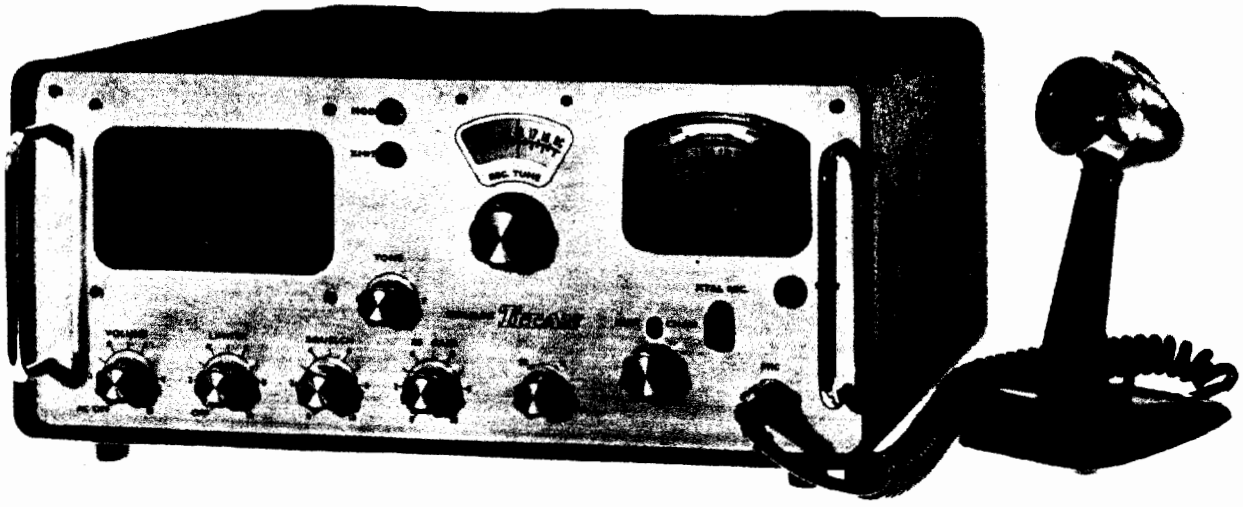
INSTRUCTION MANUAL

TRAM *TITAN*



CITIZEN'S BAND TRANSCEIVER

TRAM CORPORATION
P. O Box 187 Lower Bay Rd., Winnisquam N. H. 03289

INSTRUCTION MANUAL
for
TRAM TITAN CITIZENS BAND TWO WAY RADIO

LICENSE AND REGULATION INFORMATION

The Federal Communications Commission has made it possible for any citizen over 18 years of age to obtain a license to operate two way radios in the Citizen's Band. It is not legal to operate this equipment without a license.

Operating and equipment requirements are covered in Part 95 of the Federal Communications Commission's Rules and Regulations. All use of this equipment must conform to F. C. C. requirements. Tram Electronics, Inc. certifies that this equipment is designed and manufactured to fully comply with the F. C. C. technical requirements for Class D Citizens Radio Service operation.

To obtain your license, you must first fill out the F. C. C. application form #505. Read the application form carefully and fill out the work sheet, transfer this information to the application form, sign and mail the application with $8.00 for application fee to: FEDERAL COMMUNICATIONS COMMISSION, GETTYSBURG, PENNSYLVANIA 17325. When approved, the F. C. C. will issue your license. You will be assigned a number to be used as your station call letters.

Keep your license close to your equipment at all times. Fill out a transmitter identification card, F. C. C. form #452-C and attach it to the side of the two way radio. DO NOT MAKE TRANSMISSIONS WITH YOUR EQUIPMENT UNLESS YOU HAVE YOUR LICENSE. Read Part 95 of the F. C. C. RULES AND REGULATIONS thoroughly. Make your transmissions short and to the point. Listen to the channel before transmitting to see that it is not in use.

GENERAL INFORMATION

The Tram TITAN Citizen's Band transceiver is a quality instrument, the result of long months of careful engineering, exhaustive test and trial in the field. Yours has been fully tested and run several hours under power to ascertain that it meets or exceeds all of the requirements of our exacting specifications.

Before installing and attempting to use the radio, you should become familiar with the installation, operation and service sections of this manual. Later, you will find instructions to the effect that the owner should make only certain recommended adjustments; this is very important. Units returned to the factory for repair that bear evidence of unauthorized adjustment, will not be serviced under the warranty. Since adjustments, other than the ones included in these instructions, can only be made by a qualified technician using well calibrated test equipment, an owner will only degrade the performance of his unit and may even make it inoperative if he disturbs the factory settings.

SPECIFICATIONS

RECEIVER

Sensitivity:

. 1 uv. provides more than . 5 watts audio output with gain controls full and limiter off, signal mod. 30% @ 1000 Hz.

Audio Output

At least 1 watt into speaker @ 30% mod. @ 1000 Hz with . 5 uv. input.

Signal to Noise Ratio

. 15 uv. for 10 db. S & N to N ratio, signal mod. 30% @ 1000 Hz. Better than . 1 uv. for 6 db. S & N to N ratio signal mod. 30% @ 1000 Hz. Readable @ . 04 uv. @ 30% mod. @ 1000 Hz.

Selectivity

6 kHz minimum at 6 db.
20 kHz maximum at 90 db.

A. G. C.

Change in audio output less than 14 db. 6 uv. to . 1 volts.

Delayed A. G. C.

Knee at A. G. C. occurs between 2 and 5 uv.

Squelch

(Adjustable) Receiver will awaken with less than . 1 uv. With squelch full, receiver will awaken with 3500 uv.

Automatic Noise Limiter

Carrier controlled threshold series gated adjustable. Effective clipping of all noise peaks.

Overall Distortion

Less than 2% at 1 watt out 30% mod. at 1000 Hz.
Less than 3. 5% at 3 watts out 30% mod. at 1000 Hz.
Less than 5% at 4 watts out lim. off 30% mod. at 1000 Hz.

Hum and Noise

Overall with 1000 uv. input at least 45 db. below 1 watt.

Audio Hum and Noise

At least 55 db. below 1 watt. Not more than 3 milli-volts across a 4 ohm output load.

Audio Distortion at 1000 Hz

1 watt 1.8%
2.5 watts 2.8%
4 watts 5.4%

Audio Frequency Response Hz

5 db. ± 3 db. 250 to 3500 tone mid. pos.
5 db. ± 3 db. 250 to 2500 tone full bass.
5 db. ± 3 db. 250 to 5000 tone full treble.

Direct Image

Down 80 db. plus

Indirect Image

Down 60 db. plus

First I. F. Rejection

Down 85 db. plus

Spurious Responses

All other than above down 80 db. plus

Adjacent Channel Rejection

At least 90 db.

Alternate Channel Rejection

Down 100 db. plus

Desensitization

Adjacent channel - better than 85 db.

Cross Modulation

Adjacent channel - better than 75 db.

First I. F.

4245 to 4535 kHz

Second I. F.

455 kHz

Tube Complement

6BQ7A	R. F. Cascode amp.
6BK7B	First Mixer Oscillator
6BK7B	Second Mixer Oscillator
6BA6	First 455 kHz I. F. amp.
6EQ7	Second 455 kHz I. F. amp. delayed A. G. C.
6AL5	Detector series gated noise limiter, R. F. A. G. C.
12AX7	First audio and squelch
* 6BR8A	Second audio "S" meter VTVM
* 6GK6	Audio output

* These tubes also function in the transmitter. See below

TRANSMITTER

Plate Power Input
5 watts

Carrier Power Output
3. 5 watts minimum

Max. Modulated R. F. Output
4 watts

Modulation Capability
95 to 100%

Keyed Compression
Compression starts at about 85% on voice frequencies.

Overall Audio Distortion
At 1000 Hz and 90% mod. less than 3%.

Hum and Noise on Carrier
At least 50 db. down from 90% modulation level.

Harmonic Suppression and Spurious Emissions
Better than F. C. C. requirements

SWR Bridge
Measures power output and SWR directly.
Factory calibrated.

Antenna Matching
(Adjustable) Will match antenna loads of from 52 to 72 ohms.

Carrier Frequency
$\pm$. 004% including effects of varying temperatures.

Tube Complement

	6GK6	R. F. Power Amplifier
	12BY7A	Crystal Oscillator doubler
	6AU6A	Microphone Speech Amplifier
*	6BR8A	Second Speech Amplifier
*	6GK6	Modulator
	SI-600	Compression Diode

* These tubes also function in the receiver. See above.

Microphone

Desk type Turner Model 254X (crystal element) with coiled cord. Response 80-7000 Hz output level -54 db. Equipped with Switchcraft #09CL4M connector.

COMMON

Supply Voltage

115 ± 10% 50-60 Hz.

Power Consumption

75 Watts

Size

16 5/8 inches wide, 10 5/8 inches deep, 7 1/4 inches high

Weight

Microphone, 2 pounds in its carton. Set weight 26 pounds. Shipping weight 29 pounds.

ANTENNAS

A quarter-wave vertical ground plane type antenna is recommended for base station use. Improved results will be obtained with commercially available half-wave vertical antennas that have matching sections to match 52 ohm coaxial cable. For directional coverage to greater distances a vertical beam antenna is recommended. Many kinds of beams are available ranging from single boom three element type to a double stacked ten element beam. In areas where there is a lot of activity, a beam antenna, because of its directional characteristics, will reduce interference to other CB stations not directly in the pattern of the beam's directivity.

In all cases, if possible, install the antenna in the open, away from surrounding objects.

COAXIAL CABLE

Most commercially available antennas are designed for use with 52 ohm coaxial cable. Be sure to use the correct impedance as specified by the antenna manufacturer. The TITAN Pi-net work output will match either a 52 ohm system or 72 ohm system, but will not correct for a mismatch between the antenna and the cable feeding it. The TITAN power meter can be used to read SWR on your antenna system and is useful in correcting mismatch. (Refer to POWER METER OPERATION, page 13)

For feedline lengths under 50 feet, RG-58/U for 52 ohm systems, RG-59/U for 72 ohm systems will be satisfactory. For less loss on longer runs RG-8/U for 52 ohm systems, RG-11/U for 72 ohm systems is recommended.

Exercise great care when attaching coaxial fittings to the cable. Be sure that the center conductor is soldered. Remember that a cold soldered joint will result in a loss of power. Solder the braid carefully. Screw the fitting firmly onto the antenna. Where the fitting is exposed to the weather, wrap it with vinyl tape. The use of a lightning arrestor is recommended.

INSTALLATION INSTRUCTIONS

See Figure 1 on page 7

Connect your antenna feedline to the antenna connector on the rear of the TITAN. It is recommended that a ground wire (#14 or larger) or grounding braid be connected under one of the two cabinet mounting screws on the rear of the TITAN. The other end of the ground wire (or braid) should be connected to a suitable ground, such as a cold water pipe or a copper ground stake driven four or five feet into the earth.

Remove the microphone from its box and connect it to the microphone input socket on the right hand side of the front panel.

Now plug the AC line cord into a wall socket (117 Volts AC) and your TITAN is ready for operation. For added convenience, new TITANS are equipped with detachable line cords. This cord fits into the recessed plug at the right rear of the chassis.

OPERATION

Simplified operating instructions - Set the controls on the TITAN as follows:

1. VOLUME ON-OFF Turn on and set at 2
2. LIMITER CCW (counterclockwise) at off
3. SQUELCH CCW at zero
4. TONE Maximum CW (clockwise) at T

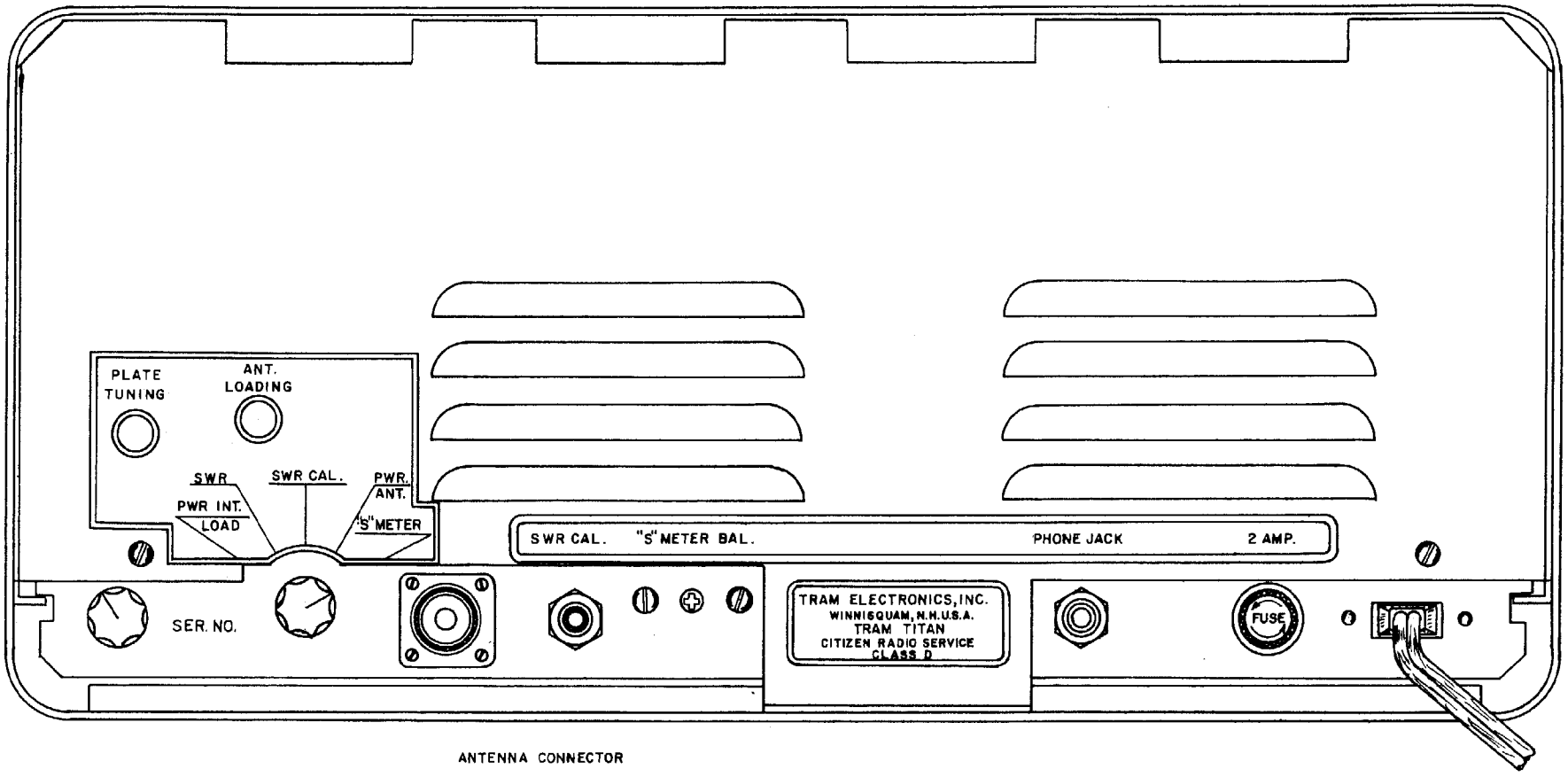
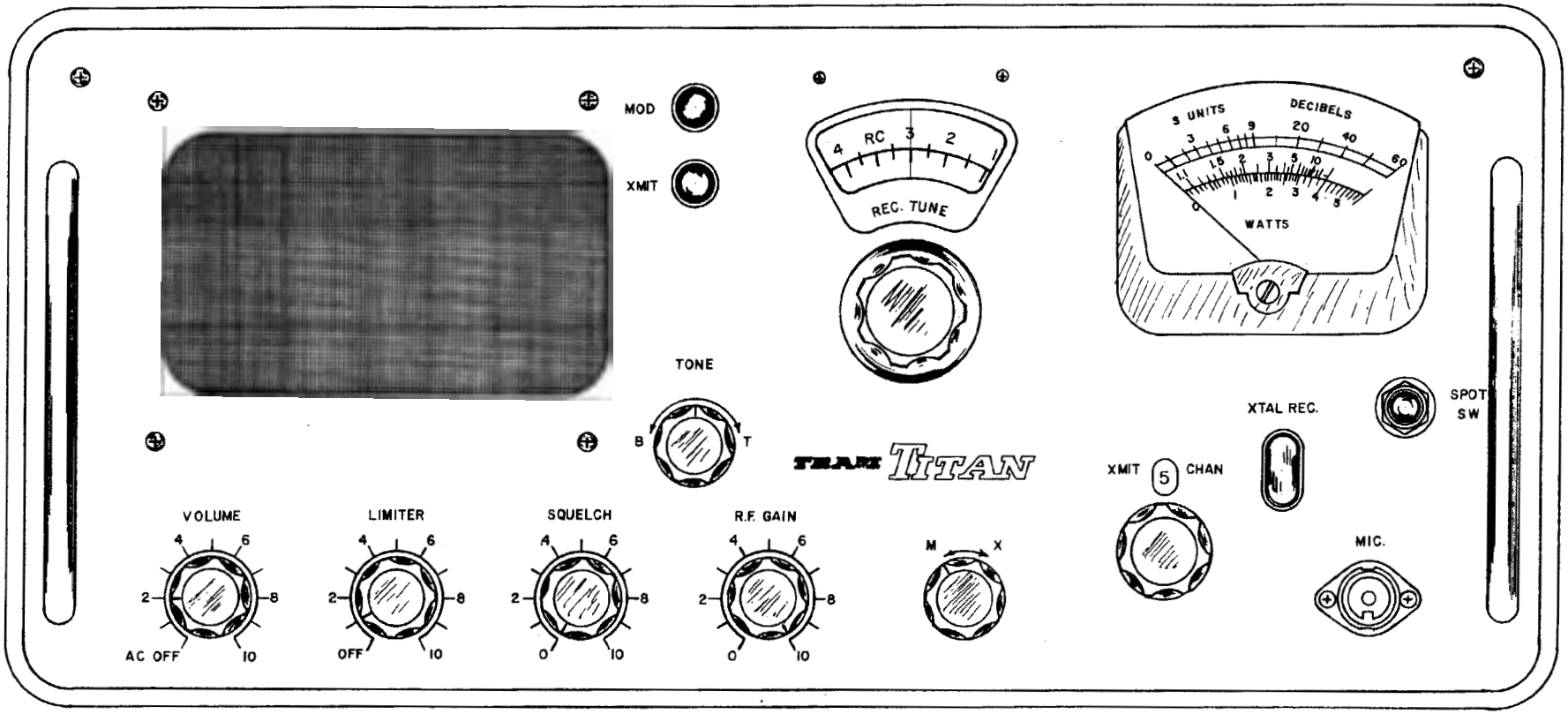


PLATE TUNING
ANT. LOADING
SWR
SWR CAL.
PWR. ANT.
PWR INT. LOAD
"S" METER
SWR CAL.
"S" METER BAL.
PHONE JACK
2 AMP.
SER. NO.
TRAM ELECTRONICS, INC.
WINNISQUAM, N.H. U.S.A.
TRAM TITAN
CITIZEN RADIO SERVICE
CLASS D
FUSE
ANTENNA CONNECTOR

FIG. 1



FRONT PANEL
FIG. 2

5. RF GAIN Maximum CW at 10

6. M-X SWITCH at M

7. RECEIVE TUNING Tune to desired channel

8. TRANSMIT CHANNEL Set to desired channel

The meter and channel indicators will light up when the power is on. Allow at least one minute warm up before transmitting. Now press the push to talk button on the microphone and you are on the air. The transmit neon will light and the modulation neon will flash as you talk. Be sure to announce your station call sign anytime you turn on the transmitter even for just short tests. Release the button to turn off the transmitter.

FUNCTION OF OPERATING CONTROLS

A. RECEIVER CONTROLS

1. VOLUME CONTROL The volume control is combined with the AC power switch. At the extreme CCW position of the knob, the AC power to the unit is switched off. Advancing the control CW from this position turns on the power. To increase the loudness of the receiver audio, turn the control toward the higher numbers. The numbers are for reference to assist in resetting the control to the same position.

2. AUTOMATIC NOISE LIMITER The limiter control consists of a switch at the extreme CCW position and a variable adjustment. Advancing the knob CW to operate the switch turns on the limiter. This places the automatic series gated noise limiter in operation to reduce pulse type noises such as ignition noise and other electrical interference. Advancing the knob further CW increases the clipping action of the limiter. Note that at higher settings of the limiter control, strong signals may be distorted due to clipping. The control should only be advanced higher under extremely noisy conditions and at low signal levels.

3. SQUELCH CONTROL This control, if turned CW, will quiet the receiver audio. If it is set just beyond the point where the receiver background noise disappears, any signal greater in strength than the noise level will restore the receiver to operation. The control may also be advanced to higher settings so that only relatively strong signals will open the squelch. This can be particularly useful if the band is open with skip signals that are weaker than the stations in your local area. The squelch can be set to open only on the strong local signals.

4. TONE CONTROL The tone control is used to vary the audio pitch of the receiver. By experimenting with different settings of this control, you will soon find where you prefer to keep it. This position will vary with each individual. You may also find that with weak stations you can sometimes improve reception by turning this control toward the B (Bass) position as this will de-emphasize any noise which may be present.

5. RF GAIN The RF gain control varies the gain of the RF amplifier and the 455 kHz I. F. amplifiers. Maximum sensitivity will be obtained with the control set at 10 (fully CW). As the control is rotated CCW, the bias on the tubes being controlled increases with a resultant decrease in gain.

The normal setting of the RF gain control is at 10(fully CW). When listening for weak signals the control should be maximum CW. When copying strong signals under crowded or noisy conditions, it may be found desirable to reduce the RF gain setting. This control can be used in conjunction with the volume control for decreasing the receiver sensitivity to prevent overload from very strong signals. To do this, set the volume control for nearly maximum and control the audio level with the RF gain control.

IMPORTANT It should be remembered that the S-meter calibration will be correct only with the RF gain control fully advanced to 10. The AGC is automatically controlled by the RF gain control so that it is not necessary to disable the AGC circuitry otherwise.

6. MANUAL-CRYSTAL (M-X) SWITCH The M-X switch controls the receiver tuning mode. In the M (Manual) position the large knob is used for tuning in the various channels. Due to the sharp selectivity of the TITAN, it may be necessary to tune slightly to one side of the channel in order to tune in clearly a station that is not exactly on frequency. Use the S-meter as a tuning indicator.

In the X (crystal) position the receiver tuning may be fixed by inserting a crystal into the receive crystal socket which is directly below the meter on the front panel. The manual tuning is inoperative when using crystal receive except that the first mixer stage output may be peaked by rotating the tuning dial to the same channel as the receive crystal being used. This tuning action can be observed on the S-meter.

7. "S"-METER The S-meter provides a visual indication of the relative strength of an incoming signal. The S-meter is calibrated in "S" units from 1 to 9 and in decibels (db) above S-9. The meter is calibrated at the factory so that a 50 microvolt signal at the antenna socket will provide a reading of S-9. Each "S" unit represents approximately a 6 db change in signal level.

NOTE: As mentioned above, the S-meter calibration holds true only when the RF gain control is set at full CW position.

8. S-METER BALANCE The S-meter balance control (R59), located on rear of chassis, is used to move the S-meter pointer to read zero in the absence of any signal whatsoever. With the M-X switch in the "X" position and no receive crystal inserted, adjust R59 with a small screwdriver until the meter reads 1/4 "S" unit above zero. Note that this adjustment must be done with the meter switch in the S-meter position. Note also that this adjustment will have no effect in any of the other meter switch positions and that if the S-meter is unbalanced for any reason, the accuracy of the meter is not affected in any of the positions except S-meter.

9. PHONE JACK Tram TITANS beginning with serial number 3071, incorporate unique circuitry allowing the external phone jack to be used in several different ways.

1. An external speaker may be plugged into the jack to hear the receiver at a remote location.

2. Headphones may also be plugged in, in place of a remote speaker, to listen to the receiver. The speaker built into the set is switched off automatically in each of the above cases.

3. The TITAN is designed such that when headphones are used and the transmitter is keyed, the operator automatically monitors his transmission through the headphones. Note that he is hearing exactly what is going out over the air so that he is able to detect any faults in either his carrier; i. e. hum, feedback, etc. or his modulation. Again, when he releases the microphone button, he hears the receiver audio in the headphones. Also, since the TITAN has a built in antenna load, the operator may select the PWR INT LOAD switch position and make transmission checks without actually being on the air.

A volume control, located at the extreme left rear of the chassis, is associated with the transmit monitor function and will vary the loudness of the audio in the headphones when the operator is modulating the carrier. Note that this control has no effect on the actual modulation level, but is solely to allow the operator to adjust the sound to a comfortable level in the headphones when he transmits. The control is also helpful when listening to the carrier alone, as the volume may then be raised to detect any low level hum, noise, or feedback, that may be present.

For use as an external speaker, a good quality speaker having either a 4 or 8 ohm impedance will be adequate.

High impedance headphones, 2,000 - 10,000 ohms, are recommended. For either a speaker or headphones, a standard two conductor phone plug of the PL55 type will mate with the jack installed on the rear of the chassis.

B. TRANSMITTER CONTROLS

1. MICROPHONE The microphone supplied with the TITAN has a high impedance crystal element. Do not expose this microphone to extreme heat or cold as the element may be damaged.

The push to talk button on the microphone, when pressed, turns on the transmitter and turns off the receiver by activating the change over relay in the unit. The transmitter is turned off and the receiver is turned on again by releasing the push to talk button. The button may be locked in the transmit position by pulling the lever on the right side of the microphone forward. This allows the operator to talk without holding down the push to talk button. Moving the lever back, releases the button and turns off the transmitter.

The microphone should be placed about 8 inches away from the lips for best intelligibility while transmitting. The distance from the microphone is not critical, however, as the speech compression characteristics of the TITAN will not only prevent overmodulation when the operator is speaking loudly into the microphone, but will also provide amplification for weak voices some distance away from the microphone.

2. MODULATION AND TRANSMIT INDICATOR LIGHTS The red neon indicator marked MOD (in the top center of the front panel) serves as an indication of modulation. It fluctuates in brilliance as you speak into the microphone. If the light flashes brightly on some syllables, but is not continuously bright, you can be sure that you have good modulation.

The red neon indicator marked XMIT glows when the transmitter is on.

3. TRANSMITTER CHANNEL SELECTOR The TITAN is supplied equipped for 23 channel operation. The desired channel is selected by rotating the transmit selector knob so that the number of the channel desired appears in the window. There is no stop on the switch so that the knob can be continuously rotated in either direction allowing quick change, for example, from channel 23 to channel 1 without turning back through the other switch positions.

4. SPOT SWITCH The spot switch, when pushed, turns on the crystal oscillator of the transmitter. This allows you to check the calibration of the manual tuning dial. For example, set the transmit channel selector to channel 11, push the spot switch and observe the S-meter while turning the main tuning knob. When the knob is adjusted carefully so that the S-meter reads highest, the main tuning dial should be at, or very close to, channel 11.

The spot switch is also useful for checking the transmitter crystals. If a defective crystal were dead, it would not provide any indication on the S-meter when "spotted". If a defective crystal were off frequency, it would spot at the wrong place on the main tuning dial. A note of caution, however, if all channels spot high on the dial or all spot low on the dial, the receiver calibration may be off. (See Page 19, Paragraph #3 of RECEIVER ALIGNMENT)

C. POWER METER OPERATION

The RF power meter in the TITAN is a precision SWR bridge and true power meter. The SWR calibration control for the power meter is located on the rear panel near the antenna connector. Refer to Figure 1.

1. METER SWITCH The functions of the meter are selected by the knob located to the left of the antenna connector on the rear of the unit.

a. S-METER The first position is the only position in which the meter will operate as an S-meter during receive. With the switch in this position, the meter will not operate during transmit.

b. POWER ANTENNA The second position switches the meter to read RF power to the antenna or other external load connected to the antenna socket.

c. SWR CAL. The third position switches the meter to read relative forward power for calibrating the SWR bridge.

d. SWR The fourth position switches the meter to read SWR. This reading is ONLY accurate when the bridge is first calibrated in the third position.

e. POWER INTERNAL LOAD The fifth position disconnects the output of the transmitter from the antenna connector and connects the output to a built-in dummy load. The meter reads true RF power to the dummy load.

2. SWR CALIBRATION The SWR calibration is adjusted by the small knurled shaft located to the right of the antenna connector.

3. THE MEANING OF SWR For best efficiency, an antenna system must have a low SWR (standing wave ratio). High SWR results from a mismatch of impedances between the coaxial feedline and the antenna. In plain language, loose connections or broken elements in the antenna will cause high SWR and poor antenna efficiency. The built-in SWR bridge in the TITAN will give you direct SWR readings. This information will tell you the condition of your antenna system. If the SWR is high, steps should be taken to find the reason for the mismatch and minimize it. An SWR less than 1.5 to 1 is good and any effort spent to reduce it will have little effect on efficiency. You will also find that the SWR of most antenna systems is not the same on all channels.

As explained above, high SWR in any antenna system, CANNOT be corrected at the transmitter. Retuning of the transmitter will NOT change the SWR. The SWR bridge in the TITAN will indicate the efficiency of your antenna system, but the efficiency can be changed only at the antenna or in the transmission line to the antenna, and not at the transmitter.

With the many types of specially constructed antennas available, you should consult the manufacturer of your particular antenna for information on matching the antenna to the feedline. Following the manufacturer's recommendations and using the TITAN's built-in SWR bridge will enable you to maintain an efficient antenna system.

NOTE: To avoid interference, the following tests should be conducted on a clear channel. Be sure to announce your call sign each time you turn on the transmitter.

4. READING THE SWR

a. Turn on the TITAN and allow to warm up at least one minute.

b. Turn the meter switch to SWR CAL.

c. Press the microphone button and adjust the SWR CAL shaft so that the meter needle is on the line marked SWR CAL on the middle scale of the meter.

d. Now turn the meter switch to SWR and read the SWR on the middle scale of the meter.

e. Release microphone button.

f. Return meter switch to S-METER for normal operation.

5. USING THE POWER METER The TITAN power meter is accurately calibrated at the factory to read true power. This power reading is actual RF power at the antenna socket.

a. Turn the meter switch to PWR. ANT.

b. Press the microphone button and read the power on the lower meter scale.

c. Release the microphone button.

d. Return meter switch to S-METER for normal operation.

6. USING THE INTERNAL DUMMY LOAD The TITAN has a built-in dummy load.

a. Turn the meter switch to PWR. INT. LOAD.

b. Press the microphone button and observe the power reading on the lower meter scale. The TITAN transmitter should provide no less than 3.5 and no more than 4 watts.

NOTE: It should be remembered that the receiver S-meter will not function unless the meter switch is returned to the S-meter position.

CIRCUIT DESCRIPTION

A. RECEIVER

Signals from the antenna go through the relay to the antenna transformer T1 which feed the grid of the RF tube V1. The RF tube is a cascode connected dual triode. Neutralization is provided by L1. T2 couples the 27 MHz output of the RF tube to the first mixer V2A, where it is mixed with the 31.5 MHz crystal controlled frequency from the first oscillator V2B. The resultant frequency 4.245 to 4.535 MHz is then fed to the second mixer V3A. The grid circuit of V3A is tunable and tracks with the manual oscillator tuning. The manual (or optional crystal) oscillator frequency from V3B is cathode coupled to V3A and the resultant 455 kHz signal passes through the filter FL1 to the 455 kHz IF strip.

The 455 kHz IF strip consists of FL1, V4, T3, V5 and T4. V6A is used as an AM detector and the resulting audio is fed through the automatic noise limiter V6B to the volume control R33. DC voltage from the detector is used for S-meter operation, squelch keying and AGC for V1.

AGC voltage for V4 and V5 is obtained from the diode section of V5.

The squelch tube V7A is a DC amplifier which clamps the grid of V7B until a signal at the antenna input provides enough voltage from the detector to offset a previously set squelch bias. The squelch control R49, may also be set at minimum so that the audio stage V7B operates continuously.

V7B amplifies the audio from the volume control R33. The tone control R55 alters the audio frequency response at the output of V7B. The audio is then fed to V10B where it is amplified for driving the audio output stage V12.

The S-meter circuit utilizes a balanced bridge in which DC voltages from the detector are applied to the grid of V10A and the resulting unbalance drives the meter. Zero balance is accomplished with R59.

The RF gain control R5 varies the cathode bias on V1, V4 and V5.

B. TRANSMITTER

The proper crystal is selected by the transmit channel selector which connects it to the grid of the oscillator-doubler stage V8. The output of the oscillator-doubler is tuned with C68 and fed to the grid of the final RF amplifier V9. The grid circuit of V9 is tuned by L8. Modulated B+ from the audio output stage is applied to the plate and screen of V9. The output tuned circuit consists of C73 plate tuning. L9 tank coil, and C76 antenna loading. All harmonics are attenuated by the low pass filter L11 and C80. The RF output passes through the SWR bridge and power meter pick up to the antenna relay and then to the antenna socket. Audio for the modulation is fed from the microphone to the microphone amplifier V11. Its output is coupled to V10B which drives the audio-modulator V12. Some of the audio from V12 is rectified and used to control the gain of V10 and V11. The resulting compression action provides high average modulation at all speaking levels.

Transmitter keying is done by the relay which is activated by pressing the button on the microphone.

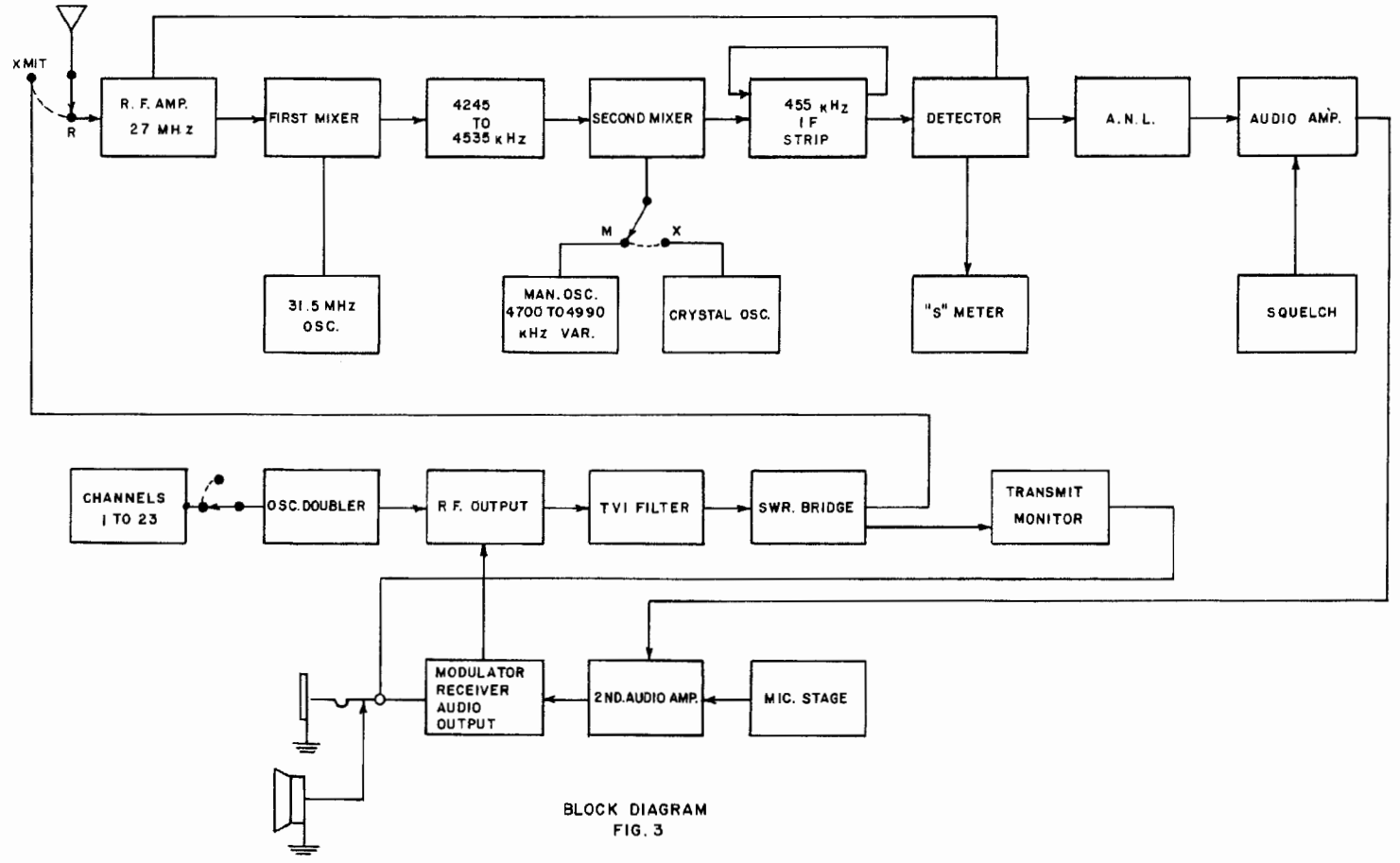
SERVICE INSTRUCTIONS

ALIGNMENT PROCEDURE

WARNING The following instructions are for qualified technicians only. Improper adjustments will result in degraded performance of the TITAN. OBVIOUS TAMPERING WILL VOID OUR WARRANTY.

The latitude of the design of this equipment is such that replacement of tubes or crystals will not normally necessitate any adjustments or alignment.

Alignment should not be attempted until all other possible causes of faulty operation have been checked.



BLOCK DIAGRAM
FIG. 3

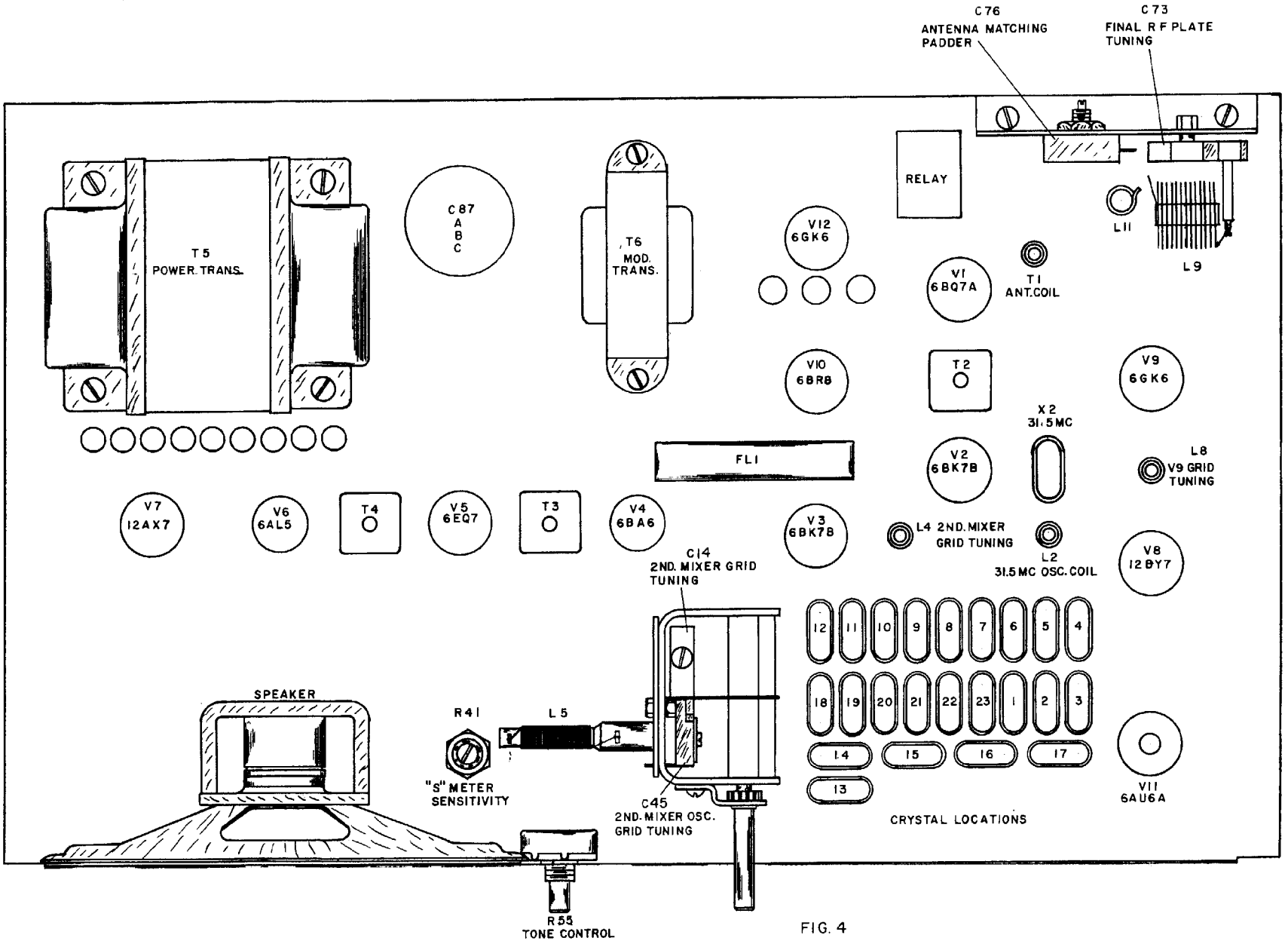


FIG. 4

TUBE LOCATIONS AND ALIGNMENT POINTS

DO NOT MAKE ANY ADJUSTMENTS UNLESS THE OPERATION OF THIS UNIT IS FULLY UNDERSTOOD AND ADEQUATE TEST EQUIPMENT IS AVAILABLE.

EQUIPMENT NECESSARY FOR ALIGNMENT

Stable RF signal generator

Properly calibrated and accurate frequency standard

High impedance VTVM

"J" Tran Alignment tool (GC-8606 or equivalent)

A. RECEIVER ALIGNMENT

1. Measure with VTVM the voltage at V2 pin 7 (31.5 MHz oscillator). Tune L2 on long slope side of peak and adjust for -5 volts.

2. Put M-X switch in X position, plug in a receive crystal, any channel. Set the transmit channel selector switch to the same channel.

Connect a VTVM between the diode detector load (cold end of the secondary of T4) and chassis.

Push the spot switch and tune the top and bottom of T3 and T4 for maximum VTVM reading. Tune C19 and C24 for maximum VTVM reading.

3. Calibrate the dial by using the spot switch for a signal source.

   a. Check the mechanical setting of the dial. When the tuning capacitor is tuned above channel 23, it should reach the stop as the last mark on the dial lines up with the hair line. If not, loosen the set screw and move the dial so that it lines up as described. Tighten set screw.

   b. Put M-X switch on M. Set the dial at channel 2. Push the spot button on channel 2 and adjust C45 for maximum S-meter reading.

4. Noise Tuning - The following adjustments are made listening to the background noise on the receiver with a 50 ohm load connected to the antenna jack.

   a. Set the dial in the middle of the band, channel 10, 11 or 12, and peak T1 for maximum noise.

b. Detune the bottom slug of T2 and peak the top slug for maximum. NOTE: Do not detune the bottom slug so far that the top slug noise peak cannot be heard.

c. Set the dial on a low channel - channel 1, 2 or 3 and peak the bottom slug of T2.

d. With the dial on a low channel, adjust C15 (mixer tuning trimmer) for maximum noise.

e. Set the dial at channel 22, and peak L4 for maximum noise.

f. Repeat steps B, C and D, as necessary, so that the noise remains constant when tuning the dial across the band.

5. S-Meter Calibration

a. Set the dial in the middle of the band. Connect a signal generator to the antenna input. Before turning on the generator, adjust the S-meter zero. Adjust R59 so that meter reads 1/4 "S" unit above zero in the absence of any signal.

b. Turn on generator, set at 50 microvolts and tune the signal generator for maximum S-meter reading. Adjust R41 so that the S-meter reads S-9.

B. TRANSMITTER ALIGNMENT

WARNING: Of the following transmitter adjustments, the ones indicated * must be made by a technician holding a first or second class radio - telephone operator's license, in conformance with the requirement of Part 95 of the F. C. C. Rules and Regulations.

* 1. Connect VTVM to V9 pin 2. Set the meter switch to PWR. INT. LOAD. Set the transmit channel selector to channel 15. Press the microphone button and adjust L8 and C68 for maximum reading on VTVM. Typical voltages are -25 to -35.

* 2. Adjust C73 plate tuning and C76 antenna loading for maximum reading on the TITAN power meter.

3. Speak into the microphone. The power meter reading should increase slightly, and the modulation indicator should light.

4. Connect VTVM to V11 pin 2. Observe the voltage while speaking into the microphone. It should vary while speaking to approximately 12 to 18 volts on loud passages. Connect VTVM to pin 9 of V10 and observe the voltage while speaking into the microphone. Typical readings are 12 to 18 volts. This voltage indicated that the compression is operating properly.

C. POWER AND SWR METER ADJUSTMENT

NOTE: This calibration should not be attempted without the use of an accurate RF power meter with a 50 ohm load.

1. Connect an accurate RF power meter to antenna with 50 ohm dummy load to the antenna socket. Use a short length of coax between the TITAN antenna connector and the external power meter.

2. Turn the meter switch to PWR ANT. Press the microphone button and observe the power reading on the external standard meter. Adjust R62 so that the TITAN meter reads the same as the external standard.

NOTE: Use a Bird Electronics Corporation Model 43 with a 5 watt element (25-60 MHz) or the Bird Model 611 absorption power meter as a standard. Other meters of this quality and accuracy are suitable.

3. Switch the meter switch to PWR INT LOAD. The reading should be the same as above within 5%.

SERVICE HINTS

IF FUSE BLOWS - REPLACE IT WITH NOTHING LARGER THAN A 2 AMP. FUSE.

Refer to schematic and to component layout Figure 4.

RECEIVER

Sensitivity Down

1. S-meter readings normal, audio output low.

   Check tubes V6 (6AL5), V7 (12AX7), V10 (6BR8A), V12 (6GK6), and their circuits.

2. S-meter readings low, audio low except on strong signals.

   Check tubes V1 (6BQ7A), V2 (6BK7B), V3 (6BK7B), V4 (6BA6), V5 (6EQ7) and their circuits.

NEVER MAKE ADJUSTMENTS ON THE RECEIVER TO RESTORE SENSITIVITY UNTIL SURE THAT EVERYTHING ELSE IS NORMAL.

Distortion High

1. S-meter readings very high, audio distorted on strong signals, turning RF Gain Control counterclockwise reduces distortion.
- Inoperative A. G. C.

Check for grounds on grid returns of A. G. C. controlled tubes V1 (6BQ7A), V4 (6BA6), and V5 (6EQ7).

2. Measure the bias, grid to cathode, on V12 (6GK6) with a VTVM. The 6GK6 may be gassy or the grid coupling capacitor leaky.

3. The limiter control may be turned full clockwise, which will cause some distortion that will be more severe with strong signals.

No Signals

1. Receiver noise seems normal. Disconnect the antenna and touch the antenna jack center conductor with a small screw driver or other metallic object. If the resulting noise pulse is heard in the speaker, look for a shorted or open coax cable. If a noise pulse is not heard when the antenna jack is touched with the metallic object, then the receiver is defective. Be sure the microphone button is not pushed down.

2. M-X switch in X position with no receive crystal. Socket accessible through front panel. If there is no crystal, switch to M (manual).

3. The 31. 5 MHz oscillator may not be functioning. To check this, connect a VTVM to pin #7 of V2 (6BK7). The voltage should be -4 to -5. If no voltage exists, tune L2 and if this doesn't restore oscillation as indicated by the VTVM, check the tube and circuitry, the 31. 5 MHz crystal may be defective.

INTERMITTENT

1. Can be due to intermittent short or open in coax antenna cable.

2. Defective tube. Tap each tube lightly as there may be an intermittent short in a tube. Use the eraser end of a pencil or similar object.

TRANSMITTER

INTERMITTENT

1. Be sure coax cable is not shorted or open. Switch to internal transmitter load and note TITAN meter reading and if it is steady, the difficulty is external to the TITAN. If the TITAN meter indicates intermittent power into the internal load, look for a defective V9 (6GK6) or V8 (12BY7). If these tubes are normal, inspect the associated circuitry for loose connections.

NO OUTPUT - One Transmit Channel

1. Defective crystal

DEAD ALL CHANNELS

1. Test V9 (6GK6) and V8 (12BY7) and circuits.

LOW OUTPUT

* 1. Switch to internal load and check output. If low, retune RF final plate capacitor C73 and padder C76 for maximum meter reading. If the output is now below 3. 5 watts, tune L8 and C68, V8 plate and V9 grid tuning for maximum DC volts at pin 2 with the channel selector set to channel 15. See alignment instructions. V9 (6GK6) may be defective. Refer to schematic for normal voltages.

RF CARRIER FEEDBACK

1. Shield on coax cable has poor ground on coax fitting. Check the SWR, a high ratio indicates, open coax, ungrounded coax shield or defective antenna.

2. Defective microphone wiring. The microphone audio cable is shielded, if the shield becomes ungrounded, a high hum level will be heard on the carrier, and RF getting onto the audio cable can result in overall RF feedback.

Connection of a ground lead to the rear of the TITAN will help.

LOW, POOR, OR NO MODULATION

1. Usually caused by defective tubes V11 (6AU6A), V10 (6BR8A), or V12 (6GK6), the latter being more common.

2. Defective microphone, wiring to plug or defective cartridge.

3. Insufficient drive on RF amp. V9 (6GK6) check schematic for correct voltage.

4. Defective RF tube V9 (6GK6)

IMPORTANT: All tube changes must be made with EXACT replacement types as indicated on the accompanying schematic (#A-0183-R2) and in the following replacement parts list.

COMMON

Set blows fuses instantly

1. Look for shorted diode CR1, CR2, CR3, or CR4.

2. Short circuit on filament lead.

Comment: Visual inspection of bottom of unit for a charred component will often localize faulty circuit.

NOTE: Refer to schematic #A-0183(R-2) for typical voltages and gain measurements.

Transmit and Receive Crystals

The Tram TITAN is supplied with all 23 transmit crystals installed. Receive crystals are available for each of the 23 receive frequencies.

For continued operation within specifications and F. C. C. Regulations, order replacement transmit crystals by Tram part number and either frequency or channel number, from Tram Electronics, Inc.

	Transmit		Receive	
Channel No.	Freq. kHz	Tram part #	Freq. kHz	Tram part #
1	13482.5	#A-0194-1	4990.0	#A-0187-1
2	13487.5	#A-0194-2	4980.0	#A-0187-2
3	13492.5	#A-0194-3	4970.0	#A-0187-3
4	13502.5	#A-0194-4	4950.0	#A-0187-4
5	13507.5	#A-0194-5	4940.0	#A-0187-5
6	13512.5	#A-0194-6	4930.0	#A-0187-6
7	13517.5	#A-0194-7	4920.0	#A-0187-7
8	13527.5	#A-0194-8	4900.0	#A-0187-8
9	13532.5	#A-0194-9	4890.0	#A-0187-9
10	13537.5	#A-0194-10	4880.0	#A-0187-10
11	13542.5	#A-0194-11	4870.0	#A-0187-11
12	13552.5	#A-0194-12	4850.0	#A-0187-12
13	13557.5	#A-0194-13	4840.0	#A-0187-13
14	13562.5	#A-0194-14	4830.0	#A-0187-14
15	13567.5	#A-0194-15	4820.0	#A-0187-15
16	13577.5	#A-0194-16	4800.0	#A-0187-16
17	13582.5	#A-0194-17	4790.0	#A-0187-17
18	13587.5	#A-0194-18	4780.0	#A-0187-18
19	13592.5	#A-0194-19	4770.0	#A-0187-19
20	13602.5	#A-0194-20	4750.0	#A-0187-20
21	13607.5	#A-0194-21	4740.0	#A-0187-21
22	13612.5	#A-0194-22	4730.0	#A-0187-22
23	13627.5	#A-0194-23	4700.0	#A-0187-23

Component Values for Tram TITAN Schematic Drawing Number A-0183-R2

R1, R9	RESISTOR, COMPOSITION TYPE 1 K OHMS 10% 1/2 WATT
R29, R52 R87, R93	RESISTOR, COMPOSITION TYPE 220,000 OHMS 10% 1/2 WATT
R2, R10, R13, R16, R56 R101, R103, R110	RESISTOR, COMPOSITION TYPE 100,000 OHMS 10% 1/2 WATT
R4, R20, R108, R115	RESISTOR, COMPOSITION TYPE 220 OHMS 10% 1/2 WATT
R5	RESISTOR, VARIABLE WIRE WOUND 500 OHMS 30% LINEAR TAPER R. F. Gain Control, Tram #A-0184
R6, R7, R22, R32 R57, R104, R96	RESISTOR, COMPOSITION TYPE 470,000 OHMS 10% 1/2 WATT
R8, R38, R74	RESISTOR, COMPOSITION TYPE 10 OHMS 10% 1/2 WATT
R19, R26 R75, R99	RESISTOR, COMPOSITION TYPE 2200 OHMS 10% 1/2 WATT
R12, R34, R18 R50, R67, R81	RESISTOR, COMPOSITION TYPE 68,000 OHMS 10% 1/2 WATT
R14, R70	RESISTOR, COMPOSITION TYPE 10,000 OHMS 10% 1/2 WATT
R15, R25, R43, R82	RESISTOR, COMPOSITION TYPE 47,000 OHMS 10% 1/2 WATT
R17, R60, R40, R73	RESISTOR, COMPOSITION TYPE 100 OHMS 10% 1/2 WATT
R21, R23, R27, R45, R46, R47 R51, R88, R91, R92, R95, R100	RESISTOR, COMPOSITION TYPE 1 MEG. OHM 10% 1/2 WATT
R24	RESISTOR, COMPOSITION TYPE 560,000 OHMS 10% 1/2 WATT
R3	RESISTOR, COMPOSITION TYPE 150 K OHMS 10% 1/2 WATT
R44	RESISTOR, COMPOSITION TYPE 820,000 OHMS 10% 1/2 WATT

R113, R11	RESISTOR, COMPOSITION TYPE 6,800 OHMS 10% 1/2 WATT
R33	RESISTOR, VARIABLE COMPOSITION With Switch 500,000 OHMS 30% AUDIO TAPER, CTS #LF 4422 Volume Control - Tram #A-0093-1
R28	RESISTOR, VARIABLE COMPOSITION 500,000 OHMS 30% LINEAR TAPER WITH REVERSE SWITCH, CTS #5378 Limiter Control - Tram #A-0093-2
R31, R30, R71, R80	RESISTOR, COMPOSITION TYPE 150,000 OHMS 10% 1/2 WATT
R36	RESISTOR, COMPOSITION TYPE 470 OHMS 10% 2 WATT
R37, R39, R111 R53, R97	RESISTOR, COMPOSITION TYPE 22,000 OHMS 10% 1/2 WATT
R35	RESISTOR, COMPOSITION TYPE 47,000 OHMS 10% 1 WATT
R41	RESISTOR, VARIABLE COMPOSITION 500,000 OHMS 30% LINEAR TAPER SLOTTED SHAFT "S" 9 METER Sensitivity Control - Tram #A-0133-3
R48	RESISTOR, COMPOSITION TYPE 6.8 MEG. OHM 10% 1/2 WATT
R49, R112	RESISTOR, VARIABLE COMPOSITION 10,000 OHMS 30% 1/2 WATT Squelch Control - Tram #A-0133-5
R54	RESISTOR, COMPOSITION TYPE 100,000 OHMS 10% 1 WATT
R55	RESISTOR, VARIABLE COMPOSITION 250,000 OHMS 30% AUDIO TAPER Tone Control - Tram #A-0133-2
R58	RESISTOR, VARIABLE COMPOSITION 2500 OHMS 30% LINEAR TAPER WITH KNURLED SHAFT, SWR Calibration Tram #A-0133-4

R105	RESISTOR, COMPOSITION TYPE 47 OHMS 10% 1/2 WATT
R61	RESISTOR, COMPOSITION TYPE 22,000 OHMS 10% 1 WATT
R59, R62	RESISTOR, VARIABLE WIRE WOUND 1000 OHMS 30% LINEAR TAPER "Humdinger" CTS #BE 23374 Tram #A-0092-1
R63, R64, R65	RESISTOR, COMPOSITION TYPE 220 OHMS 10% 2 WATT
R66, R106	RESISTOR, COMPOSITION TYPE 180 OHMS 10% 2 WATT
R68	RESISTOR, COMPOSITION TYPE 330 OHMS 10% 1/2 WATT
R69	RESISTOR, COMPOSITION TYPE 15,000 OHMS 10% 1/2 WATT
R72, R102	RESISTOR, COMPOSITION TYPE 33,000 OHMS 10% 1/2 WATT
R76, R77	RESISTOR, COMPOSITION TYPE 20 OHMS 5% 1/2 WATT
R83	RESISTOR, WIRE WOUND 100 OHMS 10% 7 WATT, IRC PW 7
R85	RESISTOR, WIRE WOUND 300 OHMS 10% 7 WATT, IRC PW 7
R86	RESISTOR, COMPOSITION TYPE 2.7 OHMS 10% 1 WATT
R79, R107	RESISTOR, COMPOSITION TYPE 1800 OHMS 10% 2 WATT
R89	RESISTOR, COMPOSITION TYPE 10,000 OHMS 10% 2 WATT
R90	RESISTOR, COMPOSITION TYPE 4700 OHMS 10% 1 WATT
R84	RESISTOR, WIRE WOUND 400 OHMS 10% 7 WATT, IRC PW 7

R94	RESISTOR, COMPOSITION TYPE 330,000 OHMS 10% 1/2 WATT
R98	RESISTOR, COMPOSITION TYPE 2.2 MEG. OHMS 10% 1/2 WATT
R42	RESISTOR, COMPOSITION TYPE 22,000 OHMS 10% 2 WATT
R78, R114	RESISTOR, COMPOSITION TYPE 1500 OHMS 10% 1/2 WATT
R109	RESISTOR, COMPOSITION TYPE 4700 OHMS 10% 1/2 WATT
C1, C2, C32	CAPACITOR, CERAMIC DISC. 33 pf 5% NPO 500 W. V. D. C.
C3, C4, C5, C6, C7, C10, C11, C38, C42, C70 C90, C91, C99, C77, C78, C113	CAPACITOR, CERAMIC DISC. GENERAL PURPOSE .001 MFD 5/16" Dia. 500 W. V. D. C.
C8, C41, C43, C112	CAPACITOR, CERAMIC DISC. 10 pf 5% NPO 500 W. V. D. C.
C9	CAPACITOR, CERAMIC DISC. 3.3 pf 10% NPO 500 W. V. D. C.
C13, C16, C72	CAPACITOR, CERAMIC DISC. 5 pf 5% NPO 500 W. V. D. C.
C14	CAPACITOR, SILVER DIP MICA 68 pf 5% 500 W. V. D. C.
C15	TRIMMER 2-20 pf, Part of C46
C17, C35, C40 C85, C95, C107	CAPACITOR, CERAMIC DISC. 220 pf 20% 500 W. V. D. C.
C18, C61, C71 C82, C84, C111	CAPACITOR, CERAMIC DISC. .005 MFD GMV or Plus 80 to Minus 20% 500 W. V. D. C.
C19, C24, C68	CAPACITOR, VARIABLE CERAMIC TRIMMER 7-25 pf NPO Erie 538-002-93R, Tram #A-0185-1

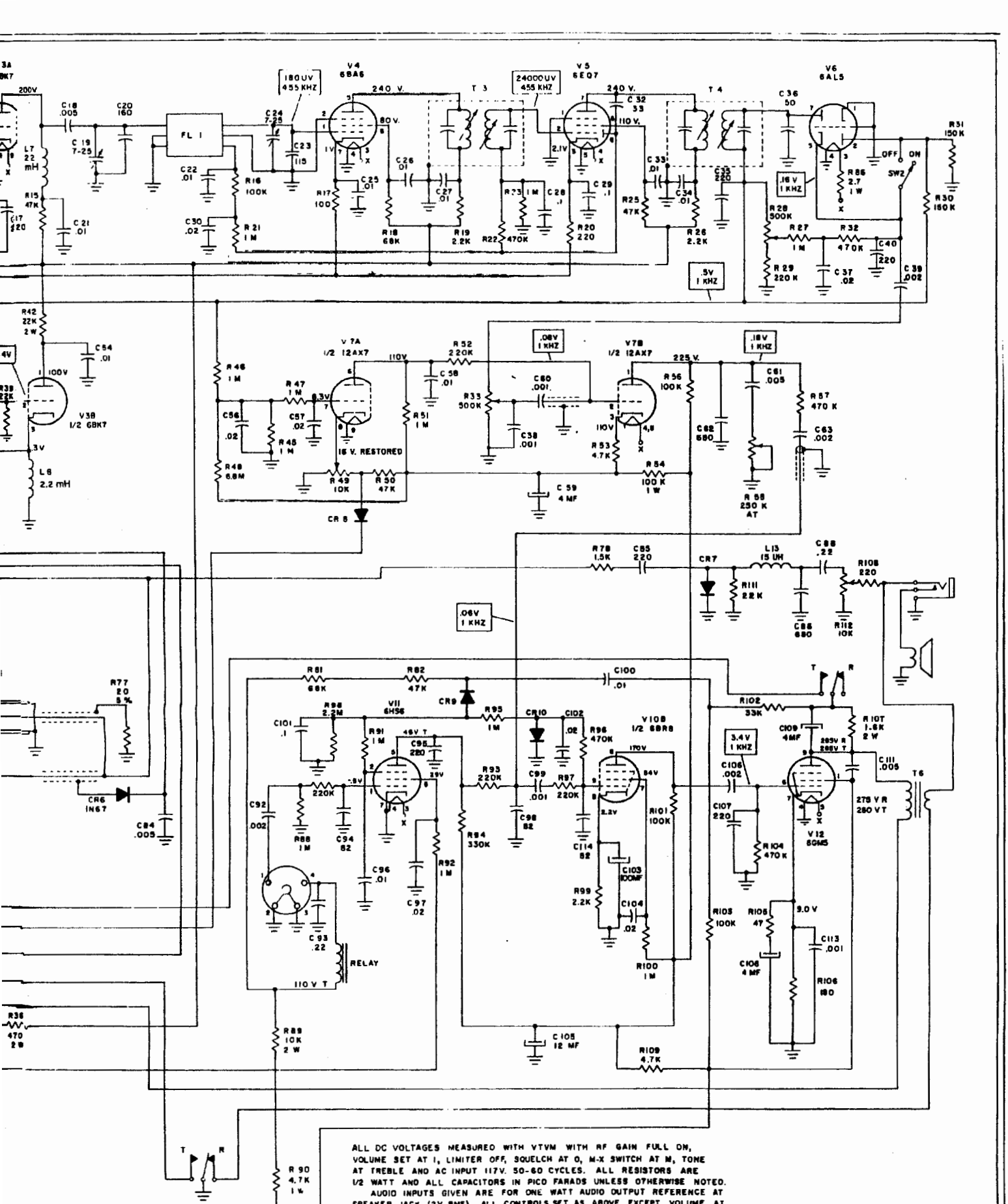
C20	CAPACITOR, SILVER DIP MICA 160 pf 5% 500 W. V. D. C.
C21, C22, C25, C26, C27, C33, C34, C54, C58, C64, C96, C100, C102, C110	CAPACITOR, CERAMIC DISC. GENERAL PURPOSE .01 MFD GMV or Plus 80 to minus 20% 500 W. V. D. C.
C23	CAPACITOR, SILVER DIP MICA 115 pf 5% 500 W. V. D. C.
C28, C29, C101	CAPACITOR, MOLDED TUBULAR .1 MFD 200 W. V. D. C.
C30, C37, C44, C56, C57, C97, C104	CAPACITOR, CERAMIC DISC. .02 MFD GMV or Plus 80 to Minus 20% 500 W. V. D. C.
C12, C31, C93, C88	CAPACITOR, MOLDED TUBULAR .22 MFD 20% 200 W. V. D. C.
C39, C60, C63, C75, C92, C106	CAPACITOR, CERAMIC DISC. .002 MFD GMV or Plus 80 to Minus 20% 500 W. V. D. C.
C74	CAPACITOR, CERAMIC DISC. 22 pf 5% NPO 500 W. V. D. C.
C46	CAPACITOR, CERAMIC DISC. 15 pf 5% Temperature Compensating N750
C47, C52, C67, C80	CAPACITOR, SILVER DIP MICA 51 pf 5% 500 W. V. D. C.
C45	CAPACITOR, CALIBRATION TRIMMER For Adjustment of Low end of Tuning Dial VARIABLE CERAMIC 3-12 pf Tram #A-0085
C46A, C46B	CAPACITOR, MAIN TUNING - SPECIAL 2 Gang Tram #A-0082-1
C50	CAPACITOR, SILVER DIP MICA 430 pf 5% 500 W. V. D. C.
C55	CAPACITOR, MOLDED TUBULAR .47 MFD 100 W. V. D. C.

C51	CAPACITOR, SILVER DIP MICA 270 pf 5% 500 W. V. D. C.
C65	CAPACITOR, SILVER DIP MICA 10 pf 5% 500 W. V. D. C.
C49	CAPACITOR, SILVER DIP MICA 43 pf 5% 500 W. V. D. C.
C53	CAPACITOR, SILVER DIP MICA 180 pf 5% 500 W. V. D. C.
C108, C109, C59	CAPACITOR, Tubular Electrolytic 4 MFD 150 W. V. D. C.
C62, C69, C86	CAPACITOR, CERAMIC DISC. 680 pf 20% 500 W. V. D. C. GENERAL PURPOSE
C66, C83	CAPACITOR, SILVER DIP MICA 100 pf 5% 500 W. V. D. C.
C73	CAPACITOR, VARIABLE AIR Final Plate Tuning 4. 7 - 25. 7 pf Tram #A-0102
C76	CAPACITOR, VARIABLE PADDER TYPE 100-500 pf Arco Electronics, Inc. Type 304 M, Tram #A-0088
C79, C81	CAPACITOR, MOLDED TUBULAR .001 MFD 10% 1000 W. V. D. C.
C87A, C87B, C87C	CAPACITOR 3 SECTION CAN TYPE ELECTROLYTIC 40/40/40 MFD 450 W. V. D. C., Tram #A-0094-1
C94, C98, C114	CAPACITOR, CERAMIC DISC. 82 pf GMV or Plus 80 to Minus 20% 500 W. V. D. C.
C103	CAPACITOR, Tubular Electrolytic 100 MFD 25 W. V. D. C.
C89A, C89B	CAPACITOR, DUAL CERAMIC DISC. A. C. Line By-Pass .0047 MFD 20%

C105	CAPACITOR, TUBULAR ELECTROLYTIC 12 MFD 450 W. V. D. C.
C36	CAPACITOR, CERAMIC DISC. 50 pf 10% 500 W. V. D. C.
L1, L10, L13	R. F. CHOKE, SOLENOID 15 MICRO-HENRY, Tram #A-0095-4
L2, L8	R. F. COIL, Tram #A-0029
L3, L7, L6	R. F. CHOKE 2.2 MILLI-HENRY Tram #A-0095-5
L4	R. F. COIL - SECOND MIXER TUNING Tram #A-0052
L5	4.5 MHz OSCILLATOR COIL Tram #A-0109
L9	PI-NETWORK COIL Tram #A-0127
L11, L12	FILTER COIL, Tram #A-0126
NE1, NE2	NEON - Obtain from Tram Electronics
T1	ANTENNA TRANSFORMER Tram #A-0030
T2	27 MHz INTERSTAGE TRANSFORMER Double Tuned, Automatic Mfg. Co. #MI-33717, Tram #A-0191
T3, T4	INTERSTAGE TRANSFORMER 455 kHz, Tram #A-0144-1 Automatic Mfg. Co. #1655-2
T5	POWER TRANSFORMER Tram #A-0002
T6	MODULATION TRANSFORMER Tram #A-0039
SPEAKER	4 x 6 OVAL 2.15 oz. MAGNET Tram #A-0182

SW6	POWER ON SWITCH Part of Volume Control R33
SW1, SW3	MANUAL TUNE or CRYSTAL RECEIVE SWITCH, Centralab PA 216, 35-2809-2 Tram #A-0190
SW2	PART OF LIMITER CONTROL R28
SW7A, SW7B, SW7C, SW7D	RELAY CONTACTS
SW4	SPOT SWITCH Switchcraft #103, Tram #A-0192
SW5A, SW5B	METER SWITCH Tram #A-0171
SW8	23 POSITION TRANSMIT SWITCH Tram #A-0188
RELAY	4 PDT, Tram #A-0135
F1	FUSE 2 AMP
CR8, CR9, CR10	SILICON RECTIFIER DIODE 600 VOLT PIV 750 MA
CR1, CR2, CR3, CR4	FULL WAVE BRIDGE - Tram #A-0205
CR5, CR6, CR7	DIODES 1N67A
X2	FIRST OSCILLATOR RECEIVE CRYSTAL 31.5 MHz .003% THIRD OVERTONE HC-6/U HOLDER, Tram #A-0178
I1, I2, I3	PILOT LAMPS #47
FL 1	MECHANICAL FILTER, Tram #A-0186
X3	RECEIVE CRYSTAL See Chart - Tram #A-0187 Specify Channel Number
J2	EXTERNAL SPEAKER & HEADPHONE JACK, Switchcraft #12-A, Tram #A-0193

J1	MICROPHONE JACK Switchcraft #60HA4F, Tram #A-0189
J3	CHASSIS CONNECTOR SO-239, Tram #A-0075
X1	TRANSMIT CRYSTAL See Chart page 25, Tram #A-0194- Specify Channel Number



ALL DC VOLTAGES MEASURED WITH VTVM WITH RF GAIN FULL ON, VOLUME SET AT 1, LIMITER OFF, SQUELCH AT 0, M-X SWITCH AT M, TONE AT TREBLE AND AC INPUT 117V. 50-60 CYCLES. ALL RESISTORS ARE 1/2 WATT AND ALL CAPACITORS IN PICO FARADS UNLESS OTHERWISE NOTED.

AUDIO INPUTS GIVEN ARE FOR ONE WATT AUDIO OUTPUT REFERENCE AT SPEAKER JACK (2V RMS). ALL CONTROLS SET AS ABOVE EXCEPT VOLUME AT MAXIMUM. AUDIO MEASUREMENTS ARE FOR 1 KHZ SINE WAVE.

RF MEASUREMENTS MADE WITH UNMODULATED SIGNAL ADJUSTED TO PROVIDE 1 VOLT DC ACROSS DETECTOR LOAD RESISTORS.

* VALUE PICKED TO CORRECT "S" METER LINEARITY.

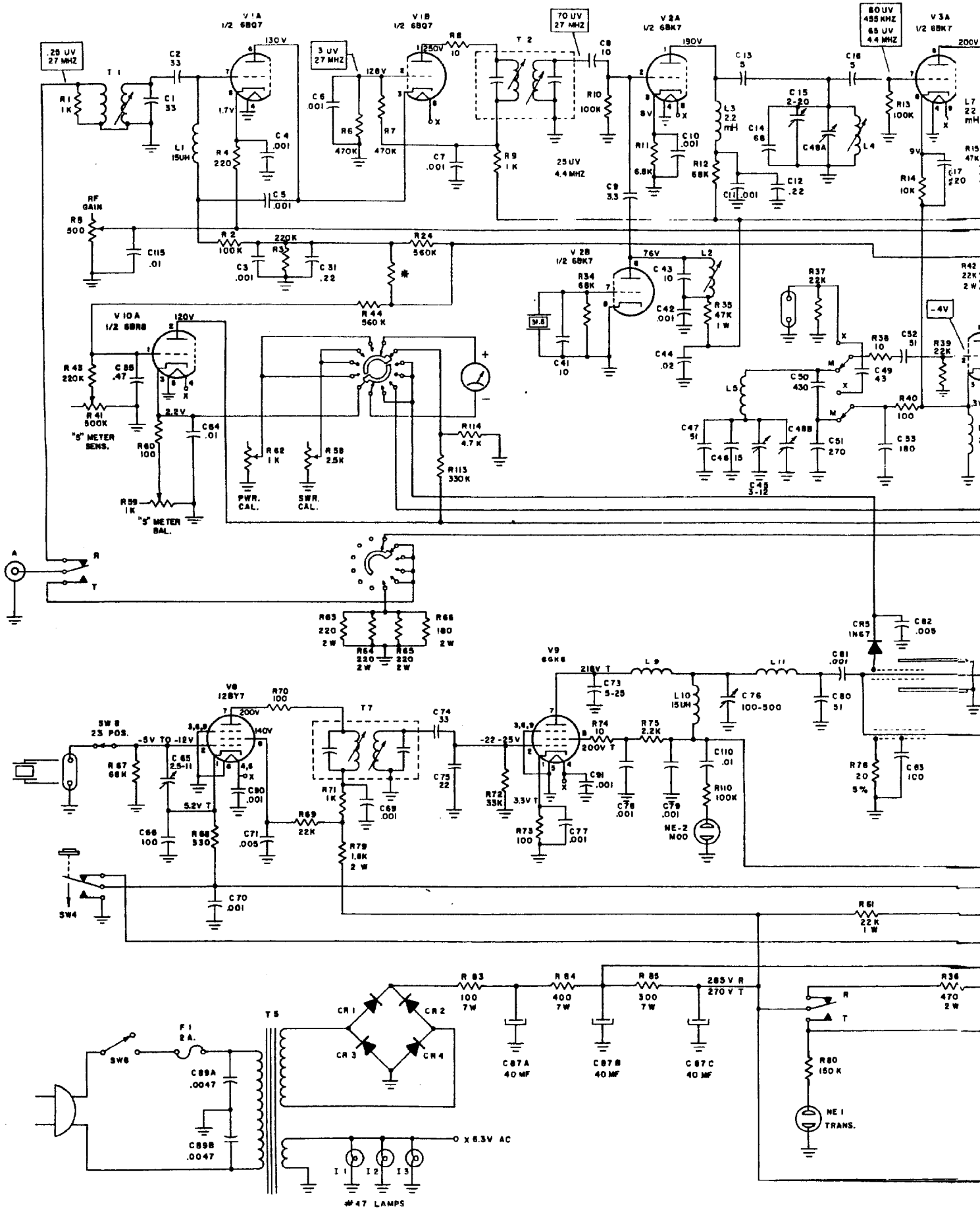
REVISED NOV 1, 1968

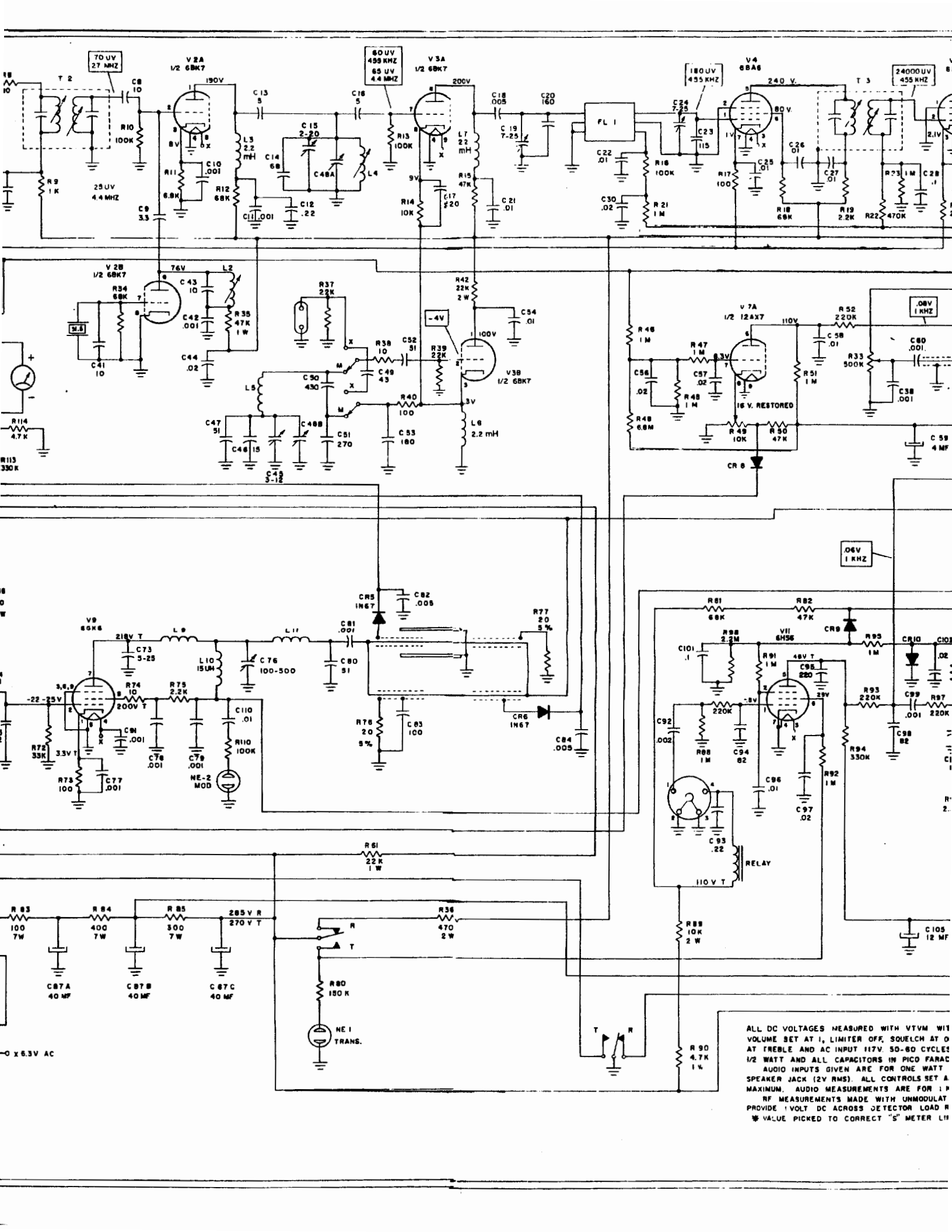
TRAM CORPORATION
WINNISQUAM, N.H.
USA

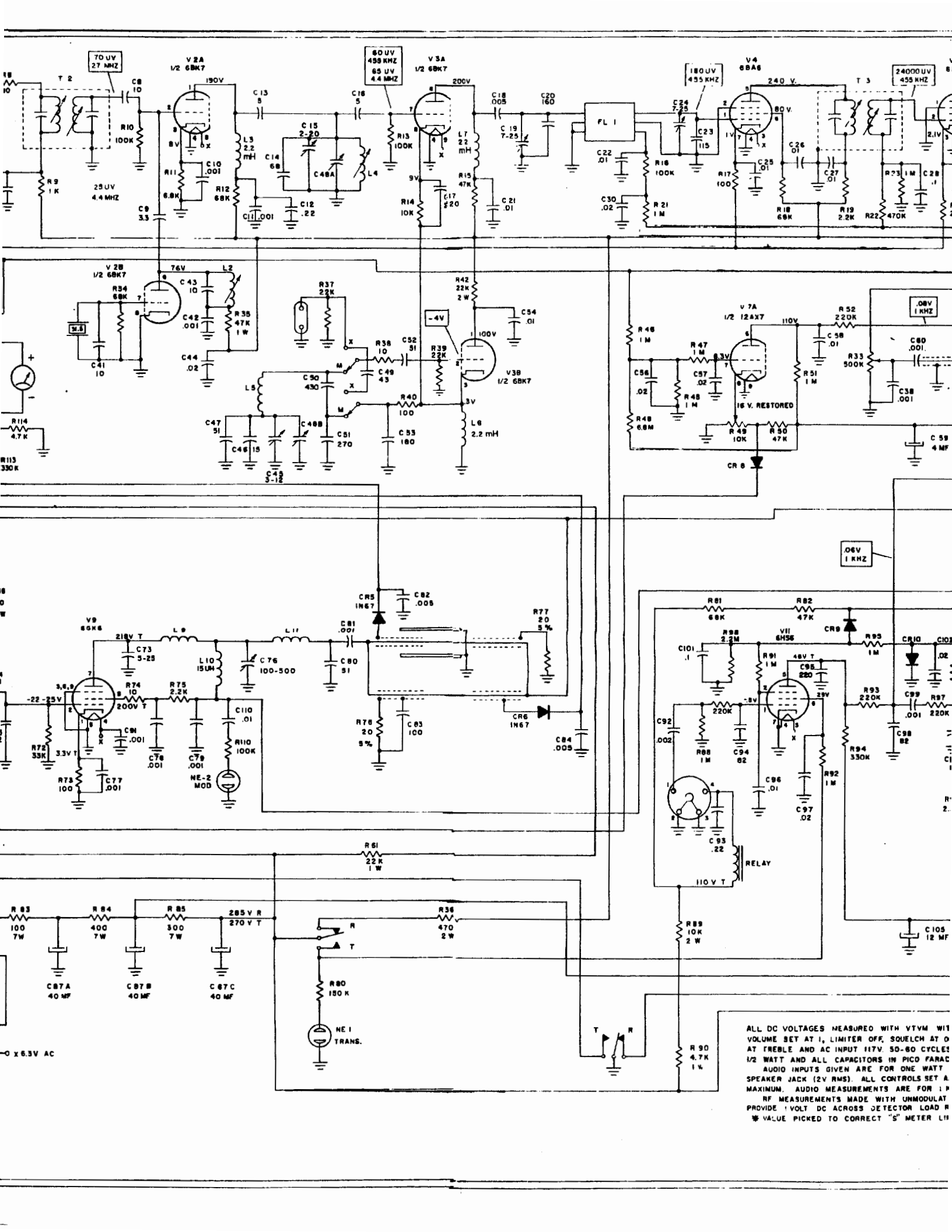
TRAM TITAN SCHEMATIC

DRAWN CHK'D

DWG A-0183 R5


.25 UV 27 MHZ
V1A 1/2 6BQ7
130 V
T1
C2 33
C1 33
L1 15UH
R1 1K
R4 220
C4 .001
C5 .001
1.7V
3 UV 27 MHZ
V1B 1/2 6BQ7
250V
R8 10
T2
70 UV 27 MHZ
C8 10
R10 100K
C6 .001
R6 470K
R7 470K
C7 .001
R9 1K
25 UV 4.4 MHZ
V2A 1/2 6BK7
190V
C13 5
L3 2.2 mH
C10 .001
R11 6.8K
R12 68K
C11 .001
C9 3.3
C14 68
C15 2-20
C48A
L4
C12 .22
60 UV 455 KHZ
65 UV 4.4 MHZ
C16 5
V3A 1/2 6BK7
200V
R13 100K
R14 10K
C17 220
RF GAIN
R5 500
C115 .01
R2 100K
R3 220K
C3 .001
C31 .22
R24 560K
R44 560 K
V2B 1/2 6BK7
76V
R34 68K
C41 10
C43 10
C42 .001
L2
R35 47K 1W
C44 .02
R37 22K
R38 10
C52 51
C49 43
C50 430
L5
C47 51
C48B
C51 270
C53 180
R40 100
-4V
R39 22K
V10A 1/2 6BR8
120V
R43 220K
C85 .47
R41 500K
"S" METER SENS.
2.2V
C84 .01
R60 100
R59 1K
"S" METER BAL.
R62 1K
R58 2.5K
PWR. CAL.
SWR. CAL.
R114 4.7 K
R113 330K
C45 3-12
A
R
T
R63 220 2W
R64 220 2W
R65 220 2W
R66 180 2W
CR5 1N67
C82 .005
C81 .001
V9 6GH6
210V T
L9
L11
C73 3-25
L10 15UH
C76 100-500
C80 51
R74 10 200V T
R75 2.2K
C110 .01
R110 100K
NE-2 M00
C78 .001
C79 .001
C91 .001
R72 33K
3.3V T
R73 100
C77 .001
R76 20 5%
C83 100
V8 12BY7
200V
R70 100
T7
C74 33
SW 8 23 POS.
-8V TO -12V
140V
C65 2.5-11
R67 68K
C66 100
R68 330
C90 .001
5.2V T
C71 .005
R69 22K
R71 1K
C69 .001
R79 1.8K 2 W
C75 22
-22 -25V
C70 .001
SW4
R61 22K 1W
R83 100 7W
R84 400 7W
R85 300 7W
285 V R
270 V T
R36 470 2W
T5
CR1
CR2
CR3
CR4
F1 2A.
SW6
C89A .0047
C89B .0047
C87A 40 MF
C87B 40 MF
C87C 40 MF
R80 150 K
NE 1 TRANS.
X 6.3V AC
I1
I2
I3
#47 LAMPS


70 UV 27 MHZ
V2A 1/2 6BK7
190V
60 UV 455 KHZ 65 UV 4.4 MHZ
V3A 1/2 6BK7
200V
180 UV 455 KHZ
V4 6BA6
240 V.
80 V.
24000 UV 455 KHZ
T 2
T 3
FL 1
25 UV 4.4 MHZ
8V
1V
2.1V
V2B 1/2 6BK7
76V
-4V
100V
V3B 1/2 6BK7
3V
V7A 1/2 12AX7
110V
.08V 1 KHZ
16 V. RESTORED
CR 8
.06V 1 KHZ
V9 6GK6
218V T
200V T
-22 -25V
3.3V T
NE-2 MOD
CR5 IN67
CR6 IN67
V11 6H56
48V T
-8V
29V
CR9
CR10
RELAY
110 V T
285 V R
270 V T
NE 1 TRANS.
R
T
ALL DC VOLTAGES MEASURED WITH VTVM WIT
VOLUME SET AT 1, LIMITER OFF, SQUELCH AT 0
AT TREBLE AND AC INPUT 117V. 50-60 CYCLES
1/2 WATT AND ALL CAPACITORS IN PICO FARAC
AUDIO INPUTS GIVEN ARE FOR ONE WATT
SPEAKER JACK (2V RMS). ALL CONTROLS SET A
MAXIMUM. AUDIO MEASUREMENTS ARE FOR 1
RF MEASUREMENTS MADE WITH UNMODULAT
PROVIDE 1 VOLT DC ACROSS DETECTOR LOAD R
* VALUE PICKED TO CORRECT "S" METER LI
-O x 6.3V AC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V 3A 1/2 6BK7
180 UV 455 KHZ
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T 2
T 3
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V 3B 1/2 6BK7
V 7A 1/2 12AX7
.08V 1 KHZ
16 V. RESTORED
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V9 6GK6
CR5 IN67
CR6 IN67
V11 6HS6
CR9
CR10
RELAY
110 V T
NE-2 MOD
NE I TRANS.
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VOLUME SET AT 1, LIMITER OFF, SQUELCH AT O
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AUDIO INPUTS GIVEN ARE FOR ONE WATT
SPEAKER JACK (2V RMS). ALL CONTROLS SET A
MAXIMUM. AUDIO MEASUREMENTS ARE FOR 1 K
RF MEASUREMENTS MADE WITH UNMODULAT
PROVIDE 1 VOLT DC ACROSS DETECTOR LOAD R
* VALUE PICKED TO CORRECT "S" METER LI