REVISED
1 FEBRUARY 1964

INSTRUCTION MANUAL

MULTI-RANGE TELEMETRY RECEIVER TYPE R-1037A

Vitro ELECTRONICS
A DIVISION OF VITRO CORPORATION OF AMERICA
919 JESUP-BLAIR DRIVE • SILVER SPRING, MARYLAND

PRODUCERS OF NEMS-CLARKE EQUIPMENT

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WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted. Extreme caution should be exercised while working with this equipment. To avoid casualties, always remove power and discharge circuits to ground before working on the equipment.

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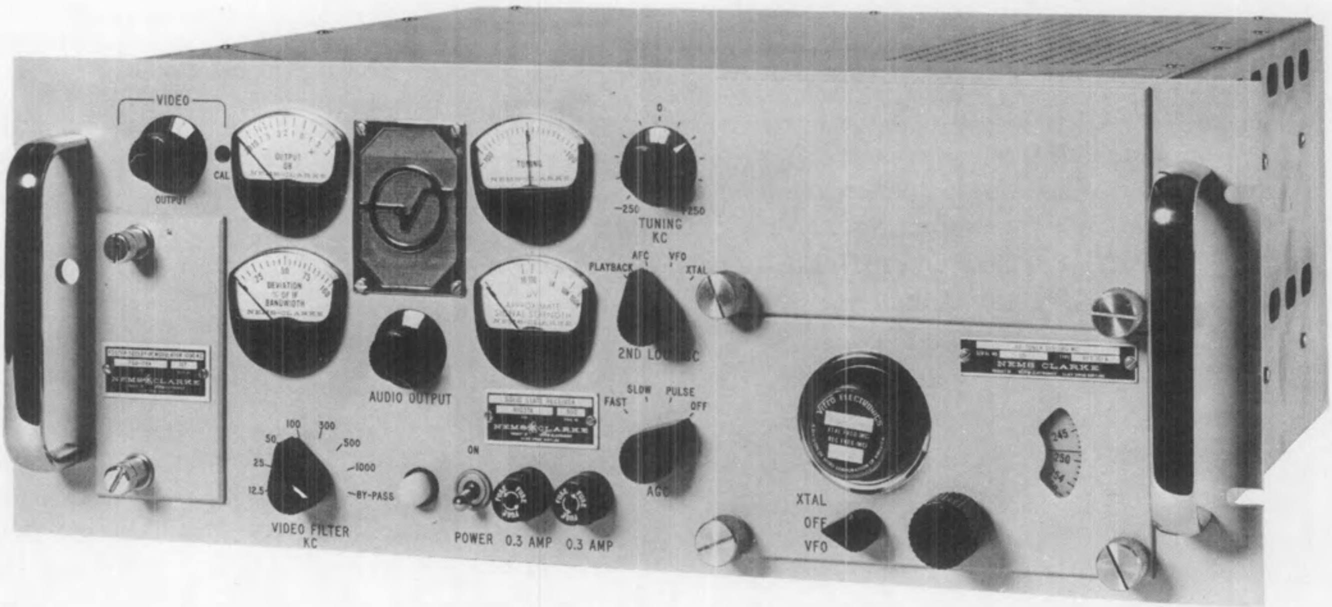


Figure 1. Multi-Range Telemetry Receiver R-1037A, Front View

SECTION 1. GENERAL DESCRIPTION

INTRODUCTION

Multi-Range Telemetry Receiver R-1037A features solid state circuitry and modular construction for telemetry and surveillance use. Its wide tuning range, available in RF plug-in tuning modules, permits operation across the spectrum of authorized telemetry bands. In addition, complete frequency coverage for surveillance and general laboratory purposes is available. Modular construction of the receiver facilitates its adaptation to techniques employed in FM/FM, PCM/FM, PDM/FM, PAM/FM, PCM/FM, PCM/PM and others. The R-1037A receiver can also be adapted for pre-detection combining, direction finding techniques including monopulse or antenna lobing and single sideband reception.

Latest circuit techniques such as phase lock demodulation for FM signals and synchronous AM demodulation for amplitude modulated signals and anti-sideband lock-out circuit for automatic signal tracking is also available in the R-1037A receiver.

High density packaging in the R-1037A receiver permits inclusion of accessory units such as a three inch spectrum display unit integral within the standard front panel utilizing three and one half inches of front panel height or a down converter for pre-detection recording at any center frequency for standard tape speeds.

The flexibility of the R-1037A receiver coupled with ruggedness, reliability, high quality, solid state components guarantees minimum maintenance and long life. Also, the wideband techniques employed minimize the number of tuning elements and prevent inferior performance due to misalignment by the operator.

PHYSICAL CHARACTERISTICS

The R-1037A receiver employs modular construction throughout which permits a choice of RF tuning ranges, IF bandwidths and different modes of detection such as Foster-Seeley, phase lock, or PM demodulation by simply plugging in the appropriate front panel modules. Refer to table 1. Therefore, maximum flexibility is provided to accommodate present as well as future requirements within the same basic receiver. Refer to figure 2 which illustrates the modularized construction of the R-1037A receiver.

The front panel affords provision for plug-in modules and also mounts all necessary tuning controls and visual monitors to properly operate the receiver. These controls are arranged in convenient groups to facilitate operation.

Plug-in modules may be substituted to provide FM/AM reception, PM reception, including the anti-sideband lock circuit and automatic searching mode, pre-detection combining, down converters for pre-detection recording and playback, and circuitry such as sum and difference channels for monopulse and direction finding applications. Adequate volume exists for two RF tuning assemblies to assist in direction finding or diversity (either frequency or space) application.

The modules are mounted on individual chassis constructed of heavy gauge aluminum and shielded within the main chassis as necessary.

All modules have 50 ohm nominal input and output impedances so that various modules can be interconnected with ease.

Table 1. Modules Available

RF Tuner Modules

Type Module	Tuning Range (mc)	Noise Figure (db)		Image (db) Rejection (min)	IF Rejection (db) (min)
		Max	Typical		
RFT-109A	55-260*	7.0	6.0	60	80
RFT-100A	135-155	5.0	4.5	60	80
RFT-101A	215-260	7.0	6.0	60	80
RFT-107A	215-315	7.0	6.0	60	80
RFT-102A	370-410	8.0	7.0	60	80
RFT-123A	400-560	11	10	60	60
RFT-103A	920-1000	11	10	60	80
RFT-104A	1435-1535	11	10	60	80
RFT-105A	1700-1850	11	10	60	80
RFT-106A	2200-2300	11	10	60	80

*Not crystal controlled.

Foster-Seeley Type FM Plug-In Demodulators

Type	Module	Bandwidths
FSD	101A	12.5 kc
FSD	102A	25 kc
FSD	103A	50 kc
FSD	104A	100 kc
FSD	105A	300 kc
FSD	106A	500 kc
FSD	107A	750 kc
FSD	108A	1000 kc
FSD	109A	1500 kc
FSD	110A	2400 kc

Phase Lock Type FM Plug-In Demodulators

Type	Module	Bandwidths
PLD	101A	12.5 kc
PLD	102A	25 kc
PLD	103A	50 kc
PLD	104A	100 kc
PLD	105A	300 kc
PLD	106A	500 kc

The basic receiver chassis contains an integral power supply which consumes less than 50 watts. This eliminates blowers and precludes prohibitive equipment temperature rises which deteriorate circuit performance.

ELECTRICAL CHARACTERISTICS

The R-1037A receiver is a single channel, double conversion superheterodyne covering the frequency range of 55 to 2300 megacycles in either the discrete frequency bands currently authorized for telemetry purposes or in a selected octave coverage series for surveillance use.

Telemetry frequency bands are covered through seven plug-in RF tuning assemblies. Choice of IF bandwidths from 12.5 kc to 3.0 mc is also through front panel plug-in filter modules. These discrete bandwidths are chosen in accordance with IRIG recommended standards for telemetry use. The basic R-1037A receiver is capable of demodulating FM, AM and PCM signals. Refer to table 2.

Optimum demodulation through the use of FM discriminators matched to the IF bandwidth filter assures maximum linearity, sensitivity, and capture ratio. The R-1037A receiver uses nuvistors and transistors to provide large dynamic range capabilities without distortion and attendant long life and low power consumption. The receiver has been subjected successfully to environmental and interference conditions in accordance with military specifications.

Table 2. Specifications

First Local Oscillator:
selectable, crystal controlled with a stability of ±0.001% with oven, ±0.005% without oven; or VFO, with a stability of 0.005% plus 0.002% per degree Centigrade.

First Intermediate Frequency:
30 mc

Second Local Oscillator:
selectable, crystal controlled; manually tunable ±250 kc or AFC; frequency, 40 mc

Second Intermediate Frequency:
10 mc

IF Bandwidths: (see table 1)
12.5, 25, 50, 100, 300, 500, 750, 1000, 1500, 2400 kc standard plug-in modules; other bandwidths up to 3.0 mc available

Phase-Lock FM Bandwidths:
12.5, 25, 50, 100, 300 and 500 kc (see table 2)

Demodulation:
FM and AM standard, PM, synchronous AM, and phase lock FM can be added; accepts an input at 10 mc for playback demodulation of recorded signals

Video Filter:
selectable cutoff frequencies of 12.5, 25, 50, 100, 300, 500, 1000 kc; attenuation slope 18 db/octave

High Level FM Video Output:
frequency response, amplifier only; 3 db max variation, 5.0 cps to 2.0 mc
output level; 10v p-p min at total harmonic distortion of 2% into a 75 ohm load or 20v p-p max into a 1000 ohm load; this output produced by a peak-to-peak deviation of one-fifth of the IF bandwidth

Low Level AM Output:
frequency response (detector and amplifier); 3 db max variation, dc to 250 kc
output level: 0.6v p-p for 50% modulation at 500 uv RF input into a 1000 ohm load

DC FM Output:
frequency response, amplifier only; 3 db max variation, dc to 250 kc
output level; 4v p-p for p-p deviation equal to IF bandwidth with load of 2000 ohms in parallel with 500 pf dc offset for properly tuned CW signal; ±1 volt max

Spectrum Display Output: (if integral SDU not used)
center frequency; 30 mc
bandwidth; 4.0 mc approx

First Local Oscillator Output:
frequency multiple of first LO crystal (or approximately for VFO operation)
output level adequate for HP-524C counter

Predetection Recording Output:
center frequency; 10 mc

Non-Limited and Limited Output:
output level; 0.5v p-p min into 50 ohm load

Signal Strength Record Output:
output level; varies from 0 to 8 volts approx for 0-100,000 uv signal strength into a 100,000 ohm load

AFC Characteristics:
drift equal to IF bandwidth corrected so that second IF center frequency error is

Table 2. Specifications (cont)

not more than ±15% of the IF bandwidth for the standard FM discriminators

AGC Characteristics:
four selectable modes of operation; FAST, for normal FM reception SLOW, for AM reception PULSE, for low duty cycle pulsed signals MAN, for noise figure measurements, gain fixed or manual

Power Requirements:
117/234 volts, ±10%, 50 to 450 cps, 50 w max

Spectrum Display Unit Type SDU-364:

Optional Sweep Width:
variable up to 4 mc

Resolution:
resolves equal amplitude signals separated by 10 kc or more

Sensitivity:
less than 5.0 uv at antenna input for full scale deflection

Display Area:
1 inch high, 2-3/4 inches wide

Power Requirements:
117/234 volts, ±10%, 50 to 450 cps, 12 w max

NOTE:
Type R-1037A Receiver utilizes Type CO-400 Plug-In Crystal Oven Assembly.

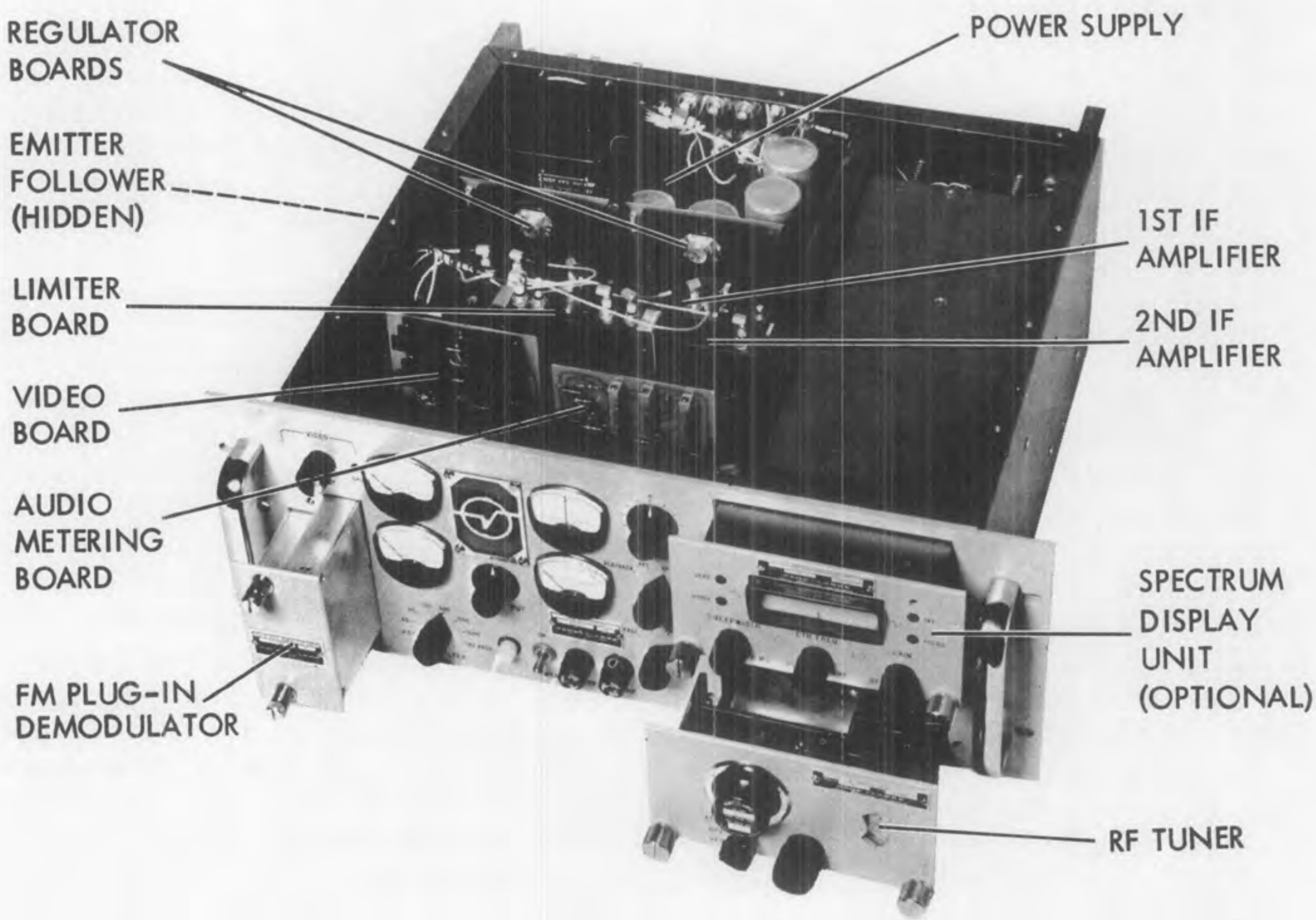


Figure 2. R-1037A Receiver, Illustrating Modular Construction

SECTION 2. INSTALLATION

INSPECTION

Check the front panel of the receiver for damage to knobs, windows, meters and the frequency indicator dial.

Operate the control knobs; examine them for looseness. Operate the tuning controls through their entire range. Binding indicates a damaged tuning system.

Remove the top and bottom covers of the receiver main chassis.

Inspect the subchassis on the upper and lower decks of the receiver for security of modules and loose or disconnected wiring.

Check line voltage switch S2 located on the main chassis deck towards the rear of the receiver and make certain it is placed in the proper position for the line voltage at the particular installation. To avoid serious damage to the receiver, do not use any fuse other than the value specified.

MOUNTING

The receiver can be rack mounted in a standard 19 inch rack installation; secured to the rack by four screws inserted through slots on the front panel and screwed into the rack frame. Because of the low internal power dissipation, no forced air ventilation is required either internal or external to the receiver. Therefore, extreme care is not required to insure adequate ventilation of the receiver.

The receiver may also be mounted for airborne installation in a vibration tray. For airborne use, the tray is shipped with the receiver and it is necessary to drill mounting holes to secure the vibration cups of the mount to a suitable flat surface.

CONNECTIONS

All external connections to this receiver are located on the rear apron. Refer to figure 3. External connection functions are:

Power Input - supplies primary ac power at J1 for proper operation of the receiver; 117 or 234 volts ±10%, 50 to 400 cps is required (power cord supplied as standard equipment).

ANT - Signal input from the antenna at J4.

SDU - 30 megacycle IF signal output from first IF amplifier for connection to spectrum display unit at J5 (integral SDU can be supplied with basic R-1037A receiver).

OSC - RF output to electronic counter for monitoring of L.O. frequency at J3. Refer to Section 4, table 6 for conversion factor.

Video - Main video output to recorders or other data processing equipment at J13.

AM - AM video output for connection to recorder or other data processing equipment at J14.

Pre-Detection - 10 megacycle unlimited IF signal for recording or other purposes at J16.

NOTE

> Unlimited or limited pre-detection is selected internally by the operator.

Limited Pre-Detection - 10 megacycle IF signal output prior to detection for recording or other purposes at J16.

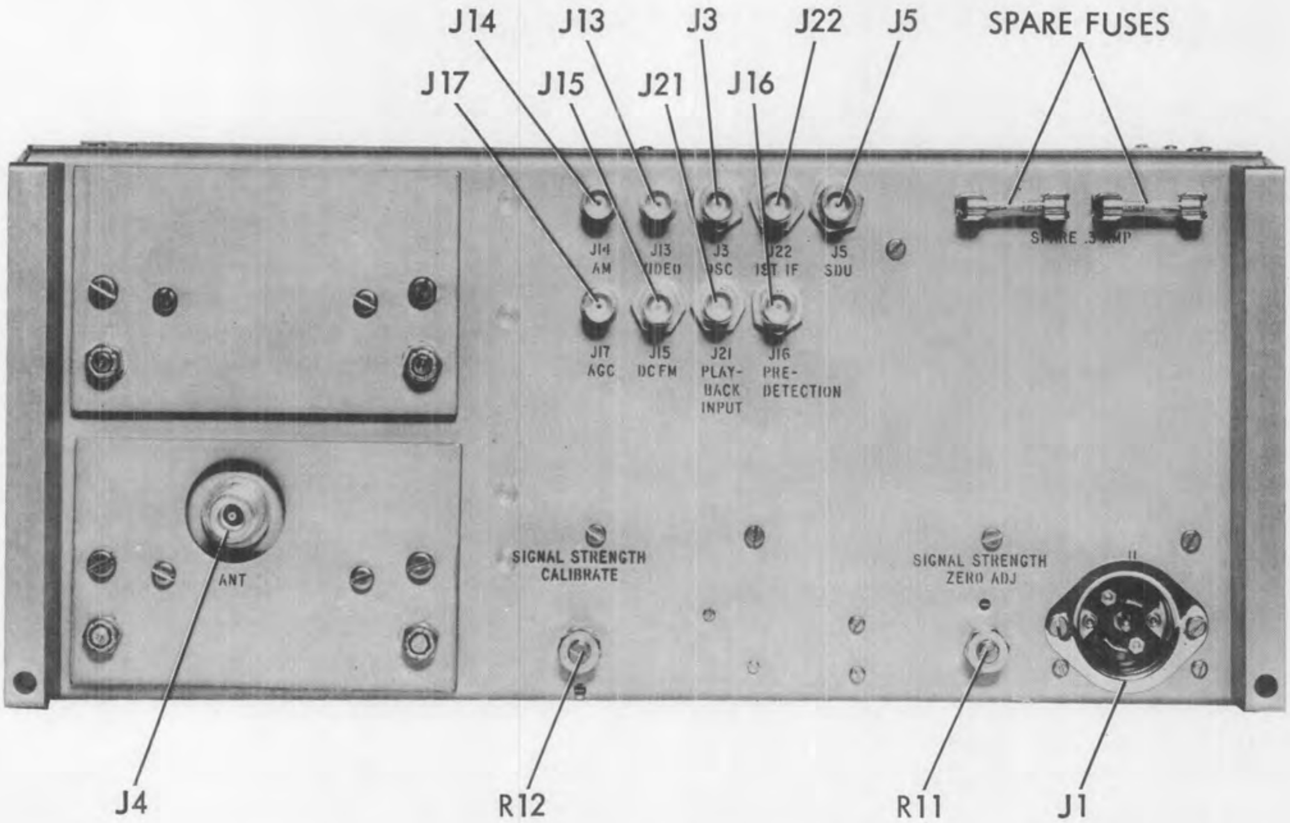


Figure 3. R-1037A Receiver Main Chassis, Rear Apron

AGC - AGC voltage output for signal strength monitoring or recording at J17.

First IF Output - 30 megacycle IF signal output for center frequency monitoring or other purposes at J22.

Playback Input - 10 megacycle IF input signal from recorder for playback demodulation at J21.

DC FM - DC FM output for connection to recorder or other data processing equipment at J15.

MODULE INSTALLATION

Module installation is accomplished by selecting the appropriate tuner or demodulator and plugging the module into the receiver main chassis.

Refer to table 3 for orientation of connections between modules and the R-1037A receiver.

NOTE

If the miniature RF connectors are not absolutely tight, the receiver will exhibit poor sensitivity and spurious response. Use a pair of slip-joint pliers to tighten the connectors.

Table 3. Module/Receiver Connections

Module	Number	Connector
RF Tuning	A1	J2
First IF Amplifier	A3	J6
Second IF Amplifier	A4	J7
Limiter	A5	J8
Demodulator	A6	J9
Emitter Follower	A7	(direct wired)
Video Bandwidth Filter	A8	(no power)
Video	A9	XA9
Audio	A10	XA10
Regulator	A11 and A12	XA11 and XA12

SECTION 3. THEORY OF OPERATION

GENERAL

Figure 4 is a functional block diagram of the R-1037A Multi-Range Telemetry Receiver. The path of signal flow through the various modules will be discussed in order.

The antenna input is connected to an RF tuner module through a sliding type contact. The various RF tuners are autonomous modules plugged into the receiver through the front panel. Tuners covering each of the authorized telemetry bands are available as well as wideband units for general purpose and surveillance use. The output frequency of any tuner regardless of input frequency range is 30 mc, fed through the first IF amplifier and second converter module.

The basic bandwidth of the first IF amplifier is 4 mc. The second local oscillator for the converter can be operated by crystal control, automatic control (AFC) or manual control. The output from the first IF amplifier and second converter at a center frequency of 10 mc connects to the IF bandwidth filter module. This module plugs into the receiver through the front panel, providing a choice of numerous bandwidths.

The output of the IF bandwidth filter, which determines the overall passband of the receiver, is connected to the second IF wideband amplifier module. Approximately 60 db of gain is achieved in this module. Its output connects to a wideband limiter module for FM reception. The limiter output drives the FM demodulator module. This unit is either a modified Foster-Seeley or a phase lock circuit. The FM demodulator circuitry is matched with the IF bandwidth filter in use and is packaged as an integral part of the IF filter module.

Because the FM demodulator has a high output impedance, a double emitter follower module is used as an impedance transformation device which allows front panel switching at low impedance levels, preserving the high frequency capability of the receiver. The emitter follower output is connected through a selectable video lowpass filter to the video amplifier module and to the audio and metering amplifier module.

The second IF amplifier contains an AM detector and amplifier with accompanying AM output for the reception of amplitude modulated signals. This AM detector output is also used for AGC purposes with an AGC amplifier and pulse stretching circuitry if operation with pulses is necessary. AGC voltage is applied to the second IF amplifier, the first IF amplifier and the RF tuner in use.

The first IF amplifier contains an IF output for use with the spectrum display unit which may or may not be part of the basic receiver.

Outputs, both limited and non-limited for pre-detection recording, are afforded in the limiter module. The playback signal is introduced at the second IF amplifier frequency, just ahead of the IF bandwidth filter.

The signal strength is monitored by a metering circuit driven by the AGC voltage. The FM demodulator output is connected to a peak rectifier circuit whose output drives the tuning meter to denote proper operation of the receiver and which also, when desired, can automatically control the frequency (AFC) of the second local oscillator to negate frequency drifts and doppler shifts. Deviation and video output meters are also provided.

An integral power supply, capable of operating from either 115 or 230 volts with power line frequencies between 50 and 450 cycles, is contained in the receiver chassis. It produces all the voltages required to operate the R-1037A receiver.

RF Tuners

The R-1037A receiver can be supplied with RF tuning assemblies which cover any of the seven authorized telemetry bands. Frequency ranges are grouped in accordance with the similarity of techniques in the various tuning assemblies, each covering one specific band. Refer to table 1 and the individual instruction manual for a specific tuner.

The four frequency ranges between 135 and 410 mc utilize nuvistor tubes as RF amplifiers.

Microwave frequency ranges between 1435 and 2300 mc utilize passive coaxial line filters as preselectors and no RF amplification. These tuning assemblies use diode mixers as first converters and derive gain at the first intermediate frequency of 30 mc in a low noise preamplifier integral with the tuning assembly.

The remaining frequency ranges between 920 and 1000 mc employ a high frequency, low noise ceramic triode as RF amplifier in an etched circuit as RF filter and mixer.

First IF amplifier and Second Converter

Refer to the block diagram in figure 5.

The output from any RF tuning assembly is connected to the first IF amplifier and second converter. Two stages of IF amplification are followed by a second mixer and emitter follower whose output is connected to the IF bandwidth restricting filter. This module also contains two oscillators. The first is crystal controlled and the second is capable of either manual tuning or by automatic control from a voltage output derived on the audio/metering board.

Refer to the schematic diagram, figure 21.

The signal from the RF tuning assembly is connected to the module through J2. At this point, two IF signal outputs are provided; J3 for connection to the spectrum display and J5 available at the rear apron for ancillary equipment.

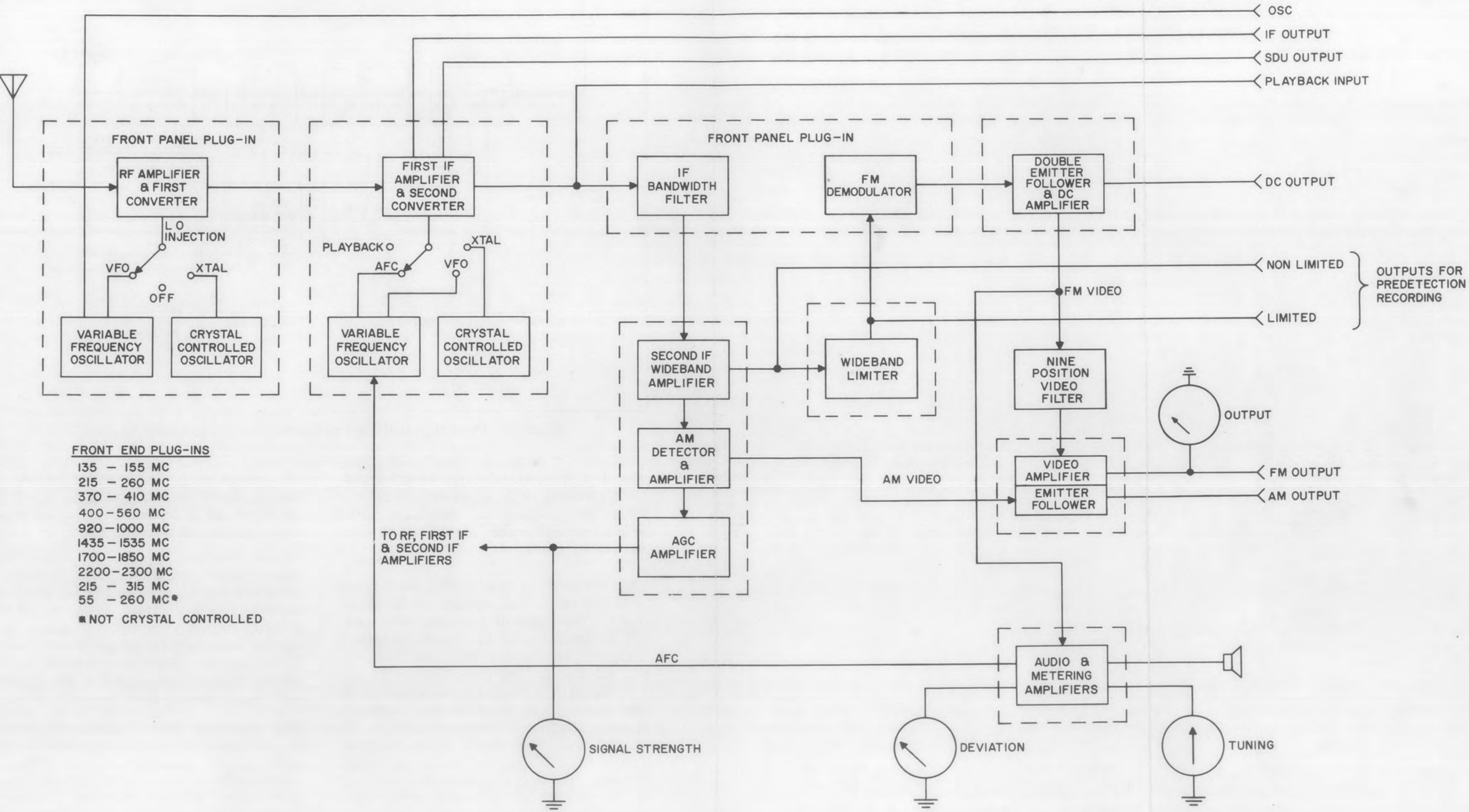


Figure 4. R-1037A Receiver, Functional Block Diagram

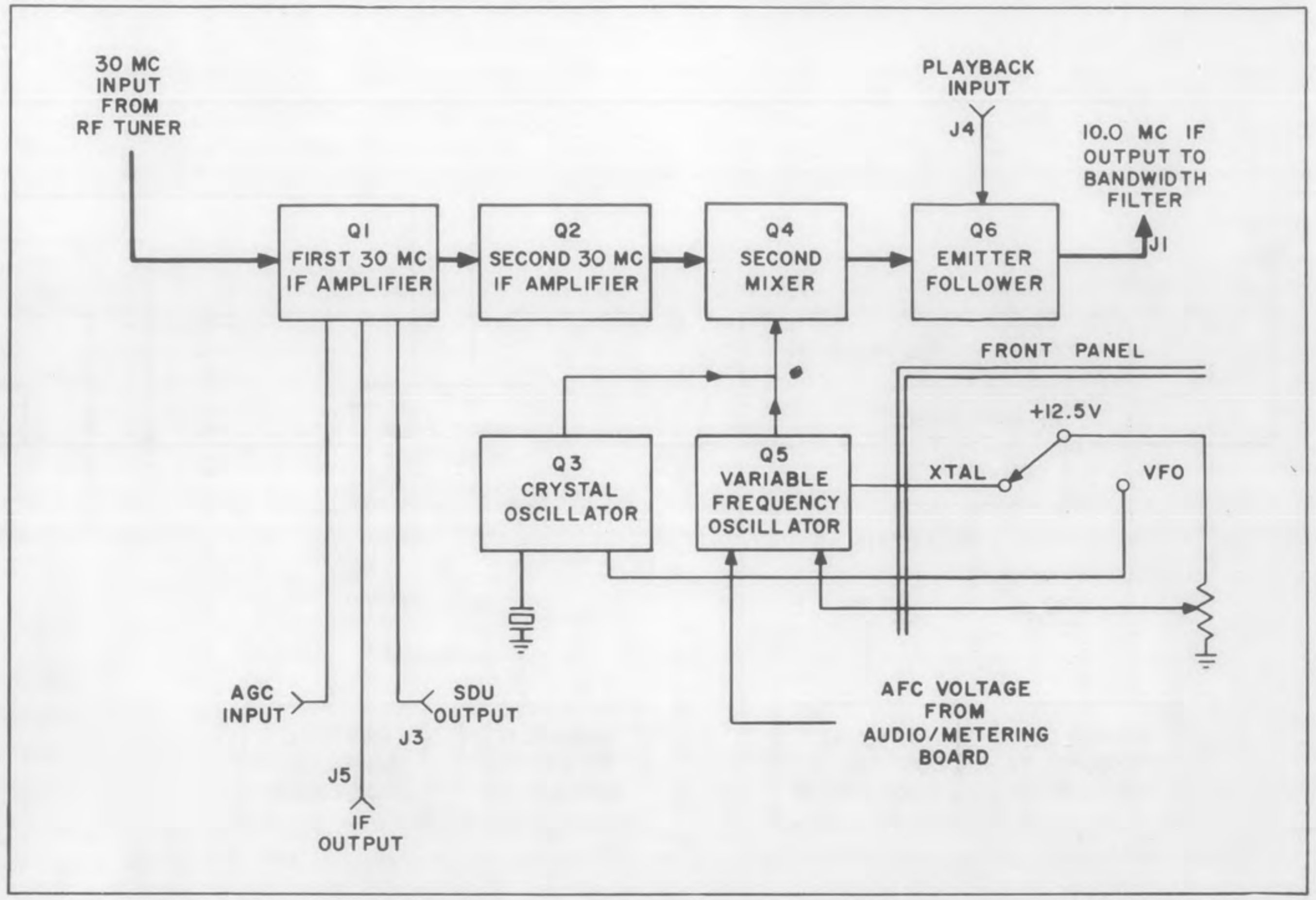


Figure 5. First IF Amplifier and Second Converter, Block Diagram

The first IF signal is connected to transistor Q1 through coupling capacitor C1. Resistor R5 produces an impedance in the emitter circuit across which a signal voltage can be developed.

The base of Q1 is ac grounded, but it is not dc grounded so AGC voltage can be introduced. The output of Q1 is coupled to second IF amplifier Q2 by a selective circuit composed of resistor R9, capacitors C4, C5, C6 and C7 and transformers T1 and T2. C4 and the output capacitance of Q1 are resonated by T1 at 30 mc. Also, T2 resonates with the combination of C6, C7 and the input capacitance of Q2. R9 loads T1 and T2 to develop the desired bandwidth of 5 mc. The signal is divided capacitively by C6 and C7 so variations of the input capacitance of Q2, caused by varying collector currents with signal level, do not detune the interstage filter.

The second stage uses a 2N708 transistor in a grounded emitter configuration. The output of Q2 is connected to second converter Q4 through a tuned circuit.

Second converter Q4 has the signal frequency introduced to its base, and local oscillator energy from either Q3 or Q5 is connected to its emitter. The output of Q4 is again connected through a frequency selective filter and interstage transformer. The output from this filter is connected to emitter follower Q6 so that a low impedance output is provided from the module.

The interstage filter between transistors Q4 and Q6 is three separate transformers combined to produce a highly selective bandpass filter at the second IF frequency. This degree of high selectivity is necessary to insure that only the proper product of the heterodyne action in Q4 is selected and all other by-products rejected.

Four modes of operation are possible for the second local oscillator. These are selected by a front panel control 2ND LOC OSC switch S3. In the XTAL position -12.5 volts is connected to the collector of Q3 and no voltage connected to Q5. Transistor Q3 oscillates in a crystal controlled manner, its frequency determined by crystal Y1. The oscillator circuit is a modified Colpitts where Y1 acts as the resonant circuit and feedback to the emitter to sustain oscillation is provided by capacitance divider C11 and C13. The combination of capacitors C8 and C12 and transformer T3 act as a vernier adjustment on the crystal oscillator frequency of 40.0 mc.

The output from Q3 is coupled to the emitter of mixer transistor Q4. No interaction is incurred with oscillator Q5 since this circuit is inactive in the XTAL position.

Transistor Q5 is a variable frequency oscillator and can be either manually tuned or automatically controlled from a voltage derived in the audio/metering circuit.

Front panel control S3 (figure 20) in VFO position disconnects the -12.5 volts from Q3 and connects 12.5 volts to the collector circuit of Q5 which causes transistor Q3 to stop oscillating and Q5 to start. The frequency of oscillation of Q5 is determined by T6 and the combination of varicap CR1 and capacitors C23 and C26. Feedback to the emitter is through the capacitance divider formed by C28 and C29. The collector of Q5 is ac grounded so the resonant circuit appears between ground and the base. The frequency of oscillation is altered by changing the effective capacitance of varicap CR1. This can be done by adjustment of front panel control TUNING KC which introduces a voltage on the cathode side of CR1 proportional to the position of the front panel potentiometer. A frequency range of ± 250 kc around the center frequency of 40.0 mc is possible. Also a dc voltage derived in the audio/metering board can be used for AFC purposes. Here the voltage is introduced to the anode side of varicap CR1 through the combination of L2 and T6. Automatic frequency pull-in is experienced over the full IF bandwidth because of the compatibility of IF bandwidth filter and matched FM demodulator.

The output of Q5 is coupled to transistor mixer Q4. Since Q3 is inoperative, no interaction is experienced. Test point TP1 monitors both oscillators' performance.

The output from the first IF amplifier and second converter appears at J1. It can be either the original real-time or a pre-detected recorded signal. This latter input is introduced through J4. Diode switch CR3 is biased heavily in a back direction because of the dc introduced through R31. The diode therefore is opened and no signal from the input circuitry is accepted. However, in the playback position, this dc voltage is removed, CR3 is switched and the playback input appears at J1. Simultaneous with the playback input enabling circuit, both oscillators Q3 and Q5 are disabled by removal of dc to their collectors so no input from the signal path can mix with the pre-detected playback function.

IF Bandwidth Filter

The IF Bandwidth Filter is a part of the demodulator module. The filter is composed of either a seven or eight pole Butterworth L-C network or a crystal network depending upon the bandwidth being utilized as tabulated below.

Butterworth L-C Network	Crystal Network
300 kc	6.25 kc
500 kc	12.50 kc
750 kc	25.00 kc
1 mc	50.00 kc
1.5 mc	100.00 kc
2.4 mc	

The demodulator module is a plug-in assembly accessible from the front panel of the receiver main chassis. This allows the interchanging of IF bandwidths with a minimum of difficulty. The filter with its sharp skirt selectivity determines the overall receiver bandwidth while the discriminator portion of the module is matched to the filter bandwidth.

The output of the first IF amplifier and converter module is connected to the filter through A2-J9. From A2-J9 the signal passes through a passive attenuator which matches the losses of all the various bandwidth Butterworth filters. From the attenuator the IF signal is connected to tapped inductance L1. The tap is set to produce a 50 ohm input impedance to match the output impedance of the first IF amplifier and converter. This inductor is tuned with C1 and variable capacitor C35. Energy from this first resonant circuit or pole is capacitively coupled through C2 to the next resonant network. The coupling capacitances and the L to C ratio of the seven or eight resonant circuits vary to obtain the required maximumally flat response. The output inductor L7 is tapped to produce a 50 ohm output impedance.

The crystal filters are hermetically sealed units having 50 ohm input and output impedances.

Second IF Amplifier

The two intermediate frequencies selected are 30 mc and 10 mc. The IF bandwidth is 3.3 mc.

The module consists of three stages of IF amplification. Each of these stages consists of two transistors arranged in cascode configuration. This circuitry selection provides automatic gain control for tuned IF amplifiers without degrading frequency response of the amplifier.

Transistor Q3 functions as an amplifier for detected AM signals. Q4 acts as an emitter follower to insure that low impedance circuitry is used for the development of the various AGC capabilities of the receiver.

Q6 is a dc AGC amplifier while Q8 is a pulse stretcher.

Refer to the block diagram in figure 6 and the schematic diagram, figure 22.

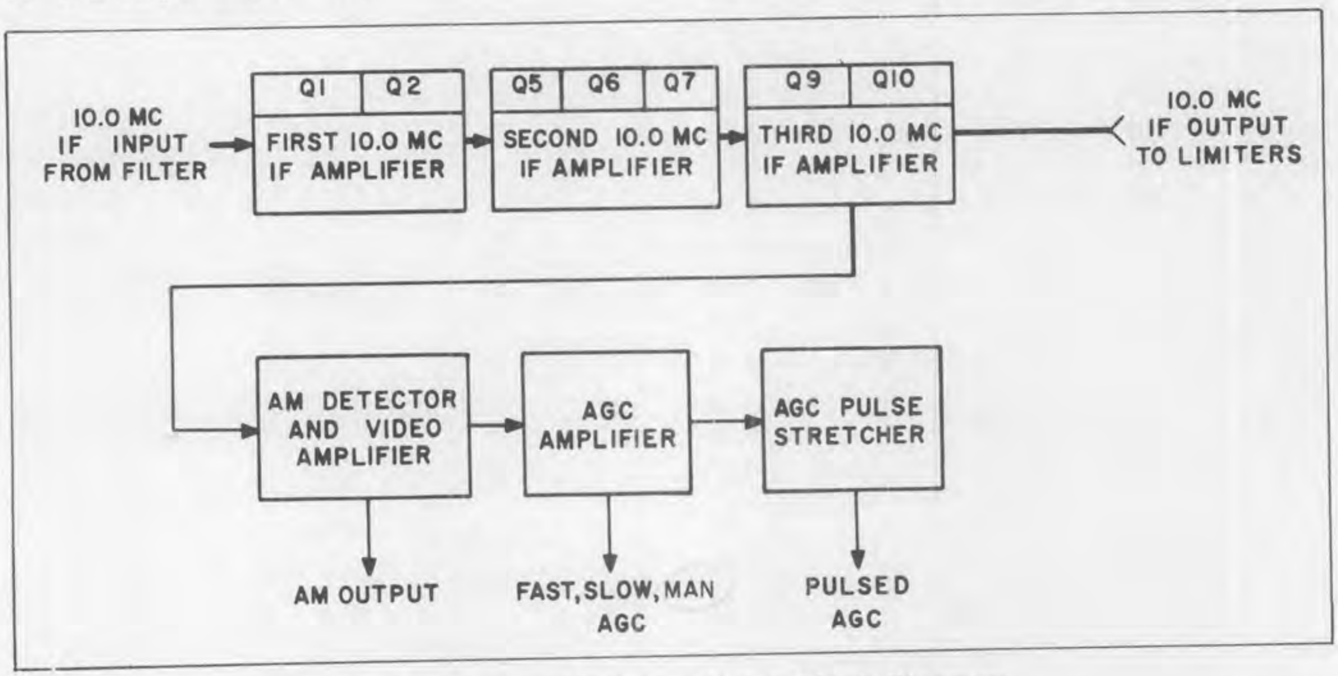


Figure 6. Second IF Amplifier, Block Diagram

The input from the IF band restricting filter is connected to the second IF amplifier at J1. Capacitor C2 terminates the filter while R2 terminates the coaxial line. The signal is coupled to the base of input amplifier Q1. The emitter circuit of Q1 is complex because of the manner in which AGC voltage is introduced.

A combination of resistor R11 and RF choke L1 produces the dc path for the emitter current. C9 grounds the emitter circuit at the bottom end of R11 to the ac signal. Diodes CR1 through CR4 exhibit a changing impedance as a function of the current through them so that C6, the emitter bypass capacitor, is not grounded but connected to ground through capacitors C1 and C5 and the variable diode impedances. Thus, emitter bypass capacitor C6 is varied as a function of the AGC voltage and in like manner the gain of Q1 is varied.

The output of Q1 is coupled directly to the emitter of Q2, a grounded base transistor. The low impedance of Q2 reduces the affect of the output impedance of Q1 on tuned circuit T1. The output of Q2 is connected to the input of the second amplifier configuration through a selective filter composed of T1, T2 and T3. As in the first IF amplifier, these transformers act as shunt series and shunt tuned circuits respectively. Additional tuning capacitors C14, C15 and C17 assist in resonating circuit capacitances. The series combination of C11, L3 and R14 assist in the AGC characteristics of Q1.

The combination of Q5, Q7 and Q9, Q10 function in an identical manner. Test points TP1 and TP2 assist in alignment of the IF amplifier.

Q3 acts as a video amplifier for the signals which have been amplitude modulated. This IF output is coupled capacitively through C18 to diodes CR5 and CR6 which act both as an AM detector and voltage doubler. The output from these diodes is coupled to the base of Q3 through a filter combination of resistors R10, R12 and R13, capacitors C8, C10 and C12, and series inductor L2. This filtering network bypasses or rejects all IF components present on the detected signal.

Two outputs from Q3 are provided. The first output labeled AM, goes to pin 18 of P1, the connector of the module and then to the video amplifier module.

The other output is connected to the base of emitter follower Q4. This provides a low impedance output for the switching functions required in the somewhat complex AGC circuitry of this module.

A front panel switch gives selection of four modes of operation; FAST, SLOW, PULSE, and OFF. In the FAST, SLOW and OFF positions, the output of emitter follower Q4 is coupled through diodes CR12 and CR13 as well as CR7 and CR8 to the base of AGC amplifier Q6.

These four diodes in series act only as dc voltage dropping components so the full charge present on the emitter of Q4 can be connected to the base of Q6 and still preserve proper dc voltages at both the emitter and base of Q4 and Q6 respectively. Q6 is a dc amplifier whose output goes directly to the RF tuning assembly through inductor L6. A divider action of potentiometer R25 is provided so that the reduced AGC voltage can be applied to the transistors on both the first and second IF amplifiers. The two different levels of dc are necessary because of the different voltage swings of nuvistors and transistors. Diode CR11 acts as a voltage clamp on the AGC line to insure that this never goes positive should transistor Q6 fail.

In the PULSE position of AGC selector switch S4, the output of Q4 bypasses diodes CR12 and CR13 and connects to the base of pulse stretcher Q8. Pulses from the receiver turn the base of transistor Q8 on so that C29 is charged negatively through a low impedance point. After the duration of the pulse has expired, transistor Q8 turns off and the charge on pulse stretching capacitor C29 can recover only by discharging through R32. Meanwhile the dc present on capacitor C29 is applied to the base of AGC amplifier Q6 and provides adequate AGC action of the receiver during the pulse interval.

Wide Band Limiter

Refer to the block diagram in figure 7 and schematic diagram, figure 23.

Three stages of limiting are presented to each of the two signal outputs, the limited IF output for demodulation, J1 and the limited output for pre-detection recording, J3. An unlimited output for pre-detection recording is also provided at J4. In each instance, the outputs are developed across low source impedances.

The 10 mc signal from the IF amplifier is presented to the module at connector J2. The signal is coupled to the base of input transistor Q1 through capacitor C1. The combination of resistors R2, R3 and R4 produce the base bias for transistor Q1. R3 is variable to insure identical base voltages for transistors Q1 and Q2. Transsistor Q1 operates as a straight voltage amplifier. However, the collector current resulting from the signal on the base alternately turns transistor Q2 on and off due to common emitter resistor R7. Thus, the transistors act as electronic switches operating at the second IF rate. The saturated wave forms appearing at collector resistors R6 and R8 are directly coupled to the bases of limiting transistors Q3 and Q4 respectively.

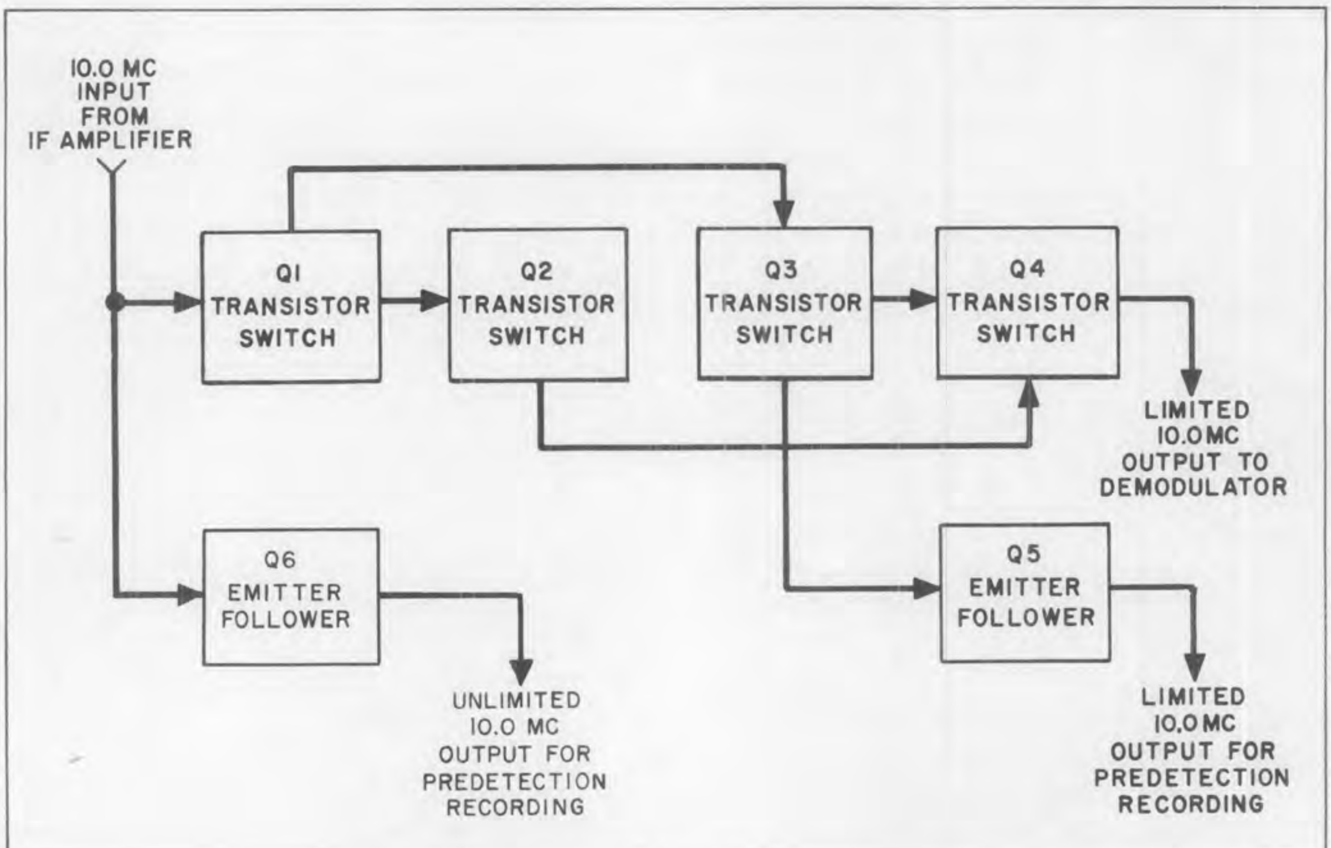


Figure 7. Wide Band Limiter, Block Diagram

Transistors Q3 and Q4 act also in a limiting and switching manner as transistors Q1 and Q2 with common emitter resistor R16 forming the signal coupling between this second pair. R13 is connected through coupling capacitor C5 to the base of emitter follower Q5. The low impedance of the emitter follower configuration is coupled via capacitor C6 to the limited pre-detection output at J3.

Crystal diodes CR1 and CR2, located in the collector circuits of transistors Q3 and Q4 respectively, also form a limiting action. Biased in the forward direction, they present low impedances to the signals appearing at the collectors of these transistors when the respective transistor is in the on or conducting state. At this point in time, the alternate transistor is turned off. When a negative going signal appears at the collector of the transistor and this transistor having been off, the diode is turned on and short circuits the signal impedance except for the contact potential of the diode. Therefore, the output from the limiter is held at approximately 0.5 volt peak-to-peak amplitude.

FM Demodulator

Refer to the individual instruction manual on a specific demodulator for a detailed discussion of the unit. Also, see table 1.

Briefly, the output from the wideband limiter is connected to the FM demodulator through a coaxial cable to jack A3 of connector P2. The output of the demodulator is then connected to the double emitter follower board for proper impedance transformation.

Emitter Follower

The output from the FM demodulator is plugged into a double emitter follower module located behind the filter plug-in assembly (see figures 11 and 20). This minimizes any stray circuit capacitance which would limit the high frequency response of the video amplifier.

The signal appearing at emitter resistor R1, due to the variations in collector current as a result of the changing base voltage, is again dc coupled to the base of transistor Q2.

The output from the emitter of Q2 is first dc coupled to the base of transistor Q3 so that proper dc voltages can be maintained. Transistor Q3 is a narrow band amplifier for narrow band FM signals. The signal appearing at the collector of Q3, across resistor R4, is connected directly to J15 on the rear apron of the receiver and affords a small signal level with frequency response from dc to 250 kc. The output of transistor Q2 is also connected directly to the audio/metering amplifier and to the video filter selector switch S5 through coupling capacitor C9. Switch S5 is an eight position selector located on the front panel of the receiver. It introduces "pi" section low pass networks of which capacitors C1 and C2 with series inductor L2 are typical. These "pi" networks provide video filtering with cutoff frequencies of 12.5, 25, 50, 100, 300, 500 and 1000 kc. Above their cutoff frequencies, these filters exhibit an 18 db per octave roll-off characteristic. The last position of S5 bypasses all video filtering and permits the full bandwidth of the receiver and video amplifier to be used. The output from any of these sections is connected to video gain control R8 which is also located on the front panel. The arm of this variable resistor then connects a variable amount of this video signal to the video amplifier module for further amplification.

Video Amplifier

The video amplifier module (figure 24) consists of four stages of video amplification, a full wave diode bridge rectifier to drive the output meter and an emitter follower to provide a low impedance for the AM output.

The input signal, derived from the FM demodulator, is connected to the base of input transistor Q1. The capacitance values are quite large to insure adequate low frequency response. The combination of capacitor C2 and resistor R2 provide an effective high input impedance to Q1 by bootstrapping. The amplified signal appearing at the collector resistor R4 is directly coupled to the base of transistor Q2. This stage's output is emitter coupled to the bases of transistors Q4 and Q5. These transistors, having complementary symmetry, can perform in a push-pull manner without the need of phase opposition at their bases.

Transistors Q4 and Q5 are biased to function as class AB amplifiers to provide a high fidelity medium power signal output of approximately 10 volts, peak-to-peak across 75 ohms load impedance. The output of Q4 and Q5 is also coupled through capacitor C8 and R15 to the full wave diode bridge composed of CR3, CR4, CR6 and CR7. This circuit rectifies the diode signal to provide a dc actuating voltage for the output meter located on the front panel. Diode CR5 prevents the output from going in the reverse direction and damaging the meter.

The output signal from the AM detector located in the second IF amplifier is applied to the base of transistor Q3 which is also located on the video amplifier board. Transistor Q3, an emitter follower, provides a low source impedance for the AM output signal available at J14 on the rear apron of the receiver.

Audio/Metering Circuit

The audio/metering amplifier is comprised of several individual functions on the same board. A schematic diagram of the audio/metering amplifier is presented in figure 25.

Transistors Q1, Q2 and Q3 amplify the audio signal to a level sufficient to drive the front panel speaker.

Transistor Q4 provides the necessary circuitry by itself to drive the deviation meter.

Transistor Q6 in conjunction with transistors Q4 and Q5 provides not only the balance of the tuning meter circuitry but also the collector signal of Q6, used for automatic frequency control voltage which is applied to the second local oscillator.

The input to the base of transistor Q1 is derived from the FM demodulator. However, the signal proceeds first to the front panel potentiometer R7 which provides an audio gain control. The signal from this control is coupled through capacitor C1 to the base of the input transistor. The output of Q1 drives the complementary symmetry transistors Q2 and Q3 which in turn provide approximately 100 milliwatts of audio power for the speaker. The output from the emitter function of Q2 and Q3 is capacitance coupled by capacitor C3 to the front panel speaker.

A second signal derived from the FM demodulator is connected to the base of voltage amplifier transistor Q4. The emitter signal appearing across resistor R10 is first capacitance coupled via C7 to the voltage doubling circuit composed of diodes CR5 and CR6, capacitor C6 and resistor R13. Its output drives the front panel deviation meter.

The output from Q4 is also connected to a diode rectifying circuit composed of diodes CR3 and CR4, capacitors C4 and C5 and resistors R11 and R12. As the signal on the emitter of Q4 swings in a positive and negative direction alternately, diodes CR3 and CR4 are converted to a conducting state and charge capacitors C4 and C5 respectively. Their outputs are added through resistors R11 and R12 to appear at the base of transistor Q5. Resistors R14 and R15 form the bias for the base of transistor Q5. R14, however, is made adjustable so that the dc component appearing at R10 during the "on frequency" signal can be balanced out. The collector signal of Q5 is directly coupled through CR7 to the base of transistor Q6. The emitter signal of Q6 is connected to the other side of the tuning meter. The tuning meter in effect is connected directly between the emitters of transistors Q5 and Q6.

The signal appearing at the collector of transistor Q6 can be used for AFC purposes. Since the tuning meter indicates in essence a difference, if any, between the received signal and the signal to which the receiver is tuned, this error voltage can be used for AFC correction.

Main Chassis

The main chassis contains the power supply which produces all necessary voltages and currents for the proper operation of the R-1037A receiver as well as the front panel controls and receptacles for the modules mounted on the chassis deck.

Power Supply

The R-1037A receiver requires 150 volts, 12.5 volts and -12.5 volts. These are produced in three circuits. Refer to figure 20.

Primary ac power, either 115 or 230 volts at frequencies between 50 and 450 cycles, is applied to the primary of the transformer through connector J1. Line filters to reduce power line conduction of signals inside the receiver are provided through "L" section filters. Power is applied to the primary of power transformer T1 through power switch S1.

The primary of transformer T1 consists of two identical windings. These can be placed in parallel for 115 volt operation by power switch S2. For operation at 230 volts, switch S2 connects these primaries in series. Overload protection is afforded by 0.3 ampere fuses F1 and F2.

The 150 volts is required by the RF tuning assemblies only. This is produced by secondary winding of transformer T1 at terminals 5 and 6. The high voltage available at these terminals is rectified in a full wave diode bridge consisting of diodes CR1 through CR4 located on TB1 (see figure 11). Filtering is afforded by the "pi" RF low pass filter. The 150 volts is applied to the RF tuning assembly at pins 18 and 19 of connector J2.

The 150 volts is regulated at voltage levels 24 vdc and 12 vdc by the series combination of resistor R5 and zener diodes CR5 and CR6 of TB2.

The 12.5 regulated voltage is supplied through Electronic Regulator Module A11. Refer to figure 20. Approximately 20 volts of ac power is available at terminals 9 and 10 of power transformer T1. This power is connected to a full wave rectifier bridge consisting of diodes CR1, CR2, CR3 and CR4. The output of the diode bridge connects to the collector of series regulator transistor Q2. The output, 12.5 volts regulated, is available at the emitter of Q2 and appears at terminals 9 through 12 of XA11 where it is then distributed to the various plug-in modules of the receiver as required.

Voltage variations appearing at the emitter of Q2, due either to load or line voltage variations, are connected to the base of transistor Q3 through zener diode CR6.

The emitter of transistor Q3 is fixed in voltage by zener diode CR5. Resistor R4 supplies dc voltage to zener diode CR5 to properly strike the diode. Transistor Q3 acts as a shunt regulator and amplifies the voltage variations existing at the emitter of transistor Q2. The collector of transistor Q3 is connected directly to the base of transistor Q1. This transistor acts as an emitter follower so that the amplified voltage variations appear at the emitter of transistor Q1 at a low impedance point so that they in turn can be directly coupled to the base of series regulator transistor Q2. Becuase of the inversion of the error signals effected by the amplifying properties of transistor Q3, transistor Q2 acts as a variable current source to supply more or less current as the load or input voltage vary and the 12.5 volts becomes regulated.

The -12.5 volts of module A12 is also supplied and regulated by the combination of transformer terminals 11 and 12 and an identical circuit both electrically and mechanically to that discussed in the 12.5 volt supply.

Electronic Regulator Modules A11 and A12 are located on plug-in boards and may be interchanged or readily replaced (see figure 2). The interchangeability of two such units while supplying opposite polarity voltages is possible by merely changing the location of the dc ground in the circuit.

The receiver module deck mounts the connectors which in turn supply the proper power to the various plug-in modules. In addition, the front panel switches, meters, gain control and speaker are mounted on the front panel.

SECTION 4. OPERATING PROCEDURE

TUNING CONTROLS

Haphazard operation or improper setting of the controls can result in poor performance. The function of all operating controls and indicators is given in tables 4 and 5.

RF TUNING MODULE

Proper tuner operation requires the tuning knob or knobs be tuned to the desired operating frequency, visible through the front panel window on the calibrated dial, plus proper selection of the first local oscillator. Either crystal or variable control of the first local oscillator is by front panel switch S1. When crystal operation is desired, it is necessary to connect the proper frequency crystal. This frequency is determined by reference to table 6 for the proper RF tuning band in use. The off position of S1 permits standby operation of the receiver.

The second local oscillator may also be operated in one of four modes as selected by front panel switch S3. The VFO position permits incremental tuning of the second local oscillator over ±250 kc. This tuning is effected by R6. In AFC, the second local oscillator is automatically controlled over a frequency range equal to the full bandwidth of the IF filter in use. In XTAL position, the second local oscillator is crystal controlled by a quartz unit located in the first IF amplifier module.

The desired IF bandwidth is selected by plugging in the appropriate filter through the front panel. This module is labeled either FSD for a Foster-Seeley demodulator or PLD for a phase lock demodulator with an accompanying type number to indicate the bandwidth of the filter.

The desired post detection video bandwidth is selected through VIDEO FILTER switch S5. This switch places the "pi" section

Table 4. Main Chassis Operating Controls and Functions

VIDEO OUTPUT	Controls output video level at J13
OUTPUT METER	Indicates output video level at J13
CAL OUTPUT	Calibrates output meter in db for a particular video output level
TUNING METER	Indicates proper tuning of receiver when centered
TUNING	Manual tuning control for second local oscillator over ±250 kc
DEVIATION METER	Indicates amount of frequency deviation of received signal (accurate for single frequency modulation, approximate or relative for complex modulation)
AUDIO OUTPUT	Controls level of audio signal to front panel speaker
SIGNAL STRENGTH	Indicates signal strength of received signal in microvolts
2ND LOCAL OSC	Selects mode of operation for second local oscillator; XTAL, crystal controlled; VFO, manually controlled; AFC, automatically frequency controlled; PLAYBACK, oscillator disabled
VIDEO FILTER KC	Selects cut-off frequency for postdetection video filtering; 12.5, 25, 50, 100, 300, 500, 1000 kc cut-off frequency with 18 db/octave roll-off; BYPASS position bypasses video filter
POWER	Applies primary ac power to receiver
0.3 AMP FUSES	Both fuses operating to permit either 115 or 230 volt operation
AGC SELECTOR	Selects time constant of automatic gain control circuitry to optimize performance for either CW or pulse reception. Off position permits noise figure measurement of receiver

Table 5. VHF/UHF Tuner Operating Controls and Functions

TUNING	Adjusts RF amplifiers and local oscillator circuitry to desired frequency
DIAL	Indicates within 1% frequency to which receiver is tuned
L.O. SELECTOR	Selects mode of operation of first local oscillator

filter, with 18 db per octave roll-off, between the FM demodulator output and the video amplifier. The bypass position removes the filter bank from the circuit and permits operation of the receiver at full video bandwidth of 2 megacycles.

Proper AGC action is selected by AGC switch S4. In FAST position, a very small attack time is used for FM reception where AM or fluctuation noise is present. The SLOW position is used for normal AM or FM reception. The PULSE position employs pulse stretching circuitry in the AGC line to insure proper AGC action for pulse reception.

FM video output amplitude is controlled by video output front panel potentiometer R8. The output meter indicates in db the output level from the receiver. Adjustment of the video output control effects the magnitude of the output from the FM demodulator to the video amplifier. Therefore, adjustment of this control not only alters the output level of the video appearing at J13 but also changes the indicating level of output meter M2.

When using several receivers, it is advisable to set the output from each receiver at an identical level. Screw driver control R9 calibrates output meter M2 at a particular setting. Thus, once the meter and receiver output are calibrated, adjustment of video output control R8 will assure the operator the receivers are operating at identical output levels or at different levels as indicated by the meter and subject to control by the operator.

An aural monitor of the receiver is provided by front panel speaker LS1. The audio level is controlled by audio output control R7 located beneath the speaker.

Two fuses on the front panel function continuously since the receiver may be operated from either 115 or 230 vac input primary power. Spare fuses are located on the rear apron of the receiver.

Table 6. Proper Crystal Frequency Selector

RF TUNING MODULE	FREQUENCY RANGE	MULTIPLYING FACTOR-N	L.O. INJECTION	COUNTER OUTPUT
RFT-100A	135-155 mc	4	730 mv	2
RFT-101A	215-260 mc	6	730 mv	2
RFT-102A	370-410 mc	9	730 mv	3
RFT-103A	920-1000 mc	24	730 mv	2
RFT-104A	1435-1535 mc	36	730 mv	2
RFT-105A	1700-1850 mc	36	730 mv	2
RFT-106A	2200-2300 mc	54	730 mv	2
RFT-107A	215-315 mc	6	730 mv	3
RFT-109A	55-260 mc	no crystal	730 mv	-

Table 6. Proper Crystal Frequency Selector (cont)

The proper crystal frequency is determined by the formula

$$F_x = \frac{F_s \pm 30}{N} \text{ mc where}$$

F_x = Crystal Frequency

F_s = Signal Frequency

N = Proper Multiplying Factor

The last column in table 6 indicates the harmonic relationship between the crystal frequency and the output signal at J3 for counting.

SECTION 5. ALIGNMENT AND ADJUSTMENT PROCEDURES

TROUBLE SHOOTING

If the receiver malfunctions, the following trouble shooting procedure should be followed before any attempt at individual module alignment, described in this section.

Inspect the receiver for proper interconnection of all equipment intermodule cabling.

Check fuses F1 and F2 on the front panel to insure they are operative and of 0.3 ampere.

Check for proper voltage at test points on the power supply platform. Use TP1 (figure 10) for +150 vdc unregulated. Test points are also provided on the printed circuit boards for plus and minus 12.5 vdc. Connect the positive terminal of a voltmeter to the orange test point and the negative terminal of the voltmeter to the violet test point and check for +12.5 vdc ±5%.

Make certain correct power inputs to each module are available at the proper pin before beginning any test or alignment procedures.

If a malfunction occurs, first determine which circuit is defective by interchanging plug-in modules if available. If spare plug-in modules are not available, use the following procedures to isolate the defect.

PRELIMINARY ALIGNMENT CHECKS

Test equipment required.

1. Audio Oscillator, H/P 200CD
2. Oscilloscope, DuMont 401A
3. Signal Generator, Boonton 202D
4. Univerter, Boonton 207E

Refer to figure 25. Connect an audio oscillator to pin 8 of audio and metering module A10. Set the output level to 3 volts peak-to-peak.

By means of the audio oscillator, the audio and metering circuitry and the video module can be checked. The deviation meter should read approximately 100 percent of usable bandwidth with a 3 volt peak-to-peak signal input. There should be 10 volts peak-to-peak of video signal into a 75 ohm load at video output jack J13.

Connect an FM signal generator, set at 10 mc with 50 percent of usable bandwidth deviation, to J2 on limiter module A5 (see figures 16 and 23).

Set the output level of the FM signal generator to 100 millivolts and check for proper demodulator operation as indicated by a deviation meter reading of approximately 50 percent, with 10 volts peak-to-peak of video at J13 on the chassis rear apron into a 75 ohm load. By varying the FM signal generator frequency an indication should appear on the tuning meter.

Reconnect P13 to J2 on the limiter module A5.

Connect the signal generator to J1 of the second (10 mc) IF amplifier module A4. Check for normal operation of the receiver as described in the previous paragraph. The signal level required to get normal operation (full limiting of output) should be less than 1 millivolt (see figures 14, 15 and 22).

Place the signal generator to the AM modulation position with 30 percent AM modulation. Connect the oscilloscope to J14 on the rear apron (AM output) and check the AM circuitry for proper operation.

Reconnect P10 to J1 of the 10 mc IF amplifier module A4.

Connect an FM signal generator to J2 of the first (30 mc) IF amplifier module A3. Set the frequency of the FM signal generator to 30 mc with 50 percent usable bandwidth deviation. Check the receiver for normal operation as in paragraph four of PRELIMINARY ALIGNMENT CHECKS. The sensitivity of the receiver at this point should be less than 300 microvolts. A malfunction for this check may be in the 30 mc IF amplifier module or the IF bandpass filter module A6. To eliminate the bandpass filter module, place a coaxial jumper cable between J1 of first IF module A3 and J1 of second IF module A4.

If the sensitivity is less than 300 microvolts, the malfunction is in filter module A6. If normal indication is observed to this point, check the RF module or the AGC loop.

FIRST IF AMPLIFIER ALIGNMENT

Test equipment required.

1. 50 ohm coaxial RF detector
2. Kay Electric, Model SKV935B Sweep Generator or equivalent
3. High impedance diode probe
4. Oscilloscope, DuMont 401A or equivalent
5. Signal Generator, Hewlett-Packard, Model 606A or equivalent
6. Variable 50 ohm attenuator Key Electric, Model 30-0 or equivalent
7. Electronic counter, Hewlett-Packard, Model 524C or equivalent

ALIGNMENT PROCEDURE

Refer to figures 12, 13, 20 and 21.

1. Remove first (30 mc) IF amplifier module A3.
2. Remove the bottom cover.
3. Connect the power test cable to the module from P1 of the IF module to J6 in the receiver.
4. Connect a coaxial cable from the electronic counter input to TP1 of the module (figure 21).
5. Place second local oscillator switch S3 in the XTAL position.

6. Adjust T3 if necessary for 40.0 mc as indicated by the counter within ±0.005%.
7. Place S3 in the VFO position and tuning control R6 in its center position (figure 20).
8. Adjust T6 as necessary for 40.0 mc within ±0.005%.
9. By varying tuning control R6 in each direction ±250 kc, check that the oscillator output as indicated by the counter indicates a variation of ±250 kc.
10. Connect the test setup as shown in figure 8.

NOTE

A signal generator is used for a marker source; however if the sweep generator used has internal markers, a signal generator will not be required. If the sweep generator has an external marker input, connect the signal generator to it.

11. Connect the signal generator to the module chassis for a marker if required.
12. Detune T4 and T5 by turning the slugs all the way in (clockwise).
13. With the probe attached to the base of Q2 (junction of C6 and C7) adjust T1 and T2 until a symmetrical pattern is obtained on the oscilloscope with the 30 mc marker in the center of it.
14. Adjust R34 for the maximum amplitude.
15. Remove the probe from the base of Q2 and connect it to the collector of Q2 and temporarily short circuit capacitor C16 using a very short piece of bus wire.
16. Adjust T4 until the signal peaks at 30 mc.
17. Remove the bus wire from C16.
18. Connect the probe to the base of Q4.
19. Adjust T4 and T5 for a symmetrical presentation on the oscilloscope with a 30 mc marker in the center of the response.

NOTE

Reduce the sweep generator output so the amplifier initial stages are not overloaded.

20. Remove the high impedance probe and replace with a 50 ohm RF detector. Connect the detector to J1.
21. Place S3 in the XTAL position.

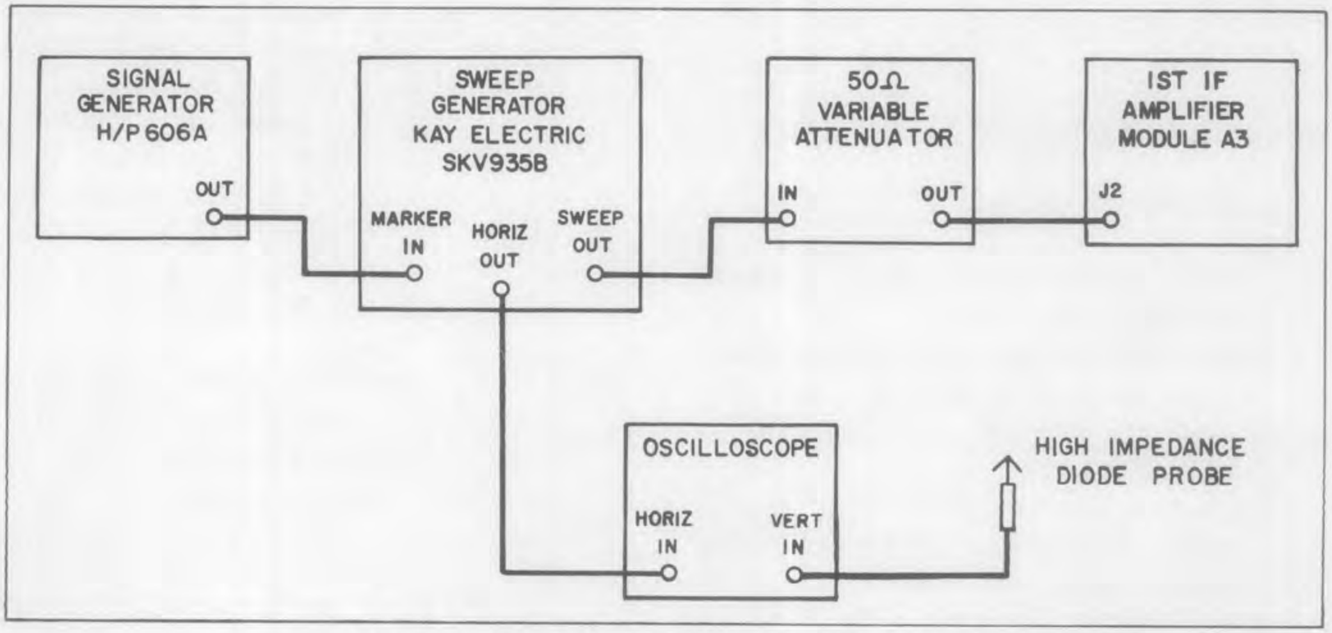


Figure 8. First IF Amplifier Test Set Up

22. Adjust T7, T8 and T9 until the response is symmetrically centered about the 30 mc marker. T5 may also require adjustment for this purpose. The bandwidth should be 4 mc at the 3 db down points.
23. Place second local oscillator switch S3 in the VFO position and adjust T6 until there is as little change as possible in the response when switching from XTAL to VFO.
24. Check the gain by the following procedure in both the XTAL and VFO positions of S3. Leave the test setups as in previous steps.
25. Disconnect the cable from J2 and the detector from J1 and connect the detector and cable together.
26. Decrease the attenuation until two horizontal traces can be observed on the oscilloscope.
27. Vary the attenuation to set a reference level at about two centimeters between traces.
28. Reconnect the cable to J2 and the detector to J1 and insert attenuation until the sweep pattern is equal to the reference level obtained in step 27.
29. The sum of the inserted attenuation will be the overall gain in db. Gain should be 35 db or greater.

SECOND IF AMPLIFIER ALIGNMENT

Test equipment required.

1. Sweep Generator, Kay Electric Model SKV935B or equivalent
2. Attenuator, Variable, 50 ohm Kay Electric Model 30-0 or equivalent
3. 50 ohm RF detector
4. 1000 uuf capacitor
5. 10 ohm 1/2 watt resistor
6. Signal Generator, Hewlett-Packard Model 606A or equivalent
7. Oscilloscope, DuMont Type 401A or equivalent

ALIGNMENT PROCEDURE

Refer to figures 14, 15, 20 and 22.

1. Remove the second (10 mc) IF amplifier module A4 from the receiver main chassis and remove its bottom cover.
2. Connect the power test cable from module A4, P1 to the receiver main chassis J7.
3. Connect the test equipment as shown in figure 9. Solder the 1000 uuf capacitor to TP2 on module A4 (figure 15).

NOTE

The signal generator is used for a marker source. If the sweep generator used has an internal marker, the signal generator will not be required. If the sweep generator has an input for external markers, connect the signal generator to it. If not, connect the signal generator to the IF amplifier chassis.

4. Detune T5 by turning the slug all the way in (clockwise) and adjust T4 and T6 in the full counterclockwise direction.
5. Adjust T7, T8, and T9 for a symmetrical pattern centered about 10 mc. The bandwidth should be approximately 3.2 mc at the 3 db down points.
6. Adjust R25 for maximum amplitude.
7. Unsolder the 1000 uuf capacitor from TP2 and solder it to TP1 (figure 15).
8. Detune T2 by turning the slug in the full clockwise direction and T1 and T3 by adjusting to the full counterclockwise direction.
9. Adjust T4, T5 and T6 for a symmetrical pattern centered about 10 mc. The bandwidth should be approximately 3.2 mc at the 3 db down points.
10. Unsolder the 1000 uuf capacitor from TP1 and connect a cable directly from the attenuator to J1 on the 10 mc IF amplifier module A4.

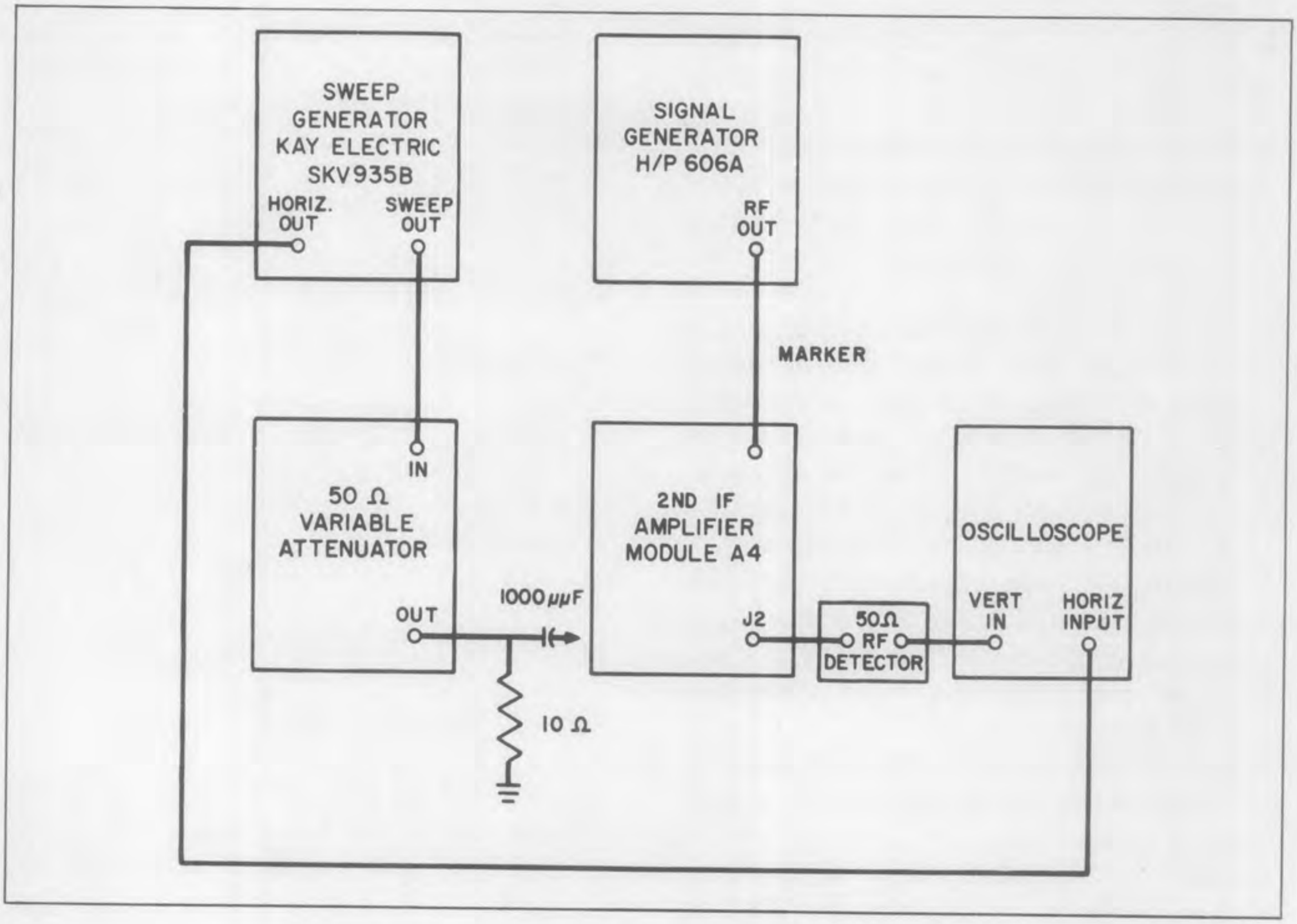


Figure 9. Second IF Amplifier Test Set Up

11. Adjust T1, T2 and T3 for a symmetrical pattern centered about 10 mc. Slight adjustment of T4 through T9 may be necessary to get an overall symmetrical flat response.
12. Connect the cable from the attenuator directly to the detector.
13. Decrease the attenuation on the attenuator until two horizontal traces are observed on the oscilloscope. Set the amplitude to approximately two centimeters.
14. Reconnect the attenuator cable to J1 and the detector to J2 and insert attenuation as necessary until the sweep pattern is equal to the two centimeter reference level set in step 13.
15. The sum of the inserted attenuation will be the overall gain in db. This gain should be approximately 55 db.
16. Replace the bottom cover on the module and replace the module in the receiver.

LIMITER ALIGNMENT

Test equipment required.

1. Signal Generator, Hewlett-Packard Type 606A or equivalent
2. Oscilloscope, Tektronix Type 541 or equivalent, 10 mc response osilloscope

ALIGNMENT PROCEDURE

Refer to figures 16, 20 and 23.

1. Remove limiter module A5 from the receiver chassis and remove its bottom cover.

2. Connect the power test cable from limiter module A5, P1 to the receiver main chassis J8.
3. Connect the Hewlett-Packard 606A signal generator to J2 on the limiter module. Set its output frequency to 10 mc.
4. Connect the oscilloscope to J1 on the limiter module.
5. Adjust R3 until maximum signal output is obtained with a minimum of signal input as observed on the oscilloscope.
6. The limiter module may also be aligned by leaving it in the receiver chassis and connecting an FM generator to limiter module jack J2 with a deviation of approximately 50 percent usable IF bandwidth FM modulation, and an oscilloscope connected to video output jack J13 at the rear of the receiver.
7. Adjust R3 for minimum noise upon the signal output while reducing the signal input level.
8. Replace the bottom cover on the limiter module and replace the limiter module in the receiver main chassis.

EMITTER FOLLOWER ALIGNMENT

Test equipment required.

1. FM Signal Generator, Boonton Type 202E
2. Univerter, Boonton Type 207E
3. Oscilloscope, DuMont Type 401A or equivalent

ALIGNMENT PROCEDURE

Refer to figures 11 and 20.

1. Connect the Boonton signal generator to first IF amplifier module A3, J2 and adjust its frequency to 30 mc with a 50 percent IF bandwidth deviation.
2. Connect the oscilloscope to audio module A10, pin 8.
3. Check that the signal out of the emitter follower at pin 8 on the audio module is 8/10 of the signal into the emitter follower (base of Q1) on emitter follower module A7 (figure 20).
4. Check the voltage at pin 8 of audio module A10. This voltage should be approximately +2 volts.

VIDEO AMPLIFIER ALIGNMENT

Test equipment required.

1. Audio Oscillator, Hewlett-Packard Type 200CD or equivalent
2. Oscilloscope, DuMont Type 401A or equivalent
3. VTVM, RCA Voltohmist or equivalent

ALIGNMENT PROCEDURE

Refer to figures 18 and 24.

1. Connect the Hewlett-Packard audio oscillator to pin 4 on video module A9. Set its level to the 3 volts peak-to-peak.
2. Connect the oscilloscope to video output jack J13 on the rear apron.
3. By adjusting video gain control R8 (figure 20), a signal amplitude of 10 volts peak-to-peak should be available at video output jack J13.
4. The video amplifier response can be checked by placing the video filter switch in the bypass position and increasing the frequency of the input signal while watching the video output level. The 3 db down points should be approximately 5 cps to 2 mc.

OUTPUT METER CALIBRATION

Refer to figure 20.

1. Adjust video gain control R8 to produce 4 volts peak-to-peak into a 75 ohm load at video output jack J13.
2. Adjust CAL control R9 on the front panel until output meter M2 indicates zero db. The output meter can be

calibrated to read zero db at any level between two and ten volts peak-to-peak output.

AM OUTPUT CHECK

1. The AM output is checked through an emitter follower (figure 18) on video amplifier module A9. When making AM output measurements, use a 1.0 mfd coupling capacitor between the receiver and the load.
2. To check the AM output, couple the audio oscillator to pin 7 of video module (A9) jack XA10.
3. Connect an oscilloscope to AM output jack J14 on the rear apron of the receiver (figure 3). The output should be approximately 8/10 of the signal level input.

VIDEO BANDWITH FILTER CHECK

Test equipment required.

1. Oscilloscope, DuMont Type 401A or equivalent
2. Audio Oscillator, Hewlett-Packard Type 200CD or equivalent

ALIGNMENT PROCEDURE

Refer to figures 11 and 20.

1. Connect the audio oscillator to collector of Q2 on emitter follower board A7.
2. Connect the oscilloscope to video output jack J13 at the rear of the receiver.
3. By placing video bandwidth selector S5 in various positions and varying the frequency of the audio oscillator, the 3 db down points are checked and should correspond within ±10 percent of those indicated on the front panel selector.

AUDIO AMPLIFIER CHECK

Test equipment required.

1. Audio Oscillator, Hewlett-Packard Type 200CD or equivalent
2. Oscilloscope, DuMont Type 401A or equivalent

ALIGNMENT PROCEDURE

Refer to figures 19 and 25.

1. Connect the audio oscillator to pin 8 of audio module input XA10.
2. Connect the oscilloscope to the audio output at pin 10 of XA10.
3. Adjust the audio oscillator output level to 3 volts peak-to-peak.
4. Adjust the audio gain control until 1.75 volts peak-to-peak appears on the oscilloscope. Observe that there is a minimum of distortion on the output across the speaker.
5. Check that the percentage of usable bandwidth meter (deviation meter) reads 100 percent for a 3 volt peak-to-peak signal input and approximately 50 percent for a 1.5 volt peak-to-peak input signal level.

AGC ADJUSTMENT

Refer to figures 13, 15, 21 and 22.

1. Connect an oscilloscope to AM output jack J14 (figure 3) on the rear apron of the receiver.
2. Set AGC selector in FAST position.
3. Connect a signal generator to the antenna input with a midband signal using 30% AM at a 1 kc rate.
4. Turn R25 on the second IF module full clockwise.
5. Adjust R34 on the first IF module until a slight jump in AM output is observed on the oscilloscope when the input signal level is varied from 10 uv to 100

mv. Set R34 for this jump to occur at approximately 400 uv.

6. Adjust R41 on the second IF module to produce best AM stability observed on the oscilloscope as the signal level is varied from 10 uv to 100 mv.
7. Variable resistors R11 and R12, located on the receiver rear apron (figure 3), adjust signal strength meter M1. Refer to figure 20. Put a 1 mv signal into the antenna input of the RF tuner module which plugs into the receiver. See table 1 and the respective instruction manual for the particular tuner in use.
8. Turn signal strength zero adjust resistor R11 until a reading of 1 mv appears on signal strength meter M1 (figures 1 and 10).
9. Increase the input signal to 100 mv and adjust signal strength calibrate resistor R12 until M1 indicates 100 mv. Repeat both adjustments as necessary to normalize the reading obtained.

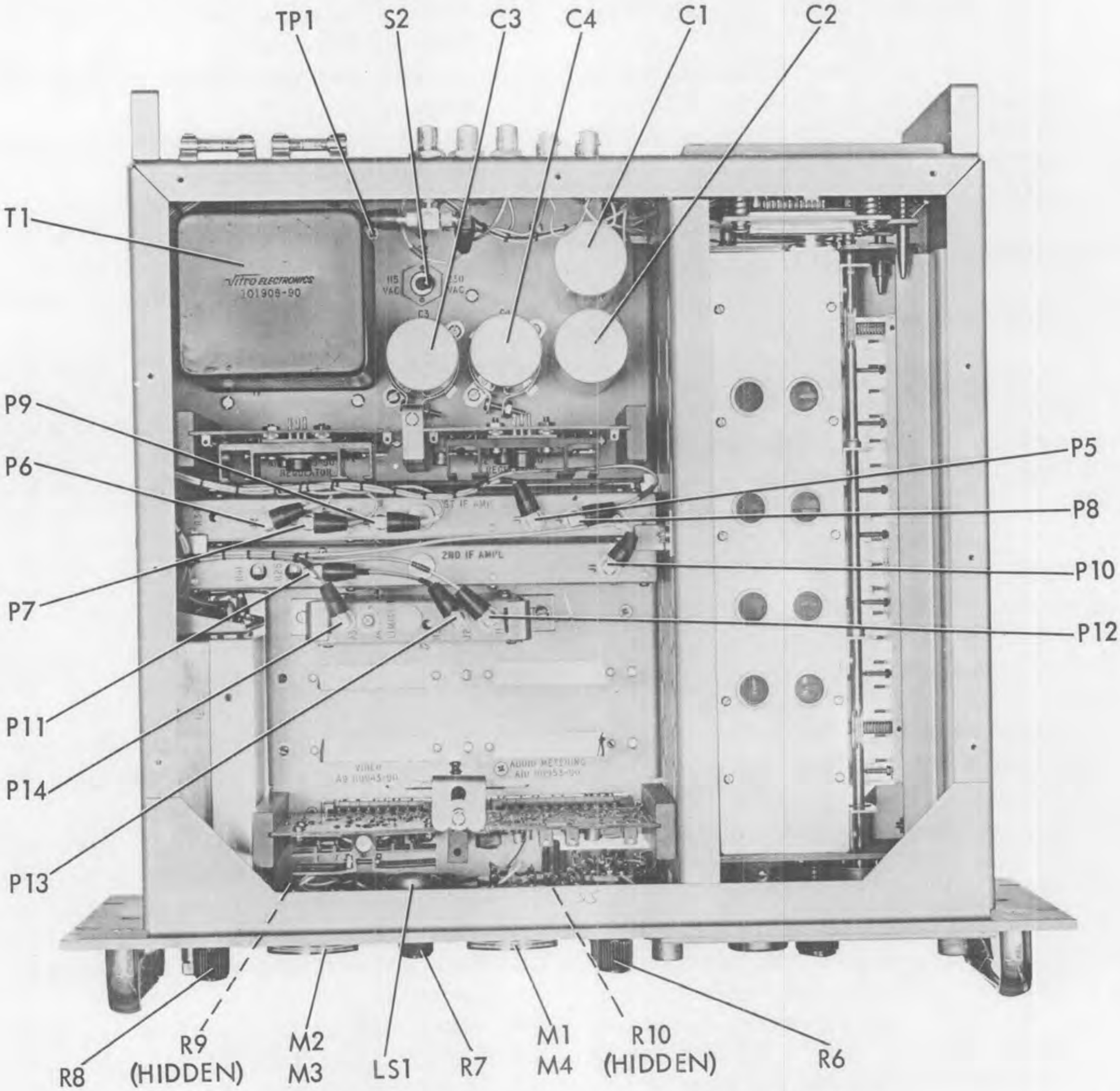


Figure 10. R-1037A Receiver Main Chassis, Top View

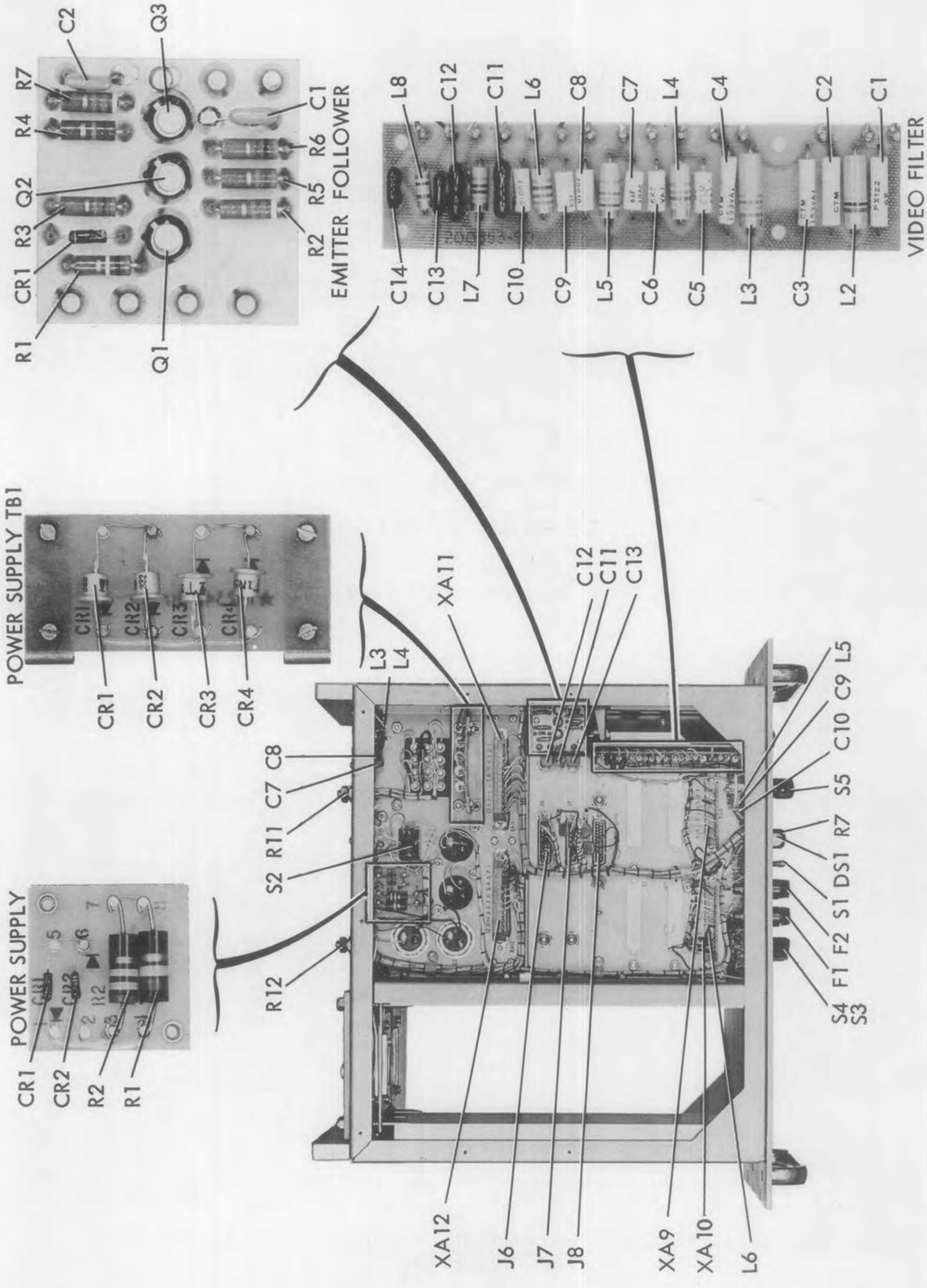


Figure 11. R-1037A Receiver Main Chassis, Bottom View

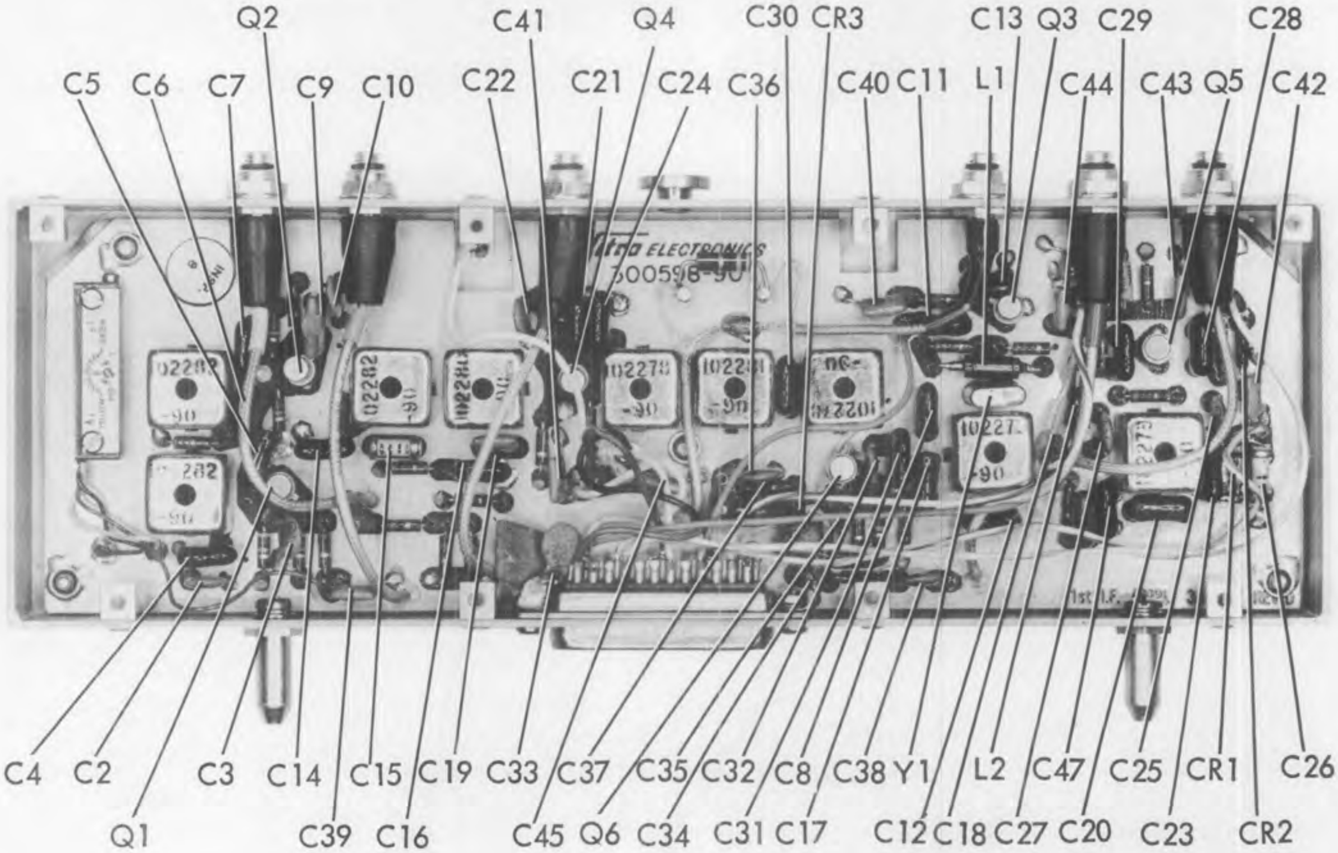


Figure 12. First IF Amplifier, Component Location of Capacitors, Coils, Crystals

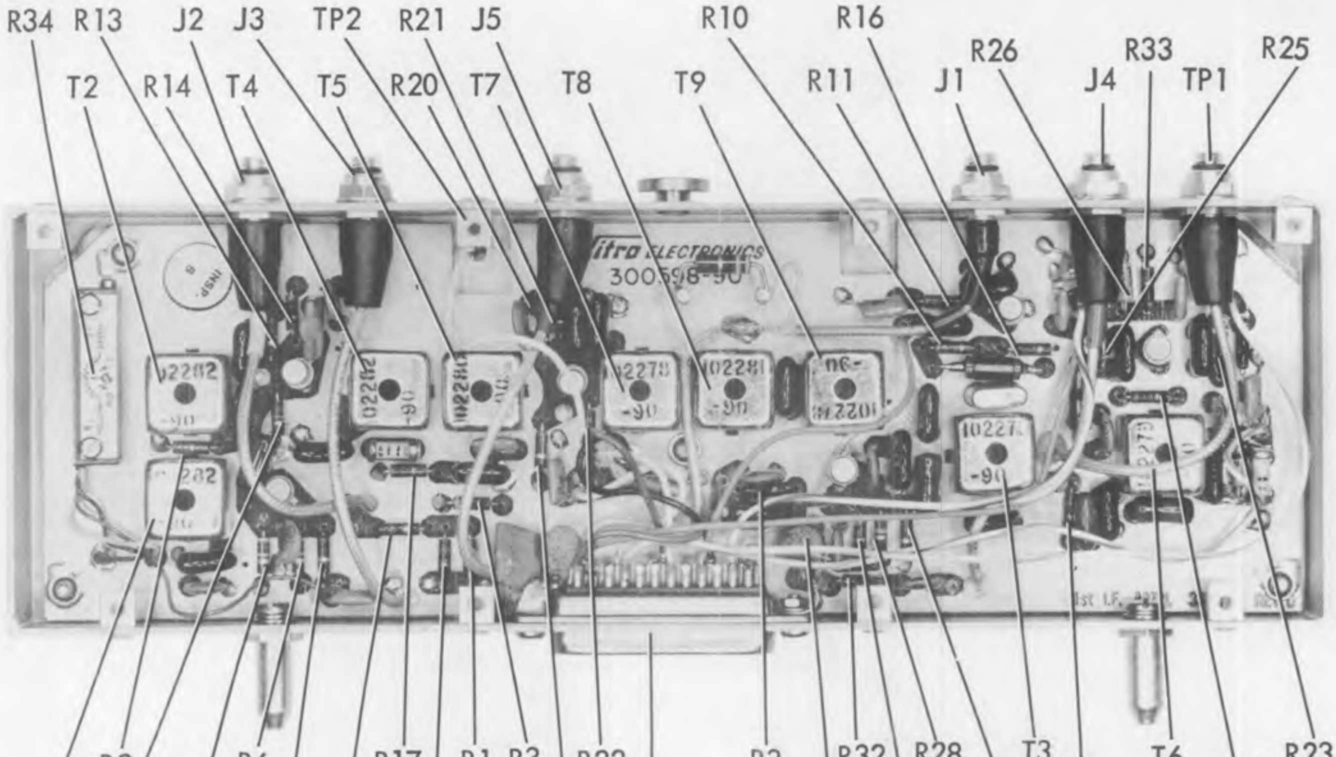


Figure 13. First IF Amplifier, Component Location of Resistors, Transformers, Jacks, Test Points

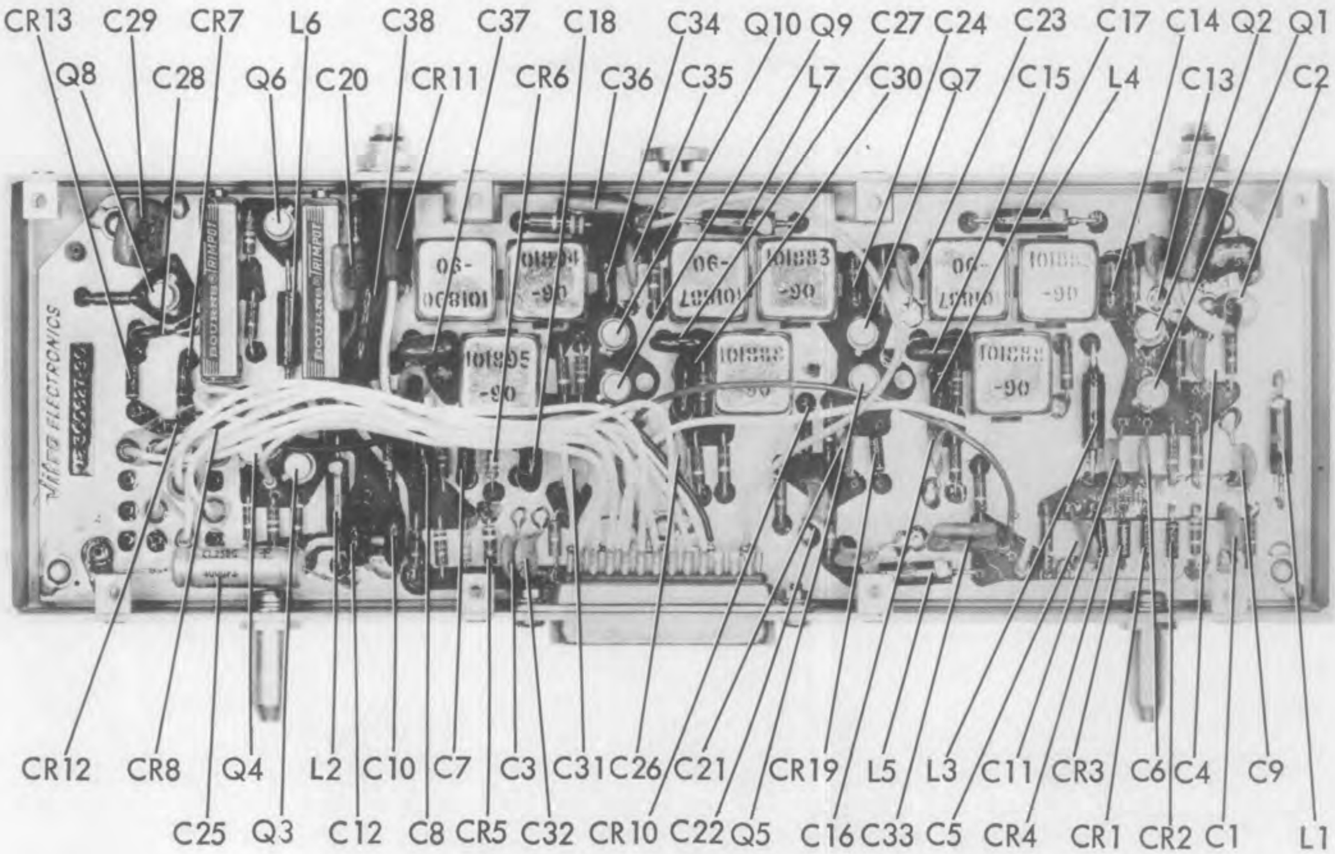


Figure 14. Second IF Amplifier, Component Location of Capacitors, Coils, Crystals

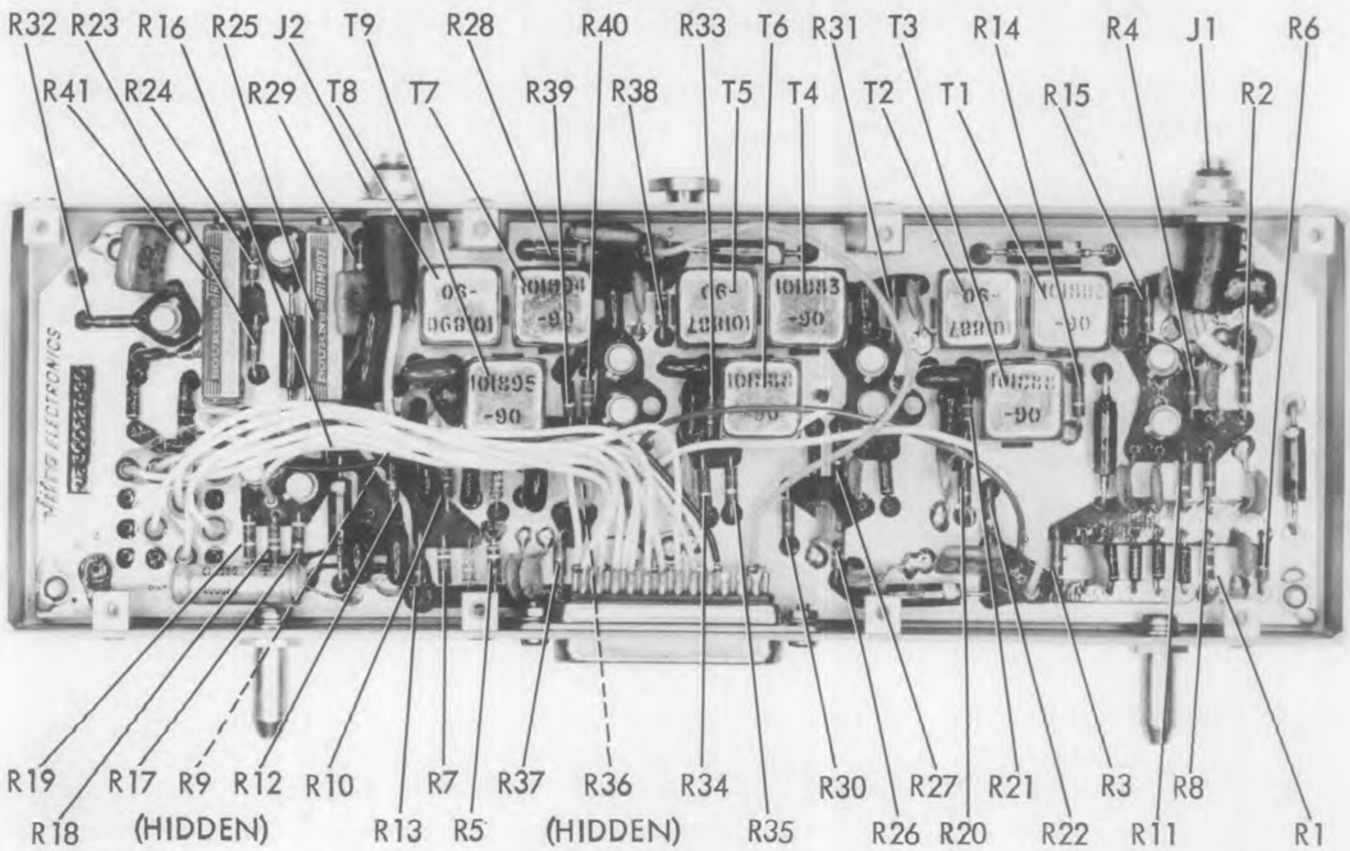


Figure 15. Second IF Amplifier, Component Location of Resistors, Transformers, Jacks, Test Points

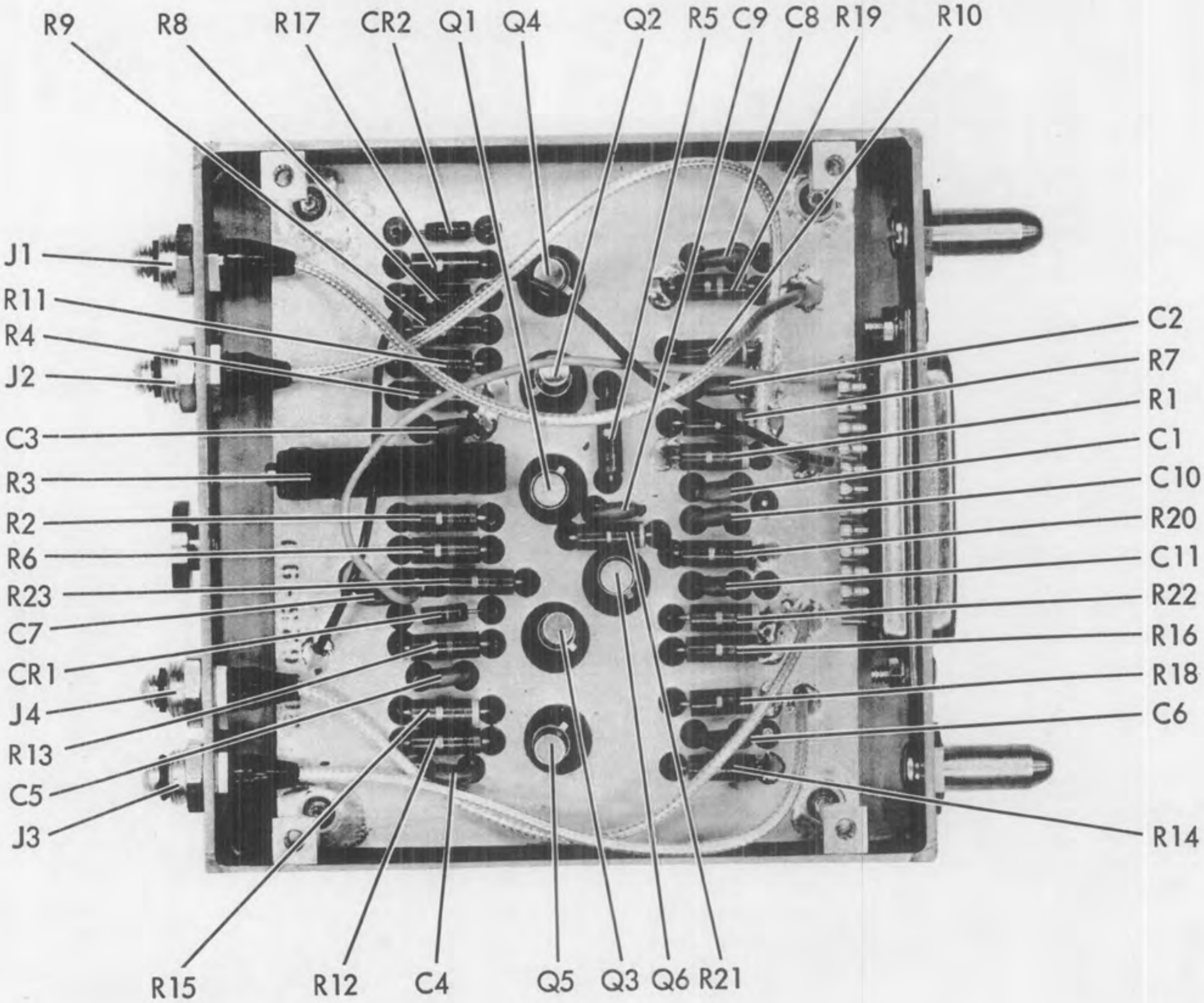


Figure 16. Limiter Board, Component Location

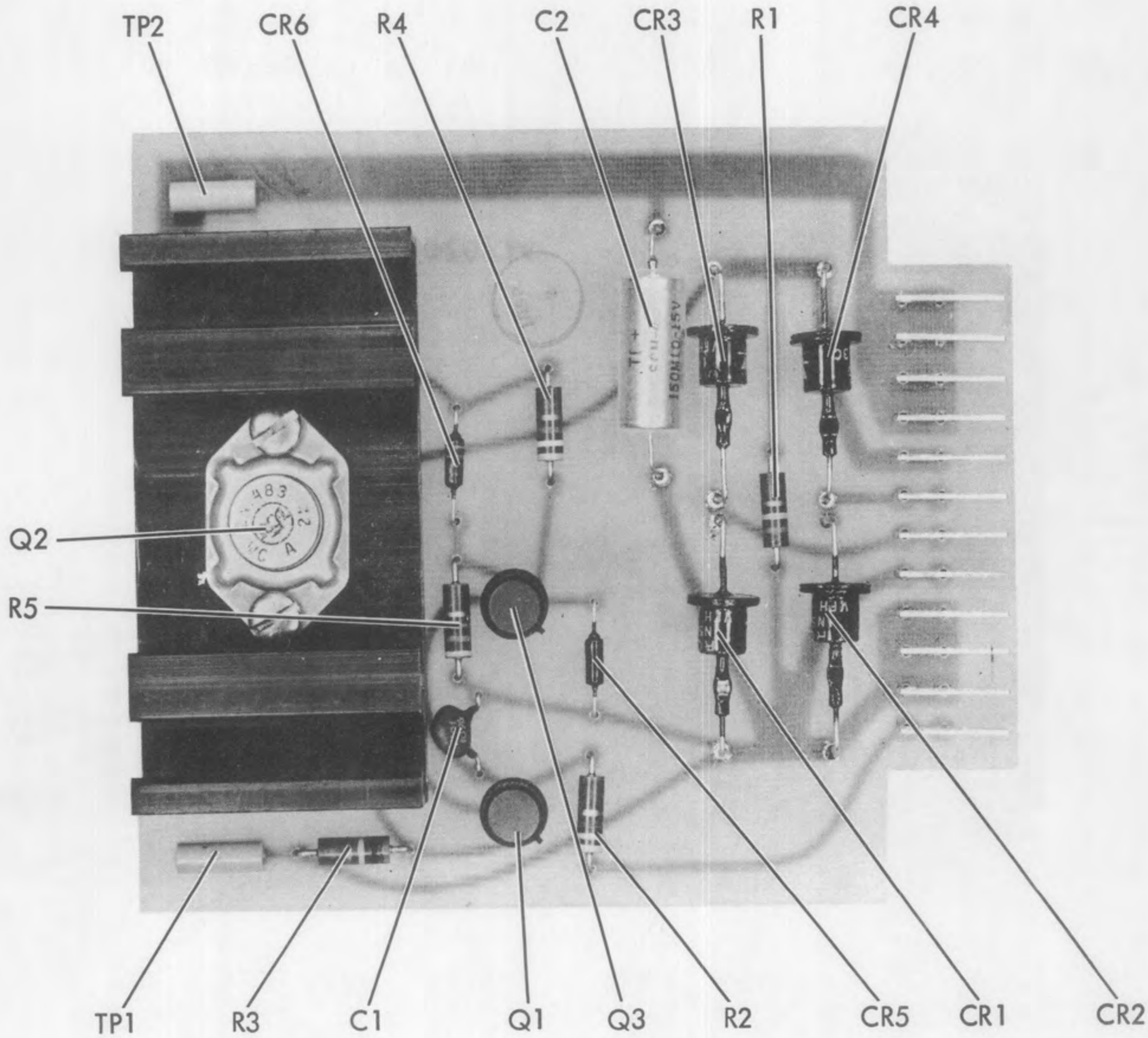


Figure 17. Regulator Board, Component Location

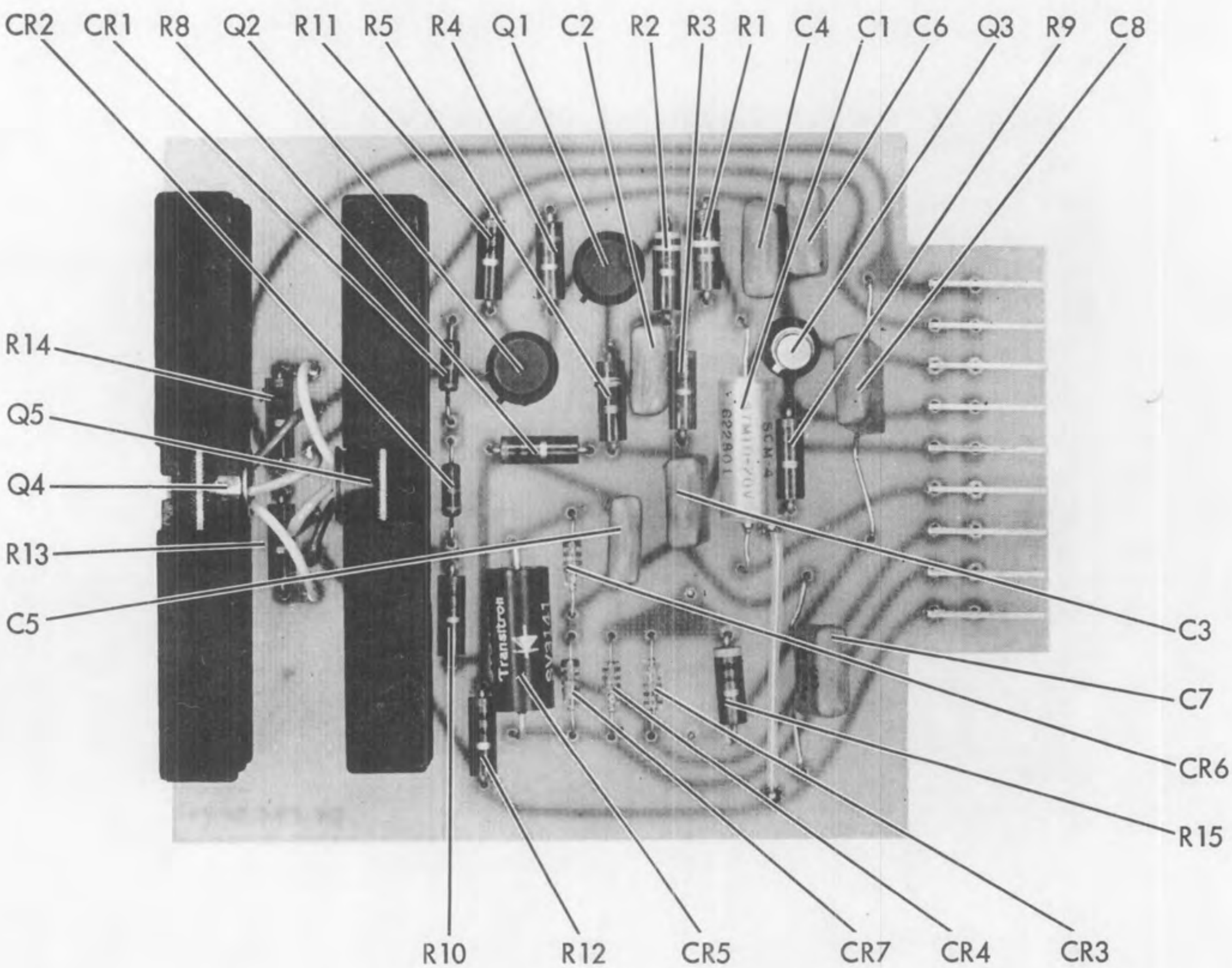


Figure 18. Video Board, Component Location

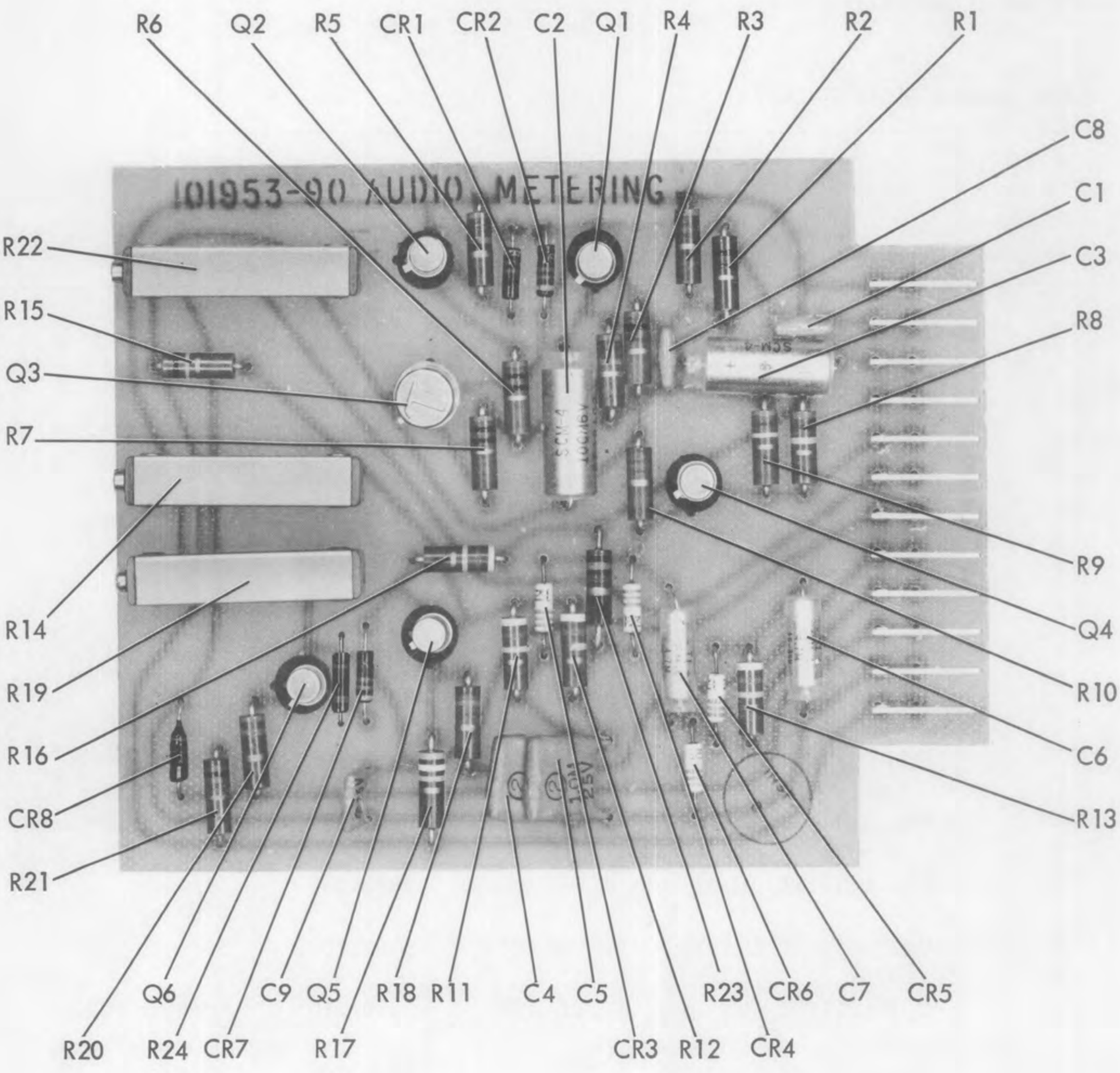


Figure 19. Audio/Metering Board, Component Location

SECTION 6. PARTS LIST

GENERAL

When ordering replacement parts, give the equipment name and model number, and the reference designation number and description of each item ordered.

MAIN CHASSIS ASSY R-1037A

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
A3	1ST IF AMPLIFIER ASSEMBLY: 30 mc	200825-90	
A4	2ND IF AMPLIFIER ASSEMBLY: 10 mc	200844-90B	
A5	LIMITER ASSEMBLY	200849-90	
A7	EMITTER FOLLOWER	101920-90	
A8	VIDEO FILTER	200853-90A	
A9	VIDEO	101943-90B	
A10	AUDIO METERING	101953-90A	
A11, 12	REGULATOR	102069-90C	
A14	DIODE BOARD ASSEMBLY	102340-90	
A15	COMPONENT BOARD ASSEMBLY	101867-90	
C1, 2	CAPACITOR, Electrolytic: 220 uf, +75% -10%, 200 v acetate sleeve	90910273	Sprague CE41C221K
C3, 4	CAPACITOR, Electrolytic: 800 uf, +100% -10%, 25 v acetate sleeve	90910279	Sprague CE31C801F
C7, 8	CAPACITOR, Ceramic disc: 0047 uf GMV 500 v	90901725	Sprague 20C8
C9	CAPACITOR, Tantalum: 47 uf, ±20%, 20 v	90910229	Texas Instruments SCM476GP020C4
C10	CAPACITOR, Mica: 470 uf, 5%, 300 v	90921257	Elmenco DM15F471J03
C12, 13	CAPACITOR, Ceramic: 0.01 uf GMV 500 v	90901760	Sprague 29C9B8
C14	CAPACITOR, Ceramic: 1.0 uf, ±20%, 25 v	90901910	Sprague 5C13
C15	CAPACITOR, Ceramic: 0.002 uf	90901705	Sprague 29C200A1
C16	CAPACITOR, Ceramic: 2.2 uf, ±20%, 25 v	90901940	Sprague 5C15
C17	CAPACITOR, Mica: 56.0 uuf, ±5%, 500 v	90920330	Elmenco CM15E560J

MAIN CHASSIS ASSY R-1037A (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
CP1	CONNECTOR ADAPTOR	91370015	Microdot 33-42-A2-B1-D1
CR1	DIODE: 1N468	91600183	
DS1	LAMP, 6v: 0.04 amp, T-1-3/4	92500330	GE 345
F1, 2 & spares	FUSE: 30 amp Slo-Blo Type	91800160	Bussmann MDL
J1	CONNECTOR, Receptacle	91371250	Hubbell 7486
J5	CONNECTOR, Receptacle, jack type, BNC/TNC adaptor	91372020	Microdot UG-909/U-33-90
J6, 7, 8	CONNECTOR, Receptacle	91370941	Cannon DBMF-25S
J9	CONNECTOR, Receptacle	91370944	Cannon DBMF-13W3S
J13, 14, 17	CONNECTOR, Receptacle	91371020	UG-1094/U
L3, 4	CHOKE: 3.1 uh	AA-15060-01	
L5	CHOKE: 10 uh	91150023	Delevan 1537-36
L6	CHOKE: 38 uh	91150039	Wilco 3038-15
LS1	SPEAKER: 45 Ω voice coil	94650050	Oxford 2P421
M1	METER, Signal Strength	101948-90	
M2	METER, Output	101949-90	
M3	METER, Deviation	101947-90	
M4	METER, Tuning	101946-90	
R1	RESISTOR, Wirewound: 10 W, Ω 1%	93580305	Dale RH-10
R6	POTENTIOMETER, Composition: 2 W 100k, 10%	93150477	Allen-Bradley JA1N048P104UA
R7	POTENTIOMETER, Composition: 2 W 5k, 10%	93150220	Allen-Bradley JA1N048P502UA
R8	POTENTIOMETER, Composition: 2 W 1k, 10%	93150085	Allen-Bradley JA1N048P102UA
R9	POTENTIOMETER, Composition: 0.5 W 2.5K, 10% MIL-R-94	93140044	RV6NAYSL252A
R10	RESISTOR, Fixed Composition: 12k 5%, 1/2 W MIL-R-11	93551050	RC20GF123J
R11	RESISTOR, Variable Composition: 2 W 10k, 10%	93150250	Allen-Bradley JA1L040S103UC
R12	RESISTOR, Variable Composition: 2 W 250k, 10%	93150500	Allen-Bradley JA1L040S254UC
R13	RESISTOR, Fixed Composition: 100k 10%, 1/2 W MIL-R-11	93551440	RC20GF104K
R14	RESISTOR, Fixed Composition: 39k 10%, 1/2 W MIL-R-11	93551260	RC20GF393K

MAIN CHASSIS ASSY R-1037A (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
S1, 2	SWITCH, Toggle: DPDT	94850535	Cutler Hammer 8363K7
S3	SWITCH, Rotary	101963-01	
S4	SWITCH, Modulator	102182-01	
S5	SWITCH, Modulator	102183-01	
T1	POWER, XMFR	101908-90	
TP1	CONNECTOR, Jack	91370117	Sealectro SKT-5BC RED
W1	CABLE ASSEMBLY	101886-90	
W2	CABLE ASSEMBLY	101899-90	
W3	CABLE ASSEMBLY	101900-90	
W4	CABLE ASSEMBLY	101901-90	
W5	CABLE ASSEMBLY	101897-90	
W6	CABLE ASSEMBLY	101896-90	
W7	CABLE ASSEMBLY	101903-90	
W8	CABLE ASSEMBLY	101902-90	
W9	CABLE ASSEMBLY	101965-90	
W10	CABLE ASSEMBLY	101966-90	
W11	CABLE ASSEMBLY	102032-90	
W12	CABLE ASSEMBLY	102200-90	
XA9	CONNECTOR, Receptacle	91371236	Elco 5002-9-A-2
XA10, 11, 12	CONNECTOR, Receptacle	91371239	Elco 5002-12-A-2-1-BR
XDS1	LIGHT, Indicator	92500075	MS25256-10 White
XF1, 2	FUSE HOLDER	92120110	Bussmann HKP

1ST IF AMPLIFIER

C1, 2, 10, 22, 25, 27, 32, 34, 35, 36, 38, 48, 49	CAPACITOR: 0.01 mfd +80% -20%, 50 v	90901758	Sprague 19C214
C4, 14, 16, 23, 47	CAPACITOR: 27 PF ±5%, 500 v	90921173	Elmenco DM15E270J03
C5	CAPACITOR: 15 PF ±2%, 500 v MIL-C-20	90900770	CC22CH150G

1ST IF AMPLIFIER (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
C6, 8	CAPACITOR: 39 PF ±5%, 500 v	90921186	Elmenco DM15E390J03
C7	CAPACITOR: 270 PF ±5%, 500 v	90921241	Elmenco DM15F271J03
C9, 33	CAPACITOR: 1.0 MFD ±20%, 25 v	90901910	Sprague 5C13
C11, 13, 28, 29	CAPACITOR: 100 PF ±5%, 500 v	90921211	Elmenco DM15F101J03
C12, 21	CAPACITOR: 560 PF ±5%, 300 v	90921261	Elmenco DM15F561J03
C15	CAPACITOR: 10 PF ±0.25, PF 500 v	90900662	Erie N750 CC20UJ100C
C17, 20	CAPACITOR: 12 PF ±5%, 500 v	90900732	R1CC22C0G120J
C18	CAPACITOR: 10 PF ±5%, 500 v	90921163	Elmenco DM15C100J
C19, 39, 40, 41, 42, 43, 44, 45, 46	CAPACITOR: 0.1 MFD ±20%, 25 v	90901810	Sprague 3C21
C24, 30	CAPACITOR: 82 PF ±5%, 500 v	90921203	Elmenco DM15E820J03
C26	CAPACITOR: 5 PF ±0.25 PF 500 v	90900412	Erie N750 CC20UJ050C
C31	CAPACITOR: 68 PF ±5%, 500 v	90921198	Elmenco DM15E680J03
C37	CAPACITOR: 0.001 MFD ±5%, 500 v	90921296	Elmenco DM15F102J
CR1	CAPACITOR: Variable: 10.0-50.0 uuf	9090400	Pacific V20
CR2	DIODE: 1N935A	91600217	
CR3	DIODE: 1N457	91600160	
J1	CABLE	102500-95	
J2	CABLE	102500-90	
J3	CABLE	102500-91	
J4	CABLE	102500-92	
J5	CABLE	102500-93	
L1	CHOKE, RF: 1.8 uh	91150008	Wilco 218-11
L2	CHOKE, RF: 10 uh	91150042	Wilco W100
P1	CONNECTOR, Plug	91370375	Cannon DBM-25P
Q1, 2, 3, 4, 6	TRANSISTOR: 2N708	95350101	

1ST IF AMPLIFIER (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
Q5	TRANSISTOR: 2N917	95350150	
R1, 2, 4	RESISTOR, Fixed composition: 27 ohms ±5%, 1/4 W MIL-R-11	93530030	RC07GF270J
R3	RESISTOR, Fixed composition: 36 ohms ±5%, 1/4 W MIL-R-11	93530040	RC07GF360J
R5, 14, 21, 29	RESISTOR, Fixed composition: 1k ±10%, 1/4 W MIL-R-11	93530491	RC07GF102K
R6, 7	RESISTOR, Fixed composition: 47k ±10%, 1/4 W MIL-R-11	93530891	RC07GF473K
R9, 11, 23	RESISTOR, Fixed composition: 270 ohms ±5%, 1/4 W MIL-R-11	93539350	RC07GF271J
R10, 25	RESISTOR, Fixed composition: 6.8k ±5%, 1/4 W MIL-R-11	93530690	RC07GF682J
R12, 13	RESISTOR, Fixed composition: 27k ±10%, 1/4 W MIL-R-11	93530831	RC07GF273K
R16, 24	RESISTOR, Fixed composition: 7.5k ±5%, 1/4 W MIL-R-11	93530700	RC07GF752J
R17, 30, 31	RESISTOR, Fixed composition: 1.0k ±5%, 1/4 W MIL-R-11	93530490	RC07GF102J
R18, 32	RESISTOR, Fixed composition: 51 ohms ±5%, 1/4 W MIL-R-11	93530180	RC07GF510J
R19, 27	RESISTOR, Fixed composition: 8.2k ±10%, 1/4 W MIL-R-11	93530711	RC07GF822K
R20	RESISTOR, Fixed composition: 2.7k ±10%, 1/4 W MIL-R-11	93530591	RC07GF272K
R22	RESISTOR, Fixed composition: 510 ohms ±5%, 1/4 W MIL-R-11	93530420	RC07GF511J
R26	RESISTOR, Fixed composition: 150 ohms ±5%, 1/4 W	93530290	RC07GF151J
R28	RESISTOR, Fixed composition: 12k ±10%, 1/4 W MIL-R-11	93530751	RC07GF123K
R33	RESISTOR, Film fixed: 16.2k ±1%, 1/10 W	93500035	Electra RN55C1622F
R34	POTENTIOMETER, Variable: W/W 10k ±10%, 1/4 W	93170008	Bourns 200L-1-103
R35	RESISTOR, Fixed composition: 33 ohms ±5%, 1/2 W	93550110	RC20GF330J
R36	RESISTOR, Fixed composition: 2.7k ±5%, 1/2 W	93550780	RC20GF272J

1ST IF AMPLIFIER (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
T1, 2, 4	TRANSFORMER, RF	102282-90	
T3, 6	TRANSFORMER, RF	102279-90	
T5	TRANSFORMER, RF	102280-90	
T7, 9	TRANSFORMER, RF	102278-90	
T8	TRANSFORMER, RF	102281-90	
TP1	CABLE	102500-94	
Y1	CRYSTAL UNIT, Quartz: 40.0350 mc ±0.002% MIL-C-3098/39	91470044	CR-61/U

2ND IF AMPLIFIER

C1, 3, 4, 5, 6, 9, 11, 13, 16, 19, 21, 22, 23, 26, 31, 32, 35	CAPACITOR, Ceramic: 0.01 MFD	90901758	Sprague 19C214
C2	CAPACITOR, Mica: 68 MMF ±5%, 500 v MIL-C-5B	90921198	DM15E680J03
C7	CAPACITOR, Mica: 47 MMF ±5%, 500 v	90921192	Elmenco DM15E470J03
C8	CAPACITOR, Mica: 150 MMF ±5%, 500 v	90921215	Elmenco DM15F151J03
C10	CAPACITOR, Mica: 220 MMF ±5%, 500 v	90921231	Elmenco DM15F221J03
C12	CAPACITOR, Mica: 56 MMF ±5%, 500 v	9091194	Elmenco DM15E560J03
C14, 24	CAPACITOR, Ceramic: 20 MMF ±5%, 500 v MIL-C-20/3A	90900881	CC22CH200J
C15, 27	CAPACITOR, Mica: 33 MMF ±5%, 500 v	90921182	Elmenco DM15E330J03
C17, 30	CAPACITOR, Mica: 330 MMF ±5%, 500 v	90921251	Elmenco DM15F331J03
C18	CAPACITOR, Mica: 270 MMF ±5%, 500 v	90921241	Elmenco DM15F271J03
C20, 33, 36	CAPACITOR: 1.0 MFD ±20%, 25 v	90901910	Sprague 5C13
C25	CAPACITOR, Tantalum: 40 MFD +75% -15%, 25 v MIL-C-3965	90910196	CL-25BG400UP3

2ND IF AMPLIFIER (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
C28	CAPACITOR, Ceramic: 0.001 MFD ±20%, 500 v MIL-C-11015B	90901628	CK60AW102M
C29	CAPACITOR, Ceramic: 2.2 MFD ±20%, 25 v	90901940	Sprague 5C15
C34	CAPACITOR, Mica: 24 MMF ±5%, 500 v	90921169	Elmenco DM15E240J03
C37	CAPACITOR, Mica: 82 MMF ±5%, 500 v	90921203	Elmenco DM15E820J03
C38	CAPACITOR, Mica: 750 MMF ±5%, 500 v	90921272	Elmenco DM20F751J03
CR1, 2, 3, 4 7-13	DIODE, Silicon: 1N457-JAN	91600161	
CR5, 6	DIODE, Germanium: 1N277	91600137	
J1	CABLE	102500-97	
J2	CABLE	102500-96	
L1, 2, 4, 5, 7	CHOKE, RF: 47 uh	91150036	Wilco W470
L3	CHOKE, RF: 10 uh	91150042	Wilco W100
L6	CHOKE, RF: 100 uh	91150038	Wilco W101
P1	CONNECTOR, Plug	91370375	Cannon DBM-25P
R1, 38	RESISTOR: 3.3k ±10%, 1/4W MIL-R-11	93530611	RC07GF332K
R2	RESISTOR, Fixed composition: 51 Ω ±10%, 1/4 W MIL-R-11	93530181	RC07GF510K
R3, 30	RESISTOR, Fixed composition: 6.2k ±10%, 1/4 W MIL-R-11	93530681	RC07GF622K
R4, 20, 34, 39	RESISTOR: 2.2k ±10%, 1/4 W MIL-R-11	93530571	RC07GF222K
R5	RESISTOR: 3.9k ±5%, 1/4 W MIL-R-11	93530630	RC07GF392J
R6	RESISTOR: 560 Ω ±10%, 1/4 W MIL-R-11	93530431	RC07GF561K
R7	RESISTOR: 390 Ω ±5%, 1/4 W MIL-R-11	93530390	RC07GF391J
R8, 22	RESISTOR, Fixed composition: 2.7k ±10%, 1/4 W MIL-R-11	93530591	RC07GF272K
R9	RESISTOR, Fixed composition: 82 Ω ±10%, 1/4 W MIL-R-11	93530231	RC07GF820K
R10	RESISTOR, Fixed composition: 10k ±5%, 1/4 W MIL-R-11	93530730	RC07GF103J
R11, 26	RESISTOR: 1.5k ±10%, 1/4 W MIL-R-11	93530531	RC07GF152K

2ND IF AMPLIFIER (cont)

Reference Designation	Name and Description	Part Number Vitro	Part Number Vendor
R12	RESISTOR, Fixed composition: 7.5k ±5%, 1/4 W MIL-R-11	93530700	RC07GF752J
R13, 23, 32	RESISTOR: 1k ±5%, 1/4 W MIL-R-11	93530490	RC07GF102J
R14	RESISTOR: 270 Ω ±10%, 1/4 W MIL-R-11	93530351	RC07GF271K
R15, 31	RESISTOR: 5.1k ±5%, 1/4 W MIL-R-11	93530660	RC07GF512J
R16, 37	RESISTOR: 750 Ω ±5%, 1/4 W MIL-R-11	93530460	RC07GF751J
R17	RESISTOR: 47 Ω ±10%, 1/4 W MIL-R-11	93530171	RC07GF470K
R18, 24	RESISTOR: 68k ±10%, 1/4 W MIL-R-11	93530931	RC07GF683K
R19	RESISTOR, Fixed composition: 4.7k ±10%, 1/4 W MIL-R-11	93530651	RC70GF472K
R21, 33	RESISTOR: 130 Ω ±5%, 1/4 W MIL-R-11	93530275	RC07GF131J
R25	POTENTIOMETER, Variable composition: 1/4 W, 100k ±20%	93140009	Bourns 215P-1-104
R27, 29, 36	RESISTOR: 10 Ω ±10%, 1/4 W MIL-R-11	93530011	RC07GF100K
R28	RESISTOR: 3.3k ±10%, 1/2 W MIL-R-11	93550820	RC20GF332K
R35	RESISTOR, Fixed composition: 5.6k ±10%, 1/4 W MIL-R-11	93530671	RC07GF562K
R40	RESISTOR: 18k ±5%, 1/4 W MIL-R-11	93530790	RC07GF183J
R41	POTENTIOMETER, Wirewound: 1/4 W 20k ±10%	93170003	Bourns 200P-1-203
Q1-10	TRANSISTOR: 2N708	95350101	
T1, 4	TRANSFORMER	101883-90	
T2, 5	TRANSFORMER	101887-90	
T3, 6	TRANSFORMER	101888-90	
T7	TRANSFORMER	101894-90	
T8	TRANSFORMER	101890-90	
T9	TRANSFORMER	101895-90	

VIDEO ASSY

C1	CAPACITOR: 47 uf ±20%, 20 v	90910229	Texas Instruments SCM476GP020C4

VIDEO ASSY (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
C2, 3, 4, 5, 6, 7, 8	CAPACITOR: 2.2 uf ±20%, 25 v	90901940	Sprague 5C15
CR1, 2	DIODE: 1N806	91600211	
CR3, 4, 6, 7	DIODE: 1N276	91600136	
CR5	DIODE	91600297	Transitron SV3141
Q1, 2	TRANSISTOR: 2N2219	95350710	
Q3	TRANSISTOR: 2N708	95350101	
Q4	TRANSISTOR: 2N1974	95350450	
Q5	TRANSISTOR: 2N1991	95350510	
R1	RESISTOR, Fixed composition: 150k ±5%, 1/2 W MIL-R-11	93551500	RC20GF154J
R2	RESISTOR, Fixed composition: 3.3k ±5%, 1/2 W MIL-R-11	93550810	RC20GF332J
R3	RESISTOR, Fixed composition: 6.2k ±5%, 1/2 W MIL-R-11	93550940	RC20GF622J
R4	RESISTOR, Fixed composition: 5.1k ±5%, 1/2 W MIL-R-11	93550900	RC20GF512J
R5	RESISTOR, Fixed composition: 130 ohms ±5%, 1/2 W MIL-R-11	93550330	RC20GF131J
R8, 11, 12, 13, 14	RESISTOR, Fixed composition: 10 ohms ±5%, 1/2 W MIL-R-11	93550020	RC20GF100J
R9	RESISTOR, Fixed composition: 1.2k ±5%, 1/2 W MIL-R-11	93550660	RC20GF122J
R10	RESISTOR, Fixed composition: 2k ±5%, 1/2 W MIL-R-11	93550730	RC20GF202J
R15	RESISTOR, Fixed composition: 3.0k ±5%, 1/2 W MIL-R-11	93550800	RC20GF302J

EMITTER FOLLOWER

C1, 2	CAPACITOR: 0.1 MFD ±20%, 25 v	90901810	Sprague 3C21
CR1	DIODE: 1N457	91600160	
Q1, 2, 3	TRANSISTOR: 2N708	95350101	
R1	RESISTOR, Fixed composition: 1/2 W 100k ±5%, MIL-R-11	93551430	RC20GF104J
R2, 7	RESISTOR, Fixed composition: 1/2 W 470 Ω ±5%, MIL-R-11	93550510	RC20GF471J
R3	RESISTOR, Fixed composition: 1/2 W 120 Ω ±5%, MIL-R-11	93550320	RC20GF121J

EMITTER FOLLOWER (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
R4	RESISTOR, Fixed composition: 1/2 W 220 Ω ±5%, MIL-R.11	93550400	RC20GF221J
R5	RESISTOR, Fixed composition: 1/2 W 820 Ω ±5%, MIL-R-11	93550590	RC20GF821J
R6	RESISTOR, Fixed composition: 1/2 W 1k ±5%, MIL-R-11	93550620	RC20GF102J

AUDIO/METERING

C1, 8, 9	CAPACITOR: 0.1 MFD ±20%, 25 v	90901810	Sprague 3C21
C2, 3	CAPACITOR: 100 MFD ±20%, 6v	90910243	Texas Instruments SCM107GP006C4
C4, 5	CAPACITOR: 1.0 MFD ±20%, 25 v	90901910	Sprague 5C13
C6, 7	CAPACITOR: 4.7 MFD ±20%, 20 v	90910022	Texas Instruments SCM475BP020C4
CR1, 2	DIODE: 1N457	91600160	Hughes
CR3, 4, 5, 6	DIODE: 1N276	91600136	Hughes
CR8	DIODE: 1N703A	91600201	Texas Instruments
Q1, 2, 4, 5, 6	TRANSISTOR: 2N708	95350101	
Q3	TRANSISTOR: 2N1991	95350510	
R1, 21	RESISTOR, Fixed composition: 2k ±5%, 1/2 W MIL-R-11	93550730	RC20GF202J
R2	RESISTOR, Fixed composition: 8.2k ±5%, 1/2 W MIL-R-11	93550990	RC20GF822J
R3	RESISTOR, Fixed composition: 1k ±5%, 1/2 W	93550620	RC20GF102J
R4	RESISTOR, Fixed composition: 150 ohms ±5%, 1/2 W MIL-R-11	93550340	RC20GF151J
R5	RESISTOR, Fixed composition: 820 ohms ±5%, 1/2 W MIL-R-11	93550590	RC20GF821J
R6, 7	RESISTOR, Fixed composition: 10 ohms ±5%, 1/2 W MIL-R-11	93550020	RC20GF100J
R8	RESISTOR, Fixed composition: 15k ±5%, 1/2 W MIL-R-11	93551080	RC20GF153J
R9	RESISTOR, Fixed composition: 12k ±5%, 1/2 W MIL-R-11	93551050	RC20GF123J
R10	RESISTOR, Fixed composition: 2.2k ±5%, 1/2 W MIL-R-11	93550750	RC20GF222J

AUDIO/METERING (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
R11, 12, 13, 16	RESISTOR, Fixed composition: 47k ±5%, 1/2 W MIL-R-11	93551290	RC20GF473J
R14	POTENTIOMETER, Wirewound: 20k ±10%, 1/4 W	93170003	Bourns 200P-1-203
R15	RESISTOR, Fixed composition: 10k ±5%, 1/2 W MIL-R-11	93551020	RC20GF103J
R17	RESISTOR, Fixed composition: 39k ±5%, 1/2 W MIL-R-11	93551250	RC20GF393J
R18	RESISTOR, Fixed composition: 5.6k ±5%, 1/2 W MIL-R-11	93550920	RC20GF562J
R19	POTENTIOMETER, Composition, variable: 50k ±20%, 1/4 W	93140007	Bourns 215P-1-503
R20	RESISTOR, Fixed composition: 6.8k ±5%, 1/2 W MIL-R-11	93550960	RC20GF682J
R23	RESISTOR, Fixed composition: 1.8 meg ±5%, 1/2 W MIL-R-11	93551865	RC20GF185J
R24	RESISTOR, Fixed composition: 750k ±5%, 1/2 W MIL-R-11	93551745	RC20GF754J

REGULATOR

C1	CAPACITOR: 0.001 MFD, 20%, 500 v EIA SPEC RS-198	90901641	R2CC60Z5U102M
C2	CAPACITOR: 150 MFD, +75%, -15%, 15 VDCW	90930500	Sprague 109D157C7015T2
CR1, 2, 3, 4	DIODE: 1N540	91600200	
CR5	DIODE: 1N753A	91600206	
CR6	DIODE: 1N752A	91600208	
Q1, 3	TRANSISTOR: 2N2218	95350709	
Q2	TRANSISTOR: 2N1483	95350230	
R1	RESISTOR, Fixed composition: 0.5 W, 51.0k, 5% MIL-R-11	93551310	RC20GF513J
R2	RESISTOR, Fixed composition: 0.5 W, 3.3k, 5% MIL-R-11	93550810	RC20GF332J
R3	RESISTOR, Fixed composition: 0.5 W, 10.0k, 5% MIL-R-11	93551020	RC20GF103J
R4	RESISTOR, Fixed composition: 0.5 W, 390 Ω, 5% MIL-R-11	93550480	RC20GF391J

REGULATOR (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
R5	RESISTOR, Fixed composition: 5 W, 360.0Ω, 5% MIL-R-11	93550470	RC20GF361J
TP1	TEST JACK, Violet	91370123	Ucinite Co. 119437
TP2	TEST JACK, Orange	91370122	Ucinite Co. 119437
XQ1, XQ3	SOCKET, TRANSISTOR	94450452	Elco 3303
XQ2	TRANSISTOR SOCKET	94450400	Nugent 3-6 NS-503-6

VIDEO FILTER

C1, 2	CAPACITOR, Fixed: Mylar 0.033 uf, ±5%, 100 v MIL-C-27287	90990019	General Electric CTM333VAJ
C3, 4	CAPACITOR, Fixed: Mylar 0.015 uf, ±5%, 100 v MIL-C-27287	90990015	General Electric CTM153VAJ
C5, 6	CAPACITOR, Fixed: Mylar 0.0068 uf, ±5%, 100 v MIL-C-27287	90990011	General Electric CTM682VAJ
C7, 8	CAPACITOR, Fixed: Mylar 0.0022 uf, ±5%, 100 v	90990006	General Electric 63F10AC222
C9, 10	CAPACITOR, Fixed: Mylar 0.0015 uf, ±5%, 100 v	90990003	General Electric 63F10AC152
C11, 12	CAPACITOR, Dur-mica: 680 uuf, ±5%, 500 v	90921271	Elmenco DM20F681J03
C12, 14	CAPACITOR, Dur-mica: 220 uuf, ±5%, 500 v	90921231	Elmenco DM15F221J03
L2	CHOKE: 10000 uf ±5%	91150350	Delevan 2500-76
L3	CHOKE: 6800 uh ±5%	91150325	Delevan 2500-68
L4	CHOKE: 3600 uh ±5%	91150300	Delevan 2500-54
L5	CHOKE: 1800 uh ±5%	91150247	Delevan 2500-40
L6	CHOKE: 560 uh ±5%	91150225	Delevan 2500-16
L7	CHOKE: 360 uh ±5%	91150195	Delevan 2500-06
L8	CHOKE: 180 uh ±5%	91150047	Delevan 1537-88

LIMITER

C1 thru 11	CAPACITOR: 0.01 MFD +80% -20%, 50 v	90901758	Sprague 19C214
CR1, 2	DIODE	91600015	Fairchild FD-824
J1-4	CONNECTOR, Receptacle	91371810	Microdot 31-33
J1-4	CABLE	102500-98	
P1	CONNECTOR, Plug	91370375	Cannon DBM-25P

LIMITER (cont)

Reference Designation	Name and Description	Part Number	
		Vitro	Vendor
Q1-6	TRANSISTOR: 2N708	95350100	
R1, 10, 18, 22, 15, 21	RESISTOR, Fixed composition: 0.5 W 470 Ω ±5% MIL-R-11	93550510	RC20GF471J
R2, 16	RESISTOR, Fixed composition: 0.5 W 750 Ω ±5% MIL-R-11	93550580	RC20GF751J
R3	RESISTOR, Variable: 1/4 W, 500 Ω ±10%	93170002	Bourns 200P-1-501
R4	RESISTOR, Fixed composition: 0.5 W 270 Ω ±5% MIL-R-11	93550430	RC20GF271J
R5	RESISTOR, Fixed composition: 0.5 W 68 Ω ±5% MIL-R-11	93550220	RC20GF680J
R6, 8, 13, 17	RESISTOR, Fixed composition: 0.5 W 220 Ω ±5% MIL-R-11	93550400	RC20GF221J
R7	RESISTOR, Fixed composition: 0.5 W 330 Ω ±5% MIL-R-11	93550450	RC20GF331J
R9	RESISTOR, Fixed composition: 0.5 W 1k ±5% MIL-R-11	93550620	RC20GF102J
R11	RESISTOR, Fixed composition: 0.5 W 180 Ω ±5% MIL-R-11	93550370	RC20GF181J
R12, 23	RESISTOR, Fixed composition: 0.5 W 100 Ω ±5% MIL-R-11	93550290	RC20GF101J
R14, 20	RESISTOR, Fixed composition: 0.5 W 1.5k ±5% MIL-R-11	93550690	RC20GF153J
R19	RESISTOR, Fixed composition: 0.5 W 10k ±5% MIL-R-11	93551020	RC20GF103J

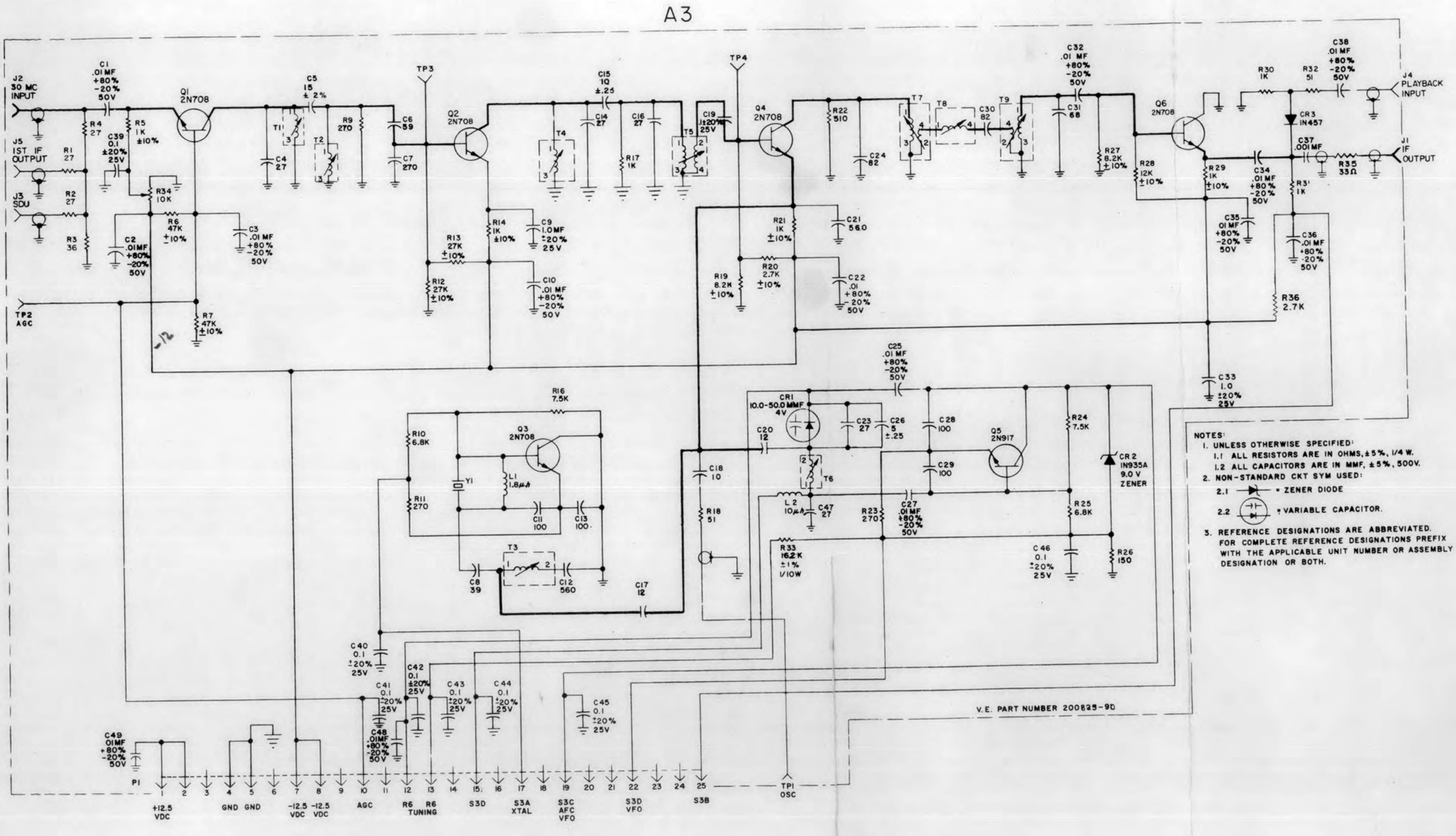
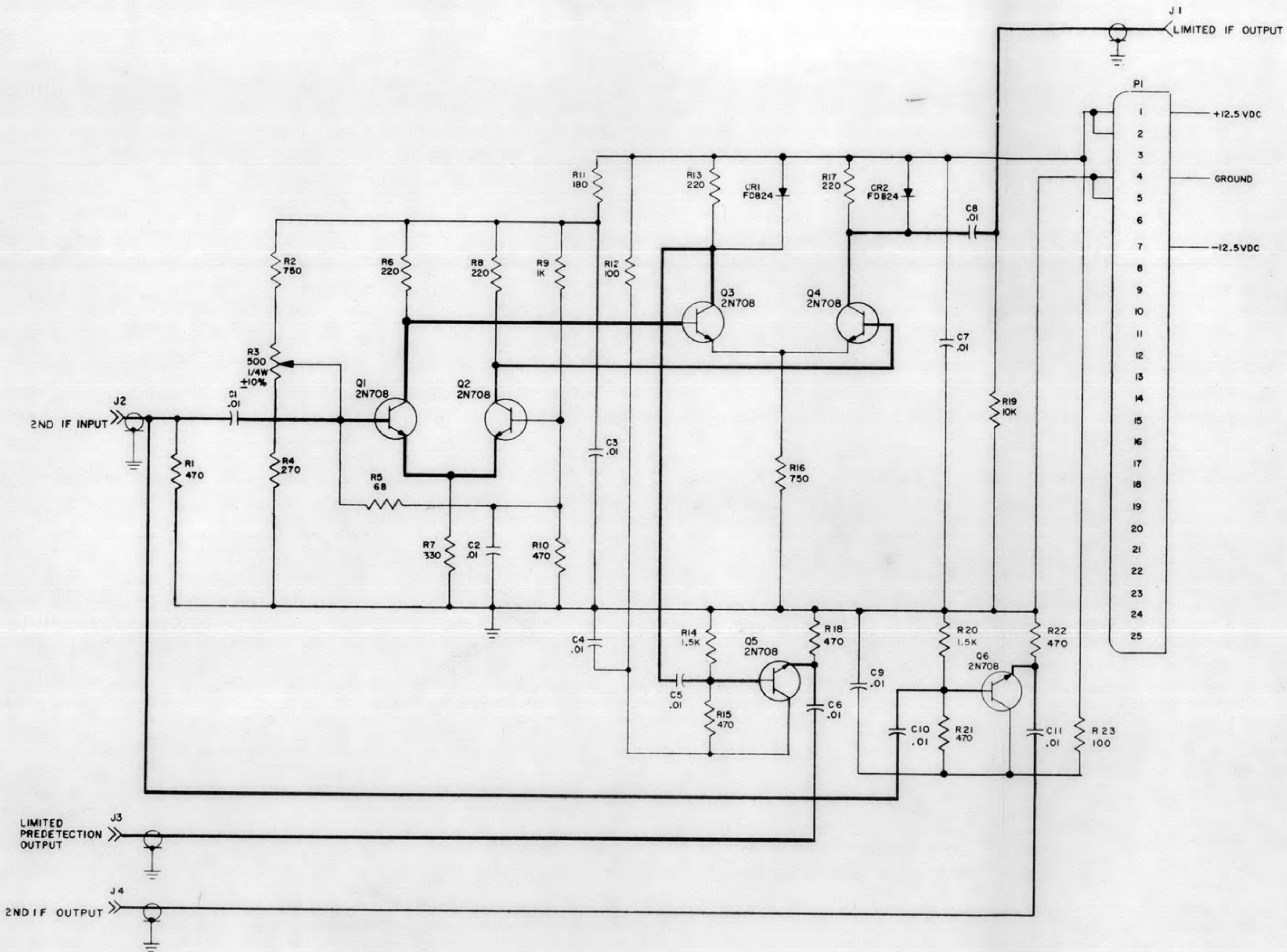


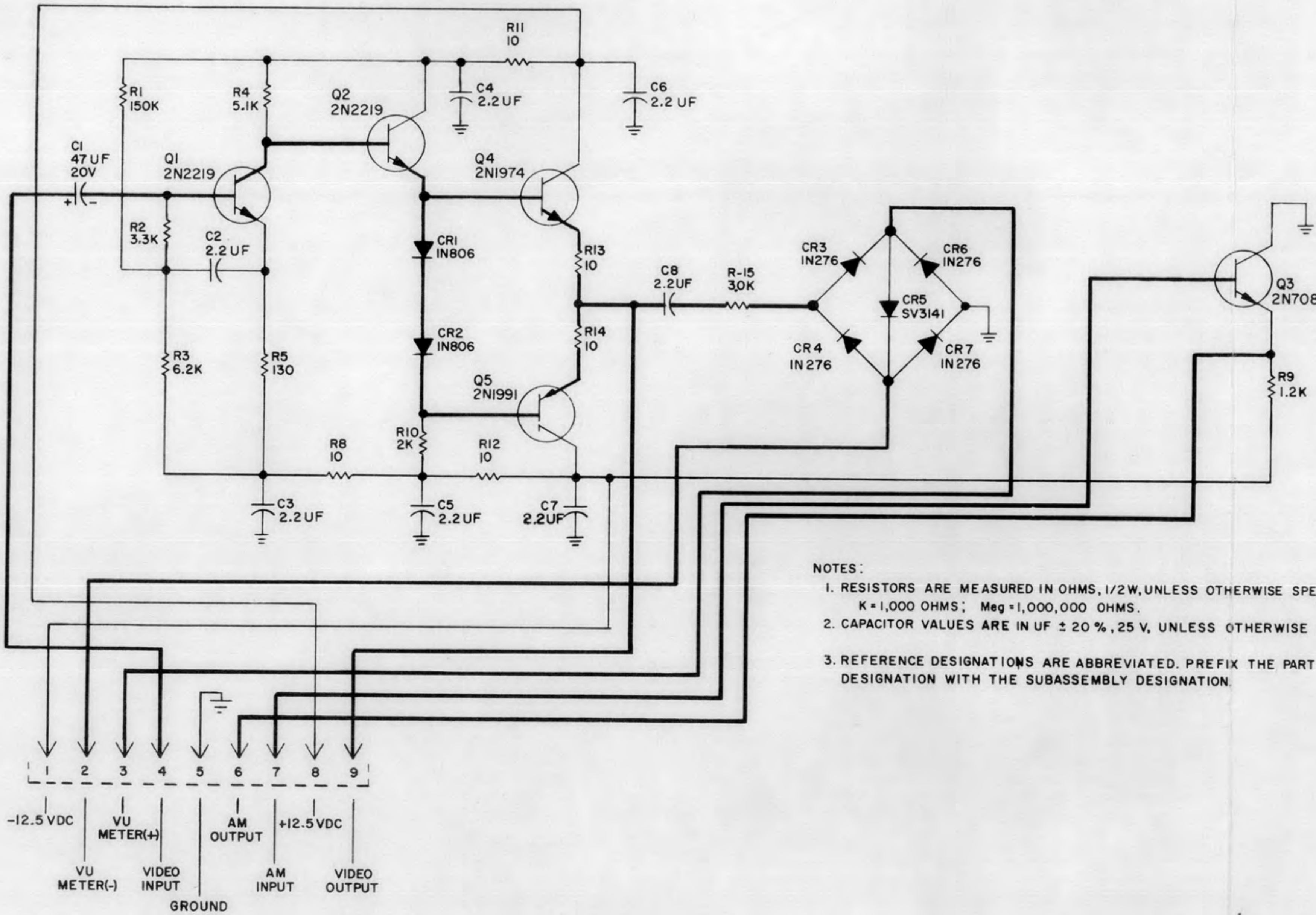
Figure 21. First IF Amplifier and Second Converter, Schematic Diagram



NOTES:

1. RESISTORS ARE MEASURED IN OHMS, 1/2 W, ±5% UNLESS OTHERWISE SPECIFIED.
   K = 1000 OHMS; Meg = 1,000,000 OHMS.
2. CAPACITOR VALUES 1.0 AND OVER ARE mmF AND CAPACITOR VALUES UNDER 1.0 ARE IN mF, + 80% − 20% UNLESS OTHERWISE SPECIFIED.
3. INDUCTORS ARE MEASURED IN μH UNLESS OTHERWISE SPECIFIED.

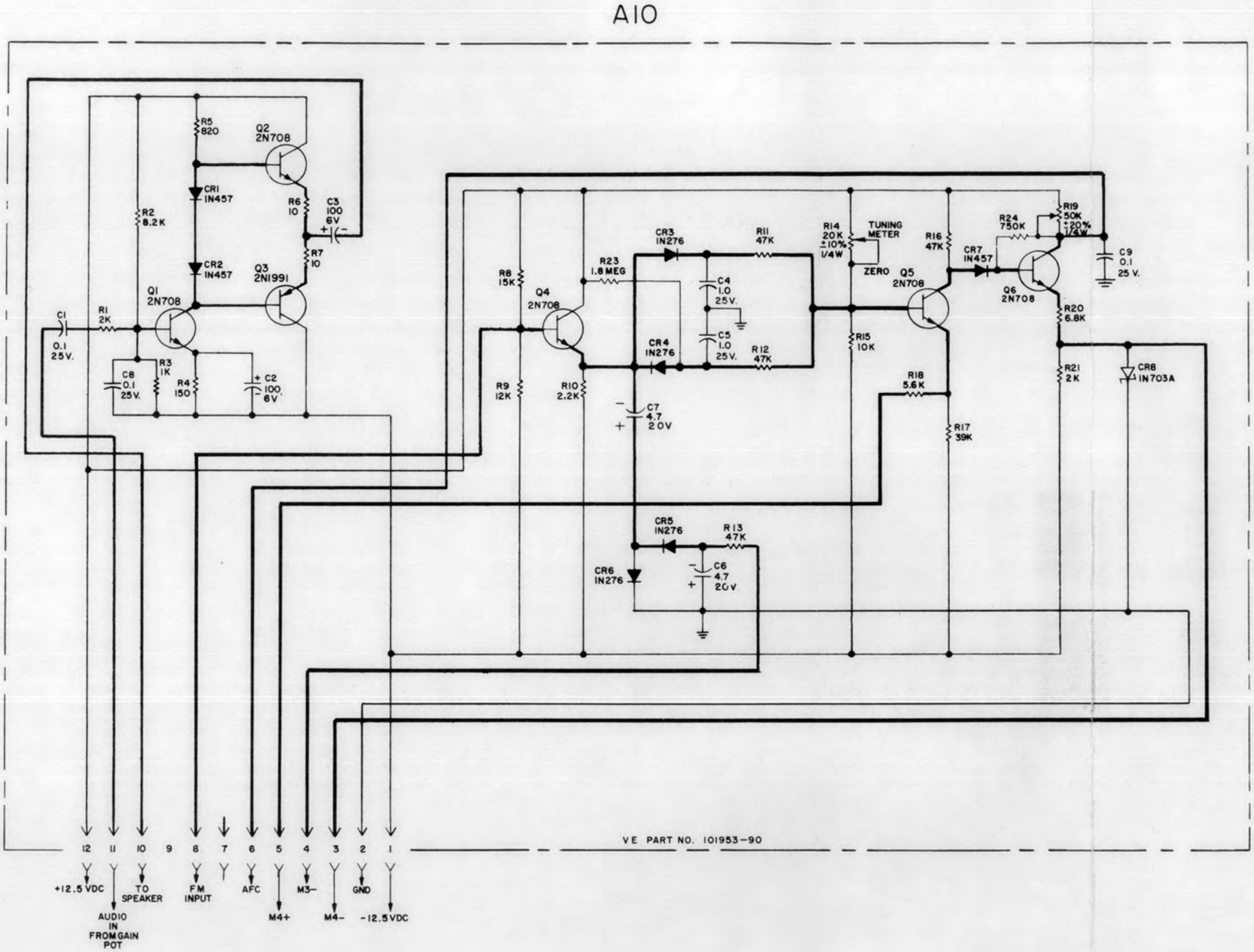
Figure 23. Wide Band Limiter, Schematic Diagram



NOTES:

1. RESISTORS ARE MEASURED IN OHMS, 1/2 W, UNLESS OTHERWISE SPECIFIED. K = 1,000 OHMS; Meg = 1,000,000 OHMS.
2. CAPACITOR VALUES ARE IN UF ± 20 %, 25 V, UNLESS OTHERWISE SPECIFIED.
3. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE PART DESIGNATION WITH THE SUBASSEMBLY DESIGNATION.

Figure 24. Video Amplifier, Schematic Diagram



NOTE:
1. UNLESS OTHERWISE SPECIFIED:
   1.1 ALL RESISTORS ARE IN OHMS ±5% 1/2 W.
   1.2 ALL CAPACITORS ARE IN MICROFARADS ±20%.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATIONS PREFIX WITH THE APPLICABLE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

Figure 25. Audio/Metering Circuit, Schematic Diagram