SPB611 – Wi-Fi 6/Bluetooth 5 Module

Data Sheet

SPB611

802.11 ax/ac/a/b/g/n Wi-Fi 6
Bluetooth 5
802.15.4

H&D Wireless

Current revision: 4.1

Revision History

Revision	Revision date	Description
0.1	2022-11-30	First draft
1.2	2023-03-23	Cleaned up in the order option alternatives
1.3	2023-07-17	Corrected some pin descriptions
2.0	2023-09-26	Added current consumptions and RF data
2.2	2023-09-28	Release after review
3.0	2023-10-03	Added certification antennas
3.1	2023-10-30	QR-code replace old marking
4.0	2023-11-29	Added antenna option B (on module)
4.1	2024-01-15	Corrected antenna used in certification

Contents

1 INTRODUCTION

1.1 Overview

SPB611 is a complete WLAN/BT module with EMC shield, ready for onboard integration in a hosted environment. SPB611 enables a cost efficient ultra-low power, high performance and feature rich client solution. It provides up to 600 Mbit/s data rate when operating in the 11ax using 80 MHz bandwidth.

SPB611 integrates RF, baseband/MAC, Bluetooth Package Engine, memory, RF filters, oscillator, and EMC shield into a highly integrated and optimized module solution with high quality and reliability to a complete standalone solution with no need for external components.

This highly integrated solution is optimized for customer applications running on a Linux host.
The host interface supports SDIO 3.0 and High Speed UART. Internal RAM comprises both code and data memory eliminating the need for external RAM, Flash or ROM memory interfaces. MAC address, trimming values etc. are stored in the on-board memory.

1.2 Key Features

- Full support for 802.11a/b/g/n/ac/ax.
- Dual band 2.4/5 GHz
- Industrial temp -40 to +85°C
- Single supply, 3.3V
- Up to 600 Mbps with 802.11ax on 80 MHz channel
- Supports 802.11d/e/h/i/k/r/u/v/w/z/mc.
- WPA2, WPA3 encryption
- Bluetooth 5.2 including LE long range and 2 Mbps.
- 802.15.4 support (order option)
- Simultaneous receive with Bluetooth and 802.15.4
- No external components except decoupling on power supply and a single antenna
- Low power consumption including sleep and standby modes.
- Supporting STA, AP and P2P simultaneous operation
- Internal coexistence between Wi-Fi/Bluetooth/802.15.4
- External coexistence interface to external radio such as LTE
- Extensive DMA hardware support for data flow to reduce CPU load.
- Advanced power management for optimum power consumption at varying load.
- External interface is SDIO for WLAN and UART for Bluetooth
- PCM/I2C audio interface for Bluetooth
- On-board High Frequency High Precision Oscillator 40MHz
- Small footprint 14 x 14 mm (196 mm2) 41-pin
- RoHS Compliant

2 HARDWARE ARCHITECTURE

2.1 Block Diagram

See technical data manual

Figure 2-2: Block diagram, Antenna Option B

2.2 Order Information

Part No.	Description
SPB611-BNDM-1	SPB611 module, Int. Antenna, without LTE filter, delivered in an ESD plastic bag
SPB611-BNDM-2	SPB611 module, Int. Antenna, without LTE filter, delivered on Tape &Reel.
SPB611-BLDM-1	SPB611 module, Int. Antenna, with LTE filter, delivered in an ESD plastic bag
SPB611-BLDM-2	SPB611 module, Int. Antenna, with LTE filter, delivered on Tape &Reel.
SPB611-BNTM-1	SPB611 module, Int. Antenna, without LTE filter, delivered in an ESD bag. 802.15.4 Support
SPB611-BNTM-2	SPB611 module, Int. Antenna, without LTE filter, delivered on Tape &Reel. 802.15.4 Support
SPB611-RNDM-1	SPB611 module, RF Pad, without LTE filter, delivered in an ESD plastic bag
SPB611-RNDM-2	SPB611 module, RF Pad, without LTE filter, delivered on Tape &Reel.
SPB611-RLDM-1	SPB611 module, RF Pad, with LTE filter, delivered in an ESD plastic bag
SPB611-RLDM-2	SPB611 module, RF Pad, with LTE filter, delivered on Tape &Reel.
SPB611-RNTM-1	SPB611 module, RF Pad, without LTE filter, delivered in an ESD bag. 802.15.4 Support
SPB611-RNTM-2	SPB611 module, RF Pad, without LTE filter, delivered on Tape &Reel. 802.15.4 Support
HDA611	Development board for SPB611 platform

Table 2-1 Order information for available SPB611-versions

Part numbering information

EXAMPLE: **SPB611- R N D M - 1**

Product Family

SPB611

Antenna Option

B = Integrated Antenna

R = RF Pad

Filter Option

N= No LTE co-existence filter

L= With LTE co-existence filter

Radio Support

D = WLAN, Bluetooth

T = WLAN, Bluetooth, 802.15.4

Operating Temperature

M = -40 to +85 °C

Delivery Package

1= ESD Bag

3= Tray

3 ELECTRICAL DATA

3.1 Absolute Maximum Ratings

Rating	Min	Max	Units
Supply voltage	-0.4	3.96	V
Supply voltage I/O	-0.4	3.96	V
Input RF level		+10	dBm
Storage temperature	-55	+125	°C
Lead temperature (No Pb), solder as per section 0		+250	°C

Table 3-1: Absolute maximum ratings. Exceeding any of the maximum ratings, even briefly lead to deterioration in performance or even destruction. Values indicates condition applied one at the time.

3.2 Electro Static Discharge (ESD)

SPB611 withstands ESD voltages up to 2000V HBM (Human Body Model) according to JEDEC JS-001 and up to 500 V CDM (Charged Device Model) according to JEDEC JS-002.

3.3 Recommended Operating Conditions

Rating	Min	Typ	Max	Units
Supply Voltage VDD	3.14	3.3	3.46	V
Supply Voltage VDD_IO	1.71	1.8 or 3.3V	3.46	V
Supply Voltage IO with VDD 0V		0	0.2	V
Operating temperature (Industrial grade)	-40	+25	+85	°C

Table 3-2: Recommended operating conditions

3.4 Power Consumption

Conditions: Tamb = 25 °C, VBAT=3.3V, Order Option R

Mode	Conditions	Min	Typ.	Max	Unit
2.4G/TX 802.11 b	DSSS 1Mbps, Pout=17 dBm		354		mA
2.4G/TX 802.11 g	OFDM 6Mbps, Pout=17 dBm		364		mA
2.4G/TX 802.11n HT40	OFDM MCS0, Pout=16 dBm		380		mA
5G/TX 802.11g	OFDM 6 Mbps, Pout=15 dBm		497		mA
5G/TX 802.11n HT40	OFDM MCS0, Pout=14 dBm		454		mA

Mode	Conditions	Min	Typ.	Max	Unit
5G/TX 802.11ax HE80	OFDM MCS0, Pout=9 dBm		416		mA
2.4G/RX 802.11 b	Normal mode – Max Sensitivity		94.5		mA
2.4G/RX 802.11 g	Normal mode – Max Sensitivity		94.5		mA
2.4G/RX MCS7 HT20	Normal mode – Max Sensitivity		96.5		mA
5G/RX 802.11g	OFDM 54 Mbps Normal mode – Max Sensitivity		113.5		mA
5G/RX MCS7 HT20	Normal mode – Max Sensitivity		115.5		mA
5G/RX MCS9 VHT40	Normal mode – Max Sensitivity		130.5		mA
5G/RX MCS11 HE80	Normal mode – Max Sensitivity		160		mA
Bluetooth Rx	SCO HV3 Peak RX		39.3		mA
Continuous Tx Class 2 (+4 dBm)	SCO HV3 Peak TX		48.3		mA
1.28 sec BLE	Advertising		0.35		mA
1.28 sec sniff as master ACL Link			0.54		mA
802.15.4	Transmitt @ 0dBm		43.5		mA
Deep Sleep	Standby		550		µA
WLAN/Power Save	DTIM = 1, Beacon Interval 100ms		2.54		mA
WLAN/Power Save	DTIM = 3, Beacon Interval 300ms		1.18		mA

Table 3-3: Typical current consumption in different modes.

3.5 RF Performance

Conditions: VBAT= 3.3V, Tamb= 25°C Spectrum Mask and BER according to IEEE 802.11a/b/g/n/ac/ax specification, Order Option LBNM*.

Parameter	Conditions	Min	Typ.	Max	Units
2.4G/Frequency range		2412		2472	MHz
2.4G/Supported Channels	ETSI	Ch1 (2412 MHz)		Ch13 (2472 MHz)	
	FCC	Ch1 (2412 MHz)		Ch11 (2462 MHz)	
5G/Frequency range		4900		5925	MHz
5G/Supported Channels		Ch36 (5180 MHz)		Ch165 (5825MHz)	
RF impedance			50		ohm
Transmitter performance 11a/b/g/n/ac/ax and BT					
2.4G/Output power	802.11b, 11Mbps		16		dBm

Parameter	Conditions	Min	Typ.	Max	Units
2.4G/Output power	802.11g, 54Mbps		14		dBm
2.4G/Output power	802.11n, MCS7, HT20		14		dBm
5G/Output power	802.11a, 54Mbps		15		dBm
5G/Output power	802.11n, MCS7, HT20		15		dBm
5G/Output power	802.11ac, MCS8, VHT20		14		dBm
5G/Output power	802.11ac, MCS9, VHT40		12		dBm
5G/Output power	802.11ac, MCS9, VHT80		10		dBm
5G/Output power	802.11ax, MCS11, HE20		12		dBm
5G/Output power	802.11ax, MCS11, HE40		11		dBm
5G/Output power	802.11ax, MCS11, HE80		10		dBm
BT BR	GFSK		6		dBm
BT EDR	π/4DQPSK		6		dBm
BT EDR	8DPSK		6		dBm
BT LE	1Mbps		6		dBm
Receiver performance 11a/b/g/n/ac/ax, Bluetooth and 802.15.4					
2.4G/Receiver sensitivity	DPSK 1Mbit/s			-97	dBm
2.4G/Receiver sensitivity	OFDM/64-QAM 54Mbit/s, HT20			-74	dBm
2.4G/Receiver sensitivity	MCS-7, OFDM/64-QAM, HT20			-71	dBm
2.4G/Receiver sensitivity	MCS-8, OFDM/256-QAM, VHT20			-66	dBm
5G/Receiver sensitivity	OFDM/64-QAM 54Mbit/s, HT20			-74	dBm
5G/Receiver sensitivity	MCS-0, BPSK, HT20			-89	dBm
5G/Receiver sensitivity	MCS-9, OFDM/256-QAM, HT40			-69	dBm
5G/Receiver sensitivity	MCS-0, BPSK, VHT80			-82	dBm
5G/Receiver sensitivity	MCS-9, OFDM/256-QAM, VHT80			-60	dBm
5G/Receiver sensitivity	MCS-11, OFDM/1024-QAM, HE80			-57	dBm
BT BR	GFSK, BER≤0.1%			-89	dBm
BT EDR	π/4DQPSK, BER≤0.1%			-91	dBm
BT EDR	8DPSK, BER≤0.1%			-84	dBm
BT LE	BER≤0.1%			-95	dBm
802.15.4			TBD		

Table 3-4: RF Performance

3.6 Digital Pin Characteristics

3.6.1 SDIO timing characteristics

The SPB611 support a SDIO device interface that conforms to the industry standard SDIO 3.0 Full-speed specification and allows a host controller using the SDIO bus protocol to access the SPB611 device. SDIO-interface can run the SDIO 1-bit and 4-bit mode with full clock range up to 208MHz.

Condition: VDDIO= 3.3 V, T_{amb}= -40 to +85°C

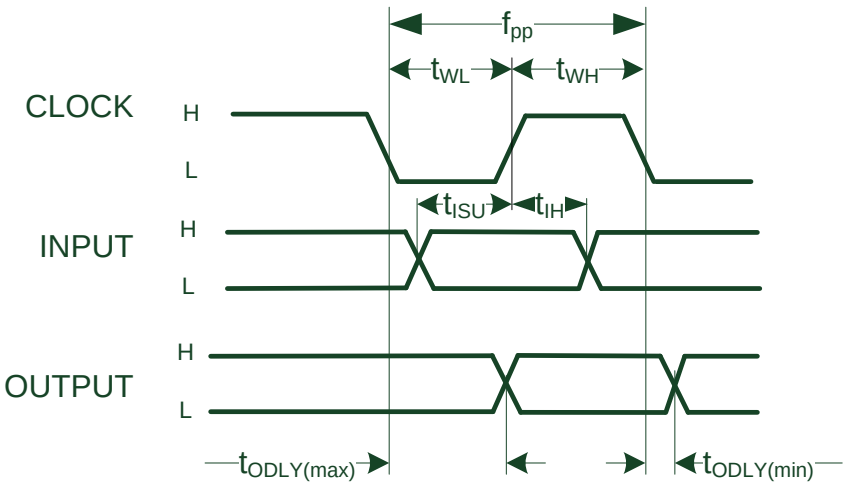

Figure 3-1: SDIO timing diagram

Parameter	Symbol	Min	Max	ns	Comments
Input set-up time	t_{ISU}	5		ns	
Input hold time	t_{IH}	5		ns	
Clock low time	t_{WL}	10		ns	
Clock high time	t_{WH}	10		ns	
Output delay time	t_{ODLY}		14	ns	
Clock Frequency	f_{pp}		25	MHz	

Table 3-5: SDIO timing parameter values (normal mode)

Parameter	Symbol	Min	Max	ns	Comments
Input set-up time	t_{ISU}	5		ns	
Input hold time	t_{IH}	2		ns	
Clock low time	t_{WL}	7		ns	
Clock high time	t_{WH}	7		ns	
Output delay time	t_{ODLY}		14	ns	
Output hold time		2.5		ns	
Clock Frequency	f_{pp}		50	MHz	

Table 3-6: SDIO timing parameter values (high speed mode 50MHz)

Parameter	Symbol	Min	Max	ns	Comments
Input set-up time	t_{ISU}	3		ns	
Input hold time	t_{IH}	0.8		ns	
Clock time	t_{clk}	10	40	ns	
Clock rise time, fall time	t_{WL}		$0.2*t_{clk}$	ns	
Output delay time	t_{ODLY}		7.5	ns	
Output hold time	t_{OH}	1.5		ns	
Clock Frequency	f_{pp}	25	100	MHz	

Table 3-7: SDIO timing parameter values (high speed mode 100MHz, VDDIO= 1.8V, SDR 12/25/50)

Parameter	Symbol	Min	Max	ns	Comments
Input set-up time	t_{ISU}	1.4		ns	
Input hold time	t_{IH}	0.8		ns	
Clock time	t_{clk}	4.8		ns	
Clock rise time, fall time	t_{WL}		$0.2*t_{clk}$	ns	
Clock Frequency	f_{pp}		208	MHz	

Table 3-8: SDIO timing parameter values (high speed mode 208MHz, VDDIO = 1.8V, SDR 104)

3.6.2 Digital input/output pad (I/O)

The digital I/O pads are of type none inverting three-state driver/receiver. It includes an input buffer and an output buffer with enable/disable control inputs. It also includes a hold-function. When an I/O is neither driven by the internal nor by an external circuitry, the hold function maintains the latest state of the I/O.

Parameter	Symbol	Min	Typ	Max	Units
Input low voltage	V_{IL}	-0.4		0.3*VDDIO	V
Input high voltage	V_{IH}	0.7*VDDIO		VDDIO+0.4	V
Input hysteresis	V_{HYS}	100			mV
Output low voltage	V_{OL}	0		0.4	V
Output high voltage	V_{OH}	VDDIO-0.4			V
VDDIO	V_{IO}	1.71 3.14	1.8 3.3	1.89 3.46	V

Table 3-9: I/O pin DC characteristics.

4 PIN CONFIGURATIONS

4.1 Pin Configuration SPB611 Module

Figure 4-1: SPB611-Rxxx package pin out, top view

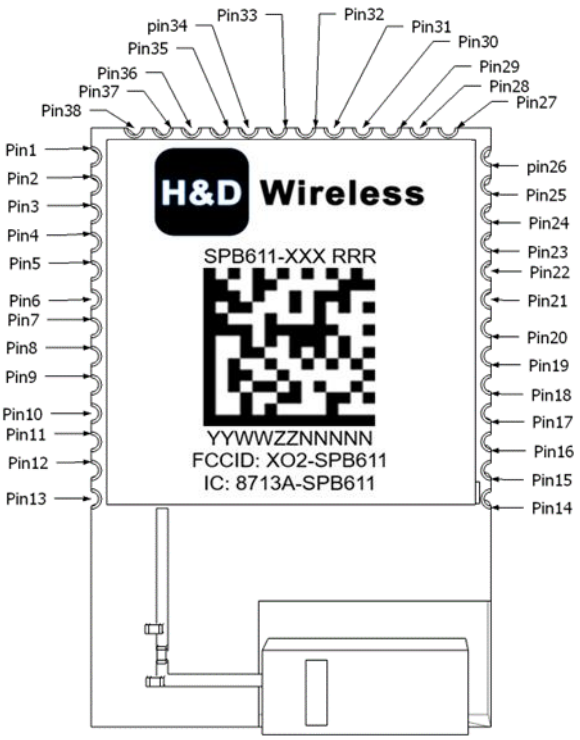

Figure 4-2: SPB611-Bxxx package pin out, top view.

4.2 Pin Assignments

Pin SPB611-R	Pin SPB611-B	Function	Type	Description
1	**1**	GND	S	Ground
2	**2**	GPIO26 WCI2_SOUT	I/O O	General Purpose I/O or LTE Coexistence Signal TXD
3	**3**	GPIO17 WLAN_WAKE_HOST	I/O O	General Purpose I/O or WiFi wakeup output
4	**4**	GPIO25 WCI2_SIN	I/O I	General Purpose I/O or LTE Coexistence Signal RXD
5	**5**	GPIO18 HOST_WAKE_BT	I/O I	General Purpose I/O or BT wakeup input
6	**6**	GPIO16 HOST_WAKE_WLAN	I/O I	General Purpose I/O or WiFi wakeup input
7	**7**	GPIO1 IND_RST_WL	I/O I	General Purpose I/O or SW reset input for WiFi
8	**8**	GPIO12 SPI_CLK	I/O I	General purpose I/O or SPI clock input
9	**9**	SPI_MISO/GPIO 15	I/O O	SPI MISO or General Purpose pin 15
10	**10**	SPI_MOSI/GPIO 14	I/O I	SPI_MOSI or General Purpose pin 14
11	**11**	GND	S	Ground
12	**12**	RFOUT1	RF	Antenna Port for (50 Ohm) for WLAN/BT, SPB611-R option, SPB611-R option. (n/a for SPB611-B antenna option)
13	**13**	GND	S	Ground
14	-	GND	S	Ground
15	-	RFOUT2		Not Connected
16	-	GND	S	Ground
17	**14**	GND	S	Ground
18	**15**	CONFIG_HOST0	I	CONFIG[0] host configuration mode, leave open
19	**16**	CONFIG_HOST1	I	CONFIG[1] host configuration mode, leave open
20	**17**	GPIO19 BT_WAKE_HOST	I/O O	General Purpose I/O or BT wakeup output
21	**18**	GPIO13 SPI_FRM	I/O I	General Purpose I/O or SPI frame input
22	**19**	GPIO20 SPI_INT	I/O O	General purpose I/O or SPI interrupt
23	**20**	GPIO2 IND_RST_BT_15.4	I/O I	General purpose I/O or SW reset input for Bluetooth/802.15.4 (combined)
24	**21**	GND	S	Ground

Pin SPB611-R	Pin SPB611-B	Function	Type	Description
25	**22**	VDD33	S	Supply pin 3.3V, decouple with 100uF
26	**23**	GPIO11 UART_TX	I/O O	General Purpose I/O or Bluetooth UART TXD output
27	**24**	GPIO9 UART_RTS	I/O O	General Purpose I/O or Bluetooth UART RTS output
28	**25**	GPIO8 UART_CTS	I/O I	General Purpose I/O or Bluetooth UART CTS input
29	**26**	GPIO10 UART_RXD	I/O I	General Purpose I/O or Bluetooth UART RXD input
30	**27**	PDn	I	Power Down of Module < 0.4 V, full power-down > 1.8 V, normal mode External pull-up/down resistor required
31	**28**	SD_DAT1	I/O	SDIO Data 1
32	**29**	SD_DAT2	I/O	SDIO Data 2
33	**30**	SD_DAT3	I/O	SDIO Data 3
34	**31**	SD_CLK	I	SDIO Clock input
35	**32**	SD_DAT0	I/O	SDIO Data 0
36	**33**	SD_CMD	I/O	SDIO Command
37	**34**	GPIO7 PCM_SYNC	I/O	General Purpose I/O or Bluetooth PCM frame sync or Bluetooth I2S left/right clock
38	**35**	GPIO5 PCM_DOUT	I/O O	General Purpose I/O or Bluetooth PCM/I2S data output
39	**36**	GPIO6 PCM_DIN	I/O I	General Purpose I/O or Bluetooth PCM/I2S data
40	**37**	GPIO4 PCM_CLK	I/O	General Purpose I/O or Bluetooth PCM data clock or Bluetooth I2S bit clock
41	**38**	VDDIO	S	IO Supply

Table 4-1: Pin Description for SPB611 Module

5 APPLICATION INFORMATION

5.1 Power Supply

SPB611 should be powered by a single supply voltage on VDD of 3.3V. It generates all required digital and analog supply voltages with the built in DC-DC converter. Ramp time applying VDD to SPB611 shall be less than 5ms (<5ms).

5.1.1 Main supply

The main power is connected to VDD. The ripple on VDD should be less than 10mV p-p.

5.2 Clock Signals

The SPB611 requires no external clock signals. It has an internal high frequency oscillator with a high precision 40 MHz crystal and a low power oscillator to generate the required clock signals.

5.3 Power-up and Standby

The Power Down pin (PDn) shall be set high during normal operation of either connectivity type. Can be connected to VDD directly.

Pulling PDn pin low, sets SPB611 in Standby mode. This turns OFF most parts of the circuit and minimizes the current consumption. All I/O interface pins are set to predefined states (high, low or high-z) when in Standby mode.

To end Standby mode set PDn high and reload firmware.

5.4 Power Save

Power save is an energy saving mode where SPB611 is only listening at regular intervals for the beacons transmitted from an access point and is set in sleep mode in between. During this sleep mode, firmware is kept in RAM but all not needed functions are turned off. Since the receive time is very short compared to the listening interval the average current consumption is reduced significantly.
The timing of the listening interval is based on the low power oscillator clock generated internally.

5.5 Interfaces

The SPB611 is equipped with a number of interfaces that can be set up in various ways by the value on CONFIG_HOST0 and CONFIG_HOST1 during boot, see section 5.5.1.

5.5.1 Host Interface SDIO and UART

The SDIO interface is SDIO 4-bit mode. For timing characteristics and trigger level see Figure 3-1 and Table 3-5, Table 3-6, Table 3-7 and Table 3-8.

The High Speed UART interface default supporting Baud Rates from 1200 up to 2764800 bps, 8 bits, no parity, 1 stop bit.

Both CONFIG_HOST0 and CONFIG_HOST1 have internal pull-up and only needs to be connected via a 100kOhm resistor to GND to be set low (0). For high level (1) the pin can be left unconnected. Table 5-1: Host Interface Selection shows the different options. The default is to leave both signals unconnected (11) and SDIO as host interface for WiFi, UART for Bluetooth and SPI for 802.15.4.

CONFIG_HOST[0:1]	WLAN Host Interface	Bluetooth Host Interface	802.15.4 Host interface
11	SDIO	UART	SPI
All other	Reserved	Reserved	Reserved

Table 5-1: Host Interface Selection

5.5.2 PCM Interface

PCM interface is used for BT audio and can operate in master or slave mode. The interface supports the following:

- 8, 13, 14, 15 or 16-bit samples
- 4 slots per frame with up to 16-bits per slot
- Long or short frame sync

5.5.3 Host Wake up

Wake up command via the SDIO interface. This is the normal wake up and is implemented in the FW.

There are options to use defined GPIO:s for Host Wake-up or opposite for SPB611 Wake-Up involving both WLAN and BT. Below table outline the options.

GPIO No.	Function
GPIO17	WLAN to Host Wake-up
GPIO19	Bluetooth to Host Wake-up
GPIO16	Host to WLAN Wake-up
GPIO18	Host to BT Wake-up

5.5.4 RF Interface

The RF output pin impedance is 50 ohm and shall be connected to an antenna with VSWR much better than 2:1.

5.6 General Application Information

5.6.1 Design directions

The design using the SPB611 must be performed according to good RF design considerations. All the leads shall be as short as possible between the circuit pins and the external components. Highest priority has the RF-port to antenna strip line.

5.6.2 Soldering

The SPB611 uses a LGA type package. The recommended solder profile is pictured in Figure 5-1.

Before assembly it is recommended to bake SPB611 for 8 days at 40°C and RH<5% in Tape&Reel or for 16 hours at 125°C with no packaging.

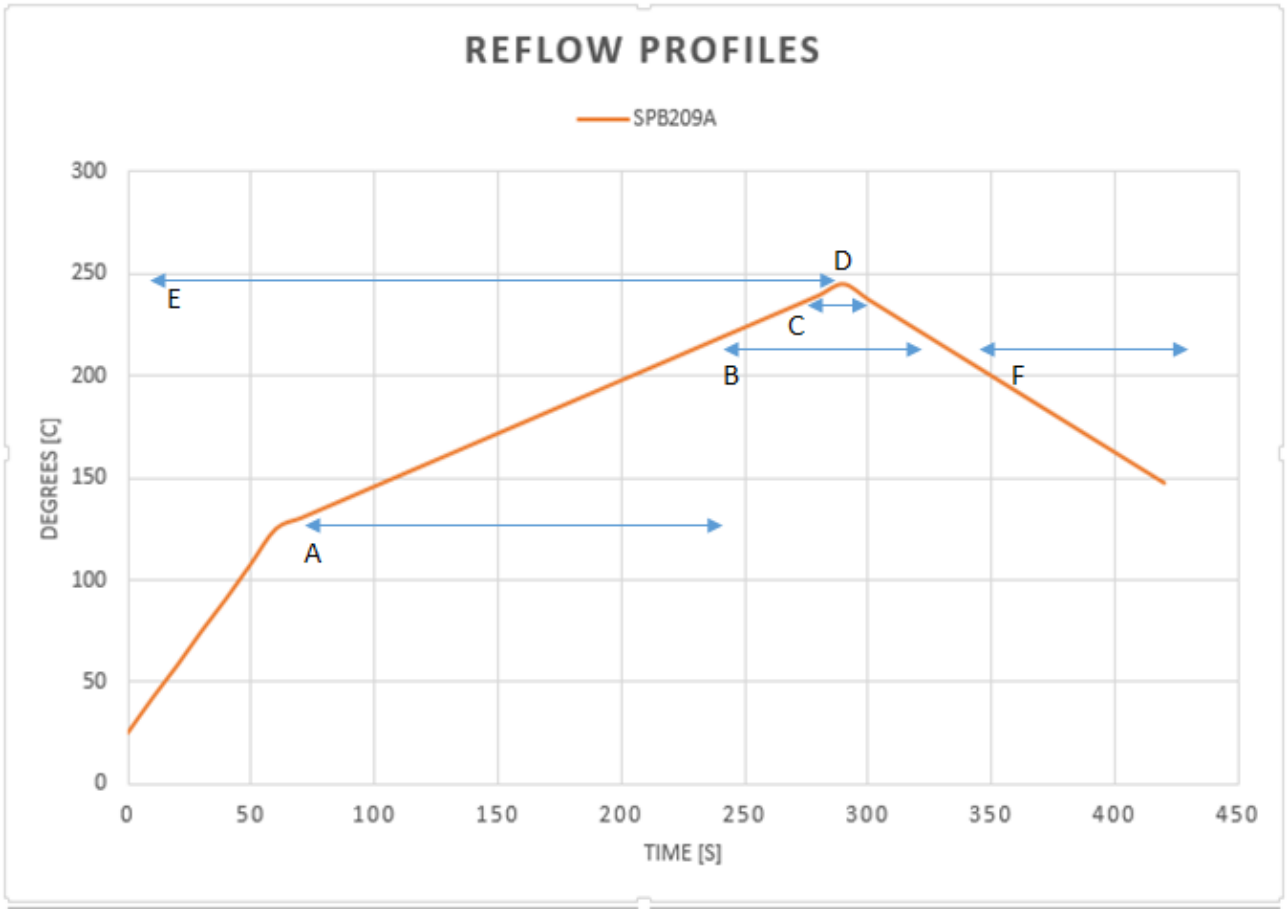

Figure 5-1: Reflow Temperature Profile

Item	Description	Temp	Time
A	Preheat ramp up rate	125-217°C	150-210s
B	Time at >217° C	>217°C	60-90s
C	Wetting time	>235°C	10-30s
D	Peak temperature	245°C	
E	Time from room to peak	25-245°C	240-360s
F	Ramp down temperature	<1°C/s	

Table 5-2: Solder Profile Specification

5.6.3 Environmental statement

The SPB611 is designed and manufactured to comply with the RoHS and Green directives.

6 PACKAGE SPECIFICATION

6.1 Mechanical SPB611 PCB Module (Antenna Option B)

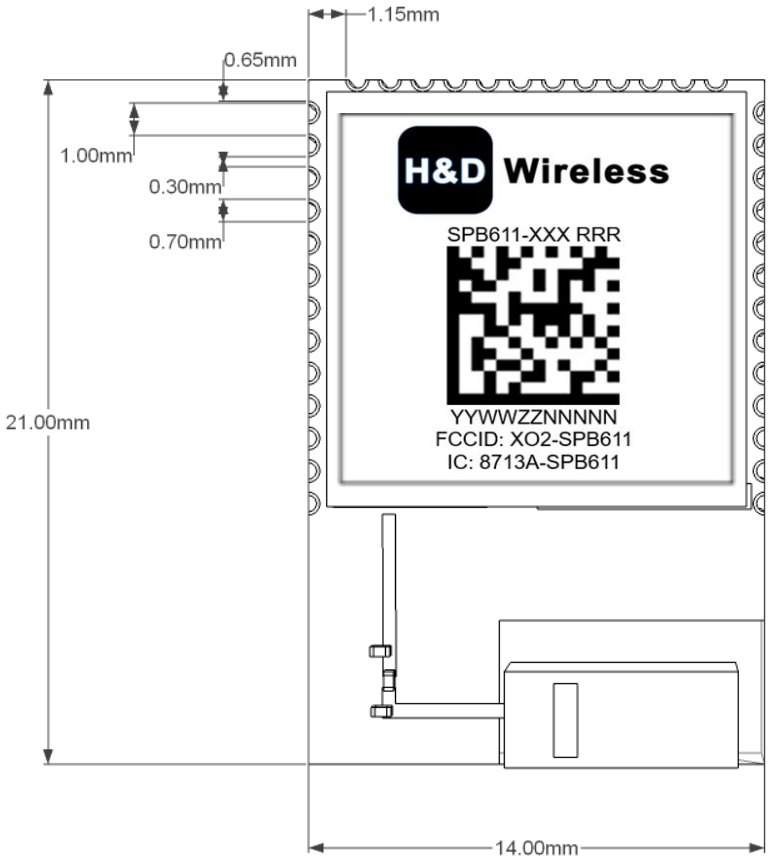

Figure 6-1: Top view (Antenna option B)

Figure 6-2: Side view

6.2 Mechanical SPB611 PCB Module (Antenna Option R)

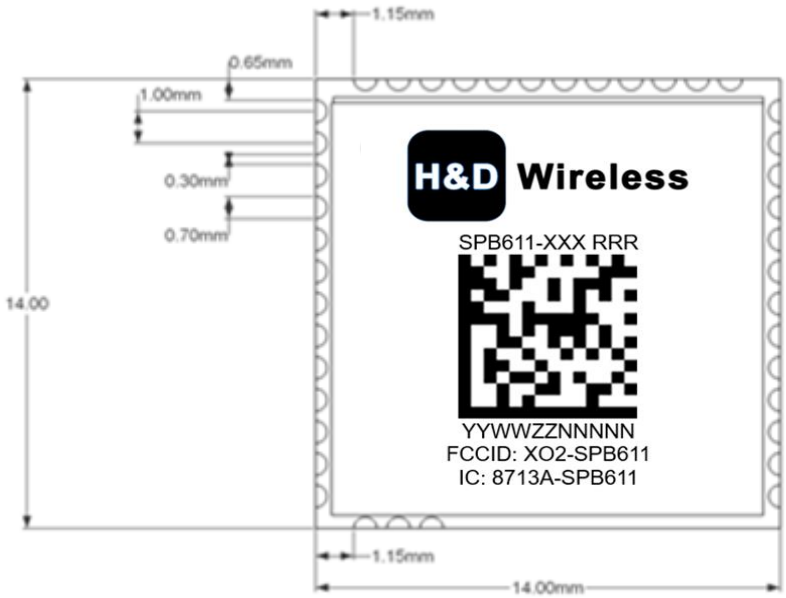

Figure 6-3: Top view (Antenna Option R)

Figure 6-4: Side view

6.3 Marking SPB611

The label on the EMC Shield is imprinted with the regulatory IDs and lot number.

Figure 6-5: SPB611 Marking

6.4 Mounting Information

6.4.1 Recommended Land Patterns for SPB611 Shielded Module

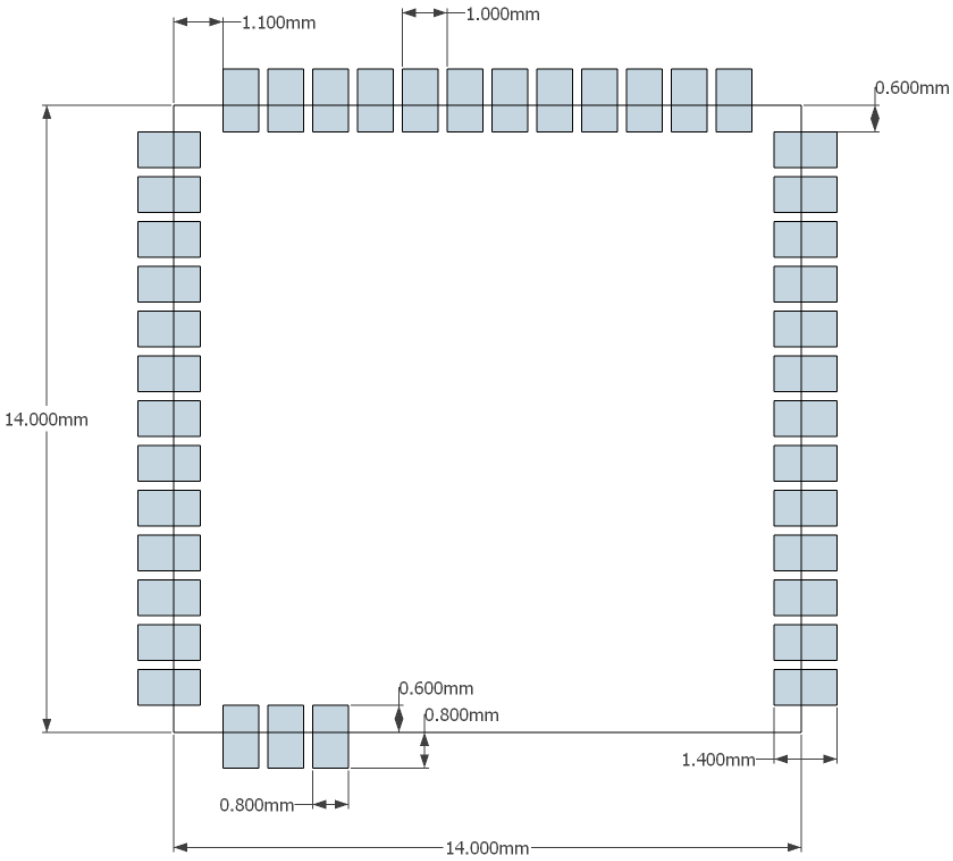

Figure 6-6: SPB611 Antenna Option R Land Pattern

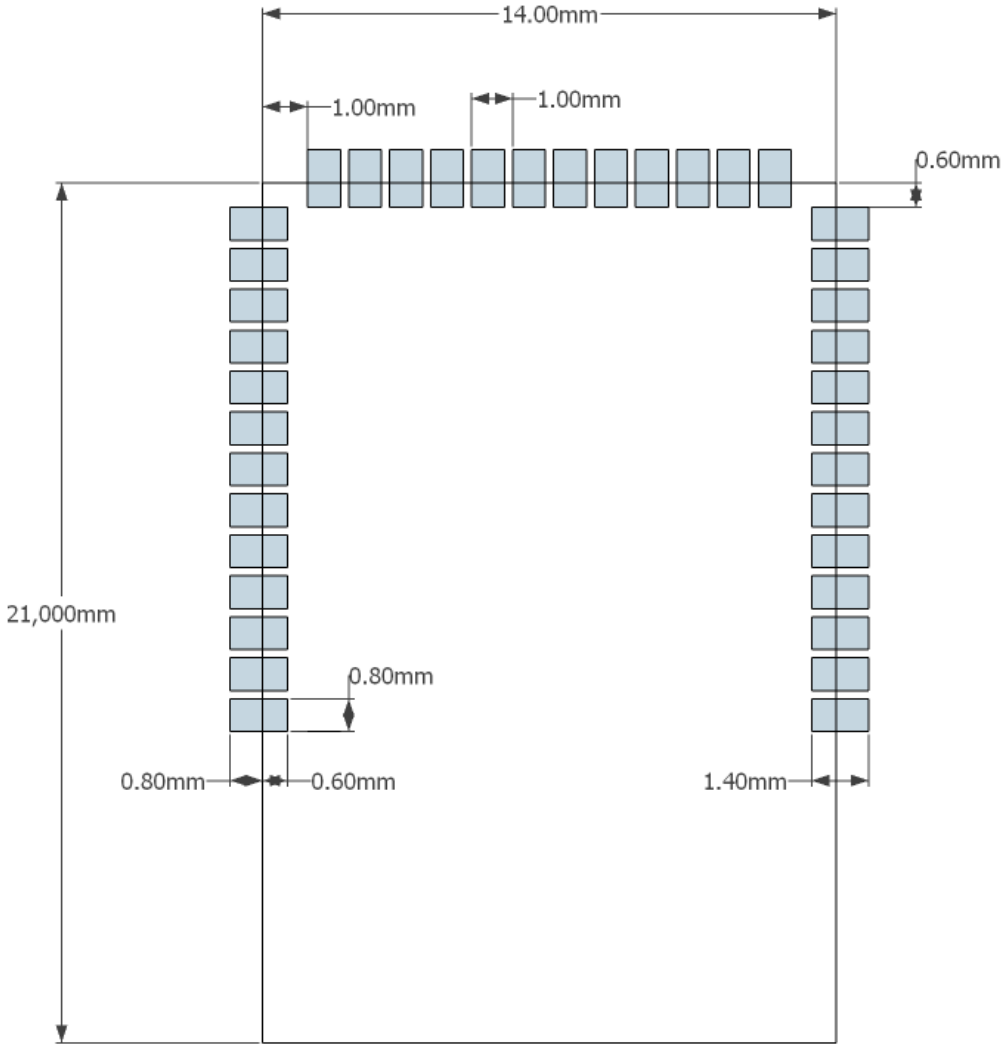

Figure 6-7: SPB611 Antenna Option B Land Pattern

Place no via holes or exposed metal under the module, but it is recommended to fill as much as possible with ground.

For the module with integrated chip antenna keep an area free of all metal around the antenna, see Figure 6-7: SPB611 Antenna Option B Land Pattern

It is recommended to place the module at the edge of the PCB with the antenna portion outside the PCB edge for the best RF performance.

7 STANDARDS COMPLIANCE

7.1 IEEE/IETF

Standard	Revision	Description
802.11	802.11™ –R2003	WLAN MAC& PHY
802.11ac	IEEE 802.11ac	Amendment to IEEE 802.11, wider channels and higher order modulation
802.11ax	IEEE 802.11ac	Amendment to IEEE 802.11, wider channels and higher order modulation
802.11a	IEEE 802.11a-1999	OFDM waveform at 5.8 GHz
802.11b	802.11™ –R2003	High Rate DSSS (5,5/11 Mbit/s)
802.11d	802.11™ –R2003	Operation in different regulatory domains
802.11e	-2005	Quality of Service
802.11g	-2003	Extended rate PHY (ERP-PBCC, DSS-OFDM)
802.11i	-2004	Security enhancements
802.11n	-2009	WLAN MAC&PHY Amendment 5
802.11r	-2008	Amendment 2: Fast Basic Service Set (BSS) Transition
802.11h	1997 edition	Bridge tunneling
802.11w	-2009	Protected Management Frames (PMF)
802.15.4	-2015	Thread and Zibee
RFC1042	Inherent	Frame encapsulation

Table 7-1: Applicable IEEE standards

7.2 WiFi

Specification	Description	Revision
Wi-Fi 802.11b with WPA system interoperability test plan for IEEE 802.11b devices	802.11b devices with WPA	2.1
WiFi 802.11g with WPA system inter operability test plan	802.11g devices with WPA	2.0
WMM (including WMM Power Save)		Ver 1.2
WPS (Wireless Protected Setup)		

Table 7-2: Applicable WiFi standards

7.3 Regulatory

Country	Approval authority	Regulatory	Frequency band
USA	FCC	FCC ID: XO2-SPB611 (Pending)	2.412 GHz -2.472 GHz 5.180 GHz – 5.825 GHz
Canada	IC	IC: Pending	2.412 GHz -2.472 GHz 5.180 GHz – 5.825 GHz
Europe		ETSI/EN Pending	2.412 GHz -2.472 GHz 5.180 GHz – 5.700 GHz

Table 7-3: Regulatory standards

7.3.1 FCC (United States of America) Pending

This equipment complies with Part 15 of the FCC rules and regulations.
To fulfill FCC Certification requirements, an OEM manufacturer must comply with the following regulations:

1. The modular transmitter must be labeled with its own FCC ID number, and, if the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

Example of label required for OEM product containing SPB611 module:

Contains FCC ID: XO2-SPB611
The enclosed device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (i) this device may not cause harmful interference and (ii) this device must accept any interference received, including interference that may cause undesired operation.

2. Only antennas approved may be used with the SPB611 module. The SPB611 module may be integrated with custom design antennas which OEM installer must authorize following the FCC 15.21 requirements.

SPB611 is pending approval with the following antennas:

Brand	**Model**	**Type**	**Cable length**	**Max Gain 2.4 GHz**	**Max Gain 5 GHz**
Molex	204281-1300	Flex Antenna	300 mm	1.3	2.3
Molex	146153-1050	Flex Antenna	50 mm	3.2	4.25
Taoglas	GW.71.5153	Dipole RP-SMA		3.8	5.5
Laird	001-0012	Dipole RP-SMA		2.0	2.0
Fractus	FR05-S1-NO-1-004	Chip Antenna		1.5	4.7

IMPORTANT: This equipment complies with Part 15 of the FCC Rules. 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 (FCC 15.19).

The internal / external antenna(s) used for this mobile transmitter must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is approved as a mobile device with respect to RF exposure compliance, and may only be marketed to OEM installers. Use in portable exposure conditions (FCC 2.1093) requires separate equipment authorization.

IMPORTANT: Modifications not expressly approved by this company could void the user's authority to operate this equipment (FCC section 15.21).

IMPORTANT: The finished product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. Compliance for unintentional radiators (Part 15 Subpart B “Unintentional Radiators”), such as digital devices, computer peripherals, radio receivers, etc. must be demonstrated.

7.3.2 ISED (Canada)

The device complies with Industry Canada’s licence-exempt RSSs. 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.

Cet appareil est conforme aux normes d’exemption de licence RSS d’Industry Canada. Son fonctionnement est soumis aux deux conditions suivantes:

(1) cet appareil ne doit pas causer d’interférence, et
(2) cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

The host product shall be properly labelled to identify the modules within the host product.

The ISED Canada certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the ISED Canada certification number for the module, preceded by the word "Contains" or similar wording expressing the same meaning, as follows:

Contains IC: 8713A-SPB611

Le produit hôte devra être correctement étiqueté, de façon à permettre l'identification des modules qui s'y trouvent.

L'étiquette d'homologation d'un module ISED Canada devra être posée sur le produit hôte à un endroit bien en vue, en tout temps. En l'absence d'étiquette, le produit hôte doit porter une étiquette sur laquelle figure le numéro d'homologation du module ISED Canada, précédé du mot « contient », ou d'une formulation similaire allant dans le même sens et qui va comme suit:

Contient IC: 8713A-SPB611

7.3.3 ETSI (Europe)

The SPB611 module has been certified for use in European union countries according to ETSI EN 300 328 (Electromagnetic compatibility and Radio spectrum matters for equipment operating in the 2,4 GHz ISM band using spread spectrum modulation techniques) and EN 301 893 (5 GHz RLAN). These standards are

harmonized within the European Union and covering essential requirements under article 3 of the Radio Equipment Directive (RED).

If the SPB611 module is incorporated into a product, the manufacturer must ensure compliance of the final end-user product to the European harmonized EMC and low voltage/safety standards. A declaration of conformity must be issued for the product including compliance references to these standards. Underlying the declaration of conformity a technical construction file (TCF), including all relevant test reports and technical documentation, must be issued and kept on file as described in the Radio Equipment Directive.

Furthermore, the manufacturer must maintain a copy of the SPB611 module documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a complete re-test must be made in order to comply with all relevant standards as basis for CE-marking. A submission to notified body must be used only if deviations from standards have been found or if non-harmonized standards have been used.

8 SALES

Global Sales Office Sweden

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164 51 Kista
Sweden

E-mail: sales@hd-wireless.se
Support page: support.hd-wireless.com
Support: support@hd-wireless.se

Local sales offices and distributors see **www.hd-wireless.com**

9 REFERENCE DESIGN USING SPB611

This document describes how to use the SPB611 module in a customer application.
See support.hd-wireless.com for the complete list of reference designs and other support documents.

10 TRADEMARKS

- Wi-Fi is a trademark of Wi-Fi Alliance
- Bluetooth is a trademark of Bluetooth Special Interest Group.