

# UHF Wireless Audio Module WA-TX-01-R/WA-RX-01A-R



## Operation Guide

Version 1.0 (Apr. 2006)

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## GENERAL DESCRIPTION & FEATURES

### Features

- RoHS compliant
- R&TTE compliant (EN 300 422 & EN 301 357\*)
- 100 dB wide dynamic range with noise reduction system
- Frequency response from 50 Hz to 15 kHz
- Fixed frequency in 863-865 MHz European audio band
- Low current for longer battery life (TX: 25 mA Max.)
- Low voltage operation (from 3 V)
- Single UM4 (1.5 V) battery operation with DC/DC converter
- Built-in mute circuit
- All functions in a compact case (TX: 27X19X5.5 mm)
- Easy installation in user systems

*\*EN 301 357 defines the equipment covered by its standard and the output power limits depend on the equipment type. The WA-TX-01-R meets the output power limits allowed for all equipment types except for 'Personal cordless'.*

### Applications

- Wireless microphone systems
- Wireless portable sound systems
- Audio guidance systems (Museum tour guide etc.)
- Wireless conference systems
- Hall sound reinforcement systems
- Sound/voice monitors

### General description

The WA-TX-01-R transmitter and WA-RX-01A-R receiver are RF modules designed to send or receive audio signals. All necessary circuits including the RF core circuits and noise reduction circuits are enclosed in a compact package for easy installation. To achieve a wide dynamic range within the frequency deviation requirements specified in the radio regulations, WA-TX-01-R uses a compander/expander noise reduction system. The whole frequency range of the system is compressed by half at a ratio of 2:1 by a compressor in the WA-TX-01-R and then, in exactly the opposite way, is doubled at a 1:2 ratio by an expander in the WA-RX-01A-R. These functions are already integrated in the modules.

The user can enjoy the advantages of a noise reduction system that is specifically required for high quality wireless audio transmission.

## SPECIFICATIONS

### Common

Frequency range	863.125 MHz, 863.625 MHz, 864.500 MHz, 864.875 MHz
Number of RF channels	Single (Fixed)
Frequency type	F3E
Distance	50 m (Line-of-sight)
S/N ratio	90 dB (W/IHF-A Filter)
Audio frequency response	50 Hz-15 kHz +/-3.5 dB
T.H.D	2 % (@AF 1 kHz, at f=15 kHz or 7.5 kHz)
Emphasis	50 u/sec
Operating temperature	0 to 50 degree C

### Transmitter (WA-TX-01-R)

Oscillation type	SAW oscillator crystal based
RF power	2 mW (e.r.p.)
Modulation	Variable reactance modulation
Frequency stability	+/-10 kHz
Pre-emphasis	50 $\mu$ s
Noise reduction	Compressor (1/2 logarithm compression)
Spurious emission	1 $\mu$ W MAX
Deviation	15 kHz (1 kHz at -25 dBv)
Audio input level	-115dBv to -15dBv (1 kHz)
Maximum DC input voltage	0 V DC max
Audio input impedance	5 k $\Omega$
I/O connector	4P connector
Supply voltage	3 to 9 V
Current consumption	25 mA MAX
Dimensions	W27 x D19 x H5.5 mm
Weight	5 g

### Receiver(WA-RX-01A-R)

Receiving method	Single super heterodyne
Local oscillator type	Crystal controlled
Oscillation frequency	(f <sub>0</sub> -10.7 MHz)/10
IF frequency	10.7 MHz
Noise reduction type	Expander
Sensitivity	21 dB $\mu$ V (at THD2 %)
Squelch sensitivity	17 dB $\mu$ V +/-4 dB
Audio output level	-20 dBv (Dev.15 kHz), Max -10 dBv (Dev. 30 kHz)
Audio output impedance	10 K $\Omega$ (Unbalanced output)
I/O connector	6P connector
Supply voltage	3 V to 12 V
Current consumption	30 mA
Dimensions	W36 x D26 x H8 mm
Weight	15 g

\*0 dBv=0.775 V

\*The data was taken at 25 C unless otherwise specified

## PIN DESCRIPTION

### WA-TX-01-R transmitter module

Pin No.	Pin name	I/O	Description
1	A	O	Antenna terminal 50 $\Omega$ impedance An antenna is not provided with the module. The recommended antenna is 1/4 lambda antenna (7.8 cm for 860 MHz) (SWR= less than 1.5). Keep the antenna away from objects which have a high dielectric constant and/or that possess electrical conductivity.
2	G	I	Power supply minus (-) terminal
3	V	I	Power supply plus (+) terminal Voltage range is DC 3 to 9 V A battery or regulated power source without ripple noise should be used. Make sure to connect it with the correct polarity. To maintain a lower voltage, no protection diode is provided in the circuit.
4	I	I	Audio input terminal Audio input level range is -115 dBv to -15 dBv. Higher input signal level more than 0 dBv and DC voltage input are prohibited.

### WA-RX-01A-R receiver module

Pin No.	Pin name	I/O	Description
1	AF	O	Audio output terminal Output impedance is 10 k $\Omega$ . Lower impedance interface will decrease the output level. Maximum output level is -10 dBv. When an audio amplifier is used, connect the terminal to the MIC.IN of the amplifier. Insert an attenuator when the amplified output is distorted as shown in the example circuit.
2	GND1	I	Audio GND terminal Power supply minus (-) terminal
3	LED	O	LED terminal Open collector, Low active The LED control circuit works with the internal mute circuit. The LED terminal becomes low when a signal is received. Current drain should be designed to be less than 20mA. For battery-powered use, choose a high intensity LED to save current consumption.
4	Vcc	I	Power supply plus (+) terminal Voltage range is DC 3 V-12V. A low-drop regulator of 2.7 V is used for the internal circuit to ensure 3 V operation. Ensure that the power supply does not exceed 12 V. A battery or regulated power source without ripple noise should be used. Make sure to connect it with the correct polarity. To maintain a lower voltage, no protection diode is provided in the circuit.
5	GND2	I	RF GND terminal
6	ANT	I	Antenna terminal 50 $\Omega$ impedance An antenna is not provided with the module. The recommended antenna is 1/4 lambda antenna (7.8 cm for 860 MHz).

**Remarks for integration of the receiver antenna**

Please pay due attention to the design of the antenna ground plane based on the general design theory. Locate the antenna in a place where there are no objects between TX and RX and that is visible from the transmitter antenna. If a PCB pattern line is used for connection between the antenna terminal and the antenna you choose, please secure the following pattern width.

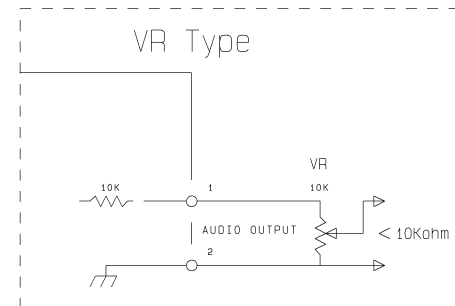
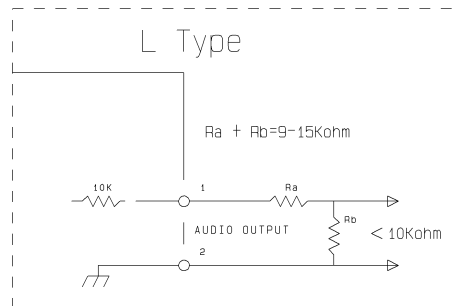
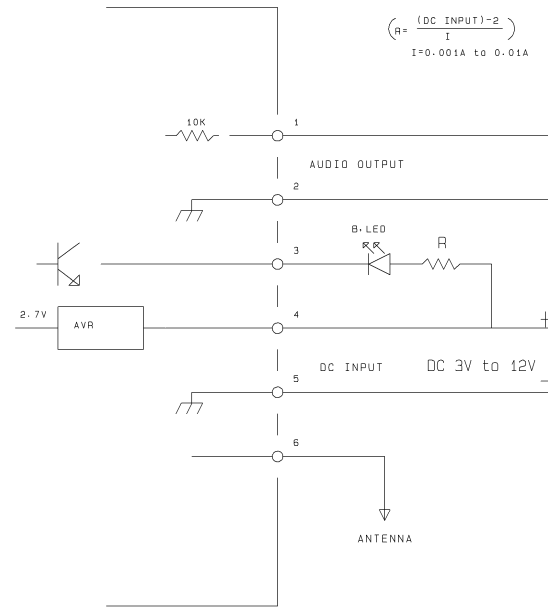
<b>PCB thickness (mm)</b>	0.8	1	1.2	1.6
<b>Pattern width (mm)</b>	1.3	1.4	1.7	2.7

(the example above shows a case where a G10 double sided PCB is used.)

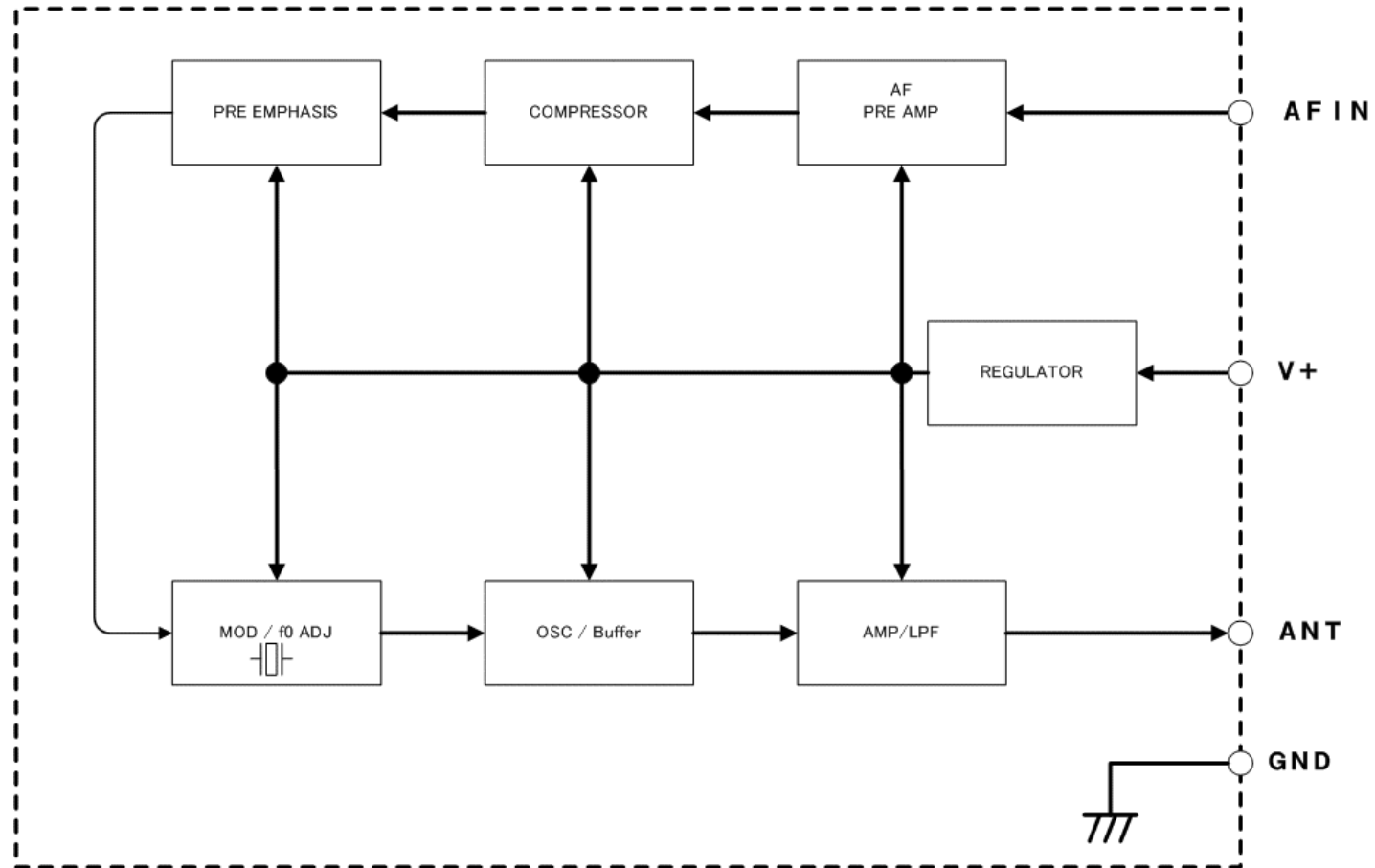
**PIN CONNECTION  
WA-RX-01A-R**

WA-RX-01A-R

1PIN	AUDIO OUTPUT	IMPEDANCE 10K	
2PIN	AUDIO GND		
3PIN	LED CONTROL	OPEN COLLECTOR	LOW ACTIVE
4PIN	DC INPUT +	DC 3V to 12V	
5PIN	RF GND		
6PIN	ANTENNA	50 ohm	

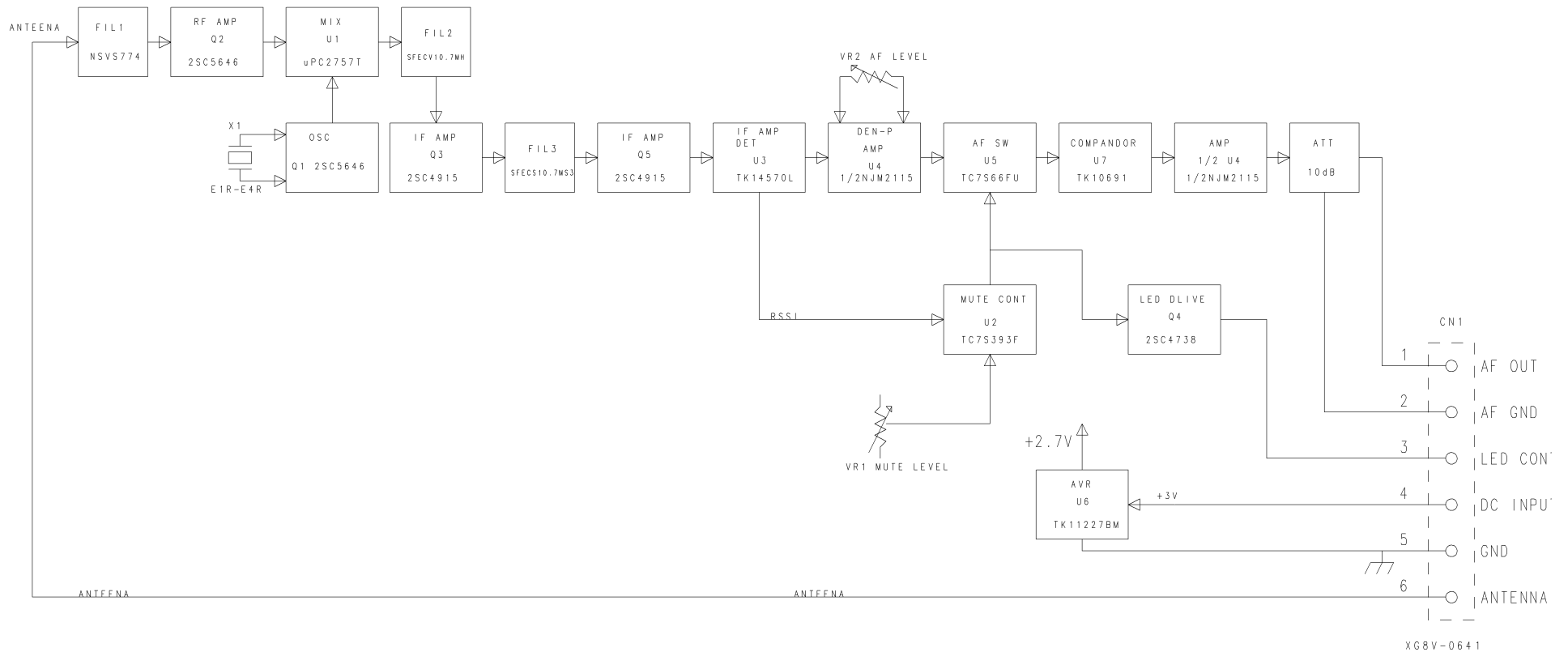


**BLOCK DIAGRAM**  
WA-TX-01-R

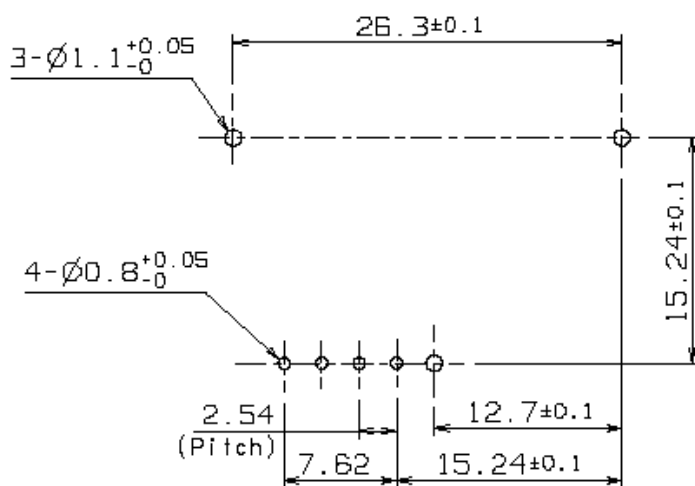
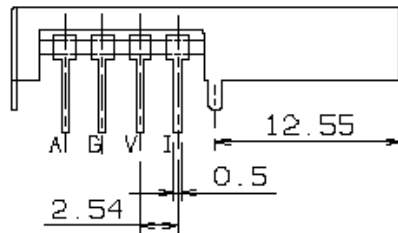
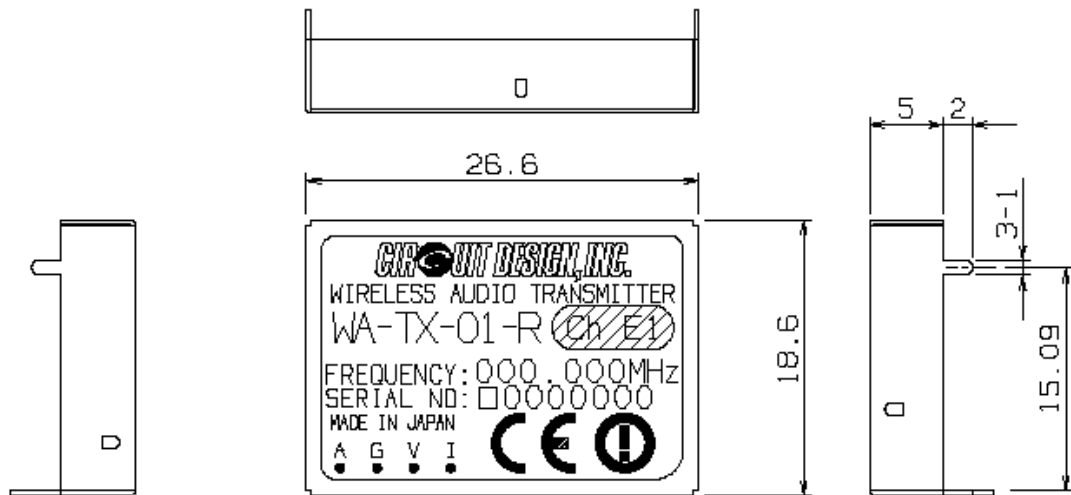




**BLOCK DIAGRAM  
WA-RX-01A-R**

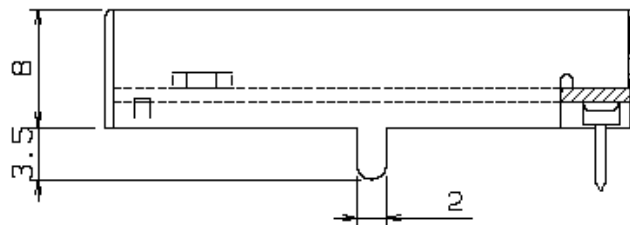
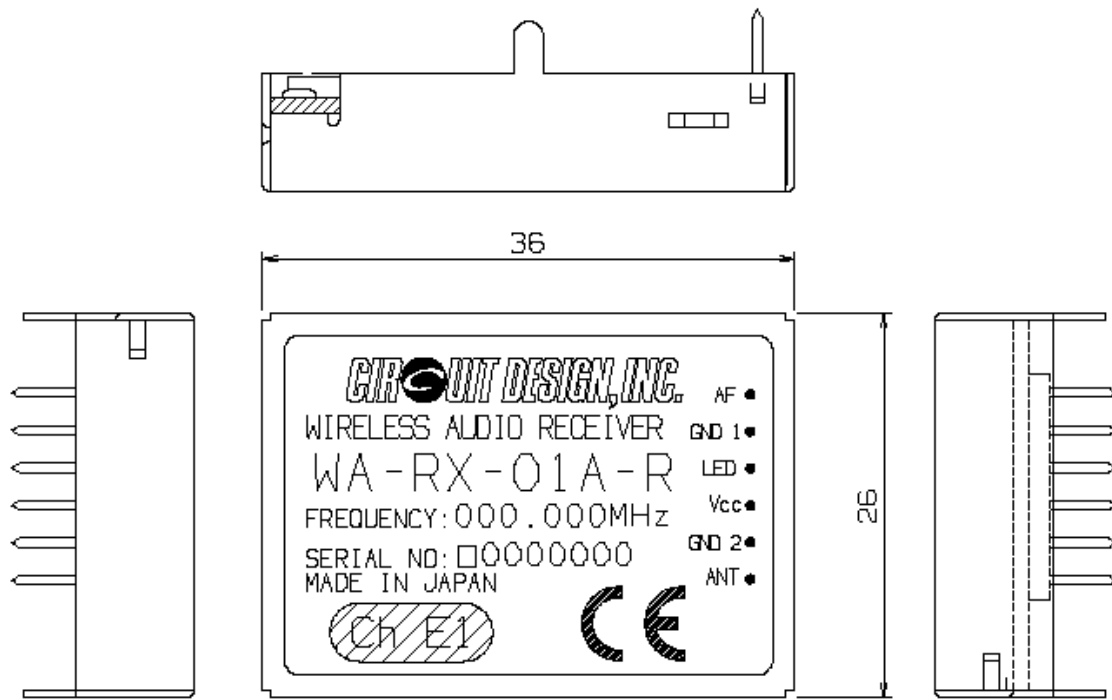


**DIMENSIONS**  
**WA-TX-01-R**

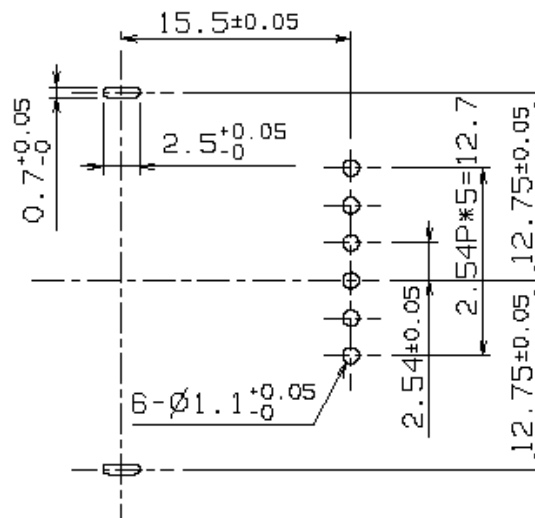


Reference hole position  
(Top View)

**WA-RX-01A-R**



Reference hole position  
(Top View)



## CHANNEL PLAN

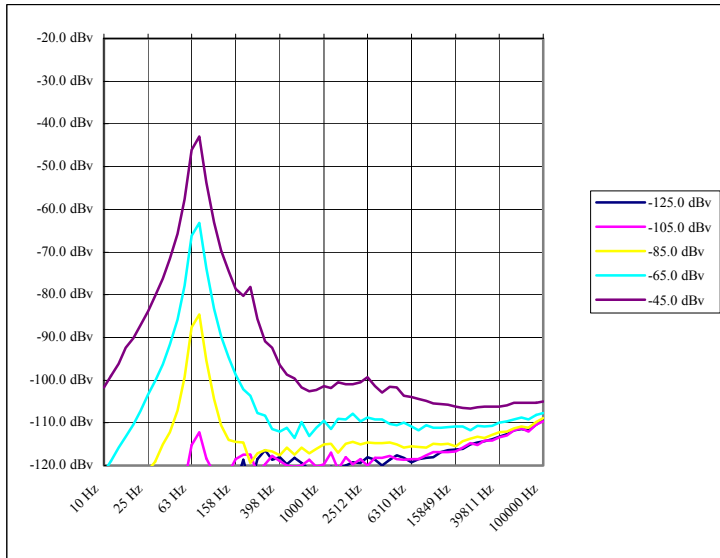
The WA-TX-01-R/RX-01A-R is a fixed frequency channel module and has been adjusted to one of the following 4 frequency channels in the factory.

<b>Channel</b>	<b>Ch E1</b>	<b>Ch E2</b>	<b>Ch E3</b>	<b>Ch E4</b>
<b>Frequency</b>	863.125 MHz	863.625 MHz	864.500 MHz	864.875 MHz

The channel number and frequency are indicated on the label of the module. Make sure the channel of the TX and the RX are identical.

The 4-frequency channel plan is made to avoid third inter-modulation, making it possible to operate maximum 4 systems in the same area.

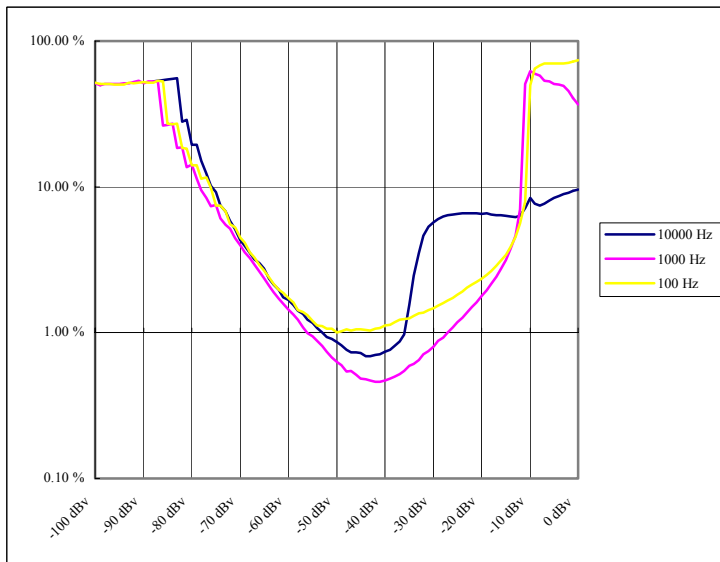
**TEST DATA**



**SPM**

**Radio Noise vs. Frequency**

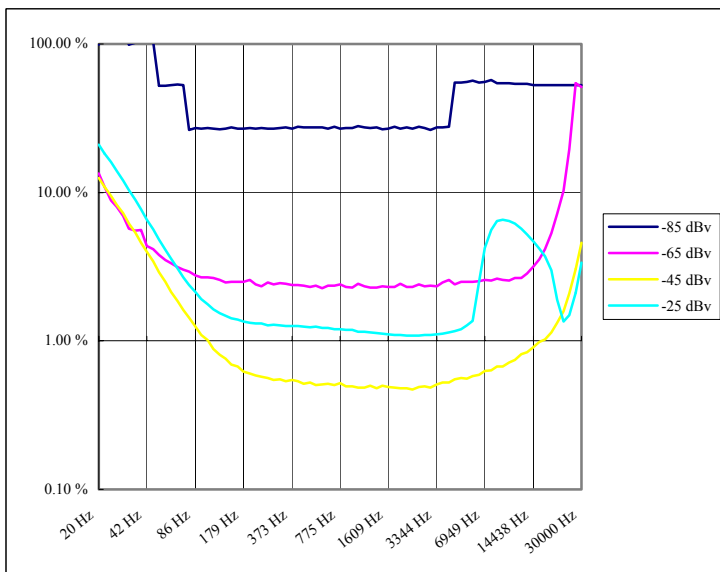
The data shows the measurement values of residual noise by frequency when a 70 Hz signal is supplied with a level from -125 dBv to -45 dBv in 20 dB steps.



**LTM**

**Levels vs. Distortion**

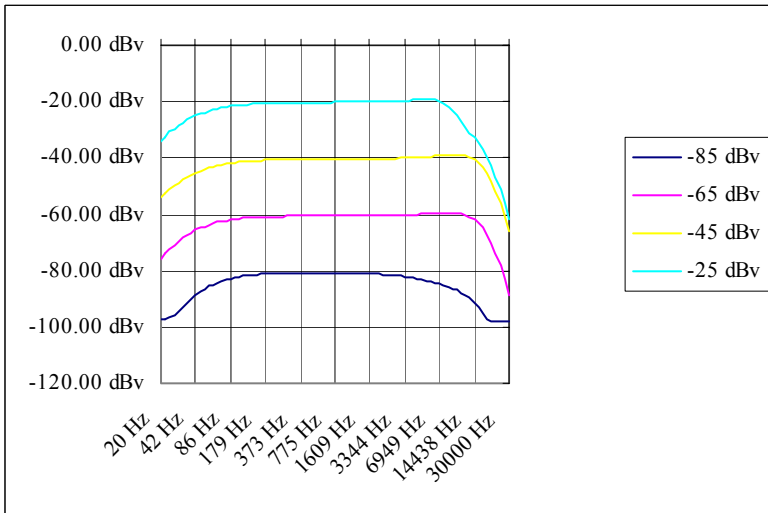
The data shows the measurement values of distortion rate at various input levels of 100 Hz, 1 kHz and 10 kHz.



**FTM**

**Frequency vs. Distortion**

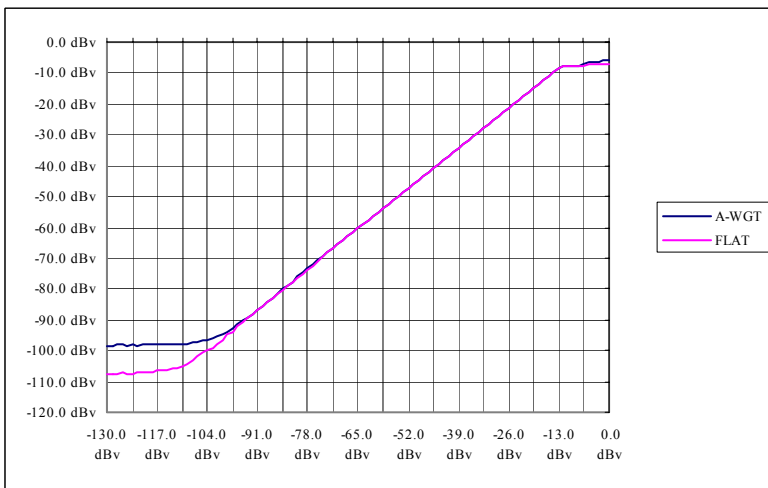
The data shows the measurement values of distortion rate at various frequencies with input levels from -85 dBv to -25 dBv in 20 dB steps.



**FLM**

**Frequency vs. INPUT level**

The data shows the measurement values of the output level at various frequencies with input levels from -85 dBv to -25 dBv in 20 dB steps.



**LLM**

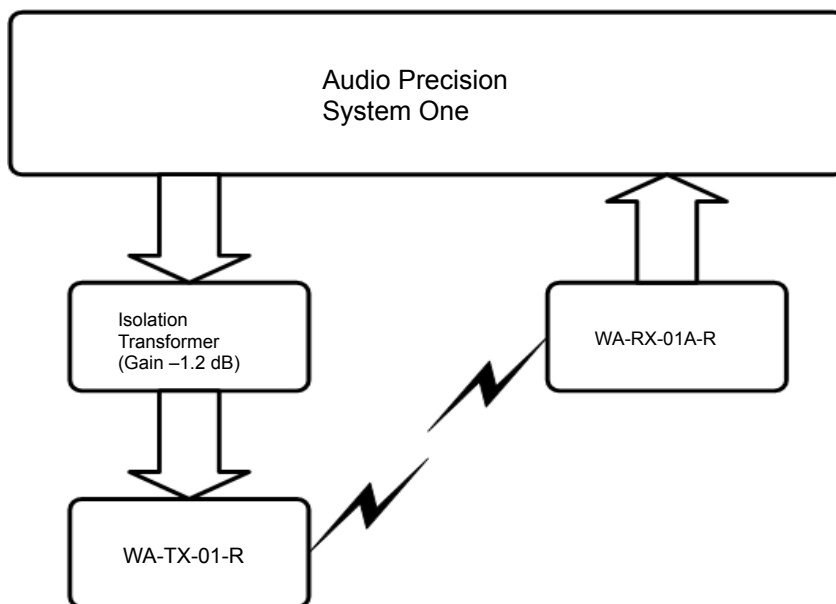
**Input level vs. Output level**

The data shows the measurement values of the output level at various input levels with/without a filter for hearing\*.

\*Filter for hearing(A-WGT)

This filter provides measurement equipment with equivalent frequency characteristics to that of human ear.

**Measurement method**



## Regulatory compliance information

### Regulatory compliance of the WA-TX-01-R and the WA-RX-01A-R

The WA-TX-01-R and the WA-RX-01A-R are designed for embedding in other equipment.

(Products incorporating the WA-TX-01-R and the WA-RX-01A-R are henceforward referred to as final products.)

The European regulation applicable to the WA-TX-01-R and the WA-RX-01A-R is the R&TTE Directive 1999/5/EC.

The WA-TX-01-R and the WA-RX-01A-R are intended to be used for the Radio Microphones defined in the ERC/REC 70-03 Annex 10 (EN 300 422) and for the Wireless Audio Applications in the ERC/REC 70-03 Annex 13 (EN 301 357\*)

The conformity assessment for the WA-TX-01-R and the WA-RX-01A-R were completed in accordance with the R&TTE Directive Annex II (RX) & III (TX) procedures, and the Declaration of Conformity is attached to this manual.

**\* NOTE:** EN 301 357 defines the equipment covered by its standard and the output power limits depend on the equipment type. The WA-TX-01-R meets the output power limits allowed for all equipment types except for 'Personal cordless'. If the WA-TX-01-R is used for the personal cordless equipment, the manufacturer of the final product is required to design the final product within the specified output power limit and perform the conformity assessment of the final product to the EN 301 357.

### Cautions related to regulatory compliance when embedding WA-TX-01-R/WA-RX-01A-R

#### 1. Antenna for the WA-TX-01-R

The WA-TX-01-R is supplied without a dedicated antenna and the user is required to provide an antenna. The conformity assessment of the WA-TX-01-R was performed using Circuit Design's evaluation board and antenna (1/4 lambda lead antenna). We recommend that you use our standard antenna (ANT-LEA-02 or ANT-RIG-02), or an antenna with equivalent characteristics and performance. For details about our evaluation boards and antennas, refer to [www.cdt21.com](http://www.cdt21.com) or contact us. If you use an antenna other than the recommended antenna, further radio conformity assessment may be required.

#### 2. Supply voltage of the WA-TX-01-R

The WA-TX-01-R should be used within the specified voltage range (3 V to 9 V).

#### 3. Enclosure

To fulfill the requirements of EMC and safety requirements, the WA-TX-01-R and the WA-RX-01A-R should be mounted on the circuit boards of the final products and must be enclosed in the cases of the final products. No surface of the WA-TX-01-R and the WA-RX-01A-R should be exposed.

### EMC requirements according to the R&TTE Directive Article 3.1b

The ESD-test (Electro Static Discharge test) was not performed on the WA-TX-01-R and the WA-RX-01A-R. The WA-TX-01-R and the WA-RX-01A-R are designed for embedding in final products and rely on the enclosures of the final products to provide the necessary protection. The ESD test should be performed on the final products incorporating the WA-TX-01-R and the WA-RX-01A-R.

### Safety requirements according to the R&TTE Directive Article 3.1a

The WA-TX-01-R and the WA-RX-01A-R rely on the final products to provide the electrical, mechanical, and fire enclosure requirements.

The nominal supply voltages of the WA-TX-01-R and the WA-RX-01A-R are 3 V - 9 Vdc (TX) and 3 V-12 Vdc (RX). The worst input currents under normal operating conditions are 35 mA and 40 mA respectively. The final product should be capable of supplying these power requirements.

The WA-TX-01-R and the WA-RX-01A-R are entirely SELV (Separated Extra Low Voltage) when the supply input from the final product is SELV, i.e. the WA-TX-01-R and the WA-RX-01A-R are Class III equipment in which protection against electric shock relies on a supply from an SELV circuit and in which hazardous voltage is not generated.

The WA-TX-01-R and the WA-RX-01A-R should be installed in the final products so that the required creepage and clearance distances (within the final products) are maintained.

### **Conformity assessment of the final product**

The manufacturer of the final product is responsible for the conformity assessment procedures of the final product in accordance with the R&TTE Directive.

As to the conformity assessment of the R&TTE Directive Article 3.2 (Efficient use of the radio spectrum), the manufacturer of the final products incorporating the R&TTE assessed WA-TX-01-R and WA-RX-01A-R will be exempted from its conformity assessment procedures. For details of how to use the conformity assessment of the WA-TX-01-R and the WA-RX-01A-R, please consult the relevant authorities or accredited certification bodies.

### **Notification of the final product**

The notification required by R&TTE Directive Article 6 (4) is not necessary if the final product is used in the harmonized frequency band and is classified as Class-1 equipment. If the final product is not used in the harmonized frequency band and is classified as Class-2 equipment, the manufacturer of the final product has a duty to notify the relevant radio regulatory authorities in the countries where the final product is sold.

\*NOTE: In case the WA-TX-01-R is used for wireless microphones according to EN 300 422, notification of the final product will be required. A list of Class-1 equipment is available at <http://www.ero.dk/>.

### **Exemption clause**

Circuit Design, Inc does not guarantee the accuracy of the above mentioned information about the conformity assessment and notification of the final product. Directives, technical standards, principles of operation and the like may be interpreted differently by the authorities in each country. Also the national laws and restrictions vary with the country. In case of doubt or uncertainty, we recommend that you check with the authorities or official certification organizations of the relevant countries.



**DECLARATION OF CONFORMITY**

We, Circuit Design, Inc.  
of 7557-1 Hotaka,  
Azumino-city  
Nagano 399-8303 Japan

declare under our sole responsibility that the product

WA-TX-01-R wireless audio transmitter  
WA-RX-01A-R wireless audio receiver

to which this declaration relates, is in conformity with the following standards and/or other normative documents.

EN 300 422-2 v1.1.1 (2000-08)  
EN 301 357-2 v1.2.1 (2001-06)  
EN 301 489-9 v1.2.1 (2001-07)  
EN 6065:1998, EN60950:2000

We hereby declare that all essential radio test suites have been carried out and that the above named product is in conformity to all the essential requirements of Directive 1999/5/EC.

The technical documentation relevant to the above equipment can be made available for inspection on application to:

Circuit Design, Inc.  
7557-1 Hotaka, Azumino-city, Nagano 399-8303 Japan

Yukinaga Koike  
(name)

Vice president  
(title)

Yukinaga Koike  
(signature of authorised person)

4 Apr / 2006  
(date)

## Cautions

- As the radio module communicates using electronic radio waves, there are cases where transmission will be temporarily cut off due to the surrounding environment and method of usage. The manufacturer is exempt from all responsibility relating to resulting harm to personnel or equipment and other secondary damage.
- Do not use the equipment within the vicinity of devices that may malfunction as a result of electronic radio waves from the radio module.
- The manufacturer is exempt from all responsibility relating to secondary damage resulting from the operation, performance and reliability of equipment connected to the radio module.
- Communication performance will be affected by the surrounding environment, so communication tests should be carried out before actual use.
- Ensure that the power supply for the radio module is within the specified rating. Short circuits and reverse connections may result in overheating and damage and must be avoided at all costs.
- Ensure that the power supply has been switched off before attempting any wiring work.
- The case is connected to the GND terminal of the internal circuit, so do not make contact between the '+' side of the power supply terminal and the case.
- When batteries are used as the power source, avoid short circuits, recharging, dismantling, and pressure. Failure to observe this caution may result in the outbreak of fire, overheating and damage to the equipment. Remove the batteries when the equipment is not to be used for a long period of time. Failure to observe this caution may result in battery leaks and damage to the equipment.
- Do not use this equipment in vehicles with the windows closed, in locations where it is subject to direct sunlight, or in locations with extremely high humidity.
- The radio module is neither waterproof nor splash proof. Ensure that it is not splashed with dirt or water. Do not use the equipment if water or other foreign matter has entered the case.
- Do not drop the radio module or otherwise subject it to strong shocks.
- Do not subject the equipment to condensation (including moving it from cold locations to locations with a significant increase in temperature.)
- Do not use the equipment in locations where it is likely to be affected by acid, alkalis, organic agents or corrosive gas.
- Do not bend or break the antenna. Metallic objects placed in the vicinity of the antenna will have a significant effect on communication performance. As far as possible, ensure that the equipment is placed well away from metallic objects.
- The ground for the radio module will also affect communication performance. If possible, ensure that the case ground and the circuit ground are connected to a large ground pattern.

## Warnings

- Do not take apart or modify the equipment.
- Do not remove the product label (the label attached to the upper surface of the module.) Using a module from which the label has been removed is prohibited.

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Customers are advised to consult with Circuit Design sales representatives before ordering.

Circuit Design, Inc. believes the information provided is accurate and reliable. However, Circuit Design, Inc. reserves the right to make changes to this product without notice.

## Revision history

Version	Date	Description	Remark
1.0	April. 2006	WA-TX-01-R/WA-RX-01A-R (RoHS compliant version) The first issue	