

SECTION 7 ALIGNMENT

7.1 RECEIVER ALIGNMENT

Receiver 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.

7.1.1 FRONT-END ALIGNMENT

Connect a good quality FM signal generator to the receiver antenna jack and an AC voltmeter (or "Sinnader" 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 5 KHz 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 0.4 μ V or less for 20dB of quieting (1/10 the original noise reading). Typical 12dB SINAD point is 0.3 μ V.

7.1.2 OSCILLATOR/MULTIPLIER ALIGNMENT

Apply a modulated test signal to the antenna jack (about 10 μ V). Using a standard hex alignment tool, tune the L110 oscillator slug in (CW) until the oscillator stops oscillating. (Received signal disappears.) Slowly turn the slug out (CCW) until the oscillator just starts, then turn the slug out 1½ turns past this point. If the oscillator does not stop, tune the coil for max L.O. RF output, or best SINAD as mentioned below. The multiplier trim caps C131, C135, C137 & C141 may be roughly tuned for best reception of an extremely weak signal; but for optimum alignment, a sensitive RF detector (RF voltmeter, Spectrum Analyzer, -10dBm power meter, etc.) should be connected to the L.O. output TP1 shown in Figure 6. The above caps should then be peaked for maximum output. If spurious response is a problem, coil slugs L111-114 should be carefully adjusted to minimize the response.

7.1.3 21.4 MHz IF ADJUSTMENT

Set the RF panel meter switch to the "Rx Signal" 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 1/10 scale. Adjust L120 for maximum meter reading. Alternately, L120 may be adjusted for best SINAD on a weak signal, (appx. 0.25 μ V). (Note: this adjustment is very broad in tuning.)

7.1.4 QUADRATURE COIL ADJUSTMENT

Use the same setup as in 7.1.1 above, except inject a strong signal (appx. 100 μ V) into the receiver. Be sure the signal is "on frequency" and has 4-5 KHz deviation. Tune the Quad Coil L122 for maximum AF output voltage as read by the AC voltmeter. Then apply a small drop of cement to the coil slug.

7.1.6 SIGNAL STRENGTH (S METER) ADJUSTMENT

Set the meter switch to the "Rx Signal" function. With no input signal, adjust R137 for a 'zero' meter reading. (For a somewhat more "sensitive" S Meter, set R137 for a no signal reading of 0.5 on the scale.

7.1.7 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 21.400 MHz above the desired receive frequency for 136 to 151.00 MHz (&220MHz) Receive Frequencies; and 21.400 MHz below the desired receive frequency for 151.001 to 174 MHz Receive Frequencies.

7.1.8 SQUELCH THRESHOLD ADJUSTMENT - SCR200A

Start with the front panel Squelch pot R604 fully CCW. Then, turn it CW until the squelch just closes. This threshold point should be with the knob set to about the "10-11 o'clock" position. If not, adjust R154 on the SCR200A receiver board until the squelch does close with R604 set to about the 10 o'clock position.

7.2 TRANSMITTER ALIGNMENT

As noted with the receiver, the transmitter should not require alignment unless a RF transistor or IC is changed. Factory tune-up of these circuits is done with elaborate equipment including a spectrum analyzer. Subsequent adjustment should not be performed unless absolutely necessary, as improper alignment could result in undesirable spurious emissions. If alignment is necessary, perform only the applicable steps below.

7.2.1 Observe the Exciter Current Meter, with no crystal installed, the unit should draw 125-200mA in the transmit mode.

Check operation of the audio processing stages by connecting an oscilloscope probe to the wiper of the deviation control. With an input at E201 from an external audio generator, the waveform should be a clean sine-wave, turning into square wave as the input audio level is increased. Adjustment of the deviation control should produce up to 7 or 8 volts of peak to peak audio at this point. When proper operation of these stages has been confirmed, set the deviation control at its mid-point and check for the modulated signal on a nearby receiver or deviation meter.

Install the crystal in its socket and key the transmitter. The indicated exciter current consumption should be noticeably higher (about 1.4 Amp. @8W out, and about 1.8-2.2 Amp. @ 10W out for the 220MHz board.) A VHF RF power meter connected to the antenna connector should now indicate some RF output. Tune all trimmer capacitors for maximum RF output. C278 in the input circuit of the 30W power Amp. stage is adjusted for maximum drive to the device (indicated by final collector current), while C282 is adjusted for maximum power output consistent with good efficiency, (minimum collector current. Normally, CW adjustment.) When tuning this stage, observe that tuning the output trimmers in one direction, (normally CCW), will cause a sharp rise in collector current with only a small change in output power. This indicates a *decline* in stage efficiency and should be avoided. When operating properly, the stage should draw 2.7 to 3.5 amps (at 13.8V) for 30W output, and, in no case, should the stage collector current be allowed to exceed 3.5 amps. *Always* tune the amplifier for maximum output efficiency and minimum white noise. Don't hesitate to loose a watt or two of output if a large current savings or white noise reduction can be obtained. *The reduced current will result in increased long term reliability!*

Tuning the system duplexer while the repeater transmitter is activated can cause very high VSWR conditions to be presented to the final amplifier stage. *Always* observe final collector current (on the front panel meter) when tuning the duplexer, and keep transmissions short when VSWR conditions are high.

REPLACING TRANSMIT CRYSTAL: If the crystal is replaced and it cannot be zeroed on frequency, change the value of C269 near the crystal. If the TX frequency is too high, increase the value of C269. If it is too low, decrease the value of C269. (Typical range: 30 to 200pF).

7.2.2 SETTING TRANSMITTER DEVIATION:

Set front panel RPT. AUDIO pot at full CW. Apply a strong signal to the receiver input (100 μ V min.) modulated \pm 5KHz with a 1KHz tone. Set the DEVIATION Adj. pot (R212) for the desired *max. deviation*. Typically 5 (commercial) or 6 KHz (amateur) MAX. Then set the Rpt. AUDIO pot at the 12 o'clock position. Set the generator dev. for \pm 4 KHz, and set the A.F. Input Level pot (R218) for 4KHz transmitter deviation. Repeat these adjustments twice.

7.2.3 REPLACING TRANSMIT CRYSTAL IN OS-18 OSCILLATOR/OVEN MODULE

The crystal must be replaced in exactly the same fashion as it is found; (i.e. a small amount of thermal grease under the crystal body, and a wire strap to hold the crystal tightly to the board.) If the crystal will not pull on frequency with trim cap C258A, then C259A or C260A may be changed. If you wish to lower the frequency, increase the value of C260A by a few pF. If you wish to raise the frequency, remove C260A; and if necessary, decrease the value of C259A by a few pF. Transmitter Deviation should always be reset after changing a transmit crystal.

7.3 ID/AF MIXER BOARD ADJUSTMENTS

See Chassis Layout (Fig. 5), and ID/AF Mixer Board Layout Dwg. and schematic. As shown on the drawings, trim-pots are provided to adjust ID Code Speed, CW Tone, ID Timing Interval, ID Audio Output Level, Local Mic Gain and AUX AF Input Level. The "Mic Gain" is normally set to max. "AUX Level" sets the deviation level of the AUX AF Input at jack J602-6.

"Code Speed" and "ID Time" may be set as desired. Note: Front Panel "Manual ID" button has no effect whatsoever on the ID timing interval. ID level is normally set for about 2 KHz deviation max. The "CW Tone" pot is adjusted for a pleasing tone pitch. If it is desired to change the "sound" or character of the CW note, the value of C506-508 may be changed on the board (see dwg. No. 3200114 and the schematic). For lower pitch notes add an additional 0.1uF cap; and for higher pitch notes, remove a 0.1uF cap.

7.4 POWER SUPPLY, REGULATOR & METERING BOARD ADJUSTMENTS

R410 - "13.8V SUPPLY ADJUST" - Adjust for 13.8 volts at E1204 on the transmitter housing with a known accurate DC voltmeter or DVM. This adjustment should be made with the transmitter activated. After this, and each of the following adjustments, turn the meter knob back and forth one position several times to be sure the meter stabilizes on the correct reading each time. Some resistance in pointer movement is normal.

R404 - "VOLT METER CAL." - After the power supply has been adjusted to 13.8 volts under load, put meter switch S606 in the "13.8V" position and adjust R404 for an indication of 13.8V on the front panel meter.

R417 - "EXCITER I. METER CAL." - Unsolder the wire connected to E1205 on the transmitter housing, and connect an accurate DC ammeter in the line. Activate the repeater transmitter and measure the current draw. With switch S606 in the "I EXC." position, adjust R417 so that the front panel meter reads the same current measured above.

R418 - "FINAL I. METER CAL." - Unsolder the wire connected to E1204 on the transmitter housing and connect an accurate DC ammeter in the line. Activate the repeater transmitter and measure the current draw. With switch S606 in the "I FINAL" position, adjust R418 so that the front panel meter reads the same current measured above.

SECTION 8 TROUBLESHOOTING

8.1 RECEIVER TROUBLESHOOTING CHART

<u>SYMPTOM</u>	<u>CHECK</u>	<u>REMEDY</u>
No audio output	U104-Pin4 (LM383) DC Voltage, w/ Squelch Open.	Replace if less than 4V.
Rcvr. completely dead	9V Test Point, E114,(See Fig.6). 13.5V TP, E104.	If 13.5V is OK, but 9V is 0, replace Q11. (B+ line was shorted).
Squelch must be advanced somewhat in very hot or cold ambient temp.		Normal in Extreme temp. conditions.
Audio Output low an/or distorted; poor squelch per- formances.	Tuning of L122	Peak for max. AF output on strong tone modulated signal
Low Sensitivity, or no copy at all.	Q101,Q102,Q103 Q104,Q105,Q106,U101 Tuning of Front End trim caps. L.O. Tuning:L110, C131,C135,C137,C141	Replace if doubtful.(If Q101 is damaged, most likely it was due to high transmitter power entering Rcvr. Ant. jack, nearby lightning, etc. Check duplexer, cables, antenna, etc. for intermittents.

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%

GENERAL TROUBLESHOOTING: When checking on a problem, standard procedure is to check the tuning of trim caps and coils, check for bad solder joints, leaky capacitors, and defective transistors and diodes. These are the most common problem areas.

8.2 TRANSMITTER TROUBLESHOOTING CHART

<u>SYMPTOM</u>	<u>CHECK</u>	<u>REMEDY</u>
Low or No Power Output (Low Final Current - Less than 3A on 30W Unit.)	1) Power Supply Voltage 2) Q308 on CTC100A Bd.; Also Q201. 3) Damaged Final Transistor 4) Power Output of Exciter 5) Tuning of Xmtr.- trim caps	Replace bad part " " Retune Exciter or replace damaged part(s)
Low Power Output (High Final Current - Over 4A on 30W Unit.)	1) Detuned Final 2) High VSWR 3) Shorted or Open Component in P.A. Output Circuit (Check Capacitors) 4) Damaged Final Transistor	Retune Tune or replace Antenna Replace Damaged Part "
Distorted Modulation	1) Excessive Audio Drive 2) Off Frequency 3) IC201 with scope for distortion. (Pins 12 & 10.)	Adjust R218 Adjust Xtal Trim cap C21 Replace defective component(s).
No Modulation	1) IC201 (Pins 12 & 10) with scope for distortion. (Inject 1 KHz Tone into E201).	Replace defective component(s)
Crystal can't be set to proper frequency.	1) Off-Frequency Crystal 2) Incorrect value of C269	Replace Crystal Change C269 (30-200pF)
Excessive White Noise or Spurious	1) Exciter and/or final amp tuning - (trim caps). (Use of a Spectrum Analyzer is highly recommended.) 2) All bypass caps	Tune for min. noise or spurious consis- tent w/max. pwr out. Replace

8.3 POWER SUPPLY TROUBLESHOOTING

Turn off the unit *immediately* after observing any power supply problem.

<u>SYMPTOM</u>	<u>CHECK</u>	<u>REMEDY</u>
13.8V Supply dead- Panel meter 0; or, very high - meter pegged. AC hum on Xmtr. signal.	Q601, Q401	Replace if shorted or o

Normal DC Voltage readings on Q601 are:

Col. - GND: 22-25V.
Base - GND: 16V.
Emit.- GND: 15V.

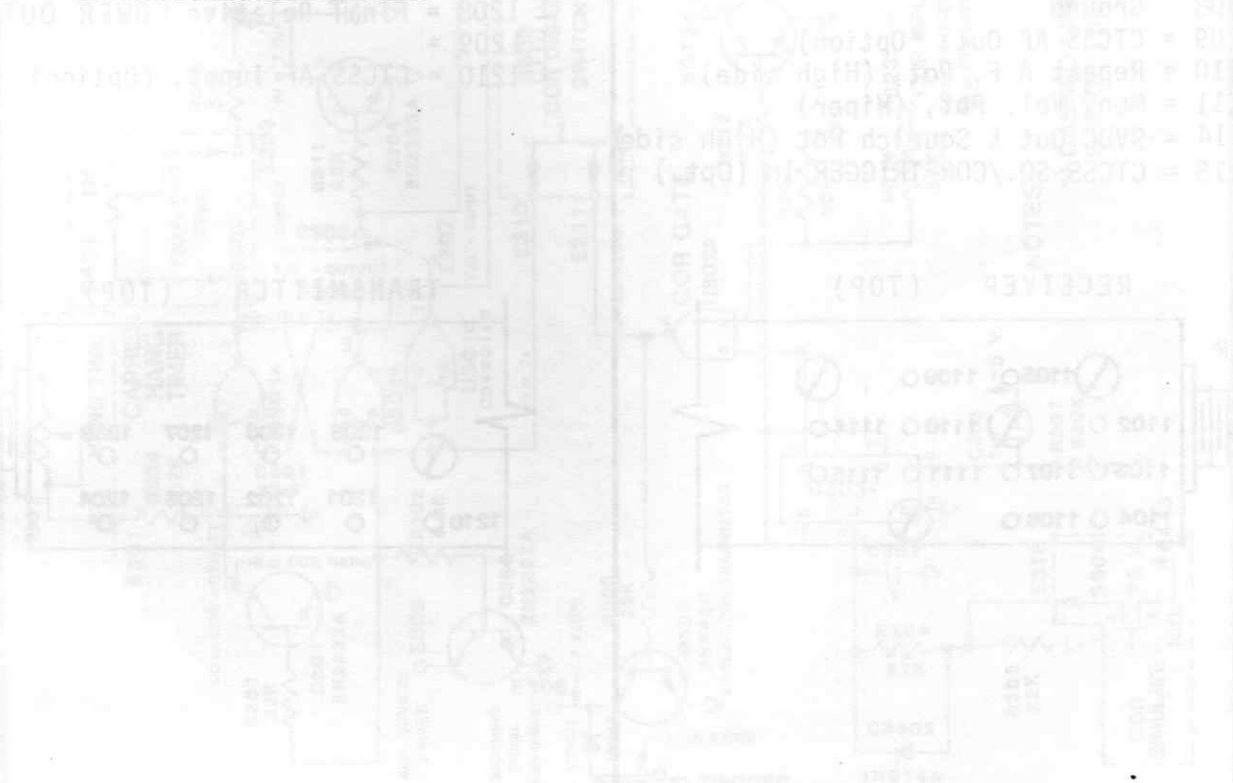
If replacing Q601 and Q401 doesn't solve the problem, then replace U401, but this normally isn't required.

8.4 REPLACEMENT PARTS/FACTORY REPAIR SERVICE

The factory normally stocks a complete line of replacement parts. Write or call the factory for a quote or for a C.O.D. Shipment, etc. If the unit is under warranty and the customer is certain of a defective part, a replacement may be sent at no cost subject to warranty provisions. The factory may request that defective parts be returned.

Units out of warranty: Always contact the factory or your dealer *first* before returning any equipment for repair. Be sure to give *full details*. (A simple fix may be possible in the field.) If notified to return the unit, pack it *very carefully*, and ship U.P.S. Insured. The unit will be repaired as quickly as possible (normally within 1 week.) Units are normally returned in the U.S. via U.P.S. C.O.D. (If you wish to know the repair costs, please call our factory Repeater Repair Dept. a few days after the unit's arrival.)

Units in warranty: See the Warranty in this manual.



SECTION 9 - TABLES

SCR1000 TERMINAL NO'S.

REAR PANEL JACKS - TABLE 1

7 Pin Jack-J603

- Pin 1 = Spare. (Autopatch line opt.)
- 2 = +5VDC @ 500mA Max.
- 3 = +13.8VDC @ 500mA Max.
- 4 = Remote RESET.(Use 5V trig. pulse.)
- 5 = Remote INHIBIT " " "
- 6 = Spare. (Autopatch line opt.)
- 7 = Ground

Banana Jacks - DC Power Input

- Red J604 = +12VDC In, for emergency battery power.
- Black J605 = Ground

8 Pin Jack-J602

- Pin 1 = Repeat A.F. Input(1 & 2 norm.
- 2 = Repeat A.F. Output jumpered)
- 3 = Repeat A.F. Signal Grounds(floating)
- *4 = AUX PTT Input. (GND = Xmit)*
- 5 = AUX COR Switch.(Goes Low, 0.1V, with incoming sig.) (Open Collector.) Can sink 100mA max.
- 6 = AUX Xmtr. A.F. Input (Zin = apx. 1K ohm)
- 7 = Rcvr. A.F. Output. (HiZ:10K ohms)
- 8 = Ground. (Chassis.)

*NOTE: Will NOT "time out".

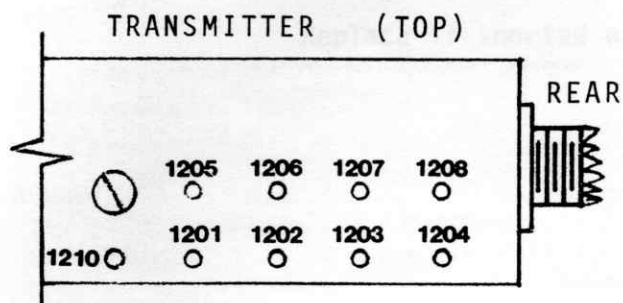
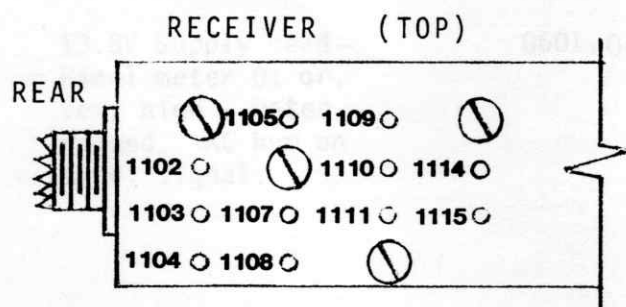
TRANSMITTER & RECEIVER FEED-THRU CAP NO'S. - TABLE 2

Receiver

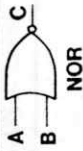
- E 1101 =
- E 1102 = Squelch Pot, (Wiper)
- E 1103 = Speaker A.F. Output
- E 1104 = 13.8 VDC Input
- E 1105 = S Meter Out
- E 1106 =
- E 1107 = COR Output. (LO = Rx Sig.)
- E 1108 Ground
- E 1109 = CTCSS AF Out, (Option).
- E 1110 = Repeat A.F. Pot, (High side)
- E 1111 = Mon. Vol. Pot, (Wiper)
- E 1114 = 9VDC Out & Squelch Pot (High side)
- E 1115 = CTCSS SQ./COR TRIGGER In (Opt.)

Transmitter

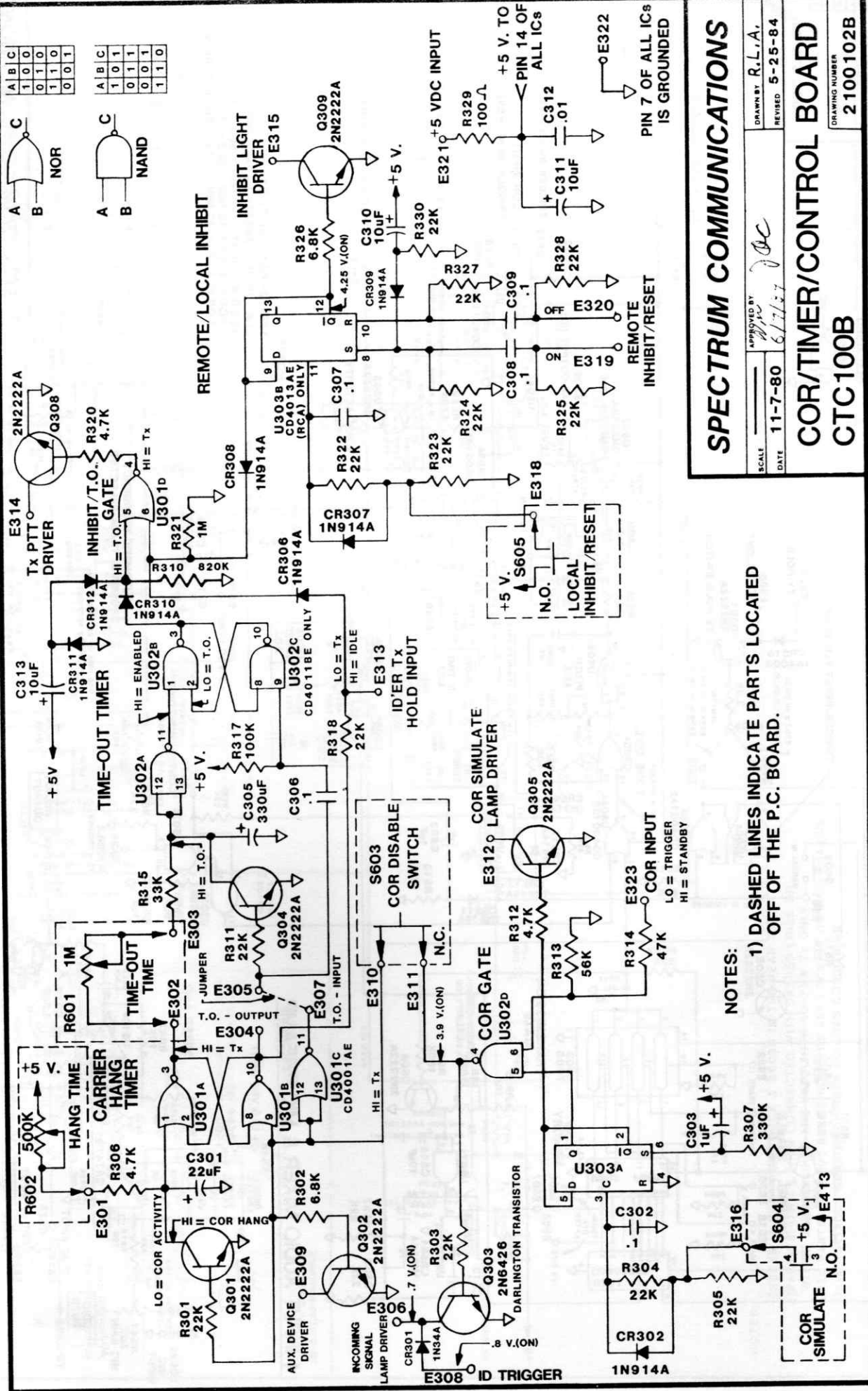
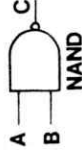
- E 1201 = A.F. Input
- E 1202 = Ground
- E 1203 = Transmit Enable, (PTT)
- E 1204 = Final DC Input, 13.8V
- E 1205 = Exciter DC Input, 13.8V
- E 1206 = Transmit Light, (13V switched)
- E 1207 = Exciter Relative POWER OUT
- E 1208 = Final Relative POWER OUT
- E 1209 =
- E 1210 = CTCSS AF Input, (Option)



A	B	C
1	0	0
0	1	0
1	1	0
0	0	1



A	B	C
1	0	1
0	1	1
0	0	1
1	1	0



SPECTRUM COMMUNICATIONS

COR/TIMER/CONTROL BOARD
CTC100B

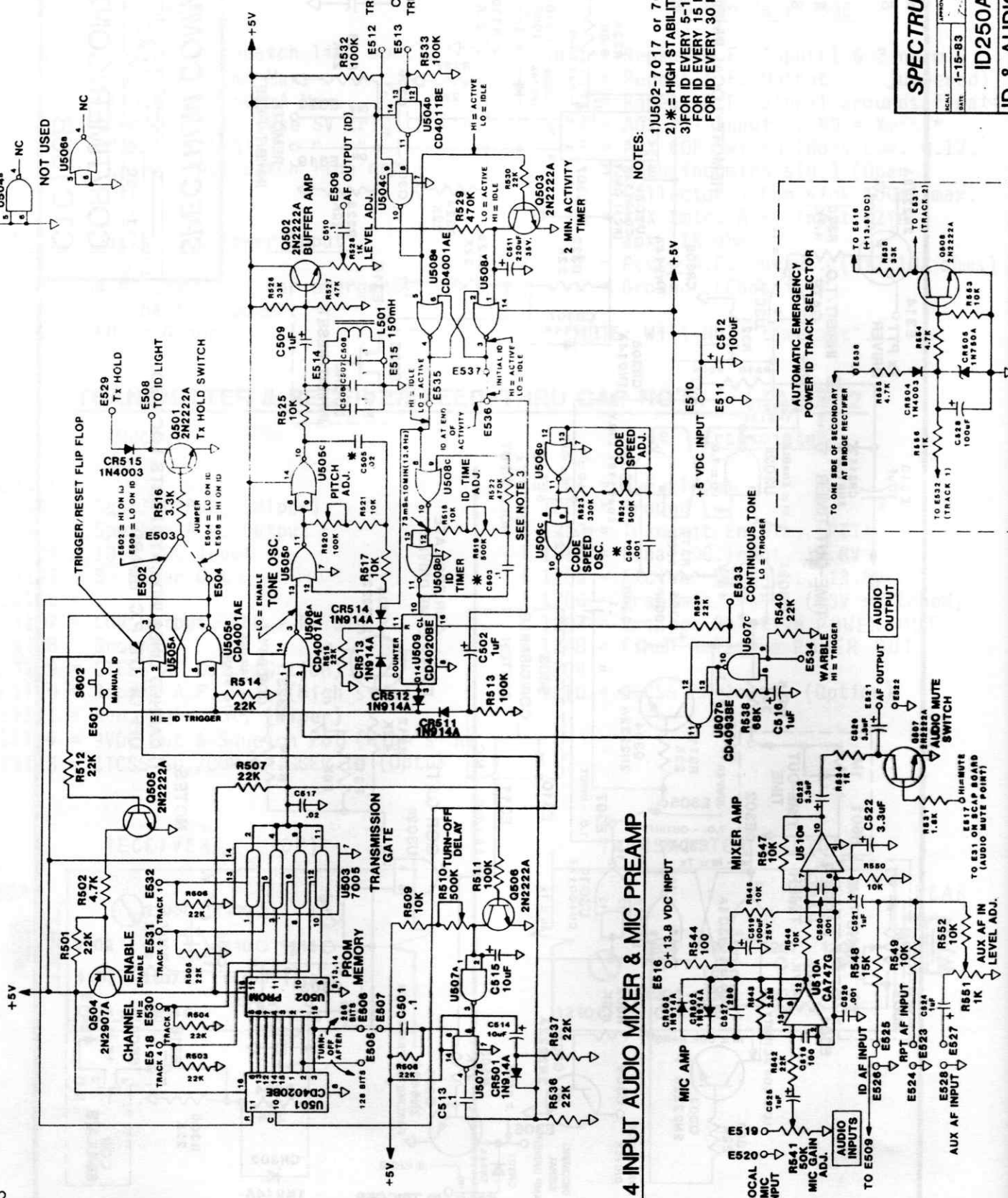
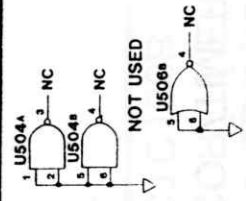
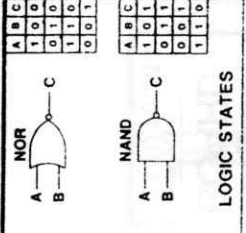
SCALE 11-7-80
DATE 6/7/87

APPROVED BY *[Signature]*

DRAWN BY R.L.A.
REVISED 5-25-84

DRAWING NUMBER 2100102B

NOTES:
1) DASHED LINES INDICATE PARTS LOCATED OFF OF THE P.C. BOARD.



NOTES:

- 1) U502-7017 or 7031.
- 2) * = HIGH STABILITY CAPACITORS.
- 3) FOR ID EVERY 5-10 MIN. C503 = .1uF. FOR ID EVERY 15 MIN. C503 = .2uF. FOR ID EVERY 30 MIN. C503 = .2uF AND R519 = 1MΩ.

4 INPUT AUDIO MIXER & MIC PREAMP

SPECTRUM COMMUNICATIONS

DESIGNED BY: *[Signature]*

SCALE: *[Scale]*

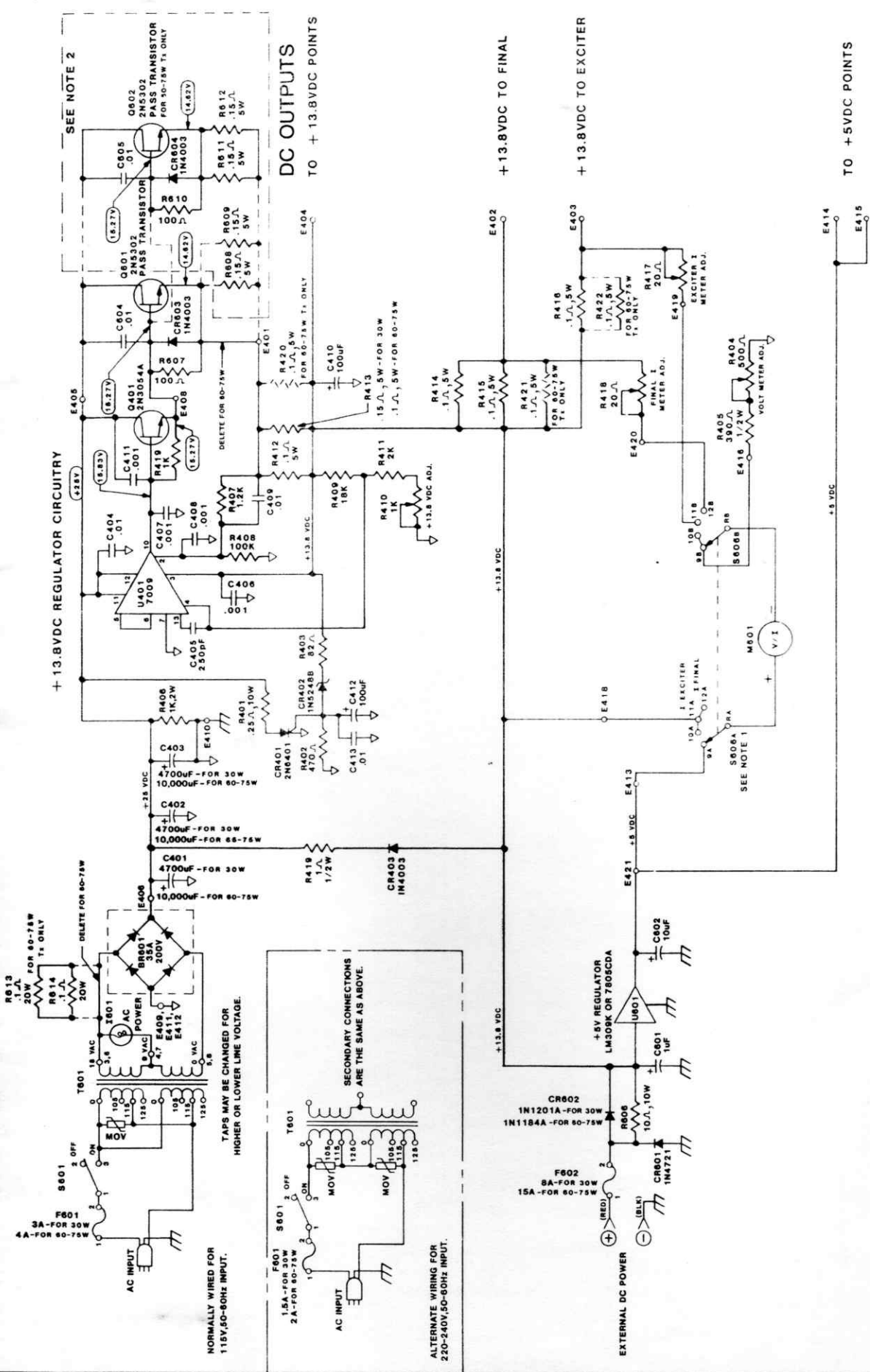
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DRAWN BY: R.L.A.

REVISED: 2-21-84

ID250A SCHEMATIC

PROJECT NUMBER: 3200114



NOTES:

- 1) S606A IS THE FRONT DECK & S606B IS THE REAR DECK.
- 2) PARTS SHOWN EITHER CONNECTED WITH DASHED LINES OR WITHIN DASHED LINES ARE USED WITH 60-75W TX ONLY.
- 3) ALL PARTS WITH 600 SERIES NUMBERS ARE LOCATED ON MAIN CHASSIS.
- 4) ALL VOLTAGES MEASURED UNDER NO LOAD CONDITIONS.

SPECTRUM COMMUNICATIONS	
SCALE: _____	APPROVED BY: _____
DATE: 5-11-84	DRAWN BY: R.L.A.
PRM200A POWER SUPPLY SCHEMATIC	
DRAWING NUMBER 2200149	