# Engineered Sound UHF Wireless Systems

ESW-R220 UHF Synthesized Diversity Dual Receiver

Installation and Operation



## **ESW-R220 UHF Synthesized Diversity Dual Receiver**

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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 aucune pièces de rechanges à l'intérieur. Tout ajustement interne doit être fait par une personne qualifié 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, replacez 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 ouvir 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.)

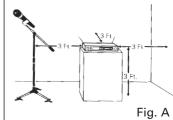
#### Receiver Installation

#### 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.



#### **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 ¼" jack, connect a cable from the ¼" 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 coppershielded 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.

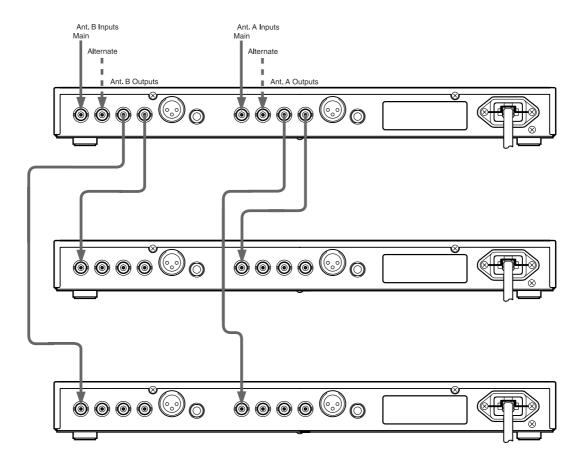
#### **Power Connections**

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.

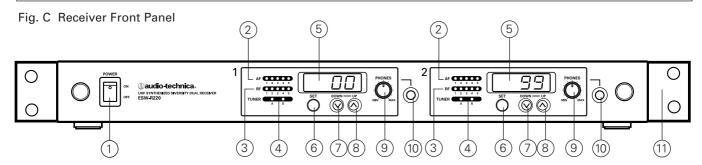
#### **Headphone Jack**

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**



#### Front Panel Controls and Functions (Fig. C)

1 POWER SWITCH: Press switch On and the Channel Designator Displays (5) will light.

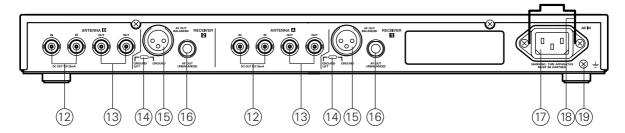
#### Receiver 1 / Receiver 2

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.
- (1) HEADPHONE OUTPUT: '/₄" TRS phone jack. Plug in a "stereo" headphone to monitor receiver signal.
- (1) 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.
- (3) 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

- (4) 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

- 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.
- 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.

- 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.
- 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<sup>†</sup>

#### OVERALL SYSTEM

OVERALL STSTEIN				
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: Balanced:	40 mV (at 1 kHz, ±5 kHz deviation, 1M ohm load) 4 mV (at 1 kHz, ±5 kHz deviation, 600 ohm load)		
Output Connectors Unbalanced: Balanced:	'/4" phone jack 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		

<sup>†</sup> 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):

#### **Engineered Sound® UHF Wireless Operating Frequencies**

Designator   Frequency (MHz)   TV Channel		Frequency and Channel Designator List								
01 728,250 57 51 734,600 58 02 728,375 57 52 734,625 58 03 728,500 57 52 734,625 58 04 728,825 57 54 738,375 58 05 728,750 57 55 735,000 58 06 728,875 57 56 735,000 58 07 729,000 57 57 57 735,000 58 08 729,125 57 58 735,000 58 10 729,375 57 59 735,500 58 11 729,500 57 57 59 735,500 58 11 729,500 57 61 735,750 58 11 729,500 57 61 735,750 58 12 729,625 57 62 735,875 58 13 729,750 57 62 735,875 58 14 729,875 57 64 736,125 58 15 730,000 57 66 736,125 58 16 730,125 57 66 736,200 58 17 730,250 57 66 736,200 58 18 730,375 57 68 736,200 58 18 730,375 57 68 736,200 58 19 730,500 57 68 736,200 58 19 730,500 57 68 736,200 58 19 730,500 57 68 736,255 58 19 730,600 58 19 730,500 57 68 736,200 58 19 730,500 57 68 736,255 58 19 730,500 57 68 736,255 58 19 730,500 57 68 736,500 58 20 730,625 57 70 736,500 58 21 730,750 57 77 737,36,500 58 22 730,875 57 77 79 736,500 58 23 731,000 57 78 79 736,500 58 24 731,125 57 77 79 737,250 58 25 731,250 57 78 79 737,250 58 26 731,375 57 78 79 737,250 58 27 731,150 57 78 79 738,500 58 28 731,250 57 78 79 738,500 58 29 731,750 57 78 79 738,600 58 20 731,850 57 78 79 738,600 58 21 732,250 57 78 79 738,600 58 22 733,150 57 78 79 738,600 58 23 731,000 57 77 79 737,750 58 24 731,125 57 78 80 738,600 58 25 731,250 57 78 79 738,600 58 26 731,375 57 78 80 738,500 58 27 731,500 57 78 80 738,500 58 28 731,500 57 78 80 738,500 58 30 731,875 58 31 732,000 57 88 738,500 58 31 732,000 57 88 738,500 58 31 732,000 57 88 738,500 58 31 732,000 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 31 732,500 57 88 738,500 58 32 733,500 57 88 738,500 58 33 732,500 57 88 738,500 58 34 732,500 57 88 738,500 58 34 732,500 57 89 738,500 58 35 732,500 58 58 36 732,500 57 89 738,500 58 38 732,500 58 58 39 733,500 59 738,50	Designator	Frequency (MHz)	TV Channel	Designator	Frequency (MHz)	TV Channel				
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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         736.250         58           16         730.125         57         67         736.500         58           18         730.250         57         67         736.500         58           19         730.500         57         69         736.750         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         737.37.50         58           25         731.250         57         75 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td></td<>										
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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         737,605         58           28         731,605         57         77         737,750         58           28         731,605         57         77         737,875         58           29         731,750         57         79         738,000         58           30         731,875         57         80         7										
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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     77     737.875     58       29     731.750     57     78     737.875     58       30     731.875     57     79     738.000     58       31     732.000     57     78     80     738.125     58       31     732.250     57     82     738.375     58       33     732.250     57     84     738.625     58       34     732.350     57     84     738.625     58       35     732.550     57     86     738.875<										
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         737.500         58           26         731.375         57         76         737.500         58           26         731.375         57         76         737.50         58           27         731.500         57         77         737.750         58           28         731.625         57         78         737.875         58           29         731.750         57         77         788.000         58           30         731.875         57         80         738.125         58           31         732.000         57         81         738.250         58           31         732.000         57         81         738.500         58           34         732.350         57         84         73										
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       26     731.375     57     77     737.750     58       28     731.625     57     77     737.875     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     82     738.375     58       34     732.375     57     84     738.625     58       34     732.300     57     81     738.500     58       35     732.500     57     85     738.750     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         738.875         58           35         732.500         57         85         7										
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     81     738.250     58       33     732.250     57     83     738.500     58       34     732.375     57     84     738.625     58       34     732.500     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     739.250     58<										
24     731.125     57     74     737.375     58       25     731.250     57     75     737.500     58       26     731.375     57     76     737.602     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       34     732.500     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     732.750     57     87     739.000     58       39     733.000     57     89     739.250     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           36         732.625         57         86         738.875         58           37         732.750         57         87         7		731.000			737.250	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         87         739.000         58           39         733.000         57         89         7	24	731.125	57	74	737.375	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         7	25	731.250	57	75	737.500	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         7	26	731.375	57	76	737.625	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         738.625         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         87         739.000         58           39         733.000         57         88         739.125         58           39         733.000         57         89         739.375         58           41         733.250         57         91         739.625         58           43         733.375         57         92         7	27	731.500	57	77	737.750	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         738.625         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         87         739.000         58           39         733.000         57         88         739.125         58           39         733.000         57         89         739.375         58           41         733.250         57         91         739.625         58           43         733.375         57         92         7	28	731.625	57	78	737.875	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     733.625     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<			57	79	738.000					
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     733.600     57     93     739.750     58       44     733.625     57     94     739.875     58       45     733.750     57     96     740.000     59       46     733.875     57     96     740.125     59       47     734.000     58     97     740.250     59<			57							
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     96     740.000     59       46     733.875     57     96     740.025     59       47     734.000     58     97     740.250     59       48     734.125     58     98     740.375     59<										
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										
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										
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										
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										
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										
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										
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										
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										
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										
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										
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										
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										
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										
46     733.875     57     96     740.000     59       47     734.000     58     97     740.250     59       48     734.125     58     98     740.375     59				94	/39.8/5	უგ				
46     /33.8/5     5/     96     740.125     59       47     734.000     58     97     740.250     59       48     734.125     58     98     740.375     59				95	740.000	59				
47     734.000     58     97     740.250     59       48     734.125     58     98     740.375     59	46	/33.875	57		740.125					
48 734.125 58 98 740.375 59	47	734.000	58		740.250					

#### **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.

