



PRELIMINARY AudioMagic™ Module Datasheet

Point-to-point AVMD6600-SWA91 module family for
Mono Wireless Audio Systems, based on Avnera's AV6600 IC

General Description

Every consumer wants to be free from wires, but it has been challenging to find a low-cost, high-quality, easy-to-use wireless audio solution for the wireless subwoofer market.

Avnera's proprietary wireless system takes a new approach to wireless audio. The wireless protocol was designed from the ground up and delivers uncompressed mono audio, with fixed latency over the air, without interference problems.

Avnera's wireless modules offer a low-touch, easy-to-integrate wireless audio solution and enable fast time to market by already solving the problem associated with FCC certification, antenna tuning and board optimization.

Modules based on Avnera's AV6600 silicon provide breakthrough wireless audio functionality with fixed low-latency point-to-point transport of uncompressed mono PCM audio data at 16-bit, 48 kHz resolution using either analog or digital (I2S) interfaces.

Applications

- ✓ Wireless Subwoofers
- ✓ Mono audio channel transmission

Ordering Options

AVMD6600-SWA91TXD: Transmit module with digital audio input and integrated printed PCB antennas

AVMD6600-SWA91RXD: Receive module with digital audio output and integrated printed PCB antennas

AVMD6600-SWA91RXA: Receive module with analog audio output and integrated printed PCB antennas

Features

- ✓ Audio Interfaces
 - ✓ I2S Digital Input Interface with 95dB end-to-end digital audio path
 - ✓ Integrated DAC supporting Analog output with 90dB SNR and 20-20KHz bandwidth (RXA model only)
- ✓ Support for 15m range
- ✓ Frequency range: 2.4 GHz ISM band, continuous dynamic frequency selection
- ✓ Forward error correction coding, error detection, and audio-specific error concealment
- ✓ Dual onboard printed PCB antennas for multipath and fading mitigation
- ✓ Auto-search/synch and dynamic channel selection
- ✓ Low, fixed latency of 13ms, suitable for video lip-synch
- ✓ Connector: 2mm header which allows for either horizontal or vertical module mounting
- ✓ Sample rate converter: Support for 16, 20, 24, and 32 bit PCM words at 8,16, 22.05, 24, 32, 44.1, and 48 kHz
- ✓ General purpose over-the-air (OTA) serial interface:
 - ✓ 2 kbps, bi-directional, full duplex
 - ✓ Support for meta-data and remote control commands



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3 AVMD6600-SWA91-TXD/RXD/RXA Functional Block Diagrams

The AVMD6600-SWA91 module is available in three variations, Digital Input Transmitter, Digital Output Receiver and Analog Output Receiver.

Note: The device does not have full I2S master capability and cannot generate MCLK as an output.

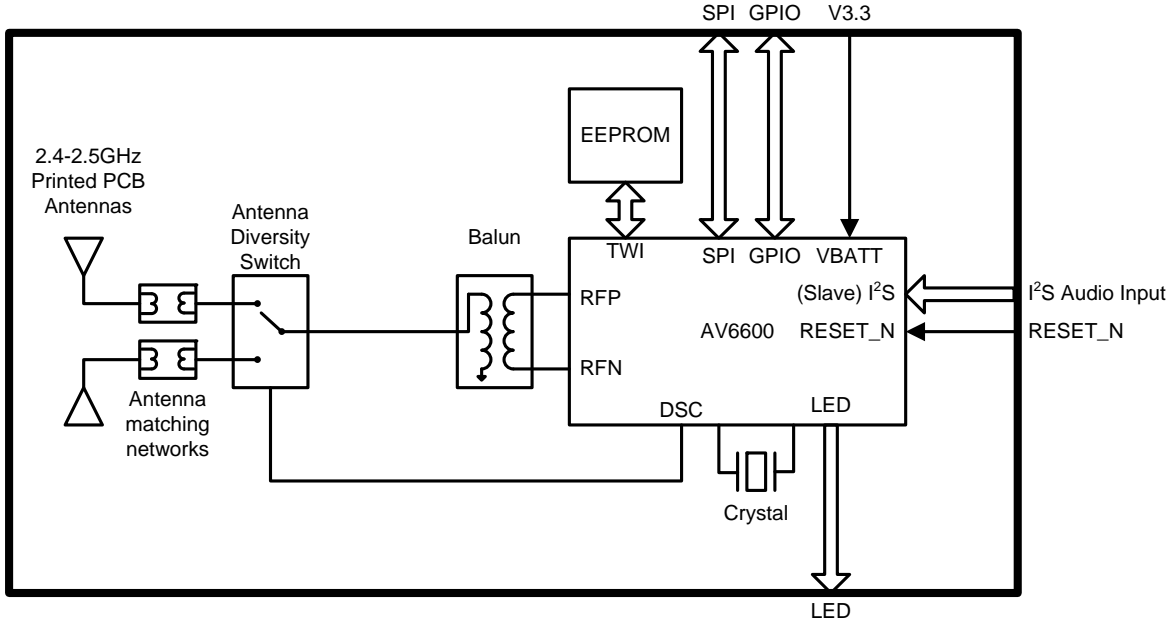


Figure 1: AVMD6600-SWA91TXD Module Block Diagram

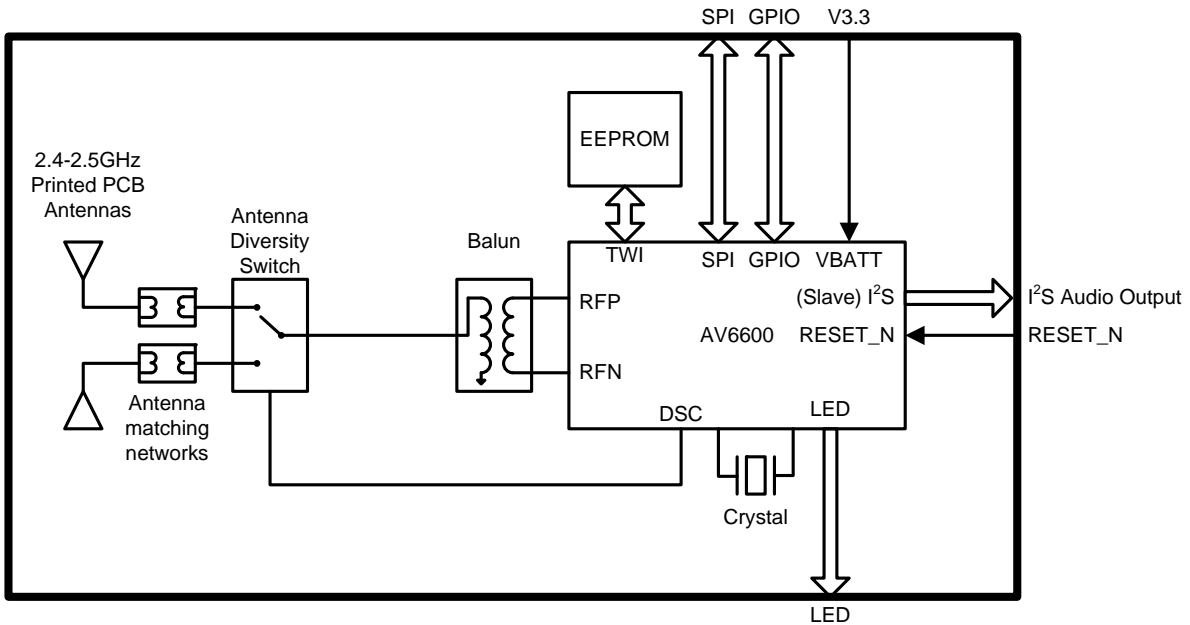


Figure 2: AVMD6600-SWA91RXD Module Block Diagram

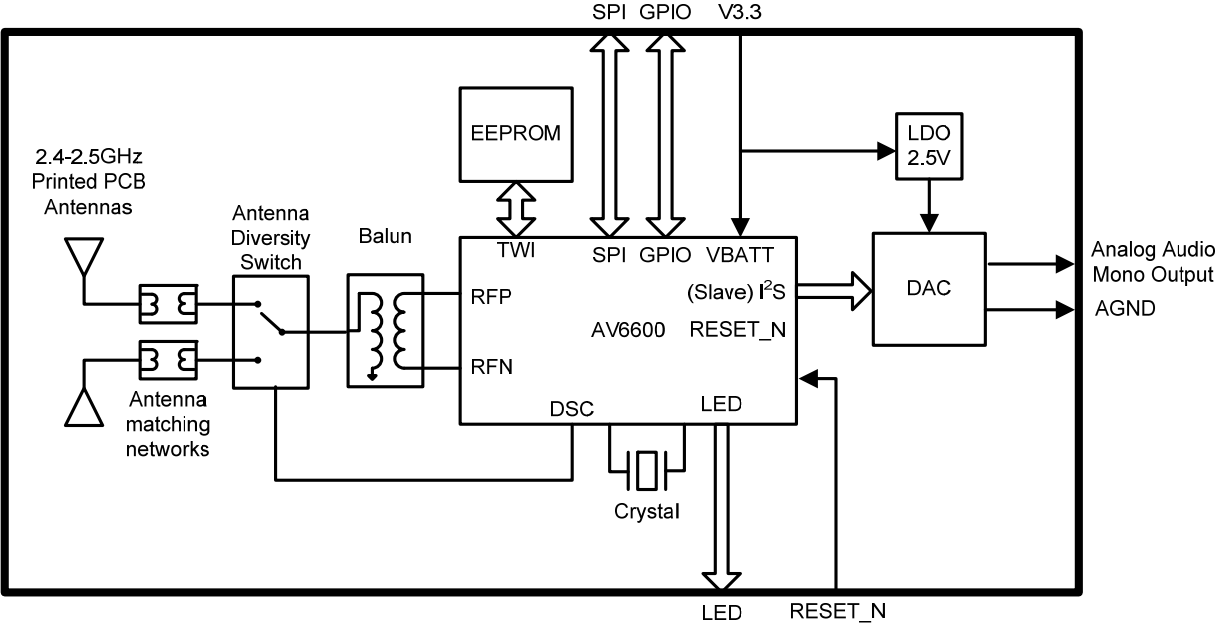


Figure 3: AVMD6600-SWA91RXA Module Block Diagram

Table 1: AVMD6600-SWA91 Module Block Diagram Description

Interface	Description
SPI	The AVMD6600s SPI interface is used to allow an external host to control the AV6600 IC and to facilitate testing of the module.
GPIO/ LED	The GPIO and LED lines allow buttons and LEDs to be connected to the AVMD6600-SWA91 to allow the user to control the Audio Magic system and communicate the system's state to the user.
Analog Audio	These pins form the AVMD6600-SWA91RXA module's analog audio output. The analog ground on the module and should be isolated from the host system's ground to prevent the creation of noise-inducing ground loops.
RESET_N	This pin connects directly to the "RESET_N" pin on the AV6600 IC and is used to signal the module to power on and off.
V3.3	This pin provides power to all elements of the AVMD6600-SWA91. Internal regulators condition the input power according to the requirements of the various sub-circuit blocks.
I2S	These input pins connect to the AV6600's digital audio interface and provide a digital audio input channel. The AVMD6600-SWA91 TXD is always an I2S slave while the AVMD6600-SWA91 RXD can be either a Slave or a <u>Master</u> I2S port but the module cannot generate MCLK as an output.. Depending upon module configuration the audio data direction will change.

4 AVMD6600-SWA91 Pin Information

Table 2: AVMD6600-SWA91 Pin Information

Pin Number	Pin Name TXD/RXD Module	Pin Name RXA Module	Type	Pin Description
1	Not Connected	Not Connected	Analog Ground	Audio section ground; must be connected to LINE_IN_COM <u>at the audio source</u> to minimize noise.
2	Not Connected	Not Connected	Analog Ground	Audio section ground. Both LINE_IN_COM and LINE_IN_COM2 must be isolated from system ground for best noise performance
3	Not Connected	Not Connected	Analog Input	Reserved, not supported on these module configurations
4	Not Connected	LINE_OUT	Analog Output	Mono Analog Audio Output
5	Not Connected	LINE_OUT_COM	Analog Ground	Audio section ground. LINE_OUT_COM must be isolated from the system ground for best noise performance.
6	GND	GND	Ground	Digital section ground. Tie to Pin 24 as close to the module as possible
7	V3.3	V3.3	Power	Main power supply (3.3 Volts)
8	ADAT/GPIO1	GPIO1	Digital I/O	Multifunction; I2S digital Audio data output (Input for TXD, Output for RXD), General Purpose I/O Default = ADAT digital module
9	LRCLK/GPIO2	GPIO2	Digital I/O	Multifunction; I2S digital Audio frame clock input (Slave for TXD, Master/Slave for RXD), General Purpose I/O Default = LRCLK digital module
10	BCLK/GPIO3	GPIO3	Digital I/O	Multifunction; I2S digital Audio bit clock input (Slave for TXD, Master/Slave for RXD), General Purpose I/O Default = BCLK digital module
11	LED	LED	Analog Output	LED drive line; current sink to GND
12	RESET_N	RESET_N	Digital Input	Active-LOW Reset input expecting open drain connection
13	CMP	CMP	Analog Input	Comparator input; default function is sensing battery status
14	S_MOSI/S_CLK/ GPIO12	S_MOSI/S_CLK/ GPIO12	Digital I/O	Multifunction, SPI slave serial data input, I2C slave clock, General-Purpose I/O Default = S_MOSI
15	S_MISO/S_SDA/ GPIO13	S_MISO/S_SDA/ GPIO13	Digital I/O	Multifunction, SPI slave serial data output, I2C slave data, General-Purpose I/O Default = S_MISO
16	S_SCLK/GPIO14	S_SCLK/GPIO14	Digital I/O	Multifunction, SPI slave clock, General-Purpose I/O Default = S_SCLK

17	S_SSB/GPIO15	S_SSB/GPIO15	Digital I/O	Multifunction, SPI slave select, General-Purpose I/O Default = S_SSB
18	UART_RX/GPIO6	UART_RX/GPIO6	Digital I/O	Multifunction, UART receive, General-Purpose I/O Default = GPIO6
19	UART_TX/GPIO7	UART_TX/GPIO7	Digital I/O	Multifunction, UART transmit, General-Purpose I/O Default = GPIO7
20	M_MOSI/M_SCL/ GPIO4	M_MOSI/M_SCL/ GPIO4	Digital I/O	Multifunction, SPI master serial data output, I2C master clock, General-Purpose I/O Default = M_SCL
21	M_MISO/M_SDA/ GPIO6	M_MISO/M_SDA/ GPIO6	Digital I/O	Multifunction, SPI master serial data input, I2C master data, General-Purpose I/O Default = M_SDA
22	M_SCLK/GPIO8	M_SCLK/GPIO8	Digital I/O	Multifunction, SPI master serial clock, General-Purpose I/O Default = GPIO8
23	M_SSB/GPIO9	M_SSB/GPIO9	Digital I/O	Multifunction, SPI master serial select, General-Purpose I/O Default = GPIO9
24	GND	GND	Ground	Digital section ground. Tie to Pin 6 as close to the module as possible

5 AVMD6600-SWA91 Mechanical Dimensions

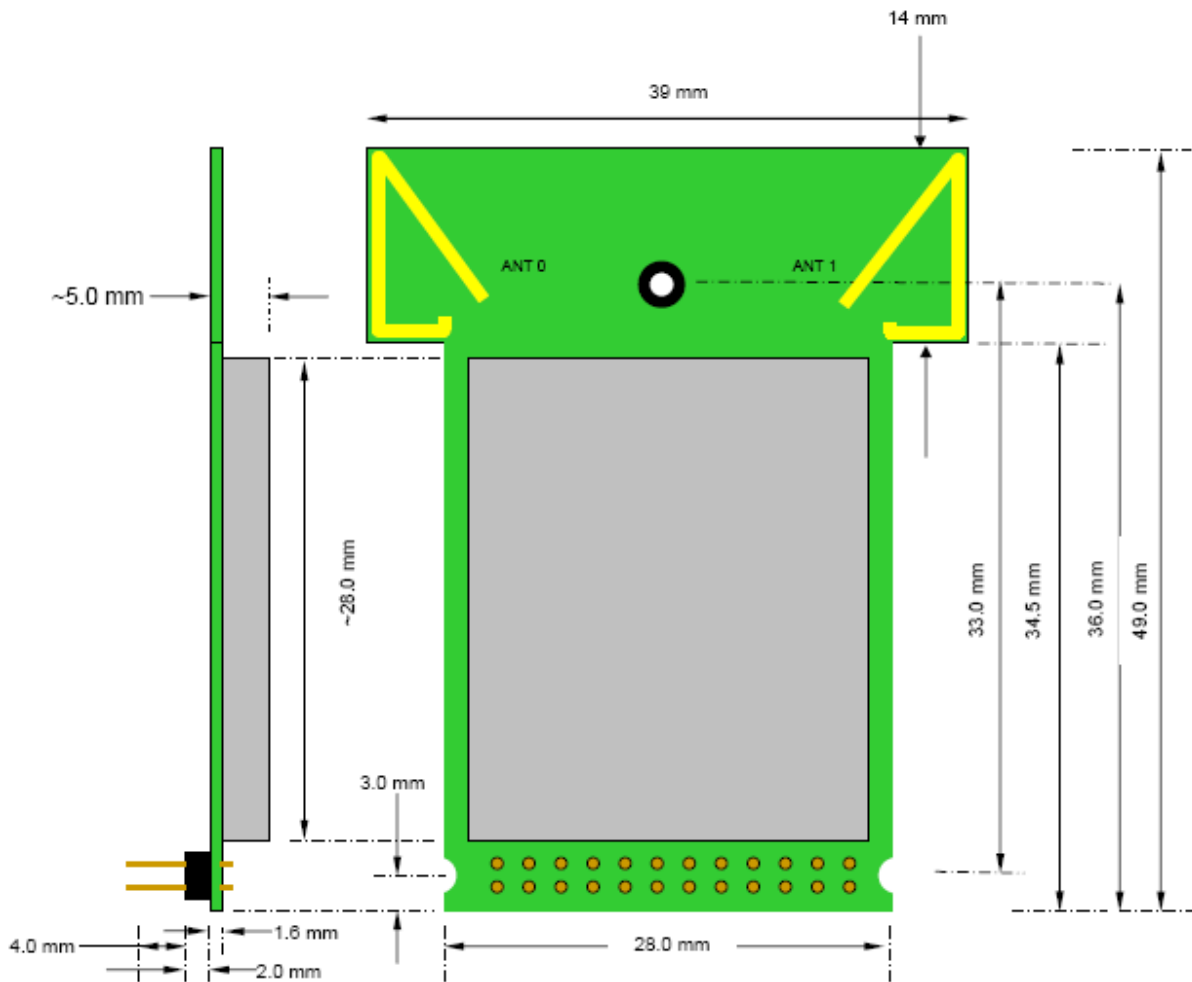


Figure 4: AVMD6600-SWA91 mechanical dimensions

6 Electrical 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
V3.3 Supply Voltage Input	-0.3V	3.6V
Input Voltage Range – Digital Inputs ¹	-0.3V	3.6V
Input Voltage Range – Analog Inputs	-0.3V	V _{3.3} +0.3V
Operating Temperature	0°C	+70°C
Storage Temperature	-40°C	+100°C
Assembly Temperature		TBD
Static Discharge Voltage – HBM ²		TBD
Static Discharge Voltage – MM ³		TBD

Notes:

Note 1: Digital GPIO Pins are 5V Tolerant when programmed as Inputs.

Note 2: Terminology: HBM => ESD human body model

Note 3: Terminology: MM => Machine model

6.2 Recommended Operating Range

PARAMETER	MIN	TYP	MAX	UNIT
V3.3 Supply pin voltage	3.0		3.6	V
Ambient Temperature (T _A)	0		70	°C

6.3 Electrical Characteristics

Test Conditions: $T_A=+25^{\circ}\text{C}$, $V_{3.3}=3.3\text{V}$

Table 3; AVMD6600-SWA91 Electrical Characteristics

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
RF Frequency Range		2405		2477	MHz
Audio Output Voltage ¹				2	V_{pk-pk}
Audio SNR Analog Output ¹			88		dB
Audio SNR I2S Input/Output ²	I2S end to end		94		dB
Analog Audio THD+N ³			tbd		dB
Range (LOS)			15		m
Current consumption	$V_{3.3}$ (Active Audio mode)		50		mA

Note 1: AVMD6600-SWA91RXA module only

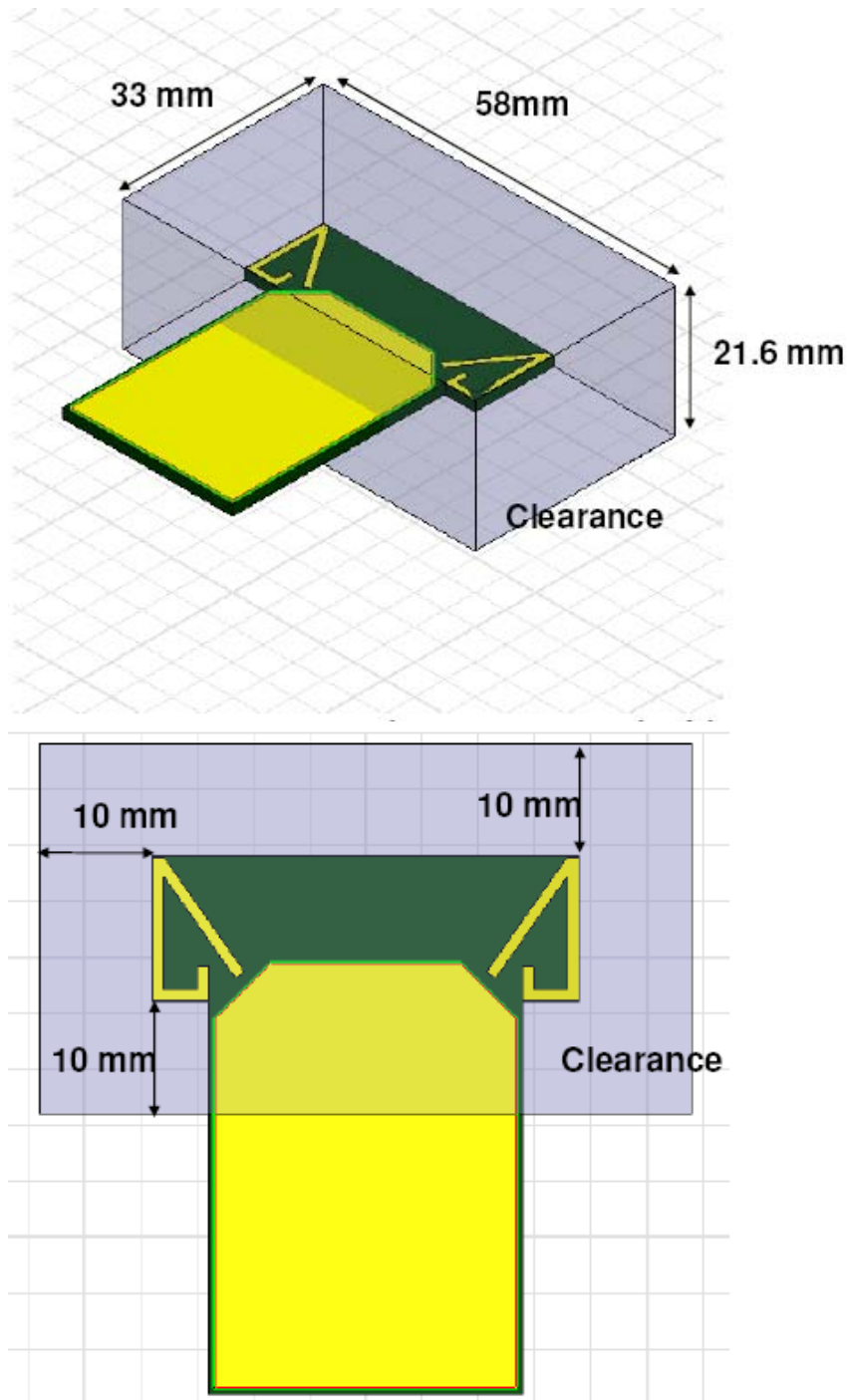
Note 2: AVMD6600-SWA91TXD/RXD modules only

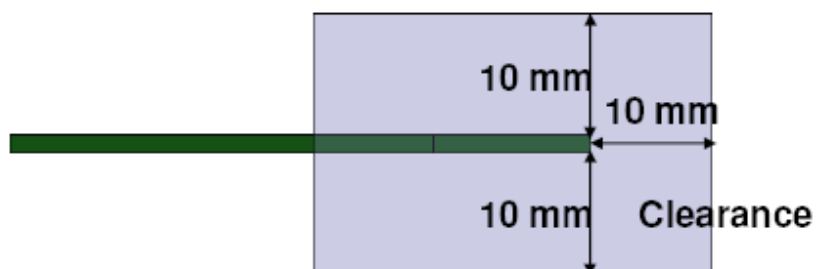
Note 3: Measured at -3dbFS input, A weighting. Output is taken, using external DAC on Avnera development board.

7 Application information

7.1 Mechanical requirements

Figure 5: Recommended module antenna system clearance





7.2 Application circuit

Schematics are provided separately.

7.3 External I2S Requirement

The AVMD6600-SWA91 TXD module is an I2S slave only device and requires connection to a master I2S device to provide LRCLK and BCLK. The AVMD6600-SWA91 RXD module is normally an I2S slave and generates LRCLK, BCLK as well as I2S data out. The AVMD6600-SWA91 RXD module can be configured as an I2S master but is not capable of generating MCLK as an output so can only be used with external slave devices that contain some form of rate converter.

8 FCC and Industry Canada certification information

8.1 Label Information

The AVMD6600-SWA91 family of modules will be certified by the requirements set by the US Federal Communications Commission (Part 15) and Industry Canada (RSS-Gen, Issue 3, 2010-12 and RSS-210 issue 8, 2010-12) for certification as modular intentional radiators. The certification identification numbers are as follows:

US FCC ID: NKR-SWA9

Industry Canada (IC): 4441A-SWA9

* IDs will be provided after certification has been completed

Avnera makes the following representations: 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,
- (2) This device must accept any interference received, including interference that may cause undesired operation.

Per FCC regulation 47 CFR 15.21: Changes or modifications not expressly approved by Avnera, as the party responsible for compliance, can void the user's authority to operate the equipment using AVMD6600-SWA91 modules.

8.2 Equipment labeling requirements

The statement shown below, or its equivalent, must appear on the external label of every piece of equipment that contains an AVMD6600 module. If the size of the final equipment is too small to support such a label, the statement described in must appear in the user manual for that equipment.

Contains
FCC ID NKR-SWA9
IC: 4441A-SWA9

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
(2) This device must accept any interference received,
including interference that may cause undesired operation

8.3 User manual labeling requirements

The statements shown below, or their equivalents, must appear in the user manual for equipment containing AVMD6600-SWA91 modules:

Contains

FCC ID NKR-SWA9

IC: 4441A-SWA9

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
- (2) this device must accept any interference received, including interference that may cause undesired operation

Per FCC regulation 47 CFR 15.21: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

9 Ordering Information

Table 4: AVMD6600-SWA91 Module Ordering Information

Module Part Number	Option Code	Description
SWA91TXD	-TXD	Digital Input , 2mm Header, integrated printed PCB antennas
SWA91RXD	-RXD	Digital Output, 2mm Header, integrated printed PCB antennas
SWA91RXA	-RXA	Analog Output, 2mm Header, integrated printed PCB antennas

10 Contact Information and Legal Disclaimer

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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.

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:

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-SWA9 ". 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:

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.

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 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-SWA9 ".