



TRIA SPB209A HW USER MANUAL

Tria TechDoC

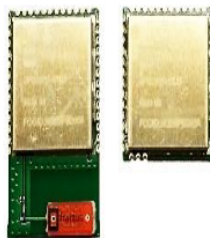


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1 General Information TRIA SPB209A

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2 Introduction TRIA SPB209A

This user guide describes the TRIA SPB209A WLAN and Bluetooth Dual-mode module developed by Tria Technologies GmbH and provides an overview of its key features and capabilities. Tria Technologies GmbH strongly recommends that users carefully read this user guide before powering on or operating the module.

2.1 Product Summary

2.1.1 Description

SPB209A is a complete WLAN and Bluetooth Dual-mode module ready for onboard integration in Linux platforms. The ultra-small 14x14x2.5mm low power, high performance module enables a feature rich client solution providing up to 433Mbit/s data rate. SPB209A fully supports concurrent or independent operation of WLAN and Bluetooth. The SPB209A connects to the host through SDIO and high speed UART interfaces. The module comes in versions with or without integrated antenna and LTE filter supporting shortest time to market for multimedia, industrial and smart home products.

The SPB209A is highly integrated and its complete system functionality, means quicker design cycles, lower risk and simplified manufacturing, all in a ultra-small package. The SPB209A delivers a complete and fully tested implementation of 802.11 a/b/g/n/ac and BT4.2 functionality. The SPB209A solution is calibrated and FCC, RED/CE pre-certified resulting in lowest possible customer production and system cost.

- Tria offers 10+ years of wireless module manufacturing and support
- For use in industrial applications on carrier boards or readily integrated on Tria compute modules / SoMs
- Long-term industrial longevity
- Full supply-chain control – no 3rd-party module dependency
- Pre-integrated hardware + software by Tria
- Complete BSP with wireless firmware for Tria SoMs
- Bluetooth SIG listing (BlueZ stack) saves cost and efforts and accelerates time-to-market
- Global radio certifications (NA & EU. Many other countries available upon request)

2.1.2 Highlights

- IEEE 802.11ac compliant
- IEEE 802.11 PHY data rates of up to 433 Mbps
- Driver support for Linux
- Advanced Power management system allowing “Always On”
- Bluetooth 4.2
- Internal co-existence arbitration
- FCC and CE approved reference design
- Interfaces SDIO 3.0, HS UART, PCM
- Industrial temp range -40 to +85C°
- High RF output TX power
- Supports multiple SW features such as 802.11e/i (Security, QoS), Soft AP and Wi-Fi Direct
- Extensive DMA hardware support for data flow to reduce CPU load

- RoHS compliant

3 Product Specification TRIA SPB209A

3.1 Ordering Information

3.1.1 Order Reference

Part No.	Description	Integrated PCB Antenna	LTE Filter	Chip
SPB209A-LRNMQ	WLAN BT MODULE without Antenna without LTE Filter	No	No	88W8887-A2-CBKE/AZ
SPB209A-LRLMQ	WLAN BT MODULE without Antenna with LTE Filter	No	Yes	88W8887-A2-CBKE/AZ
SPB209A-LBNMZ	WLAN BT MODULE with Antenna without LTE Filter	Yes	No	88W8887-A2-CBKE/AZ
SPB209A-LBLMZ	WLAN BT MODULE with Antenna with LTE Filter	Yes	Yes	88W8887-A2-CBKE/AZ

Ordering Information for available SPB209A-versions

3.2 Functional Specification

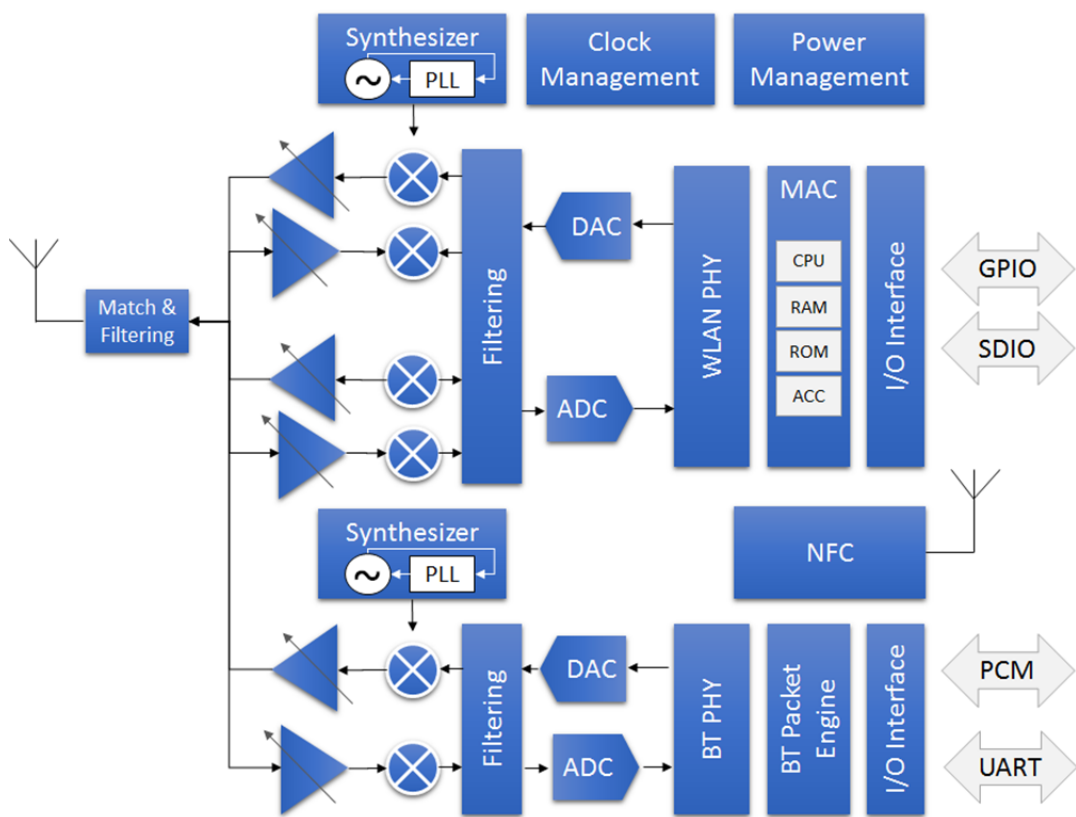
3.2.1 Technical Data

Wireless Network Standard Support	IEEE 802.11a/b/g/n/ac, BT4.2
Frequency Band	Dual, 2.4/5 GHz
Data rates	802.11 a/b/g standard rates 802.11n 20/40Mhz channels 802.11ac 20/40/80Mhz channels up to 433Mbps Bluetooth BR, EDR 2Mbps
Hardware interfaces	SDIO 3.0, UART, GPIO:s – Host / PCM – BT Audio
WLAN functions, QoS	Power save modes, automatic roaming, Ad-hoc, Soft AP, Wi-Fi Direct and Infrastructure mode
Wireless Security	✓ WEP-64 ✓ WEP-128 ✓ WPA-PSK ✓ WPA2-PSK
NFC	Functions: R/W, Card Emulation and P2P
Bluetooth	BT for stereo audio and data BLE for fast configuration and sensor data upload
HW dimensions	14 mm x 14 mm x 2.5 mm
Output power	802.11 b: 18 dBm 802.11 a/g/n/ac: 15 dBm Bluetooth: 7 dBm

Power consumption	2.5GHz HT20: Wi-Fi IEEE 802.11 b TX 295mA RX:51mA Wi-Fi IEEE 802.11 g/n/ac: TX 285mA / RX 66mA 5GHz HT80: Wi-Fi IEEE 802.11 ac MCS9: TX 330mA / RX 121mA BT BT TX (+4dBm) 22mA / RX 17mA
Supply Voltage	3.0-3.6V
Operating Temp.	-40 to + 85°C (industrial)

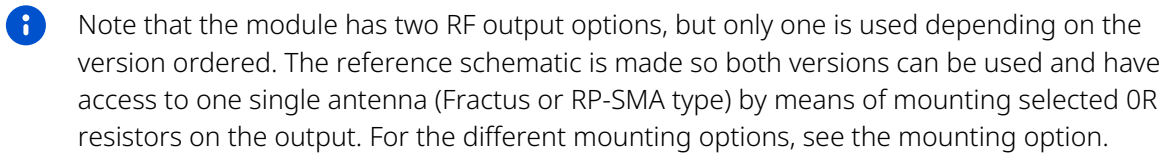
Technical Data for TRIA SPB209A

3.2.2 Block Diagram



Block Diagram TRIA SPB209A

SPB209A reference schematic



3.2.4 Bill of Material

Comp	Part name	MFG nr	Description
A1	PCB		Printed circuit board
C1	120PF 0402 C0G 50V 5% HDW	GRM1555C1H121JA01D	Murata GRM15 Series Chip Monolithic Ceramic Capacitor
C3	180PF 0402 C0G 50V 5% HDW	GRM1555C1H181JA01D	Murata GRM15 Series Chip Monolithic Ceramic Capacitor
C4	180PF 0402 C0G 50V 5% HDW	GRM1555C1H181JA01D	Murata GRM15 Series Chip Monolithic Ceramic Capacitor
C5	330PF 0402 C0G 50V 5% HDW	GRM1555C1H331JA01	Murata GRM15 Series Chip Monolithic Ceramic Capacitor
C6	1.2PF 0402 C0G 50V HDW		Murata GRM15 Series Chip Monolithic Ceramic Capacitor
C7	330PF 0402 C0G 50V 5% HDW	GRM1555C1H331JA01	Murata GRM15 Series Chip Monolithic Ceramic Capacitor
C10	100UF 6.3V X7R 1206 HDW		Ceramic chip capacitor
J3	SMA JACK EDGE MOUNT 132357		Amphenol 132357-11
L2	3N3 0402 0.1NH LQP15M HDW	LQP15MN3N3B02	Murata LQP15MN3N3B02 Film Type Chip Coil
L3	1N8 0402 0.1NH LQP15M HDW	LQP15MN1N8B02	Murata LQP15MN Film Type Chip Coil
L4	560NH 0402 5% LQB15 HDW	LQB15NNR56J10	Murata LQB15NN Film Type Chip Coil
L5	560NH 0402 5% LQB15 HDW	LQB15NNR56J10	Murata LQB15NN Film Type Chip Coil
P3	SPB209A		SPB209A PCB Module
P5	WAFER 2-2.54 HDW		Pin Posts single row C/C 2.54 2-Pin
R3	10R 0402 1% HDW	RC0402FR-0710RL	Chip resistor 0.063W
R6	10R 0402 1% HDW	RC0402FR-0710RL	Chip resistor 0.063W
R10	0R 0402 HDW	RC0402JR-070RL	Chip resistor 0.063W
R11	100K 0402 1% HDW	RC0402FR-07100KL	Chip resistor 0.063W
R14	0R 0402 HDW	RC0402JR-070RL	Chip resistor 0.063W
R15	10R 0402 1% HDW	RC0402FR-0710RL	Chip resistor 0.063W
R16	10R 0402 1% HDW	RC0402FR-0710RL	Chip resistor 0.063W
R17	10R 0402 1% HDW	RC0402FR-0710RL	Chip resistor 0.063W
R23	0R 0402 HDW	RC0402JR-070RL	Chip resistor 0.063W
R25	0R 0402 HDW	RC0402JR-070RL	Chip resistor 0.063W
R26	0R 0402 HDW	RC0402JR-070RL	Chip resistor 0.063W
X2	ANTENNA FR05-S1-NO-1-004 SMD	FR05-S1-NO-1-004	Fractus Dual-band Reach Xtend Chip Antenna

Reference schematic BOM.

3.3 Interfaces

The SPB209A is equipped with a number of interfaces that can be set up in various ways by the value on GPIO2 and GPIO3 during boot.

3.3.1 Host Interface SDIO and UART

The SDIO interface is SDIO 4-bit mode. For timing characteristics and trigger level check [Digital Pin Characteristics](#)

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

Both GPIO2 and GPIO3 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 Host Interface Selection shows the different options. The default is to leave GPIO2 and GPIO3 unconnected (1 1) and SDIO as host interface for all services.

GPIO2	GPIO3	WLAN Host Interface	BT/BLE Host Interface	FW Download interface	FW Download mode
0	0	SDIO	UART	SDIO	Serial
0	1	SDIO	SDIO	SDIO	Parallel
1	0	SDIO	UART	SDIO+UART	Parallel
1	1	SDIO	SDIO	SDIO	Serial

Host Interface Selection

Module Pin number	Pin Name	Description
34	SD_CLK	Clock input
36	SD_CMD	SDIO 4-bit mode: Command SDIO 1-bit mode: Command
33	SD_DAT3	SDIO 4-bit mode: Data line bit [3] SDIO 1-bit mode: Not used
32	SD_DAT2	SDIO 4-bit mode: Data line bit [2] or Read Wait (optional) SDIO 1-bit mode: Read Wait (optional)
31	SD_DAT1	SDIO 4-bit mode: Data line bit [1] SDIO 1-bit mode: Interrupt
35	SD_DAT0	SDIO 4-bit mode: Data line bit [0] SDIO 1-bit mode: Data line

SDIO Host Interface



The SDIO Interface supports 1-bit and 4-bit SDIO transfer modes up to 208MHz clock frequency.

3.3.2 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

3.3.3 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 SPB209A Wake-Up involving both WLAN and BT. Below table outline the options.

GPIO No.	Function
GPIO1	WLAN to Host Wake-up
GPIO13	BT to Host Wake-up
GPIO14	Host to WLAN Wake-up
GPIO15	Host to BT Wake-up

Pin number	Pin Name	No Pad Power State	Reset State	HW ⁽²⁾ State	PD ⁽³⁾ State	PD ⁽⁴⁾ Prog	Internal PU/PD	PU ⁽⁵⁾	PD ⁽⁵⁾
2	GPIO17	Tristate	Input	Input	Tristate	Yes	Weak PU	No	No
GPIO Mode: GPIO17 (input/output) JTAG Mode: TDO (JTAG test data output) LTE Coexistence Mode: UART_LTE_TXD (output)									
4	GPIO16	Tristate	Input	Input	Tristate	Yes	Nominal PU	Yes	Yes
GPIO Mode: GPIO16 (input/output) JTAG Mode: TDI (JTAG test data input) LTE Coexistence Mode: UART_LTE_RXD (input)									

Pin number	Pin Name	No Pad Power State	Reset State	HW ⁽²⁾ State	PD ⁽³⁾ State	PD ⁽⁴⁾ Prog	Internal PU/PD	PU ⁽⁵⁾	PD ⁽⁵⁾
5	GPIO15	Tristate	Input	Input	Drive high	Yes	Nominal PU	Yes	Yes
GPIO Mode: GPIO15 input/output JTAG Mode: TMS (JTAG controller select, input) Out-of-Band Mode: Host wakeup Bluetooth (input)									
6	GPIO14	Tristate	Input	Input	Tristate	Yes	Nominal PU	Yes	Yes
GPIO Mode: GPIO14 (input/output) JTAG Mode: TCK (JTAG test clock, input) Out-of-Band Mode: Host wakeup WLAN (input)									
20	GPIO13	Tristate	Input	Input	Drive high	Yes	Nominal PU	No	No
GPIO Mode: GPIO13 (input/output) UART Mode: UART_DTRn (output) Out-of-Band Mode: Bluetooth wakeup host (output)									
21	GPIO12	Tristate	Input	Input	Tristate	Yes	Nominal PU	Yes	Yes
GPIO Mode: GPIO12 (input/output) UART Mode: UART_DSRn (input)									
27	GPIO11	Tristate	Input	Input	Drive high	Yes	Weak PU	No	No
GPIO Mode: GPIO11 (input/output) UART Mode: UART_RTSn (output)									
28	GPIO10	Tristate	Input	Input	Tristate	Yes	Nominal PU	Yes	Yes
GPIO Mode: GPIO10 (input/output) UART Mode: UART_CTSn (input)									
29	GPIO9	Tristate	Input	Input	Tristate	Yes	Nominal PU	Yes	Yes
GPIO Mode: GPIO9 (input/output) UART Mode: UART_RXD (input)									
26	GPIO8	Tristate	Input	Input	Drive low	Yes	Weak PU	No	No
GPIO Mode: GPIO8 (input/output) UART Mode: UART_TXD (input)									
37	GPIO7	Tristate	Input	Input	Tristate	Yes	Nominal PU	Yes	Yes
GPIO Mode: GPIO7 (input/output) PCM Mode: PCM_SYNC (output if master, input if slave)									
40	GPIO6	Tristate	Input	Input	Tristate	Yes	Nominal PU	Yes	Yes
GPIO Mode: GPIO6 (input/output) PCM Mode: PCM_CLK (output if master/input if slave)									
38	GPIO5	Tristate	Input	Input	Tristate	Yes	Weak PU	Yes	Yes
GPIO Mode: GPIO5 (input/output) PCM Mode: PCM_DOUT (output)									
39	GPIO4	Tristate	Input	Input	Tristate	Yes	Nominal PU	Yes	Yes
GPIO Mode: GPIO4 (input/output) PCM Mode: PCM_DIN (input)									
19	GPIO3	Tristate	Input	Output	Tristate	Yes	Weak PU	No	No
GPIO Mode: GPIO3 (input/output) PCM Mode: PCM_MCLK (optional, output if master/input if slave) LED Mode: LED_OUT_BT (output) Configuration Mode: CON[1] (input)									
18	GPIO2	Tristate	Input	Output	Tristate	Yes	Weak PU	No	No
GPIO Mode: GPIO2 (input/output) LED Mode: LED_OUT_WLAN (output) Configuration Mode: CON[0] (input)									
3	GPIO1	Tristate	Input	Input	Tristate	Yes	Weak PU	No	No

Pin number	Pin Name	No Pad Power State	Reset State	HW ⁽²⁾ State	PD ⁽³⁾ State	PD ⁽⁴⁾ Prog	Internal PU/PD	PU ⁽⁵⁾	PD ⁽⁵⁾
GPIO Mode: GPIO1 (input/output) Out-of-Band Mode: WLAN wakeup host (output)									
7	GPIO0	Tristate	Output	Output	Drive low	Yes	Nominal PU	Yes	No
GPIO Mode: GPIO0 (input/output) Oscillator Mode: XOSC_EN/CLK_REQ (output) 0=disable external oscillator 1=enable external oscillator									
30	PDn	-	-	-	-	-	-	-	-
Full power-down (input) 0 = full power-down 1 = normal mode · Connect to power-down pin of host or VDD33. · External host required to drive this pin high for normal operation. No internal pull-up on this pin)									



- (1) Not all GPIO pins can be used for wakeup signals.
- (2) Hardware default state after reset.
- (3) Power-down state.
- (4) Power-down state programmable.
- (5) Programmable pull-up/pull-down.

3.3.4 RF Interface

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

RF interfaces are not valid for antenna option B as the RF module have an integrated antenna

Module Pin number	Pin Name	Description
12	RFOUT1	RF input/output (default, RN- and BN-option)
15	RFOUT2	RF input/output (RL- and RN-option)

RF Interface

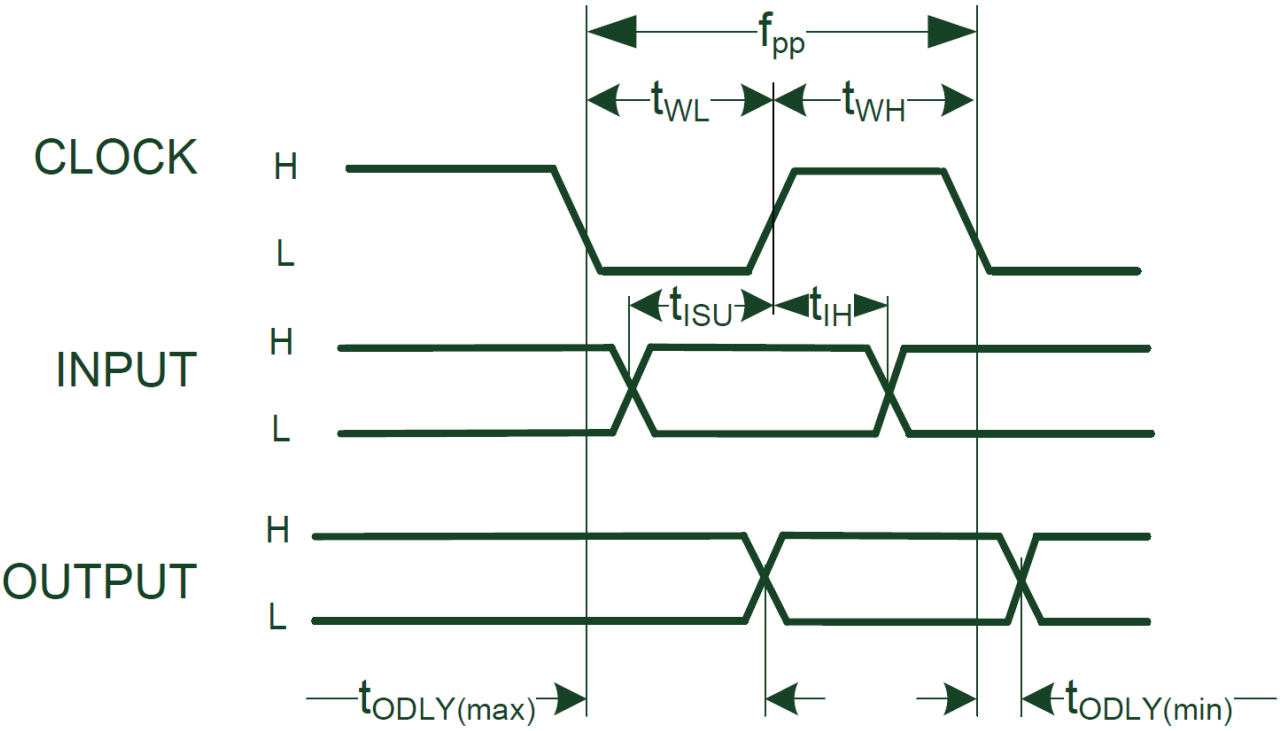
3.4 Digital Pin Characteristics

3.4.1 SDIO timing characteristics

The SPB209A 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 SPB209A 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



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	

SDIO timing parameter values (normal mode)

Parameter	Symbol	Min	Max	ns	Comments
Input set-up time	t_{ISU}	6		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}	2.5	14	ns	
Output hold time		2.5		ns	
Clock Frequency	f_{pp}		50	MHz	

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 low time	t_{WL}		4	ns	

Parameter	Symbol	Min	Max	ns	Comments
Clock high time	t_{WH}		4	ns	
Output delay time	t_{ODLY}	1.5	7.5	ns	
Output hold time	t_{OH}	1.5		ns	
Clock Frequency	f_{pp}		100	MHz	

SDIO timing parameter values (high speed mode 100MHz, VDDIO= 1.8V)

Parameter	Symbol	Min	Max	ns	Comments
Input set-up time	t_{ISU}	1.4		ns	
Input hold time	t_{IH}	0.8		ns	
Clock low time	t_{WL}		1.5	ns	
Clock high time	t_{WH}		1.5	ns	
Clock Frequency	f_{pp}		208	MHz	

SDIO timing parameter values (high speed mode 208MHz, VDDIO = 1.8V)

3.4.2 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	Comments
Input low voltage	V_{IL}	-0.3		$0.3 \cdot V_{IO}$	V	
Input high voltage	V_{IH}	$0.7 \cdot V_{IO}$		$0.3 \cdot V_{IO}$	V	
Input leakage current	I_{IL}	-5		5	μA	
Output low voltage	V_{OL}	0		4	V	$I_{out} < -11mA$
Output high voltage	V_{OH}	$V_{IO} - 0.4$			V_{IO}	$I_{out} > 3mA$
Input pin capacitance	C_{IP}		2.5		pF	
VDDIO	V_{IO}	1.75		3.46	V	

I/O pin DC characteristics

3.5 Electrical Specifications

3.5.1 Power Supply

SPB209A 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 SPB209A shall be less than 5ms (<5ms).

Module Pin number	Pin Name	Description
25	VDD33	Analog 3.3V Supply, decouple with 100uF.
41	VDDIO	Digital IO supply, can be connected with VDD33 and share decoupling.

Module Pin number	Pin Name	Description
1,11,13,14, 16,17,24	GND	Ground

Supply Interface

3.5.2 Main supply

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

3.5.3 Clock Signals

The SPB209A requires no external clock signals. It has an internal high frequency oscillator with a high precision 37.4 MHz crystal and a low power oscillator to generate the required clock signals.

3.5.4 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 SPB209A 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.

3.5.5 Power Save

Power save is an energy saving mode where SPB209A 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.

3.5.6 Absolute Maximum Ratings

Rating	Min	Max	Units
Supply voltage	-0.3	3.6	V
Supply voltage I/O	-0.3	4.0	V
Input RF level		+10	dBm
Storage temperature order option LxNM	-55	+125	°C
Storage temperature order option LxLM	-55	+85	°C
Lead temperature (No Pb), solder as per section 0		+250	°C

Absolute maximum ratings



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.

3.5.7 Electrostatic Discharge (ESD)

SPB209A withstands ESD voltages up to 1000V HBM (Human Body Model) according to JESD22-A114 and up to 500 V CDM (Charged Device Model) according to JESD22-C101.

3.5.8 Recommended Operating Conditions

Rating	Min	Typ	Max	Units
Supply Voltage VDD	3.0	3.3	3.6	V
Supply Voltage VDD_IO	1.75	1.8 or 3.3V	3.6	V
Supply Voltage IO with VDD 0V		0	0.2	V
Operating temperature (Industrial grade)	-40	+25	+85	°C

Recommended operating conditions

3.5.9 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		295		mA
2.4G/TX 802.11 g	OFDM 6Mbps, Pout=17 dBm		285		mA
2.4G/TX 802.11n HT40	OFDM MCS0, Pout=16 dBm		270		mA
5G/TX 802.11g	OFDM 6 Mbps, Pout=15 dBm		330		mA
5G/TX 802.11n HT40	OFDM MCS0, Pout=14 dBm		310		mA
5G/TX 802.11ac VHT80	OFDM MCS0, Pout=9 dBm		335		mA
2.4G/RX 802.11 b	Normal mode – Max Sensitivity		51		mA
2.4G/RX 802.11 g	Normal mode – Max Sensitivity		54		mA
2.4G/RX MCS7 HT20	Normal mode – Max Sensitivity		66		mA
5G/RX 802.11g	OFDM 54 Mbps Normal mode – Max Sensitivity		67		mA
5G/RX MCS7 HT20	Normal mode – Max Sensitivity		78		mA
5G/RX MCS9 VHT40	Normal mode – Max Sensitivity		103		mA
5G/RX MCS9 VHT80	Normal mode – Max Sensitivity		121		mA
Continuous RX burst	SCO HV3 Peak RX		17		mA
Continuous Tx Class 2 (+4 dBm)	SCO HV3 Peak TX		22		mA
1.28 sec LE ADV			0.149		mA
1.28 sec sniff as master ACL Link			0.186		mA
Deep Sleep	Standby		200		µA
WLAN/Power Save	DTIM = 1, Beacon Interval 100ms		1.14		mA

Mode	Conditions	Min	Typ.	Max	Unit
WLAN/Power Save	DTIM = 3, Beacon Interval 300ms		0.47		mA

Typical current consumption in different modes.

3.5.10 RF Performance

Conditions: VBAT= 3.3V, Tamb= 25°C Spectrum Mask and BER according to IEEE 802.11a/b/g/n/ac 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 and BT					
2.4G/Output power**	802.11b, 11Mbps		17	19	dBm
2.4G/Output power**	802.11g, 54Mbps		17	19	dBm
2.4G/Output power**	802.11n/ac, MCS7, HT20		16	18	dBm
5G/Output power	802.11a, 54Mbps		15	17	dBm
5G/Output power	802.11n/ac, MCS7, HT20		14	16	dBm
5G/Output power	802.11ac, MCS8, VHT20		10	12	dBm
5G/Output power	802.11ac, MCS9, VHT40		9	11	dBm
5G/Output power	802.11ac, MCS9, VHT80		9	11	dBm
BT BR	GFSK		6	8	dBm
BT EDR	$\pi/4$ DQPSK		3	5	dBm
BT EDR	8DPSK		3	5	dBm
BT LE			7	9	dBm
Receiver performance 11a/b/g/n/ac and BT					
2.4G/Receiver sensitivity	DPSK 1Mbit/s		-98		dBm
2.4G/Receiver sensitivity	OFDM/64-QAM 54Mbit/s, HT20		-74		dBm
2.4G/Receiver sensitivity	MCS-7, OFDM/64-QAM, HT20		-73		dBm
5G/Receiver sensitivity	OFDM/64-QAM 54Mbit/s, HT20		-70		dBm
5G/Receiver sensitivity	MCS-0, BPSK, HT20		-86		dBm
5G/Receiver sensitivity	MCS-9, OFDM/256-QAM, HT40		-60		dBm
5G/Receiver sensitivity	MCS-0, BPSK, HT80		-82		dBm
5G/Receiver sensitivity	MCS-9, OFDM/256-QAM, HT80		-57		dBm

Parameter	Conditions	Min	Typ.	Max	Units
BT BR	GFSK, BER≤0.1%		-92		dBm
BT EDR	$\pi/4$ DQPSK, BER≤0.1%		-92		dBm
BT EDR	8DPSK, BER≤0.1%		-86		dBm

RF Performance



*: Order option LRNM will have ~2dB reduced BT Tx power
Order option LxLM (with LTE Filter) will have ~2 dB reduced TX Power and sensitivity for BT and WiFi 2.4GHz.

***: Channel 12 will have up to 2 dB and channel 13 will have 3-4 dB lower output power than the other 2.4GHz channels to comply with FCC band edge compliance. This only applies when FCC Regulatory Domain is selected. The SPB209A devices are already calibrated with Power Tables loaded by the driver at device start supporting both SPB209A unique setting and Regulatory Domain setting.

3.6 Design Specification

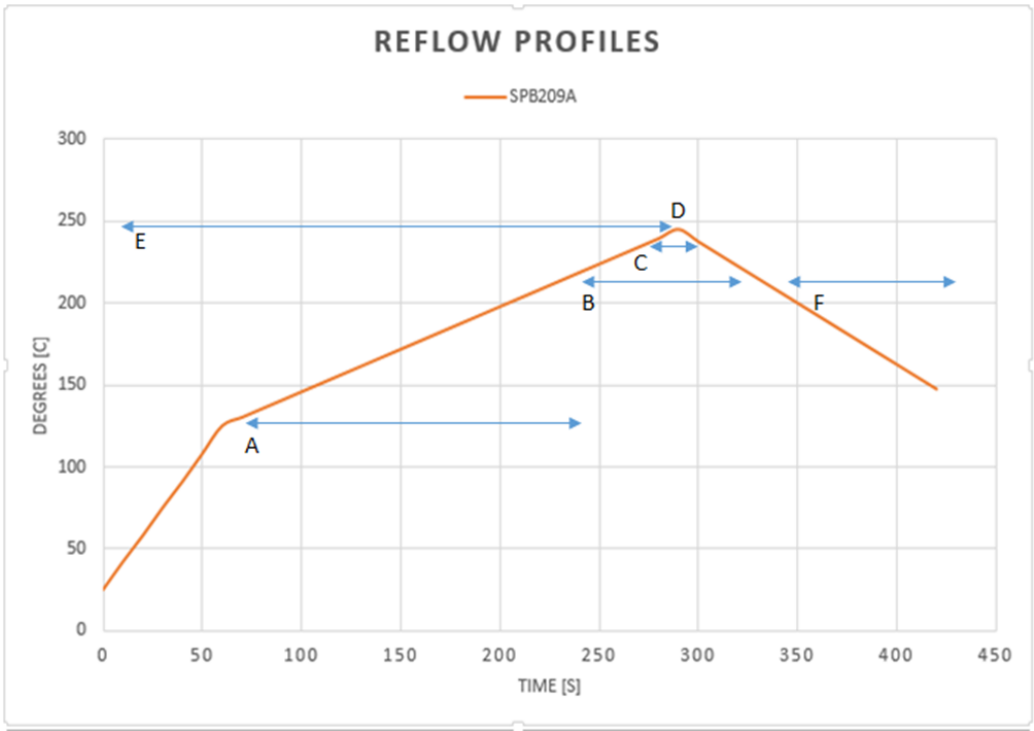
3.6.1 Design directions

The design using the SPB209A 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.

3.6.2 Soldering

The SPB209A uses a LGA type package. The recommended solder profile is pictured in Figure below:

Before assembly it is recommended to bake SPB209A for 8 days at 40°C and RH<5% in Tape&Reel or for 16 hours at 125°C with no packaging.



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	

Solder Profile Specification

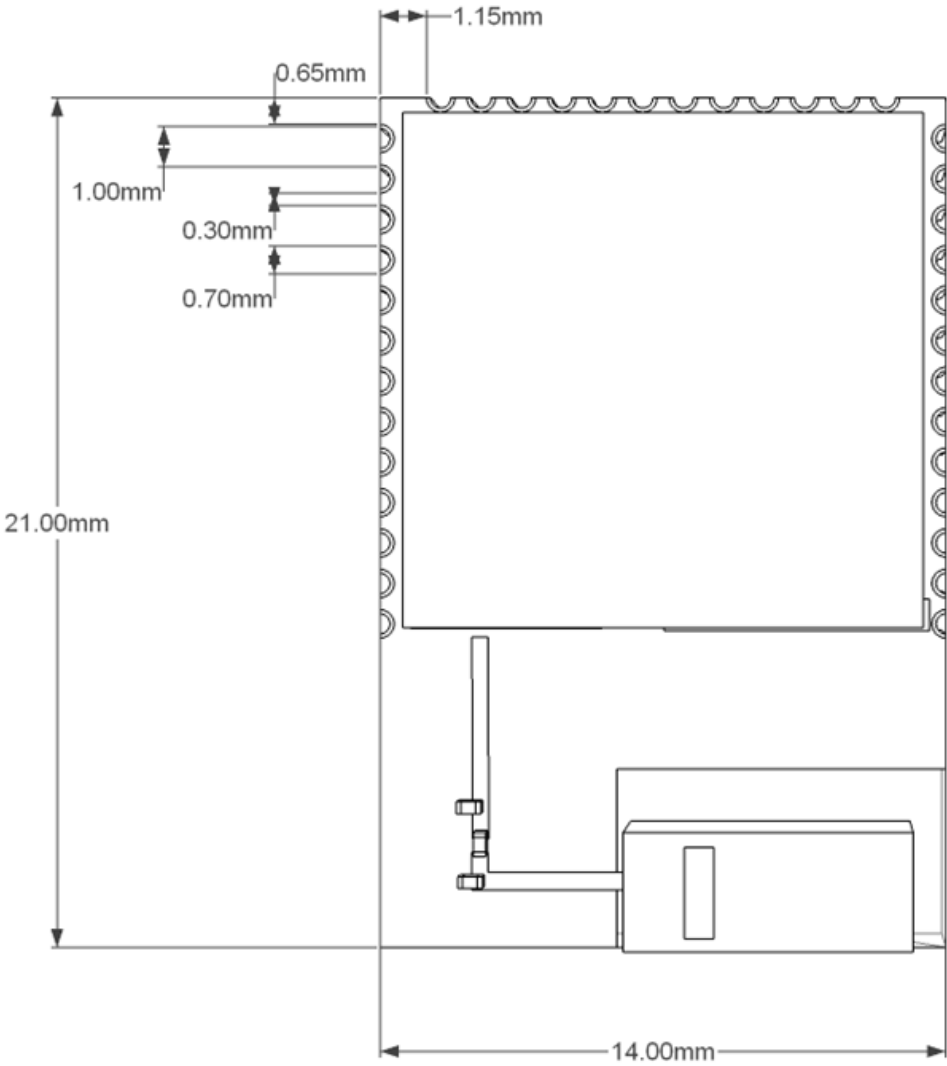
3.6.3 Environmental statement

The SPB209A is designed and manufactured to comply with the RoHS and Green directives.

3.7 Mechanical Specification

3.7.1 SPB209A PCB Module (Antenna Option B)





Top view (Antenna Option B)



Side view

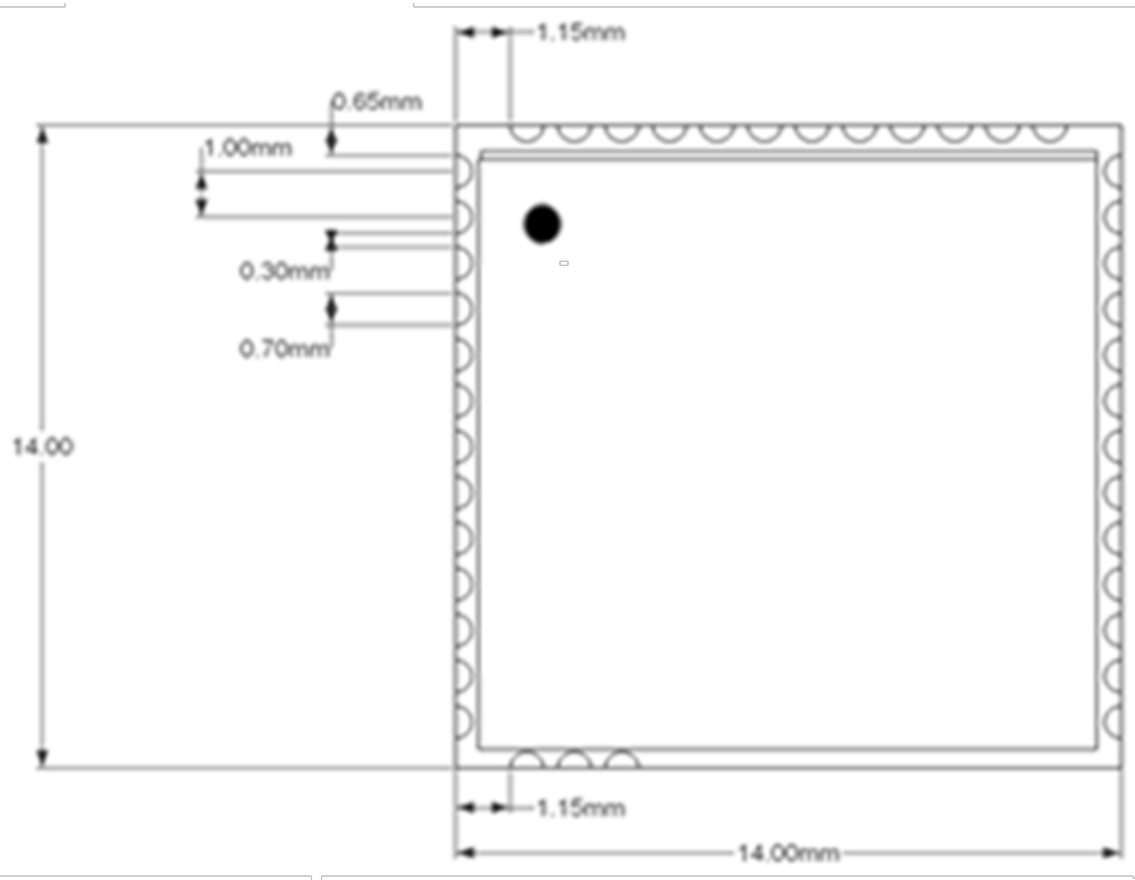
3.7.2 SPB209A PCB Module (Antenna Option R)

SPB209A
XXX

YYWW ZZ



FCCID:XO2SPB209A
IC:8713A-SPB209A
CMIIT: 2018AJ7522



Top view (Antenna Option R)



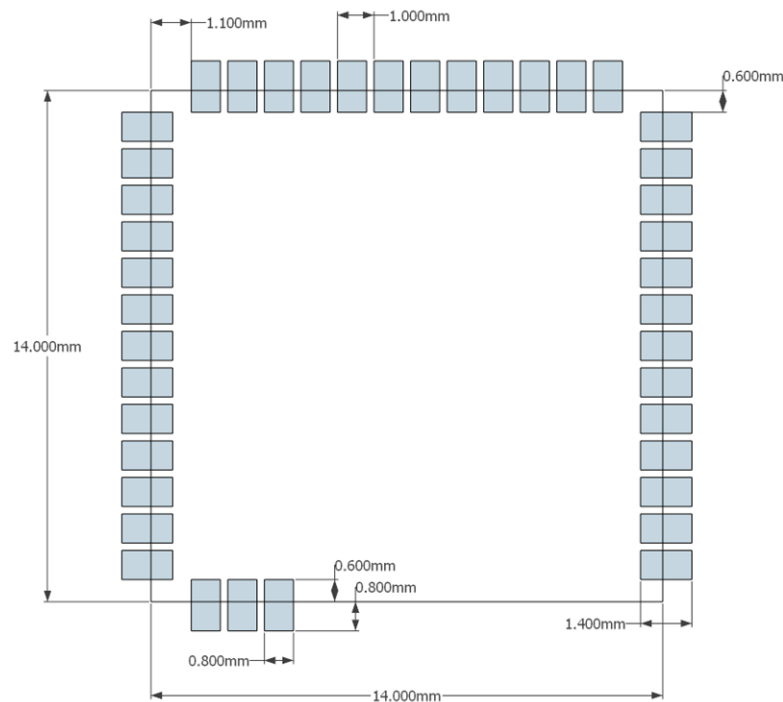
Side view

3.7.2.1 Marking SPB209A

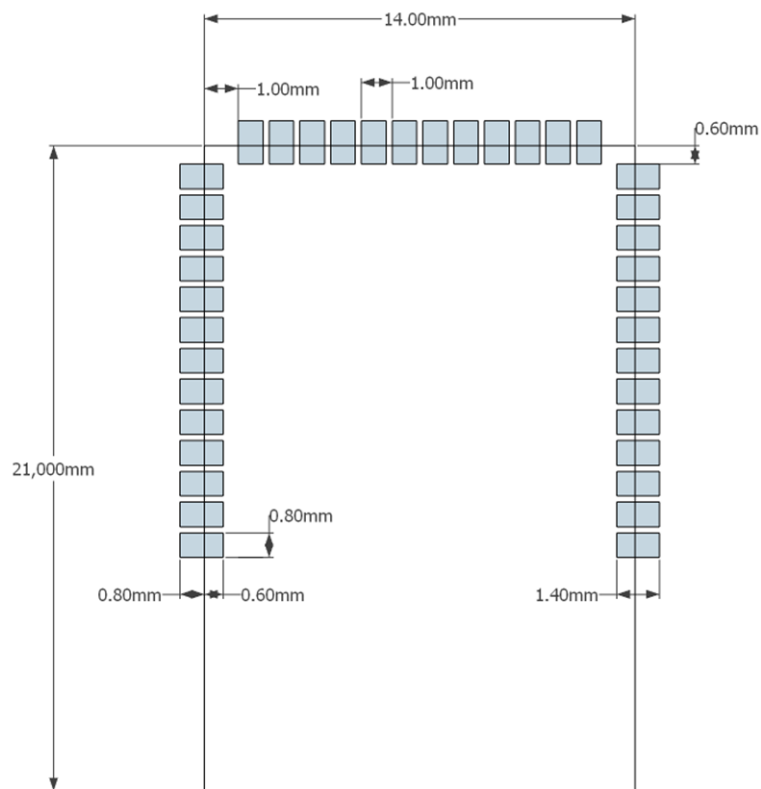
The label on the EMC Shield is imprinted with the regulatory IDs and lot number.

3.8 Mounting Instruction

3.8.1 Recommended Land Patterns for SPB209A Shielded Module



SPB209A-R Module Land Pattern



SPB209A-B Module land pattern

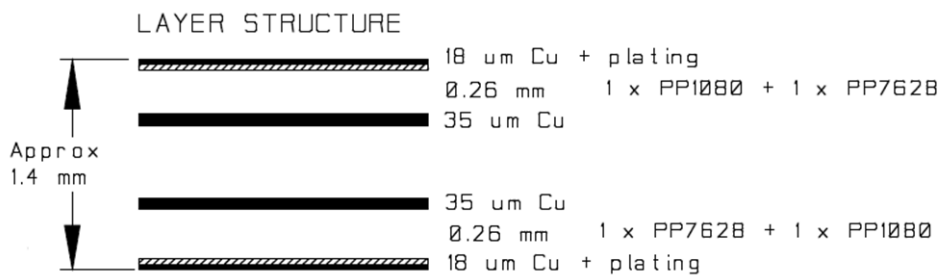


Place no via holes or exposed metal under the module, but it is recommended to fill as much as possible with ground.

For the module with integrated chip antenna keep an area free of all metal around the antenna, see Figure : Top view (Antenna Option B).

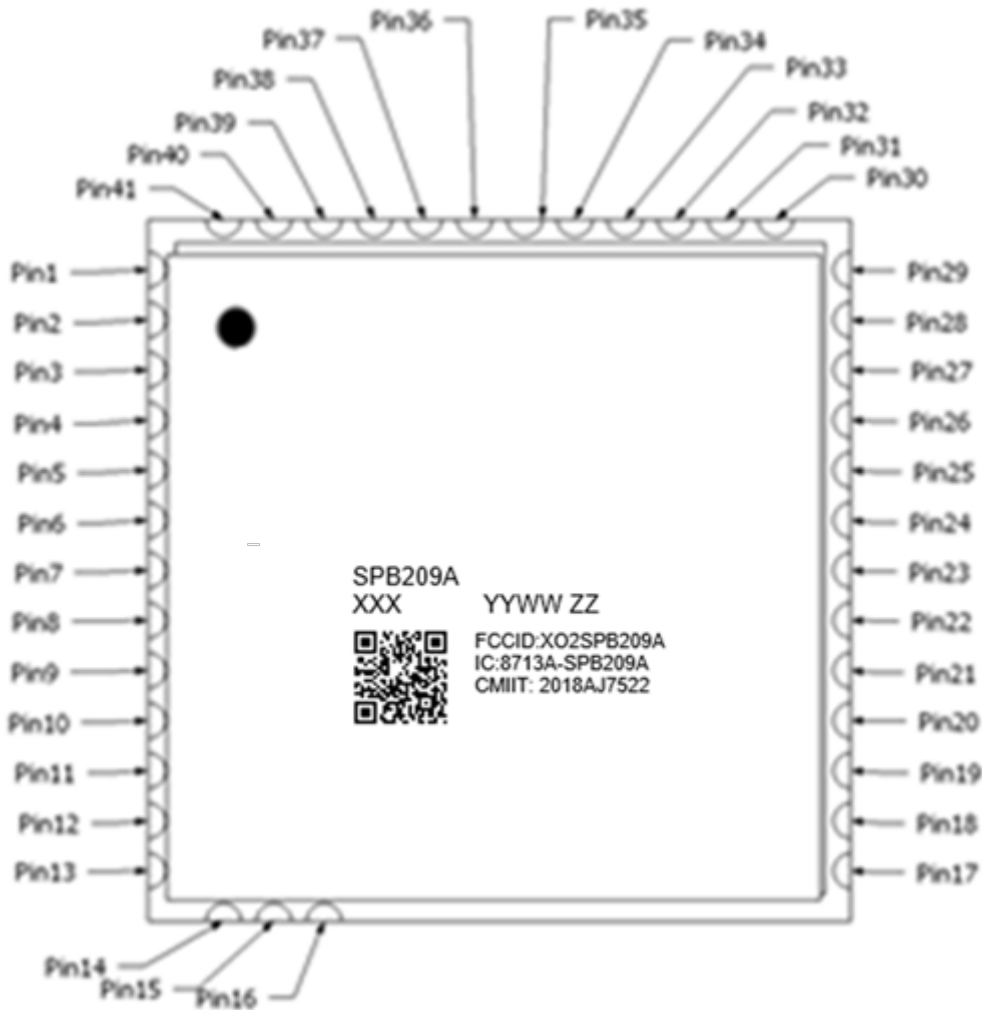
It is recommended to place the module at the edge of the PCB with the antenna portion outside the PCB edge for the best RF performance.

3.8.2 Reference PCB Stack-up

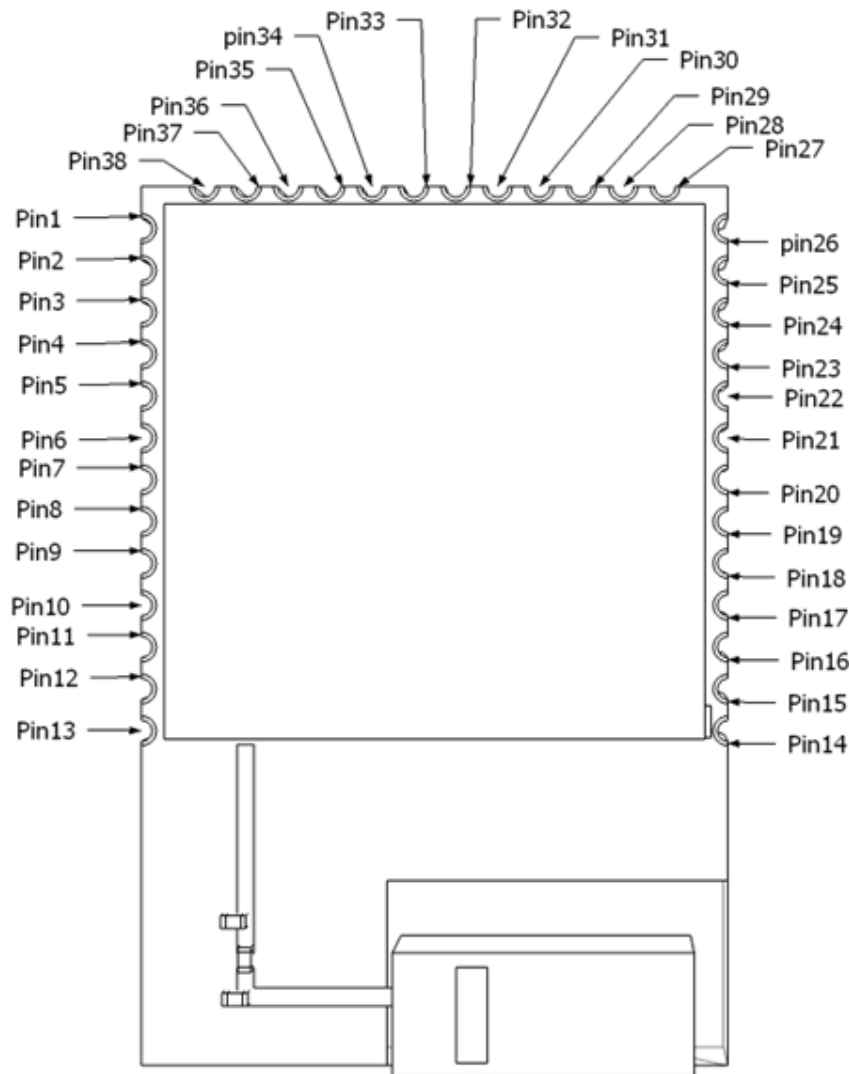


Reference PCB stack-up

3.9 Pin Configuration SPB209A Module



SPB209A-LR package pin out, top view



SPB209A-LB package pin out, top view

3.9.1 Pinout List

Pin SPB209A-R	Pin SPB209A-B	Function	Type	Description
1	1	GND	S	Ground
2	2	GPIO17	O	General Purpose I/O (LTE Coexistence Signal TXD)
3	3	GPIO1	I/O	General Purpose I/O
4	4	GPIO16	I/O	General Purpose I/O (LTE Coexistence Signal RXD)
5	5	GPIO15	I/O	General Purpose I/O
6	6	GPIO14	I/O	General Purpose I/O
7	7	GPIO0	I/O	General Purpose I/O
8	8	NC	I/O	Do not connect

Pin SPB209A-R	Pin SPB209A-B	Function	Type	Description
9	9	NC	IPU	Do not connect
10	10	NC	IPU	Do not connect
11	11	GND	S	Ground (NA for antenna option B)
12	12	RFOUT1	RF	Antenna Port SPB209A-RNM option (50 Ohm) for WLAN/BT (NA for antenna option B)
13	13	GND	S	Ground (NA for antenna option B)
14	-	GND	S	Ground (NA for antenna option B)
15	-	RFOUT2	RF	Antenna Port SPB209A-RLM option (50 Ohm) for WLAN/BT (NA for antenna option B)
16	-	GND	S	Ground (NA for antenna option B)
17	14	GND	S	Ground
18	15	GPIO2	I/O	General Purpose I/O (CON[0] configuration mode)
19	16	GPIO3	I/O	General Purpose I/O (CON[1] configuration mode and BT PCM MCLK)
20	17	GPIO13	I/O	General Purpose I/O
21	18	GPIO12	I/O	General Purpose I/O
22	19	NFC_ANT_P	RF	NFC antenna connection
23	20	NFC_ANT_N	RF	NFC antenna connection
24	21	GND	S	Ground
25	22	VDD33	S	Supply pin 3.3V, decouple with 100uF
26	23	GPIO8	I/O	General Purpose I/O (BT UART TXD (HCI))
27	24	GPIO11	I/O	General Purpose I/O (BT UART RTS)
28	25	GPIO10	I/O	General Purpose I/O (BT UART CTS)
29	26	GPIO9	I/O	General Purpose I/O (BT UART RXD (HCI))
30	27	PDn	I	Power Down of Module (0 = full power-down; 1 = normal mode)
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	IPU	SDIO Clock
35	32	SD_DAT0	I/O	SDIO Data 0
36	33	SD_CMD	I	SDIO Command
37	34	GPIO7	I/O	General Purpose I/O (BT PCM Sync)
38	35	GPIO5	I/O	General Purpose I/O (BT PCM Data Out)
39	36	GPIO4	I/O	General Purpose I/O (BT PCM Data In)
40	37	GPIO6	I/O	General Purpose I/O (BT PCM Clock)
41	38	VDDIO	S	IO Supply

Pin Description for SPB209A Module

3.9.2 Firmware Boot Options

GPIO3 (CON[1]) and GPIO2 (CON[0]) serves as configuration inputs to set parameters following a reset. The definition of these pins changes immediately after reset to their normal function. To set a configuration bit to 0, attach a 100kohm resistor from the pin to ground. No external circuitry is needed to set a configuration bit to 1. Software reads and boots according to table below.

CON[1:0]	WLAN	BT/BLE/NFC	FW Download Interface	FW Download Mode	Number of SDIO Functions
00	SDIO	UART	SDIO	Serial	1 (WLAN)
01	SDIO	SDIO	SDIO	Parallel	3 (WLAN, BT, NFC)

CON[1:0]	WLAN	BT/BLE/NFC	FW Download Interface	FW Download Mode	Number of SDIO Functions
10	SDIO	UART	SDIO+UART	Parallel	1 (WLAN)
11 (default)	SDIO	SDIO	SDIO	Serial	3 (WLAN, BT, NFC)

Boot options

Different boot options require different firmware drivers. Currently, only the default configuration is supported.

3.9.3 PCB layout

3.9.3.1 Hardware Options

Antenna Option R

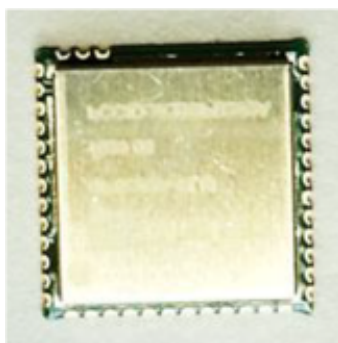
The option R is using an antenna that is placed external to the module. The external antenna is either the surface mounted Fractus FR05-S1-NO-1-004 antenna or any of the three approved antennas (per table Table 18. Mounting options for the different approved antennas) connected to a RP-SMA connector on the board. This option comes in two different pinnings:

- Option RN : The RF is connected to pin 12 of the module
- Option RL : The RF is connected to pin 15 of the module

Antenna Option B

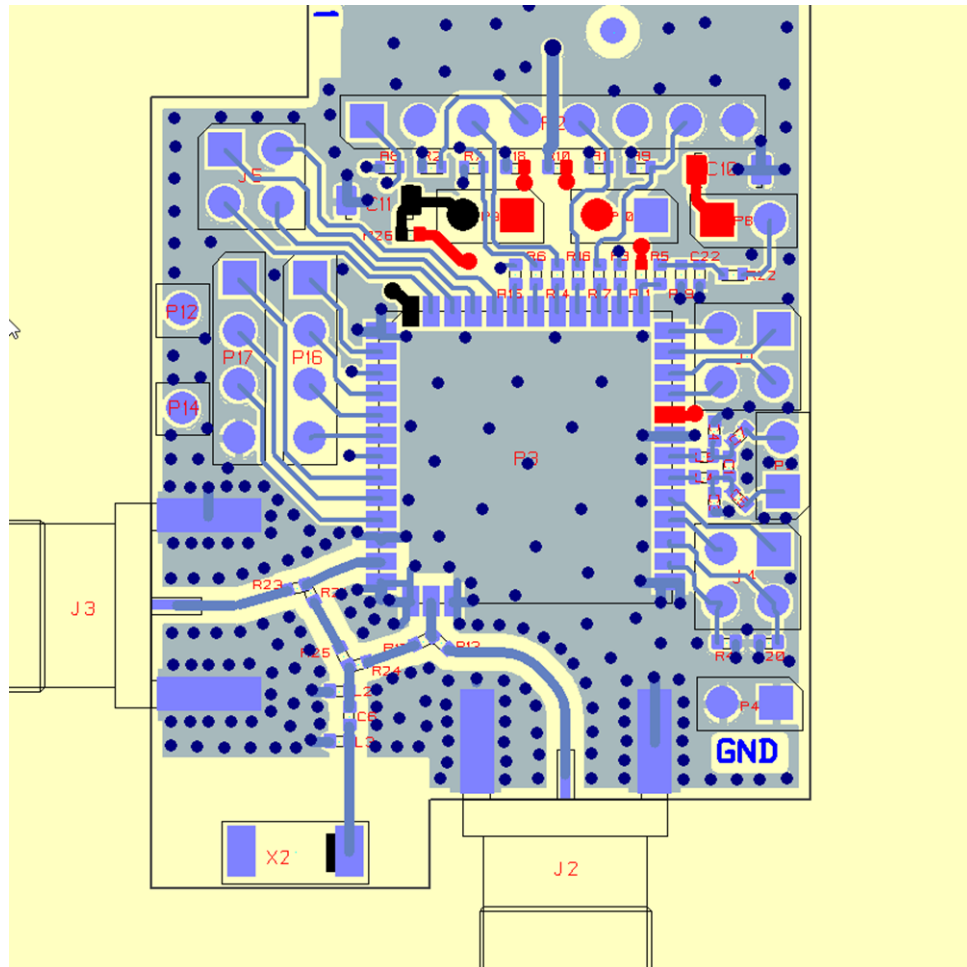
The antenna option B is using a surface mounted antenna already mounted on the module

3.9.3.2 Antenna option R, no antenna on the module



SPB209A option without antenna on module

Use normal layout common sense. Include a pi-network in front of the antenna to add the possibility to tune its impedance to 50ohm. The module requires a 50ohm load on its RF pins. If another antenna is used, the matching components need to be revised. The power supply is arranged as power planes on the bottom layer with vias up to the top level. The four layers of the reference PCB is shown below, where the red area is the VCC33 net and the black is the VDDIO net. All IOs are connected to pin-strips for test purposes.



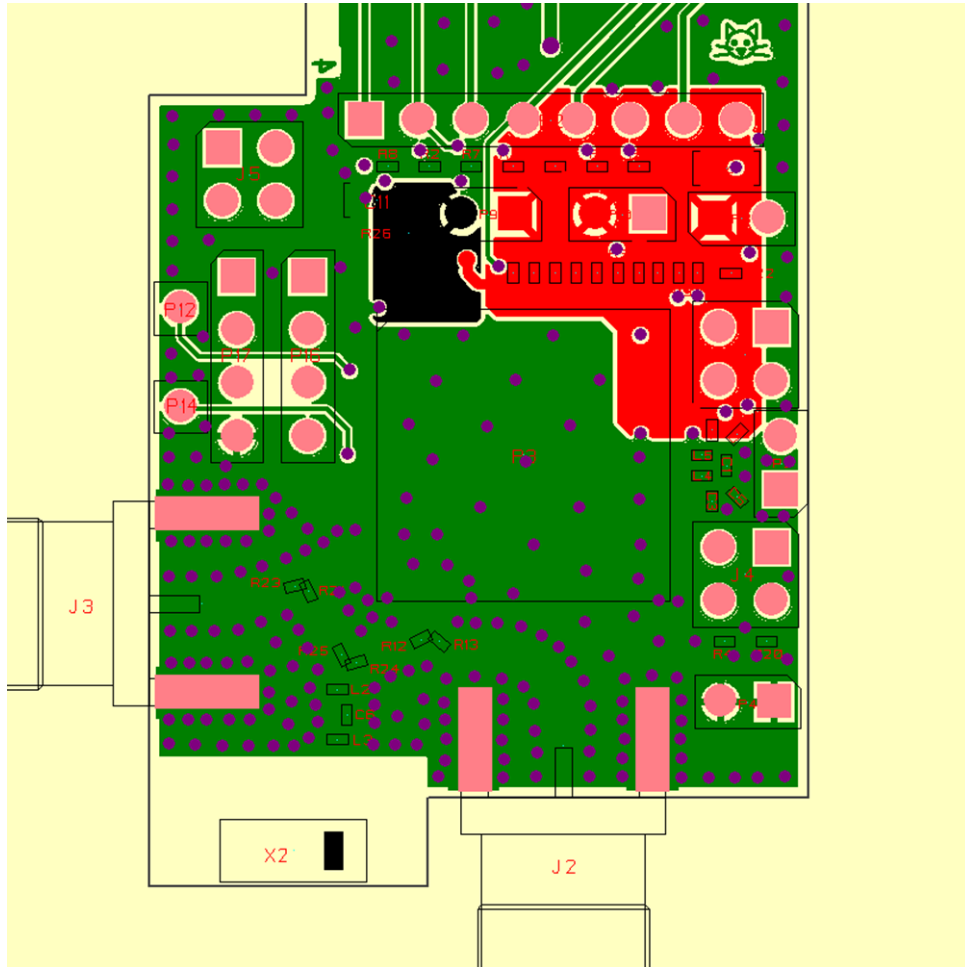
Top layer



Second layer (RF ground)



Third layer, ground and supply



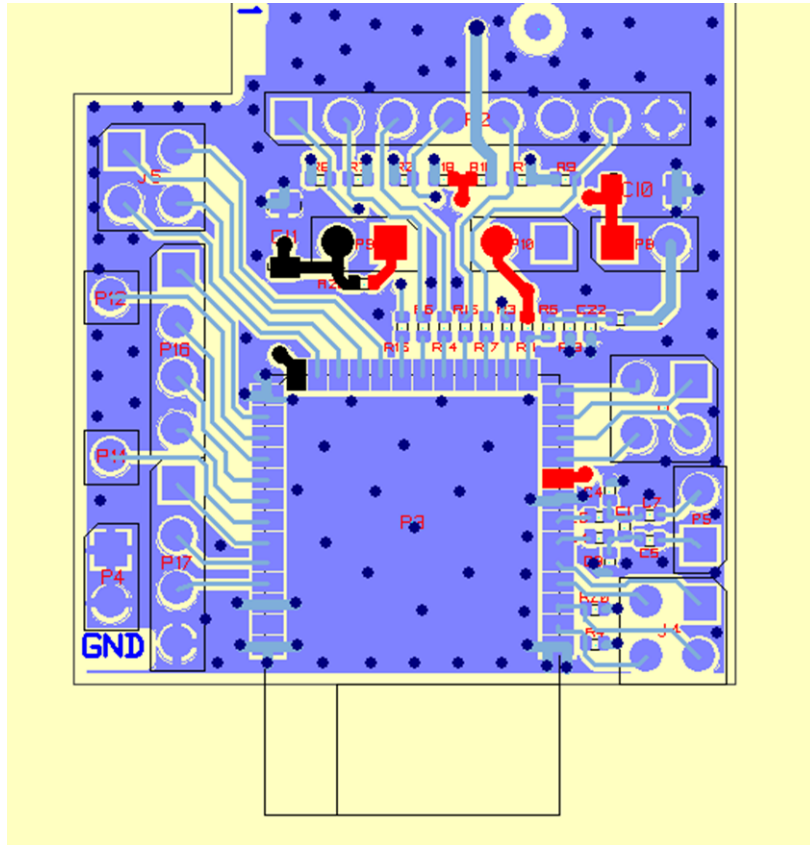
Bottom layer, ground and supply

3.9.3.3 Antenna option B, antenna mounted on module

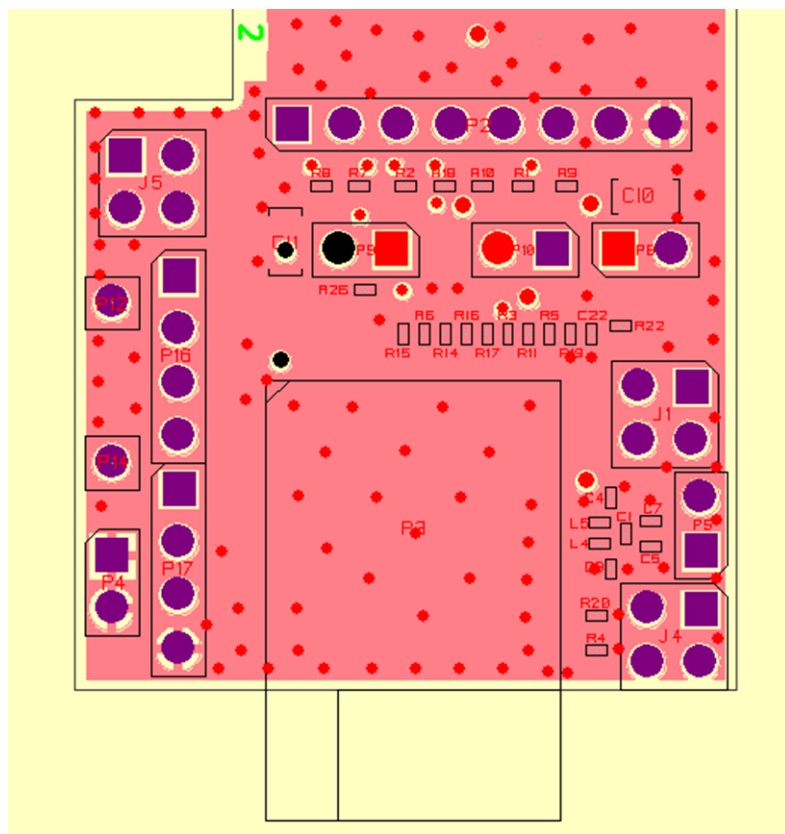


SPB209A option with antenna mounted on module.

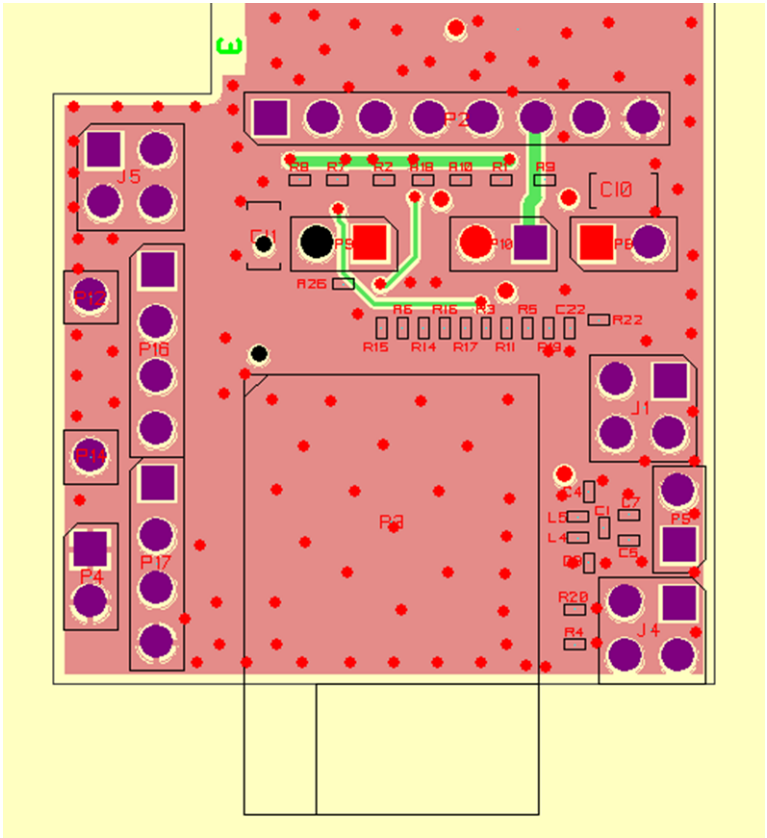
Use normal layout common sense. The power supply is arranged as power planes on the bottom layer with vias up to the top level. The four layers of the reference pcb is shown below, where the red area is the VCC33 net and the black is the VDDIO net. All IOs are connected to pin-strips for test purposes



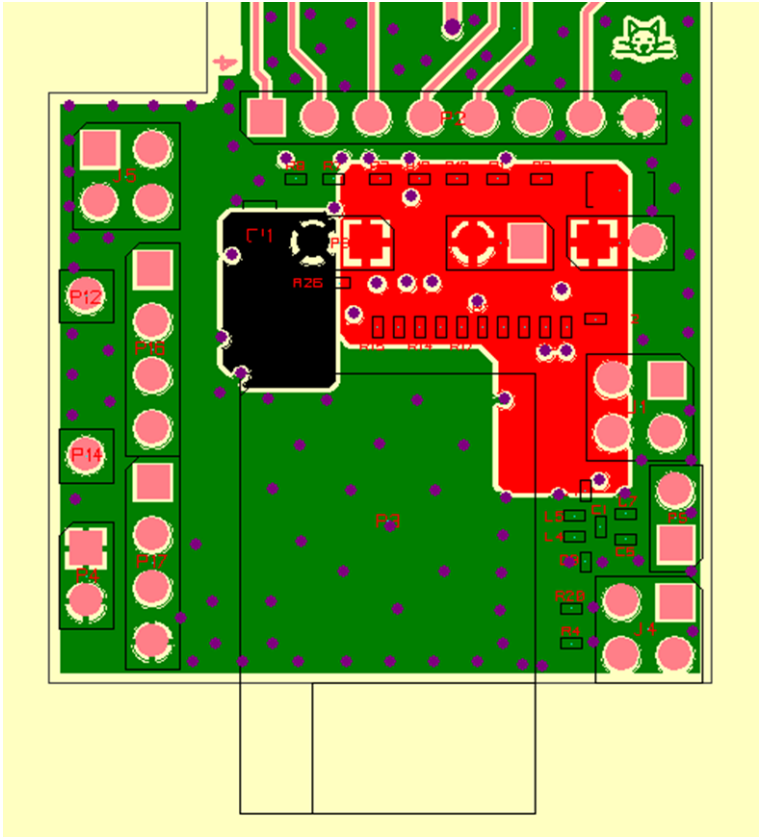
Top layer



Second layer (RF ground)



Third layer, ground and supply



Bottom layer, ground and supply

4 Additional Information TRIA SPB209A

4.1 Customer Support

We believe in helping our customers by giving them the best support on the market. In case of any questions, issues or unclear information please get in contact with us.

Get in contact with Tria Technologies technical support by opening a ticket: <https://tria-technologies.atlassian.net/servicedesk/customer/portal/1>.

Or send us an email to: support.boards@tria-technologies.com

Or call our support line under: +49 89 419193-199

Or visit our website at: <https://tria-technologies.com/support>

4.2 Customer Service

As a trusted technology innovator and global solutions provider, Tria Technologies extends its embedded market strengths into a services portfolio allowing companies to break the barriers of traditional product lifecycles. Proven product expertise coupled with collaborative and highly-experienced support enables Tria Technologies to provide exceptional peace of mind to build and maintain successful products.

4.3 Customer Comments

If you have any difficulties using this user guide, discover an error, or just want to provide some feedback, contact Tria Technologies Support: <https://tria-technologies.com/support>

4.4 Quality and Environmental Management

Tria Technologies aims to deliver reliable high-class products designed and built for quality, and aims to complying with environmental laws, regulations, and other environmentally oriented requirements. For more information regarding Tria Technologies's quality and environmental responsibilities, visit <https://www.tria-technologies.com/quality-management/>.

4.4.1 Disposal and Recycling

Tria Technologies products are manufactured to satisfy environmental protection requirements where possible. Many of the components used are capable of being recycled. Final disposal of this product should be carried out in accordance with local regulations after consideration of reuse and recycling.

4.4.2 WEEE Compliance

The Waste Electrical and Electronic Equipment (WEEE) Directive aims to:

- Reduce waste arising from electrical and electronic equipment (EEE)
- Make producers of EEE responsible for the environmental impact of their products, especially when the product become waste

- Encourage separate collection and subsequent treatment, reuse, recovery, recycling and sound environmental disposal of EEE
- Improve the environmental performance of all those involved during the lifecycle of EEE



- Environmental protection is a high priority of Tria Technologies.
- Tria Technologies follows the WEEE directive.
- You are encouraged to return our products for proper disposal according to your local regulations and requirements.

4.5 Standard Compliance

4.5.1 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
802.11a	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)
RFC1042	Inherent	Frame encapsulation

Applicable IEEE standards

4.5.2 Wi-Fi

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 interoperability test plan	802.11g devices with WPA	2.0
WMM (including WMM Power Save)		Ver 1.2
WPS (Wireless Protected Setup)		

Applicable Wi-Fi standards

4.5.3 Regulatory

The following table shows the list of countries / regions, where the SPB209A has undergone testing and shows compliance to the according regulatory requirements. It is up to the integrator to show compliance in the end-product.

Country	Approval authority	Logo	Regulatory	Frequency band [MHz]	Antennas*
USA	FCC		FCC ID XO2SPB209A	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5720 5745 - 5825	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1 WE-MCA 7488910245
Canada	IC		IC: 8713A-SPB209A	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5580 5560 - 5720 5745 - 5825	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1 WE-MCA 7488910245
Europe	-		-	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5700	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1
China	SRRC		CMIIT ID 2018Aj7522	[BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5745 - 5825	Fractus FR5-S1-NO-1-004
Brazil	ANATEL		06762-18-11560	[NFC] 13,56 [BT] 2400 - 2483,5 [WLAN] 2412 - 2462 5180 - 5240 5260 - 5320 5550 - 5700 5745 - 5825	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1
Australia	ACMA		-	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5580 5650 - 5700	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1
New Zealand	ACMA		-	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5700	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1

South Korea	National Radio Research Agency (RRA)		R-C-H3G-SPB209A	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2472	TBD
Japan (radio law)	Ministry of Internal Affairs and Communications (MIC)		005-102031	[BT] 2402 - 2480 [WLAN] 2412 - 2472	TBD
Hong Kong	Hong Kong Communications Authority (CA)		HK0021900062	[NFC] 13,56 [BT] 2400 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5700 5745 - 5825	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1
India (WPC, Radio)	Ministry of Communications & IT - India	ETA - 1244/2017/ RLO(SR) ETA - 1275/2017/ RLO(SR)	ETA - 1244/ 2017/ RLO(SR) ETA - 1275/ 2017/ RLO(SR)	[BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5700	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1
Mexico	Instituto Federal de Telecomunicaciones (IFT)		IFT: RCPHDSP19-1119	[BT] 2400 - 2483,5 [WLAN] 2412 - 2472 5745 - 5825	TBD
Jordan	Telecom Regulatory Agency (TRC)	TRC/LPD/ 2018/99	Type approval No.: TRC/SS/2018/99	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1
Philippines	National Telecommunications Commission (NTC)		No.: ESD - 1817994C	[NFC] 13,56 [BT] 2400 - 2483,5 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5700	TBD
Russia		Registration Nr. 45-355	Registration Nr. 45-355	[NFC] 13,56 [BT] 2400 - 2483,5 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5660 - 5825	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1
South Africa	ICASA		TA-2018/2950	[BT] 2400 - 2483,5 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5700	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1
Taiwan (radio)	National Communication Commission (NCC)		CCAN19LP0520T0	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2462	Fractus FR5-S1-NO-1-004
Thailand	Thailand Office of the National Telecommunications Commission	-	-	[BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5700	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1

Tunisia	Research and Studies Telecommunications Centre (CERT)	-	No: AHO-1316-18	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2462 5180 - 5240 5260 - 5320	TBD
United Arab Emirates	Telecommunications Regulatory Authority (TRA)		REGISTERED No: ER65717/18 DEALER No: DA76836/18	[NFC] 13,56 [BT] 2402 - 2480 [WLAN] 2412 - 2472 5180 - 5240 5260 - 5320 5500 - 5700	Fractus FR5-S1-NO-1-004 Taoglas GW.40.2153 Taoglas FXP832.03.0458D Walsin RFDPA870900SBLB8G1

Regulatory standards

4.5.3.1 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 SPB209A module

2. Only antennas approved may be used with the SPB209A module. The SPB209A module may be integrated with custom design antennas which OEM installer must authorize following the FCC 15.21 requirements.

The customer will need to sign a Software Configuration Control Agreement declaring the integration responsibility of the SPB209A WLAN/BT product when it comes to making sure compliance to regulatory domain.



IMPORTANT: The integrator must install and use specific antenna(s) and reference design as noted in the "Hardware Design Guide SPB209A Application Note" and must follow the specific software configuration guidelines specified. This "Hardware Design Guide SPB209A Application Note" is restricted and available only under fully executed NDA.



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.

4.5.3.2 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-SPB209A

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-SPB209A



Note that only indoor use is allowed in the band 5150 – 5250 MHz.

4.5.3.3 ETSI (Europe)

The SPB209A 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 ETSI EN 301 893 (5GHz RLAN). This standard is harmonized within the European Union and covering essential requirements under article 3 of the Radio Equipment Directive (RED). Note that only indoor use is allowed in the band 5150 – 5350 MHz.

If the SPB209A 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 Annex II of the Radio Equipment Directive.

Furthermore, the manufacturer must maintain a copy of the SPB209A 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.

4.5.3.4 SRRC (State Radio Regulatory Commission of P. R. China)

This equipment is approved by SRRC (State Radio Regulatory Commission of P. R. China). The assigned CMIIT ID is: CMIIT ID 2018AJ7522.

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas which the OEM installer must then authorize first following the national requirements.



Note that only indoor use is allowed in the band 5150 – 5250 MHz.

The CMIIT ID of the module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the CMIIT ID for the module.

CMIIT ID: 2018AJ7522

4.5.3.5 ANATEL (Agência Nacional de Telecomunicações Brazil)

This equipment is approved by ANATEL. The assigned ID is: 06762-18-11560

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

Note that only indoor use is allowed in the band 5150 – 5250 MHz (no Access Point mode) and 5250 – 5350 MHz.

The endproduct must also state: “Este produto contém a placa SPB209A código de homologação 06762-18-11560.”

ADENDO AO MANUAL

Modelo: SPB209A

Atendimento à Regulamentação Anatel

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados.

Este produto está homologado pela ANATEL, de acordo com os procedimentos regulamentados pela Resolução 242/2000, e atende aos requisitos técnicos aplicados.

Para maiores informações, consulte o site da ANATEL www.anatel.gov.br



06762-18-11560

4.5.3.6 Taiwan regulatory information (NCC)

This equipment is approved by the National Communication Commission (NCC). The assigned ID is: CCAN19LP0520T0

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

The NCC 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 NCC certification label for the module.



低功率電波輻射性電機管理辦法

第十二條 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

English translation: Article 12

Without permission granted by the NCC, any company, enterprise, or user is not allowed to change frequency, enhance transmitting power or alter original characteristic as well as performance to a approved low power radio-frequency devices.

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電通信。

低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

English translation: Article 14

The low power radio-frequency devices shall not influence aircraft security and interfere legal communications; If found, the user shall cease operating immediately until no interference is achieved.

The said legal communications means radio communications is operated in compliance with the Telecommunications Act.

The low power radio-frequency devices must be susceptible with the interference from legal communications or ISM radio wave radiated devices.

4.5.3.7 Australia & New Zealand

The SPB209 module has been certified and stated suitable for use in Australia & New Zealand under the following conditions: The manufacturer integrating the SPB209A module may need to update the report per applicable standard version, limit the transmission per applicable frequency bands and / or re-test the host equipment for spurious emissions.

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

Note that only indoor use is allowed in the band 5150 – 5250 MHz and 5250 – 5350 MHz.

The ACMA & NZ 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 ACMA & NZ certification label for the module.



R-NZ

4.5.3.8 South Korea

This equipment is approved by the National Radio Research Agency (RRA).

The assigned ID is: R-C-H3G-SPB209A

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

The KCC certification number 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 KCC certification number for the module.



해당 무선 설비는 운용 중 전파혼신 가능성이 있음.

(This wireless device has possibility to electric wave interference in operation.)

4.5.3.9 Japan (radio law)

This equipment is approved by the Ministry of Internal Affairs and Communications (MIC) on the basis of the Japanese Radio Law. The assigned ID is: 005-102031

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

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

contains MIC ID:  005-102031

4.5.3.10 Hong Kong

This equipment is approved by the Hong Kong Communications Authority (CA). The assigned ID is: HK0021900062

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only following approved antennas may be used with the SPB209A module:

Antenna	Max Gain 2.4 GHz	Max Gain 5 GHz	Power Table
Fractus FR05-S1-NO-1-004	1.8 dBi	4.9 dBi	V1
Taoglas GW.40.2153	3.7 dBi	2.5 dBi	V2
Taoglas FXP832.03.0458D	3.7 dBi	5.3 dBi	V2
Walsin RFDPA870900SBLB8G1	2 dBi	3 dBi	V3

The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

Note that only indoor use is allowed in the band 5150 – 5250 MHz and 5250 – 5350 MHz.

The CA certification label and number of the module can be made visible when installed in the host product; otherwise, the host product can be labelled to display CA certification label and number for the module.



4.5.3.11 India (WPC, Radio)

The SPB209 module has undergone the Equipment Type Approval by the Ministry of Communications & IT - India. The assigned IDs are:

ETA: 1244/2017/RLO(SR)

Online ID: 2018116885

ETA: 1275/2017/RLO(SR)

Online ID: 2018116890

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

The ETA number of the module can be made visible when installed in the host product; otherwise, the host product can be labelled to display the ETA number for the module.

4.5.3.12 Mexico

This equipment is approved by the Instituto Federal de Telecomunicaciones (IFT). The assigned ID is: RCPHDSP19-1119

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

The IFT number and certification label of the module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the IFT number and certification label for the module.



4.5.3.13 Jordan

This equipment is approved by Telecom Regulatory Agency (TRC). The assigned Type approval No. is: TRC/SS/2018/99

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

The TRC number and certification label of the module shall be clearly visible at all times in the user manual.

4.5.3.14 Philippines

This equipment is approved by the National Telecommunications Commission (NTC). The assigned ID is: No.: ESD – 1817994C

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

The NTC ID and certification label of the module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the NTC ID and certification label for the module.

4.5.3.15 Russia

This equipment is approved by Russia RF Telecom. The assigned Reg No is: 45355

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

The Registration number of the module can be made visible when installed in the host product; otherwise, the host product can be labelled to display the Registration number for the module.

Registration Nr. 45-355

4.5.3.16 South Africa

This equipment is approved by ICASA. The assigned ID is: TA-2018/2950

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

Note that only indoor use is allowed in the band 5150 – 5250 MHz and 5250 – 5350 MHz.

The ICASA ID and certification label of the module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the ICASA ID and certification label for the module.



4.5.3.17 Thailand

This equipment is approved by the Thailand Office of the National Telecommunications Commission. A signed Declaration of Conformity is available upon request.

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

Note that only indoor use is allowed in the band 5150 – 5250 MHz and 5250 – 5350 MHz.

4.5.3.18 Tunisia

This equipment is approved by Research and Studies Telecommunications Centre (CERT). The assigned Number is: AHO-1316-18

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

4.5.3.19 United Arab Emirates

This equipment is approved by the Telecommunications Regulatory Authority (TRA). The assigned IDs are:

REGISTERED No: ER65717/18

DEALER No: DA76836/18

Integrating the SPB209 into a product, the manufacturer must ensure compliance of the final end-user product to the according national standards still not exceeding the specified power ratings, antenna specifications, and/or installation requirements and so on.

Only approved antennas may be used with the SPB209A module. The SPB209A module may also be integrated with custom design antennas, which the OEM installer must then authorize first following the national requirements.

Note that only indoor use is allowed in the band 5150 – 5250 MHz and 5250 – 5350 MHz.

The TRA number and DEALER number of the module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the TRA number and DEALER number for the module.



4.5.4 TRADEMARKS

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

4.5.5 Appendix

4.5.5.1 Reference Document

#	Document	Revision	Last Update	Link
1				
2				
3				
4				

4.5.5.2 Change History

This documentation is build up via confluence and using sub pages to create the final document. Some documents have been created before in a different system and show a revision number. In the current system revision numbers are generated automatically and per page. When content is included from one of these pages a revision change of the included page is not reflected in the page where the content is included, but the content has changed. Therefore we don't use revision numbers in this new system.

Rev.	Date	Description
0.1	2026-02-15	Migrated to confluence

Change History

4.5.5.3 Known Limitations