6. ACCESSORIES

6.1 MODEL SCC-4 CRYSTAL CALIBRATOR

6.1.1 GENERAL DESCRIPTION

The SCC-4 is a 100 kHz crystal controlled oscillator that injects into the receiver a harmonic every 100 kHz throughout the SPR-4 frequency coverage.

6.1.2 INSTALLATION

Remove the top row of 3 screws on each side of the SPR-4 cabinet. Disconnect the power cord, internal speaker cable and remove cabinet top. Install the SCC-4 by inserting it into the socket marked CALIBRATOR at the left rear of the SPR-4 chassis. Replace the cabinet top, power cord, and speaker cable.

6.1.3 OPERATION

The calibrator is switched on by placing the accessories switch on the front panel in the CAL position.

6.1.4 CIRCUIT DESCRIPTION

Transistor Q2 and the 100 kHz crystal form the oscillator which drives the harmonic amplifier Q1. Harmonics of 100 kHz are generated by the wave shaping diode CR1. The amplified 100 kHz harmonics are coupled to the SPR-4 antenna input through C2.

6.1.5 SERVICE DATA

A voltage chart, schematic and a circuit board layout, Figure 7 are provided for servicing the SCC-4.

6.1.6 ALIGNMENT

The SCC-4 is factory aligned, but due to shock and vibration during shipment, or normal long term drift, adjustment is sometimes necessary. Turn on the receiver and the calibrator and allow it to warm up for at least 30 minutes. Tune in a standard frequency station such as WWV. Carefully adjust the ceramic trimmer capacitor located on top of the calibrator circuit board for zero beat. This completes all necessary alignment.

6.2 MODEL 5-NB NOISE BLANKER

6.2.1 GENERAL DESCRIPTION

The 5-NB is a solid state noise blanker for use with the SPR-4 Receiver. The 5-NB works by muting the receiver for the duration of the noise

pulse. Between noise pulses, full receiver gain is restored. Receiver AVC is affected only by the desired signal and not by noise when the 5-NB is in use. The 5-NB is most effective on strong, periodic impulse noise such as ignition noise.

6.2.2 INSTALLATION

To install the 5-NB, remove the top row of three screws on each side of the SPR-4 Receiver cabinet. Disconnect the power cord, the internal speaker cable and remove the cabinet top. Unplug the jumper cable from the two sockets near the power transformer and marked noise blanker. Retain the jumper cable so that it may be used if the 5-NB should ever require service. Install the 5-NB by plugging it into the two sockets on top of the SPR-4 chassis. Be sure that the 5-NB is seated in the sockets and do not disturb any components on the 5-NB circuit board. Replace the cabinet top, power cord, and speaker cable.

6.2.3 OPERATION

The 5-NB is controlled by the SPR-4 accessory switch. When the accessory switch is in NB position, the 5-NB is turned on. The accessory switch may be left in the NB position for full time protection against noise interference. Some distortion may be noted when using the 5-NB on extremely strong signals.

6.2.4 CIRCUIT DESCRIPTION

Signals at the I.F. frequency from the 1st mixer in the SPR-4 pass through the two pole crystal filter in the 5-NB and are amplified by Q4. The signal on the collector of Q4 is coupled to Q9 and Q10 through T2, C27, T3 and C33 where it is amplified further and passes through T4 to the series gate CR1, CR2 and into the SPR-4 I.F. through T5. The I.F. signal on the emitter of Q4 is coupled through C16 to Q1 which drives the balanced mixer, Q5 and Q6. The balanced mixer subtracts the I.F. signal from the crystal oscillator Q3 and the difference frequency is coupled to Q7 through T7 and C23. Transistors Q7 and Q8 amplify the mixer output. The collector of Q8 drives the pulse detector, Q15 and the AGC amplifiers, Q11, Q13 and Q14. Q14 drives Q2 and Q16 which control the gain of Q1 and Q7 respectively. The AGC system maintains the amplitude of the signals at the collector of Q8 so that the pulse detector, Q15, remains cut-off for normal radio communication signals. When transistor Q15 is cut-off, Q12 conducts and applies a positive potential to the center tap of the secondary winding of T4 which is greater than the + 1 volt applied to the center tap of T5 primary maintaining the series gate in the "on" state. With the series gate "on", radio signals pass through the 5-NB unaffected. Noise impulses larger than the average communication signal will turn on Q15 for the duration of the impulse. This turns off Q12 for the same duration causing the series gate to be

reverse biased and turned "off". With the series gate "off", the signal path through the 5-NB is broken and reception is blanked for the duration of the interferring noise pulse. The 5-NB is turned on by the accessory switch in the SPR-4 which removes the ground from Pin 1 of P-5 and allows Q3 in the 5-NB to oscillate permitting signals to mix in the 5-NB balanced mixer and eventually operates the series gate.

6.2.5 SERVICE DATA

A voltage chart, schematic, and a circuit board layout, Figure 10 are provided for servicing the 5-NB.

6.2.6 ALIGNMENT

The 5-NB requires no alignment at the time of installation. However, should alignment ever become necessary, the following procedure should be used.

Connect a VTVM at 15 volts full scale between the chassis and R46 of the 5-NB (see Figure 10). Tune the SPR-4 to 21.9 MHz while using a signal generator as a signal source. With the 5-NB turned off, adjust C-21, C-26, and C-28 for maximum S-meter reading. It may be necessary to touch up the adjustment of C-21 for the best AM passband as indicated by the S-meter. With the accessory switch in NB position, and the signal source turned off, adjust R-19 for maximum positive voltage on R-46. With the signal source turned on, adjust C-7 and C-18 for minimum voltage on R-46. Tune the SPR-4 to 21.5 MHz while using the 21.5 MHz crystal. With the signal generator turned off, adjust the spacing between C12 and C49 for maximum voltage on R-46. With the signal generator turned on, and still on 21.9 MHz, adjust R-38 so that the S-meter has the same reading with the 5-NB installed as it does with the jumper cable installed.

6.3 MODEL RY-4 RADIO TELETYPE ADAPTOR

6.3.1 GENERAL DESCRIPTION

The RY-4 Radio teletype Adaptor allows the 50 kHz BFO in the SPR-4 to be remotely switched so that standard shift RTTY tones may be centered in the passband of the 50 kHz I.F. filter. The switching is performed by an external circuit which must short the RTTY jack to ground.

When the mode switch is in the CW position and the RTTY jack grounded, the BFO frequency will be switched to 48.590 kHz so that standard 2125 and 2295 Hz tones may be received.

When the mode switch is in the LSB position and the RTTY jack grounded, the BFO frequency will be shifted to 49.350 kHz so that standard 2125 and 2975 Hz tones may be received.

When the mode switch is in the AM or USB position, shorting the RTTY jack will have no effect.

6.3.2 INSTALLATION

This modification should be made by a competent technician. If you need help or want the RY-4 to be installed by one of our factory authorized service centers or by the factory service technicians, please call or write our Customer Service Department.

Disconnect the speaker cable, the line cord, and remove the SPR-4 cabinet. Mount the circuit board in the location shown in Figure 12 using a No. 4 sheet metal screw with a No. 4 lockwasher between the screwhead and the mounting foot. Some early SPR-4 Receivers may not have the hole in the chassis. In this case, mount the circuit board foot under the No. 6 nut on the PTO spade bolt as shown in Figure 12 .

Mount the phono jack (with nut, lockwasher and ground lug on the inside of the chassis) in the hole next to the grounding screw on the rear apron of the chassis. Connect the .01 disc capacitor between the phono jack and the ground lug. Solder only the ground lug. Connect the 3 wires between the terminals on the RY-4 circuit board and the terminals on the BFO board as shown in Figure 13 . Use bare wire and sleeving. DO NOT use any more heat than necessary when soldering the terminals as the circuit boards may be damaged.

Connect the 3 color coded wires between the RY-4 circuit board terminals and switch S-14R as shown in Figure 13 . Connect the white/yellow wire from the RY-4 circuit board to the installed phono connector. Dress this wire along the wiring harness. Solder all connections.

The BFO transformer T-17, must be adjusted for 50 kHz. Place the mode switch in the USB position and the RF gain control fully clockwise. The position of the crystal selector, range switch, and preselector is unimportant. Connect a clip lead with a series blocking capacitor of 1000 pf between the terminal on T-15 and the 10 K resistor of the SCC-4 crystal calibrator. See Figure 8 and Figure 12 . Adjust the slug in T-17 for zero beat. Remove the clip lead and replace the cabinet, If an SCC-4 is not available, follow the B.F.O. alignment in "5.3.1" and make certain the RTTY jack on the rear of the SPR-4 is not connected to ground.

6.3.3 OPERATION

Reception of standard shift (850 Hz) RTTY signals is accomplished by placing the mode switch in LSB position and shorting the RTTY jack with an external switch provided by the user. Reception of narrow shift (170 Hz) RTTY signals is accomplished by placing the mode switch in CW position and shorting the RTTY jack with an external switch.

6.3.4 CIRCUIT DESCRIPTION

The BFO is shifted in frequency for RTTY reception by shunting a capacitor across T17 with an electronic switch. Transistor Q2 electronically switches C2 across T17, and Q3 switches C3. Switch S14R connects the collector of Q1 to the base of Q3 in CW and to the base of Q2 in LSB. If J1 (RTTY jack) is shorted, Q1 conducts and turns on either Q2 in LSB or Q3 in CW, allowing reception of RTTY signals.

6.3.5 SERVICE DATA

A voltage chart,schematic and a circuit board layout, Figure 14 are provided for servicing the RY-4.

6.3.6 ALIGNMENT

Place the mode switch in the USB position and the RF gain control fully clockwise. The position of the crystal selector, range switch and pre-selector is unimportant. Connect a clip lead with a series blocking capacitor of 1000 pf between the terminal on T15 and the 10 K resistor of the SCC-4 crystal calibrator. See Figure 8 and Figure 12 . Adjust the slug in T-17 for zero beat. Remove the clip lead and replace the cabinet. If an SCC-4 is not available, follow the BFO alignment in "5.3.1" and make certain the RTTY jack on the rear of the SPR-4 is not connected to ground.

6.4 MODEL TA-4 TRANSCEIVE ADAPTOR

6.4.1 GENERAL DESCRIPTION

The TA-4 Transceive Adaptor allows the SPR-4 to transceive with the T-4/T-4B/T-4X/T-4XB Drake Transmitters.

6.4.2 INSTALLATION

This modification should be made by a competent technician. If you need help or want the TA-4 to be installed by one of our factory authorized service centers or by the factory service technicians, please call or write our Customer Service Department.

Disconnect the speaker cable and the line cord and remove the SPR-4 cabinet. Mount the TA-4 circuit board with two number 4 sheet metal screws and two lockwashers (with the lockwashers between the screw-heads and the mounting feet) in the chassis holes as shown in Figure 16 .

Connect the five color coded TA-4 circuit board wires by pushing the connectors at the end of each wire onto the appropriate mating pins in the SPR-4 until they are fully seated. See Figure 17 for the location of the

pins. Late SPR-4's have a 12 K 1/2 watt resistor between T-6 and the pre-mixer board. Cut the resistor lead from T-6 and remove the resistor. Route the coax cable along the wiring harness and install the phono fitting on the end of the cable in the large hole near the center of rear chassis apron as shown in Figure 17 . The nut and the flat washer should be on the outside of the chassis.

Remove the SPR-4 S-meter lamp bracket by squeezing the sides of the bracket. Remove the lamp bracket from the crystal selector frame by removing the mounting screw.Locate the audio transformer mounting feet over the two holes in the top of the chassis which are in front of the crystal selector. The black transformer lead should be facing the front panel. Mount the audio transformer by inserting number six screws through the chassis holes from the bottom and into the speed nuts on the transformer. Route the two transformer leads through the rectangular chassis hole. Push the pin on the black wire into the clip on the head-phone jack. Some early SPR-4 Receivers do not have this clip. In this case, solder the black wire to the headphone terminal closest to the RF and audio gain controls. Route the red wire along the wiring harness to the rear of the chassis and mount the phono fitting in the 3/8 inch hole directly below the speaker jack. Some early SPR-4 Receivers may have a 1/4 inch hole in this location. In this case, enlarge the 1/4 inch hole to 3/8 inch. Replace both lamp brackets.

It will be necessary to adjust the injection trimmers after the TA-4 instal-lation. See "5.3 , Paragraph 3" for the required accessory crystals for tuning the injection trimmers. Tune in the signals in the chart below from a signal generator or the crystal calibrator and peak the preselector for maximum S-meter reading. Detune T6 by grasping a metal screwdriver shaft and touching it to the rotor contact of S4R and tune the rear most injection trimmer for the band under alignment for max-imum AVC deflection or S-meter reading. Detune T1 by touching the rotor contact of S8F and tune the front injection trimmer for maximum AVC deflection or S-meter reading.

BAND	FREQUENCY IN MHz
H	28.7 MHz
G	21.5
F	14.0
E	6.0
D	3.8
C	1.9
B	1.6

6.4.3 OPERATION

The TA-4 is activated by circuits in the Drake T-4/T-4B/T-4X/T-4XB Transmitters, therefore operation of the TA-4 is performed at the trans-ceive switch on these transmitters.

6.4.4 CIRCUIT DESCRIPTION

The transceive switch on the T-4/T-4B/T-4X/T-4XB Transmitter controls the TA-4 by applying a negative or positive D.C. potential to the injection cable. When the transceive switch on the transmitter is in SPOT position, no D.C. potential is applied to the injection cable and the injection cable is not utilized. In SEPARATE position, the injection line is connected to the mute jack through a 68 K resistor. The mute jack in the SPR-4 becomes positive under open circuit (receiver muted) condition which supplies base current through R6, CR2 and CR3 to Q2 and turns it on. Whenever, Q2 is on, Q1, Q3 and Q4 are also conducting. The collector current in Q4 drops the gate voltage on the SPR-4 premixer transistor Q5 and cuts it off which eliminates the possibility of the SPR-4 injection frequency from getting into the transmitter and causing a spurious signal.

In RCVR position, the cathode of the premixer tube, V8, in the T-4/T-4B/T-4X/T-4XB Transmitter is connected directly to the injection line which makes it positive, but not enough to cause CR2 to conduct preventing Q4 from disabling the SPR-4 premixer.

T-6 in the SPR-4, drives Q5, an emitter follower, through C5 and R-12 in the TA-4. The output of Q5 drives the injection jack through C7 which allows the T-4XB to transceive on the SPR-4 dial frequency.

In XMTR position, the injection line is made negative which turns on Q1, Q3 and Q4. Collector current in Q4 drops the gate voltage on the SPR-4 premixer transistor Q5 and cuts it off. The injection frequency signal from the transmitter drives the center tap on the link of T6 through Q1 which is used as a switching diode.

T1 in the TA-4 is an audio transformer which matches the SPR-4 audio output impedance to the anti-vox circuit in the transmitter.

6.4.5 SERVICE DATA

A voltage chart, schematic, and circuit board layout, Figure 18 are provided for servicing the TA-4.

6.4.6 ALIGNMENT

The carrier oscillator in the T-4XB must be adjusted so that the SPR-4 and the T-4XB will transceive. Both SPR-4 carrier oscillators must be on frequency. The SPR-4 oscillators are set at the factory and should not require any adjustment. If the SPR-4 alignment is under suspicion, perform the 50 kHz IF and 5645 kHz IF alignment described in 5.3.1 and 5.3.2.

CONTROL OR SWITCH	SPR-4	T-4XB
Band or Range switch	D	3.5
Crystal switch	3.5	---
Function	---	SSB
Mode	LSB	---
Audio Gain	3 o'clock	---
Transceive	---	Spot
Anti-Vox	---	Full clockwise
Sideband	---	Lower
Preselector	Both the SPR-4 and T-4XB preselectors should be set to about 6.5 and peaked for the loudest "canary" sound from the speaker.	

Adjust C-2 in the T-4XB until the "canary" sound slows down to only a few chirps a second and then zero chirp a second and all that is heard is a single tone.

6.5 AVC ALTERATIONS

6.5.1 GENERAL DESCRIPTION

It is possible to alter the SPR-4 AVC system by simple connections to two circuit boards. These alterations allow the gain to be controlled manually with the RF GAIN control and allow fast AVC on CW only instead of the supplied slow AVC response.

6.5.2 FAST AVC ALTERATION

Fast AVC can be obtained on CW for SPR-4's with serial numbers above 1000, by placing a jumper wire between the two terminals at the center of the 2nd mixer board. One terminal has a white/yellow wire connected to it and the other terminal is unused. A resistor placed between these terminals will allow an AVC response between fast and slow. A 6.8 megohm resistor will halve the AVC response time.

6.5.3 AVC OFF ALTERATION

The AVC may be remotely turned off in SPR-4's with serial numbers above 1,000. This is obtained by altering connections to two terminals on the power supply board. One of these two terminals has two white/blue wires attached. Cut the jumper from these two terminals and connect an external SPST switch across these terminals for AVC OFF operation.

SPR-4 ACCESSORY CRYSTAL CHART

OPERATING FREQ. in MHz.	CRYSTAL FREQ. in MHz.	OPERATING FREQ. in MHz.	CRYSTAL FREQ. in MHz.
.15 - .5*	None Required.	15.0 - 15.5*	26.09
.5 - 1.0*	11.59	15.5 - 16.0	26.59
1.0 - 1.5*	12.09	16.0 - 16.5	27.09
1.5 - 2.0	12.59	16.5 - 17.0	27.59
2.0 - 2.5	13.09	17.0 - 17.5	28.09
2.5 - 3.0	13.59	17.5 - 18.0*	28.59
3.0 - 3.5	14.09	18.0 - 18.5	29.09
3.5 - 4.0	14.59	18.5 - 19.0	29.59
4.0 - 4.5	15.09	19.0 - 19.5	30.09
4.5 - 5.0	15.59	19.5 - 20.0	30.59
5.0 - 5.5	16.09	20.0 - 20.5	31.09
5.5 - 6.0	16.59	20.5 - 21.0	31.59
6.0 - 6.5*	17.09	21.0 - 21.5	32.09
6.5 - 7.0	17.59	21.5 - 22.0*	32.59
7.0 - 7.5*	18.09	22.0 - 22.5	33.09
7.5 - 8.0	18.59	22.5 - 23.0	33.59
8.0 - 8.5	19.09	23.0 - 23.5	34.09
8.5 - 9.0	19.59	23.5 - 24.0	34.59
9.0 - 9.5	20.09	24.0 - 24.5	35.09
9.5 - 10.0*	20.59	24.5 - 25.0	35.59
10.0 - 10.5	21.09	25.0 - 25.5	36.09
10.5 - 11.0	21.59	25.5 - 26.0	36.59
11.0 - 11.5	22.09	26.0 - 26.5	37.09
11.5 - 12.0*	22.59	26.5 - 27.0	37.59
12.0 - 12.5	23.09	27.0 - 27.5	38.09
12.5 - 13.0	23.59	27.5 - 28.0	38.59
13.0 - 13.5	24.09	28.0 - 28.5	39.09
13.5 - 14.0	24.59	28.5 - 29.0	39.59
14.0 - 14.5	25.09	29.0 - 29.5	40.09
14.5 - 15.0	25.59	29.5 - 30.0	40.59

* SPR-4 normally supplied with these operating frequencies.

SCC-4 D.C. and R.F. VOLTAGE CHART

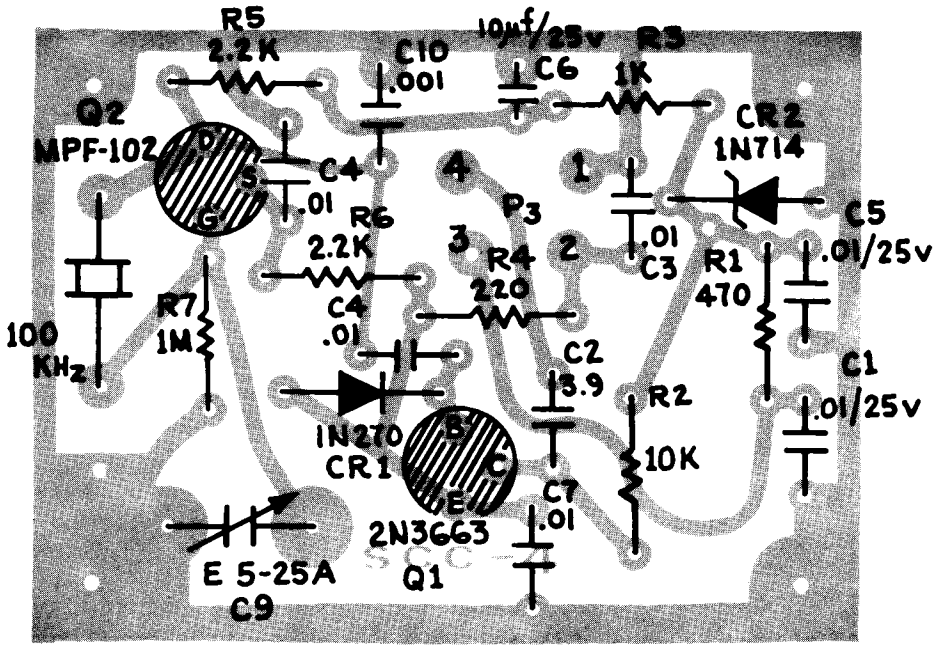
Transistor	Drain Collector	Source Emitter	Gate Base
Q1	3.3 (3 V)	3.0	.8
Q2	6.2 (670 mV)	2.4	0.0

MEASUREMENT CONDITIONS

Conditions same as the SPR-4 R.F. Voltage chart with the accessory switch in CAL position.

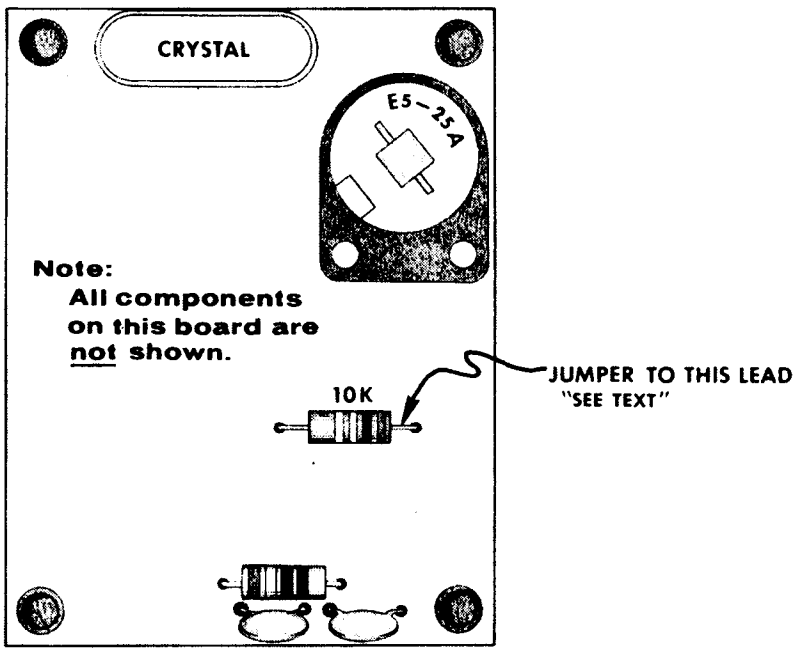
11 megohm VTVM and Boonton Model 91 CA R.F. voltmeter used. 100:1 divider used on measurements above 500 mV.

Measurements in parenthesis are R.F. voltages.



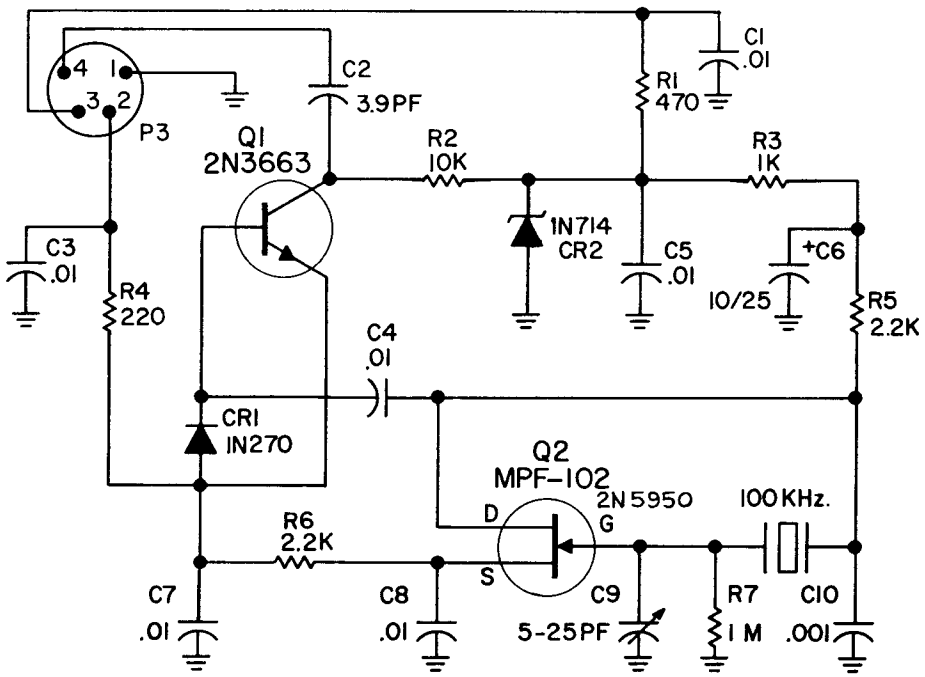
SCC-4 CIRCUIT BOARD

Figure 7



RY-4 CALIBRATION CONNECTION TO SPR-4

Figure 8



SCC-4

SCC-4 SCHEMATIC DIAGRAM
Figure 9

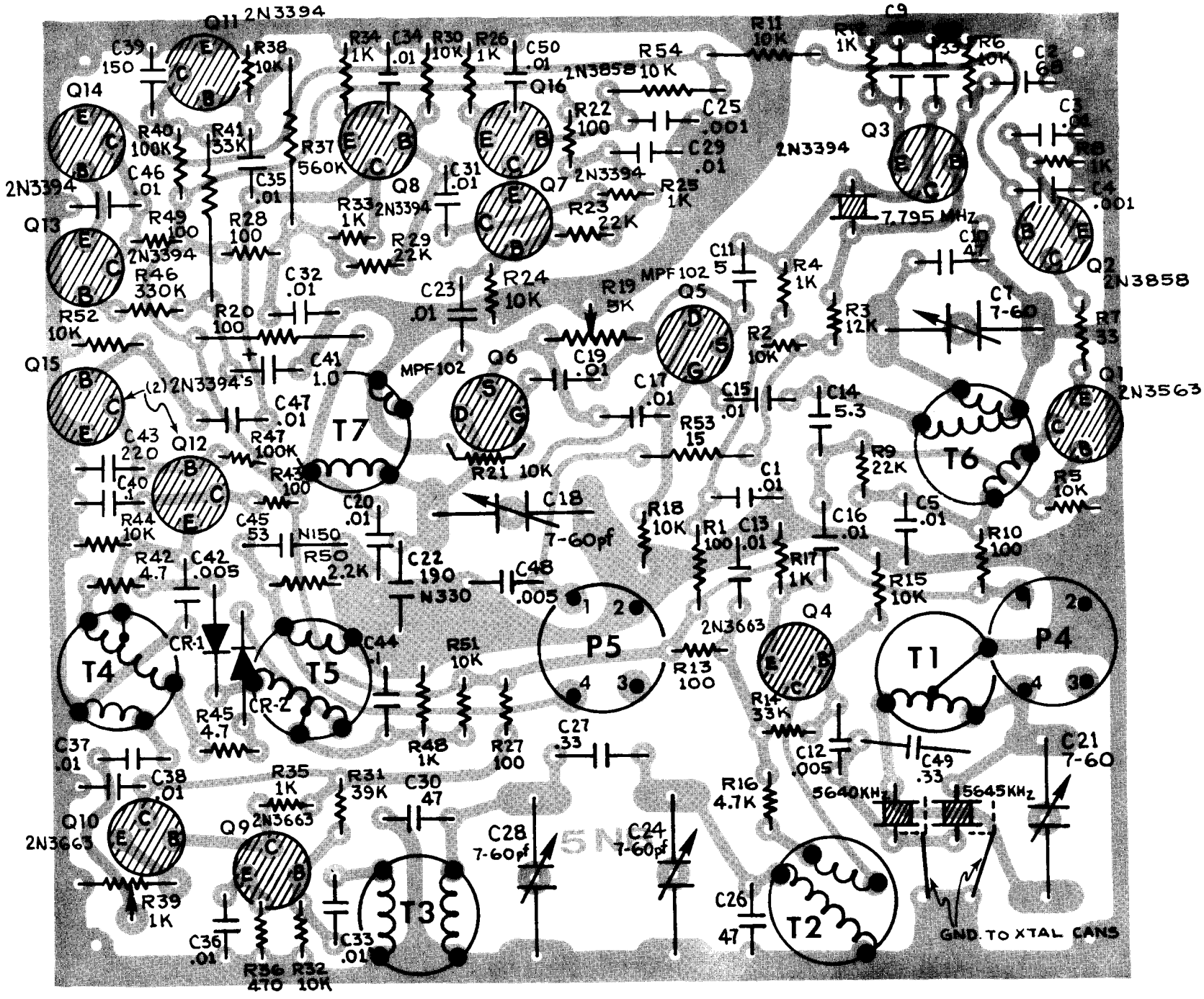
5-NB D.C. AND R.F. VOLTAGE CHART

Transistor	Drain Collector	Source Emitter	Gate 1 Base
Q1	12.1 (31)	2.7	3.4 (4)
Q2	2.6	2.4	3.0
Q3	8.5 (3.4 V)	3.4	3.0
Q4	3.1 (9.4)	1.8 (6.4)	2.5 (3.8)
Q5	12.3 (57)	1.0	0.0 (480)
Q6	12.3 (57)	1.4	0.0 (480)
Q7	9.6 (12.5)	2.7	3.4 (12)
Q8	9.3 (290)	2.7	3.4
Q9	9.0	1.25	1.8 (8)
Q10	11.5	8.2 (21)	8.8
Q11	4.4 (650)	0.0	0.2
Q12	11.8	5.5	6.1
Q13	12.3	3.85	4.3
Q14	12.3	3.3	3.8
Q15	6.2	0.0	0.0
Q16	2.7	2.4	3.4

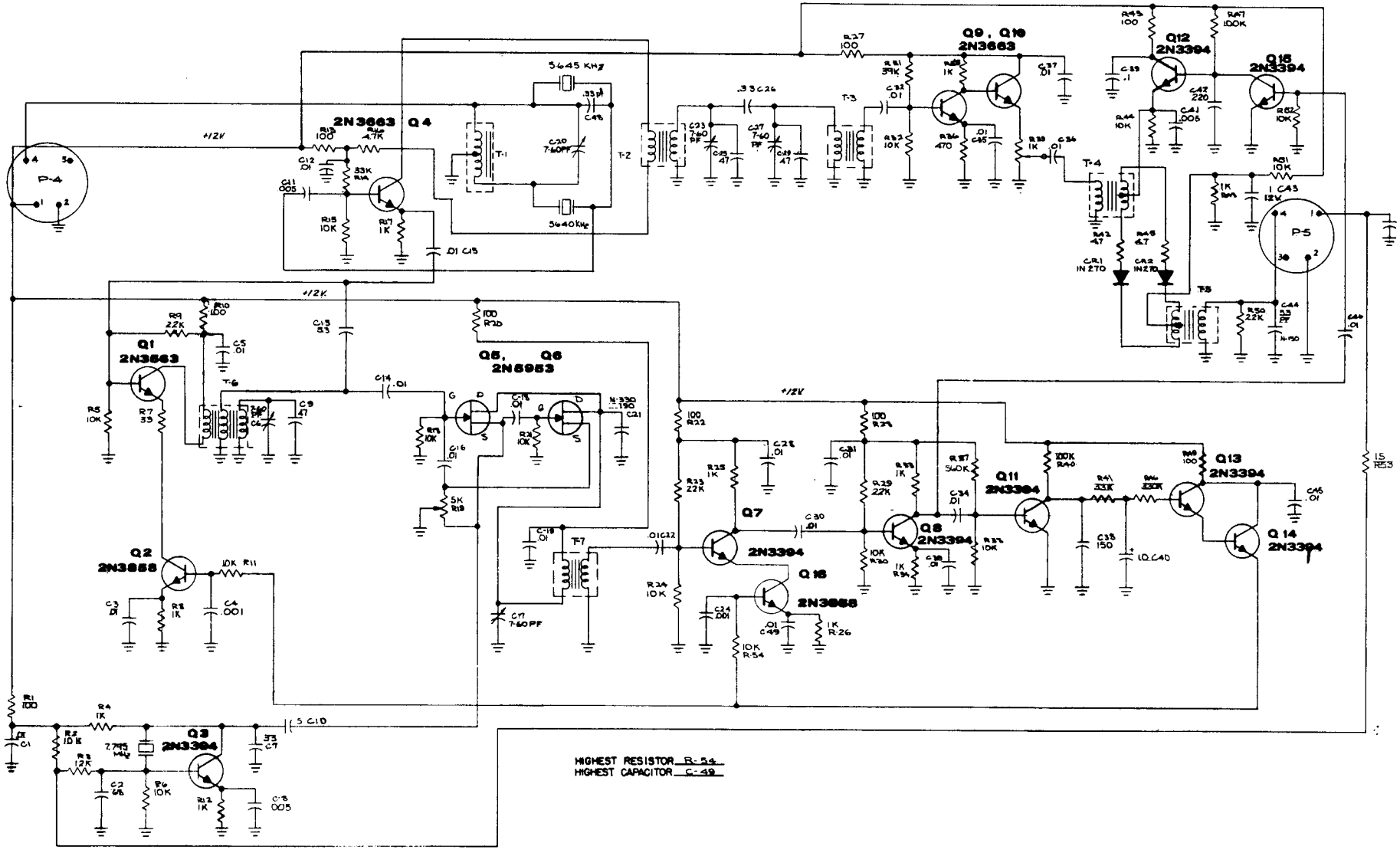
MEASUREMENT CONDITIONS

Conditions same as the SPR-4 R. F. voltage chart with the accessory switch in NB position.

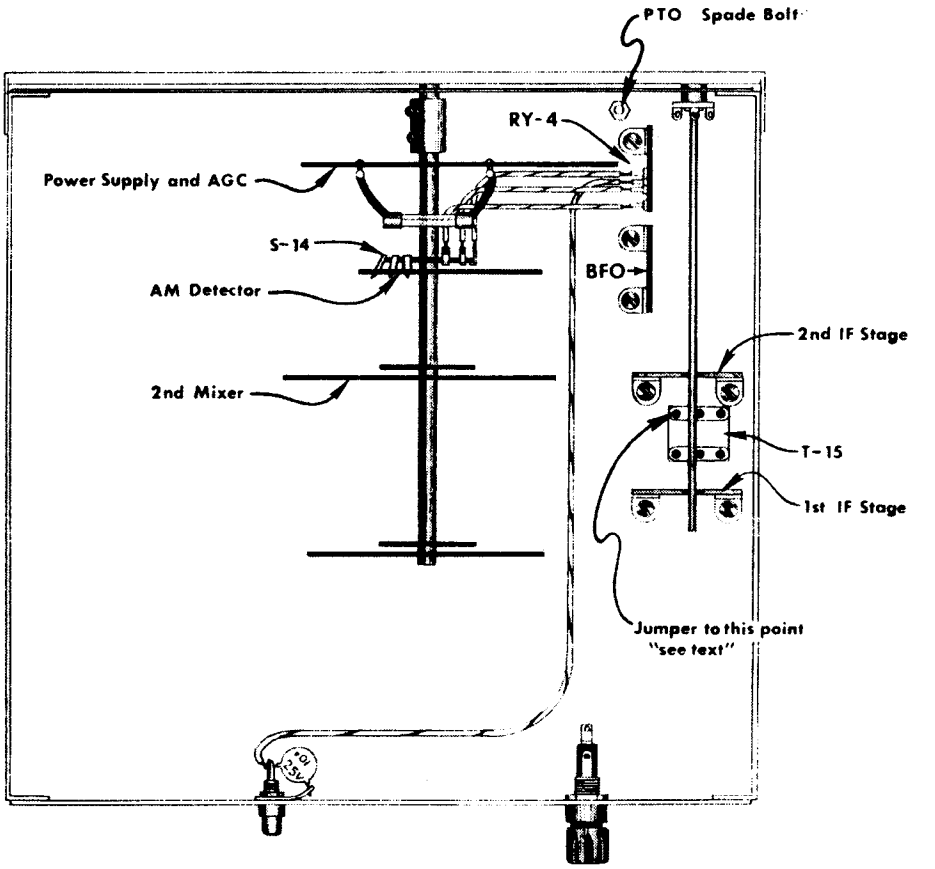
11 megohm VTVM and Boonton Model 91CA R.F. voltmeter used.
100:1 divider used on measurements above 500 mV.
Measurements in parenthesis are R.F. voltages.



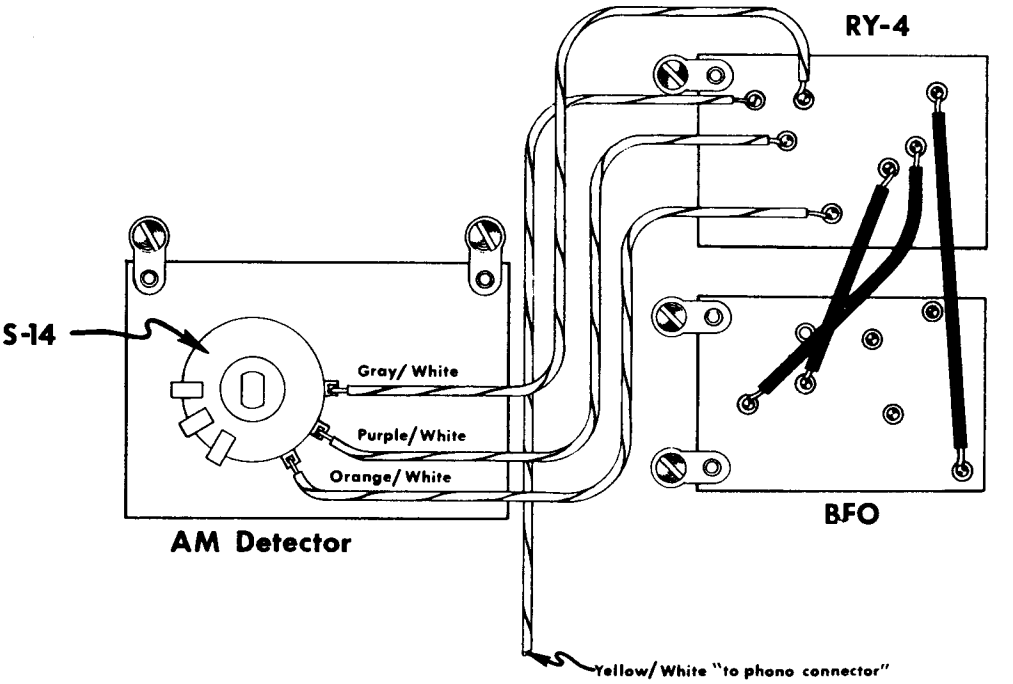
5-NB CIRCUIT BOARD
Figure 10



5-NB SCHEMATIC DIAGRAM
Figure 11



RY-4 CIRCUIT BOARD INSTALLATION DIAGRAM
Figure 12



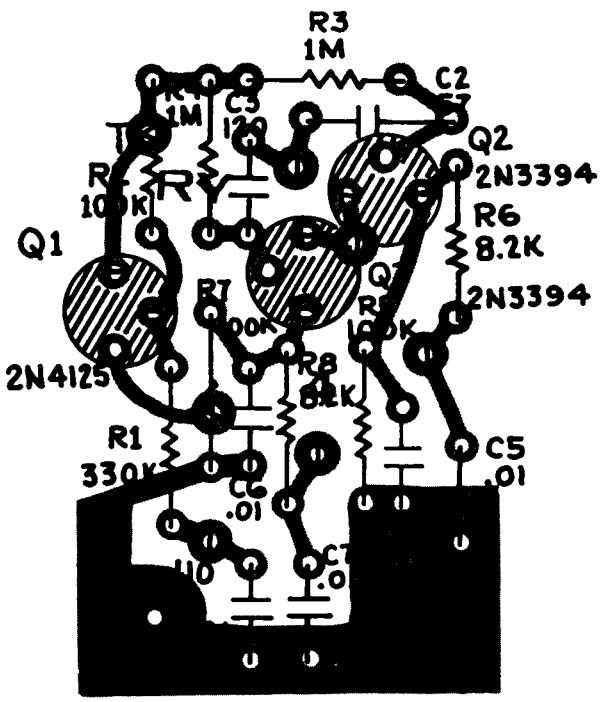
RY-4 PICTORIAL WIRING DIAGRAM
Figure 13

Transistor	Collector	Emitter	Base
Q1, CW	- 1.4	8.8	8.7
Q1, LSB	- 1.1	8.8	8.7
Q2, CW	29	2.2	-.3
Q2, LSB	30	2.2	-.3
Q3, CW	33	2.2	-.5
Q3, LSB	33	2.2	-.5

MEASUREMENT CONDITIONS

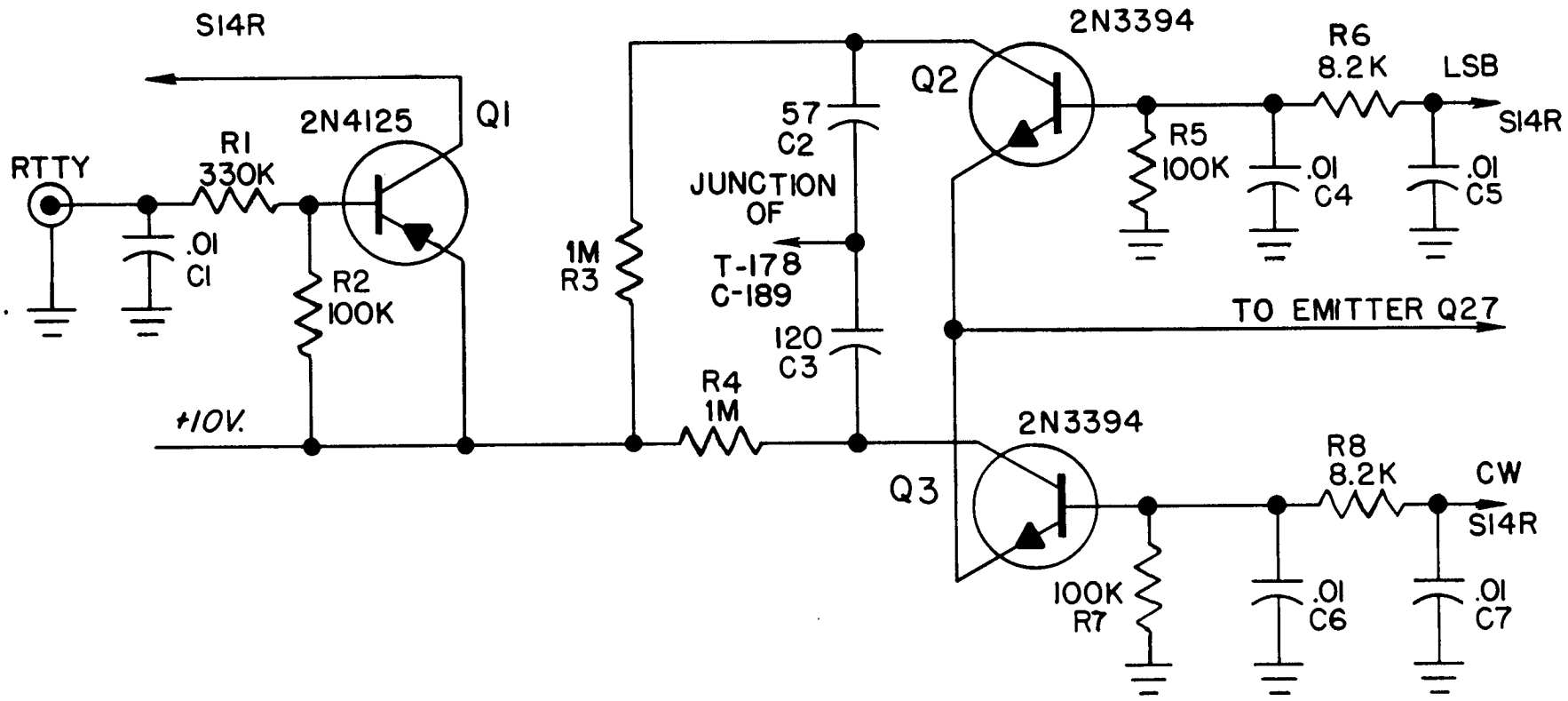
Conditions same as the SPR-4 R.F. voltage chart.
RY jack shorted to ground.
11 megohm VTVM used.

RY-4 D.C. VOLTAGE CHART



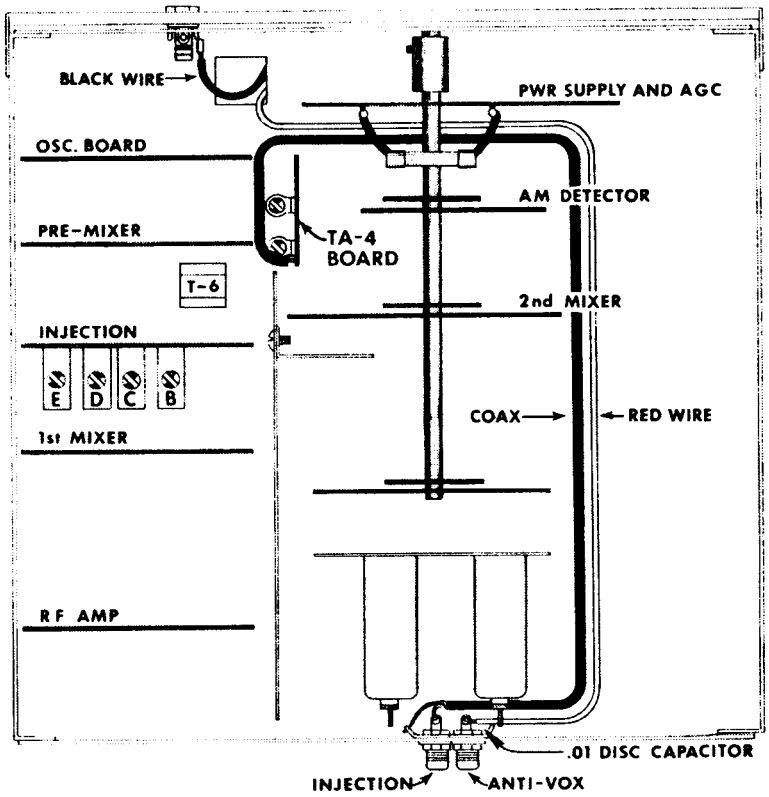
RY-4 CIRCUIT BOARD

Figure 14



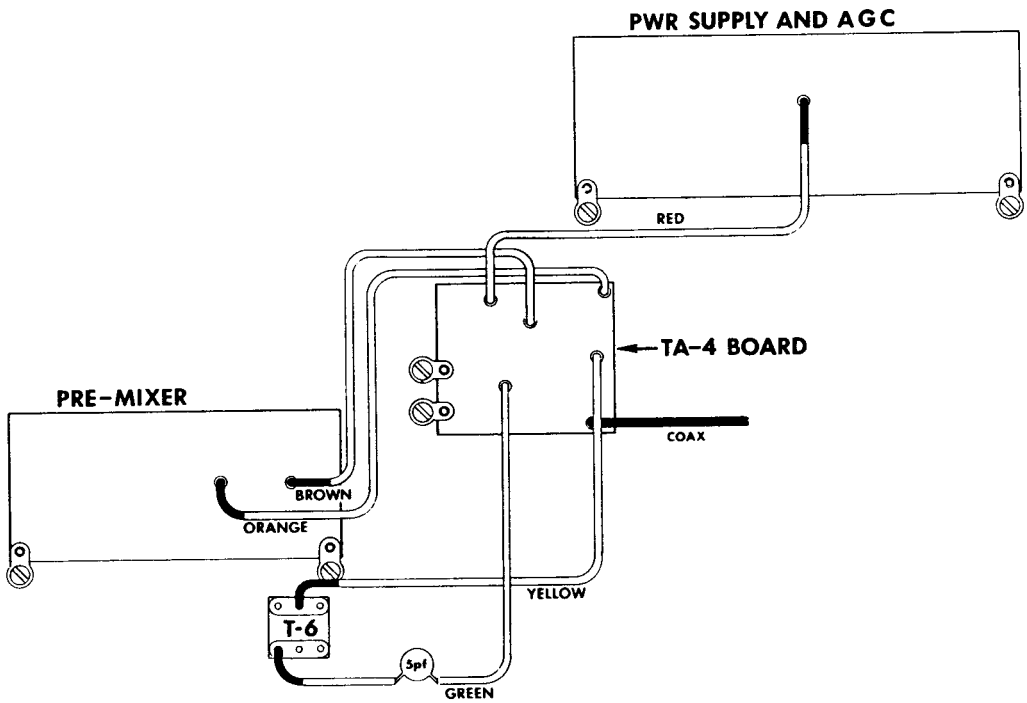
RY-4 SCHEMATIC DIAGRAM

Figure 15



TA-4 CIRCUIT BOARD INSTALLATION DIAGRAM

Figure 16



TA-4 PICTORIAL WIRING DIAGRAM

Figure 17

TA-4 D.C. VOLTAGE CHART

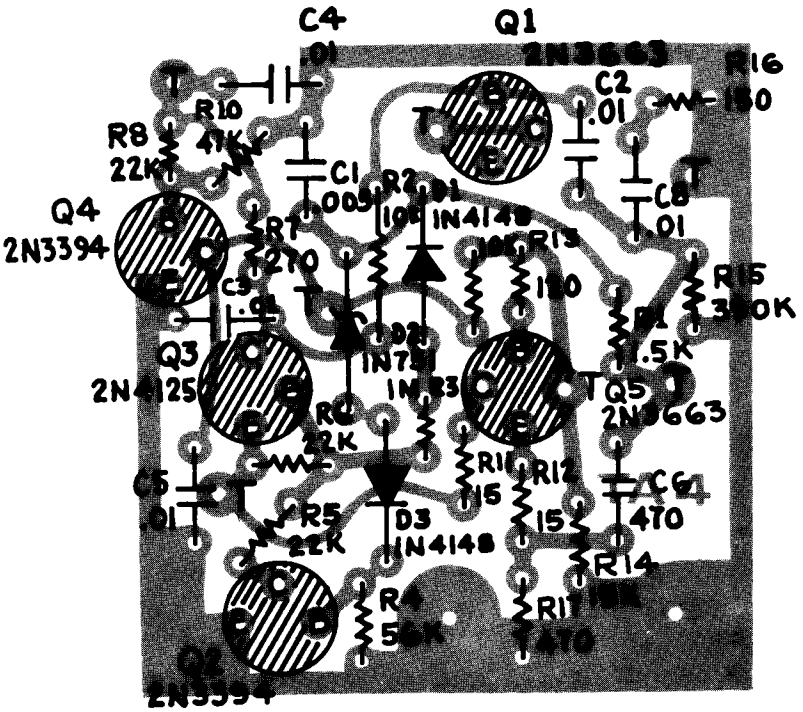
Transistor	Transceive Mode	Collector	Emitter	Base
Q1	Separate	-----	0.0	0.7
Q1	Transmitter	-----	0.0	0.7
Q2	Separate	0.05	0.0	0.6
Q2	Transmitter	11.1	0.0	0.0
Q3	Separate	12.2	12.2	11.5
Q3	Transmitter	0.02	11.9	10.6
Q4	Separate	0.0	0.0	0.6
Q4	Transmitter	0.02	0.0	0.6
Q5	Separate	12.2	0.0	0.01
Q5	Transmitter	12.0	2.3	3.0

MEASUREMENT CONDITIONS

Conditions same as the SPR-4 R.F. voltage chart and including inter-connection with a T4XB.

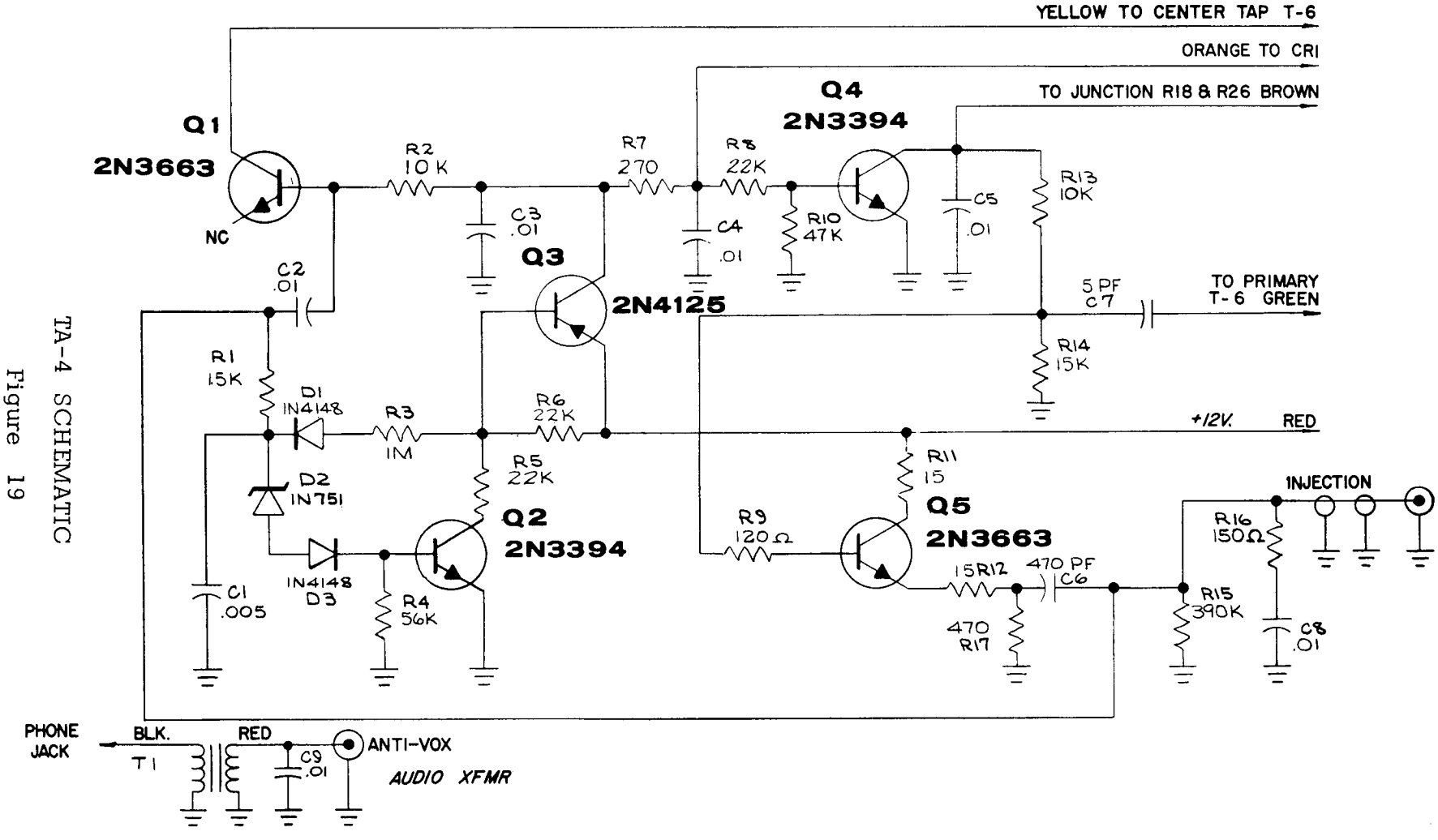
Measurements taken in SEPARATE mode were with T-4XB transmitting.

11 megohm VTVM used.



TA-4 CIRCUIT BOARD

Figure 18



TA-4 SCHEMATIC

Figure 19