SPB438 – Wi-Fi 6/Bluetooth 5 M.2 2230 MODULE

Data Sheet

SPB438

M.2 2230 Key E

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

H&D Wireless

Current revision: 5.0

Revision History

Revision	Revision date	Description
0.1	2023-04-21	First Draft
1.0	2023-04-21	First Release
1.1	2023-04-24	Update SPB438 removed from header/footer
2.0	2023-09-26	Added 802.15.4 Order option
3.0	2023-10-03	Added certification antennas
3.1	2023-10-18	Order information example corrected
3.2	2024-01-15	Corrected antenna used for certification
4.0	2024-02-01	Updated with block diagrams
5.0	2024-04-24	Updated order options

Content

1 INTRODUCTION

1.1 Overview

SPB438 is a complete Wi-Fi 6/Bluetooth 5 module with integrated EMC shield, ready for integration in a M.2 Key E slot. The size and pinning are according to NGFF M.2 standard size 2230. It is using H&D Wireless module SPB611 that 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, UART and I2C. 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.

For detailed functional description and specification of the module, please refer to the datasheet of SPB611.

1.2 Order information

EXAMPLE: **SPB438- N D C - 1**

Product Family

SPB438

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

Host Interface

C= SDIO Host Interface for WLAN, UART for BT and SPI for Thread, 3.3V I/O

D= SDIO Host Interface for WLAN, UART for BT and SPI for Thread, 1.8V I/O

Delivery Package

1= ESD Bag

3= Tray

Available options:

Part No.	LTE Filter	802.15.4 Support	VDDIO
SPB438-NDC	No	No	3.3V
SPB438-NTC	No	Yes	3.3V
SPB438-NDD	No	No	1.8V
SPB438-NTD	No	Yes	1.8V
SPB438-LDC	Yes	No	3.3V
SPB438-LDD	Yes	No	1.8V

Table 1-1 Order information for available SPB438 versions

Delivery Package

Order Number ending	Package
-1	ESD Bag
-3	Tray

Table 1-2: Order information for delivery package

2 ELECTRICAL DATA

For dual radio version the SDIO is used for communication with Wi-Fi and UART with Bluetooth.

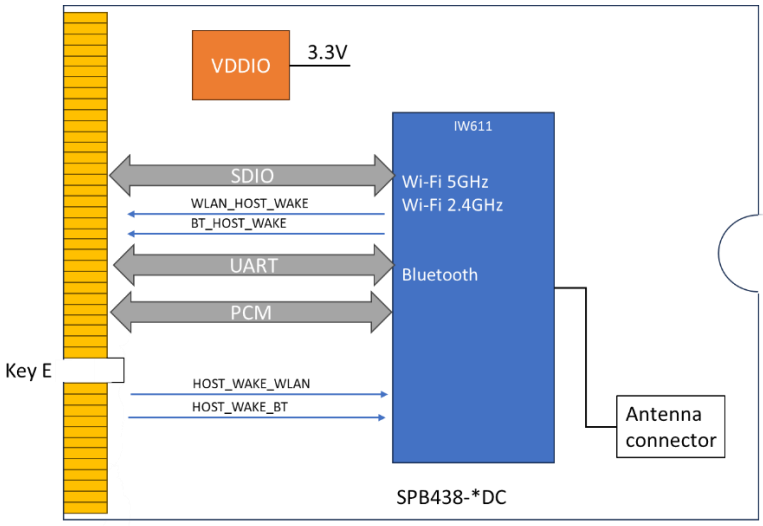


Figure 2-1: Block diagram for SPB438-*DC 3.3V IO-voltage

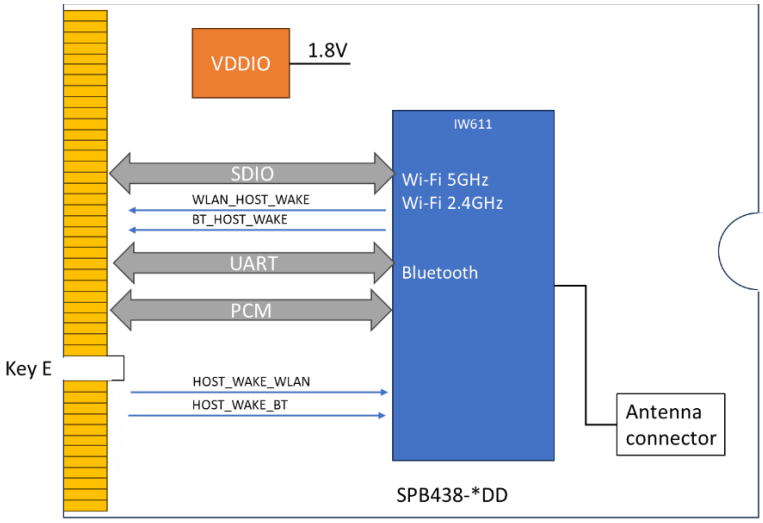


Figure 2-2: : Block diagram for SPB438-*DC 1.8V IO-voltage

For triple radio version the SDIO is used for communication with Wi-Fi, UART with Bluetooth, while SPI is used for 802.15.4 radio. I2C is used to expand the number of GPIO out-of-band signals.

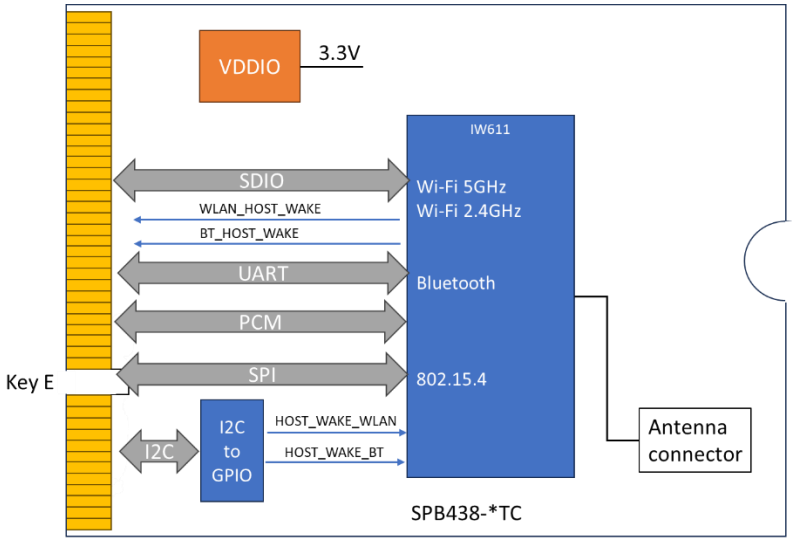


Figure 2-3: Block diagram for SPB438-*TC 3.3V IO-Voltage

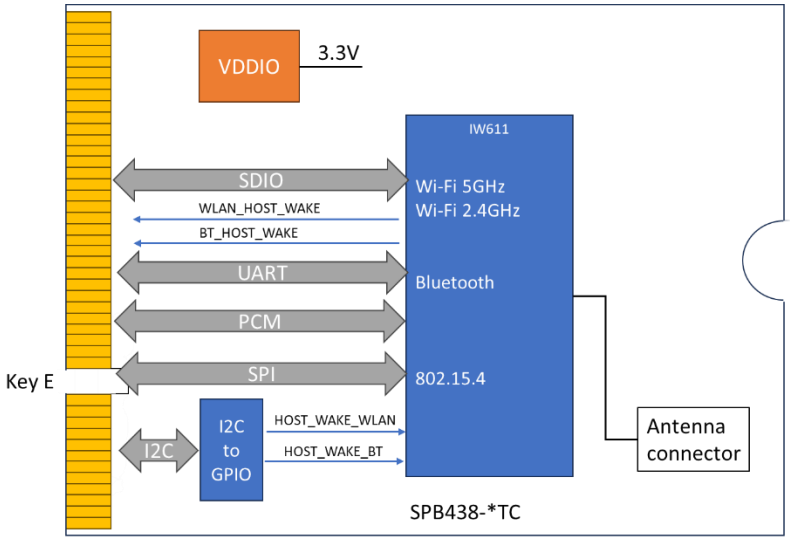


Figure 2-4: Block diagram for SPB438-*TC 1.8V IO-Voltage

For performance data please refer to the SPB611 datasheet.

3 PIN CONFIGURATIONS

3.1 Pin Configuration SPB438

The connector has 75 positions, but eight positions are used for the keying, so the actual pin-count is 67. The pinning is according to PCIe M.2 specification Key E.

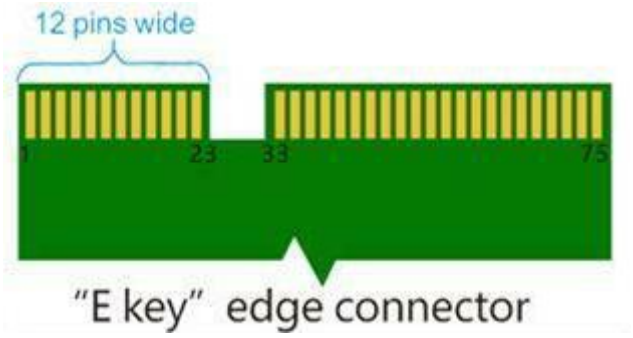


Figure 3-1: Connector Pinning

3.2 Pin assignments SPB438-C/D (SDIO / UART/ I2C Host interface)

Pin	PCIe Function	Type[1]	IO Supply[2]	Description
1	GND	S		Ground
2	VDD33	S		3.3V supply
3	NC	-		No connection
4	VDD33	S		3.3V supply
5	NC	-		No connection
6	LED_OUT_WLAN	O	1.8/3.3 V	No connection
7	GND	S		Ground
8	PCM_CLK	I/O	1.8/3.3 V	PCM Clock
9	SDIO_CLK	I	1.8/3.3 V	SDIO Clock
10	PCM_SYNC	I/O	1.8/3.3 V	PCM Sync
11	SDIO_CMD	I/O	1.8/3.3 V	SDIO CMD
12	PCM_OUT	O	1.8/3.3 V	PCM Data Output
13	SDIO_D0	I/O	1.8/3.3 V	SDIO Data0
14	PCM_IN	I	1.8/3.3 V	PCM Data Input
15	SDIO_D1	I/O	1.8/3.3 V	SDIO Data1
16	LED_OUT_BT	O	1.8/3.3 V	No connection
17	SDIO_D2	I/O	1.8/3.3 V	SDIO Data2
18	GND	S		Ground
19	SDIO_D3	I/O	1.8/3.3 V	SDIO Data3
20	UART_WL_WAKE_HOSTn	O	1.8/3.3 V	BT_15.4_WAKE_OUT
21	SDIO WAKE#	O	1.8/3.3 V	WL_WAKE_OUT
22	UART_TXD	O	1.8/3.3 V	UART Tx Data, default baud rate 115200
23	SDIO_RESET#	O	1.8/3.3 V	IND_RST_WL
24-31		Key-E Gap		

Pin	PCIe Function	Type[1]	IO Supply[2]	Description
32	UART_RXD	I	1.8/3.3 V	UART Rx Data, default baud rate 115200
33	GND	S		Ground
34	UART_RTSn	O	1.8/3.3 V	UART Request To Send, must be connected
35	PCIE_RXP	I	1.8V	Not used
36	UART_CTSn	I	1.8/3.3 V	UART Clear To Send, must be connected
37	PCIE_RXN	I	1.8V	Not used
38	VENDOR DEFINED	I	1.8/3.3 V	SPI_MOSI: SPI master transmitt signal.
39	GND	S		Ground
40	VENDOR DEFINED	O	1.8/3.3 V	SPI_MISO: SPI master receive signal.
41	PCIE_TXP	O	1.8V	Not used
42	VENDOR DEFINED	I	1.8/3.3 V	SPI_CLK: SPI clock signal.
43	PCIE_TXN	O	1.8V	Not used
44	COEX3	I/O	1.8/3.3 V	Not used
45	GND	S		Ground
46	UART_LTX_TX	O	1.8/3.3 V	GPIO31 reserved for serial data output to external LTE device
47	PCIE_RCLK_P	I	1.8V	Not used
48	UART_LTX_RX	I	1.8/3.3 V	GPIO30 reserved for serial data input from external LTE device
49	PCIE_RCLK_N	I	1.8V	Not used
50	NC	-		No connection
51	GND	S		Ground
52	PCIE_PERSTn	I	1.8/3.3 V	GPIO20
53	PCIE_CLKREQn	I/O		Not used
54	W_DISABLE2#	O	1.8/3.3 V	IND_RST_BT
55	PCIE_WAKEn	I/O		Not used
56	PCIE_WLAN_DISABLEn	I	3.3V	Connected to POWERDOWNn on SPB611. Power Down < 0.4V High Z => Power On
57	GND	S		Ground
58	I2C_DATA	I/O	1.8/3.3 V	I2C SDA, Open drain. Pullup required
59	NC	-		No connection
60	I2C_CLK	I	1.8/3.3 V	No connection
61	NC	-		No connection
62	ALERT#	O		SPI_INT: SPI interrupt signal.

Pin	PCIe Function	Type[1]	IO Supply[2]	Description
				Open drain. Pullup required.
63	GND	S		Ground
64	RESERVED	I		SPI_FRM: SPI interrupt signal.
65	NC	-		No connection
66	NC	-		No connection
67	NC	-		No connection
68	NC	-		No connection
69	GND	S		Ground
70	NC	-		No connection
71	NC	-		No connection
72	VDD33	S		3.3V supply
73	NC	-		No connection
74	VDD33	S		3.3V supply
75	GND	S		Ground

1) Pin direction refers to the SPB438 module.
2) IO voltage depends on order option.

4 Mechanical details of SPB438 Module

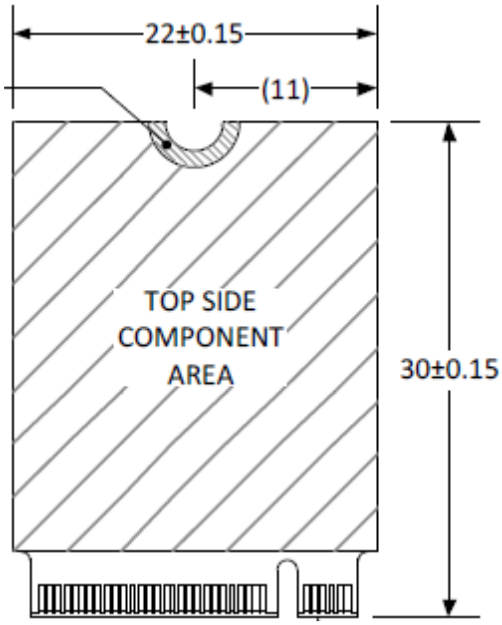
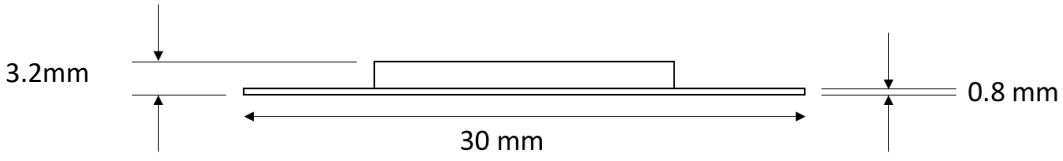


Figure 4-1: Top view



Nominal height is 3.2 mm

Figure 4-2: Side view

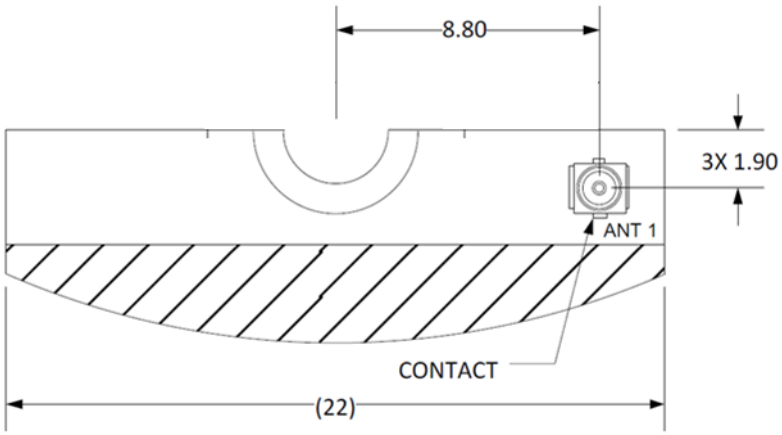


Figure 4-3: Antenna Positions

Antenna	Function	Type
ANT1	Wi-Fi/Bluetooth/Thread	MHF 4

5 STANDARDS COMPLIANCE

The same standards apply as for SPB611. For more details, please refer to the datasheet of SPB611.

5.1 Regulatory

Country	Approval authority	Regulatory	Frequency band
USA	FCC	FCC ID: XO2-SPB611	2.412 GHz -2.472 GHz 5.180 GHz – 5.825 GHz
Canada	IC	IC: 8713A-SPB611	2.412 GHz -2.472 GHz 5.180 GHz – 5.825 GHz
Europe	Self	ETSI/EN	2.412 GHz -2.472 GHz 5.180 GHz – 5.700 GHz

Table 5-1: Regulatory standards

5.1.1 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 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

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.

5.1.2 ISED (Canada)

The device complies with Industry Canada’s license-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

5.1.3 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.

6 SALES

Global Sales Office Sweden

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Support page: support.hd-wireless.com
Support: support@hd-wireless.se

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

7 TRADEMARKS

- Wi-Fi is a trademark of Wi-Fi Alliance
- Bluetooth is a trademark of Bluetooth SIG