

# Wireless Audio Module

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## AVMD7520-SWA2 Datasheet

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**Customer P/N:** N/A

**Avnera Model:** AVMD7520-SWA2

**WNC P/N:** 55SWA201.SG1

**Description:** Wireless Audio Module



# AVMD7520-SWA2

+15dBm, U.FL connector, 4 channel digital I/O

Wireless HD Audio Module Solution

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## General Description

The AVMD7520-SWA2 module is a complete radio module solution containing all the necessary HW and FW to provide a system-integration-ready, multichannel wireless HD audio solution compatible with the AM2G and AAL wireless audio system.

The module is comprised of an AV7520 IC combined with RF front-end circuits (RF PA + balun + filter + RF switch), flash memory, crystal, and passive components. It is an FCC modular certified solution with RF connectors for connection to external antennas. The module also provides a convenient set of digital I/O interfaces for digital audio through an I2S port, host MCU control through an SPI or I2C interface and optional GPIO for various control and indicator functions.

The module is a card slot style using the 36 pin PCIe card edge pin arrangement to save space and cost in connecting to a main system board.

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## Features

- ✓ Complete, Integrated Wireless Module
  - AV7520 IC
  - Complete RF front-end
  - Single +5V supply voltage connection
- ✓ High Performance Audio and RF solution
  - Supports 16 bit, 48kHz up to 24 bit, 96kHz digital audio formats
  - 120dB SNR Audio Path
  - Fixed Low Latency solution
  - +15dBm transmit RF output power
  - -82dBm receive RF sensitivity
  - Support for 30m/150m range NLOS/LOS
- ✓ Digital interfaces and Audio
  - 4 channel digital audio I/O (2 stereo I2S ports)
    - Configurable as inputs or outputs
  - Stereo audio DAC output
  - 4-wire SPI slave interface or 2-wire I2C-compatible communication with the host MCU
- ✓ Package and connections
  - Compact size (30mm x 50mm)
  - 36 pin (2x18) PCIe style card slot edge connector
  - Dual U.FL RF outputs for diversity antenna support

## Revision History

Revision	Change Summary	Release Date
0.9	Preliminary release for Avnera internal review	Nov, 2010

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# 1 AVMD7520-SWA2 PIN CONFIGURATION

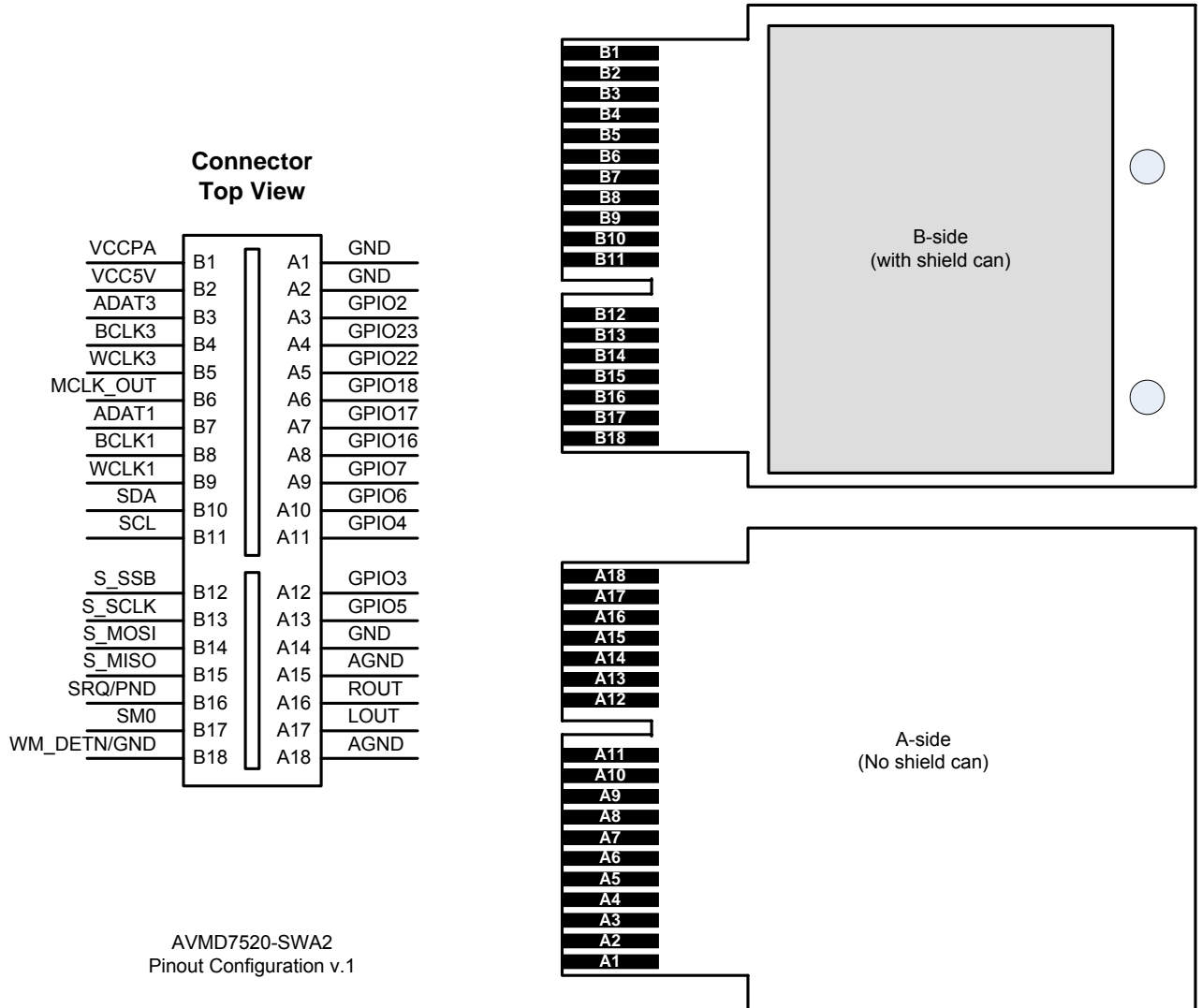


Figure 1-1 – AVMD7520-SWA2 module pin configuration

Table 1-1 AVMD7520-SWA2 Pin Description

#	Pin Name	Pin Type	Description
A1	GND	Analog	Module ground
A2	GND	Analog	Module ground
A3	GPIO2	Digital I/O	GPIO #2 – See Note
A4	GPIO23	Digital I/O	GPIO #23
A5	GPIO22	Digital I/O	GPIO #22
A6	GPIO18	Digital I/O	GPIO #18
A7	GPIO17	Digital I/O	GPIO #17
A8	GPIO16	Digital I/O	GPIO #16
A9	GPIO7	Digital I/O	GPIO #7
A10	GPIO6	Digital I/O	GPIO #6
A11	GPIO4	Digital I/O	GPIO #4
A12	GPIO3	Digital I/O	GPIO #3
A13	GPIO5	Digital I/O	GPIO #5
A14	GND	Ground	Module ground -- See Note
A15	AGND	Analog	Audio DAC ground; do not connect to module or system board ground
A16	ROUT	Analog	Audio DAC right channel output
A17	LOUT	Analog	Audio DAC left channel output
A18	AGND	Analog	Audio DAC ground; do not connect to module or system board ground
B1	VCCPA	Analog	+5V supply voltage input for the RF power amplifier
B2	VCC5V	Analog	+5V supply voltage input for the module
B3	ADAT3	Digital I/O	I2S Audio Data for AV75xx I2S I/O Port # 3
B4	BCLK3	Digital I/O	I2S Bit Clock for AV75xx I2S I/O Port # 3
B5	WCLK3	Digital I/O	I2S Word Clock for AV75xx I2S I/O Port # 3
B6	MCLK_OUT	Digital Output	MCLK for I2S audio data
B7	ADAT1	Digital I/O	I2S Audio Data for AV75xx I2S I/O Port # 1
B8	BCLK1	Digital I/O	I2S Bit Clock for AV75xx I2S I/O Port # 1
B9	WCLK1	Digital I/O	I2S Word Clock for AV75xx I2S I/O Port # 1
B10	SDA	Digital I/O	I2C compatible serial data I/O
B11	SCL	Digital I/O	I2C compatible serial clock I/O
B12	S_SSB	Digital I/O	SPI Slave – Slave Select (active low)
B13	S_SCLK	Digital I/O	SPI Slave – Serial Clock
B14	S_MOSI	Digital I/O	SPI Slave – Master Out / Slave In
B15	S_MISO	Digital I/O	SPI Slave – Master In / Slave Out
B16	SRQ/PND	Digital Output	Notification signal to host (pending notification)
B17	SM0	Digital Input	Serial MUX control (for flash programming) and module reset (active low)
B18	WM_DET / GND	Digital output	Wireless module detect (low signal to indicate module is inserted in product) (This pin is internally connected to “Module ground” pins A1, A2, & A14)

Note: The GPIO2 module pin assignment is different from that used on the AVMD7520-SWA1 and AVMD7540-SWA4 modules, which assign GPIO2 to Pin A14

## 2 ELECTRICAL SPECIFICATIONS

### 2.1 Absolute Maximum Ratings

The Absolute Maximum Rating (AMR) corresponds to the maximum value that can be applied without leading to instantaneous or very short-term unrecoverable hard failure (destructive breakdown). Absolute Maximum Ratings are stress ratings only. Permanent damage to the device may be caused by continuously operating at or beyond these limits. Device functional operating limits and guaranteed performance specifications are given under Electrical Characteristics and for the test conditions specified.

**Table 2-1 AVMD7520-SWA2 Absolute Maximum Ratings**

CONDITION	MIN	MAX	Units
Supply (relative to GND)			
+5V supply voltage range (VCCPA and VCC5V pins)	-0.3	6.0	V
Input Voltage Range – Digital Inputs	-0.3	3.6V	V
Short circuit to GND (any pin)	---	continuous	
Storage Temperature	-20	+85	°C
ESD Voltage Rating – Human Body Model test		2000	V

### 2.2 DC Electrical Characteristics

Operating Conditions: VCC = 5.0V ±10%, T<sub>A</sub>=0°C to +50 °C; RF Chan. Freq = 2412MHz to 2462MHz. All specifications are referenced to the AVMD7520-SWA2 edge connector pins and RF connectors, unless otherwise specified. "Typical" specifications use VCC = 5.0V and T<sub>A</sub>=25 °C.

**Table 2-2 AVMD7520-SWA2 DC Electrical Characteristics**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input supply voltage	Driven by an external regulator	4.5		5.5	V
Supply Current – +5V supply (Note 1)	RESET		6		mA
	OTA-RX mode, 2 output channels via I2S		126		mA
	OTA-TX mode, 2 input channels via I2S		160		mA
	FCC_TX (Pout = +15dBm)		425		mA
	RX_search		220		mA
<b>CMOS I/O Logic Levels – 3.3V I/O</b>					
Input Voltage Logic Low, V <sub>IL</sub>	V <sub>VDC33</sub> = 3.3V			0.6	V
Input Voltage Logic High, V <sub>IH</sub>	V <sub>VDC33</sub> = 3.3V	2.0			V
Output Voltage Logic Low, V <sub>OL</sub>	V <sub>VDC33</sub> = 3.3V; I <sub>LOAD</sub> =1mA			0.4	V
Output Voltage Logic High, V <sub>OH</sub>	V <sub>VDC33</sub> = 3.3V; I <sub>LOAD</sub> =1mA	2.9			V

**Note 1:** The operating states are defined as follows:

RESET: The AVMD7520-SWA2 is held in RESET by holding the SM0 input LOW

OTA-RX mode: The AVMD7520-SWA2 is operating in an Over-The-Air (OTA) link as a Client node, receiving 2 channels of 16bit, 48 kHz audio

OTA-TX mode: The AVMD7520-SWA2 is operating in an OTA link as an Arbiter node, transmitting 2 channels of 16bit 48 kHz audio

FCC\_TX mode: The AVMD7520-SWA2 is operating in the diagnostic "FCC\_TX" mode

RX\_search mode: The AVMD7520-SWA2 is configured as a Client and is powered ON but not operating in a link (in which case it will be in continuous RX search mode)

## 2.3 Electrical Characteristics – RF Receiver

Operating Conditions: VCC = 5.0V  $\pm$ 10%, T<sub>A</sub>=0°C to +50 °C; RF Chan. Freq = 2412MHz to 2462MHz. All specifications are referenced to the AVMD7520-SWA2 edge connector pins and RF connectors, unless otherwise specified. “Typical” specifications use VCC = 5.0V and T<sub>A</sub>=25 °C.

**Table 2-3 AVMD7520-SWA2 Electrical Characteristics – RF Receiver**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
RF Channel Frequency Range		2412		2462	MHz
Sensitivity (Note 1)	T <sub>A</sub> =25°C		-82		dBm
Maximum Input Signal (Note 1)			-5		dBm
Spurious RF outputs	2400-2483.5 MHz			-47	dBm
	<2400 MHz			-60	dBm
	>2483.5 MHz			-60	dBm
LO leakage	Measured at the 2412 MHz, 2438 MHz, and 2462 MHz channel center frequencies			-47	dBm

**Note 1:** Sensitivity and Maximum Input Signal levels are defined as the input power at the onset of 1% BLER (Block Error Rate).

## 2.4 Electrical Characteristics – RF Transmitter

Operating Conditions: VCC = 5.0V  $\pm$ 10%, T<sub>A</sub>=0°C to +50 °C; RF Chan. Freq = 2412MHz to 2462MHz. All specifications are referenced to the AVMD7520-SWA2 edge connector pins and RF connectors, unless otherwise specified. “Typical” specifications use VCC = 5.0V and T<sub>A</sub>=25 °C.

**Table 2-4 AVMD7520-SWA2 Electrical Characteristics – RF Transmitter**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
RF Channel Frequency Range		2412		2462	MHz
Output Power (Note 1)	T <sub>A</sub> =25°C, OFDM signal, 16MHz channel BW		+15		dBm
Harmonics (Note 2)	2 <sup>nd</sup> harmonic			-50	dBm
	3 <sup>rd</sup> harmonic			-55	dBm
Conducted RF Spurious signals (Note 2)	< 2390MHz; RBW=1MHz			-45	dBm
	> 2483.5MHz; RBW=1MHz			-45	dBm
Radiated Spurious RF signals (Note 3)	30-88MHz,		34		dBuV/m
	88-216MHz		37		dBuV/m
	216-960MHz		40		dBuV/m
	>960MHz		48		dBuV/m

**Note 1:** Output power is the average transmitter output power in a 16MHz bandwidth centered on the channel, measured at the U.FL connector with the port terminated into a load of 50 ohms at the frequency of interest. The stated specification refers to the maximum level measured at *either* antenna port.

**Note 2:** Harmonic and Conducted RF Spurious Signal power are measured at the U.FL connector, with the port terminated into a load of 50 ohms at the frequency of interest. The stated specification refers to the maximum level measured at *either* antenna port.

**Note 3:** Radiated Spurious RF Signal strength is the radiated power measured in a calibrated chamber, with the module antenna ports connected to dipole antennas having +2dBi (nominal) gain. The stated specification refers to the level measured from *either* antenna port.

## 2.5 Electrical Characteristics – RF Channel Frequency

Operating Conditions: VCC = 5.0V ±10%, T<sub>A</sub>=0°C to +50 °C; RF Chan. Freq = see below. All specifications are referenced to the AVMD7520-SWA2 edge connector pins and RF connectors, unless otherwise specified. “Typical” specifications use VCC = 5.0V and T<sub>A</sub>=25 °C.

**Table 2-5 AVMD7520-SWA2 Electrical Characteristics – RF Channel Frequencies**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Channel Center Frequency	AM2G system Channel 1		2412		MHz
	AM2G system Channel 2		2438		MHz
	AM2G system Channel 3		2462		MHz
Frequency Error	16MHz crystal			+/- 20	ppm

## 2.6 Electrical Characteristics – End-to-end Audio Characteristics

### 2.6.1 I2S Paths

Operating Conditions: VCC = 5.0V ±10%, T<sub>A</sub>=0°C to +50 °C; RF Chan. Freq = 2412MHz to 2462MHz. All specifications are referenced to the AVMD7520-SWA2 edge connector pins and RF connectors, unless otherwise specified. “Typical” specifications use VCC = 5.0V and T<sub>A</sub>=25 °C.

**Table 2-6 AVMD7520-SWA2 Electrical Characteristics – End-to-end I2S Channel Audio Characteristics**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
End-to-end SNR	I2S in to I2S out, no interference;				
	16bit / 48kHz mode	96			dB
	24bit / 48kHz mode	120			dB
	16bit / 96kHz mode	97			dB
Latency	24bit / 96kHz mode	120			dB
	48kHz, interleaving level = 0			11	ms
	48kHz, interleaving level = 1			15	ms
	48kHz, interleaving level = 2			19	ms
	96kHz, interleaving level = 0			9.5	ms
	96kHz, interleaving level = 1			13.5	ms
Bandwidth	96kHz, interleaving level = 2			17.5	ms
	+/-0.5dB flatness, 48Khz modes	20		20k	Hz
	+/-0.5dB flatness, 96Khz modes	20		40k	Hz

### 2.6.2 Audio DAC Path

Operating Conditions: VCC = 5.0V ±10%, T<sub>A</sub>=0°C to +50 °C; RF Chan. Freq = 2412MHz to 2462MHz. All specifications are referenced to the AVMD7520-SWA2 edge connector pins and RF connectors, unless otherwise specified. Measurements use a 24bit, 96kHz digital I2S audio input on the sending side. “Typical” specifications use VCC = 5.0V and T<sub>A</sub>=25 °C.

**Table 2-7 AVMD7520-SWA2 Electrical Characteristics – Analog Audio (DAC) Characteristics**

PARAMETER	CONDITIONS (See Note)	MIN	TYP	MAX	UNITS
THD+N	0 dBFS		-88		dB
Dynamic range	fs = 48 kHz (-60 dBFS, A-weighted)		99		dB
	fs = 48 kHz (-60 dBFS, BW = 20Hz – 20kHz)		99		dB
	fs = 96 kHz (-60 dBFS, BW = 20Hz – 40kHz)		99		dB
Channel isolation			100		dB



Load resistance		5	10		k $\Omega$
Load capacitance				25	pF
Common-mode output voltage			1.40		V
Full-scale output voltage swing			1.70		V <sub>P-P</sub>

Note: Audio DAC path characteristics reflect the capabilities of the on-chip DAC and module; however, care must be taken in the layout and wiring of the external audio path to prevent degradation of the signal environment.

## 2.7 Electrical Characteristics – MCLK Characteristics

Operating Conditions: VCC = 5.0V  $\pm$ 10%, T<sub>A</sub>=0°C to +50 °C; RF Chan. Freq = 2412MHz to 2462MHz. All specifications are referenced to the AVMD7520-SWA2 edge connector pins and RF connectors, unless otherwise specified. “Typical” specifications use VCC = 5.0V and T<sub>A</sub>=25 °C.

**Table 2-8 AVMD7520-SWA2 Electrical Characteristics – MCLK Characteristics**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
MCLK frequency	“24MHz” mode (256MHz divide by 10.5)		24.38		MHz
	“12MHz” mode (256MHz divide by 21)		12.19		MHz
MCLK output duty cycle		40		60	%

## 2.8 Over-the-air Range

Operating Conditions: VCC = 5.0V  $\pm$ 10%, T<sub>A</sub>=0°C to +50 °C; RF Chan. Freq = 2412MHz to 2462MHz. All specifications are referenced to the AVMD7520-SWA2 edge connector pins and RF connectors, unless otherwise specified. “Typical” specifications use VCC = 5.0V and T<sub>A</sub>=25 °C.

**Table 2-9 AVMD7520-SWA2 Electrical Characteristics – Over-the-air Range (Note 1)**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
LOS (line-of-sight) Range	2 channel audio link; $\geq$ 100cm height		150		m
NLOS (non-line-of-sight) Range	2 channel audio link; $\geq$ 100cm height		30		m

**Note 1:** The AVMD7520-SWA2 module is connected to external 2dBi (nominal) dipole antennas. Range is defined as the maximum distance at which there are no audio breaks. The LOS environment is outdoors, with no obstructions between the arbiter and client AV75xx radios. NLOS is indoors, with obstructions (typically walls) between the arbiter and client AV75xx radios. NLOS range performance will be highly dependent on the actual environment.

### 3 Package Information

#### 3.1 Mechanical Dimensions

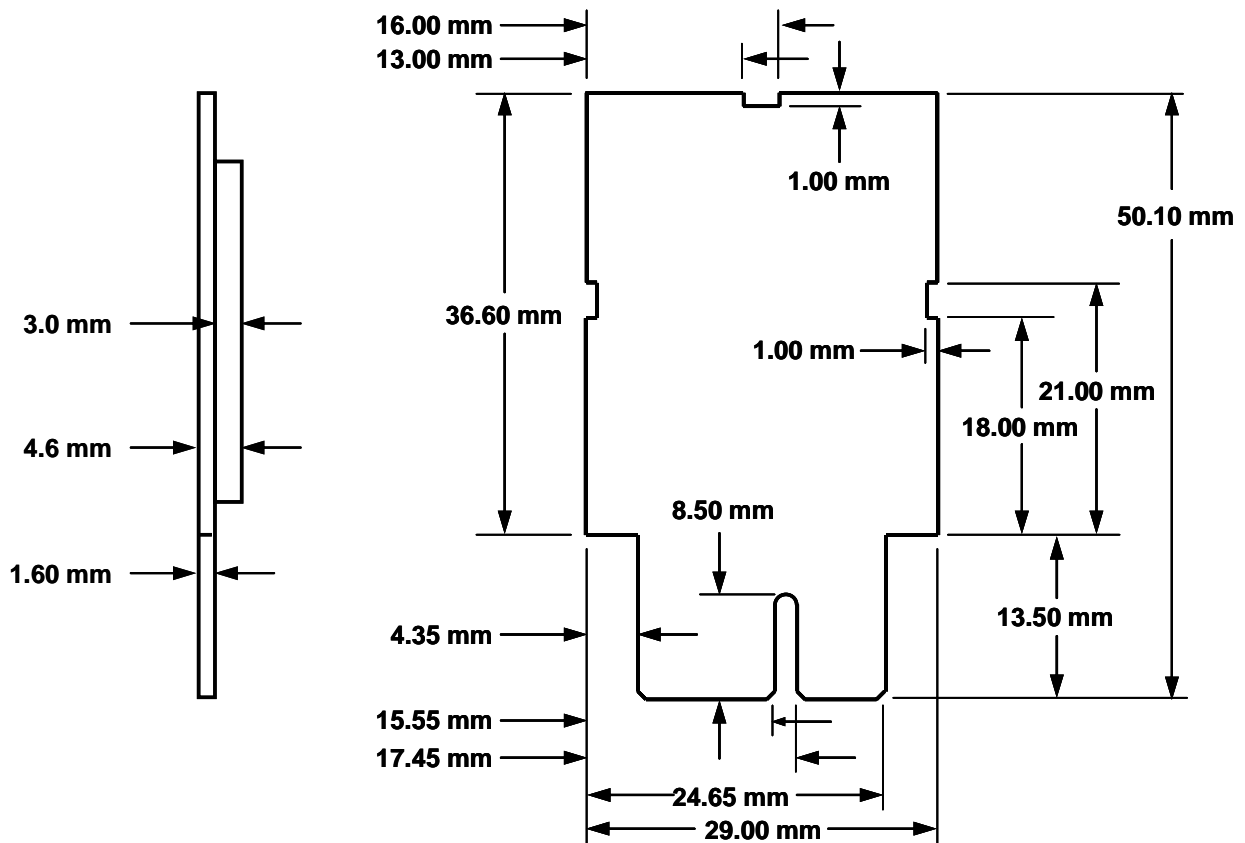


Figure 3-1 - AVMD7520-SWA2 module mechanical dimensions

## 4 Ordering Information

**Table 4-1 AVMD7520-SWA2 Module Ordering Information**

Module Part Number	Description
AVMD7520-SWA2	+15dBm TX power, U.FL antenna connectors, AV7520 based wireless audio module (see Note)

Note: External antenna cables and/or antennas are not included

## 5 CONTACT INFO & LEGAL DISCLAIMER

**Avnera Corporation**  
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Avnera Corporation reserves the right to make changes without notice to the product to improve function, reliability, or performance.

Avnera Corporation does not assume any liability arising from the application or use of the products or circuits described herein.

## FCC Statement

### Federal Communication Commission Interference Statement

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 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 device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

### IMPORTANT NOTE:

#### FCC 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.

**IMPORTANT NOTE:**

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

**USERS MANUAL OF THE END PRODUCT:**

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

**LABEL OF THE END PRODUCT:**

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: NKR-SWA2". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

## IC Statement:

This Class B digital apparatus complies with Canadian ICES-003.  
Cet appareil numérique de la classe B conforme à la norme NMB-003 du Canada.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

### IMPORTANT NOTE:

#### IC Radiation Exposure Statement:

This equipment complies with IC RSS-102 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.

### IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the IC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the IC RSS-102 radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

### USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. IC statement is required to be available in the users manual: This Class B digital apparatus complies with Canadian ICES-003. 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.

### LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX IC : 4441A-SWA2 ".