{OH}	High-Level Output Voltage	I_{OH} < 8mA	VCC-0.4	-	V
I_{O1}	Output Current GPIO(5,6,15)		-	16	mA
I_{O2}	Output Current GPIO(10,8), TXD, /JTAG-RES		-	2	mA
I_{O3}	Output Current Other PIO except USB			8	

Note: Please refer to ATMEL AT91SAM7S data sheet for more specific information

5.2.3 USB Pins

Vcc = 3.3V, T_{amb} = - 40℃ to +85℃

Symbol	Item	Condition	Limit		Unit
			Min	Max	
V_{IL}	Low-Level Input Voltage			0.8	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{DI}	Diff. Input Sensitivity		0.2		V
V_{CM}	Common Mode Range		0.8	2.5	V
V_{OL}	Low-Level Output Voltage	R_L = 1.425k to 3V6	0.0	0.3	V
V_{OH}	High-Level Output Voltage	R_L = 14.25k to GND	2.8	3.6-	V

5.3 Power consumption and power down modes

To reduce power consumption of the BlueMod+C11/G2 power down modes can be activated automatically by the BlueMod+C11/G2 (controlled by parameter settings).

If no Bluetooth connection is established, the following states are implemented, the activation of these states can be controlled by the parameters *bpsm* and *pwd*.

For more details please refer to the BlueMod+C11/G2 software manual.

5.3.1 SPP configuration

5.3.1.1 Deep Sleep state

The Bluetooth RF is completely deactivated, no paging requests from other Bluetooth devices will be recognized. Only rising control line DTR will activate the BlueMod+C11/G2 and may initiate a Bluetooth link dependent on other parameters.

Note: In Deep Sleep state the AT command set is not active, CTS line is low

5.3.1.2 Power down state

The Bluetooth RF is activated every 1.25 seconds, paging requests from other Bluetooth devices will be recognized after that intervals and accepted if allowed. Additionally rising control line DTR will activate the BlueMod+C11/G2 and may initiate a Bluetooth link dependent on other parameters.

Note: In Power down state the AT command set is not active, CTS line is low

5.3.1.3 Idle state

The Bluetooth RF is activated every 1.25 seconds, paging requests from other Bluetooth devices will be recognized after that intervals and accepted if allowed. Additionally rising control line DTR will activate the BlueMod+C11/G2 and may initiate a Bluetooth link dependent on other parameters

5.3.1.4 Power Consumption

Condition	Current Consumption	
	I_{MEAN}/mA	I_{PEAK}/mA
Deep sleep	tbd	tbd
Power down	tbd	tbd
Idle, all functions available, no Bluetooth link	tbd	tbd
Page Scan	12,1	101,0
Inquiry and Page Scan	12,4	101,0
Bluetooth connected, no data traffic, max. TX PWR (Slave)	34,7	185,0
ACL connected DH5 max PWR, shortest Poll Period (Slave)	133,3	175,0
ACL connected DH5 min PWR, shortest Poll Period (Slave)	57,5	99,0
ACL connected DH1 max PWR, shortest Poll Period (Slave)	59,0	175,0
ACL connected DH1 min PWR, shortest Poll Period (Slave)	55,0	110,0

Note: Table to be extended after further measurements

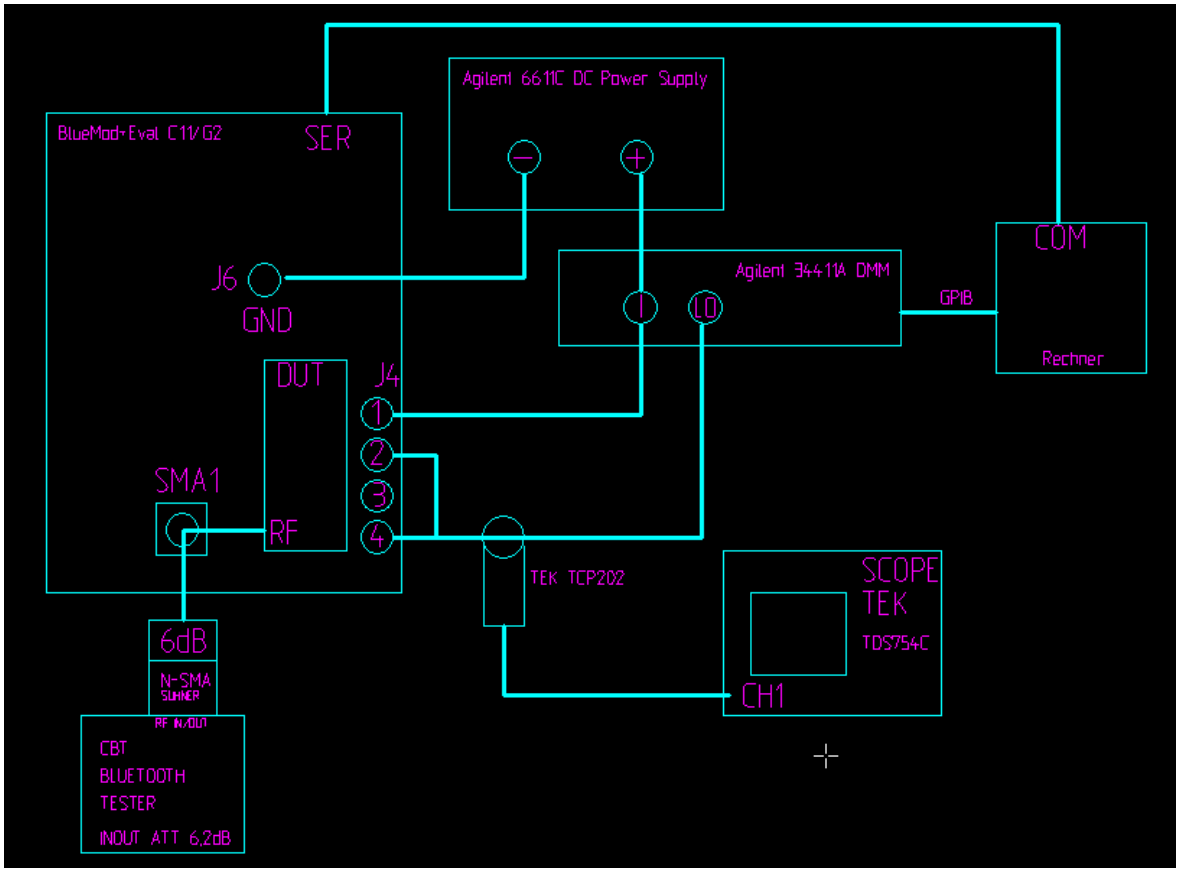


Fig. 3: MEASURMENT SET UP

5.4 RF performance

Vcc = 3.0V to 3.6V, T_{amb} = - 40°C to +85°C

Receiver	Frequency [GHz]	Limit			BT	Unit
		Min	Typ	Max	Spec	
Sensitivity at 0.1% BER DH1	2.402		-90,0	-80,0	≤-70	dBm
	2.441		-90,0	-80,0		
	2.480		-90,0	-80,0		
Sensitivity at 0.1% BER DH5	2.402		-90,0	-80,0	≤-70	dBm
	2.441		-90,0	-80,0		
	2.480		-90,0	-80,0		
Sensitivity at 0.1% BER PI/4 DQPSK	2.402		-88,0	-80,0	≤-70	dBm
	2.441		-88,0	-80,0		
	2.480		-88,0	-80,0		
Sensitivity at 0.1% BER 8DPSK	2.402		-82,0	-74,0	≤-70	dBm
	2.441		-82,0	-74,0		
	2.480		-82,0	-74,0		
Maximum received signal at 0.1% BER with DH1		-20,0	>10		≥-20	dBm
Maximum received signal at 0.1% BER with DH5		-20,0	>10		≥-20	dBm
Maximum received signal at 0.1% BER with PI/4 DQPSK		-20,0	-12,0		≥-20	dBm
Maximum received signal at 0.1% BER with 8DPSK		-20,0	-18,0		≥-20	dBm

Vcc = 3.0V to 3.6V, Tamb = - 40°C to +85°C

Transmitter	Frequency [GHz]	Limit			BT	Unit
		Min	Typ	Max	Spec	
RF transmit power 50 Ω load, at antenna Class 1 device GFSK [a)]	2.402	16,0	18,5	19,0	+4 to +20	dBm
	2.441	16,0	18,5	19,0		
	2.480	16,0	18,5	19,0		
RF transmit power 50 Ω load, at antenna Class 1 device EDR2 [a)]	2.402		tbd			
	2.441		tbd			
	2.480		tbd			
RF transmit power 50 Ω load, at antenna Class 1 device EDR3 [a)]	2.402		tbd			
	2.441		tbd			
	2.480		tbd			
RF power control range			17			dB
RF power range control resolution			4		2 to 8	dB
20 dB bandwidth for modulated carrier			780	1000	≤1000	kHz
Initial carrier frequency tolerance			5	30	≤ ±75	kHz
Carrier frequency drift (packet DH1)			7	25	≤ ±25	kHz
Drift Rate			6	20	20	kHz/ 50µs
$\Delta f1_{avg}$ “Maximum Modulation”		140	165	175	≥140 to ≤175	kHz
$\Delta f2_{avg}$ “Minimum Modulation”		115	154		≥ 115	kHz
C/I co-channel [b)]			8	11	≤ 11	dB
Adjacent channel selectivity C/I f = f_0 + 1MHz [b)]			-6	0	≤ 0	dB
Adjacent channel selectivity C/I f = f_0 - 1MHz [b)]			-4	0	≤ 0	dB
Adjacent channel selectivity C/I f ≥ f_0 + 2MHz [b)]			-38	-30	≤ -30	dB
Adjacent channel selectivity C/I f ≤ f_0 - 2MHz [b)]			-24	-20	≤ -30	dB
Adjacent channel selectivity C/I f ≥ f_0 + 3MHz [b)]			-45	-40	≤ -40	dB
Adjacent channel selectivity C/I f ≤ f_0 - 5MHz [b)]			-45	-40	≤ -40	dB
Adjacent channel selectivity C/I f = f_{image} [b)]			-21	-9	≤ -9	dB

Notes:

a) Including +2dBi antenna gain

b) Applies according to BT Test Specification Ver. 1.2/2.0/2.0 + EDR only for Tamb = 20℃

Enviromental Requirements

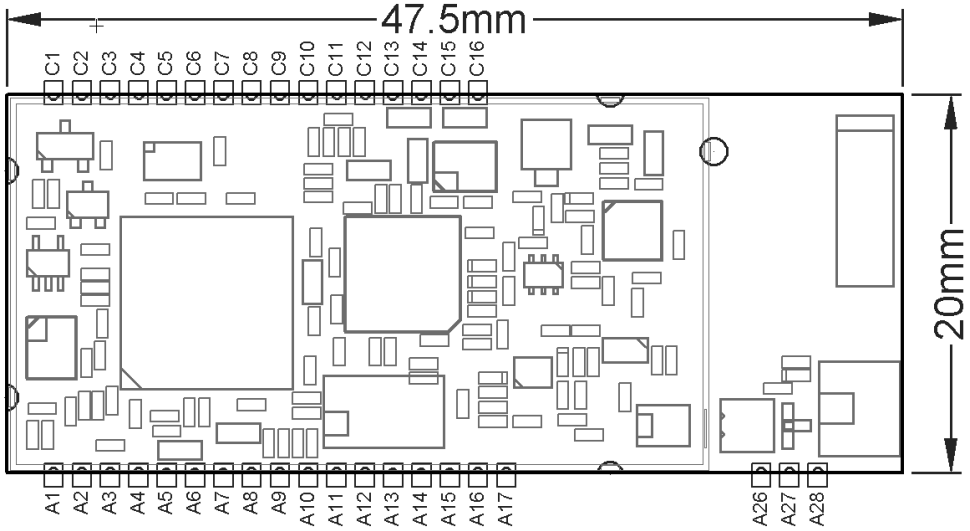
Item	Symbol	Absolute Maximum Ratings	Unit
Storage temperature range	T_{stg}	-40 to +105	℃
Operating temperature range	T_{op}	-40 to +85	℃

5.5 Power-up Time

The time until the BlueMod+C11/G2 is able to accept link requests or serial data is about TBD seconds after power-up. This time can be reduced to approx. tbd second by parameter change.

6 Mechanical Characteristics

6.1 Dimensions



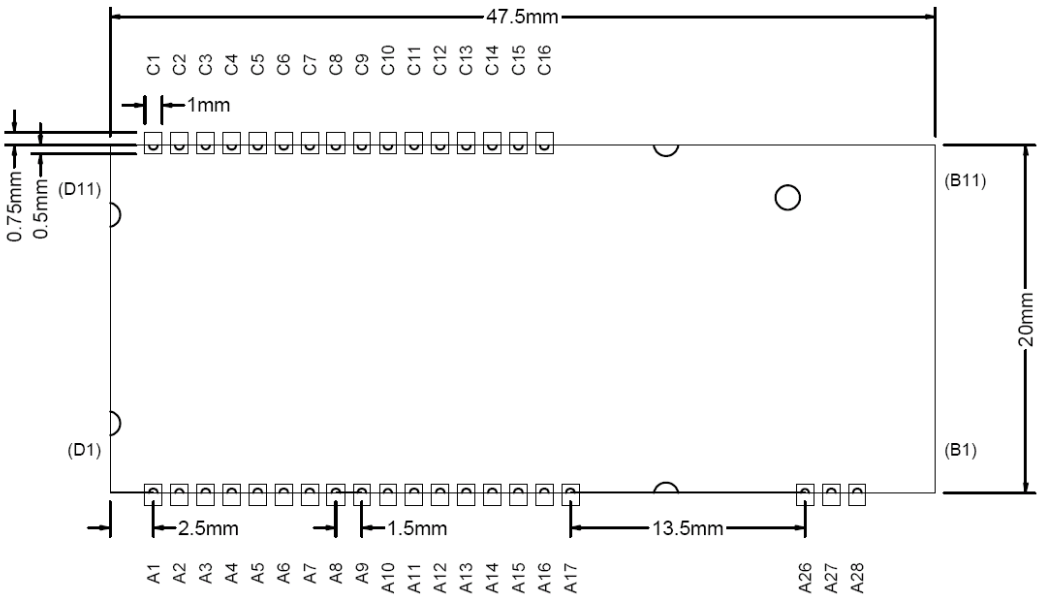
6.2 Connectors

Except for the stamp pins A-[1-17,26-28] and C-[1-16] and the UMP antenna connector no user accessible connectors are implemented.

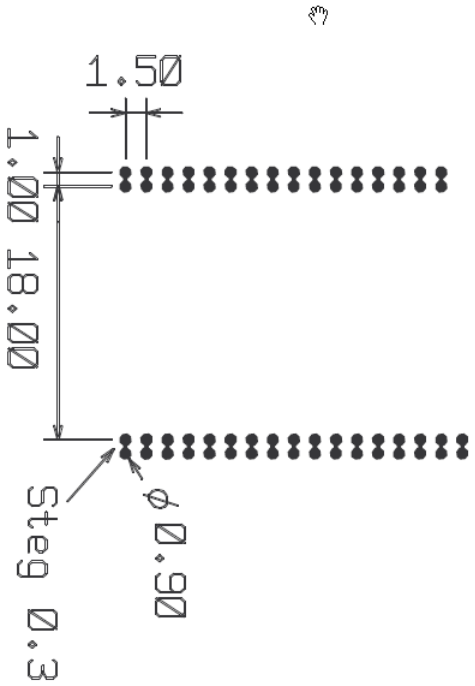
If the use of the UMP antenna connector is considered, please contact Stollmann for information on accessories like cables, plugs etc. Or look at www.radiall.com for the UMP type family. On the BlueMod+C11/G2 the following receptacle will be populated for RF signal routing, if the BlueMod+C11/G2/-AE variant is ordered.

Manufacturer	Type
Radiall	RADIALL: R107103020 UMP connector receptable

6.3 Recommended Land Pattern



Land pattern recommended for manual soldering



Alternative land pattern recommended for reflow soldering

6.4 Housing Guidelines

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

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

6.5 Antenna Issues

BlueMod+C11/G2 is shipped with 3 different antenna designs:

- BlueMod+C11/G2/-AI comprises a ceramic antenna which as a component is soldered to the circuit board. This is functional for a BlueMod+C11/G2/-AI integrated into a plastic housing. No additional antenna is required.

For an external antenna to be set in, e.g. because the BlueMod+C11/G2 is integrated into a metal housing, the ceramic antenna is replaced by 2 alternative solutions

- BlueMod+C11/G2/-AE has a UMP connector (50 Ohm technology) populated as Antenna Interface
- BlueMod+C11/G21/-AP routes the antenna signal to pin A27.

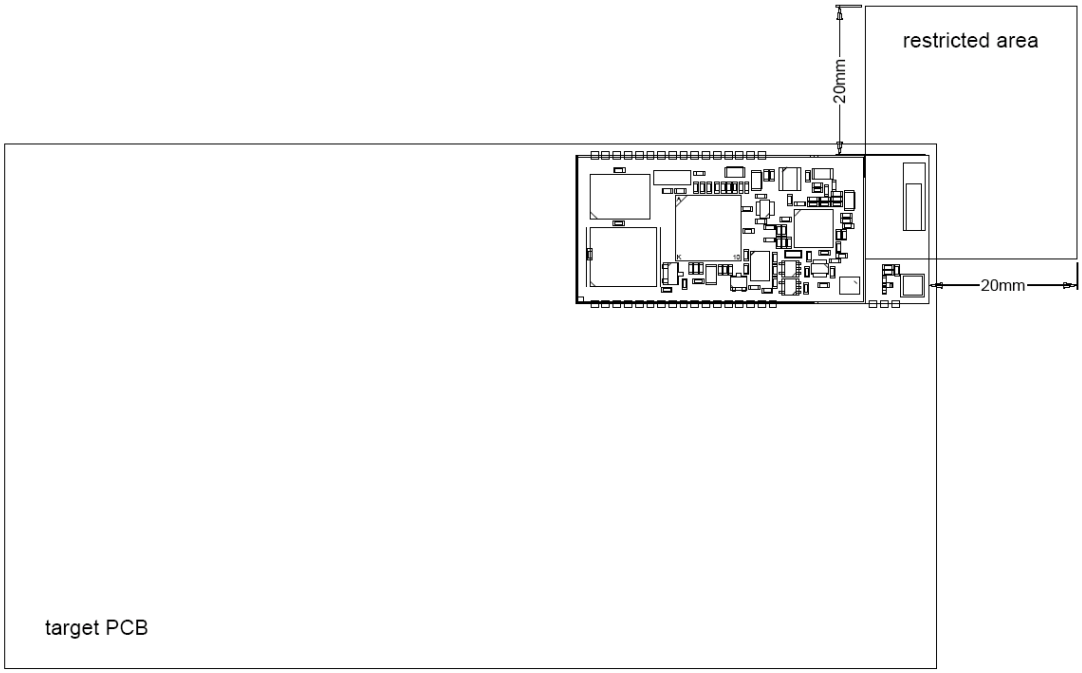
The gain of the external antenna shall not exceed +2dB$_i$.

When using an external Antenna the antenna is fixed and cannot be removed or replaced by the end user. The performance of the internal antenna respectively the external antenna has in any case 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.

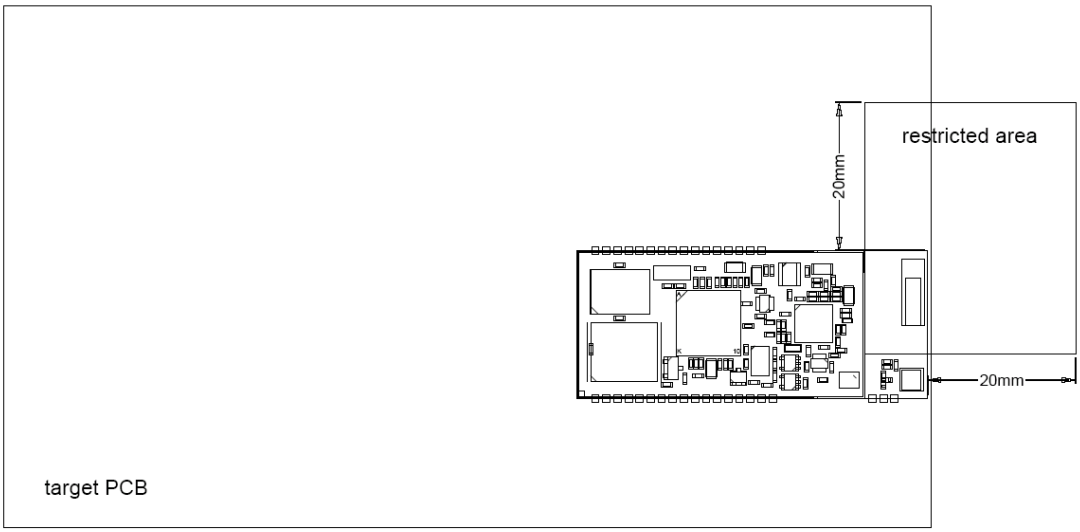
Antenna – recommended restricted area

To give an optimized antenna performance the restricted area having no ground or power planes, traces or parts should be widened. The following dimensions should be implemented, depending on your possible space.



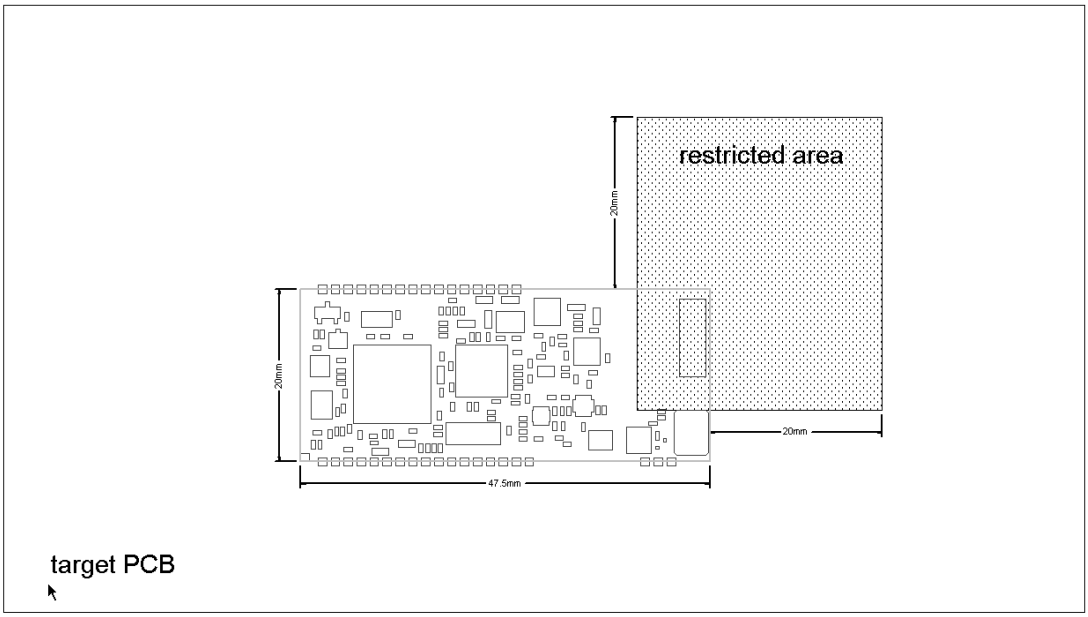
Optimal placement

The best position to place the BlueMod+C11/G2 on the target PCB is in the upper right corner. This position is optimal concerning antenna interference; radiation pattern and PCB space that has to be keep free for the restricted area.



recomendable placement

When placing the BlueMod+C11/G2 at the right edge of the PCB ensure that the restricted area on the target PCB is free of planes, traces and parts.



acceptable, but not optimal placement

When placing the BlueMod+C11/G2 on other positions than the right side the complete restricted area should be kept free of planes, traces and parts.

7 Safety Guidelines

According to SAR regulation EN 50371-2002 the BlueMod+C11/G2 is not intended to be used in close proximity to the human body. Please refer to above-mentioned regulation for more specific information.

In respect to the safety regulation EN 60950-1: 2001 all conductive parts of the BlueMod+C11 are to be classified as SELV circuitry. OEM's implementing the BlueMod+C11/G2 in their products should follow the isolation rules given in regulation EN 60950-1: 2001.

The PCB material of the BlueMod+C11/G2 is classified UL-94V0.

8 Regulatory Information

8.1 Declaration of conformity

Declaration of Conformity in accordance with Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/EC (R&TTE Directive

Stollmann E+V GmbH, Mendelssohnstr. 15d, D-22761 Hamburg, Jens Jensen
The manufacturer / responsible person

declares that the product family BlueMod+C11/G2
Telecommunications terminal equipment with intended purpose: Serial Bluetooth Module
complies with the essential requirements of §3 and the other relevant provisions of the FTEG (Article 3 of the R&TTE Directive), when used for its intended purpose.

Health and safety requirements pursuant to §3(1)1.(Article 3(1)a)):

Average Output Power is lower than 20mW, not intended to be used close to the human body.
Harmonised standards applied

EN 60 950-1: 2001, EN 50371-2002

Protection requirements concerning electromagnetic compatibility §3(1)(2), (Article 3(1)b))

harmonised standards applied

EN 301 489-1 V1.5.1 (tested mounted on Blue+EVA built in plastic housing)
EN 301 489-17 V1.2.1 (tested mounted on Blue+EVA built in plastic housing)
EN 300 328-2 V1.6.1 (2004) (tested mounted on Blue+EVA built in plastic housing)

Electromagnetic compatibility and Radio Spectrum Matters (ERM)

Original signed available on request

8.1.1 FCC Compliance and FCC Statement

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada.

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.

8.1.2 Caution

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

8.1.3 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.

The radiated output power of BlueMod+C11/G2 is far below the FCC radio frequency exposure limits. Nevertheless, the BlueMod+C11/G2 shall be used in such a manner, that the potential for human contact during normal operation is minimized.

8.1.4 RF-exposure Statement

The BlueMod+C11/G2 contains a portable modular transmitter. Thus it must have a separation of at least 2.5 cm between the antenna and the body of the user or nearby persons, excluding hands, wrists, feet, and ankles.

Any notification to the end user of installation or removal instructions about the integrated radio module is **not** allowed.

8.1.5 Labelling and re-test requirements for the End Product

Any End Product integrating the BlueMod+C11/G2 must be labeled with at least the following information:

This device contains transmitter with	
FCCID:	RFR- C11G2
IC ID:	4957A-C11G2

Since the BlueMod+C11/G2 is a module to be integrated into a for the FCC authority unknown end product, the FCC approval under this ID is a “Limited Modular Approval”, also called LMO. This implies that all OEM’s incorporating the BlueMod+C11/G2 in their end product and wanting to ship to the USA or Canada have to measure spurious emissions according to FCC Part 15.247 in a FCC accredited EMC lab and have to keep the test report in their technical compliance folder ready for being checked by US/CA market authorities.

8.2 Bluetooth Qualification

This product uses a Bluetooth qualified end product with Bluetooth QD ID (Qualified Design Identifier) **B012419**

8.3 RoHS Declaration

Declaration of environmental compatibility for supplied products:
Hereby we declare to our best present knowledge based on declaration of our suppliers that this product do not contain by now the following substances which are banned by Directive 2002/95/EC (RoHS) or if contain a maximum concentration of 0,1% by weight in homogeneous materials for

- Lead and lead compounds
- Mercury and mercury compounds
- Chromium (VI)
- PBB (polybrominated biphenyl) category
- PBDE (polybrominated biphenyl ether) category

And a maximum concentration of 0,01% by weight in homogeneous materials forCadmium and cadmium compounds

9 Related Documents

- ATMEL data sheet AT91SAM7Sxxx Rev. F
- CSR product data book BlueCore™4-ROM BC41B143A April 2006
- Radiall UMP MMP Introduction
- Radiall data sheet UMP R107.103.020
- Stollmann BlueMod+C11/G2 Software Manual
- Bluetooth SIG RF_TS_EDR.pdf test specification
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10 Ordering Information

The BlueRS+C11/G2 is available in the following variants:

Name	Antenna	Art No.
BlueMod+C11/G2/AI/SPP	Internal	52672
…/EDR		
BlueMod+C11/G2/AE/SPP	External	52733
…/EDR		
BlueMod+C11/G2/AI/SMA		52715
…/EDR		
BlueMod+C11/G2/AI/SMA		52731
…/EDR		
BlueMod+C11/G2/AP/SPP	External	tbd
…/EDR		
BlueEva+C11/G2, Evaluation Kit	Internal	tbd
…/EDR		

11 Life Support Policy

This Stollmann product is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or

system, or to affect its safety or effectiveness. Stollmann customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Stollmann for any damages resulting.

12 History

Version	Release Date	By	Change description
0.1	20.10.2006	JJ	Initial Document - preliminary
0.2	27.10.2006	JJ	Updated Alternative GPIO Functionality, Name correction
1.0	20.02.2007	JJ	Updated to evaluated data