

Engineered Sound[®]

UHF Wireless Systems

ESW-R220 UHF Synthesized Diversity Dual Receiver

Installation and Operation



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This device complies with part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

This device complies with INDUSTRY CANADA R.S.S. 210, en conformité avec IC: RSS-210/CNR210. Operation is subject to the following conditions: 1) This device may not cause harmful interference and 2) this device must accept any interference received, including interference which may cause undesired operation.

Individuals with implanted cardiac pacemakers or AICD devices: Please see notice on back cover.

CAUTION! The circuits inside the receiver and transmitter have been precisely adjusted for optimum performance and compliance with federal regulations. Do not attempt to open the receiver or transmitter. To do so will void the warranty, and may cause improper operation.

CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN

AVIS
RISQUE DE CHOC ÉLECTRIQUE
NE PAS OUVRIR



To prevent electric shock, do not remove the cover. There are no user-serviceable parts inside. Internal adjustments are for qualified professionals only. Refer all servicing to qualified service personnel.



Pour prévenir un choc électrique, ne pas ouvrir le couvercle. Il n'y a aucune pièces de rechanges à l'intérieur. Tout ajustement interne doit être fait par une personne qualifiée seulement. Référez tout réparation au personnel qualifié.



Warning: This apparatus must be grounded. This product is a safety class 1 product. There must be an uninterruptible safety earth ground from the main power source to the product's AC input. Whenever it is likely that the protection has been impaired, disconnect the power cord until the ground has been restored.



Attention: Cet appareil doit être mise à la terre. Cet appareil est de classe de sûreté 1. Il doit y avoir un ininterrompable de mise à la terre de sécurité provenant de la source principale de courant de l'appareil de l'entrée du courant alternatif. Quand la protection a été affaiblie, débrancher le fil de courant jusqu'à la mise à terre a bien été réétablie.



Warning: To prevent fire or shock hazard, do not expose this appliance to rain or moisture.

Attention: Pour prévenir feu ou choc électrique, ne pas exposé l'appareil à la pluie ou à l'humidité.



Caution/Avis: For continued protection against fire hazard, replace only with same type/rating of fuse.

Pour poursuivre la protection contre le feu, remplacez la fusible de même type/cote.



Warning/Attention: There are some sharp edges inside. To reduce the risk of injury, do not remove cover.

Bord tranchant à l'intérieur. Pour réduire le risque de blessure, ne pas ouvrir le couvercle.

Introduction

Audio-Technica Engineered Sound® wireless systems are offered as separate receiver and transmitter units, rather than in predetermined combinations, for greatest system flexibility. Operating details for Engineered Sound transmitters are included with each transmitter.

Engineered Sound receivers feature a sophisticated Tone Lock™ tone squelch system that opens only when an Engineered Sound transmitter is detected, reducing the possibility of interference. As a result, Engineered Sound transmitters and receivers must be used together and should not be used with components from other Audio-Technica wireless systems, or with those of other manufacturers.

The ESW-220 Dual Receiver unit features two independent receivers in its housing, along with an antenna combiner/divider system. Each receiver offers 100 PLL-synthesized UHF frequencies and true diversity reception. In each receiver, two antennas feed two completely independent RF sections (Tuners) on the same frequency. Automatic logic circuitry continuously compares and selects the superior received signal, providing better sound quality and reducing the possibility of interference and dropouts. The ESW-R220 is housed in a full-width standard 19" (1U) rack-mountable case, with rack-mount adapters included.

The antenna combiner/divider system in the ESW-R220 provides two "A" and two "B" antenna inputs that feed each of the two diversity tuners in each receiver. As one example, the two pairs of inputs might be used when coverage of a split banquet/meeting room is difficult with a single pair of antennas, or when considerable multipath interference is present. Two "A" and two "B" antenna **output** jacks are provided to feed other wireless receivers operating in the same frequency band. With the addition of two more ESW-R220 dual receiver units, up to six receiver channels can be operated from a single pair of antennas. However, any type of receiver in the same band, or even a separate active antenna divider, may be fed by the antenna outputs. The ESW-R220 also provides +12V DC on the antenna input jacks to power in-line RF devices.

Please note that in multiple-system applications there must be a transmitter-receiver pair set to a separate frequency for each input desired (only one transmitter at a time for each receiver). Because the wireless frequencies are on UHF TV frequencies, only certain wireless frequencies may be useable in a particular geographic area. Also, only certain of the available operating frequencies may be used together in multi-channel systems. (Suggestions for multiple-frequency groupings will be found on page 7.)

Receiver Installation

Location

For best operation the receiver should be at least 3 ft. above the ground and at least 3 ft. away from a wall or metal surface to minimize reflections. The transmitter should be at least 3 ft. from the receiver, as shown in Figure A.

Keep antennas away from noise sources such as digital equipment, motors, automobiles and neon lights, as well as large metal objects.

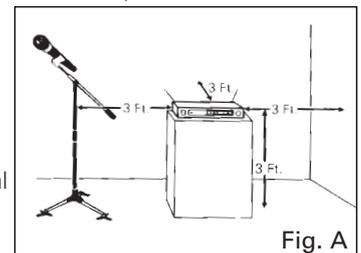


Fig. A

Output Connections

There are two audio output jacks on the back for each of the receivers: balanced (4 mV) and unbalanced (40 mV). Use shielded audio cable for the connection between the receiver and the mixer. If the input of the mixer is a 1/4" jack, connect a cable from the 1/4" unbalanced audio output on the back of the receiver housing to the mixer. If the input of the mixer is an XLR-type input, connect a cable from the balanced XLR-type audio output on the back panel to the mixer. The two isolated audio outputs permit simultaneous feeds to both unbalanced and balanced inputs. For example, both a tape recorder and a mixer can be driven by each receiver.

Antennas

Attach a pair of UHF antennas to the antenna input jacks; connect one to the main "Antenna A In" jack and one to the main "Antenna B In" jack. See Figure B. The antennas are normally positioned in the shape of a "V" (45° from vertical) for best reception.

The antennas can be remotely located from the receiver. However, due to signal loss in cables at UHF frequencies, use the lowest-loss RF cable type(s) practical for any cable runs over 25 feet. RG-8 is a good choice. Use only copper-shielded cable, not CATV-type foil-shielded wire.

The two pairs of antenna inputs might be used when coverage of a split banquet/meeting room is difficult with a single pair of antennas, or in the case of multipath-prone areas. Simply connect another set of *remote* antennas to the alternate "A" and "B" inputs. (Main and alternate antenna inputs are identical and interchangeable.) The unique RF nature of each venue normally requires some experimentation to determine the best locations, if any, for additional antennas.

All four antenna input jacks also provide +12V DC output on their center pins to power in-line RF devices. A combined total of 20 mA can be drawn from the "A" jacks and 20 mA from the "B" jacks. While an accidental short-circuit will not harm the internal 12V supply, make certain that an antenna cable shield does not contact the center conductor.

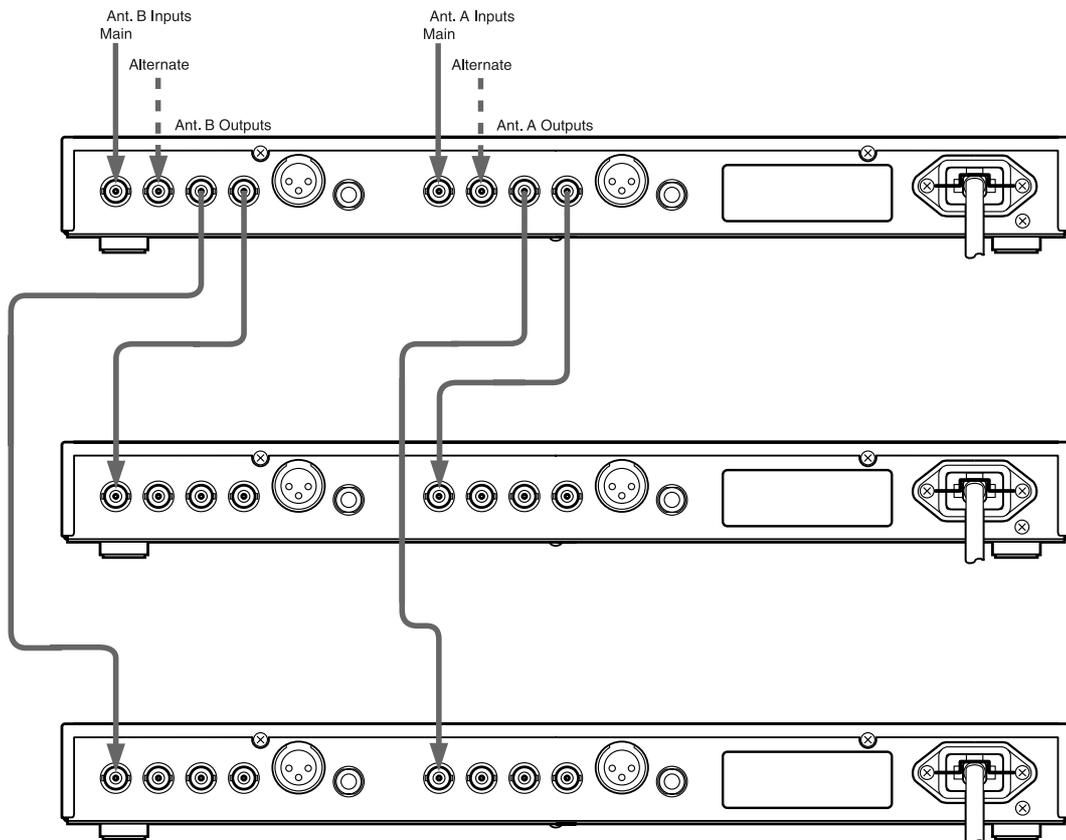
Power Connections

The switching power supply is designed to operate properly from any AC power source 120-240V, 50/60 Hz without adjustment. Simply connect to a standard AC power outlet, using an IEC input cordset approved for the country of operation. Use the included cable clamp to secure the plug in the chassis connector. Power to the unit is controlled by the front-panel Power switch.

Headphone Jack

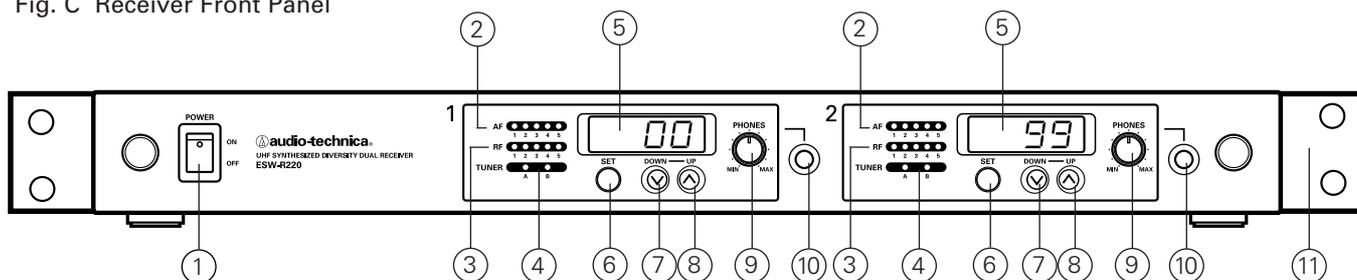
A headphone jack on the front panel provides monitoring of each receiver's output. The 1/4" TRS jack is intended for use with stereo headphones. The "Phones" level control affects the headphone jack only.

Fig. B Antenna Connections



Receiver Controls And Functions

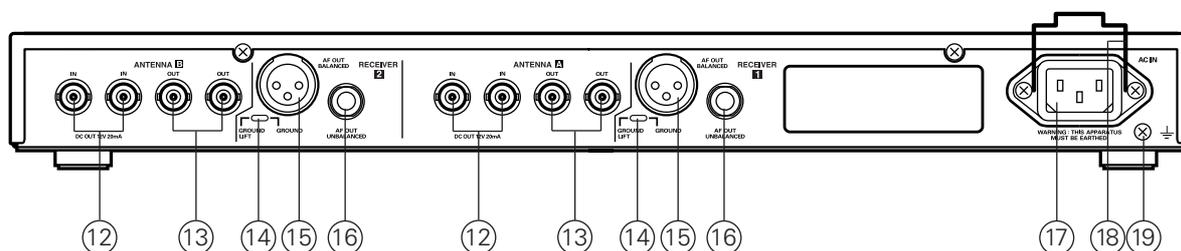
Fig. C Receiver Front Panel



Front Panel Controls and Functions (Fig. C)

- ① **POWER SWITCH:** Press switch On and the Channel Designator Displays (5) will light.
- Receiver 1 / Receiver 2**
Controls and operation of the two receivers are identical.
- ② **AF LEVEL INDICATOR:** Indicates the audio modulation level of the received signal. The LEDs light up from left to right.
- ③ **RF LEVEL INDICATOR:** Indicates the strength of the RF signal received from the transmitter.
- ④ **TUNER OPERATION INDICATOR:** Indicates which Tuner (A or B) has the better reception and is in operation. Lights only when receiving an ES transmitter's signal.
- ⑤ **CHANNEL DESIGNATOR DISPLAY:** Indicates the current channel setting.
- ⑥ **CHANNEL SET BUTTON:** Hold this button in and press "Up" or "Down" to change the channel shown in the Channel Designator Display.
- ⑦ **CHANNEL SELECTOR "DOWN" SWITCH:** Changes the channel designator, decreasing from 99 to 00. "Rolls over" from 00 to 99.
- ⑧ **CHANNEL SELECTOR "UP" SWITCH:** Changes the channel designator, increasing from 00 to 99. "Rolls over" from 99 to 00.
- ⑨ **"PHONES" LEVEL CONTROL:** Adjusts the level of the headphone jack only; it does not affect receiver audio output.
- ⑩ **HEADPHONE OUTPUT:** 1/4" TRS phone jack. Plug in a "stereo" headphone to monitor receiver signal.
- ⑪ **MOUNTING ADAPTERS:** For mounting the receiver in any standard 19" rack. Attach to receiver with screws supplied.

Fig. D Receiver Rear Panel



Rear Panel Controls and Functions (Fig. D)

Antenna "A" / Antenna "B"

- ⑫ **INPUT JACKS:** BNC-type antenna connectors for "A" and "B" Tuners in both receivers. Attach antennas directly, or extend them with low-loss antenna cable. See the "Antennas" section on page 3 for more details.
- ⑬ **OUTPUT JACKS:** Provide RF distribution to other receivers operating in the same frequency band. Each output should be connected to only one other antenna input, without "daisy-chaining." (Using two additional ESW-R220 dual receiver units provides a total of six channels in three rack spaces with a single pair of antennas.)
- Receiver 1 / Receiver 2**
- ⑭ **GROUND LIFT SWITCH:** Disconnects the ground pin of the balanced output (15) from ground. Normally, the switch should be to the right (ground connected). If hum caused by a ground loop occurs, slide switch to the left.
- ⑮ **BALANCED AUDIO OUTPUT JACK:** XLRM-type connector. A standard 2-conductor shielded cable can be used to connect the receiver output to a balanced microphone-level input on a mixer or integrated amplifier.
- ⑯ **UNBALANCED AUDIO OUTPUT JACK:** 1/4" phone jack. Can be connected to an unbalanced aux-level input of a mixer, guitar amp or tape recorder.
- ⑰ **AC POWER:** IEC-type connector for 120-240V AC 50/60 Hz power input. No adjustment for mains voltage/frequency is necessary.
- ⑱ **POWER CABLE CLAMP:** Use provided cable clamp to secure the plug in the chassis connector.
- ⑲ **GROUND TERMINAL:** Case grounding screw, if needed.

System Operation

Turn down the mixer/amplifier level before starting up the wireless system.

Switch on the receiver. Do **not** switch on the transmitter yet.

Receiver On...

The Channel Designator Displays will light. If any of the RF LEDs light up at this point, there may be RF interference in the area. If this occurs, select another frequency using the front-panel channel selectors. While holding in the "Set" button, press the "Up" or "Down" button to access the desired frequency; then release the Set button to select the channel.

Transmitter On...

Refer to the manual included with each Engineered Sound transmitter for details of setup and operation.

Before turning on the transmitter, **make certain it is set to the same operating channel as the receiver.** When the transmitter is switched on and in normal operation, the receiver's RF signal level indicators will light up from left to right. For optimum performance at least four, and preferably five, of the signal strength indicators should light up when the transmitter is switched on. One of the Tuner LEDs (A or B) also will light up when the transmitter is on, indicating that its signal has been received and the receiver's Tone Lock squelch circuit has opened.

Setting Levels

Although Engineered Sound receivers require no level adjustment, correct adjustment of transmitter audio input and mixer/amplifier input and output levels is important for optimum system performance.

Engineered Sound transmitters include adjustments for optimum audio modulation levels. Refer to the transmitter's manual for full details. Maximum audio input to the mic or guitar should light about three or four green LEDs on the receiver's AF Level indicator. Audio modulation from the transmitter level should not be allowed to light the red LED – doing so will cause the system to overload and distort.

The audio output level of the ESW-R220 has been optimized for best performance and no adjustment is necessary. The level control on the front panel controls the headphone jack only.

Receiver Squelch

The sophisticated Tone Lock™ system in ES wireless units eliminates the need for any user-adjustable squelch control on the receiver. Do not attempt to open the receiver housing or adjust any internal alignment controls.

RF Interference

Please note that wireless frequencies are shared with other radio services. According to Federal Communications Commission regulations, "Wireless microphone operations are unprotected from interference from other licensed operations in the band. If any interference is received by any Government or non-Government operation, the wireless microphone must cease operation..."

If you need assistance with operation or frequency selection, please contact your dealer or the Audio-Technica professional division. Extensive wireless information also is available on the Audio-Technica Web site at www.audio-technica.com.

Ten Tips To Obtain The Best Results

1. Use only fresh alkaline batteries. Do not use "general purpose" (carbon-zinc) batteries.
2. Position the receiver so that it has the fewest possible obstructions between it and the normal location of the transmitter. Line-of-sight is best.
3. The transmitter and the receiver should be as close together as conveniently possible, but no closer together than three feet.
4. The receiver antennas should be in the open and away from any metal. If mounted in a rack, have the unit on top, or use external/remote antennas.
5. Each transmitter/receiver pair must be set to the same channel number.
6. A single receiver cannot receive signals from two transmitters at the same time.
7. For best operation, all the RF Level LEDs should be lit (maximize RF input); but only the first two or three AF Level LEDs should be lit (don't overmodulate).
8. You need to change channels 1) when a strong interference signal is received, 2) when the channel breaks down, or 3) during multiple-system operation in order to select an interference-free channel.
9. In the UniPak transmitter, the "MT" or "GT" input control not in use should be set to minimum.
10. Turn the transmitter off when not in use. Remove the batteries if the transmitter is not to be used for a period of time.

Specifications†

OVERALL SYSTEM

Operating Frequency	UHF band, 728.125 to 740.500 MHz
Number of Channels	100 total
Frequency Stability	±0.005%, Phase Lock Loop frequency control
Modulation Mode	FM
Normal Deviation	±5 kHz
Tone Squelch Frequency	32.768 kHz
Operating Range	300' typical
Operating Temperature Range	41° F (5° C) to 113° F (45° C)
Frequency Response	100 Hz to 15 kHz

ESW-R220 RECEIVER

Receiving System	Dual independent tuners, automatic switching diversity
Image Rejection	>100 dB
Signal-to-noise Ratio	>107 dB (IEC-weighted at ±40 kHz deviation)
Total Harmonic Distortion	<1% (±5 kHz deviation at 1 kHz)
Sensitivity	18 dBµV (S/N 60 dB at ±5 kHz deviation, IEC-weighted)
Intermediate Frequencies	54.25 MHz, 10.7 MHz
Audio Output	
Unbalanced:	40 mV (at 1 kHz, ±5 kHz deviation, 1M ohm load)
Balanced:	4 mV (at 1 kHz, ±5 kHz deviation, 600 ohm load)
Output Connectors	
Unbalanced:	¼" phone jack
Balanced:	XLRM-type
Headphone Output	20 mW max. into 16 ohms (at 1 kHz, ±5 kHz deviation)
Antenna Inputs	BNC-type, 50 ohms, two "A" and two "B"
Antenna Outputs	BNC-type, 50 ohms, two "A" and two "B"
Antenna Power	+12V DC on input jacks, 20 mA max. from "A" jacks, 20 mA max. from "B" jacks
Power Supply	120-240V AC, 50/60 Hz, autoadjusting
Dimensions	16.93" (430.0 mm) W x 1.73" (44.0 mm) H x 6.89" (175.0 mm) D without antennas, power cable or rack-mount adapters
Weight	6.4 lbs (2.9 kg)
Accessories Included	Two flexible UHF antennas, rack-mount adapters, power cable and power cable clamp

† In the interest of standards development, A.T.U.S. offers full details on its test methods to other industry professionals on request.

Receiver Accessories

ATW-A20	Pair of UHF ground-plane antennas with 5/8"-27 thread for mounting to microphone stands, etc. Takes RF cables with BNC connectors, not included.
ATW-D70	UHF (728-750 MHz) active unity-gain antenna distribution system provides two "1-in, 4-out" RF channels; connects a pair of antennas to as many as four diversity receivers. Includes four DC interconnect cables to power up to four receivers, eight RF output cables and two rack-mount adapters. Mounts in a single (1U) 19" rack space.

For future reference, please record your system information here (the serial number appears on the bottom of the receiver):

Receiver ESW-R220 Serial Number _____

Engineered Sound® UHF Wireless Operating Frequencies

Frequency and Channel Designator List

Designator	Frequency (MHz)	TV Channel	Designator	Frequency (MHz)	TV Channel
00	728.125	57	50	734.375	58
01	728.250	57	51	734.500	58
02	728.375	57	52	734.625	58
03	728.500	57	53	734.750	58
04	728.625	57	54	734.875	58
05	728.750	57	55	735.000	58
06	728.875	57	56	735.125	58
07	729.000	57	57	735.250	58
08	729.125	57	58	735.375	58
09	729.250	57	59	735.500	58
10	729.375	57	60	735.625	58
11	729.500	57	61	735.750	58
12	729.625	57	62	735.875	58
13	729.750	57	63	736.000	58
14	729.875	57	64	736.125	58
15	730.000	57	65	736.250	58
16	730.125	57	66	736.375	58
17	730.250	57	67	736.500	58
18	730.375	57	68	736.625	58
19	730.500	57	69	736.750	58
20	730.625	57	70	736.875	58
21	730.750	57	71	737.000	58
22	730.875	57	72	737.125	58
23	731.000	57	73	737.250	58
24	731.125	57	74	737.375	58
25	731.250	57	75	737.500	58
26	731.375	57	76	737.625	58
27	731.500	57	77	737.750	58
28	731.625	57	78	737.875	58
29	731.750	57	79	738.000	58
30	731.875	57	80	738.125	58
31	732.000	57	81	738.250	58
32	732.125	57	82	738.375	58
33	732.250	57	83	738.500	58
34	732.375	57	84	738.625	58
35	732.500	57	85	738.750	58
36	732.625	57	86	738.875	58
37	732.750	57	87	739.000	58
38	732.875	57	88	739.125	58
39	733.000	57	89	739.250	58
40	733.125	57	90	739.375	58
41	733.250	57	91	739.500	58
42	733.375	57	92	739.625	58
43	733.500	57	93	739.750	58
44	733.625	57	94	739.875	58
45	733.750	57	95	740.000	59
46	733.875	57	96	740.125	59
47	734.000	58	97	740.250	59
48	734.125	58	98	740.375	59
49	734.250	58	99	740.500	59

Multi-channel Systems

Following are groupings of frequencies suggested for multi-channel wireless systems.

- Group A: Channels 00, 02, 08, 15, 46, 50, 60 (or 62), 71, 76, 80, 93, 99 -or-
- Group B: Channels 01, 03, 07, 25, 30, 41, 44, 56, 69, 76, 77, 86

For use where TV Channel 57 is operating:

- Channels 50, 60 (or 62), 71, 76, 80, 93, 99 (from Group A) -or-
- Channels 56, 69, 76, 77, 86 (from Group B)

For use where TV Channel 58 is operating:

- Channels 00, 02, 08, 15, 46, 99 (from Group A) -or-
- Channels 01, 03, 07, 25, 30, 41, 44 (from Group B)

For use where TV Channel 59 is operating:

- Channels 00, 02, 08, 15, 46, 50, 60 (or 62), 71, 76, 80, 93 (from Group A) -or-
- Channels 01, 03, 07, 25, 30, 41, 44, 56, 69, 76, 77, 86 (All of Group B)

Notice to individuals *with implanted cardiac pacemakers or AICD devices:*

Any source of RF (radio frequency) energy *may* interfere with normal functioning of the implanted device. All wireless microphones have low-power transmitters (less than 0.05 watts output) which are unlikely to cause difficulty, especially if they are at least a few inches away. However, since a "body-pack" mic transmitter typically is placed against the body, we suggest attaching it at the belt, rather than in a shirt pocket where it may be immediately adjacent to the medical device. Note also that *any medical-device disruption will cease when the RF transmitting source is turned off*. Please contact your physician or medical-device provider if you have any questions, or experience any problems with the use of this or any other RF equipment.

One-Year Limited Warranty

Audio-Technica professional wireless systems purchased in the U.S.A. are warranted for one year from date of purchase by Audio-Technica U.S., Inc. (A.T.U.S.) to be free of defects in materials and workmanship. In event of such defect, product will be repaired promptly without charge or, at our option, replaced with a new product of equal or superior value if delivered to A.T.U.S. or an Authorized Service Center, prepaid, together with the sales slip or other proof of purchase date. **Prior approval from A.T.U.S. is required for return.** This warranty excludes defects due to normal wear, abuse, shipping damage, or failure to use product in accordance with the instructions. This warranty is void in the event of unauthorized repair or modification, or removal or defacing of the product labeling.

For return approval and shipping information, contact the Service Dept., Audio-Technica U.S., Inc., 1221 Commerce Drive, Stow, Ohio 44224.

Except to the extent precluded by applicable state law, **A.T.U.S. will have no liability for any consequential, incidental, or special damages; any warranty of merchantability or fitness for particular purpose expires when this warranty expires.**

This warranty gives you specific legal rights, and you may have other rights which vary from state to state.

Outside the U.S.A., please contact your local dealer for warranty details.

