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Approval Sheet

Date : 12-NOV-2015

Customer	
Part Number	
Description	**Mono/Stereo Wireless Audio System**
Customer's Project	
Manufacturer	**Rayson Technology Co., Ltd**
Model Name	
Firmware Version	
Rayson Part Number	

Supplier Level：■New Source □Second Source

Contact Person：_____ Tel：+886-3-5633666

Approval status :

E.E. engineer：_____ ■Approval □Reject

M.E. engineer：_____ □Approval □Reject

P.E. engineer：_____ □Approval □Reject

Approval：_____

Accessories：

■ Specification ■ Sample □ Drawing □ Test Report

□ AT Command sets □ Packing Diagram

SWA51 5GHz Module Datasheet

Mono/Stereo Wireless Audio System, based on the Avnera AV5100 IC

General Description

The SWA51 module is a member of a family of products representing a new level of system integration offering customers fast time to market with a point-to-point mono, or stereo, wireless connection. These modules are optimized for low-cost, high-quality and ease-of-use.

The module incorporates Avnera's proprietary 5GHz wireless audio protocol, designed from the ground up specifically for audio. It features low fixed latency, uncompressed CD quality mono or stereo audio, superior interference immunity, and inherent coexistence with WiFi.

The SWA51 module integrates all features necessary to complete a wireless stereo or mono link, including AV5100 Wireless Audio Chip, printed diversity antennas, flash memory, interface connector and all passive components. Just provide power and an I2S interface and you are ready to create a wireless audio link.

The module measures 26 x 47 x 3.5 mm and is provided with a 24 pin FPC connector.

The module is certified to FCC and CE standards.

Applications

- ✓ Wireless Subwoofers
- ✓ Stereo Wireless Rear Speakers
- ✓ Soundbar / Audio Video Receiver / BluRay
- ✓ Mono/Stereo Audio Channel Transmission

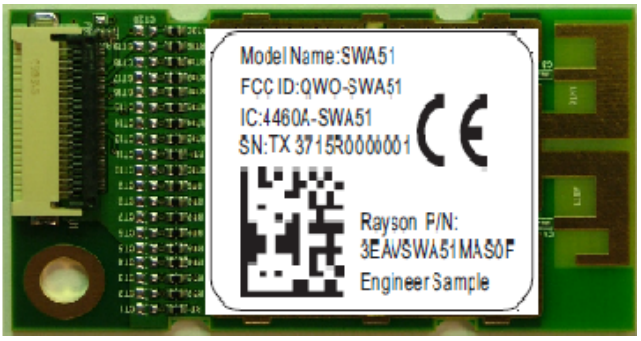
Ordering Options

SWA51-TX: Transmit module with digital audio input

SWA51- RX: Receive module with digital audio output

Features

- ✓ Audio Interfaces
  - I2S Digital Input / Output interface with >93dB end-to-end digital audio path
- ✓ Wireless Range (Typ)
  - >15m Non Line Of Sight (NLOS) range
  - > 50m Line Of Sight (LOS) range
- ✓ Frequency range: 5.15-5.25 GHz, 5.725-5.850 GHz, continuous dynamic frequency selection
- ✓ Forward error correction coding, error detection, and audio-specific error concealment
- ✓ Dual printed PCB diversity antennas for multipath and fading mitigation
- ✓ Auto-search/synch and dynamic channel selection
- ✓ Low, fixed latency
- ✓ Up to Three full-band channels (20KHz BW)
- ✓ Sample rate converter: Support for 32 - 96kHz input sample rates
- ✓ Customizable firmware for simple, low-cost, sub-woofer amplifier implementations
- ✓ RF parts can-shielded, module meets FCC part 15 rules for emissions and susceptibility.
- ✓ General purpose over-the-air (OTA) serial interface:
- ✓ 11 kbps, bi-directional, full duplex
- ✓ Support for amplifier control data, meta-data, and remote control commands



Different labels and P/Ns are used to distinguish between TX and RX.

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3 Revision History

Revision	Description of Changes	Date
1.0	Initial Draft	11/12/2015

4 SWA51 Functional Block Diagram and Functional Description

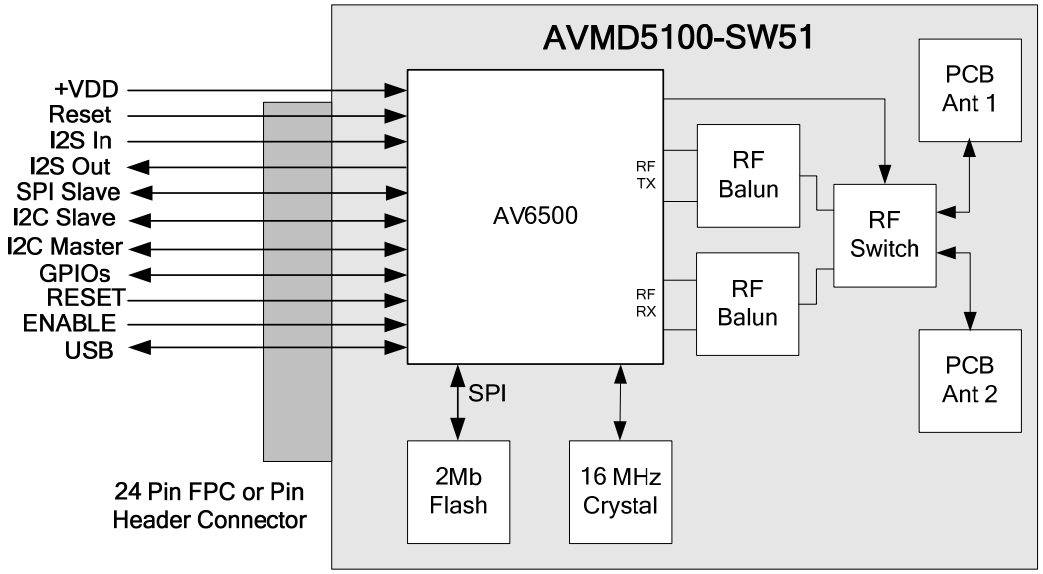


Figure 1: SWA51 Module Block Diagram

The SWA51 module is available in 2 variations; digital input transmitter module or digital output receiver module.

There are three available I2S digital audio data inputs/outputs, each of these can be configured to operate as either a master or a slave - depending on the application, the I2S ports can operate simultaneously as either inputs or outputs. When configured as slaves, the I2S inputs/outputs can be independently clocked by external masters. In addition, MCLK can be output from the module to provide a reference clock source to an external ADC or DAC.

Figure 1 shows the block diagram of the SWA51 module. The hardware for the audio input (transmit) and audio output (receive) versions of the module is identical and only the firmware loaded onto the module determines its function.

The highly integrated nature of the AV5100 transceiver IC results in few external components being required for the SWA51 module design. 2 printed PCB antennas are used to achieve increased range, and to achieve antenna spatial diversity. The simple RF path consists only of the antennas, associated tuning components, shield can, the RF switch and two baluns, one connected to each of the RF input and RF output ports on the AV5100 IC.

A 16MHz crystal oscillator generates the AV5100 fundamental system clock used as the basis for all RF and digital audio clocks.

A 2Mb flash memory chip is used to store the module's application firmware. The AV5100 is able to boot from internal ROM upon first power up, which enables programming the flash chip with the application firmware ~~f~~ through USB. In addition, Over-the-air Firmware upgrade capability can be enabled through the application firmware. The module can be controlled from an external host device via the I2C Slave or the SPI Slave data interfaces. The I2C master port allows the module to control other system audio devices such as a sub-woofer amplifier system without having to add another MCU to the product design. Up to 119 additional GPIOs are available on the SWA51 module (not including I2C and I2S signals) for implementing different UI features on the target application. The resources mentioned above can be leveraged to implement low cost sub-woofer designs as outlined below.

4.1 Typical Sub-Woofer Implementation

A basic AV5100 Wireless Subwoofer system block Diagram is shown in Fig. 2.

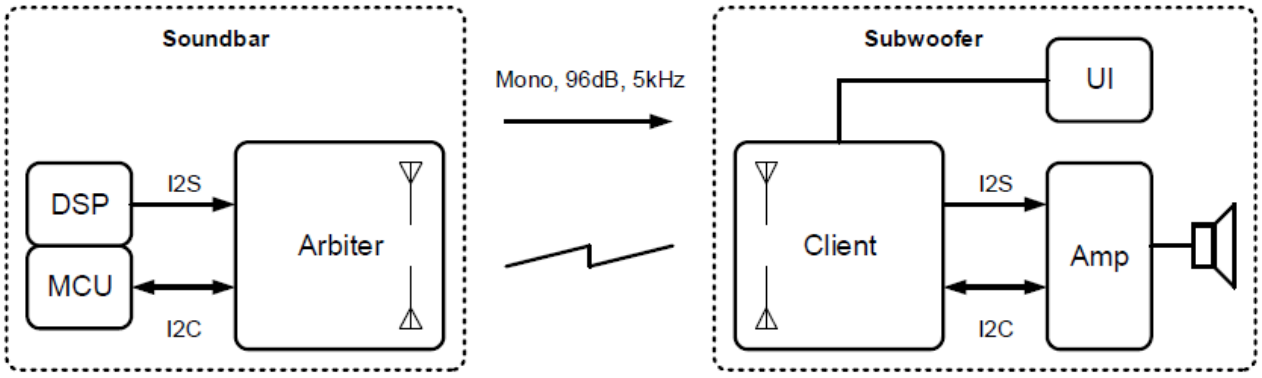


Figure 2: AV5100 Wireless Subwoofer Solution Block Diagram

A simple low cost implementation of sub-woofer design is shown in Figure 3. The sub amplifier consists of a PWM chip plus an output stage device, but no external MCU is required as the SWA51-RX module performs the control function using the I2C master communication port in conjunction with multiple GPIOs. The SWA51 module is configured to accept nominal +3.3V or +5V power from the main application board. An optional reset signal can be supplied to the SWA51-RX module and I2C or SPI slave communication can be used to control the module if required.

Several GPIOs can be used to drive LEDs, or to connect to UI buttons. Typically 2 LEDs may be used and 1 button for pairing purposes. Another button could be used, for example, to implement a “bass enhance” feature. Another GPIO can be used to control the power supply to external system blocks such as the PWM IC and the output stage. The SWA51-RX module can remain powered up during a standby or low power operating mode; however, a true power-down mode can be implemented by configuring pin 17 (GPIO15/ADAT2/CEN) to be used as a chip-enable pin that can be used to power down the AV5100. The SWA51 can also be completely powered down by turning off the main 3.3V supply.

If the wireless link is lost (ex. when the sound bar is powered down), the SWA51_RX module can, after a timeout period, power down the amplifier and output stage sections to conserve power and to help meet Energy Start requirements.

The I2C master port from the SWA51_RX module (pins 5 and 6 on the connector) can communicate, control, and initialize external audio ICs such as the PWM chip in this example. Other GPIOs can be used to detect fault conditions (over temperature etc) and notify the module. The audio is routed from the SWA51-RX module to the amplifier circuit with the I2S output port which can be configured as either a master or a slave as required. MCLK can also be generated from the SWA51-RX module as a -12.28800MHz clock if required.

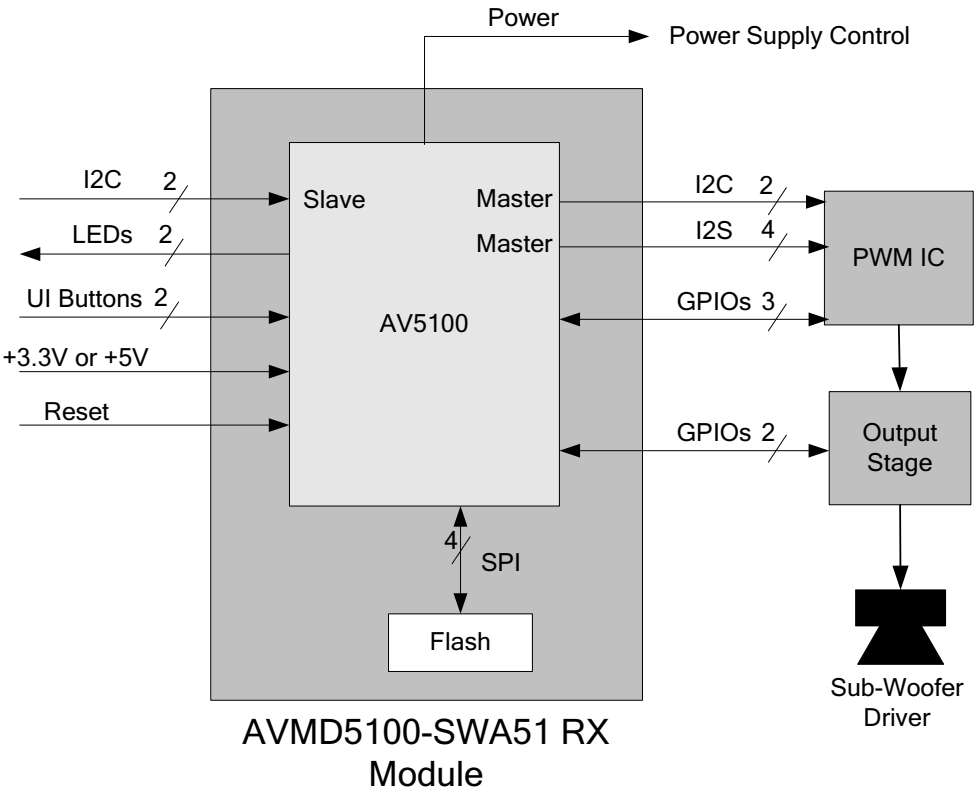


Figure 3: SWA51 Module Simple Sub-Woofer Implementation

4.2 Typical Rear 2.1 Implementation

A basic AV5100 Wireless Rear 2.1 system block Diagram is shown in Fig. 4.

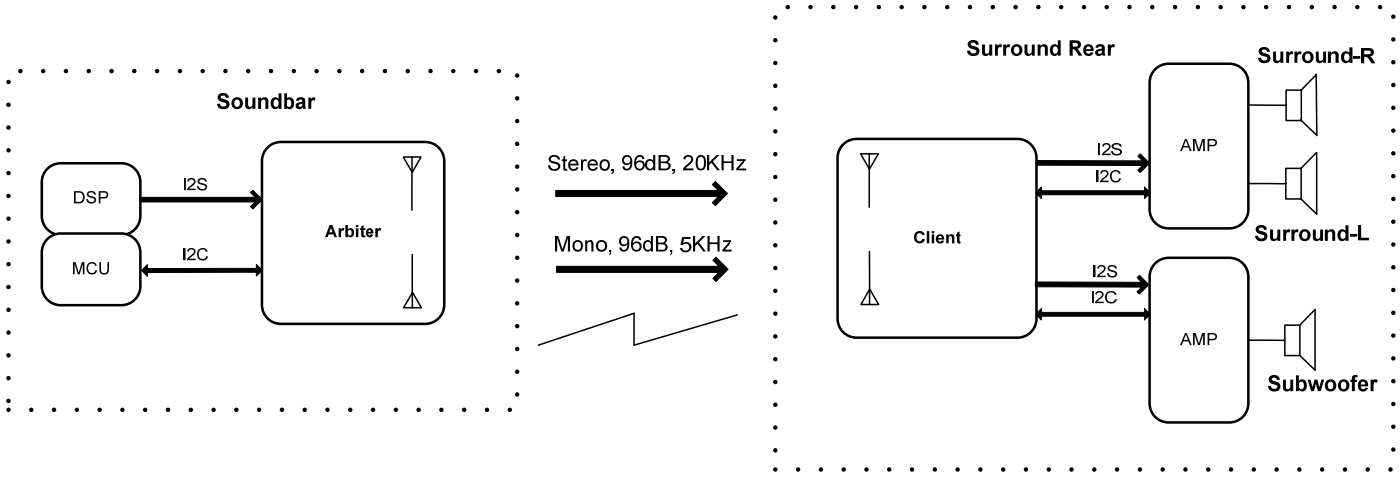


Figure 4: AV5100 Wireless Rear 2.1 Solution Block Diagram

This implementation involves transmitting three channels over the air, one full-band stereo channel (2 x 96dB, 20KHz) used for the rear surround audio, and one mono 96dB, 5KHz channel for subwoofer audio[1]. The hardware implementation on the client side is very similar to the subwoofer implementation, only two PWM

ICs and two audio amplifiers are used; one to drive the mono subwoofer and one to drive to stereo left and right surround speakers. Still, no micro-controller is required; the Av5100 can act as a master controller for the PWM and amplifier ICs via I2C, and as an I2S master with MCLK sourced either internally by the AV5100 or externally from an external clock source. The actual subwoofer and surround speaker drivers can be housed inside the same physical unit, or be housed in separate enclosures with wired connections to the client unit. Fig. 3 still applies to the surround rear 2.1 application, only 2 PWM and output stages are used.

4.3 SWA51 Module Connections and Interfaces

Signal Type	Description
+3.3V Supply	The SWA51 hardware is configured to accept a +3.3V supply
Reset	Active low reset input. This pin is driven from an open collector/drain device such that it can be pulled to ground for the active reset state but, when released, must go to a high impedance state. This pin should not be actively driven high, as the AV5100 internal reset circuit will not operate correctly.
I2S In Port	The I2S input port can be configured as a master or slave. Consequently BCLK and LRCK can be either inputs or outputs. In addition, MCLK can be sourced by the module on pin 16. Since the AV5100 IC contains a sample rate converter, MCLK is not required to be supplied to the module when it is an I2S slave. CMOS 3.3V logic levels are used for all I2S signals.
I2S Out Port	The I2S output port can be configured as a master or slave. Consequently BCLK and LRCK can be either inputs or outputs. In addition, MCLK can be sourced by the module on pin 16. Since the AV5100 IC contains a sample rate converter, MCLK is not required to be supplied to the module when it is an I2S slave. CMOS 3.3V logic levels are used for all I2S signals.
I2C Slave Port	The I2C slave port can be used for external host communication and for module testing. It is assumed that external pull up resistors are connected at the I2C master communicating with the module.
I2C Master Port	The I2C master port is used to communicate with external audio devices such as a sub-woofer amplifier. It is assumed that external pull up resistors are included on the application board.
GPIOs	3.3V CMOS logic level GPIOs available to connect to other devices, or to use as UI supporting GPIOs for LED and button support. All supported GPIOs can be configured as outputs or inputs with configurable pull-ups/pull-downs.

[1] The SSC (Single Side Carrier) modulation scheme used in the SWA51 supports three one-directional full-band channels (96dB, 20 KHz).

5 SWA51 Connector Information

Table 1: SWA51 Connector Information

No	Pin Name	Pin Type	AV65100 Pin	SWA51-TX Pin Description	SWA51-RX Pin Description
1	GPIO2/S_SSB	Digital I/O	12	GPIO or SPI Slave Chip Select	GPIO or SPI Slave Chip Select
2	GPIO3/S_SCLK	Digital I/O	11	GPIO or SPI Slave Serial Clock	GPIO or SPI Slave Serial Clock
3	GPIO4/S_SDA/S_MOSI	Digital I/O	10	GPIO, I2C Slave Serial Data or SPI Slave Data In	GPIO, I2C Slave Serial Data or SPI Slave Data In
4	GPIO5/S_SCL/S_MISO	Digital I/O	9	GPIO, I2C Slave Serial Clock or SPI Slave Data Out	GPIO, I2C Slave Serial Clock or SPI Slave Data Out
5	GPIO16/M_SDA	Digital I/O	4	GPIO, I2C Master Serial Data	GPIO, I2C Master Serial Data
6	GPIO17/M_SCL	Digital I/O	3	GPIO, I2C Master Serial Clock	GPIO, I2C Master Serial Clock
7	GPIO20/LINK_LED	Digital I/O	56	GPIO, or LINK_LED Output	GPIO, or LINK_LED Output
8	GPIO21/PAIR	Digital I/O	55	GPIO, or input from PAIR Button	GPIO, or input from PAIR Button
9	GPIO18/BCLK1	Digital I/O	2	GPIO or I2S Port 1 Bit Clock	GPIO or I2S Port 1 Bit Clock
10	GPIO19/WCLK1	Digital I/O	1	GPIO or I2S Port 1 Word Clock	GPIO or I2S Port 1 Word Clock
11	GPIO10/MCLK	Digital I/O	53	GPIO or Master Clock Out	GPIO or Master Clock Out
12	GND	GND	Paddle (57)	GND	GND
13	GPIO11/BCLK0	Digital I/O	52	GPIO or I2S Port 0 Bit Clock	GPIO or I2S Port 0 Bit Clock
14	GPIO12/WCLK0	Digital I/O	51	GPIO or I2S Port 0 Word Clock	GPIO or I2S Port 0 Word Clock
15	GPIO13/ADAT0	Digital I/O	50	GPIO or I2S Port 0 Audio Data	GPIO or I2S Port 0 Audio Data
16	GPIO14/ADAT1	Digital I/O	49	GPIO or I2S Port 1 Audio Data	GPIO or I2S Port 1 Audio Data
17	GPIO15/ADAT2/CEN	Digital I/O or Digital Input	48 or 38	GPIO, I2S Port 2 Audio Data or chip enable (1)	GPIO, I2S Port 2 Audio Data or chip enable (1)

18	GPIO22/D+	Digital I/O	47 or 43	GPIO or USB Data Plus (2)	GPIO or USB Data Plus (2)
19	GPIO23/D-	Digital I/O	46 or 42	GPIO or USB Data Minus (2)	GPIO or USB Data Minus (2)
20	GPIO24	Digital I/O	41	GPIO (3)	GPIO (3)
21	RESETN_EXT	Digital Input	37	RESET signal active low (4)	RESET signal active low (4)
22	GND	GND	Paddle (57)	GND	GND
23	VDD	Supply Input	31, 45, 54	+3.3V input supply voltage	+3.3V input supply voltage
24	VDD	Supply Input	31, 45, 54	+3.3V input supply voltage	+3.3V input supply voltage

Notes:

(1) Pin 17 is hardware configured as GPIO15/ADAT2 by default; utilizing this pin as a CEN requires a different stuffing option.

(2) Utilizing pins 18 and 19 as USB D+ and D- requires the firmware to Tri-state GPIOs 22 and 23.

(3) Pin 20 (GPIO24) can be utilized to implement a “Data Waiting” interrupt signal for I2C and SPI Slave data communication.

(4) Pin 21 (RESET_EXT) can be pulled to GND with a switch or an open drain/collector type device to provide a hard reset signal to the AV5100. This pin is pulled up to VDDIO (3.3V) internally in the AV5100 and should not be actively driven high.

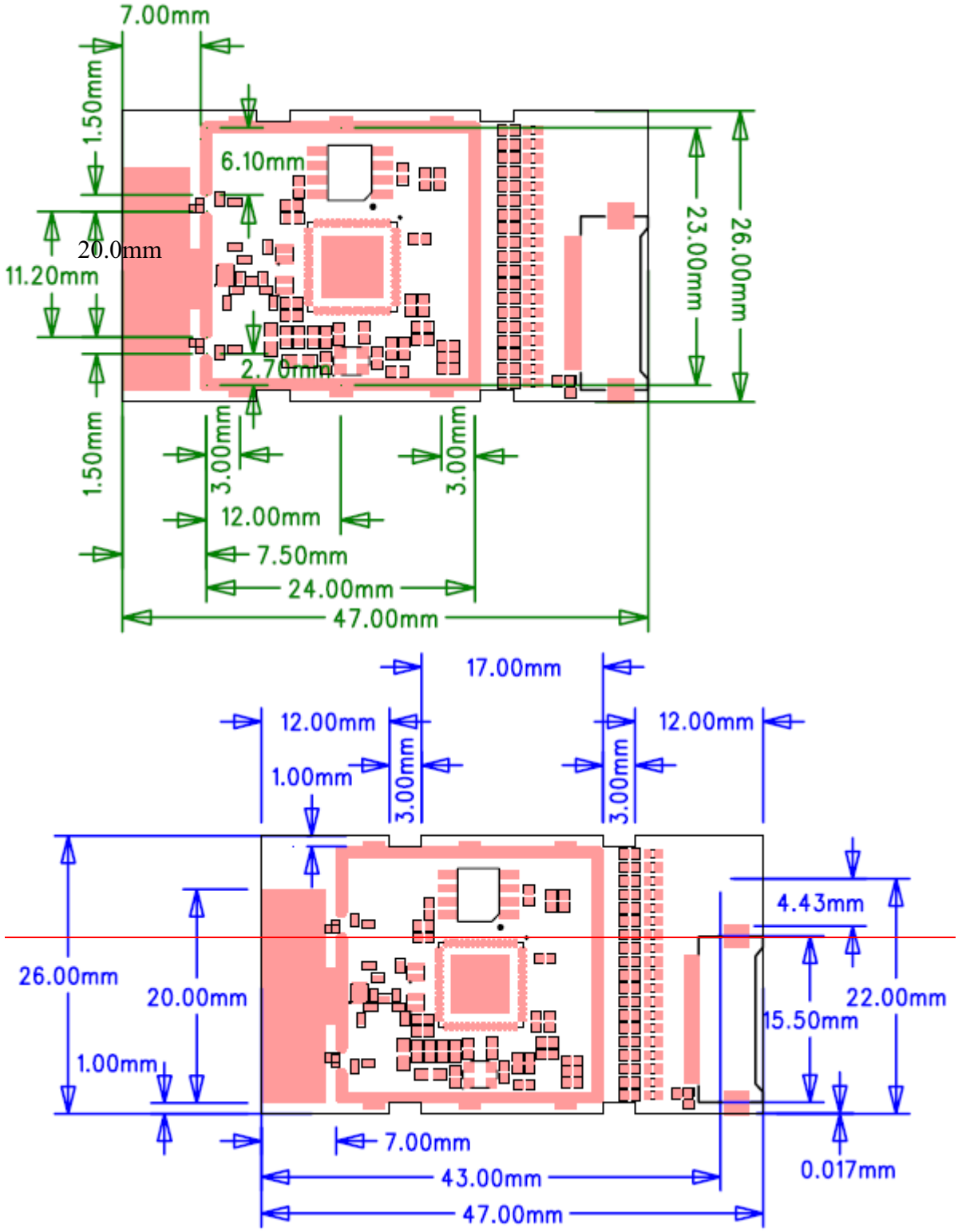


Figure 4 – SWA51 Module Outline and Mechanical Dimensions

- PCB thickness is 1.0mm
- The top of shield is 2.4mm above PCB
- The maximum height from the bottom of the PCB to the top of the shield can is 3.4mm.

6 Electrical, Audio and Timing Specifications

6.1 Absolute Maximum Ratings

Absolute Maximum Ratings (AMR) are stress ratings only. AMR corresponds to the maximum value that can be applied without leading to instantaneous or very short-term unrecoverable hard failure (destructive breakdown). Stresses beyond those listed under AMR may cause permanent damage to the device.

Functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Range” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may adversely affect device reliability.

Device functional operating limits and guaranteed performance specifications are given under Electrical Characteristics at the test conditions specified.

CONDITION	MIN	MAX
+3.3V Supply Voltage Input	-0.3V	4.0V
Input Voltage Range – Digital Inputs	-0.3V	3.6V
Input Voltage Range – Analog Inputs	-0.3V	3.6V
Operating Temperature	-40 ºC	+85 ºC
Storage Temperature	-40 ºC	+100 ºC
Static Discharge Voltage[1]	2KV	----

Notes:

1) HBM = ESD Human Body Model; C = 100pF, R = 1kΩ

6.2 Recommended Operating Range

PARAMETER	MIN	TYP	MAX	UNIT
VDD, +3.3V Supply pin voltage	3.135	3.3	3.465	V
Ambient Temperature (T_A)	0		70	ºC
RESET pin hold time	10			msec
Power Supply Rise Time (to 3.0V)	0		10	msec

6.3 Electrical Characteristics – DC Characteristics

Operating Conditions: VDD = 3.135 to 3.465V, TA = 0°C to +70 °C, RF Freq = 5150-5250, 5725-5850MHz, measured relative to the RF balun single-ended I/O. Typical specifications at TA = 25°C, VDD = 3.3V

3.3V.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Current (IVDDA)	Shutdown (chip disabled)		TBD	1	uA
	Standby (also USB suspend)		TBD	2.5	mA
	RX mode (continuous RX)		TBD		mA
	TX mode (continuous TX); pout=+3dBm		TBD		mA
CMOS I/O Logic Levels – 3.3V I/O					
Input Voltage Logic Low, VIL				0.6	V

Input Voltage Logic High, VIH		VDDIO -0.6			V
Output Voltage Logic Low, VOL				0.3	V
Output Voltage Logic High, VOH		VDDIO -0.3			V

6.4 Electrical Characteristics – RF PLL Characteristics

Operating Conditions: VDD = 3.135 to 3.465V, TA = 0°C to +70 °C, RF Freq = 5150-5250, 5725-5850MHz, measured relative to the RF balun single-ended I/O. Typical specifications at TA = 25°C, VDD = 3.3V

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
RF Channel Frequency Range	Lower band Upper band	5150 5725		5250 5850	MHz MHz
RF Channel frequency resolution (raster)			1		MHz
RF I/O Impedance	Balanced I/O port; TX and RX RF ports		100		ohm
Crystal Oscillator Frequency	External crystal		16		MHz
Crystal Accuracy Requirement	External XTAL, -20°C to +70 °C			+/-20	ppm

6.5 Electrical Characteristics – RF RX Characteristics

Operating Conditions: VDD = 3.135 to 3.465V, TA = 0°C to +70 °C, RF Freq = 5150-5250, 5725-5850MHz, measured relative to the RF balun single-ended I/O. Typical specifications at TA = 25°C, VDD = 3.3V

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
RF Channel Frequency Range	Lower band Upper band	5150 5725		5250 5850	MHz MHz
RF I/O Impedance	Balanced I/O port; TX and RX RF ports		100		ohm
RX Sensitivity	SSC (single sub-carrier) DSC (dual sub-carrier)		-89 -86		dBm dBm
Max input signal	LNA = low gain mode, min IF gain		-5		dBm
Out-of-band blocker level	<5150 MHz, >5850 MHz 2400-2483.5 MHz		-45 -20		dBm dBm
Spurious RF outputs	5150-5850 MHz <5150 MHz >5850 MHz		-55 -63 -63		dBm dBm dBm

6.6 Electrical Characteristics – RF TX Characteristics

Operating Conditions: VDD = 3.135 to 3.465V, TA = 0°C to +70 °C, RF Freq = 5150-5250, 5725-5850MHz, measured relative to the RF balun single-ended I/O. Typical specifications at TA = 25°C, VDD = 3.3V

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
RF Channel Frequency Range	Lower band Upper band	5150 5725		5250 5850	MHz MHz
RF I/O Impedance	Balanced I/O port; TX and RX RF ports		100		ohm
TX Output power	SSC (single sub-carrier) DSC (dual sub-carrier)		3 (1) 0		dBm dBm

Adjacent Channel Power (SSB)	Pout = +3dBm Upper Adjacent: +1.5 to +3 MHz offset Upper Alternate: +3 to +4.5 MHz offset Lower Adjacent: -1.5 to -3 MHz offset Lower Alternate: -3 to -4.5 MHz offset		 TBD TBD TBD TBD		 dBc dBc dBc dBc
LO leakage			-20		dBc
Output harmonics	Pout = +3dBm 2nd harmonic 3rd harmonic		 TBD TBD		 dBm dBm
Out-of-band spurious	RF < 5150MHz, > 5850MHz		TBD		dBm

(1) Measured at the worst performing frequency

6.7 Electrical Characteristics – Audio C/CS

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Response (-3dB)	16 bit audio, 11KSps over-the-air sample rate	20		5K	Hz
	16 bit audio, 14.8KSps over-the-air sample rate	20		6.5K	Hz
	16 bit audio, 22KSps over-the-air sample rate	20		10K	Hz
	16 bit audio, 29.6KSps over-the-air sample rate	20		13K	Hz
	16 bit audio, 44KSps over-the-air sample rate	20		20K	Hz
Gain Flatness	0dB Input / Output Gain		±0.2		dB
SNR	I2S Input / Output	93 (1)			dB
THD+N			94		dB

Notes

1. 16bit audio, all OTA sample rates. OTA 12-bit path for voice is possible, but will limit the SNR to 72dB.

6.8 AV5100 Rate Converter Characteristics

SRC Block	Input Rates	Output Rates	SNR (dB)	SRC BW (-3dB)
SRC 0 (Audio)	I2S 32-96K USB 8k – 48K, ECU (TX) “11K” “14.8k” “22k” “29.6k” “44k”	I2S Master: 48k Slave: 44.1K-96K ECU (TX) “11K” “14.8k” “22k” “29.6k” “44k”	All rates support 16bit, >93dB	Actual bandwidth is dependent on the lower of the input or output rates. Output BW vs OTA “11k” = 5kHz “14.8k” = 6.5kHz “22k” = 10kHz “29.6k” = 13kHz “44k” = 20kHz
SRC 1 (LFE)	I2S 32-96K	I2S Master: 48k	All rates support	Actual bandwidth is

	USB 8k – 48K, ECU (TX) “11K” “14.8k” “22k” “29.6k” “44k”	Slave: 44.1K-96K ECU (TX) “11K” “14.8k” “22k” “29.6k” “44k”	16bit, >93dB	dependent on the lower of the input or output rates. Output BW vs OTA “11k” = 5kHz “14.8k” = 6.5kHz “22k” = 10kHz “29.6k” = 13kHz “44k” = 20kHz
SRC 2 (Voice)	I2S 32-96K USB 8k – 48K, ECU (TX) “14.8k”	I2S Master: 48k Slave: 44.1K-96K USB 8k – 48K, ECU (RX) “14.8k”	All rates support 16bit, >93dB, but the OTA 12bit path will limit SNR to 72dB	Actual bandwidth is dependent on the lower of the input or output rates. Output BW vs OTA “11k” = 5kHz “14.8k” = 6.5kHz “22k” = 10kHz “29.6k” = 13kHz “44k” = 20kHz

6.9 I²S Communication Interface Timing

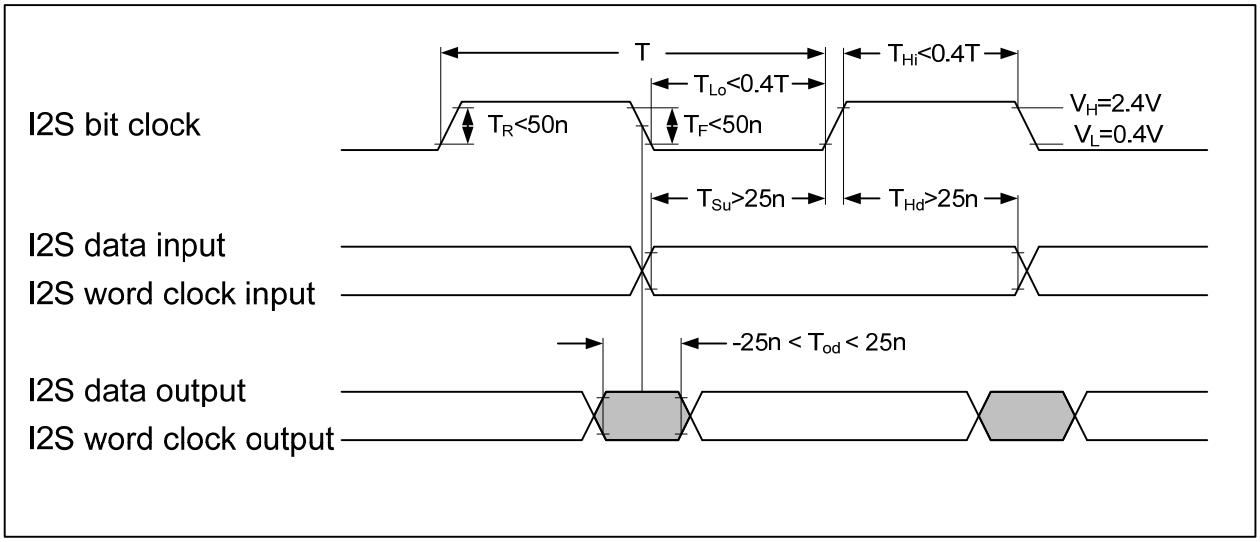
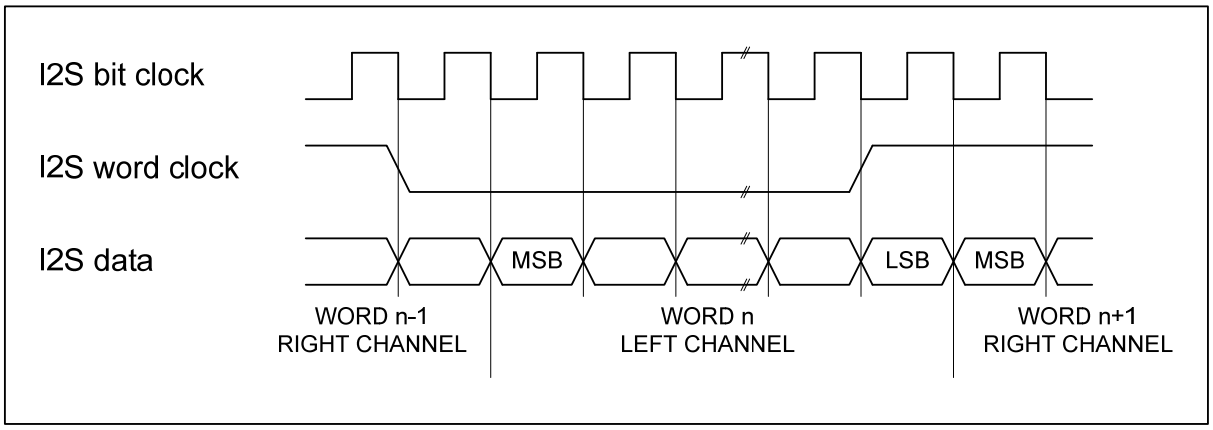


Table 2: SWA51 I2S Timing

		MIN	TYP	MAX	UNIT	NOTES
V_L	low voltage level	-0.3V	0.0V	0.4V	V	
V_H	high voltage level	2.4V	3.3V	3.6V	V	
T	clock period		325.5n		s	1/3.072MHz
T_{Lo}	clock low period	0.4T		0.6T		
T_{Hi}	clock high period	0.4T		0.6T		
T_R	rise time			50n	s	Note 1
T_F	fall time			50n	s	Note 1
T_{Su}	setup time	25n			s	
T_{Hd}	hold time	25n			s	
T_{Od}	output delay	-25n		25n	s	
	bit clocks/word clock		64			

I2S protocol is “I2S Justified” as shown below.



Note 1: The timing specified for the rise and fall times represents the edge rates on the module itself. The rise and fall times of the I2S signals are determined by ESD/EMI mitigation components on the modules, as well as external loading, and will be higher than the specified numbers

6.10 I2C Master/Slave Communication Interface Timing (S_SCL, S_SDA)

The SWA51 has both I2C slave and master interfaces available with their respective pins S_SCL, S_SDA and M_SCL, M_SDA. The interfaces operate in I2C fast-mode and can receive and transmit at up to 400 kbit/s.

Bytes are 8 bits long and are transferred with the most significant bit (MSB) first. Each byte has to be followed by an acknowledge bit. The SWA51 will apply clock-stopping (by holding the clock line S_SCL LOW to force the master into a wait state) if necessary due to internal high-priority tasks.

The slave/master interface can be used both for writing (e.g. sending commands) or reading (e.g. requesting status). An additional GPIO pin on the SWA51 (Ex. GPIO24), can be used to notify the I2C master when a pending message is ready to be sent.

The SWA51 slave interface responds to the 7-bit slave address 1000000 (0x40) as shown in Figure 1 below.

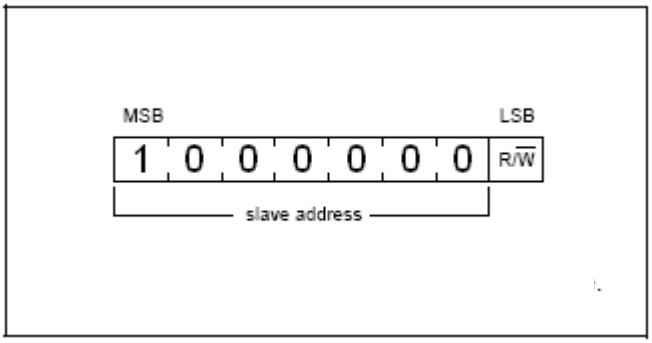


Figure 5: First Byte after the START Procedure

ELECTRICAL SPECIFICATIONS AND TIMING

Table 3: Characteristics of the S_SDA and S_SCL I/Os

PARAMETER	SYMBOL	FAST-MODE		UNIT
		MIN.	MAX.	
LOW level input voltage	VIL	0.3	0.8	V
HIGH level input voltage	VIH	2.0	3.6	V
LOW level output voltage (open drain or open collector) at 1 mA sink current:	VOL	0	0.4	V
Output fall time from VIHmin to VILmax with a bus capacitance from 10 pF to 400 pF	tof	0	250	ns

Pulse width of spikes which must be suppressed by the input filter	tSP	0	50	ns
S_SCL clock frequency	fSCL	0	400	kHz
LOW period of the S_SCL clock	tLOW	1.3	–	s
HIGH period of the S_SCL clock	tHIGH	0.6	–	s
Data hold time	tHD;DAT	100	–	ns
Data set-up time	tSU;DAT	100	–	ns

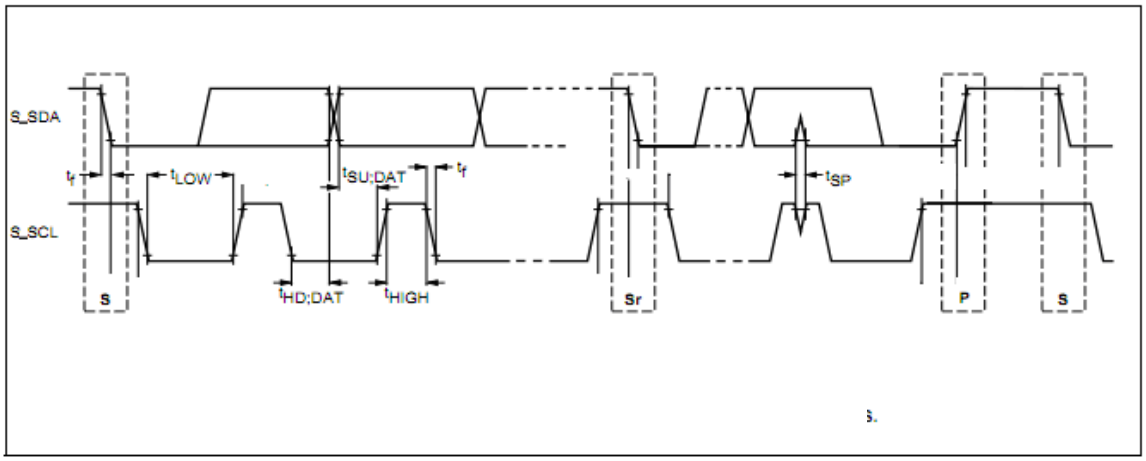


Figure 6: Definition of Timing for F/S-Mode Devices on the I^2C-Bus

7 FCC and Industry Canada certification information

7.1 Federal Communication Commission Interference Statement

FOR MOBILE DEVICE USAGE (>20cm/low power)

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as **2** conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

FOR MOBILE DEVICE USAGE (>20cm/low power)

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID: **QWO-SWA51**”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.
The end user manual shall include all required regulatory information/warning as show in this manual.

This device 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.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as **2** conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID: QWO-SWA51”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

7.2 Industry Canada statement:

This device complies with RSS-247 of the Industry Canada 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.

Ce dispositif est conforme à la norme CNR-247 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Caution :

(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;

(ii) the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits specified for point-to-point and non-point-to-point operation as appropriate; and

(iii) Users should also be advised that high-power radars are allocated as primary users (i.e. priority users) of the bands 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

Avertissement:

(i) les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;

(ii) le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5725 à 5 850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée pour l'exploitation point à point et l'exploitation non point à point, selon le cas;

(iii) De plus, les utilisateurs devraient aussi être avisés que les utilisateurs de radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) pour les bandes 5650-5850 MHz et que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs LAN-EL.

FOR MOBILE DEVICE USAGE (>20cm/low power)

Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

This device is intended only for OEM integrators under the following conditions: (For module device use)

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and 2) the transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

1) L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et 2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 2 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling FOR MOBILE DEVICE USAGE (>20cm/low power)

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains IC: ”.

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: ".

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

8 Ordering Information

Table 4: SWA51 Module Ordering Information

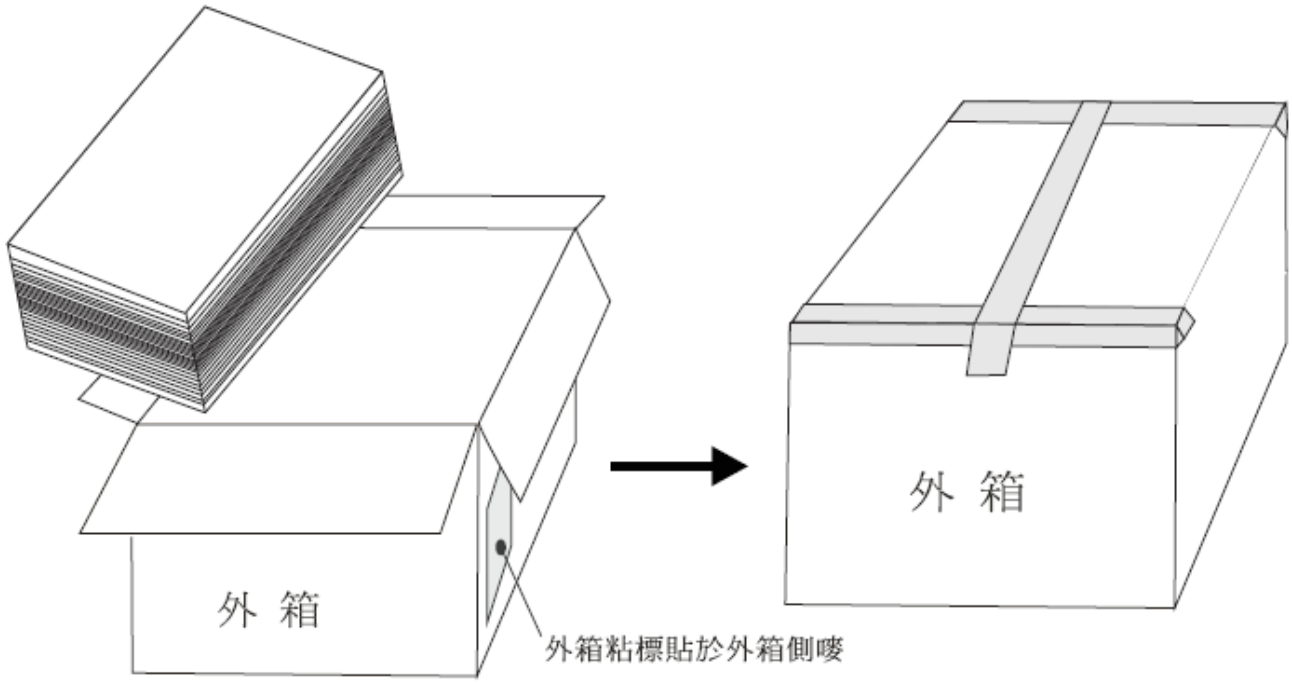
Module Part Number	Option Code	Description
SWA51 TX	-TX	Digital Input , FPC Connector, integrated printed PCB antennas
SWA51 RX	-RX	Digital Output, FPC Connector, integrated printed PCB antennas

9 Label/Carton/Packing information

9.1 Module Label Drawing

9.2 Carton Label Drawing

25托盘入外箱，1200PCS/箱

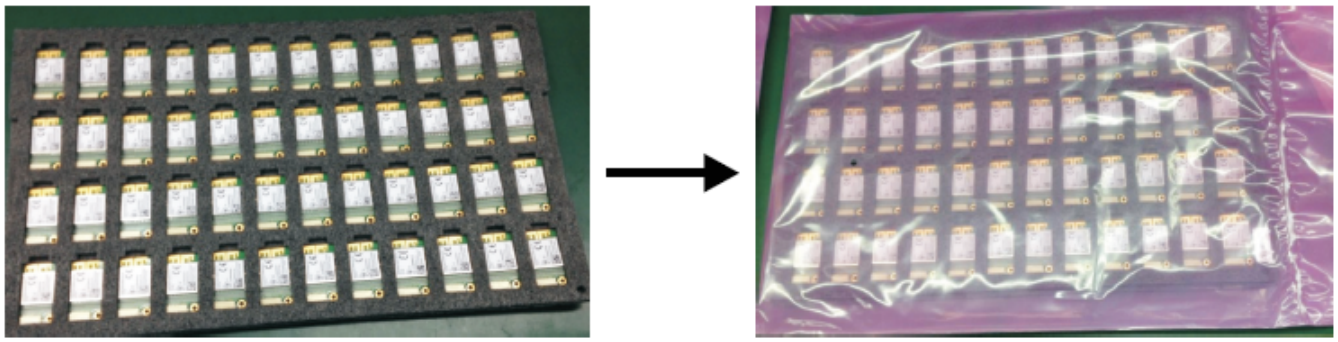


9.3 Module weight

SWA51 module weight is 5.3g

9.4 Packing information

2.托盘装48PCS,贴托盘贴纸， 入粉色静电袋



25托盘入外箱，1200PCS/箱