BlueRS+I/G2

Hardware reference

Note

This device was developed for purposes of communication in an office environment. It is intended solely for our industrial clients who will physically integrate them into their own technical products after having them careful examined for their suitability for the intended purpose by experienced technical personnel. 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 field of applications. Performance data (range, power requirements, etc.) may depend on the operating environment, the field of application, the configuration, and method of control as well as other conditions of use; they may deviate from the technical specifications, the Design Guide specifications or other product documentation. The exact 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 which you can request from us at any time.

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1 Introduction

This Hardware Reference Guide documents how BlueRS+I/G2 can be integrated into customer systems. It addresses developers of hardware environments for BlueRS+I/G2. For detailed information about software interfaces refer to the software reference manual.

1.1 Feature Summary

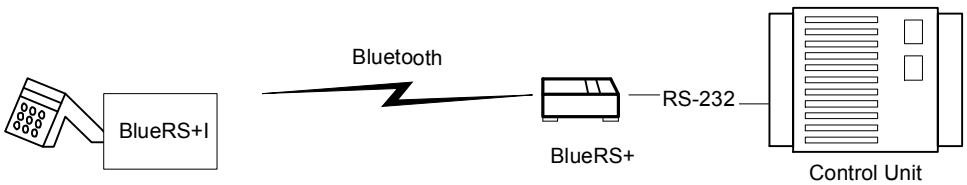
- Bluetooth specification V1.2
- Complete Co-location and Co-existence with 802.11 (AWMA, AFH and SFH)
- Fast Connection Setup
- RF output power class 2 with power control
- Supply Voltage 3.3V or 5V
- Internal crystal oscillator (12 MHz and 32 kHz for deep sleep)
- Full Bluetooth data rate up to 723kbps asymmetric
- Support for very low-power modes (sleep and deep sleep)
- Full 8- to 128-bit encryption
- High sensitivity design (-86 dBm typ.)
- ARM7TDMI core for embedded profiles or application software
- Power control

1.2 Applications

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

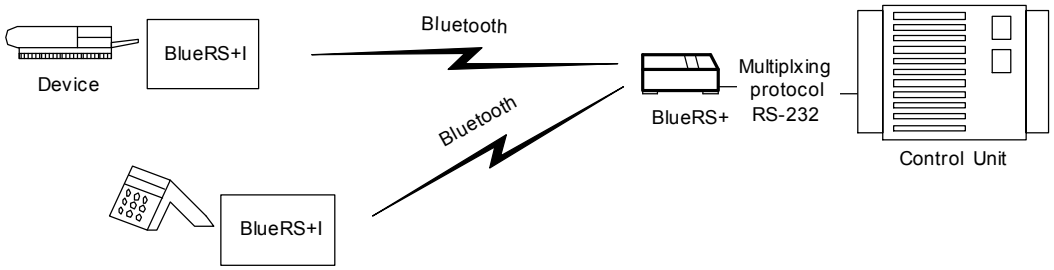
1.2.1 Cable Replacement Serial Point-to-point

To establish a cable replacement between two devices with a serial interface, BlueRS+I/G2 can be used.



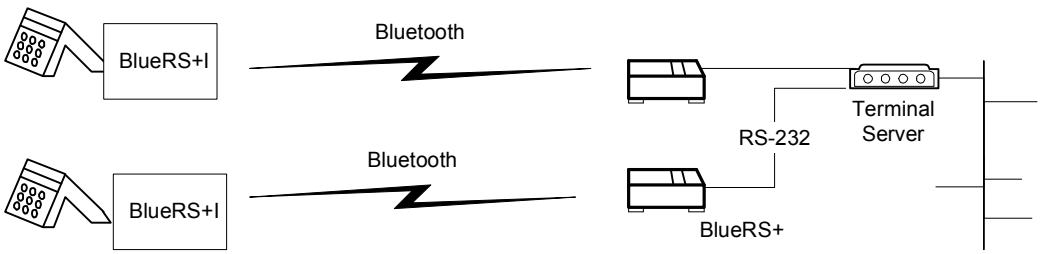
1.2.2 Cable Replacement Multipoint

Since several devices may be connected with a master device via Bluetooth, several end devices can also be multiplexed via Bluetooth. This adaptation is shown below for a desktop device.



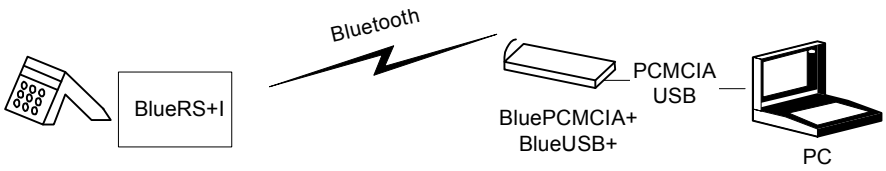
In order to handle multiple links a multiplexing protocol is required for the communication between devices, the BlueRS+ and the host. The BlueRS+ has to be adapted to the routing scheme of the protocol to transmit the data in an appropriate way. This includes Bluetooth connection control (i.e. are the Bluetooth links permanently active or only on demand) and data distribution (i.e. are all data from the host to be forwarded to all devices or only depending on the address header; are data from the devices are transmitted to the host transparently or is an address header to be added). In case you have a multipoint application please contact Stollmann for specific support.

1.2.3 Terminal Server

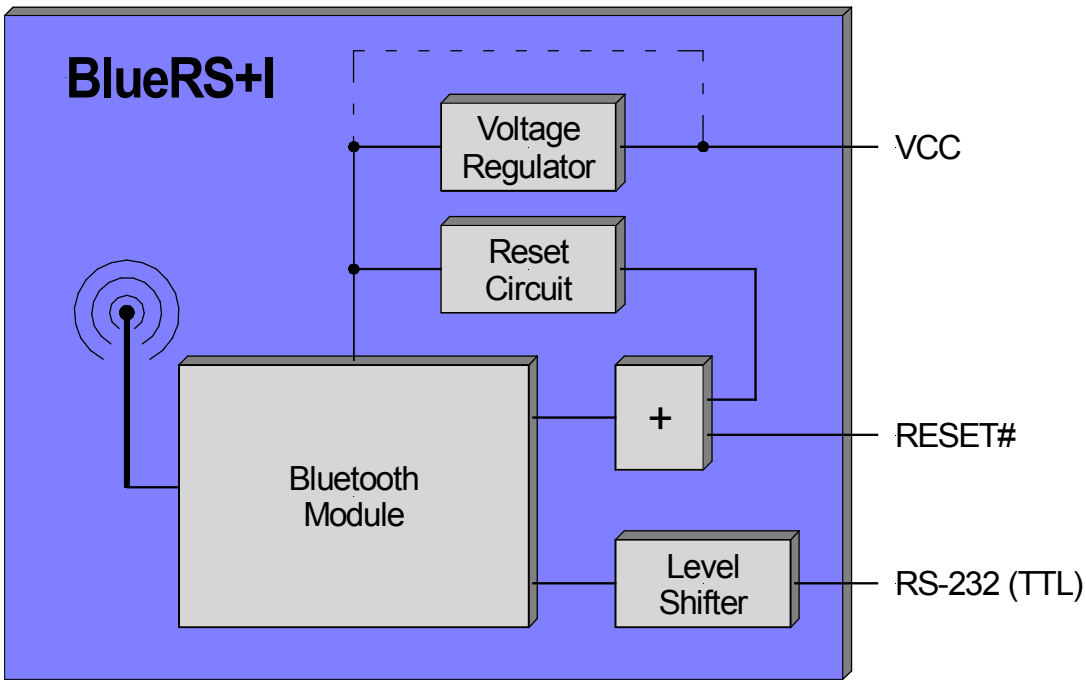


1.2.4 PC Client

BlueRS+I/G2 as Bluetooth Client can establish connections with other Bluetooth interfaces, e.g. in PCs.



2 Block Diagram



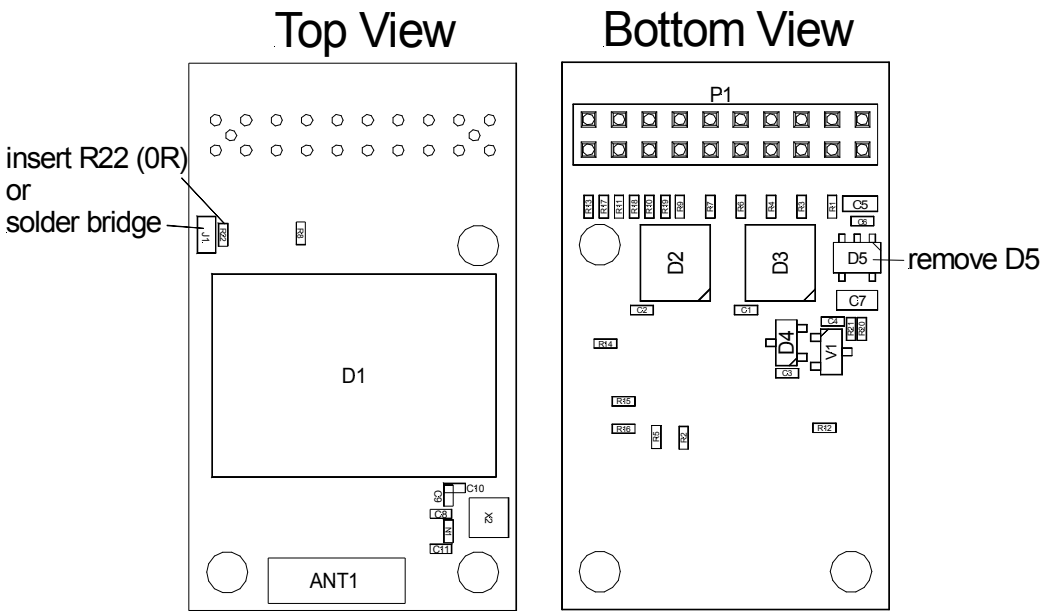
3 Application Interface

3.1 Power Supply

There are two variants of supplying power to the BlueRS+I/G2:

- 5VDC ±10%, the voltage is regulated on the BlueRS+I/G2 (linear regulator). The regulator is temperature and overcurrent protected.
- 3.3VDC ±2% low noise, the supply voltage is directly used (0 Ohm)

The power supply voltage can be switched from 5V to 3.3V as follows. The linear regulator (D5) needs to be replaced by a 0 Ohm resistor (R22) or a solder bridge (J1).



3.2 Reset

The BlueRS+I/G2 is equipped with circuitry for generating Power On Reset and Low Voltage Supervision. A reset is generated if the 3.3V supply falls below 2.9V.

Via Pin 11 of connector P1 an external reset can be generated by holding /RESET at ≤ 0.3V for ≥ 10ms.

If /RESET 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. It is compatible to the BlueRS+.

- Transmission speeds 300 – 230.400 bps (asynchronous)
- Character representation: 7 or 8 Bit, even,odd or no Parity 1 stop bit
- 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.

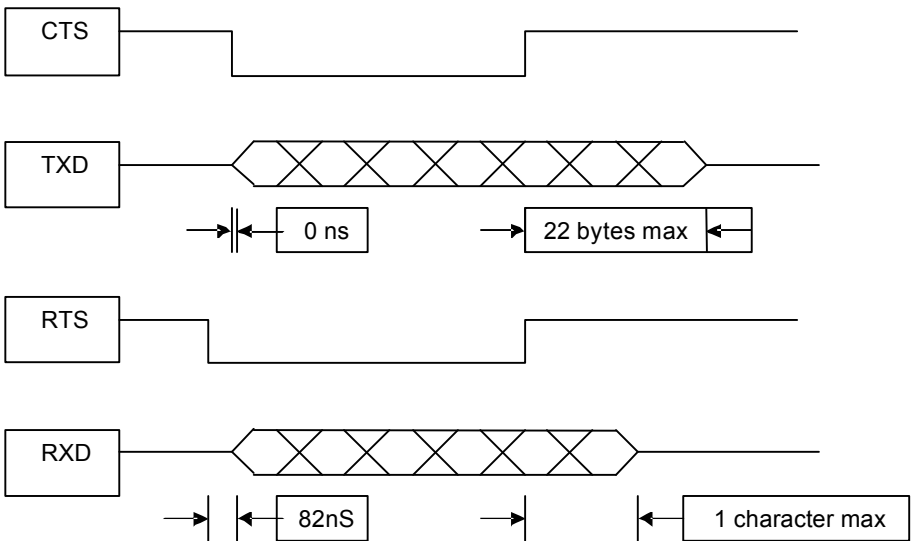


Figure 1. UART Timing Diagram

3.4 GPIO Interface

It is possible to use the GPIOs on the BlueRS+I/G2 pins /UEx und /UAx. Their behavior has to be defined project specific in the firmware.

3.5 Bluetooth radio Interface

The BlueRS+I/G2 AE variants presents a 50Ω impedance Antenna Interface on a U.FL connector.

The BlueRS+I/G2 AI variants presents an integrated ceramic antenna.

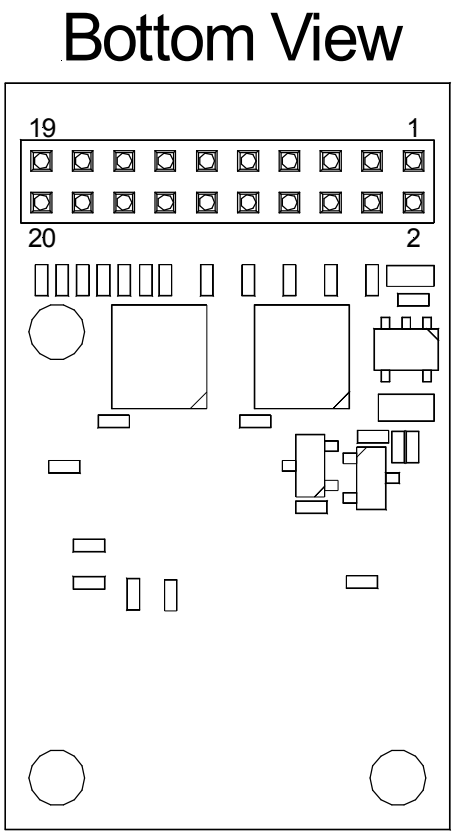
If the antenna performance does not meet your requirements or you need antenna support, please contact Stollmann.

4 Pin Description

The BlueRS+I/G2 is connected via the double pin row connector P1. This includes:

- power supply
- serial communication interface (V.24/RS-232 with TTL level)
- reserved general purpose IO pins

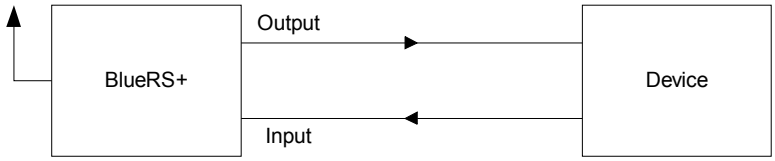
4.1 Pin Numbering



4.2 Pin Description

4.2.1 Connector P1

This Connector includes the serial Interface (TTL) and power supply.



Output/Input definition of table below

P1	Signal	Dir	active	Pull Up	BlueRS+I/G2 usage
1	GND	I	-		GND
2	VCC	I	-		+5V / +3.3V -Power
3	GND	I	-		GND
4	TXD	I	H	10k	Transmit Data
5	GND	I	-		GND
6	RXD	O	H	10k	Receive Data
7					reserved
8	/RTS	I	L	10k	RTS low active
9					reserved
10	/CTS	O	L	10k	CTS low active
11	/RESET	I	L	10k	RESET low active
12	/DTR	I	L	100k	DTR low active
13					reserved
14	/DCD	O	L	100k	DCD low active
15	/RI	O	L	100k	RI low active
16	/DSR	O	L	100k	DSR low active
17	UA	O	H	100k	User Output 1
18	/UE	I	L	100k	User Input 1
19	UA2	O	H	100k	User Output 2
20	/UE2	I	L	100k	User Input 2

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
		U3 Variant	U5 Variant	
Supply voltage	V_{cc}	-0.1 to +3.6	-0.5 to 6.5V	V
Voltage on any pin	V_{Pin}	-0.3 to Vcc+0.3	-0.5 to 6.5V	V
Input RF level	P_{max}	15		dBm
ESD on any pin	V_{ESD}	Max 2000 V (C_{Load} = 150 pF, R_{Load} = 330Ω)		V

5.2 Electrical Requirements

U3: Vcc = 3.3V U5: Vcc = 5V, T_{amb} = 25°C if nothing else stated

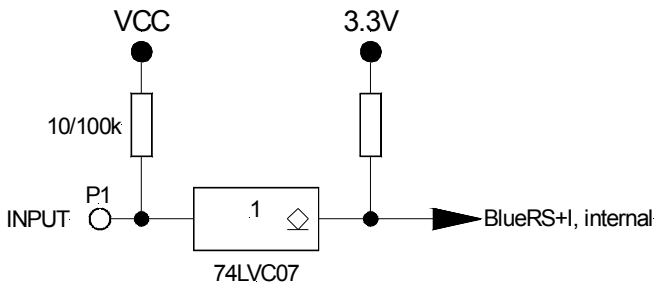
Item	Condition	Limit			Unit
		Min	Typ	Max	
Frequency Range		2400		2483.5	MHz
Load impedance	Measured with network analyzer in the frequency range at antenna pin		50		Ω
Output return loss	Receive Mode to 50Ω load Transmit Mode to 50Ω load	-10 -10			dBm
Supply voltage U3 variant.	The typical voltage is recommended Vcc at voltage pin	3.23	3.3	3.37	Vdc
Supply voltage U5 variant.	The typical voltage is recommended Vcc at voltage pin	4.5	5.0	5.5	Vdc
Ripple on Vcc	Ripple frequency ≥200kHz Ripple frequency <200kHz			tbd tbd	mVpp

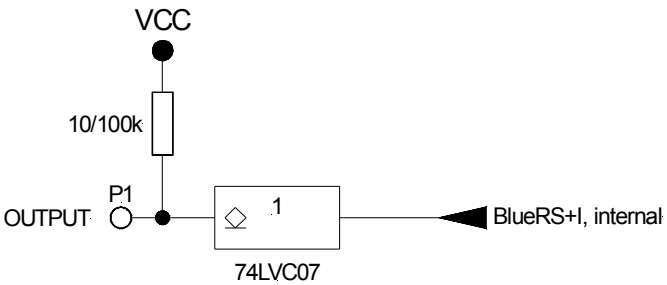
5.3 Enviromental Requirements

Item	Sym-bol	Absolute Maximum Ratings	Unit
Storage temperature range	T_{stg}	-40 to +105	°C
Operating temperature range	T_{op}	-25 to +85	°C

5.4 IO-Interface

Signal levels depend on the supply voltage. All inputs are in any case 5V tolerant. The outputs are supplied as open-drain with 10 kOhm or 100 kOhm (see 4.2) pull up resistor. This should be the same on the motherboard to achieve compatibility. Current sinks should be low-active. 10mA can be driven. It is not possible to drive LEDs high active directly. Drive LEDs low active or via driver circuitry.





Variant U3 - Vcc = 3.3V, T_{amb} = 25°C

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_{OL}	Low-Level Output Voltage	I_{OL} = 0.1mA I_{OL} = 4mA I_{OL} = 24mA	-	0.2 0.45 0.55	V
V_{OH}	High-Level Output Voltage	I_{OH} = 10µA /100k PU I_{OH} = 100µA /10k PU	-	2.3	V
I_{OL}	Low -Level Output Current	V_{OL} = 0.55V	-	24	mA
I_{OH}	High-Level Output Current	V_{OH} = 2.3V /100k PU V_{OH} = 2.3V /10k PU	-	10 100	µA

Variant U5 - Vcc = 5.0V, T_{amb} = 25°C

Symbol	Item	Condition	Limit		Unit
			Min	Max	
V_{IL}	Low-Level Input Voltage		-	0.3xV_{CC}	V
V_{IH}	High-Level Input Voltage		0.7xV_{CC}	-	V
V_{OL}	Low-Level Output Voltage	I_{OL} = 0.1mA I_{OL} = 4mA I_{OL} = 24mA	-	0.2 0.45 0.55	V
V_{OH}	High-Level Output Voltage	I_{OH} = 10µA /100k PU I_{OH} = 100µA /10k PU	-	4.0	V
I_{OL}	Low -Level Output Current	V_{OL} = 0.55V	-	24	mA
I_{OH}	High-Level Output Current	V_{OH} = 4.0V /100k PU V_{OH} = 4.0V /10k PU	-	10 100	µA

5.5 Power consumption and power down modes

To reduce power consumption of the BlueRS+I/G2 power down modes can be activated automatically by the BlueRS+I/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 parameter *bpsm* and *pwd*.

For more details please refer to the BlueRS+I/G2 manual.

5.5.1 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 BlueRS+I/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.

5.5.2 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 BlueRS+I/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.

5.5.3 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 BlueRS+I/G2 and may initiate a Bluetooth link dependent on other parameters.

5.5.4 Power consumption

The following values are approximate power consumption values in the different states:

Condition	Current Consumption	
	Variant U3 3,3V [mA]	Variant U5 5,0V [mA]
Deep sleep	0,6	1,0
Power down	2,4	2,4
Idle, all functions available, no Bluetooth link	18,7	17,8
Bluetooth connected, no data traffic, (Master/slave)	18,9/31,5	19,0/31,6
Bluetooth connected, data traffic 115 kbit/s	35,6	32,5

5.6 RF performance

U3: Vcc = 3.3V U5: Vcc = 5V, T_{amb} = 25°C, 50Ω antenna

Receiver	Frequency [GHz]	Limit Min	Typ	Max	BT Spec	Unit
Sensitivity at 0.1% BER	2.402	-	-85	-	≤-70	dBm
	2.441	-	-85	-		
	2.480	-	-85	-		
Maximum received signal at 0.1% BER with DH1		-	-5	-	≥-20	dBm

Transmitter	Frequency [GHz]	Limit Min	Typ	Max	BT Spec	Unit
RF transmit power 50 Ω load, at antenna Class 2 device	2.402	-	0	4	-6 to +4	dBm
	2.441	-	0	4		
	2.480	-	0	4		
RF power control range		-	30	-	≥16	dB
RF power range control resolution		-	4	-	2 to 8	dB
20 dB bandwidth for modulated carrier		-	930	-	≤1000	kHz
Initial carrier frequency tolerance		-10	0	+12	≤ ±75	kHz
Carrier frequency drift (packet DH1)		-	±4	±8	≤ ±25	kHz
Drift Rate		-	60	210	400	Hz/µs
$\Delta f1_{avg}$ “Maximum Modulation”		145	166	170	≥140 to ≤175	kHz
$\Delta f2_{avg}$ “Minimum Modulation”		110	160	-	≥ 115	kHz
C/I co-channel		<11	-	0	≤ 11	dB
Adjacent channel selectivity C/I f = f_0 ± 1MHz		0	-	0	≤ 0	dB
Adjacent channel selectivity C/I f = f_0 ± 2MHz		<-30	-	0	≤ -30	dB
Adjacent channel selectivity C/I f ≥ f_0 +3MHz		<-40	-	0	≤ -40	dB
Adjacent channel selectivity C/I f ≤ f_0 -3MHz		<-40	-	0	≤ -40	dB
Adjacent channel selectivity C/I f = f_{image}		<-9	-	0	≤ -9	dB
Adjacent channel Transmit power f = f_0 ± 2MHz		-39	-43	-47	≤ -20	dBc
Adjacent channel Transmit power f = f_0 ± 3MHz		-45	-48	-52	≤ -40	dBc

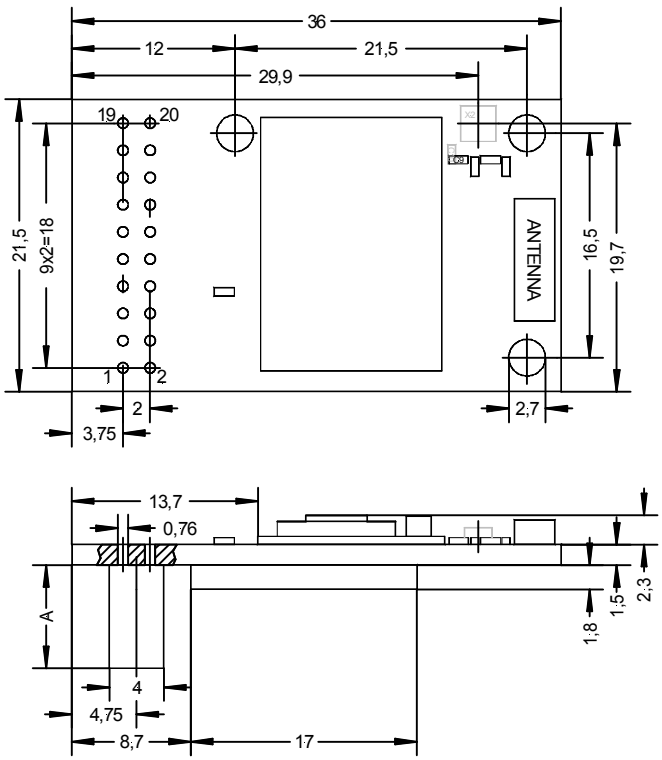
Note: The tests were made to the bluetooth regulation, with the BER limit of 0,1%. With the output limits given as a minimum value, there was no bit error failure and the test was pass. Therefore the maximum values were not measured.

5.7 Power-up Time

The time until the BlueRS+I/G2 is able to accept link requests or serial data is about 3 seconds after power-up. This time can be reduced to approx. 1 second by parameter change.

6 Mechanical Characteristics

6.1 Dimensions



Connector	A [mm]
SQW	7,62
TLE	4,5
CLT	2,26

6.2 Connectors

6.2.1 Connector P1 - BlueRS+I/G2 C2 U5 Ax 7mm

This variant uses a Samtec SQW-110-01-L-D-VS-K-TR 2mm micro pitch socket. This socket is not made for pass-through or through-hole contacts. Please assure that adequate headers for connector P1 are used. A selection of possible terminals is listed in the following table.

manufacturer	type
Samtec	TMM-110-03-x-D
FCI (Berg)	57102-x06-10
Fischer Elektronik	SLY 2 085 20 x
Tyco	2-176264-4

See www.samtec.com for more suitable terminals.

6.2.2 Connector P1 - BlueRS+I/G2 C2 U3 Ax 4mm

This variant uses a Samtec TLE-110-01-G-DV-K-TR 2mm micro pitch socket. This socket allows pass-through or through-hole contacts.A possible terminal is listed in the following table.

manufacturer	type
Samtec	TMM-110-03-x-D

See www.samtec.com for more suitable terminals.

6.2.3 Connector P1 - BlueRS+I/G2 C2 U3 Ax 2mm

This variant uses a Samtec CLT-110-02-G-D 2mm micro pitch socket. This socket allows pass-through or through-hole contacts.A possible terminal is listed in the following table.

manufacturer	type
Samtec	TMM-110-05-x-D

See www.samtec.com for more suitable terminals.

6.2.4 External Antenna connector

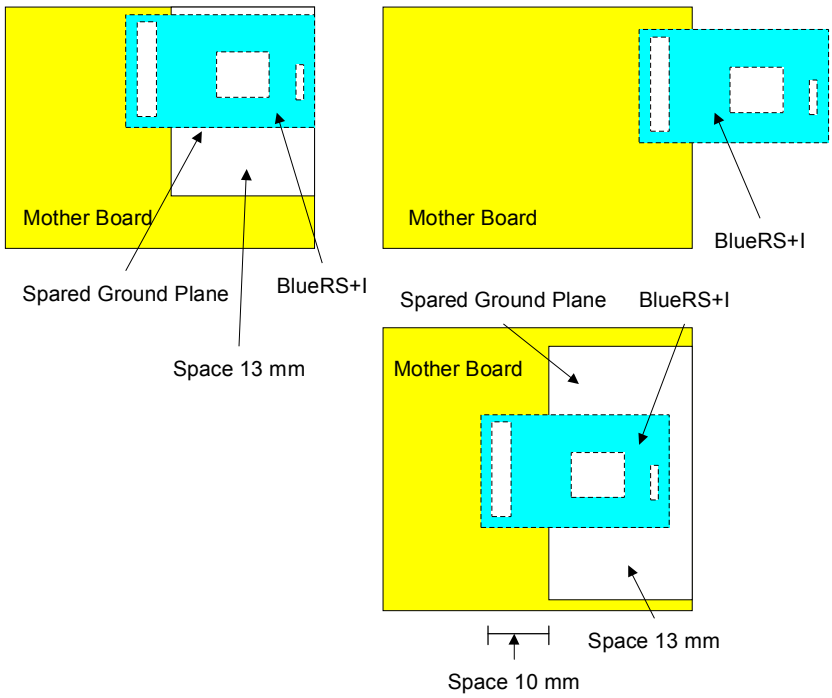
The AE variants are equipped with a Hirose U.FL receptacle part no. U.FL-R-SMT(xx) Adequate plugs and cable Assemblies are available from Hirose. For details see www.hirose-connectors.com

A compatible plug is manufactured by Murata, the GSC family see http://www.murata.com/.

When using an external Antenna the antenna must be fixed and may not be removed or replaced by the enduser.

6.3 Trace and Component Restricted Areas

The mother board should have no ground plane under the BlueRS+I/G2 to allow best radiation.



Furthermore there must be a space of at least 15 mm in each direction from the antenna free from wire, circuits and conductive material.

It must be ensured that the antenna is not co-located or operating in conjunction with any other antenna or transmitter.

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

7 Regulatory Information

7.1 Declaration of conformity

Konformitätserklärung gemäß dem Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG) und der Richtlinie 1999/5/EG (R&TTE)

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. 15, D-22761 Hamburg., Jens Jensen

Hersteller/Verantwortliche Person // The manufacturer / responsible person

erklärt, daß die Produktfamilie
declares that the product family

BlueMod+P24 (with external antenna)
BlueMod+P25 (with internal Chip antenna)
BlueRS+I / G2 (with external or internal antenna)
BlueRS+E / G2 (with external or internal antenna)

Telekommunikationendeinrichtung mit Verwendungszweck: Serielles Bluetooth Modul
Telecommunications terminal equipment with intended purpose: Serial Bluetooth Module

bei bestimmungsgemäßer Verwendung den grundlegenden Anforderungen des §3 und den übrigen einschlägigen Bestimmungen des FTEG (Artikel 3 der R&TTE) entspricht.
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

Gesundheit und Sicherheit gemäß §3(1)1.(Artikel 3 (1) a))
Health and safety requirements pursuant to §3(1)1.(Article 3(1)a))
Ausgangsleistung ist kleiner 20mW
Output Power is lower than 20mW (see Amendemt)
angewendete harmonisierte Normen
harmonised standards applied
EN 60 950 Version 06/2000

Schutzanforderungen in Bezug auf die elektromagnetische Verträglichkeit §3(1)2, Artikel 3(1)b))
Protection requirements concerning electromagnetic compatibility §3(1)(2), (Article 3(1)b))

angewendete harmonisierte Normen
harmonised standards applied

EN 301 489-1 V1.4.1
EN 301 489-17 V1.2.1
EN 300 328-2 V1.6.1
Elektromagnetische Verträglichkeit in Bezug auf das Radio Frequenz Spektrum
Electromagnetic compatibility and Radio Spectrum Matters (ERM)

Ort, Datum Place & date of issue	Firmenstempel Firm stamp	Name, Unterschrift Name and signature
Hamburg, den 12.04.2006	Stollmann E+V GmbH Mendelssohnstr. 15 22761 Hamburg	i.A.

7.2 FCC Compliance

7.2.1 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 my not cause harmful interference, and

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

7.2.2 Caution

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

7.2.3 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 BlueRS+I/G2 is far below the FCC radio frequency exposure limits. Nevertheless, the BlueRS+I/G2 shall be used in such a manner, that the potential for human contact during normal operation is minimized.

7.2.4 RF-exposure Statement

The BlueRS+I/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.

7.2.5 Labeling requirements for the End Product

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

This device contains transmitter with FCCID: RFR-BRSI2 / IC: 4957A-BRSI2

7.3 Bluetooth Qualification

This product uses a Bluetooth qualified endprodukt with Bluetooth identifier B01839.

7.4 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 for

- Cadmium and cadmium compounds

8 Related Documents

9 Ordering Information

BlueRS+I/G2 is available in the following variants:

Name	Supply Voltage	Antenna	Connector height	Article No.
BlueRS+I G2 C2 U3 AI 4mm	3,3V	Internal	4,50 mm	52478
BlueRS+I G2 C2 U5 AI 4mm	5V	Internal	4,50 mm	52589

Other variants on request, please contact Stollmann sales department.

10 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.

11 History

Version	Release Date	By	Change description
0.80	02.02.2006	JW	initial document - preliminary
1.00	27.04.2006	GJ	final document – first release
1.10	13.06.2006	GJ/ JW	available product variants changed chap. 5.7 Power-up Time - Time corrected