UCR210D

DIVERSITY UHF RECEIVER

OPERATING INSTRUCTIONS
and trouble-shooting guide

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GENERAL TECHNICAL DESCRIPTION

The UCR210D is a portable, high performance, triple-conversion, frequency synthesized, UHF receiver. The RF performance is extremely stable over a very wide temperature range, making the UCR210D perfectly suited to the rough environmental conditions found in the field. The proprietary audio processing includes a dual-band compandor for very low distortion and a superior signal to noise ratio. The Smart Squelch system is operated by a separate pilot tone and mutes the audio output directly at the output connector.

DIVERSITY RECEPTION

The antenna phase SMART switching diversity technique was chosen in order to keep the receiver compact enough for camera mounted or shoulder bag applications. This diversity reception technique effectively minimizes dropouts in short range situations where multi-path reflections can cause serious problems. The optimum diversity reception is realized with the diversity antenna placed away from the receiver, however, dropouts are significantly reduced even if the two antennas are mounted directly on the receiver.

RF SECTION

The problem posed to the design staff was to retain the RF reliability of the Lectrosonics' fixed frequency designs but add the flexibility of a frequency agile design. The universal (and poor) way to build frequency agile systems is to design a wide open front end that will pass any frequency within the tuning range of the system. This leads to very poor RF performance with lots of interference, driving the user to switch frequencies in an attempt to sidestep the interference. This makes frequency agile receivers a self fulfilling system; you have to use the frequency agility to get away from the problems caused by the frequency agile design compromises.

The problem of frequency agility is further compounded when you realize that frequency changes "on the fly" cannot be made on any type of wireless system. For example, if there is suddenly an interference problem with a system in use, on stage for instance, a frequency change cannot be made without interrupting the program. Basically, the show must go on. In multi-channel applications, changing the frequency of one system will usually produce all kinds of new intermodulation problems with the other systems operating in the same location. Frequency agility is not the universal panacea for interference problems. It is only another tool and a limited tool at that. The first line of defense must be the system's basic immunity to interference. That required a new look at frequency agile receiver design.

FREQUENCY TRACKING FRONT-END

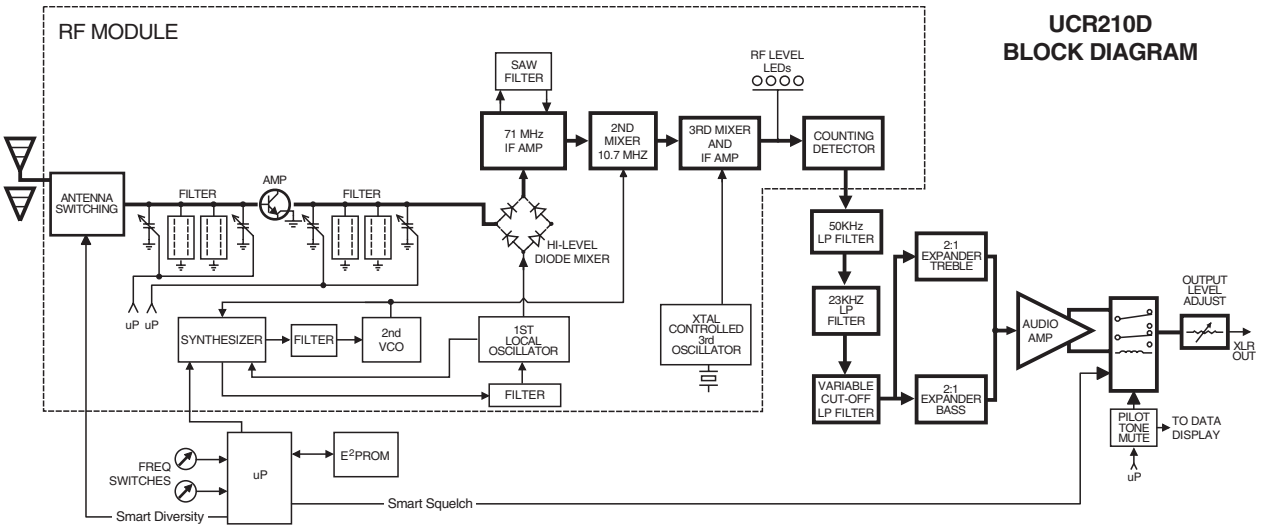
Our solution to the wide open front end problem was to design a selective front end that can be tuned to the frequency in use. Since we wanted this front end to be equivalent to our fixed frequency front ends, this was a daunting task. Lectrosonics has always used front ends with more sections and much more selectivity than any other wireless manufacturer. The final design consists of a total of 4 transmission line resonators with variable capacitance applied to each resonator by the hexadecimal switches.

This sophistication produces a front end that is as selective as fixed frequency designs. The next step to improve the front end is to use good old fashioned "brute force."

HIGH CURRENT LOW NOISE AMPLIFIERS

The gain stage in the front end uses a rather special transistor in a feedback regulated high current circuit that combines three parameters that are generally at odds with one another. These are: low noise, low gain and relatively high power. It is easy to understand the advantages of low noise and high power capability but why is low gain desirable? The answer is that in a receiver, low gain allows the front end to handle stronger RF signals without output overload, which is "increased headroom," so to speak. The result of a design that takes all three of these parameters into consideration at once, is a low noise RF amplifier with a sensitivity rating equal or better than the best conventional design with a hundred times less susceptibility to intermodulation interference.

Combining the high power gain stage with the tracking front end produces a receiver that is unusually immune to single and multiple interfering signals close to the operating frequency and in addition strongly rejects signals that are much farther away.



DOUBLE BALANCED DIODE MIXERS

In all wireless receivers, a mixer is used to convert the carrier frequency to the IF frequency where most of the filtering and gain in the receiver takes place. After doing all the right things in the front end, it would be a shame to waste the performance with a second rate mixer. In other designs that is exactly what happens since mediocre mixers cause more intermodulation problems than mediocre front ends. The only solution was a high power, double balanced diode mixer driven by a local oscillator with more output power than most wireless transmitters (50 mW). The mixer in the UCR210D produces output at only the sum and difference signals, with minimal spurious signals. This mixer offers a very high overload threshold and a high degree of isolation between ports. The IF output of this mixer is at 71 MHz which is unusually high for a wireless receiver. This high frequency was chosen to increase the image rejection in the front end to as high or a higher level than our fixed frequency designs. The mixer is followed by high current, low noise amplifiers and SAW filters to preserve the superior RF performance.

SURFACE ACOUSTIC WAVE FILTER

The UCR210D is unique in that it uses a state of the art SAW filter in the IF section. The SAW filter is the only filter that can combine sharp skirts, constant group delay, and wide bandwidth in one filter. Though expensive, this special type of filter allows us to follow the basic receiver rule of doing the primary filtering as early as possible, at as high a frequency as possible and before high gain is applied to the signal. Since these filters are made of quartz, they are very temperature stable. Conventional LC filters at these frequencies don't begin to perform as well and in addition would drift unacceptably in the elevated temperatures of an equipment rack. After following the rule in a rigorous way, and due to the sharp filtering action of the SAW filters, the 71MHz signal is converted to 10.7Mhz and then to the low frequency of 300 kHz. Lots of gain is then applied in a conventional IC and the signal is then converted to audio. 300 kHz is very unconventional for a second IF in a wide deviation (±50 kHz) system. We chose to use 300 kHz to obtain an outstanding AM rejection figure over a very wide range of signal strengths and to produce an excellent noise improvement at low signal strengths (capture ratio). To use an IF at 300 kHz requires an unusual circuit to convert the IF to audio.

DIGITAL PULSE COUNTING DETECTOR

The UCR210D receiver uses an advanced digital pulse detector to demodulate the FM signal, rather than a conventional quadrature detector. The common problem with quadrature detectors is thermal drift, particularly those that operate at higher frequencies like 10.7 MHz. Though the quadrature detectors may work well at room temperature, if they are not carefully compensated, they will produce amplitude changes and audio distortion in the elevated temperatures of an equipment rack. Some manufacturers try to get around the problem by tuning their systems at higher temperatures after they've been on for some time. This just means that for the first hours in a cool room the receiver is well out of specification or after a few hours in a hot rack.

The UCR210D design presents an elegantly simple, yet highly effective solution to this age old problem. The UCR210D detector basically works like this: A stream of precision pulses is generated at 300kHz locked to the FM signal coming from the 300 kHz IF section. The pulse width is constant, but the timing between pulses varies with the frequency shift of the FM signal. The integrated voltage of the pulses within any given time interval varies in direct proportion to the frequency modulation of the radio signal. Another way of describing it is that as the FM modulation increases the frequency, the circuit produces more pulses and as the modulation decreases the frequency, the circuit produces fewer pulses. More pulses produces a higher voltage and fewer pulses a lower voltage. The resultant varying voltage is the audio signal.

This type of detector eliminates the traditional problems with quadrature detectors and provides very low audio distortion, high temperature stability and stable audio level. The counting detector also adds additional AM rejection, in addition to the limiting in the IF section. The amplitude of the pulses is constant, so level differences in the IF signal do not affect the pulse.

TRI MODE DYNAMIC FILTER

The audio signal is passed through a "dynamic noise reduction circuit". The cutoff frequency of this filter is varied automatically by measuring the amplitude and frequency of the audio signal and the quality of the RF signal. The audio bandwidth is held only to that point necessary to pass the highest frequency audio signal present at the time. If the RF level is weak, then the filter becomes more aggressive. This results in a dramatic reduction of "hiss" at all times. During passages with a high frequency content, this filter gets completely "out of the way" and passes the signal with no decrease in high-frequency response. Keep in mind that if hiss is added to a signal, there is a psycho acoustic effect that makes the sound seem brighter. The other side of this is that if hiss is removed from a signal it will sound duller. Basically the ear's detection apparatus is pre-sensitized to high frequency sounds by small amounts of high frequency hiss. Consider this effect when making a judgment about the sound quality of various wireless systems and this particular filter. We have satisfied ourselves through elaborate tests that this filter is totally transparent.

PILOT TONE MUTE

The UCR210D uses a pilot tone muting technique in order to protect against the reception of stray signals. The Lectrosonics transmitter adds an inaudible signal, known as the pilot tone, to the transmitted signal. The receiver detects (and removes) the pilot tone, and is thus able to identify the desired signal and mute all others.

When the receiver is powered up, receive audio is muted unless a proper pilot tone is detected. The pilot tone must be present for approximately one second before the signal is accepted.

If the PILOT TONE BYPASS button is pressed, received audio remains unmuted regardless of the presence or absence of a pilot tone. This position is useful for locating a clear frequency, since any potential interference may be heard. It may also be used in situations where squelching behavior is undesirable. The "PILOT TONE BYPASS" disables the squelch, as described below.

SMART SQUELCH

The UCR210D employs a sophisticated squelching system in an attempt to deliver the cleanest possible audio during marginal conditions of reception. Any squelching system faces inevitable trade-offs: squelch too much and valuable audio information may be lost, squelch too little and excessive noise may be heard; re-

spond too rapidly and the audio sounds “choppy”, respond too sluggishly and syllables or entire words are cut off.

The UCR210D combines several techniques to achieve an optimal balance, removing distracting noise, without the squelching action itself becoming a distraction. One of these techniques involves waiting for a word or syllable to complete before squelching. Another incorporates recent squelching history and recent signal strength, adjusting squelching behavior dynamically for the most serviceable result under variable conditions. Using these and other techniques, the UCR210D can deliver acceptable audio quality from otherwise unusable signals.

In the “PILOT TONE BYPASS” mode, the squelch system is disabled. Received audio remains unmuted at all times with this setting.

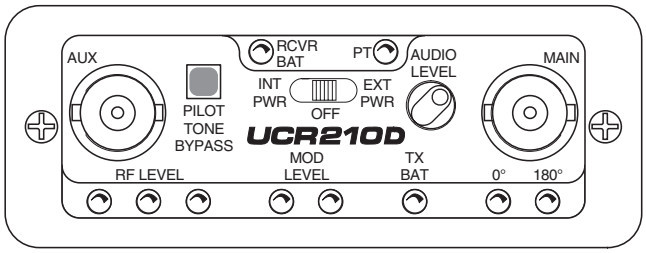
OUTPUT LEVEL ADJUST AND RANGE SWITCH

The front panel Output control will adjust the audio output within the range set by the -20/0/+8 range switch (located on the back panel.) In the -20 position the adjustment range is from –50dBm to –20dBm, the 0 position (center) allows an adjustment from –30dBm to 0dBm, and the +8 position sets the audio output to a fixed +8dBm with no front panel control.

POWER SUPPLY

The UCR210D may be operated from an external DC source (see Specifications and Features section for allowed voltages.) The power supply has a built in Poly-Fuse to protect the unit. This fuse resets if the power supply is disconnected for about 15 seconds.

FRONT PANEL CONTROLS AND FUNCTIONS



PT LED (Pilot Tone)

The audio output muting (squelch) function of the UCR210D is controlled by a 32kHz tone modulation of the RF carrier. The audio output is muted until this tone is present. This LED shows three conditions:

- Off - No pilot tone detected
- Green - Pilot tone detected
- Red - Pilot tone bypassed - press pilot tone bypass button to engage

TRANSMITTER MOD LEVEL METER

The two audio level LED's are bi-colored (red/.green) and indicate 5 levels -

off - off	no audio modulation
Green - off	low audio
Green - green	moderate audio
Red - off	full audio
Red - Red	limiting

RF LEVEL INDICATORS

The RF (radio frequency) level meter has three tri-colored LED's which can indicate 10 levels

off	off	off	no RF level
red	off	off	
red	red	off	
red	red	red	
yellow	red	red	
yellow	yellow	red	
yellow	yellow	yellow	
green	yellow	yellow	
green	green	yellow	
green	green	green	Strongest RF level

RCVR BAT LED

This tri-color LED will indicate the battery condition in the receiver as follows

- Green - battery good
- Yellow - battery getting low
- Red - battery very low - change now
- Blinking Red - battery critical failure imminent

Note: When using external power, this LED will only show GREEN as a power indicator. It doesn't monitor the level of the external voltage. (Later versions of this receiver do monitor the external voltage as well as the internal battery voltage.)

TX BAT LED

This tri-color LED will indicate the condition of the battery *in the transmitter* as follows:

- Blinking Green - condition unknown - checking level - wait for one of the following indications:
- Green - battery good
- Yellow - battery getting low
- Red - battery very low - change now
- Blinking Red - battery critical - failure imminent

POWER SWITCH

This switch turns on the receiver - when switched to the left INT PWR the unit will run on the internal batteries. When switched to the right EXT PWR the unit operates on the external power connection - the power source could be an external battery, a camera battery or the AC adpater.

PILOT TONE BYPASS

Pressing the pilot tone bypass switch over-rides the pilot tone circuitry to allow you to listen to an interfering signal for determine its source or for diagnostic purposes. Be careful when bypassing pilot tone. Gross audio noise may come through if the radio is receiving severe interference. To re-engage pilot tone, press the button again.

AUDIO OUTPUT LEVEL CONTROL

The front panel Audio Output Level control will adjust the audio output within the range set by the Lo/Mid/Hi range switch (located on the rear panel.) In the Low position the adjustment range is from –50dBm to –20dBm, the High position (center) allows an adjustment from –30dBm to 0dBm, and the Fixed position sets the audio output to a fixed +8dBm with no front panel control.

ANTENNA CONNECTORS

These are standard 50 Ohm BNC type jacks for the RF input to the receiver. The left jack is the main antenna and the right jack is for the diversity antenna.

ANTENNA PHASE LEDs

These two LEDs labeled "0°" and "180°" indicate the Smart Diversity circuitry is active. If one stays off constantly, double check antenna position. In typical operation, the lights will change back and forth as the signal changes.

REAR PANEL CONTROLS AND FUNCTIONS

DC IN JACK

The UCR210D can be powered from external DC applied directly to this jack (see Specifications and Features section for allowed voltages), or from the supplied CH20 adapter. The UCR210D is protected from reverse polarity conditions which prevents damage if a positive ground power source is applied. The center pin of this jack is POSITIVE. This power connector is threaded to allow the plug to be locked to prevent accidental pull-out.

AUDIO OUTPUT XLR JACK

This jack is a standard 3 pin XLR connector. For balanced applications, Audio High is on pin 2, audio Low is on pin 3, and audio Common is pin 1. For unbalanced use, the signal is developed between pin 2 (Audio High) and pin 1 (Audio Common or Ground.) It's not necessary or desirable to ground pin 3. (The output is balanced and center tapped.)

AUDIO OUTPUT RANGE SWITCH

The audio output range switch controls the range of adjustment of the front panel Audio Output control. In the -20 position the adjustment range is from -50dBm to -20dBm, the 0 position allows an adjustment from -30dBm to 0dBm and the fixed position sets the audio output to a fixed +8dBm (the front panel control has no effect when the switch is in this position).

BATTERY RELEASE

To release the battery magazine, slide the battery release latch away from the audio output jack. If batteries are already inside, the force of the springs will push the magazine clear. Slide the magazine off. After replacing the batteries, slide the magazine back into place making sure the latch engages securely.

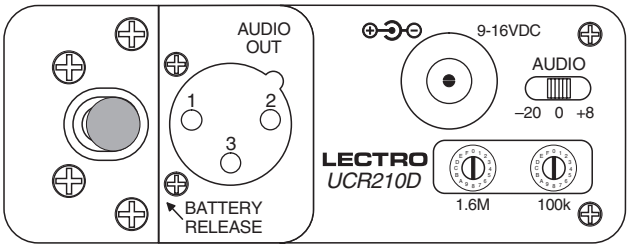
FREQUENCY ADJUSTMENT SWITCHES

To gain access to these switches, slide the access door sideways with a fingernail. These two rotary switches change frequency of the receiver. The frequency range (block) of the unit is laser engraved on this switch cover.

ADJUSTING THE RECEIVER FREQUENCY

If you are experiencing interference from another signal on your frequency, you may want to change the operating frequency of your system. The left switch changes the operating frequency by 1.6 MHz per step and the right switch changes it 100 kHz per step. If you are experiencing interference, change the operating frequency in 100 kHz steps to find a clear channel. If it is not possible to find a clear channel using the 100 kHz switch, return it to its original position and change the 1.6 MHz switch by one click then try the 100 kHz switch again.

Important - make certain that the switches on the transmitter are set to the same position. If not the system will not be on matched frequencies and will not work. Transmitter and receiver must also be on the same block.



ANTENNA USE AND PLACEMENT

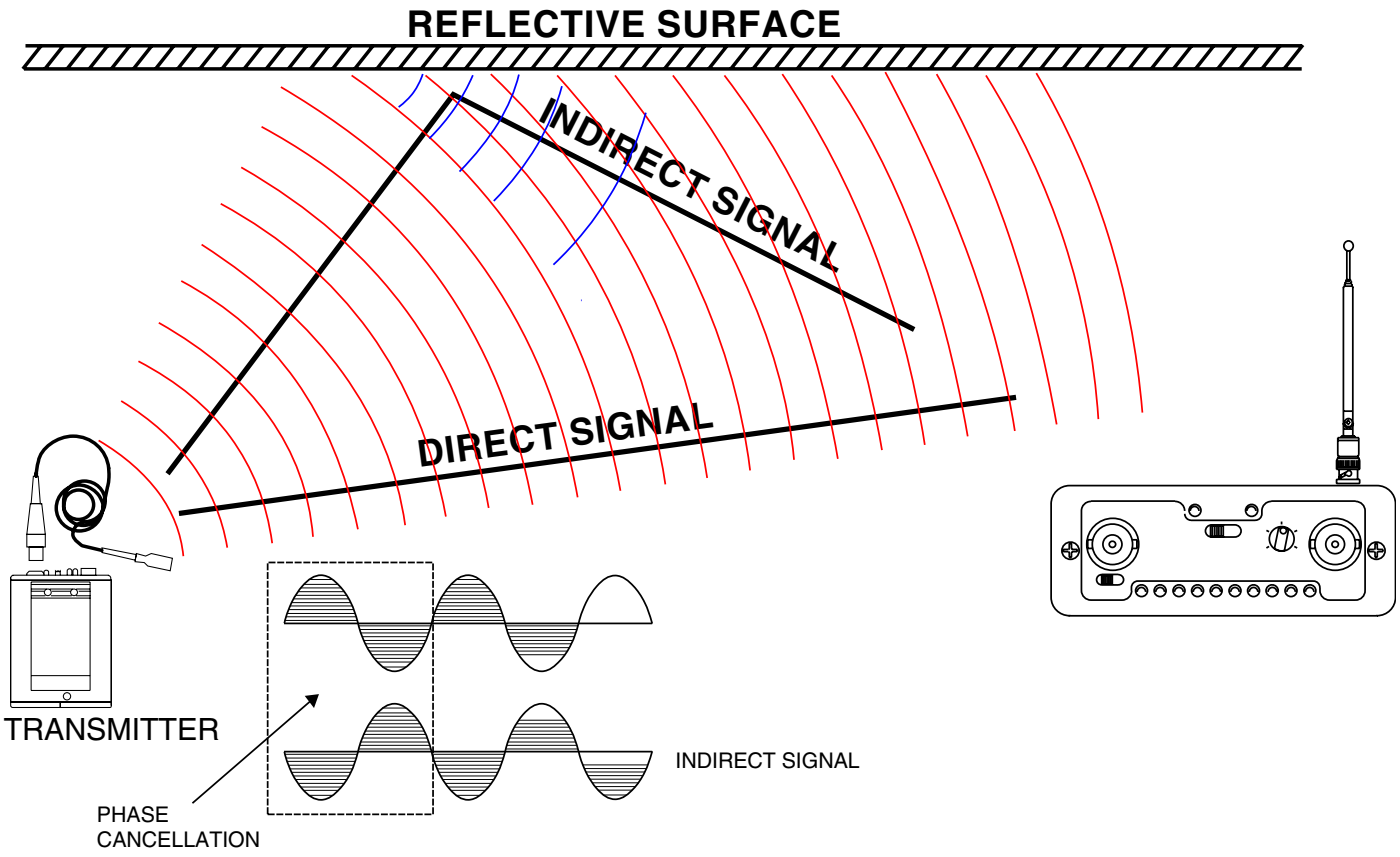
The receiver is supplied with two straight BNC antenna. In some circumstances remote anteannas such as the SNA600 or ALP700 may be useful for improving reception. Position remote antennas at least three or four feet apart and so that they are not within 3 or 4 feet of large metal surfaces. If this is not possible, try to position the antennas so that they are as far away from the metal surface as is practical. It is also good to position the receiver so that there is a direct "line of sight" between the transmitter and the receiver antenna. In situations where the operating range is less than about 100 feet, the antenna positioning is much less critical. The antennas can also be configured with one whip mounted directly onto the panel of the UCR210D receiver, and the other one mounted remotely.

Be careful about the length of cabling from antenna to receiver. Long cable runs can have serious signal loss. Lectrosonics has in-line RF amplifiers suitable for compensating for long cable runs. Contact your dealer of the factory for more information.

A wireless transmitter sends a radio signal out in all directions. This signal will often bounce off nearby walls, ceilings, etc. and a strong reflection can arrive at the receiver antenna along with the direct signal. If the direct and reflected signals are out of phase with each other a cancellation may occur. The result would be a "drop-out." A drop-out sounds like either audible noise (hiss), or in severe cases, may result in a complete loss of the carrier and the sound when the transmitter is positioned in certain locations in the room. A UHF drop-out normally sounds like a short "hiss" or a "swishing" sound. Moving the transmitter even a few inches will change the sound of the hum or hiss, or eliminate it. A drop-out situation may be either better or worse as the crowd fills and/or leaves the room, or when the transmitter or receiver is operated in a different location.

The UCR210D receiver offers a sophisticated diversity design which overcomes drop-out problems in almost any situation. In the event, however, that you do encounter a dropout problem, first try moving the antenna at least 3 or 4 feet from where it was. This may alleviate the drop-out problem on that antenna. If drop-outs are still a problem, try moving the antenna to an entirely different location in the room or moving the antennas in closer to the transmitter location.

Lectrosonics transmitters radiate power very efficiently, and the receivers are very sensitive. This reduces drop-outs to an insignificant level. If, however, you do encounter drop-outs frequently, call the factory or consult your dealer. There is probably a simple solution.



MULTI-PATH DROPOUT

INSTALLATION AND OPERATING INSTRUCTIONS

1. Install batteries or connect the power cord. Batteries should be inserted negative end first into the battery magazine. See the illustration on the magazine.

2. Attach the antennas.

3. Set the frequency switches to match the transmitter frequency switch setting. See page 7.

4. Connect the audio cable to the audio output XLR.

5. Set the front panel Audio Output Level control to minimum and set the Power switch to ON (right position.) Check to see that the front panel Power LED lights up.

6. Adjust the transmitter gain. THIS IS PERHAPS THE MOST IMPORTANT STEP IN THE SET UP PROCEDURE. See your transmitter manual (Operating Instructions section) for details on how to adjust the transmitter gain. In general, adjust the transmitter gain so that the voice peaks will cause the first Mod Level LED on the front of the receiver to light red on the loudest peak audio levels. Normal levels should cause both LED's to show green. This will result in the best possible signal to noise ratio for the system without causing overload distortion.

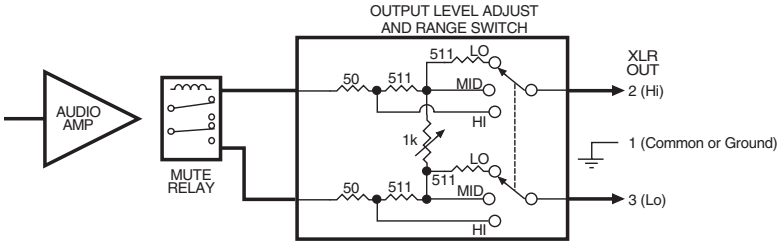
7. Adjust the Audio Output control according to the type of input on your equipment. The Range switch sets the adjustment range of the front panel Audio Output control and has three positions.

-20: The adjustment range is from –50dBm to –20dBm.

0: Allows an adjustment from –30dBm to 0dBm

+8: Sets the audio output to a fixed +8dBm with no front panel control.

The input levels of different cameras, VCRs, and PA equipment vary, which may require that you set the Audio Output control to an intermediate position. Try different settings and listen to the results. If the output of the receiver is too high, you may hear distortion or a loss of the natural dynamics of the audio signal. If the output is too low, you may hear steady noise (hiss) along with the audio. The UCR210D audio output is designed to drive any audio input device from microphone level to +8dBm line level.



UCR210D Simplified Audio Output Circuit

Note:

When using the +8 dBm HI position of the output range switch, do not ground pin 2 or pin 3 of the XLR output! The output impedance is only 50 Ohms (unbalanced) when in the HI position and this is not enough to isolate the audio amplifier from a short to ground. Distortion will result

UCR210D REPLACEMENT PARTS and ACCESSORIES

Part No.	Description
A8U	UHF Marine Phosphor Bronze Antenna, straight connector - specify block
BP210AA	Battery magazine - holds 4 AA batteries
32251	Velcro mounting strips
35753	Zippered, padded vinyl system pouch
PS200	Power supply cable locking plug on one end and a Hirose plug on the other for hookup to a camera.
21586	Power supply cable with locking plug on one end and pigtail leads on the other

FREQUENCY BLOCKS AND RANGES

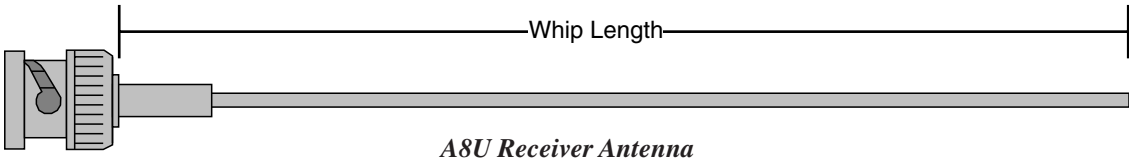
The table below lists the factory designated frequency ranges available for the UCR210D receiver. For convenience, the table includes information about the transmitter antennas as well.

Each UCR210D receiver is built to cover a pre-selected range of frequencies (a "block") as shown below. The receiver will tune to any of 256 different frequencies within this factory assigned block.

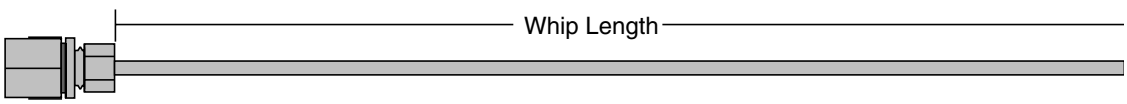
The UCR210D UHF Receiver antennas (model A8U) are color coded to indicate the frequency block that they operate within. The length of the antenna varies with the frequency block. The actual length of the antenna is not as critical as it might appear in the table below. The usable bandwidth of the A8U antennas are +/- 50 MHz from the center frequency, so it is acceptable to use an antenna from an adjacent block above or below the operating frequency.

The color of the antenna sleeve is in keeping with standard resistor value color codes for the second digit of the block number.

BLOCK	FREQUENCY RANGE	ANT SLEEVE COLOR	ANTENNA WHIP LENGTH
21	537.600 - 563.100	Brown	4.74"
22	563.200 - 588.700	Red	4.48"
23	588.800 - 614.300	Orange	4.24"
24	614.400 - 639.900	Yellow	4.01"
25	640.000 - 665.500	Green	3.81"
26	665.600 - 691.100	Blue	3.62"
27	691.200 - 716.700	Violet (Pink)	3.46"
28	716.800 - 742.300	Grey	3.31"
29	742.400 - 767.900	White	3.18"
30	768.000 - 793.500	Orange/Black	3.08"
31	793.600 - 819.100	Orange/Brown	2.99"
32	819.200 - 844.700	Orange/Red	2.92"
33	844.800 - 865.000	Orange/Orange	2.87"



A8U Receiver Antenna



A6U Transmitter Antenna

TROUBLESHOOTING

POWER SUPPLY AND FUSE

LEDs not lit or dimly lit

- External power supply disconnected or inadequate.
- Main power supply fuse tripped. Turn the receiver off, remove the cause of the overload and turn the receiver back on.
- Wrong polarity power source. The external DC in requires POSITIVE to be on the center pin.

PILOT TONE SQUELCH

The PILOT indicator lamp on the front panel glows green to indicate that the audio has been turned on at the transmitter, and that the audio output on the receiver is enabled. When the lamp is on, the audio is enabled. When the lamp is off, the audio is muted. If the lamp is red, the pilot tone is bypassed.

PILOT lamp green, but no sound

- Audio output cable bad or disconnected.
- Audio Output level set too low.

PILOT lamp does not come on when transmitter audio switch is turned on

- It takes several seconds for the relay to actuate the PILOT lamp. Turn the transmitter power and audio switches on and wait 3 to 5 seconds for the lamp to come on.

Noise on audio and Pilot lamp is red.

- The pilot tone bypass has been pressed. Press again to reset.

ANTENNAS AND RF SIGNAL STRENGTH

RF Level is weak.

- Antenna is disconnected or there is a bad connection
- Antenna may need to be moved or re-oriented
- Improper length of antenna, or wrong antenna. UHF whip antennas are generally about 3 to 5 inches long. UHF helical antennas may be shorter, but are often less efficient.

No RF Signal

- Make certain frequency switches on transmitter and receiver are on the same setting.
- Check battery in transmitter

AUDIO SIGNAL QUALITY

Poor signal to noise ratio

- **Transmitter gain set too low**
- Noise may not be in wireless system. Mute the audio signal at the transmitter and see if noise remains. If the noise remains, then turn the power off at the transmitter and see if it remains. If the noise is still present, then the problem is not in the transmitter.
- If noise is still present when the transmitter is turned off, try lowering the audio output level on the UCR210D rear panel and see if the noise lowers correspondingly. If the noise remains, the problem is not in the receiver.
- Receiver output is too low for the input of the device it is feeding. Try increasing the output level of the UCR210D and lowering the input gain on the device the UCR210D is feeding.

Distortion

- Transmitter input gain too high. Check and/or re-adjust input gain on transmitter according to the LEDs on the transmitter and then verify the setting with the transmitter Mod level LED pair on the UCR210D front panel.
- Audio output level too high for the device the UCR210D is feeding. Lower the output level of the UCR210D.

SPECIFICATIONS AND FEATURES

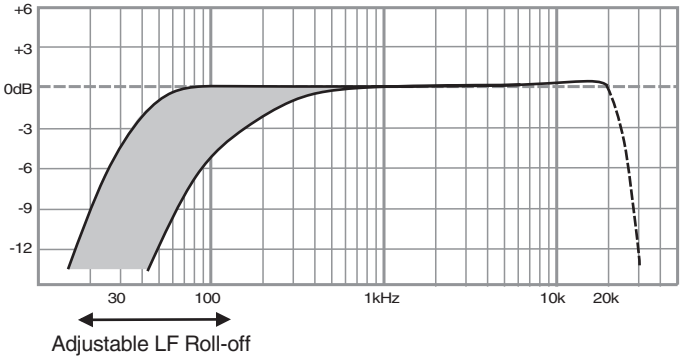
Operating Frequencies (MHz):

Block 21	537.600 - 563.100	Block 28	716.800 - 742.300
Block 22	563.200 - 588.700	Block 29	742.400 - 767.900
Block 23	588.800 - 614.300 (outside USA)	Block 30	768.000 - 793.500 (outside USA)
Block 24	614.400 - 639.900	Block 31	793.600 - 819.100 (outside USA)
Block 25	640.000 - 665.500	Block 32	819.200 - 844.700 (outside USA)
Block 26	665.600 - 691.100	Block 33	844.800 - 865.000 (outside USA)
Block 27	691.200 - 716.700		

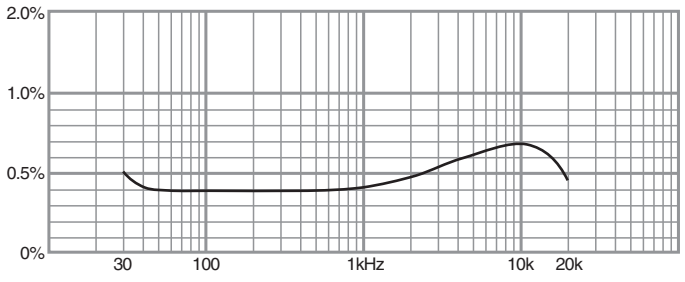
Frequency Adjustment Range:	25.5 MHz in 100kHz steps
Receiver Type:	Triple conversion, superheterodyne, 71MHz , 10.7MHz and 300kHz
Frequency Stability:	±0.002 %
Front end bandwidth:	+/- 5.5MHz @ -3dB
Sensitivity	
20 dB Sinad:	0.8 uV (-109 dBm), A weighted
60 dB Quieting:	1.12 uV (-106 dBm), A weighted
Squelch quieting:	Greater than 125 dB
AM rejection:	Greater than 60 dB, 2 uV to 1 Volt (Undetectable after processing)
Modulation acceptance:	>90 kHz
Image and spurious rejection:	>85 dB
Third order intercept:	+12 dBm
Diversity method:	Phased antenna diversity
FM Detector:	Digital Pulse Counting Detector operating at 300kHz
Antenna inputs:	Dual BNC female; 50 Ohm impedance
Audio outputs	
Rear Panel XLR:	Nominal 600 Ohm balanced, three level ranges: LO - Variable -50 dBm to -20 dBm MID - Variable -30 dBm to 0 dBm HI - +7 dBm line level.
Front Panel Controls and Indicators:	Main and Diversity antenna BNC connectors; Rotary volume control; Power switch and LED; 3 stage pilot tone LED; Three LED, 10 stage RF signal level; Two LED, 5 stage TX mod level; 4 stage RX battery level LED; 4 stage TX battery level LED; Two diversity LED's.
Rear Panel Controls and features:	XLR audio output jack; Frequency selection switches; External DC input; Audio level range select switch.
Power Options:	**Ext DC:** Minimum 9 Volts to maximum 16 Volts DC; 1.6 W, 130 mA at 12VDC **Int Batt:** Four AA alkaline or lithium
Battery Life:	**Four AA alkaline** - 4 hours continuous; 7 hours intermittent **Four AA lithium** - up to 16 hours (continuous and intermittent usage are the same)
Weight:	20oz.
Dimensions:	3.23" wide x 1.25" high x 6" deep

Specifications subject to change without notice.

System Frequency Response



Typical System THD + Noise



50% modulation (35 kHz deviation)

SERVICE AND REPAIR

If your system malfunctions, you should attempt to correct or isolate the trouble before concluding that the equipment needs repair. Make sure you have followed the setup procedure and operating instructions. Check out the interconnecting cords and then go through the TROUBLE SHOOTING section in the manual

We strongly recommend that you **do not** try to repair the equipment yourself and **do not** have the local repair shop attempt anything other than the simplest repair. If the repair is more complicated than a broken wire or loose connection, send the unit to the factory for repair and service. Don't attempt to adjust any controls inside the units. Once set at the factory, the various controls and trimmers do not drift with age or vibration and never require readjustment. **There are no adjustments inside that will make a malfunctioning unit start working**.

LECTROSONICS' service department is equipped and staffed to quickly repair your equipment. In warranty repairs are made at no charge in accordance with the terms of the warranty. Out of warranty repairs are charged at a modest flat rate plus parts and shipping. Since it takes almost as much time and effort to determine what is wrong as it does to make the repair, there is a charge for an exact quotation. We will be happy to quote approximate charges by phone for out of warranty repairs.

RETURNING UNITS FOR REPAIR

You will save yourself time and trouble if you will follow the steps below:

A. DO NOT return equipment to the factory for repair without first contacting us by letter or by phone. We need to know the nature of the problem, the model number and the serial number of the equipment. We also need a phone number where you can be reached 8 am to 4 pm (Mountain Standard Time).

B. After receiving your request, we will issue you a return authorization number (R.A.). This number will help speed your repair through our receiving and repair departments. The return authorization number must be clearly shown on the outside of the shipping container.

C. Pack the equipment carefully and ship to us, shipping costs prepaid. If necessary, we can provide you with the proper packing materials. UPS is usually the best way to ship the units. Heavy units should be "double-boxed" for safe transport.

D. We also strongly recommend that you insure the equipment, since we cannot be responsible for loss of or damage to equipment that you ship. Of course, we insure the equipment when we ship it back to you.

Mailing address:
Lectrosonics, Inc.
PO Box 15900
Rio Rancho, NM 87174
USA

Shipping address:
Lectrosonics, Inc.
581 Laser Rd.
Rio Rancho, NM 87124
USA

Telephones:
Regular: (505) 892-4501
Toll Free (800) 821-1121
FAX: (505) 892-6243

Web: *http://www.lectrosonics.com*

Email: *sales@lectrosonics.com*

LIMITED ONE YEAR WARRANTY

The equipment is warranted for one year from date of purchase against defects in materials or workmanship provided it was purchased from an authorized dealer. This warranty does not cover equipment which has been abused or damaged by careless handling or shipping. This warranty does not apply to used or demonstrator equipment.

Should any defect develop, Lectrosonics, Inc. will, at our option, repair or replace any defective parts without charge for either parts or labor. If Lectrosonics, Inc. cannot correct the defect in your equipment, it will be replaced at no charge with a similar new item. Lectrosonics, Inc. will pay for the cost of returning your equipment to you.

This warranty applies only to items returned to Lectrosonics, Inc. or an authorized dealer, shipping costs prepaid, within one year from the date of purchase.

This Limited Warranty is governed by the laws of the State of New Mexico. It states the entire liablility of Lectrosonics Inc. and the entire remedy of the purchaser for any breach of warranty as outlined above. NEITHER LECTROSONICS, INC. NOR ANYONE INVOLVED IN THE PRODUCTION OR DELIVERY OF THE EQUIPMENT SHALL BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, CONSEQUENTIAL, OR INCIDENTAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THIS EQUIPMENT EVEN IF LECTROSONICS, INC. HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL THE LIABILITY OF LECTROSONICS, INC. EXCEED THE PURCHASE PRICE OF ANY DEFECTIVE EQUIPMENT.

This warranty gives you specific legal rights. You may have additional legal rights which vary from state to state.

LECTROSONICS, INC.

581 LASER ROAD
RIO RANCHO, NM 87124 USA

November 1, 2001