SCR500

VHF RECEIVER
SERVICE MANUAL

SERIAL-91359

SPECTRUM COMMUNICATIONS CORP.

1055 W. GERMANTOWN PIKE
NORRISTOWN, PA 19403-9616 U.S.A.
(215) 631-1710
(GREATER PHILADELPHIA AREA)

TELEX
846-211
SPECTRUM NTW

Edition I - 7/87

SPECTRUM COMMUNICATIONS CORP.

1055 W.GERMANTOWN PK.
NORRISTOWN, PA. 19401-9616 U.S.A.
(215) 631-1710

TELEX
846-211
SPECTRUM NTW

SCR500 RECEIVER MANUAL

SECTION 1 INTRODUCTION

We would like to take this opportunity to thank you for becoming one of the discerning individuals or organizations to own the Spectrum Communications' SCR500 VHF or UHF FM Receiver. This instrument represents a state of the art achievement, and embodies thousands of hours of engineering time. Our company is dedicated to the development of very high quality products, manufactured in limited quantities, and we anticipate that they will always be in short supply. Only the finest quality components and workmanship are used throughout the SCR500. The components are carefully selected and derated for many years of trouble-free operation. The unit is 100% solid-state and is designed for continuous duty, unattended service. (No relays are used in the receiver.) Front panel Volume and Squelch controls and 2 panel meters are provided for operator convenience to facilitate initial set-up and long-term maintenance. An AC power supply is normally built-in, but the unit is also available without the AC supply, (nom. 12VDC Input). The SCR500M includes 2 front panel meters, while the SCR500 does not.

SECTION 2 UNPACKING

Carefully unpack the receiver and *save the packing material.*

In case of damage - be sure to notify the delivering carrier at once. All shipments are insured for full value, and damages are the responsibility of the freight common carrier. Our equipment is carefully packed and shipped in perfect condition, and our responsibility for damage ends when the carton is delivered to the carrier.

SECTION 3 OPERATING CONTROLS AND INSTRUCTIONS

Connect the receiver antenna input. Plug the line cord into a source of 115-120V, 60Hz power. (Or 220V 50-60Hz, or 12VDC if unit is so supplied as an option). Connect the receiver's audio output, and COR & CTCSS outputs if used.

3.1 FRONT PANEL CONTROLS

3.1.1 AC POWER - activates or deactivates AC input power. (Light indicates power on). Note: if you purchased the SCR500M without the AC supply but with panel metering, this switch and AC fuse are not connected, but you can wire your DC Input through them if you wish.

3.1.2 AC LINE - ½A AC line fuse

3.1.3 MONITOR - Standard ¼" phone jack wired in parallel with front panel monitor speaker. When a phone plug is inserted, the speaker is disconnected. This low impedance output is very helpful for monitoring or test purposes.

3.1.4 VOLUME - Adjusts the receiver audio level to the front panel monitor speaker. (Has no effect on the final low level audio output). This control should be set to minimum when the receiver is left unattended.

3.1.5 SQUELCH - Sets the receiver squelch threshold. As the control is advanced clockwise, a stronger signal will be required to open the squelch. Since the squelch circuit is *very sensitive*, it is *not necessary* to set this control on the *very edge of threshold*. Normally it should be set at least 1 to 2 divisions *beyond* threshold. This will still be very sensitive, but will prevent "nuisance triggering" of the squelch by extremely weak signals, noise, or other extraneous signals which may be present at the receiver site.

Note that with this "hysteresis" squelch circuit, there is a very beneficial effect with weak, fluttery incoming signals, especially at lower settings of the squelch control. If a signal fades *below* the level necessary to initially "break" the squelch, it would normally "chop-out" of the squelch with most standard receiver designs. However with this circuit, the signal can fade a few dB *below* the opening point before the squelch closes. This has the effect of greatly reducing chopping on weak, fading signals - which can be quite annoying. The hysteresis squelch circuit makes operation of the receiver with weak incoming signals much smoother and more of a pleasure to operate. Note that the amount of hysteresis (i.e. the difference between the squelch opening and closing levels at a given setting) decreases as the squelch control is advanced.

3.1.6 RF SIGNAL METER/SWITCH - The Signal Strength meter is a relative reading indicator which can be very useful for tests at the site. It operates over the range of signals from "noisy" to "dead full quieting". It is very helpful for tuning duplexers, making antenna adjustments and other tests with a weak received signal, and for comparative signal strength checks on various incoming signals.

3.1.7 DEV - DEVIATION - When the switch is in this position, the meter will indicate the FM deviation of the received signal. The top (black) meter scale is used for this function, and due to the very sharp bandwidth of the IF Crystal Filters, this function is mainly accurate up to about 7KHz peak deviation, and is most useful in the range from about 2.5 to 6KHz. If it is desired to get the most accurate reading possible, ask the operator whom you are monitoring to whistle loudly into his mic at a low pitch. (This normally gives a much more accurate indication than trying to read sporadic voice peaks). Note that this and also the Discriminator meter functions were designed for quick "off the air checks" with an approximate accuracy of ±1KHz from +10° to 35°C.

In addition, *for best accuracy on these functions*, the received signal should be "*full quieting*" into the receiver. A good way to check this is to be sure that the Deviation Meter reads *zero* when the received signal is *unmodulated*. (You may want to tell the transmitting station to give you a "dead carrier" for 5-10 sec. to check this).

The Deviation Meter has a second useful function. It can also be used as a true "*quieting meter*" which can be very helpful to check relative signal strength (quieting) of *very weak received signals*. Simply turn the Squelch control all of the way down, and observe the relative quieting of the received signal. This can be a great aid when tuning duplexers, antennas, comparing 2 mobile units, etc.

3.1.8 DISC. - DISCRIMINATOR METER - This function is very useful to determine whether the received signal is on frequency or not. The frequency error of the incoming signal can be determined by directly reading the lower (green) meter scale. This function is mainly accurate over the critical range of ±4KHz. Note that for maximum accuracy, the SCR500's receiver LO crystal must be on frequency. (This crystal is subject to the normal ±0.001% drift over temperature and exhibits greatest stability within ±15°C of room temperature). If your application requires tighter receiver LO frequency stability, we recommend the Spectrum Communications crystal oscillator/oven which will provide superior temperature stability. (±0.0002% -30 to +60°C).

Note: If the Discriminator Meter pointer should drift appreciably off 0, (with an 'on freq.' signal), it can easily be reset to 0 by adjusting the quadrature detector coil on the receiver board (L122) for a center (0) reading. Put a small drop of cement on the coil slug.

3.1.9 VOLTAGE METER/SWITCH - The Voltage meter is used to monitor the 9 and 13.8 Volt points on the receiver board. The voltages are read on the top (black) 0-15V scale.

SECTION 4 CONNECTIONS

4.1 AUDIO OUTPUT - Terminal E1110 for normal unbalanced audio output. This fixed output level is appx. 1 Vpp for ±5KHz deviation, 1KHz tone. Do not load this point with less than a 2K ohm load.

For optional 600 ohm balanced AF output, connect to terminals E1101 and E1102.

4.2 DC INPUT - (Terminal E1104) - If your unit was purchased without the built-in AC supply, connect a source of 12-13.8VDC @ 0.5A to this terminal.

4.3 GROUND - (Terminal E1108)

4.4 CTCSS OUTPUT - (Terminal E109/1109) - If it is desired to connect a CTCSS ("PL") tone decoder or Tone Panel to this receiver, its Tone Input point may be connected to this terminal (through shielded wire). Note that the decoder board's input impedance must be greater than 25K ohms.

4.5 COR OUTPUT - (Terminal E107/1107) - This output can be used to trigger a repeater, link transmitter or other circuitry, (via a COR or digital control circuit board). Note that this IC output can only switch high impedance loads. It can "source" (supply) up to 10mA of output current; and it can "sink" (to ground) up to 1mA max. (It cannot directly switch relays, lamps, etc. Interface circuitry, such as a transistor switch or CMOS gate, etc. must be used if the currents to be switched exceed the above limits. See Figure 1.) The output "High" state voltage is appx. 7 VDC; and the "Low" state voltage is appx. 0.1 VDC. When the squelch is open, the COR output state will be "Low". When the Squelch is closed, the COR output will be "High".

4.6 9 VDC OUTPUT - (Terminal E114/1114) - This output can be used to supply regulated 9 VDC to other circuitry. Maximum load current = 25mA. (DO NOT short this terminal to ground.)

4.7 OTHER CONNECTIONS - If you have the basic version of the SCR500 without front panel metering, see Figure 2 for additional connections which may be used if desired.

SECTION 5 RECEIVER SPECIFICATIONS

Front End	Extremely wide dynamic range/low noise figure front end. Built-in Preamp plus RF Stage and 8 Poles of Preselection filtering. Optional super sharp UHF 4 Pole Helical Resonator Front End Assembly (FL-4) also available. With Double Balanced Mixer which greatly reduces intermod, 'desense', and overload.
Sensitivity	0.22-0.3µV typ. for 12dB SINAD. 0.3µV typ. with FL-4. 0.35µV max.
Squelch/COR Threshold	0.1-0.2µV typ. 0.25µV max. (Noise operated squelch; fast attack.) Schmidt Trigger/Hysteresis design.
Selectivity	
STD. FILTER	8 Pole Crystal Filter, +4 Pole Ceramic Filter. -6dB @ ±6.5KHz; -70dB typ. @ ±15KHz; >-125dB @ ±25KHz. (20dB quieting method.) (-85dB nom. EIA RS-204B meth.)
OPT. SHARP FILTER #FLS SEE NOTE 1	-6dB @ ±5.5KHz nom. (20dB Qt. Method) -104dB @ ±15KHz typ. >-125dB @ ±25KHz nom. (-94dB nom. EIA RS-204B Method)
"Desense - Overload"	With a 1µV desired signal, "desense" just begins at appx. 50,000µV @ ±600KHz; 100,000µV @ ±1MHz with UHF FL-4.
Image & Spurious Response	-90dB typ. (>-100dB Image with UHF FL-4.) -85dB typ. Spurious on VHF Units
IF	21.4MHz & 455KHz. Double Conversion.

CRYSTAL INFORMATION

Receive Frequency	Equation
30-50MHz	Crystal Freq. = Rcve.Freq. + 21.4MHz
66-88MHz	Crystal Freq. = Rcve.Freq. - 21.4MHz
136-151.000MHz	Crystal Freq. = $\frac{\text{Rcve.Freq. + 21.4MHz}}{2}$
151.001-174MHz	Crystal Freq. = $\frac{\text{Rcve.Freq. - 21.4MHz}}{2}$
216-250MHz	Crystal Freq. = $\frac{\text{Rcve.Freq. + 21.4MHz}}{3}$
406-512MHz	Crystal Freq. = $\frac{\text{Rcve.Freq. - 21.4MHz}}{6}$

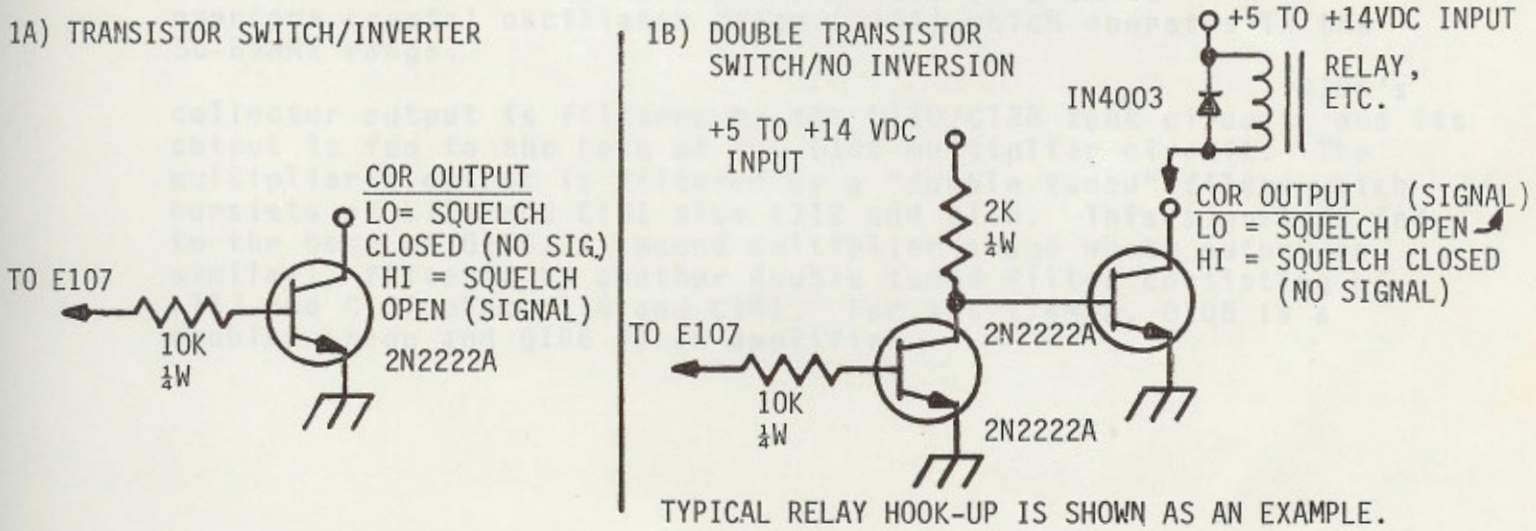
NOTE 1: 6 KHz IF Bandwidth Crystal Filter also available for 12.5 KHz "Split Channels". (Selectivity: -85dB nom. EIA.) 30 & 100KHz B.W. IF Filters also available.

Crystal Specifications Continued	3rd overtone, parallel resonant, w/8 pF load capacity; R_S<30 ohms. HC-25/U case. Calibration Tolerance: ±0.0005% @ 23°C. Temp. Tolerance: ±0.0005% from -20 to +60°C.

Note: Some mfgrs. may have to supply a 5th overtone xtal for fundamental over 75MHz, although 3rd O.T.is highly recommended. Xtals should be purchased from Spectrum.

Frequency Range	136-174MHz. 216-250MHz 406-512MHz. 66-88MHz. 30-50MHz.
Frequency Stability	±0.0005% typ. (-20 to +60°C) ±0.001% max. (-30 to +60°C) [Rcvr. Crystal Oven available.]
Intermodulation	-73dB nom. EIA (-85dB nom w/UHF FL-4).
Modulation Acceptance	7KHz nom.
AF De-emphasis	-6dB/octave per EIA Specifications.
Local Monitor	High Quality speaker with oversize magnet for excellent voice fidelity.
Audio Output	2W min. w/8ohm speaker @ 10% dist. 5W nom. w/4ohm speaker @ 10% dist.

INTERFACING COR OUTPUT TO EXTERNAL CIRCUITRY-FIGURE 1



TYPICAL RELAY HOOK-UP IS SHOWN AS AN EXAMPLE.

THE 2N2222A WILL SWITCH UP TO 25VDC AT UP TO 200mA MAX.

NOTE: SPECTRUM CTC100A COR/TIMER BOARD IS ALSO AVAILABLE.

SECTION 6 CIRCUIT DESCRIPTION

6.1 The Receiver Front End consists of an RF Preamplifier stage followed by a second RF Amplifier stage. The transistors used for this application are state of the art types which are designed to provide an extremely low noise figure, while simultaneously giving high gain, and an extremely wide dynamic range. Eight Hi Q resonators are intermixed before, between, and after the two RF transistors. These tuned circuits provide extremely good rejection of strong out of band signals - which could otherwise overload the front end. Shield partitions are used between each tuned circuit in order to obtain optimum skirt selectivity characteristics.

For UHF units, the FL-4 Four Pole Helical Resonator front end assembly is available as an option. The 'Helicals' are far sharper than the standard front end, and they greatly increase rejection of strong, nearby UHF signals more than a few MHz away. The FL-4 is of considerable help at high RF density sites. Also, since the inserion loss of each helical is very low, only one RF stage is required, thereby increasing dynamic range and IM rejection.

The output of the RF amplifier stage is fed to a true Double Balanced Mixer which converts the VHF/UHF input signal down to the 21.4MHz IF frequency. This type of mixer is used due to its extremely wide dynamic range characteristics and its simplicity of operation. Note that they are widely used in microwave applications due to their superior performance capabilities. Double Balanced Mixers are well known for their excellent strong signal handling capabilities - which lead to very low spurious response, 'desense', and overload.

6.2 The Local Oscillator (LO) chain consists of a third overtone crystal oscillator stage (Q104) which operates in the 50-85MHz range.

Q104's collector output is filtered by the L110/C128 tank circuit, and its output is fed to the base of the Q105 multiplier circuit. The multiplier's output is filtered by a "double tuned" filter which consists of L111 and C131 plus L112 and C135. This signal is fed to the base of Q106, a second multiplier stage whose output is similarly filtered by another double tuned filter consisting of L113 and C137 plus L114 and C141. For 136-174MHz, Q105 is a doubler stage and Q106 is an amplifier.

For 216-150MHz, Q105 is a tripler and Q106 an amplifier. For 406-512MHz, Q105 acts as a tripler, Q106 as a doubler. The multiplier chain's RF output is filtered by a double tuned filter in order to reduce spurious outputs which would lead to spurious responses in the receiver. On UHF Units, the signal is now fed to the base of an amplifier stage, Q107. The signal at Q107's collector is again filtered by a very sharp triple tuned filter which consists of L115 and C143, plus L116 and C145, plus L117 and C147. The final output is at a level of approximately 5-10mW, (the relatively high level required by the mixer). The L.O. output frequency is always exactly 21.400MHz above the desired receive frequency for 136-151.000MHz and for 216-250MHz receivers. The L.O. output frequency is exactly 21.400MHz below the desired receive frequency for 151.001-174MHz and for 406-512MHz receivers. This is done to minimize problems with the image response. A L.O. output test point is provided at TP1, and a frequency counter or spectrum analyzer may be connected to this terminal.

6.3 The First Mixer (M101) is immediately followed by a 4 Pole first IF crystal filter (FL101 and FL102), which begins to filter out off channel signals before they reach the IF amplifier stages. This filter network is followed by Q103, the first IF amplifier stage, which provides about 30dB of gain. Q103's output is tuned by the L120 and C153 tank circuit, and fed to a second 4 Pole crystal filter (FL103 and FL104) which adds further adjacent channel selectivity. A 21.4MHz IF frequency is used in this design since it places the image 42.8MHz away from the desired receive frequency. This image is extremely well attenuated by the very sharp filters in the receiver front end stages. This high frequency IF is far superior in this respect to the commonly used 10.7MHz IF stages.

6.4 The 21.4MHz first IF signal is fed to U101 which is a Multi-purpose Second IF IC. This IC performs the functions of second LO and mixer (down to the 455KHz second IF frequency). This mixer is also doubly-balanced to reduce spurious responses. The second LO operates at a frequency of 21.855MHz. U101 also includes the 455KHz second IF Amplifier and Limiter stages, as well as the FM Quadrature Detector, and high frequency (35KHz) Squelch Noise Amp. The second mixer's output at U101 pin 3 is filtered by a 4 Pole ceramic filter which provides additional skirt selectivity for excellent adjacent channel rejection. Its output is fed to pin 5, which is the Limiter Amplifier input. The Amplifier's output is at pin 7 and feeds the FM Detector's input at pin 8. The resonant circuit composed of L122 and C162 form the tuned circuit required for the Quadrature Detector. The detected FM output is internally amplified and appears at U101 pin 9. The audio output is coupled to the 35KHz high frequency noise amp and active bandpass filter, the input to which is U101, pin 10.

Pin 11 is the Noise Amp output. The amplified noise is fed to a detector circuit composed of C175, R150, diode CR108 and bias resistor R151. This circuit rectifies the high frequency noise and converts it to a negative DC voltage which is proportional to signal quieting in the FM receiver; and this negative voltage drives the bias voltage across C175 down as the noise increases (weaker, or no signal).

6.5 The squelch pot R604 sets the squelch threshold point by setting the voltage at which diode CR108 begins to conduct, thereby setting the maximum voltage across C175. The voltage across C175 directly triggers the squelch gate built into U101. Pin 12 is the squelch trigger terminal, and pin 13 is the gating terminal which, through a 200K ohm resistor, biases U102A pin 3 to cutoff for squelch action. There is 100mV of hysteresis at pin 12, and this circuit allows the squelch to close at a weaker incoming signal level than the level required to open the squelch initially. This feature allows the squelch to remain open even though the signal may fade a few dB into the noise, and reduces squelch chopping effects on weak, fluttery mobile signals.

6.6 The audio output from the FM detector at pin 9 of U101 is de-emphasized by the R145/C178 network at 6dB per octave rolloff per EIA specifications, and connected to the AF Preamp input at pin 3 of U102A. A CTCSS tone output point is provided at terminal E109. Op Amp stage U102A is an audio pre-amplifier with a gain of about 3 times, and the audio output is taken from pin 4. (Gain measured from junction R146/C179 to terminal E110.) The AF Preamp's audio output is connected to the audio output terminal E1110, Monitor Volume pot, and terminal block TB601, Pin 2. For the 600 ohm audio output option, the AF Preamp's audio output is connected to the 600 ohm audio interface board, Pin E1. The output of the 600 ohm transformer (E5 & E6) is connected E1101, E1102 and terminal block TB601 pins 1 & 2. Audio from the Monitor Volume pot is fed to U104, the audio power amplifier IC. U104 drives the front panel monitor speaker so that incoming signals may be monitored.

6.7 Q108 is an emitter follower Discriminator Meter DC Amplifier. Q108's emitter is connected to trim pot R133 which is used to calibrate the front panel Discriminator Meter, while diodes CR104 and CR105 are used to provide a reference voltage to zero the meter when there is no incoming signal. (L122 is used to make the final zero adjustment for the Discriminator Meter). U103 is the 455KHz S Meter Amplifier. This amplifier increases the level of the 455KHz IF signal to a point sufficient to be detected by diodes CR106 and CR107. This detected IF voltage drives Q109 an emitter follower buffer stage. Q109's emitter is connected to E105, the S Meter output, through current limiting resistor R141. (R141 sets full scale on the S Meter and may be adjusted if the S Meter reads too high or low on an extremely strong signal-greater than 100µV).

6.8 The Deviation Meter Amplifier is U102C which amplifies the undeemphasized audio directly from the FM detector. This amplified audio voltage is fed to pin 12 of U102D, the Deviation Meter peak reading detector. C197 at the detector's output sets the time constant so that the meter will read voice peaks better. This detected voltage is connected to the base of Q110 an emitter follower buffer which feeds E106, the Deviation Meter output, through current limiting trim pot R163. R163 is used to calibrate the deviation meter. Q111 is used as a voltage regulator stage, and supplies regulated 9VDC to all of the appropriate points on the board. Zener diode CR114 sets the 10V reference voltage on the base of Q111.

SECTION 7 ALIGNMENT

7.1 Alignment should not be required unless an RF transistor, IF U101, or the receive frequency is changed. Even in this case, only a slight "touch up" should be required.

7.2 FRONT-END ALIGNMENT - Connect a good quality FM signal generator to the receiver antenna jack and an AC voltmeter (or "Sinadder" Meter) from the 'hot' speaker lead to chassis ground. With the signal generator set for minimum (0) output, note the average AC voltmeter reading. (Squelch full CCW). Increase the generator's output level and tune it for best receiver quieting, or best SINAD with 5KHz deviation. Alternately tune the 8 RF Amp trimmer caps (C102, 4, 9, 10, 12, 16, 17, 19) for best quieting or SINAD, keeping the generator set for about 10dB of quieting or 10-12 db SINAD. With the generator tuned for the best quieting point in the receiver passband, it should be possible to achieve 0.35µV or less for 20dB of quieting (1/10 the original noise reading). Typical 12dB SINAD point is 0.25µV.

7.3 OSCILLATOR/MULTIPLIER ALIGNMENT - Connect a VHF/UHF RF Millivoltmeter or Spectrum Analyzer to the base of the first multiplier transistor Q105 and peak osc. coil L110 for max RF output at the oscillator's frequency. In a similar fashion, connect your probe to the base of each following multiplier or amplifier stage, and peak the preceeding stage's collector output trim caps for maximum RF output at the proper frequency. (See Schematic and Layout dwgs.) Tune C131, 135, 137 and 141 on VHF boards; plus C143, 145 and 147 on UHF units. (Probe at TP1.) Repeat this entire procedure about 3 times.

Finally, with your probe at TP1, tune all of the preceeding adjustments slightly for max power at TP1. [If you are without test equipment in the field, all of the above may be roughly tuned for best reception of a very weak signal, appx. 0.25µV.] If there is a problem with a spurious response, carefully tune all of the Multiplier Coil slugs (L111, 112, 113, 114) to minimize the response. Otherwise, the coil slugs need not be touched.

7.4 21.4MHz IF ADJUSTMENT - Set the RF panel meter switch to the "Signal Str." function. Apply an unmodulated signal to the receiver RF input at the proper frequency and increase the signal level until the front panel meter reads approximately 1/4 scale. Adjust L120 for maximum meter reading. Alternately, L120 may be adjusted for best SINAD on a weak signal, (appx. 0.25µV). (This adjustment is very non-critical).

7.5 QUADRATURE COIL AND DISCRIMINATOR METER ADJUSTMENT - Inject an input signal into the receiver. Set the RF panel meter switch to the "Disc." function. Adjust L122 to center the meter with an "on freq." signal. Apply a 100µV (nom.) unmodulated signal to the receiver at exactly 3KHz above the proper receive frequency. Adjust R133 so that the meter reads +3 on the green scale. Reapply the 'on freq' signal, and retune L122 to center the meter. Repeat this process until the proper meter calibration and centering is obtained. (Check calibration at -3KHz). Then apply a small drop of cement to the coil slug and the pot. [See Note 1 below.]

7.6 DEVIATION METER ADJUSTMENT - Apply a 100µV (nom.) signal to the receiver RF input at the proper frequency. Set the FM modulation on the generator to exactly 4KHz. Set the RF panel meter switch to the "Dev" function. Adjust R163 so that the panel meter reads "4". The meter circuit is gated to read zero when the squelch is closed.

7.7 SIGNAL STRENGTH (S METER) ADJUSTMENT - Set the meter switch to the "Signal Strength" function. With no input signal, adjust R137 for a 'zero' meter reading.

7.8 CRYSTAL FREQUENCY ADJUSTMENT - Connect an accurate and sensitive frequency counter to TP1, and adjust the crystal trimmer cap (C122) for the correct frequency. The LO output frequency will be 21.400MHz above the desired receive frequency for 136-151.00MHz and 216-250MHz Receive Frequencies; and 21.400MHz below the desired receive frequency for 151.001-174MHz, 66-88MHz, and 406-512MHz.
L.O. is 21.400MHz above RX freq. for 30-50MHz receivers.

Note 1: For the SCR500 (without Discriminator/Freq. Error Meter), inject a strong tone modulated signal (with 5KHz deviation) into the receiver, and peak L122 for max audio output voltage. (Measure with an AC voltmeter across the speaker terminals.)

SECTION 8 TROUBLESHOOTING

8.1 RECEIVER TROUBLESHOOTING CHART

SYMPTOM	CHECK	REMEDY
No audio output	U104-Pin 4 DC Voltage with Squelch Open.	Replace if less than 4V.
Rcvr. completely dead	9V Test Point, E114. 13.5V TP, E104.	If 13.5V is OK, but 9V is 0, replace Q111. (B+ line was shorted).
Squelch must be advanced slightly in very hot or cold ambient temp.		Normal in Extreme temp. conditions.
Audio Output low and/or distorted; poor squelch performance	Tuning of L122	Peak for max. AF output on strong tone modulated signal. [Or, if Discrim. Mtr. is used, see para. 7.5 .]
Low Sensitivity, or no copy at all	Q101,Q103,Q104 Q105,Q106,Q102,Q107 Tuning of Front End trim caps. LO Tuning: L110, C131, C135, C137, C141, C143, C145, C147. Crystal.	Replace if doubtful. If Q101 is damaged, most likely it was due to high transmitter power entering Rcvr. Ant. Jack, nearby lightening, etc. Check Duplexer, cables, antenna, etc. for intermittents.

Note: On VHF versions, some of the above Q and C numbers are not used.

NOTE: The boards are designed to fold out for service. Be sure power is disconnected from the unit when a board is being moved. Also, be sure that no short circuits occur during servicing, as certain semiconductors could be instantly damaged.

NOTE: Tubular Cap Color Code - Receiver & Transmitter Boards.

1) First two color bands - same as standard resistor color code.
2) Third band - White = X0.1; Gray = X.01.
3) Fourth band - Gold = 5% tolerance.
4) EXAMPLE: Blue-Gray-White-Gold = 6.8pF, 5%.

RECEIVER HOUSING FEEDTHRU CONFIGURATION

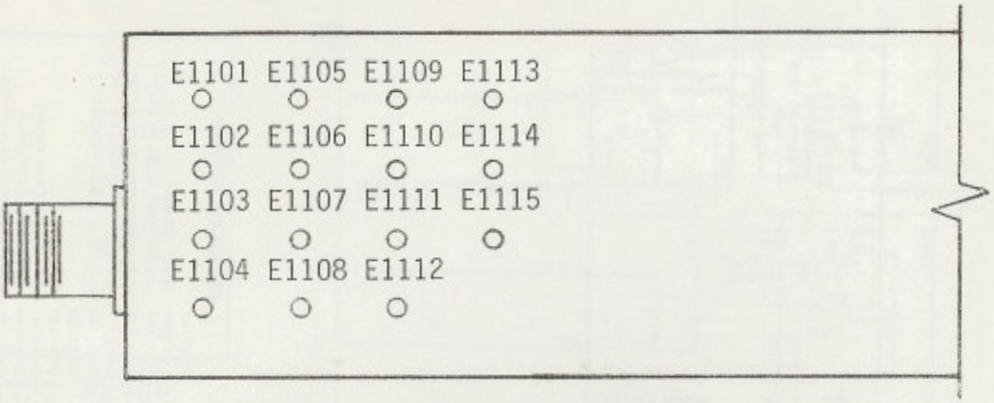


FIGURE 2

E1101 } 600 ohm AUDIO OUTPUT
E1102 }
E1103 - SPEAKER AF OUTPUT
E1104 - +13.8VDC INPUT
E1105 - SIGNAL STRENGTH METER OUTPUT
E1106 - DEVIATION METER OUTPUT
E1107 - COR OUTPUT (LOW=RX SIGNAL)
E1108 - GROUND
E1109 -
E1110 - AUDIO OUTPUT (UNBALANCED, HIGH IMPEDANCE, 2K ohm min. load imped.)
E1111 - TO VOLT METER CALIBRATION CIRCUIT
E1112 - DISCRIMINATOR METER (+) OUTPUT
E1113 - DISCRIMINATOR METER (-) OUTPUT
E1114 - +9VDC OUTPUT
E1115 -

TERMINAL BLOCK CONNECTIONS

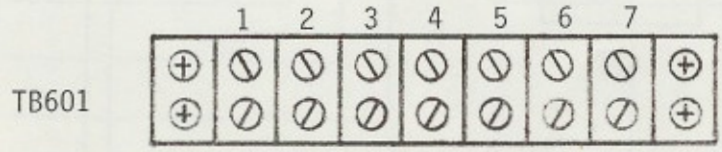
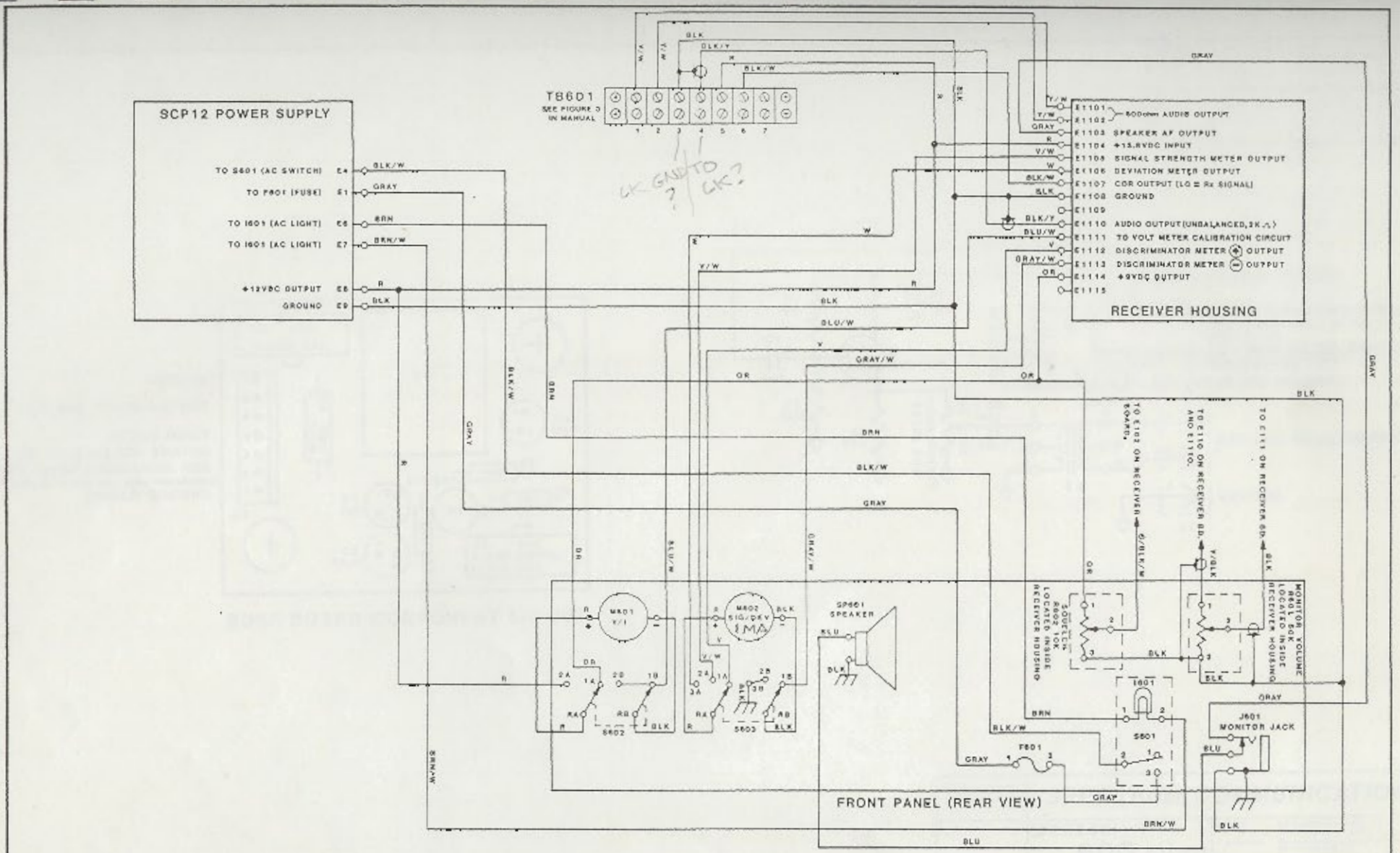
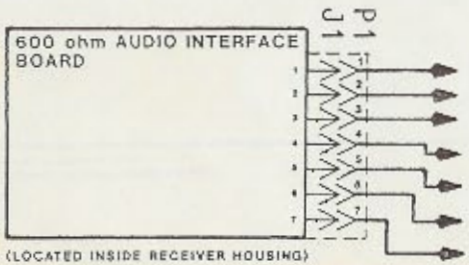


FIGURE 3

1 } 600 ohm BALANCED AUDIO OUTPUT
2 }
3 - GROUND
4 - AUDIO OUTPUT (UNBALANCED, HIGH IMPEDANCE, 2K ohm min. load impedance)
5 - +13.8VDC INPUT
6 - COR OUTPUT (LOW=RX SIGNAL)
7 -



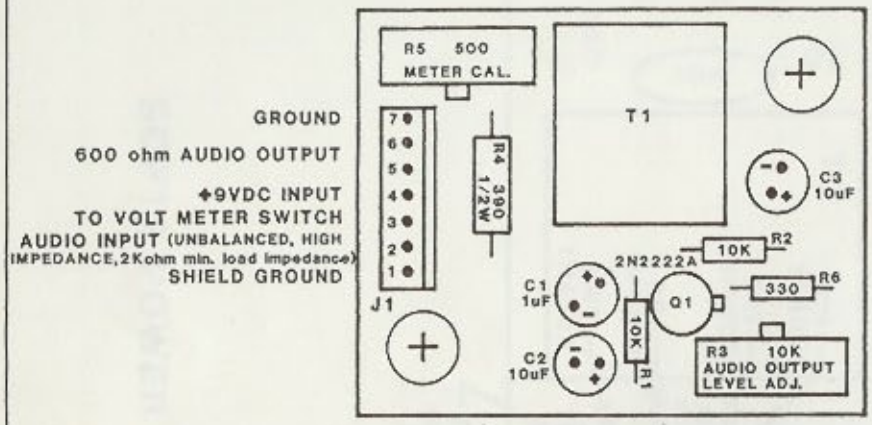


NO CONNECTION
TO E1110
TO E1111
TO E1114 (+9VDC)
TO E1101
TO E1102
TO CHASSIS GROUND

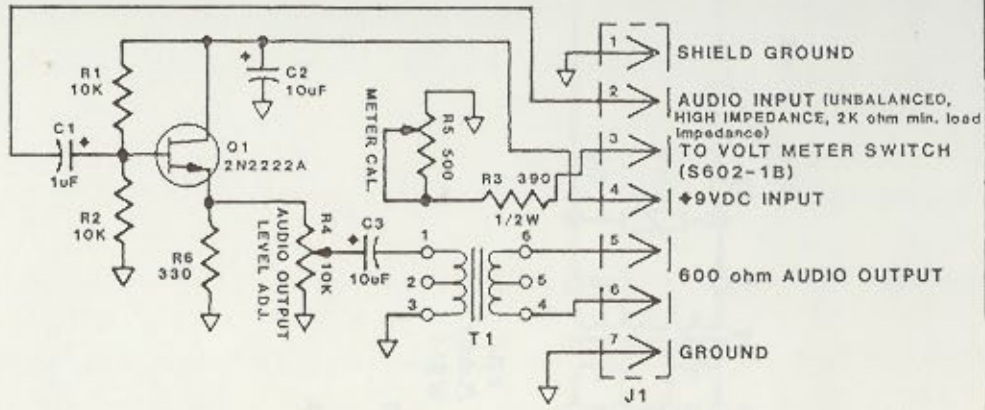
M602= 0-1MA METER

SPECTRUM COMMUNICATIONS		
SCALE	APPROVED BY	DRAWN BY R.L.A.
DATE 4-11-84		REVISED 6-15-87
SCR500 RECEIVER INTER – CONNECT DIAGRAM		DRAWING NUMBER 3200146

DATE	SYM	REVISION RECORD	AUTH	DR	CK



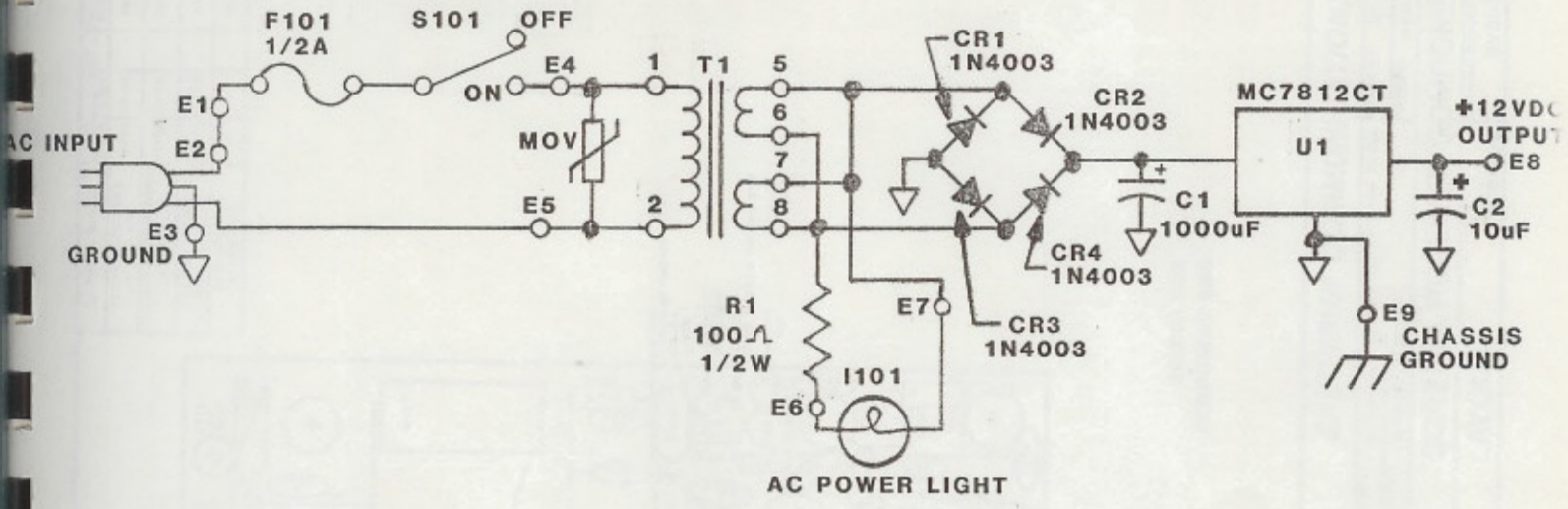
600R BOARD COMPONENT LAYOUT

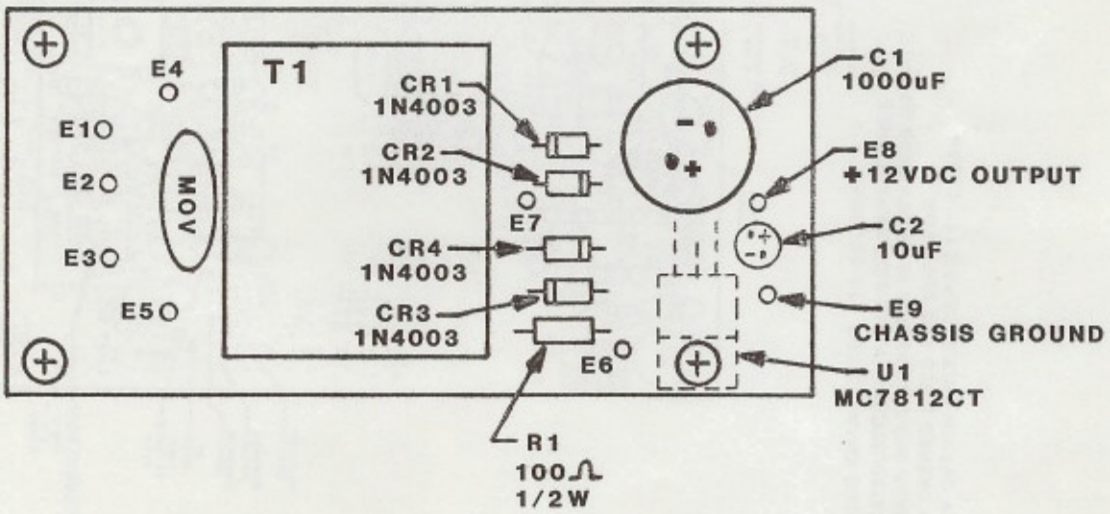


TOLERANCES (EXCEPT AS NOTED)	SPECTRUM COMMUNICATIONS		
DECIMAL	(SCR500) 600 ohm	SCALE —	DRAWN BY R.L.A.
FRACTIONAL	TITLE AUDIO INTERFACE BD.		APPROVED BY
ANGULAR	DATE 11-8-90	DRAWING NUMBER 1200141	

K-E CRYSTALENE (11x17) ENGINEERS STANDARD FORM

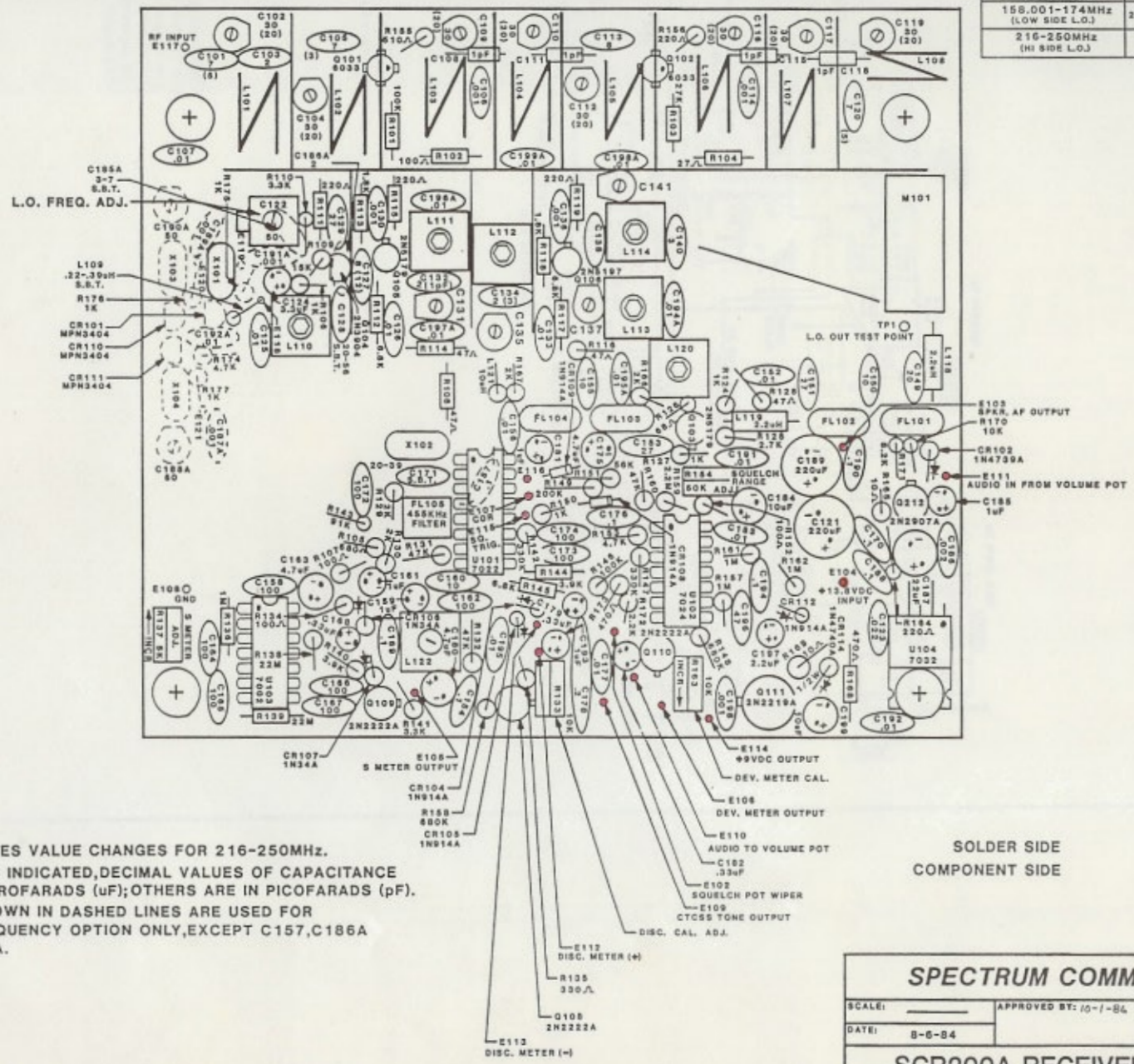
MADE IN U.S.A.





SCP12 POWER SUPPLY

Rx FREQ. RANGE	CAP VALUES					
	C131	C138		C137	C141	
136-151.000MHz (HI SIDE L.O.)	20/30	10-30		30	50	
151.001-158.000MHz (LOW SIDE L.O.)	20/30	10-30		30	30	
158.001-174MHz (LOW SIDE L.O.)	20/30	10-30		50	50	
216-250MHz (HI SIDE L.O.)	20	20		10	10	



SOLDER SIDE
COMPONENT SIDE

NOTES:

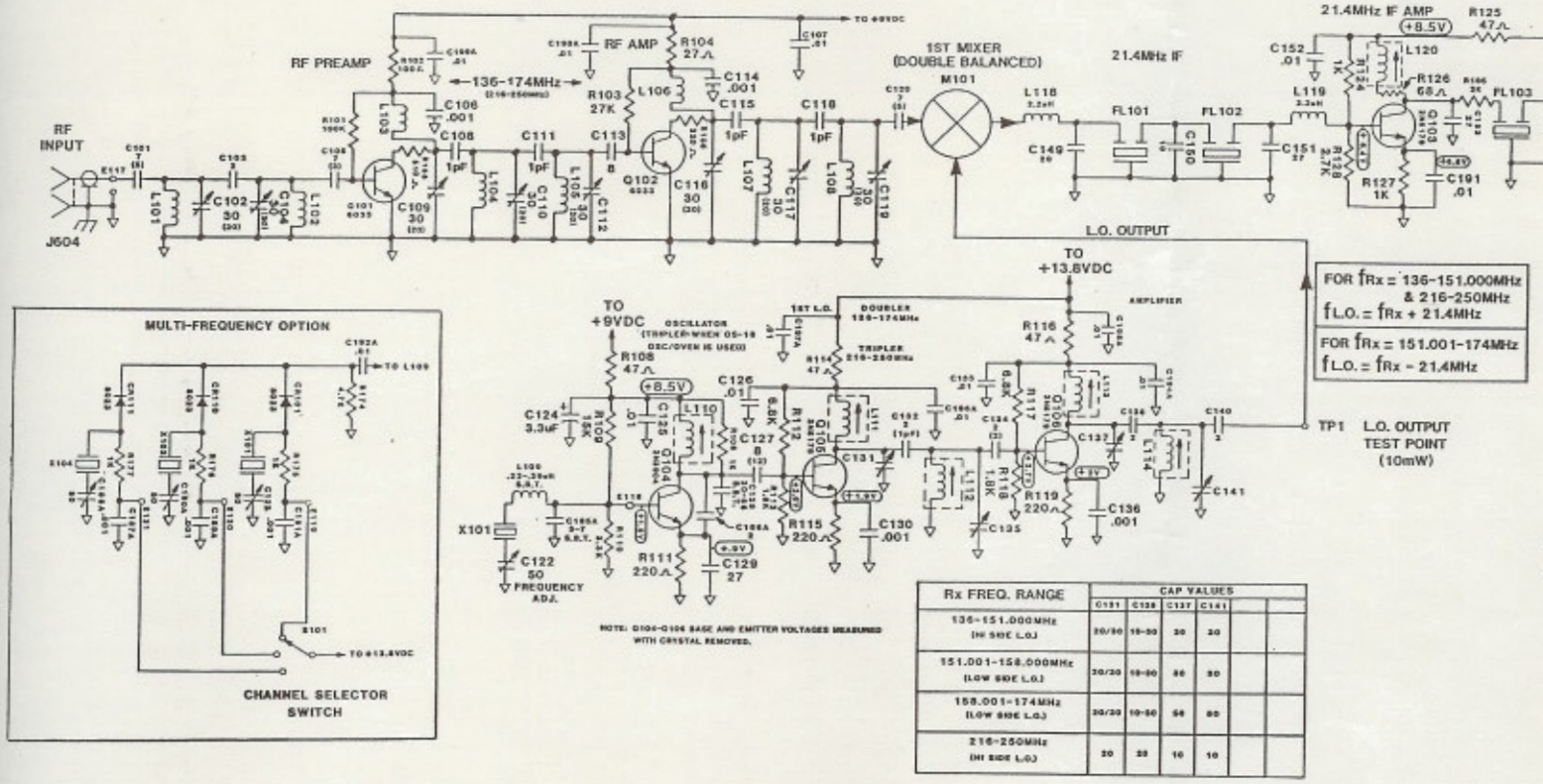
1) ( ) DENOTES VALUE CHANGES FOR 216-250MHz.
2) EXCEPT AS INDICATED, DECIMAL VALUES OF CAPACITANCE ARE IN MICROFARADS (uF); OTHERS ARE IN PICOFARADS (pF).
3) PARTS SHOWN IN DASHED LINES ARE USED FOR MULTI-FREQUENCY OPTION ONLY, EXCEPT C157, C186A AND C185A.

SPECTRUM COMMUNICATIONS

SCALE: ———	APPROVED BY: 10-1-84 WAF	DRAWN BY R. L. A.
DATE: 8-6-84		REVISED 7-29-86

SCR200A RECEIVER COMPONENT LAYOUT (BOARDS)

DRAWING NUMBER 3200157



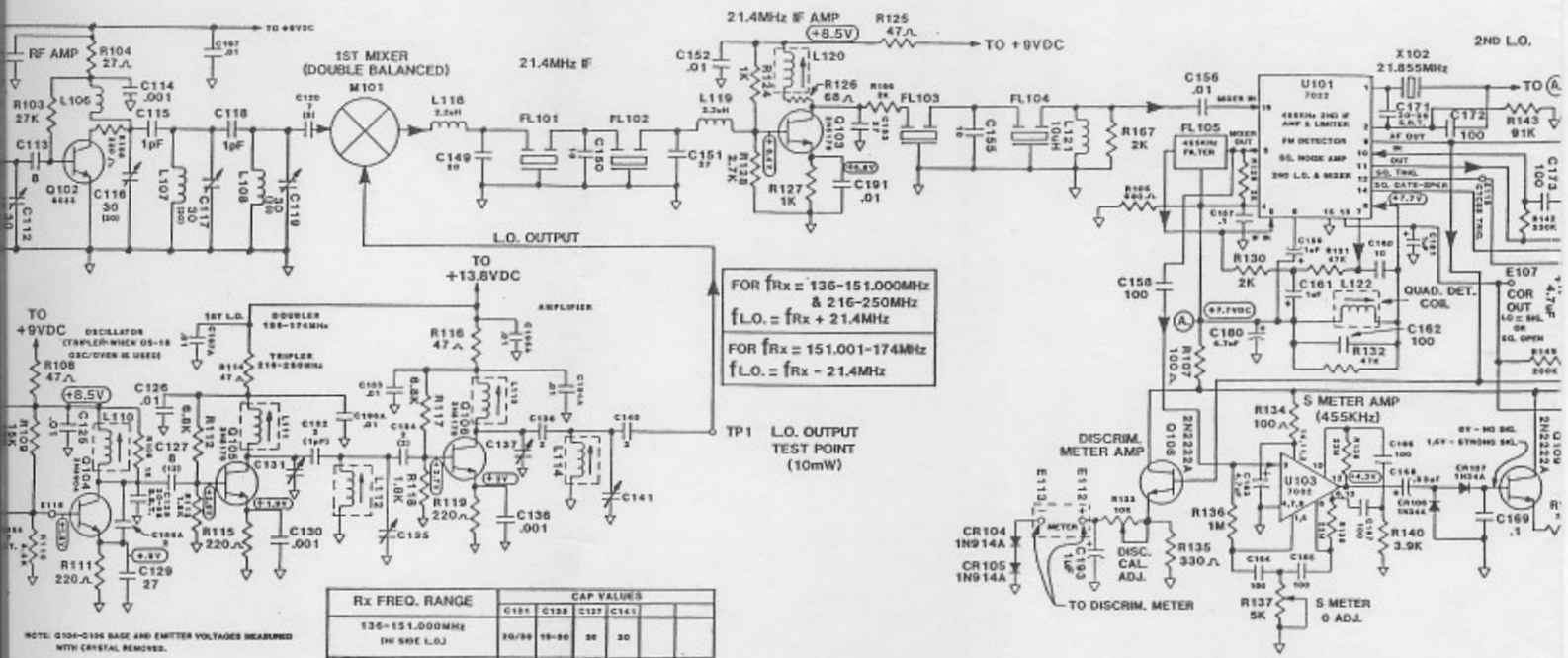
Rx FREQ. RANGE	CAP VALUES					
	C131	C135	C137	C141		
136-151.000MHz (HI SIDE L.O.)	20/30	10-50	30	30		
151.001-158.000MHz (LOW SIDE L.O.)	30/30	10-50	50	50		
158.001-174MHz (LOW SIDE L.O.)	30/30	10-50	50	50		
216-250MHz (HI SIDE L.O.)	20	20	10	10		

NOTE: Q104-Q106 BASE AND EMITTER VOLTAGES MEASURED WITH CRYSTAL REMOVED.

NOTES:

1)COMPONENTS SHOWN IN DASHED LINES (EXCEPT COILS) ARE LOCATED OFF THE BOARD.
2)ARROWS SHOW DIRECTION OF SIGNAL FLOW.
3)EXCEPT AS INDICATED, DECIMAL VALUES OF CAPACITANCE ARE IN MICROFARADS (uF); OTHERS ARE IN PICOFARADS (pF).
4)TYPICAL VOLTAGES ARE SHOWN IN ( ). AF VOLTAGES ARE MEASURED WITH A SCOPE, WITH 5KHz DEV. SIGNAL, (1KHz TONE).

$F_{LO} = \frac{146.}{21.}$ / 167.



Rx FREQ. RANGE	CAP VALUES					
	C101	C128	C127	C141		
136-151.000MHz (HI SIDE L.O.)	20/50	10-50	30	30		
151.001-158.000MHz (LOW SIDE L.O.)	20/30	10-50	30	30		
158.001-174MHz (LOW SIDE L.O.)	20/30	10-50	50	50		
216-250MHz (HI SIDE L.O.)	20	20	10	10		

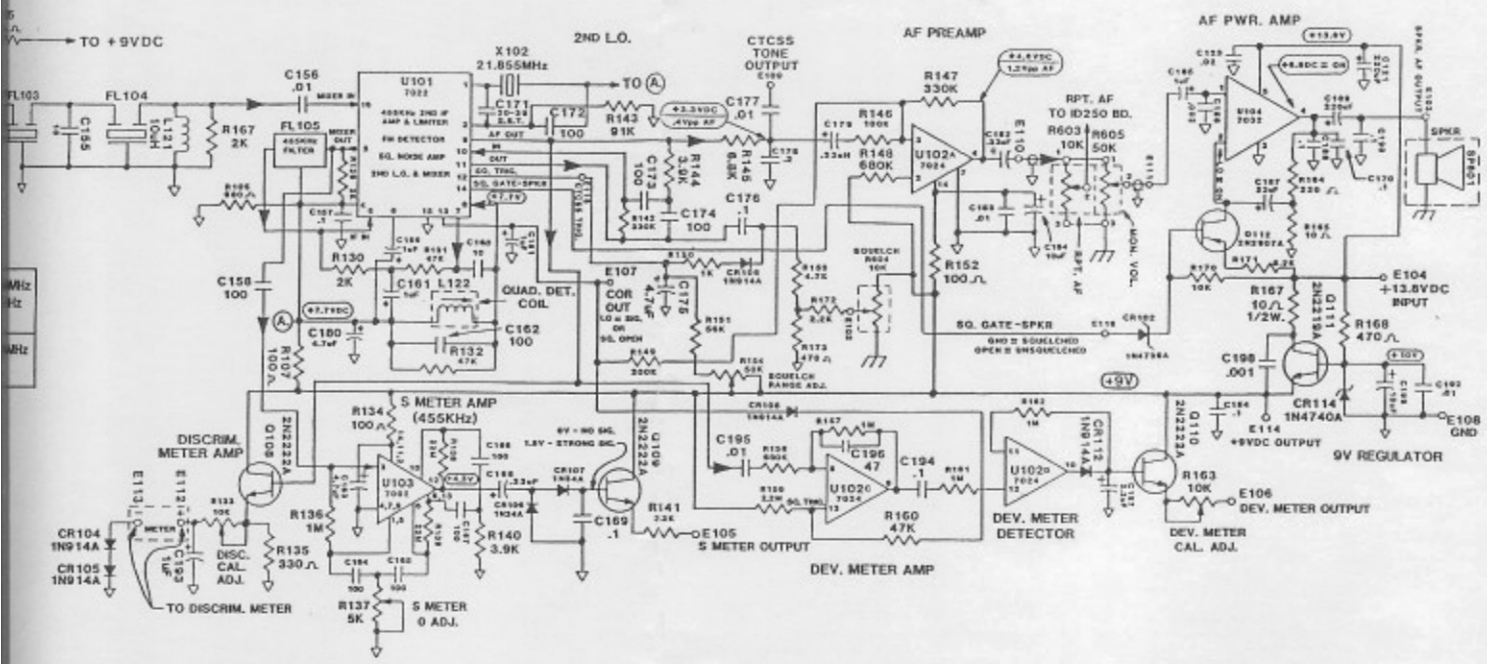
NOTE: Q104-Q106 BASE AND EMITTER VOLTAGES MEASURED WITH CRYSTAL REMOVED.

CATED OFF THE BOARD.

MICROFARADS (uF);

EASURED WITH A

$$F_{LO} = \frac{146.265}{167.665}$$



46.265
21.4
67.665

SPECTRUM COMMUNICATIONS		
SCALE: ———	APPROVED BY 10-1-86 W. Roy	DRAWN BY R.L.A.
DATE: 10-11-84		REVISED 7-22-86
SCR200A RECEIVER SCHEMATIC		
	(BOARDS)	DRAWING NUMBER 4100122