DEPARTMENT OF THE ARMY TECHNICAL MANUAL

GS AND DEPOT MAINTENANCE MANUAL

SIMULATOR, RADIO FREQUENCY

SM-442A/GRC

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1968

WARNING

Voltages up to 200 volts dc and 115 volts ac exist in this equipment. Serious injury may result if operating and maintenance personnel fail to observe safety precautions.

DON'T TAKE CHANCES!

Operation and maintenance personnel should be familiar with the requirements of TB SIG 291 before attempting installation or operation of Simulator, Radio Frequency SM-442A/GRC.

CAUTION

Make resistance measurements in the transistorized circuits of this equipment only as specified; the voltage present in the ohmmeter may destroy transistors.

TECHNICAL MANUAL
No. 11-6625-847-45

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *7 March 1968*

GS AND DEPOT MAINTENANCE MANUAL

SIMULATOR, RADIO FREQUENCY SM-442A/GRC

*This manual supersedes TM 11-6625-847-45, 11 October 1967.

CHAPTER 1
FUNCTIONING OF SIMULATOR, RADIO FREQUENCY SM-422A/GRC

Section I. GENERAL FUNCTIONING

1-1. Scope

a. This manual covers general support (GS) and depot maintenance for Simulator, Radio Frequency SM-442A/GRC (fig. 1-1). It includes instructions appropriate to GS and depot maintenance categories for troubleshooting, testing, aligning, and repairing the equipment, and replacing specified maintenance parts. It also lists test equipment, tools, and materials for GS and depot maintenance. Detailed functions of the equipment are covered in this chapter. The complete technical manual for this equipment includes TM 11-662-847-12.

b. Report of errors, omissions and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-Q, Fort Monmouth, NJ 07703.

NOTE

For applicable forms and records, see paragraph 1-3, TM 11-6625-847-12.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to the latest issue of DA Pam 310-7 to determine whether there are modification work orders (MWOs) pertaining to the equipment.

1-3. Common Names and Abbreviated Reference Designators

a. Common Names.

Equipment	*Common name*
Radio Set AN/GRC-106	
Simulator, Radio Frequency SM-442A/GRC	
Test set A2	Test set
Receiver-Transmitter, Radio RT-662/GRC	
Amplifier, Radio Frequency AM-3349/GRC-106	
Common module tray A1A1	Tray A1A1
Common module tray A1A2	
Synthesizer test tray A1A3	Tray A1A3
Converter and control tray A1A4	Tray A1A4
Driver, discriminator, and antenna coupler tray A1A5	Tray A1A5

b. Abbreviated Reference Designation. The designator A2A1A1 refers to pulse generator assembly A1A1 which is part of test set A2. An abbreviation such as A1A1 will be used within a paragraph where the component is referenced. On common module tray A1A2, AUDIOGAIN control R1 may be referred to as A1A2R1 or it may be referred to as R1 within a paragraph where the identity will not be confused with other controls.

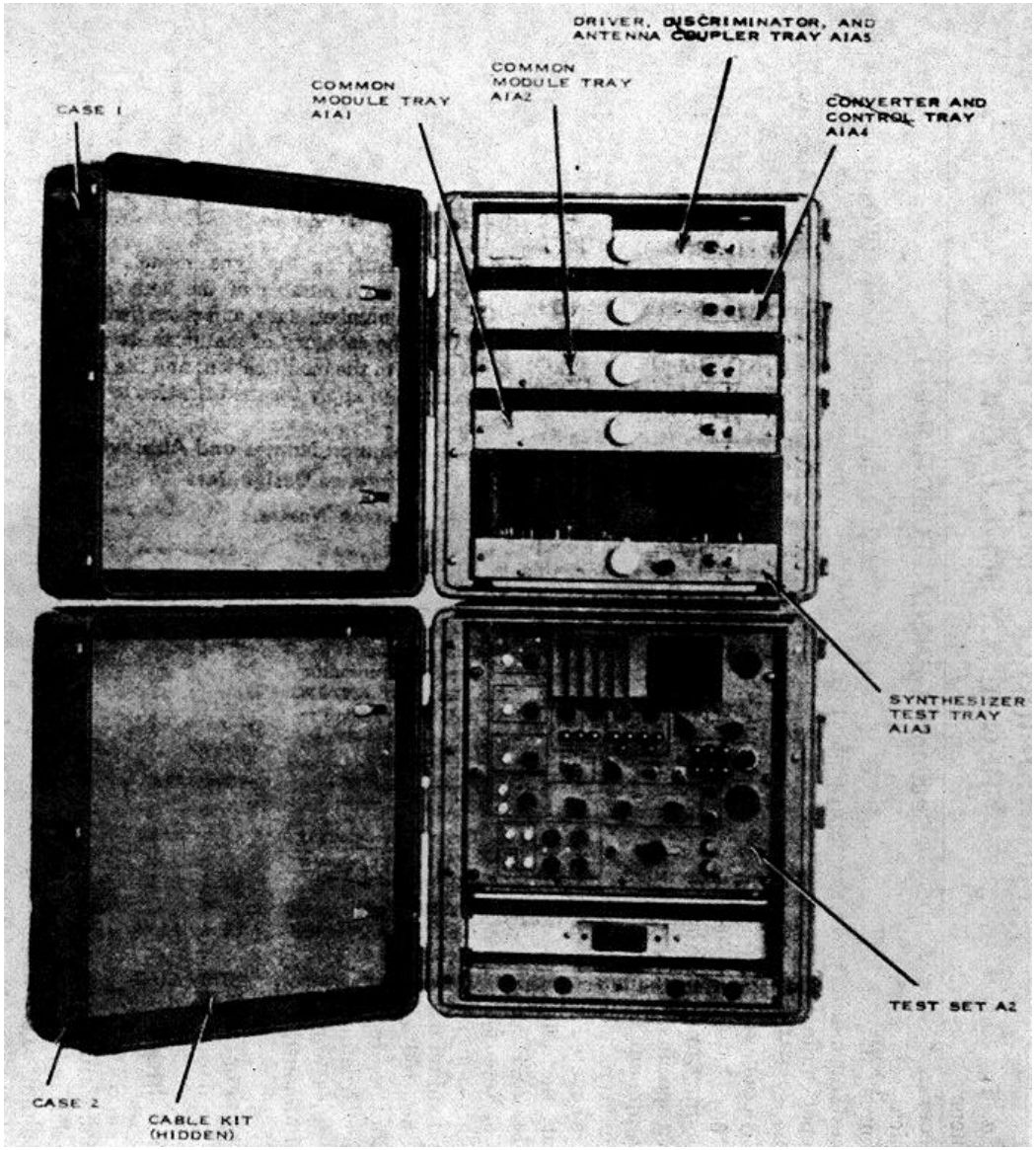


Figure 1-1. Simulator, Radio Frequency SM-442A/GRC.

Section II. BLOCK DIAGRAM ANALYSIS

1-4. General

a. The purpose of Simulator, Radio Frequency SM-442A/GRC is to provide all the necessary stimulus control, test points, electrical connections, mechanical coupling, power source, and resistive power loads for testing Radio Set AN/GRC-106. With standard external test equipment, both GS and depot categories of testing can be performed on either the modules or subassemblies of the AN/GRC-106 or performance tests can be made of Receiver-Transmitter, Radio RT-662/GRC and Amplifier, Radio Frequency AM-3349/GRC-106 units separately or as a complete AN/GRC-106.

b. When conducting system tests of the AN/GRC-106, the units being tested are connected directly to the test set A2 by test cables. For module testing of the AN/GRC-106, the appropriate test fixture tray is required. Direct current (dc) and alternating current (ac), mechanical coupling, switching information, and the stimulus that is normally supplied by a complete radio set are supplied by the test fixture tray to the module being tested.

1-5. Block Diagram Analysis of System Testing

a. Figure 1-2 is a functional block diagram showing the test set connected for system testing of AN/GRC-106. Test cable W12 is the only connection required between the RT-662/GRC and the AUDIO IN/OUT connector on the test set. Test cable W12 connects the two sets of audio test points, AUDIO IN 600 (ohms) and 50 (ohms) and AUDIO OUT 2 WATT and 10 MW, on the front panel of the test set, to the RT-662/GRC. The AUDIO IN test points connect an external audio source of either high or low impedance to the AN/GRC-106. The AUDIO OUT test points measure the two audio output voltages of the AN/GRC-106. The test set also provides for keying the AN/GRC-106 by connecting the KEY switch, on the front panel of the test set, to the RT662/GRC unit through test cable W12.

b. Using the SM-442A/GRC to test the RT-662/GRC as a separate unit requires audio test cable W12 and PA CONTROL cable W11 (fig. 1-3). The test cables are connected: between the RT-662/GRC and the test set. The AM-3349/GRC-106 can also be checked as a separate unit.

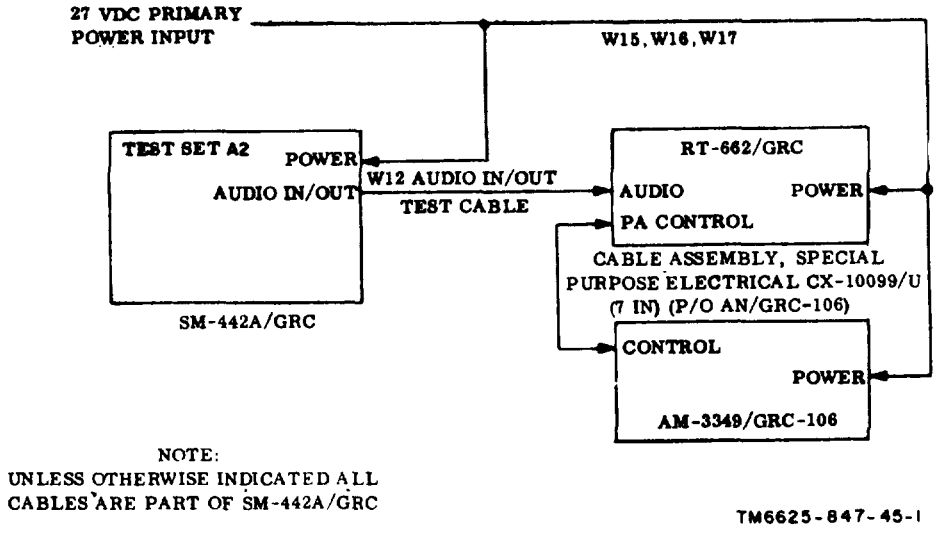


Figure 1-2. Radio Set AN/GRC-106 testing, block diagram.

1-6. Block Diagram Analysis of Module Testing

Figure 1-4 through Figure 1-8 are functional block diagrams showing the various modules of the AN/GRC-106 connected to the appropriate test fixture tray for module level test. The test fixture tray in use is connected to the test set by connector J1 on the rear panel of the test fixture tray and on the lower front panel of the test set. Connector J1 supplies the dc and ac power inputs, switching controls and resistive loads to the test tray from the test set that are necessary for module and subassembly level test. When testing the inputs, to the antenna coupler module, converter and control tray A1A4 requires that a test cable connected between the test set PA CONTROL connector and the AM-3349/GRC-106.

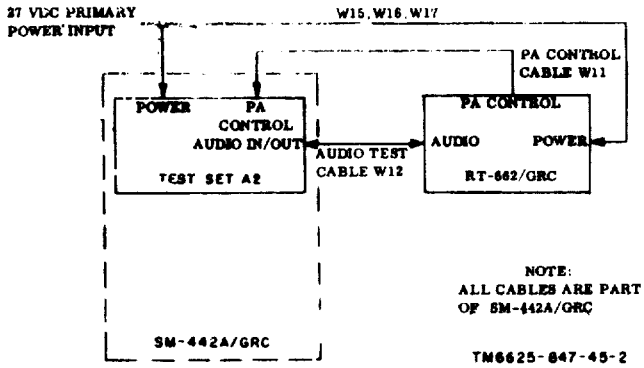


Figure 1-3. RT-662/GRC unit system testing, block diagram.

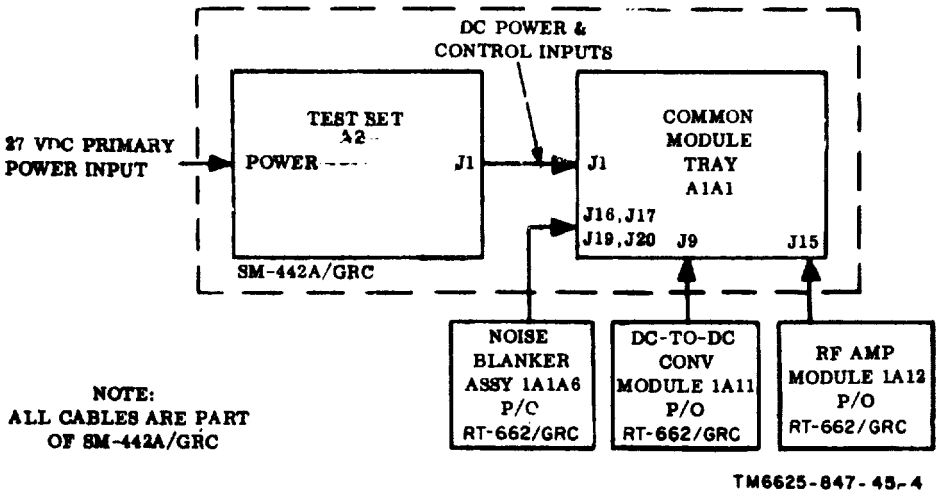


Figure 1-4. Common module tray A1A1, module-testing, block diagram.

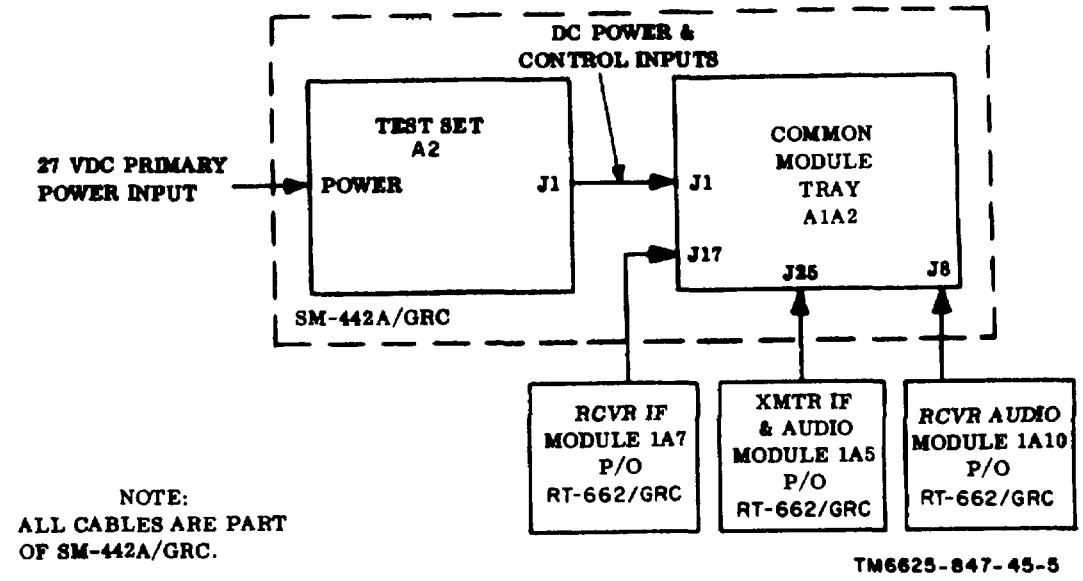


Figure 1-5. Common module tray A1A2, module testing, block diagram.

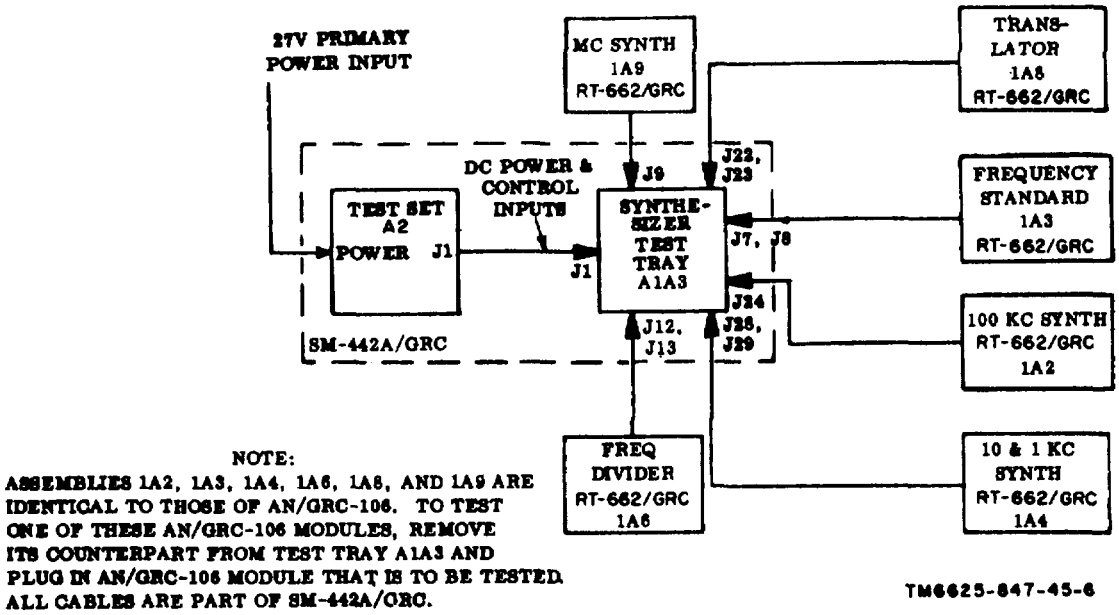


Figure 1-6. Synthesizer test tray A1A3, module testing, block diagram.

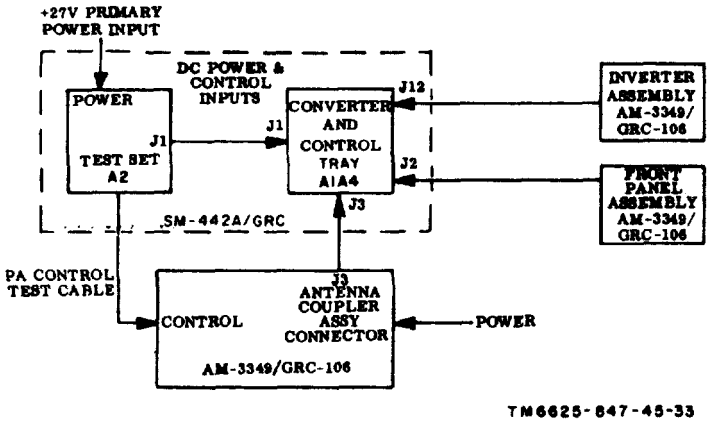


Figure 1-7. Converter and control tray A1A4, module testing, block diagram.

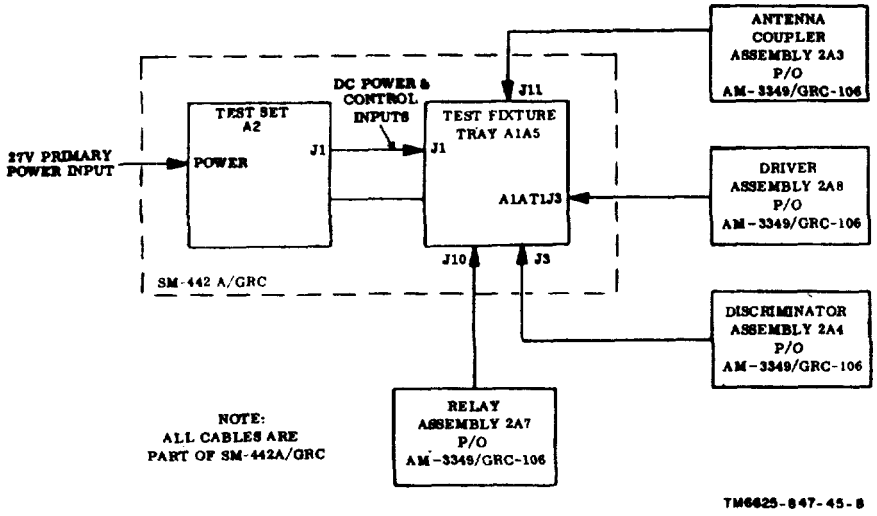


Figure 1-8. Driver, discriminator, and antenna coupler tray A1A5, module testing, block diagram.

Section III. FUNCTIONAL ANALYSIS

1-7. General

Paragraphs 1-8 through 1-24 discuss the test set and each of the five test fixture trays of the SM-442A/GRC, describing first the major components, purpose, and operation of each and then the detailed circuits of electronic subassemblies or modules when necessary. This is done, whenever possible, on a simplified schematic or block diagram.

Note. Partial reference designators are used in paragraphs 1-8 through 1-24. Prefix all reference designators with test set reference designator A2, unless otherwise specified.

1-8. Test Set A2

a. Figure 1-9 shows the various controls, stimulus inputs, test points, and resistive loads supplied by the test set. The +27-volt dc primary power is supplied through the ON position

of POWER switch A1S2 to SERV SEL switch A1S1, through thermal activated switch S1 to blower motors B1 and B2, and to test set connector J1. The SERV SEL switch controls the mode of operation of the test set in the first four positions, OFF, OVEN ON, STBY, and SSB/NSK, and stimulates the functions that are normally supplied to test set connector J1 by the SERVICE SELECTOR switch on the front panel of the RT-662/GRC in positions OFF, OVEN ON, STBY, SSB/NSK, FSK, AM and CW. The SERV SEL switch in any position other than OFF supplies +27-volt dc primary power to the regulator section of dc-to-dc converter and regulator module A3. Figure 6-3 is the test set schematic diagram.

b. Module A3 (fig. 6-3) regulates the +27-volt dc primary power to +20 volts dc. The ON position of the POWER switch on one of the module testing trays, when connected to the test set, supplies +27-volt dc primary power to the converter section of module A3. The converter section of module A3 converts the +27-volt dc primary power to + 125 volts dc, -33 volts dc and 6.3 volts ac. The + 20-volt dc output of module A3 is used on the test set as B+ supply voltage for intermediate frequency (if) oscillator modules A1A2, A1A3, and A1A4. For operating voltages, pulse generator module A1A1 requires the +20-volt dc and the *33-volt dc outputs for the dc-to-dc converter and regulator module A3.

c. Two-tone select switch A1S8 controls the output of the three IF oscillator modules, A1A2, A1A3, and A1A4, by switching the +20-volt dc B + supply voltage either on or off to one or more of the modules. Modules A1A2 and A1A3, when selected supply 1.7525-megacycle (mc) and 1.7515-mc inputs to mixer assembly A1A5. The output of the mixer assembly is either 1.7525 mc or 1.7515 mc, or both, depending on the position of two-tone selector switch A1S8. The output of the mixer assembly is connected to connector J1. With common module tray A1A2 (fig. 68) connected to the test set, the output of the mixer assembly can be switched from if. oscillator modules A1A2 and A1A3 to an external two-tone signal generator source by placing RCVR IF AGC SYNC switch A2S6 on tray A1A2 to OFF. The output of IF oscillator module A1A4, when selected by switch A1S8, is 1.7500 mc and is connected directly to connector J1.

d. Megacycle frequency selection is accomplished by MC FREQ 10 MC switch A1S9, .1 MC switch A1S11, and .1 MC switch A1S10. These switches are used to control the position of the mc frequency couplers on common module tray A1A1 and synthesizer test tray A1A3 and provide the five-wire coding inputs to the AM-3349/GRC-106 at PA CONTROL connector A1J12.

e. Dc-to-dc converter module A2 on the test set is controlled by an interlock jumper wire on connector J1 of driver, discriminator, and antenna coupler tray A1A5. When tray A1A5 is connected to the test set, the +27-volt dc primary power is supplied to module A2 for conversion to + 200 volts dc. The +200-volt dc power is then connected back to tray A1A5 for module excitation.

f. The resistive loads supplied by the test set to the module testing tray are as follows: a 2,400-volt dc load, a 500-volt dc load, a 200-ohm, 250-watt resistor, and a 420-ohm, 250-watt resistor. The 2,400-volt dc load is controlled by seven-position 2400 VDC LOAD switch A1S3 by selecting the number of resistors in parallel with the input leads of the load. The 500-volt dc load is controlled by 500 VDC LOAD switch A1S7 as either a low or high current load by the paralleling of two fixed resistors across the input leads.

g. Pulse generator module A1A1 supplies a 1 microsecond (usec) pulse and either an 85-usec positive pulse or a 150-usec negative pulse to the front panel of the test set at OUTPUTS connectors 1, 2, and 3, respectively. The pulse generator is triggered by an external audio signal generator connected to the PULSE GENERATOR INPUT connector. The frequency of the audio signal generator determines the pulse repetition rate of the pulse generator.

h. When in the TUNE position, XMIT STATUS switch A1S5 supplies a ground to test set connector J1. In the ON position, KEY switch A1S6 supplies a ground and +20 volts dc to two pins of connector J1 and a ground to connector A1J4. The REC XMIT switch re-

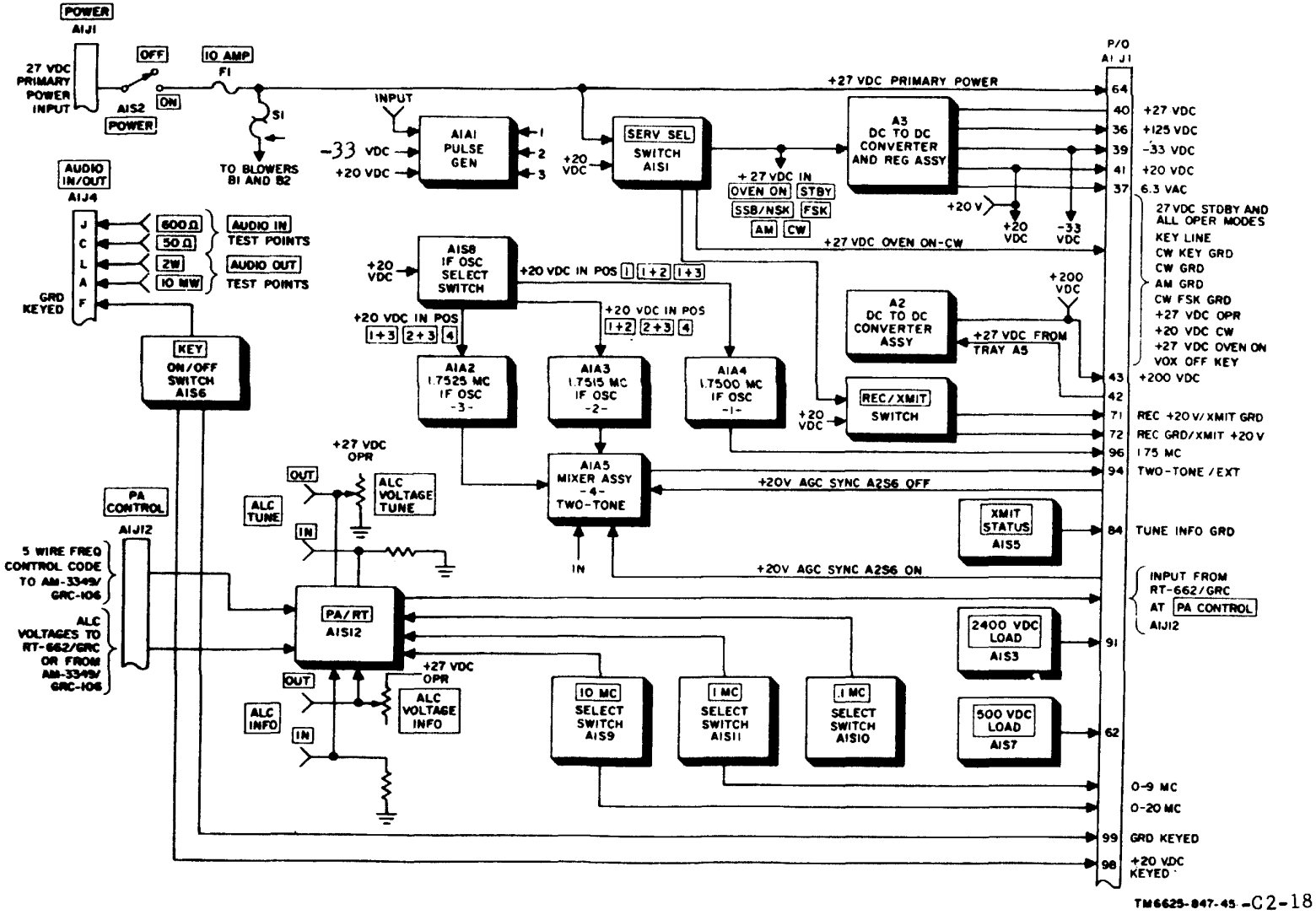


Figure 1-9. Test set, block diagram.

verses + 20 volts dc and ground on the two pins of connector J1 when switched from either REC or XMIT.

1-9. Pulse Generator Subassembly A2A1A1
(fig. 1-17, fig. 3-10, and fig. 6-4)

Note. Where partial reference designators are used, prefix with test set and pulse generator reference designator A2A1A1, unless otherwise specified.

a. The function of pulse generator subassembly A2A1A1 is to supply to separate connectors on the front panel of the test set with a 1-usec wide positive pulse and either a 150-usec negative pulse or an 85-usec positive pulse. Front panel controls on the test set adjust the width and amplitude of the 1-usec pulse and the width and amplitude of either the 85-usec wide pulse or the 150-usec wide pulse. The pulse repetition rate of the pulse generator is controlled by the frequency of the external audio signal generator connected to INPUT connector J1.

b. The input audio signal at INPUT connector J1 is connected to the base of first pulse shaper transistor A1Q1 by capacitor A1C1. Transistors A1Q1 and A1Q2 are utilized as a pulse shaping circuit to shape the input sine wave into a square wave. The output of the pulse shaping circuitry, at the collector of A1Q2, is the input to the base of transistor A1Q6 and to capacitor A1C3. Diode A1CR3 connected between capacitor A1C3 and the collector of transistor A1Q3 couples the positive portion of the square wave as the trigger input to the monostable multivibrator consisting of transistors A1Q3 and A1Q4. The negative portion of the square wave input at capacitor A1C3 is shunted to ground by diode A1CR2. Each positive trigger input to the multivibrator generates an output pulse by switching the multivibrator from the normal stable state to the unstable state for a length of time depending on the setting of WIDTH control resistor R2. The WIDTH control is used to set the output of the multivibrator for either an 85-usec or (150-usec) duration pulse. The negative output pulse of the multivibrator, at the collector of transistor A1Q4, is the input to the base of inverter amplifier transistor A1Q5. The amplitude of the pulse output of A1Q5 is controlled by basebiasing resistor AMPLITUDE control R1. The negative (150-usec) output pulse is coupled to connector J2 from the emitter of A1Q5 by capacitor A1C6. The positive (85 usec) output pulse is coupled by capacitor A1C7 from the collector of A1Q5 to connector J3.

c. The square wave output of transistor A1Q2 is further amplified and shaped by transistor A1Q6. The output of A1Q6 is differentiated into a positive and negative pulse by capacitor A1C9 and resistor A1R18. The negative pulse is shunted to ground by diode A1CR4. The positive pulse, coupled by diode A1CR5, is the input to a Schmitt trigger multivibrator consisting of transistors A1Q7 and A1Q8. The Schmitt trigger circuit provides a standard pulse output for each positive input trigger pulse. Variable WIDTH control resistor R4 controls the duration of the output pulse of the Schmitt trigger to 1-usec. The amplitude of the 1-usec output pulse is controlled by coupling a portion of the pulse developed across collector load AMPLITUDE resistor R3 and coupled by capacitor A1C12 to connector J4.

1-10. Dc-to-Dc Converter and Regulator Module A2A3
(fig. 1-18 and fig. 6-5)

Note. Where only partial reference designator are used, prefix with test set and dc-to-dc converter and regulator module reference designator A2A3, unless otherwise specified.

a. The function of dc-to-dc converter and regulator module A2A3 is to produce all operating voltages required by the SM-442A/ GRC with the exception of the + 27-volt dc primary power.

b. In the regulator section, the +27-volt dc is applied to the collector of transistor 1A1Q1 on the chassis of the test set and to pin 13 of J2. The effective collector-to-emitter resistance of test set transistor 1A1Q1, in series with the +27-volt dc line, drops the voltage to a constant +20 volts dc for any given current required by the external circuits. The value of the series resistance is determined by the rate of conduction of test set transistor 1A1Q1, controlled by the regulator circuit. The differential amplifier, consisting of transistors A1Q3 and A1Q4, compares the output from test set transistor

1A1Q1 to the reference established by 4.7-volt Zener diode A1VR2. The output at the emitter of test set transistor 1A1Q1 is developed across the voltage divider, consisting of resistors A1R7, 1A1R4, and A1R8. Variable resistor 1A1R4 on the front panel of the test set provides adjustments of the base voltage of A1Q4 to maintain a constant output voltage from the regulator with variations in component values because of age and temperature. Assume that the + 20-volt dc output instantaneously increases to +22 volts dc. The voltage across the voltage divider will increase the base bias of transistor A1Q4. Transistor A1Q4 will have an increased rate of conduction, increasing the voltage developed across resistor A1R6. This decreases the forward-biasing of transistor A1Q3, increasing the voltage at the collector of transistor A1Q3. This increased voltage will decrease the forward bias on dc amplifier A1Q2, increasing the voltage on the collector of dc amplifier A1Q2. The base voltage of dc amplifier A1Q2 is stabilized by Zener diode A1VR1; therefore, the emitter-to-base voltage on driver A1Q1 will decrease, decreasing the voltage on the collector of driver A1Q1. The collector voltage of driver A1Q1 is the base bias for test set transistor A1Q1; therefore, the decrease at the collector of driver A1Q1 causes test set -transistor A1Q1 to conduct less. This action increases the collector-to-emitter resistance to drop the voltage back to +20 volts dc. A similar sequence of events will occur if the +20 volts dc decreases; however, the reverse will occur in all the circuits to increase the conduction rate of test set transistor A1Q1 and thereby decrease the collector-to-emitter resistance to increase the voltage at the emitter of test set transistor 1A1Q1 to +20 volts dc. Capacitor A1C5 provides filtering for the + 20 volt dc output line. Capacitor A1C4 provides filtering feedback for transistor A1Q4; therefore, any ripple on the + 20-volt dc output line will be fed 'back into the regulator circuit, ,and. in turn, to test transistor 1A1Q1 which is 180° out-of-phase with itself and allow the ripple to be canceled. Capacitors A1C1, A1C2, and A1C3 provide high frequency filtering. If the + 20-volt dc line becomes short-circuited, the resulting ground with forward-bias diode A1CR1, shutting off dc amplifier A1Q2, which, in turn, shuts off driver A1Q1 and test transistor 1A1Q1. When the short-circuit is removed, the regular will recover and resume regulating action.

c. The dc-to-dc converter is a saturable core oscillator used to produce the dc and ac operating voltages required by the SM-442A/ GRC. The +27-volt dc primary power is applied to pin 7 of connector J2, from which it is applied through a pi-section filter network to pin 9 of transformer T1. The pi-section filter consists of inductor L1 and capacitors A2C1, A2C2, A2C3, and A2C4. The +27-volt dc is applied through the transformer winding to the collector of both transistors Q1 and Q2 and through resistor A2R1, the transformer winding, and resistors R1 and R2 to the bases of transistors Q1 and Q2. The differences in the two transistors will cause one of them to turn on first. Assume that transistor Q1 turns on first. Application of +27 volts dc then will induce a voltage in the windings of transformers T1 with the following polarities: pin 9, plus; pin 2, minus; pin 1, plus; and pin 3, minus; X therefore, transistor Q1 is more forward-biased by the positive voltage on its base and is driven toward saturation. Transistor Q1 will conduct into saturation, at which time the magnetic field created in the windings will collapse since the current becomes constant. The polarities of the windings will be reversed, turning transistor Q2 on. This action will continue, producing a square wave ac signal across the primary of transformer T1. Resistors R1 and R2 are base current limiting resistors. Diode A2CR1 will clamp pin 10 of transformer T1 at ground so that maximum drive can be applied to the conduction transistor to drive it into saturation.

d. The 54-volt ac output from dc-tide converter switch Q1, Q2 is stepped-down in transformer winding 4-5, filtered, and applied to pins 1 and 9 of connector J2 as u.3 volts ac. The 54-volt ac is stepped-up by transformer winding 6-12, full-wave rectified by diodes A3CR1 through A3CR4, filtered, and applied to pin 6 of connector J2 as the + 125-volt dc

output. The 54-volt ac is stepped-up by transformer winding 7-8, full-wave rectified by diodes A3CR5 through A3CR8, regulated by 33-volt Zener diode A3VR1, filtered, and applied to pin 14 of connector J2.

Note: Figure 6-2 contains the charts for MIL Standard resistors, capacitors, and inductors.

1-1 1. IF Oscillator Circuit (fig. 1-19, fig. 6-3, and fig. 6-6)

Note. Where partial reference designators are used, prefix with test set reference designator AZ, and the appropriate IF oscillator module presence designator A1A2, A1A3, or A1A4, for example: A2A1A2.

a. The function of the IF oscillator circuitry is to provide either a two-tone or single-tone IF frequency to connector A2J1 on the test set. The IF oscillator circuit consists of three crystal-controlled oscillators modules A2A1A2, A2A1A3, and A2A1A4 and two-tone selector switch A2A1S8. The two-tone selector switch selects the output of the IF oscillator circuit by switching the + 20-vk dc B + supply voltage to the oscillator module selected, energizing the oscillator. Oscillator module A2A1A4, when selected, provides a 1.7500-mc output to test set connector A2J1. Oscillator modules A2A1A2 and A2A1A3 provide 1.7525-mc and 1.7515-mc inputs, respectively, to two-tone mixer assembly A2A1A5.

b. Oscillator modules A2A1A2, A2A1A3, and A2A1A4 are identical in operation and in circuitry with the exception of the frequency of the crystals. Each oscillator module contains a crystal controlled transistor oscillator A1Q1 and a buffer amplifier A1Q2. Oscillation of transistor A1Q1 is sustained by coupling the in-phase signal from the emitter of A1Q1 through resistor A1R7 and capacitor A1C1 to the base of A1Q1. A positive output trigger from the crystal-driven tank circuit consisting of capacitors all, A1C2, and diode A1CR1 is coupled to the base of A1Q1 through diode A1CR2 and A1C4 to frequency-stabilize the OSCILLATOR The -input of oscillator A1Q1 is the input at the base of buffer amplifier A1Q2. Variable resistor A1R1 in the emitter of A1Q2 controls the output amplitude of the buffer amplifier at output jack J1 for module A2A1A4. For modules A2A1A2 and A2A1A3, the output is the input of two-tone mixer assembly A2A1A5 (fig. 6-3).

1-1 2. Mixer Assembly A1A5 (fig. 1-10 and fig. 6-3)

Note. Where partial reference designators are used, prefix with test set and mixer assembly reference designator A2A1A5, unless otherwise specified, for example: A2A1A5 C1.

The input from IF oscillators modules A2A1A2 and A2A1A3 are combined by the common tie point of capacitors C1 and C2 and by diode CR1. Diode CR1 is utilized as a diode switch and controlled by the RCVR IF AGC SYNC switch on tray A1A2. When the RCVR IF AGC SYNC switch is set to ON, +20-volt dc is supplied to the anode of diode CR1 through resistor R5, forward-biasing the diode into conduction. When diode CR1 is forward based, the input signals at J3 and J4 are coupled to AMPLITUDE control resistor R1 through diode CR1 and capacitor C5. Resistor R1 is used to control the output level of the mixer assembly. Placing the RCVR IF AGC SYNC switch on tray A1A2 to OFF removes the forward-bias from diode CR1, disconnecting the input signals from J3 and J4 from J2 and OUT connector J5, and forward-biasing diode CR2 into conduction. When diode CR2 is forward-biased, the external if. signal connected to IN connector J1 of the mixer assembly is coupled as the output of the mixer assembly through capacitor C3, diode CR2, and capacitor C4 to connector J2 and OUT connector J5. Resistor R1 controls the amplitude by shunting a portion of the input signal to ground.

1-13. SERV SEL Switch (fig. 6-3)

Note. Prefix reference designators with test set reference designator A2, unless otherwise specified.

a. The +27-volt dc applied to pins A and B of POWER connector A1J1 is applied through the ON position of POWER switch A1S2; through 10 AMP fuse A1F1; to contact 1 of switch A1S1, section A, front; to indicator A1DS1; and through switch S1 to fan motors

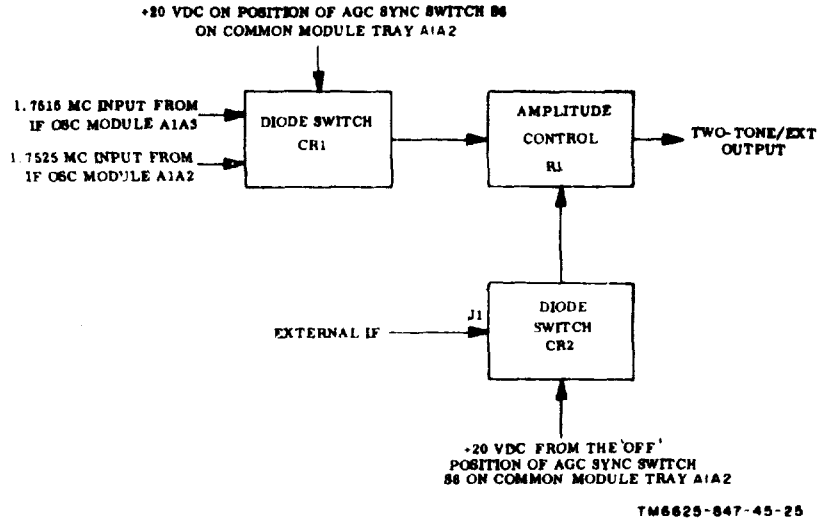


Figure 1-10. Test set mixer assembly, functional block diagram

B1 and B2. When the SERV SEL switch is set to OVEN ON, the + 27-volt dc primary power is applied through contacts 1 and 2 of switch A1S1, section A, front, to pin 34 of connector J1. When the SERV SEL switch is set at STBY, the + 27-volt dc primary power is applied through contacts 1 and 3 of switch A1S1, section A, front, to pin 29 of connector J1, to contact 9 of REC XMIT switch A1S4, and to dc-to-dc converter and regulator module A3. This voltage is used in dc-to-dc converter and regulator module A3 to energize the +20-volt dc regulator circuits. When the SERV SEL switch is placed at any operate position (SSB/ NSK, FSK, AM, CW), the +27-volt dc primary power is applied to all STANDBY and OVEN ON circuits, as previously explained, and through contacts 1 and 4 of switch A1S1, section A, front, to pin 35 of connector J1 and to pin 2 of assembly A1S1 and A1S2.

b. When the SERV SEL switch is set at CW, the + 20-volt dc output from transistor Q1 is applied through contacts 5 and 6 of switch A1S1, section A, rear, to pin 30 of connector J1. When the SERV SEL switch is set at SSB/ NSK or AM, pin 75 of J1 is connected through contacts 10 and 11 of switch A1S1, section A, rear, to contact 10 of switch A1S1, section C, front. When the SERV SEL switch is set at CW 1-12 or FSK, contacts 10 and 11 of switch A1S1, section A, rear, are open.

c. When the SERV SEL switch is set at STBY, the required standby ground for PA CONTROL connector pin N is supplied through contacts 9 and 8 of switch A1S1, section B, front. When the SERV SEL switch is set at any operate position (SSB/NSK, CW, AM, FSK), the required operate ground for PA CONTROL connector pin P is applied through contacts 9 and 10 of switch A1S1, section B, front.

d. When the SERV SEL switch is set at SSB/NSK, the ground on contact 11 of switch A1S1, section B, rear, is applied through contacts 11 and 12 of switch A1S1 section B, rear, to pin 87 of J1. When the SERV SEL switch is set at FSK, ground is applied through contacts 11 and 1 of switch A1S1 section B rear, to pin 31 of connector J1. When the SERV SEL switch is set at AM, the ground is applied through contacts 11 and 12 of switch. A1S1, section B, rear, to pin 87 of connector J1, and through contacts 11 and 2 of switch- A1S1, section B, rear, to pin 32 of connector J1. When the SERV SEL switch is set at CW, the ground is applied through contacts 11 and 1 to pin 81 of connector J1 and through contacts 11 and 8 to pin 33 of connector J1.

e.When the SERV SEL switch is set to SSB/NSK or AM, pin 86 of connector J1 is connected through contacts 8 and 9 or 8 and 11 of switch A1S1, section C, front, to pin 79 of connector J1. When the SERV SEL switch is set to FSK, pin 86 of connector J1 is connected through contacts 8 and 10 of switch A1S1, section C, front, to pin 76 of connector J1 is connected through contacts 8 and 10 of switch A1S1 section C, front, to pin 76 of connector J1. When the SERV SEL switch is set to CW, pin 86 of connector J1 is connected through contacts 8 and 12 of switch A1S1, section C, front, to pin 88 of connector J1.

1-14. Mc Frequency Selection Circuit (fig. 6-3)

NOTE

Prefix all reference designators with the test set reference designator A2, unless otherwise specified.

a. MC FREQ select switches 10 MC and 1 MC, A1S9 and A1S11, establish the code for the 28 position switches on the motor drive assemblies on tray A1A1 and tray A1A3, and simultaneously with .1 MC switch A1S1, generate the 5-wire code for the AM-3349/GRC-106 through the RT position of PA/RT switch A1S12 to PA CONTROL connector A1J12. The chart in b below lists the various combinations of grounds and opens on the five-wire coding lines for each frequency selected.

b. Five-Wire Coding Scheme.

NOTE

1 represents ground;
0 represents open.

Frequency (mc)	PA CONTROL A1J12				
	Pin R	Pin E	Pin S	Pin U	Pin V
2.0-2.5	0	1	0	1	0
3.0-3.5	0	0	1	0	1
14-15	1	0	0	1	0
1516	1	1	0	0	1
24-25	0	1	1	0	0
25-26	0	0	1	1	0
16-17	0	0	0	1	1
17-18	1	0	0	0	1
2.5-3.0	0	1	0	0	0
3.5-4.0	0	0	1	0	0
18-19	0	0	0	1	0
19-20	0	0	0	0	1
26-27	1	0	0	0	0
27-28	1	1	0	0	0
28-29	1	1	1	0	0
29-30	1	1	1	1	0
20-21	0	1	1	1	1
21-22	1	0	1	1	1
22-23	1	1	0	1	1
22-24	1	1	0	1	1
4-5	1	0	1	1	0
5-6	0	1	0	1	1
8-9	1	0	1	0	1
9-10	1	1	0	1	0
6-7	1	1	1	0	1
7-8	0	1	1	1	0
12-13	0	0	1	1	1
13-14	1	0	0	1	1
10-11	0	1	0	0	1
11-12	1	0	1	0	0
Code line	1	2	3	4	5

1-15. Common Module Tray A1A1 (fig. 1-11 and 6-7)

NOTE

Prefix all reference designators with common module tray A1A1 reference designator A1A1, unless otherwise specified.

a. Figure 1-11 shows the various controls, stimulus inputs, connectors, resistive loads, and test points available on common module tray A1A1 for testing the noise blanker subassembly, radio frequency (RF) amplifier module, and dc-to dc converter and regulator module of the RT-662/GRC. The +27-volt dc primary power input to tray A1A1 from the test set is controlled by POWER switch S1. In the ON position, POWER switch S1 supplies +27-volt dc to DC/DC CONVERTER TEST SELECTOR switch, contact terminal 7; to POWER indicator DS1; to DC/DC CONVERTER CONV/REG TEST switches REG and CONV, contact terminals 1; and to pin 40 of J1.

The +27-volt dc at J1, supplied through POWER switch S3, energizes the converter section of the dc-to-dc converter and regulator module A3 on the test set. The +20-volt dc input from the test set is connected directly to NOISE BLANKER 20 VDC connector J2. The + 125-volt dc input from the test set is connected to pin 5 of RF AMPL connector J15. The -33-volt dc input from the test set is connected to RF AMPL AGC ADJ control resistor RI. The 6.3-volt ac input is connected to pin 1 of RF AMPL connector J15.

b. When testing the dc-to-dc converter and regulator module of the RT-662/GRC at J9, the +27-volt dc input to connector J9 is broken by

DC/DC CONVERTER CONV/REG TEST switches REG and CONV and caused to flow through an external ammeter. The ammeter is connected across test points HI and CONV LOW for current measurements of the converter section and test points HI and REG LOW for current measurements of the regulator section of the module DC/DC CONVERTER TEST SELECTOR switch S4 controls the pin selection of DC/DC CONVERTER test points HI and LO for voltage measurements under specified loads at the connector pins J9 as follows: position 1 monitors the +27-volt dc input voltage from the test set; position 2 connects the test points to the output of the +20-volt dc regulator at the emitter of transistor A2Q1; position 3 monitors the + 125-volt dc at pin 6 of J9; position 4 monitors the -33 volt dc at pin 14 of J9, position 5 connects the test points across 6.3-volt ac at pins 1 and 9 of J9. Transistor A2Q1 replaces the +20-volt dc series regulator transistor of the dc-to-dc converter and regulator module that is mounted on the chassis of the RT-162/GRC unit and disconnected from the regulator section when the module is removed. The output of the +20-volt dc regulator is controlled by three-position DC/DC CONVERTER LOAD SELECT switch S6. The positions of the LOAD SELECT switch are designated 100, 500, and 600 for resistive loads providing current drains of 100 milliamperes (ma), 500 ma, and 600 ma, respectively. Test point J11 is for measuring the output voltage of the +20-volt dc regulator.

c. When testing the noise blanker subassembly of the RT-662/GRC, the NOISE BLANKER 1 USEC PULSE IN MODULE, PULSE OUT MODULE, and PULSE OUT TEST connectors provide the necessary mating connectors and impedance loads for connecting external test equipment with BNC connectors to the noise blanker subassembly microdot connectors.

d. When testing the RF amplifier module of the RT-62/GRC, the voltage at the wiper of RF AMPL AGC ADJ control resistor R1 is connected through the ON contacts of RF AMP AGC switch N5 as simulated automatic gain control (age) voltage to pin 3 of J15. The voltage as controlled by RF AMPL AGC ADJ at pin 3 of J15 is the simulated age input voltage to the rf amplifier module.

1-16 Common Module Tray A1A2
(fig. 1-12 and fig. 6-8)

NOTE
Prefix reference designators in tray A1A2 with reference designators A1A2, unless otherwise specified.

a. Figure 1-12 shows the various controls, stimulus inputs, resistive loads, and test points available on tray A1A2 for testing the receiver IF module, the receiver audio module, and the transmitter IF and audio module of the RT-662/GRC.

b. The +27-volt dc input to tray A1A2 from the test set is controlled by POWER switch S3. In the ON position, POWER switch S3 supplies the +27-volt dc input voltage to module connectors J8, pin 8, and J25, pin 28 (fig. 6-8); to POWER indicator DS1; to KCVR AUDIO test point SQUELCH SYNC; and to pin 40 of connector J1, energizing the converter section of dc-to-dc converter and regulator module A3 on the test set. The +20-volt dc input from the test set is connected directly to module connectors J8, pin 7; J17, pin 1; and J25, pin 1; to amplifier assembly A1; and to AGC SYNC switch S6.

c. When testing the receiver audio module of the RT-662/GRC, the external audio signal from the COMMON AUDIO 600 Ω IN connector on tray A1A2 is connected to AUDIO GAIN control variable resistor R1, and through the ON position of the SQUELCH SYNC switch S1, to receiver audio module connector J8. SQUELCH ON/OFF switch S2 controls the squelch circuitry of the receiver audio module by supplying a ground to pin 13 of J8. The test set SERV SEL switch supplies a ground to pin 5 of connector J8 when in the FSK and CW positions. OUTPUTS test points 2 WAIT and 1O MW monitor the output audio signal of the receiver audio module.

d. When testing the transmitter IF and audio module of the RT-662/GRC, the external audio signal from the COMMON AUDIO 600 Ω IN connector is connected to pin 16 of transmitter IF and audio module connector J25. A 1.750-mc signal is supplied to pin A2 of J25 from the test set IF OSCILLATOR (1) 1.75 MC module. From the mixer module of the test set, pin A3 of connector J25 receives a

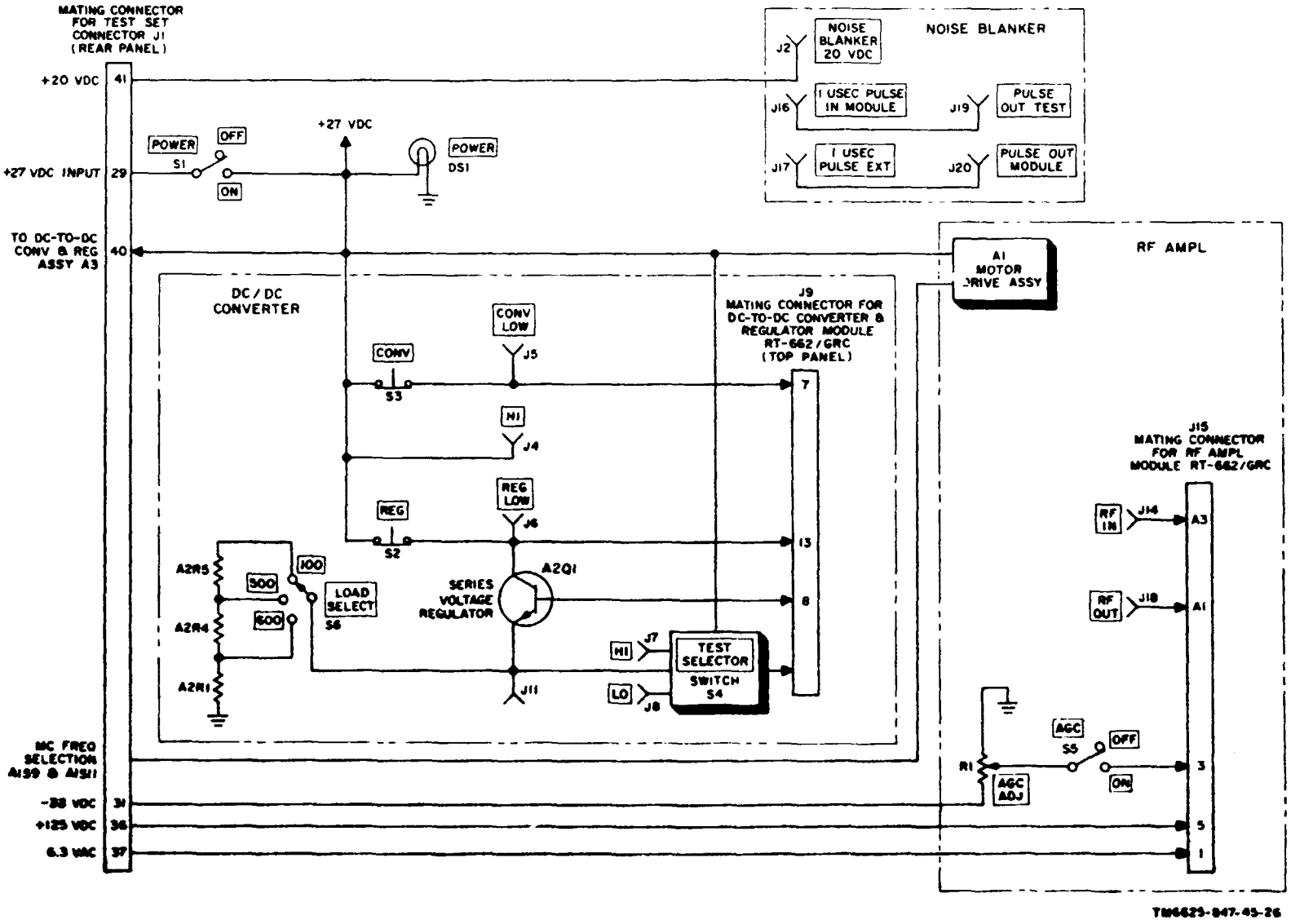


Figure 1-11. Common module tray, A1A1, simplified schematic diagram.

two-tone signal from either the internal IF oscillator modules, 1.7515 MC and 1.7525 MC, or an external two-tone signal generator source, depending on the position of AGC SYNC switch S6. When in the ON position, the KEY switch on the test set supplies +20-volt dc through pin 98 of connector J1 to ALC APC PPC CONTROL-POWER CONTROL resistor R6. The output of the ALC APC PPC CONTROL-POWER CONTROL resistor is selected by ALC APC PPC CONTROL-APC/PPC SEL switch S9, to pin 7 of connector J25 in the APC position, and to pin 8 of connector J25 in the PPC position. When in the ON position, ALC APC PPC CONTROL-ALC switch S10 connects the output voltage of the ALC APC PPC CONTROL-POWER CONTROL resistor R6 to pin 6 of connector J25.

1-17. TEST SELECTOR Switch S7

(fig. 6-8)

a. TEST SELECTOR switch S7 controls the selection of the XMTR IF AND AUDIO test points HI and LO for voltage measurements at the connector pins on the transmitter IF and audio module when connected to JS as follows: position 1 connects to the +20-volt dc input to connector J8 at pin 1; position 2 measures the ALC meter output voltage at pin 4 of J8; position 3 monitors the voltage level of ALC APC PPC CONTROL-POWER CONTROL resistor R6; with a shorting bar connected across the XMTR IF AND AUDIO test points HI and LO, position 4 of the TEST SELECTOR switch supplies + 27-volt dc to KEYLINE test point RT and to pin 31 of J25; with a shorting bar connected across the XMTR rF AND AUDIO test points HI and LO, position 5 of the TEST SELECTOR switch supplies +27-volt dc to KEYLINE test point PA and to pin 32 of connector J25. In the CW position, the SERV SEL switch on the test set supplies a ground on pin 14 of J25, +20-volt dc to pin 13 of J25 and a ground to pin 30 of J25 with the HEY switch at ON. A ground is supplied to pin 22 in either the CW or FSK positions of the SERV SEL switch. In the AM position, the SERV SEL switch supplies a ground to pin 9 of connector J25. In the XMIT position, the REC XMIT switch on the test set supplies a 1-16 ground to pin 24 and + 20-volt dc to pin 2 of connector J25; with the switch in the REC position, pin 24 receives + 20-volt dc and pin 2 is grounded.

b. Test point AUDIO OUT measures thus audio output signal at pin 19 of connector J25 across the 100-ohm load of resistor R8. INPUTS test points 50 a AUDIO and 1 KC PULSE connect external test equipment to the transmitter IF and audio module. The IF output frequency of the transmitter IF and audio module at pin Al of connector J25 is measured across the 51-ohm load of resistor R2 at COMMON test point IF OUT.

1-18. VOICE MODES Switch S8

(fig. 1-12 and fig. 6-8)

a. VOICE MODES switch S8 controls the ground to pin 29 and 27 of transmitter IF and audio module connector J25. In the PUSH TO TALK position, a ground is supplied to pin 27 of J25 and supplies a ground to pin 99 of connector J1. The ground at pin 99 is connected through the VOICE MODES switch in the PUSH TO TALK position, contacts 6 and 8 of pin 75, connector J1. The ground is then coupled through the SSB/NSK or AM positions of the SERV SEL switch on the test set to pin 76 of connector J1 and to pin 29 of J25. In the PUSH TO VOX position of S8, pin 27 of connector J25 is grounded as follows. The ON position of the KEY switch on the test set supplies a ground to pin 99 of connector J1. Pin 99 is jumped to pin 86 on connector J1 by tray A1A2, and the ground at pin 86 is then connected to the SERV SEL switch on the t set. The SERV SEL switch, in positions SSB/ NSK or AM, connects the ground to pin 79 of J1 through contacts 5 and 3 of the VOICE MODES switch. In the PUSH TO VOX position of the VOICE MODES switch, connection is made to pin 27 of J25; in the VOX position, pin 27 of connector J25 is grounded as follows. In the SSB/NSK or AM positions, the SERV SEL switch on the test set supplies a ground to pin 87 of connector J1, and pin 87 of J1 is connected through contacts 9 and 3 of the VOICE MODES switch; in the VOX position of the VOICE MODES switch, connection is made to pin 27 of connector J25.

b. For testing the receiver IF module of the RT-662/GRC, the external audio signal from the COMMON AUDIO 600 Ω IN connector is connected directly to pin 3 of receiver IF module connector J17. The 1.7500-mc signal is supplied to pin A4 of connector J17 from the test set IF OSCILLATOR (1) 1.75 MC module. From the mixer module on the test set, pin A2 of connector J17 receives a two-tone signal from either the internal IF oscillator modules of the test set, 1.7525 MC 1.7515 MC, or an external two-tone signal generator source, depending on the position of RCVR IF AGC SYNC switch S6. The IF output of the receiver IF module is amplified by amplifier, assembly Al and supplies to test point AMPL IF OUT.

1-19. RCVR IF TEST SELECTOR Switch S4
(fig. 1-12 and fig. 6-8)

a. RCVR 'IF TEST SELECTOR switch X4 controls the selection of the RCVR IF test points HI and LO for voltage measurements of the receiver IF module at connector J17. The positions of the switch are discussed in *b* below.

b. Position 1 connects to the -33-volt dc input voltage at pin 6 of J17. Position 2 monitors the level of the voltage controlled by RF GAIN control resistor R4 at pin X of connector J17. Position 3 monitors the voltage level controlled by BFO TONE control resistor R3 at pin 11 of connector J17. Position 4 connects to pin 29 of connector J17 for audio output measurements. Position 5 monitors the S-meter voltage at pin 7 of connector J17.

c. The CW position of the SERV SEL switch on the test set supplies +20-volt dc to BFO TONE control resistor R3 at pin 10 of connector J 17. The ON position of RCVR IF AGC switch 55 supplies -20-volt dc to pin 15 of connector J17. Pin 13 of connector J17 if grounded when the XMIT STATUS switch on the test set is set to TUNE. The REC/SMIT switch on the test set supplies +20-volt dc to pin 9 when in the SMIT position and ground when in the REC position. RF AGC OUTPUT test point is connected to pin 5 of connector J17 for age measurements. AGC SYNC test point is connected to pin 5 of connector J17 for age measurements. AGC SYNC test point J14 externally triggers an oscilloscope with a +27-volt signal when AGC SYNC switch S6 is set to ON.

1-20. Common Module Tray A1A2 Electronic Circuits (fig. 6-9)

NOTE
When partial reference designators are used, prefix with common module tray A1A2 reference designator A1A2, unless otherwise specified.

The 1.75-mc input to amplifier assembly A1 is amplified approximately 20 decibels (db). The input to the amplifier is coupled to transmit IF transistor A1Q3 by capacitors A1C3 and A1C6. The amplifier output of transistor A1Q3 is coupled through capacitor A1C15 to the voltage divide circuit consisting of resistor A1R20 and the collector—to emitter and collector-to-base resistance of transistor A1Q4. The amount of control provided by this variable voltage divider depends on the dc level of the base of A1Q4 that is controlled by variable resistor A1R14. Resistor A1R14 is used to adjust the overall gain of the amplifier. The output of the voltage divider is coupled to the base of transistor A1Q6 by capacitor A1C19. The output from transistor A1Q6 is coupled to connector A1J1 by transformer A1T2 for application to the IF OUT connector.

1-21. Synthesizer Test Tray A1A3
(fig. 1-13 and fig. 6-10)

NOTE
Prefix reference designators with synthesizer test tray A1A3 reference designator A1A3, unless otherwise specified.

a. Figure 1-13 shows the controls, test points, connections, and mechanical coupling available on tray A1A3 for testing the mc synthesizer module, the frequency standard module, the 10 and 1-kilocycle (kc) synthesizer module, the 100-ke synthesizer module, and the frequency divider module of the RT-662/GRC. On tray A1A3 the testing of an individual module requires stimulus inputs from one or more of the other modules that are to be tested by the tray.

b. The +27-volt dc primary power input to tray A1A3 is controlled by POWER switch S1. In the ON position, POWER switch S1 supplies +27-volt dc primary power to POWER indicator DS1, to pin 3 of frequency standard

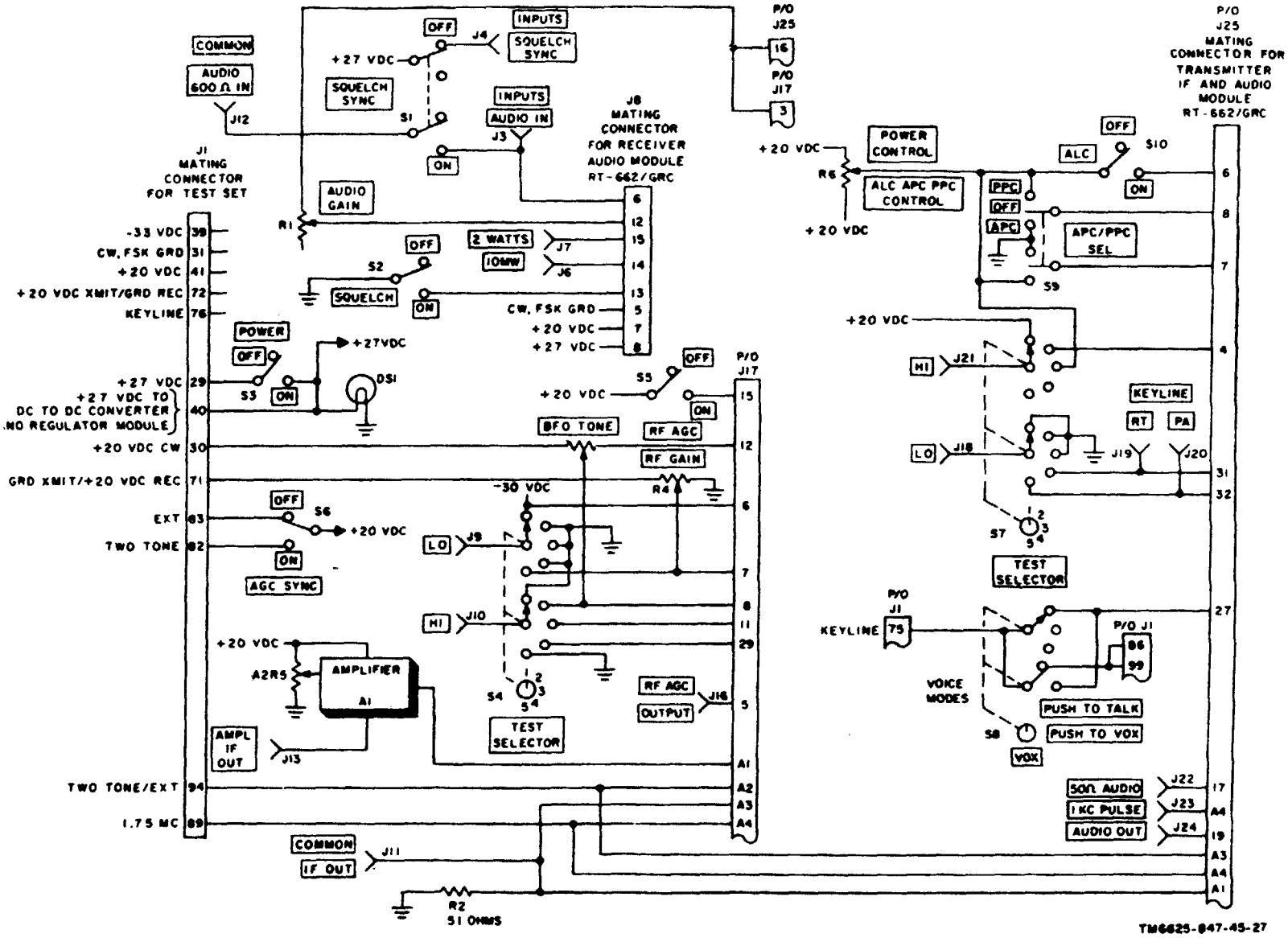


Figure 1-12. Common module tray A1A2, simplified schematic diagram.

module connector J7 (fig. 6-10), to the emitter of voltage regulator transistor Q1, and to pin 40 of tray A1A3 connector J1, energizing the converter section of the dc-to-dc converter and regulator module on the test set. The + 20 volt dc input to tray A1A3 is connected to contact terminal 2 (wiper), section B, of MODULE SELECT switch S3. The output voltage from the collector of voltage regulator transistor Q1 is connected to contact terminal 3 of FIXED/VAR switch 82 and is controlled by POWER ADJ resistor RI. FIX/VAR switch S2 selects the voltage to contact terminal 1, section A, of MODULE SELECT switch S3. In the FIXED position, the FIXED/VAR switch supplies the fixed level + 20-volt dc from the test set to the module selected by MODULE SELECT switch S3. When S2 is in the VAR position, the voltage output of voltage regulator transistor Q1 is supplied to the module selected by MODULE SELECT switch SS. The remaining modules of the RT-662/GRC installed on tray A1A3 receive the fixed level +20-volt dc from the test set.

Note. The modules of RT-662/GRC that are mounted on tray A1A3 are part of the SM-442A/ GRC.

c. The frequency standard module of the RT-662/GRC provides a 1-mc RF output signal to amplifier module AR1 (fig. 1-13), a 10-mc RF output signal to amplifier module AR2, and a 500-kc RF output signal to the frequency divider module. The amplified RF out qf amplifier AR1 is the 1-mc input to the mc synthesizer module. Motor positioner A2 positions the mc shaft coupler of the mcsynthesizer module to the position representative of the frequency selected by the MC FREQ controls on the test set. The mc synthesizer module also provides a high-lo frequency band signal to the 100-kc synthesizer module and to the translator module. The high lo signal controls the switching of the frequency bands on these modules. MC SYNTH HI/ LO indicators DS2 and DS3 (fig.-10) provide visual indication of the frequency band selected by the mc synthesizer module. The amplified RF output of amplifier AR2 is the 10 mc input to the 100-kc synthesizer module. The 500-kc input to the frequency divider module provides the 1-kc pulse output and the 10-kc spectrum output as inputs to the 10 and 1-kc synthesizer module and a 100-kc spectrum input to the 100-kc synthesizer module. FREQ SHIFT switch S4 is used to check the crystal oscillators on the frequency divider module. The 10-kc and 1-kc shaft couplers for the 10 and 1-kc synthesizer module are controlled by the FREQ SELECT 10 KC and 1 KC controls. The 7.1-mc output of the 10 and 1-kc synthesizer module is amplified by amplifier assembly AR5 and supplied to the 100 kc synthesizer module. The output of the 100 kc synthesizer module is one of the inputs to the translator module. The output of the 10 and 1-kc synthesizer module is amplified by amplifier assembly AR4 and is one of the inputs to the translator module. The RF output signal of the mc synthesizer module is amplified by amplifier assembly AR3 and is one of the inputs to the translator module.

d. The amplified output of the mc synthesizer module is measured at the MC SYNTH OUTPUT connector. The 1 MC output of the frequency standard module is measured at FREQ STANDARD OUTPUT connector 1 MC. The amplified 10 MC output of the frequency standard module is measured at FREQ STANDARD OUTPUT connector 10 MC. The output of the 100 kc synthesizer module can be measured at 100 KC SNYTH OUTPUT connector. The 7.1-mc output of the 10 and 1-kc synthesizer module is measured at the 10 & 1 KC SYNTH OUTPUT connector 7.1 MC. The amplified 10 and 1-kc synthesizer module outputs to the translator module are measured at 10 & 1 KC SYNTH OUTPUTS connector 10 & 1 KC. The outputs of the frequency modules are measured at FREQ DIVIDER OUTPUTS connectors 1.75 MC J11, 10 KC SPECTRUM J15, 1 KC PULSE J14, and 100 KC SPECTRUM J10. The outputs of the translator module can be monitored at TRANSLATOR OUTPUTS, RCVR IF and XMTR RF. Translator module inputs can be monitored at connectors TRANSLATOR INPUTS, RCVR RF and XMTR IF. The 5-mc signal from the frequency standard module can be monitored at FREQ STANDARD 5 MC EXT/INT connector J5.

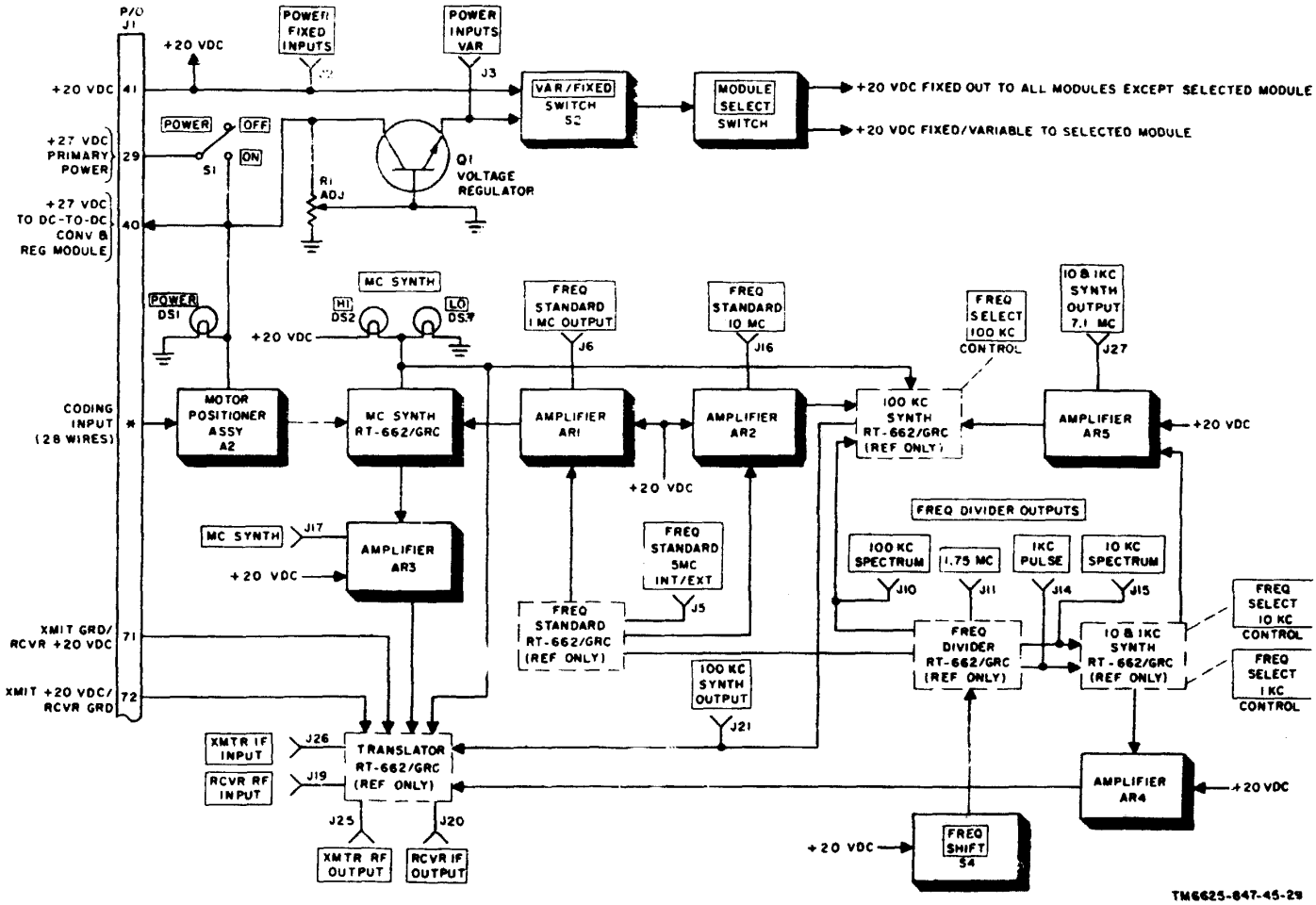


Figure 1-13. Synthesizer test tray A1A3, simplified schematic diagram

1-22. Synthesizer Test Tray A1A3 Electronic Circuits (fig. 6-11 and 6-12)

Note. Where partial reference designators are used, prefix with synthesizer test tray A1A3 reference designator A1A3, unless otherwise specified

a. Amplifier modules AR1 through AR5 are used to amplify the RF output signals of the RT-662/GRC modules on tray A1A3. The amplifier module consists of POWER switch S1, VOLT ADJ control RI, and two-stage transistor amplifier board A1.

b. The RF input to the amplifier module is controlled by AMPL ON/OFF switch S1. With S1 in the OFF position, the input at J1 to the amplifier module is connected directly to output connectors J3 and J2 by passing the amplifier board. With S1 in the ON position, the rf input signal to the amplifier module is coupled to the base of first stage transistor A1Q1 by capacitor A1Q2. The amplified output of A1Q1 is sampled by the position of the wiper arm of VOLT ADJ collector load resistor R1. The sampled portion of the amplifier signal is the input to the base of second amplifier A1Q2. The amplifier output of A1Q2 is coupled from the emitter by capacitor A1C5 through the bandpass filter, consisting of inductor A1L1 and amplifier A1C6, on amplifier modules AR1, AR2, AR4, and AR5, to contact terminal 4 of AMPL ON/OFF switch S1. On amplifier module AR3, inductor A1L1 and capacitor A1C6 are connected in a band reject configuration (fig. 6-12) between the output of A1Q2 and ground. The ON position, the AMPL ON/OFF switch connects the amplified output of A1Q2 to output connects 33 and J2.

1-23. Converter and Control Tray A1 A4 (fig. 1-14 and fig. 6-18)

Note. Prefix reference designation with converter and control tray A1A4 reference designator A1A4, unless otherwise specified.

a. Figure 1-14 shows the various controls, indicators, connectors stimulus inputs, resistive loads, and test points available on tray A1A4 for testing the inverter assembly, the front panel assembly, and the inputs of the antenna coupler assembly on the AM-349/GRC-106.

b. The + 27-volt dc input to tray A1A4 from the test set is controlled by POWER switch S1. The ON position, POWER switch S1 supplies + 27-volt dc primary power to POWER indicator DS1; to CONTROL TEST indicators A1 through A5, B1 through B5, and C1 through C5; to GRID DRIVE control resistors R3 and A1R4; and to pin 40 of connector J1, energizing the converter section of dc-to-dc converter and regulator module AS on the test set.

c. When testing the inverter assembly on the AM-3349/GRC-106, INPUT CURRENT switch S6 permits s current measurements of the input +27-volt dc primary power across test points HI and LO TEST SELECTOR switch S8 controls the selection of test points HI and LOA for voltage measurements of the inverter assembly at connector J12. Position 1 of TEST SELECTOR switch S8 connects the test points to +27-volt dc primary power at 10 AMP fuse F1. When switch S8 is in position 2, the test points are connected to pin 9 of J12 for measuring the voltage drop across load resistor R9 in the test set. With the switch in position 3, the test points measure the voltage drop across resistor A2R1 at pin 6 of J12. Position 4 of the TEST SELECTOR switch connects the test points to pin 13 of J12 for measuring the voltage drop across resistors A2R2 and A2R3. With the switch in position 5, the test points connect to pin 1 and 2 of J12 for measuring the voltage drop across resistor R8 on the test set. EXTERNAL BLOWER switch S7 in the HI position connects pin 10, connector J12, and in the LO position, pin 11, connector J12, to load resistor R9 on the test set.

d. When testing the AM-349/GRC-106 front panel assembly at connector J2, CONTROL TEST indicator C5 indicates a ground at pin 23 of connector J2. CONTROL TEST indicators A1 through AS indicate grounds at pins 6 through 10 of J2, respectively. CONTROL TEST indictors B1 through B4 indicate grounds at pins 17, 18, 14, and 20 of J2, respectively. CONTROL TEST indicators C2, C3, and C4 indicate voltages at pins 4, 11, and 12 of connector J2, respectively. PA METER TEST GRID DRIVE control RS controls the level of the dc voltage to pin 25 of connector J2. PA METER TEST ANTENNA LOAD/

TUNE control R1 controls the level of the dc voltage to contact terminal 2 of LOAD/ ANT. TUNE switch S5. The ANT. LOAD/ ANT. TUNE switch connects to pin 30 of J22 when set to ANT. LOAD, or to pin 28 of J2 when set ANT. TUNE. PA METER TEST ALC METER control R2 controls the level of the dc voltage to pins A3, 27, and 32 of connector J2 (fig. 6-13).

e. Testing the inputs to the antenna coupler assembly at connector J3, AM-3349/GRC, CONTROL TEST RF BAND/50 a /WHIP switch S2 selects the pans on connector J3 monitored by CONTROL TEST indicators Al through A5, B1, and B2 for the three positions of the switch, CONTROL TEST ANT. MOTOR CONTROL CODE switch S4 grounds pin 23 of connector J3 when in the RF BAND position, and pin 12 when in the CAP position. CONTROL TEST ANT. MOTOR CONTROL MONITOR switch S3 selects the pins of J8 monitored by CONTROL TEST indicators B5 and C1. CONTROL TEST indicator B5 indicates a ground at pin 14 on connector J3 when S3 is set to CAP. or one at pin 22 when S3 is set to RF BAND. CONTROL TEST indicator C1 indicates voltage at pin 14 on connector J3 when S3 is set to CAP. or voltage at pin 22 when S3 is set to RF BAND.

1-24. Driver, Discriminator, and Antenna Coupler Tray A1AS

(fig. 1-15 and fig. 6-14)

Note. Prefix reference designators with driver, discriminator, and antenna coupler tray A1A5 refer mc designator A1A5, unless specified

a. Figure 1-15 shows the various controls, connectors, indicators, stimulus inputs, and test points available on tray A1A5 for testing the relay assembly, antenna coupler driver assembly, and discriminator assembly on the AM-349/GRC-106.

b. The + 27-volt dc input to tray A1A5 (fig. 6-14) from the test set is controlled by POWER switch S1. The ON position of POWER switch S1 supplies + 27-volt dc primary power to POWER indicator DS1; to contact terminal 4 of DRIVER TEST SELECTOR switch S2; to RELAY indicator 1; and to pin 40 of connector J1, energizing the converter section of the dc-to-dc converter and regulator module A3 on the test set.

c. When testing the driver assembly on the, AM-349/GRC-106, DRIVER TEST SELECTOR switch S2 controls the selection of test points HI and LO for voltage measurements at connector J3 on the A1AT1 attenuator assembly. Position 1 of the TEST SELECTOR switch connects the test points to pin 2, connector A1AT1J3, for ac filament voltage. With switch S2 in position 2, the test points are connected to pin 1 of A1AT1J3 for + 200-volt dc B + voltage measurements. Position 3 connects the test points to pin 4 of A1AT1J3 for meter voltage measurements across load resistor A2R1. Position 4 monitors the + 27 vdc bias input voltage to the driver module. Position 5 connects the test points across resistor A2R1 to ca the current-resistance (IR) drop which determines driver current. DRIVER BAND S switch A151 selects, mechanically, load transformers for testing the output of the driver assembly at 3.25 me, 15.5 me, and 29.5 mc.

d. For discriminator assembly test DIS CRIMINATOR. TEST SELECTOR itch S3 controls the selection of DISCRIMINATOR test points HI and LO for voltage measurements of the discriminator assembly at connector J3. Position 1 of the switch S3 connects the test points across connector J8, pins 7 and 1; position 2 connects the test points across connector J3, pins 8 and 2; position 3 measures the signal at pin 10 of connector TS.

e. When testing the RELAY assembly connected to connector J10, RELAY CONTROL switch S4 supplies ground to pi 5, 9, 2, and 11 of connector J10, in position 2, 3, 4, and 5, respectively. Position I is open. RELAY Indicator 1 indicates + 27-volt &at pin 6 of J10; RELAY indicators 2 through 6 indicate, ground at pins 7, 8, 4, 1, and 8, respectively; RELAY indicator 7 ground at pin 12 J10.

f. The antenna coupler test at connector J11 uses ANTENNA COUPLER CODE switch S5 for the simulation of coding information to the pins of connector J11 selected by the ANTENNA COUPLER 50 Ω DUMMY LOAD/COUPLER TERMINATION WHIP/50 Ω DOUBLET switch S6. ANTENNA COUPLER CAP. MOTOR indicator DS3 indicates a ground at pin 12 and + 27-volt dc at pin 14 of J11. ANTENNA (COUPLER BAND SW MOTOR indicator DS4 indicates a ground at pin 22 and + 27-volt dc at pin 28 of connector J11.

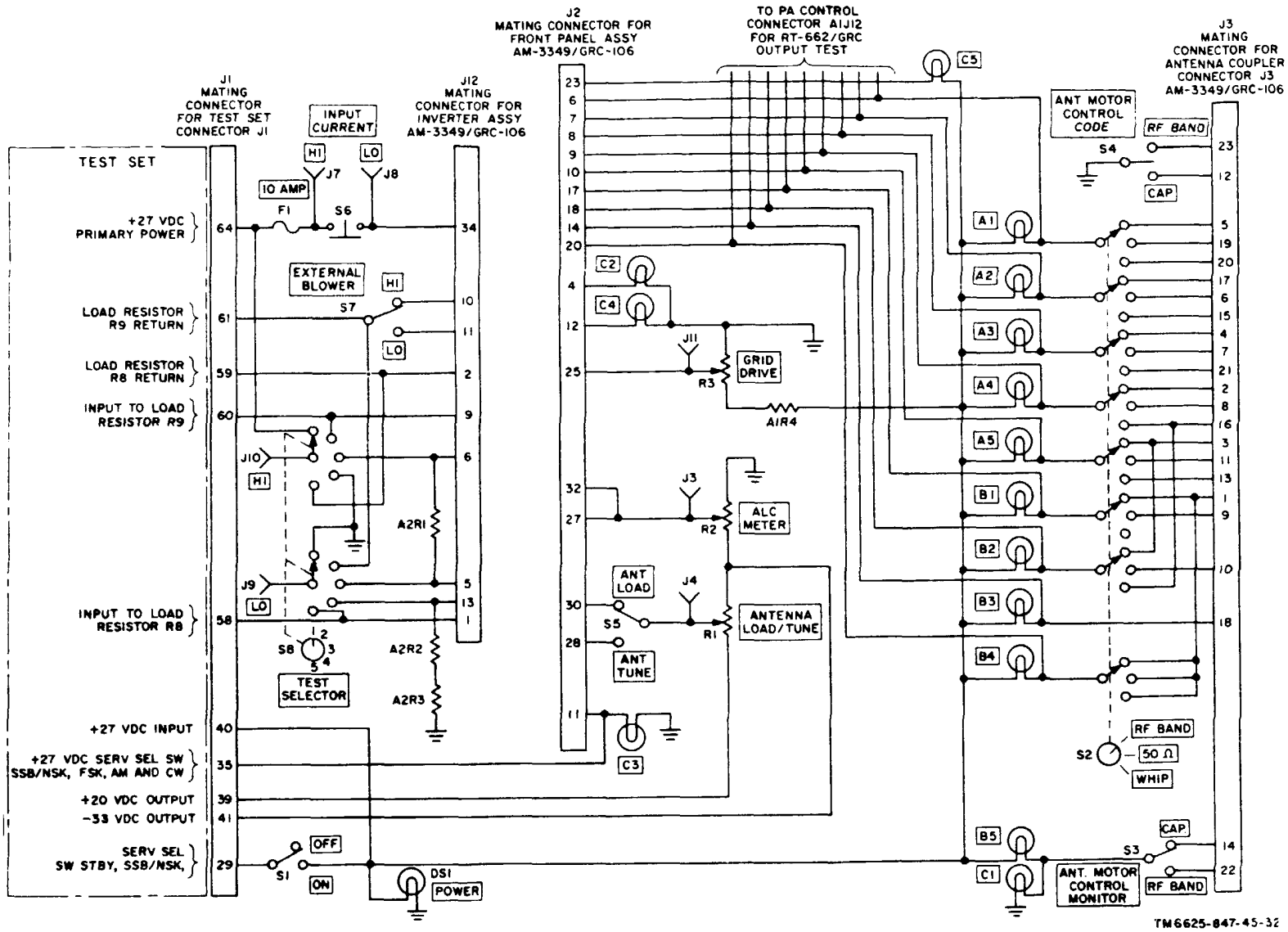


Figure 1-14. Converter and control tray A1A4, simplified schematic diagram.

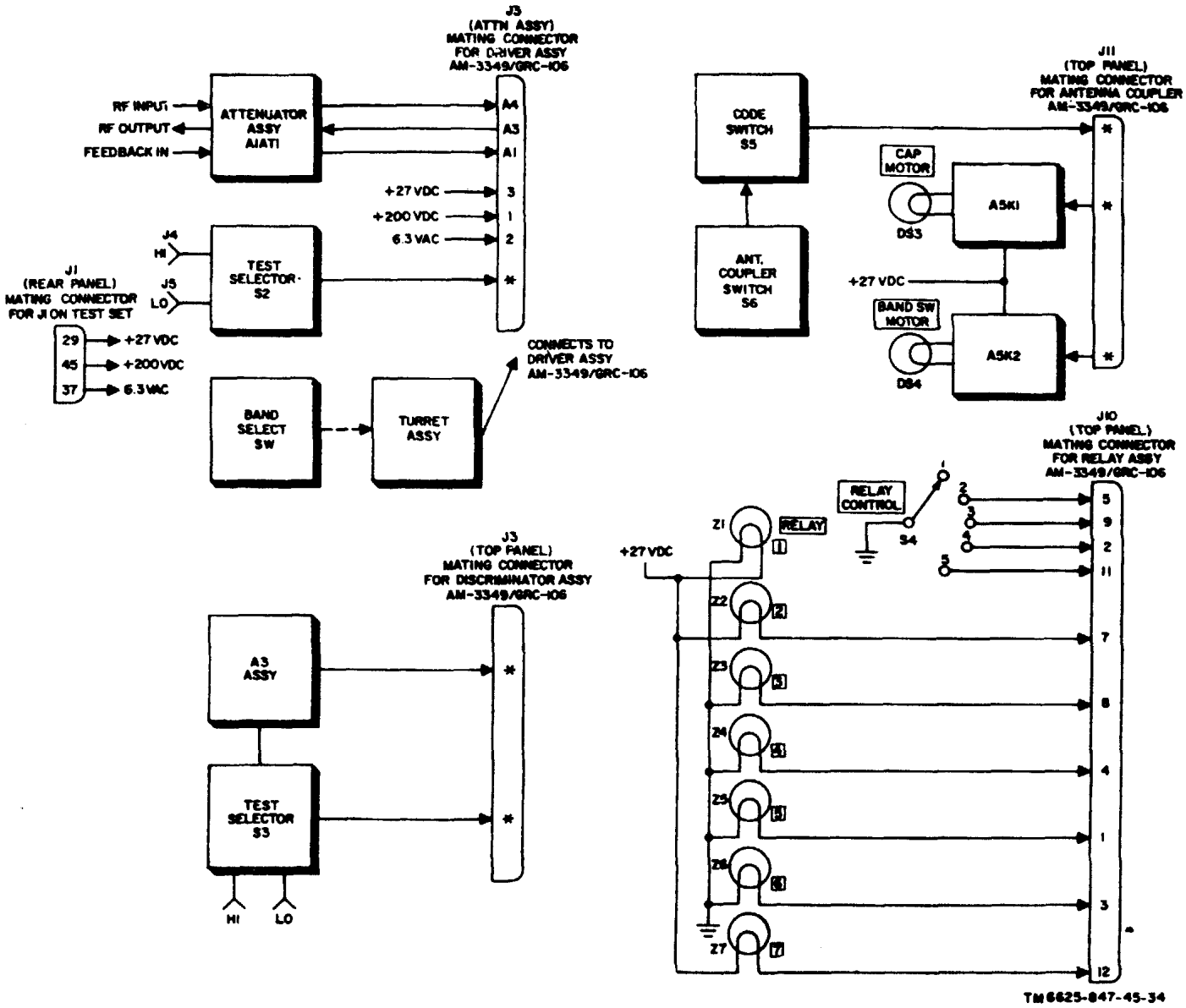


Figure 1-15. Driver, discriminator and antenna coupler tray A1A5, simplified diagram.

Section IV. FUNCTIONAL OPERATION OF MECHANICAL ASSEMBLIES

1-25. General

Paragraphs 1-26 through 1-28 discuss the Technical assemblies located on tray A1A1, tray A1A3, and tray A1A5 of the SM-442A/ GRC.

1-26. Common Module Tray A1A1

(fig. 1-11, fig. 1-16, fig. 3-17(1), and fig. 6-7)

a. The operation of the mechanical module couplers on tray A1A1 are controlled by the RF AMPL 100 KC SELECTOR knobs on the top panel of the tray. The rotation of the knobs is transferred to the appropriate coupler by sprocket gears on the shafts of the selector knob and coupler, connected by a loop drive chain. An adjustable idler sprocket gear between two sprocket gears is used to adjust the slack from the drive chain.

b. The gear drive assembly provides the mechanical means of position the RF AMPL mc coupler on the RF amplifier module of the RT-662/GRC when connected to tray A1A1. The frequency coding information input to drive assembly A1 for positioning the mc coupler is received as a ground on one of the 28 input lines as selected by the MC FREQ 10 MC and 1 MC frequency selector switches on the test set. The gear drive assembly is an open circuit seeking assembly that consists of switch A1S1, relay A1K1, motor A1B1, and associated gearing and mechanical couplers.

Note. Where only partial reference designation are used, prefix with comma module tray A1A1 reference designator A1A1, unless otherwise specified.

c. Refer to figures 1-16 and 6-7 in the following discussion. Switch A1S1 is a 28-position rotary switch positioned by the shaft of motor A1B1. A ground on one of the contact terminals of switch A1S1 will energize relay A1K1 if the shaft of motor A1B1 is not at a position that is representative of the frequency selected on the test set. Relay A1K1, when energized, supplies +27-volt dc to energize motor A1B1. motor A1B1 will then rotate and reposition the mc shaft coupler and connecting switch A1S1 until an open circuit is reached. Upon reaching an open circuit, switch A1S1 will deenergize relay A1Kl, removing the + 27-volt dc from motor A1B1. The mc shaft coupler will then be at a position that is representative of the frequency selected.

1-27. Synthesizer Test Tray A1A3 (fig. 1-13 and fig. 6-10)

a. Motor drive assembly A2 provides the mechanical means of positioning the mc synthesizer module (on the RT-662/GRC) shaft coupler. The frequency coding information input to motor drive assembly A2, for position the mc coupler, is received as a ground on one of the 28 input lines as selected by the MC FREQ 10 MC and 1 MC frequency selector switches on the test set. The motor drive assembly is an open-circuit seeking assembly that consists of switch A2S1, relay A2K1, motor A2B1, and associated gearing and mechanical couplers.

Note. Where partial reference designators are used, prefix with synthesizer test tray A1A3 reference designator A1A3, unless otherwise specified

b. Refer to figure 6-10. and figure 6-14 during the following discussion. Switch A2S1 is a 28 position rotary switch positioned by the shaft of motor A2B1. A ground on one of the contact terminals of switch A2S1 will energize relay A2K1 if the shaft of motor A2B1 is not at a position that is representative of the frequency selected on the test set. Relay A2K1, when energized, supplies +27-volt dc to energize motor A2B1. Motor A2B1 will then rotate and reposition the mc shaft coupler and switch A2S1 until an open circuit is reached. Upon reaching a open circuit, switch A2S1 will deenergize relay A2K1, removing the +27-volt dc from motor A2B1. The mc shaft coupler will then be at a position that is representative of the frequency selected.

1-28. Driver, Discriminator, and Antenna Coupler Tray A1A5

(fig. 1-15 and fig. 6-14)

The operation of turret assembly A1A1 is controlled by the DRIVER BAND SEL switch on the top panel of tray A1A5. The BAND

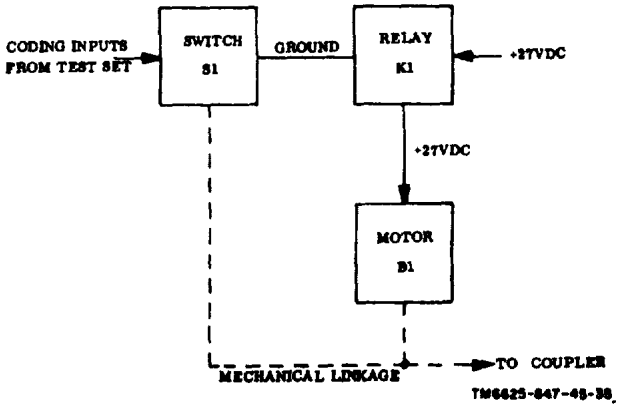


Figure 1-16. Gear drive assembly functional block diagram

SEL control is connected to the turret assembly by a loop drive -chain connected to sprocket gears on the shafts of the turret assembly and the BAND SEL control. Rotating the BAND SEL control positions the turret assembly to one of three detented positions, 8.25 MC, 15.5 MC, and 29.5 MC, representing the low, middle, and high ends of the frequency band o the driver assembly on the AM-3349/GRC2 106. Transformers T1, T2, and T3, mounted on the turret assembly, provide the proper impedance loads for the driver assembly (when mounted on tray A1A5) for the frequencies selected. The wiper contacts on the appropriate transformer mesh with the contacts on the driver assembly when the turret assembly is In a detonate position. When the turret assembly is not in a detonate position (rotating), microswitch A1S1 disconnects the + 200-volt dc B + supply voltage from the driver assembly and extinguishes 200 VDC indicator DS2.

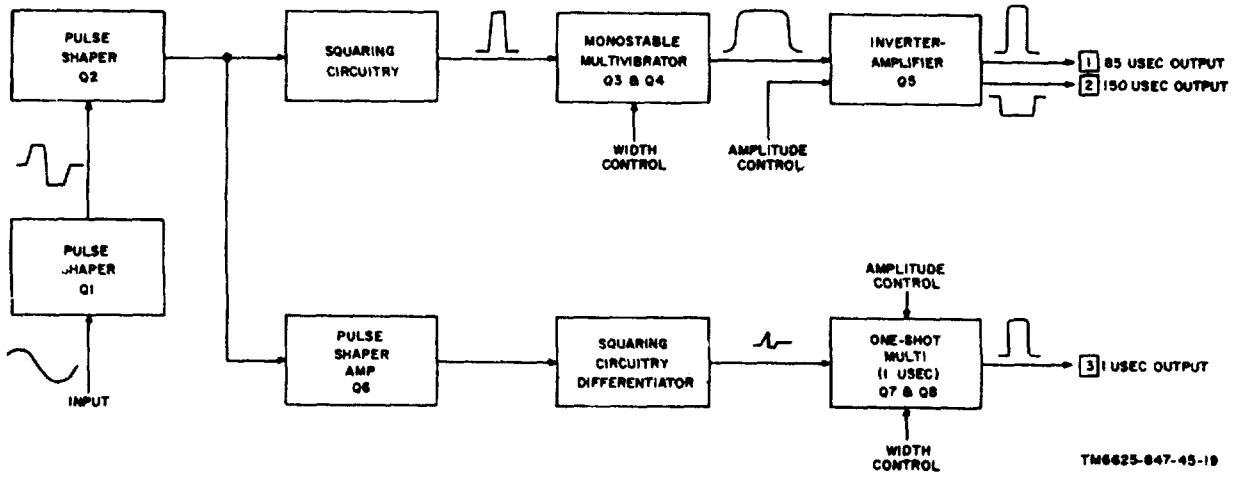


Figure 1-17. Test set pulse generator assembly block diagram.

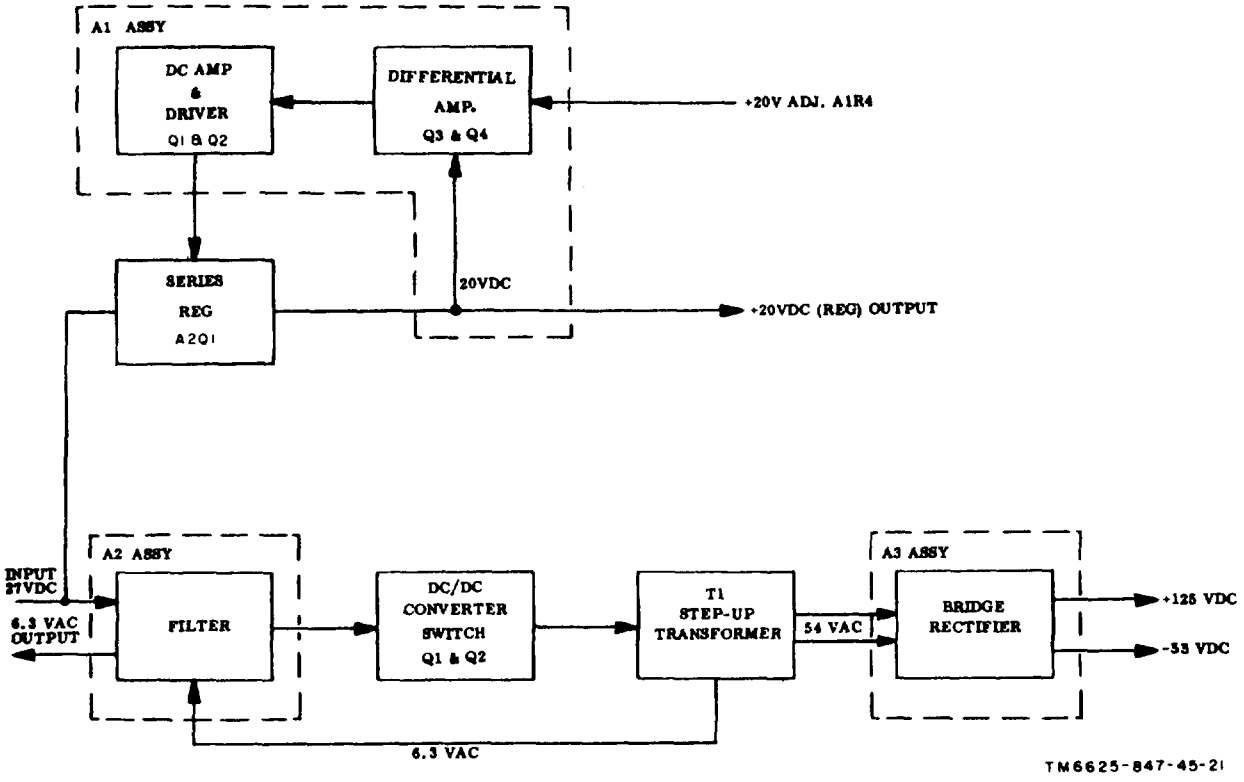


Figure 1-18. Test Set dc-to-dc converter and regulator module A3, block diagram

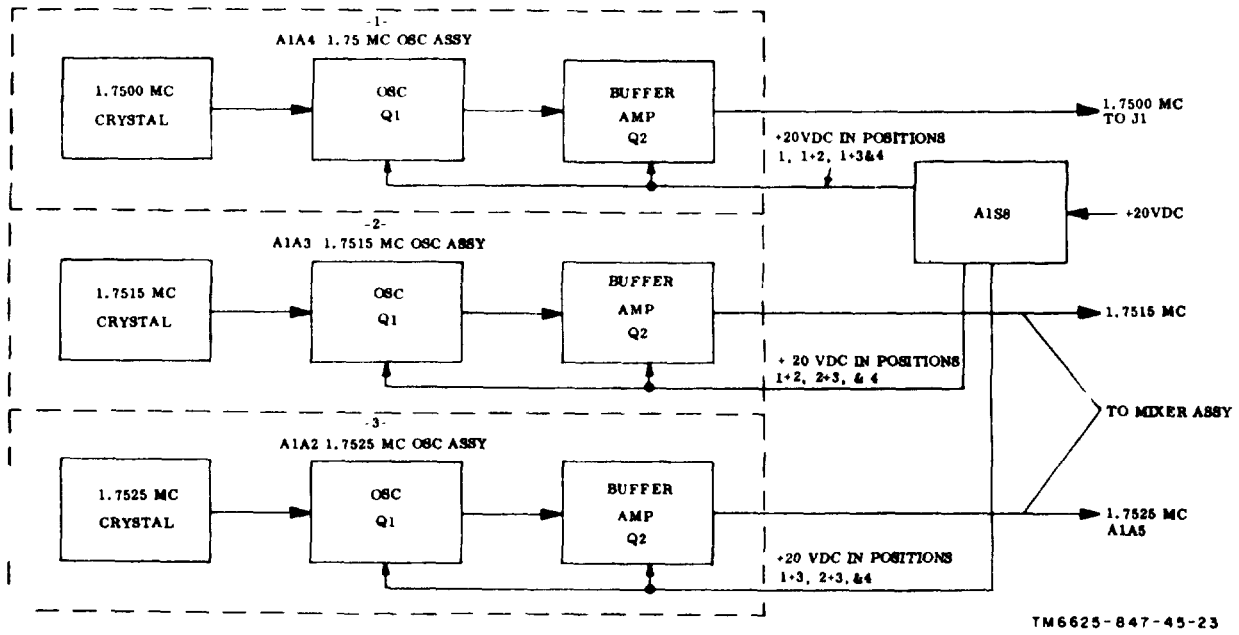


Figure 1-19. Test set IF oscillator section, block diagram

CHAPTER 2

TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

Warnings:

1. Voltages as high as 200 volts dc and 115 volts ac exist in the SM-442A/GRC. Be extremely careful when working on the equipment when it is out of its case.

2. Operation and maintenance personnel should be familiar with the requirements of TB SIG 291 before attempting installation, operation, or repair of the SM-442A/GRC.

2-1. General Instructions

Troubleshooting at the GS and depot maintenance categories includes all the techniques outlined for organizational maintenance and any special or additional techniques required to isolate a malfunction to a specific functional circuit or stage and then to locate the defective part or parts. Section II, (paras 2-18 through 2-23) provides intraunit (within the unit) troubleshooting procedures to be used by the GS category maintenance personnel in localizing and isolating circuit malfunctions within the modules and subassemblies of the SM-442A/GRC.

2-2. Organization of Troubleshooting Procedure

a. General. The first procedure in servicing the modules and subassemblies of the SM-442A/GRC is to sectionalize the fault, which means tracing the fault to a functional circuit such as the regulator circuitry in dc-to dc converter and regulator module A3 of the test set. the second procedure is to localize the fault by tracing the trouble to a stage within a defective functional circuit. The third and final procedure is to isolate the trouble to a defective part or parts responsible for the fault. Some defective parts, such as burned resistors and arcing, shorted transformers can often be located by sight, smell, and hearing. Most defective parts, however, must be isolated by checking voltages and resistances.

b. *Sectionalization*. The SM-442A/GRC consists of five test trays which are used, independent of each other, with the test set. The first procedure in tracing the trouble in the module or subassembly is to locate the functional circuit at fault by the following methods:

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits.

All meter indications or other visual signs should be observed and an attempt made to sectionalize the trouble to a functional circuit within the module or subassembly being tested at the time.

(2) *Operational tests*. Operational tests frequently indicate the general location of the trouble. In many instances the tests will help in determining the exact nature of the fault. The operational performance given in paragraphs 4-1 through 4-12 for the individual modules and assemblies of the SM-442A/GRC can be used to sectionalize the trouble to a particular functional circuit.

c. Localization. Localization procedures should be performed after the trouble has been sectionalized (*b* above). The localization procedures

applicable to this equipment are listed in (1) and (2) below and should be used to localize the trouble to a stage within a defective functional circuit.

(1) *Troubleshooting chart*. The troubleshooting charts, paragraphs 2-18 through 2-23, list the symptoms of common troubles occurring within the modules and, subassemblies of the SM-442A/GRC and give (or references) corrective measures. The troubleshooting chart are to be used in conjunction with the performance tests given in paragraphs 4-1 through 4-12 as described in paragraph 2-4. The charts do not list all the troubles that may occur. The repairman should use these charts as a guide in analyzing symptoms that are not listed.

(2) *Stage gain charts*. The stage gain charts (paras 2-14 and 2-16) will help in locating difficult troubles that produce weak signals in amplifier modules AR1 through AR5 and IF amplifier module Al.

(3) *Wave shapes.* When troubleshooting the pulse generator module, compare the wave shapes in figure 1-17 with those obtained using the procedures in paragraph 2-10 and troubleshooting chart 2-19

d. Isolate Once the trouble has been localized to a particular stage of a functional circuit, the faulty components responsible for the malfunction can be isolated by applying one or more of the following procedures:

(1) *Voltage measure*. Th is equipment is transistorized. When making voltage measurements, use the same voltmeter specified ill the troubleshooting charts and the schematic diagrams of the modules and subassemblies. Use tape or sleeving (spaghetti) to insulate the entire test prod, except for the extreme tip.

(2) *Resistance measurements* .Make resistance measurements only as directed in the troubleshooting charts and schematic diagrams and in paragraph 2-17.

CAUTION: Before using any ohmmeter to test transistors or transistor circuits, check the open-circuit voltage across the ohmmeter test leads Do not use an ohmmeter or a multimeter it the open-circuit voltage exceeds 1.5 volts. Since the Rx1 range normally connects the ohmmeter internal battery directly across the test leads, the comparatively high current (50 ma or more) may damage the transistor under test. The Rx1 range of any ohmmeter should not be used when testing low-powered transistor

(3) Intermittent troubles. In all tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. Make a visual inspection of the wiring and connections to the units of the SM-442A/GRC. Minute cracks in printed circuit boards can cause intermittent operational A magnifying glass is helpful in locating defects in printed boards. Continuity measurements of printed conductors may be made using the same techniques ordinarily used on hidden conventional wiring; follow the ohmmeter precautions in (2) above

2-3. Test Equipment

The chart below lists the test equipment required for troubleshooting the SM-442A/GRC.

Test equipment	Technical manual	Federal stock No.
Multimeter AN/PSM-6B	TM 11-6625-475-10	6625-643-1686
Voltmeter, Electronic AN URM-145	TM 11-6625-475-10	6625-973-3986

Test equipment	Technical manual	Federal stock No.
Analyzer, Spectrum TS-723(*)/U*	TM 11-5097	6625-668-9418
Frequency Selective Voltmeter (equivalent to be selected).	None	None
Generator, Signal AN/URM-427.	TM 11-6625-683-15	6675-783-5965
Oscilloscope AN/USM-140(*)[b]	TM11-6625-535-15 and TM 11-4625-535-15-1.	6625-066-2525
Generator, Signal AN/URM-50.	TM 11-625-573-15	662-868-8353
Multimeter ME-26(*)/U[c]	TM 11-6625-200-12	6625-360-2493
Power Supply PP-3940/G ----------	TM 11-6130-247-15	6130-985-8136
Tee Connector UG-274B/U ----------	None	5935-702-0125
Test Cables W15, W1, W2, W3, W22, and W25.		
Charger, Battery PP-1451/G --------	TM 11-6130-236-12	6130-985-8157
Electronic Counter, Digital Readout, AN/USM-207.	TM 11-6625-700-10	6625-911-6368

[a]Analyzer, Spectrum TS-723(*)/U represents Analyzer, Spectrurn TS-733A/U, TS-723B/U, or TS-732C/U, or TS-723D/U.
[b]Oscilloscope AN/USM-140(*) represents Oscilloscope AN/USM-140A or AN/USM-140B.
[c]Multimeter MS-26(*)/U represents Multimeter ME-26A/U, ME-26B/U, ME-26C/U. or ME-26D/U.

Cautions:

1. Test set A2 contains transistor circuits. Never connect the 2 types of test equipments which have outputs directly to transistor circuits; use coupling capacitors. Some of the modules have input and output coupling capacitors in their circuitry; check the schematic diagram of the respective modular assembly.

2. Make test equipment connections with care so that short circuits will not be caused by exposed test equipment connectors. Tape or use sleeves (spaghetti) on test prods or clips as necessary to leave as little area exposed as needed to make contact to the circuit under test.

3. The test set is recommended as a source of power (para. 2-5) when servicing the transistorized modules and subassemblies. Observe the polarity of the power source. Polarity reversal may damage the transistors or electrolytic capacitors in the circuit. If a power -source other than the one contained in the test 9 is used, it must have good voltage regulator and low ac ripple. Good regulation is important because the output voltage of a power supply that has poor regulation may exceed i maximum voltage rating of the transistors the module or subassembly being tested.

2-4. Use of Troubleshooting Charts

Troubleshooting the SM-442A/GRC is based on the trouble localization and trouble isolation charts given in TM 11-6625-847-12 and the troubleshooting charts in paragraphs 2-18 through 2-23 of this manual. During troubleshooting, if trouble within the SM-442A is isolated to a module or assembly, perform or apply the corrective measures given in the chart. Refer to paragraph 2-17 for the proper technique in isolating defective parts within a stage. The troubleshooting charts given in TM 11-6625-847-12 are suitable for isolating SM-442A/GRC malfunctions of controls, switches, indicating lamps, modules, and subassemblies; however, they are not to be used to locate troubles within a defective module or subassembly. If organizational maintenance has not isolated a trouble to a control, switch, module, or subassembly, general support maintenance will start troubleshooting by using the troubleshooting checks in TM 11-6625-847-12 and performing the corrective actions cited.

2-5. Power Supply Requirements

Testing the various modules and subassemblies of the SM-442A/GRC requires connection to a power source of + 20-3 -, and + 27 volt dc, depending on the power requirements of the module or subassembly being tested. If

standard dc power supplies are not available, the + 20-volt dc supply voltage can be obtained from the front panel of the test set at DC VOLTAGE test points +20 and ground, and the -33 volt dc supply voltage from across test points RCVR IF HI and LO on tray A1A2, connected to the test set and energized, with the RCVR IF TEST SELECTOR switch set to position 1. The dc voltage required by the SM-442A/GRC is supplied by a 27-volt dc power source, connected to the POWER connector on the test. A typical power source for the set is given in paragraph 2-3. It has a voltage range of 20 .to 32 volts dc and a direct current range of 100 amperes, maximum.

2-6. General Troubleshooting Information

Information on the function and operation of test set and test tray controls, switches, and lamps is contained in TM 11-6625-847-12. Instructions for removal and replacement of modules, board assemblies, and component parts are given in paragraphs 3-1 through 3-54. When replacing any defective wiring or component parts, refer to the wiring and soldering instructions in notes, paragraph 3-12.

2-7. Troubleshooting Test Set Dc-to-Dc Converter and Regulator Module A3

When troubleshooting dc-to-dc converter and regulator module A3, perform the general support tests given in paragraph 4-6. Refer to figure 1-18 and the troubleshooting chart in paragraph 2-18 for localizing and isolating malfunctions.

2-8. Troubleshooting Test Set Dc-to-Dc Converter Module A2

Dc-to-dc converter module A2 is an encapsulated unit which is not repairable. To troubleshoot the module, perform the general support tests given in paragraph 4-5. Replace module A2 if any of the performance standards are not satisfied.

2-9. Troubleshooting Test Set Pulse Generator Module A1A1

When troubleshooting the pulse generator module, perform the general support tests given in paragraph 4-7. Refer to figure 6-4 and troubleshooting chart 2-19 for localizing. and isolating malfunctions. When checking pulse wave forms in pulse generator module A1A1, connect the test equipment as described in paragraph 2-10.

2-10. Test Set Pulse Generator Module A1A1 Waveform Check

Connect Tee Connector UG-274B/U to the output of Generator, Signal AN/URM-127. Connect one side of UG-274B/U to connector J1 on pulse generator assembly A1A1 and the other side to the trigger input on Oscilloscope AN/USM-140(*). Connect 20 volts dc between terminals 3 and 4 (ground) and -30 volts dc between terminals 14 and 4 (ground), using the test set as a power source (para. 2-5). Adjust the output of the AN/URM-127 to 500 cycles per second (cps) at 2 volts peak to peak. Connect the AN/USM-140(*) probe as directed in troubleshooting chart 2-19, and compare the waveforms obtained with those illustrated in figure 1-17.

2-11. Troubleshooting Test Set If. Oscillator Modules A1A2, A1A3, and A1A4

When troubleshooting any of the oscillator modules, perform the general support tests in paragraph 4-8. Refer to figure 1-19, figure 6-3 and figure 6-6 and the troubleshooting chart (para. 2-20) for localizing and isolating malfunctions. The only difference in the circuitry of the oscillator modules is the operating frequency of the crystal used in each module. When signal tracing in any of the oscillator modules, use the test set as a source of power and the AN/USM-140(*) with a probe having dc isolation. Make sure that one side of AN/USM-140(*) is grounded; connect the probe as directed in the troubleshooting chart (para. 2-20).

2-12. Troubleshooting Test Set Mixer Module A1A5

When troubleshooting mixer module A1A1, perform the general support tests in paragraph 4-9. Refer to figure 6-3 and the troubleshooting chart in paragraph 2-21 for localizing a isolating malfunctions.

1-13. Troubleshooting Common Module ray A1A2 If. Amplifier Module A1

When troubleshooting amplifier module A1, perform the general support tests in paragraph 4-10. Refer to figure 69 and the troubleshooting chart in paragraph 2-22 for localizing and isolating malfunctions. When the output of the if. amplifier module is abnormally low or distorted, make the stage gain measurement as indicated in paragraph 2-14 to localize the fault.

2-14. Stage Gain Measurements (IF Amplifier Module A1)

Connect test equipment to IF amplifier module as shown in figure 6-20. If a 20-volt dc power supply is not available, use the +20 volt dc output of the test set as described in paragraph 2-5.

a. Gain Measurements. Adjust the output of Generator, Signal AN/GRM-50 to 1 ± 0.2 millivolts (mv) at 1.75 megacycles. Connect a Multimeter ME-26(*)/U between terminal E5 and ground, and adjust 10-kilohm potentiometer A2R5 for an indication of + 1.5 volts. Leave the AN/GRM-50 connected between terminals E2 and E3 throughout test. Disconnect the ME-26(*)/U from terminal E5, and connect Voltmeter, Electronic AN/URM-145 as directed in the stage gain chart (*b* below).Compare the indications on the AN/URM-145 with those listed in the *Output of stage* column. Agreement within 10 percent indicates normal operation. Stage gain is computed by dividing the output voltage of the transistor stage under test by the input voltage to the transistor stage. The cumulative gain in decibels of the if. amplifier is computed by applying the following formula:

Gain in db = 20 Log E1/E2

E1 is the output voltage, and E2 is the input voltage to the if. amplifier module. Since the output voltage is 9.6 mv for an input of 1 mv, the cumulative gain in db is 20 Log 9.6 mv (20 x .9823) which equals 19.65. This result is within the design specifications of the if. amplifier module (gain of 20 ±0.5 db).

b. Stage Gain Chart.

Test connections		Voltage (mv)		Stage gain
AN/GRM-50	AN/U RM-145	Input to stage	Output of stage	
Between E2 and E3 (ground) -	Collector of Q3	1	3.2	3.2
Same as above	Collector J3 (Q6)	3.2	9.6	8

2-15. Troubleshooting Synthesizer Test Tray A1A3 (Amplifier Modules AR1 through AR5)

When troubleshooting amplifier modules AR1 through AR5, perform the general support tests in paragraphs 4-11 and 4-12. Refer to figure 6-11 and 6-12 and the shooting chart in paragraph 2-28 for localizing and isolating malfunctions. If any of the outputs f amplifier modules AR1 through AR5 is abnormally low or distorted make the stage gain measurements in paragraph 2-16 to help localize the fault.

2-16. Stage Gain Measurements, Tray A1A3 (Amplifier Modules All Through AR5)

Connect the test equipment to the amplifier module under test as shown in figure 6-21. If a 20-volt dc power supply Is not available, use the 20-volt dc output of the test set as described in paragraph 2-5.

a. Gain Measurement. Adjust the output of the AN/GRM-50 to 50 mv at 1 megacycle and rotate potentiometer R1 fully connected the AN/URM-145 ea directed in the stage gain chart (*b* below). Compare the indication

obtained on the AN/URM-145 with those listed in the output column. Agreement within 10 percent indicates within normal operations. Stage gains computed by dividing the output voyage of the transistor stage under test by the input voltage to the transistor stages

b. Stage Gain Chart.

AMPLIFIER module	AN/GRM-50-	TEST connection AN/URM-145	VOLTAGE (Mv) Input to transistor stage	Output of transistor stage	Stage gain
AR3	Connector J1	Collector of Q1	50	780 ±10%	15.6 ±10%
	Connector J1	Connector J3 (Q2)	780	590 ±10%	0.76 ±10%
AR1, AR2, AR4,and	Connector J	Collector of Q1	50	847± 10%	16.9 ±10%
AR5	Connector J1	Connector J3 (Q2)	847	625± 10%	0.74 ±10%

2-17. Isolating Trouble Within Stage

When trouble has been localized to a stage, use the following techniques to isolate the defective part:

a. In-Circuit Transistor Voltage Measurements. If transistors are wired in the circuit, troubleshoot the equipment without physically unsoldering and removing transistors. If transistors can be removed without the use of a soldering iron, test them out of the circuit. If a transistor tester is available, test the pluckout transistors before making other circuit test For in-circuit to , make the transistor dc voltage measurements indicated on the schematic diagram of the module being tested. Carefully follow instruction and observe notes on schematic diagrams; carelessness may cause more troubles in the equipment and make the troubleshooting job more difficult. Do not remove or insert a transistor with voltage applied to the circuit. If the dc voltage at the emitter, collector, or base of the transistor being checked is abnormally low or high, make in-circuit transistor resistance measurements using the techniques described in *b* below.

b. *In-Circuit Transistor Resistance Measurement*. When measuring the resistance of circuit elements connected across the junctions of any transistor (base-emitter or base-collector), consider the polarity of the ME-26(*)/U and try measurements with the ME-26(*)/U connected one way; then reverse the leads. For example, figure 6-12 shows a typical common emitter stage (Q1) used in each of the amplifier modules (AR1 through AR5). If the positive lead of the ME-26(*)/U is placed at the junction of R2 and R3 and the negative lead is placed at ground when measuring RS in this circuit, the ME-26(*)/U battery forward biases the base-emitter junction, causing a short circuit between the base and emitter. This places RS in parallel with R4 and R5. The MS 26(*)/U indication will be slightly less than 60 ohms because of the parallel resistances. If the ME-26(*)/U leads are then reversed, the transistor will be reverse-biased, causing a very high resistance to appear between the base and the emitter. In this case, the indication would be 820 ohms, the value of R3. If the indication is the same in both case, the transistor is probably open-circuited or short-circuited. Consider, all, that differ values of resistance will be obtained with the ME-26(*)/U on different ranges. For example, if the transistor junction or a resistor plus the transistor junction is measured in the forward direction or the RX10 range, the actual indication will be less than if taken with the ME-26(*)/U ok the RX100 range.

Section II. TROUBLESHOOTING CHARTS

2-18. Troubleshooting Chart, Test Set (Dc-to-Dc Converter and Regulator Module A3)

Note. Attach tray A1A1 to the Test set. Refer to paragraph 2-7 before using chart.

Item No.	Indication	Probable trouble	Procedure
1	The + 20 volt dc output level is not indicated on the ME-26(*)/U when the TEST SELECTOR switch on tray A1A1 is set to position 2	Defective series regulating transistor 1A1Q1.	Connect the ME-26 (*)/U between test point J11 on tray A1A5 and ground. Check for an indication of +20 volts dc. If +20 volts dc is not indicated, check transistor 1A1Q1 in the test set for defects. Replace defective parts,
2	The + 1 volt dc converter output does not stay within the limits of +19.1 to +19.9 volts (LOAD SELECT switch on tray A1A1 set to 100) and +19A to +19.6 volts (LOAD SELECT switch on tray A1A1 set to 500) when the primary dc source connected to the test set is adjusted to +27 and +20 volts respectively.	Defective +20-volt dc regulating circuit	Se LOAD SELECT switch on tray A1A1 to 500, and make the voltage measurements in a through *d* below using the ME-26 (*)/U.
			a Connect the ME-26(*)/U between the emitter of transistor A1Q4 ad grand Check for an indication of +4.0 volts de. If +4.0 volts dc is not Indicated, check resistor A1R6 and transistors A1QS and A1Q4 for defects. Replace defective parts.
			b. If the ME-26(*)/U indicates +4.0 o dc in a above, connect the ME-2W(*)/U between the base of transistor A1QS and ground and check for an indication of +4.8 volts de. If Indication is not approximately +4.8 volts de, check Zener diode A1VR2 and resistors A1R2 and A1R4 for defects. Replace defective parts.

Item No.	Indication	Probable trouble	Procedure
			c. If the ME-26 (*)/U indicates + 4.8 dc in *b* above connect the ME-2(*)/U between the emitter of transistor A1Q2 and sound end check for an indication Of +11.5 volts dc Then connect the ME-26(*)/U between the base of transistor A12 and ground, and check for an indication of +11.5 volts dc If either indication is not approximately +11.5 volts dc, check Zener diode A1VR1 transistor A1Q2, diode A1CR1, and resistor A122 for defects. Replace defective parts
			d. If the ME-26(*)/U indicates +11.5 volt, dc in *a* above, on the ME-26(*)/U between the collector of transistor A1Q1 and ground and check for an indication of +20 volts dc. If indication is not approximately +20 volts dc, check transistor A capacitor A1Q1 A1C2, and resistor A1LR for defects. Replace defective parts.
3	Wave analyzer indication for 20 volt dc regulator-output in not -45 db below the value recorded when the wave analyzer in connected to +27-volt d regulator input (analyzer tuned to 120 cps).	Defective filtering capacitors	Check capacitors A1C5, A1C1, and A1C2 for defects. Replace defective parts
4	Converter output(+125 volt. dc, 33 volts dc, and +8.3 volts) are not indicated by the ME-26(*)U when TEST SELECTOR switch is at to position. 3, 4, and 5, respectively.	*a*. Defective dc-to dc converter switch +17V filter circuit in A2.	*a* Connect the ME-26(*)/U between terminal A2E8 and ground, mod check for an indication of +27 volts de. If indication is substantially below +27 volts dc or if no indication Is observed, check capacitors A2C1 through A2C4, resistor A2R1, inductor U, and diode A2CR1 for defective. Replace detective peat.
	b.	*b*. Defective dc-dc converter switch (transistor Q1 and Q2)	*b*. If +27 volts dc is indicated at A2E8 in *a* above, connect the AN/USM-140 between terminal 9 of transformer T1

Item No.	Indication	Probable trouble	Procedure
			and ground. Adjust the AN/USM-140(*) to indicate a +54-volt peak-to-peak square wave having a pulse repetition frequency(prf) of approximately 5kc. If square wave is not observed on the AN/USM-140(*), check transistorsQ1 and Q2, resistors R1 and R2, and capacitors C1 and C2 for defects. Replace defective parts.
		c. Defective transformer T1.....	*c*. Using the AN/PSM-6B, check primary and secondary winding resistances of transformer T1. If primary or secondary windings resistances are abnormally low (shorted) or high (open), replace transformer T1.
5	The +6.3-volt ac output from T1 is not indicated on the ME-26(*)/U when TEST SELECTOR switch on tray A1A1 is set to position 5; however, the + 125- and 33-volt dc outputs are present for their respective TEST SELECTOR switch positions.	Defective +6.3-volt ac filter circuits.	Connect the ME-26(*)/U between test points A2J1 and A2J2, and check for 6.3 volts ac. If 6.3 volts ac is not present at test points A2J2 and A2J1, check capacitors A2C5 through A2C8 and inductors A2L1 and A2L2 for defects. Replace defective parts.
6	The AN/USM-140(*) shows excessive ripple for +6.3-volt ac output.	Same as 5 above ----------	Check parts of filter circuits for defects. Replace defective parts.
7	The ME-26(*)/U does not indicate -33 volt output level when TEST SELECTOR switch on tray A1A1 is set to position 4; however, the ME-26(0)/U indicates +125-volt dc and +6.3-volt ac levels for the respective TEST SELECTOR switch positions.	*a*. Defective bridge rectifier circuit of -33-volt dc output.	*a*. Connect the ME-26(*)/U between the anode of Zener diode A3VR1 and ground, and check for an indication of -33 volts dc. If -3 volts dc is not indicated, check diodes A3CR5 through A3CR8, capacitor A3C4, resistor A3R2, and Zener diode A3VR1 for defects. Replace defective parts.
		b. Defective -33 volt dc filter circuit.	*b*. If -33 volts dc is indicated at the anode of A3VR1 in *a* above, connect the ME-26(*)/U between test point A3J2 and ground, and check for an indication

Item No.	Indication	Probable trouble	Procedure
			of -33 volts dc. If -30 volts dc is not indicated, check capacitors A3C5 and A3C6 and inductor A3L2 for defects. Replace defective parts.
8	The AN/USM-140(0) shows excessive ripple for -33 volt dc output.	Same as 7*b* above ----------	Check -33 volt dc filter circuit components for defects as described in 7*b* above. Replace defective parts.
9.	The ME-26(*)/U does not indicate +125-volt dc level when TEST SELECTOR switch is set to position 3; however, the ME-26(*)/U indicates -33 volt dc and +6.3-volt ac levels for their respective TEST SELECTOR switch positions.	*a*. Defective bridge rectifier circuit of +125-volt dc output.	a. Connect the ME-26(*)/U between terminal A3E9 and ground, and check for an indication of +125 volts dc. If +125 volts dc is not indicated, check diodes A3CR1 through A3CR4 for defects. Replace defective parts.
		b. Defective +125 volt dc filter circuit.	*b*. If +125 volts dc is indicated in a above at terminal A3E9, connect the ME-26(*)/U to test point A3J1 and ground. Check for an indication of +125 volts dc. IF + 125 volts dc is not indicated, check capacitors A3C1 through A3C3, inductors A3L1 and L2, and resistor A3R1 for defects. Replace defective parts.
10	The AN/USM-140(*) shows excessive ripple for +125-volt dc output.	Same as 9*b* above ----------	Check + 125-volt dc filter circuit parts for defects as described in 9*b* above. Replace defective parts.

2-19. Troubleshooting Chart, Test Set (Pulse Generator Module A1A1 (fig. 6-4)

Note. Refer to paragraph 2-9 before using the chart.

Item No.	Indication	Probable trouble	Corrective measures
1	Amplitude of 150 usec and 85-usec pulse outputs does not vary when potentiometer R1 is rotated from fully counterclockwise to fully clockwise.	Defective AMPLITUDE control R1.	Replace defective potentiometer R1.

Item No.	Indication	Probable trouble	Procedure
2	Amplitude of 1-usec pulse output does not vary when potentiometer R3 is rotated from fully counterclockwise to fully clockwise	Defective AMPLITUDE control R3.	Replace defective potentiometer R3.
3	Pulse width of 160-usec and 85-usec pulse outputs does not vary when potentiometer R2 is rotated from fully counterclockwise to fully clockwise.	Defective pulse WIDTH control R2.	Replace defective potentiometer R2.
4	Pulse width of 1-usec pulse output does not vary when potentiometer R4 is rotated from fully counterclockwise to fully clockwise.	Defective pulse WIDTH control R4.	Replace defective potentiometer R4.
5	The AN/USK-140(0) does not show 85-usec pulse output at connector J3, but 150-usec pulse output is observable at connector J2.	Elective output coupling capacitor A1C7.	Replace defective capacitor A1C7.
6	The AN/USM-140(*) does not show 160-usec pulse output at connector J2, but 85-usec pulse output is observable at connector J3.	Defective output coupling capacitor A1C6.	Replace defective capacitor A14.
7	The 150-, 86-, and 1-usec pulse outputs at connectors J2, J3, and J4 are not visible on the AN/USM-140(*).	Defective pulse shaping circuitry (transistors Q1 and Q2).	*a.* Connect test equipment as described in paragraph 2-10. See figure 1-17 for waveshapes. *b.* Connect the AN/USM-140(*) probe to base of transistor Q1, and adjust the AN/USM-140(*) to show a 500 cps audio signal. If signal is not present, check capacitor A1C1, resistor A1R1, and diode A1CR1 for defects. Replace defective parts. *c.* If audio signal is present at base of transistor Q1, connect the AN/USM-140(*) probe to collector of transistor Q1 and adjust the AN/USM-140(*) to show

Item No.	Indication	Probable trouble	Procedure
			a 600-cps square wave. If square wave in not present, check transistor Q1 for defects. Replace defective parts.
			d. If square wave Is present at collector of transistor Q1, connect the AN/USM-140(*) probe to collector of transistor Q2 and observe 500-cps square wave. If square wave is not pres ent, check transistor Q2, capacitor A1C2 and resistors A1R2 and A1R3 for defects. Replace defective parts.
8	The 1-usee pulse output is not shown on the AN/USM-140(*) at connector J4; however, 150-usec and 85-usec pulse outputs are observable at connectors J2 and J3.	*a.* Defective pulse shaping and amplifier circuit (transistor Q6).	*a.* Perform the following: (1) Connect test equipment as described in paragraph 2-10. (2) Connect the AN/USM-140(*) probe to collector of transistor Q8, and adjust the AN/USM-140(*) to observe a 500-cps square wave. If square wave is not present, check transistor Q6, capacitor C8, and resistors A1R16 and A1R17 for defects. Replace defective parts.
		b. Defective differentiating and squaring circuit.	*b.* If 500-cps square wave is present at collector of transistor Q6, connect the AN/USM-140(*) probe to base of transistor Q7 and adjust the AN/USM-140(*) show 500-cps positive trigger pulse. If trig ger pulses are not present, check diodes A1CR4 and A1CR5, resistor A1R18, and capacitor A1C9 for defect. Replace defective parts.
		c. Defective 8chmitt trigger multivibrator (transistors Q8 and Q7).	c. If positive trigger pulses are present at base of transistor Q7, connect the AN/USM-140(*) probe to collector of transistor Q8 and adjust the AN/USM-140(*) to show 1-usec wide positive pulses (control R3 rotated fully clockwise).

Item No.	Indication	Probable trouble	Procedure
			If positive 1-use pulses are not present, check transistors Q7 and Q8, capacitors A1C10 and A1C11, and resistors A1R19, ARW20 A1R21, and A1R22 for defects. Replace defective parts.
		d. Defective output coupling capacitor A1C12.	*d.* Replace defective capacitor A1C12.
9	The 150-usec and 85-usec pulse outputs are not observable on the AN/USM-140(*) at connectors J2 and J3; however, 1-usec pulse output is observable at connector J4.	*a.* Defective squaring circuit.	*a.* Perform the following: (1) Connect test equipment as described in paragraph 2-10. (2) Connect the AN/USM-140(*) probe to collector of transistor Q3, and adjust the AN/USM-140(*) to show 500-cps positive trigger pulses. If trigger pulses are not present, check diodes A1CR2 and A1CR3, resistors A14, A1R6 and A1R6, and capacitor A1C3 for defects. Replace defective parts.
		b. Defective monostable multivibrator (transistors Q3 and Q4).	*b.* If positive trigger pulses are present at collector of transistor Q4 in *a* above, connect the AN/USM-140(*) probe to collector of transistor Q4 and adjust the AN/U8M-140(*) to show 150-usec wide positive pulses (control R2 rotated fully clockwise). If 150-usec pulses are not present, check transistors Q3 and Q4, capacitors A1C4 and A1C5, and resistors A1R8 through A1R12 for defects. Replace defective parts.
		c. Defective output amplifier circuit (transistor Q3).	*c.* If positive pulses are present at collector of transistor Q4 in *b* above, connect the AN/USM-140(*) probe to emitter of transistor Q5 and adjust the AN/USM-140(*) to show 150-usec negative pulses. If negative pulses are not present, check transistor Q5, resistors A1R15 and A1R14, and

Item No.	Indication	Probable trouble	Procedure
			output coupling capacitors A1C6 and A1C7 for defects. Replace defective parts.

2-20. Troubleshooting Chart, Test Set (IF Oscillators A1A2, A1A3, and A1A4)
(figs. 1-19, 6-3, and 6-6)

Note. **Refer to paragraph 2-11 before using the chart.**

Item No.	Indication	Probable trouble	Procedure
1	The AN/USM-140(*) output level indication or the AN/URM-145 does not vary when potentiometer control R1 in varied from fully counterclockwise to fully clockwise.	Defective potentiometer control R1.	With no power or signal inputs connected to the oscillator assembly, connect the AN/PSM-6B between. terminal 5 and ground. Rotate the potentiometer from fully counterclockwise to fully clockwise, and check the AN/PSM-6B for a resistance variation from 0 to 250 ohms. Replace potentiometer R1 if defective
2	Electronic Counter, Digital Readout. AN/USM-207 does not indicate the correct frequency for the oscillator under test.	Defective crystal Y1 or capacitors C1 and C2 in A1.	Replace crystal Y1 or capacitors C1 and C2 in A1, if defective.
3	Frequency indication on the AN/USM-207 does not vary when variable capacitor C1 is rotated through its full travel.	Defective variable capacitor A1C1.	Replace variable capacitor A1C1.
4	Oscillator output level from A1 is not indited on the AN/URM-145 with potentiometer R1 adjusted fully clockwise.	*a.* Defective crystal tank circuit.	*a.* Perform the following: (1) Connect test equipment as described in paragraph 2-11. (2) Adjust the AN/USM-140(*) to show a 1.75mc signal. (3) Connect the AN/USM-140(*) probe to base of transistor Q1 (turn gain control up on the AN/USM-140(*) and check for a 1.75-mc sinusoidal signal. if signal is not present, cheek crystal Y1 and on A1 (fig. 6-3), diodes CR1 and CR2, resistors R2, R4, and RT1, and capacitors C1

Item No.	Indication	Probable trouble	Procedure
			through C4 for defects. Replace defective parts (fig. 6-6).
		b. Defective oscillator stage Q1.	*b.* If a 1.75-mc signal is present at base of transistor Q1 in *a* above, connect the AN/USM-140(*) probe to the collector of transistor Q1 and adjust the AN/USM-140(*) to show a 1.76-mc signal. If signal is not present, check translator Q1, resistors R7, RB, and R10, and capacitors C5, C6, and C8 for defects. Replace defective parts.
		c. Defective buffer amplifier stage Q2.	*c.* If 1.75-mc signal is present in *b* above at collector of transistor Q1, connect the AN/USM-140(*) probe to emitter of transistor Q2 and adjust the AN/USM-140(*) to show a 1.76-mc signal. If signal is not present, check transistor Q2 and potentiometer R1 for defects. Replace defective parts.
		d. Defective output coupling capacitor C9.	*d.* Replace defective capacitor C9.

2-21. Troubleshooting Chart, Test Set (Mixer Module A1A5)

(fig. 6-3)

Note. Refer to paragraph 2-12 before using chart.

Item No.	Indication	Probable trouble	Procedure
1.	When the AN/GRM-50 is connected to connector J1, J2, J8, or J4, the mixer output at connector J6 does not vary an potentiometer R1 is varied from fully counter-clockwise to fully clockwise.	Defective potentiometer control R1.	With no power or signal inputs to the mixer assembly, connect the AN/PSM-6B between connector J2 and ground. Check the AN/PSM-6B for resistance indication of 0 to 1,000 ohms as potentiometer R1 is varied from fully counterclockwise to fully clockwise. If the AN/PSM-6B does not indicate a variable resistance, replace potentiometer R1.
2	When the AN/GRM-50 is connected to connector J1, the frequency selective voltmeter does not indicate mixer output level.	*a.* Defective two-tone mixer circuit (diode CR2 and associated parts).	*a.* Perform the following: (1) With no power or signal inputs to the mixer assembly, connect the AN/PSM-6B between terminals E1 and

Item No.	Indication	Probable trouble	Procedure
			ground (fig. 4-5) Make sure the pod- tive lead of the AN/ PSM-6B is connected to terminal E1. (2) Check with the AN/ PSM-6B for a re- sistance indication of approximately 2,000 ohms. Reverse the AN/PSM-6B leads, and check for an indication of infinity. If meter indicates 2,000 ohms for both measurements, check diode CR2 for de- fects. If meter in- dicates infinity for both measurements, check resistors R3 and R4 and diode CR2 for defects. (8) Replace defective parts.
		b. Defective coupling capacitor C3 or C4.	*b.* Replace capacitors C3 and C4, if defective.
3	When the AN/GRM- 50 is connected to connector J3 or J4, frequency selective voltmeter does not indicate mixer out- put level.	*a.* Defective two-tone mixer circuit (diode CR1 and associated components).	*a.* Perform the following: (1) With no power or sig- nal inputs to the mixer module, con- nect the AN/PSM- 6B between ter- minals E2 (fig. 4-5) and ground. Make sure the positive lead of the AN/PSM-6B is connected to ter- minal E2. (2) Check the AN/PSM- 6B for a resistance indication of 2,000 ohms. Reverse the AN/PSM-6B leads, and check for an in- dication of infinity. If meter Indicates approximately 2,000 ohms for both mea- surements, check diode CR1 for de fects. If meter indi- cates infinity for both measurements, check resistors R2 and R6, and diode CR1 for defects. (3) Replace defective com- ponents.

Item No.	Indication	Probable trouble	Procedure
		b. Defective coupling capacitor C5.	*b.* Replace defective capacitor C5.
4	The selective frequency voltmeter does not indicate mixer output level with the AN/GRM40 connected to connector J8 but indicates a mixer output level when the AN/GRM60 is connected to connector J4.	Defective coupling capacitor C1.	Replace defective capacitor C1.
5	The frequency selective voltmeter does not indicate mixer output level with the AN/GRM-50 connected to connector J4 but indicates an output level when the AN/GRM-60 is connected to connector J8.	Defective coupling capacitor C2.	Replace defective capacitor C2.

2-22. Troubleshooting Chart, If Amplifier Module A1, Common Module Tray A1A2
(figs. 1-12, 6-8, and 6-9)

Note. Refer to paragraph 2-13 before using chart.

Item No.	Indication	Probable trouble	Procedure
1	Output level indication on the AN/URM-145 does not change when 10-kilohm potentiometer A2R5 is adjusted for maximum output.	Defective APC attenuator circuit.	*a.* Connect the ME-20 (*) /U between the emitter of transistor Q4 and ground, and check for a 0-volt indication. If 0 volt is not indicated, check diode CR9 for defects. *b.* If diode CR9 is not defective, connect the ME-26(*)/U between the collector of transistor Q4 and ground. Adjust 10K potentiometer (fig. 6-8) A2-R5, clockwise and then counterclockwise; check to see that resistance indication increases and decreases as the potentiometer is adjusted. If no resistance variation is observed, check transistor Q4, resistors R16, R84, and R28, capacitors C11, C28, and C18, diode CR8, and inductor L4 for defects. *c.* Replace defective parts.
2	Output gain of amplifier is below 20 ±0.5 db.	*a.* Defective if. amplifier stage (transistor Q3).	*a.* Connect test equipment as described In paragraph 2-14. Make stage gain

Item No.	Indication	Probable trouble	Procedure
			measurement of transistor stage Q3 as indicated in chart (para 2-14*b*). If gain of transistor Q3 is not 3.2, check transistors Q3 and Q2, resistors R6 through R11, and capacitors C3, C6, and C7 for defects. Replace defective parts.
		b. Defective if. amplifier stage (transistor Q6).	*b.* Connect test equipment as shown in figure 6-20. Make stage gain measurements of transistor stage Q6. If gain is not 3, check transistors Q5 and Q6, resistors R24 through R30, transformers T1 and T2, and capacitors C9, C15, C19, C20, and C21 for defects. Replace defective parts.
3	Output level is not indicated on the AN/URM-145.	*a.* Defective if. amplifier ages (transistors Q3 or Q6).	*a.* Check transistor stages QS and Q6 as indicated in item No. 2 above. Replace de festive parts.
		b. Defective 20-volt dc filter circuit	*b.* Connect the ME-26(*)/U across capacitor C5, and check for an indication of +20 volts dc. If +20 volt s dc is not indicated, check capacitors C5 and C4, and inductor L2 for defects. Replace defective parts.

2-23. Troubleshooting Chart, Troy A1A3 (Amplifier Modules AR1 through AR5)

(figs. 1-18 and 6-10-12)

Note. Refer to paragraph 2-15 before using chart.

Item No.	Indication	Probable trouble	Procedure
1	The AN/URM-115 does not indicate output level of the AN/GRM-50 when amplifier module switch S1 is set to OFF.	Defective amplifier module switch S1.	Check switch for physical damage. Using the AN/PSM-6B, check continuity between terminals 3 and 6 of switch S1. Replace defective switch S1 and any defective wiring.
2	Amplifier output level indication on the AN/URM-145 does not vary when potentiometer R1 is varied from fully counter clockwise to fully clockwise.	Defective potentiometer R1	With no power or signal inputs to the amplifier module under test, connect the AN/PSM-6B between terminals E5 and E6 (fig. 4-7). Rotate potentiometer R1 from fully counterclockwise to fully clockwise, and check for a resistance variation of from 0 to approximately 500 ohms. Replace potentiometer R1 if defective.

Item No.	Indication	Probable trouble	Procedure
3	When the AN/GRM-50 is adjusted for an output of 50 mv (560 mv for module AR3 (fig. 6-15)) at 1 megacycle, the amplifier module output level indication on the AN/URM-145 is substantially below 100 mv (60 mv for module AR3).	*a.* Defective transistor a Q1.	*a.* Perform the following: (1) Connect test equipment as described in paragraph 2-16. (2) Make stage gain measurement for transistor stage Q1 as indicated in paragraph 2-16*b*. (3) If stage gain of transistor stage Q1 is abnormally below 16.9 (15.6 for module AR3), check transistor Q1, a sistors R1 through R5, and capacitors C2 and C4 for defer Replace defective parts.
		b. Defective transistor stage Q2.	*b.* Perform the following: (1) Make stage gain measurement of transistor stage Q2 as indicated in paragraph 2-16b. (2) If stage gain of transistor stage Q2 is abnormally below 0.74 (0.76 for module AR3), check transistor Q2, resistors R6 through R9, and capacitors C3 and C5 for defects. Replace defective parts.
4	With potentiometer R1 set fully clockwise, the AN/URM-145 does not indicate amplifier output level.	*a.* Defective input or output coupling circuits.	*a.* Check capacitors A1C2 and A1C5 and resistors A1R1 and A1R9 for defects. Replace defective parts.
		b. Defective amplifier module switch S1.	*b.* Replace defective switch S1.
5	When frequency of the AN/GRM-50 is changed from 1 mc to 7.1 mc, 10 mc, and 23.1 me, the output level indication on the AN/URM-145 changes substantially.	Defective bandpass filter	Check inductor L1and capacitor C6 for defects. Replace defective parts.

CHAPTER 3

REPAIRS AND ALIGNMENT

Section I. GENERAL

3-1. General Parts Replacement Techniques

Most of the parts in the SM-442A/GRC can be removed and replaced using conventional techniques. Those parts requiring special techniques or procedures are described in paragraphs 3-7 through 3-54. The following precautions must be observed when working on the SM-442A/GRC.

a. Use a pencil-type soldering iron with a 25watt maximum capacity. The SM-442A/GRC is transistorized. If the soldering iron must be used with ac, use an isolation transformer between the soldering iron and the ac line. Do not use a soldering gun; soldering guns use high wattage's which can prove harmful to components.

b. When soldering transistor leads, solder quickly. Use a heat sink (such as a pair of long-nosed pliers) whenever possible. Use approximately the same length and dress of transistor leads as used originally.

3-2. Special Tools and Test Equipment

The chart in paragraph 3-3 lists the special test equipment required to align the SM442A/GRC components.

3-3. Special Test Equipment Chart

Test equipment	Technical manual
Multimeter AN/PSM-6B	TM 11-6625-475-10
Voltmeter, Electronic AN/URM-145.	TM 11-6625-524-14
Analyzer, Spectrum TS-723 (*)/U.	TM 11-5097 or TM 11-6625-255-15
Frequency Selective Voltmeter (to be selected).	
Generator, Signal AN/URM-127.	TM 11-6625-683-15
Oscilloscope AN/USM-140(*).	TM 11-6625-535-15 and TM 11-6625-535-15-1
Generator, Signal AN/GRM-50.	TM 11-6625-573-15
Electronic Counter, Digital Readout AN/USM-207.	TM 11-6625-700-10
Charger, Battery PP-1451/G.	TM 11-6130-236-12
Preamplifier, HP5261A	None
Tee Connector UG-274B/U.	None
Test Cables W15, W1, W2, W3, W22 and W25.	None
Power Supply PP-3940G	TM 11-6130-247-15
Attenuator, HP355D	None
Multimeter ME-26 (*)/U	.TM 11-6625-200-12

3-4. Characteristics of Test Equipment Required for Alignment

The type of test equipment required to align the simulator is described in the chart in paragraph 35.

3-5. Test Equipment Characteristics

Test equipment	Characteristics
Multimeter AN/PSM-6B	Frequency range: 0 to 30kc. Voltage range: 0 to 1,000 ac and to 5,000 dc. Current range: 0 to 10 amp. Resistance range: 0 to 10 megohms. Sensitivity: 1,000 ohms/volt ac 20,000 ohms/volt dc. Accuracy: ±4%

Test equipment	Characteristics
Voltmeter, Electronic AN/URM-146.	Frequency range: 0.1 mc to 1,000 mc. Voltage range: 300 microvolts to 3 volts rms.
Electronic Counter, Digital Readout AN/USM-207.	Frequency range: 10 cps to 100 mc.
Frequency selective voltmeter.	Frequency range:20 kc to 30 mc. Voltage range: 0 to 150 mlllivolts. Sensitivity: 5 megohms
Generator, Signal AN/URM-127.	Frequency range: 20 cps to 20 kc. Output level: 3 watts into 600 ohms.
Oscilloscope AN/USM-140(*).	Frequency range: 0 to 15 mc
Generator Signal AN/GRM-50.	Frequency range: 2 to 30 mc. Output level: 0 to 3 volts Output impedance-50 ohms.
Charger, Battery PP-1451/G.	Voltage range: 20 to 32 bolts. Current range: 100 amperes maximum.
Preamplifier, HP 5261A	Frequency counter plug-in.
Tee Connector UG-274B/U.	Type BNC (FSN 5986-702-0125)
Test Cables W16, W1, W2, WS, W22 and W25.	(Part of SM-442A/GRC Cable Kit).
Power Supply PP-3940/G.	Voltage range 0 to 30 volts dc. Current range: 150 ma (min).
Analyzer, Spectrum TS-728(*)/U.	20 cps to 30 kc, 10 mv to 1 volt, p band-width
Attenuator, HP355D	Attenuation range 0 to 110 db (FSN 5910-957-1800).
Multimeter, M#-26 (*)/U	Dc voltage range: 0 to 1,000 volts. Ac voltage range: 0 to 300 volts. Resistance range: 0 to 500 megohns. Frequency range: 20 cps to 700 mc.

3-6. Special Tools Chart

CA 58057 Extraction tool Cannon Electric Co.	5120-970-2722
107-1001 Insert tool Winchester Inc.	
Winchester Crimp and Extraction tool.	

Section II. REPAIRS

3-7. Cleaning

a. The SM-442A/GRC should be kept clean and free of foreign matter to insure proper operation.

Warnings:

1. Compressed air in dangerous and can cause serious bodily harm. It can also cause mechanical damage to the equipment. Do not use compressed air to dry parts where cleaning compound has been used.

2. Prolonged breathing of cleaning compound is dangerous; make certain that adequate ventilation is provided. Cleaning compound in flammable; do not use near a flame. Avoid contact with the skin; wash off any that spills on your hands.

b. After disassembly, the mechanical components can be cleaned with cleaning compound (FSN 7988959542). Clean switch contacts with a cloth lightly moistened with an approved electrical contact cleaner.

3-8. Inspection

After cleaning, inspect the disassembled mechanical parts for the following:

a. Parts that are nicked, burred, or scratched.

b. Broken or damaged gears and gear teeth.

c. Damage to couplers.

d. Bent or worn shafts.

e. Burred bushings or bearings.

f. Wires that have insulation burned or scraped off.

g. Broken wafer switch.

3-9. Lubrication

Lubricate by applying small amounts of silicon grease (FSN 9150-257-5358) or any approved alternate, to gear teeth, shaft bushings, and bearings.

3-10. Removal of Gear Drive Assemblies

To remove the gear assemblies from tray A1A1 (fig. 3-1) and tray A1A8 (fig. 3-2), proceed as given in *a* through *c* below.

a. Remove the bottom cover from the appropriate tray, tag and unsolder the wires connected to gear drive assembly relay K1 (fig. 3-8).

Note. **Before proceeding to *b* below for tray A1A3, perform the following:**

(1) Remove the setscrews from the motor driven coupler (fig. 3-4).
(2) Remove the coupler from the shaft.

b. Remove the four top panel mounting screws (fig. 3-3) that secure the gear drive assembly to either tray A1A1 or tray A1A8. Lower and rotate the gear drive assembly outward for access.

Note. **If the gear drive assembly Is to be removed from the parent tray intact, proceed with *c* below; however, if the disassembly of the gear drive assembly is the final objective, proceed a outlined in paragraph 3-11.**

c. Tag and unsolder the 28 wires connected to switch S1 (fig. 3-3), and remove the gear drive assembly.

3-11. Disassembly of Gear Drive Assemblies

To disassemble the gear drive assembly after removal from tray A1A1 or tray A1A3 (para 3-10*b*), proceed as follows:

a. Refer to figure 3-5; then remove the retaining ring (1) from the idler gear shaft (2). Slide the Idler gear (3) off the shaft (2).

b. Remove the two retaining rings (4) from the switch shaft, and loosen the hex setscrew (5) on the switch gear (6).

c. Remove the two retaining rings (7) from the spur gear shaft (8).

d. Using a drift punch, drive the pins (9) from the drive gear (22) and the spur gear (23). Loosen the hex setscrews (10) on both gears.

e. Remove the four hex nuts (11), screws (12), flat washers (18), and spacers (14) that secure the switch wafer (15) to the top plate (16).

f. Remove the six bottom plate screws (17), lockwashers (18), and flat washers (19), and the four spacers (20), and remove the bottom plate (21).

g. Slide the drive gear (22), spur gear (28), and switch gear (6) from their shafts.

h. Slide the switch shaft (24) from the wafer switch upward through the top plate.

Note. **For the gear drive assembly when removed from tray A1A1, proceed as in (1) and (2) below.**

(1) Remove the four screws (25) holding to the top plate. Slide the coupler (26) and connected shaft upward from the adapter bearing (27).
(2) Drive the coupler pin (28) from the shaft with a drift punch. Loosen the hex setscrew (29), and remove the coupler (30).

i. Remove the two hex nuts (81) and screws (32) securing the channel motor mount (88) and connected components from the top plate.

j. Drive the pin (34) from the worm gear on the channel motor mount with a drift punch, loosen the hex setscrew (35), and slide the worm gear (36) from the motor shaft.

k. Tag and unsolder the wires connecting the channel motor to relay K1 (37).

l. Remove the four screws (38), four lockwashers (39), and four flat washers (40) securing the motor to the channel motor mount. Remove the channel motor (41).

m. Remove the two hex nuts (42) and screws (43) securing the relay to the channel motor mount. Remove relay K1 (37).

3-12. Reassembly of Gear Drive Assembly

(fig. 3-5)

a. Fasten the adapter bearing (27), using the four screws (25), to the top plate (16).

b. Slip the coupler (30) on the spur gear shaft (8), driving the coupler pins (28) Into the appropriate pin holes. Tighten the hex setscrew (29). Slide the spur gear shaft (8) through the hole in the top plate (16) through

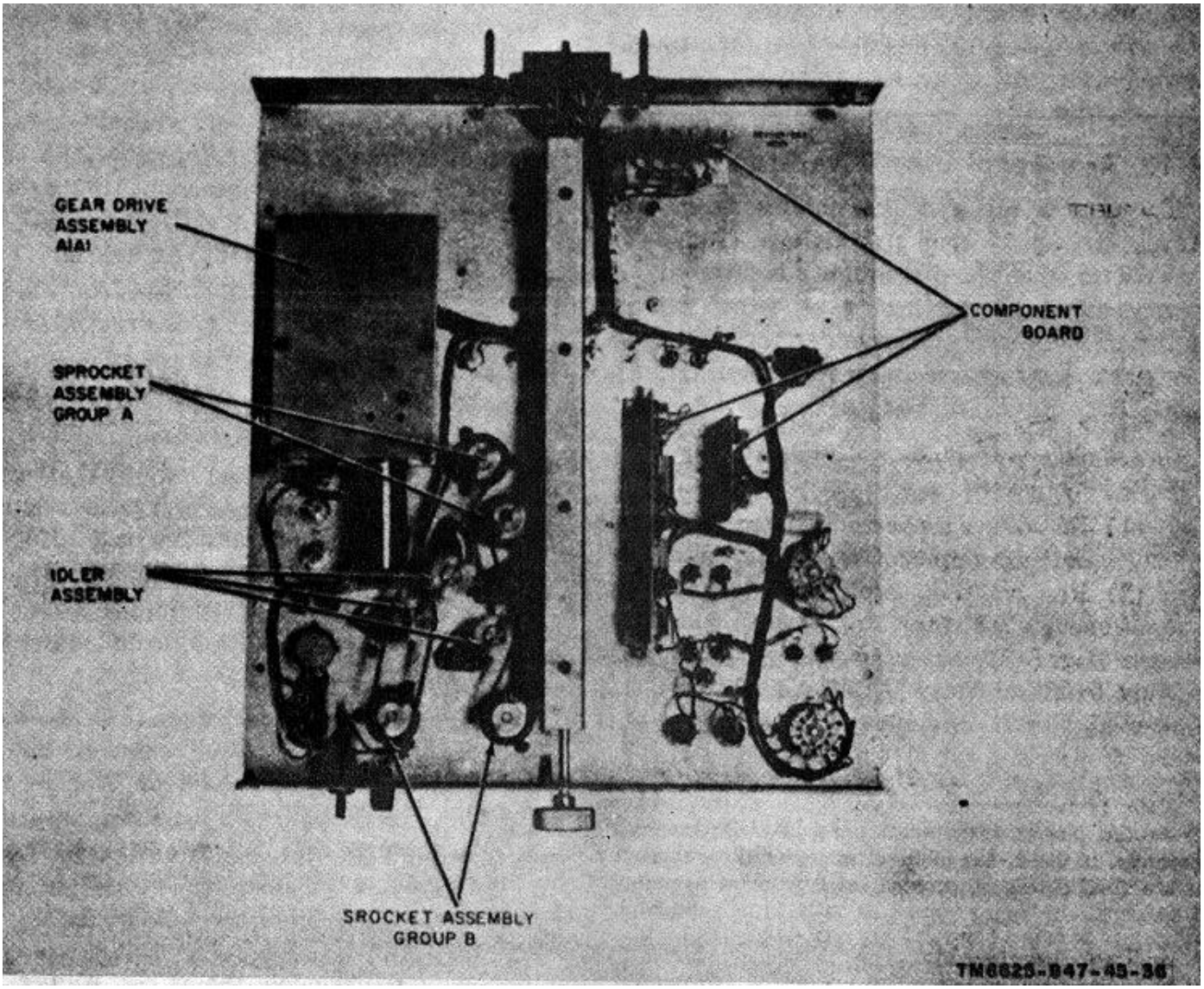


Figure 3-1. Common module tray A1A1, module and subassemblies locations.

the adapter bearing. Replace the retaining ring (7) on the top of the spur gear shaft.

c. Connect relay K1 (37) to the channel motor mount (33) with the two screws (43) and two hex nuts (42).

d. Place the idler gear (3) on the idler gear shaft (2); lock it in place with the retaining ring (1).

e. Press the idler gear shaft (2) into the bottom plate.

f. Slip the switch wafer (15) into the switch shaft (24), and secure it to the top plate (16) with the four hex nuts (11), screws (12), flat -washers (13), and spacers (14). Using an ME-26(*)/U with the negative probe on pin 1 of connector J1 and switch wafer (15) in position 29, place the positive probe of the ME-26(*)/U on contact 29A (wiper contact on the rear of the switch wafer (15)). Rotate the wafer switch until an infinity indication is owned on the ME-(*)/U.

g. Slide the spur gear (23) on the spur gear shaft (8), and tighten the hex setscrew (10) for snug fit. Slide the drive gear (22) on the spur gear shaft (8), and tighten the hex 5 screw (10) for snug fit. Align the drive gear (22) with the idler gear (3); drive the pin (9) into the drive gear (22).

h. Reassemble the channel motor (41) in the channel motor mount (88), slip the worm

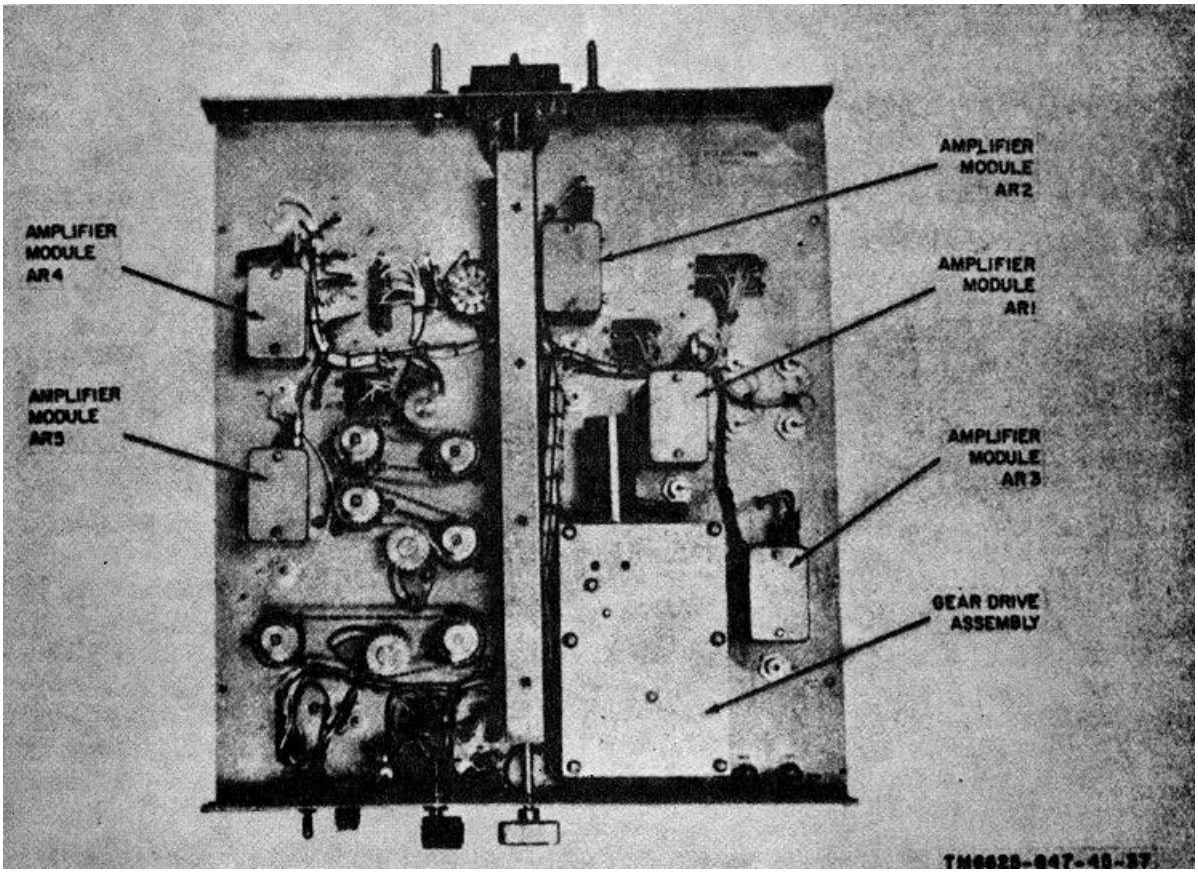


Figure 3-2. Synthesizer test to A1A3, module and subassemblies locations.

gear (36) on the channel motor shaft, and tighten the hex setscrew (35) for snug fit. Fasten the channel motor (41) to the channel motor mount (33) with the four screws (38), lockwashers (39), and flat washers (40). Attach the channel motor mount (33) to the top plate (16) with the two screws (32) and hex nuts (31).

i. Slide the switch gear (6) on the switch shaft (24); lock the switch gear to the switch on the shaft with the retaining ring (4).

j. Secure the bottom plate with the six plate screws (17), six lockwashers (18), and six flat washers (19).

k. Align the switch gear (6) with the idler gear (3), align the drive gear (22) with the idler gear (3), and align the spur gear (23) with the worm gear (36). Align the notch on the coupler (26) so that the center line of the notch and the center line of the screw hole (44) exactly align. Secure the gear assemblies with the appropriate pins and hex setscrews.

Note. The gear drive assemblies are now electrically and mechanically aligned at 29 mc.

l. If wires were unsoldered from switch S1, resolder the wires to the power terminals as indicated by the tags.

m. Place the gear drive assembly in its proper position on the tray, and secure it with the four screws previously removed.

n. On tray A1A3, place the coupler on the shaft with the pin towards the rear of tray A1A3, and secure it in position with the set screws.

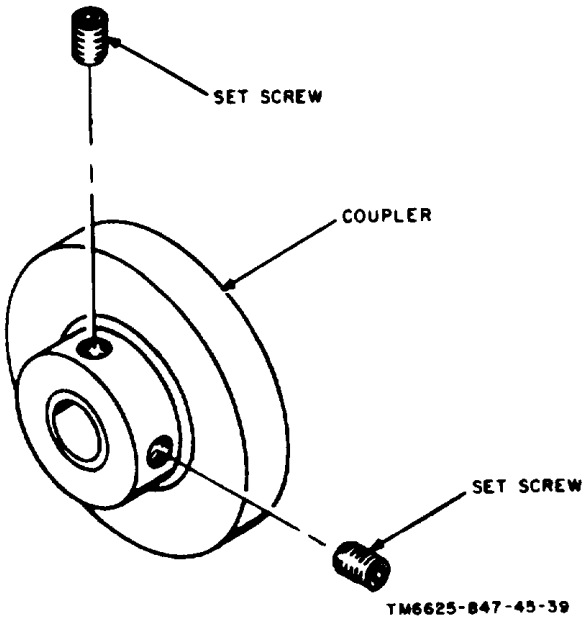


Figure 3-4. Common module tray A1A1, gear drive assembly coupe.

b. Drive the pin (3) from the transformer assembly with a drift punch. Loosen the hex setscrew (4) on the transformer assembly.

c. Remove the turret assembly shaft top mounting screw (5), and withdraw the shaft (6) from the transformer assembly and the sprocket gear through the turret frame.

d. Slide the transformer assembly (7) sideways from the turret frame assembly.

e. Remove the seven screws (8) from the transformer assembly top plate (9), and remove the top plate. Remove the three transformer sections (10).

3-15. Reassembly of Turret Transformer Assembly

a. Position the three transformer sections (10, fig. 3-9) in the turret frame. Position the top plate (9), and secure it with the seven screws (8).

b. Slide the transformer assembly (7) sideways toward the turret frame assembly.

c. Slide the turret assembly shaft (6) through the turret frame, and slide the sprocket gear (2) and transformer assembly (7) on the shaft.

d. Tighten the hex setscrew (4). Using the pin (3), connect the transformer assembly to the shaft.

e. Align the sprocket gear (2) with the pin hole in the shaft (6). Drive the pin (1) through the sprocket gear pin hole and through the shaft.

f. Position the turret assembly on the tray A1AS, and secure it firmly in place with the four top panel mounting screws (2, fig. 8-4).

g. Install the microswitch mounting screws (3) securing it to the turret assembly top panel. Attach the leads from the turret transformer assembly.

h. Attach the wires from the attenuator assembly (1).

i. Slip the drive chain in place upon the sprocket gear of the control shaft (fig. 3-7).

j. Rotate the idler sprocket gear inward toward the drive chain making certain that it is in its original position. Tighten the hex nuts.

3-16. Removal of Pulse Generator Subassembly

To remove the pulse generator subassembly from the test set, refer to figure 3-10 and proceed as follows:

a. Unsolder and tag the leads connected to pins 3 and 14 on A1 (fig. 6-4).

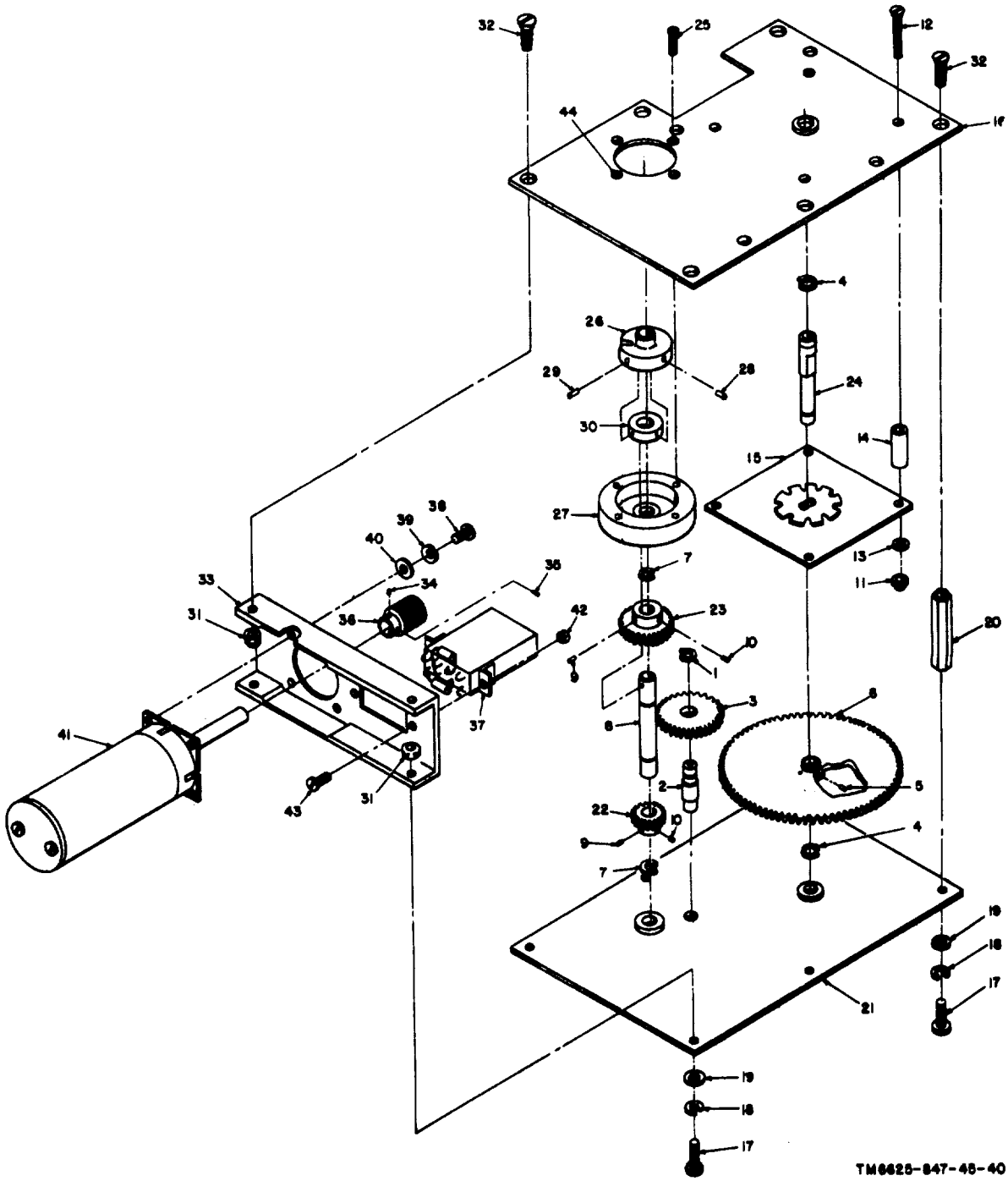
b. Loosen the setscrew securing each of the two WIDTH control knobs on the front pane (fig. 3-11 and 3-12). Remove the knobs from the panel. Loosen the setscrew securing each of the two AMPLITUDE control knobs on the front panel; remove the knobs from the panel.

c. Remove the two front panel screws which secure the pulse generator assembly to the front panel. Remove the pulse generator assembly from the test set.

3-17. Disassembly of Pulse Generator Assembly

To disassemble the pulse generator assembly after removal from the test set, remove the four screws and four spacers which secure the pulse generator subassembly to the generator plate.

> **Note. To remove electrical components, use conventional techniques. Refer to paragraph 3-1.**



1	Retaining ring	5	Hex setscrew	9	Pin
2	Idler gear shaft	6	Switch gear	10	Hex setscrew
3	Idler gear	7	Retaining ring	11	Hex nut
4	Retaining ring	8	Spur gear shaft		

Figure 3-5. Gear drive assembly, exploded view.

12 Screw
13 Flat washer
14 Spacer
15 Switch wafer
16 Top plate
17 Screw
18 Lockwasher
19 Flat washer
20 Spacer
21 Bottom plate
22 Drive gear
23 Spur gear
24 Switch shaft
25 Screw
26 Coupler
27 Adapter bearing
28 Pin
29 Setscrew
30 Coupler
31 Hex nut
32 Screw
33 Channel motor mount
34 Pin
35 Hex setscrew
36 Worm gear
37 Relay K1
38 Screw
39 Lockwasher
40 Flat washer
41 Channel motor
42 Hex nut
43 Screw
44 Screw hole

Figure 3-5-Continued.

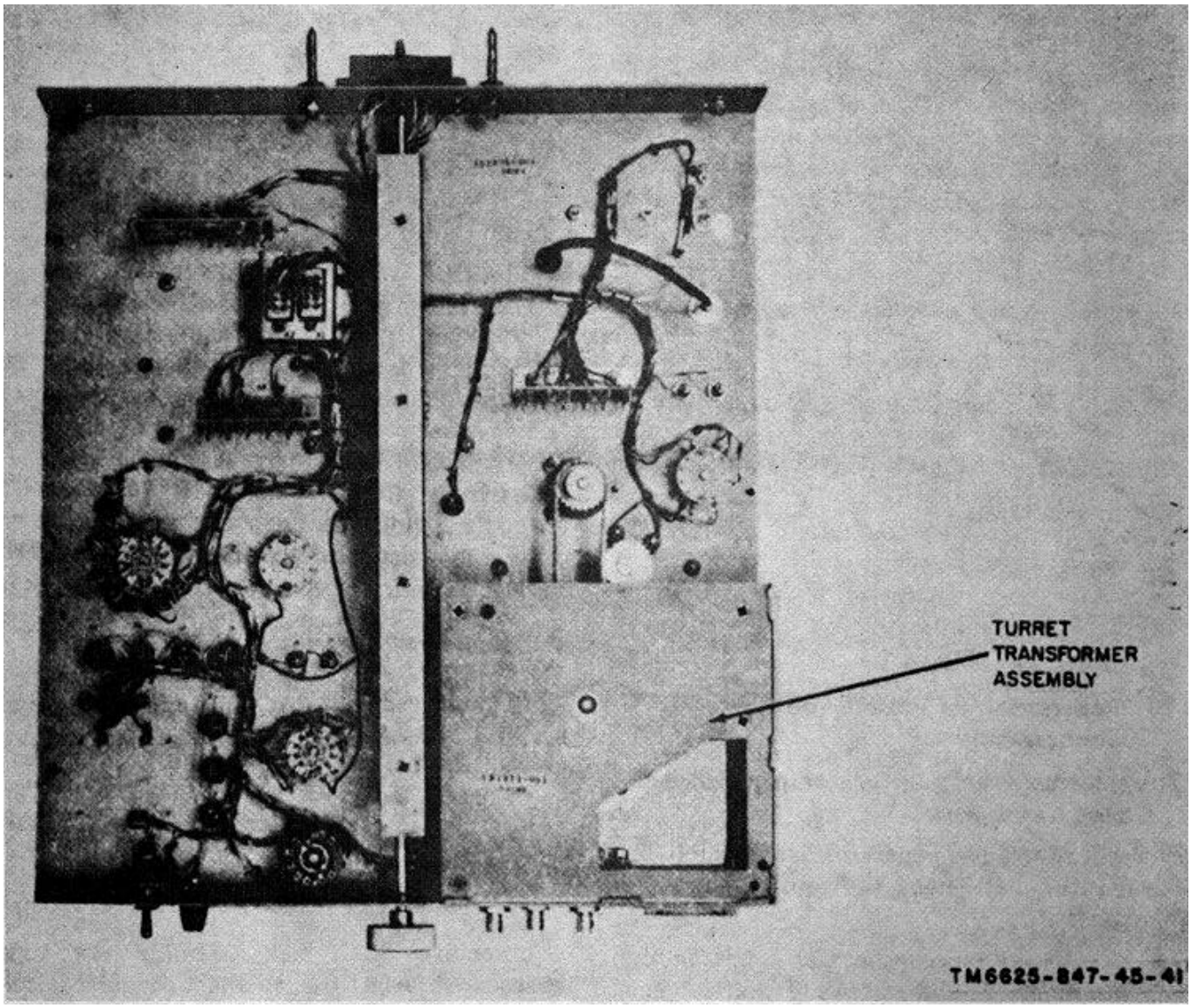


Figure 3-6. Driver, discriminator, and antenna coupler tray A1A5, subassembly location.

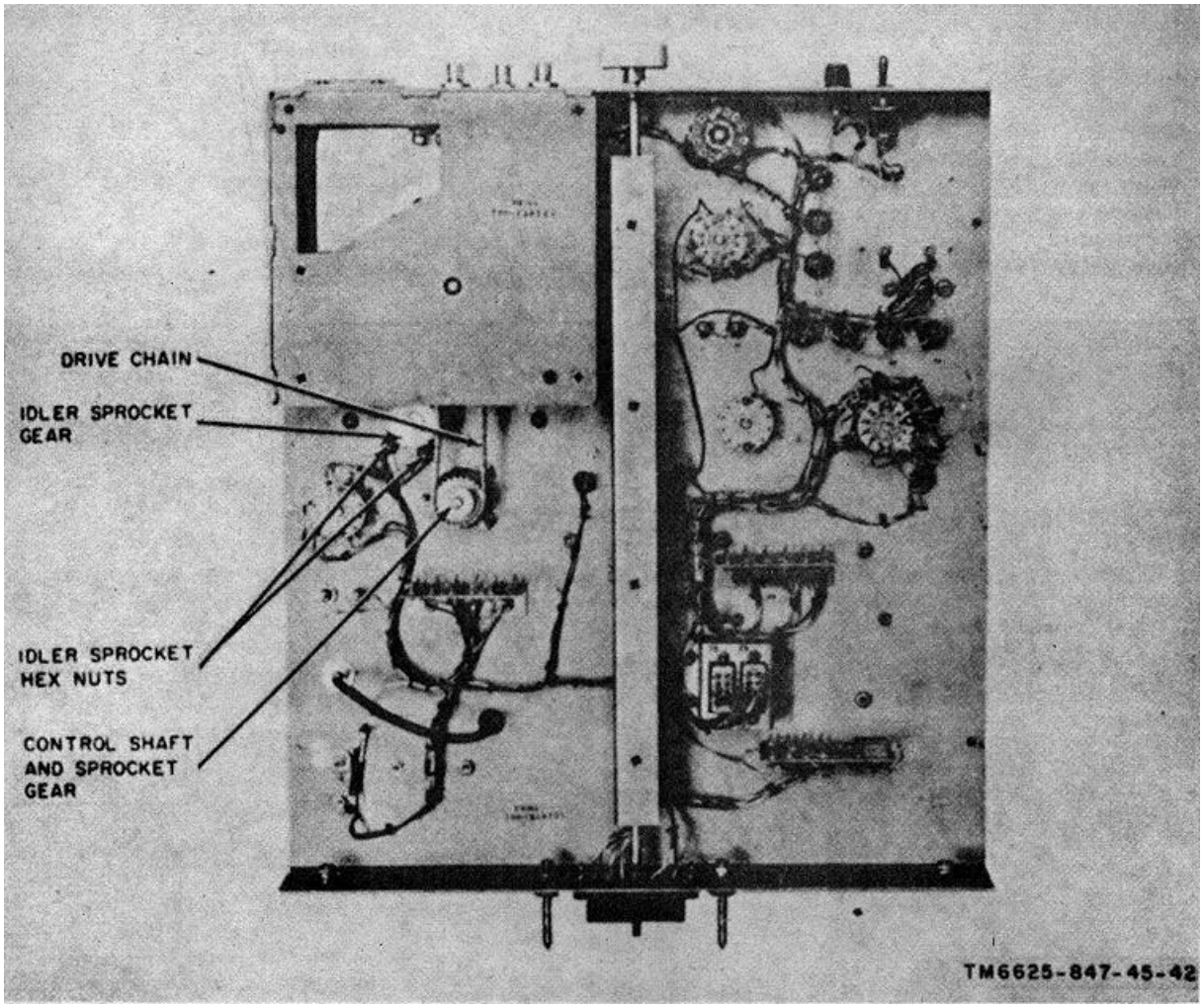


Figure 3-7. Driver, discriminator, and antenna coupler tray A1A5, bottom view.

3-18. Reassembly of Pulse Generator Subassembly

To reassemble the pulse generator subassembly, proceed as follows:

a. Secure the pulse generator subassembly to the generator plate using the four screws and four spacers.

b. Position the pulse generator subassembly in its proper place at the rear of the test set front panel. Align the assembly with its mounting holes in the front panel.

c. Install the two screws, securing the pulse generator subassembly firmly in place.

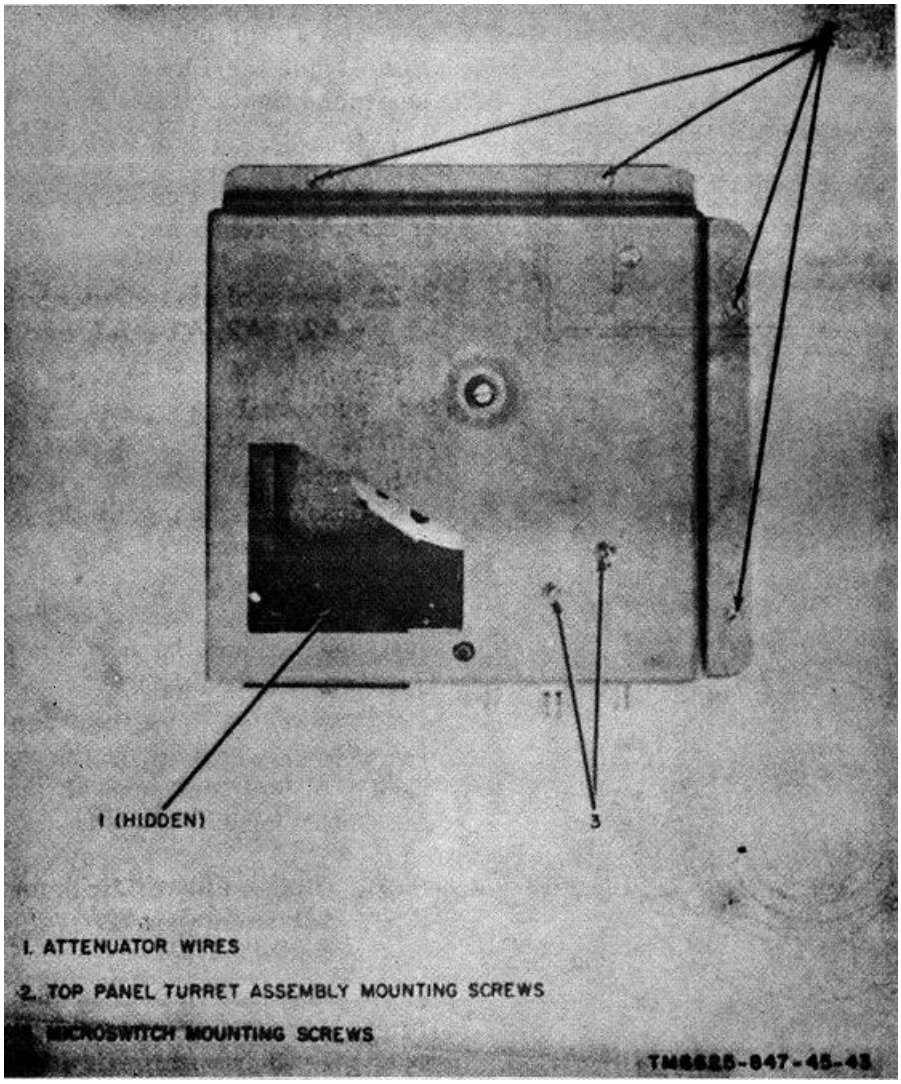
d. Mount each of the four knobs (figs. 3-11 and 3-12) on its shaft, and tighten the setscrews.

e. Resolder the two disconnected leads to pins 3 and 14 on A1 (fig. 6-4).

3-19. Removal of Mixer Assembly

To remove the mixer assembly (two-tone subassembly A1A5) from the test set (fig. 3-10), proceed as given in *a* through *c* below.

a. Detach and tag each of the three leads connected to the three mixer assembly connectors (fig. 6-3).



1 Attenuator wires 2 Top panel turret assembly mounting screws 3 Microswitch mounting screws
Figure 3-8. Driver, discriminator, and antenna coupler tray A1A5, turret assembly, top view.

b. Loosen the setscrew securing the two-tone LEVEL control knob (fig. 3-12) on the front panel; remove the knob from the panel.

c. Unsolder the leads to pins 1 and 2 on subassembly A1A5.

d. Remove the two front panel screws which secure the mixer assembly to the front panel. Remove the mixer assembly from the test set.

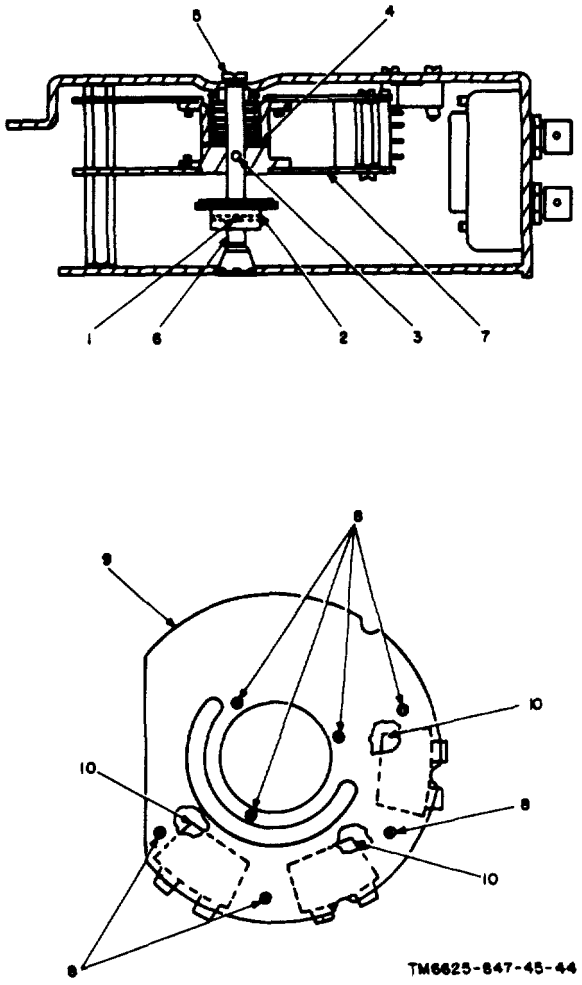
3-20. Disassembly of Mixer Assembly

To disassemble the mixer assembly after removal from the test set, remove the two screws and four washers, then remove the cover.

Note. To remove electrical components, use conventional techniques Refer to paragraph 3-1.

3-21. Reassemble of Mixer Assembly

To reassemble the mixer assembly, proceed as follows:



1	Pin	6	Shaft
2	Sprocket gear	7	Transformer assembly
3	Pin	8	Screw
4	Hex Setscrew	9	Top plate
5	Screw	10	Transformer section

Figure 3-9. Turrent transformer assembly, side and top view.

a. Secure the cover of the mixer assembly firmly in place with the two screws and four washers.

b. Position the mixer assembly in its proper place, at the rear of the test set front panel. Align the assembly with its mounting holes in the front panel.

c. Install the two screws securing the mixer assembly firmly in place.

d. Mount the LEVEL control knob on its shaft, and tighten the setscrew.

e. Resolder the two leads to pins 1 and 2 on A1A5 (fig. 6-8).

f. Resolder the three leads to the three mixer assembly connectors.

3-22. Removal of Oscillator Subassemblies A2A1A2, A2A1A3, and A2A1A4

To remove any of the three identical oscillator subassemblies A2A1A2, A2A1A3, or A2A1A4 (fig. 4-4) from the test set (fig. 3-10), proceed as given in *a* through *c* below.

a. Unsolder and tag the leads connected to oscillator subassembly connector J2 and pin E1.

b. Loosen the setscrew securing the output level control knob on the front panel (fig. 3-11). Remove the knob.

c. Remove the three front panel screws and two washers which secure the oscillator subassembly to the front panel. Remove the oscillator subassembly from the test set.

3-23. Disassembly of Oscillator Subassemblies A2A1A2, A2A1A3 and A2A1A4

To disassemble an oscillator subassembly (fig. 8-13) after removal from the test set, proceed as given in *a* through *d* below.

a. Remove the screw (1) and two washers (2) securing the cover (3). Remove the cover.

b. Remove the metallic standoff (4).

c. Remove the three screws (5) and six flat washers (6) sewing the oscillator subassembly (7). Unsolder and tag all leads. Remove the oscillator subassembly from the case (8).

Note. To remove electrical components, use conventional techniques. Refer to paragraph 3-1.

d. Disconnect and tag the leads attached to the crystal unit (9). Remove the two nuts (10) and four washers (11) to remove the crystal unit (9) and crystal socket clip (12) from the case (8).

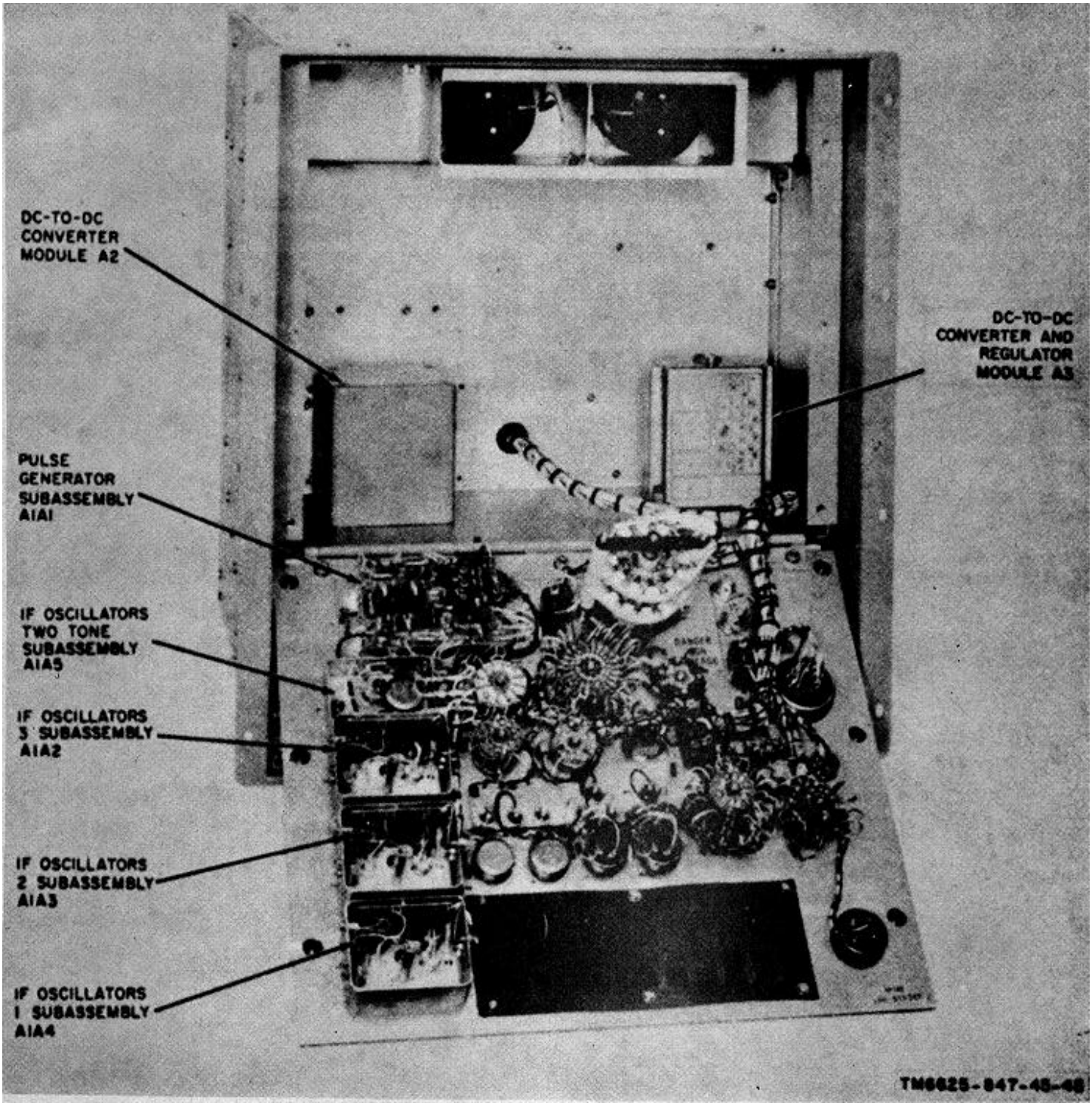


Figure 3-10. Test set A2, module and subassembly locations.

3-24. Reassembly of Oscillator Subassemblies A2A1A2, A2A1A3 and A2A1A4

To reassemble an oscillator subassembly (fig. 3-13), proceed as follows:

a. Secure the crystal socket clip (12) and the crystal unit (9) to the case (8), using the four washers (11) and two nuts (10). Connect the leads.

b. Place the oscillator subassembly (7) in its proper position, as shown in figure 3-13, and install the three crews (5) and six flat washers (6). Connect all leads.

c. Install the metallic standoff (4).

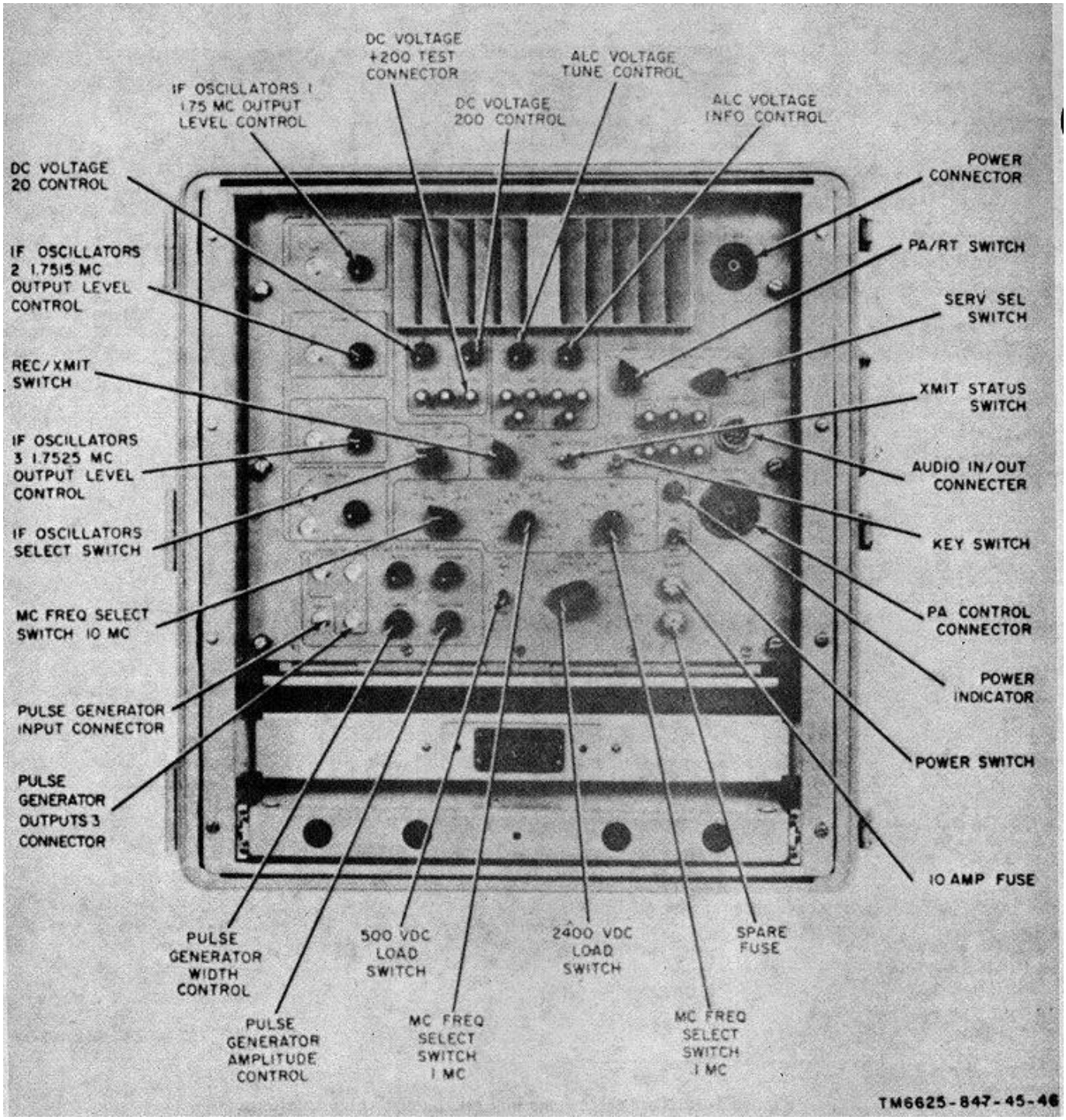


Figure 3-11. Test set A2, controls, switches, and connectors.

d. Attach the cover (3) to the case, using the screw (1) and two washers (2).

e. Place the oscillator subassembly in its proper position on the rear of the front plate of the test set (fig. 3-10). Align the three holes in the oscillator subassembly case with the matching holes in the front panel. Install the three front panel screws and two washers which secure the oscillator subassembly to the front panel.

f. Connect the two leads to connector J2 and pin E1 (fig. 4-4).

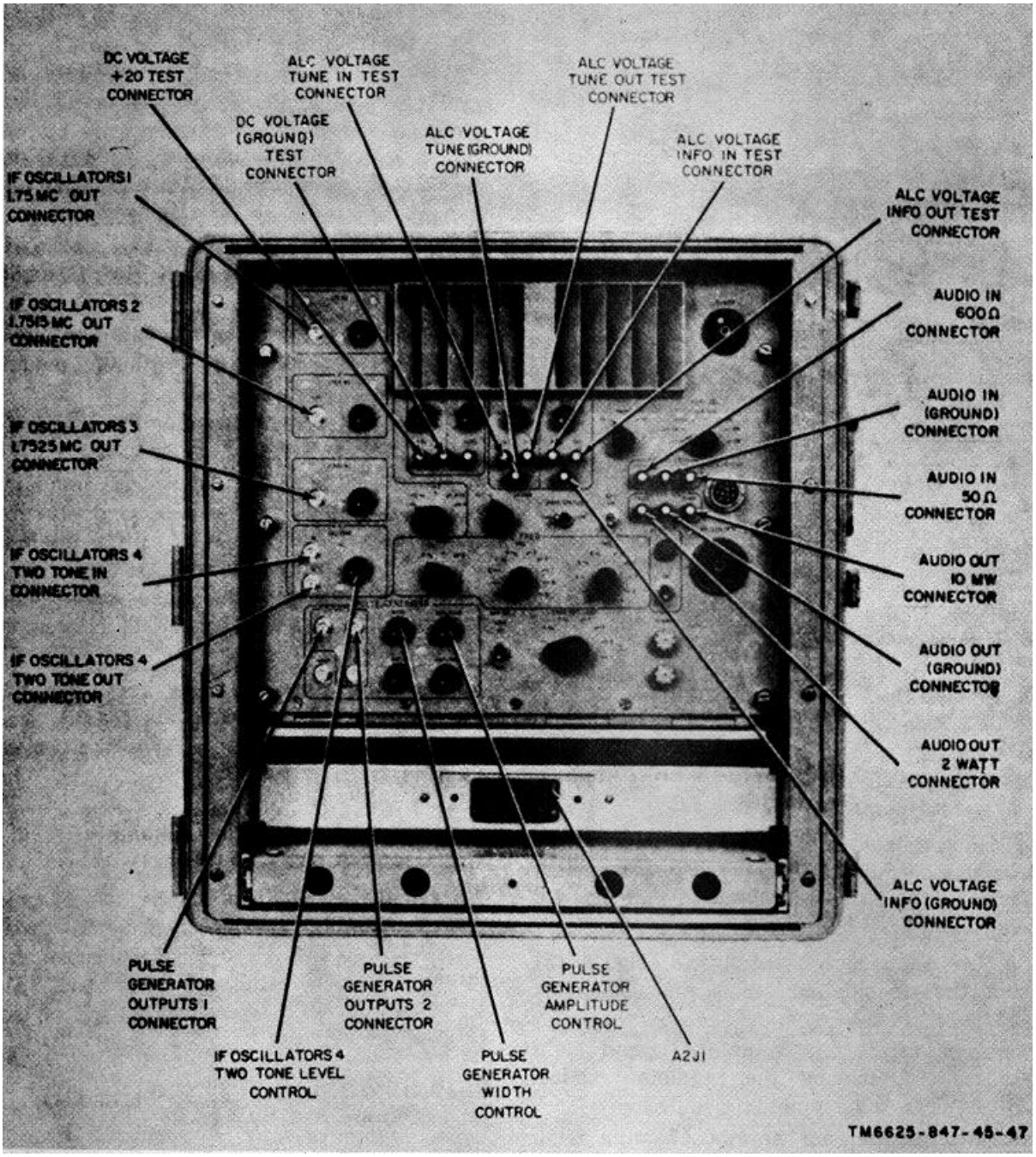
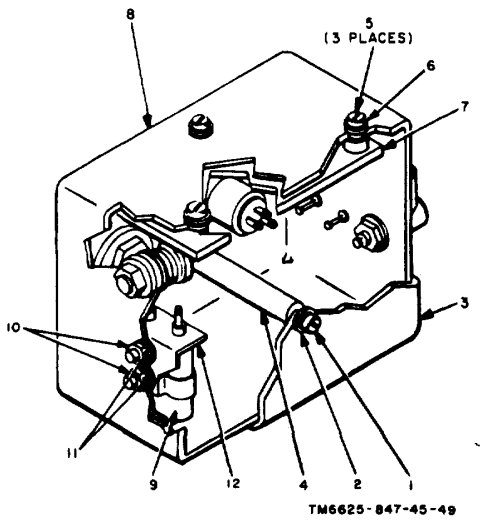


Figure 3-12. Test set A2, controls, connectors, and jack J1.

g. Mount the output level control knob on its shaft, and tighten the setscrew.

3-25. Removal of Dc-to-Dc Converter and Regulator Module A3

To remove dc-to-dc converter and regulator module A3 (fig. 3-10, 3-14, and 3-15), remove the four screws (1, fig. 3-15) and eight Washers (2) securing the dc-to-dc converter and regulator module to the bottom plate; lift the module from the test set.



1	Screw	7	Oscillator subassembly
2	Washer	8	Case
3	Cover	9	Crystal unit
4	Metallic standoff	10	Nut
5	Screw	11	Washer
6	Flat washer	12	Crystal socket clip

Figure 3-13. Oscillator subassembly.

3-26. Disassembly of Dc-to-Dc Converter and Regulator Module A3

To disassemble the dc-to-dc converter and regulator module A3 after removal from the test set A2, proceed as given in a through d below.

a. Lift the cover assembly (3, fig. 3-15) from the dc-to-dc converter and regulator module.

b. Remove the four screws (4) and eight washers (5) securing the regulator module (6). Remove the regulator module.

c. Remove the four screws (7) and eight washers (8) securing the input filter assembly (9). Remove the input filter assembly.

d. Remove the four screws (10) and eight washers (11) securing the rectifier output filter assembly (12). Remove the rectifier output filter assembly.

Note. **To remove parts, use conventional techniques Refer to paragraph 3-1.**

3-27. Reassembly of Dc-to-Dc Converter and Regulator Module A3

To reassemble the dc-to-dc converter and regulator module A3, proceed as given in *a* through *f* below.

a. Install the four screws (10, fig. 3-15) and eight washers (11) to secure the rectifier output filter assembly (12) firmly in place.

b. Install the four screws (7) and eight washers (8) to secure the input filter assembly (9) firmly in place.

c. Install the four screws (4) and eight washers (5) to secure the regulator module (6) firmly in place.

d. Position the cover assembly (3), and press it into place.

e. Place dc-to-dc converter and regulator module A3 in its proper position on the bottom plate of test set A2 (fig. 3-10). Align the four holes in the assembly base with the four drilled holes in the bottom plate. Make certain that assembly connector J1 (fig. 3-14) is plugged in.

f. Install the four screws (1, fig. 3-15) and eight washers (2) to secure the dc-to-dc converter and regulator module AS to the bottom plate.

3-28. Removal of Sprocket Assembly Group A, Tray A1A1

To remove either one of the two A-type sprocket assembly groups (fig. 3-16) from tray A1A1 (figs. 3-17 and 3-1), remove the three nuts (1, fig. 3-16) and three cleats (2). Detach the chain from the sprocket (4) of the sprocket assembly group being removed.

3-29. Disassembly of Sprocket Assembly Group A, Tray A1A1 (fig. 3-16)

To disassemble either one of the two A-type sprocket assembly groups, proceed as given in *a* through *g* below.

a. Remove the pin (3) from the sprocker (4), and slide the sprocket off the assembly.

b. Remove the flat washer (5) and bearing holder (6).

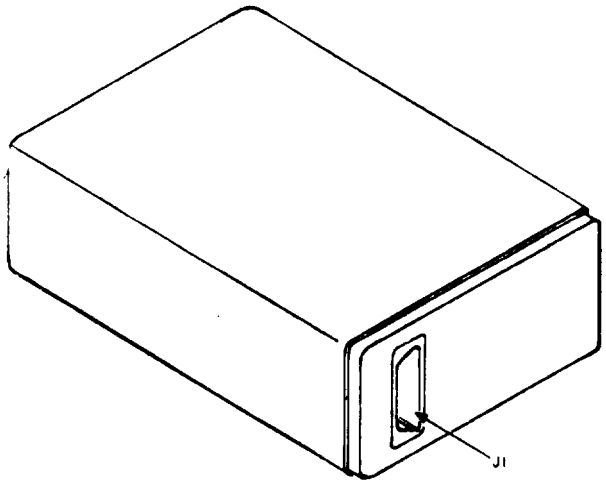


Figure 3-14. Test set A-2, dc to dc converter and regulator module A3.

c. Remove the bearing (7) and flat washer (8)d. Remove the washer spring (9) and flat washer (10).

e. Remove the retaining ring (11).

f. Remove the pin (12). Remove the two pins (13), and slide off the outer ring (14).

g. Slide the inner ring (15) off the shaft (16).

3-30. Reassembly of Sprocket Assembly Group A, Troy A1A1 (fig. 3-16)

To reassemble either one of the two A-type sprocket assembly groups, proceed as given in *a* through *g* below.

a. Slide the inner ring (15) onto the shaft (16); slide the outer ring (14) over the inner ring (15) so that the three pin holes are aligned. Insert the pin (12) and two pins (18).

b. Install the retaining ring (11).

c. Install a flat washer (10) and the washer spring (9).

d. Install a flat washer (8) and the bearing (7)

e. Place the bearing holder (6) over the assembled components, and install a flat washer (5).

f. Slide the sprocket (4) onto the shaft, and position the chain on the sprocket. Align the pin hole in the sprocket with the hole in the shaft. Install the pin (3).

g. Place the assembly in its proper position on the tray (fig. 3-1). Install the three cleats (2, fig. 3-16) on the three studs, and secure the sprocket assembly group firmly in position with the three nuts (1).

3-31. Removal of Sprocket Assembly Group B, Tray A1A1

To remove either one of the two B-type sprocket assembly groups (fig. 3-18) from tray A1A1 (fig. 3-17 and 3-1), loosen the setscrew and remove the selector knob. Remove the three nuts (1, fig. 3-18) and the three cleats (2). Detach the chain from the sprocket (4) of the sprocket assembly group being removed.

3-32. Disassembly of Sprocket Assembly Group B, Tray A1A1

To disassemble either one of the two B-type sprocket assembly groups (fig. 3-18), proceed as given in a through d below.

a. Remove the pin (3) from the sprocket (4), and slide the sprocket off the assembly.

b. Remove the flat washer (5) and bearing holder (6).

c. Remove the bearing (7) and flat washer (8).

d. Remove the retaining ring (9) from the shaft (10).

3-33. Reassembly of Sprocket Assembly Group B, Tray A1A1

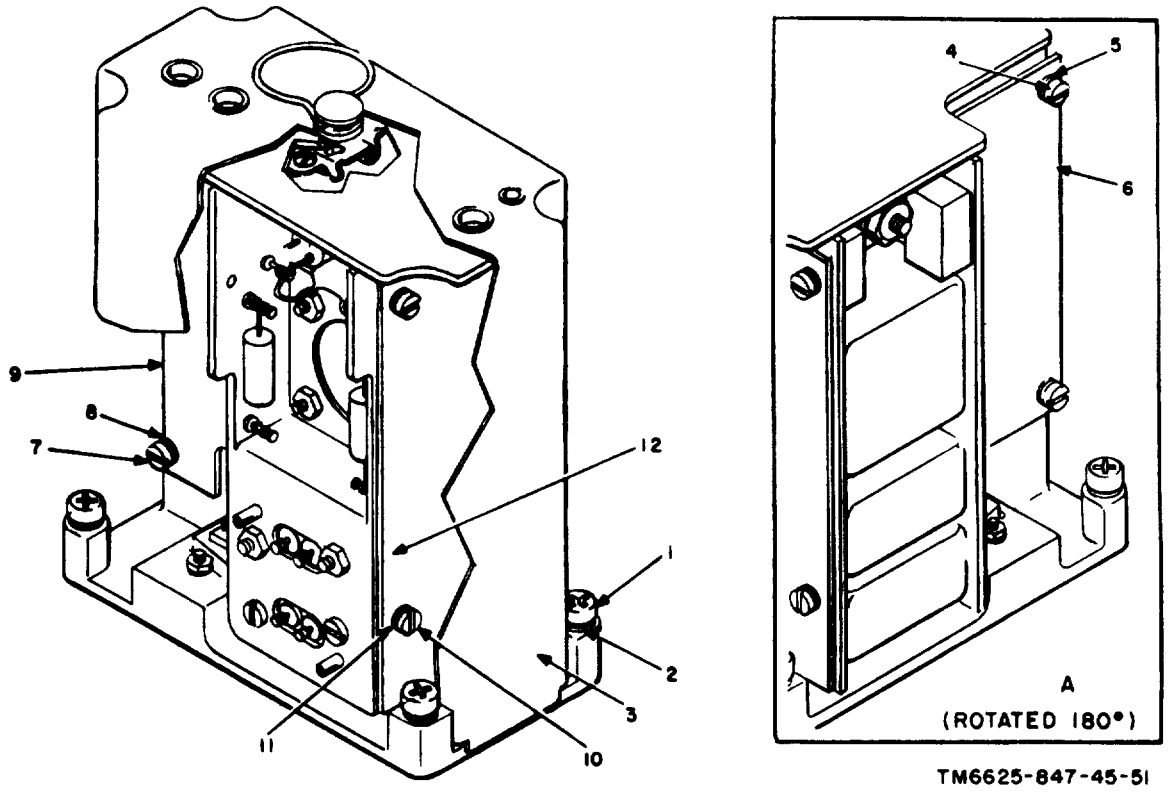
To reassemble either one of the two A-type sprocket assembly groups (fig. 3-18), proceed as given in a through e below.

a. Place the retaining ring (9) on the shaft (10).

b. Install a flat washer (8) and the bearing (7).

c. Place the bearing holder (6) over the assembled components, and install a flat washer (5).

d. Slide the sprocket (4) onto the shaft, and position the chain on the sprocket. Align the pin hole in the sprocket with the hole in the shaft. Install the pin (3).



1	Screw	5	Washer	9	Input filter assembly
2	Washer	6	Regulator module	10	Screw
3	Cover assembly	7	Screw	11	Washer
4	Screw	8	Washer	12	Output filter assembly

Figure 3-15. Dc to dc- converter and regulator module A3.

e. Place the assembly in its proper position on tray A1A1 (fig. 3-1). Install the three cleats (2, fig. 3-18) on the three studs, and secure the sprocket assembly group firmly in position with the three nuts (1).

3-34. Removal of Idler Assembly, Tray A1A1

To remove any one of the three idler assemblies (fig. 3-19), remove the two nuts and two washers which secure the adjustable idler block (1) to tray A1A1.

3-35. Disassembly of Idler Assembly, Tray A1A1

To disassembly any one of the three idler assemblies (fig. 3-19), proceed as follows:

a. Remove the idler sprocket shaft (2) which is pressed into the adjustable idler block (1).

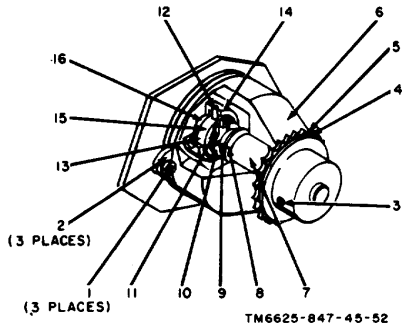
b. Remove the idler bearing (3) and idler sprocket (4) from the shaft. Remove the press fitted idler bearing (3) from the idler sprocket.

3-36. Reassembly of Idler Assembly, Tray A1A1

To reassemble any of the three idler assemblies (fig. 3-19), proceed as follows:

a. Press the idler bearing (3) into the idler sprocket (4).

b. Slide the idler bearing (3) and idler(sprocket (4) on the idler sprocket shaft (2) and press the shaft into the adjustable idler block (1)



1	Nut	9	Washer spring
2	Cleat	10	Flat washer
3	Pin	11	Retaining ring
4	Sprocket	12	Pin
5	Flat washer	13	Pin
6	Bearing holder	14	Outer ring
7	Bearing	15	Inner ring
8	Flat washer	16	Shaft

Figure 3-16. Sprocket assembly group A.

c. Place the idler assembly in its proper position on tray A1A1, and install the two nuts and two washers to secure it firmly in place.

3-37. Removal of Component Boards, Tray A1A1

To remove any of the three component boards (fig. 3-1), detach and tag all leads connected to the component board and remove the two nuts and four washers.

3-38. Disassembly of Component Boards, Tray A1A1

To remove parts from a component board, use conventional techniques. Refer to paragraph 3-1.

3-39. Reassembly of Component Boards, Tray A1A1

Secure the component board to tray A1A1 (fig. 3-1), with the two nuts and four washers. Connect the leads.

3-40. Removal of Terminal Board, Tray A1A2

To remove the terminal board from tray A1A2, (fig. 3-20), remove the two nuts and four washers securing the assembly to tray A1A2.

3-41. Disassembly of Terminal Board, Tray A1A2

To remove parts from the terminal board use conventional replacement techniques. Refer to paragraph 3-1.

3-42. Reassembly of Terminal Board, Tray A1A2

Reassemble the terminal board on tray A1A2 (fig. 3-20), using the four washers and two nuts.

3-40. Removal of IF Amplifier Subassembly A2, Tray A1A2

To remove IF amplifier subassembly A2 from tray A1A2 (fig. 3-20), remove the four screws, four plain washers, and four lockwashers.

3-44. Disassembly of IF Amplifier Subassembly A2, Tray A1A2

To remove parts from IF amplifier subassembly A2, use conventional replacement techniques. Refer to paragraph 3-1.

3-45. Reassembly of IF Amplifier Subassembly A2, Tray A1A2

Reassemble IF amplifier subassembly A2 on tray A1A2 (fig. 3-20), using the four screws, four plain washers, and four lockwashers.

3-46. Replacement of Sprocket Assembly Groups A, Tray A1A3

To remove, disassemble, and reassemble any of the three A-type sprocket assembly groups of tray A1A3, refer to paragraphs 3-28 through 3-30.

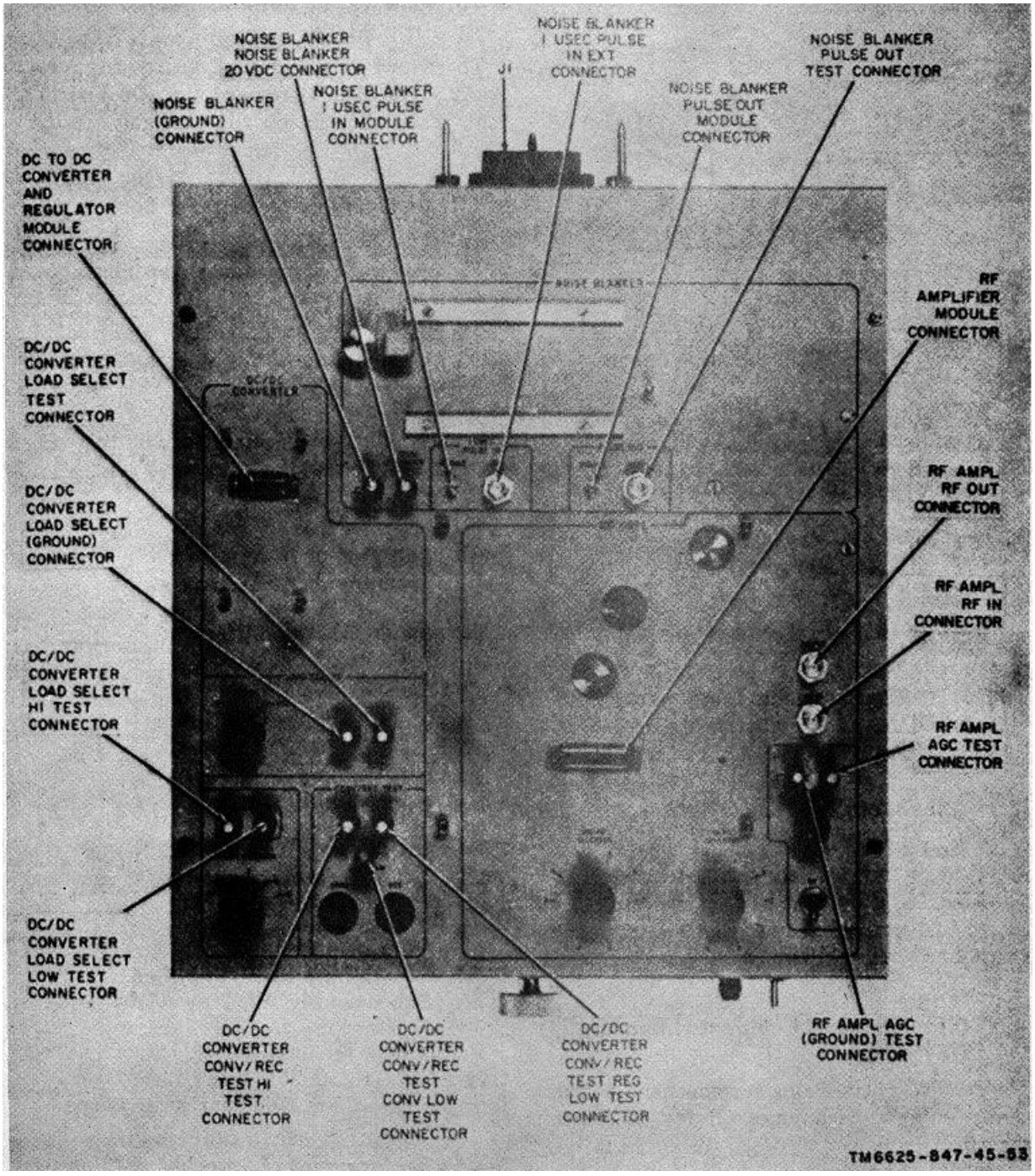


Figure 3-17(1). Common module tray A1A1, controls and indicators (part 1 of 2).

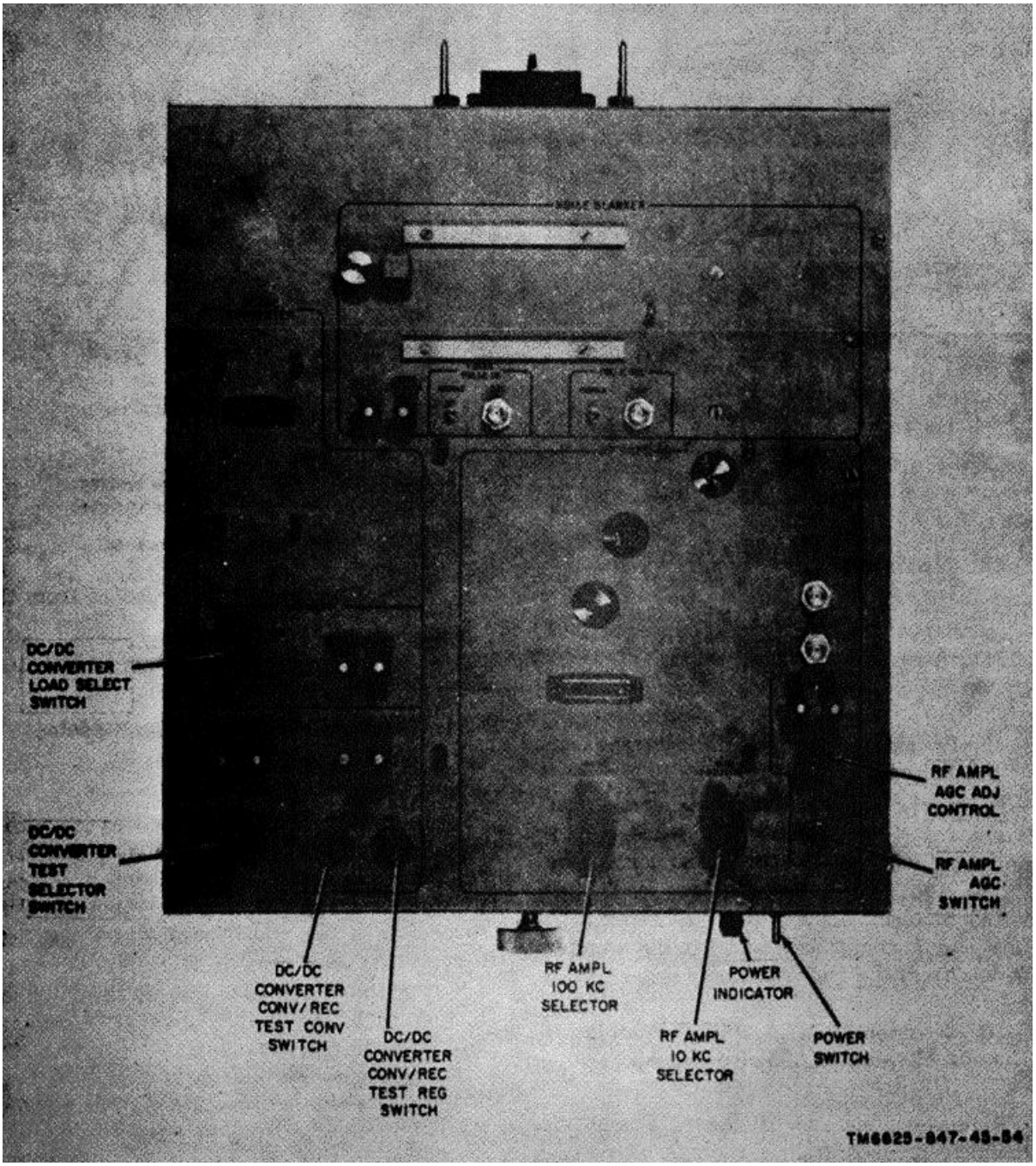
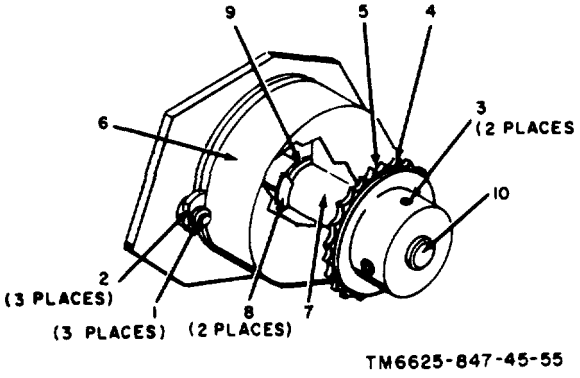


Figure 3-17(2). Common module tray A1A1, controls and indicators (part 2 of 2).

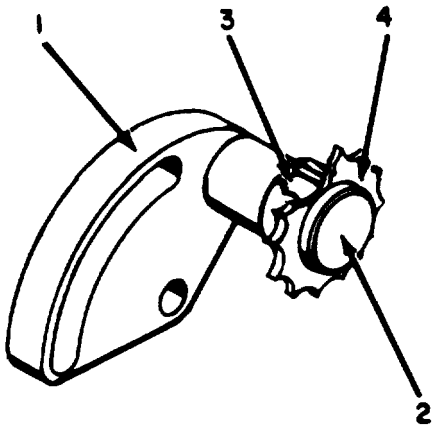
3-47. Replacement of Sprocket Assembly Group B, Tray A1A3

To remove, disassembly, and reassemble any of the three B-type sprocket assembly groups of tray A1A3, refer to paragraph 3-31 through 3-33.



1	Nut	6	Bearing holder
2	Cleat	7	Bearing
3	Pin	8	Flat washer
4	Sprocket	9	Retaining ring
5	Flat washer	10	Shaft

Figure 3-18. Sprocket assembly group B.



1	Adjustable idler block	3	Idler bearing
2	Idler sprocket shaft	4	Idler sprocket

Figure 3-19. Idler assembly.

3-48. Replacement of Idler Assembly, Tray A1A3

To remove, disassemble, and reassemble any of the three idler assemblies, refer to paragraphs 3-34 through paragraphs 3-36.

3-49. Removal of Amplifier Modules AR1 through ARS, Tray A1A3

To remove any of the five amplifier modules (fig. 3-21) from tray A1A3 (fig. 3-22), detach and tag the three leads attached to connectors J1, J2, and J3 and detach the two leads connected to terminals E1 and E2. Remove two nuts and four washers, and lift the amplifier module from the tray A1A3.

3-50. Disassembly of Amplifier Modules AR1 through AR5, Tray A1A3 (fig. 3-21)

To disassemble any of the five amplifier modules, proceed as in a through c below.

a. Remove the two screws (1) and two flat washers (2), and remove the cover (3).

b. Detach and tag the six leads connected to the amplifier board (4).

c. Remove the three screws (5) and three flat washers (6) securing the amplifier board (4), and remove the amplifier board from the case (7).

Note. **To remove parts, use convention A1 techniques. Refer to paragraph 3-1.**

3-51. Reassembly of Amplifier Modules AR1 through AR5 (fig. 3-21)

To reassemble any of the five amplifier modules, proceed as in a through c below.

a. Place the amplifier board (4) in the case (7), and secure it firmly in position using the three screws (5) and three washers (6). Connect the six leads to the amplifier board.

b. Position the cover (3)-on the amplifier module, and install the two screws (1) and two washers (2).

c. Place the amplifier module in tray A1A3 (fig. 3-22), and install the two nuts and four washers. Attach connectors J1, J2, and J8, and connect the leads to E1 and E2 (fig. 3-21).

3-52. Removal of Terminal Boards, Tray A1A4

To remove the two terminal boards from tray A1A4 (fig. 3-23), detach and tag All led connected to the board. Remove the nuts and washers securing the board to the tray A1A4.

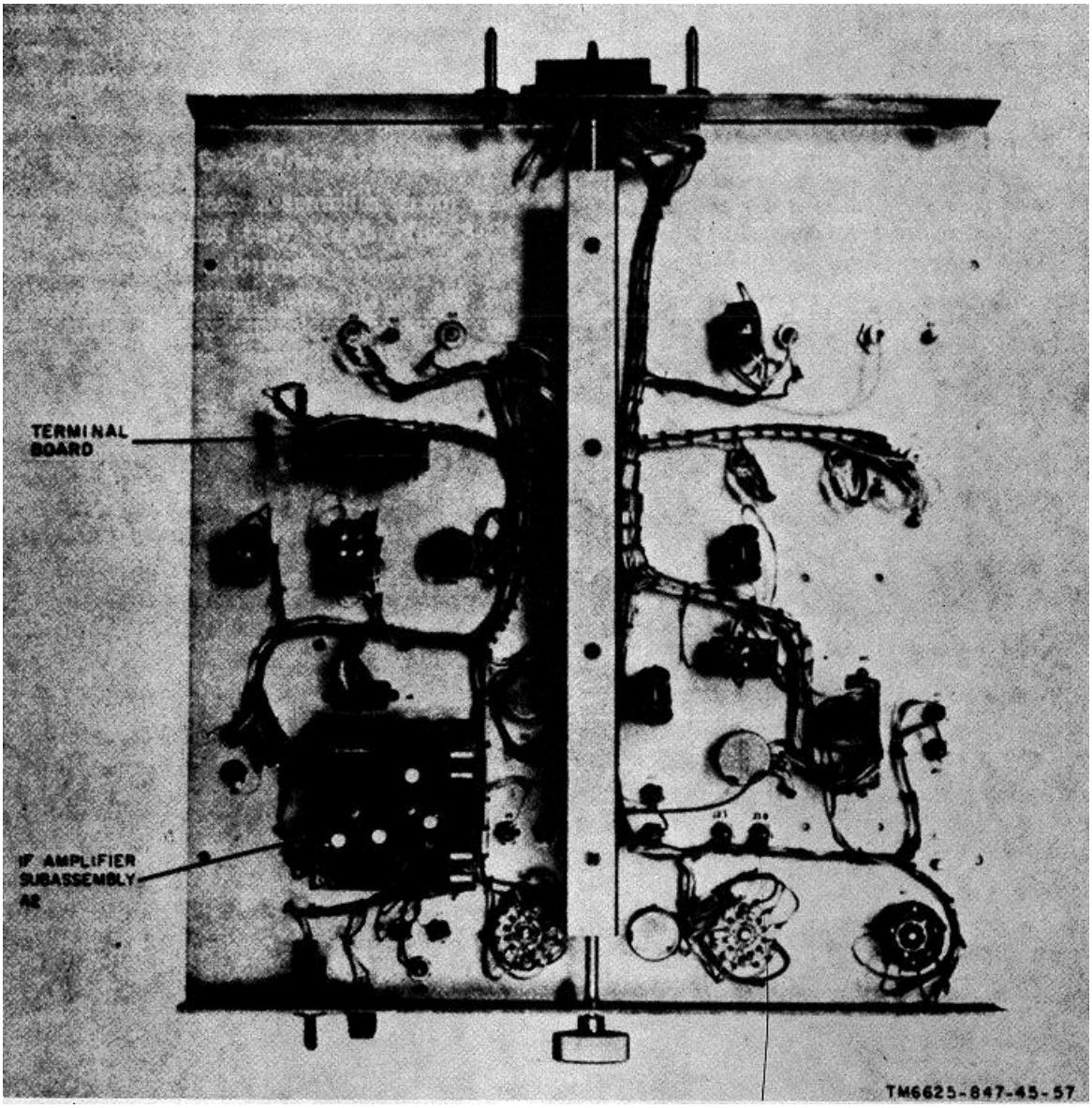


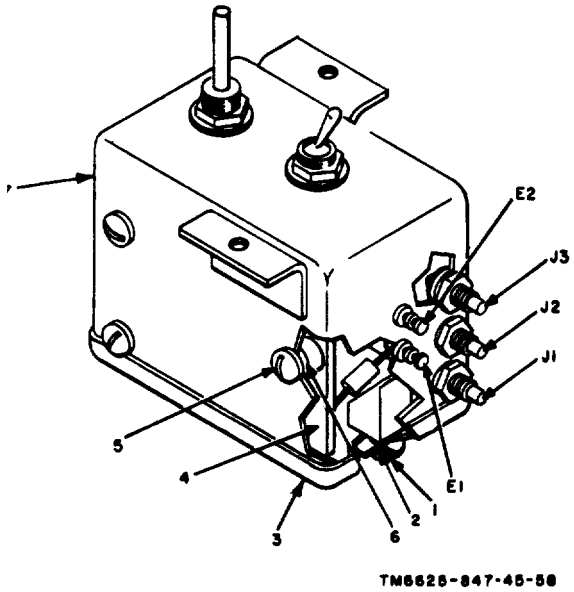
Figure 3-20. Common module tray A1A2 subassembly location.

3-53. Disassembly of Terminal Boards, Tray A1A4

To remove parts from the two terminal boards of tray A1A4, use conventional replacement techniques. Refer to paragraph 3-1.

3-54. Reassembly of Terminal Boards, Tray A1A4

To reassemble the two terminal boards of tray A1A4, place the boards in their original positions in tray A1A4 (fig. 3-23), and install the nuts and washers. Connect the leads.



1 Screw
2 Flat washer
3 Cover
4 Amplifier board
5 Screw
6 Flat washer
7 Case

Figure 3-21. Amplifier modules AR1 through AR5.

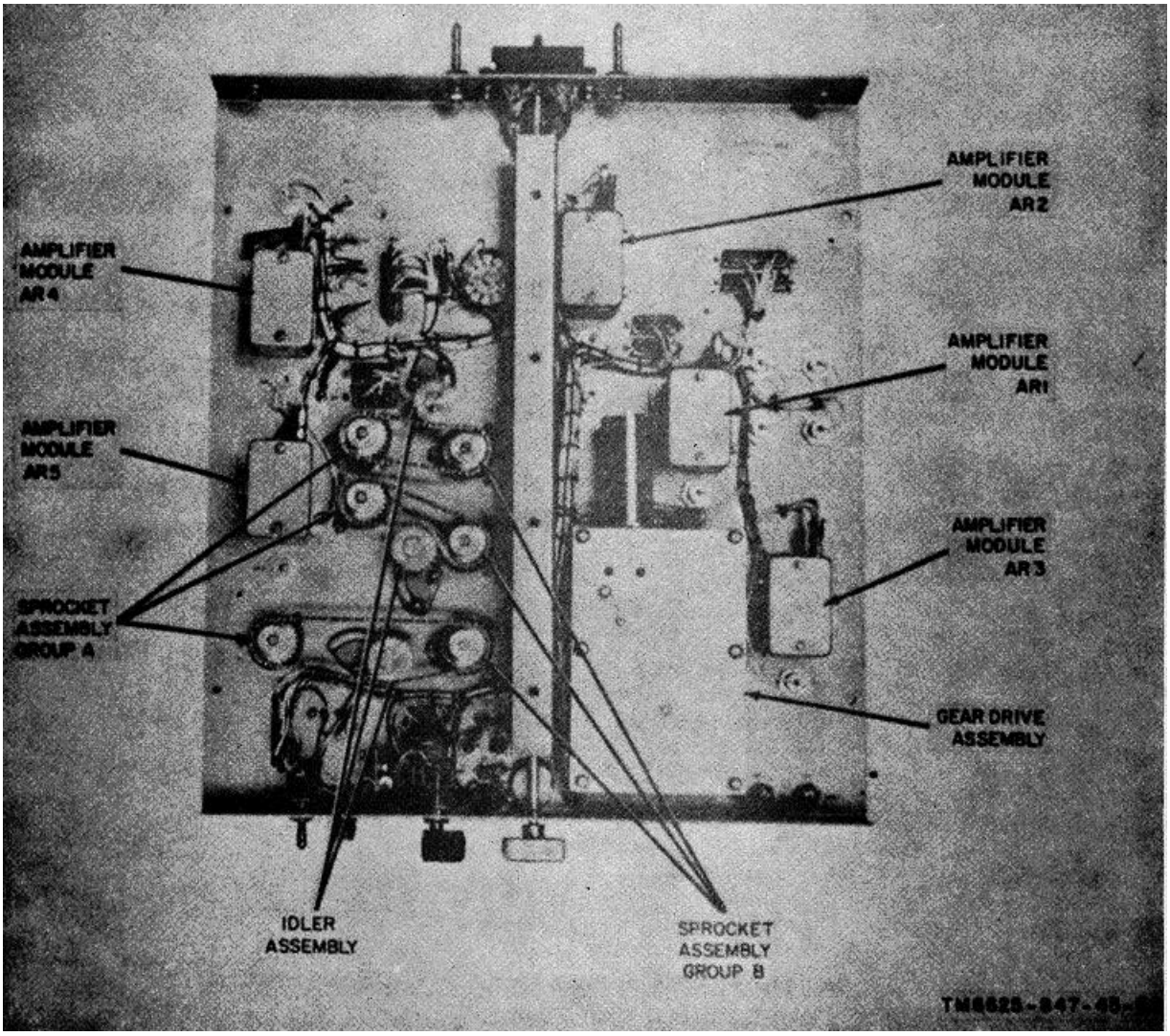


Figure 3-22. Synthesizer test tray A1A3, subassembly locations.

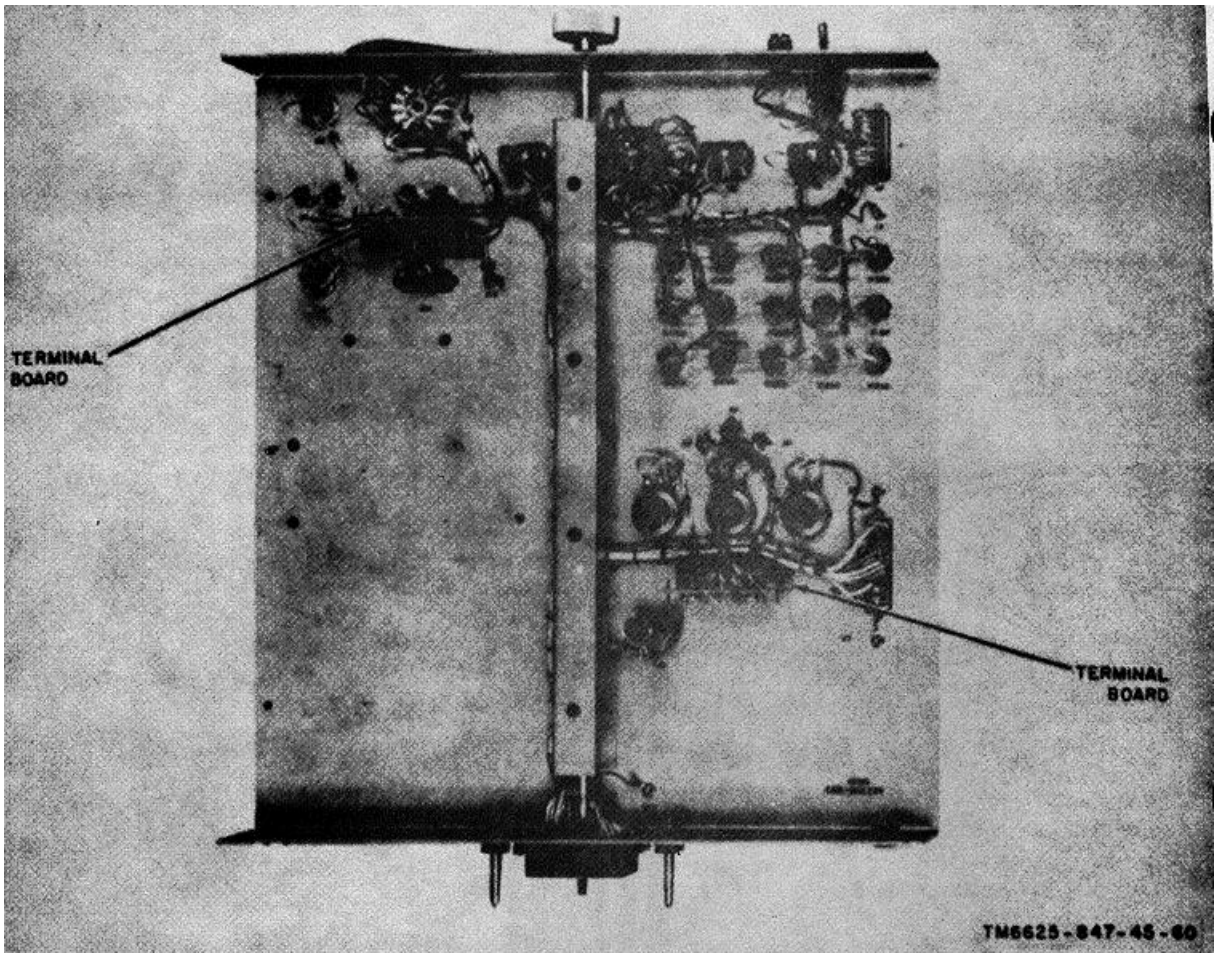


Figure 3-23. Converter and control tray A1A4, electrical circuitry.

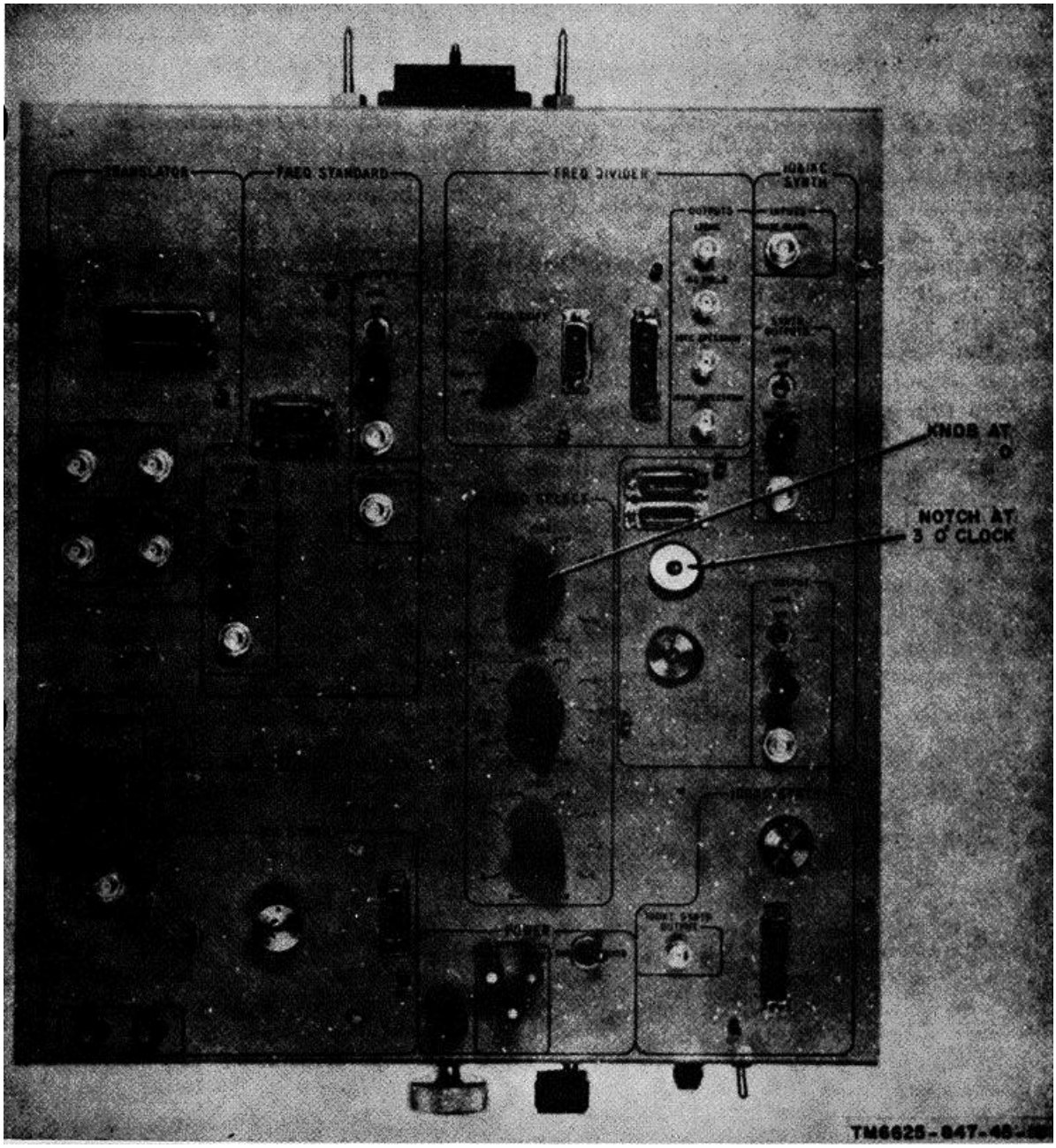


Figure 3-24. Synthesizer test tray A1A3 module couplers alignment

Section III. ADJUSMENTS

3-55. Tray A1 A2, IF Amplifier Subassembly A2 Adjustments

To adjust IF amplifier subassembly A2 (fig. 3-20) of tray A1A2 for 20 db, proceed as in a through i below.

a. Place tray A1A2 on its right side near the test set.

b. Remove the 16 bottom cover screws, and remove the cover from tray A1A2.

c. Connect the banana pins of test cable W22 to test points DC VOLTAGE + 20 and to

ground on the test set. Connect the clips at the remaining end of cable W22 to terminal A1E11 (+20 volts dc) and to A1E8 (ground) on tray A1A2 (fig. 4-6), and connect a jumper wire from terminal A1E11 to terminal A1E4.

d. Using test cable W25, connect the rf output connector of Generator, Signal AN/GRM-50 to terminal A1E3. Ground the AN/GRM50 to terminal A1E2. Set the output of the AN/ GRM-50 at terminal A1E3 to 1 mv.

e. Connect the AN/URM-145 to the RCVR IF test connector and AMPL IF OUT on tray A1A2.

f. Set the test set POWER switch to ON, and rotate the SERV SEL switch to OVEN ON.

g. With the ME-26(*)/U, adjust the voltage at terminal A1E11 (fig. 4-6) for +20 volts dc, using the DC VOLTAGE 20 control on the test set to adjust the level.

h. Adjust resistor A2R5 (fig. 6-8) until the AN/GRM-50 indicates a gain of 20 ±0.6 db at the output of if. amplifier Subassembly A2.

***Note*. With a 1-mv input level a 20-bd gain amplifier will indicate with equal input and output impedance, an output voltage level of 10 mv.**

i. Rotate the SERV SEL switch on the test set to OFF. Set the test set POWER switch to OFF, and disconnect All test equipment. Replace the bottom cover, and secure it with the screws removed in *b* above.

3-56. Tray A1A2 Adjustment (fig. 3-24)

a. The proper relationship between-the position of the 10 & 1 KC SYNTH and 100 KC SYNTH module couplers are the associated FREQ SELECT knob position is required to provide the proper operating frequency of the plug-in module when installed on tray A1A2. The couplers notch should be positioned at 3 o'clock when viewed from the front of the chassis, and the associated knob at 0. Establish this relationship by first rotating the knob until the coupler is positioned properly, then loosening the Allen setscrews on the knob, repositioning the knob to 0, and retightening the Allen setscrews.

b. To adjust the drive chain tension, loosen the nuts seeming the idler assembly until the chain is firm but not taut. When the proper drive chain tension is attained, tighten the nub securing the idler assembly in position.

CHAPTER 4
GENERA1 SUPPORT TESTING PROCEDURES

4-1. General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for general support maintenance of signal equipment to determine the acceptability of repaired equipment. These procedures set forth specific requirements that repaired equipment must meet before it is returned to the using organization.

b. Comply with the instructions preceding each chart before proceeding to the chart. Perform each step in sequence. *Do not vary the sequence.* For each step, perform All the actions required in the *Teat equipment control settings c*olumn; then set the controls and switches on the module or subassembly being tested to the positions indicated in the *Equipment under test control settings column*; then perform each specific test procedure and verify it against its performance standard. If a performance standard is not met while testing a module or subassembly, refer to the applicable troubleshooting chart for corrective measures as indicated under the performance standard.

4-2. Test Equipment, Tools, and Materials

All test equipment, tools, materials, and other equipment required to perform the testing procedures given in this section are listed in the charts in *a* through *d* below, and are authorized under TA 11-17, Signal Field Maintenance Shops, and TA 11-100(11-17), Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shop, Continental United States.

a. Test Equipment.

Nomenclature	*Federal stock No.*	*Technical manual*
Multimeter AN/PSM-6B	6625-643-1688	TM 11 6625-475-10
Voltmeter, Electronic AN/URM-145.	6625-973-3986	TM 11-6625-524-14
Electric Counter, Digital Readout AN/USM-207.	6625-911-6368	TM 11-6625-700-10
Frequency Selective Voltmeter	None	None
Generator, Signal AN/URM-127.	6625-783-5965	TM 11-6625-683-15
Oscilloscope AN/USM-140(*)	6625-066-2525	TM 11-6625-535-15
Generator, Signal AN/GRM-	6625-868-8353	TM 11-6625-573-15
Analyzer, Spectrum TS-723(*)/U.	6625-668-9418	TM 11-5097

b. Tools.

Tool	*Federal Stock No.*		
107-1001 Inert tool,	None		
Tool	Federal stock No.	Winchester Inc.	
Tool Kit, Electronic Equipment TK-100/G.	5180-605-0079	Winchester Crimp and Extraction tool. Amp Inc.	None
Crimp Tools	None		
Tool Kit, Electronic Equipment TK-105/G.	5180-610-8177	Crimp Tool, Thomas & Betes Co. No. WT-GA 58037	None
Extraction tool, Cannon Electric Co.	5120-970-2722	219 Screwdriver with screw-holding clip.	None

c. Other Equipment.

Equipment	Federal stock No.	Technical Manual
Charger, Battery PP-1451/G	6130-985-8157	TM 11-6130-236-12
Preamplifier, HP5261A	None	None
Tee Connector UG-274B/U BNC Type.	None	None
Test Cables W15, W1, W2, W3, W22, and W25.	None	None
Power Supply PP-3940/G	6130-985-8167	TM 11-6130-247-15
Attenuator HP355D	5910-957-1860	None
Cable Assembly, Radio Frequency	None	None

d. Materials (for Fabrication of Special Test Cables).

Material	Qty reqd	Federal stock No
Resistor, fixed composition 10,000 ohms ±5%; 1 watt.	1	5905-185-851
Resistor, fixed composition 560 dns ±5%; 1/2 watt.	1	
Resistor, fixed composition 2000 ohms ±5%; 1/2 watt.	1	
Resistor, fixed composition 51 ohms ±5%; 1/2 watt	8	
Resistor, fixed, wire wound: 1000 ohms ±5%; 50 watt.	1	
Resistor, fixed, wire wound: 250 ohms ±5%; 15 watt	1	
Resistor, variable composition 500 ohms ±20%; 50 watt	1	
Resistor, variable, composition 10,000 ohms ±20%; 2 watts.	1	
Capacitor, fixed, ceramic 0.01 uf ± 10%; 50 vdcw.	2	
Connector UG-1460/U	4	
Selector #5051 BNC Connector (with two 6 inch pieces of RG-196/U coax).	2	
#22 AWG insulated wire (6 inches).	1	
Resistor, fixed composition 2,490 ohms, 10 watts	1	
Resistor, fixed, wire-wound, 8.45 ohms, 10 watts	1	

4-3. Power Supply for General Support Tests

The general support tests given in paragraphs 4-5 through paragraph 4-11 require 20-, 30, and 27-volts dc (adjustable) power supplies. If standard power supplies are not available, the + 20-volt dc supply can be obtained from the front panel of the test set at DC VOLTAGE test points +20 and (ground). The -33 volt dc supply is obtained across test points RCVR IF III and LO on common module tray A1A2, connected to the test set and energized, with the RCVR IF TEST SELECTOR switch set to position 1.

4-4. Test Setups and Fabrication of Test Cables

Figures 4-1 through Figure 4-7 and Figure 6-15 through Figure 6-21 illustrate the necessary test setups required for completion of the general support tests of the modules and subassemblies of the SM-442A/GRC. The modules and subassemblies being tested are contained in the test set, common module tray A1A2, and synthesizer test tray A1A3. Common module tray A1, converter and control tray A4, and driver, discriminator, and antenna coupler tray A1A5 do not have any modules or subassemblies that require general support testing. When necessary, the fabrication of special test cables is illustrated on the appropriate test setup illustration. The cheat in paragraph 4-2d lists the materials needed for the fabrication of the special.

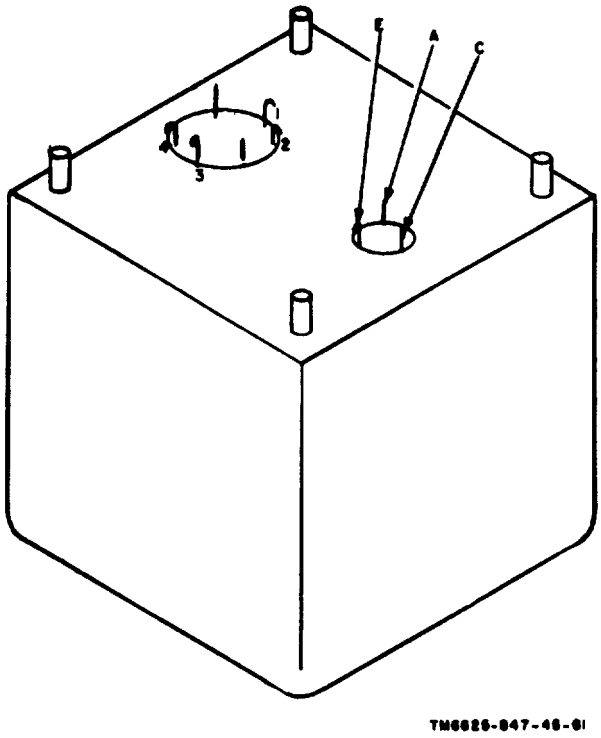


Figure 4-1. Test set A2, dc to dc converter module A2.

4-5. Test Set A2, Dc-to-Dc Converter Module A2; Voltage, Regulation, and Ripple Tests

Dc-to-dc converter module A2 (fig. 4-1) (module A2) is on the boom plate in the beck of the front panel of the test set (fig. 3-10) and is secured by four hexagonal nuts. Module A2 (fig. 4-1) is an encapsulated unit and is not repairable. If any of the performance standards are not satisfied, replace module A2.

a. Test Equipment and Materials,

(1) Multimeter AN/PSM-6B.
(2) Oscilloscope AN/USM-140.
(3) Resistor: 1,000 ohms, 50 watts.
(4) Charger, Battery PP-1451/G.
(5) Resistor: 260 ohms, 15 watts.

b. Test Connections and Conditions. Connect the equipment as shown in figure 6-15.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure
1	AN/PSM-6B FUNCTION switch: DCV-20KΩ/V. RANGE switch: 250.	POWER switch: OFF SERV SEL switch: OFF PA/RT switch: PA KEY switch: OFF XMIT STATUS switch: OPR REC-XMIT switch: REC ALC VOLTAGE INFO control: Fully counterclockwise ALC VOLTAGE TUNE control: Fully counterclockwise IF OSCILLATOR select switch: 4. MC FREQ 10MC switch: 0 MC FREQ 1MC switch: 0 MC FREQ 1MC switch: 0 500 VDC LOAD switch: LOW 2400 VDC LOAD switch: 1	*a*. Set the DC VOLTAGE 200 control to approximately midrange. *b*. Connect the AN/PSM-6B dc test leads to the PP-1451/G output terminals to check the output voltage. *c*. Set the PP-1451/G NORMAL CHARGE switch to NORMAL and the power switch ON. Set the VOLTAGE ADJUST control for an output of +27 volts dc on the AN/PSM-6B. *d*. Turn the PP-1451/G power switch to OFF, and disconnect the AN/PSM-6B. *e*. Connect the AN/PSM-6B across terminals 3 and 4 of module A2 between +200 DC VOLTAGE test point A1J3, on the front panel of the test set and DC VOLTAGE (ground) test connector A1J2. *f* Turn the test set SERV SEL switch to OVEN ON and the power switch to ON; set the PP-1451/G power switch to ON. *g*. Turn the DC VOLTAGE 200 control from fully counterclockwise to fully clockwise. *h*. Turn the PP-1461/G power switch to OFF, and the test set power switch to OFF.
	The voltage should vary from		les mo the
2	Same as step 1 above. 1% of the value in step 1 above.	Same as step 1 above.	*a*. Connect the AN/PSM-6B dc test leads to the PP-1451/G output terminals. Energize the PP-1451/G. Adjust the output voltage to +26 volts or to +24 volts if the PP-1451/G can be adjusted to that low value. Turn the PP-1451/G off, and remove the AN/PSM-6B leads.

			b. Connect the AN/PSM-6B between test points DC VOLTAGE +200 and DC VOLTAGE (ground) on the test set. *c*. Turn the PP-1451/G power switch and the test set POWER switch to ON. *d*. While monitoring the AN/PSM-6B, adjust the DC VOLTAGE 200 control from fully counterclockwise to fully clockwise. *e*. Turn the PP-1451/G power switch and the test set POWER switch to OFF. *f*. Repeat the procedures in a through *e* above with the PP-1451/G set at +30 volts dc. *g*. Return the PP-1451/G output to 27 volts, after completion of *f* above. Turn the power switch to OFF.
3.	*AN/USM-140(*)* Ripple shall not be greater Adjust the AN/USM-140(*) controls to the setting required to monitor the ripe pie on a segment of the +200-volt dc output.	Same as step 1 above.	*a*. Connect the AN/USM-140(*) test probe between test points DC VOLTAGE +200 and DC VOLTAGE (ground) on the test set *b*. Turn the PP-4461/G power switch to ON. *c*. Monitor the ripple on a segment of the +200-volt dc output. *d*. Turn the power switch on PP-1451/G and the POWER switch on the test set to OFF.

tha
vol

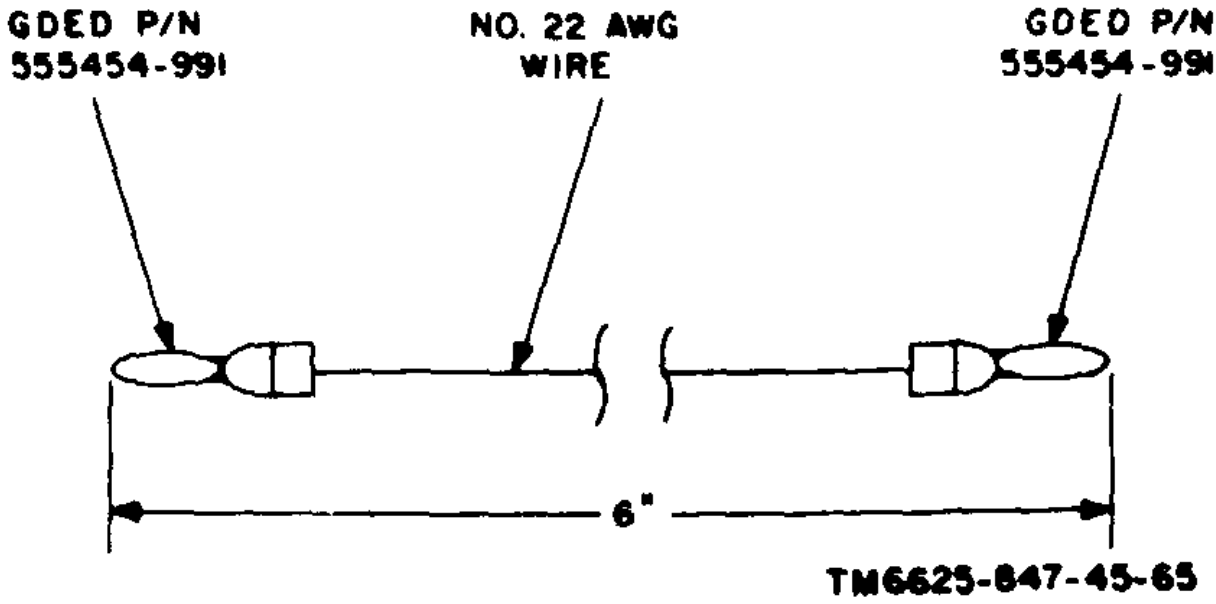


Figure 4-2. Jumper wire fabrication diagram.

4-6. Test Set A2, Dc-to-Dc Converter and Regulator Module A3 Tests

Dc-to-dc converter and regulator module AS (module A3) (fig. 3-10) is in the bank of the test set front panel and is secured to the bottom plate by four captive screws. The general support test of this module utilizes the test set as test equipment.

a. Test Equipment and Materials.

(1) Multimeter AN/PSM-6B.
(2) Oscilloscope AN/USM-140(*).
(3) Charger, Battery PP-1451/G.
(4) One each of the following load resistors:
  (a) 39 ohms, 25 watts.
  (b) 10,000 ohms, 1 watt.
  (c) 2,490 ohms, 10 watts.
  (d) 8.45 ohms, 10 watts.
(5) Fabricate the -test cable as shown in figure 4-2.

b. Test Connections and Conditions. Connect the equipment as shown in figure 6-16.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	*AN/PSM4B* FUNCTION switch: DCV-20KΩ/V RANGE switch: 250	*Test set A2* *a*. POWER switch: OFF *b*. SERV SEL switch: OFF *c*. PA/RT switch: PA *d*. KEY switch: OFF *e*. XMIT STATUS switch: OPR *f*. ALC VOLTAGE INFO switch: max ccw OFF *g*. ALC VOLTAGE TUNE switch: max ccw OFF *h*. IF OSCILLATOR switch: 4 *i*. MC FREQ 10MC switch: 0 MC FREQ .1MC switch: 0 *j*. 600 VDC LOAD switch: LOW *k*. 2400 VDC LOAD switch: 1	*a*. Set the PP1461/G power switch to OFF. *b*. Connect a jumper wire between pins 64 and 40 on connector J1. *c*. Connect a 39-ohm, 25-watt resistor between DC VOLTAGE 20, test connector A1J11, and ground pin 38 on J1. *d*. Set the power switch on the PP-1451/G to ON. *e*. Set the POWER switch on the test set to ON; rotate the SERV SEL switch to STBY. *f*. Check to see that the test set POWER indicator is lighted. *g*. Connect AN/PSM-6B across the 39-ohm load resistor. *h*. Rotate the test set DC VOLTAGE 20 control from fully counterclockwise to fully clockwise. *i*. Set the test set POWER switch to OFF, and disconnect the 39-ohm load resistor.	Less than 18 to more than 22 volts dc.
2	Same as step 1 above, except set RANGE switch to 50.	Same as step 1 above.	*a*. Connect a 10,000-ohm, 1-watt load resistor between pins 89 and 70 of J1. *b*. Connect the AN/PSM-6B across the 10,000-ohm load resistor (observe polarity); Connect the positive lead of the AN/PSM-6B to pin 70 on J1, and the negative lead to pin 39 on J1. *c*. Set the POWER switch on the test set to ON (SERV SEL switch is still at STBY). *d*. Observe and record the voltage reading on the AN/PSM-6B. *e*. Set the POWER switch on the test et to OFF, and disconnect the 10,000-ohm load resistor.	Between -31 to -35 volts dc.
3	Same as step 1 above, except set the ANI PSM-6B RANGE switch to 250.	Same as step 1 above.	*a*. Connect the 2,490-ohm, 10-watt load resistor between pins 36 and 70 of J1. *b*. Connect the AN/PSM-6B across the 2,490-ohm load resistor. *c*. Set the test set POWER switch to ON. Observe and record the reading on the AN/PSM-6B. *d*. Set the test set POWER switch to OFF, and disconnect the 2,490-ohm load resistor.	Between 115 and 135 volts dc.
4	Adjust the controls on the AN/USM-140(*) for a square wave of approximately 15 volts peak to peak.	Same as in step 1 above.	*a*. Connect an 8.45-ohm, 10-watt load resistor between pins 37 and 38 of J1. *b*. Connect the AN/USM-140(*) across the 8.45-ohm load resistor. *c*. Final-adjust the AN/USM-140(*) as required for the performance standard indication. *d*. Disconnect all test equipment, set the test set POWER switch to OFF, and set the power switch on the PP-1451/G to OFF.	Between 12 and 14 volts, peak-to-peak, square wave.

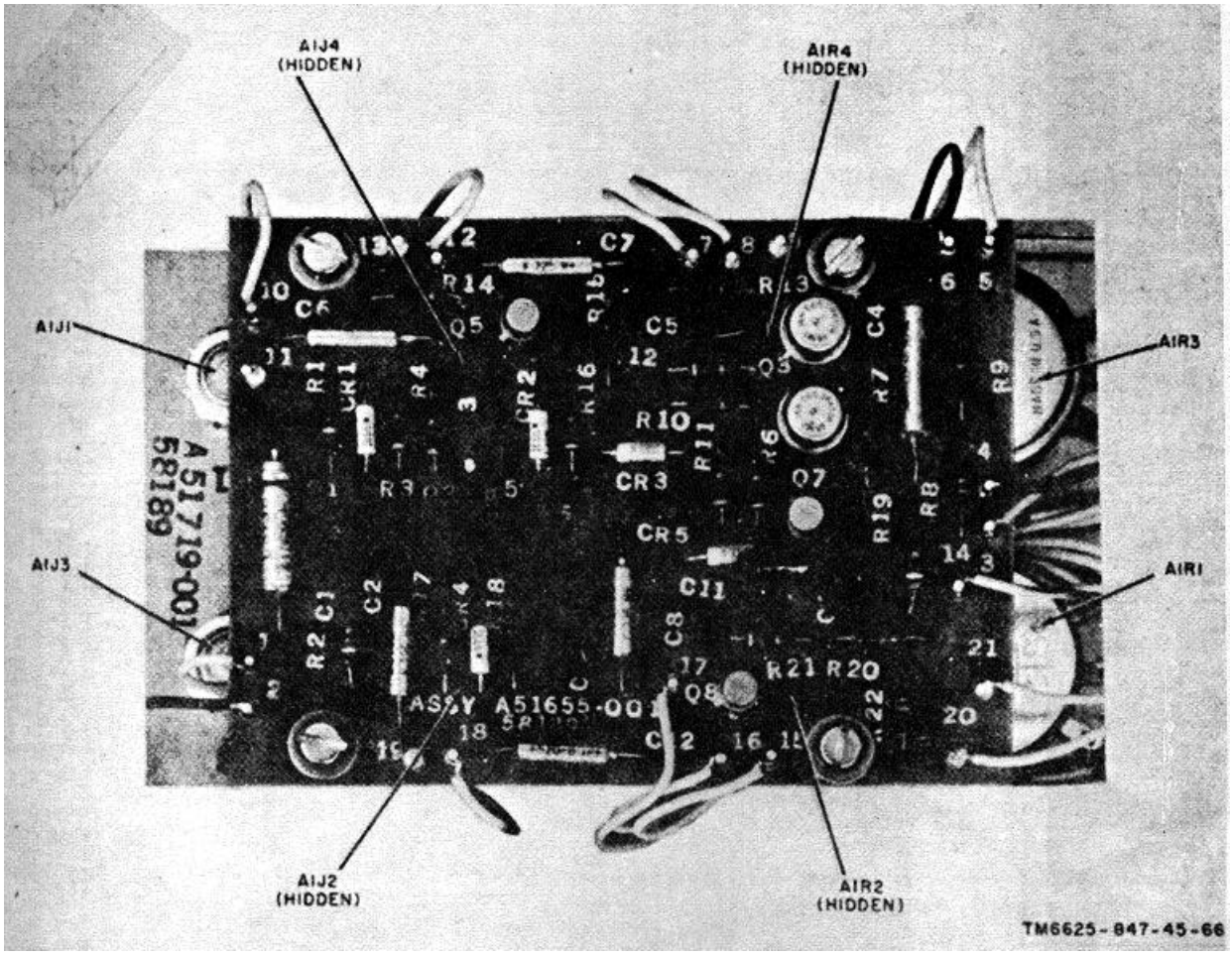


Figure 4-3. Test set A2, pulse generator assembly A1A1.

4-7. Test Set A2, Pulse Generator Assembly A1A1, Tests

a. Test Equipment and Materials.

(1) Generator, Signal AN/URM-127.
(2) Oscilloscope AN/USM-140(*).
(3) Tee Connector UG-274B/U.
(4) A test cable, fabricated as shown in figure 6-17 from materials listed in paragraph 4-2*c*.

b. Test Connections and Conditions. Connect the test equipment as shown in figure 6-17 to test pulse generator assembly A1A1. Pulse generator assembly A1A1 is illustrated by figure 4-3.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	AN/USM-140 POWER switch: ON INTENSITY control: Adjust for ease of viewing. FOCUS control: adjust for a sharp clear display. Adjust other controls as required. AN/URM-127 POWER switch: ON FREQ RANGE MULTIPLIER: X1 Dial: 500 cps ATTENUATOR and OUTPJT CONTROL: Adjust as required to maintain 2 volts. PP-1451/G Power switch: ON	Test set A2 POWER switch: OFF PA/RT switch: PA SERV SEL switch: OFF KEY switch: OFF XMIT STATUS: OPR ALC VOLTAGE INFO: max ccw OFF. ALC VOLTAGE TUNE control: max ccw OFF IF OSCILLATOR select switch: 4 MC FREQ 10MC switch: 0 MC FREQ 1MC switch: 0 MC FREQ .1MC switch: 0 500 VDC LOAD switch: LOW 2400 VDC LOAD switch: 1 Install common module tray A1A2.	*a*. Set the SERV SEL switch to STBY, and set the POWER switch on the test set to ON. Set common module tray A1A2 POWER switch to 0N.	*a*. None.
			b. Connect the fabricated cable to the connector of pulse generator assembly A1A1 from which a reading is to be taken (outputs 1, 2, or 3).	*b*. None.
			c. Connect the AN/USM-140(*) probe to the output of the AN/URM-127. Verify the presence of 500 cps at 2 volts - (Check to see that the test set is being supplied +27 volts dc from the PP-1451/G.)	*c*. None.
			d. Connect the AN/USM-140(*) probe to the output leads of the fabricated cable connected to A1J4, and adjust the AN/USM-140(*) for a single 1-µsec positive pulse.	*d*. None.
			e. Set A1R3 fully clockwise, and adjust A1R4 from fully counterclockwise to fully clockwise	*e*. A positive pulse from less than 1.0 µsec to more than 1.2 µsec (A1R4 rotated clockwise).
			f. Adjust A1R3 from fully counterclockwise to fully clockwise.	*f*. A positive pulse of less than 0.35 volt increasing to more than 5 volts as A1R3. is rotated clockwise.
			g. Connect the AN/USM-140(*) and the fabricated cable to A1J3, and set A1R1 to fully clockwise.	*g*. None.
			h. Adjust the AN/USM-140(*) to display a single positive pulse of approximately 140-µsec duration.	*h*. None.
			i. Adjust A1R2 from fully counterclockwise to fully clockwise.	*i* A positive pulse from less than 70 µsec to greater than 210 µsec as A1R2 is rotated clockwise.
			j. Adjust A1R1, from fully counterclockwise to fully clockwise.	*j*. Amplitude varies from less than 0.1 volt to more than 1.3 volts
			k. Connect the AN/USM-140(*) and the fabricated lead to A1J2, and adjust the AN/USM-140(*) to display an average single pulse of 140 µsec.	*k*. None.
			l. Set A1R1 to a fully clockwise position, and adjust A1R2 from fully counterclockwise to fully clockwise.	*l*. A negative pulse from less than 70 µsec to more than 210 µsec as A1R2 is rotated clockwise.
			m. Adjust A1R1 fully counterclockwise to fully clockwise.	*m*. The amplitude varies from less than 0.1 volt to more than 0.8 volt
			n. Turn the POWER switch on the test set and the power switch on the PP-1451/G to OFF.	*n*. None.

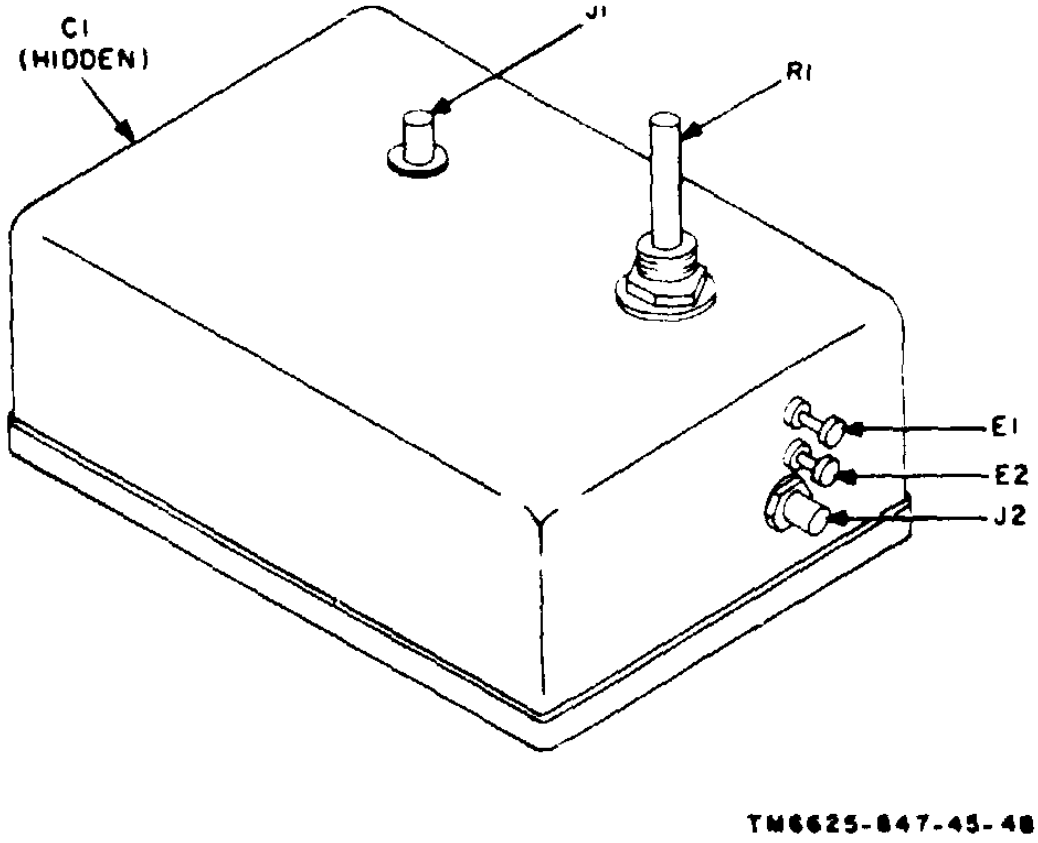


Figure 4-4. Test set A2, if. oscillator modules A1A2, A1A3, and A1A4 (typical).

4-8. Test Set A2, If. Oscillator Modules A1A2, A1A3, and A1A4 Tests

The test of each oscillator module differs only in the operating frequency of the oscillator.

a. Test Equipment and Materials.

(1) Voltmeter, Electronic AN/URM-145.
(2) Electronic Counter, Digital Readout AN/URM-207.
(3) Fixed resistor: 51 ohms, 1/2 watt.
(4) Connector UG1460/U.

b. Test Connections and Conditions. Connect the equipment as shown in Figure 6-18. Figure 4-4 illustrates the if. oscillator module controls, jacks, and test points.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	AN/URM-145 Power switch: ON VOLTS switch: .01 PP-1451/G Power switch: OFF NORMAL CHARGE switch: NORMAL	SM442A/GRC POWER switch: OFF SERV SEL switch: STBY PA/RT switch: PA KEY switch: OFF XMIT STATUS switch: OPR REC-XMIT switch: REC ALC VOLTAGE INFO control: fully counterclockwise. ALC VOLTAGE TUNE control: fully counterclockwise. IF OSCILLATOR SELECT switch: 1+3 (change as required). MC FREQ 10MC switch: 0 MC FREQ 1MC switch: 0 MC FREQ .1MC switch: 0 500 VDC LOAD switch: LOW 2400 VDC LOAD switch: 1 IF OSCILLATORS 1, 2, and 3 output level controls: fully counterclockwise.	*a*. Set the PP-1451/G power switch and the test set POWER switch to ON (test set supplied 27 volts dc).	*a*. None.
			b. Connect the AN/URM-145 probe, in turn, to A1A2J1, A1A3J1, and A1A4J1. (For a more accurate indication on the AN/URM-145, use a lower voltage range.) Change the IF OSCILLATOR, SELECT switch setting as required.	*b*. Indication should be less than 30 mv.
			c. Turn the three IF OSCILLATOR output level controls 1, 2, and 3 (A2R1, A3R1, and A4R1) fully clockwise.	*c*. None.
			d. Check to see that the AN/URM-145 VOLTS switch is on the .01 range. Connect the probe of the AN/URM-145, in turn, to A1A2J1, A1A3J1, and A1A4J1, and record each reading. Change the IF OSCILLATOR select switch setting as required.	*d*. The output voltage should be at least more than 300 mv.
			e. Turn the AN/URM-145 power switch off.	*e*. None.
2	Same as above, except that the AN/URM-145 is not used. *AN/USM-207* SENSITIVITY switch: .1V POWER switch: TRACK DISPLAY control: Set for display time desired.	Same as above, except set the IF OSCILLATORS level controls fully clockwise. **Note. If signal levels are too low, an amplifier may be required to increase the signal to above.1 volt rms, to provide adequate input to the AN/USM-207.**	*a*. Turn the power switch on the PP-1451/G and the POWER switch on the test set to ON.	*a*. None.
			b. Attach the Cable Assembly Radio Frequency from FREQ A on the AN/USM-207 to A1A2J1, A1A3J1, and AMA4J1, in turn, and record the frequency displayed at each test point.	*b*. The following should be displayed: (1) A1A431: 1.7500 mc, 100 cps. (2) A1A3J1: 1.7515 mc, 100 cps. (3) A1A2J1: 1.7525 mc, 100 cps.
			c. Refer to figures 3-10, 4-4, and 6-3 to locate capacitor C1 on each if. oscillator. Rotate C1 on each if. oscillator, respectively, through its full travel, and record the minimum and maximum frequencies for each if. oscillator.	*c*. The frequency should not vary more than $\pm$100 cps from the value recorded in *b* above.
			d. Turn the POWER switch on the test set, the power switch on the PP-1451/G, and the POWER switch on the AN/USM-207 to OFF.	*d*. None.

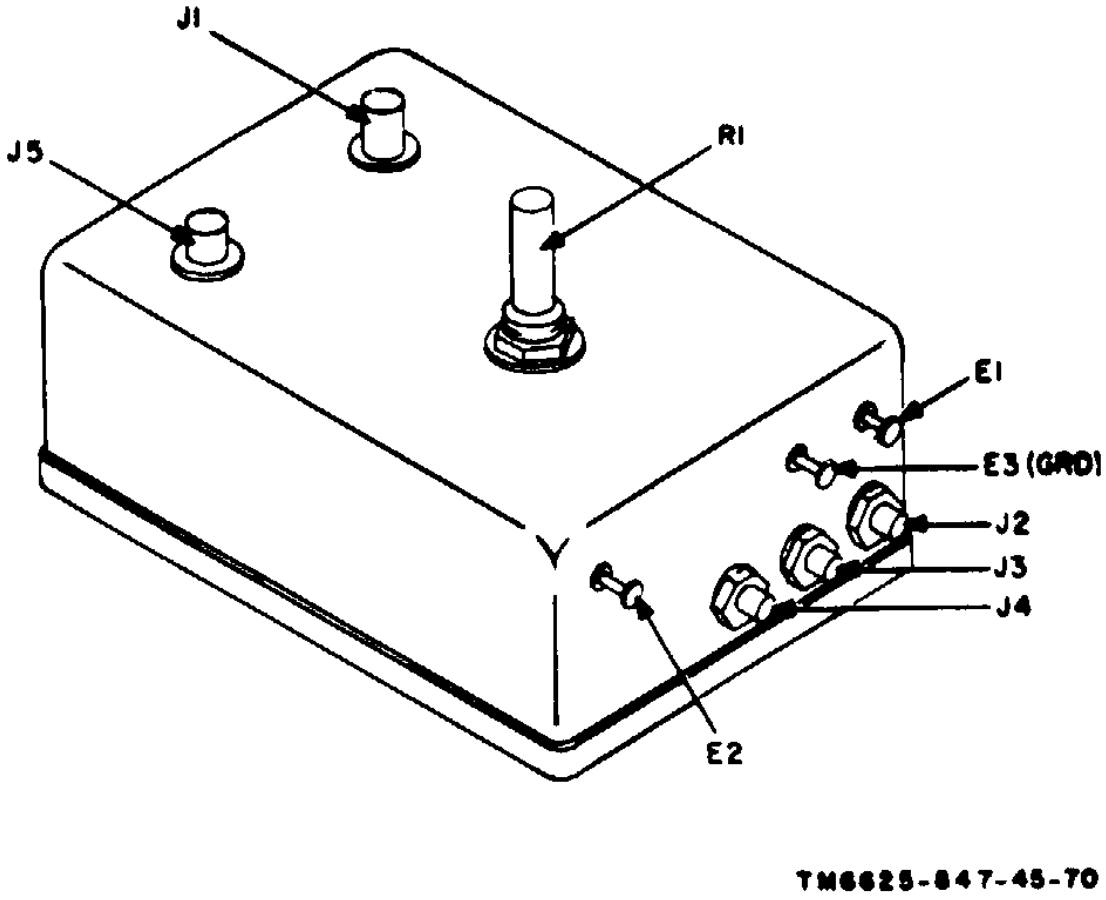


Figure 4-5. Test set A2, mixer assembly A1A5.

4-9. Test Set, Mixer Assembly A1A5, Tests

a. Test Equipment and Materials.

(1) Generator, Signal AN/GRM-5D.
(2) Voltmeter, Electronic AN/URM-145.
(3) Four UG-1460/U connectors.
(4) Tee Connect UG-274B/U.
(5) Two Sealectro 5051 BNC connectors.
(6) Twelve index of RG-196/U coaxial cable.
(7) Two fixed resistors, 51 ohms, 1/2 watt each.
(8) Two clips, electrical (alligator clips).

b. Test Connections and Conditions. Connect the test equipment, as shown in Figure 6-19, to mixer assembly A1A5 (Fig. 4-5). Fabricate the two 51-ohm test leads (Fig. 6-19), and connect as directed in the procedure (*c* below).

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	AN/GRM-50 RANGE switch: 530KC-1800KC FREQUENCY control: 1750.00KC MODULATION SELECTOR: CW AN/URM-145 VOLTS switch: .3 Power switch: ON	SM-442A/GRC POWER switch: OFF SERV SEL switch: STBY PA/RT switch: PA KEY switch: OFF XMIT STATUS switch: OPR REC-XMIT switch: REC ALC VOLTAGE INFO control: Fully counterclockwise ALC VOLTAGE TUNE control: Fully counterclockwise IF OSCILLATOR SELECT switch: 1 IF OSCILLATORS 1, 2, and 3 output level controls: Fully counterclockwise MC FREQ 10MC switch: 0 MC FREQ 1MC switch: 0 MC FREQ .1MC ditch: 0 500 VDC LOAD switch: LOW 2400 VDC LOAD switch: 1	*a*. Connect the 51-ohm fabricated test loads (fig. 4-5 and 6-19) to A1A5J2 and to A1A5J4 on mixer assembly A1A5 (fig. 3-10). *b*. Connect one end of cable W1 to the Tee Connector UG-274B/U on the AN/GRM-50 to TWO TONE IN connector A1A5J1. *c*. Set A1A5R1 fully clockwise and turn the PP-1451/G power switch and the SM-442A/GRC POWER switch to ON. *d*. With the AN/URM-145 connected to the remaining end of the tee connector, adjust the AN/GRM-50 to 1.75 mc at 150 mv. *e*. Connect the AN/URM-145 to the TWO TONE OUT connector, and record the output level.	*a*. None. *b*. None. *c*. None. *d*. None *e*. Not less than 0.075 mv.
2	Same as step 1 above.	Same as step 1 above.	*a*. Connect the AN/GRM-50 to A1A5J4. Connect the AN/URM-145 to the tee connector on the AN/GRM-50, and check to see that the output is 150 mv. *b*. Connect one end of cable W1 to the tee connector on the AN/GRM-50 to TWO TONE IN connector A1A5J1. *c*. Connect one of the 51-ohm fabricated test leads to A1A5J3, and set A1A5R1 fully counterclockwise. *d*. Connect the AN/URM-145 to A1A5J5, and measure the output (use 0.003 range). *e*. Set A1A5R1 fully clockwise..... *f*. Remove the 51-ohm test load from A1A5J3, connect it to A1A5J4, and set A1A5R1 fully counterclockwise. *g*. Feed the 150-mv signal into A1A5J1. *h*. Set A1A5R1 fully clockwise..... *i*. Turn the power switches to OFF.	*a*. None. *b*. None. *c*. None. *d*. Less than 1-mv output. *e*. More than 10-mv output. *f*. None *g*. Less than 1-mv output. *h*. More than 10-mv output.

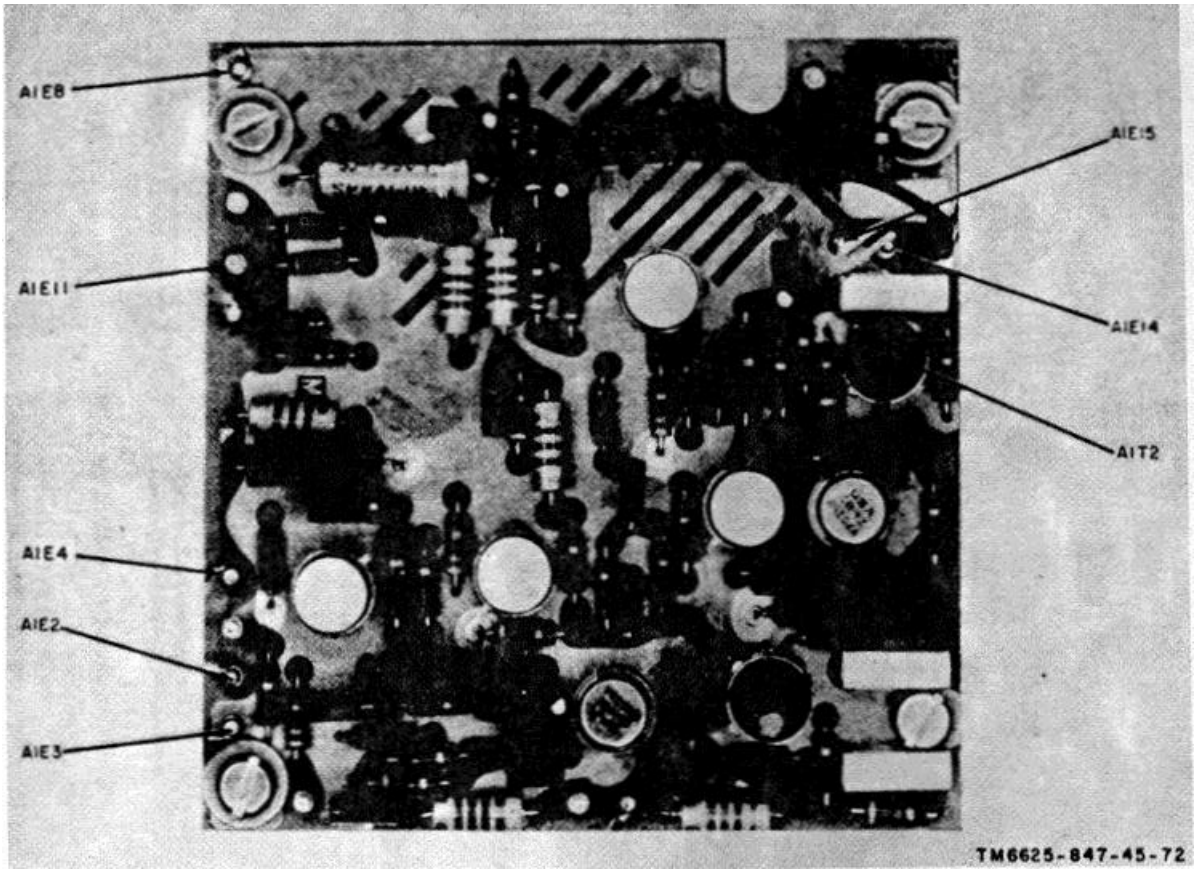


Figure 4-6. Common module tray A1A2 if. amplifier module A1.

4-10. Common Module Army A1A2 If. Amplifier Module A1 Tests

a. Test Equipment and Materials.

(1) Voltmeter, Electronic AN/URM-145.
(2) Generator, Signal AN/GRM-50.
(3) Potentiometer, 10-kilohms, 2 watts.
(4) The test set ±20-volt dc supply.

b. Test Connections and Conditions. Connect the test equipment as shown in figure 6-20 to if. amplifier module A1. (To remove if. amplifier module A1 from tray A1A2, refer to paragraph 8-43 and figure 3-20. The fast points are shown on figure 4-6.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	
1	*AN/URM-145* VOLTS switch: .003 Power switch: ON *AN/GRM-50* RANGE switch: 530 kc to 1,801 kc FREQUENCY control: 1750.00 MODULATION SELECTOR: CW POWER switch: ON *PP-1451/G* NORMAL CHARGE switch: NORMAL Power switch: ON	*SM-442A/GRC* POWER switch: OFF *Tray A1A2* POWER switch: OFF SQUELCH switch: OFF SQUELCH SYNC switch: OFF AUDIO GAIN control: Fully counterclockwise AGC SYNC switch: OFF RF AGC ON OFF switch: OFF TEST SELECTOR switch: 1 BFO TONE control: Fully counterclockwise RF GAIN control: Fully counterclockwise ALC APC CONTROL ALC switch: OFF ALC APC PPC CONTROL POWER control: Fully counterclockwise ALC APC PPC CONTROL APC/PPC SEL switch: OFF VOICE MODES switch: PUSH TO TALK TEST SELECTOR switch: 1 *Note*. If A1A2A1 is tested separately from tray A1A2, the above control settings need not be made on tray A1A2.	*a.* Connect a ground lead between test set connector J1, pin 70, and pin 70 of J1 on tray A1A2., *b.* Connect a lead between pin 41 of J1 on the test set and pin 41 of J1 on tray A1A4 *Note*. If test is made with A1A2A1 out of tray A1A2, connect the ground lead to A1A2A1E8, and the +20-volt dc lead to A1A2A1E11. *c.* TURN the test set POWER switch and the tray A1A2 power switch to ON. *d.* Connect the AN/URM-145 probe to terminal A1E2, and the probe clip to terminal A1E3. Adjust the AN/GRM-50 for an output at 1.75 meat 1 ± 0.1 mv rms. *e*. Remove the AN/URM-145 probe loads from A1E2 and A1E3, and connect the probe to terminal A1E14 and the probe clip lead to terminal A1E15. *f.* Adjust the 10-kilohm, 2-watt potentiometer for maximum output on the AN/URM-146. *g.* Turn the POWER switches OFF, and disconnect the equipment.	*a.* No *b.* No *c.* No *d.* No *e.* No *f.* Ou ma *g.* No

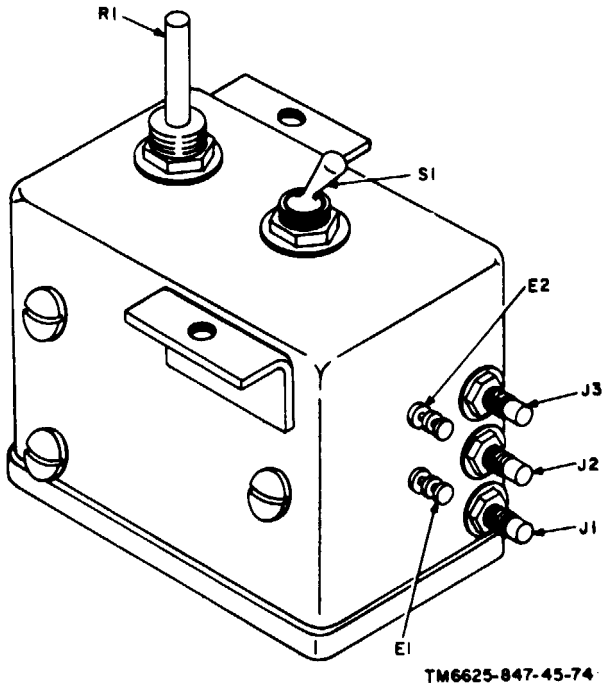


Figure 4-7. Synthesizer test tray A1A3, amplifier modules AR1 through AR5.

4-11. Synthesizer Test Tray A1A3, Amplifier Modules AR1 through AR5 Tests

The tests of amplifier modules AR1 through AR5 are the same for each module; however, the test results, step 2, for AR3 are different. To remove and replace the modules for the individual bench testing, refer to paragraphs 3-49 and 3-51*c*.

a. Test Equipment and Materials.

(1) Generator, Signal AN/GRM-50.
(2) Voltmeter, Electronic AN/URM-145.
(3) Test set A2 20-volt dc supply.
(4) Tee Connector UG-274B/U.
(5) Two Connectors UG-88C/U and two Sealectro 5051 connectors.
(6) Two Connectors UG-1460/U.

b. Test Connectors and Conditions. Connect the test equipment, as shown in figure 6-21, to amplifier modules AR1 through AR5 (fig. 4-7) to be tested.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	*PP-1451/G* NORMAL-CHARGE switch: NORMAL Power switch: OFF VOLTAGE ADJUST control: Set for 27-volt dc on OUTPUT VOLTAGE meter *AN/GRM-50* RANGE switch: 530KC-1800 KC FREQUENCY control: 1000KC POWER switch: ON VERNIER ATTENUATOR switch: *AN/URM-145* Power switch: ON VOLTS switch: .1	*Test set A2* POWER switch: OFF *Tray A1A3* Power switch: OFF MODULE SELECT switch: 10 and 1 KC POWER VAR-FINED switch: FIXED ADJ control: Midrange FREQ SFLECT: 10 KC control: 0 1 KC control: 0 100 KC control: 0 10 & 1 KC SYNTH: SYNTH OUTPUTS AMPL ON-OFF switch: OFF SYNTH OUTPUTS VOLT ADJ control: Midrange OUTPUT AMPL ON-OFF switch: OFF OUTPUT VOLT ADJ control: Midrange FREQ DIVIDER FREQ SHIFT switch: OFF FREQ STANDARD: OUTPUT AMPL ON-OFF switch (2): OFF OUTPUT VOLT ADJ control (2): Midrange MC SYNTH section: OUTPUT AMPL ON-OFF switch: OFF OUTPUT VOIT ADJ control: Midrange	*a*. Turn the PP-1451/G power switch to ON. Turn the test set POWER switch to ON. Turn the FREQ STANDARD OUTPUT AMPL SWITCH to OFF. Set tray A1A3 power switch to ON. Turn the FREQ STANDARD OUTPUT VOLT ADJ control fully counterclockwise.	*a.* None.
			b. Connect the AN/URM-145 probe to the W1 cable on the AN/GRM-50, Adjust the AN/GRM-50 for a 1,000-kc output at 50 mv.	*b.* None.
			c. Disconnect the AN/URM-145 probe from the AN/GRM-50 (cable W1), and connect it to the lead attached to A1A3A1J3. Observe the voltage level on the AN/URM-145.	*c.* Not less than 45 mv.
			d. Set the amplifier module A1 FREQ STANDARD OUTPUT AMPL switch to ON. Record the reading on AN/URM-145.	*d* Less than 40 mv.
			e. Rotate the amplifier module A1 FREQ STANDARD OUTPUT VOLT ADJ control fully clockwise, and observe the indication an the AN/URM-145.	*e*. At least 100 mv.
			f. Repeat the procedures in *a* through *e* above with input frequencies of 7.1, 10, and 23.5 mc.	*f*. None.
2	Same as step 1 above 1 except set the VOLTS switch on the AN/URM-145 to 1.	Same as step 1 above.	*a*. Check to see that equipment is set up, connected, and turned on in the same manner as in step 1 above.	*a*. None.
			b. Set the amplifier module A1 FREQ STANDARD OUTPUT AMPL switch to OFF, and the amplifier module A1 FREQ STANDARD OUTPUT VOLT ADJ control fully counterclockwise.	*b*. None.
			c. Connect the AN/URM-145 probe to cable W1 on the AN/GRM-50, and adjust the AN/GRM-50 for an output of 1 mc at 560 ± 100 mv. Record this reading.	*c*. None.
			d. Connect the AN/URM-145 probe to the lead attached to A1A3A1J3. Observe and record the voltage level on the AN/URM-145.	*d*. Not less than 5 mv of the level recorded in *c* above.
			e. Set the FREQ STANDARD OUTPUT AMPL switch to ON. Observe the indication an AN/URM-145.	*e*. Less than 460 mv.
			f. Rotate the FREQ STANDARD OUTPUT VOLT ADJ control fully clockwise.	*f*. More than 660 mv.
			g. Turn the power switch on the PP-1451/G to OFF, and disconnect the test equipment.	

4-12. Summary of Test Data

Personnel may find it convenient to arrange the checklist in a manner similar to that shown below:

Simulator, Radio Frequency SM-442A/GRC

Test	Performance standard
1. Voltage test	Less than + 190 volts dc to more than +210 volts dc.
2. Regulation test	± 1 percent of the value in test 1 above.
3. Ripple test	Ripple not greater than 0.2 percent rms of output voltage.
4. Test set DC VOLTAGE 20	Less than 18 volts dc to more than 22 volts dc.
5. Negative voltage	Between -31 volts dc and -35 volts dc.
6. 125 volts dc	Between 115 vdc and 135 vdc.
7. 6.3-volt ac filament voltage	Between 12 volts to 14 volts, peak to peak, square wave.
8. Pulse generator module A1A1	Positive pulse less than 1.0 usec to more than 1.2 usec.
9. A1R3 rotated	Positive pulse less than 0.35 volts to more than 5 volts.
10. A1R2 rotated	Positive pulse less than 70 usec to more than 210 usec.
11. A1R1 rotated	Amplitude less than 0.1 volt to more than 1.3 volts.

Simulator, Radio Frequency SM-442A/GRC-Continued

Test	Performance standard
12. A1R1 fully clockwise and A1R2 rotated	Less than 70 usec to more than 210 usec.
13. A1R1 fully counterclockwise to fully clockwise	Amplitude varies less than 0.1 to more than 0.8 volt
14. Oscillator modules A1A2, A1A3, and A1A4	Less than 30 mv.
15. IF OSCILLATOR control fully clockwise	More than 300 mv.
16. Frequency check	1.7500 mc ±100 cps; 1.7515 mc ±100 cps; 1.7525 mc ±100 cps
17. Rotate C1 on each IF oscillator	Not more than ±100 cps from value in test 16 above.
18. Mixer module A1A5	TWO TONE OUT, 0.075 mv.
19. Test load at A1A5J3	Less than 1 mv; A1A5R1 counterclockwise.
20. Test load at A1A5J3	More than 10 mv; A1A5R1 clockwise.
21. Test load at A1A5J4	Less than 1 mv; A1A5R1 counterclockwise.
22. Test load at A1A5J4	More than 10 mv; A1A5R1 clockwise
23. Potentiometer adjusted for maximum output.	25 mv or approximately 20 db.
24. Modules A1, A2, A4, and A5	At A1A3A1J3: not less than 45 mv; less than 40 mv; at least 100 mv.
25. Module A3	Not less than 5 mv; less than 460 mv; more than 660 mv.

CHAPTER 5
DEPOT OVERHAUL STANDARDS

5-1. General
Complete rebuild of the SM-442A/GRC or its individual components may be accomplished by depot maintenance facilities, when authorized.

5-2. Applicability of Depot Overhaul Standards
The tests outlined in this chapter are designed to measure the performance capability of a repaired SM-442A/GRC. Equipment that is to be returned to stock should meet the standards given in these tests.

5-3. Applicable References
a. Repair Standards. Applicable procedures of the depots performing these tests and the general standards for repaired electronic equipment given in TB SIG 355-1, TB SIG 355-2, and TB SIG 355-3 form a part of the requirements for testing this equipment.

b. Modifications Work Orders. Perform all modification work orders applicable to this equipment before making the tests specified. DA Pam 310-7 lists all available MWO's.

5-4. Test Facilities Required
The equipment in the chair below is required for depot testing.

Test equipment	*Technical manual*
Multimeter AN/PSM-6B	TM 11-6625-475-10
Voltmeter, Electronic AN/URM-145.	TM 11-6625-524-14
Electronic Counter. Digital Readout AN/USM-207.	TM 11-6625-700-10
Generator, Signal AN/URM-127.	TM 11-6625-683-15
Oscilloscope AN/USM-140 (*).	TM 11-6625-535-15
Charger, Battery PP-1451/G.	TM 11-6130-236-12
Multimeter ME-26(*)/U	TM 11-6625-200-12

5-5. Depot Testing
Before performing each of the tests (para 5-7, 5-9, 5-11, 5-13, 5-15, and 5-17), make certain that the preliminary switch and control settings (para 5-6, 5-8, 5-10, 5-12, 5-14, and 5-16) preceding each test have been complied with. When testing, perform each step in its proper numerical sequence.

5-6. Test Set, Preliminary Switch and Control Settings

Switch or control	*Setting*
POWER switch	OFF
SERV SEL switch	OFF
PA/RT switch	PA
KEY switch	OFF
XMIT STATUS switch	OPR
REC/XMIT switch	REC
ALC VOLTAGE INFO control	Fully counterclockwise
ALC VOLTAGE TUNE control	Fully counterclockwise
IF OSCILLATOR elect switch	4
MC FREQ 10MC switch	0
MC FREQ 1MC switch	0
MC FREQ .1MC switch	0
500 VDC LOAD switch	LOW
2400 VDC LOAD switch	1

5-7. Test Set, Operational Performance Test

Step No.	Operation of test equipment	Control setting and operation of equipment under test	Performance standard
1	Make sure that +27-volt dc primary power is supplied to the POWER connector on the test set.	*a.* Set the switches and controls on the test set to the settings listed in paragraph 5-6.	*a.* None.
2		*b.* Set the POWER switch to ON.	*b.* POWER indicator is illuminated.

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
3	Refer to figure 5-1 for test equipment; energize and allow 30 minutes for warmup. Connect the dc test leads of the ME-26(*)/U to DC VOLTAGE test points +20 and ground.	Rotate the SERV SEL switch to OVEN ON. Adjust the DC VOLTAGE 20 control for an indication of + 20 volts dc on the ME-26(*)/U.	
4	Use the AN/USM-207 to measure the frequency at IF OSCILLATOR 1 1.750 MC OUT connector.	Adjust the IF OSCILLATOR 1.1750 MC output control for an indication on the AN/USM-207.	Indication if 1.75000 mc ±100 cps.
5	Disconnect the AN/USM-207 from the IF OSCILLATOR 1 1.75 MC OUT connector, and connect the AN/URM-145 (terminated) in 50 ohms).	Rotate the IF OSCILLATOR 1.175 MC output control from fully counter clockwise to fully clockwise.	Output rf level varies from 0 to not less than 300 mv rms.
6	Use the AN/USM-207 to measure the frequency at IF OSCILLATOR 2 1.7515 MC OUT connector.	Adjust the IF OSCILLATOR 2 1.7515. MC output control for an indication on the AN/USM-207.	Indication is 1.752500 mc ± 100 cps.
7	Disconnect the AN/USM-207 from the IF OSCILLATOR 2 1.7515 MC OUT connector, and connect the AN/USM-145 (terminated in 50 ohms).	Rotate the IF OSCILLATOR 2 1.7515 MC output control from fully counter-clockwise, to fully clockwise.	Output rf level varies from 0 to not less than 300 mv rms.
8	Use the AN/USM-207 to measure the frequency at the IF OSCILLATOR 3 1.7525 MC OUT CONNECTOR.	Adjust the IF OSCILLATOR 3 1.7525 MC output control for an indication of the AN/USM-207.	Indication is 1.752500 mc ±100 cps.
9	Disconnect the AN/USM-207 from the IF OSCILLATOR 3 1.7525 MC OUT connector, and connect the AN/USM-145 (terminated in 50 ohms).	Rotate the IF OSCILLATOR 3 1.7525 MC output control from fully counter-clockwise to fully clockwise.	Output rf level varies from 0 to not less than 300 mv rms.

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
10	Set the AN/URM-127 to 500 cps at 6 volts amplitude. Connect the output of the AN/URM-127 to the PULSE GENERATOR INPUT connector. Connect the AN/USM-140(*) to the PULSE GENERATOR OUTPUTS 3 connector.	Adjust PULSE GENERATOR (lower) WIDTH and AMPLITUDE controls for an indication of 1-usec, 1-volt positive pulse (Check pulse generator need for -33 VDC).	
11	Connect the AN/USM-140(*) to the PULSE GENERATOR OUTPUTS 2 connector.	Adjust PULSE GENERATOR (upper) WIDTH and AMPLITUDE controls for an indication of 150-usec, 1-volt negative pulse.	
12	Connect the AN/USM-140(*) to the PULSE GENERATOR OUTPUTS 1 connector.	Adjust PULSE GENERATOR (upper) WIDTH and AMPLITUDE controls for an indication of an 85-usec, 1-volt positive pulse.	
13	Connect the ME-26(*)/U dc test leads between ALC VOLTAGE TUNE OUT test point and ground.	Rotate the SERV SEL switch to SSB/NSK. Adjust ALC VOLTAGE TUNE control from fully counterclockwise to fully clockwise.	Output voltage varies from 0 to 20 ± 1 volt dc.
14	Connect the ME-26(*)/U dc test leads between ALC VOLTAGE INFO OUT test point and ground.	Rotate SERV SEL switch to SSB/NSK. Rotate the ALC VOLTAGE INFO control from fully counterclockwise to fully clockwise	Output voltage varies from 0 to 20 ± 1 volt dc.
15	Disconnect all test equipment.	Reset all switches and controls to the settings in paragraph 5-6.	POWER indicator is extinguished.

5-8. Common Module Tray A1A1, Preliminary Switch and Control Settings

Switch or control	Setting
POWER switch	OFF
DC/DC CONVERTER section:	
LOAD SELECT switch.	100
TEST SELECTOR switch.	1
TEST CONV switch	Normal, relaxed
TEST REG switch	Normal, relaxed
RF AMPL section:	
100 KC SELECTOR switch.	0
10 KC SELECTOR switch.	0
AGC ON/OFF switch.	OFF
AGC ADJ control	Fully counterclockwise

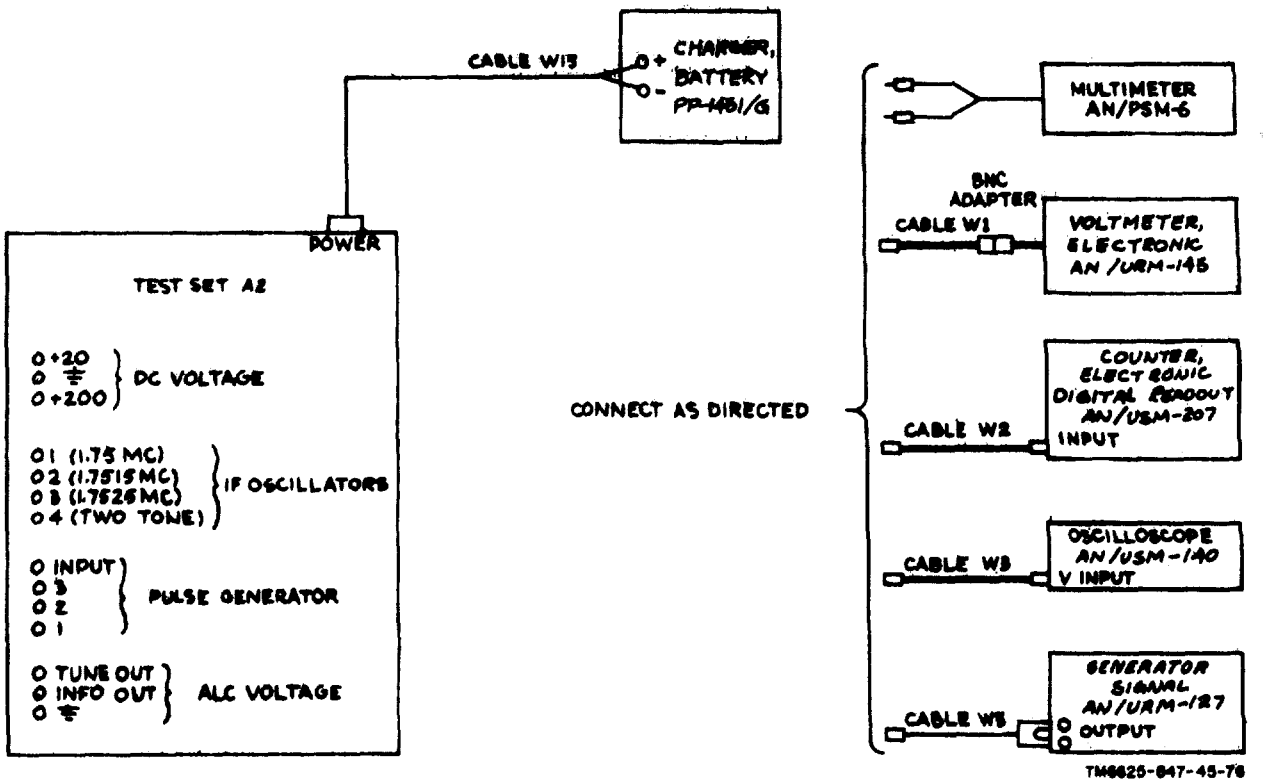


Figure 5-1. Test set operational performance test setup.

5-9. Common Module Tray A1A1, Operational Performance Test

Note. The ME-26(*)/U is the only piece of test equipment required for this test.

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
1		Remove common module tray A1A1 from case 2, and secure it to the test set.	
2	Make sure that +27-volt dc primary power is supplied to the POWER connecter on the test set.	Set the switches and controls on the test set to the positions listed in paragraph 5-6. Set the switches and controls on common module tray A1A1 to the settings listed in paragraph 5-8.	
3		Set the POWER switch on the test set to ON. Set the POWER switch on common module tray A1A1 to ON.	POWER indicator on test set is illuminated
4	Measure the dc voltage at DC/DC CONVERTER test points HI and LOW on tray A1A1 using the ME-26(*)/U.	Rotate the SERV SEL switch on the test set to SSB/NSK.	Measured is +27 ± 1 dc; POWER indicator on common module tray A1A1 is illuminated.

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
5	Connect the dc test leads of the ME-26(*)/U to AGC test points TEST and ground on tray A1A1.	Set the AGC OFF/ON switch on tray A1A1 to ON. Rotate the AGC ADJ control from fully counterclockwise to fully clockwise.	Measured voltage varies from 0 to -33 ±2 volts dc.
6	Measure the dc voltage at NOISE BLANKER 20 VDC test point on tray A1A1 using ME-26(*)/U.		Measure voltage is + 20 ± 1 volts dc.
7		Rotate the MC FREQ 10MC and 1MC frequency select switches 01 the test set from 2.0 mc to 29.0 mc in 1-mc steps.	Mc shaft coupler on tray A1A1 rotates, indicating the 28 positions selected.
8	Disconnect the ME-26(*)/U.	Reset all switches and controls to the settings, listed in paragraphs 5-6 and 5-8.	POWER indicators on the test set and common module tray A1A1 are extinguished.

5-10. Common Module Tray A1A2, Preliminary Switch and Control Settings

Switch or control	*Setting*
POWER switch	OFF
RCVR AUDIO section:	
SQUELCH switch	OFF
SQUELCH SYNC switch.	OFF
AUDIO GAIN control.	Fully counterclockwise
RCVR IF section:	
AGC SYNC switch	OFF
RF-AGC ON/OFF switch.	OFF
TEST SELECTOR switch.	1
BFO TONE control	Fully counterclockwise
RF GAIN control	Fully counterclockwise
XMTR IF AND AUDIO section:	
ALC APC PPC CONTROL:	
ALC switch	OFF
ALC/PPC SEL switch.	OFF
POWER CONTROL.	Fully counterclockwise
CE MODES switch.	PUSH TO TALK
TEST SELECTOR switch.	1

5-11. Common Module Tray A1A2, Operational Performance Test

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
1		Remove common on module tray A1A2 from the case 2, and secure it to the test set.	
2	Make sure that +27-volt dc primarily power is supplied to the POWER connector on the test set.	Set the switches and controls on the test set to the settings listed in paragraph 5-6. Set the switches and controls on common module tray A1A2 to the settings listed in paragraph 5-10.	
3		Set the POWER switch on the test set to ON.	POWER indicator is illuminated on the test set.

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
4	**NOTE** Allow a 10-minute, warmup period for test set frequency standard.	Rotate the SERV SEL. switch on the test set to SSB/ NSK. Set. the POWER switch on common module tray A1A2 to ON.	POWER indicator on common module tray A1A2 illuminated.
5	Connect the dc test leads of the ME-26(*)/U to RCVR IF test points HI and LO on tray A1A2.		Voltage measures 33 ± 2 volts dc.
6		Set the RCVR IF TEST SE-LECTOR switch on tray less than 2.5 volts dc. Rotate the RCVR IF RF GAIN control from fully counterclockwise.	Dc voltage varies from not more than 0.35 to not less than 2.5 volts dc.
7	Check the dc voltage indication on the ME-26(*)/U when the REC XMIT switch on the test set is set to XMIT.	Switch the REC XMIT switch oil this test set from REC to XMIT, then back to REC.	Dc voltage drops to 0 when REC XMIT switch is set to XMIT.
8		ON tray A1A2, set the RCVR IF TEST SELECTOR switch to position 3. Rotate the SERV SEL switch on the test set to CW. Rotate the RCVR IF BFO TONE control on tray A1A2 from fully clockwise clockwise to fully clockwise.	Indication is + 20 ± 1 volts dc (BFO TONE control has effect on the voltage).
9	Connect the AN/USM-207 to the TWO TONE OUT connector on the test set; refer to figure 5-1.	Set the AGC SYNC switch on tray A1A2 to ON. Set the test set IF OSCILLATOR select switch to 1 +2.	Measurement is 1.7515 mc ± 100 cps.
10		Set the test set IF OSCILLATOR select switch to 1 +3.	Measurement is 1.7525 rnc ± 100 cps.
11	Measure the dc voltage at XMTR IF AND AUDIO test points HI and LO on tray A1A2.		Voltage measures + 20 ± 1 volt dc.
12		Set the XMTR IF AND AUDIO TEST SELECTOR switch on tray A1A2 to 3, find the test set KEY switch to ON. Rotate the XMTR IF AND AUDIO ALC APC PPC POWER CONTROL on tray A1A2 from fully clockwise to fully counterclockwise.	Dc voltage varies from a mini-mum of 0 volt dc to a maxi-mum of + 20 volts dc.
18	Disconnect all test equip-ment.	Reset all switches and controls to the setting listed in paragraphs 5-6 and 5-10.	POWER indicators on the test set and tray A1A2 are ex-tinguished.

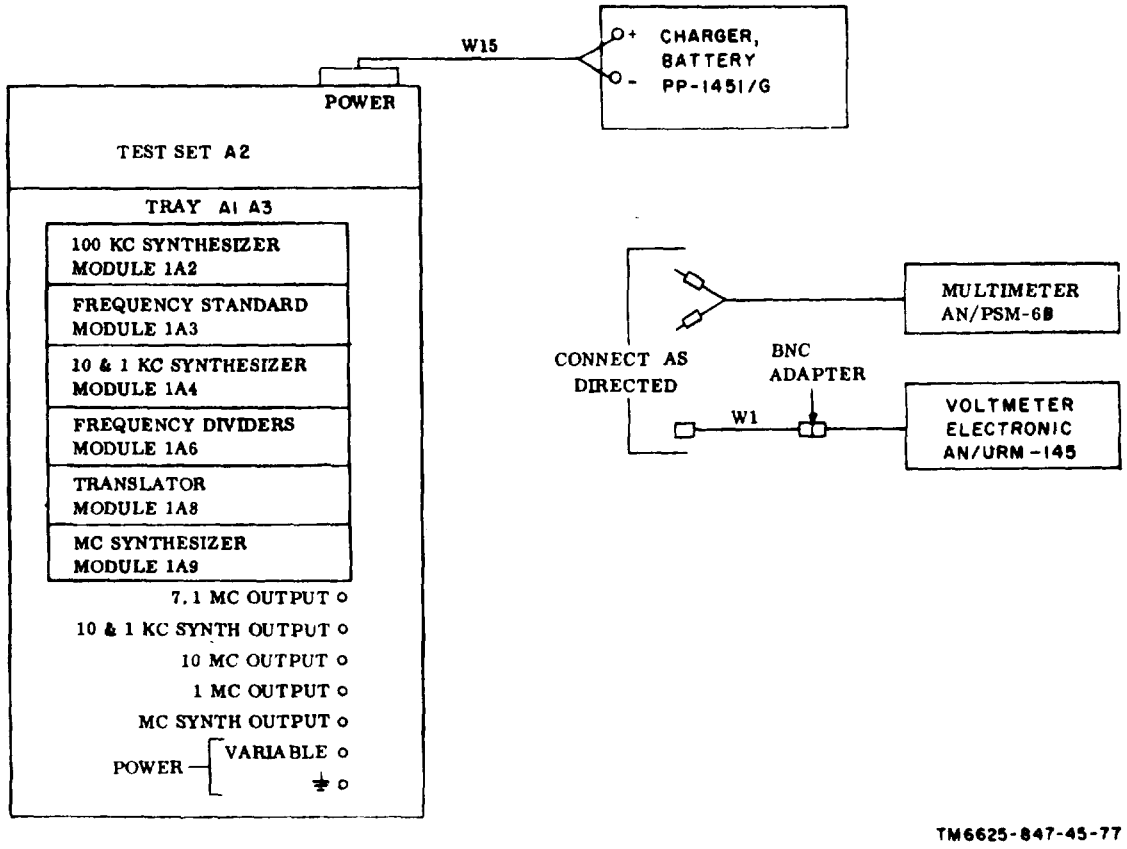


Figure 5-2. Synthesizer test tray A1A3, operative performance test, test equipment.

5-12. Synthesizer Test Tray A1A3, Preliminary Switch and Control Settings

Switch or control	Setting
POWER switch	OFF
MODULE SELECT switch	10 & 1KC
POWER section:	
VAR/FIXED switch	FIXED
ADJ control	Midrange
FREQ SELECT section:	
10KC control	0
1KC control	0
100 KC control	0
10&1KC SYNTH section:	
SYNTH OUTPUTS AMPL switch.	OFF
SYNTH OUTPUTS VOLTS ADJ control.	Midrange
OUTPUT AMPL switch.	OFF
OUTPUT VOLT ADJ control.	Midrange
FREQ DIVIDER section:	
FREQ SHIFT switch	OFF
FREQ STANDARD section:	
OUTPUT AMPL switch (both switches).	OFF
OUTPUT VOLT ADJ control (both controls).	Midrange
MC SYNTH section:	
OUTPUT AMPL switch	OFF
OUTPUT VOLT ADJ control.	Midrange

5-13. Synthesizer Test Tray A1A3, Operational Performance Test

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
1	Make sure that +27-volt dc primary power is supplied to the POWER connector on the test set.	On the test set, set switches and controls to the settings listed in paragraph 5-6.	
2		Remove synthesizer test tray A1A3 from case, and install it in the test set.	
3		On synthesizer test tray A1A3, set switches and controls to the setting listed in paragraph 5-12.	
4		On the test set, set the POWER switch to ON; set the SERV SEL switch to STBY.	Test met POWER indicator il-luminated.
5		On synthesizer test tray A1A3, set the POWER switch to ON.	Synthesizer test tray A1A3 POWER indicator is illuminated
6		On the test set, rotate the MC FREQ 10MC and 1MC switches from 2 mc to 29 mc in 1-mc steps. Check module coupler in MC SYNTH section on synthesizer test tray A3.	On synthesizer test tray A1A3, MC SYNTH module coupler is adjusted to a now setting each time the MC FREQ 10MC and 1 switches are adjusted.
7		On synthesizer test tray A1A3, set the POWER switch to OFF. On the test et, set the SERV SEL itch to OFF.	On synthesizer test tray A1A3, POWER indicator is extin-guished.
8	Connect the test equip-ment as indicated in figure 5-2, and apply operating power to the test equipment. Secure the following RT-662/GRC modules, and install then in their appropriate connectors on synthesizer test tray A1A3 (check coupler alignments): *a.* Module 1A2, 100-kc synthesizer. *b.* Module 1A3, frequency standard. *c.* Module 1A4, 10- and 1-kc synthesizer. *d.* Module 1A6, frequency divider. *e.* Module 1A8, transistor. *f.* Module 1A9, mc syn-thesizer.		
9		On the test set, set the SERV SEL switch to STBY. On syn-thesizer test tray A1A3, set the POWER switch to ON.	On synthesizer test tray A1A3, POWER indicator is illuminated.
10		If operating from a cold start, allow 15 minutes warmup time for equipment stability. If equipment has been warmed up within the last hour, 5 minutes warmup time in sufficient.	

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
11	Connect the ME-26(*)/U across the POWER INPUT VAR and ground test points on synthesizer test tray A1A3.	On synthesizer-test tray A1A3, adjust the POWER ADJ control from fully counterclockwise to fully clockwise. Place VAR/FIXED switch to VAR position.	The ME-26(*)/U indicates voltage varying from a minimum of 0 volt dc to a maximum of + 27 volts dc; set to + 20 volts dc.
12	Disconnect the ME-26(*)/U from the POWER INPUT test points.		
13	Connect the AN/URM-145 to the 7.1 MC connector in OUTPUT portion of 10 & 1 KC SYNTH section on synthesizer test tray A1A3. **CAUTION** Adjust AN/URM-145 scale above 1 volt and readjust accordingly to avoid damage to the instrument.	In OUTPUT portion of 10 & 1KC SYNTH section on synthesizer, test tray A1A1, set the AMPL switch to ON and adjust the VOLT ADJ control from fully counter-clockwise to fully clockwise. Return the VOLT ADJ control to midrange.	Output increases as adjustment is made clockwise.
14	Disconnect the AN/URM-145 from the 7.1 MC connector.		
15	Connect the AN/URM-145 to the 10 & 1 KC connector in the SYNTH OUTPUT portion of the 10 & 1 KC SYNTH section on synthesizer test tray A1A3. **CAUTION** Adjust the AN/URM-145 to scale above 1 volt, and readjust accordingly to avoid damage to the instrument.	In SYNTH OUTPUT portion of 10 & 1 KC SYNTH section on synthesizer test tray A1A3, Set the AMPL switch to ON and adjust the VOLT ADJ control from fully counter-clockwise to fully clockwise. Return the VOLT ADJ control to midrange.	Check to see that the output increases as the adjustment is made clockwise.
16	Disconnect the AN/URM-145 from the 10 & 1 KC connector.		
17	Connect the AN/URM-145 to the 10 MC OUT PUT connector in the FREQ STANDARD section on synthesizers test tray A1A3. **CAUTION** Adjust AN/URM-145 to scale above 1 volt and readjust accordingly to avoid damage to the instrument.	In the 10 MC OUTPUT position on the FREQ STANDARD section on synthesizer test tray A1A3, set the AMPL, switch to ON and adjust the VOLT ADJ control from fully counter-clockwise to fully clockwise. Return the VOLT ADJ control to midrange.	Output increases as adjustment is made clockwise.
18	Disconnect the AN/URM-145 from the 10 MC connector.		
19	Connect the AN/URM-145 to the 1 MC OUTPUT connector in the FREQ STANDARD section on synthesizer test tray A1A3.	In the 1 MC OUTPUT section of the FREQ STANDARD seetion in synthesizer test tray A1A3, set the AMPL, switch to ON and adjust the VOLT ADJ control firm fully counterclock-	Output increases as adjustment is made clockwise.

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
	CAUTION Adjust the AN/URM-145 to scale above 1 volt, and readjust accordingly to avoid damage to the instrument.	wise to fully clockwise. Return the VOLT ADJ control to midrange	
20	Disconnect the AN/URM-145 from the 1 MC connector.		
21	Connect the AN/URM-145) to the MC SYNTH connector in the OUTPUT portion of the MC SYNTH section on synthesizer test tray A1A3. **CAUTION** Adjust AN/URM-145 to scale above 1volt and readjust accord -ingly to avoid damage to the instrument.	In the OUTPUT portion of the MC SYNTH section on synthesizer test tray A1A3. set the AMPL switch to ON and adjust the VOLT ADJ control from fully counterclockwise to fully clockwise. Return the VOLT ADJ control to midrange.	Output increases as adjustment is made clockwise.
22	Disconnect the AN/URM-145 from the MC SYNTH connector,.		
23		Reset all switches and controls to the settings. listed in paragraphs 5-6 and 5-12.	POWER indicators on the test set and synthesizer test tray A1A3 are extinguished.
24	Remove the RT-662/GRC modules (1A2, 1A3, 1A4, 1A8, and 1A9) from synthesizer test tray A1A3, and return them to their proper storage place.	Remove synthesizer test tray A1A3 from the test set, and return it to case 2.	

5-14. Converter and Control Tray A1A4, Preliminary Switch and Control Settings

Switch or control	*Setting*
POWER switch	OFF
INPUT CURRENT switch	Normal, relaxed
TEST SELECTOR switch	1
PA METER TEST section:	
ANT. LOAD/ANT. TUNE switch.	ANT. TUNE
ANTENNA LOAD TUNE control.	Midrange
ALC METER control	Fully counterclockwise
GRID DRIVE control	Fully counterclockwise
CONTROL TEST section:	
ANT. MOTOR CONTROL MONITOR switch.	RF BAND
ANT. MOTOR CONTROL CODE switch.	Midposition
RF BAND-500 WHIP switch	RF BAND

5-15. Converter and Control Tray A1A4, Operational Performance Test

Note. The ME-26(*)/U is the only test equipment required for this test.

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
1		Remove converter and control tray A1A4 from case 2, and secure it to the test set.	
2	Make sure that +27-volt dc primary power is supplied to the POWER connector on the test set.	Set the switches and controls on the test set to the settings listed in paragraph 5-6. Set the switches and controls on converter and control tray A1A4 to settings listed in paragraph 5-14.	
3		Set the POWER switch on the test set to ON. Rotate the SERV SEL switch to STBY. Set the POWER switch on converter and control tray A1A4 to ON.	POWER indicators on the test set and converter and control tray A1A4 are illuminated. Indicator lights B-5 and C-1 are dimly lit.
4	Connect the ME-26(*)/U to the test set DC VOLTAGE +20 test point.	Adjust the test set DC VOLTAGE 20 control to obtain an indication of 20 volts dc on the ME-26(*)/U.	
5		Press indicators A1 through A3, B1 through B5, and C1 through C5 to test them.	Each indicator lights when pressed.
6	Connect the dc leads of the ME-26(*)/U across the PA METER TEST ANTENNA LOAD/TUNE test point and ground.	Rotate the PA METER TEST ANTENNA LOAD/TUNE control from fully counterclockwise to fully clockwise.	Voltage varies from +3.6 to -4 volts dc.
7	Connect the dc test leads of the ME-26(*)/U across the PA METER TEST ALC METER test point and ground.	Rotate the PA METER TEST ALC METER control from fully counterclockwise to fully clockwise.	Voltage varies from 0 to +1.7 volts dc.
8	Connect the dc test leads of the ME-26(*)/U across the PA METER TEST GRID DRIVE test point and ground.	Rotate the PA METER TEST GRID DRIVE control from fully counterclockwise to fully clockwise.	Voltage varies from 0 to 22 volts dc
9	Connect the dc test leads of the ME-26(*)/U across the INPUT CURRENT LO test point and ground.		Voltage measures +27 ± 1 volt dc.
10		Press the INPUT CURRENT test switch.	Voltage measures 0 volt dc.
11	Disconnect the ME-26(*)/U.	Reset all switches and controls to settings listed in paragraphs 5-6 and 5-14.	POWER indicators on test set A2 and tray A1A4 are extinguished.

5-16. Driver, Discriminator, and Antenna Coupler Tray A1A3, Preliminary Switch and Control Settings

Switch or control	Setting
POWER switch	Off
RELAY CONTROL switch.	1
ANTENNA COUPLER section:	
CODE switch	1
50 Ω DUMMY LOAD-COUPLER TERMINATION WHIP-50 Ω DOUBLET switch.	50 Ω DUMMY LOAD
DISCRIMINATOR TEST SELECTOR switch.	1
DRIVER section:	
BAND SEL switch	3.25 MC
TEST SELECTOR switch.	1

5-17. Driver, Discriminator, and Antenna Coupler Tray A1A5, Operational Performance Test

Note. The ME-26(*)/U is the only piece of test equipment required for this test.

Step No.	Operation of test procedure	Control setting and operation of equipment under test	Performance standard
1		Remove driver, discriminator, and antenna coupler tray A1A5 from case 2, and secure it to the test set.	
2	Make sure that +27-volt dc primary power is supplied to the POWER connector on the test set.	Set the switches and controls on the test set to the settings listed in paragraph 5-6. Set the switches and controls on driver, discriminator, and antenna coupler tray A1A5 to the settings listed in paragraph 5-16.	
3		Set the POWER switch on the test set to ON. Rotate the SERV SEL switch to STBY on the test set.	POWER indicator on test is set illuminated.
4		Set the POWER switch on driver, discriminator, and antenna coupler tray A1A5 to ON.	POWER, RELAY 1 and DRIVER 200 VDC indicators on driver, discriminator, and antenna coupler tray A1A5 are illuminated.
5		Rotate the DRIVER BAND SEL switch from 3.25 MC to 15.5 MC and 29.5 MC.	Indicator 200 VDC is illuminated when DRIVER BAND SEL switch is in a detent setting and is extinguished when switch is rotating.
6	Connect the ac test leads of the ME-26(*)/U to DRIVER test points HI and LO.	Set the DRIVER TEST SELECTOR switch to position 1.	Voltage measures 7 ± 0.5 volts ac.
7		Set the DRIVER TEST SELECTOR switch to position 2. Adjust the DC VOLTAGE 200 control on the test set for an indication of +200 volts dc on the ME-26(*)/U.	
8		Set the DRIVER TEST SELECTOR switch to position 4.	Voltage measures +27 ± 1 volt dc.
9		Press indicators 1 through 7 to test.	Each indicator lights when pressed.
10	Disconnect the ME-26(*)/U.	Reset all switches and, controls to the positions listed in paragraphs 5-6 and 5-16.	POWER indicators on the test set and driver discriminator, and antenna coupler tray A1A5 are extinguished.

NOTES

If it becomes necessary to adjust Capacitor A1A5A1AT1C2 perform the following steps.

1. Insert a known good Driver Assembly 2A8 into Tray A1A5.

2. Connect a signal generator, 50 ohms impedance out, to input of Driver Assembly 2A8.

3. Connect a Boonton 91C, or equal, RF Sensitive Voltmeter to the "RF" out connector across a 50 ohm load adapter.

4. Turn on equipment and let warmup for at least a half hour.

5. Set signal generator and equipment to 29.5 MHz (use a frequency counter).

6. Adjust signal generator output to obtain approximately 1.0 volt rms on the Boonton 91C meter. Note the signal generator output reading.

7. Peak Capacitor A1A5A1AT1C2.

8. Reset signal generator to 20.0 MHz (use frequency counter) using same signal generator output as in step 6 above.

9. At 29.0 MHz and 30 MHz the output on the Boonton 91C meter shall stay within ± 1 db of the output reading, at 29.5 MHz. If it is not within this tolerance, reset C2 and check until the readings comply with the requirement of ± 1 db

10. After the requirements of step 9 above have been met, set up at 15.5 MHz and note Boonton 91C meter output reading as in step 6 above. Then check at 15.0 and 16.0 MHz and see if these limits fall with the ± 1 db tolerance. If not, go back and forth between the limits at 29.5 MHz and at 15.5 MHz and find a compromise setting of Capacitor A1A5AT1C2 to meet tolerance for both frequencies.

11. The same procedure should be followed at the center frequency of 3.25 MHz with the tolerance of ± 1 db at the 3.0 and 3.5 MHz points. Again, if necessary, find a compromise setting of Capacitor A1A5AT1C2 in order to obtain an intolerance condition for all three frequencies.

CHAPTER 6

FOLDOUT ILLUSTRATIONS

This chapter contains fold-out schematic diagrams.

Figure 6-1.

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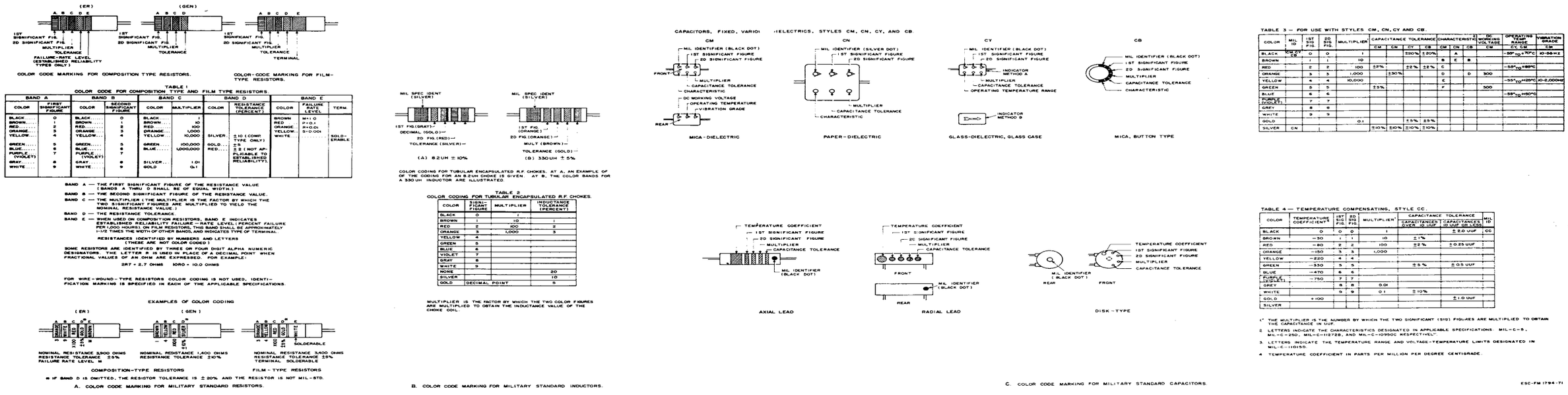


Figure 6-2. Resistor, inductor, and capacitor color code charts.

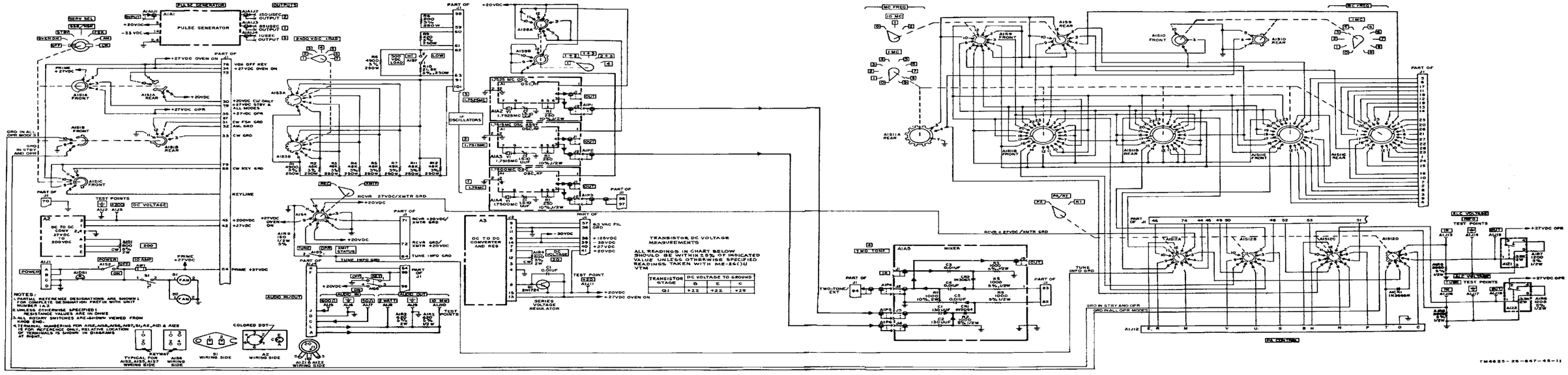
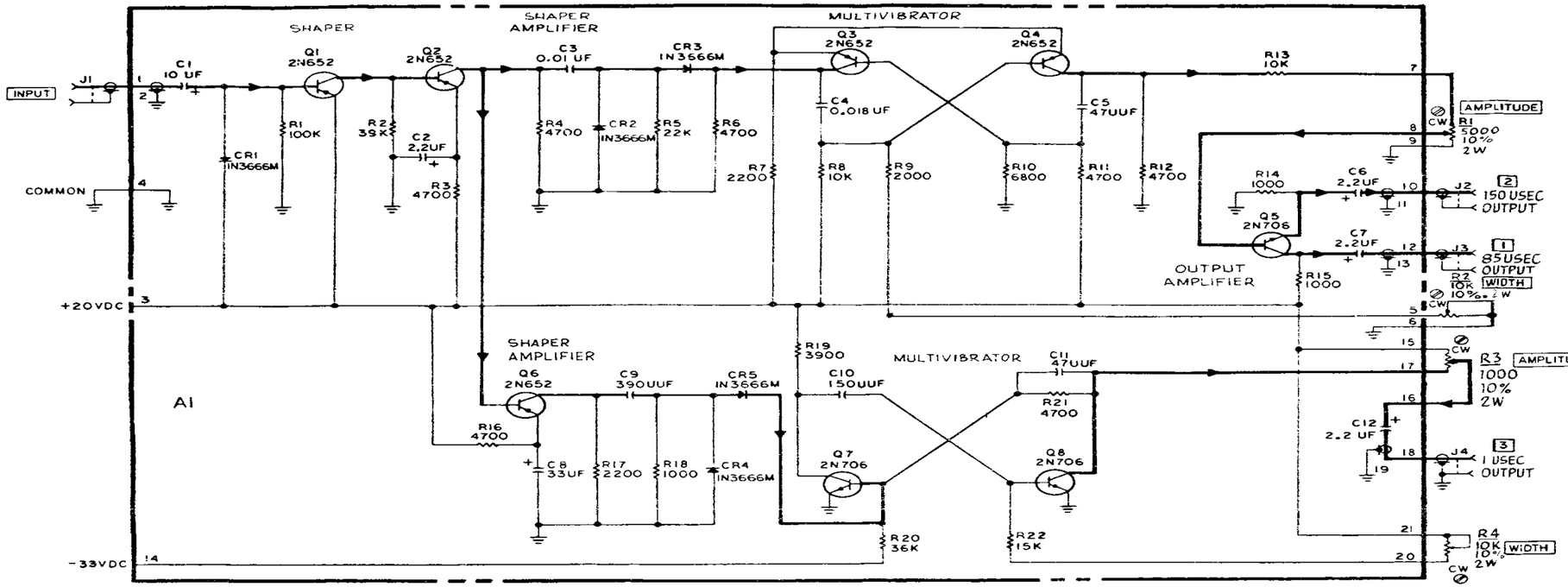


Figure 6-3. Test set, schematic diagram.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).
2. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE VALUES ARE IN OHMS.
   RESISTOR TOLERANCES ARE ±5%.
   RESISTOR RATINGS ARE 1/4W.

TRANSISTOR DC VOLTAGE MEASUREMENTS

ALL READING IN CHART BELOW SHOULD BE WITHIN ±5% OF INDICATED VALUE UNLESS OTHERWISE SPECIFIED READINGS TAKEN WITH ME-26( )U VTVM

TRANSISTOR STAGE	DC VOLTAGE TO GROUND		
	B	E	C
Q1	+20	+20	+20
Q2	+20	+20	+5
Q3	+12	+8.5	+8.5
Q4	+8.5	+8.5	+8.5
Q5	+3	+2.5	+18
Q6	+5	+5.5	+5.5
Q7	-5	0	+20
Q8	+.8	0	+.2

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Figure 6-4. Test set, pulse generator assembly A1A1, schematic diagram.

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS.
   ALL RESISTOR TOLERANCES ARE ±5%.
   ALL RESISTOR RATINGS ARE 1/4W.
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. IAIQI AND IAIR4 ARE SHOWN ON THIS DRAWING FOR REFERENCE ONLY. SEE ELECTRICAL SCHEMATIC FIGURE 1-10.
4. TRANSISTOR DC VOLTAGE MEASUREMENTS ALL READINGS IN CHART BELOW SHOULD BE WITHIN ±5% OF THE INDICATED VALUE UNLESS OTHERWISE SPECIFIED.

TRANSISTOR	DC VOLTAGE TO GROUND		
STAGE	B	E	C
Q1	6	0	27
Q2	6	0	27
AIQ1	26	27	20
AIQ2	11.5	11.5	26
AIQ3	4.8	4	11.5
AIQ4	4.8	4	20

TRANSFORMER T1 RESISTANCE MEASUREMENTS

TERMINAL	RESISTANCE (OHMS)
2-11	.58
6-12	2.7
7-8	.96
1-3	.29
4-5	.08

DC RESISTANCE OF COILS

COIL	DC RESISTANCE (OHMS)
L1	1
L2	30
A2L1	LESS THAN 1OHM
A2L2	LESS THAN 1OHM
A3L1	14
A3L2	14

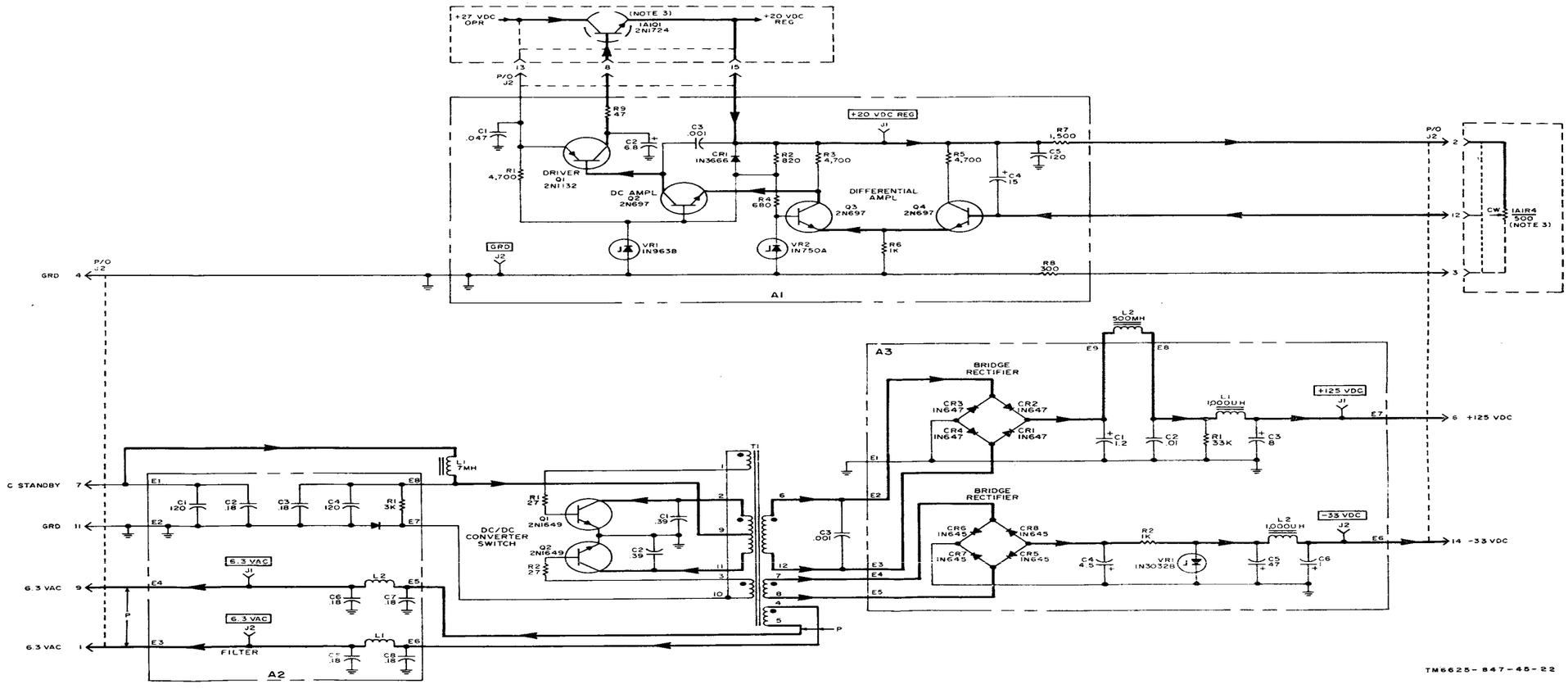


Figure 6-5. Test set, dc-to-dc converter and regulator assembly A3, schematic diagram.

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).
2. UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, RESISTOR TOLERANCES ARE ± 5%; RESISTOR RATINGS ARE 1/4 W. CAPACITANCE VALUES ARE IN MICROMICROFARADS.
3. TRANSISTOR DC VOLTAGE MEASUREMENTS: ALL READINGS IN CHART BELOW SHOULD BE WITHIN ± 5% OF INDICATED VALUE UNLESS OTHERWISE SPECIFIED. READINGS TAKEN WITH ME-26( )/U VTVM.

TRANSISTOR STAGE	DC VOLTAGE TO GROUND		
	B	E	C
Q1	+9.2	+8.6	+19.2
Q2	+6.3	+6	+19.2

DC RESISTANCE OF COILS

COIL	RESISTANCE (OHMS)
L1	8Ω
L2	LESS THAN 1Ω
L3	14Ω

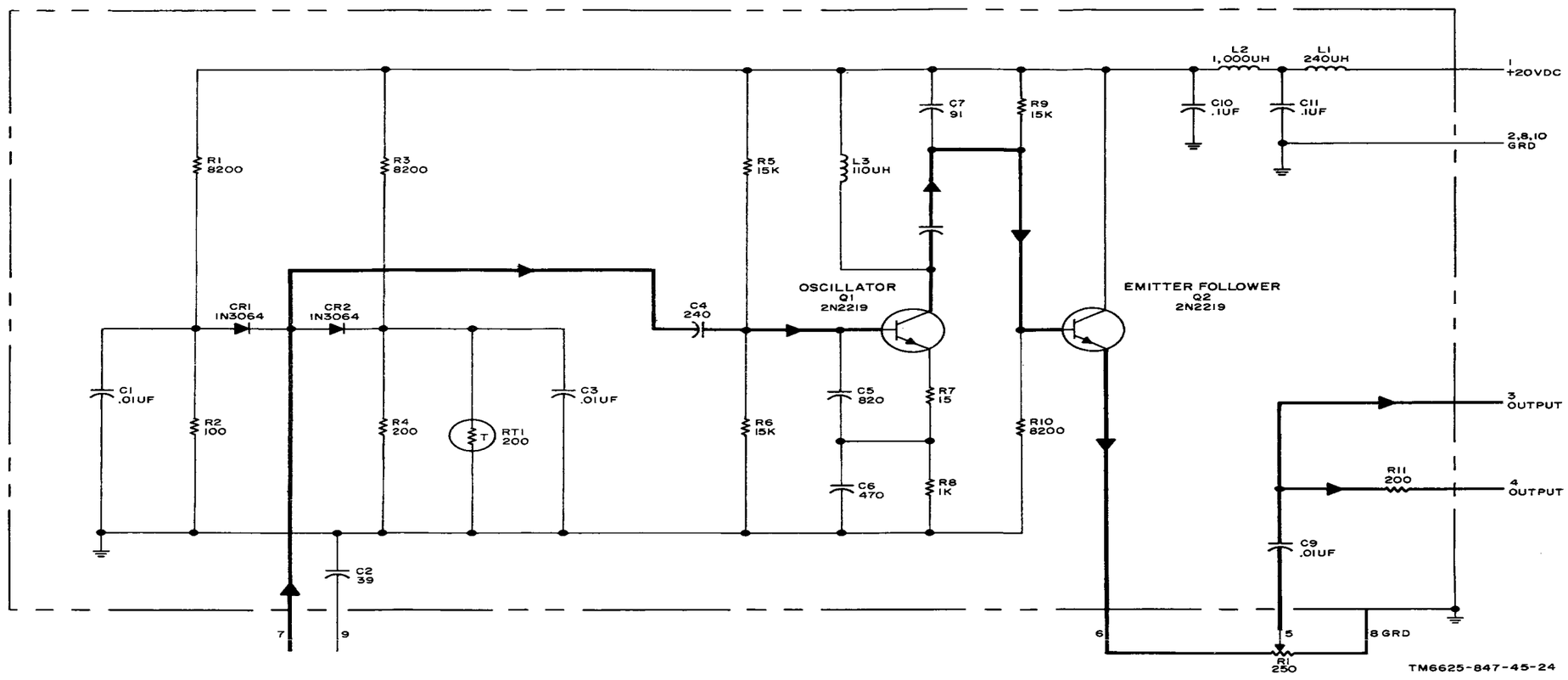


Figure 6-6. Test set IF oscillators A1A2, A1A3, and A1A4, schematic diagram.

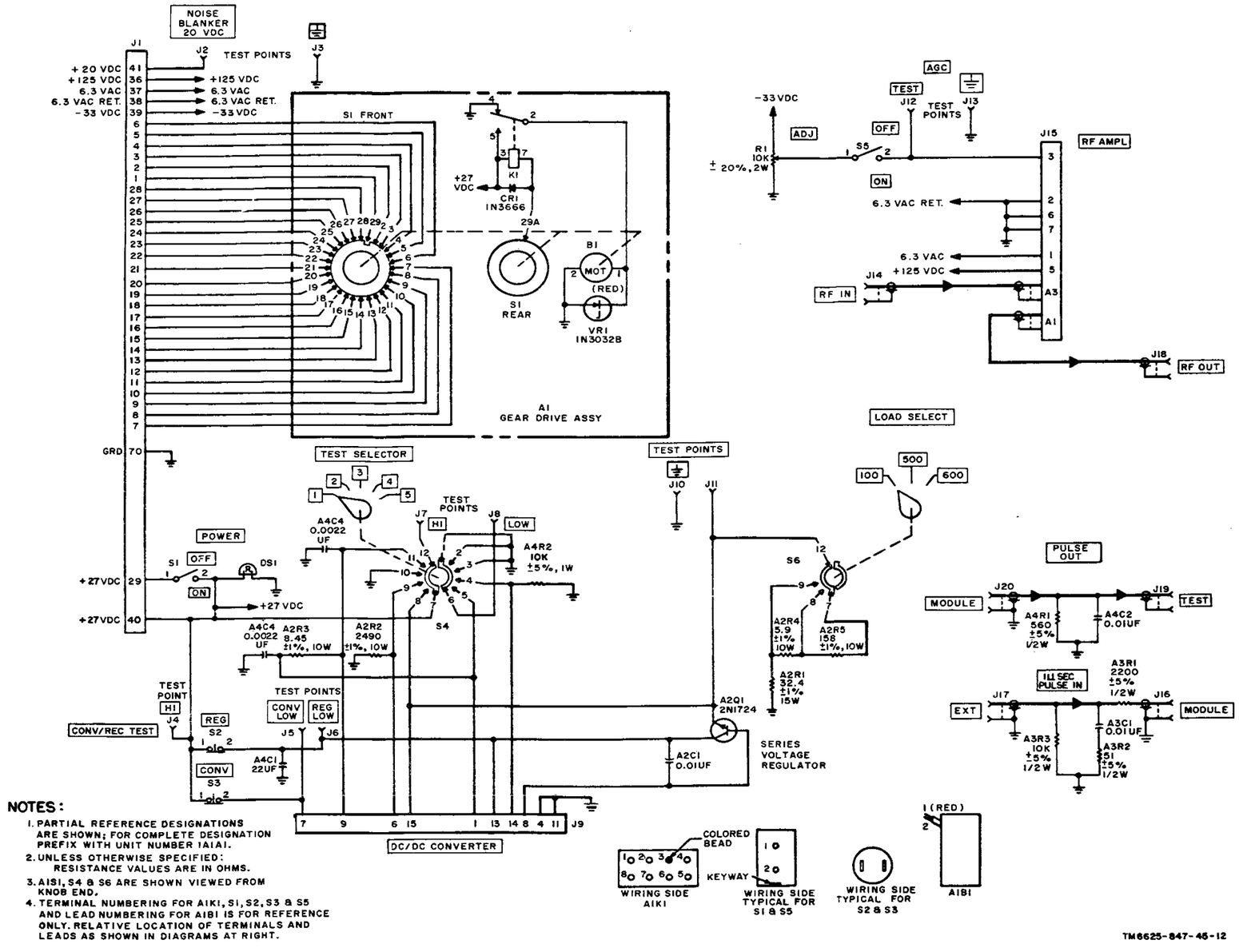
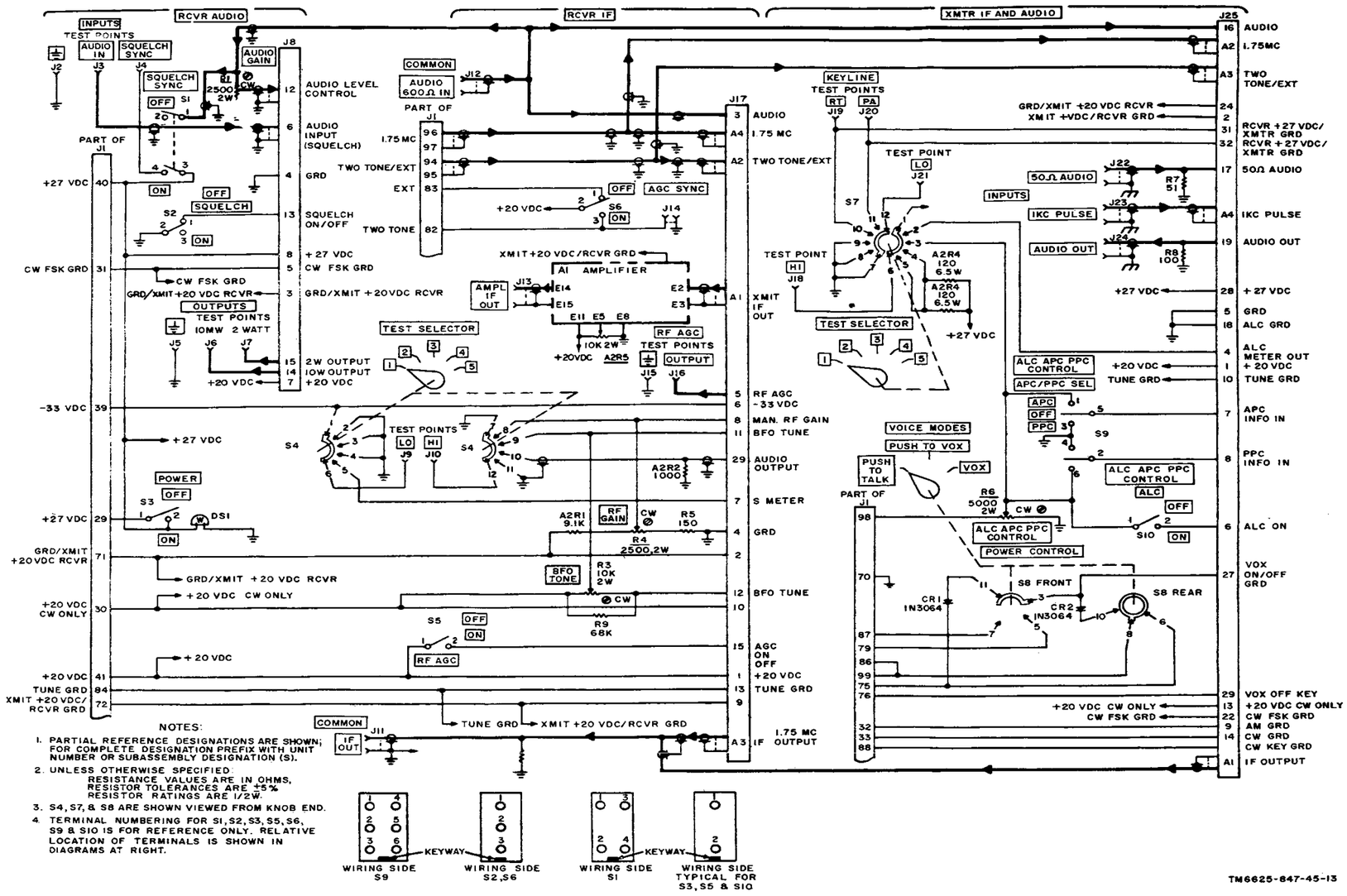


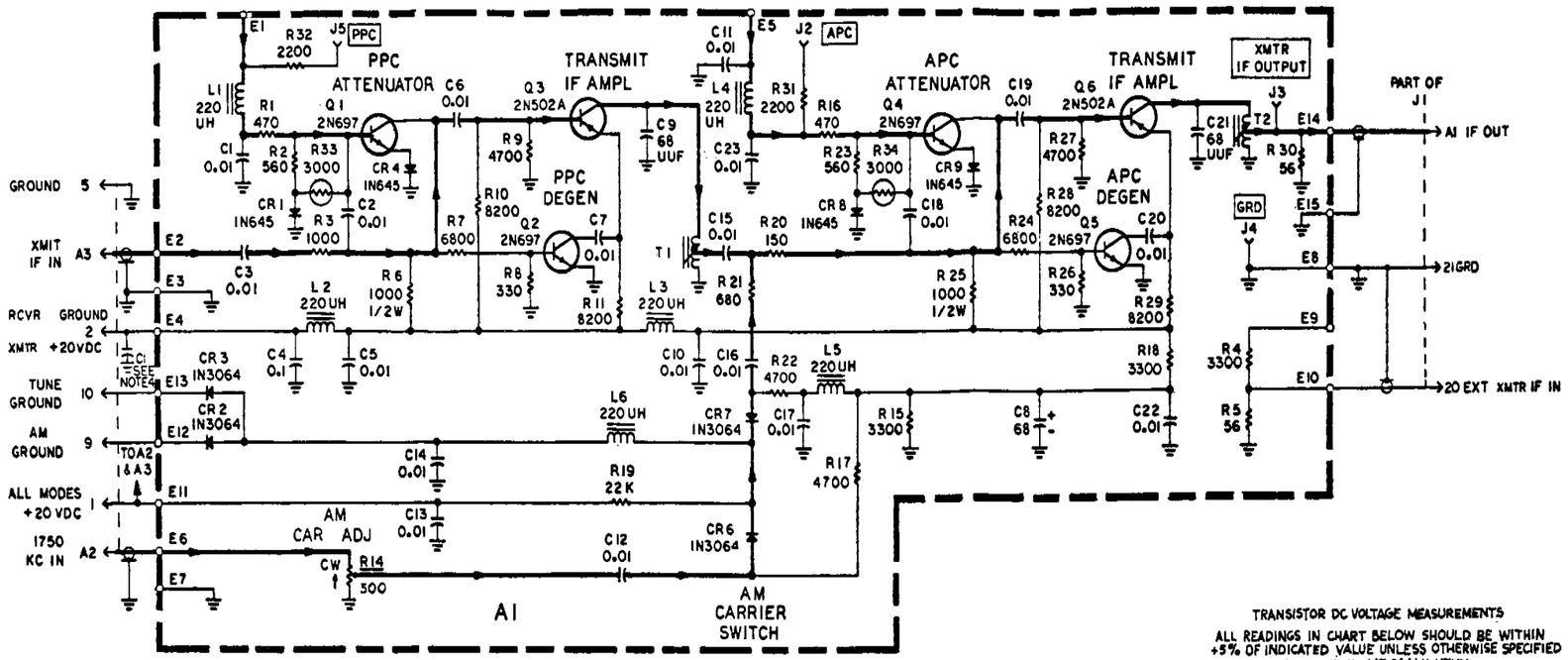
Figure 6-7. Common module tray A1A1, schematic diagram.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION (S).
2. UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, RESISTOR TOLERANCES ARE ±5%, RESISTOR RATINGS ARE 1/2W.
3. S4, S7, & S8 ARE SHOWN VIEWED FROM KNOB END.
4. TERMINAL NUMBERING FOR S1, S2, S3, S5, S6, S9 & S10 IS FOR REFERENCE ONLY. RELATIVE LOCATION OF TERMINALS IS SHOWN IN DIAGRAMS AT RIGHT.

Figure 6-8. Common module tray A1A2, schematic diagram.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATIONS
2. UNLESS OTHERWISE SPECIFIED:
   a. ALL RESISTOR VALUES ARE IN OHM 1/4W, ±5%
   b. ALL CAPACITOR VALUES ARE IN MICROFARADS

DC RESISTANCE OF TRANSFORMERS

TRANSFORMER	RESISTANCE (OHMS)
A1A2T1	2Ω
A1A2T2	2Ω

TRANSISTOR DC VOLTAGE MEASUREMENTS

ALL READINGS IN CHART BELOW SHOULD BE WITHIN ±5% OF INDICATED VALUE UNLESS OTHERWISE SPECIFIED

READINGS TAKEN WITH ME-26(*)U VTVM

TRANSISTOR STAGE	DC VOLTAGE TO GROUND		
	B	E	C
A1 Q1	0	0	18.0
A1 Q2	0.65	0	0.05
A1 Q3	7.0	7.4	
A1 Q4	0	0	18.0
A1 Q5	0.65	0	0.05
A1 Q6	7.8	7.5	

DC RESISTANCE OF COILS

COIL	RESISTANCE (OHMS)
A1L1	7.5Ω
A1L2	7.5Ω
A1L3	8.5Ω
A1L4	7.5Ω
A1L5	7.5Ω
A1L6	7.5Ω

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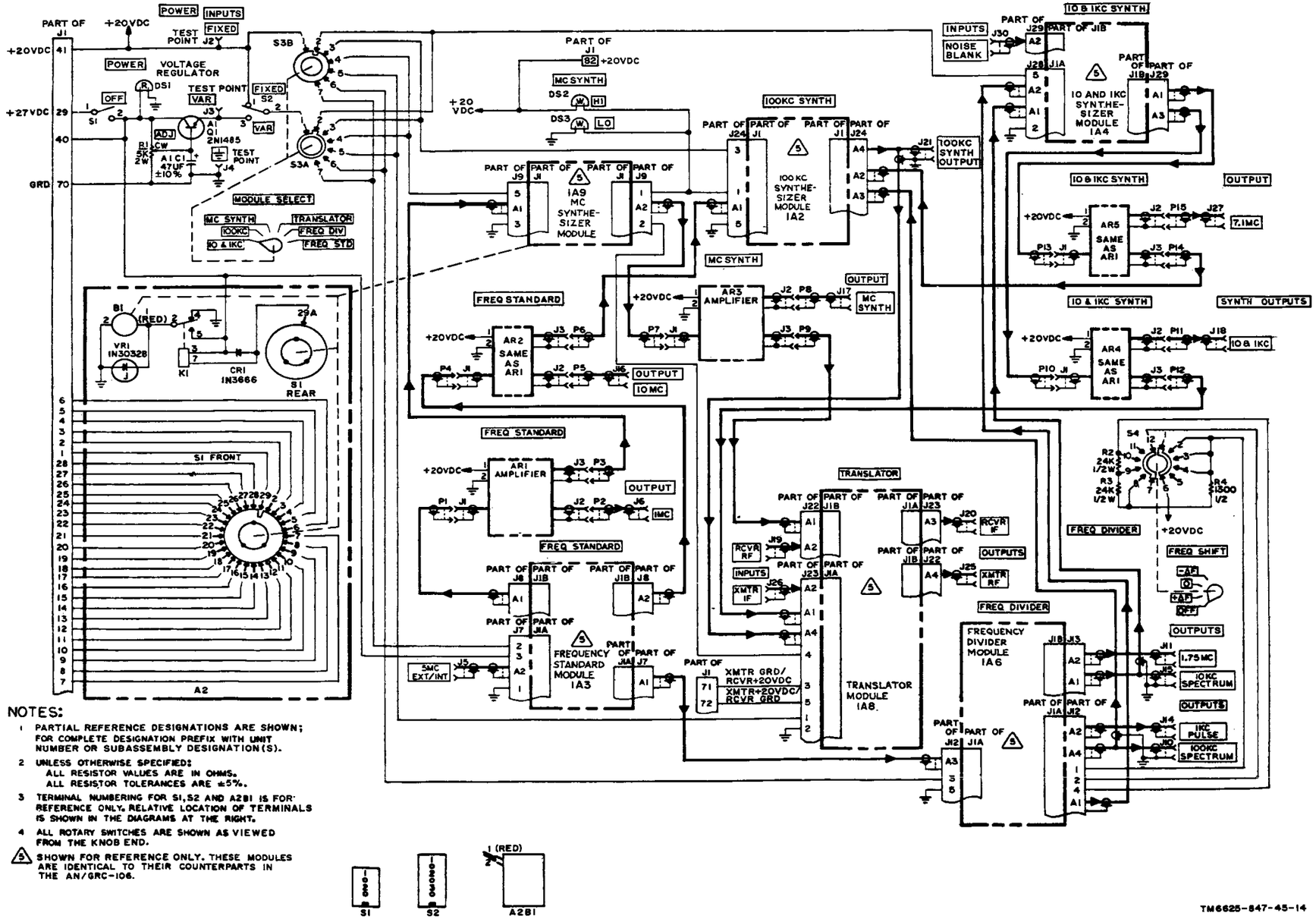
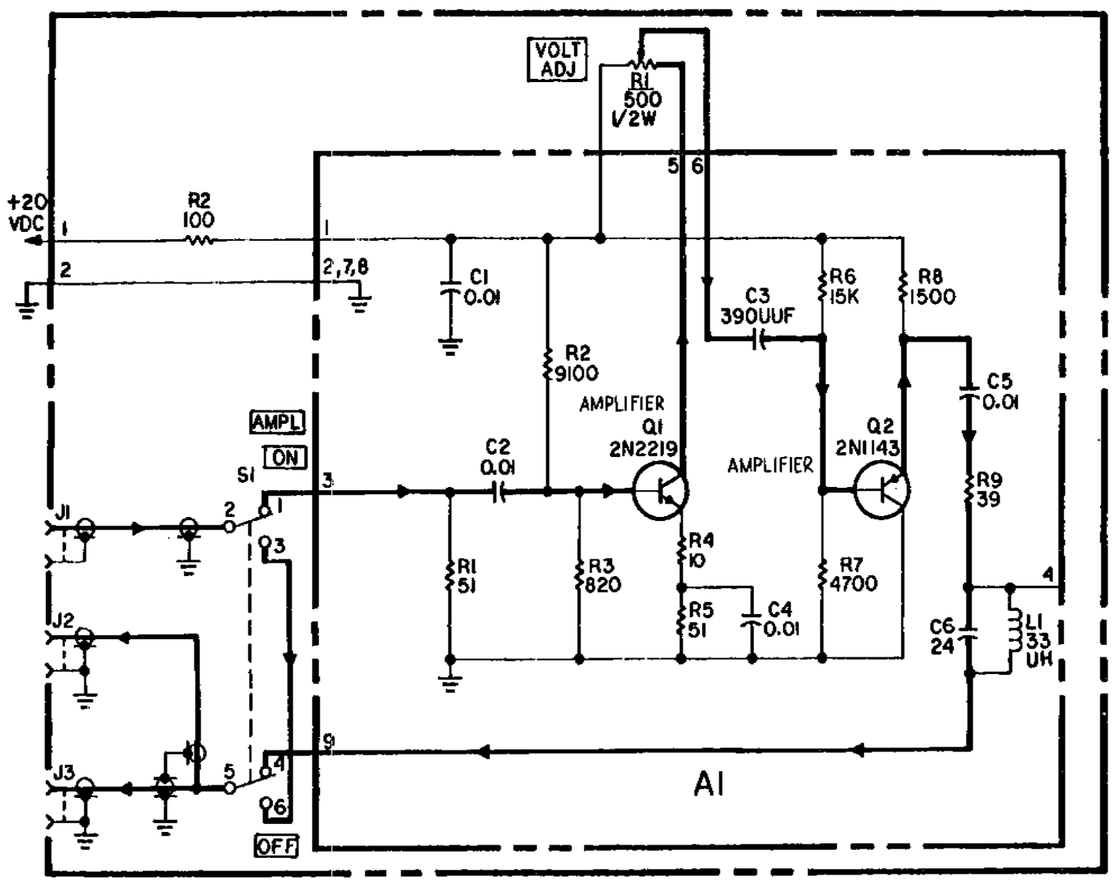


NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS.
   ALL RESISTOR TOLERANCES ARE ±5%.
3. TERMINAL NUMBERING FOR S1, S2 AND A2B1 IS FOR REFERENCE ONLY. RELATIVE LOCATION OF TERMINALS IS SHOWN IN THE DIAGRAMS AT THE RIGHT.
4. ALL ROTARY SWITCHES ARE SHOWN AS VIEWED FROM THE KNOB END.

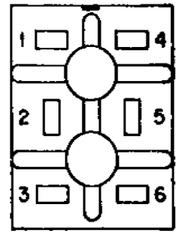
⑤ SHOWN FOR REFERENCE ONLY. THESE MODULES ARE IDENTICAL TO THEIR COUNTERPARTS IN THE AN/GRC-106.

Figure 6-10. Synthesizer test tray A1A3, schematic diagram.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS.
   ALL RESISTOR TOLERANCES ARE ±5%.
   ALL RESISTOR RATINGS ARE 1/4W.
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. TERMINAL NUMBERING FOR S1 IS FOR REFERENCE ONLY. RELATIVE LOCATION OF TERMINALS IS SHOWN IN THE DIAGRAM AT THE RIGHT.



S1

TRANSISTOR DC VOLTAGE MEASUREMENTS

ALL READINGS IN CHART BELOW SHOULD BE WITHIN ±5% OF INDICATED VALUE UNLESS OTHERWISE SPECIFIED. READINGS TAKEN WITH ME-26( )U VTVM

TRANSISTOR STAGE	DC VOLTAGE TO GROUND		
	B	E	C
Q1	+1	+10.5	+10.5
Q2	+6	0	+6.5

DC RESISTANCE OF COILS

COIL	RESISTANCE (OHMS)
L1	LESS THAN 1Ω
A1L1	LESS THAN 1Ω

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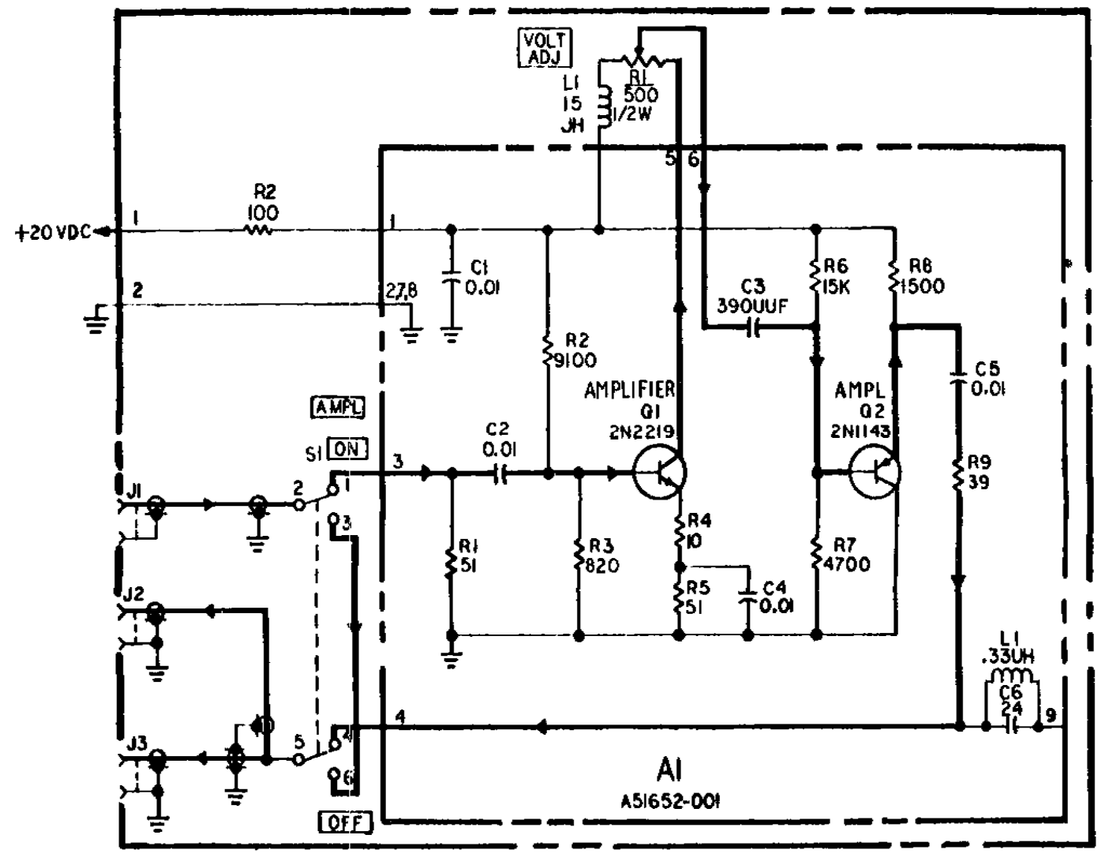
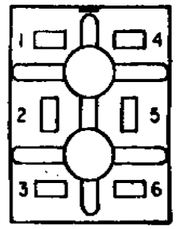
Figure 6-11. Synthesizer test tray A1A3, amplifier modules AR1, AR2, AF4, and AR5, schematic diagram.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS.
   ALL RESISTOR TOLERANCES ARE ±5%.
   ALL RESISTOR RATINGS ARE 1/4W.
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. TERMINAL NUMBERING FOR S1 IS FOR REFERENCE ONLY. RELATIVE LOCATION OF TERMINALS IS SHOWN IN THE DIAGRAM AT THE RIGHT.



TRANSISTOR DC VOLTAGE MEASUREMENTS
ALL READINGS IN CHART BELOW SHOULD BE WITHIN ±5% OF INDICATED VALUE UNLESS OTHERWISE SPECIFIED READINGS TAKEN WITH ME-26(1)U VTVM

TRANSISTOR STAGE	DC VOLTAGE TO GROUND		
	B	E	C
Q1	+1	+10.5	+10.5
Q2	+6	0	+6.5

DC RESISTANCE OF COILS

COIL	RESISTANCE (OHMS)
L1	LESS THAN 1Ω
A1L1	LESS THAN 1Ω

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Figure 6-12. Synthesizer test tray A1A3, amplifier module AR3, schematic diagram.

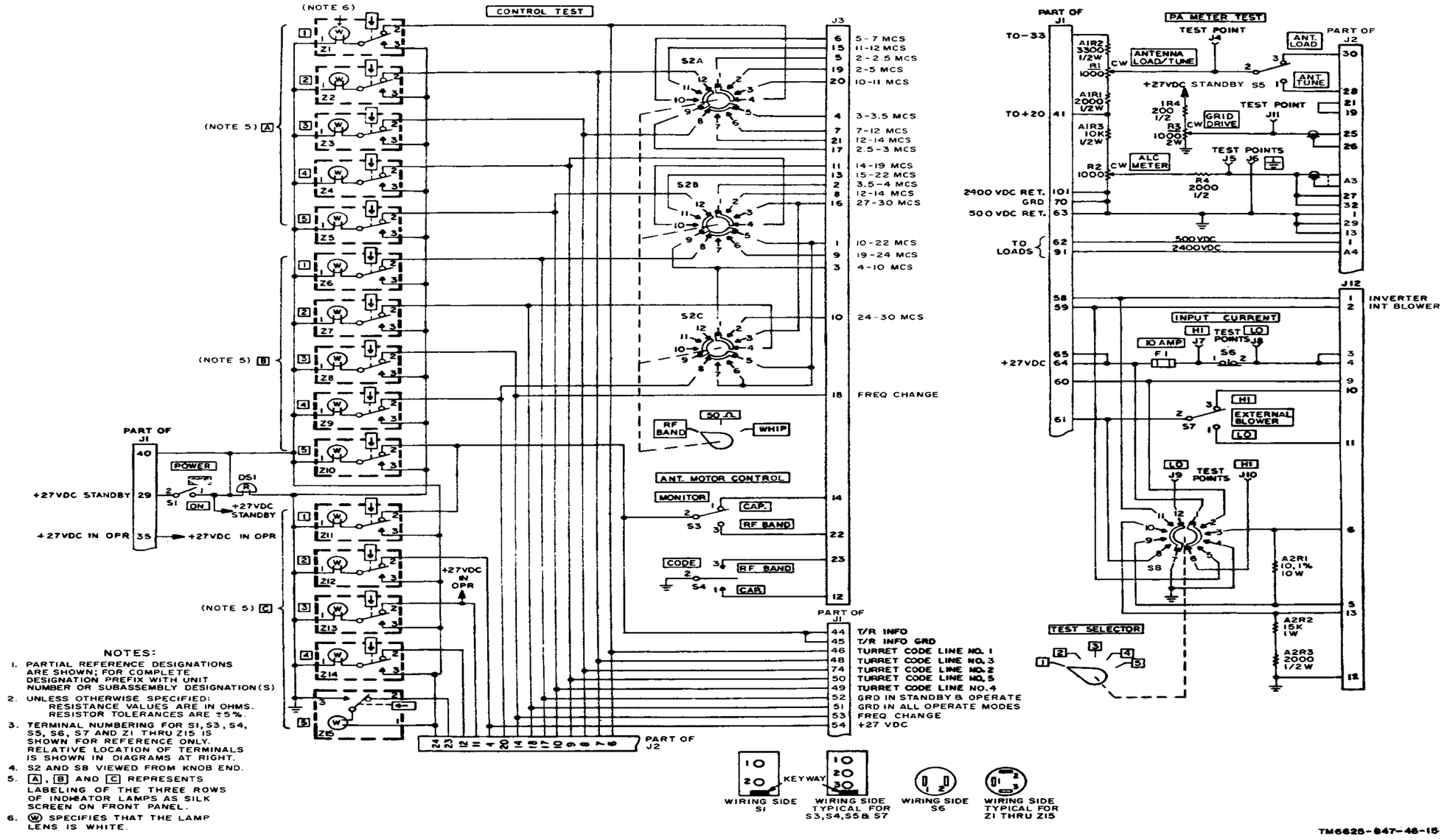

Figure 6-13. Converter and control tray A1A4, schematic diagram.

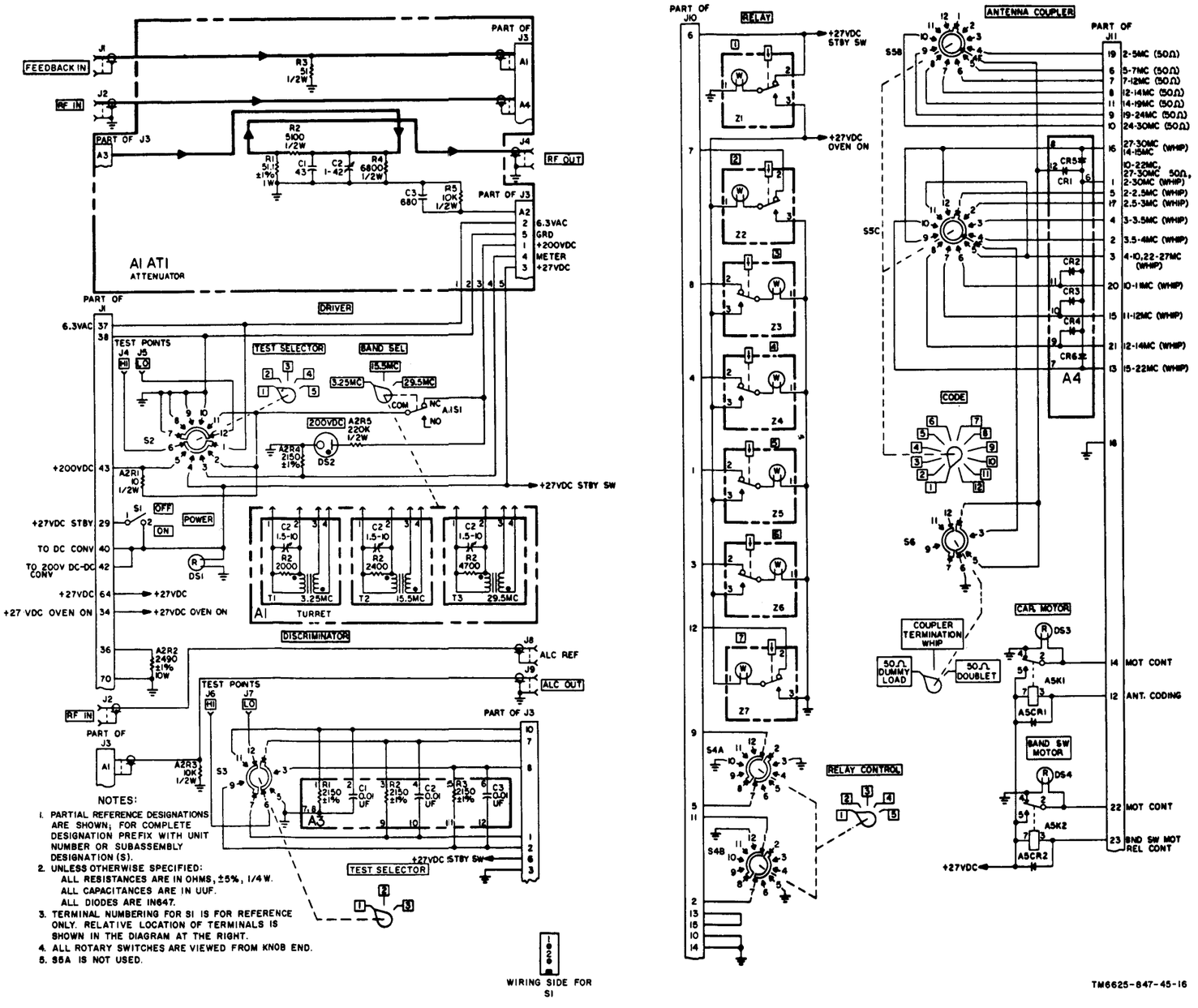

Figure 6-14. Driver, discriminator, and antenna coupler tray A1A5, schematic diagram.

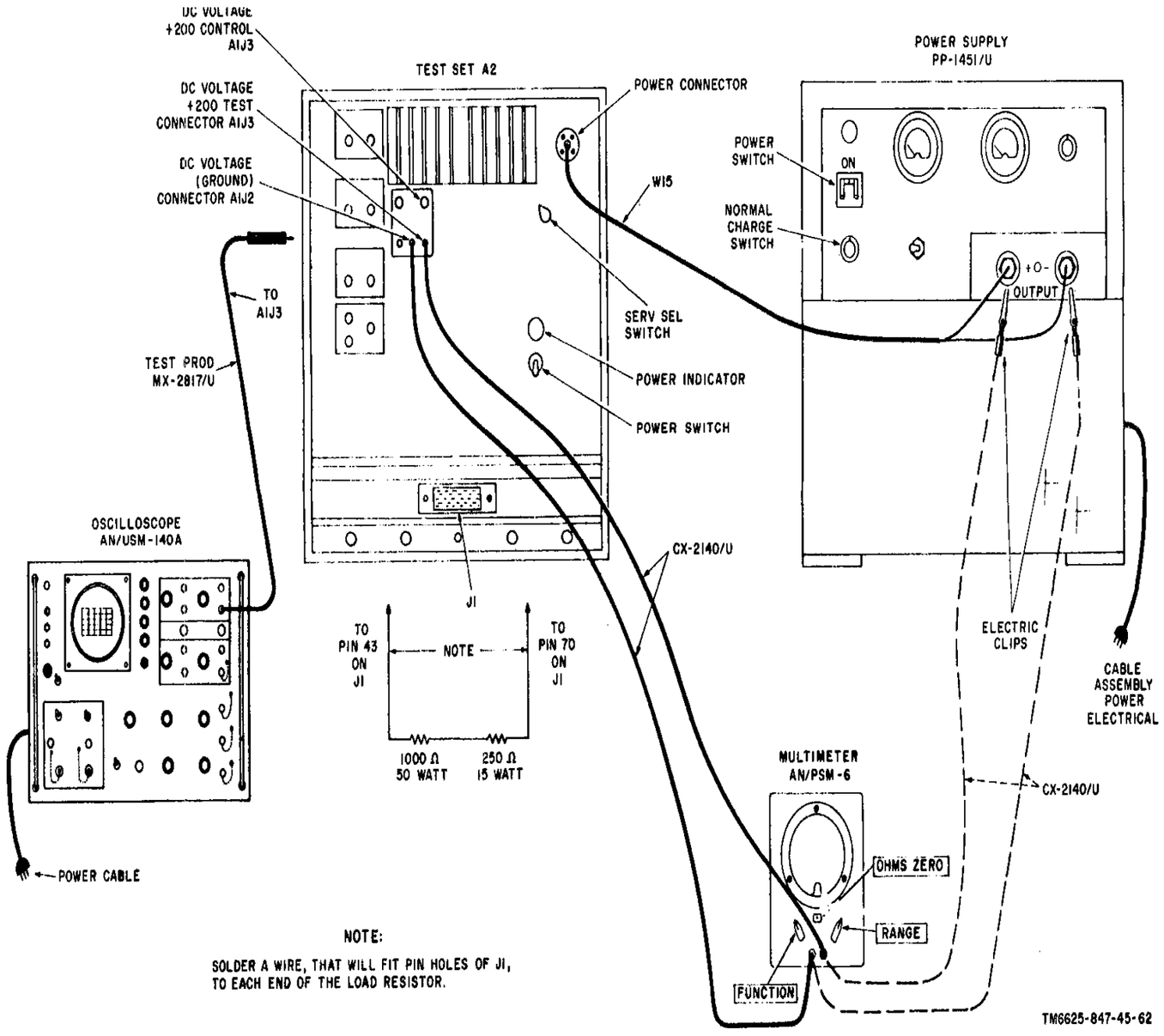

Figure 6-15. Test set A2, dc-to-dc converter module A2, test setup.

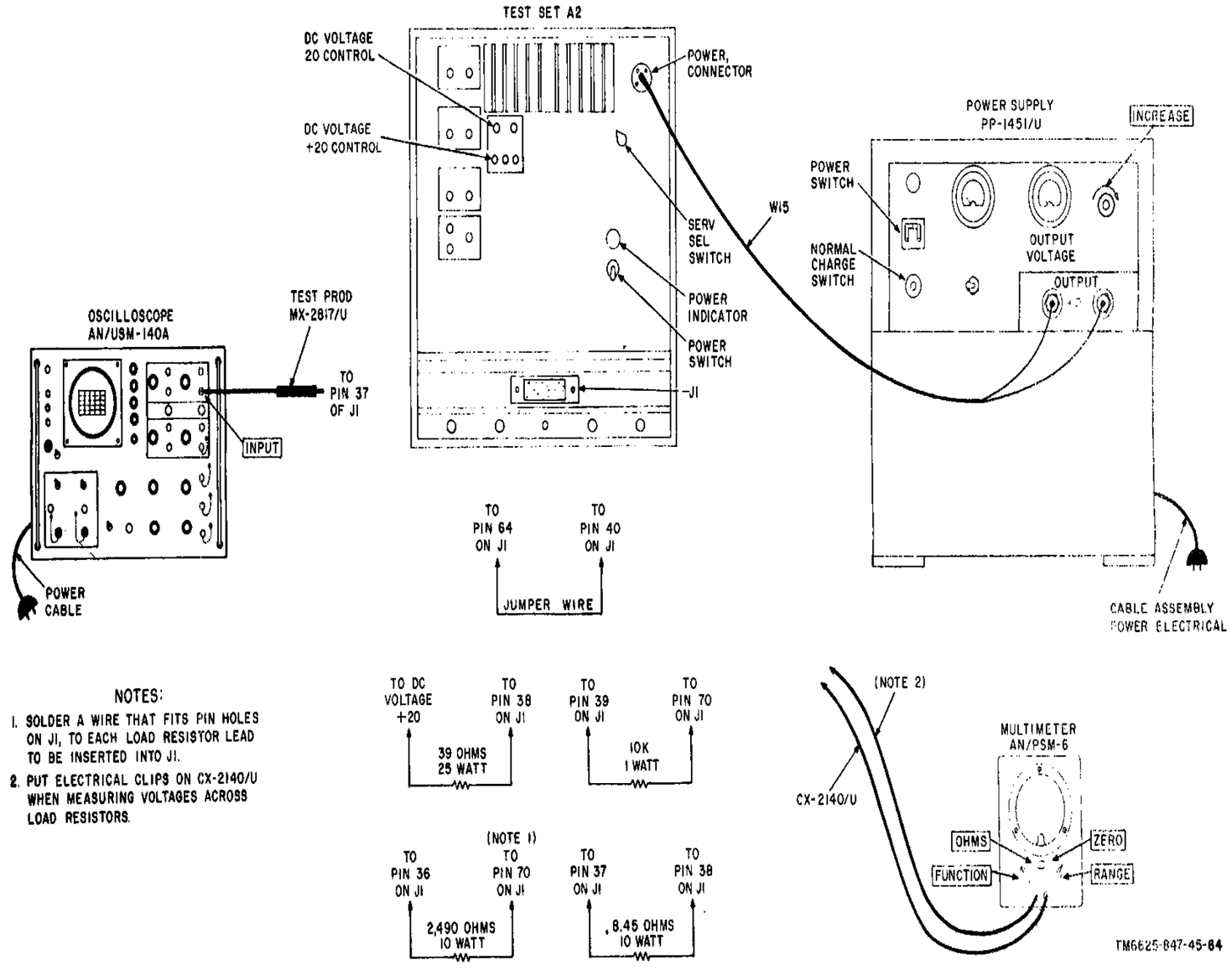

Figure 6-16. Test set A2, dc-to-dc converter and regulator module A3, test setup.

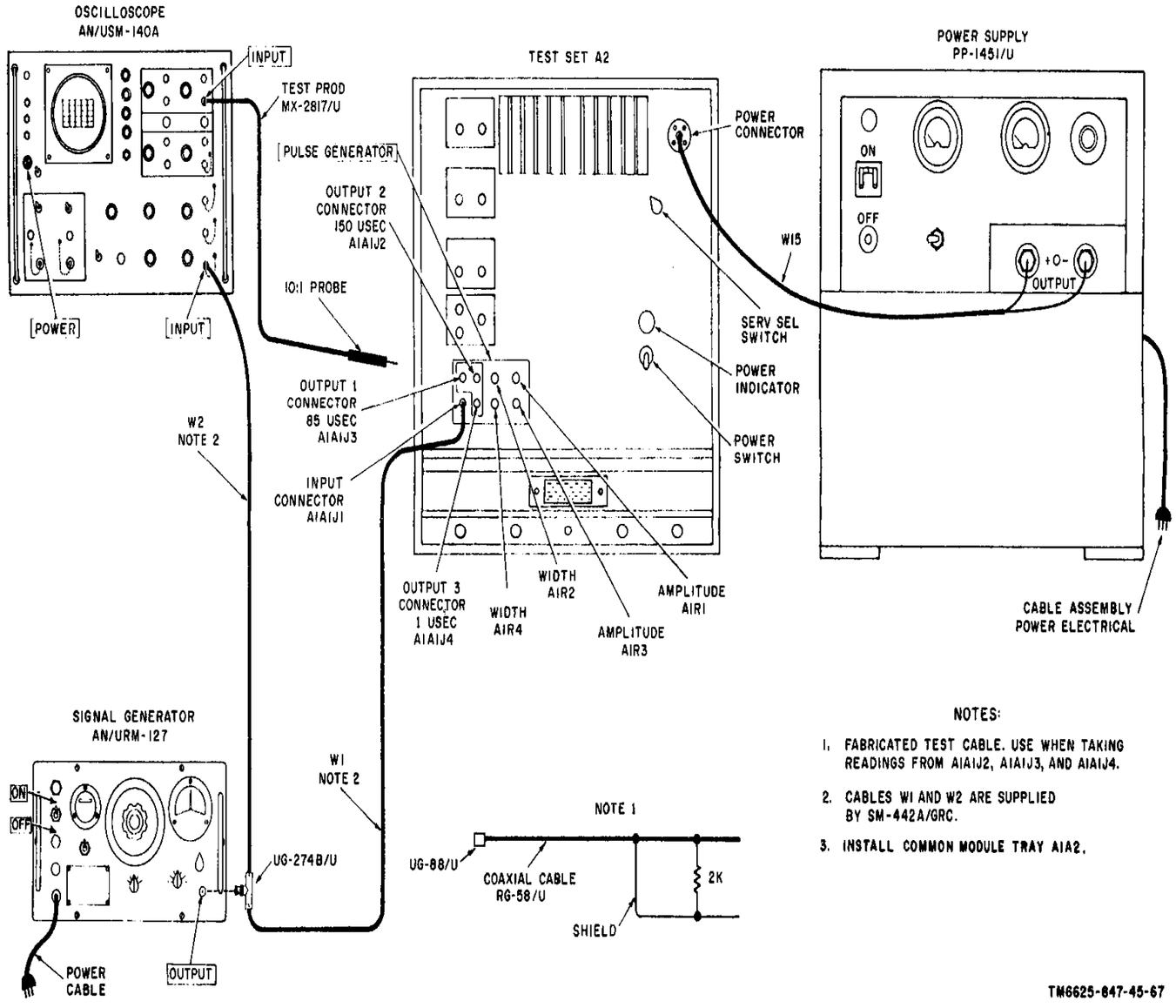

Figure 6-17. Test set A2, pulse generator assembly A1A1, test setup.

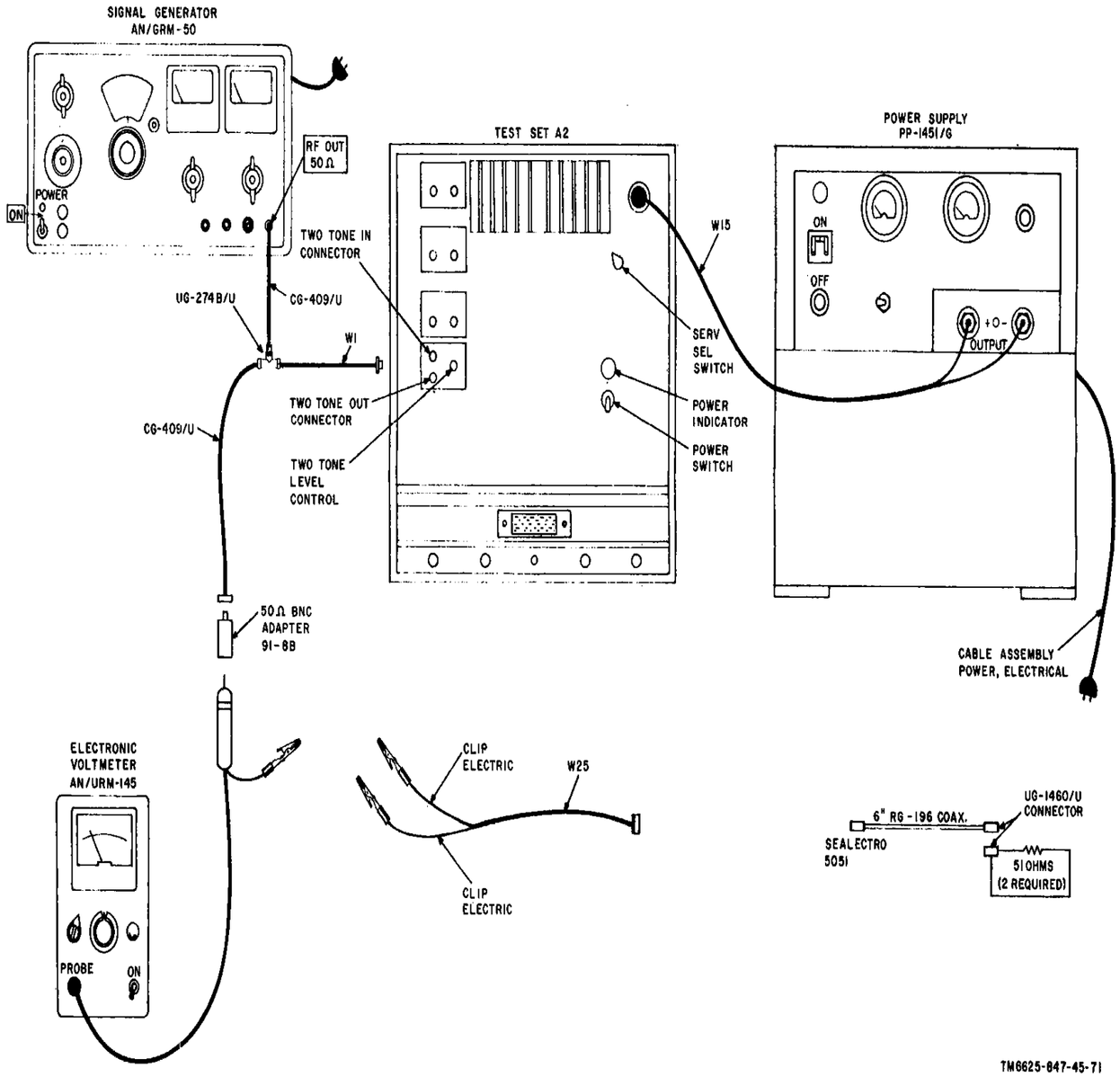

Figure 6-18. Test set A2, IF oscillator modules A1A2, A1A3, and A1A4 test setup.

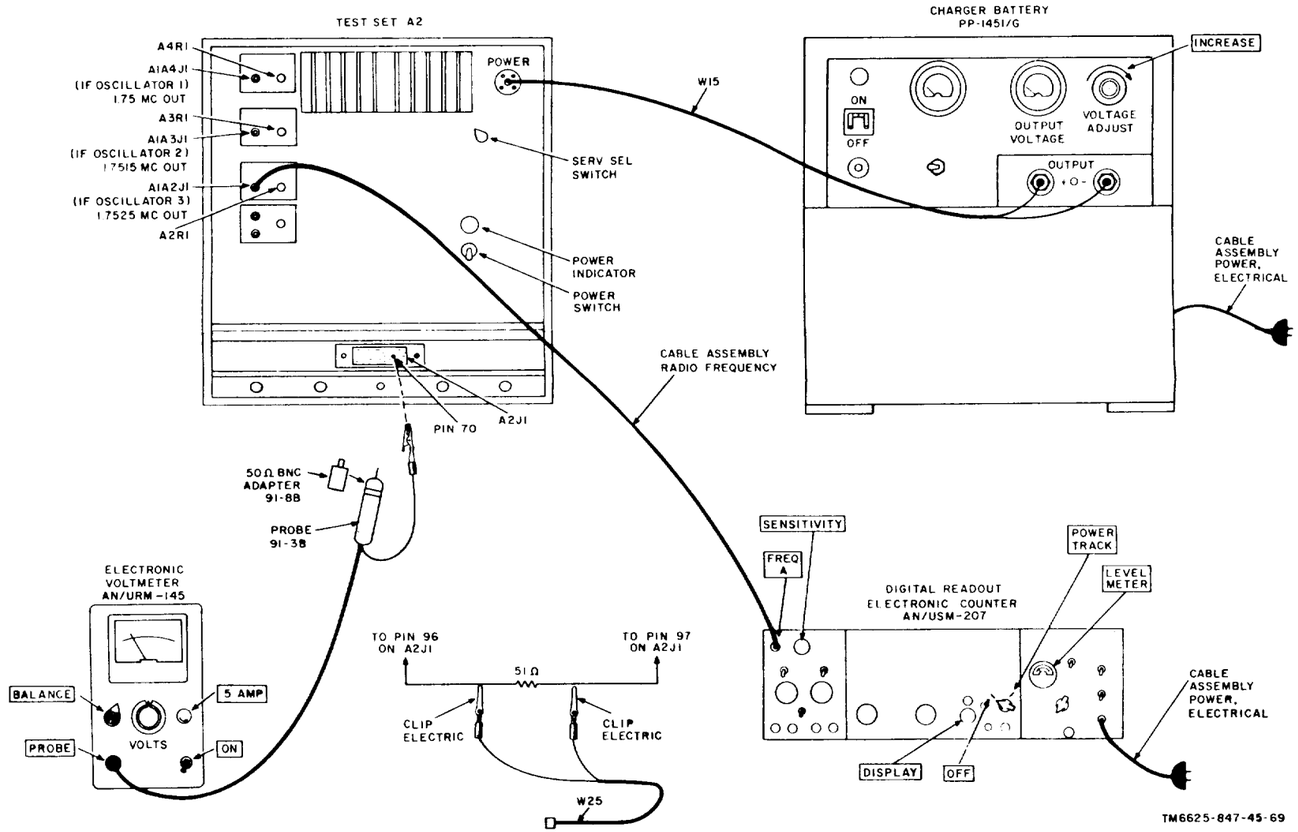

Figure 6-19. Test set A2, mixer assembly A1A5, test setup.

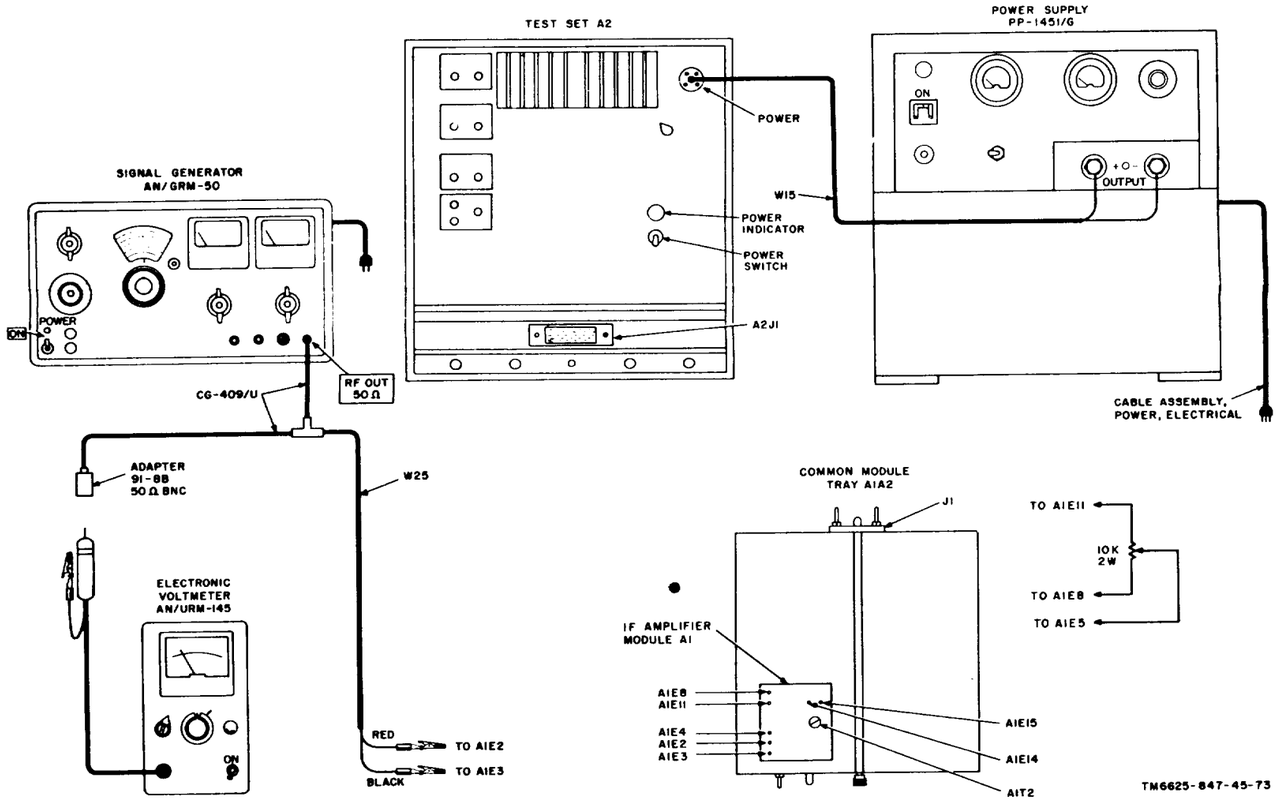

Figure 6-20. Common module tray A1A2 IF amplifier module A1, test setup.

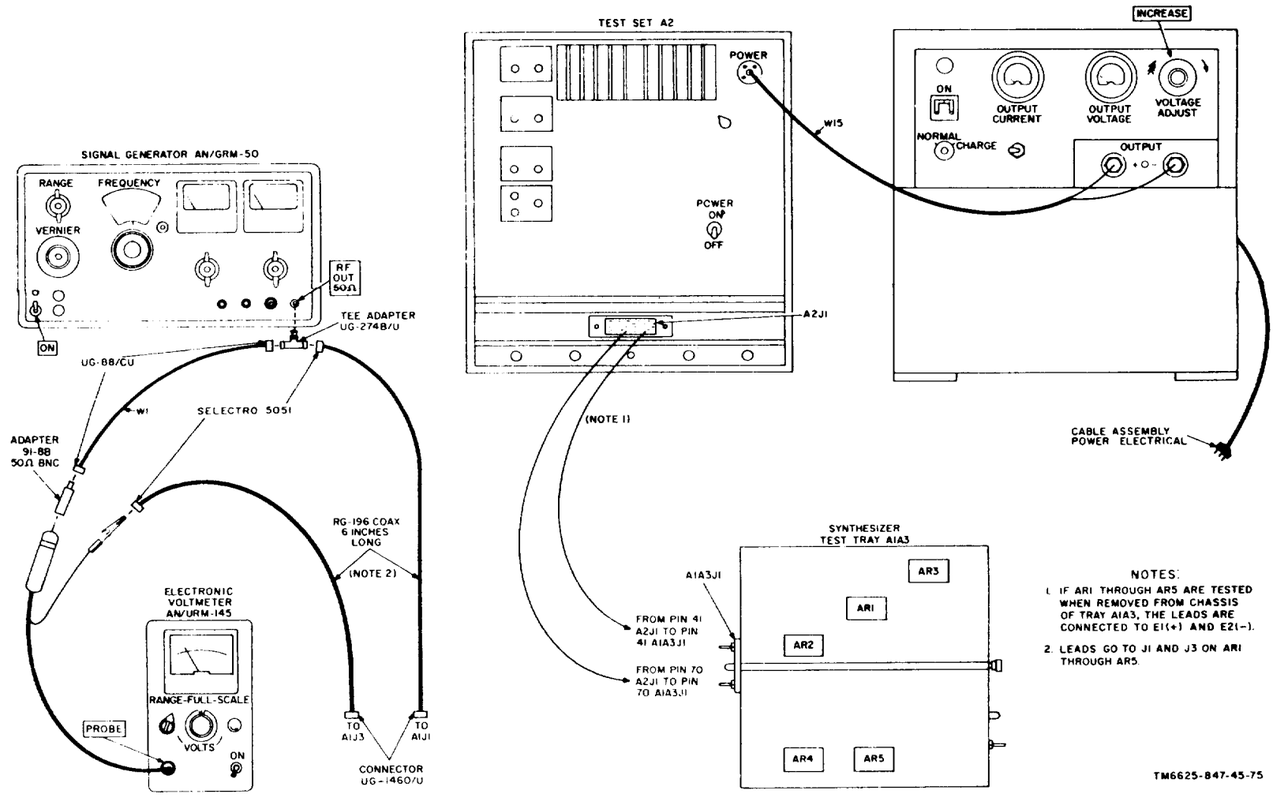

Figure 6-21. Synthesizer test tray A1A3, amplifier modules AR1 through AR5, test setup.

APPENDIX A
REFERENCES

Following is a list of applicable publications that should be available to the GS and depot maintenance personnel for the SM442A/GRC:

AR 700-58	Report of Packaging and Handling Deficiencies.
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals Types 7,8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
SB 11-131	Vehicular Radio Sets and Authorized Installations.
SB 38-100	Preservation, Packaging, and Packing Materials, Supplies, and Equipment Used by the Army.
TB SIG 291	Safety Measures to be Observed When Installing and Using Whip Antennas, Field Type Masts, Towers, Antennas, and Metal Poles that are used with Communication, Radar, and Direction Finder Equipment. (TO 31P5-1-1).
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 35S2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TB SIG 74610	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 11-5097	Spectrum Analyzers TS-723A/U, TS-723B/U, TS-723C/U, and TS723D/U (TO 33A1-664-1).
TM 11-5820-520-12	Operator's and Organizational Maintenance Manual Including Repair Parts and Special Tools Lists: Radio Sets AN/GRC(106 and AN/GRC-106A.
TM 11-6130-236-12	Organizational Maintenance Manual: Charger, Battery PP-1451/G.
TM 11-6130-247-15	Operator's, Organizational, DS, GS, and Depot Maintenance Manual (Including Repair Parts and Special Tools List): Power Supply PP-3940/G.
*TM 11-6625200-15	Operator's, Organizational, DS, GS, and Depot Maintenance Manual:
*	Multimeters ME-26A/U, ME-26B[U, ME-26C/U, and ME-26D/U.
TM 11-6625475-10	Operator's Manual: Multimeters AN/PSM-6, AN/PSM-6A, and AN/PSM-6B.
TM 11-6625-524-14	Operator, Organizational and Field Maintenance Manual: Voltmeter, Electronic AN/URM-145.
TM 11-6625-535-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Osillos-cope AN/USM-140A.
TM 11-6625-535-15-1	Organizational, DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tools List: Oscilloscopes AN/USM-140B, AN/USM-140C, AN/USM-141A, and AN/USM-141B.
TM 11-6625-683-15	Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Signal Generator ANtURM-127.
TM 114625-700-10	Operator's Manual: Digital Readout, Electronic Counter AN/USM-207.
TM 11-26-847-12	Operator's, Organizational Maintenance Manual Including Repair Parts and Special Tools List: Simulator, Radio Frequency SM442A/GRC.
*TM 38750	The Army Maintenance Management System (TAMMS).
TM 43-0139	Painting Instructions for Field Use.

INDEX

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1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.365	metric tons	short tons	1.102
pound-inches	newton-meters	.11375			

Temperature (Exact)

^{o}F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	^{o}C

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