SPB800P-WiFi 802.11b+g SMD Board

Data Sheet

SPB800P

WiFi SMD Board

H&D Wireless

Revision History

Revision	Revision date	Description
PA1	2010-07-14	First Draft
PA2	2010-10-22	Updated pin and signal list
PA3	2010-11-08	Added evaluation kit information
PA4	2010-11-25	Revised land pattern
PA5	2010-12-10	Land pattern dimensions clarified
PA6	2010-12-13	Land pattern drawing updated
PA7	2010-12-17	FCC ID added
PA8	2010-12-17	Cleaned up pagination
PA9	2011-01-27	Pin list revised
PA10	2011-01-28	Spb800-e x ref table corrected.
PA11	2012-03-12	Power management added
PA12	2012-03-19	Revised after review
PA13	2012-04-25	Added SPB800-BMM package
PA14	2012-05-11	HOST_ATT pin corrected in figure 4-1
PA15	2012-06-08	LED pins clarified

Disclaimer and copyright notice
Information in this document, including URL references, is subject to change without notice.
THIS DOCUMENT IS PROVIDED "AS IS" WITH NO WARRANTIES WHATSOEVER, INCLUDING ANY WARRANTY OF MERCHANTABILITY, NONINFRINGEMENT, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY WARRANTY OTHERWISE ARISING OUT OF ANY PROPOSAL, SPECIFICATION OR SAMPLE. All liability, including liability for infringement of any proprietary rights, relating to use of information in this document is disclaimed.
No licenses express or implied, by estoppel or otherwise, to any intellectual property rights are granted herein.

The Wi-Fi Alliance Member Logo is a trademark of the Wi-Fi Alliance.

All trade names, trademarks and registered trademarks mentioned in this document are property of their respective owners, and are hereby acknowledged.
Copyright © 2009, 2010, 2011 H&D Wireless AB. All rights reserved.

CONTENTS

1 INTRODUCTION

1.1 Overview

SPB800 is a SMD module with the H&D Wireless' WLAN System In Package, SIP module and a micro processor including external flash memory and peripheral components required. It is a complete solution designed to be function as a standalone communication module, serial cable replacement or as an easy to use WLAN addition with a minimal resource need, to an existing system.

SPB800 features a WLAN Access Point mode ideal for configuration of Wireless LAN, IP, and other system parameters to be set by the user via web page.

SPB800 enables a cost efficient ultra low power, high performance and feature rich client solution. It provides up to 54 Mbit/s data rate when operating in the OFDM mode and up to 11 Mbit/s data rate when operating in the DSSS/CCK mode. The SPB800 offloads the IP-stack and much of the WiFi-handling code from the host to drastically reduce memory footprint and MCU requirements for adding WiFi to a host system.

The SPB800 functions in two modes

- SPB800P; WLAN addition to a system using the (o)WL-pico API that requires a minimum footprint on the host processor. Optimized for battery powered systems.
- SPB800S; Serial WiFi adapter with UART interface. Intended for stationary non-battery operated system.

This data sheet pertains to the SPB800P, the (o)WL-pico mode in regards to pin out and features. For Serial_to_WiFi pinning please refer to the 1451-SPB800S_datasheet.

1.2 Key Features

Integrated IP-stack
Support for 8 TCP, 4 UDP and 4 Raw simultaneous sockets
Data Rates: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, and 54Mbps
Modulation: QPSK, 16QAM, 64QAM DBPSK, DQPSK, CCK, OFDM with BPSK
WEP, WPA and WPA2 Supported
Works in WLAN Access Point or station mode
Low power consumption
Advanced power management for optimum power consumption at varying load.
Simple configuration and control via (o)WL-pico API.
Single Supply Voltage 3.3 V
Small footprint 22 x 34 mm (866 x 1338 mil) bottom pad version.
RoHS Compliant
Integrated Chip antenna or U.FL connector versions available

2 HARDWARE ARCHITECTURE

2.1 Block Diagram

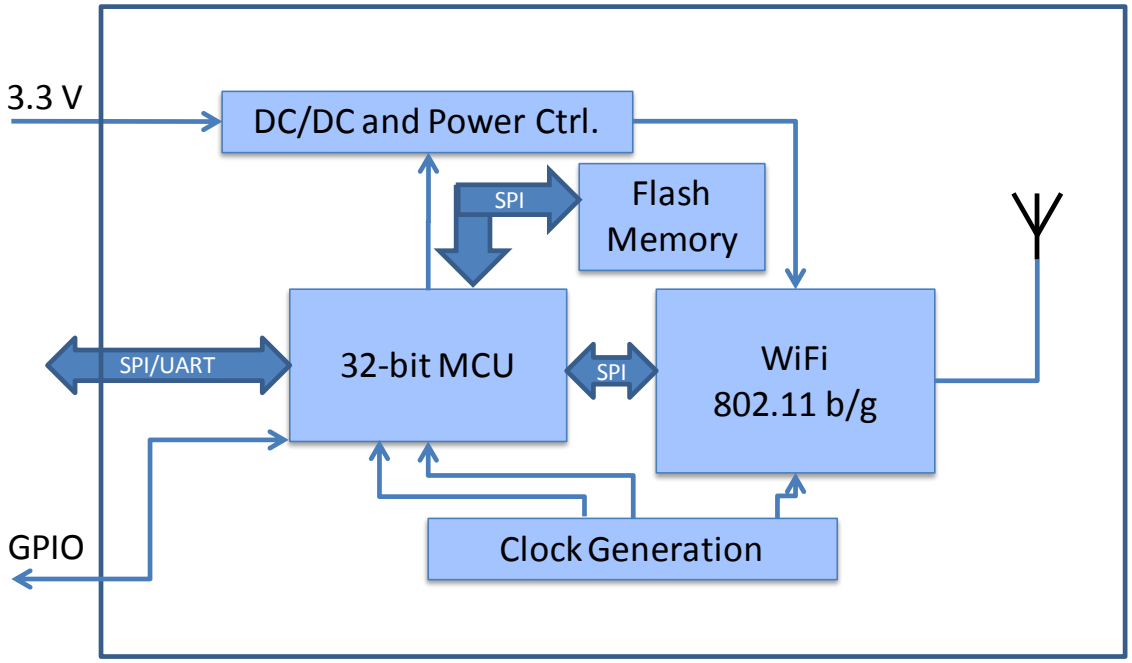


Figure 2-1 Block Diagram:

2.2 Order information

EXAMPLE: **SPB800P - B C P 1**

Product Family
SPB800

Firmware pre-programming
P = (o)WL-pico Server
S= Serial_to_WiFi

Antenna Option
B= Intergrated Chip Antenna
D= U.fl RF connector

Operating Temperature
C= 0°C - 70°C
M= -40°C - 85°C

Package
P= 42 pin SMD module, bottom pads
M= 10 pin socket 2x5, 2.54 mm pitch

Delivery Package
1= ESD bag
2= Tape & Reel
3= Tray

3 ELECTRICAL DATA

3.1 Absolute maximum ratings

Rating	Min	Max	Unit
Supply voltage	0	4	V
Input RF level		10	dBm
Storage temperature	-50	+125	°C

Table 3-1: Abolute 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 ESD

SPB800P withstands ESD voltages up to 2000 V HBM (Human Body Model) according to JESD22-A114 and up to 300 V MM (Machine Model) according to JESD22-A115.

3.3 Recommended operating conditions

Symbol		Min	Typ.	Max	Unit
VCC	Supply Voltage	3.0	3.3	3.6	V
V_{IHH}	High Input Tolerant Pins, UART_TX UART_RX, UART_CTS, UART_RTS, SPI_CLK	2.0		5.0	V
V_{IHN}	All other input pins	2.0		3.6	V
V_{IL}	All pins	-0.3		0.8	V
T_{OP}	Operating temperature SPB800P-xC	0	+25	+70	°C
T_{OP}	Operating temperature SPB800P-xM	-40	+25	+85	°C

Table 3-2: Recommended operating conditions

3.4 Power Consumption

3.4.1 Current Consumption

Mode	Conditions	Parameter	Voltage	Min	Typ.	Max	Unit
All modes		VCC	3.6 V			300	mA
TX [802.11b]	25ºC	VCC	3.3 V		240	270	mA
TX [802.11g]	25ºC	VCC	3.3 V		200	230	mA
RX [802.11b]	25ºC	VCC	3.3 V		120		mA

RX [802.11g]	25ºC	VCC	3.3 V		110		mA
Power Save[1]	25ºC, Listening to every 30th beacon	VCC	3.3 V		0.5		mA
Shutdown[2]	25ºC	VCC	3.3 V		50.0		nA

Table 3-3: Current consumption in different modes.

Notes:

1) Conditions WLAN in power save mode listening to access point beacons every 3s. MCU wakes up both from WLAN or external interrupt.
2) When connected with host controlled power down switch as shown in Figure 5-4

3.4.2 Power Consumption

Conditions: T_{amb}=25°C, VCC=3.3 V

Mode	Output Power	Power Consumption	Comments
TX 802.11b	+17 dBm	790 mW	1, 2, 5.5, 11 Mbit/s
TX 802.11g	+14 dBm	654 mW	6, 9, 12, 18, 24, 36, 48, 54 Mbit/s
RX 802.11b	N/A	284 mW	
RX 802.11g	N/A	294 mW	
AP mode	+17dBm	430mW	One station connected
Power Save[1]	N/A	1.6mW	Listen to every 30th beacon
Shutdown[2]	N/A	0,0016 mW	System off

Table 3.4: Power consumption in different modes.

Notes:

1) Conditions WLAN in power save mode listening to access point beacons every 3s. MCU wakes up both from WLAN or external interrupt
2) When connected with host controlled power down switch as shown in Figure 5-4

3.5 RF Performance

VCC= 2.75 – 3.6V, Tamb= -40 to +85°C, RF signal level referred to antenna port

Parameter	Conditions	Min	Typical	Max	Units
Frequency range		2400		2500	MHz
RF impedance			50		ohm
Transmitter performance[1]					
Output power	QPSK, Calibrated.	+16,5	+17	+17,5	dBm
Output power	OFDM 54Mbit/s, Calibrated.	+13,0	+14	+14,5	dBm
EVM at +15dBm	QPSK		15	35	%
EVM at +11dBm	OFDM 54MBit/s		3.5	5.6	%
Receiver performance, Tamb 27°C					
Receiver sensitivity	DPSK 1Mbit/s		-96		dBm
Receiver sensitivity	QDPSK 2Mbit/s		-92		dBm
Receiver sensitivity	CCK/DPSK 5.5Mbit/s		-91		dBm
Receiver sensitivity	CCK/BPSKK 11Mbit/s		-88		dBm
Receiver sensitivity	OFDM 6Mbit/s		-91		dBm
Receiver sensitivity	OFDM 9Mbit/s		-90		dBm
Receiver sensitivity	OFDM 12Mbit/s		-88		dBm
Receiver sensitivity	OFDM 18Mbit/s		-86		dBm
Receiver sensitivity	OFDM 24Mbit/s		-83		dBm
Receiver sensitivity	OFDM 36Mbit/s		-80		dBm
Receiver sensitivity	OFDM 48Mbit/s		-76		dBm
Receiver sensitivity	OFDM 54Mbit/s		-74		dBm

Table 3.5: RF performance.

1) TX output power varies with temperature as shown in Figure 3-1

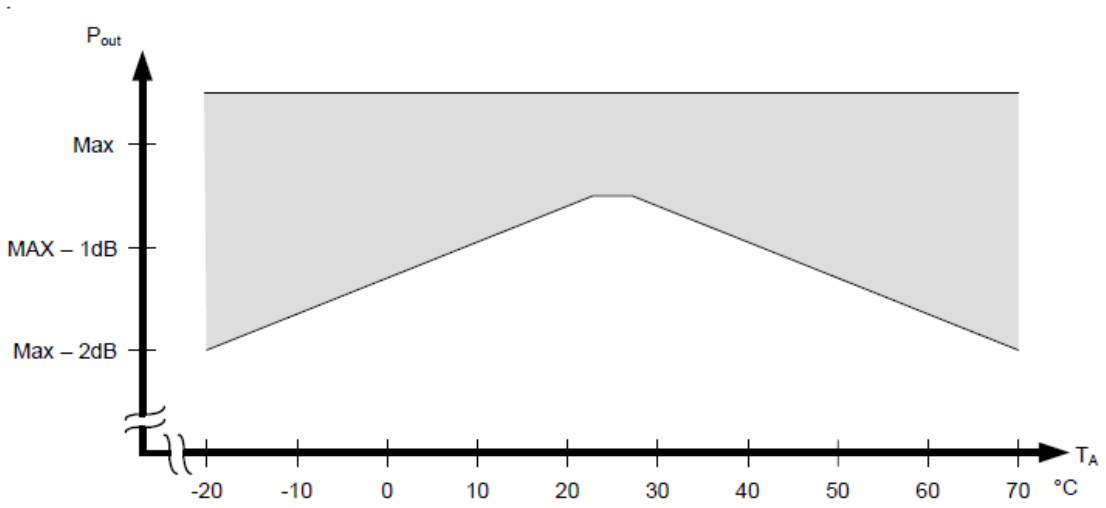


Figure 3-1: Pout vs. ambient temperature

3.6 Throughput

The user data throughput is dependent on the set baud rate of the UART port and but is limited by hardware to 112kbps.

4 PIN CONFIGURATIONS

4.1 Pin Configuration SPB800-**P

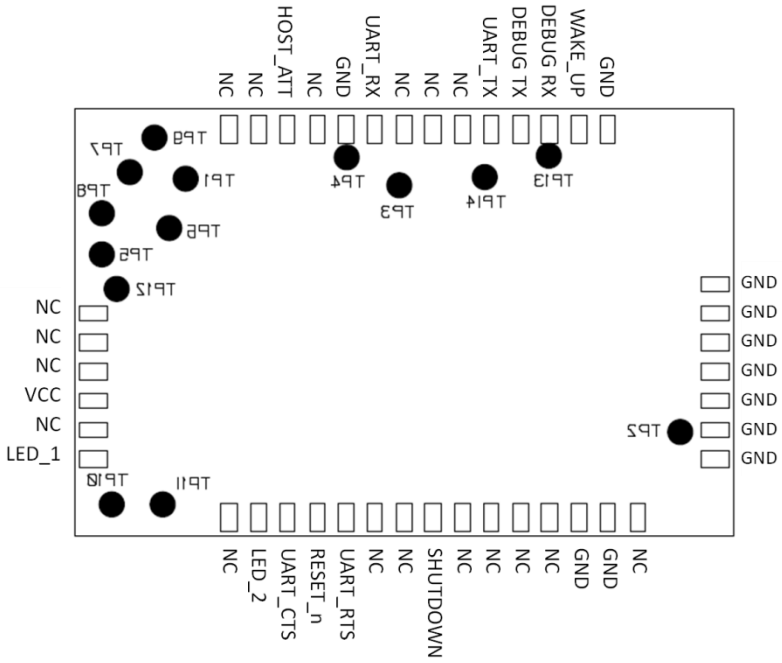


Figure 4-1: Module pads, Top view. Test points used in production test.

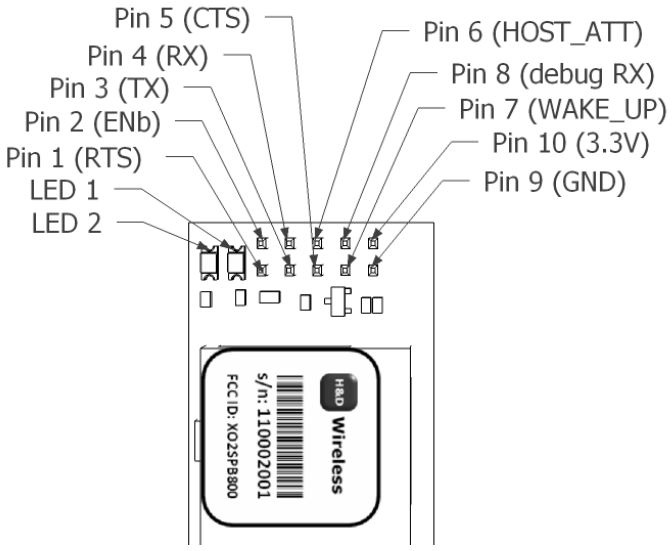


Figure 4-2: Pin out on SPB800-xxM module and the SPB800-E with 2.54 mm socket, Note that the LEDs are only mounted on SPB800-E evaluation kit

4.2 Pin assignments

Pin SPB800P	Pin SPB800-E SPB800-xxM	Function	Type	Description
1	-	NO CONNECTION	NC	Do not connect
2	On board	LED_2	-	Indicates IP address acquired [1]
3	5	UART_CTS/SPI_CS	I	Clear to send (active low) or SPI_Chip Select in SPI mode
4	-	RESET_n	I	Reset of the SPB800P MCU (active low)
5	1	UART_RTS/SPI_IRQ/SPI_SEL	I/O	Ready to send (active low) SPI Interrupt Request Select SPI Mode (active low)
6 -12	-	NO CONNECTION	NC	Do not connect
13	9	GND	S	Ground
14	9	GND	S	Ground
15	-	NO CONNECTION	NC	Do not connect
16-23	9	GND	S	Ground
24	7	WAKE_UP	I	Active Low, awakes the SPB800P from Sleep Mode. Internal Pull up
25	8	DEBUG_RX / SPI_CLK	I/O	SPI_CLK in SPI mode
26	-	DEBUG_TX	O	
27	3	UART_TX / SPI_MISO	O	UART TX or SPI_MISO
28-30	-	NO CONNECTION	NC	Do not connect
31	4	UART_RX /SPI_MOSI	I	UART RX or SPI_MOSI
32	9	GND	S	Ground
33	-	NO CONNECTION	NC	Do not connect
34	6	HOST_ATT	O	Host Attention (active low)
35-39	-	NO CONNECTION	NC	Do not connect
40	10	VCC	S	3.3V supply voltage
41	-	NO CONNECTION	NC	Do not connect
42	On Board	LED_1	O	Indicates WiFi Connection[1]

Table 4-1: Pin Description for the module

1) LED functions may vary depending on firmware and mode.

5 APPLICATION INFORMATION

5.1 Power Supply

SPB800P is powered by a 3.3V supply on the VCC pin.

5.2 Initialization

At power on and after rest the SPB800P will print dots on the UART1 interface during 5s. During these 5s the upgrade mode can be entered by the host or a serial port terminal. To speed up the start up a “w” must be sent to the SPB800P with the default baud rate 115200.

5.3 Serial interface mode selection

Note: Firmware support for SPI communication is included from oWL-pico release 1.4

To select UART mode leave pin 5, SPI_SEL, unconnected or pulled up to VCC. SPI_SEL has an internal pull-up.

To select SPI as communication interface pin 5, SPI_SEL, has to be driven low during the 5s power up sequence. When the SPB800P detects a low signal it switch to SPI mode. SPI_SEL will change from input to output and function to SPI_INT.

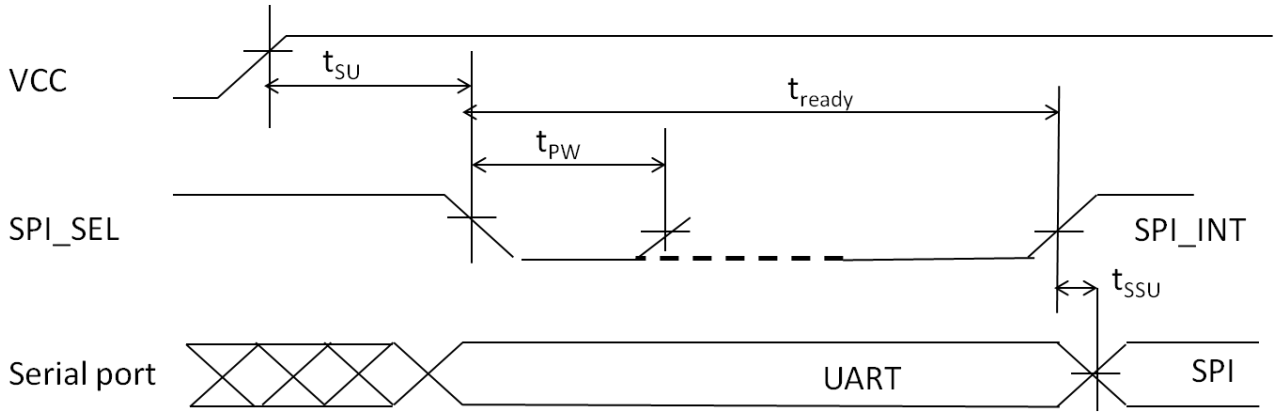


Figure 5-1: SPI Select timing

Symbol	Parameter	Min	Max	Unit
t_{su}	SPI_SEL low from power on	50	5000	ms
t_{PW}	SPI_SEL low drive time	5	10	ms
t_{ready}	SPI	0	10	ms
t_{SSU}	Serial port set to SPI mode	0	10	ms

5.4 Serial interface UART mode

To select UART as communication interface pin 5, UART_RTS, has to be high during all of power on and start-up sequence. The pin has an internal pull-up and can be left unconnected.

After the completion of the start up the pin becomes an output with the function of UART_RTS, if hardware control is activated.

To communicate with the SPB800P a UART interface is used. The signals “UART_RTS” and “UART_CTS” are only active when hardware flow control is enabled by commands from the host.

5.5 Serial interface SPI mode

Note: Firmware support for SPI communication is included from oWL-pico release 1.4

To select UART as communication interface pin 5, SPI_SEL, has to be driven low during the 5s power up sequence.

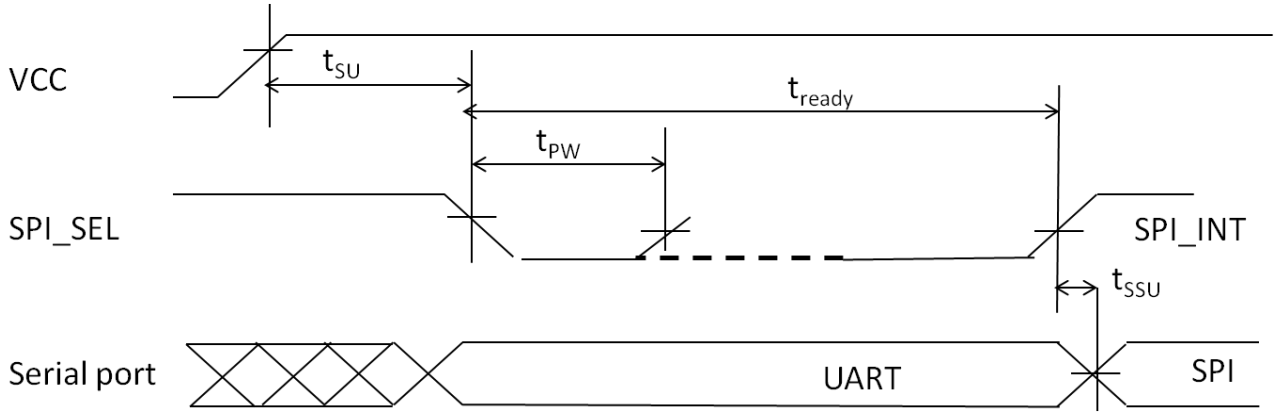


Figure 5-2: SPI Select timing

Symbol	Parameter	Min	Max	Unit
t_{su}	SPI_SEL low from power on	50	5000	ms
t_{PW}	SPI_SEL low drive time	5	10	ms
t_{ready}	SPI	0	10	ms
t_{SSU}	Serial port set to SPI mode	0	10	ms

5.6 Interrupt Signals

5.6.1 WAKE_UP

Active low input signal, allows the host to wake up the SPB800P from Power Save. If not use it can be left unconnected as the signal has an internal pull up resistor.

5.6.2 HOST_ATT

Active low output signal. Allows the host to be put in low power mode and be woken by the SPB800P when data is received on the WLAN.

5.7 RF interface

The SPB800P-B has a high performance chip antenna as the primary RF interface.

The SPB800P-D has a U.FL connector as RF interface. Use Hirose U.FL receptacle or comparable for connection.

5.8 LED pins

The LED signal pins LED_1 and LED_2 and actively driven active low signals. The pins are active low intended to sing the current for a LED connected to 3.3V via a current limiting resistor.

5.8.1 LED_1

The LED_1 signal will go low under these conditions:

- The SPB800 are associated with an Access Point (in station mode)
- While the SPB800 are switching between station and access point mode (after reset)
- Blinking with 2s interval indicating a failed firmware upgrade
- In AP mode when a station is connected

5.8.2 LED_2

The LED_2 signal will go low under these conditions:

- The SPB800 has an IP-address, either set statically or assigned by a DHCP server
- In AP mode when a station is connected

5.9 General application information

5.9.1 Design directions

The design using the SPB800P must be performed according to good RF design considerations. Keep the area under the antenna free from all metal including signal or ground wires. To avoid connection with the test pads under the SPB800P no via or otherwise exposed metal should be placed under the module

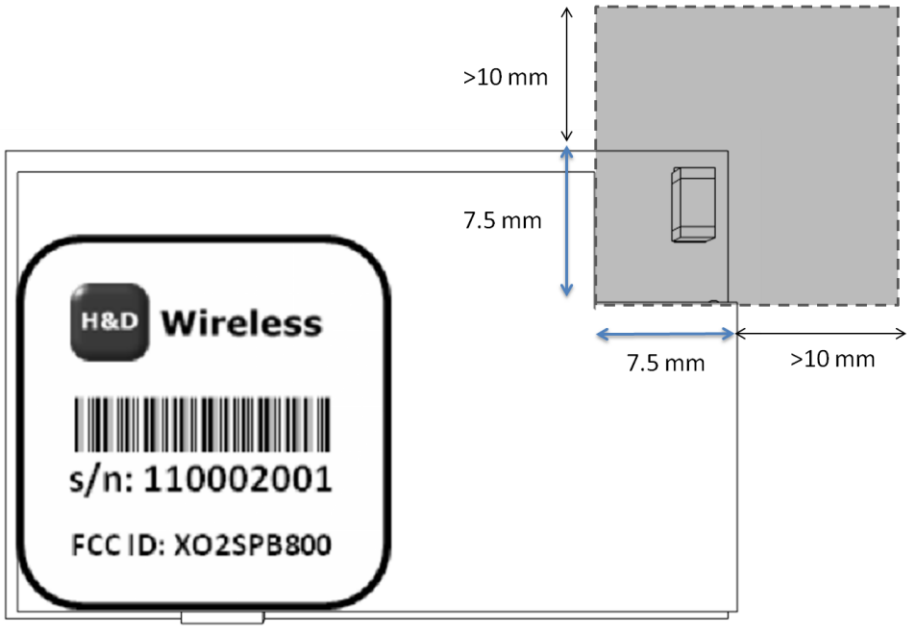


Figure 5-3: Proposed keep out area

5.10 Typical Application

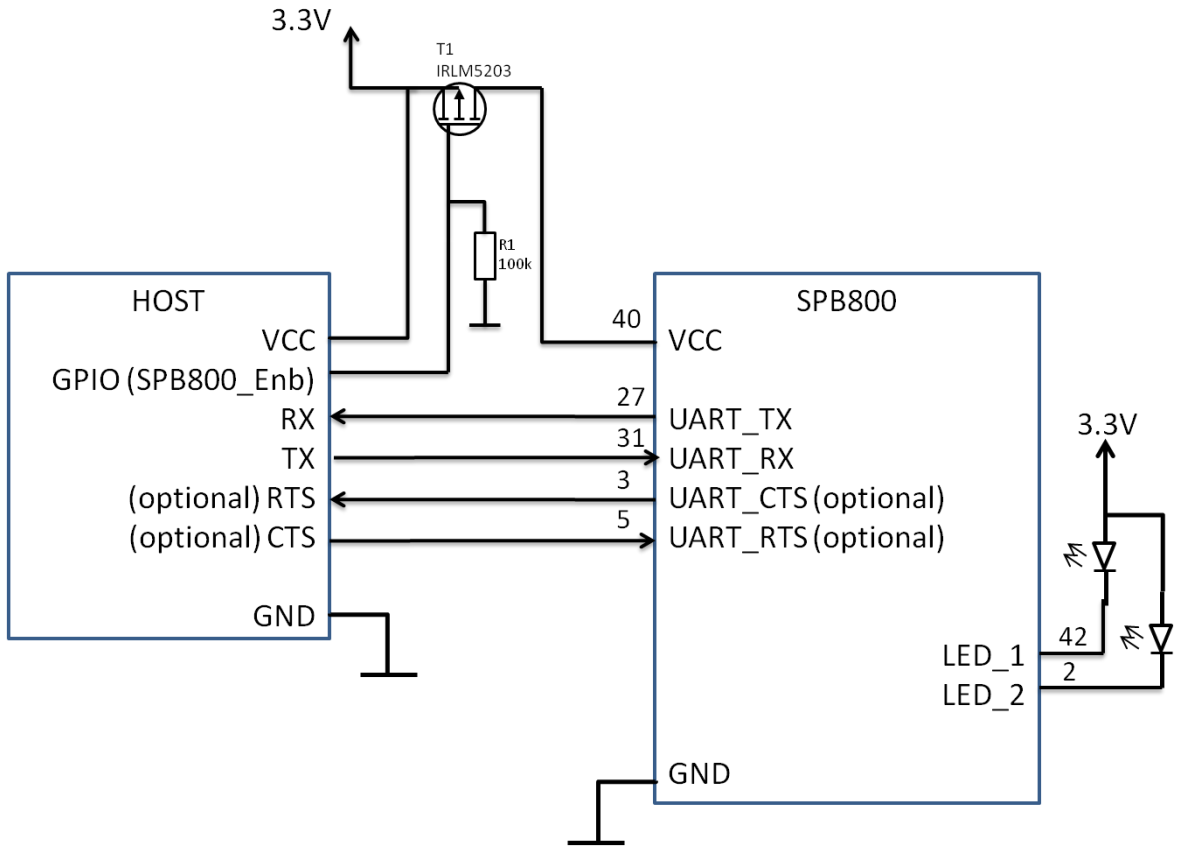


Figure 5-4: Typical application connection

5.11 Soldering

The SPB800P is a surface mount PCB module. If the modules has been exposed to air or are delivered in non-hermetically sealed packages it is recommended to bake the modules before soldering. To lower the moister content bake the packages for 192 hours at 40–45°C and <5%RH, or 24 hours at 120–130°C, depending on the maximum temperature rating of the packaging. The recommended solder profile is pictured in Figure 5.6

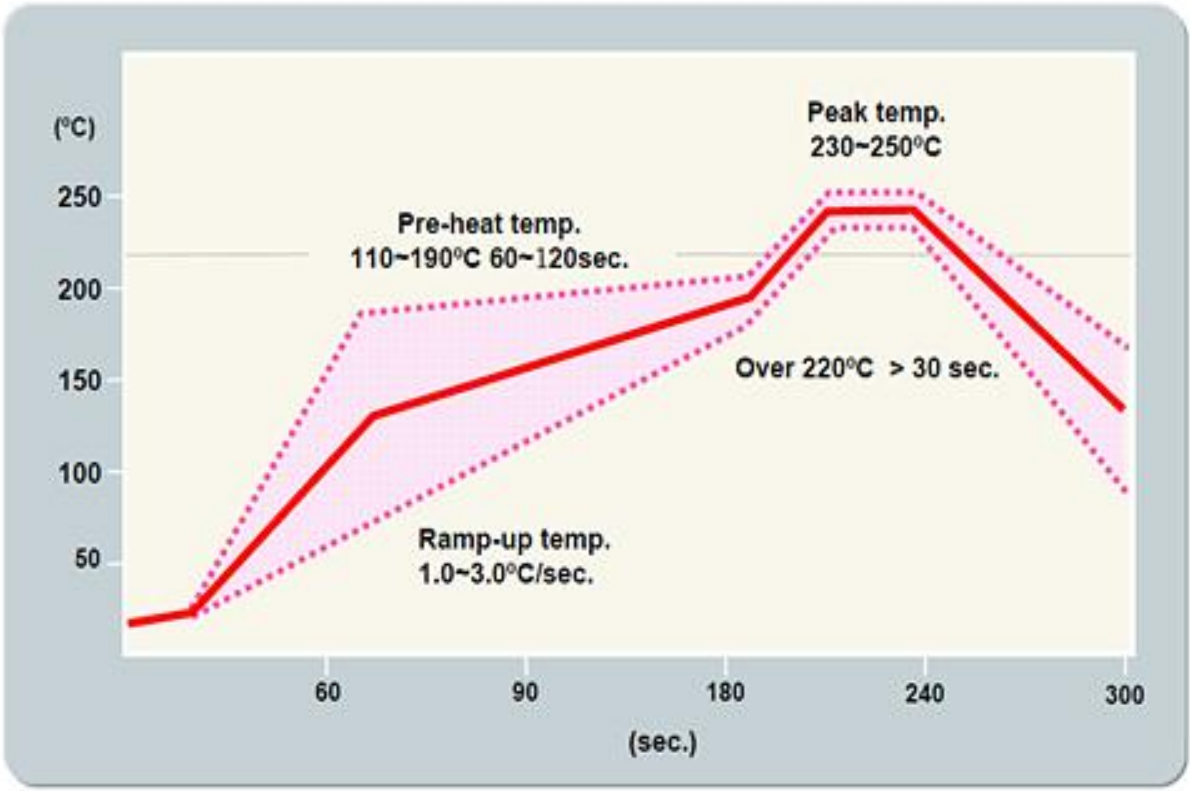


Figure 5-5: Reflow Temperature Profile.

Type	Rising Zone	Preheat Zone	Reflow Zone	Peak Zone	Cooldown Zone	Comment
PSR	125ºC-Peak No	110-190ºC 60-120 s	>220ºC >30 s	230-250ºC	Peak-125ºC No	

5.11.1 Environmental statement

The SPB800P is designed and manufactured to comply with the RoHS and Green directives.

6 PACKAGE SPECIFICATIONS

6.1 Mechanical outline of the SPB800P module, bottom pads

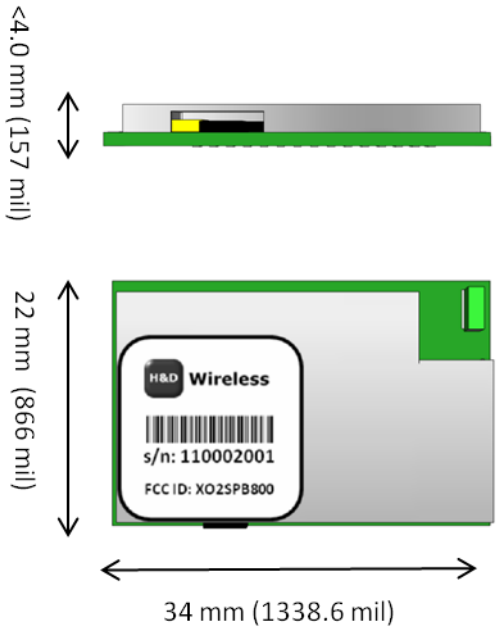


Figure 6-1: Mechanical drawing, SPB800P module with solder pads

6.2 Mechanical outline of the SPB800P module, 2x5 pin socket

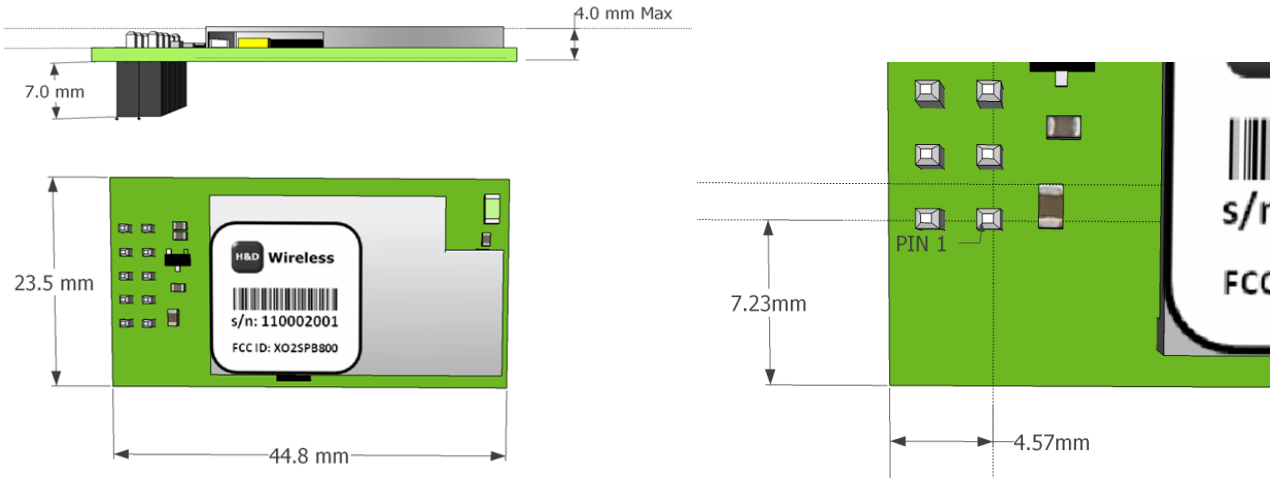


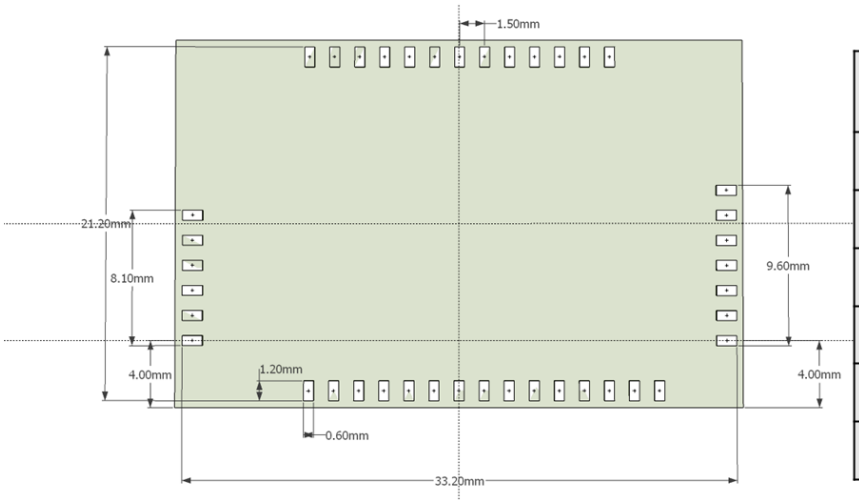
Figure 6-2: Mechanical drawing, SPB800P module with 2x5 pin socket

6.3 Markings on the SPB800P

The label on the EMC Shield is imprinted with the FCC ID and part number and serial number

6.4 Package dimensions

6.4.1 Package



Symbol	Text	Meas [mm]
L	Module Length	34.0
W	Module Width	22.0
P1	Pad length	1.2
P2	Pad width	0.6
P3	Pad Pitch	1.5
A1	Pad edge to PCB edge	0.40

Figure 6-3: SPB800P Top View

6.5 Mounting information

Recommended land pattern on the PCB for the bottom pad version

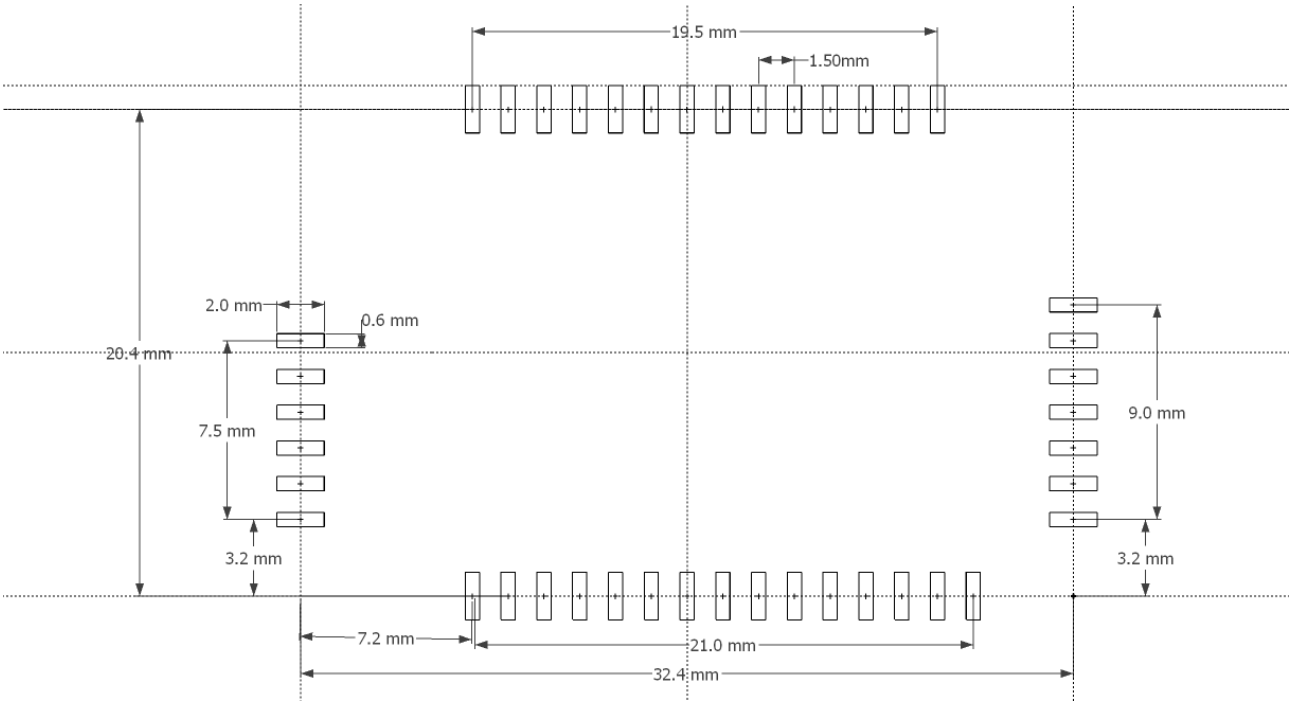


Figure 6-4: Land pattern for the SPB800P bottom pad version

7 Evaluation Kit

The SPB800E is delivered with Serial_to_WiFi firmware. To evaluate the SPB800P with oWL-pico server the SPB800-E you must first shift the firmware with the HDA800 kit. See HDA800 manual and http://pico.hd-wireless.se for more information and downloads.
The Evaluation kit has the main signals of the SPB800 conveniently available on a 10 position header socket. The LED indicator signals are connected to two onboard LEDs. An additional ENb signal is an active low signal that enables power to the EVK. As the ENb has an onboard pull down resistance that will keep it low (active) it can be left unconnected. To shutdown the SPB800P the ENb signal has to be set high.

7.1 Pin out for the SPB800-xxM and the EVK (SPB800E)

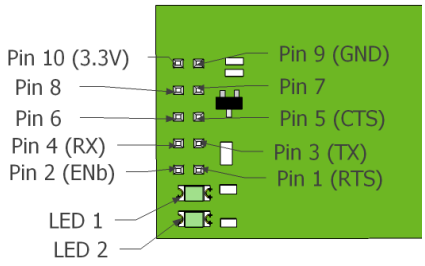
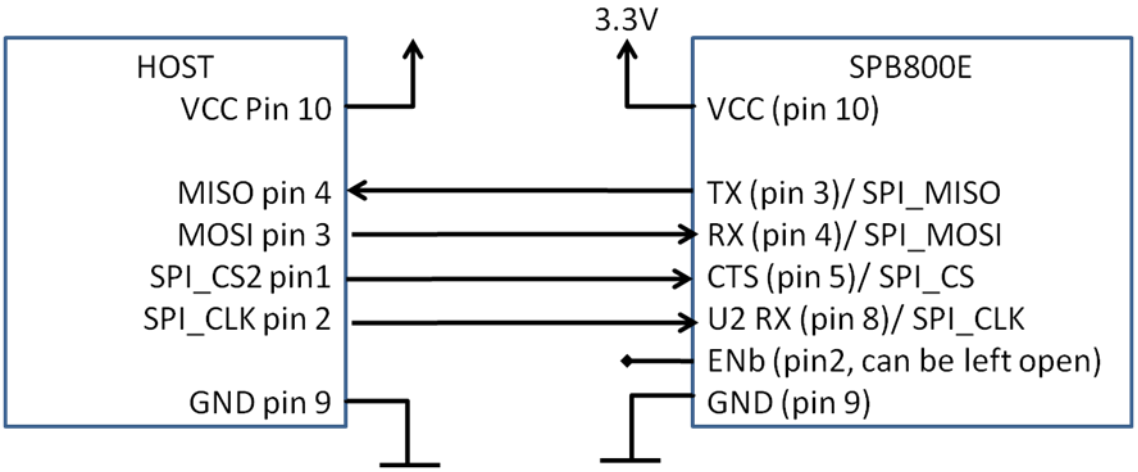


Figure 7-1: SPB800 EVK pins top view

Header Pin	Pin Function	SPB800 Pad	Comment
1	UART_RTS/SPI_IRQ/SPI_SEL	5	Optional
2	ENb	-	Active low with internal pull down can be left unconnected
3	UART_TX / SPI_MISO	27	
4	UART_RX / SPI_MOSI	31	
5	UART_CTS / SPI_CS	3	Optional
6	HOST_ATT	34	Host attention only available from Rev R2A
7	WAKE_UP	24	Wake up the SPB800 from sleep only available from Rev R2A
8	DEBUG_RX / SPI_CLK	26	
9	Ground	13, 14,16-23, 32	
10	Supply 3.3V	40	

Table 7-1: SPB800 Evaluation Kit pin out

To connect to a host MCU in UART mode follow the block diagram below:



8 STANDARDS COMPLIANCE

8.1 IEEE/IETF

Standard	Revision	Description
802.11	802.11™ -2007	WLAN MAC& PHY
802.11k	2008	Amendment 1: Radio Resource Measurement of Wireless LANs
802.11r	2008	Amendment 2: Fast Basic Service Set (BSS) Transition
RFC1023	Inherent	Frame encapsulation

Table 7.1: applicable IEEE standards

8.2 WiFi

Specification	Description	Revision
Wi-Fi 802.11b with WPA system inter operability 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 1.1

Table 7.2: Applicable WiFi standards

8.3 Regulatory

Country	Approval authority	Regulatory	Frequency band
USA	FCC	FCC ID: XO2SPB800	2.4 GHz -2.4835 GHz
Canada	IC	RSS: 8713A-SPB800	2.4 GHz -2.4835 GHz
Europe	National	ETSI	2.4 GHz -2.4835 GHz

Table 7.3: Regulatory standards

8.3.1 FCC (United States of America)

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 SPB800P module

Contains FCC ID: XO2SPB800
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. To be used with the SPB800P module, only external antennas with a gain 2 dBi or less are allowed. The SPB800P Module may be integrated with custom design antennas which OEM installer must authorize following the FCC 15.21 requirements.

WARNING: The Original Equipment Manufacturer (OEM) must ensure that the OEM modular transmitter must be labeled with its own FCC ID number. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown below. If the FCC ID is not visible when the equipment is installed inside another device, then the outside of the device into which the equipment is installed must also display a label referring to the enclosed equipment.

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.

Installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance. 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: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense (FCC section 15.105).

8.3.2 IC (Canada)

Equipment is subject to certification under the applicable RSSs, shall be permanently labeled on each item, or as an inseparable combination. The label must contain the following information for full compliance:

Certification Number:	**IC: 8713A-SPB800**
Manufacturer's Name, Trade Name or Brand Name	**H&D Wireless AB**
Model Name:	**SPB800**

IMPORTANT: This equipment for which a certificate has been issued is not considered certified if it is not properly labeled. The information on the Canadian label can be combined with the manufacturer's other labeling requirements

IMPORTANT: 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.

IMPORTANT: To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

IMPORTANT: The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population. Consult Safety Code 6, obtainable from Health Canada's website www.hc-sc.gc.ca/rpb.

8.3.3 ETSI (Europe)

The SPB800P 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). This standard is harmonized within the European Union and covering essential requirements under article 3.2 of the R&TTE-directive.

If the SPB800P module are 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 Annex II of the R&TTE-directive.

Furthermore, the manufacturer must maintain a copy of the SPB800P 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.

9 Related Documents

1543-SPB800P (o)WL-pico API, user manual.

10 SALES OFFICES

Global Sales Office Sweden

H&D Wireless AB
H&D Wireless AB
Norgegatan 1
164 32 Kista
Sweden

E-mail: info@hd-wireless.se
Support: support@hd-wireless.se
Home page: www.hd-wireless.se

Local sales offices and representatives see www.hd-wireless.se