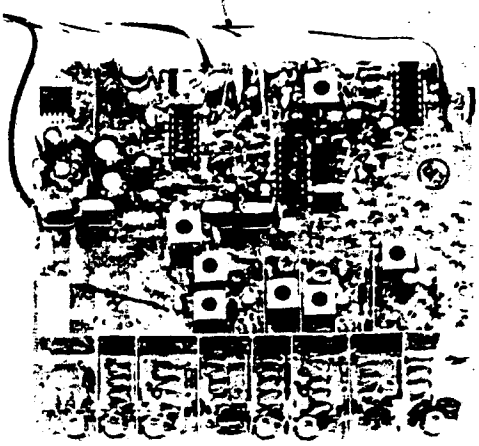
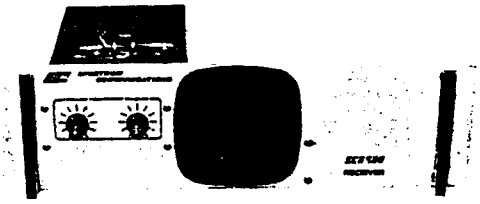
SCR200A & SCR450A

HIGH PERFORMANCE VHF & UHF FM OR FSK RECEIVERS
BOARDS, HOUSING ASSY., OR RACK MOUNT



VHF RCVR BOARD

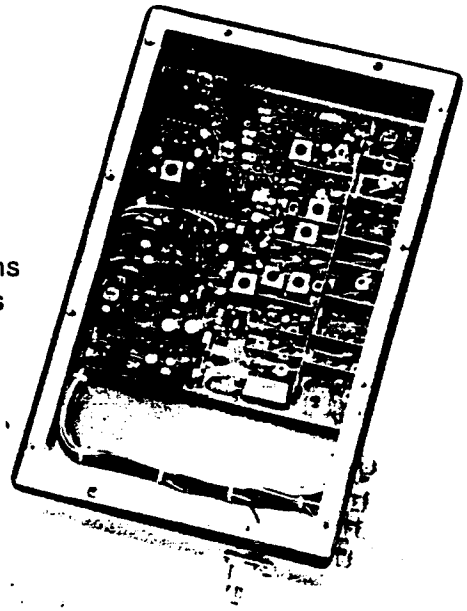


SCR500 RACK MT. RCVR – (LESS METERS)

APPLICATIONS:

- Repeaters
- RF Links
- Telemetry
- Security or Surveillance Systems
- Special Applications

- 100% SOLID STATE
- HIGH SENSITIVITY, SELECTIVITY, & WIDE DYNAMIC RANGE
- VERY SHARP UHF FL-4 HELICAL RESONATOR OPTION
- 12 POLE IF FILTER 5 IF BANDWIDTHS AVAILABLE
- 3 METERING OUTPUTS
- USED IN SPECTRUM REPEATERS



UHF RCVR IN SHIELDED HOUSING ASSY.
Highly Recommended!

The Spectrum Communications Corp. SCR200A and SCR450A VHF & UHF Receivers utilize the very latest in design techniques and "State of the Art" components to achieve what have to be the very finest Receiver Boards or Shielded Sub-Assemblies on the market today! A maximum of ICs and other sealed components (such as a true **Double-Balanced Mixer** and monolythic **Crystal & Ceramic Filters)** have been incorporated for optimum long-term circuit stability and performance, as well as circuit simplicity. Very wide dynamic range (for excellent rejection of spurious responses, desense, and "intermods"), plus superior Sensitivity & Selectivity make the SCR200A and SCR450A ***ideal for numerous VHF/UHF FM & FSK applications.***

CIRCUIT DESCRIPTION

The Receiver Front End includes 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" Preselector Resonators are intermixed with the two RF transistors. These tuned circuits provide extremely good rejection of strong out of band signals. A Double Balanced Mixer converts the input signal down to the 21.4 MHz IF frequency. (This type of mixer inherently has extremely wide dynamic range characteristics and they are widely used in microwave receiver applications due to their superior performance capabilities.) The Local Oscillator chain consists of an overtone crystal oscillator stage followed by two multiplier stages. "Double-tuned" filter sections are used through-out the LO chain in order to filter-out spurious signals. This results in an extremely "clean" drive signal to the Mixer, and therefore super-low overall receiver spurious responses. The first mixer is immediately followed by an **8 Pole first IF Crystal Filter** and a 21.4MHz IF Amp. stage. **A 21.4MHz IF frequency** is used in this design since it greatly helps in the attenuation of image and spurious responses. *This high frequency IF is far superior in this respect to the commonly used 10.7 MHz IF stages.*

The 21.4MHz first IF signal is fed to a multi-purpose second IF IC. This IC performs the functions of second LO and Mixer (also doubly-balanced to reduce spurious responses). It also includes 455KHz second IF Amplifier and limiter stages, as well as the FM Quadrature Detector, and high frequency Squelch Noise Amp. The second mixer's output is filtered by a **4 Pole Ceramic Filter** *which provides additional skirt selectivity for superior adjacent channel rejection.* In addition, the receiver incorporates **a new advanced design Squelch circuit** which has many benefits over older, simpler designs. *The Hysteresis circuit reduces squelch "chop-out" effects on weak, fluttery signals.* This circuit keeps the squelch *"open"* even though the weak received signal may have faded a few dB *below* the original threshold (opening) point. **Optionally, a true NRZ FSK Data Output is available at either TTL or CMOS level.**

The AF Amp IC will supply up to 5W of very clean and clear audio output to a 3.2Ω minimum load. The audio is very low in distortion, and fidelity and quality are unusually good.

The Receivers also include built-in Discriminator, Deviation, and Signal Strength Meter functions. These functions can be *very valuable to the control operator or maintenance technician at the receiver site* since he can quickly and conveniently check all of the users on the air for Peak Deviation, Frequency Error and relative Signal Level. (Accuracy is typically within ± 1Khz @ + 10 to + 35 C.) These functions (if used) can be wired to a front panel switch and 1mA DC meter. **A COR output is standard. Detector AF and Squelch Trigger points for a CTCSS Decoder** are on the board, and may be brought out to feedthrough caps as an option for Housing Assembly or Rack Mount units.

SPECTRUM COMMUNICATIONS CORP.

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PERFORMANCE SPECIFICATIONS

	SCR200A VHF RECEIVER	SCR450A UHF RECEIVER
FREQUENCY RANGE	136-174MHz 216-250MHz 29-54MHz 66-88MHz	406-512MHz
SENSITIVITY	0.2-0.28 μV/12dB SINAD TYP. 0.3 μV MAX.	0.2-0.28 μV/12dB SINAD TYP. 0.3 μV MAX. (0.35 μV MAX. WITH FL-4)
SQUELCH THRESHOLD	0.1-0.15 μV TYP., 0.2 μV MAX.	0.1-0.15 μV TYP., 0.2 μV MAX.
SELECTIVITY (TYP.) STANDARD	-6dB @ $\pm$ 6.5 KHz; -75dB @ $\pm$ 15KHz; >-125dB @ $\pm$ 25KHz. (20dB Qt. METHOD.) [-85dB EIA.]	
SPECIFY FILTER **OPTION**	"SHARP" 11KHz B.W. FILTER #FL11 (12 POLE) -6dB @ $\pm$ 5.5KHz, -104dB @ $\pm$ 15KHz [-94dB EIA.] *(ONLY RECOMMENDED WHERE THERE IS LOCAL ACTIVITY @ $\pm$ 15-20KHz.)* [STEEPER SKIRT 14 POLE FILTER AVAILABLE, #FL10.]	
OPTION	NARROW 6KHz B.W. FILTER #FL12/6. -6dB @ $\pm$ 3KHZ, -80dB @ $\pm$ 11KHz. *(ONLY FOR 2.5KHz DEVIATION SYSTEMS.)*	
OPTION	**WIDE 30KHz B.W. FILTER #FL30.** -6dB @ $\pm$ 15KHz. -60dB @ $\pm$ 25KHz. *(FOR HIGH SPEED DATA & BROADCAST RPU.)*	
OPTION	**WIDE 100KHz B.W. FILTER #FL100.** -6dB @ $\pm$ 50KHz. -60dB @ $\pm$ 100KHz. *(FOR HIGH SPEED DATA & BROADCAST RPU.)*	
FREQUENCY STABILITY	$\pm$ 0.0005% TYP. (-20 TO +60°C). $\pm$ 0.001% MAX. (-30 TO +60°C).	
OPTION	OV-1 CRYSTAL OVEN *(RECOMMENDED FOR WIDE AMBIENT TEMP. VARIATIONS, ESP. AT UHF.)* *FOR VERY HIGH STABILITY* $\pm$ 0.0003% TYP. (-30 TO +60°C).	
SPURIOUS RESPONSE	-85dB NOM.	-90dB NOM.
IMAGE RESPONSE	>-100dB(136-174MHz). -90dB nom. other bands.	-90dB NOM. (>-100dB IMAGE WITH FL-4)
FRONT END	LOW NOISE, W/DOUBLE BALANCED MIXER FOR EXTREMELY LOW I.M.	
'DESENSE'/OVERLOAD	WITH A 1 μV DESIRED SIGNAL, 'DESENSE' BEGINS AT APPX. 50,000 μV @ $\pm$ 600KHz. APPX. 100,000 μV @ $\pm$ 3MHz.	(100,000 μV @ $\pm$ 1 MHz W/UHF FL-4)
INTERMODULATION	-73dB NOM. EIA.	-73dB NOM.EIA. (-85dB NOM. WITH FL-4)
MODULATION ACCEPTANCE	7KHz NOM.	7KHz NOM.
I.F.	DOUBLE CONVERSION, 21.4 MHz FIRST IF. 455 KHz SECOND IF.	
SQUELCH	FAST ATTACK. NOISE OPERATED. HYSTERESIS CIRCUIT MINIMIZES "CHOPPING" ON WEAK, FADING SIGNALS.	
AUDIO (OR FSK DATA) OUTPUT	2W TO 8 OHM LOAD; UP TO 5W TO 3.2 OHM LOAD. *(FOR FSK, SPECIFY TTL OR CMOS LEVEL.)*	
A.F. DE-EMPHASIS	-6dB/OCTAVE PER EIA SPECIFICATIONS	-6dB/OCTAVE PER EIA SPECIFICATIONS
OPERATING VOLTAGE	13.8VDC (NOM.), 11V MIN. 14.5V MAX.	13.8VDC (NOM.), 11V MIN. 14.5 MAX.
CURRENT DRAW-SQUELCHED	150mA (NOM.)	160mA (NOM.)
NORMAL AF OUTPUT	200mA	210mA
MAXIMUM AF OUTPUT	400mA	410mA
CONTROLS REQUIRED		
-SQUELCH	10K OHM (LINEAR TAPER)	10K OHM (LINEAR TAPER)
-AF OUTPUT	50K OHM	50K OHM
RECOMMENDED METER (IF USED)	1mA DC. 1 K Ω INTERNAL RESISTANCE. (OPTIONAL SPECTRUM SIGNAL METER #SM-1 IS AVAILABLE.)	
SIZE	**BOARD:** 5.5" x 4.9" x 1.2"	**SHRX-1 HOUSING:** 8 3/4" x 5 5/8" x 2 5/16" W/O CONNECTOR & F.T. CAPS
MINIMUM RECOMMENDED SHIELDED HOUSING SIZE	6¼" L x 5½" W x 2" H (INSIDE)	
RECOMMENDED HOUSING	SPECTRUM CUSTOM SHRX-1 RCVR. HOUSING.	
HOUSING ASSY. RF CONNECTOR	S0239	TYPE N FEMALE

SOLD FACTORY DIRECT. (ASSEMBLED & TESTED.) AS USED IN SPECTRUM REPEATERS, ETC.
SUPPLIED W/1 PRECISION GRADE 0.0005% CRYSTAL. (HIGHEST QUALITY AVAILABLE.)

AVAILABLE WITH OR WITHOUT SHIELDED HOUSING ASSEMBLY WITH FEED-THRU CAPS AND RF CONNECTOR. ASSEMBLY ALSO AVAILABLE MOUNTED TO 19" RACK PANEL - EITHER WITH PANEL SPEAKER, VOLUME & SQUELCH CONTROLS (SCR500); OR LOW COST BLANK PANEL (RMT.) ALL COMPLETELY WIRED & TESTED.

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SCR200A/SCR450A RECEIVER BOARDS OR ASSEMBLIES

11/87

1.0 INSTALLATION

1.1 The board should be mounted in a shielded aluminum housing with the standoffs provided. Use a housing which allows at least ½" of clearance on all sides (around the board) and at least 1" above the board. This is necessary to prevent stray coupling around the various high gain RF and IF stages.

For proper operation as a repeater receiver, the SCR200A or SCR450A receiver board must be mounted in a tightly shielded housing of at least a minimum size of 6½ X 5 3/4 X 2". The box should have tightly sealed seams to prevent stray transmitter RF from entering. 1000pF or larger feedthrough capacitors must be used for all leads (except ground) which enter or leave the housing. (The use of ferrite beads just inside the feedthrough will improve the effectiveness of the shielding/filtering, but this is not usually necessary.) A UHF or Type N connector is recommended for RF input. Double shielded coax cable is highly recommended for use throughout all repeater systems (RG9, 223, or 214/U).

1.2 See the Receiver Schematic and Board Layout for connections such as Local Monitor Volume and Squelch pots, 13 VDC input, etc. Shielded wire must be used for connections to the Monitor Volume pot, (and Repeat Audio Level pot - if the board is used for repeater or link receiver application). Note that for repeater or link application, R603, the Rpt. AF Level pot (not supplied) is used to set the AF level into the repeater or link transmitter. The transmitter's audio input impedance should be greater than 1K ohm. (Use shielded wire to transmitter's AF Input terminal.) Also note that if it is desired to decrease the "bass" response ("Lows") of the repeated audio, a low value coupling cap (.01 to .1uF typ.) should be wired in series with the transmitter's AF Input terminal.

1.3 For Spectrum SCR200A/SCR450A Receiver/Housing Assembly: See Figure 1 which lists the housing Feedthru Cap Numbers. These Feed-Thru cap numbers correspond to the "E numbers" listed on the SCR200A or SCR450A Schematic. Simply add 1000 to the board terminal number for the corresponding housing feedthru cap number.

2.0 METERING FUNCTIONS

2.1 This receiver board is quite unique in that it has three different metering functions "built-in" on-board. These include Discriminator, Deviation, and Signal Strength Meter functions. These functions (should you desire to use them) can be extremely useful to the operator at the receiver site. Now the frequency, peak deviation, and relative signal strength of all the system's users can be checked - very quickly and easily . . . without the hassle of bringing in each transceiver to a shop for testing. (See the Schematic Diagram for hook-up.) A 1mA DC Panel Meter sould be used, (preferably the custom Spectrum #SM-1 "Signal/Deviation" Meter). (Internal resistance must be about 1K ohm.) See para.'s 5.1.4 to 5.1.7 for Calibration and Adjustments. (Dev. and Disc. Meter functions are typically accurate to within ±1KHz at +10 to +35° C.) Also, for best accuracy on these two functions, the incoming signal should be "full quieting". And, the Deviation Meter should read zero on the received signal when there is no modulation - (this is definitely full quieting).

3.0 ADDITIONAL FUNCTIONS/OUTPUTS

3.1 In addition to the above functions, the receiver board also includes other outputs which may be used in certain applications. These are as follows:

3.1.1 CTCSS OUTPUT - (Terminal E109/1109) - If it is desired to connect a CTCSS ("PL") tone decoder unit 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.

3.1.2 COR OUTPUT - (Terminal E107/1107) - This output can be used to trigger a repeater or link transmitter, (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 max. (It cannot directly switch relays, lamps, etc. Interface circuitry, such as a transistor switch, must be used if the currents to be switched exceed the above limits. See Figure 2.) 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".

Note that this COR output will directly interface with the Spectrum CTC100A COR/Timer/Control board, and its use is highly recommended for this application since it has a very high input impedance (CMOS gate). Simply connect the receiver's COR output terminal (E107/1107) to E323 on the CTC100A board.

3.1.3 9 VDC OUTPUT - (Terminal E114/1114) - This output can be connected to a front panel DC voltmeter which would be used to monitor system voltages. It can also be used to supply regulated 9 VDC to other circuitry. Maximum load current = 25mA.

4.0 CIRCUIT DESCRIPTION

4.1 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 very wide dynamic range. Eight "High 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. The output of the RF amplifier stages 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 and excellent strong signal handling capabilities. This leads to very low spurious response, 'desense', and overload.

4.2 The Local Oscillator (LO) chain consists of a third overtone crystal oscillator stage (Q104) which operates in the 65-85MHz range. When the optional OV-1 Crystal Oven module is used, frequency stability is increased to ±0.0003% nominal. 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 the SCR450A, 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 21.4000MHz 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.

4.3 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.

4.4 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. (20.945MHz on special order.) 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 porportional 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).

4.5 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. (Trim pot R154 sets the dynamic range of the squelch circuit, and mainly affects the signal level required to open the squelch when R604 is set full "tight squelch"; i.e. fully CW.) There is 100mV of hysterisis 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 eventhough the signal may fade a few dB into the noise and reduces chopping effects on weak, fluttery mobile signals.

4.6 The audio output from the FM detector at pin 9 of U101 is de-emphasized by the R145/C178 network at 6dB per octave roll off per EIA specifications, and connected to the AF Preamp input at pin 3 of U102A. Audio pre-amp stage U102A provides a gain of about 3, 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 Monitor Volume Pot and Rpt. AF or Fixed AF Output pot, if used. Audio from the Monitor Volume pot is fed to U104, the audio power amplifier IC. U104 can drive a monitor speaker so that incoming signals may be monitored.

4.7 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.) FL106 filters the noise band of the 455KHz IF to minimum so very wideband noise is not introduced into the high gain amplifier stages of U103. U103 is used as 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 on an extremely strong signal - (greater than 100uV.)

4.8 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 properly read voice Peaks. 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.

5.0 ALIGNMENT

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

5.1.1 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 10-12dB SINAD). With the generator tuned for the best quieting point in the receiver passband, it should be possible to achieve 0.35uV or less for 20dB of quieting (1/10 the original noise reading). Typical 12dB SINAD point is 0.25 - 0.3uV.

5.1.2 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. 0.25uV.] 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.

5.1.3 21.4MHz IF ADJUSTMENT - L120 should be adjusted for best SINAD or quieting with a weak signal, (appx. 0.25uV). (This adjustment is very non-critical.)

5.1.4 QUADRATURE COIL AND DISCRIMINATOR METER ADJUSTMENT - If this meter function is used, set the meter switch to the "Disc. or Freq. Error" function. Adjust L122 to center the meter with a strong input signal which is exactly on frequency. Apply a 100uV (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. Reset the signal to center freq., and readjust 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. If the Discriminator Meter Function is not used, simply peak L122 for max audio output with a strong tone modulated input signal.

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

5.1.6 SIGNAL STRENGTH (S METER) ADJUSTEMENT - Set the meter switch to the "Rx Signal". function. With an input signal of approximately 10 uV or greater set 'S' meter reading to 10 by adjusting R137. This is the point of saturation of U103. Then return to zero signal input and verify 'S' meter reads '0'. Note: The 'S' meter is a relative indicator.

5.1.7 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 30-54, 136-151.00MHz and 216-250MHz Receive Frequencies; and 21.400MHz below the desired receive frequency for 151.001-174MHz, 406-512MHz, and 66-88MHz Receive Frequencies.

6.0 CRYSTAL SPECIFICATIONS

RECEIVE FREQUENCY	EQUATION
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. = $\frac{\text{Rcve. Freq. - 21.4MHz}}{6}$
30-54MHz	Crystal Freq. = Rcve. Freq. + 21.4MHz

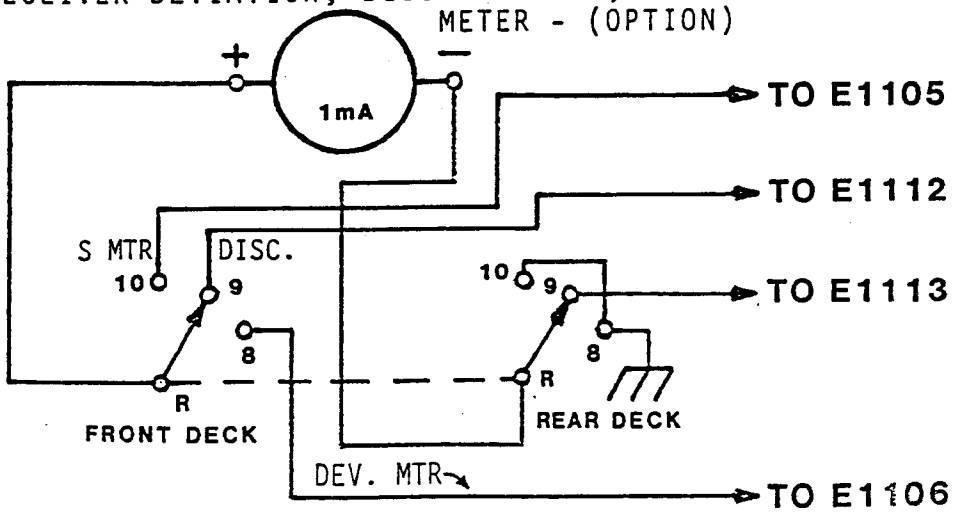
Mode: Third Overtone. Note: For crystal frequencies over 75MHz, some crystal manufacturers may have to supply a 5th overtone crystal, however, we do not recommend this. We recommend that all replacement crystals be purchased from Spectrum Communications to ensure proper operation in your Spectrum receiver.

Parallel Resonant with 8pF Load Capacity.
Case: HC-25/U
R_S less than 30 ohms
Calibration Tolerance: ±0.0005% @ 23°C
Temperature Tolerance: ±0.0005% from -20 to +60°C.

Crystal must be designed for maximum "pullability"; i.e. max change in freq. for a change in load capacity.

METER FUNCTIONS INTERCONNECTION DIAGRAM

RECEIVER DEVIATION, DISCRIMINATOR, SIGNAL STRENGTH METER - (OPTION)



1101 = Not Used

1102 = Squelch Pot, (wiper)

1103 = Speaker A.F. Output

1104 = 13.8 VDC Input

1105 = S Meter Out

1106 = Dev. Meter Out

1107 = COR Output. (LO = Rx Sig.)

1108 = Ground; & pin 3 of Squelch & Audio Pot(s)

1109 = CTCSS AF Out, (Option).

1110 = Mon. Vol. & Repeat AF Pots, (high side). [Main AF Output]

1111 = Monitor Volume Pot, (wiper). [To U104, AF Amp Input]

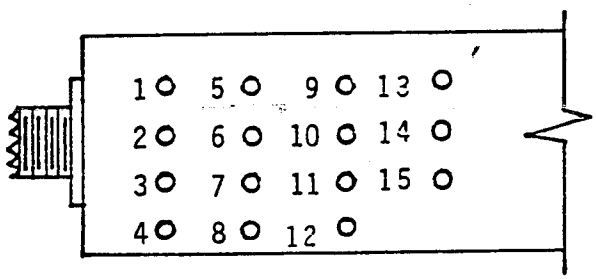
1112 = Disc. Meter(+) Out

1113 = Disc. Meter (-) Out

1114 = 9 VDC Out & Squelch High Side

1115 = CTCSS Trigger, (Option)

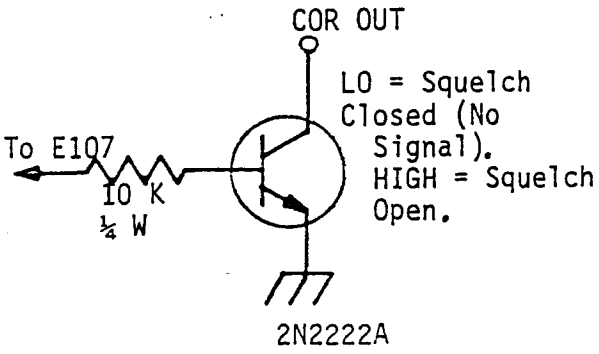
HOUSING CONFIGURATION



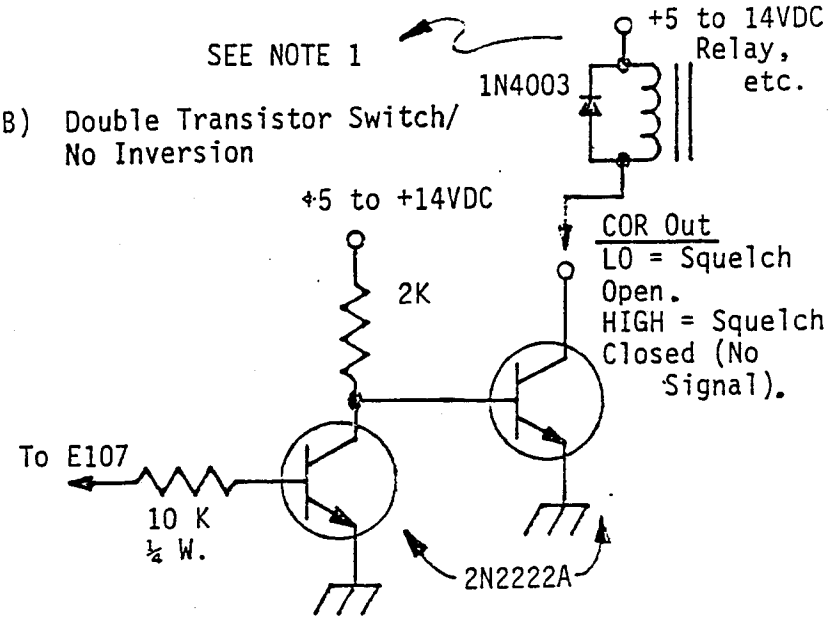
1100 Series

INTERFACING COR OUTPUT TO EXTERNAL CIRCUITRY FIGURE 2

2A) Transistor Switch/Inverter



2B) Double Transistor Switch/ No Inversion



The 2N2222A will switch up to 25 VDC, at up to 150mA max.

NOTE 1: Typical relay hook-up is shown as an example.

SPECTRUM COMMUNICATIONS CORP.

1055 W. GERMANTOWN PIKE
NORRISTOWN, PA 19403-9616 U.S.A.
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846-211
SPECTRUM NTW

April 10, 1989

ADDENDUM

SCR 200A and SCR 450A
RECEIVERS

This addendum concerns only SCR 200A and SCR 450A receivers which were manufactured with SOKOL Crystal Products 21.4 Mhz IF Crystal Filters and were shipped previous to this addendum. Equipment which is presently being manufactured and shipped contains the correct value choke. Older units with SOKOL filters should be examined to determine whether or not the described choke needs replacing. The problem is as follows:

> A problem occurs in the high IF sensitivity after the first pair of crystals noted in the schematic as FL101 and FL102. Inductive coupling by L119 is of incorrect value, creating approximately 15-20 dB loss to the IF amp. The value of this choke is shown on the schematic as 2.2 uh. The correct value to solve the coupling problem is 3.9 uh.

Accordingly, if your SCR 200A of SCR 450A receiver board uses SOKOL Crystal Products 21.4 Mhz IF Crystal Filters, and was shipped prior to 1987, check L119 and be certain the choke is a 3.9 uh, molded type, and not the 2.2 uh indicated on the schematic. Please change your diagrams to reflect that the proper choke for L119 is 3.9 uh. On units shipped after the above date, the proper choke has already been installed by Spectrum; however, you will still need to indicate the proper value on the schematic diagrams and component drawings since they have not yet been reprinted. If you have further questions, please contact Werner Rex, (215)631-1710. Thank you.

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ADDENDUM
SCR200A & SCR450A RECEIVERS

This addendum concerns the 'S' meter circuitry of ALL VHF & UHF receivers manufactured by Spectrum Communications Corp.

The following changes/additions have imporved the response and sensitivity of the 'S' meter amplifier U103 (7002).

Item #1- FL107 (CFU455D or equivalent)to input of U103 pin 3.

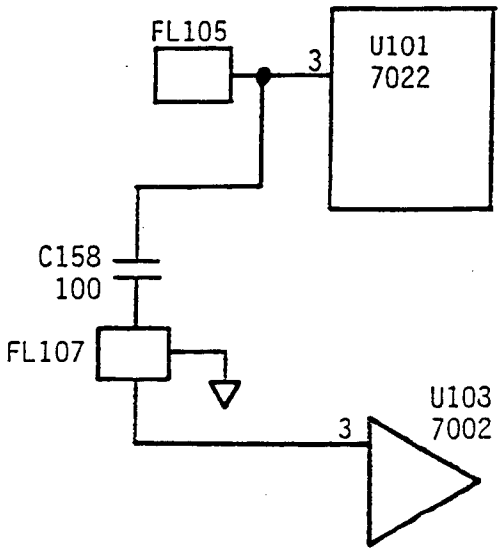
Item #2- R138, R139 to 2.2 megohm 1/4 w. increased amplifier gain.

Item #3- C165 to .001 uF to, improve roll-off of response in IC103.

Item #4- C158 to 82 pF-isolate FL107 from FL105.

Results of changes/additions give an 'S' meter deflection beginning at 0.5 uv for a properly tuned receiver and an almost linear indication up to 10uv.

For furhter information or assistance call Werner Rex at (215)631-1711.



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RECEIVER WIRE COLOR FUNCTIONS

E1101 - NOT USED

E1102 - GREEN/BLACK/WHITE, SQUELCH POT WIPER

E1103 - GRAY, SPEAKER AF OUTPUT

E1104 - RED, +13.8VDC INPUT

E1105 - VIOLET/WHITE, 'S' METER OUTPUT

E1106 - WHITE, DEV. METER OUPUT

E1107 - BLACK/WHITE, COR OUTPUT

E1108 - BLACK, GROUND

E1109 - GREEN, CTCSS AF OUTPUT (OPTION)

E1110 - YELLOW/BLACK COAX, MONITOR VOLUME & REPEAT AF POTS HIGH SIDE

E1111 - BLACK COAX, MONITOR VOLUME POT WIPER

E1112 - VIOLET, DISC. METER + OUTPUT

E1113 - GRAY/WHITE, DISC. METER - OUTPUT

E1114 - ORANGE, +9VDC OUTPUT & SQUELCH POT HIGH SIDE

E1115 - GREEN/WHITE, CTCSS TRIGGER (OPTION)

SPECTRUM COMMUNICATIONS CORPORATION

BOARDS & SUBASSEMBLIES

LIMITED WARRANTY

Spectrum Communications warrants its equipment to be free from defective material or factory workmanship and agrees to remedy any such defect by repair or replacement at the company's option, which in the company's judgement is a fault of its manufacturing, for a period of 100 days from date of original receipt by the original purchaser, provided that the equipment is returned to the factory or its authorized dealer intact and with all transportation charges prepaid. If a malfunction is suspected, call or write IN DETAIL to our service department for suggestions concerning the operation, repair or return of the unit if this should prove necessary. Do Not return equipment to the factory without authorization!

NOTE THAT THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT ONLY. WE DO NOT OFFER A MONEY-BACK GUARANTEE.

WHEN IT IS NECESSARY TO RETURN A UNIT FOR FACTORY REPAIR (AT NO CHARGE UNDER WARRANTY), BE SURE TO RETURN IT BEFORE THE 100 DAY WARRANTY EXPIRES. UNITS RETURNED FOR REPAIR AFTER THAT TIME PERIOD ARE OF COURSE SUBJECT TO OUR NORMAL PARTS AND LABOR CHARGES.

For units to be shipped within the continental 48 U.S. states, return freight from the factory to the customer via U.P.S. Surface will be prepaid by Spectrum. For units to be shipped outside of the 48 states, or where a customer desires some premium method of shipment such as Airfreight, the customer must pay the full amount of the freight.

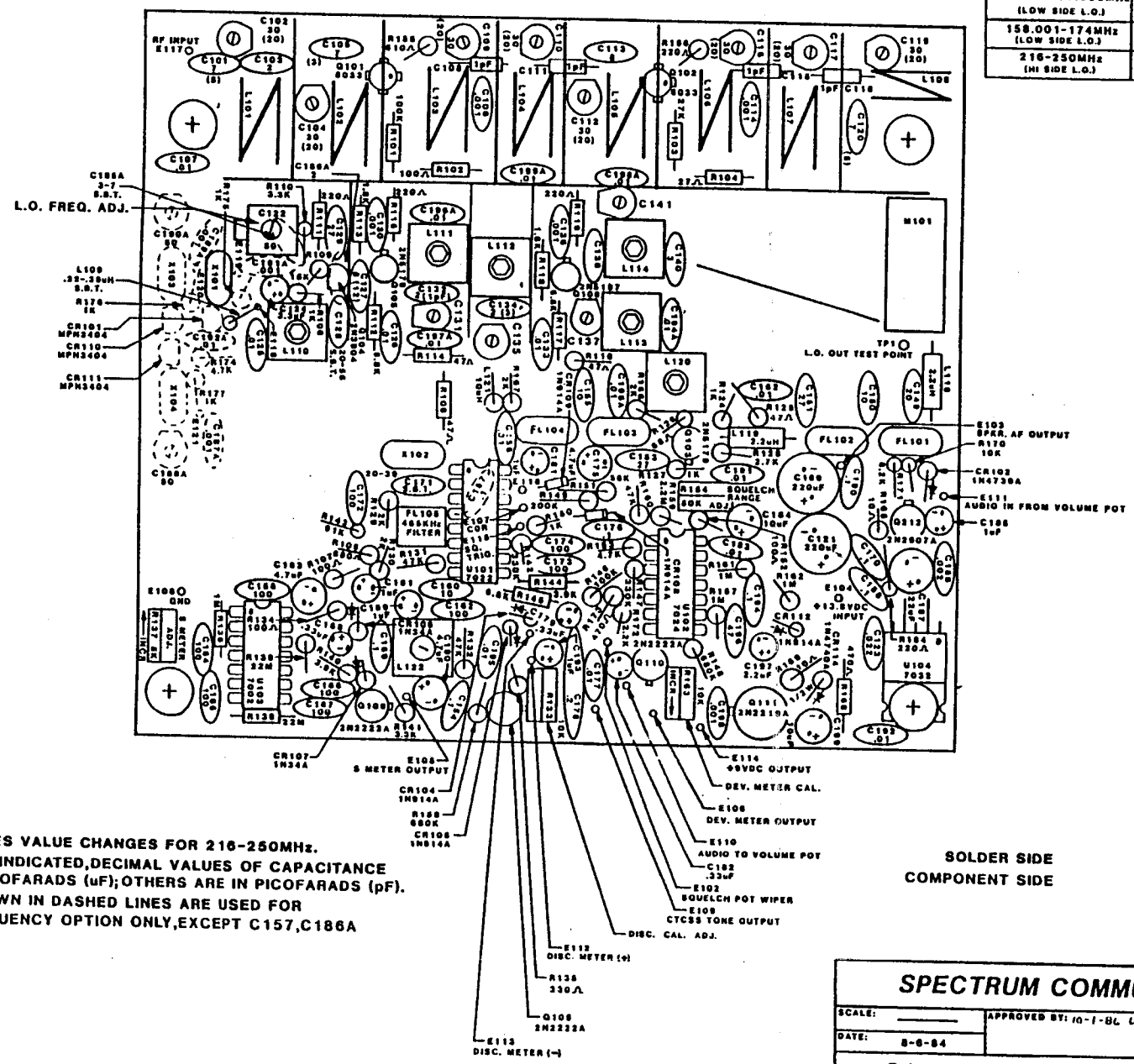
This warranty shall be invalid in the event of (a) unauthorized repair, detuning, tampering or alteration of any kind, (b) misuse, abuse, negligence or accident, (c) connection, installation, or operation in a manner at variance with the instruction manual, (d) alteration, disfigurement or removal of the serial number, or (e) use with accessories not manufactured or recommended by us.

Any part of a unit approved for remedy or exchange will be remedied or exchanged by Spectrum Communications Corp. or its authorized dealer without charge to the owner. Spectrum is liable only for the repair or replacement of defective equipment during the warranty period, and not for any incidental or consequential damages.

SPECTRUM COMMUNICATIONS CORP. reserves the right to make any changes to designs or specifications of its products without notice, and without assuming any obligations to install such changes in its previously manufactured products.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

Rx FREQ. RANGE	CAP VALUES					
	C131	C138		C127	C141	
136-151.000MHz (HI SIDE L.O.)	20/30	10-30		30	30	
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	



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.

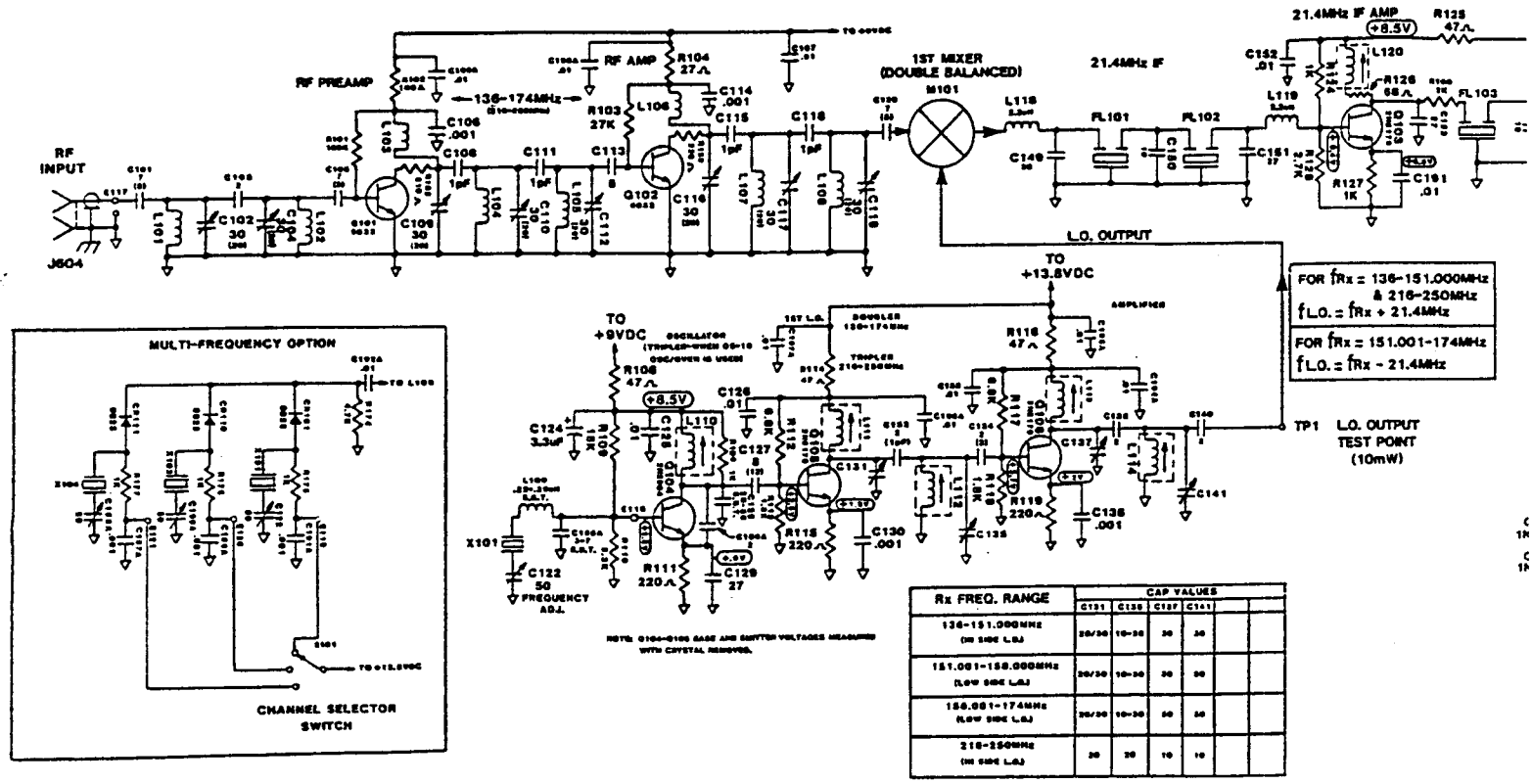
SOLDER SIDE
COMPONENT SIDE

SPECTRUM COMMUNICATIONS

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

SCR200A RECEIVER COMPONENT LAYOUT (BOARDS)

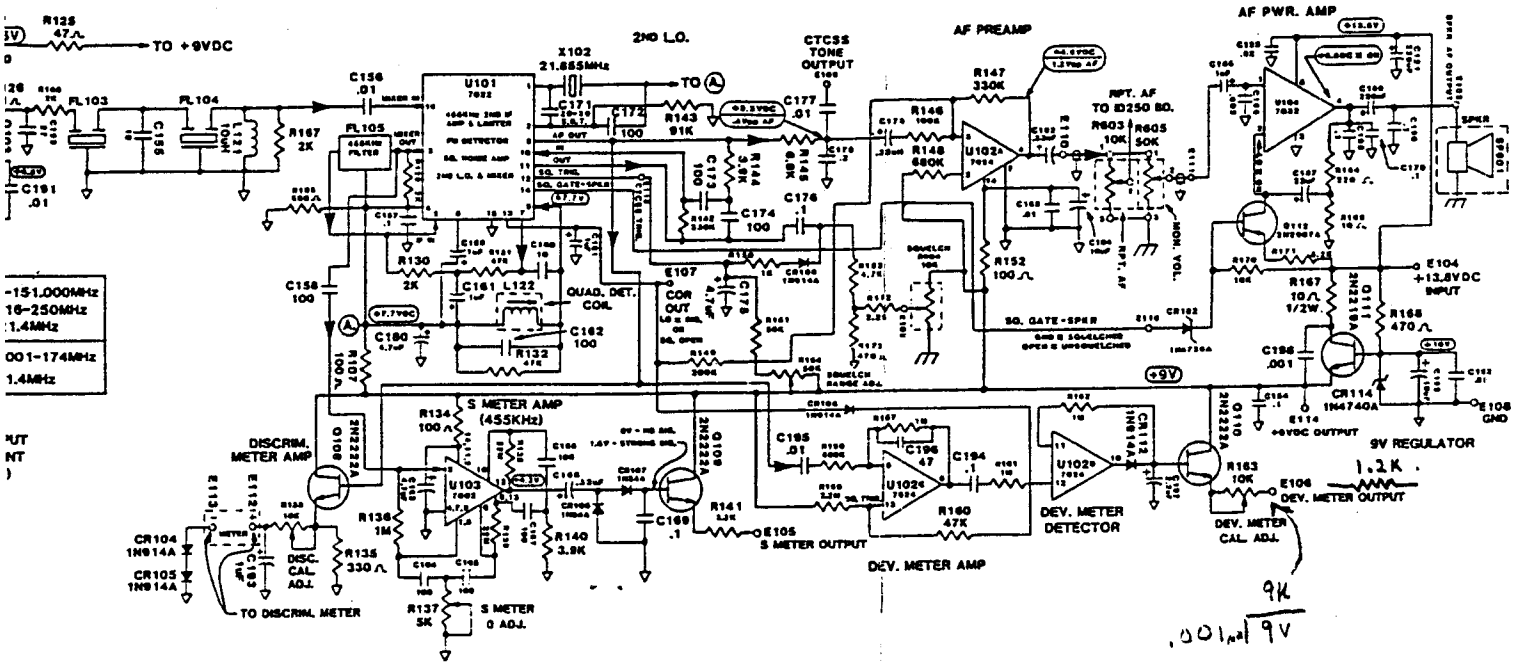
DRAWING NUMBER 3200157



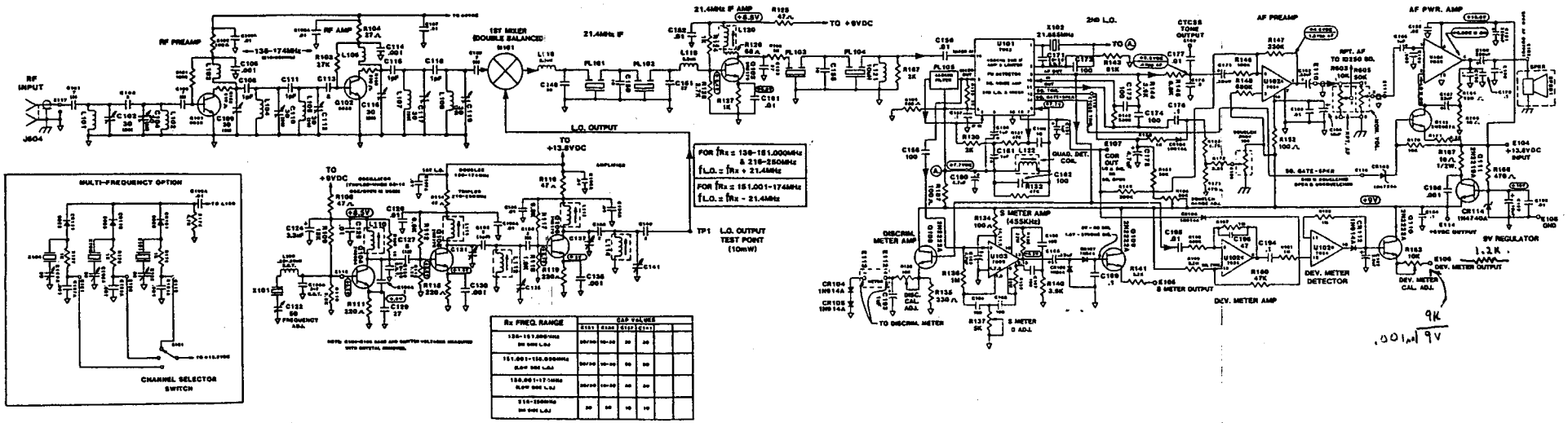
Rx FREQ. RANGE	CAP VALUES					
	C121	C126	C127	C141		
136-151.000MHz (HI SIDE L.O.)	20/30	10-30	30	30		
151.001-158.000MHz (LOW SIDE L.O.)	20/30	10-30	30	30		
158.001-174MHz (LOW SIDE L.O.)	20/30	10-30	30	30		
216-250MHz (HI SIDE L.O.)	30	30	10	10		

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).



SPECTRUM COMMUNICATIONS		
SCALE: ———	APPROVED BY 10-1-84 W Roy	DRAWN BY R.L.A.
DATE: 10-11-84		REVISED 7-12-88
SCR200A RECEIVER SCHEMATIC		
(BOARDS)		DRAWING NUMBER 4100122



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).

SPECTRUM COMMUNICATIONS

SCALE:		DRAWN BY: R.L.A.
DATE: 10-11-84		REVISED: 7-25-86

SCR200A RECEIVER SCHEMATIC

(BOARDS) 4100122