202H
FM-AM SIGNAL GENERATOR

OPERATING AND SERVICE MANUAL

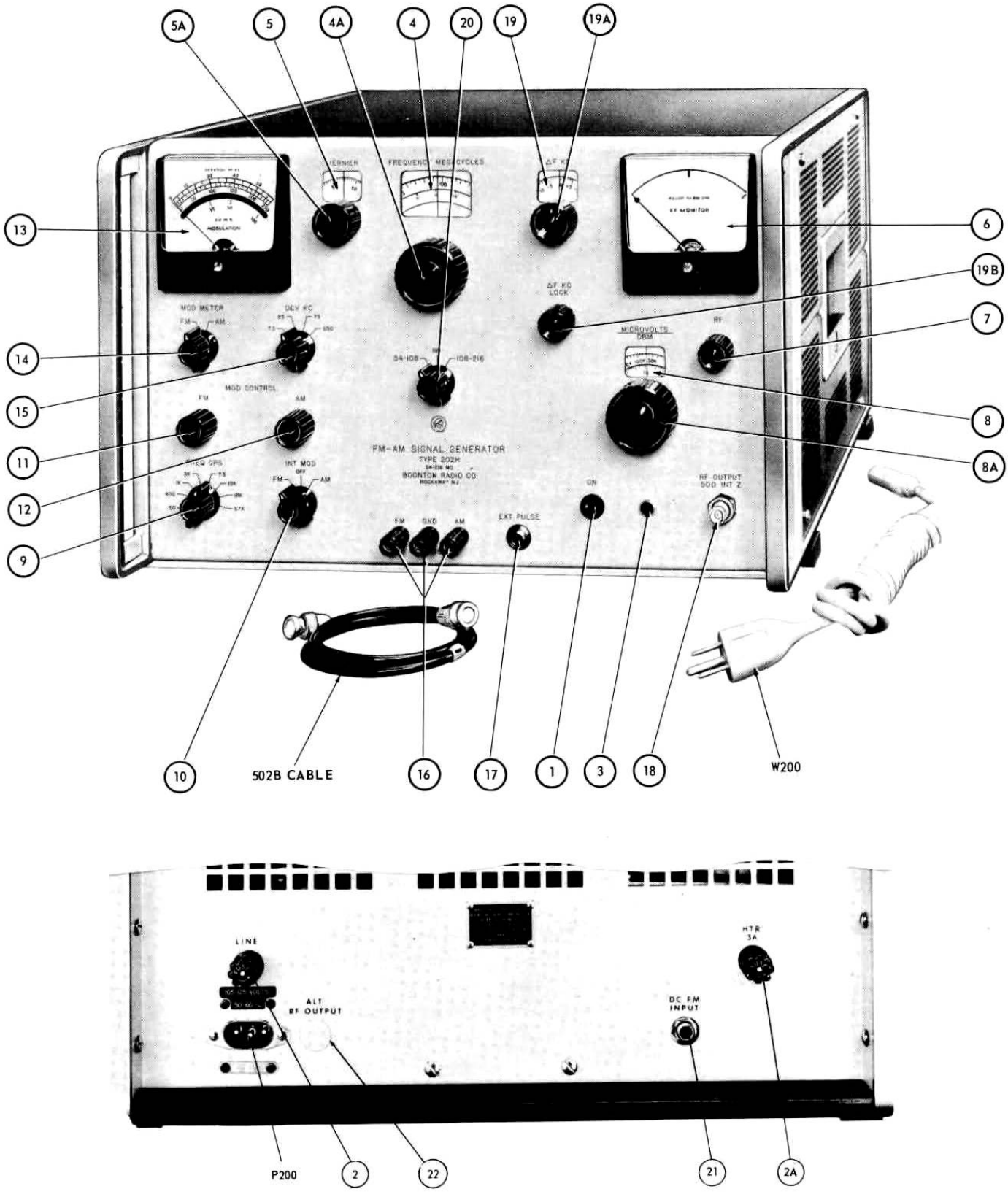


Figure 1. Operating Controls and Layout

1. Power Switch
2. Fuse (AC Line)
2A. Fuse (Filament)
3. Pilot Light
4. Main Frequency Dial
4A. Main Frequency Control
5. Vernier Frequency Dial
5A. Vernier Frequency Control
6. RF Monitor Meter
7. RF Control
8. RF Output Attenuator Dial
8A. RF Output Attenuator Control
9. Modulating Oscillator Frequency Selector
10. Internal Modulation Selector Switch
11. FM Deviation Control
12. Amplitude Modulation Control
13. Modulation Meter
14. Modulation Meter Switch
15. Deviation Range Switch
16. External Modulation Input Terminals
17. External Pulse Modulation Jack
18. RF Output Jack
19. Electronic Vernier Dial
19A. Electronic Vernier Control
19B. Electronic Vernier Dial Lock
20. RF Range Switch
21. DC FM Input
22. Alternate RF Output

SECTION I
DESCRIPTION

GENERAL

The Type 202H FM-AM Signal Generator covers the frequency range from 54 to 216 mc and is designed for the testing and calibration of FM receiving systems in the areas of broadcast FM, VHF, TV, mobile, and general communications. The generator consists of a four-stage RF Unit, together with a modulating oscillator, metering circuitry, and power supply, all housed in a single cabinet which may be readily adapted for rack mounting.

The RF Unit consists of a variable frequency oscillator, a reactance tube modulator, a frequency doubler, and an output amplifier/doubler stage. The modulator is especially designed for minimum distortion and operates in conjunction with the electronic venier to provide changes in RF output frequency as small as 10 cps, with indications in 1 kc increments. The RF output is fed through a precision, variable attenuator; automatic RF level set is incorporated which maintains "red line" on the RF monitor meter over the entire range of output frequencies and levels. The RF Unit is shock mounted for minimum microphonism.

An internal audio oscillator provides a choice of eight frequencies which may be used for either frequency or amplitude modulation. A modulation meter, responding to the average value of modulating signal indicates FM deviation. A detected signal is used for percent AM indications. Both FM and AM readings are calibrated for sine-wave modulation.

A completely solid-state power supply furnishes all necessary operating voltages.

OPERATING CONTROLS AND LAYOUT

A front and rear view of the instrument with all of its controls is shown in Fig. 1. All of the controls for operation of the 202H are located on the front panel. Instrument front panel designations are shown within quotation marks.

1. Power Switch

This switch applies power to the circuits when in the "ON" position.

2. Fuse (AC LINE)

This fuse in the ac line is located on the back panel of the instrument (3 amp. for 115 v input, 1½ amp. for 230 v input).

2A. Fuse (Filament)

This fuse (3 amp.) in the dc filament line is located on the back panel of the instrument.

3. Pilot Light

4. Main Frequency Dial "FREQUENCY MEGACYCLES"

The Main Frequency Dial is calibrated from 54-108 mc (in increments of 0.5 mc) and 108-216 mc (in increments of 1.0 mc). A secondary or logging scale is divided into 23 equal parts for use with the Vernier Frequency Dial (5).

4A. Main Frequency Control

The Main Frequency control operates the Main Frequency Dial (4).

5. Vernier Frequency Dial "VERNIER"

This dial is divided into 100 divisions and is coupled to the Main Frequency Dial through a 24:1 gear train, providing a total of approximately 2300 logging divisions over the tuning range. A logging curve is shown in Fig. 2.

5A. Vernier Frequency Control

The Vernier Frequency Control operates the Vernier Frequency Dial (5) and the Main Frequency Dial (4).

6. RF Monitor Meter "RF MONITOR"

The RF Monitor Meter is used to standardize the input power level to the attenuator. In operation, the meter pointer is set to the center of the red calibration line on the meter scale.

7. RF Control "RF"

This adjustment sets the RF Monitor Meter (6) to the proper reference level such that the output attenuator calibration is direct reading for a 50-ohm termination.

8. RF Output Attenuator Dial "MICROVOLTS/DBM"

The RF Output Attenuator Dial is calibrated directly in (a) microvolts and (b) decibels below 1 milliwatt output to a 50 ohm load. It is standardized by setting the pointer of the RF Monitor Meter (6) to the center of the red calibration mark on the meter scale.

8A. RF Output Attenuator Control

The RF Output Attenuator Control operates the RF Output Attenuator Dial (8).

9. Modulating Oscillator Frequency Selector "FREQ CPS"

This control selects any one of eight fixed audio frequencies between 50 cps and 67 kc for either frequency or

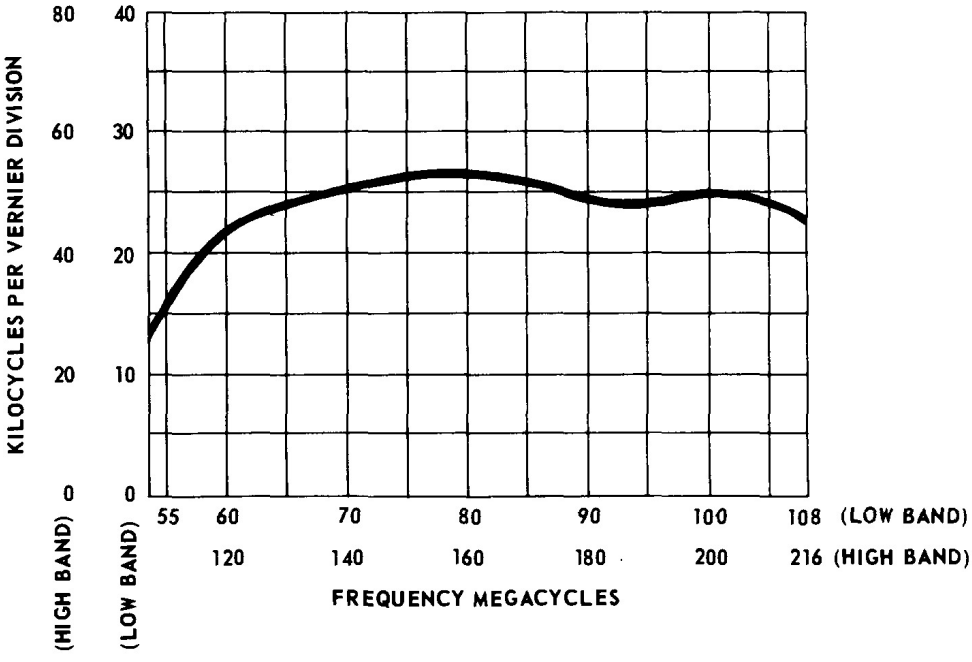


Figure 2. Logging Scale

amplitude modulation.

10. Internal Modulation Selector Switch "INT MOD"

This switch connects the internal modulating oscillator for either frequency modulation or amplitude modulation. The OFF position disables the oscillator, but the panel terminals are connected, permitting external AM and FM.

11. FM Deviation Control "MOD CONTROL—FM"

A continuously variable control for adjusting the frequency deviation on any of the four internal ranges: 0-7.5 kc, 0-25 kc, 0-75 kc, 0-250 kc; or for external modulation.

12. Amplitude Modulation Control "MOD CONTROL—AM"

A continuously variable control for adjusting the amplitude modulation level when either the internal AF oscillator or an external source is used.

13. Modulation Meter "MODULATION"

The Modulation Meter has three scales providing four FM deviation ranges and one amplitude modulation range; 0-7.5 kc deviation in 0.5 increments, 0 to 25 kc deviation in 1 kc increments, 0 to 75 kc deviation in 5 kc increments, 0 to 250 kc in 10 kc increments, 0-100% amplitude modulation with calibration marks at 30%, 50%, and 100%. 100% AM is specified only when an external modulating oscillator is used.

14. Modulation Meter Switch "MOD METER"

With this control the Modulation Meter (13) may be switched to indicate the amount of FM or AM present on the signal.

15. Deviation Range Switch "DEV KC"

This rotary type switch selects four modulation meter FM deviation ranges: 0-75 kc, 0-25 kc, 0-75 kc, and 0-250 kc.

16. External Modulation Input Terminals "FM GND AM—EXT OSC"

These terminals provide a means whereby an external source of modulating voltage may be applied to the instrument. The output voltage of the internal oscillator is available at the external modulation input terminals for oscilloscope synchronizing or other purposes.

17. External Pulse Modulation Jack "EXT PULSE"

The Pulse Modulation Jack is provided to permit direct connection of an external modulation voltage source to the screen of the final RF stage for pulse or square wave modulation. When this connection is made the internal circuits are disconnected from the screen element.

18. RF Output Jack "RF OUTPUT 50Ω INT Z"

This BNC Type connector makes the generator RF signal available for use.

19. Electronic Vernier Dial "△F KC"

The Electronic Vernier Dial is calibrated to ± 30 kc for electronically shifting the output frequency in small increments. The total range of the control associated with this dial is ± 40 kc minimum. The Electronic Vernier Control knob (19A) is set for the electrical center of the control when the arrow points toward the top of the instrument (vertical). For least FM distorton, the knob arrow should be vertical.

19A. Electronic Vernier Control

The Electronic Vernier Control operates the Electronic Vernier Dial (19).

19B. Electronic Vernier Dial Lock "△FKC LOCK"

The Electronic Vernier Dial Lock is used to mechanically zero the Electronic Vernier Dial (19). The dial is set to a desired reference indication and then locked while the Electronic Vernier Control is set for the desired reference frequency.

20. RF Range Switch

The Band Switch changes the RF range of the 202H between 54 to 108 mc and 108 to 216 mc. It has an OFF position which substantially reduces the level from the RF output jack, putting the instrument in a standby condition.

21. DC FM INPUT

The DC FM INPUT is located on the back panel of the 202H. This jack may be used to introduce an external dc voltage to control the output frequency over a limited range. Typically, the sensitivity is approximately 110 kc per volt dc on the high band and 55 kc per volt dc on the low band.

22. ALT RF OUTPUT

The RF Output Jack (18) may be removed from the front panel and inserted in the hole provided on the rear panel. This hole is covered by an easily removable plug button. This plug button is used to cover the front panel hole when the Output Jack is placed on the rear panel.

For changing the RF Output Jack and External Modulation Input Terminals from front panel to rear, a 523A Adapter must be used for rack mounting.

SECTION II
SPECIFICATIONS

Radio Frequency Characteristics

RF RANGE:
Total Range: 54 to 216 MC
No. Bands: 2
Band Ranges: 54-108 MC 108-216 MC

RF ACCURACY:
Main Dial: ±0.5%*
Electronic Vernier: ±(10% + 1 KC)*
*after one hour warm-up

RF CALIBRATION:
Main Dial: Increments of 0.5 MC (54-108MC)
Increments of 1.0 MC (108-216 MC)

MECHANICAL VERNIER:
2300 divisions through each range

ELECTRONIC VERNIER:
Increments of 1 KC over ±30 KC range*
*total range ±40 KC; provision for slipping dial to place "0" at a specific frequency

RF STABILITY:
< 0.01% per hour*
*after two hour warm-up

RF OUTPUT:
Range: 0.1 μv to 0.2 volts*
*across external 50 ohm load at panel jack
Accuracy: ±10%, 0.1 μv to 50 K μv
±20%, 50 K μv to 0.2 volts
Auto Level Set: holds RF monitor meter to "red line" over band
Impedance: 50 ohms
VSWR: < 1.2
Spurious Output: All spurious RF output voltages are at least 30 db below desired fundamental

RF LEAKAGE:
Sufficiently low to permit measurements at 0.1 μv

Amplitude Modulation Characteristics

AM RANGE:
Internal: 0-50%
External: 0-100%

AM ACCURACY: ±10% of reading at 400 cps at 30% and 50% AM

AM CALIBRATION: 30, 50, 100%

AM DISTORTION:
< 5% at 30%
< 8% at 50%
< 20% at 100%

AM FIDELITY:
±1 db, 30 cps to 200 KC

EXTERNAL AM REQUIREMENTS:
Approx 60 volts RMS into 5000 ohms for 100% AM

Frequency Modulation Characteristics

FM DEVIATION RANGE:
Internal: 0-250 KC in 4 ranges
External: 0-250 KC in 4 ranges

FM DEVIATION ACCURACY:
±5% of full-scale*
*for 400 cps sine-wave

FM CALIBRATION:
0-7.5 KC in increments of 0.5 KC
0-25 KC in increments of 1 KC
0-75 KC in increments of 5 KC
0-250 KC in increments of 10 KC

FM DISTORTION: (at 400 cps Mod Freq)
Total % Harmonic Distortion
< 0.5% at 75 KC (100 MC)
< 1% at 75 KC (54-216 MC)
< 10% at 250 KC (54-216 MC)

FM FIDELITY:
±1 db, 5 cps to 200 KC

SIGNAL-TO-NOISE RATIO:
> 50 db below 10 kc without significant external acoustic or mechanical excitation

MICROPHONISM:
Extremely low; shock-mounted RF unit

EXTERNAL FM REQUIREMENTS:
< 3 volts RMS into 2000 ohms for 250 KC deviation

Pulse Modulation Characteristics

PM SOURCE: External

PM RISE TIME: ≤ 0.6 μsec

PM DECAY TIME: < 0.8 μsec

Modulating Oscillator Characteristics

OSC FREQUENCY:

50 cps	7.5 KC
400 cps	10 KC
1000 cps	15 KC
3000 cps	67 KC

OSC ACCURACY: ±5%

OSC DISTORTION:
< 0.5% at FM terminals (50 cps to 15 KC)
< 1.0% at FM terminals (67 KC)

Accessories

FURNISHED:
Type 502-B Patching Cable

AVAILABLE:
Type 207-H Univerter
Type 501-B Output Cable
Type 504-A Adapter
Type 505-B Attenuator
Type 506-B Patching Cable
Type 507-B Adapter
Type 508-B Adapter
Type 509-B Attenuator
Type 510-B Attenuator
Type 514-B Output Cable
Type 517-B Output Cable
Type 523A Adapter

Tube Complement

TUBES	DIODES	TRANSISTORS
3—6688	2—1N660	1—2N1136
1—6DZ4	2—1N1763	3—2N1379
2—6AW8A	4—1N1764	1—2N1533
3—6AU6A	2—1N1581	
1—6BK7A	1—S1029	
1—6AQ5A		
1—6DJ8		

502B Patching Cable

Provides simple connection for a matched load. (See Fig. 7.)

501B Output Cable

The 501B Cable attached to the 202H is illustrated by Fig. 8, where R_2 is the 50-ohm termination of the 501B Cable.

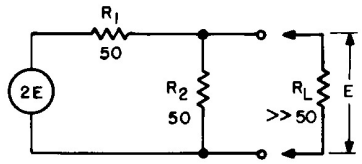


Figure 8. Output Circuit of 202H with 501B Output Cable Attached

The equivalent circuit (Fig. 9) is readily determined by applying Thevinin's theorem. This arrangement is recommended for general use where it is desirable to connect the 202H output to an input circuit of much higher impedance than 50 ohms. The attenuator of the 202H will read the open-circuit output directly.

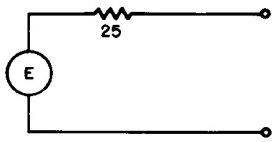


Figure 9. Equivalent Output Circuit of 202H with 501B Output Cable Attached

505B 6 db Pad

This pad is used as a dummy antenna in testing unbalanced receivers with a 50-ohm input as shown in Fig. 10.

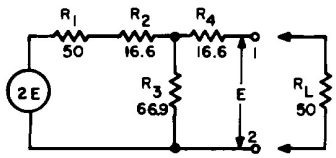


Figure 10. 505B T-Pad (Attenuator) Circuit

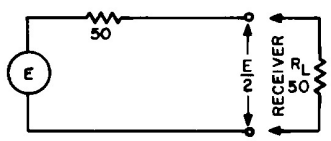


Figure 11. 505B T-Pad (Attenuator) Equivalent Circuit

The open-circuit voltage appearing across terminals 1 and 2 is by Ohms law equal to E, half of the source voltage. Applying Thevinin's theorem, the equivalent circuit of Fig. 11 is obtained, and thus the attenuator dial of the 202H reads receiver sensitivity directly for the assumed standard output. This circuit is well matched and the 202H attenuator reads the open circuit source voltage as specified in footnote 1 for receiver sensitivity measurement.

509B 20 db T-Pad

The 509B pad, like the 505B, may be used as a dummy antenna, except that the open-ciruit voltage, which is a measure of receiver sensitivity (equivalent source voltage), is one-fifth the 202H attenuator dial reading. The source impedance is 50 ohms.

SECTION IV
THEORY OF OPERATION

GENERAL

The 202H FM-AM Signal Generator shown in the block diagram (Fig. 12) covers a frequency of 54 to 216 mc, inclusive. This instrument is designed for use in the testing and calibration of FM receiver systems in the entertainment field (FM radio and VHF-TV), mobile and general communication.

The generator consists of an RF Unit, which is the radio frequency generating portion of the instrument; modulation circuitry; an output monitoring system; an internal modulating oscillator; and a power supply.

RF UNIT

The RF Unit is a four-stage frequency generating subassembly. It contains an RF Oscillator, 1st frequency doubler, 2nd frequency doubler or amplifier, and reactance modulator.

The RF oscillator V101 (6AF4A) is a tuned plate oscillator covering the range of frequencies from 27 mc to 54 mc, inclusive. Tuning is accomplished by means of C109 which is part of the ganged tuning capacitor also including C101, C115, and C123. (See Fig. 9.)

The first frequency doubler V102 (6688) has an output frequency range of 54 to 108 mc, inclusive. This stage acts as a buffer to isolate the frequency source from the output. The high gain of this stage supplies sufficient driving voltage for saturation and limiting action in the second frequency doubler/amplifier (V103) resulting in a constant amplitude output frequency.

The output tube V103 (6688) is used as a doubler or as an amplifier depending on the position of the 202H RF range switch, thereby providing output coverage from 54 to 216 mc.

The reactance modulator V100 (6688) or frequency modulator is actually an inductive element across the tuning tank of the RF oscillator (V101). In order to maintain constant frequency deviation sensitivity over the entire tuning range of the instrument, the amount of inductance produced by V100 is made to vary directly as the carrier frequency. This is accomplished by the proper attenuation characteristic of a bridged-tee 90° phase shift network consisting primarily of R101, C101, R100 and C_{gp}, with associated circuitry as shown in Fig. 13. Although

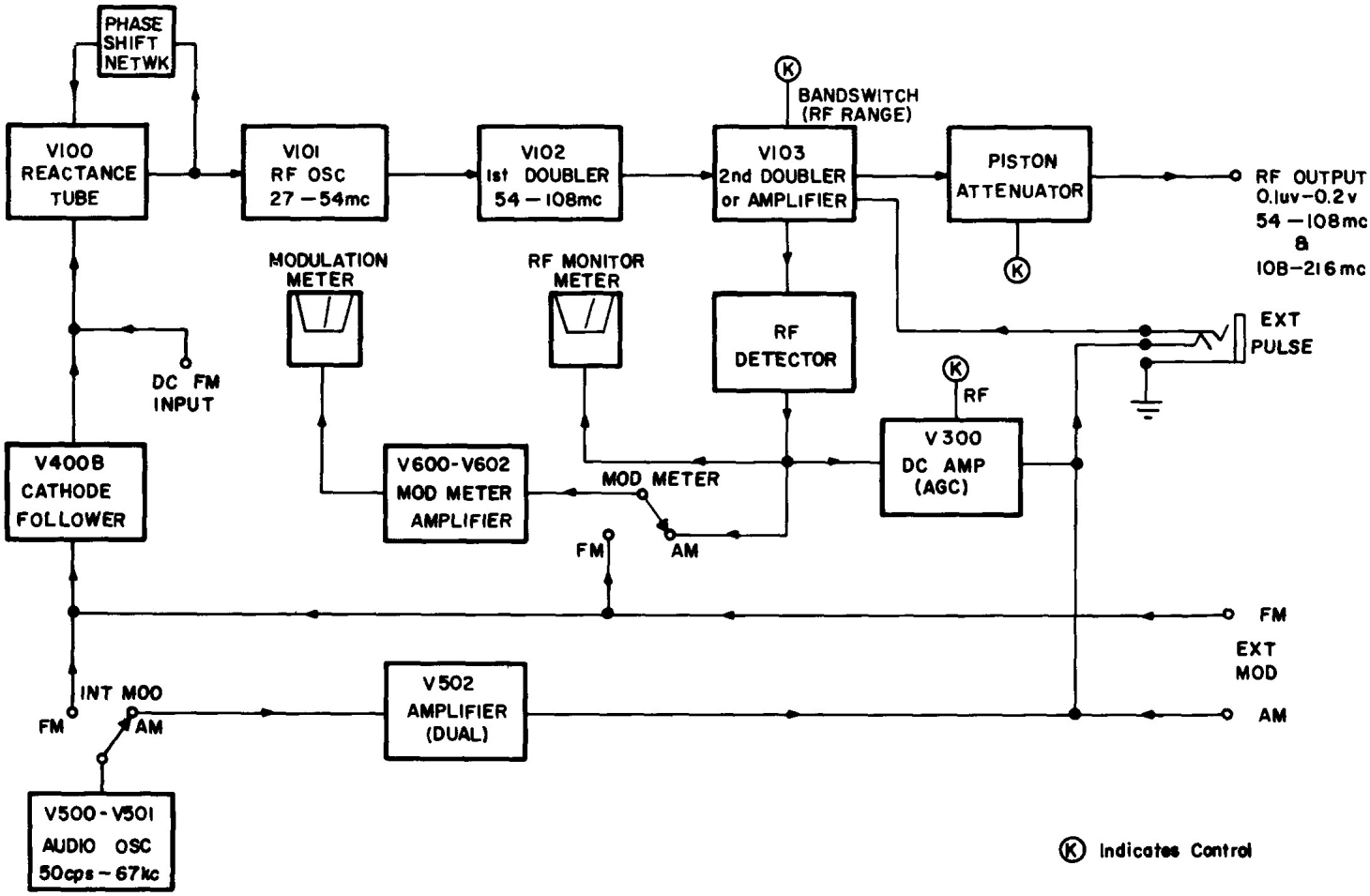


Figure 12. 202H Block Diagram

this circuit arrangement is capable of producing fairly constant deviation with fixed components. C101 is made variable and ganged with the oscillator tuning capacitor to provide the constancy of frequency deviation required in a precision signal generator.

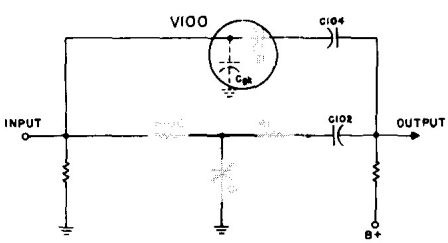


Figure 13. Bridged-Tee Phase Shift Network

Fixed bias is supplied through variable resistor R107 to establish the operating point of V100. RF signals are bypassed at the cathode by C126. Additional modulation frequency gain stability, by means of negative current feedback, is achieved by the small value of bypass capacitor C126.

For FM, V100 is modulated by applying the modulating voltage to the grid of the tube through Section 5 of the RF Filter 308645.

For AM, V103 is modulated by applying the modulating voltage from either the internal oscillator or an external source to the screen grid-plate of the tube. The screen grid-plate dc voltage is supplied from the AGC amplifier.

For pulse modulation, the screen grid of V103 is modulated as with AM, except that no internal voltages are supplied to the screen grid, so all voltages must be supplied through the EXT PULSE jack on the front panel of the instrument.

A piston type RF attenuator is inductively coupled to the tank coil of the modulator by means of a two turn pick-up loop in the same plane as the loop of the tank coil. A 50-ohm carbon film resistor, in series with the loop, provides a 50-ohm source impedance. At the point where the loop connects to the output coaxial cable there is an impedance compensating circuit composed of a 50-ohm resistor and a capacitor in series to ground (Fig. 14). The compensating circuit tends to draw current of a leading phase when the loop phase is lagging, resulting in the maintenance of good low VSWR source impedance from the attenuator output.

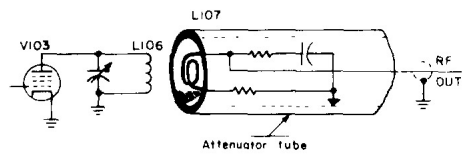


Figure 14. Piston Attenuator Circuit

The pickup loop of the attenuator is continuously adjustable along the axis of the attenuator tube by means of a rack and pinion drive.

The Transverse Electric (TE_{11}) wave amplitude is held constant by the AGC circuit and is logarithmically attenuated in the "waveguide-below-cutoff" attenuator tube.[1]

1—"Technique of Microwave Measurements," Vol. 11, Radiation Lab. Series, Chapt. 11, Page 686.

The attenuator dial is calibrated directly in microvolts and decibels below 1 milliwatt (dbm) across an EXTERNAL 50-ohm load. Thus, the dial is calibrated as "E" of Figs. 7 through 11. The output is standardized by setting the output monitor meter to "red line".

The attenuator can be represented by the equivalent Thevenin circuit where 2E varies logarithmically with the placement of the attenuator piston in the tube (Fig. 7).

MODULATION CIRCUITS

The FM circuit can be modulated by the internal oscillator or through the external modulation input terminals provided on the front panel of the instrument. The external source will be required to supply less than 3 volts rms to the 2K input for 250 kc deviation with the FM Deviation Control maximum clockwise. This external channel has a flat response of ± 1 db, from 5 cps to 200 kc.

The metering of the frequency modulation is accomplished by sampling the input voltage to the cathode follower which drives the reactance modulator. The diagram (Fig. 15) shows the frequency modulation and metering of the 202H.

The RF carrier can be amplitude modulated by the internal oscillator or through the external modulation input terminals provided on the front panel of the instrument. The external source will be required to supply approximately 60 volts rms into 5000 ohms for 100% AM. The AM channel has a flat response (±1 db, from 30 cps to 200 kc). Figure 16 shows in block diagram form the circuitry for amplitude modulating the 202H. In contrast to the metering of the FM function, the AM is metered by sampling the modulated RF, detecting and measuring the recovered signal. This is indicated in Fig. 16.

In contrast to the metering of the FM function, the AM is metered by sampling the modulated RF, detecting, and measuring the recovered signal. This is indicated in Fig. 16.

For internal AM operation a two stage feedback amplifier is inserted between the internal audio oscillator and the screen grid-plate of the RF Unit output stages. The purpose of this stage is to present a low source impedance

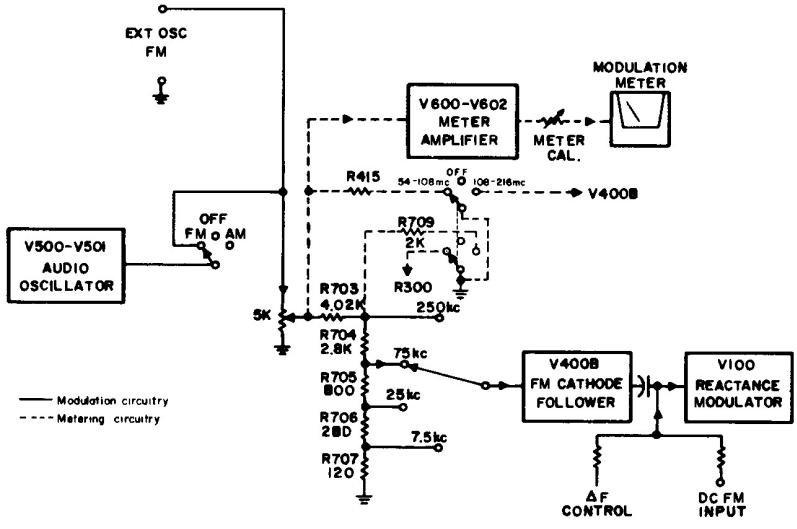


Figure 15. Modulation & Metering — FM

to the screen grid-plate of the RF Unit output tube, which is paralleled by the AGC circuitry, and provide sufficient voltage gain to produce a minimum of 50% AM with a good safety factor at all internal modulation frequencies.

Pulse modulation of the 202H is done at the same point as for AM, the screen grid-plate of the output stage. When pulse modulating, which must be done from an external source, all internal circuits are disconnected from the screen grid-plate of V103, including the automatic level setting circuitry (See Fig. 17). When the external plug disconnects the internal circuitry, the screen grid-plate voltage is determined by the external circuit. With zero volts at the screen grid-plate, the output of the 202H will decrease approximately 30 db below normal. The approximate range of control of the output tube by the screen grid-plate is from 60 to 80 volts for full output to zero volts for essentially cut-off condition. (See Fig. 6.) Inasmuch as the oscillator is still operating, there will be a small amount of RF leakage through the output tube interelectrode capacitance. See Section III — Using the Signal Generator, Pulse Modulation.

OUTPUT MONITOR SYSTEM (Fig. 18)

The detector diode (CR 101) in the plate circuit of the RF Unit output stage serves two functions:

(1) It supplies a dc level (Proportional to the RF carrier amplitude) to the RF Level Monitor Meter and AGC Circuits.

(2) Supplies a demodulated AM (ac) signal to the Modulation Meter circuit for indicating percent AM.

For satisfactory AGC operation a large load impedance for the detector diode is desirable in order to produce the largest possible change in dc output for a change in RF Level.

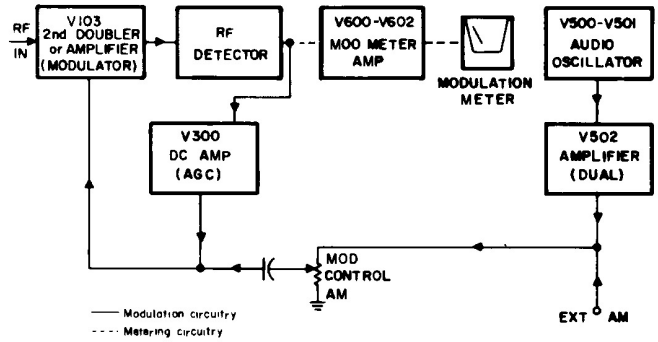


Figure 16. Modulation & Metering — AM

For accurate indication of % AM with the RF Monitor Meter set to "Red Line", the ratio of ac output (AM meter) to dc output (RF Monitor Meter) must be held constant, requiring a flat frequency response for the demodulated AM signal for modulation frequencies up to the specified AM fidelity limit of 200 kc. The flat response is obtained by first, isolating the diode and meter circuits using a resistive divider (R116, R316) to reduce the effective diode source impedance to the filter and stray capacitance on the detected AM lead. A shunt peaking inductor (L 300) further flattens the response. Without the inductor the demodulated output would be attenuated at the higher modulation frequencies.

The dc level (beyond the filter) having been attenuated by the resistive divider is not sufficient to produce satisfactory AGC operation.

The second filter lead, therefore, brings a signal to the AGC circuit having sufficient change in dc with a change in RF Level to produce proper AGC loop gain.

MODULATING OSCILLATOR

The AF oscillator employed is quite free of distortion, having, in general, total harmonic content of less than 0.5% internally.[1] The conventional Wein Bridge type R-C oscillator is used. Approximately 26 volts rms is available from the AM-External Modulation Input Terminals for oscilloscope synchronization or sweep. The output is controlled by adjustment of R510 which regulates the amount of negative feedback voltage applied to the cathode of V500.

1—See Section VI — Maintenance, for Harmonic Distortion measurement.

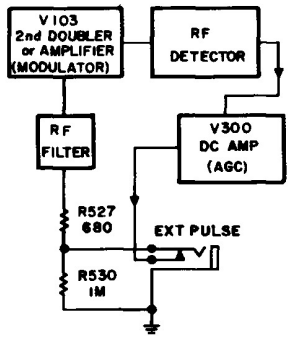


Figure 17. Modulation — Pulse

The specific modulation frequencies supplied by the 202H internal audio oscillator were chosen to give general coverage of the audio range. The frequencies, 400 cps and 1 kc, are industry standards for measurement.

DC FM INPUT

The instantaneous voltage on the grid of the reactance modulator tube (V100) determines the instantaneous output frequency of the 202H. Referring to Fig. 19, it will be noted that either an ac voltage (by way of the cathode follower V400B) or a dc voltage (through the DC FM INPUT jack) can be supplied to the reactance modulator (V100). There are two sources of dc. First, is the small incremental frequency deviation voltage supplied by the ΔF KC control. Secondly, the external dc voltage can be supplied from an external AFC system or from an external frequency plotter system. The frequency sensitivity of the DC FM INPUT jack is approximately 1 volt dc for 110 kc deviation on the high band, and approximately 1 volt dc for 55 kc deviation on the low band. The impedance is 22K ohms. The time constant of the DC FM INPUT is approximately 1 second.

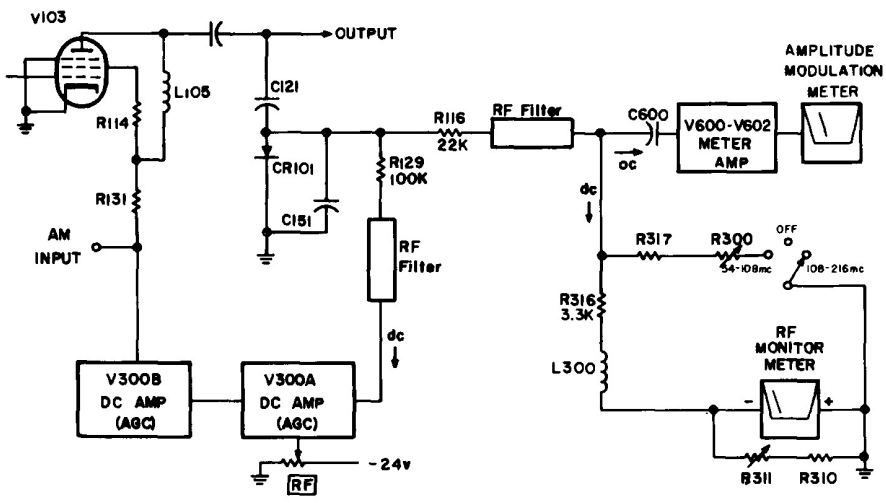


Figure 18. Output Monitor System

POWER SUPPLY

The 202H power supply utilizes solid-state components in the circuitry. Silicon diodes are used in the full-wave bridge rectifier and the dc filament supply. All regulation is done with semiconductors; i.e., transistors and zener diodes.

The +150 volt regulator is shown in Fig. 20. It is identical in principle to the conventional "series regulator" with voltage reference (CR210), feedback amplifier (Q202, Q203, and Q204) and series control element (Q201). Since Q201 is connected between the negative 100 volt input and ground, all regulator voltage variations must occur across Q201, R200, and R201 if the +150 to ground voltage is to be independent of voltage variation as the line voltage or load current vary. CR209 limits the maximum voltage across Q201 and R200-R201 limit the series current. Q202 is a current amplifier which causes the collector current of Q201 to increase (resistance of emitter-collector circuit drops) for a small increase in Q202 base current. The base current of Q202 increases as its base potential gets more negative since it is a PNP device. Thus, if Q204 had zero collector current, Q202 and Q201 would be saturated (i.e., large collector current, low collector-emitter voltage) and E_0 would approach E_{in}. Thus, decreasing Q204 collector current increases E_0.

Now, consider the amplifier composed of Q203 and Q204. Since CR210 represents a stable reference voltage, the collector current of Q204 must depend only on its emitter current which is inversely controlled by the emitter current of Q203, which in turn depends on the value of E_o and the setting of R207. If E_0 decreases, the base current (and hence emitter current) of Q203 increases, thus decreasing the emitter current (and hence collector current) of Q204. Since we have seen before that a decreased collector current in Q204 increases E_o, regulation will occur. Since

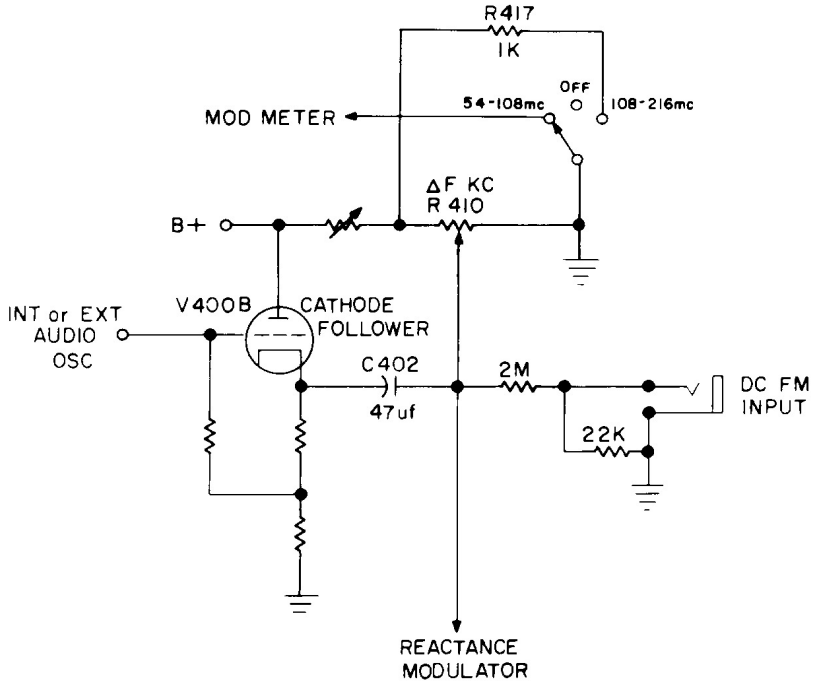


Figure 19. DC FM System

the current gain from the base of Q203 to the collector of Q201 is high, the output E_o will depend only on the setting of R207, and the drop across CR210. C204 and C210 reduce the high frequency gain of the amplifier to keep it stable.

The use of two transistors, Q203 and Q204, is to balance their base-emitter voltage change with temperature variation, thus, achieving the stability required.

A second dc voltage from the power supply is for use in the RF Unit and V400 filaments. It utilizes two silicon diodes as a full-wave rectifier with a zener diode and a transistor to maintain the proper regulated output of 7.3 volts dc. This is dropped to 6.3 volts in the RF Unit for V100 to V103 by the dc resistance in the RF filter. This function is provided by CR211 for the FM cathode follower, V400.

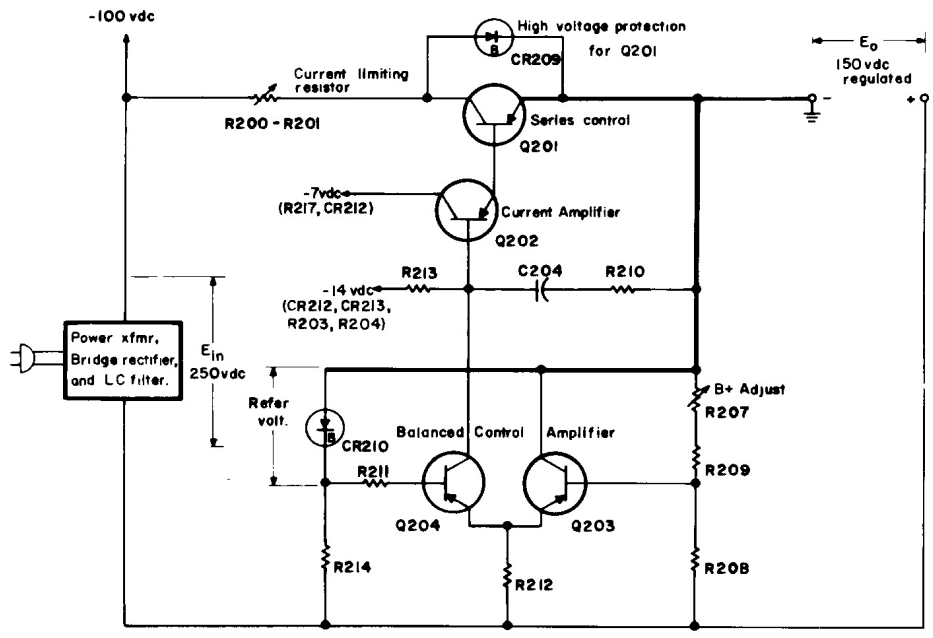


Figure 20. Power Supply B+ Regulation Circuit

Table of Replaceable Parts

Stock No	Description	Mfg	Mfg. Part No.	TQ	RS
00202-80006	Oscillator Coil Assembly			1	
00202-80007	Coil Assembly: 1st Doubler			1	
00202-80009	Choke, RF: 10 μh			2	1
00202-80010	RF Shielding Braid: Approx. 17" long			1	
00202-80012	Insulator, Transistor: (Q200, Q201)			2	2
00211-00023	Plate, Stop (AT100)			1	

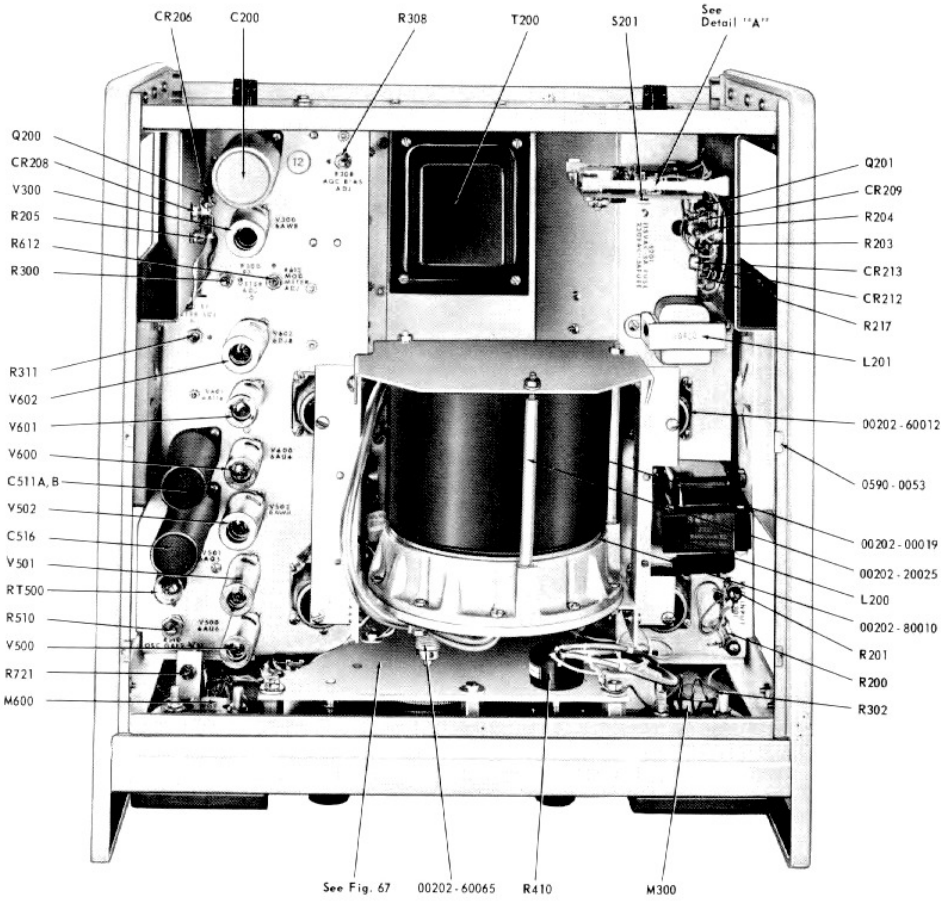
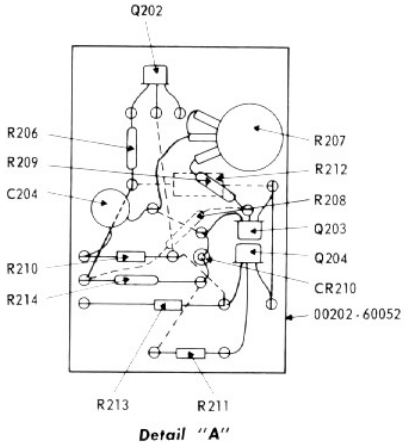
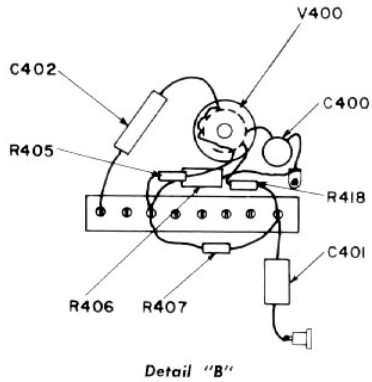


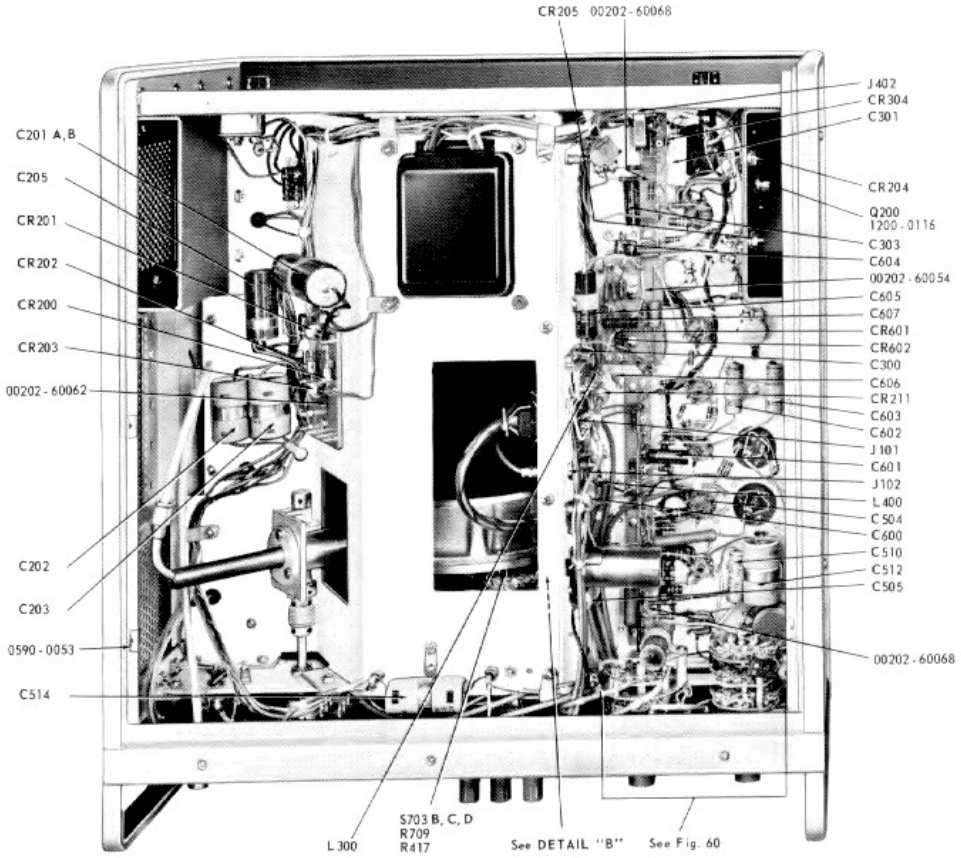
Figure 58. 202H — Top View



Detail "A"



Detail "B"



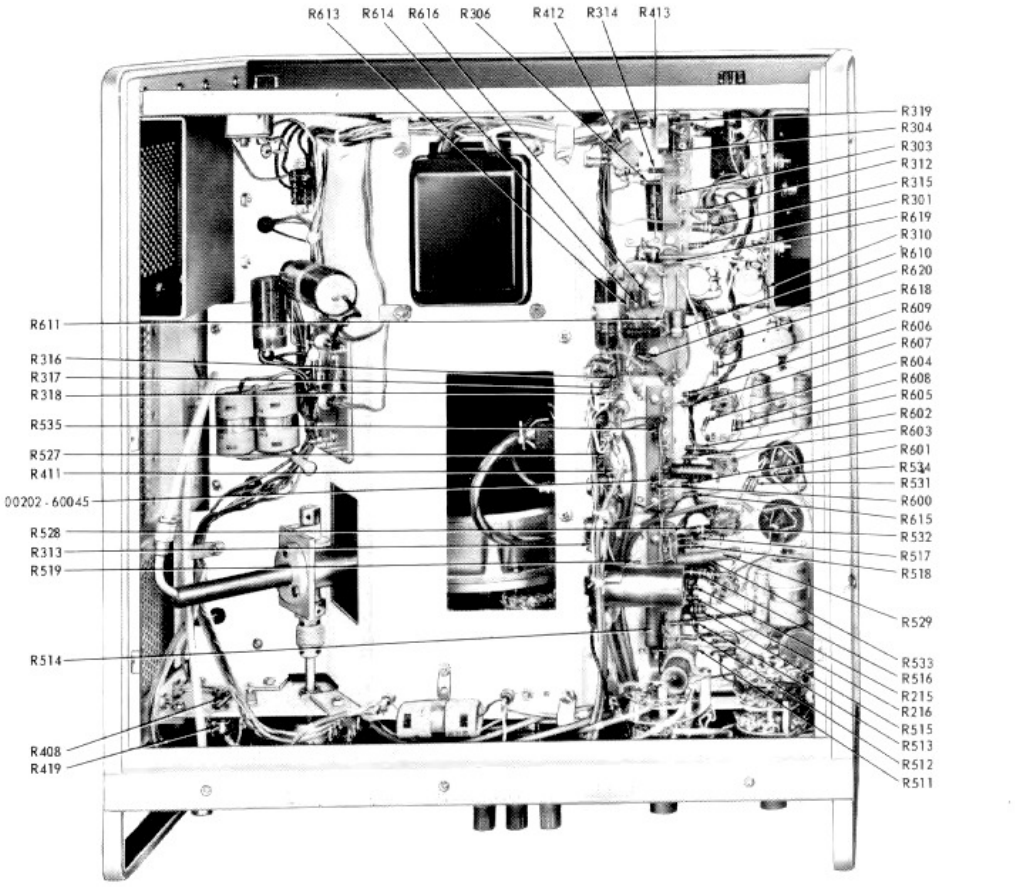


Figure 59. 202H — Bottom View

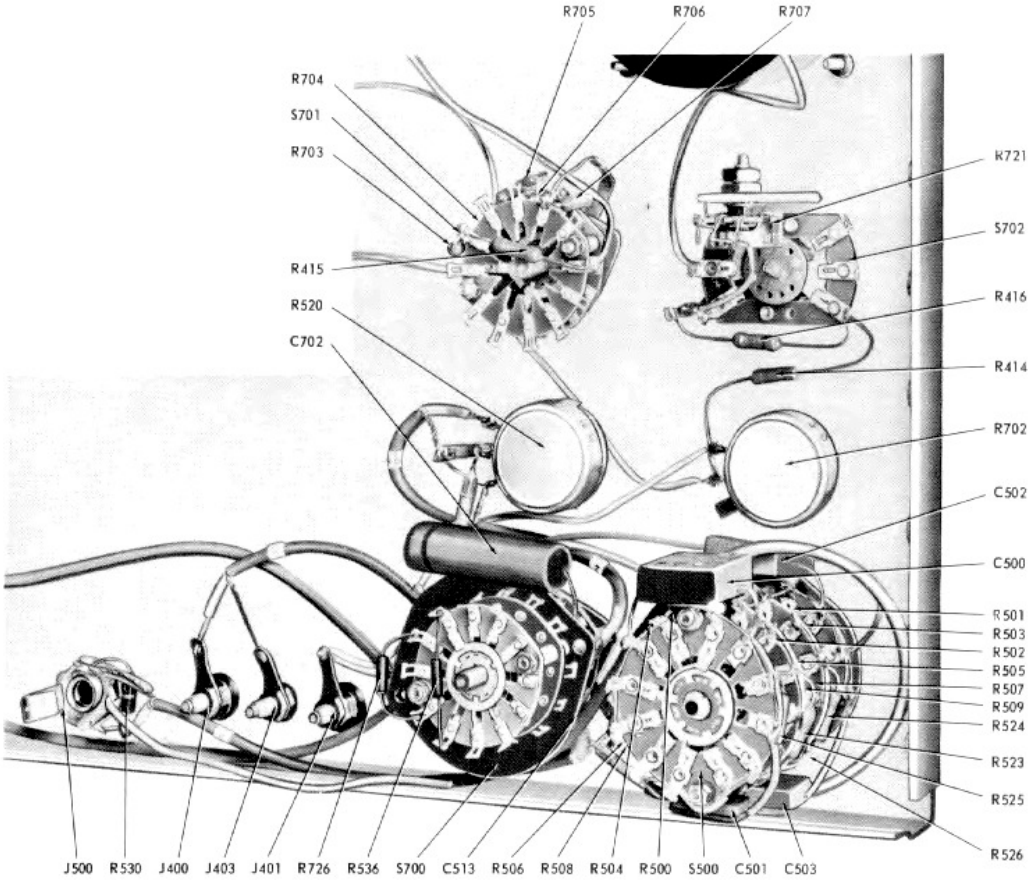


Figure 60. 202H Front Panel — Rear View

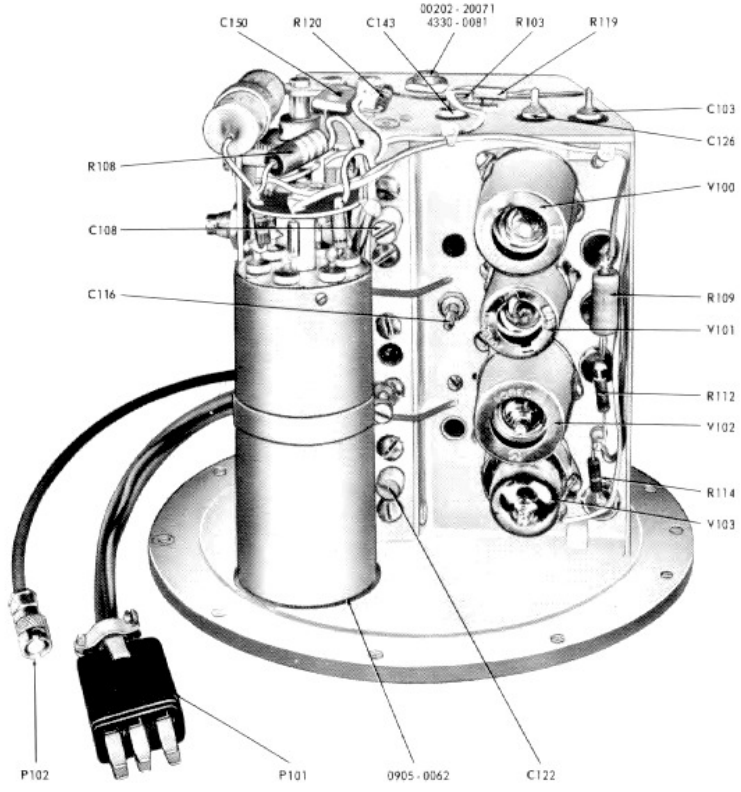


Figure 61. RF Unit — Top View

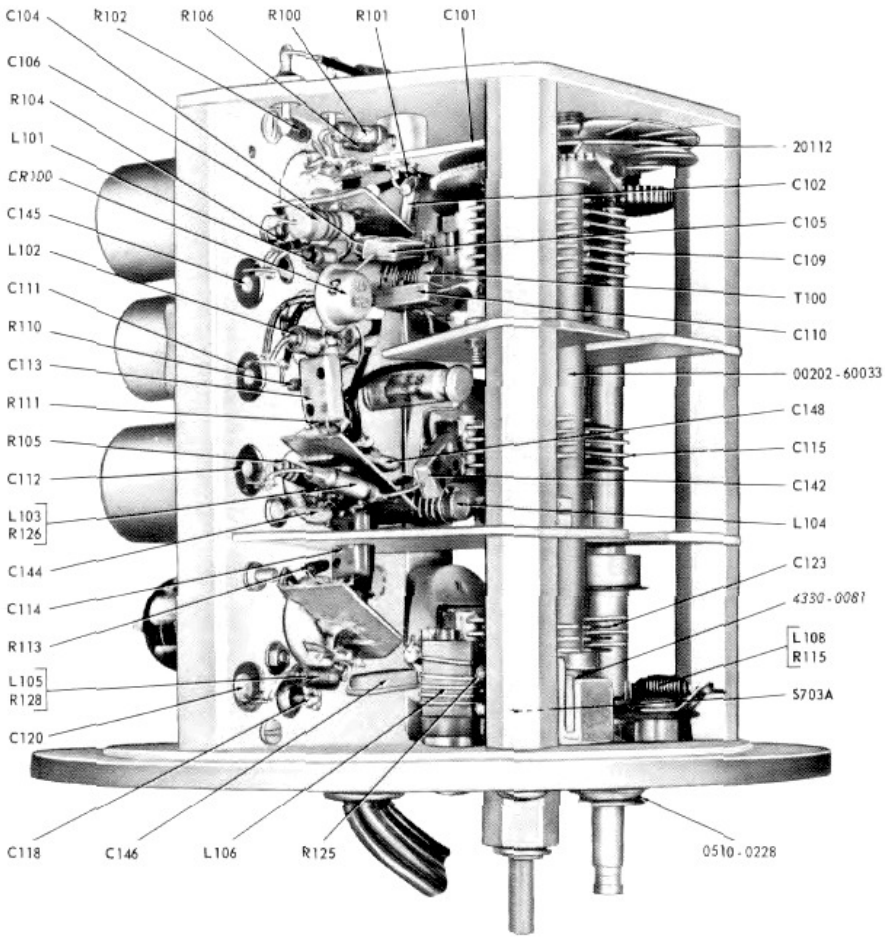


Figure 62. RF Unit — Bottom View

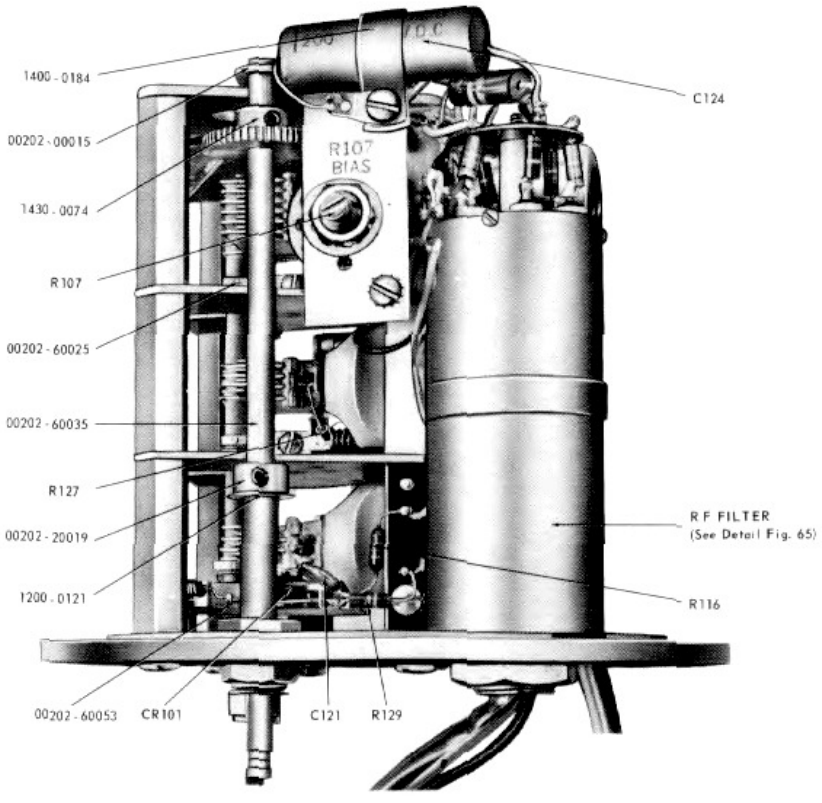


Figure 63. RF Unit — Side View

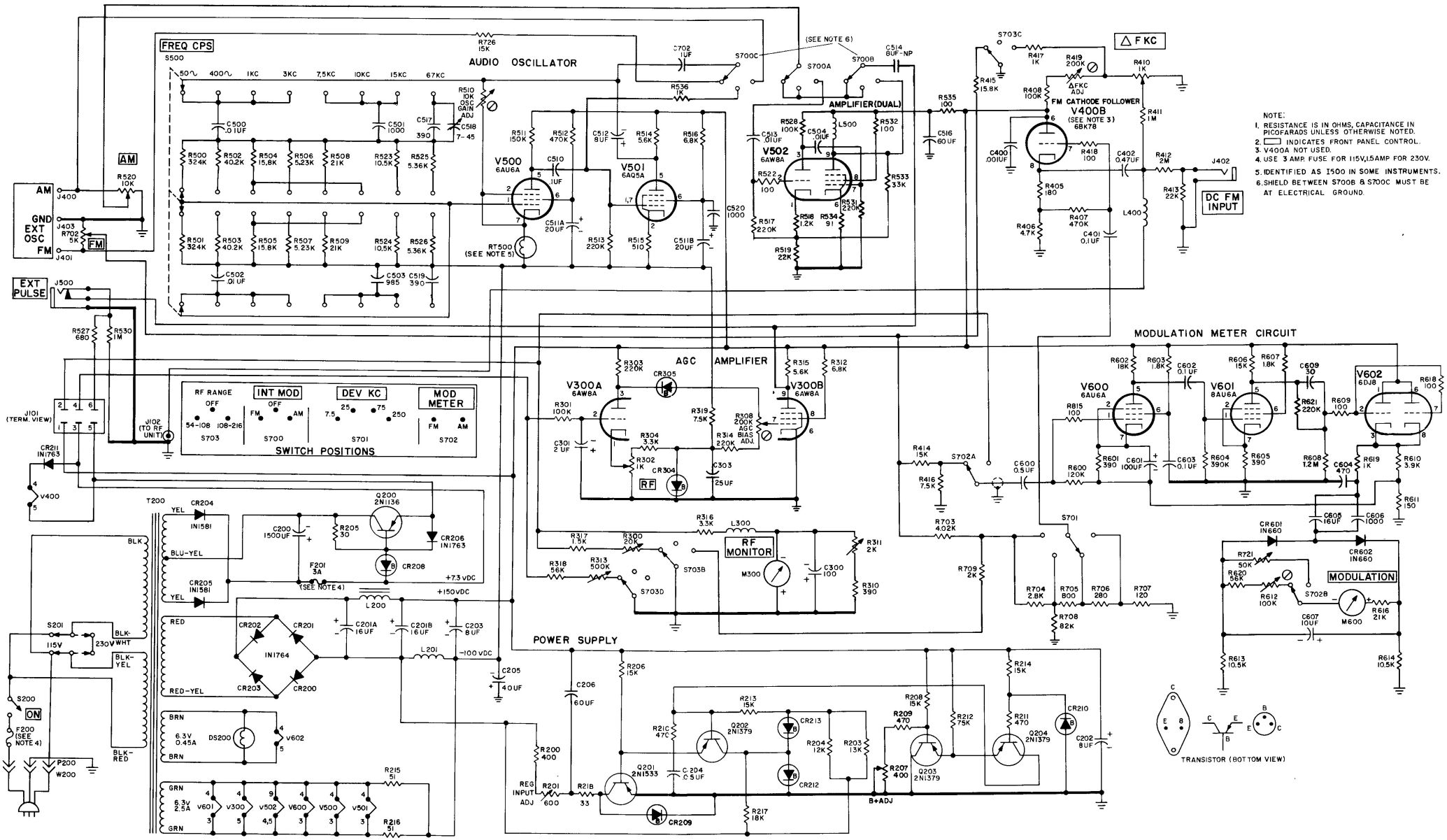
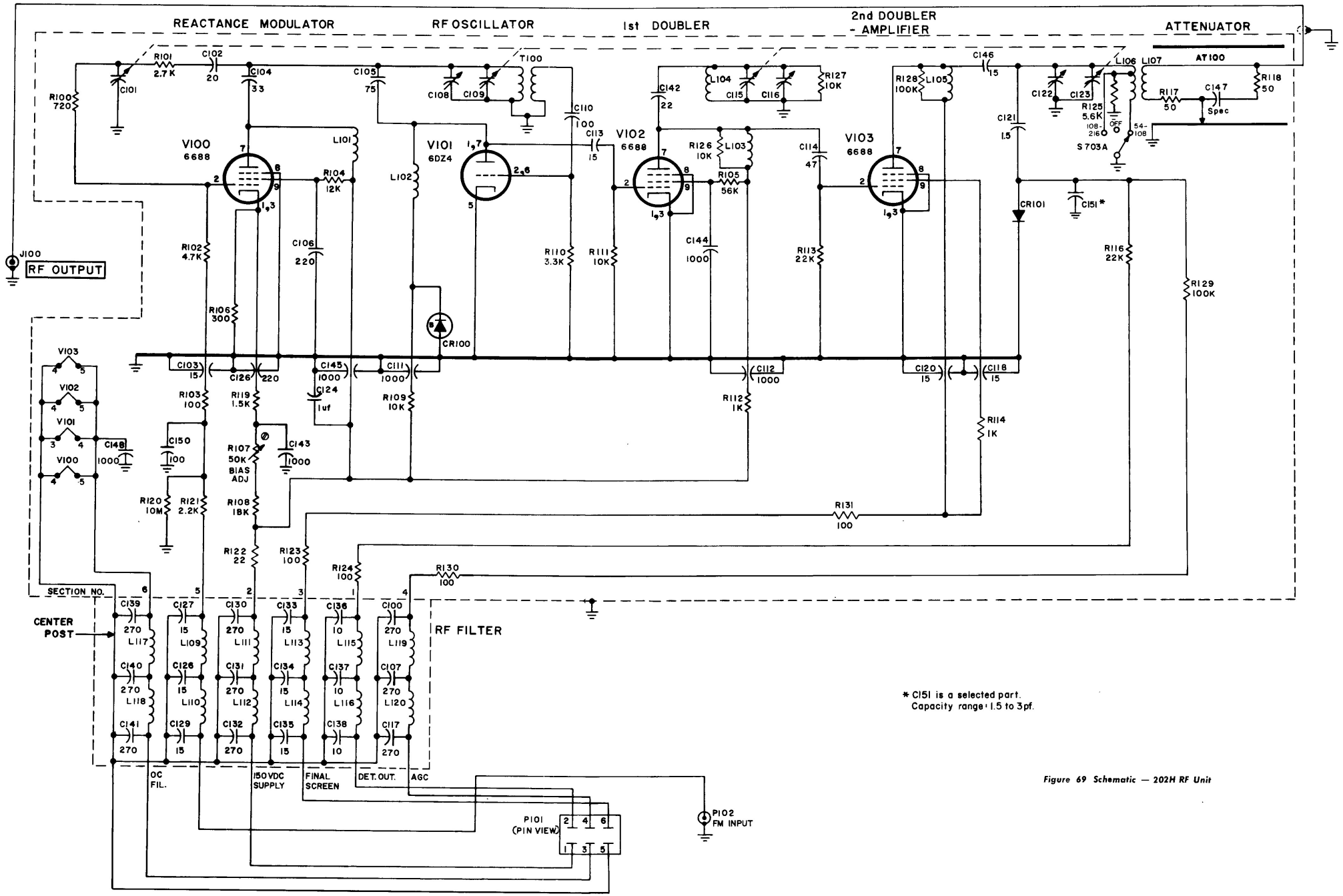


Figure 68. Schematic — 202H Main Chassis



* C151 is a selected part.
Capacity range 1.5 to 3pf.

Figure 69 Schematic — 202H RF Unit