## 3.2 FRONT PANEL CONTROLS

3.2.1 AC POWER - activates or deactivates AC line power. (Light indicates power on.)

3.2.2 AC LINE - 3A AC line fuse

3.2.3 INCOMING SIGNAL - Indicates the presence of an incoming signal to the COR circuitry.

3.2.4 TRANSMIT LIGHT - Indicates that the transmitter is activated and "On the Air". (Actually triggered from the Exciter B+ line.)

3.2.5 COR DISABLE - When this button is pushed, (and the lamp is illuminated), the COR circuitry is disabled. An incoming signal may be monitored on the local speaker and signal level meter, but it will not trigger the repeater transmitter. Note that when the COR is disabled, the ID'er and local mic can still bring-up the repeater transmitter. Also, in this position, the unit may be operated as a full duplex Base Station.

3.2.6 COR SIMULATE - This pushbutton will trigger the COR circuitry, and simulate an incoming signal to the switching circuits. This is very useful for repeater testing purposes, as it brings-up the transmitter and permits the other front-panel controls to be tested. A push-on, push-off switch is used, and will remain *activated* until the button is pushed a *second* time and the light goes off. While activated, the Time-Out timer may be set, and the INHIBIT-RESET and COR DISABLE functions checked. When released, the HANG TIME may be set. Also, while activated, the Exciter and Final Amp currents and relative outputs may be checked on the meters. The machine is "Timed-Out" when the INCOMING SIGNAL lamp is lit, but the TRANSMITTER light is out - (assuming the repeater is not in INHIBIT mode.)

3.2.7 INHIBIT-RESET - This pushbutton/indicator performs a double function. 1.) Positive local control of the repeater transmitter. Whenpushed, (and illuminated), the transmitter is shut-down and cannot be brought up by *any* means, (except the local mic PTT button.) 2.) If the transmitter has been *remotely* inhibited, this lamp will be illuminated to display this condition of the internal logic circuits. The Inhibit mode, (either remote or locally initiated), may be Reset by pushing this button. (Light goes out.)

3.2.8 MANUAL ID - When pushed, this button instantly brings up the CW ID without waiting for the normal time interval. The light indicates that the ID is on, (whether manually or automatically activated). This control is very useful for setting the various ID board controls. If the button is held in, the unit will ID continuously until the button is released. (Pushing this button will *not* upset the normal ID timing interval set by the timer pot on the ID board).

3.2.9 MONITOR VOLUME - Adjusts the receiver audio level to the front panel monitor speaker. (Has *no* effect on repeated audio.) Note that the CW ID is not audible on the local monitor speaker. This control should be set to minimum when the repeater is left unattended.

3.2.10 SQUELCH - Simultaneously sets both the receiver squelch threshold and the COR Trigger point. As the control is advanced clockwise, a stronger signal will be required to trigger the repeater. Since the Squelch/COR 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 1/8 to 1/4 turn *beyond* threshold. This will still be very sensitive, but will prevent "nuisance triggering" of the machine by extremely weak signals, noise, or other extraneous signals which may be present at the repeater 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 repeater with weak incoming signals much smoother and much 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.

3.2.11 REPEAT AUDIO - Sets the level of audio from the receiver (only) into the transmitter. This control should be set such that a *received* signal with 4 KHz deviation is *repeated* with exactly 4 KHz deviation also. (The proper setting for 1:1 input-output deviation is with the knob straight-up at the 12 o'clock position. Increasing this control beyond this setting will result in signals being re-transmitted with greater output deviation than input deviation, and consequently, an increase in background noise, hum and distortion. Also, this will drive the repeater audio stages into clipping, (at about 5 KHz of *output* deviation). *Remember* - all FM signals are clipped and filtered at the transceiver. *Any further clipping* at the repeater transmitter only adds needless distortion and *loss of audio quality!* (Note that the repeater transmitter's audio processing stages prevent overdeviation of the repeater transmitter. Max deviation is normally internally set at 5 KHz--- e.g. if an incoming signal has 6-7 KHz deviation, it will be retransmitted at 5 KHz deviation.)

3.2.12 HANG TIME - Sets the repeater transmitter's "carrier hang time" (The amount of time the repeater transmitter stays on the air *after* the received signal drops). Typically set for 4 to 5 sec.

3.2.13 TIME-OUT - Sets the transmitter "time-out time". When the repeater is "timed-out", the transmitter is shut-down after a certain time duration. The time-out may be either on the input (receiver), or output (transmitter) of the repeater per a jumper wire on the COR/TIMER/CONTROL Board. When T.O. is on the input, the timer circuit times the duration of the *incoming signal* and shuts-down the transmitter after the predetermined time interval has elapsed. The timer resets *instantly* when the incoming signal drops and is reapplied (in this case, the Hang Time is usually several seconds, and there is *no need* to let the repeater carrier drop to reset the timer. Repeater users may reset the timer by merely letting up on their mic button for a fraction of a second). When T.O. is on the output, the timer resets when the *repeater transmitter carrier drops*. In this case, users must let the repeater carrier drop for reset, and hang time is usually fairly short. We recommend T.O. on the input with about 4 sec. hang time. The repeater will be factory set up for T.O. on the input unless otherwise specified.

3.2.14 RF/SIGNAL METER/SWITCH - Reads Transmitter, Exciter and Final Relative RF Output. Readings should be logged for future reference. If readings are significantly different after a period of time, a problem is indicated. Load SWR will affect the readings. The Receive Signal meter is a relative reading signal strength meter which can be very useful for tests at the repeater 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, for comparative signal strength checks on repeater users, etc.

3.2.15 VOLT-CURRENT METER/SWITCH - These readings should also be logged for future reference. The 5V and 13.8V readings should be within $\pm\frac{1}{2}$V. If a sizable variation is noted in the future, a problem is indicated with that stage.

For the 30 Wt. 136-174MHz Repeater: The normal range of Exciter Current is 1.1 to 1.4A on the 1.5 A scale. The normal range of Final Amp. Current is about 2.7 to 3.5A on the 7.5A scale.

For the 30 Wt. 220-240MHz Repeater: The Exciter Current is read as 2X the 1.5A scale;(i.e. 3A Full Scale). Normal current is 1.7 to 2.2A.

For the 75 Wt. 136-174MHz Repeater: Both Exciter and Final Current are read as 2X the normal 1.5 and 7.5A scales;(i.e. 3A and 15A Full Scale). Normal Exciter Current is 2.0 - 2.5A. Normal Final Current is 7.5-8.5A, and should not exceed 9A!

> NOTE: For 75 Wt. 136-174 MHz Repeaters: See Section 6.4.1 for detailed information on the 75 Wt. unit.

## 3.3 REAR PANEL JACKS

### 3.3.1 EXTERNAL DC INPUT - EMERGENCY POWER (Red & Black Binding Posts)

This DC input is provided so that the repeater can be operated on an external source of DC power, such as a car or truck battery, should there be a failure in AC line power. Assuming a 12 V battery is connected to the terminals, when the built-in AC power supply's output voltage drops below 11 V, the battery current conducts through the power diode to power the repeater until AC current is restored. The switching action is instantaneous, reliable, and 100% solid state - no manual switches or relays are required.

When the repeater is operating normally on its built-in AC power supply, about 100mA of current is delivered to the battery as a trickle charge. Note: This is *not* enough to charge a discharged battery - only enough to "float" a *fully charged* battery and prevent self-discharge. When the battery is discharged, it must [redacted].

The Red terminal is the +12 V input. Black is the ground or - terminal. The input is fused with an 8 A fuse. If the 12 V leads are reversed, the reverse voltage protection diode will conduct very heavily and blow the fuse - thus protecting the repeater from damage. When operating on battery power, the repeater will draw about 5 amps of current while transmitting. At least a 70 Amp-Hour battery is recommended. Keep the battery leads as short as possible (6 to 8 feet *maximum*) and use *at least* #12 wire (#8 or #10 preferred).

In normal operation, the *battery voltage must not exceed 13.0V* or there could be damage to the repeater. If it is desired to run the repeater *strictly* on an external DC Power Supply, disconnect the AC line cord, and in this case *only*, the external DC voltage may be as high as 14.6V.

### 3.3.2 ACCESSORY JACKS J602 & J603

These jacks are provided for convenience in interfacing the repeater to other auxiliary equipment and for test purposes. See Table 2 for the pin configurations.

J603 includes pins for +5 and +13.8 VDC output to power auxiliary equipment (½ A max. each - continuous). There are also two pins for remote repeater transmitter control. With this feature, the repeater transmitter may be Inhibited (shutdown) or Reset (to normal operation) remotely - a very useful feature. When inhibited, the transmitter cannot be brought up by *any* means (except the local microphone). Note that the front panel Inhibit-Reset lighted push-button switch performs this same control function *locally* (the indicator lamp is illuminated when the repeater is in Inhibit mode).

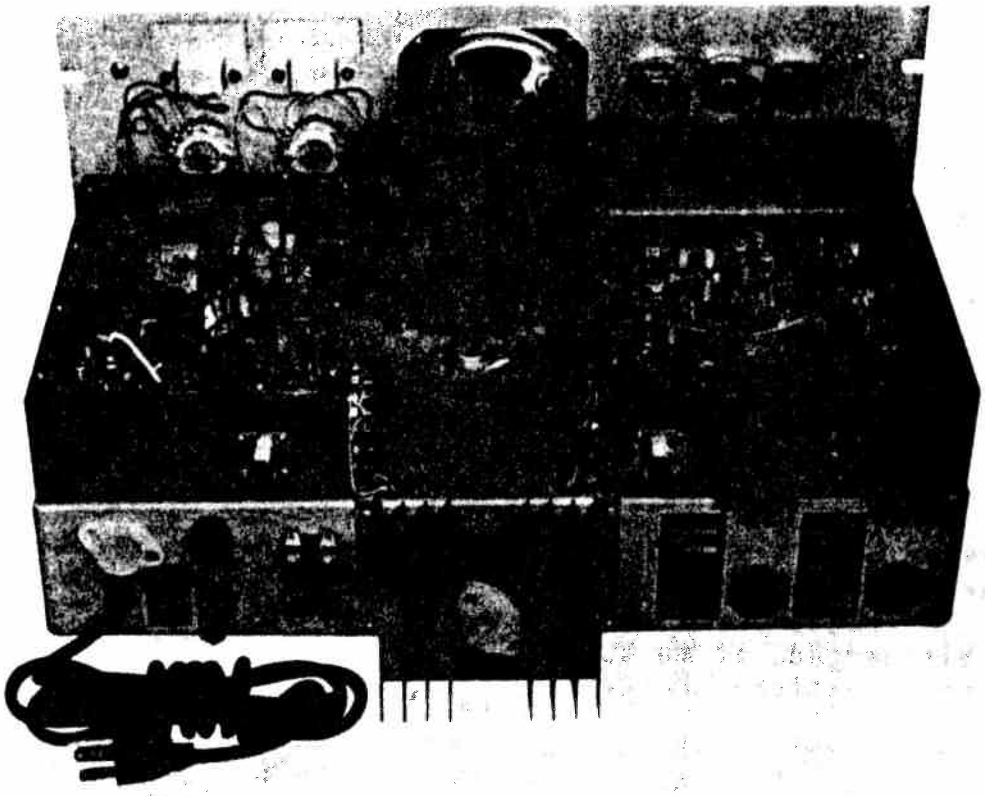


FIGURE 2 - REAR VIEW OF THE SCR1000

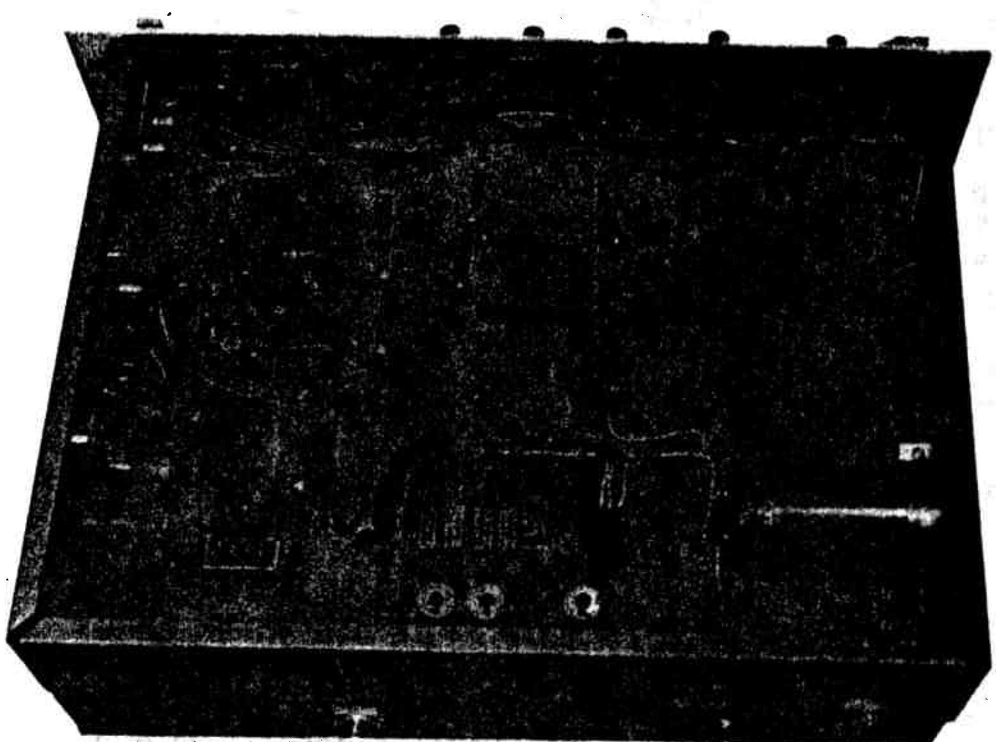


FIGURE 3 - UNDER CHASSIS VIEW SHOWING COR , ID , AND POWER SUPPLY BOARDS

A positive-going standard 4-5 V logic level trigger pulse is required to trigger the Inhibit-Reset circuitry. (The circuit triggers on the *leading edge* of a fast rise time pulse.) This trigger pulse may be the output TTL level pulse of a Touch Tone decoder (such as the Spectrum TTC100), other digital circuitry, a simple transistor switch, or even relay contacts connected between the Reset and Inhibit pins and the +5 V supply. A single pulse into the Inhibit pin will instantly shut down the transmitter. The transmitter will remain in Inhibit mode until a trigger pulse is applied to the Reset pin-which will instantly reset the control circuits to normal operation.

J602 includes pins for Audio Inputs and Outputs, transmitter keying (PTT) and COR switching. These connections are very useful for interfacing equipment such as an Autopatch, TT Decoder, or external source of audio input to the repeater transmitter.

Pins 1, 2, and 3 bring Repeat Audio out of, and back into the repeater. (Repeat Audio is the audio out of the receiver which modulates the transmitter.) Pins 1 and 2 are normally jumpered together, but this connection may be opened for autopatch or other use. Also, with proper external circuitry (Such as a DIP relay or transmission gate), repeat audio could be *muted* for the duration of a touch-tone autopatch turn-on swquence so that these tones are not repeated. Shielded wire *must* be used for these connections, and pin 3 used for the shield ground connections. (Pin 3 is not directly grounded at the jack in order to eliminate hum-producing "ground loops". It *is* connected to chassis ground at the far end of the internal shielded wires.) In order to keep hum to a minimum, only low-level audio signal grounds should be connected to Pin 3 (i.e. not DC ground, etc.).

Pin 4 - *Ground* this pin to trigger the transmitter remotely (may be grounded through the collector of an NPN switching transistor such as a 2N2222A, or through relay contacts, etc.). Triggering the transmitter for *any length* of time via Pin 4 *will not* cause the transmitter to "time out".

Pin 5 - This is an open collector transistor switch which is triggered by the COR - (switches ON--or "low" -- when there is an incoming signal to the receiver). Useful for autopatch and many other applications.

Pin 6 - Auxiliary Audio Input to the transmitter. (Level Adjust pot is on the ID & Audio Mixer Board). Maximum input sensitivity is 100mVp-p (36Vrms) for ±5KHz transmitter deviation with a 1 KHz tone. Use shielded wire on pin 6 and use pin 3 for ground. Useful for autopatch or any other application which requires voice or tone audio to modulate the repeater's transmitter.

Pin 7 - Receiver Audio Output (High Impedance line), *after* squelch gate. Maximum output level: 0.6 Vp-p (0.22 Vrms) w/1 KHz tone @±5 KHz deviation. *Do not* load down this terminal with low impedance loads. Use at least a 10K ohm load impedance *or greater*. (10K ohm pot, etc.) Shielded wire *is required* for connection to this point. Use pin 8 for ground.

Pin 8 - Chassis Ground.

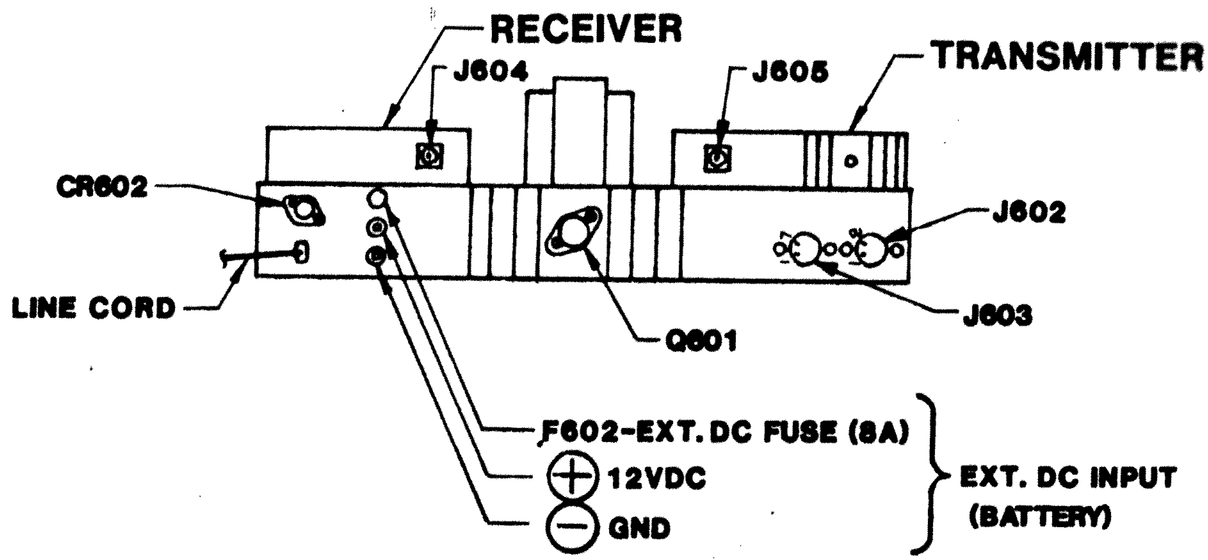



FIGURE 4

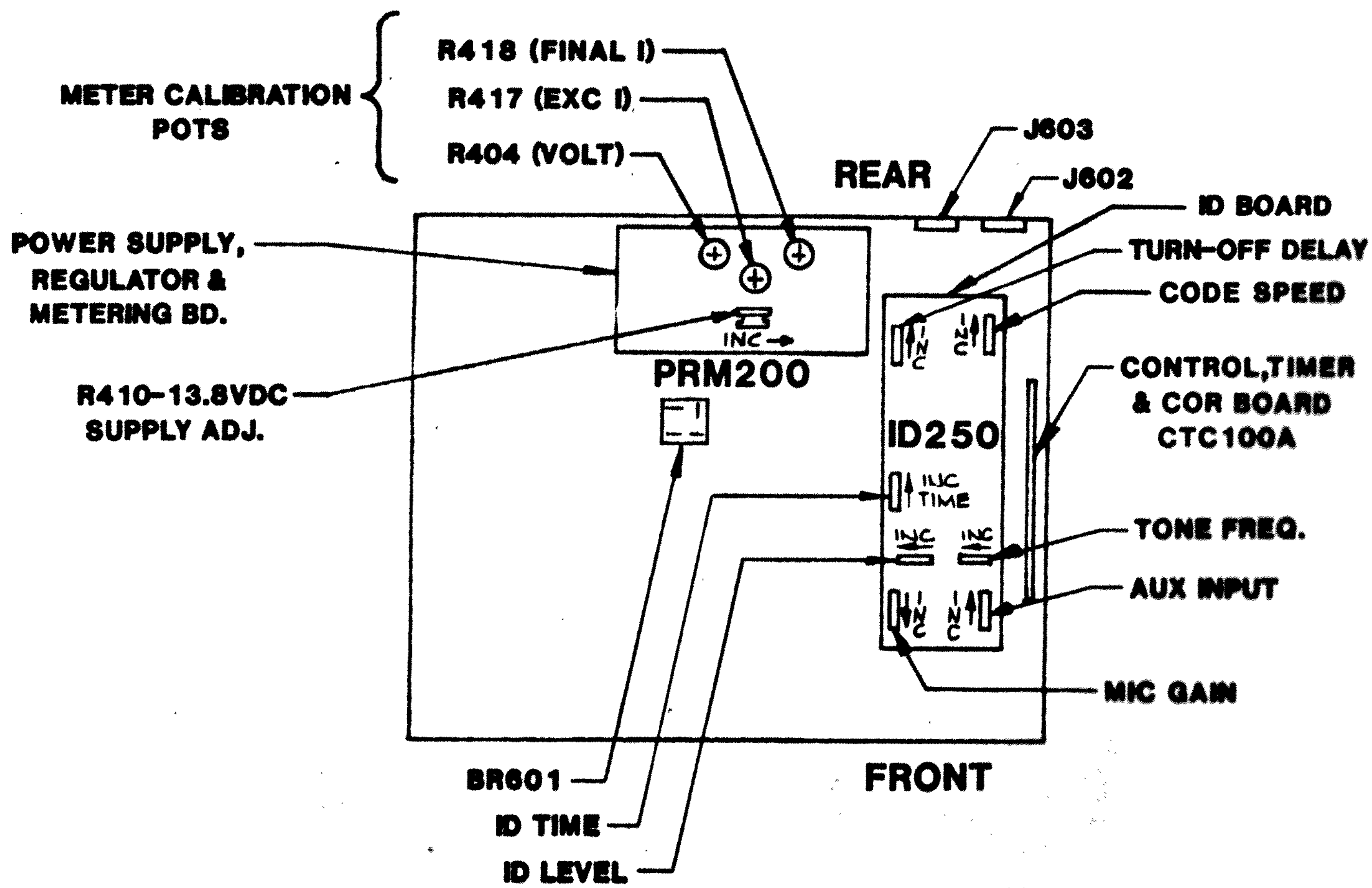



FIGURE 5

# SCR1000 REPEATER CHASSIS LAYOUT

## SECTION 4 REPEATER INSTALLATION & OPERATION

### 4.1 DUPLEXERS, WHITE NOISE, "DESENSE", ETC.

We recommend a good quality duplexer with approximately 90 dB isolation and silver-plated cavity center conductors. Duplexers with a bandpass/bandreject response are highly recommended. Each repeater transmitter is carefully checked on a spectrum analyzer before it is shipped, and white noise is at least 90 dB down @±.6MH Spurious outputs are at least 70 dB down. Note that transmitter "white noise" is low level wideband noise that is generated in *all* types of oscillator, multiplier and amplifier stages. This noise will be found to varying degrees in *all* transmitters. If not properly filtered out by the duplexer, this noise can mask weak received signals.

System performance may be computed as follows:

| | |
|---|---|
| + 45dBm | 30 Wts. Output (Note: 0dBm = 1mW) |
| -90dB | White Noise is 90dB below carrier |
| -45dBm | Absolute Level of Noise |
| -90dB | Duplexer isolation to receiver port |
| -135dBm | Level of white noise at receiver port |

This is *below* minimum detectable signal level of the receiver.

Transmitter white noise is best checked with a steady, weak signal into the repeater system (20 to 30dB of quieting) with duplexer and antenna connected. Listen on the local monitor speaker, and alternately push the COR Disable switch on and off, while listening for an increase in noise which may mask the weak signal. (Reduce Hang Time to zero.) If an increase in noise is heard when the transmitter is activated, it is most likely *not "desense"* as is commonly believed, but transmitter white noise getting back into the receiver due to insufficient isolation in the duplexer. The extremely wide dynamic range of the Spec Comm receiver *precludes true desensitization* of the receiver due to overload by the transmit carrier *unless* the duplexer is greatly out of tune, or, where two antennas are used and there is insufficient separation. (80dB <u>minimum</u> - 100 ft. vertical separation min.-recommended.)

#### 4.1.1 DUPLEXER TUNING

If transmitter white noise is a problem, the duplexer may have to be tuned slightly into your system since different cable lengths and antenna VSWR can affect cavity tuning. (Antenna <u>VSWR must be *under* 1.4:1</u> for a duplexer to operate properly.) If cavity tuning is required, carefully tune the "Transmitter" cavities for minimum noise on the weak signal, consistent with maximum power out to the antenna. (Note: *Only double shielded* coax cable should be used in the system - such as RG-9B/U or RG-214/U. *Do not* use the commonly available "loose braid" coax such as "RG8 Type". Keep cables at least one foot apart. It is recommended that the cavity tuning rods be measured or marked, so that you can return to the original settings if required.

## 4.2 TRANSMITTER TUNING FOR MINIMUM WHITE NOISE

If the duplexer has been tuned and some white noise remains, it may be necessary to tune the repeater transmitter for minimum noise. Again, this should be done with a weak, steady received signal which is monitored on the local speaker while the COR Disable button is pushed on and off. The coils and the various trimmer caps should be carefully tuned for minimum white noise consistent with maximum output power (preferably with a Bird wattmeter, or equivalent, at the output of the duplexer). The coils should be tuned ±1 turn, or ±2 turns, and the effect noted. *If there is no effect, return to the original setting.* If necessary, the ceramic trimmer caps may be adjusted - a fraction of a turn only. Driver and final amp trimmers are adjusted for maximum output consistent with minimum white noise and minimum current.

If all else fails, any remaining white noise can normally be eliminated by the addition of one or more cavities(notch type) to the *Transmit* side of the duplexer. This will pass the transmit carrier, but notch-out white noise on the receive frequency.

## 4.3 HIGH POWER AMPLIFIERS

If it is desired to add an amplifier to the repeater transmitter's output, with 70-150 watts output, one additional cavity (notch type) may be required in the Transmit side of the duplexer. It is a little recognized fact that transmitting amplifiers (like receiving pre-amps) have gain, *and a noise figure* - which is typically about *30 dB* for solid state amps! In other words, while the amplifier will provide 5 to 8 dB of gain, it will also increase white noise by about 30 dB. If this is a problem, the only solution is an additional transmitter *notch* cavity, which will supply about 30 dB of increased filtering of white noise between transmitter and receiver.

## 4.4 INCREASING RECEIVER REJECTION OF "OUT-OF-BAND" SIGNALS

The Spec Comm Receiver incorporates one of the "sharpest" and widest dynamic range front-end designs on the market, but even so, if the repeater antenna is located at a site with many nearby VHF transmitters, additional front-end filtering may be required to prevent spurious mixing products (a filter should be planned into the system in advance in this case). Transmitters within ±20 MHz will usually be the biggest problem. Remember - most duplexers have *little or no out of band rejection* - only a notch on the transmit frequency, so do not rely on the duplexer for out of band filtering; *with the exception of the bandpass/band-reject type* which is supplied by Spectrum Communications Corporation.

If spurious received signals or "desense"/front-end overload is a problem due to nearby VHF transmitters, (sometimes producing extreme received levels of *several hundred-thousand microvolts*), the only solution is a good quality cavity *filter* in the receiver input line. In general, a Bandpass Filter is recommended as this will greatly attenuate everything beyond about ±5 MHz. For "closer-in" interference, or where there is only 1 interfering signal, a "Notch Type Filter" is usually preferable. Contact Spectrum Communications for further details. Our FL-6 Filter/ Preamp is highly recommended to "filter out" strong signals more than 4 MHz away.

## 4.5 "TOWER & GUY WIRE NOISE"

In some single-site repeater installations, there may be a problem with intermittent "crackling noises" on the repeater signal, (particularly on weak received signals), especially when there are high winds. This noise has been traced to poor and intermittent metal to metal connections on the antenna tower or nearby metal objects - such as guy wire connection points, tower leg joints, supporting mast intermittently touching the tower's top collar, rusty joints, etc. These metal objects pick up RF from the repeater's transmitted signal, and when moved slightly, will *arc* microscopically to any other metal object touching it. The arc, (which is a very low level effect), produces a wideband RF noise which is radiated, picked up by the repeater's antenna, and heard in the receiver - which is, of course, then re-transmitted.

One stubborn case was traced to a point where a rusty steel supporting mast passed through the collar at the top of a tower, only a few feet below the repeater antenna. The cure to the intermittent connection, which produced a heavy static on windy days, was rather unique. The tower collar was packed with automotive lithium "chassis lubricant"! This grease is very lossy at VHF, and effectively 'shorted-out' the poor connection, and eliminated the noise from that source.

The solution to these intermittent joints is to either bond or insulate the poor connections. Bonding involves either clamping, soldering, or welding the connections together. Wire braid, copper strap, heavy wire, etc., may be used. Any materials which can rust *must not* be used since rusty joints are the *worst* offenders. Once bonded, the connections should be waterproofed with a material such as the commonly available "Silicon Rubber." As an alternative, the connections may be insulated. Guy wires should be insulated with ceramic compression insulators only about 1" from each tower leg. Any wire or metal objects within about 50' of the antenna should not touch each other ! Also, beware of "noise" on the repeater's output due to intermittent cable or antenna connections! Some fiberglass encased 6 dB gain base station antennas are known to become *internally intermittent* after as little as 2 years service - thus producing a terrific noise on the transmitted signal! (Check for intermittent VSWR.)

# SECTION 5 SPECIFICATIONS

## 5.1 RECEIVER

| | |
|---|---|
| Front End | Extremely wide dynamic range/low noise figure front end. Built-in Preamp plus RF Stage and 8 Poles of Preselection filtering. With Exclusive Double Balanced Mixer which greatly reduces intermod, "desense", and overload. |
| Sensitivity | 0.3µV typ. for 12dB SINAD. |
| Squelch/COR/Threshold | 0.1 - 0.2µV typ. 0.25µV max. (Noise operated squelch; fast attack.) Schmidt Trigger/ Hysteresis design. |
| Selectivity — Std. Fltr. | 8 Pole Crystal Filter, +4 Pole Ceramic Filter. -6db @ ± 6.5KHz;-70dB typ. @ ± 15KHz;>-125dB typ. @ ± 25KHz. (20dB quieting Method) \| -85dB nom. EIA |
| Opt. Sharp Fltr. | -6dB @ ± 5.5KHz; -104dB typ. @ ± 15KHz |
| "Desense" - Overload | With a 1µV desired signal, "desense" begins at approx. 50,000µV @ ±600KHz and 100,000µV @ ± 3MHz. |
| Modulation Acceptance | 7KHz nom. |
| Image and Spurious Response | -90dB typ. image<br>-70dB min. spurious |
| Intermodulation | -75dB nom. EIA |
| IF | 21.4MHz & 455KHz. Double conversion. |

Crystal Info.
(40-50MHz Range)

RECV. FREQ.

| | |
|---|---|
| 136-151.000 MHz | $\text{Xtal Freq.} = \frac{\text{Recv. Freq.} + 21.4\text{MHz}}{4}$ |
| 151.001-174MHz | $\text{Xtal Freq.} = \frac{\text{Recv. Freq.} - 21.4\text{MHz}}{3}$ |
| 216-250MHz | $\text{Xtal Freq.} = \frac{\text{Recv. Freq.} + 21.4\text{MHz}}{6}$ |

3rd Overtone, Parallel Resonant, w/30pf Load Cap. Rs 30 ohms. HC-25/U case. Calibration Tolerance: ± 0.001% @ 23°C. Temp. Tolerance: ± 0.0005% from -20 to +60°C.

| | |
|---|---|
| AF De-emphasis | -6dB/octave per EIA Specifications |
| Local Monitor | High quality speaker with oversize magnet for excellent voice fidelity. |

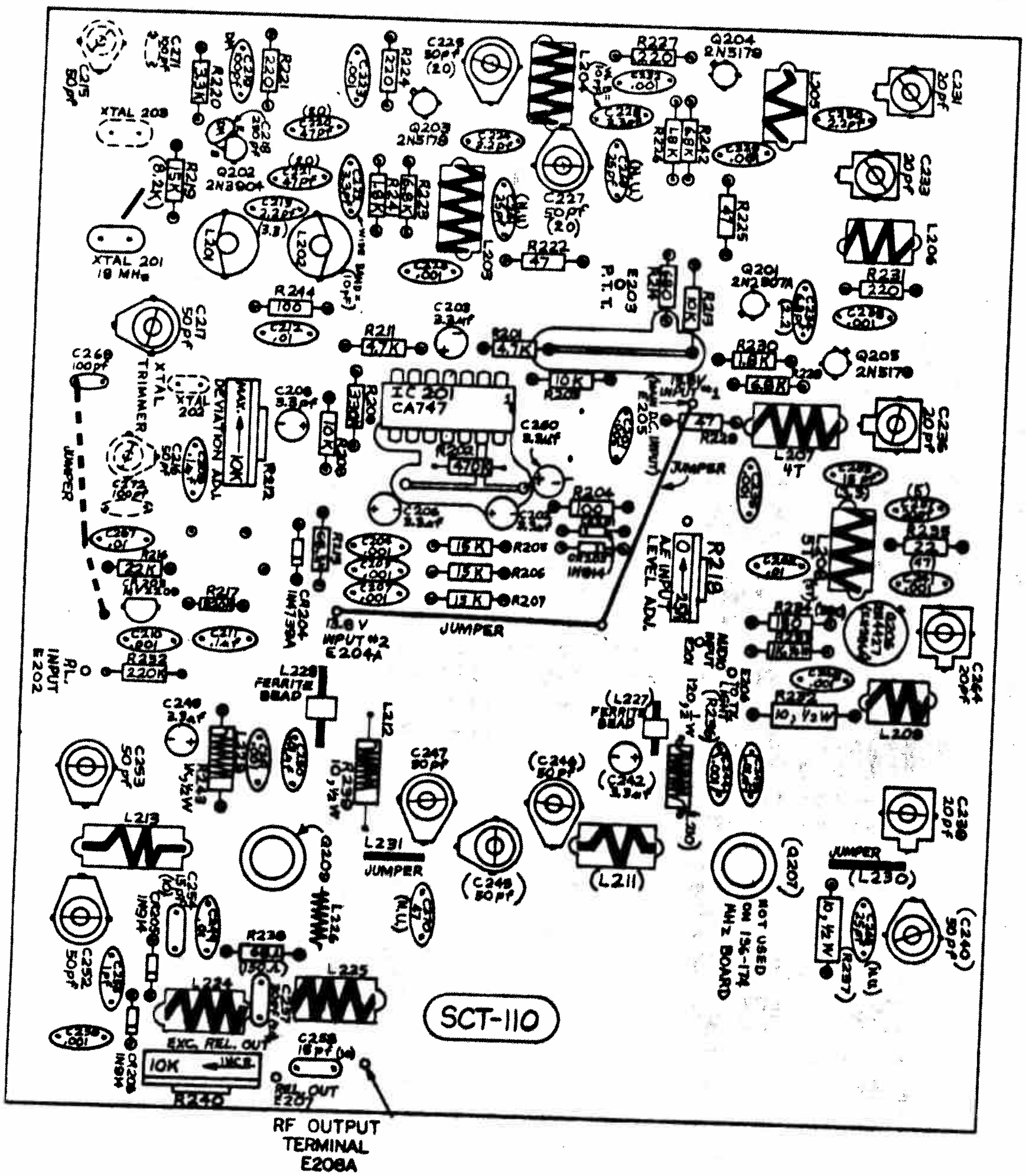
## 5.2 TRANSMITTER

| | |
|---|---|
| RF Output | 30W typ. @ 13.8VDC. 25W min. |
| Final Stage | Efficiency: 70% typ. Emitter ballasted transistor withstands infinite VSWR for up to 1 min. without damage. High efficiency heat sink. |
| Modulation | True FM for optimum audio quality. Instantaneous deviation limiting. Up to ±7KHz max. Each unit is factory calibrated for 1:1 input-output deviation. (e.g. 5KHz input dev. = 5KHz output dev.) Front panel adjustable. Hum & Noise on the carrier is negligible. Overall system audio fidelity & quality is excellent - so much so that it's very difficult to tell the difference between "Direct" and "Repeat" copy! |
| Pre-emphasis | 6dB per octave; per EIA Specs |
| Spurious | -75dB typ. -70dB min. |
| Harmonics | -65dB min. Triple section lowpass filter built-in. |
| Transmit Crystals | Fundamental mode, parallel resonant, w/32 pF load capacity; $R_s$ less than 25 ohms, HC-25/U case. Calibration Tolerance: ±0.001% @ 23°C. Temperature Tolerance: ±0.0005% from -20 to +60°C. |
| For OS-18 Crystal Oscillator Oven: | Calibration Tolerance: ±0.001% @ 80°C. Temperature Tolerance: ±0.0005% from +40 to +90°C. |

| TX. FREQ. | |
|---|---|
| 136-174 MHz | Crystal Frequency = $\frac{\text{Transmit Frequency (MHz)}}{8}$ |
| 216-250 MHz | Crystal Frequency = $\frac{\text{Transmit Frequency (MHz)}}{12}$ |

## 5.3 GENERAL

| | |
|---|---|
| Frequency Range | 136-174MHz. 2M Amateur Band. 216-250MHz. |
| Frequency Stability Tx: | ±0.00020% max. (-30 to +60°C.) w/OS-18 Crystal Oscillator Oven. |
| Rx & Tx w/o OS-18: | ±0.001% nom. (-20 to + 60°C.). ±0.0005% Precision Grade Crystals supplied throughout. |
| Remote Control | "Inhibits" or Resets xmtr. remotely with a 5V trigger pulse or level shift. |
| Timers (All adjustable) | "Time Out": 0.5 to 4 min. typ. Carrier "Hang" time: 0.1 - 6 sec. typ. ID Time: 0.5 to 10 min. typ. (Can be modified to 30 min. max.) |



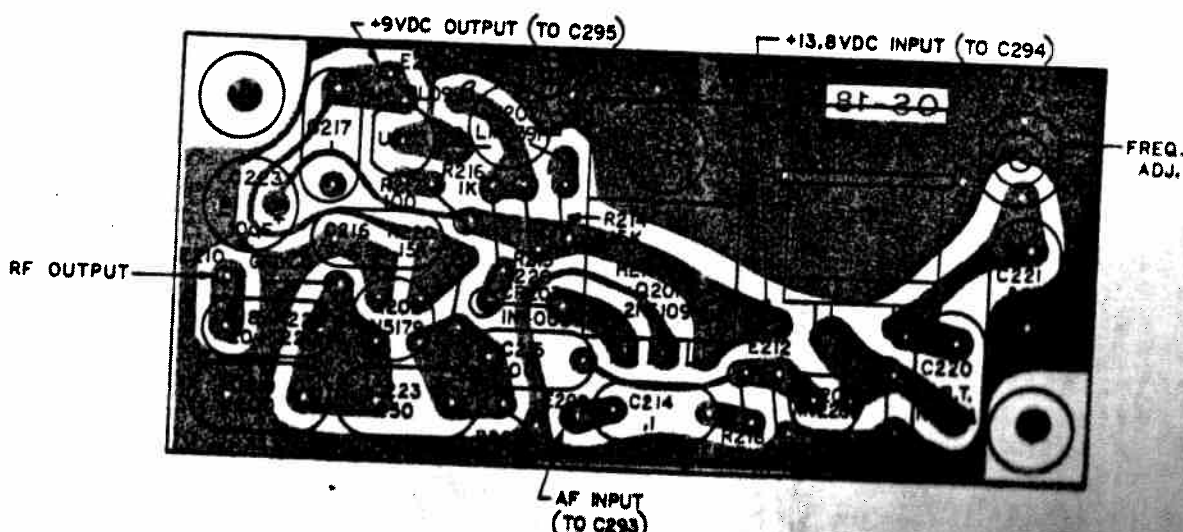

# SCT-110 TRANSMITTER BD. COMPONENT LAYOUT

SCALE 2:1 — DATE 11-14-77 — DRAWN BY R.L.A. — REVISED 2/20/80

FIGURE 7

NOTES:
1) VALUES IN ( ) ARE FOR 220 MHz UNIT. (N.U.)= NOT USED ON 220 MHz UNIT.
2) NOT ALL PARTS SHOWN ARE USED ON ALL VERSIONS OF THE SCT-110.

OS-18



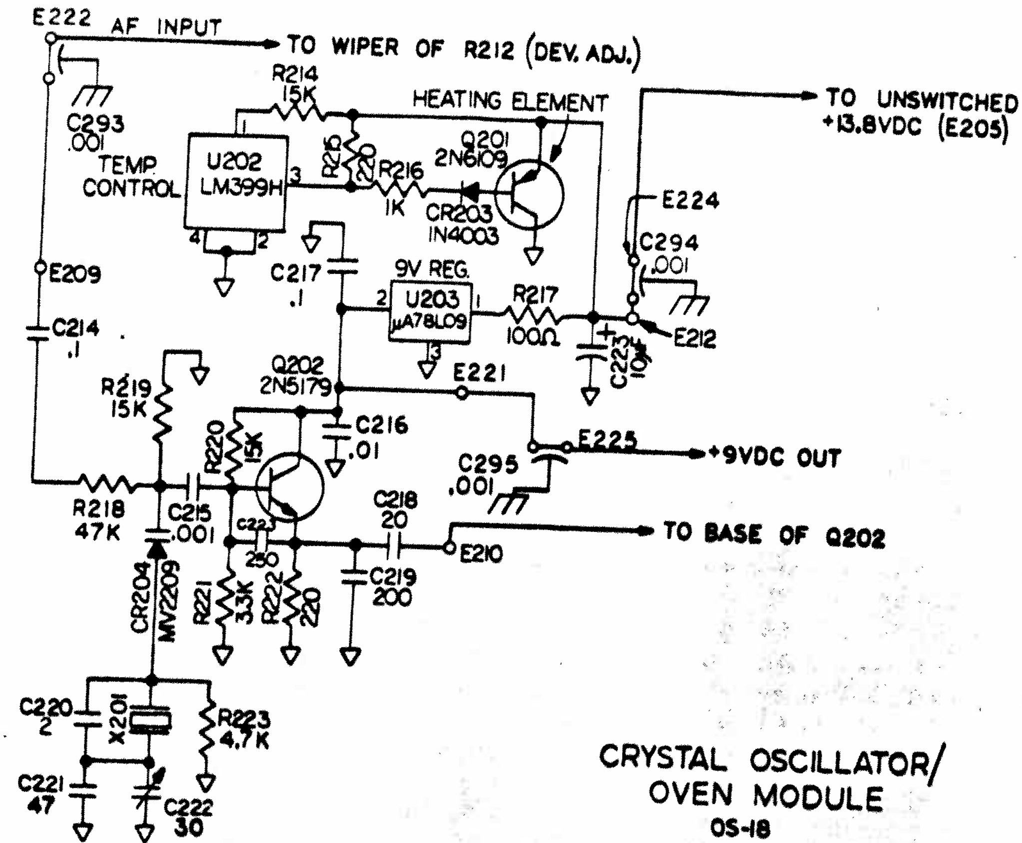
## 6.2 TRANSMITTER

Initial FM signal generation is accomplished at Q202 and its supporting circuitry. This stage is a modified Clapp oscillator with the 18 MHz crystal operating on the inductive slope of its parallel resonance curve. The collector circuit of Q202 is resonated at the second harmonic of the crystal frequency, (third harmonic on 220 MHz versions), by a double-tuned filter, and is applied to the base of Q203, a frequency doubler. FM modulation is affected by "modulating" the crystal load capacitance with varactor diode CR203. A steady-state D.C. bias for CR203 is provided by R217, and the modulating audio signal is superimposed on this voltage through C209.

Modulating audio for CR203 is pre-emphasized by R203, C201 and C259, and is applied to IC201A where it is amplified by a factor of 68. The output of IC201A is applied to "back-to-back" diodes CR201 and CR202 which cause the audio signal to be limited to a maximum value of about 1.4 Vp-p. The limited audio signal is next applied to a 3 section RC lowpass filter which removes most of the high order harmonic distortion produced by the limiting process. The output of the lowpass filter is fed to IC201B for further amplification, and is finally connected to the varactor modulator through Deviation Pot R212.

The RF drive to Q203, now at 36 MHz (55 MHz in 220 MHz versions), is doubled in frequency and is filtered by another double tuned circuit before being applied to the base of Q204. Q204 is another frequency doubler, and the 72 MHz drive at its base (110 MHz in 220 MHz versions), is multiplied in the collector circuit to 144 MHz (220 MHz), the final output frequency. The signal is again filtered in a double-tuned circuit, and is fed to the base of pre-driver Q205. The signal is further amplified by Q206, and is applied as drive to the Class "C" amplifier chain consisting of Q207 and Q208. (In SCR1000 2M repeater applications, the output from Q206 is applied directly to Q208, and Q207 is eliminated. Power output from Q208 (about 10-12 watts in 220 MHz versions) is finally applied to a 2 section harmonic filter, and is routed to the RF output of the board. A sample of the RF output from Q208 is picked off before the harmonic filter, and is rectified by CR205 and CR206 to drive a Relative Output meter.

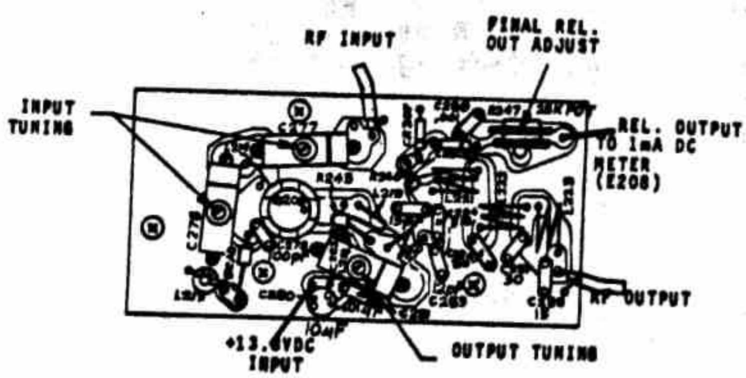
For high stability applications, (FCC Type Accepted unit, etc.), the OS-18 Crystal Oscillator/Oven is used. Q211 is the oscillator transistor which is operated in the Clapp configuration in the 17-22 MHz range. IC202 is the precision Temperature Controller IC which maintains the oven temperature at +80 ±2oC. Q210 is the power transistor employed as an effective heating element for the oven. The Temperature Controller is a proportional type which smoothly controls the temperature of the crystal and all of the oscillator components. This results in extremely good frequency stability, even over very wide temperature excursions, far superior to that of typical TCXOs! The oscillator's output drives the base of multiplier transistor Q202. See schematic diagram - Figure 5.



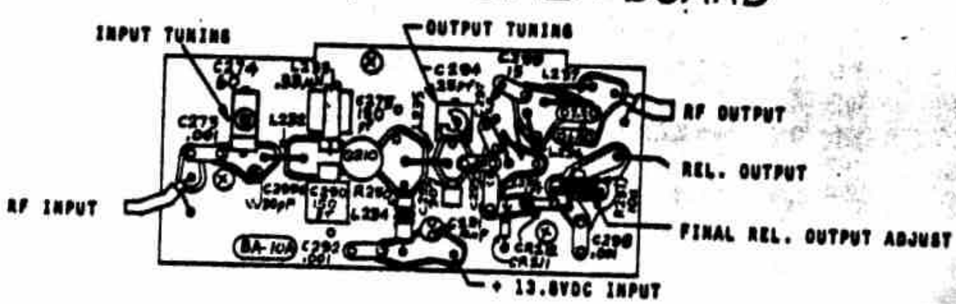

CRYSTAL OSCILLATOR/ OVEN MODULE
OS-18
6-4-80

FIGURE 8

## BA-10 (136–174 MHz) AMPLIFIER BOARD
### COMPONENT LAYOUT




## BA-10A (220 MHz) AMPLIFIER BOARD




NOTES: 1) Use silicon grease under transistor stud flange.
Do not overtorque stud.
2) Mount board w/1/8" spacers +.04" washers.
3) Tune Input for max. Peak. Tune Output for max. Peak. - consistent w/ min. current. (3.5A max.)

1-18-80
R.L.A.

FIGURE 9

The 13.8 VDC input is applied directly to Class "C" stages Q207 and Q208, and also to audio stage IC201. Oscillator stage Q202 is run continuously from a 9 volt zener diode regulator for maximum stability. Grounding the PTT input to Q201 causes Q201 to turn on, applying +13.5 volts to both frequency doubler stages and both pre-driver stages.

The RF output of exciter board is next applied to the final amplifier board. The final amplifier is Q209 (or Q210), an emitter ballasted RF power transistor. The power amplifier is designed with sufficient heat-sinking to provide a nominal output of 30 Watts in continuous service when operated into a proper 50 ohm load. The power transistor is capable of withstanding open and shorted load conditions for short periods of time, but this should be avoided, since certain VSWR conditions can cause excessive heat build-up in the amplifier and possibly damage the device.

The output of the amplifier is passed through a 3 section (2 section on 220 MHz) lowpass filter which greatly attenuates all harmonics. A diode rectifier provides a relative indication of peak output voltage which is sampled just ahead of the lowpass filter. R247 is set for a relative final output reading of 6-8 on the meter for approximately 30 Watts out to a 50 ohm load.

## 6.3 CONTROL/TIMER/COR BOARD (CTC100A)

Referring to the schematic, the COR trigger output from the receiver is connected to terminal E 323 on the COR board. This trigger voltage is in a "high" state with no received signal (squelch closed); and it switches "low" with a received signal (squelch open). The voltage is dropped to a lower level by resistive voltage divider R13 and R14, and then applied to one input (pin 6) of NOR gate U2D. The remaining input of U2D is driven from the output of U3A, a flip-flop which is toggled by the front panel "COR SIMULATE" indicator lamp driver. The output of U2D, then, is a logic "high" in the presence of either a simulated or an actual signal acquisition, and is used to drive Q3, the "INCOMING SIGNAL" indicator lamp driver. This logic level is switched by the front panel "COR DISABLE" switch and is used to trigger the "HANG" timer which consists of Q1, and NOR gates U1A and U1B.

The HANG timer works in the following manner: A "COR" activation causes pin 9 of U1B to go "high" which in turn causes the U1A/U1B flip-flop to be set. Simultaneously, transistor Q1 is turned on, causing the 20uF capacitor to rapidly discharge. At this point, pins 3 and 10 of U1 are at logic levels "one" and "zero" respectively, and remain in this state as long as the COR is activated. Upon deactivation of the COR, pin 9 of U1B goes "low", and transistor Q1 turns off, allowing the 20uF capacitor to charge through R9, the front panel "HANG TIME" pot.

When the 20 uF capacitor has charged to the threshold point of U1A, the U1A-U1B flip-flop is reset and returns to the standby mode.

The "TIME-OUT" timer operates in the following manner: Upon activation of the COR, and for the duration of COR activation, pin 3 of U1 will be high, and pin 10 of U1, as well as pin 11 of U1, will be low. The low condition on pins 10 and 11 of U1 will cause transistor Q4 to be in the off state, and the high condition on pin 3 will cause the 330 uF capacitor to charge through the front panel "TIME-OUT" pot. When the voltage on the 330 uF capacitor reaches the threshold of U2A, pin 1 of U2B will go "low", triggering the U2B-U2C flip-flop. At this point the timer is in the "timed-out" state with pins 3 and 10 of U2 at logic "one" and "zero" respectively. The timer remains in this state until a negative transition appears at board terminal #5, at which time the U2B-U2C flip-flop will be reset. Depending on which jumper wire configuration is selected (term #5 and 4, or term #5 and 7) time-out reset will occur either upon COR deactivation (removal of RCVR signal) or upon "HANG" timer reset (transmitter drop).

The normally low output from the time-out timer and the active low output from the hang timer are summed in NOR gate U2D, which turns on the transmitter PTT driver, Q8. Also summed into U1D is the output of the reset-inhibit flip-flop, U3B. Momentary activation of the inhibit lamp driver, Q9. A pair of inputs are provided for remote inhibit and reset through terminals 20 and 19 respectively.

A positive going pulse of Vcc amplitude on pin 20 will inhibit the transmitter, while a similar pulse on pin 19 will reset the unit to normal operation.

Note: In the above description Add 300 to all COR Board part and terminal numbers.

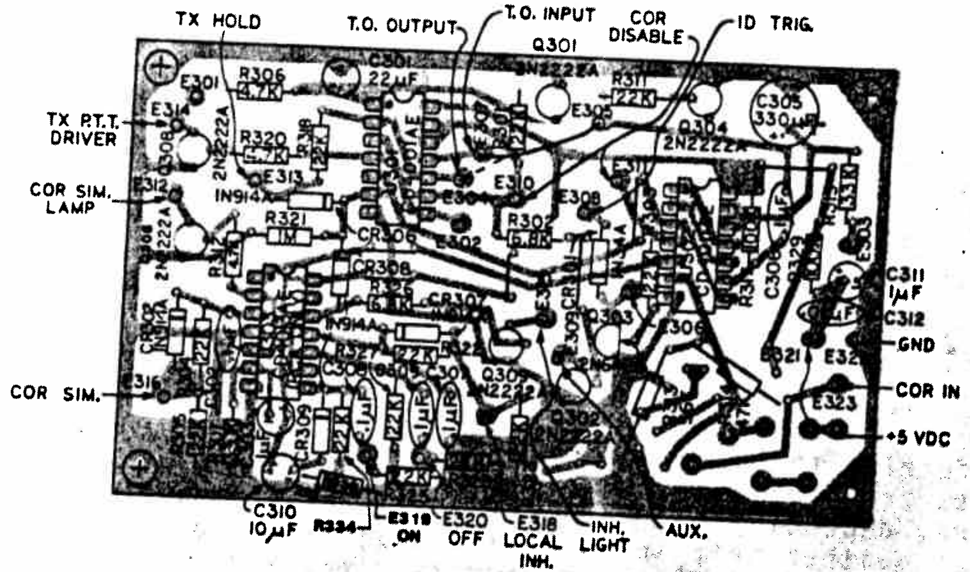



FIGURE 10

SPECTRUM COMMUNICATIONS

DATE 3-21-80 | 5/25/80 | R.L.A.

COR/TIMER/CONTROL BOARD

CTC100A

1300104A

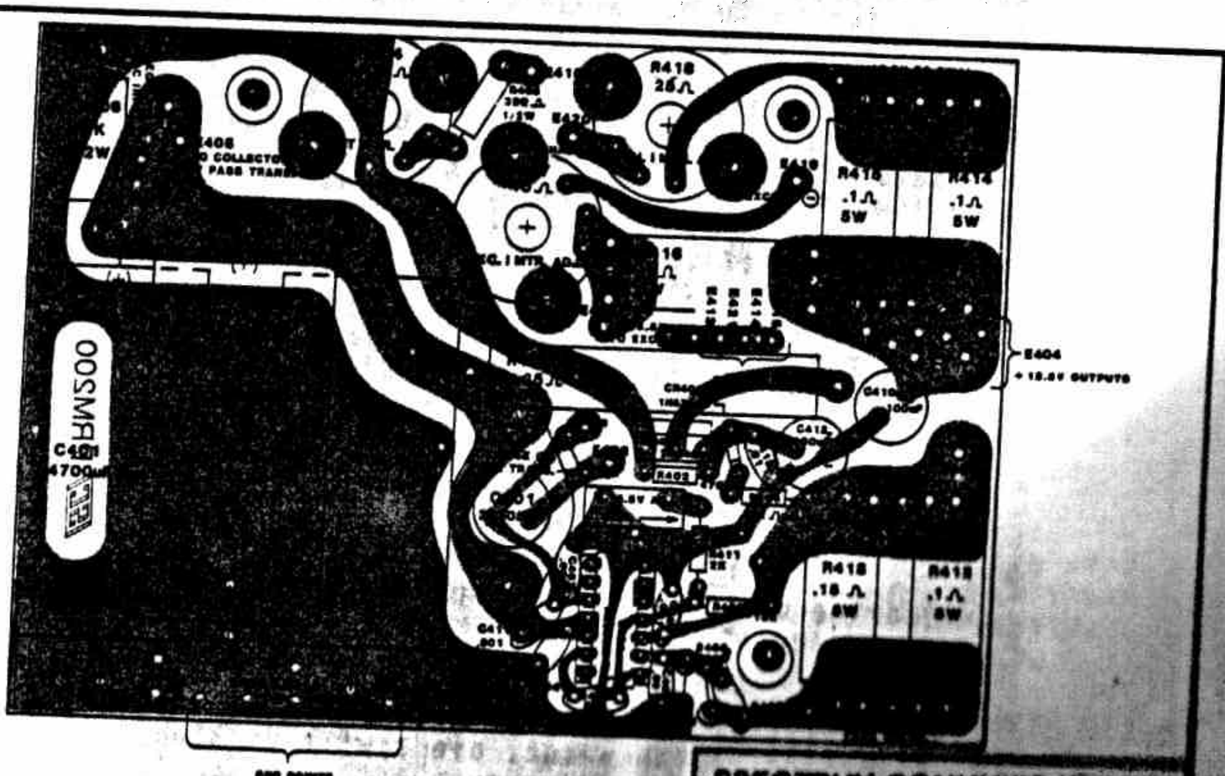



FIGURE 11

SPECTRUM COMMUNICATIONS

PSM200 POWER SUPPLY