SECTION I

GENERAL INFORMATION

1-1. GENERAL DESCRIPTION.

1-2. The Model 612A UHF Signal Generator, Figure 1-1, covers a frequency range of 450 to 1230 MHz. It provides an output from a maximum of 0.5 volt into 50 ohms which can be attenuated precisely to levels as low as 0.1 microvolt. The attenuator is a waveguide-beyond-cutoff type, which, together with the crystal monitor circuit, provides reliable RF outputs which can be directly set on the calibrated dial.

1-3. The output frequency is determined by the use of high-frequency pencil triodes in a cavity-tuned circuit which permits wide-range operation and uniform tracking over the entire band. One pencil triode acts as the oscillator in a tuned-cathode, tuned-plate circuit while the other acts as an RF amplifier in a double tuned amplifier stage with a bandwidth of 15 MHz. This arrangement permits high modulation percentages with modulating frequencies up to 5 MHz with minimum incidental FM. The frequency is tuned by means of a direct screw operating mechanism together with a direct reading dial. No charts or interpolations are required.

1-4. The Model 612A may be modulated internally or externally for amplitude or pulse modulation. Internal modulation is provided by a built-in, fixed-frequency oscillator for either 400 or 1000 Hz. External modulation can be either sine waves or pulses as described in Table 1-1. Pulse modulation may be applied to either the amplifier or directly to the oscillator when high on-off signal ratios are required. A dc restorer circuit permits modulation to occur either up or down from the level set to simulate TV modulation characteristics. The percent modulation meter responds to the peak value, indicating the degree of pulse modulation.

1-5. This generator has found wide acceptance in the UHF field including TV, public service communications, citizen's radio, marine operations, studio

Figure 1-1. Model 612A UHF Signal Generator

Table 1-1. Specifications

Frequency Range:
450 to 1,230 MHz in one band. Scale length approximately 15 inches.

Calibration Accuracy:
Within ±1%. Resettability better than 5 MHz at high frequencies.

Output Voltage:
0.1 μV to 0.5 V into 50 Ω load. Calibrated in V and dBm (0 dBm = 1 mW).

Output Accuracy:
±1 dB, 0 to -127 dBm over entire frequency.

Internal Impedance:
50 Ω. Maximum SWR 1.2 for attenuator settings of 0 dBm and below.

Leakage:
Negligible. Permits receiver sensitivity measurements down to 1 μV.

Amplitude Modulation:
Above 470 MHz, 0 to 90% at audio frequencies, indicated by panel meter. Accuracy, ±10% of full scale, 30% to 90% modulation.

Incidental FM:
Less than 0.002% for 30% AM.

Internal Modulation:
400 Hz and 1000 Hz ±10%. Envelope distortion less than 3% at 30% modulation for frequencies above 550 MHz.

External Modulation:
20 Hz to 5 MHz. Above 470 MHz, 2 V rms produces 85% AM at modulating frequencies up to 500 kHz; at least 40% AM at 5 MHz. Modulation may be up or down from the carrier level or symmetrical about the carrier level. Positive or negative pulses may be applied to increase or decrease RF output from the carrier level.

Pulse Modulation:
Pulse 1, (pulse applied to amplifier) positive or negative pulses, 4 to 40 V peak produce an RF on-off ratio of at least 20 dB. Minimum RF output pulse length, 1.0 μsec.

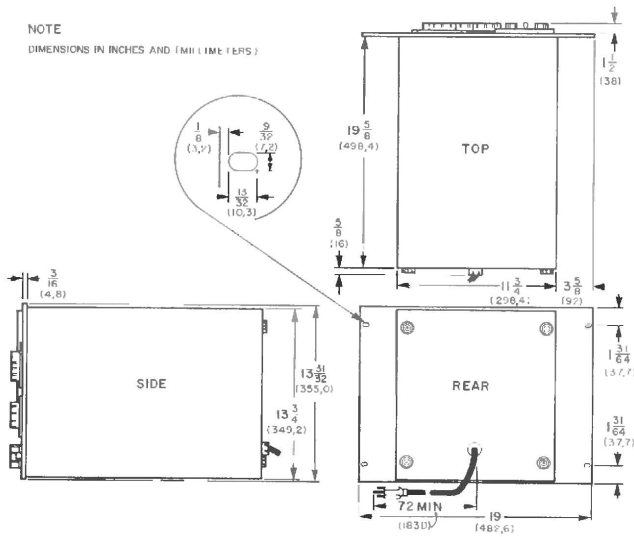
Pulse 2, (pulse applied to oscillator) positive or negative pulses, 4 to 40 V peak. No RF output during off time. Minimum RF output pulse length, 1.0 μsec.

RFI:
Conducted and radiated leakage limits are below those specified in MIL-I-6181D.

Power:
115 or 230 V ± 10%, 48 to 440 Hz, 360 VA.

Dimensions:
Cabinet Mount: 13-1/2 in. (343 mm) wide, 16-1/2 in. (419 mm) high, 21-1/2 in. (546 mm) deep.

Rack Mount:



Weight:
Net 57 lb (25, 5 kg)

Accessories Available:
Model 11500A RF Cable Assembly

Model 10503A Video Cable Assembly

Model 360B Low-Pass Filter (may be used where harmonic output must be reduced to a minimum as in slotted line measurements).

transmitter links, and aeronautical-radio-navigation. It will be found useful for measuring gain, sensitivity or image rejection of receivers, and selectivity. UHF television equipment can be tested directly, under actual modulation conditions, with the Model 612A.

1-6. DAMAGE IN TRANSIT.

1-7. Should shipping damage occur to this instrument, follow the procedure in the "Claim for Damage in Shipment" section on the last page of this manual.

"1-8. POWER REQUIREMENTS

1-9. The Model 612AUHF SignalGenerator requires a power source of 115 or 230 Vac $\pm 10\%$. A two-position slide switch(S5)permits operation from either a 115 or 230 volt power source. The number visible on the switch slider indicates the line voltage for which the instrument is connected. To prepare the instrument for operation, position the 115-230 volt switch so that the number visible on the slider corresponds to the available line voltage, and install a fuse of the correct rating.

1-10. POWER CABLE

1-11. The three-conductor power cable supplied with this instrument is terminated in a polarized three-prong male connector recommended by the National Electrical Manufacturers' Association. The third contact is an offset round pin added to a standard two-blade connector which grounds the instrument chassis when used with an appropriate receptacle. To use this connector in a standard two-contact receptacle, an adapter should be used to connect the NEMA connector to the two-contact system. When the adapter is used the third contact is terminated in a short lead from the adapter which can then be connected to the outlet mounting box in order to ground the instrument chassis.

1-12. HARMONIC FILTERS.

1-13. When measurements are being made to high accuracy and harmonic output is a problem, HP Model 360A or 360B low-pass filters should be used at the RF output connector. The Model 360A has a cutoff frequency of 700 MHz, and the Model 360B has a cutoff frequency of 1200 MHz.

SECTION III

CIRCUIT DESCRIPTION

3-1. GENERAL.

3-2. As shown in the block diagram, Figure 3-1, the Model 612A consists of the following sections:

Power Supply	Modulator
RF Oscillator	400/1000 Hz Generator
RF Power Amplifier	Output Meter
Output Attenuator	Percent Modulation Meter

3-3. POWER SUPPLY.

3-4. Full wave bridge circuits of the silicon rectifier type supply dc to the instrument. CR9, 10, 11, 12 B- and CR13, 14, 15, 16 B+ supply the B+ through the regulator and gate section V15 and V16. Bias voltage is supplied from CR3 through the regulator section consisting of V12, V13 and V14.

3-5. The filaments of pencil triodes V6 and V7 are supplied with dc voltage from rectifiers CR17-CR20 and transistor Q1.

3-6. RF OSCILLATOR.

3-7. The carrier oscillator (Figure 3-2) is a coaxial type employing plunger tuned coaxial resonators. The oscillator tube V6 is a pencil triode whose plate and cathode are manually tuned by sliding plungers over

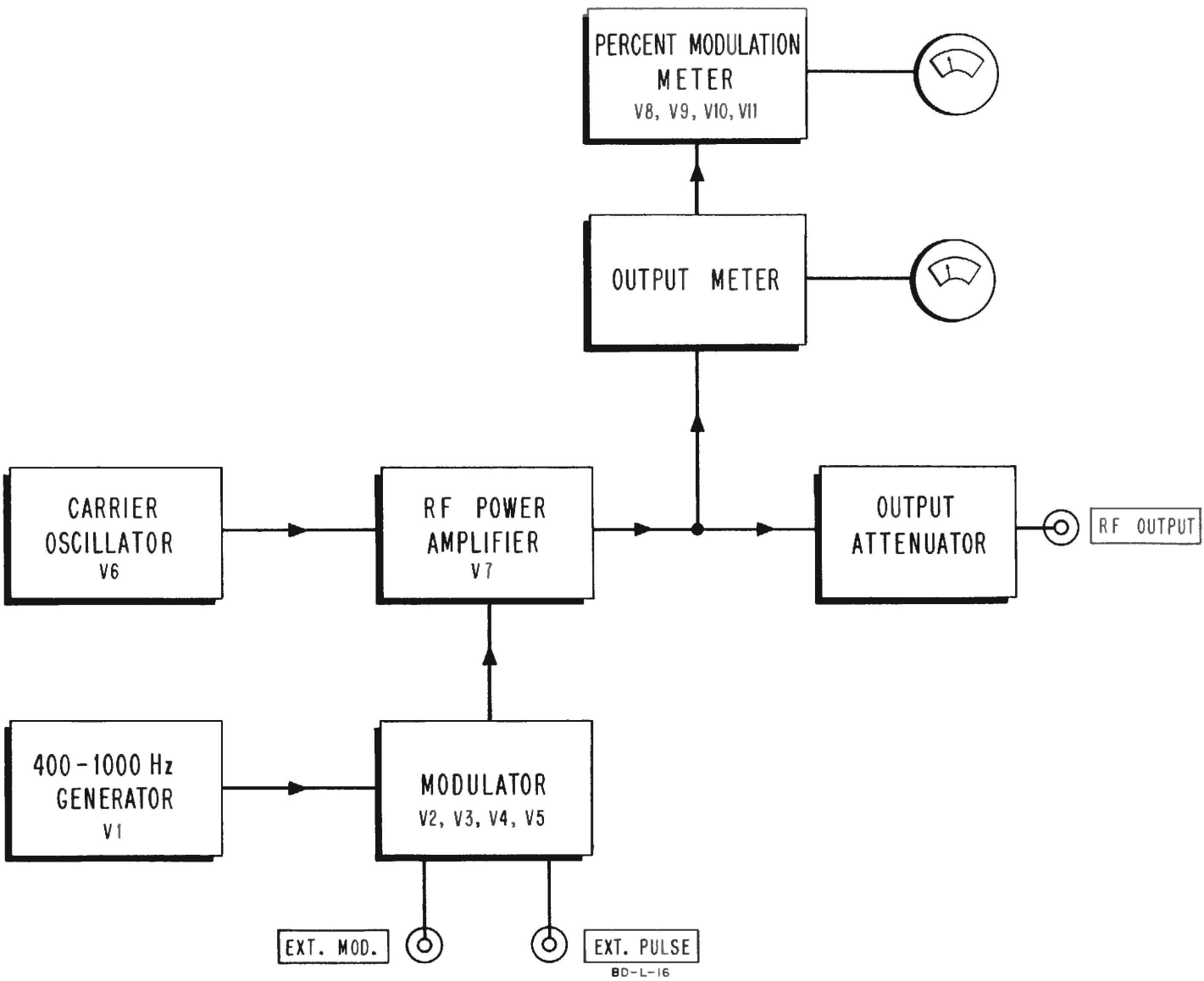


Figure 3-1. Circuit Block Diagram

the center conductors of the coaxial units. Coupling for oscillation between the cathode and the plate is accomplished through stray capacities and an insulated wire "capacitor" which adds capacity from plate to cathode.

3-8. RF POWER AMPLIFIER.

3-9. Coupling from the oscillator to RF amplifier is both capacitive and inductive, and is accomplished by V7's cathode pick-up coil; in some instruments the capacitive coupling is increased by the addition of a metal clip C30 on the cathode of V7, one end of which is close to the cathode of V6. The plate of V7 is tuned and loaded with a plunger tuned coaxial resonator which tracks with the oscillator tuning units. V7 acts as a grounded-grid amplifier whose plate resonator is coupled to an output resonator by means of a mechanical probe, C32. The output coaxial resonator is ganged to track with the oscillator and RF amplifier as part of the tuning unit. The RF amplifier is designed with sufficient reserve power to accommodate a 6 dB peak up from the normal output level of +4 dBm.

3-10. OUTPUT ATTENUATOR.

3-11. The attenuator system is a piston operating in a circular section which acts as a waveguide beyond cutoff for propagation modes used in the Model 612A. The desired mode character is achieved by a Faraday Shield which prevents capacitive coupling from the cavity into the attenuator guide. Coupling is accomplished inductively by a loop probe on the piston which is calibrated over a 127 dB range. The SWR of the output system is better than 1.2 over the entire frequency range which permits an accuracy of ±1 dB across 50 ohms. The output reference level is established at 0.35 volts across 50 ohms of +4 dBm to allow 100% modulation of the output.

3-12. MODULATOR.

3-13. V2, V3, V4 and V5 comprise the modulation amplifier section.

3-14. Dual Triode V2 is arranged so that when the instrument is driven by either positive or negative pulses, V2 furnishes constant amplitude positive pulses to drive the video amplifier V3. The output of V3 drives the cathode followers V4 and V5 depending upon the position of S1 (CW - Pulse 2). In the PULSE 2 position the output of V4 biases the carrier oscillator to cut off between pulses. While the incidental FM and the envelope shape characteristics are not as good as for the PULSE 1 position the advantage exists of having no residual carrier voltage between pulses.

3-15. In the PULSE 1 position the output of V5 biases the output of the RF amplifier to cut off between pulses; the RF amplifier being keyed by each pulse. The PULSE 1 position provides fastest rise time, minimum overshoot, and minimum incidental FM.

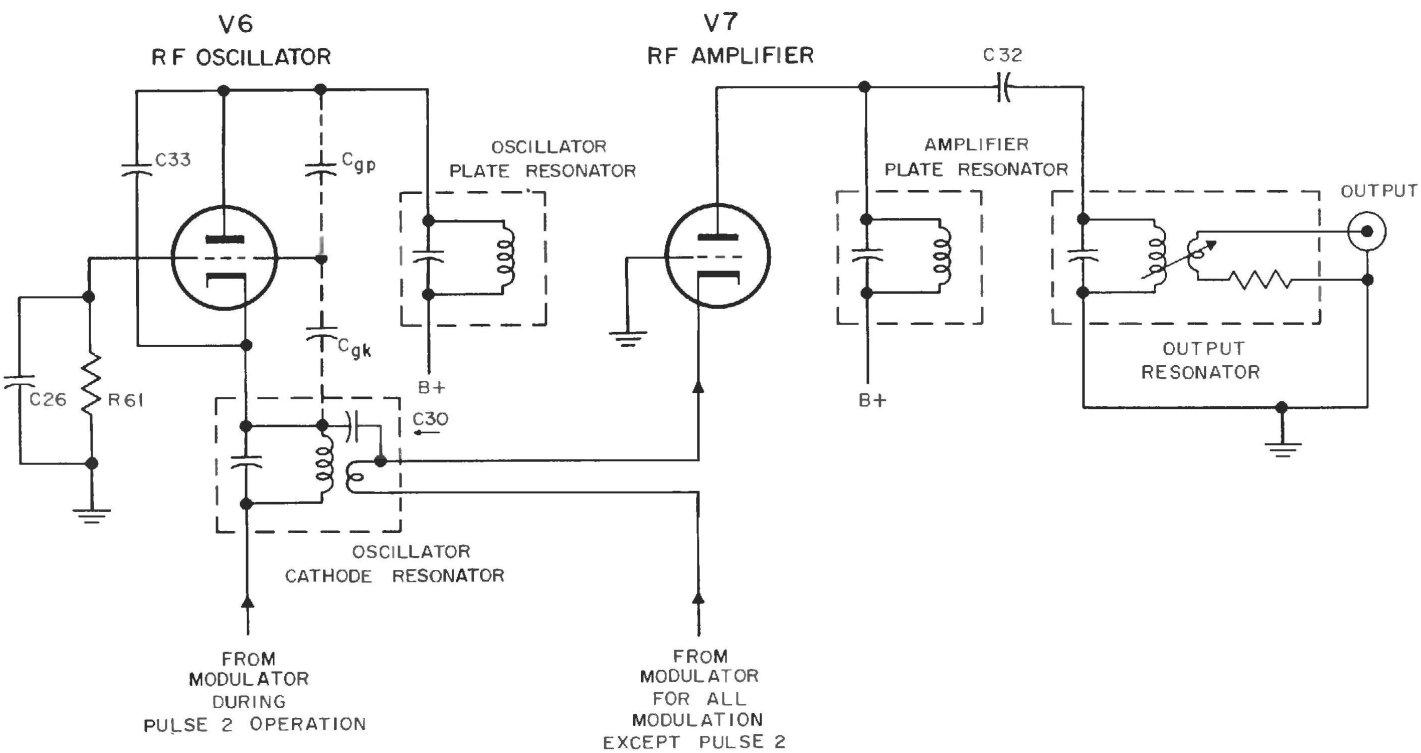


Figure 3-2. Simplified Schematic Diagram of Carrier Oscillator and Amplifier

Both the PULSE 1 and 2 positions require a peak pulse voltage of approximately 4 volts minimum at the MOD. INPUT jack.

3-16. When S1 is in the EXT MOD position, the carrier may be modulated through the RF amplifier by sine waves, pulses, or video signals.

3-17. 400/1000 Hz GENERATOR.

3-18. The modulation generator V1 is a conventional resistance-capacity oscillator. The selection of 400 or 1000 Hz is accomplished by switching the resistance values in the RC bridge in the oscillator circuit. The output from the modulation generator is applied to the cathode of the RF amplifier through cathode follower V5. The modulation signal then becomes a variation in the steady state cathode-bias voltage provided by V5.

3-19. OUTPUT METER.

3-20. The output meter samples the RF power level at the input to the output attenuator. The RF power is picked up by R66, is rectified by CR8 and fed through RF filter FL6 to the meter calibrating circuit. Crystal diode CR3 in the calibrating circuit serves as a nonlinear resistor loading CR8 and makes possible a more evenly spaced dB scale on the OUTPUT VOLTS meter.

3-21. PERCENT MODULATION METER.

3-22. The output obtained from CR8 after passing through the RF filter contains all modulation on the original RF energy. The ac component of the rectified RF energy from CR8 is coupled through C35 to amplifier tubes V8 and V9. The output of V9 drives full-wave rectifier V10 which charges C44 and C43 to the peak-to-peak voltage and applies a positive dc voltage to one grid of V11, and a negative dc voltage to the other grid of V11. V11A and V11B are two arms of a bridge circuit. Unbalancing this bridge causes the PERCENT MODULATION meter to read.

3-23. When modulation Up or Down, CR1 and CR2 are switched into the grid-bias circuit of V5 as dc restorers by S3A to preserve the bias required for good unidirectional modulation. Switch S3B removes a shunt from the meter circuit doubling its sensitivity so that the calibration is correct for this mode of operation.

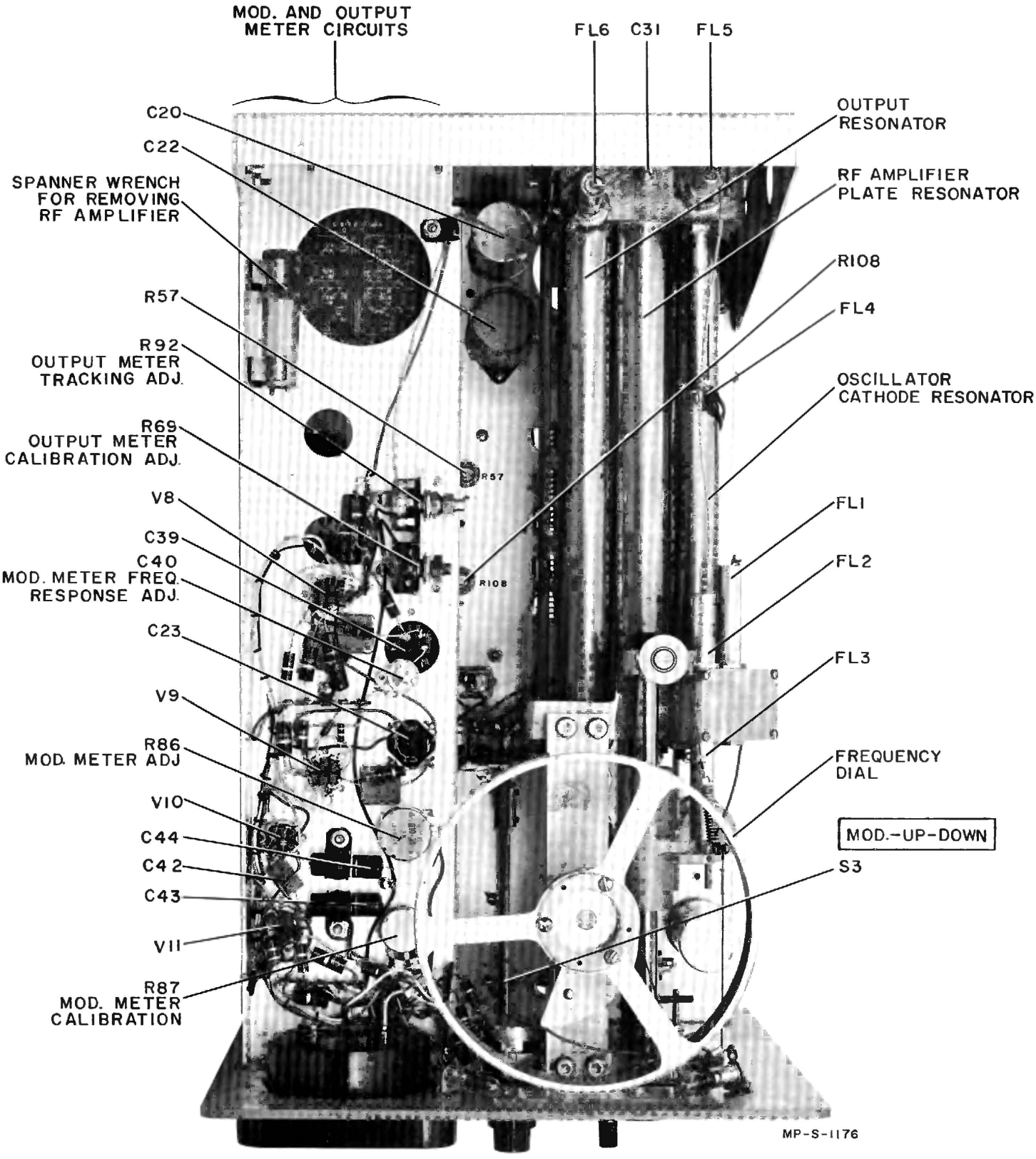


Figure 4-1. Top View Cover Removed

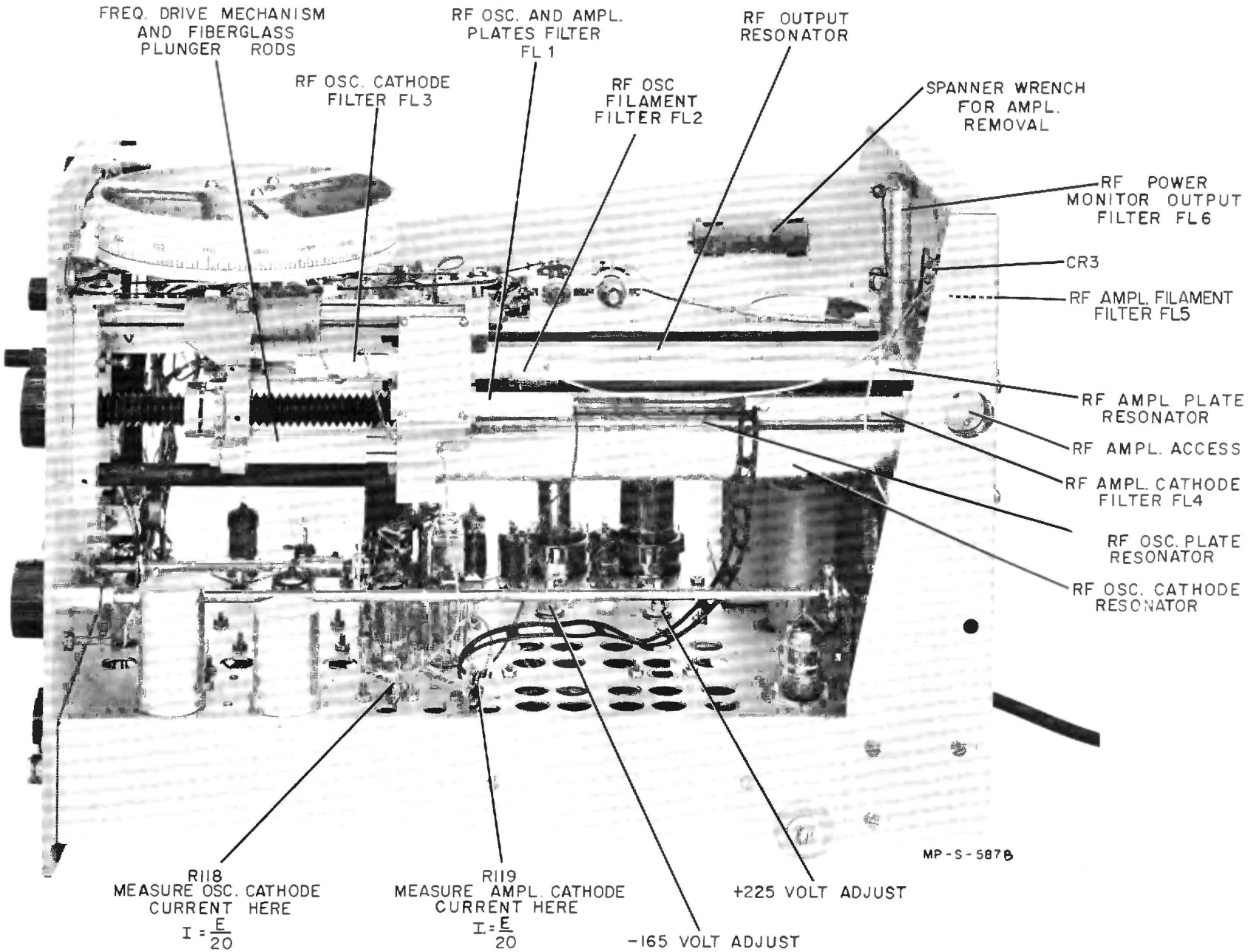


Figure 4-2. Right Side View Cover Removed

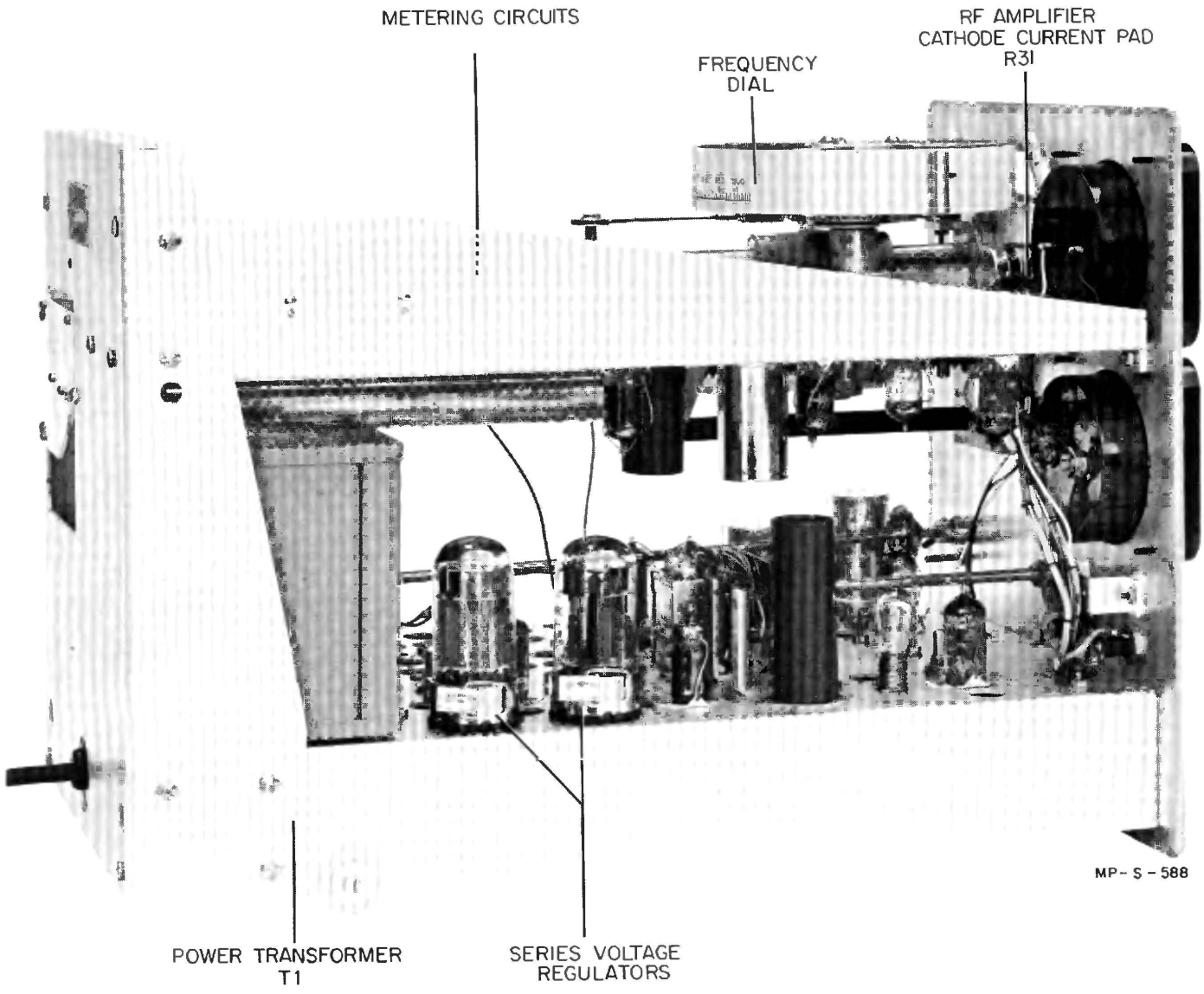


Figure 4-3. Left Side View Cover Removed

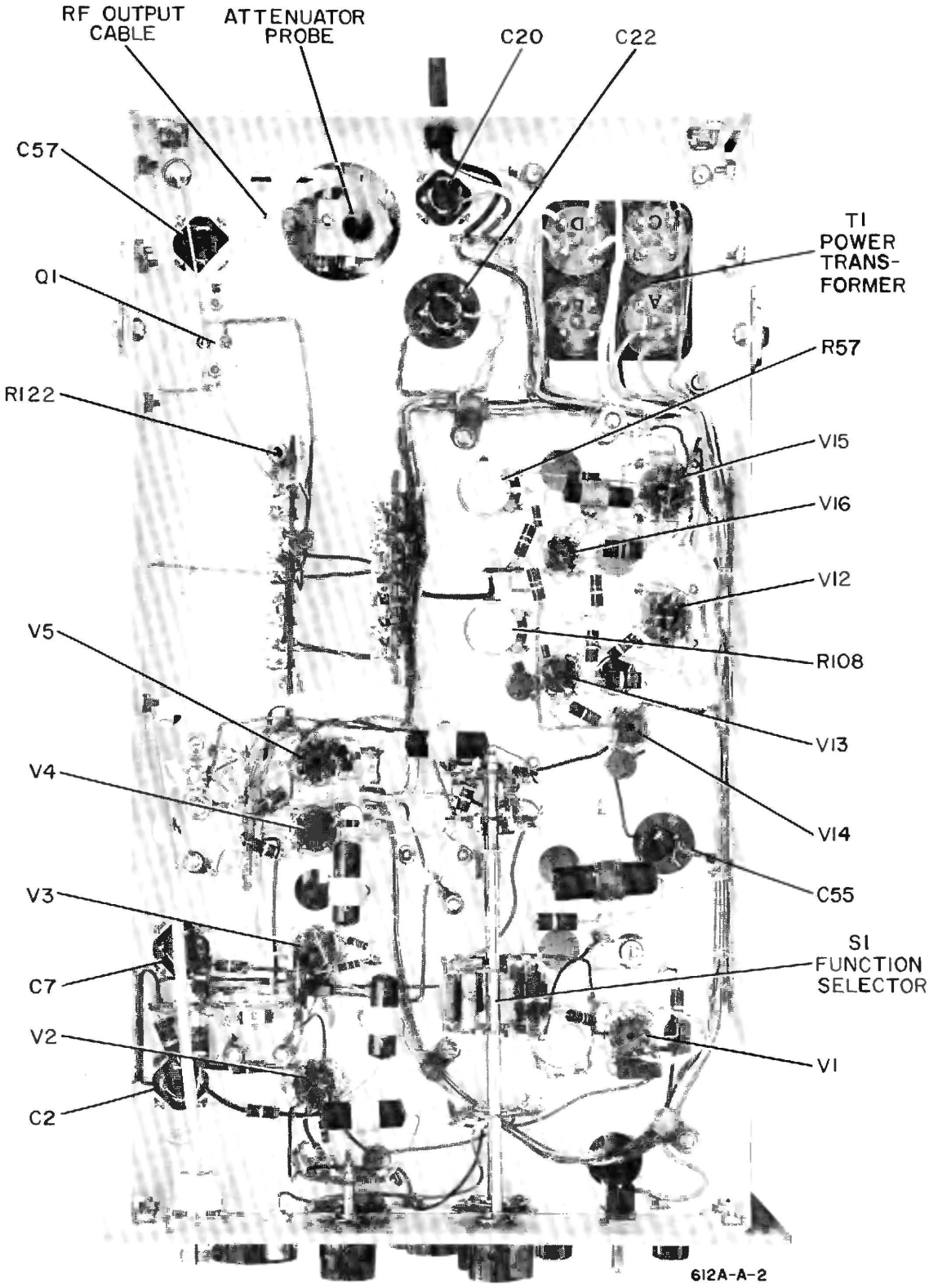


Figure 4-4. Underside View Cover Removed

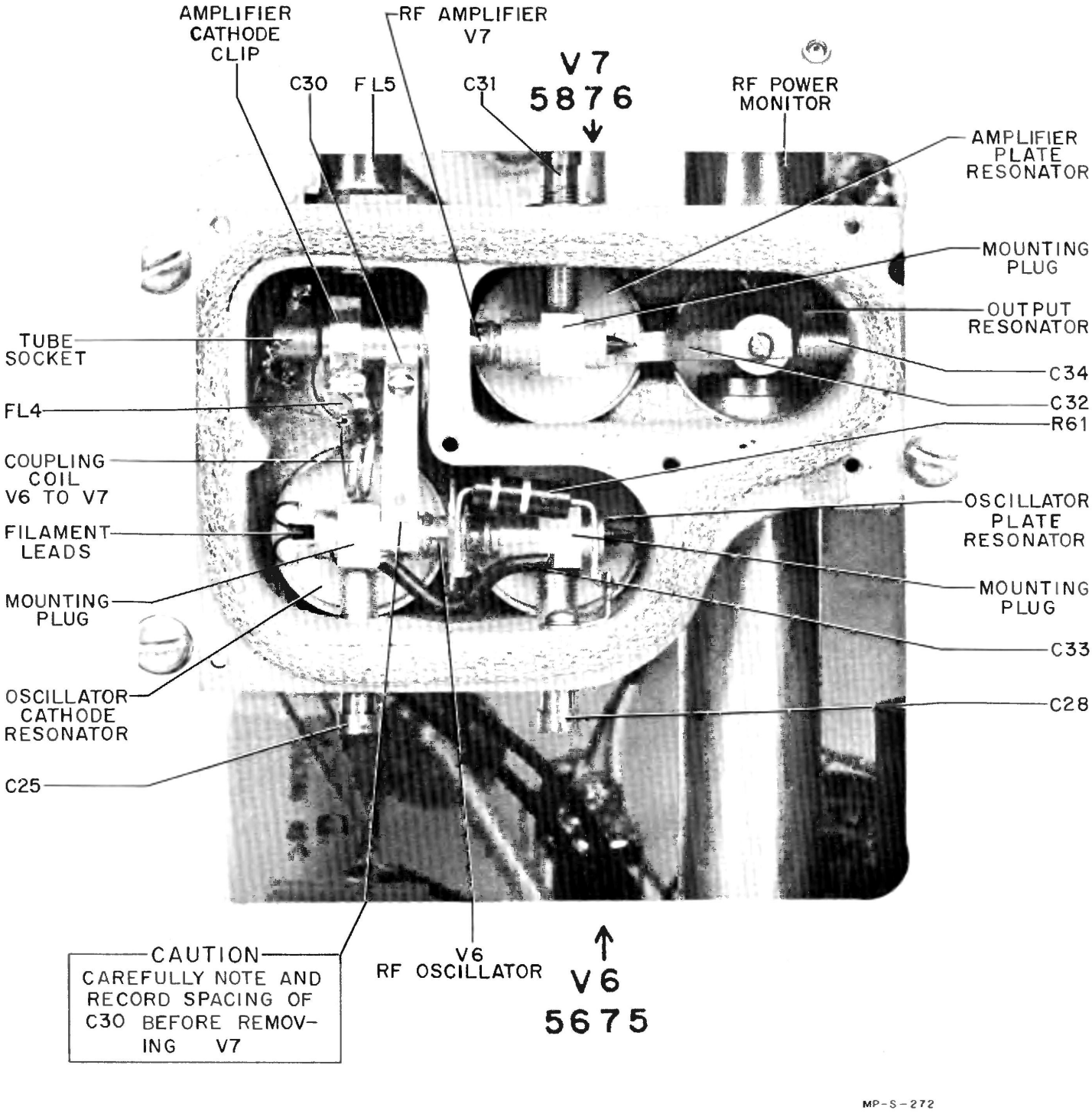


Figure 4-5. Rear View RF Housing, Showing Pencil Triodes

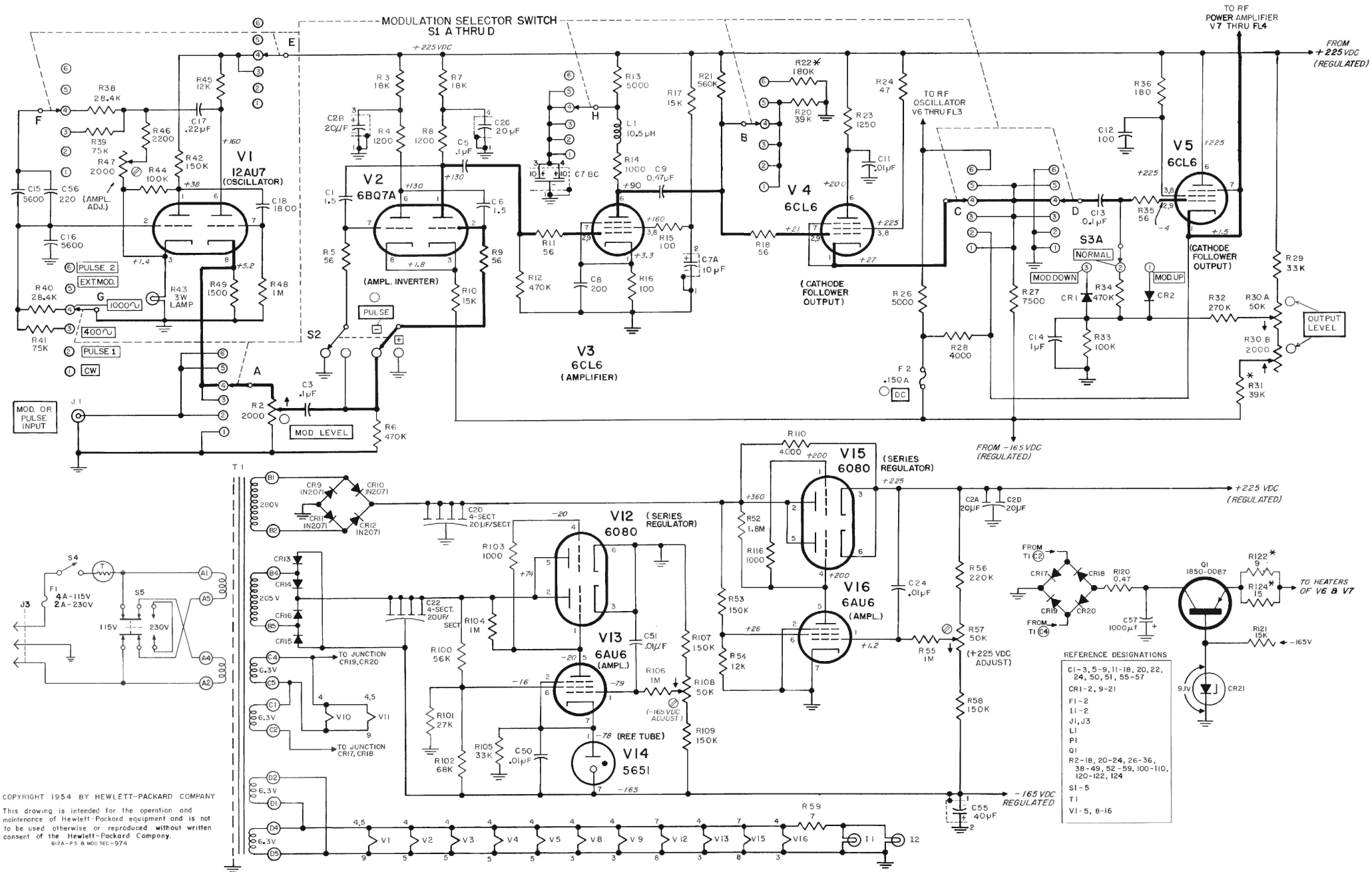
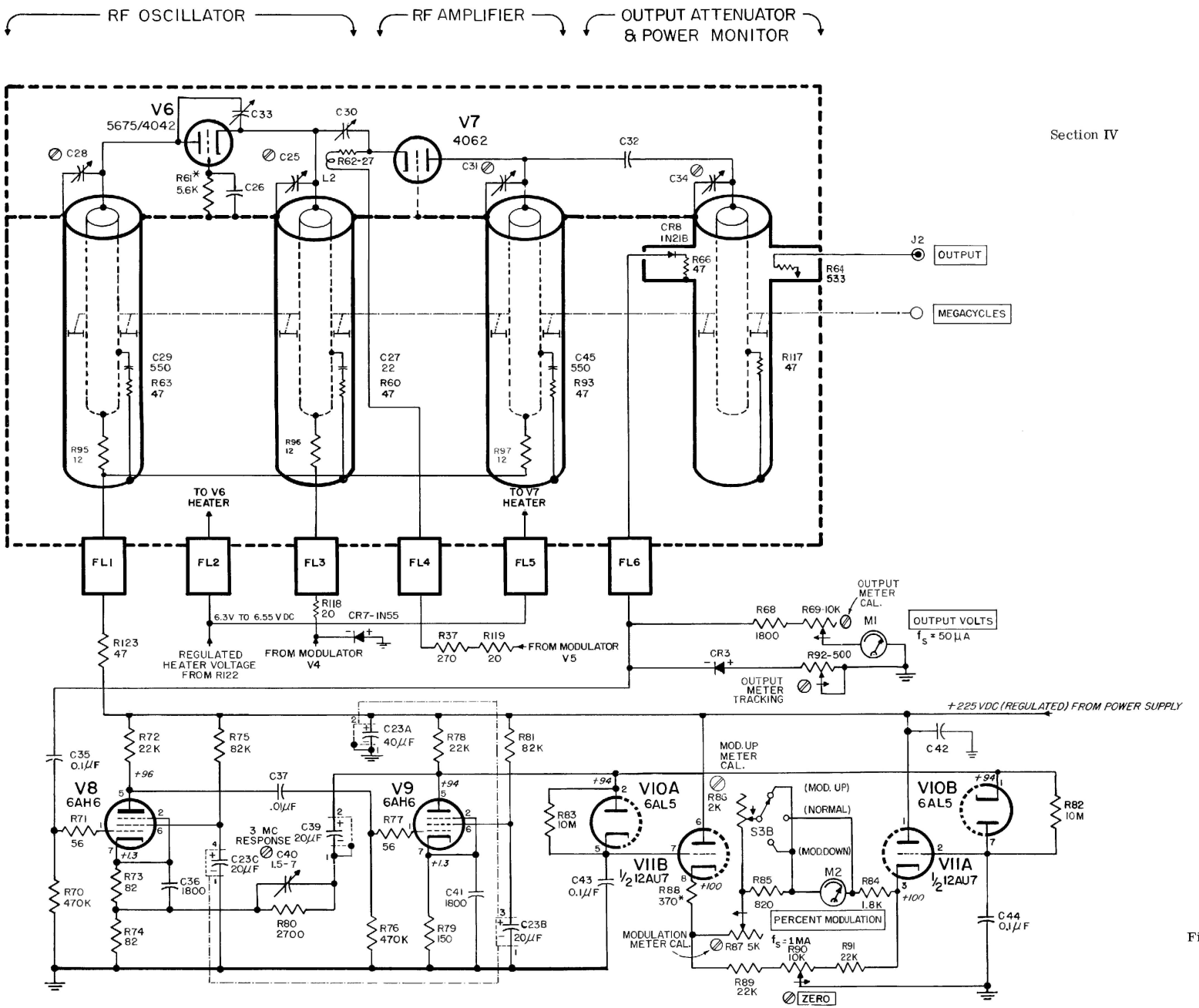


Figure 4-13. Power Supply and Modulator Se



NOTES....

CONDITIONS OF DC VOLTAGE MEASUREMENT

1. 115/230V, 50-1000Hz POWER SUPPLY.
2. MEASUREMENT TAKEN BETWEEN THE INDICATED POINTS AND CHASSIS WITH A VOLTMETER OF 122 MEGOHMS INPUT RESISTANCE.
3. OUTPUT LEVEL AT SET LEVEL ON OUTPUT METER.
4. MOD. LEVEL SET COUNTER-CLOCKWISE.
5. PULSE SET AT NEGATIVE (S2)
6. S3A,B SET AT NORMAL
7. FUNCTION SELECTOR SWITCH (S1A THRU S1H) SET AT 1000∿
8. FREQ. SET AT 1000 MHz

* ELECTRICAL VALUE ADJUSTED AT FACTORY. AVERAGE VALUE SHOWN. PART MAY BE OMITTED.

CAPACITANCE IN pF UNLESS OTHERWISE NOTED.

RESISTANCE IN OHMS UNLESS OTHERWISE NOTED.

K = 1000 OHMS. M = 1 MEGOHM.

⏚ = CHASSIS. = PANEL CONTROL

= SCREWDRIVER ADJ.

↑ = INDICATES CLOCKWISE ROTATION VIEWED FROM SHAFT END

REFERENCE DESIGNATORS

C23, 25-37, 39-45
CR3, 7-8
FL1-6
J2
L2
M1-2
R37, 60-64, 66, 68-93, 95-97, 117-119, 123
S3
V6-11

Figure 4-12. RF and Modulation Meter Section