UHF-R Service Manual

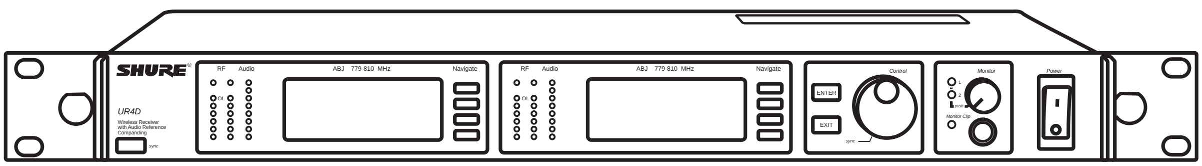
25-1099

UR4D RECEIVER

PRODUCT DESCRIPTION

GENERAL

The UR4D (Dual Channel) and UR4S (Single Channel) are top the the line UHF band Wireless microphone receivers. Each unit is housed in a single space, metal rack-rack mount chassis. The product is designed in five different frequency Groups spanning from 518 MHz to 865 MHz.



DESIGN FEATURES

- Narrow band track tuned front-end filters.
- Synthesized tuning with 25kHz steps.
- High dynamic range LNA and double balanced mixers for maximum compatibility.
- As many as 40 compatible channels within each 60Mhz band.
- Front panel LED indication of RSSI and RF overload.
- Full MARCAD diversity.
- Tonekey squelching.
- ASK modulated tonekey sends transmitter data to receiver.
- Audio Reference Companding noise reduction system.
- Front panel LED indication of audio signal level.
- Isolated XLR and ¼” balanced outputs.
- Mic/Line switch on XLR output.
- Pin 1 lift for both XLR and ¼” outputs.
- Headphone monitor with separate clip indicator.
- Bitmap LCD displays.
- Bi-directional IR link for data communication with UHF-R transmitters.
- Ethernet and USB connectivity for control and metering.
- Universal switching power supply with daisy chain power connector.

Service Note: Shure recommends that all service procedures be perform by a Factory-Authorized Service Center or that the Product be returned directly to Shure Incorporated.

25-1099 (Rev. 1)

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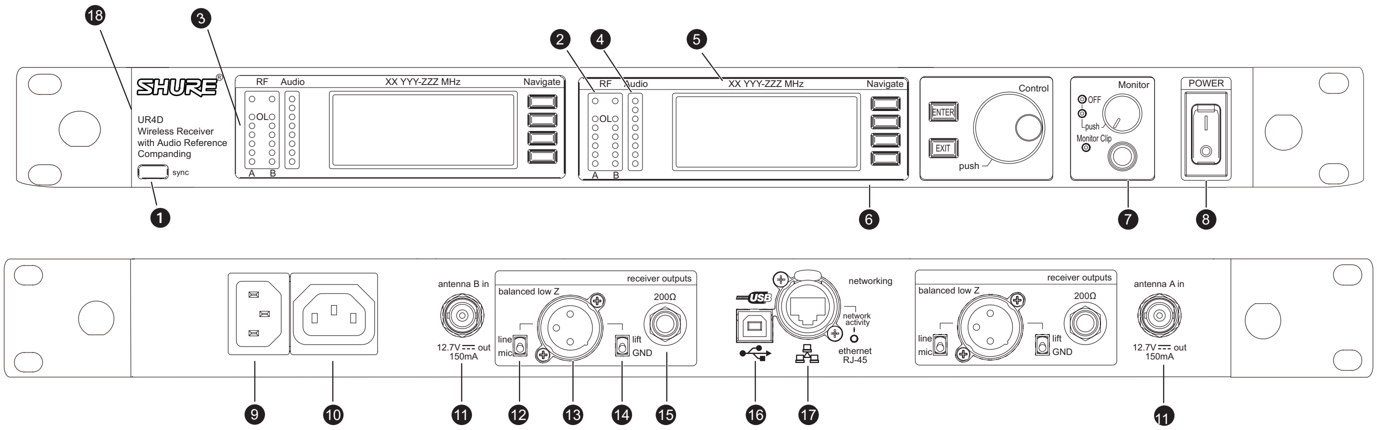


FIGURE 1. UR4D AND UR4S FRONT AND REAR PANELS

Receiver Controls and Connectors

1. **SYNC** Infrared (IR) port. Transmits group, channel, and other settings to a transmitter.
2. Squelch LEDs.

- Blue (On) = Transmitter signal detected
- Off = no signal or signal squelched because of poor reception or no tonekey

NOTE: The receiver will not output audio unless at least one blue LED is illuminated.

3. **RF** LEDs. Indicate RF signal strength from the transmitter at each antenna and diversity condition.

- Amber = normal
- Red = overload (greater than –25 dBm)

4. **Audio** LEDs. Indicate audio signal strength from transmitter.

- Green = signal present
- Yellow = normal peak
- Red = overload

To correct this level, adjust the transmitter gain.

5. Indicates the name and range of receiver frequency band.
6. LCD Interface. Provides a convenient way to program the receiver from the front panel.
7. **Monitor**. 1/4” output jack and volume knob for headphones.

- **Monitor Clip** LED indicates headphone audio is clipping.
- *Dual models*: Push the knob to switch from receiver one to reiver two.

8. **Power** switch. Powers the unit on and off.
9. AC mains power input, IEC connector. 100–240 Vac.
10. AC mains power passthrough (unswitched). Use with an IEC extension cable to supply AC power to another device.
11. Diversity antenna inputs A and B.

Note: Antenna inputs are DC biased. Use only antenna combiners and accessories listed. Some types of antenna splitters or other products may short the DC power and damage the receiver. Bias can be removed through internal jumper setting.

12. **Mic/Line** switch. Changes output level –30 dB (XLR output only).
13. Electrically balanced XLR output jack
14. **Lift/GND** switch. Lifts ground from Pin 1 of the XLR connector (default = **GND**).
15. Impedance balanced 1/4” output jack (200Ω)
16. USB jack for computer interface.
17. RJ-45 jack for Ethernet network interface. Accepts both regular and “ruggedized” RJ-45 plugs.
18. Temperature-activated fan ensures top performance in high temperature environments. Clean fan screen as needed to remove dust.

Standard Operating Conditions

Power Supply: 100 VAC to 240 VAC   50 to 60 Hz

Temperature: -20C to 57C

RF: -80 to -20 dBm into 50 Ohms

FM Deviation: <45 kHz of 1KHz tone for THD<1%

Operating Information

The basic steps required for unit operation:

- Switch and control functions
- Basic Settings
- User Interface and Status Indication

UHF-R RECEIVER PROGRAMMNING

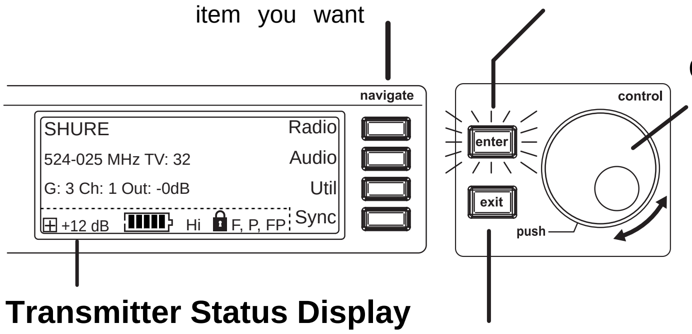
Receiver LCD Interface

Menu Access

Press the **Navigate** key next to the menu item you want

Accept Changes

After changing a parameter, the **ENTER** button flashes.



Cursor Control

Push the **Control** wheel to move the cursor to the next item.

Turn the **Control** wheel to change a parameter value.

Transmitter Status Display

Everything under the dotted line reflects the settings for the transmitter, if present.

Exit/Cancel

Press the **Exit** button to cancel changes and return to the previous

Receiver Parameters

Use the following instructions to set parameters through the LCD interface.

NOTE: After adjusting a parameter, you must press the flashing **ENTER** button to accept the change.

Group and Channel

Menu: Radio

- Push the **Control** wheel to move the cursor to the Group (G) or Channel (Ch) parameter.
- Turn the **Control** wheel to change the parameter.

Frequency

Menu: Radio

- Push the **Control** wheel to move the cursor to the integer value (741.000 MHz) or fractional value (741.025).
- Turn the **Control** wheel to change the value.

Automatic Transmitter Sync

Menu: Sync.

Receiver Name

Menu: Util

- Turn the **Control** wheel to change the letter.
- Push the **Control** wheel to move to the next letter.

Output Level

Menu: Audio

This setting adjusts the signal level at the XLR and 1/4" audio output jacks.

- Turn the **Control** wheel to change the relative level in dB. (0 dB to –32 dB).
- Turn the wheel all the way down to mute the outputs.

Squelch

Menu: Radio > Squelch

- Turn the **Control** wheel to change the parameter

Receiver Lock

When locked, the receiver settings cannot be changed from the front panel. However, you can still navigate the LCD menu to view the settings (and turn the lock off).

Menu: Util > Lock

- Turn the **Control** wheel to toggle the lock on or off (ON or OFF).

LCD View

Menu: Util > Title

- Turn the **Control** wheel to mark an item for display.
- Push the **Control** wheel to move to the next item.

LCD Contrast

Menu: Util > Contrast

- Turn the **Control** wheel to increase or decrease contrast.

Tonekey

Menu: Radio > Squelch > Tonekey

Tonekey squelch mutes the outputs unless the receiver detects a transmitter. Tonekey should be left on (On) except for certain troubleshooting operations.

Network Parameters

NOTE:

- The receiver reboots after you press **ENTER** to accept network parameter changes
- In dual models (UR4D), these settings affect *both* receivers (the dual receiver is treated as a single network device).

Set the Receiver Network Mode

Menu: Util > Network

1. Push the **Control** wheel to move the cursor to the Mode parameter.
2. Turn the **Control** wheel to set the receiver to one of the following values:
   - DHCP: use this setting when connecting the receiver to a DHCP server.
   - Manual: allows you to set the receiver to a specific IP address or subnet.

IP Address and Subnet

Menu: Util > Network

NOTE: To change these settings, the network mode must be set to Manual.

1. Push the **Control** wheel to move the cursor to any of the following parameters:
   - IP (IP address)
   - Sub (Subnet mask)
2. Turn the **Control** wheel to change the value.

Device ID

Assists in identifying receivers through the Wireless Workbench Software (has no effect on network identification).

Menu: Util > Network

1. Push the **Control** wheel to move the cursor to the DevID parameter.
2. Turn the **Control** wheel to set the receiver to change the value.

Custom Groups

This feature allows you to create your own groups of frequencies.

Creating new groups...

Menu: Radio > Custom

1. Turn the **Control** wheel to select a custom group number (U1, U2, U3, etc.)
2. Push the **Control** wheel to move to the Channel parameter and turn it to select a channel (01, 02, 03, etc.)
3. Push the **Control** wheel to move to the Freq parameter and select a frequency for that channel.
4. Push the NEXT menu key to select a frequency for the next channel in that group.

Follow these steps to use the channel scan and group scan features.

Automatic Frequency Selection

Before you begin...

- Install the receivers in the location where they will be used and power them on.
- Mute all inputs on mixing devices connected to receivers.
- Turn off all bodypack or handheld transmitters for the systems you are setting up.
- *Turn on potential sources of interference* such as other wireless systems or devices, computers, CD players, effects processors, and digital rack equipment *so they are operating as they would be during the presentation or performance.*

Single Receiver

1. Select Radio > Scan > Chan Scan using the **Navigate** keys on the receiver LCD interface.
2. Turn the **Control** wheel to select a group.
3. Press Chan Scan. The display indicates that the receiver is searching. Once it has finished, it displays the selected channel.
4. Press the flashing **ENTER** button to accept the suggested channel.
5. Sync the transmitter (see page 15).

Networked or Dual Receivers

With networked or dual receivers, you can take advantage of the group scan feature to set group and channel settings for all the receivers at the same time. (See page 7 for instructions on networking.)

Perform a group scan from any receiver...

1. Select Radio > Scan > Group Scan using the **Navigate** keys on the receiver LCD interface. The display indicates that the receiver is searching (Scan In Progress). Once it has finished, it displays the group with the most open channels.
2. If you wish, turn the **Control** wheel to change groups. The number of open channels for each group is displayed.
3. Press the flashing **ENTER** button to set all receivers to open channels in that group.

NOTE: The group scan feature only works for receivers in the same frequency band. For example, if you did a group scan on a "H4" band receiver, all "H4" band receivers would be set up, but not "J5" band receivers.

Multiple Receivers—Not Networked

If your receivers are not networked (or in different bands), the group scan cannot automatically set their group and channel settings. However, you can still take advantage of the group scan feature to find the group with the most open channels and the channel scan feature to find open channels in that group.

Find the group with the most open channels...

Perform a group scan using the steps for a networked receiver (above). However, *make a note of the selected group* before pressing the flashing **ENTER** button to accept it.

Set the receivers to open channels in that group...

Perform a channel scan on the remaining receivers using the steps for a single receiver (above). Make sure to select the same group for each receiver before performing the channel scan.

IMPORTANT: After setting the channel for the first receiver, immediately sync the transmitter for that receiver and leave it on so that the next receiver detects that channel during its channel scan. Otherwise, all the receivers will be set to the same open channel.

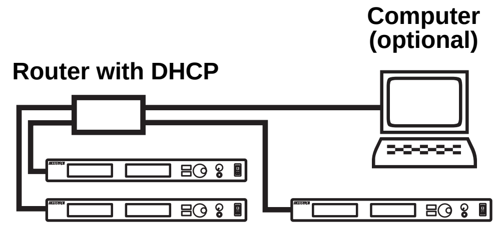
NOTE: Receivers in different bands (H4, J5, L3, etc.) do not need to be set to the same group.

Networking Receivers

Basic Network

Connect receivers to an Ethernet router with DHCP service. Use Ethernet switches to extend the network for larger installations.

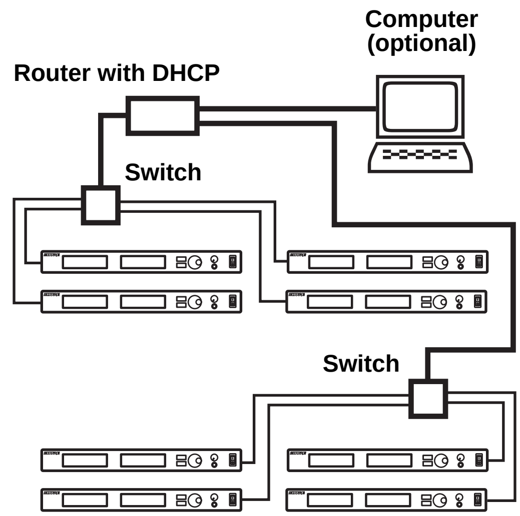
Use the receiver's default network setting (Util > Network > Mode = DHCP).



Accessing the Network with a Computer

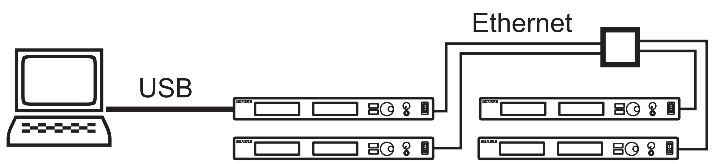
If you want to use the Wireless Workbench software, connect your computer to the network and install the software from the CD that came with the receiver. Make sure your computer is configured for DHCP (from *Control Panel*, click *Network Connections*. Double-click on *Local Area Connection*. Select *Internet Protocol (TCP/IP)* and click *Properties*. Select *Obtain IP address automatically* and *Obtain DNS server address automatically* and click OK).

NOTE: Some security software or firewall settings on your computer can prevent you from connecting to the receivers. If using firewall software, allow connections on port 2201.



Using USB...

Connect the computer to the USB port on any of the receivers to access the whole network.



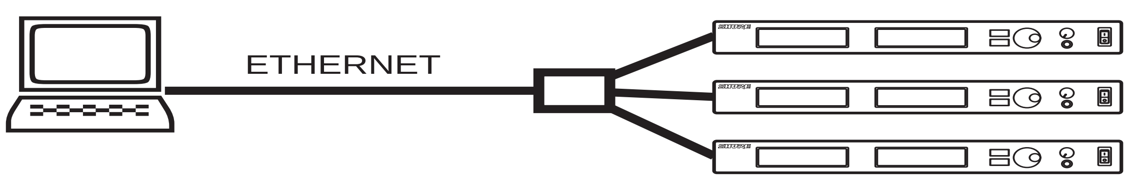
Static IP Addressing

The receiver also supports static IP addressing. Assign your own IP addresses (Util > Network > Mode = Manual). See "Network Parameters" on page 10.

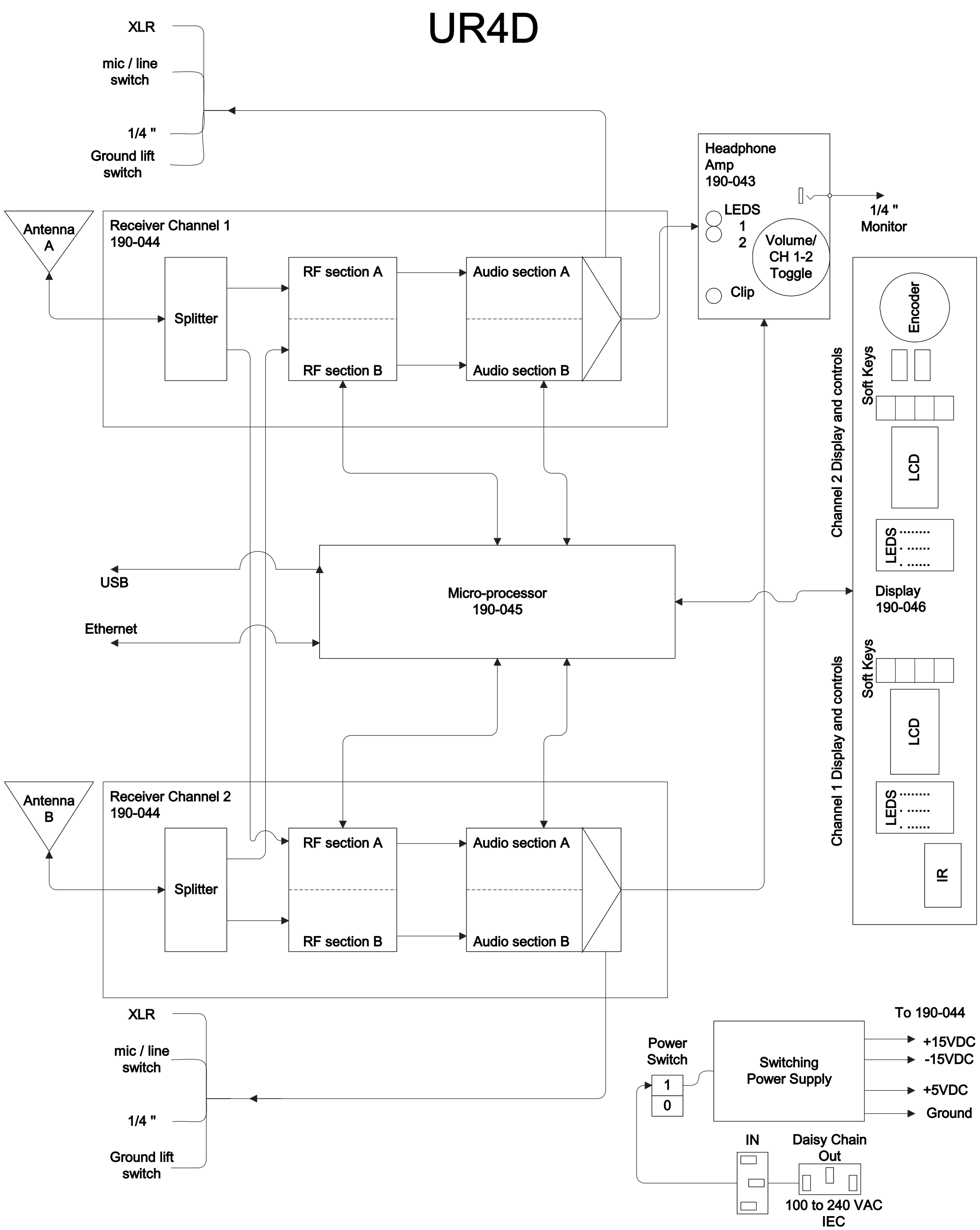
NOTE: Dual receivers use a single IP address, which may be set through either LCD interface.

Existing UHF Network Installations

Both Shure's UHF-R receivers and legacy UHF receivers can be networked to the same PC and accessed using the latest Wireless Workbench software.



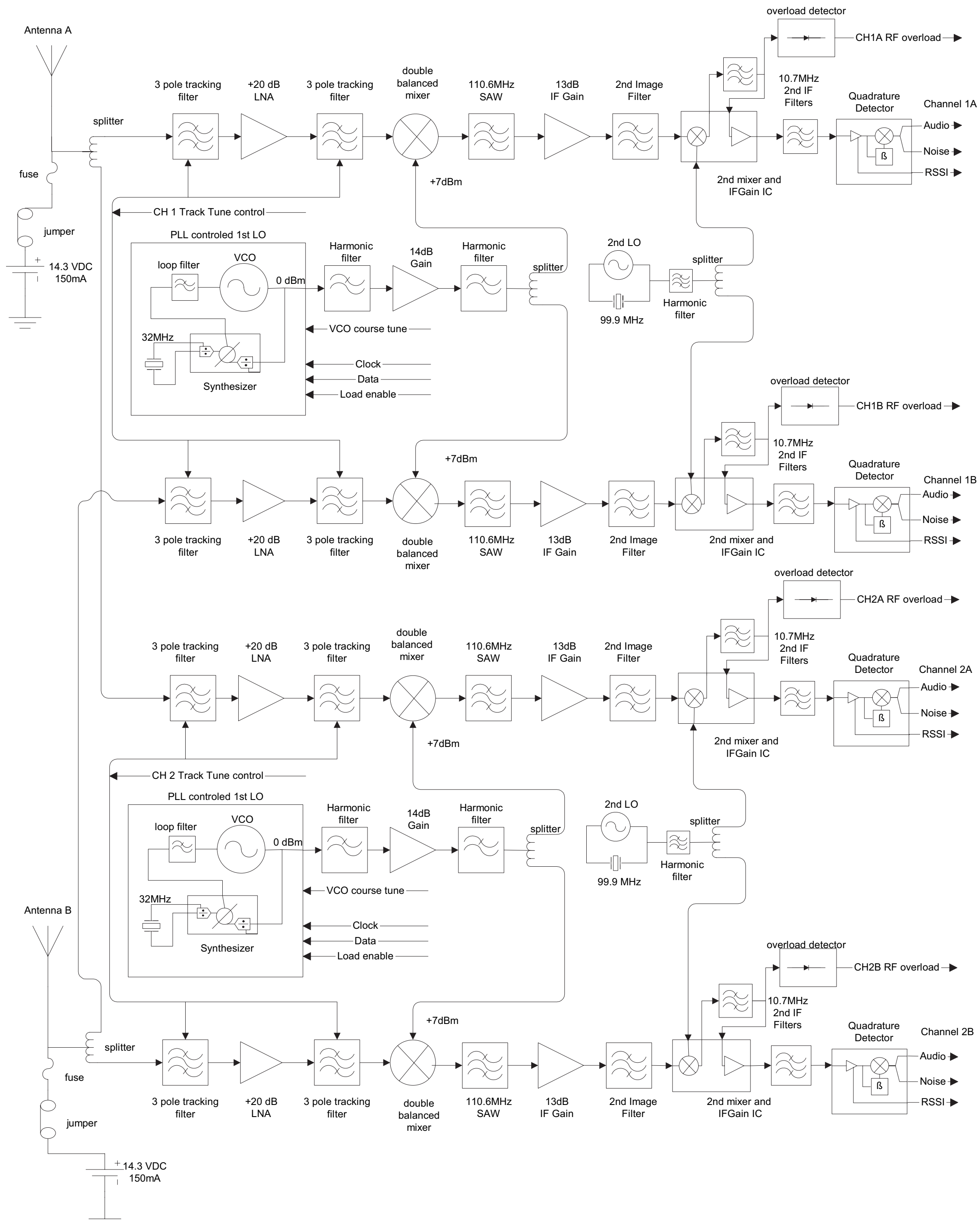
Top Level Architecture



General Block Diagram Description

The UR4D/S incorporates four separate PC boards: 190-044 main board, 190-045 Microprocessor board, 190-046 Display Board, and 190-043 Headphone amp board. The product is powered by a 3” X 5” universal switching power supply that provides +15V, -15V, and +5V. Power from the switching power supply is connected to the 190-044 main board and distributed from the main board to the remaining boards. +3.3V for the microprocessor is derived from +5V by a linear regulator on the main board.

UR4D RF Block Diagram



RF Sub System General Description

The receiver RF Sub System consists of all of the hardware needed to receive the wireless radio signal and convert it into audio. It can be broken down into several sub-components: the antenna system, the front end, mixer, 1st IF, 2nd IF and detector. Each has an important part to play in determining the overall performance of the product. The UR4 receiver has two BNC input connectors, and will be supplied with a pair of detachable 1/2 wave antennas that can be remoted using accessory 50-Ohm cables if desired. Both single and dual receivers will use Shure's MARCAD diversity for unsurpassed protection against signal dropouts.

UR4S and UR4D RF sections are located on the 190-044 main board. Each receiver channel in a UR4 system contains two RF sections referred to as sections A and B. Dual channel systems like the UR4D will contain 4 RF sections and will be referred to by CH1A, CH1B, CH2A, and CH2B. Single channel systems like the UR4S will use the CH2A and CH2B part of the 190-044 main board.

RF signals enter the UR4 receiver at the BNC ports labeled **Antenna A In** and **Antenna B In**. The receiver provides +12.4 VDC @ 150 mA at each antenna port for use with external RF amplifiers. Up to two external line amps, or one line amp and one active antenna can be driven from each antenna port. Power to the antenna ports can be removed via jumper settings on the 190-044 main board. UR4D systems passively split the signals present at each antenna port and send them equally to channels 1 and 2. UR4S systems send antenna signals directly to channel 2 without splitting. Receiver channels 1 and 2 are identical so operational descriptions of a single receive channel may be applied equally to both channels in a UR4D system.

Each RF channel requires +15V and +5V from the power supply.

Each channel frequency is user adjustable from the 190-046 display board. Several signals are derived from the channel frequency are used to automatically tune the RF section. The following tuning related signals are input to the RF section from the 190-045 microprocessor board: [(digital signals) Clock, Data, Load enable], [(DAC signals) VCO course Tune voltage, Track tune filter voltage].

The front end incorporates two track-tuned filters for superior protection from unwanted signals, while providing an industry leading 60 MHz of frequency coverage per SKU (slightly more in the higher frequency bands). Conversion to the 1st IF is accomplished through a double balanced mixer to provide greatly improved RF dynamic range and system compatibility. The design also uses a 1st IF frequency of 110.6 MHz, together with a narrow SAW (Surface Acoustic Wave) filter, to minimize spurious (unwanted) receiver responses. The Saw filter is followed by a 1St IF amp and 2 pole band-pass filter, providing improved sensitivity and second image rejection.

The 2nd IF consists of an integrated amplifier and mixer coupled with a discreet designed 99.9 MHz crystal oscillator. The outputs from both 1st and 2nd local oscillators are shared between RF sections A and B. Demodulation produces the following baseband information signals: Audio (with Tonekey), and Noise. Each RF channel outputs the following respective information signals to the audio section of the 190-044 main board: Audio A, Audio B, Noise A, Noise B. A 32kHz ASK Tonekey signal is embedded within the audio signal and will be filtered and demodulated in the audio section of the 190-044 main board.

After conversion to the 2nd IF, the signal level present in each RF section is detected. A DC signal proportional to the 2nd IF level is created and referred to as the received signal strength indicator or RSSI. When antenna signals are within the receiver's normal operating range the RSSI is displayed by a string of six LEDs on the 190-046 display board. Antenna signals that exceed the maximum dynamic range of the receiver are detected in each 2nd IF section by separate RF overload circuitry. A DC signal proportional to the RF overload level is generated and used to activate a RF overload LED on the 190-046 display board. Each RF channel outputs the following respective DC signals to the 190-045 microprocessor board: RSSI A, RSSI B, RF overload A, RF overload B.

Audio general description:

The audio, and noise outputs of the FM detector are trimmed for level and applied to the MARCAD circuit. The MARCAD circuit compares the noise of both channels and decides which audio channel, if not both, to pass. This circuit also compares noise levels to an overall minimum squelch level providing the noise squelch function. The chosen audio channel is fed to both a tonekey detection filter and a 20kHz low-pass filter via the tonekey mute switch. The output of the low-pass filter passes to the ARC expander section. User gain is summed into the VCA here for an adjustable range of 0 to –32 dB. The user can also mute the audio section from the audio menu. This is accomplished by turning off the tonekey mute switch. The output of the expander passes to the output drivers and on to the ¼" and XLR outputs. The XLR output has a 30 dB resistive pad that can be engaged by the user just before the output connector for best noise performance.

The tonekey detection filter is responsible for detecting presence of tonekey as well as conditioning the signal to be read by an ADC so that the encoded data can be read by the microprocessor. The output of the audio section immediately after the MARCAD switches is fed to two series connected high-Q 32kHz band-pass filters. These filters strip off both the modulated audio signal as well as any high frequency noise. The signal at this point is good enough to use to detect the amplitude-shifted data, but is not robust enough to be used for tonekey squelching. To provide the robust detection a 32kHz crystal filter is used. The output of the crystal filter is used to gate the input to ADC.

Audio signal metering is accomplished by a combination of two DC signals sent to corresponding ADCs. The first is a full wave peak detection tapped off just before the expander. This signal is used to give the user an idea of how transient signals, such as guitar, are propagating through the system. The second DC signal is derived from the output of the RMS detector portion of the expander. The RMS detector output is representative of the power contained in the signal averaged over a short period of time as well as how the compander is working. The microprocessor measures these two inputs and displays the appropriate LED output on the front panel.

The signal at the audio output is tapped and sent to the headphone monitor as a balanced pair to avoid noise pickup. The headphone amp board has a D flip-flop connected to the push button on the volume control. The flip-flop toggles a bank of analog switches to select between the two channels (on/off in the case of a UR4S). The signal passes through a differential amplifier to a user adjustable gain stage ($-\infty$ to +14dB). The output of the gain stage is presented to the output drivers and one input to the distortion detection circuit. The output drivers consist of four parallel sections from 33178 opamps, two sections for the left and two for the right output. Each driver section feeds out with 100 Ohms for a total output impedance of 50 Ohms. One of the opamps feeding the left channel provides the second input for the distortion detector. The distortion detector circuit compares the output signal with the signal applied to the output drivers. If enough difference (distortion) is detected the red clip light is lit.

The front panel display board contains serial data (SPI) display and collection devices, as well as the circuitry used for infrared communication. The LEDs are driven from a series of 595 serial to parallel latches. Brightness is set by each LEDs current limiting resistor. Buttons are read with a pair of parallel to serial latches. The quadrature encoder output is fist sent to a 4-bit binary counter to make detection through the latch easier. LCD modules are connected to the microprocessor via the same SPI interface. The IR circuitry is there to drive the transmit LED, and filter and condition signals from the receive section of the IR transceiver component.

Receiver Front End:

Signals from the antenna ports are filtered with a 3rd order Chebyshev tracking filter. Each pole of the tracking filter is connected to the same DC tracking control voltage. The tracking voltage is derived from a quadratic equation in the microprocessor. The coefficients of the quadratic are dependent on the frequency group of the receiver and are stored on the 190-045 microprocessor board. The track tuning output of the microprocessor is D/A converted and DC amplified. The tracking control voltage is varied continuously from 0-14 VDC and tunes the filters center frequency over a range of 60 to 75MHz (depending on the receiver model). Each front-end filter exhibits 5-6 dB of insertion loss (depending on tuning voltage) and 20-35 MHz 3dB bandwidth (depending on frequency range). A high dynamic range SiGe HBT then provides 20dB of LNA gain. The discreet LNA transistor is matched with high-pass input and low-pass output networks and is designed to maximize input IP3. A second 3rd order Chebyshev tracking filter is provided after the LNA for superior image rejection and LO-Antenna port isolation. Output from the last front-end filter is sent to a double balanced mixer. The double balanced mixer provides excellent dynamic range and superior port-to-port isolation. The LO port of the mixer is high side injected and driven at +7dBm from the 1st LO section.

1st Local Oscillator:

The 1st LO is derived from a dual control VCO. The VCO contains two control ports referred to as course tune and fine tune. The course tune control is a DC voltage derived from a tuning algorithm in the microprocessor section. The microprocessor output is D/A converted and DC amplified to cover 0-14VDC. The tuning algorithm incorporates factory adjusted (VCO calibration) DAC values. The course tune control adjusts the VCO to a frequency range close to the desired frequency. Fine tune frequency control provides a high degree of frequency accuracy and is accomplished through a third order PLL. The PLL frequency synthesizer derives a 25kHz-reference frequency from an external 32 MHz crystal. The synthesizer contains an integrated prescaler, phase detector and charge pump. The charge pump gain is set to 5mA and feeds a second order lowpass loop filter. The PLL is designed for 600 Hz open loop bandwidth and phase margin of 80 degrees. The 600 Hz bandwidth was chosen to minimize phase noise as well as low frequency transient responses. 80-degree phase margin insures stability of the loop and flattens the FM noise of the VCO. The VCO output (approximately 0 dBm) is lowpass filtered with a 5th order Chebyshev filter to reduce harmonics. 14 dB of gain and additional 5th order harmonic filtering are then provided. The LO signal is then split to the 1st mixers in RF sections A and B.

1st and 2nd IF stages:

The first IF is output from the double balanced mixer and filtered with a narrow band, 110.6 MHz, SAW filter. A high dynamic range MMIC amplifier then provides 13 dB of low noise IF gain. The amplifier output is filtered, with a second order Chebyshev bandpass filter, to improve 2nd image rejection.

The first IF is mixed with 99.9MHz from the 2nd LO to produce the 2nd IF frequency of 10.7 MHz. The 2nd LO is formed from a 3rd overtone crystal and discreet Colpitts oscillator. A second order Chebyshev bandpass filter is used to insure high spectral purity of the 2nd LO signal. LO output is split to provide -2dBm injection to the 2nd mixers in RF sections A and B.

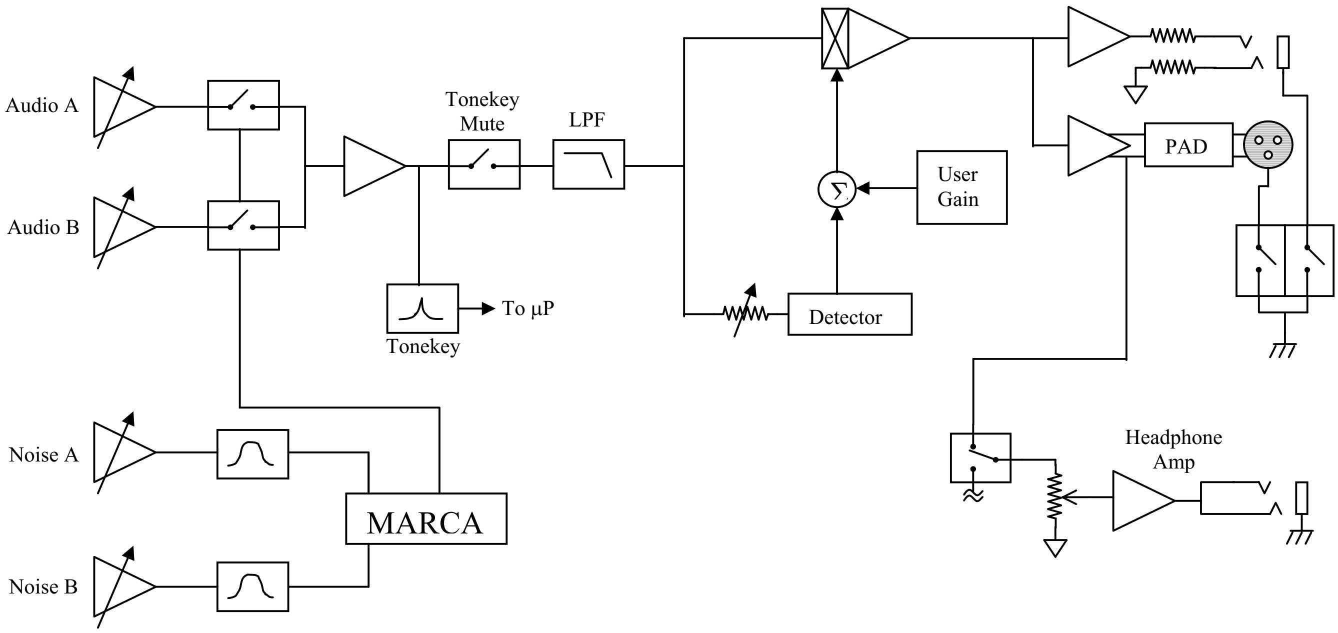
The second IF stage utilizes an integrated circuit mixer and amplifier. The output of the second mixer is bandpass filtered at 10.7 MHz with two 280kHz wide ceramic filters. RF overload detection is provided by lightly coupling the output of the first ceramic filter to a zero bias diode detector. The DC output of the diode detector is calibrated to indicate the presence of antenna signals greater than –25 dBm. The filtered IF signal is fed to the ICs amplifier section. Two additional 10.7MHz filters are provided after the amplifier to minimize adjacent channel interference.

FM detector:

The final stage of the RF section consists of a quadrature detector IC. The filtered 2nd IF signal is input to the detector's internal limiter. A DC signal proportional to the IF input level is produced at each detector's RSSI output. The RSSI output is calibrated and used to drive the receivers RF signal level LEDs. The detector's quadrature phase shift is produced by an adjustable external quad-coil. Demodulated baseband signals are then routed to the Audio A, Audio B, Noise A and Noise B inputs of the audio section for additional processing.

Audio Section

UR4 Audio Block Diagram



The base-band audio signal output from the FM detectors is first affected by a NTC thermistor network. It was found that the output of the detectors varies approximately 1dB across operating temperature. Since the companding process approaches a 5:1 ratio, this variation is effectively multiplied. The thermistor network helps to mitigate the varience. Each audio signal is then applied to a trimmable opamp gain stage (+21dB +/- 3dB). These trims are considered the deviation trim pot. The output of these two opamps each pass through a 200 Ohm resistor and an analog switch to a high impedance summing junction. The analog switches are controlled by the MARCAD circuitry described below. The effect is that either, or both channels can be turned on and the same audio level will be present at the output of the summing stage provided both audio channels have the same signal.

The **MARCAD** circuitry provides both noise squelching against a fixed reference as well as diversity switching. The noise outputs A & B are taken from the two FM detectors. A three stage multi-pole band-pass filter is used to look only at the signal content around 100 kHz (~60kHz BW). The amount of noise present is relative to the quality of the received signal. Each channel (A&B) is trimmed for a specific level using a low power carrier. The carrier amplitude is adjusted to provide 35 dB SINAD audio output. The A and B filtered noise output are both rectified and compared against both each other and a reference squelch level. If either channel is higher than the preset squelch level that channel is turned off. Below that the signals are compared such that if one channel is 6dB better than the other, the noisier channel is turned off. The rectifiers caps are slightly biased (~40mV) to avoid excessive channel switching when both channels are low in noise content. The output of the comparator drives the analog switches mentioned above. They are also available as inputs to the microprocessor to be used to determine LED display status.

The output of the MARCAD summing junction feeds the tonekey detection circuitry. **Tonekey** is a crystal referenced 32kHz pilot tone added to the audio sent from the transmitter. The level of the tonekey is amplitude shift keyed (ASK) to encode data relating to various transmitter settings and battery level. To detect the presence of tonekey the base band first passes through a pair of opamp based band-pass filters (Q=16). See the block diagram above. These filters strip off most all of the base-band audio and high frequency noise. The signal at this point is rectified and applied to an ADC so that the data can be read by the microprocessor. Because the filter Q is only 16 however the signal to noise is not good enough for robust tonekey muting operation. Noise bursts can cause false tonekey detection. To solve that problem, an additional band-pass filter stage using a 32kHz tuning fork crystal is used in parallel. The crystal filter has a very high Q (~8000) which gives a very good signal to noise ratio. The output of the crystal filter is rectified and compared against a reference. If the crystal filter output is below this reference it is determined to not be present and the comparator gates off the signal into the ADC. Because the frequency of the crystal shifts over temperature, care must be taken in setting the acceptance level to ensure proper operation over temperature.

The microprocessor determines if tonekey is present and controls an analog switch muting the audio into the low-pass filter. The microprocessor also uses this switch to mute audio during scanning functions, or if the user gain is set to the mute position.

The **low-pass filter** following the tonekey mute switch is used to strip off both the tonekey and any additional out of band high frequency noise that can corrupt the tracking of the expander. The filter is derived from a topology first used in PSM receivers. It combines a four pole 20kHz low-pass filter along with a tonekey notch filter centered at 32kHz. The low-pass filter stage has its Q modified to counteract roll off of the notch filter and maintain flat response to 20kHz. The final stage has a small DC bias (-100mV) applied to ensure proper bias on the proceeding electrolytic capacitors.

The signal from the low-pass filter output is sent to the audio peak meter circuit, and the expander. The **expander** section is based on the design first used in ULX wireless, except that it uses a THAT 4320 IC. The input to the RMS detector is trimmed to set the appropriate threshold. The threshold is set at the IC's internal reference voltage, and the input level trimmed to that, to minimize the effects of the 4320's temperature coefficient. The stage following the RMS detector sets the expansion ratio and provides the "soft-knee". Feed-forward ratio is defined as $dB_{out} = (1-G)dB_{in}$ (THAT CORP Application Note 101a) which in this case = 1:(1-(-4)) = 1:5. The Vbe temperature drift of the soft-knee diode is compensated for by using a dual transistor package. The second transistor in the package is used to subtract the Vbe drop from the output and thus compensating by sharing the same temperature and coefficient. The expander control voltage is then summed at the gain control summing amp. The required amount of **fixed attenuation** is derived, and trimmed, from the 4320's internal PTAT (Proportional To Absolute Temperature) reference voltage. The PTAT voltage is nominally –72mVDC at room temperature and has the same temperature coefficient as the RMS detector and VCA; this provides temperature compensation for fixed attenuation. The fixed attenuation is sent to the VCA via the gain control summing amp. Filtering and scaling the DC output of an 8-bit DAC provides **user gain**. The DAC output is scaled such that full-scale output (3.3VDC) results in a 32dB gain reduction (.125dB/register value). Additionally summed with the user gain is a device power on/off pulse. This pulse causes the gain of the VCA to quickly go very low at both turn on and turn off to keep the VCA stable and reduce DC pops and thumps.

Front panel audio **metering** is accomplished by looking at the signal at two locations, and applying a representative DC voltage to ADCs. The first location is immediately prior to the expander. The signal is full wave rectified and scaled for the ADC. The rectifier has a fast attack to represent the peak response of the transmitted signal. The second point is taken from the output of the RMS detector. This DC signal is proportional to the power response of the transmitted signal. This signal is scaled and sent to another ADC. The microprocessor uses the information from both converters to display the appropriate LEDs.

Following the expander is the **output stage**. Because the expander uses lower supply rails (+/- 5VDC), gain is applied to scale the signal up to match the clip points of the expander with the clip points of the output stages (+/- 15VDC). Output is provided on both ¼" phone jack as well as XLR.

The output on the ¼" jack is an impedance balanced configuration. The signal is buffered and applied to the tip connection via a 200 Ohm build-out and phantom protection capacitor. The ring connection is made in the same manner, but is not driven with signal. This configuration gives all the noise immunity benefits of a balanced connection, when used as such, with the ability to use an unbalanced connection (guitar applications) without shorting an output driver. The output signal is 6dB less than the XLR output because it is only driven on the tip.

The XLR output uses two buffers to drive both pin 2 and pin 3 of the XLR at opposite polarities. Half of the 200 Ohm build-out resistance is included inside the feedback loop of the drivers to reduce output impedance. 100uF 63VDC capacitors are used for phantom power protection. A 30dB resistive pad is available just before the output connector to provide the user with options regarding system gain structure.

A ground lift switch is also provided on the back panel. It lifts pin 1 from the XLR and also the shield connection of the ¼" jack from ground. This option can help reduce hum in certain instances. The ground lift for the ¼" jack only works if the threads and nut of the connector are isolated from the chassis, they currently are not, but could be modified to be so in the future.

The output of the two XLR drivers is also sent to the Headphone amp. Using a balanced pair helps increase noise immunity inside the receiver. The headphone amp board is a separate board mounted to the front panel. It uses a volume control with an integrated push button to switch between channel 1 & 2 on a dual, and on/off in a single receiver. The push button is de-bounced with an RC network followed by a Schmitt input buffer. The output of the buffer drives a D flip-flop set up as a toggle. The flip-flop output controls a quad analog switch to select which pair of input lines to pass, and also drives the yellow LEDs on the front panel showing which selection is made.

The pair of input line that pass through the analog switch are applied to a differential amplifier to remove noise and passed to an adjustable gain stage. The gain stage, which is adjusted by the volume control, has a gain range of -∞ to +14dB. The output of the gain stage is applied to the output driver section. The output driver section consists of four parallel sections of 33178 opamp in a non-inverting unity gain configuration. Each channel (left/right) is driven by a pair of these drivers through a 100 Ohm build out resistor each. One of the output drivers is connected to the distortion detection circuit.

The distortion detection circuit uses a high gain differential stage to compare the input of the driver to its output. Any difference in signal is distortion and is amplified by this stage. The output is full-wave rectified and averaged with a fast attack slow release RC network. This voltage is used to drive the gate of a MOSFET. When the distortion is significant the voltage rises to a point where the MOSFET turns on and lights a red LED on the front panel.

Operating Range

System Specifications	Min	Typical	Max	Unit	Notes
Approximate Frequency Ranges	518		865	MHz	Country dependent.
Signal to Noise Ratio (A-weighted)		100		dB	
Frequency Response	-3	-	+3	dB	From 50 Hz to 15 KHz referenced to 1 KHz level.
Operating Range		100		meters	

Additional Product Specifications

Specification	UR4S	UR4D
Nominal squelch setting (0)	35±3 dB SINAD	35±3 dB SINAD
Minimum squelch setting (-10)	25±3 dB SINAD	25±3 dB SINAD
Maximum squelch setting (+10)	40±3 dB SINAD	40±3 dB SINAD
12 dB SINAD	<-104 dBm	<-100 dBm
30 dB SINAD	<-97 dBm	<-93 dBm
40 dB SINAD	<-88 dBm	<-84 dBm
Radiation level of the first LO at antenna terminals (conductive)	<-90 dBm	<-90 dBm
First IF frequency	110.6 MHz	110.6 MHz
First IF rejection (note 1)	>100 dB	>100 dB
First Image rejection (note 1)	>110 dB	>110 dB
Second IF frequency	10.7 MHz	10.7 MHz
Radiation level of the second LO (99.9MHz) at the antenna terminals (conductive)	<-110 dBm	<-110 dBm
Second IF rejection (note 1)	>127 dB	>127 dB
Second Image rejection (note 1)	>127 dB	>127 dB
Maximum FM deviation (Note 2)	>45 kHz	>45 kHz
S/N ref 1kHz tone 45 kHz Dev, 20-20 kHz BW	>105 dB	>105 dB
Third order, 2 tone IMD test (note 1)	> 60 dB	> 60 dB
Channel to channel (diversity) isolation (note 1)	56 dB typ.	56 dB typ.
Expander Ratio @ 2.8 kHz deviation (referenced to 28 kHz), 1 kHz modulation	-44.35 dBV ± 1.0dB	-44.35 dBV ± 1.0dB
Audio Meter Red LED Turn On 1 kHz tone	45 kHz Dev	45 kHz Dev
Signal Strength Meter LEDs ALL ON:	-70 ±2 dBm	-70 ±2 dBm
Signal Strength Meter LEDs ALL OFF:	-90 ±2 dBm	-90 ±2 dBm
RF Overload LEDs ON	-25 ±2 dBm	-25 ±2 dBm

Note 1: Referenced to 12dB SINAD

Note 2: Referenced to 1% distortion

Listening Test

Before completely disassembling the receiver, operate it to determine whether it is functioning normally and try duplicating the reported malfunction. Refer to the User Guide for operating instructions, troubleshooting suggestions, and specifications.

Review any customer complaint or request, and focus the listening test on any reported problem. The following, more extensive, functional tests require partial disassembly.

Test Equipment

RF Generator	HP E4400B
Audio Analyzer	HP 8903B
Digital Multimeter	Fluke 87
BNC TO BNC Male cable	PT 1838A
Spectrum Analyzer	HP 8594E
DC Blocker	PT 1838W
Cable-XLR(F) to double & single banana plug	PT- 1841

Audio Frequency Response Test

Set Up

1. *Connect UR4 to RF generator to either antenna port A or B with appropriate coax cable, and DC block.*
2. Connect audio signal analyzer to the XLR balanced output of the appropriate channel.
3. Set mic/line switch is in Line position (up)
4. *Set receiver audio output is set to 0 dB (*Audio *menu)*
5. *Turn off receiver tonekey detection (*Radio -> Squelch -> Tonekey *menus)*
6. *Tune receiver to the* f_{MID} *(Refer page 21)of its operating band. (*Radio *menu)*
7. Tune RF generator to the same frequency.
8. Set RF generator to 28kHz deviation, 1kHz FM modulation, -40 dBm amplitude.

Frequency Response Test

1. Measured output of receiver should be: +2.2 dBu (0dBV) +/- 1dB.
2. Save this level pressing ratio button on audio analyzer.
3. Set RF generator FM rate to 100Hz modulation.
4. Measured output of receiver should be: +8.2 dB +/- 2dB relative to 1kHz measurement.
5. Set RF generator FM rate to 10kHz modulation.
6. Measured output of receiver should be: -12.5 dB +/- 2dB relative to 1kHz measurement

Distortion & Squelch Test

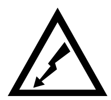
1. Disengage ratio button and engage the distortion button on Audio Analyzer.
2. Set RF signal generator FM rate to 1Khz.
3. Verify distortion measures less than .5% .
4. Verify unit squelches at -90dbm.
5. *Reset receiver tonekey detection to* ON.

! IMPORTANT SAFETY INSTRUCTIONS !

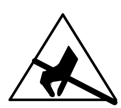
1. READ these instructions.
2. KEEP these instructions.
3. HEED all warnings.
4. FOLLOW all instructions.
5. DO NOT use this apparatus near water.
6. CLEAN ONLY with dry cloth.
7. DO NOT block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. DO NOT install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. DO NOT defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wider blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. PROTECT the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. ONLY USE attachments/accessories specified by the manufacturer.
12.  USE only with a cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. UNPLUG this apparatus during lightning storms or when unused for long periods of time.
14. REFER all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15. DO NOT expose the apparatus to dripping and splashing. DO NOT put objects filled with liquids, such as vases, on the apparatus.

!CAUTION!

Observe precautions when handling this static-sensitive device.



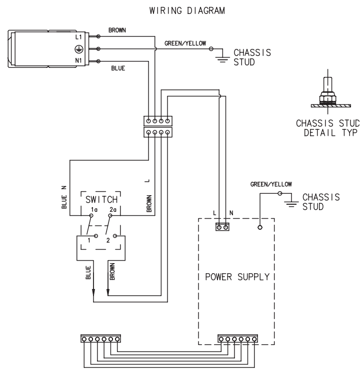
1.. READ these instructions.
2.. KEEP these instructions.
3.. HEED all warnings.
4.. FOLLOW all instructions.
5.. DO NOT use this apparatus near water.
6.. CLEAN ONLY with a damp cloth.
7.. DO NOT block any of the ventilation openings. Install in accordance with the manufacturer’s instructions.
8.. DO NOT defeat the safety purpose of the grounding-type plug. The third prong is provided for your safety. When the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
9.. PROTECT the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point of exit from the apparatus.
10.. USE only attachments/accessories specified by the manufacturer.
11.. USE only with a cart, stand, tripod, bracket, or table specified by the manufacturer or sold with the apparatus. When a cart is used, use caution when moving the cart-apparatus combination to avoid injury from tip-over.
12.. UNPLUG this apparatus during lightning storms or when unused for long periods of time.
13.. REFER all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as when the power-supply cord or plug has been damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

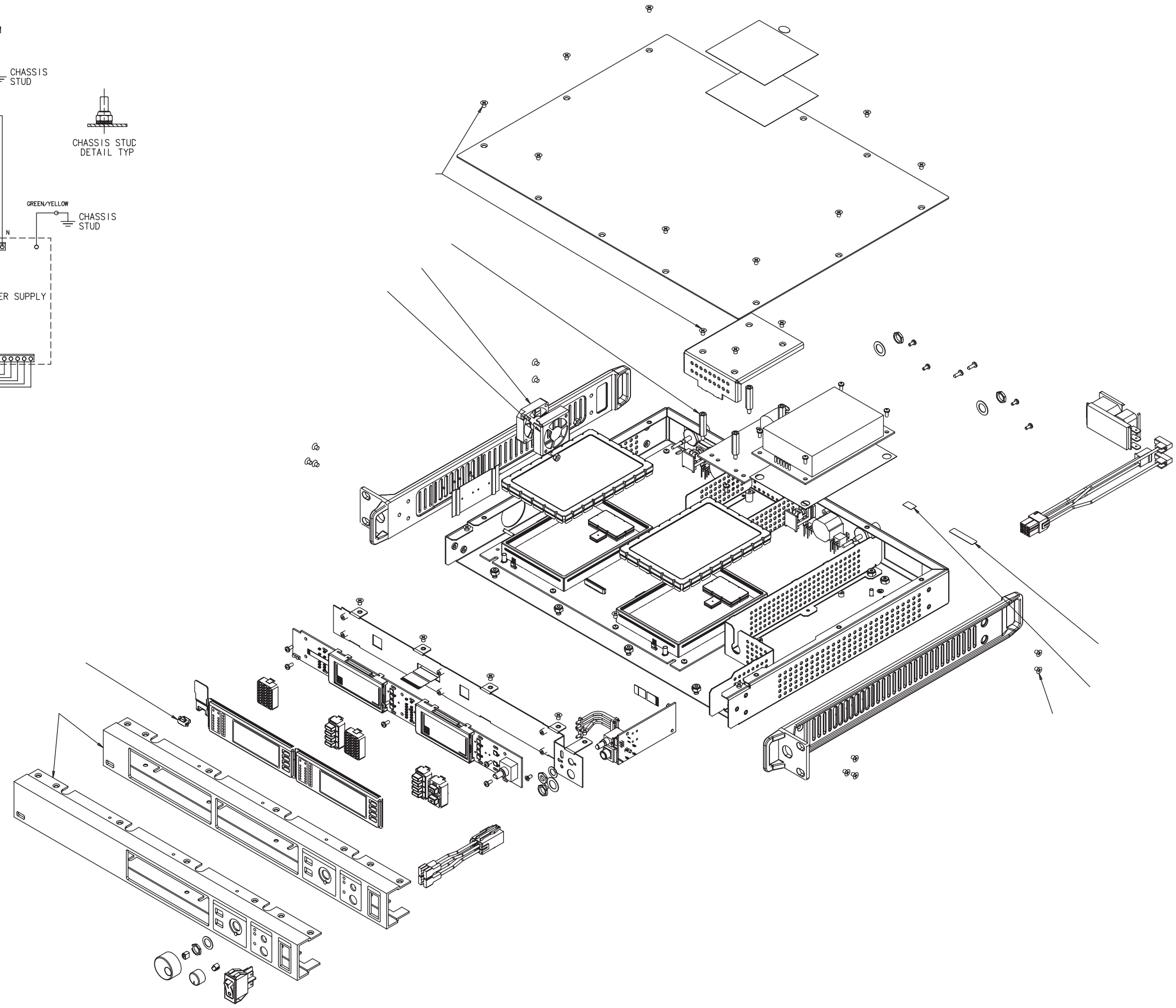


! CAUTION !

Observe precautions when handling this static-sensitive device.

Disassembly





Remove top cover:

1. *Remove 12 screws from Top.*
2. *Remove the Top cover.*

Remove front panel:

1. Unplug the ribbon cable from front panel.
2. Unplug the ribbon cable from headphone board.
3. Remove 4 nut from inside bottom.
4. Unplug power switch harness
5. Remove 2 screws from top far ends.

Reverse above procedure to assemble.

ALIGNMENT/FACTROY ADJUSTMENT METHODS:

Test Equipment

Most test equipment needed is described in the Shure WirelessService Equipment Manual. The following test equipment (or approved Equivalent) is also needed.

RF Generator	**HP E4400B**
Audio Analyzer	HP 8903B
Digital Multimeter	Fluke 87
Frequency Counter	HP 5381A
Spectrum Analyzer	HP 8594E
Shure Transmitter	UR1/ UR2
DC Blocker	PT 1838W
Cable Assembly,BNC male both ends(2)	PT- 1838A
Toray non-Inductive tuning tool-PINK	PT- 1838L
Toray non-Inductive tuning tool-white	PT-1838M
Toray non-Inductive tuning tool-blue	PT- 1838K
Non-inductive hex driver(for tuning) wrench	PT-1838N
Cable-XLR(F) to double & single banana plug	PT- 1841

dB Conversion Chart

0dBV = 2.214 dBu
0dBu = 0dBm assuming the load = 600 ohms
Be aware that dBu is a measure of voltage
and dBm is a measure of power.
The HP8903, for example,
should be labeled dBu instead of
dBm since it is a voltage measurement.
These two terms are often used interchangeably
even though they have different meanings.

UR4D CHANNEL 2 ALIGNMENT PROCEDURE

ALIGNMENT

Align Receivers 1 and 2 seperately.Receiver 1 is on the left side and Receiver 2 is on the right side when looking at the front panel. Equipment setup for the alignment procedure is sequential.

PCB Group	Frequency Band Names:	Tuning Frequency f_0 MHz	Tuning Frequency f_{MID} MHz
A	H4 (US / Canada)	578.000	548.000
A	H4E (Europe)	578.000	548.000
B	J5 (US / Canada)	638.000	607.000
B	J5E (Europe)	638.000	607.000
C	L3 (US / Canada)	698.000	668.000
C	L3E (Europe)	698.000	668.000
D	Q5 (Europe)	814.000	777.000
D	Q6 (Korea)	814.000	777.000
D	Q9 (US / Canada)	814.000	777.000
D	Q10 (China)	814.000	777.000
D	ABJ (Japan)	814.000	777.000
E	R9 (UK / Europe)	865.000	828.000

PRE-TEST SETUP

1. Remove the top cover from UR4S/UR4D receiver.
2. To reduce the risk of electrical shock, do not touch or short any components in the receiver switching power supply. The heat sink on the power supply and all AC wiring contains hazardous voltages.
3. Dc voltages are present at most RF test points. Use DC blocks on the RF signal generator to protect the test equipment.
4. Use RG58 or any other low loss 50 ohm cables for all RF connectons.Keep test cables as short as possible. Include insertion loss of cable and connectors when making RF measurements.

TEST SETUP

1. Press and hold the "**enter"** button and the top "**Navigate"** button (closest to the "**enter"** button) while powering the receiver ON. Continue holding until the display stops changing. (**Note**: The following menu is not present following a normal power up sequence.)
2. Press the "**exit"** button to return to the main menu.
3. Select "**RF"** from the navigate menu.
4. Set RF signal generator as follows:
   - Amplitude to **-10dBm**
   - Modulation to **OFF**
   - Frequency to $\mathbf{f_o}$ (see table above)
5. Set the spectrum analyzer as follows:
   - Frequency to $\mathbf{f_o}$ (see table above)
   - Span to **1 MHZ**
   - Amplitude to **-20dBm**
6. Set the receiver frequency to $\mathbf{f_o}$.

VCO TUNING - CHANNEL 2

Note: VCO must be calibrated before tuning the preselect filters.

1. Remove RF section shield cover.
2. Through the **“Navigate”** menu select: **Audio** > **RF** > **VcoCal**.
3. Follow the directions on the receiver’s display. The receiver is automatically tuning to the frequency shown in the display.
4. Adjust the control knob on the receiver until 1Vdc +/- 0.1V is measured at I 76(IC 14 PIN 3) then press the **“enter”** button to save the value.
5. Adjust the control knob on the receiver until 2.5Vdc +/- 0.1V is measured at I 76 then press the **“enter”** button.
6. Adjust the control knob on the receiver until 4Vdc +/- 0.1V is measured at I 76 then press the **“enter”** button.
7. Press **“enter”** to save, and then **“exit”** the VCO calibration menu.

PRESELECTOR & IMAGE REJECTION FILTER ALIGNMENTS

SET UP

1. Through the **“Navigate”** menu select: **Audio**>**RF**>**Filter**.
2. Verify receiver frequency is set to $\mathbf{f_o}$
3. Verify that the receiver provides 14VDC to I 32 (U2 pin 1). Use a DVM for this measurement.
4. Connect the RF signal generator to antenna port “**A**” Using a short piece (<1m) of 50 Ω coax.

CHANNEL 2A PRESELECTOR FILTER ALIGNMENT

1. Connect the spectrum analyzer input to test point **I 4**.
2. Adjust CV25 to maximize the spectrum analyzer power at $f_{o.}$
3. Adjust CV24 to maximize the spectrum analyzer power at $f_{o.}$
4. Adjust CV26 to maximize the spectrum analyzer power at f_o.

CHANNEL 2A IMAGE REJECTION FILTER ALIGNMENT

1. Connect the spectrum analyzer input to **I 16.**
2. Adjust CV9 to maximize the spectrum analyzer power at f_o.
3. Adjust CV10 to maximize the spectrum analyzer power at f_o.
4. Adjust CV8 to maximize the spectrum analyzer power at $f_{o.}$
5. Readjust CV24 to maximize the spectrum analyzer power at $f_{o.}$ (-18 dBm typ.)

CHANNEL 2B PRESELECTOR FILTER ALIGNMENT

1. Connect the RF signal generator to antenna port “**B”** Using a short piece (<1m) of 50 Ω coax.
2. Connect the spectrum analyzer input to **I 3.**
3. Adjust CV22 to maximize the spectrum analyzer power at f_o.
4. Adjust CV21 to maximize the spectrum analyzer power at $f_{o.}$
5. Adjust CV23 to maximize the spectrum analyzer power at f_o.

CHANNEL 2B IMAGE REJECTION FILTER ALIGNMENT

1. Connect the spectrum analyzer input to **I 13.**
2. Adjust CV19 to maximize the spectrum analyzer power at f_o.
3. Adjust CV18 to maximize the spectrum analyzer power at f_o.
4. Adjust CV20 to maximize the spectrum analyzer power at $f_{o.}$
5. Readjust CV21 to maximize the spectrum analyzer power at f_o. (-18 dBm typ.)

CHANNEL 2 1st LO ALIGNMENT

1. Connect the spectrum analyzer input to 2nd IF test point **I 100 (Near FL 14)**.
2. Set the spectrum analyzer as follows:

Center frequency to **10.7MHz**,

Span to **100KHz**

Amplitude to **0 dBm**

3. Adjust synthesizer crystal trimmer CV17 to center the 2nd IF frequency at 10.7MHz +/- 1KHz. (The spectrum analyzer power at 10.7MHz is ~ -9dBm typ.)

CHANNEL 2B QUADRATURE COIL ALIGNMENT

1. Set RF signal generator as follows:

Amplitude to **-40dBm**

Modulation to **ON**

Modulation **FM**

Modulating frequency to **1KHz**

Deviation to **38KHz**

2. Connect the audio analyzer input to **I 604.** (Pin 7 of IC 600)
3. Adjust L75 to maximize audio analyzer SINAD reading. (>50dB)
4. Set RF generator:

Amplitude to -100 dBm (UR4D)

5. Engage Audio Analyzer A-weighting.
6. Verify audio analyzer SINAD reading (A weighted) is >12dB

CHANNEL 2A QUADRATURE COIL ALIGNMENT

1. Connect the RF signal generator to antenna port "**A**" Using a short piece (<1m) of 50 Ω coax.
2. Set RF signal generator as follows:

Amplitude to **–40dBm**

Modulation to **ON**

Modulation **FM**

Modulating frequency to **1KHz**

Deviation to **38KHz**

3. Connect the audio analyzer input to **I 601.**(Pin 1 of IC 601)
4. Adjust L52 to maximize audio analyzer SINAD reading. (>50dB)
5. Set RF generator:

Amplitude to -100 dBm (UR4D)

6. Verify audio analyzer SINAD reading (A weighted) is >12dB

CHANNEL 2A RF LEVEL INDICATION AND OVER LOAD LED ALIGNMENT

1. Set the receiver frequency to **f_{MID}**.
2. Set the RF signal generator frequency to **f_{MID}**.
3. Turn off modulation from the RF signal generator.
4. Through the **“Navigate”** menu select: **Audio** > **Meter** > **RSSI**.

   Press the **Get** Navigate key.
5. Set RF signal generator: Amplitude to **-90dBm**

   Press the **Get** Navigate key.
6. Set RF signal generator: Amplitude to **-85dBm**

   Press the **Get** Navigate key.
7. Set RF signal generator: Amplitude to **-80dBm**

   Press the **Get** Navigate key.
8. Set RF signal generator: Amplitude to **-75dBm**

   Press the **Get** Navigate key.
9. Set RF signal generator: Amplitude to **-70dBm**

   Press the **Get** Navigate key.
10. Set RF signal generator: Amplitude to **-50dBm**

    Press the **Get** Navigate key.
11. Set RF signal generator: Amplitude to **-25dBm**

    Press the **Get** Navigate key.
12. Verify all RF LED lit on corresponding channel.

CHANNEL 2B RF LEVEL INDICATION AND OVERLOAD LED ALIGNMENT

1. Connect the RF signal generator to antenna port “**B**” Using a short piece (<1m) of 50 Ω coax.
2. Set RF signal generator: Amplitude to **-90dBm**

   Press the **Get** Navigate key.
3. Set RF signal generator: Amplitude to **-85dBm**

   Press the **Get** Navigate key.
4. Set RF signal generator: Amplitude to **-80dBm**

   Press the **Get** Navigate key.
5. Set RF signal generator: Amplitude to **-75dBm**

   Press the **Get** Navigate key.
6. Set RF signal generator: Amplitude to **-70dBm**

   Press the **Get** Navigate key.
7. Set RF signal generator: Amplitude to **-50dBm**

   Press the **Get** Navigate key.
8. Set RF signal generator: Amplitude to **-25dBm**

   Press the **Get** Navigate key.
9. Verify all RF LED lit on corresponding channel.
10. Press the **Enter** button to save all values.

UR4D CHANNEL 1 ALIGNMENT PROCEDURE

TEST SETUP

1. Press and hold the "**enter"** button and the top "**Navigate"** button (closest to the "**enter"** button) while powering the receiver ON. Continue holding until the display stops changing. (**Note**: The following menu is not present following a normal power up sequence.)
2. Press the "**exit"** button to return to the main menu.
3. Select "**RF"** from the navigate menu.
4. Set RF signal generator as follows:
   - Amplitude to **-10dBm**
   - Modulation to **OFF**
   - Frequency to $\mathbf{f_o}$ (see table above)
5. Set the spectrum analyzer as follows:
   - Frequency to $\mathbf{f_o}$ (see table above)
   - Span to **1 MHZ**
   - Amplitude to **-20dBm**
6. Set the receiver frequency to $\mathbf{f_o}$**.**

VCO TUNING - CHANNEL 1

Note: VCO must be calibrated before tuning the preselector filters.

1. Remove RF section shield cover.
2. Through the **"Navigate"** menu select: **Audio** > **RF** > **VcoCal**.
3. Follow the directions on the receiver's display. The receiver is automatically tuning to the frequency shown in the display.
4. Adjust the control knob on the receiver until 1Vdc +/- 0.1V is measured at I 76(IC 14 PIN 3) then press the **"enter"** button to save the value.
5. Adjust the control knob on the receiver until 2.5Vdc +/- 0.1V is measured at I 76 then press the **"enter"** button.
6. Adjust the control knob on the receiver until 4Vdc +/- 0.1V is measured at I 76 then press the **"enter"** button.
7. Press **"enter"** to save, and then **"exit"** the VCO calibration menu.

PRESELECTOR & IMAGE REJECTION FILTER ALIGNMENT

SETUP

1. Through the **"Navigate"** menu select: **Audio**>**RF**>**Filter**.
2. Verify that the receiver provides 14VDC to I 23 (U6 pin 1). Use a DVM for this measurement.
3. Connect the RF signal generator to antenna port "**A**" Using a short piece (<1m) of 50 Ω coax.

CHANNEL 1A PRESELECTOR FILTER ALIGNMENT

1. Connect the spectrum analyzer input to **I 6**
2. Adjust CV28 to maximize the spectrum analyzer power at f_o.
3. Adjust CV29 to maximize the spectrum analyzer power at f_o.
4. Adjust CV27 to maximize the spectrum analyzer power at f_o.

CHANNEL 1A IMAGE REJECTION FILTER ALIGNMENT

1. Connect the spectrum analyzer input to **I 9.**
2. Adjust CV2 to maximize the spectrum analyzer power at f_o.
3. Adjust CV1 to maximize the spectrum analyzer power at f_o.
4. Adjust CV3 to maximize the spectrum analyzer power at f_o.
5. Readjust CV29 to maximize the spectrum analyzer power at f_o. (-18 dBm typ.)

CHANNEL 1B PRESELCTOR FILTER ALIGNMENT

1. Connect the RF signal generator to antenna port "**B**" Using a short piece (<1m) of 50 Ω coax.
2. Connect the spectrum analyzer input to **I 5.**
3. Adjust CV12 to maximize the spectrum analyzer power at f_o.
4. Adjust CV11 to maximize the spectrum analyzer power at f_o.
5. Adjust CV13 to maximize the spectrum analyzer power at f_o.

CHANNEL 1B IMAGE REJECTION FILTER ALIGNMENT

1. Connect the spectrum analyzer input to **I 7.**
2. Adjust CV5 to maximize the spectrum analyzer power at $f_{o.}$
3. Adjust CV6 to maximize the spectrum analyzer power at f_o.
4. Adjust CV4 to maximize the spectrum analyzer power at f_o.
5. Readjust CV11 to maximize the spectrum analyzer power at f_o. (-18 dBm typ.)

CHANNEL 1 1st LO ALIGNMENT

1. Connect the spectrum analyzer input to **I 98 (Near FL 17)**.
2. Set the spectrum analyzer:

Center frequency to **10.7MHz**,

Span to **100KHz**

Amplitude to **0dBm**

3. Adjust the synthesizer crystal CV7 to center the 2nd IF frequency at 10.7MHz +/- 1KHz. The spectrum analyzer power at 10.7MHz is ~ -9dBm typ.

CHANNEL 1B QUADRATURE COIL ALIGNMENT

1. Set RF signal generator as follows:

Amplitude to **-40dBm**

Modulation to **ON**

Modulation **FM**

Modulating frequency to **1KHz**

Deviation to **38KHz**

2. Connect the audio analyzer input to **I 404. (Pin 7 of IC 400)**
3. Adjust L28 to maximize audio analyzer SINAD reading. (>50dB)
4. Set RF generator as follows:

Amplitude to -100 dBm

5. Engage Audio Analyzer a-weighting
6. Verify audio analyzer SINAD reading (A weighted) is >12dB

CHANNEL 1A QUADRATURE COIL ALIGNMENT

1. Connect the RF signal generator to antenna port "**A**" Using a short piece (<1m) of 50 Ω coax.
2. Set RF signal generator as follows:

Amplitude to **-40dBm**

Modulation to **ON**

Modulation **FM**

Modulating frequency to **1KHz**

Deviation to **38KHz**

3. Connect the audio analyzer input to **I 401 (Pin 1 of IC 401)**
4. Adjust L1 to maximize audio analyzer SINAD reading. (>50dB)
5. Set RF generator as follows:

   Amplitude to -100 dBm
6. Verify audio analyzer SINAD reading (A weighted) is >12dB

CHANNEL 1A RF LEVEL INDICATION AND OVERLOAD LED ALIGNMENT

1. Set the receiver frequency to $\mathbf{f_{MID}}$.
2. Set RF generator frequency to $\mathbf{f_{MID}}$.
3. Through the **"Navigate"** menu select : **Audio** > **Meter** > **RSSI**
4. Turn off the RF signal generator modulation.
5. Set RF signal generator: Amplitude to **-90dBm**

   Press the **Get** Navigate key.
6. Set RF signal generator: Amplitude to **-85dBm**

   Press the **Get** Navigate key.
7. Set RF signal generator: Amplitude to **-80dBm**

   Press the **Get** Navigate key.
8. Set RF signal generator: Amplitude to **-75dBm**

   Press the **Get** Navigate key.
9. Set RF signal generator: Amplitude to **-70dBm**

   Press the **Get** Navigate key.
10. Set RF signal generator: Amplitude to **-50dBm**

    Press the **Get** Navigate key.
11. Set RF signal generator: Amplitude to **-25dBm**

    Press the **Get** Navigate key.
12. Verify all RF LED lit on correspondining channel.

CHANEEL1B RF LEVEL INDICATION AND OVERLOAD LED ALIGNMENT

1. Connect the RF signal generator to antenna port "**B**" Using a short piece (<1m) of 50 Ω coax.
2. Set RF signal generator: Amplitude to **-90dBm**

   Press the **Get** Navigate key.
3. Set RF signal generator: Amplitude to **-85dBm**

   Press the **Get** Navigate key.
4. Set RF signal generator: Amplitude to **-80dBm**

   Press the **Get** Navigate key.
5. Set RF signal generator: Amplitude to **-75dBm**

   Press the **Get** Navigate key.
6. Set RF signal generator: Amplitude to **-70dBm**

   Press the **Get** Navigate key.
7. Set RF signal generator: Amplitude to **-50dBm**

   Press the **Get** Navigate key.
8. Set RF signal generator: Amplitude to **-25dBm**

   Press the **Get** Navigate key.
9. Verify all RF LED lit on corresponding channel.
10. Press the **Enter** button to save all values.

AUDIO TRIM: Must be done in the following order:

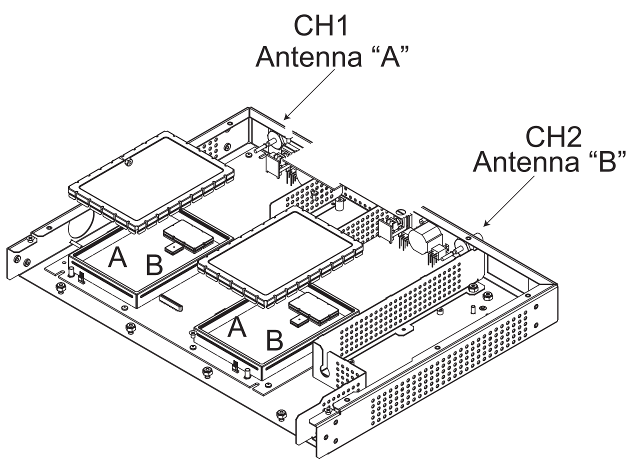
DEVIATION TUNING

SET UR4 AS FOLLOWS:

1. Set UR4 frequency to $\mathbf{f_{MID}}$.
2. Set UR4 Squelch to –10.
3. Turn OFF Tonekey.

SET SIGNAL GENERATOR AND AUDIO ANALYZER AS FOLLOWS:

1. Set Signal Generator Amplitude to –40dBm.
2. Set Signal Generator frequency $\mathbf{f_{MID}}$.
3. Set Signal Generator FM Rate to 1KHZ.
4. Set Signal generator Deviation @28KHZ.
5. Connect Signal Generator to UR4 Antenna Port A or B accordingly to the table below.
6. Disengage Audio Analyzer A-Weighting.
7. Adjust Audio Deviation Pots Accordingly to the table below.



Channel:	Trim:	Measure at:	Value:
CH-1A	TR400	I407(Pin 7 of IC- 426)	+11.01dBu +/- 0.01dB
CH-1B	TR402	I407(Pin 7 of IC-426)	+11.01dBu +/- 0.01dB
CH-2A	TR600	I607(Pin 7 of IC- 626)	+11.01dBu +/- 0.01dB
CH-2B	TR602	I607(Pin 7 of IC-626)	+11.01dBu +/- 0.01dB

THRESHOLD:

1. Change Signal Generator Deviation to 2.8kHz.
2. Connect Audio Analyzer Input to UR4 balanced output.
3. Measure the balanced output of the channel being tuned and record value (T1)
4. Change RF deviation to 28kHz
5. Set mic/line switch to Line
6. Adjust Threshold trim-pot so that balanced output = T2 = T1 + 44.35dB (+/- .1 dB)

Channel:	Trim:	Measure at:	Value:
CH-1	TR401	XLR output	T2 +/- 0.1dB
CH-2	TR601	XLR output	T2 +/- 0.1dB

FIXED GAIN:

Adjust Fixed Gain trim-pot such that T2 = 2.21dBu (+/- .25 dB)

Channel:	Trim:	Measure at:	Value:
CH-1	TR403	XLR output	2.21dBu +/- .25 dB
CH-2	TR603	XLR output	2.21dBu +/- .25 dB

NOISE TRIM: (2 trim pots)

1. Change Signal Generator Amplitude to –95dBm.
2. Adjust Signal Generator Amplitude in .5 dBm increments until closest to 35dB SINAD.
3. Read these measurements on UR4 balanced output.
4. Use 30kHz low pass filter with no A-Weighting on Audio Analyzer.
5. Trim for 4Vdc at rectifier capacitor below.

Channel:	Trim:	Measure at:	Value:
CH-1A	TR404	I420 (near C462 marked “A”)	4.0 +/- 0.05 VDC
CH-1B	TR405	I424 (Near C476 marked “B”)	4.0 +/- 0.05 VDC
CH-2A	TR604	I619 (near C662 marked “A”)	4.0 +/- 0.05 VDC
CH-2B	TR605	I623 (near C676 marked “B”)	4.0 +/- 0.05 VDC

TONE KEY ALIGNMENT:

NOTE: Do not use Audio Analyzer 8903 for this measurement. Use Volt meter(DVM).

1. Set Signal Generator Amplitude to –40dBm.
2. Set FM Rate to 32.001kHz.
3. Deviation to 5kHz.
4. Frequency to $\mathbf{f_{MID}}$.
5. Connect Signal generator to UR4 appropriate Antenna channel port.

.

Ch:	Trim:	Measure at:	Value:		Trim:	Measure at:	Value:		Trim:	Measure at:	Value:
CH-1	CV14	I67 IC 25 PIN 5	Peak		TR1	I79 IC 25 PIN 7	1.5V		TR3	I67 IC 25 PIN 5	3.0V
CH-2	CV15	I111 IC 25 PIN 3	Peak		TR2	I112 IC 25 PIN 1	1.5V		TR4	I111 IC 25 PIN 3	3.0V

1. Adjust Tonekey trim-cap (CV14, CV15) to maximize DC voltage at (I67, I111).
2. Adjust Tonekey trim-pot (TR1, TR2) for 1.5 VDC at (I79, I112).
3. Adjust Tonekey trim-pot (TR3, TR4) for 3.0 VDC at (I67, I111).

AUDIO METER CALIBRATION:

Under the Audio menu there is a new menu item called Meter. Within this menu one can change the RSSI, Audio Peak, and Audio RMS meter levels and ballistics stored on the units EEPROM.

Use the push button of the encoder to selects a value to change. Then use the encoder to change the value, or, with the intended signal level applied, use the GET function to take a reading from the ADC and store that value. Press the Enter button to store values to EEPROM when finished

AUDIO RMS METER VALUES:

LED:	Deviation: (1kHz modulation)	Typical values:	Reference output level: (XLR balanced)
G0	10.7 kHz	31	-27.78 dBu
G1	15.2 kHz	65	-18.78 dBu
G2	20.2 kHz	92	-9.78 Bu
G3	23.8 kHz	108	-3.78 dBu
Y4	28.0 kHz	124	+2.21 dBu
Y5	32.9 kHz	139	+8.21 dBu
Y6	38.6 kHz	154	+14.21 dBu
R7	45.0 kHz	169	+20.21 dBu
D	--	4	Decay time

NOTE: Repeat above steps to next channel.

AUDIO PEAK METER VALUES:

LED:	Deviation: (1kHz modulation)	Typical values:	
G0	15.2 kHz	35	
G1	20.2 kHz	48	
G2	23.8 kHz	58	
G3	28.0 kHz	68	
Y4	32.9 kHz	83	
Y5	38.6 kHz	98	
Y6	45.0 kHz	115	
R7	58.0 kHz	150	
D	--	4	Decay time
S	--	12	Stack avg. size

PRODUCT SPECIFICATIONS

USING AN HP ESG SERIES SIGNAL RF GENERATOR set the RF generator frequency to the first available receiver frequency, level=-65dBm, FM waveform=Dual-Sine: FM Tone1=1kHz @ 33kHz deviation and FM Tone2 = 32.000kHz @ 15% of tone 1 deviation (this is equivalent to 28 kHz deviation of a 1KHz tone with 5kHz deviation of a 32kHz tone). Use audio analyzer bandwidth of 30kHz, A-weighting is off unless otherwise specified.

All specifications are over temperature range –18C to 57C unless otherwise specified. Typical values are at 25C.

Specification	Minimum	Typical	Maximum
Frequency range	518 MHz	**See Prod. spec's**	865 MHz
AC current drain @ 120VAC, 60Hz single receiver without inline amplifiers or active antennas	131 mA	145 mA @25C	160 mA 170mA @ 57C
AC current drain @ 120VAC,60Hz dual receiver without inline amplifiers or active antennas	180 mA	200 mA @ 25C	220 mA 225mA @ 57C
DC voltage at RF antenna ports with 60 Ohm load	12.8 V	13.3 V	13.8 V
UR4S 40dB SINAD (channel A or B) measured at the lowest available receiver frequency (A-weighted)		-92 dBm UR4S	-88 dBm UR4S
UR4D 40dB SINAD (channel A or B) measured with both channels set to the lowest available receiver frequency (A-weighted)		-88 dBm UR4D	-84 dBm UR4D
Total Harmonic Distortion at -40dBm with 1kHz modulating frequency, 28kHz deviation		0.15%	0.5%
Audio Output Level @ unbalanced output, Rx audio Output Level setting = 0dB, unloaded, 28kHz deviation, 1kHz audio.	-6.8 dBu -9.0 dBV	-3.8 dBu -6.0 dBV	-0.8 dBu -3.0 dBV
Audio Output Level @ balanced output, Rx audio Output Level setting = 0dB, unloaded, Line, 28kHz deviation, 1kHz audio.	-0.8 dBu -3.0 dBV	+2.2 dBu 0 dBV	+5.2 dBu +3.0 dBV
Audio Output Level @ balanced output, Rx audio Output Level setting = -12dB, unloaded, Line, 28kHz deviation, 1kHz audio. Measurement relative to Output Level setting = 0dB	-13 dBr -17dBr @ -18C	-12 dBr	-11 dBr -9 dBr @57C
100 Hz Audio Frequency Response **with respect to 1kHz**, -50dBm RF input, no pre-emphasis.	6.2 dB	8.2 dB	10.2 dB
10 kHz Audio Frequency Response **with respect to 1kHz**, -50dBm RF input, no pre-emphasis.	-14.5 dB	-12.5 dB	-10.5 dB
Squelch Threshold settings = +10	36 dB SINAD	40 dB SINAD	44 dB SINAD
Squelch Threshold settings = 0	30 dB SINAD	35 dB SINAD	40 dB SINAD
Squelch Threshold settings = -10	20 dB SINAD	25 dB SINAD	30 dB SINAD
Signal Strength Meter LEDs ALL ON: Test RX at or as close as possible to mid-band. For UR4D set both channels to the same frequency before performing the test. Note: Max allowable change from nominal 25 C measurement is ± 3dB over full temperature range.	-73 dBm @ 25C	-70 dBm @ 25C	-67 dBm @ 25C
Signal Strength Meter LEDs ALL OFF: Test RX at or as close as possible to mid-band. For UR4D set both channels to the same frequency before performing the test. Note: Max allowable change from nominal 25 C measurement is ± 3dB over full temperature range.	-93 dBm @ 25C	-90 dBm @ 25C	-87 dBm @ 25C
RF Overload Indicator LED ON: Test RX at or as close as possible to mid-band. For UR4D set both channels to the same frequency before performing the test. Note: Max allowable change from nominal 25C measurement is +7dB @ 57C, –4dB @ -18C.	-28 dBm@ 25C	-25 dBm @ 25C	-22 dBm@ 25C

Frequency Range

PCB Group	Frequency Band Names:	Min	Typical	Max	Notes
		MHz		MHz	
A	H4 (US / Canada) H4E (Europe)	518.000	-	578.000	
B	J5 (US / Canada)	578.000 614.025	- -	607.975 638.000	Excludes 608.000 to 614.000 MHz. (Radio Astronomy Band)
B	J5E (Europe)	578.000	-	638.000	
C	L3 (US / Canada) L3E (Europe)	638.000	-	698.000	
D	Q5 (Europe)	740.000	-	814.000	
D	Q6 (Korea)	740.125	-	751.875	
D	Q9 (US / Canada)	740.000	-	805.975	
D	Q10 (China)	740.000	-	797.900	
D	ABJ (Japan) Switchable between Band A and Band B	779.125 797.125 806.125	Band A Band A Band B	787.875 805.875 809.750	Band A (uses A24 transmitters Excludes 788.000 to 797.000 MHz.) Band B (uses JBX transmitters 806.125-809.750 MHZ)
E	R9A (Europe)	790.000		865.000	

NOTE: This Radio equipment Is Intended for use In musical professional entertainment and similar applications.

This Radio aparatus may be capable of operating on some frequencies not authorized in your region. Please contact your national authority to obtain information on authorized frequencies and RF power levels for wireless microphone products.

RF Carrier Frequency Range
518-865 MHz, depending on region

Audio Frequency Response

40-18,000 Hz, ±1 dB.
NOTE: Overall system frequency response depends on the microphone element

Modulation
FM (45 kHz max. deviation), compander system with pre- and de-emphasis

RF Power Output
See table above

Dynamic Range
>110 dB, A-weighted

Image Rejection
110 dB typical

RF Sensitivity

UR4S	UR4D
–110 dBm Typical 12 dB SINAD	–107 dBm Typical 12 dB SINAD
–105 dBm Typical 30 dB SINAD	–102 dBm Typical 30 dB SINAD

Spurious Rejection

90 dB typical

Ultimate Quieting (ref. 45 kHz deviation)

>100 dB, A-weighted

Signal Polarity

Positive pressure on microphone diaphragm (or positive voltage applied to tip of WA302 phone plug) produces positive voltage on XLR output pin 2 with respect to XLR pin 3 and on the tip of the 1/4-inch output jack.

System Distortion (ref. ± 45 kHz deviation, 1 kHz modulation)

0.3% Total Harmonic Distortion typical

Power Requirements

UR4D, UR4S: 100 - 240 Vac, 50/60 Hz

Current Drain

UR4D, UR4S: 0.8 Amps max.

Operating Temperature Range

–18° to +57° C (0° to +135° F)

NOTE: Battery characteristics may limit this range

NOTE: Electrical safety approval is based on a maximum ambient temperature of 35°C (95 F°)

Overall Dimensions

UR4S/UR4D: 43.5 mm H x 482.6 mm W x 366 mm D
(1.718 x 19.000 x 14.385 in.)

Net Weight

UR4S: 4.94 kg (10.9 lbs)
UR4D: 5.14 kg (11.3 lbs)

Housing:

UR4S, UR4D: Galvanized steel

Compliance Information

		Units tested		Notes
US	FCC Pt15B	H4, L3, Q9	Emissions	Dual Receivers
Canada	RSS 123	H4, L3, Q9	Spurious emissions	Dual Receivers
Europe	301 489-1	L3E	Emissions, immunity	Dual Receiver
	300 422-1, -2	H4E, L3E, R9A	Spurious emissions	Dual Receivers 518 to 865 MHz
China	GB 8898-2001 GB 13837-2003 GB 17625.1-2003	Q10	Emissions	Dual Receivers CISPR 13 & 22, EN 61000-3-2 reports from DLS. Will accept Elite.
Japan	CISPR 13	ABJ		Dual Receivers CISPR 13 & 22 report @ 100 V from UL.
Korea	CISPR 13	Q6	Emissions, immunity	Dual Receivers Cetecom test report

NOTE: The list above constitutes the agency/approval testing done at the time the product was originally approved. It is recommended that anyone re-certifying this product, or any product, re-examine the list of required compliance tests to make sure all current and relevant testing is performed.

Receiver Input

	Antenna	Power
Connector Type:	BNC	IEC
Actual Impedance:	50 Ω	-
Nominal Input Level:	–95 to –30 dBm	100-240 VAC, 50/60 Hz
Maximum Input Level:	20 dBm	240 VAC, +10%, 50/60 Hz
Pin Assignments:	Shell = Ground Center = Signal	IEC Standard
Bias Voltage*:	12.2 Vdc @ 150 mA maximum	N/A

* For remote antennas amplifiers.

Receiver Audio Output

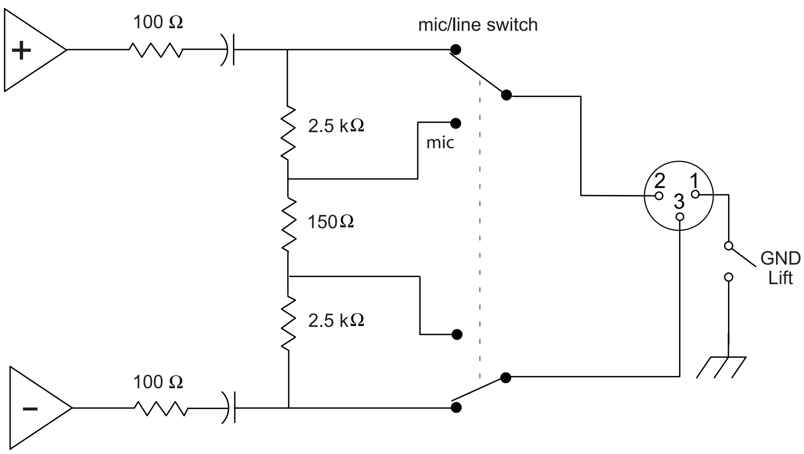
	Monitor (1/4” Headphone)	1/4” Phono	XLR
Output Configuration:	Unbalanced mono, 1/4 inch	Impedance Balanced	Electrically Balanced
Actual Impedance:	50 Ω	200 Ω	200 Ω (active balanced) (150 Ω mic)
Maximum Ouput Level:	1 Watt @ 63 Ω	+18 dBu	+24 dBu (–6 dBu mic) with 100 Hz modulating tone
Pin Assignments:	Tip = Hot Ring = Hot Sleeve = Gnd	Tip = Hot Ring = no signal Sleeve = Gnd	1 = Ground 2 = Audio + 3 = Audio –
Phantom Power Protection?	No	Yes	Yes

Computer/Network Interface

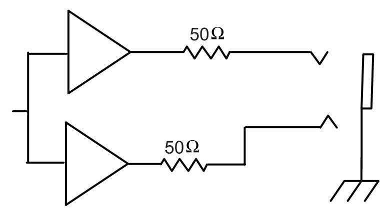
Ethernet	USB
RJ45	USB Series “B” Receptacle

* USB-IF logo is a trademark of Universal Serial Bus Implementers Forum, Inc.

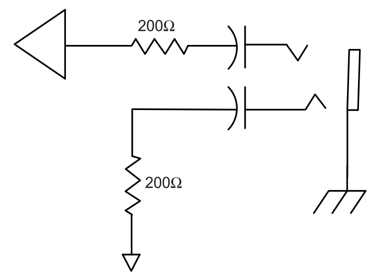
XLR



1/4” Monitor/headphone



1/4” Phone



TROUBLESHOOTING

Troubleshooting and Service features

To aid in troubleshooting DC bias voltages and typical RF and Audio levels are indicated at various points in the schematic. RF levels assume –50dBm input at the antenna port and no modulation. Audio levels assume 28KHz deviation of a 1KHz tone.

RF section

For the following tests place the receiver into calibration mode. This mode allows the control knob to actively adjust the received frequency.

Setup and Entering Calibration menu

- **While turning receiver on** press and hold the **ENTER** button and the **Top NAVAGATE** button closest to the enter button. Continue holding until the display stops changing.
- Exit to the main menu.
- Press the **Audio** navigate button to enter the calibration menu.

Changing frequency Bands, Band limits, & RF metering response.

- Each receiver board group (A,B,C,D,E) may be used for more than one frequency band. This band is indicated by the receiver model number and may be a subset of the PCB's total tuning range. During the tuning procedure each PCB is tuned for maximum tuning range and then software limited to the desired frequency band. Bands may be changed from the calibration menu by entering the **Band** submenu and rotating the control knob. Press **ENTER** to confirm your changes
- Additional band limits may be set by entering the **Band** > **Bandlimit** submenu. Two sets of start and stop frequencies may be entered. Toggle between limit variables (start frequency L1, stop frequency L2, start frequency L3 and stop frequency L4) by pressing the control knob. Rotate the control knob to change the variable. Set limits to **On** to activate the new band limits. Press **ENTER** to save the changes.
- Entering the **RssiAvg** submenu can change the response speed of the RF metering. The RF meters are driven by the average value of the detectors RSSI voltage. This average is taken over a limited number of samples (the default number of samples is +8). Rotate the control knob to change the number of samples used in calculating the average (1-200). Increasing the number will cause the RF meters to respond slower to changes in RF strength. Press **ENTER** to save the changes.

VCO, MMIC and Synthesizer

- Measure VCO power by connecting a 50ohm probe at the input to the mixer while leaving the mixer connected. This level is typically +3 to +7dBm.
- The MMIC amp after the VCO provides approximately 14 dB of gain.
- VCO calibration sets three values of the course tune voltage. Each value covers 1/3 of the tuning range of the receiver board group (A,B,C,D,E). Course tune voltage should show 2 step increases as the receivers is tuned from the lowest to highest frequency.
- VCO fine tune voltage ranges from 1 to 4 VDC within each 1/3 of the tuning range of the board group (A,B,C,D,E).
- Use the control knob to very the receiver frequency while monitoring the VCO output and control voltages.
- Synthesizer reference crystal should measure –3dBm @ 32MHz ± 3kHz depending on trimmer position. Note: The oscillator will not function if the synthesizer has not received valid data.

Tracking filters

Isolate the filter by lifting one side of the input and output capacitors. These capacitors are part of the filter. Using spectrum analyzer with a tracking generator inject signal into the lifted end of the input capacitor. Measure the output by connecting the spectrum analyzer to the lifted end of the output capacitor.

Insertion loss	**4-6 dB**
3dB Band Width	**20-35MHz**

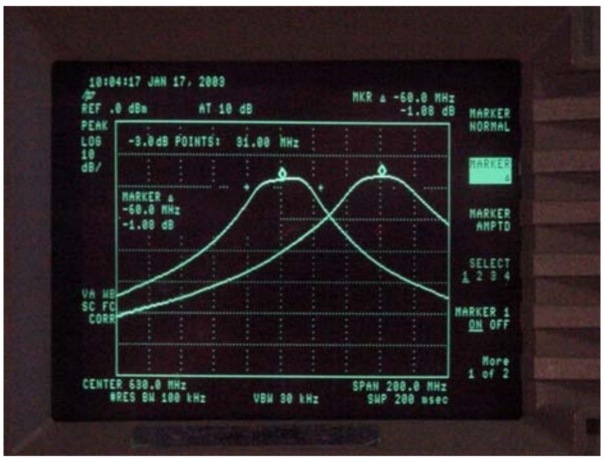
Insertion loss is lower at the receiver's higher frequencies (higher tracking voltage).

Band Width is lower for the lower frequency bands (better filter Q).

- Rotate the control knob to very the tuning frequency. Verify the filter is centered on the desired frequency and tracks frequency with minimal change to filter response shape.
- Verify tracking voltage increases with frequency (1-14V typ)
- All air wound filter coils are the same for the same board group.
- All trim caps are the same value and must be set to maximum value at the start of the filter tuning procedure.
- Entering the **RFFilter** submenu automatically places 14VDC on the tuning voltage line and sets the VCO to the highest frequency of the board group. This is useful for retuning the filters.
- The in-circuit filter response can be checked by probing the filters test points with a 50ohm cable. Test points are isolated from the filters by 500ohms. A small dip in the center of the pass band is expected at the output of the second filter. This dip is caused by the additional loading of the 1st IF. The dip will not be present if the VCO is not present or not tuned.

Frequency response of one 3rd order tracking filter

2V –15 V tracking voltage, 200MHz span

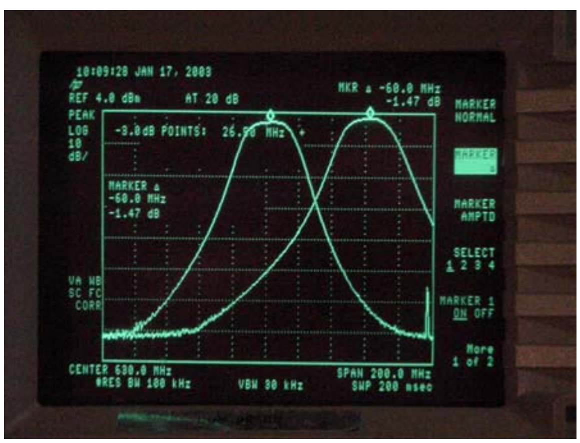


Frequency response of Cascaded

Filter-LNA-Filter

2V –15 V tracking voltage,

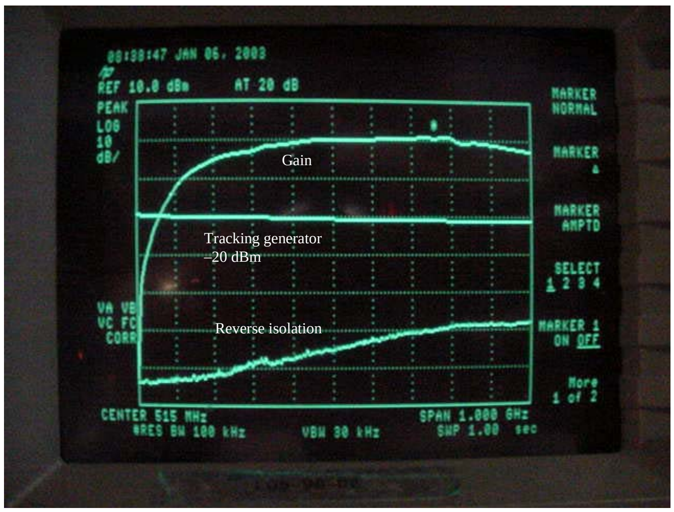
200MHz span



LNA

Isolate the LNA by removing the adjoining tracking filters output and input capacitors. Using spectrum analyzer with a tracking generator inject signal into the LNA. Measure the output of the LNA by connecting the spectrum analyzer to the pad of the removed filter capacitor.

LNA	BFP650
Noise figure	≈ 0.9 dB
Input VSWR	1.3:1
Gain	20-23 dB 518-865 MHz
Output P1dB	+18 dBm
Output IP3	+30 dBm
Reverse Isolation	30dB min



Double Balanced Mixer

Provide –50dBm (no modulation) to the antenna port.

Without isolating the mixer, measure the RF, LO, and IF ports of the mixer using a 50-ohm cable.

RF	**~ -43 to -47 dBm**
LO	**+3 to +7 dBm**
IF	**~-44 to -48 dBm**

Measure the following by isolating the mixer and driving the LO port from a generator at +7dBm:

	Double balanced mixer @RF=500 MHz	**Double balanced mixer @RF=860 MHz**
Conversion Loss	7 dB	7.3 dB
Isolation RF-IF	30.2 dB	28.3 dB
Isolation LO-IF	35.1 dB	32.5 dB
Isolation LO-RF	38.0 dB	37.3 dB
RF 1dB compression point	0.6 dBm	+1.0 dBm
Input IP3	+9 dBm RF1=520MHz @ -10dBm RF2=521MHz @ -10dbm	-

Input IP3 = [(IF to intermod ratio in dB) / 2] + RF input level in dBm

1st IF

With –50dBm at the antenna ports verify DC voltage and RF power levels as indicated on the schematic.

Lift one side of the inductors that match the input and output of the saw filter to 50Ohms. Use a tracking generator to sweep the filter and verify the response is centered at 110.6 MHz with insertion loss < 4dB.

Remove the parts connecting the input and output of the MMIC amplifier. Sweep the amp with a tracking generator and verify it has gain > 12dB at 110.6 MHz.

The output capacitor of the (discrete design) second image filter is used to match to the second mixer. To sweep this filter change the output capacitor to the same value as the input capacitor. This will make the filter 50 Ohms in and out.

2nd IF, 2nd LO and Detector

With –50dBm at the antenna ports verify DC voltage and RF power levels as indicated on the schematic.

Verify the performance of the 2nd IF by removing the input capacitor to the second mixer. Inject the second mixer with 110.6 MHz from a generator. Measure the sensitivity of the second IF section at the output of the detector using 1000pF de-emphasis capacitor. The second IF sensitivity should be >107 dBm for 12 dB SINAD.

AUDIO SECTION

To aid in troubleshooting DC bias voltages and typical RF and Audio levels are indicated at various points in the schematic. RF levels assume –50dBm input at the antenna port and no modulation. Audio levels assume 28KHz deviation of a 1KHz tone.

It is often required to enter the *Radio – Squelch – Tonekey* menu and turn off tonekey detection.

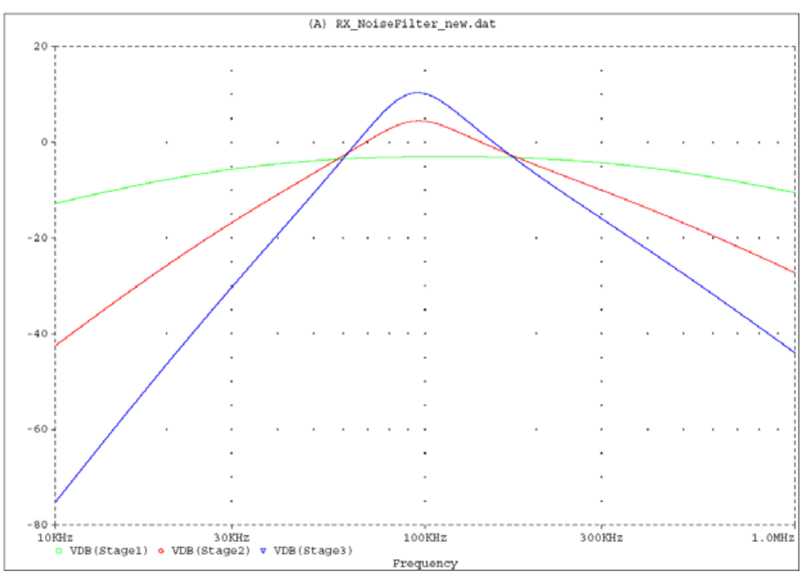
Deviation Trim

With RF applied to the appropriate channel, check for signal at the output of the detector (pin 6). The signal level with 28kHz deviation of a 1kHz tone should be around -12dBV. The deviation stage should be adding around 20dB of gain. The signal can be followed through the MARCAD switches and the switch buffer. The blue LEDs on the front panel indicate which of the MARCAD switches are open, provided tonekey detection is turned off.

A properly tuned receiver will have exactly 8.80dBV at the output of the lowpass filter (I407, I607) for either antenna.

Noise detection / MARCAD

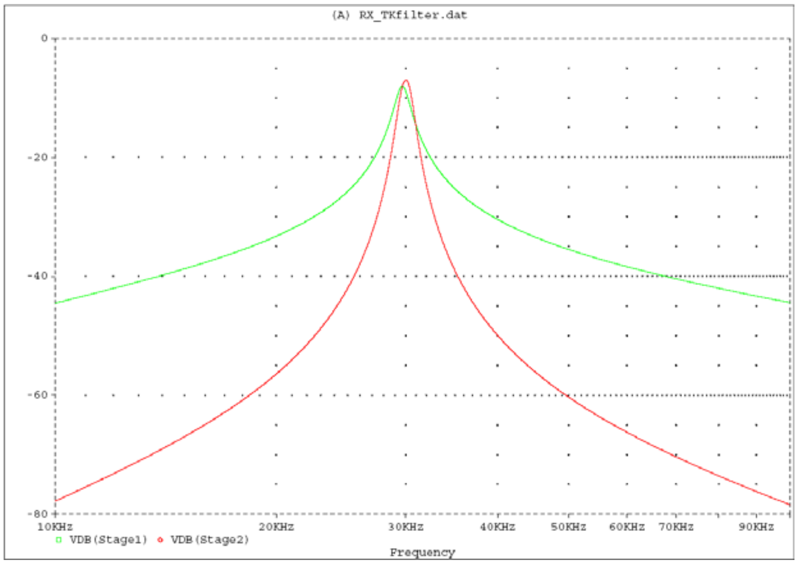
To ensure the MARCAD detector treats each receiver channel equally, the unit is tuned such that the noise output levels are matched at a specific audio SINAD level. To check the filter performance, one can lift one side of the 100pF prior to the noise trim opamp, and inject a signal (-20dBV) from a generator. Measure the output of the opamp corresponding to each stage. The sweep graphs should look similar to the simulation plot below.



Tonekey Detection

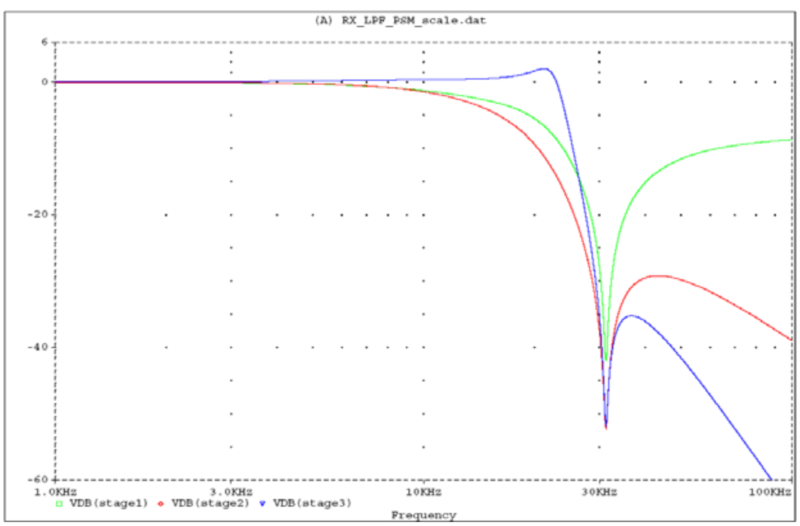
Apply an accurate 32kHz tone from an Audio Precision or ESG generator at 5kHz deviation to either RF channel. The RMS voltage levels should match those on the schematic.

To check performance of the pre-conditioning bandpass filter first remove any RF. Apply an audio generator signal (-20dBV) to the input of the MARCAD summing amplifier (e.g. I80). Without any RF the switches will be off, isolating the preceding opamps from the generator. Measure the output of the opamp corresponding to each stage and compare the curves to the simulated curves below.



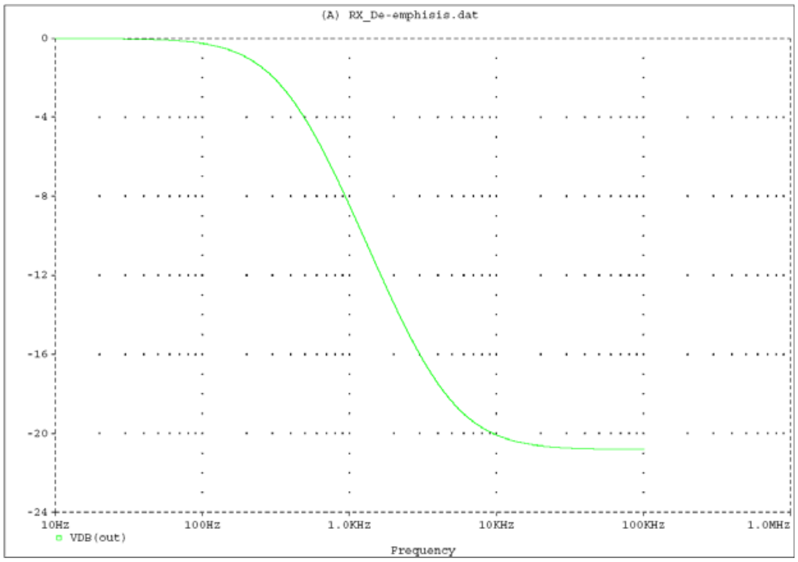
Lowpass Filter

The lowpass filter is used to limit high frequency noise and remove tonekey from affecting the expansion. The output (i.e. I407, I607) is also the audio deviation reference point as is noted on the schematic. With no RF applied to the receiver the tonekey switch will be open. This allows one to apply signal directly to the input of the three-stage filter. Using a generator set to 0dBV one can follow the response of the filter through the stages and compare the results to the simulation graph below. The response of the first stage is NOT measured at the output of the opamp. Rather it is taken after the 16.5k resistor.



Expander

Troubleshooting the expander section is best done by tuning both channels of a dual receiver to the same frequency and comparing voltages are different points. The THAT 4320 has a few built in opamps that perform different functions. The one that uses pins 2, 3, & 4 sums the three DC control signals for the VCA. The opamp on the output of the VCA also has the de-emphasis network applied. The intended curve is shown below normalized for low frequencies.



Mechanical Specifications

Overall Dimensions:
44 mm H x 483 mm W x 366 mm D (1.72 in. x 19.000 in. x 14.39 in.)

Weight:
UR4S: 4.8 kg (10.6 lbs.)
UR4D: 5.0 kg (11.0 lbs.)

Housing:
Galvanized steel

Antenna:
1/2 wavelength, semi-rigid, PCB mount.

NOTES

Furnished Accessories

Microphone Stand Adapter (UR2)	WA371
Zipper Bag (UR1)	26A13
Zipper Bag (UR2)	26A14
Antenna Extension Cables (2)	95A9023
Hardware Kit, Locking Connector	WA340
Antenna (UR1), 518-578 MHz	UA710
Antenna (UR1), 578-698 MHz	UA720
Antenna (UR1), 740-865 MHz	UA730
Two Antennas (UR4), Band Dependent (see table)	UA820
Transmitter Carrying Case	95A9053

Optional Accessories

SM58 Head with Grille	RPW112
SM86 Head with Grille	RPW114
BETA 58 Head with Grille	RPW118
BETA 87A Head with Grille	RPW120
BETA 87C Head with Grille	RPW122
SM87A Head with Grille	RPW116
KSM9/SL Head with Grille	RPW180
KSM9/BK Head with Grille	RPW184
Matte Silver Grille (SM58)	RK143G
Matte Silver Grille (SM86)	RPM266
Matte Silver Grille (BETA 58)	RK265G
Black Grille (SM87)	RK214
Matte Silver Grille (BETA 87A)	RK312
Matte Silver Grille (BETA 87C)	RK312
Black Grille (BETA 58)	RK323G
Black Grille (BETA 87A/BETA 87C)	RK324G
Black Grille (KSM9)	RPM264
Champagne Grille (KSM9)	RPM260
Belt Clip	44A8031
Body-Pack Pouch (Black), UR1	WA580B
Body-Pack Pouch (White), UR1	WA580W
Popper Stopper‘ Windscreen	A85WS

Antenna Combiners and Accessories

Antennas and receivers must be from the same frequency band.

The supplied 1/2 wave antennas can be remotely mounted or mounted directly to the UA845.

Antennas and cables for use with the UA845 can also be used with stand-alone UHF-R receivers.

Passive Antenna/Splitter Combiner Kit (recommended for 2 receivers)	UA221
UHF Antenna Power Distribution Amplifier (recommended for 3 or more receivers)	UA845
U.S.A.	UA845US
Europe	UA845E
UK	UA845UK
1/2 Wave, Omnidirectional, Wideband Antenna	UA860WB
Active Directional Wideband Antenna	UA870WB
Wideband In-Line RF Amplifier	UA830WB
Unididrectional Wideband Antenna	PA805WB
1/2 wave antennas (2)	
H4E, H4 BandS	UA820H4
J5E, J5 BandS	UA820J
L3E, L3 Band	UA820L3
Q5, Q6, Q10 Bands	UA820Q
R9, ABJ, Bands	UA820A
25’ Antenna Cable (RG-8/X)	UA825
50’ Antenna Cable (RG-8/X)	UA850
100’ Antenna Cable	UA8100

Architects' and Engineers' Specifications

The wireless system shall operate in the UHF band between 518 MHz and 865 MHz, with the specific range being dependent on the user's locale. The system shall include the option of changing the operating frequency in order to avoid RF interference, enabling up to 108 systems to operate simultaneously in the same location. Preconfigured group, channel and frequency setups shall be available to ensure that multiple systems in use do not interfere with one another.

All transmitters shall be powered by 2 AA batteries and shall have a power on/off switch. The bodypack will have an LED indicating that power is on. Available transmitters shall include: a body pack for use with electric guitars, basses, and other electric instruments, and a handheld microphone for vocals. The system shall have a DC/DC converter to ensure consistent performance, even if battery voltages change.

The receiver shall have a user programmable menu-driven LCD screen showing group, channel, frequency, name, squelch level, and locked/unlocked status. The system shall use technology such as MARCAD signal combining circuitry to improve reception, minimize signal dropouts, and achieve the best possible signal-to-noise ratio. Tone key squelch, and noise squelch circuitry shall be built in to the system to provide optimal sound quality and minimize unwanted noise. The receiver shall include dual RF meters (one for each antenna), an audio level meter, and a Networking Interface connector for computer control and monitoring. The receiver shall have a volume control and an adjustable noise squelch control.

The system shall be the Shure UHF-R Wireless.

REPLACEMENT PARTS AND DRAWINGS

The following comments apply to the parts list and the schematics:

Resistors: Unless otherwise noted, all resistors are surface-mounted with 1/10 W rating and 1% tolerance.

Capacitors: Unless otherwise noted, non-polarized capacitors are surface-mount NPO dialectric types with a 100 V capacity and a 5 % tolerance, and polarized capacitors are tantalum types.

UR4 MODEL VARIATION

COUNTRY CODE	FREQUENCY RANGE	COUNTRY DESIGNATION	PCB NUMBER	ANTENNA	BEZEL
H4	518.000 MHZ TO 578.000 MHZ	US/ CANADA	200H4047	UA820H4	65A8599
H4E	518.000 MHZ TO 578.000 MHZ	EUROPE	200H4E047	UA820H4	65J8599
J5	578.000 MHZ TO 607.975 MHZ	US/CANADA	200J5047	UA820J	65B8599
J5	614.025 MHZ TO 638.000 MHZ	US/CANADA	200J5047	UA820J	65B8599
J5E	578.00 MHZ TO 638.00 MHZ	EUROPE	200J5E047	UA820J	65K8599
L3	638.000 MHZ TO 698.000 MHZ	US/CANADA	200L3047	UA820L3	65C8599
L3E	638.000 MHZ TO 698.000 MHZ	EUROPE	200L3E047	UA820L3	65H8599
Q5	740.000 MHZ TO 814.000 MHZ	EUROPE	200Q5047	UA820Q	65B8599
Q6	740.125 MHZ TO 751.875 MHZ	KOREA	200Q6047	UA820Q	65F8599
Q9	740.000 MHZ TO 805.975 MHZ	US/CANADA	200Q9047	UA820Q	65L8599
Q10	740.000 MHZ TO 797.900 MHZ	CHINA	200Q10047	UA820Q	65N8599
R9	790.000 MHZ TO 865.000 MHZ	EUROPE	200R9047	UA820A-04	65P8599
ABJ	779.125 MHZ TO 787.875 MHZ	JAPAN	200ABJ047	UA820Q	65G8599
ABJ	797.125 MHZ TO 805.875 MHZ	JAPAN	200ABJ047	UA820Q	65G8599
ABJ	806.125 MHZ TO 809.750 MHZ	JAPAN	200ABJ047	UA820Q	65G8599

UR4 HARDWARE REPLACEMENT PARTS

REFERENCE DESIGNATION	DESCRIPTION	SHURE PART NUMBER
A1	PC BOARD ASSY-UR4 HEAD PHONE AMP	190A043-01
A2	PC BOARD-UHR-COMMROUTER	190A045-01
A3	PC BOARD,DISPLAY-UR4D	190D046-02
A4	BNC CABLE ASSEMBLY	95A9023
A5	CABLE, ETHERCON,60in	95A9101
A6	CORD,POWER,AC, TYPE SJT	95A8389
A7	CORD,POWER,JUMPER,AC,US	95A8576
A8	CABLE INTERCONNECT,BD,PHONE/PWR	90F8848
A9	RECEPTALE,POWER,IEC,DUAL INLET/OUTLET	95A8577
A10	POWER SUPPLY SWITCHING	95A8995
A11	LCD ASSEMBLY	95A9038
A12	FAN/CONNECTOR ASSEMBLY	95A9134
A13	CABLE/BNC,17.25"	95D8418
MP1	HARDWARE KIT	90V1371
MP2	NUT,HEX,STEEL,PLATED,M7x.75	30A8049A
MP3	LOCKNUT,STEEL PLATED,#6-32	30A8185
MP4	NUT,HEX,BRASS,PLATED,3/8-32	30A884B
MP5	WASHER,STEEL,PLATED	30A961A
MP6	SCREW,MACHINE,HEAD,FLAT,PH,STL,BLK,#6-32(Top cover)	30B8161A
MP7	SCREW,SEMS,HEAD,ROUND,PH,STL,PLTD,#4-40(pcb)	30C622B
MP8	SCREW,SELF-TAPPING,HEAD,PAN,STL,BLK,#4	30C689C
MP9	KNOB,ENCODER,BRASS,PLATED,BLACK	31B8169
MP10	KNOB ,MONITOR,PLATED,BLACK	31B8170
MP11	RACK,EAR,UR4	32C8042
MP12	INSULATOR,POLYPROPYLENE	34A8447

MP13	WASHER,STEEL,PLATED,M7	46X8059
MP14	PANEL,FRONT,	48C8051
MP15	COVER,STEEL,COATED,POWDER,BLACK	53A8582
MP16	CHASSIS	95F9093
MP17	SHIELD,WALL,STEEL,GALVANNEALED(Front panel)	53A8608
MP18	SWITCH,POWER,ROCKER,DPST	55A8140
MP19	WASHER,STEEL,PLATED,BLACK	30A8187A
MP20	NUT,HEX,STEEL,PLATED,BLACK,M9X .75(Monitor $control pot)	30A8186
MP21	ACUATOR,NAVIAGATION,POLYCARBONATE,PRINTED	65A8490
MP22	LENS,INFRARED,POLYCARBONATE	65A8491
MP23	LIGHTPIPE,MONITOR,POLYCARBONATE	65A8495
MP24	ACUATOR,CONTROL,POLYCARBONATE,PRINTED(ENTER/EXIT)	65A8496
MP25	FENCE,LIGHT,ABS,WHITE(RF-CH-A,B/AUDIO)	65A8497
MP26	STANDOFF,HEX,MALE/FEMALE,BRASS,PLATED#32	31A8179
MP27	WIRE,GROUND,A.C	90C8677
MP28	HARNESS,WIRE,AC	95A9091
MP29	CABLE,RIBBON,FLAT,24 CIRCUIT, 4"(AXON)	95W8925D
MP30	CABLE,RIBBON,FLAT,10 CIRCUIT, 9"	95G8925J
MP31	SHIELD COVER,STEEL,PLATED(RF SECTION)	53A8468
MP32	COVER SHIELD,STEEL,GALANNEALED(COMMROUTER)	53B8620
MP33	BAG,POLYTHYLENE.17"x25"	29B8177
MP34	CLIP,IR,STEEL,GALVANNEALED	53A8624
MP35	SCREW,PN/HD,SELF TAPPING,M2 .5, 6mm(XLR CONN)	30C8230A
MP36	SPRING,KNOB,STEEL,PLATED	31A8180
MP37	SCREW,MACHINE,HD,FLAT,PH,STEEL,BLK,#4-40	30B1224C
MP38	LABEL-DATE CODE	28A384
MP39	LABEL HI-POT	28A8248
MP40	NUT,KEPS,STEEL,PLATED, #4-40	30A1041
MP41	SCREEN, MESH,STAINLESS STEEL	53A8631
MP42	SHIELD, FAN,STEEL,GALVANNEALED	53A8632
MP43	NAMEPLATE REAR,POLYCARBONATE	39B8460
MP44	CHASSIS,RECEIVER,STEEL,PLATED	53B8581
MP45	NUT HEX,1/2-28	95W8631
MP46	LOCKWASHER,INTERNAL TOOTH,1/2"	95X8631
MP47	PROTECTIVE FILM-SEN 8256	38A8019
MP48	KNOB ,ENCODER	31B8169
MP49	KNOB, MONITOR	31B8170
MP50	SHOCKMOUNT,ELASTOMER,SILICON	36A8108
MP51	SHIELD,COVER,PLATED(SMALL)	53A8599A
MP52	SHIELD COVER,SMALL,STEEL,TINTED(VCO)	53A8602
MP53	SHUNT,2MM	95A2169
MP54	LCD FRAME	53A8607
MP55	FOAM PAD	36A8102

RF/ AUDIO Printed Circuit Board Replacement parts

Designation reference	Description	Shure Part Number
Y2,Y3	CRYSTAL,QUARTZ,3.2x2.5mm, 32MHZ	140A30
TR400,TR402,TR403,TR600,TR602,TR603	POTENTIOMETER, TRIM,CHIP,SMD, 1K.	146B02
TR404,TR405,TR604,TR605	POTENTIOMETER,TRIM,CHIP,SMD,5K	146D02
TR1,TR2,TR3,TR4	POTENTIOMETER,TRIM,CHIP,SMD,10K	146E02
TR401,TR601	POTENTIOMETER,TRIM,CHIP,SMD,100K	146H02
C3,C603	CAPACITOR,FILM,PPS,SMD 805, .01uF,16V,5%	150JE103JP
C124,C201	CAPACITOR,TANTALUM,SMD1206, .1uF,50V,10%	151AH104KA
C62,C87,C169,C180,C241,C371,C372,C380,C422,C462, C476,C489,C623,C662,C676,CC689,C919,C920,C928,C931	CAPACITOR,TANTALUM,SMD1206,1uF,35V,10%	151AG105KA
C19,C20,C160,C165	CAPACITOR,TANTALUM,SMD2916.15uF,25V,20%	151AF156MD
C104,C199	CAPACITOR,TANTALUM,SMD1206,2.2uF,6V,20#	151AB225MA
C913,C926	CAPACITOR,TANTALUM,SMD2916.47uF,6V,10%	151AD476KD
C200,C395	CAPACITOR,TANTALUM,SMD2916,470uF,6V,10%	151AB477KD
C441,C450,C473,C487,C641,C650,C673,C687	CAPACITOR,ELECTROLYTIC,SMD,100uF,63V,20%	151BH107MH
C502,C702	CAPACITOR,ELECTROLYTIC,SMD,22uF,35V,10%	151BF226KD
C17,C49,C75,C81,C185,C190,C294,C365,C902,C906	CAPACITOR,ELECTROLYTIC,SMD,330uF,25V,20%	151BE337MG
C4,C7,C9,C119,C151,C205,C298,C299,C323,C375,C376,C418,C419,C460,C463,C601,C606,C607,C618,C619,C660,C663,C903,C907,C911,	CAPACITOR,ELCETROLYTIC,SMD, 4.7uF,35V,20%	151BF475MB
C123,C146,C289,C310	CAPACITOR,ELECTROLYTIC,SMD,47uF,25V,20%	151BE476ME
C377,C910	CAPACITOR,ELECTROLYTIC,SMD,470uF,16V,20%	151BD477MG
CV1,CV2,CV3,CV4,CV5,CV6,CV8,CV9,CV10,CV11,CV12,CV13,CV18,CV19,CV20,CV21,CV22,CV23,CV24,CV25,CV26,CV27,CV28,CV29	CAPACITOR,TRIM,SMD, 2. 0-6.0pf	152B05
CV7,CV17	CAPACITOR,TRIM,SMD, 3-15pF	152E05
CV14,CV15	CAPACITOR,TRIM,SMD, 4, 5-20pF	152F05
U1,U3,U10,U11,U12,U13	SPILITTER,POWER,0 DEGREE	161A02
T4,T6,T7,T8,T10,T11,T13,T14	TRASFORMER,BALUN,TYPE,B4F	161A04
T3,T5,T9,T12	TRASFORMER,BALUN,SMD,458PT-1087	161A05
L99,L100	INDUCTOR,SMD1008, .18uH	162D06
E5,E9	INDUCTOR,SMD,805, 33nH	162F10
L42,L43,L67,L68	INDUCTOR,SMD,805, 68nH	162K10
L2,L3,L6,L9,L10,L11,L12,L21,L22,L25,L27,L33,L35,L40,L45,L46,L58,L59,L60,L61,L65,L66,L71,L72L73,L74,L81,L82,L93,L94,L102,L104	INDUCTOR,SMD,805, 180nH	162R10
L23,L26,L44,L57,L69,L98	INDUCTOR,SMD,805, 220nH	162S10
E1,E2,E3,E4,E6,E7,E8,E10,E400,E401,E402,E403,E404,E405,E406,E407,E600,E601,E602,E603E604,E605,E606,E607	BEAD,FERRITE,SMD 603. 1000 OHM	162B46
L29,L39L56,L92	INDUCTOR,SMD, 603, 6.8nH	162K56
L4,L5,L31,L37,L50,L51,L53,L54,L55,L70,L86,L90	INDUCTOR,SMD,603, 8.2nH	162L56
L30,L38,L79,L80,L83,L84	INDUCTOR,SMD 603, 100nH	162AC56
L17,L18,L24,L300,L301,L304	INDUCTOR,SMD,402, 100nH	162AD65
FL1,FL9,FL11,FL12	FILTER,SAW,110.592MHZ	162A68
CON900	CONNECTOR,CABLE,RIBBON,10 CIRCUIT	170G30
CON902	CONNECTOR,CABLE,RIBBON,24 CIRCUIT	170W30
CON5	CONNECTOR,HEADER,RT ANGLE,WIRE-BOARD	170A44
CON2	CONNECTOR,HEADER,0. 8mm,40 CIRCUIT	170A77
Q5,Q6	TRANSISTOR, UHF/ VHF,RF,SOT-23,NPN	183A03
Q400,Q600	TRANSISTOR,NPN,DUAL,SC70-6	183A56
Q3,Q4,Q9,Q10	TRANSISTOR,NPN,RF	183A64

Q1,Q2,Q300,Q301	TRANSISTOR,HIGH FREQ,3 PIN,MINI MOLD,NPN	183A66
D2,D5,D23,D28,D901	DIODE,DUAL,COMMON CATHODE,SOT-23, 85VDC	184A03
D47,D48,D402,D403,D404,D405,D602,D603,D604,D605	DIODE,SIGNAL,SWITCHING,SOT-23.100VDC	184A08
D37,D42	RECTIFIER,SILICON, 140VDC	184A20
D11,D14,D19,D33	DIODE,SCHOTTKY,CROSSOVER QUAD	184A60
D20,D21,D22,D29	DIODE,SCHOTTKY,SCD80	184A65
D1,D3,D4,D6,D7,D8,D9,D10,D13,D15,D16,D17,D18,D24 ,D26,D27,D30,D31,D32,D34,D35,D36,D38,D39,D40,D41 D300,D301	DIODE,CAPACITANCE,VARIABLE,SC79-2	184A72
D12,D25,D43,D44,D407,D408,D607,D608	DIODE,SCHOTTKY,DUAL,SOT-323	184A85
D45,D46	DIODE,SERIES SWITCHING,DUAL,SOT323	184A86
F1,F2	FUSE,RESETTABLE, R=25L, IMAX=150MA	187A12
RT1,RT2,RT3,RT4	THERMISTOR,SMD0603, 4.7K,5%	187B24
IC23,IC24,IC400,IC401,IC410,IC412,IC414,IC426,IC427, IC600,IC601,IC610,IC612,IC614,IC626,IC627	AMPLIFIER,OPERATIONAL,DUAL,SO-8,SC79161	188A18
IC405,IC605	SWITCH,ANALOG,CMOS,SPST,QUAD,SO-16,DG445	188A57
IC21,U2,U6	AMPLIFIER,OPERATIONAL,DUAL,SO-8,TLC2272	188A118
IC403,IC603	COMPRATOR,QUAD,LOW POWER,SO-14,LP339MX	188A123
1C25	COMPRATOR,VOLTAGE,DUAL,SO-8,TLC393CDR	188A136
IC900	REGULATOR,VOLTAGE,3.3VTO263,LM3940IS -3 .3	188A311
IC404,IC604	AMPLFIER,OPERATIONAL,QUAD,SO-14,LM837MX	188A381
IC8,IC14	SYNTHESIZER,DUAL,POWER,LOW,LMX2335 LTM	188B388
IC3,IC10,IC15,1C20	IC,FM,FRONT END,MFP10	188A404
IC903,IC904	ADC,SERIEL 8BIT,20 SSOP	188A537
IC406,IC606	AMPLIFIER,OPERATIONAL,PRECISION,SOT-23-5	188A559
IC1,IC5,IC12,IC17	AMPLIFIER,MMIC,DC-3500 MHZ,SOT-63	188A563
IC428,IC628	COMPANDER,THAT4320,28 PIN QSOP	188A568
IC4,IC11	REGULATOR,LOW NOISE,ADJ VOLT,SOT23-5	188A571
IC2,IC6,IC13,IC16	IC, FM IF, MFP16FS	188A583
IC409,IC609	IC, AMPLFIER,130 MHZ,R-R OUPUT,SOIC-8	188A668
IC7	EEPROM,SPI SERIEL, 8Kbit,S08	188B601
IC9,IC18	IC, AMP,NMIC,DC-4500 MHZ,SOT-89	188A632
IC19	DAC,8 CHAN.,8-BIT,16-LEAD SSOP	188A635
IC22	BUFFER,3-STATE OUTPUT,ULP,SC70-5	188A638
IC27	CONTROLLER/DRIVER,FAN,SO-8EP	188B658
Y1,Y4	CRYSTAL,QUARTZ,OVERTONE,3rD,99.900 MHZ	40A8018W
Y5,Y6	CRYSTAL,TUNING FORK,32.0 KHZ	40A8020
SHLD11,SHLD12	SHIELD,FENCE,STEEL,TINNED	53A8502
SHLD13,SHLD14	FENCE SHIELD,STEEL,PLATED,TIN	53C8538
SHLD1,SHLD2	SHIELD FENCE	53A8598
SW400,SW401,SW600,SW601(MIC/LINE-GND/LIFT)	SWITCH,TOGGLE,DPDT,VERTICAL	55A8148
CON12,CON13	STRIP,INTERCONNECT,3 POSITION	56D8074
L1,L28,L52,L75	COIL.QUADRATURE,10.7 MHZ	82A8004
FL2,FL3,FL4,FL5,FL6,FL7,FL8,FL10,FL13,FL14,FL15,FL16,FL17,FL18,FL19,FL20,	FILTER,CERAMIC,10.7 MHZ,RED,SFELA10M7FA00	86A8991
CON1,CON6	PIN,JACK,MINI	95A8278
CON401,CON601	JACK,PHONE,STERE0,SWITCH,RT ANGLE,1/4"	95Z8322
CON901	HEADER,LOCKING,6 POSITION	95A8363
CON400,CON600	CONNECTOR,XLR,MALE,METAL FACE,R/HND.MNT	95B9084

DISPLAY BOARD

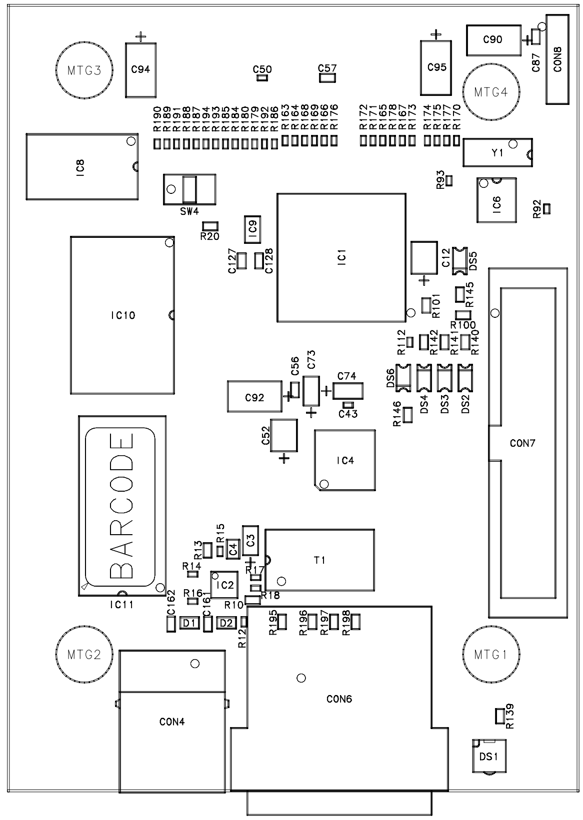
Display Board	PCB ASSEMBLY	190S046-02
C20,C24,C37	CAPACITOR,TANTALUM,SMD2916, 47uF,16V,10%	151AD476KD
SW5,SW6,SW7,SW8,SW9,SW10	SWITCH,TACT,LO PROFILE	155A33
CON3	CONNECTOR,CABLE,RIBBON,24 CIRCUIT	170W30
CON1	CONNECTOR, CABLE,RIBBON,24 CIRCUIT	170W30
Q1,Q2,Q3,Q4,Q5	TRANSISTOR,GENERAL,PNP,SOT-416/SC-75	183A71
DS35,DS38,DS41,DS44,DS61	LED,HYPER-BRIGHT,0805,TRUE GREEN	184A61
DS26,DS29,DS32	LED,HYPER-BRIGHT,0805,TRUE GREEN ,0805,YELLOW	184B61
DS25,DS27,DS28,DS62	LED,HYPER-BRIGHT,0805,SUPER RED	184D61
DS30,DS31,DS33,DS34,DS36,DS37,DS39,	LED,HYPER-BRIGHT,0805,ORANGE	184H61
DS40,DS42,DS43	LED,HYPER-BRIGHT,0805,ORANGE	184H61
DS23,DS24	LED,HYPER-BRIGHT,0805,BLUE	184L61
IC10,IC15	BUFFER,NON-INV,SCHMITT TRIGER.,SOT-353	188A584
IC14	INVERTER,SCHMITT TRIG,SOT-353	188A591
IC9	GATE,NAND,DUAL, 2-INPUT,US8	188A592
IC12	TRANCEIVER,TOPLOCK,SLIM,TOP VIEW LP	188A593
IC7,IC8	REGISTER,SHIFT,8-BIT,16-LEAD SOIC	188A594
IC13	IC,COUNTER,4-BIT.SYNC,BINARY	188A600
IC4,IC5,1C6	REGISTER, SHIFT,8-BIT,SO-16,TSSOP-16	188C216
IC11	DETECTOR,VOLTAGE,2.1V,SOT-23A-3	188D210
SW11	SWITCH,ROT ENCODER,24 POS.2 BIT	55B8150

	MONITOR BOARD	
C25,C26	CAPACITOR,ELECTROLYTIC,SMD,100uF,35V,20%	151BF107MF
E1,E2,E3	BEAD,FERRITE,SMD,805,30 OHM	162A30
CON2	CONNECTOR,CABLE,RIBBON,10 CIRCUIT	170G30
Q1	TRANSISTOR,TMOS,SOT-23,FET,2N7002	183A30
D3	DIODE,DUAL,COMMON CATHODE,SOT-23,85VDC	184A03
D1,D2	DIODE,SIGNAL,SWITCHING,SOT-23,100VDC	184A08
DS2,DS3	LED,HYPER-BRIGHT,0805,YELLOW	184B61
DS4	LED,HYPER-BRIGHT,0805,SUPER RED	184D61
IC2,IC3,IC4,IC5	AMPLIFIER,OPERATIONAL,DUAL,SO-8,SC79161	188A18
IC7	FLIP-FLOP,SINGLE D	188A509
IC1	SWITCH,ANALOG,CMOS,SPST,QUAD,SO-16,DG445	188A57
IC6	BUFFER,NON-INV,SCHMITT TRIGER.,SOT-353	188A584
RV1	POTENTIOMETER,SWITCH,LOG TAPER,100K	46A8059
CON1	JACK,PHONE,STERO,SWITCH,RT ANGLE,1/4"	95Z8322

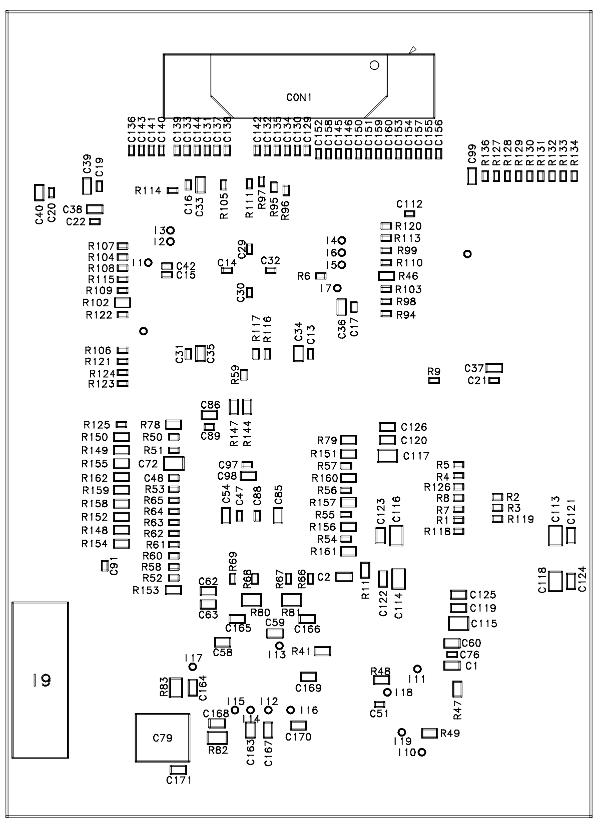
	COMMROUTER PC BOARD	
Y1	CRYATAL,HIGH FREQ,SMD,25HZ	140A07
C3,C73	CAPACITOR,TANTALUM,SMD1206,1uF,16v,10%	151AD105KA
C12,C52	CAPACITOE,TANTALUM,SMD1411,10uF,16V,10%	151AD106KA
C74	CAPACITOR,TANTALUM,SMD1206,2.2uF,6V,20%	151AB225MA
C90,C92,C94,C95	CAPACITOR,TANTALUM,SMD2412,22uF,6V,10%	151AB226KC
T1	TRANSFORMER,ULTRA SERIES	161A07
CON1	CONNECTOR,4/10	170A78
DS2,DS3,DS4,DS5,DS6	DIODE,EMITTING,LIGHT,PURE GREEN	184C18
DS1	LED,GREEN,HYPER SIDELED,HYPER BRIGHT	184A78
D1,D2	DIODE,SCHOTTKY,DUAL,SOT-323	184A85
IC8	TRANCEIVER,BUS,SOIC-20,74LCX245WM	188A281
IC1	MICROPROCESSER,INTEGRATED,32 BIT,324BGA	188A470
IC6	IC,CLOCK,FLASH PROGRAM	188A476
IC4	IC,TRANSCEIVER,FAST ETHERNET	188A477
IC10	MEMORY,FLASH	188B478B
IC11	RAM,SYNCRONOUS,DYNAMIC,143MHZ,50TSOP	188B525
IC9	IC,SUPERVISORY,PROCESSOR,MANRESET,SOT23	188A565
IC2	TRANCEIVER,USB,ADVANCED,MODE INP,HBCC16	188A651
CON6	CONNECTOR,EITHERCON	95A8983
CON4	CONNECTOR,USB,4 PIN	95A8984

PCB ASSEMBLY UR4 RECEIVER

COMMROUTER PCB

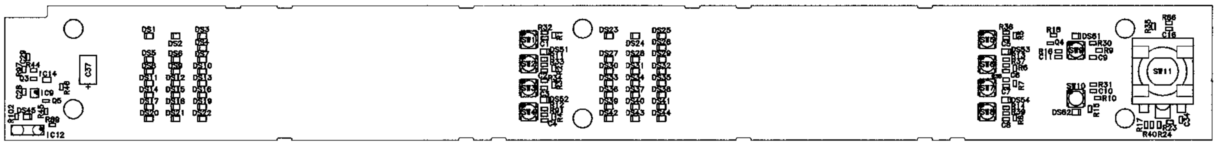


SIDE 1

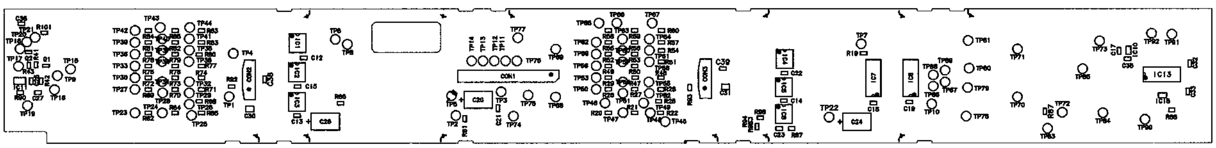


SIDE 2

DISPLAY PCB ASSEMBLY

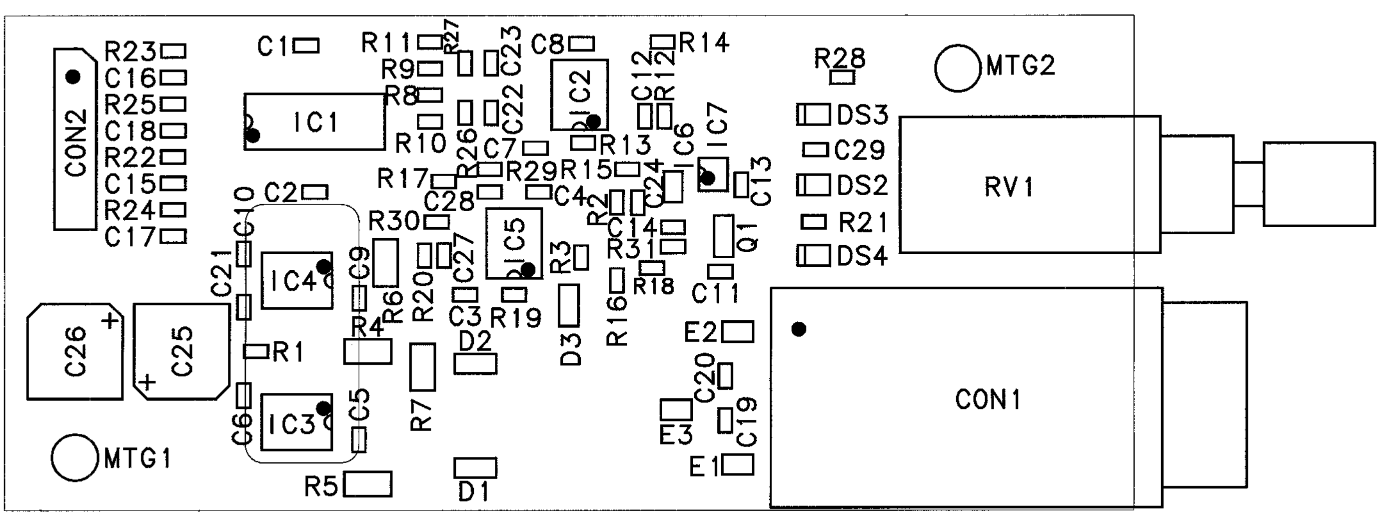


COMPONENTS SIDE 1 VIEW



Components side 2 View

HEADPHONE AMP PCB ASSEMBLY



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