TM 11-5826-219-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT MAINTENANCE MANUAL

RECEIVERS, RADIO R-1041/ARN AND R-1041A/ARN

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY
18 NOVEMBER 1963

CAUTION

This equipment is transistorized. Do not make resistance measurements before reading the instructions in paragraphs 22*c*(2), 23, and 29.

CHANGE No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *1 April 1966*

DS, GS, and Depot Maintenance Manual
RECEIVERS, RADIO R-1041/ARN AND R-1041A/ARN

TM 11-5826-219-35, 18 November 1963, is changed as follows:

Page 3, paragraph 3. Make the following changes:

Designate the existing text as subparagraph *a*.

Add subparagraph *b* after subparagraph *a*:

b. Circuit differences that exist between R-1041A/ARN procured on Order No. 4183-PP-60 and Order No. 15493-PP-63 are listed in the chart below:

Item	R-1041A/ARN Order No. 4183-PP-60	R-1041A/ARN Order No. 15493-PP-63
Q7	2N464	2N466
Q11	2N464	2N466
Q12	2N464	2N466
R34	6,800 ohms	2,200 ohms
R41	10 ohms	56 ohms

Page 10, paragraph 14*a*(1). Make the following changes:

Line 6. Change "2,500" to 3,000.

Line 18. Change "250" to 1,000.

Page 30, paragraph 32*h*, line 2. Change "500" to 1,000

Page 36, paragraph 45*c*, line 4. Change "500" to 1,000.

Page 47, figure 17 (foldout). Make the following changes:

Add the following to the notes:

15. Q7, Q11, AND Q12 ARE TRANSISTOR TYPES 2N466 ON ORDER NO. 15493-PP-63.
16. RESISTORS R34 AND R41 ARE 56 OHMS AND 2,2'0 OHMS RESPECTIVELY ON ORDER NO. 15493-PP-63.

Change potentiometer R21, located in the 3D IF. AMPL stage, to terminate to ground.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-36 requirements for Direct and General Support (Unclas) for all fixed and rotor wing accounts.

Technical Manual
No. 11-5826-219-35

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *18 November 1963*

RECEIVERS, RADIO R-1041/ARN AND R-1041A/ARN

***This manual supersedes C1, 14 May 1962, to TM 11-5826-208-35, 28 July 1960.**

CHAPTER 1
INTRODUCTION

1. Scope

a. This manual contains instructions for field and depot maintenance for Receivers, Radio R-1041/ARN and R-1041A/ARN. It includes instructions appropriate to third, fourth, and fifth echelons for troubleshooting, testing, aligning, and repairing the equipment, and replacing maintenance parts. It also lists tools, materials, and test equipment for third, fourth, and fifth echelon maintenance. Detailed functions of the equipment are covered in chapter 2.

b. The direct reporting, by the individual user, of errors, omissions, and recommendations for improving this equipment manual is authorized and encouraged. DA Form 2028 will be used for reporting these improvements. This form may be completed using pencil, pen, or typewriter. DA Form 2028 will be completed in triplicate and forwarded by the individual using the manual. The original and one copy will be forwarded direct to: Commanding Officer, U. S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, New Jersey 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc).

Note: For other applicable forms and records, see paragraph 3, TM 11-5826-219-12.

2. Index of Publications

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. Department of the Army Pamphlet No. 310-4 is a current index of technical manuals, technical bulletins, supply manuals (types 4, 6, 7, and 9), supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc) and the latest changes and revisions of each equipment publication.

3. Differences in Models

The basic circuit configuration of Receiver, Radio R-1041A/ARN is the same as the circuit configuration of Receiver, Radio R-1041/ARN. However, some internal circuit differences exist between the R-1041A/ARN and the R-1041/ARN; these differences are listed in the chart below. Also, a number of circuit differences exists among the R-1041A/ARN's; these differences are detailed in the notes on the schematic diagram (fig. 17).

Item	R-1041/ARN	R-1041A/ARN
Network Z1 -----	Not included	Included; contains the following parts: crystal Y2; capacitors C18, C25, C48, and C49; resistors R5 through R7 and R62 through R65; and transistors Q2 and Q13.
Buffer amplifier Q13.	Not included	Included (part of Z1).
Bandpass filter FL-BP1.	Not included	Included.
Capacitors C17, C50 through C55, and C57.	Not included	Included.
Coils:		
L4 ----------	Not included	Included.
L5 ----------	Included ---	Not included.
Resistors:		
R5 ----------	Not included	Included.
R49 ---------	Included ---	Not included.
R62 ---------	Not included	Included.
Thermistors RT3 and RT4.	Not included	Included.

by the delayed automatic gain control (agc) circuit ((3) below). The gain of second if. amplifier Q4 is also controlled by the sensitivity control circuit through the remote sensitivity switch located on the aircraft control panel. The sensitivity control circuit is preset to provide either a high or low sensitivity as selected by the remote sensitivity switch.

(3) The audio output from detector CR3 (c(1) below) is applied to delayed agc rectifier CR4; rectifier CR4 is normally reverse biased to prevent decreasing the gain when a weak signal is received. When the audio voltage overcomes the reverse bias applied to the diode, rectifier CR4 conducts and applies the rectified voltage to agc amplifier Q8. The direct current (dc) voltage output from agc amplifier Q8 is applied to the first and second if. amplifiers ((2) above).

c. *Audio Circuit.*

(1) Detector CR3 removes the radiofrequency (rf) component from the signal, leaving only an audiofrequency (af) signal of 400, 1,300, or 3,000 cps; the frequency depends on the type of marker beacon signal being received. The output from detector CR3 is applied to first audio amplifier Q6 and to delayed agc rectifier CR4.

(2) The signal applied to first audio amplifier Q6 is amplified and applied to second audio amplifier Q7. The amplified output from second audio amplifier Q7 is transformer coupled, through output transformer T15, to the audio attenuation circuit and the switching circuit (*d* below).

(3) The audio attenuation circuit is a coarse volume control that provides five different levels of audio output as selected by a five-position switch. The output from the audio attenuation circuit is applied to the headset through the interphone connections of the aircraft. The remote volume control may be used between the receiver and the interphone system to control the audio output within the range selected by the coarse volume control.

d. *Switching Circuit.*

(1) With no signal applied to the receiver, the normal condition of the switching circuit transistors is: Q9, off; Q10, on; and Q11 and Q12 (parallel-connected), off. In this condition, no output from the switching circuit is applied to the remote indicator lamp and the lamp is not lighted.

(2) When a signal from output transformer T15 is applied to first shaping amplifier Q9, the stage becomes operative. The output from shaping amplifier Q9 turns off second shaping amplifier Q10. When shaping amplifier Q10 becomes inoperative, parallel-connected light switches Q11 and Q12 become operative and an output current is produced. The output current is applied to the remote indicator lamp; this causes the lamp to light, indicating reception of a marker beacon signal. The rate of flashing of the indicator lamp indicates the type of marker beacon signal being received.

Section II. CIRCUIT ANALYSIS

6. Preselector
(fig. 17 and 18)

The preselector increases receiver selectivity, which reduces image and most adjacent channel frequency interference. The preselector also prevents coupling of the 70.8-mc oscillator signal into the antenna.

a. The preselector consists of individual filters T1 through T4. Each filter is a paralled-resonant tank circuit tuned to 75 mc; the combination produces a bandpass of 80 kc. The tapped coil of filter T1 offers an impedance of 50 ohms to the antenna for impedance matching. At frequencies other than 75 mc, this impedance changes and a mismatch occurs.

b. Signal input to the preselector is obtained through input jack J1 and coil L3 and applied to the center tap of the coil of filter T1. Coil L3, in series with the signal input to the receiver, attenuates high-frequency signal inputs, resulting in an increase in the selectivity of the receiver. In the R-1041A/ARN, bandpass filter FL-BP1, in series with coil L3, improves the rejection ratio to the image and adjacent channel frequencies.

c. Coupling between filters in the preselector is provided by capacitors C2, C4, and C6. The output from the preselector is taken from the tap on the coil of filter T4; the coil is tapped to provide a 500-ohm impedance to the cathode circuit of crystal diode mixer CR1.

7. Oscillator
(fig. 17 and 18)

Oscillator Q1, a Hartley-type, crystal-controlled oscillator, generates a frequency of 70.8 mc that is beat against the incoming signal in the mixer stage.

a. Transistor Q1 and its associated components are connected as a modified Hartley-type, crystal-controlled oscillator. Regenerative feedback is obtained from a tap on the tank circuit, consisting of the primary winding of transformer T8 and capacitor C16, and applied to the emitter of the transistor. A fifth overtone crystal, Y1, and capacitor C15 make up the feedback path. The feedback circuit operates as a series-resonant circuit, offering a low impedance at the operating frequency of 70.8 mc. At all other frequencies, the impedance is high. Since feedback is greater at 70.8 mc, the oscillator operates at that frequency. Coil L1 neutralizes the capacitance of the crystal holder.

b. Resistors R1 and R2 form a voltage divider between B+ and ground and develop the base voltage for transistor Q1. Capacitor C14 is an rf bypass from the base to ground. The emitter input signal (regenerative feedback) is developed across resistor R3, which also acts as the emitter swamping resistor. Capacitor C43 and the secondary of transformer T8 couple the output of the oscillator to the plate circuit of crystal diode mixer CR1 through the primary winding of transformer T5. Resistor R4 is a voltage-dropping resistor. Capacitor C42 filters the dc voltage applied to the oscillator. In the R-1041A/ARN, capacitor C55 in the oscillator output circuit reduces spurious frequency response.

8. Mixer
(fig. 17 and 18)

The mixer stage consists of crystal diode CR1, a tapped portion of the coil in filter T4, a tank circuit consisting of the secondary winding of transformer T8 and capacitor C43, and a tank circuit consisting of the primary winding of transformer T5 and capacitor C44. The modulated 75-mc signal from the preselector is developed across the tapped coil in filter T4 and applied to the cathode circuit of the crystal diode. At the same time, the output from the oscillator (70.8 mc) is developed across the secondary winding of transformer T8 and applied to the anode of the crystal diode. The diode mixes both frequencies and, as a result, a difference frequency of 4.2 mc and a sum frequency of 145.8 mc is produced. The primary tank circuit of transformer T5 is tuned to the difference frequency. The 4.2-mc signal in the mixer output is applied to the 4.2-mc bandpass filter.

9. Bandpass Filter, 4.2-Mc
(fig. 17 and 18)

The 4.2-mc bandpass filter consists of transformers T5 and T7 and bandpass filter T6. Each is tuned to 4.2 mc by the use of a variable core. The filter provides a bandwidth of 80 kc centered on 4.2 mc.

Adjacent channel frequencies are further reduced by the filter and only the marker beacon signal is coupled to the converter stage. Capacitors C9 and C10 provide coupling between filter sections.

10. Converter
(fig. 17 and 18)

Converter Q2 acts as an oscillator, an amplifier, and a mixer to convert the 4.2-mc modulated signal into a second if. signal of 520 kc.

a. The signal input to the converter is developed across the secondary winding of transformer T7 and applied to the emitter of transistor Q2. The oscillator, which is similar to a Pierce crystal oscillator, generates a frequency of 4.72 mc. The frequency is determined by crystal Y2, which offers a low impedance feedback path from the collector to the base for 4.72 mc and a high impedance for all other frequencies. Capacitor C18 is an rf bypass from base to ground, but, at a frequency of 4.72 mc, it has sufficient impedance to develop feedback voltage to keep the stage oscillating. Capacitor C18 also provides the necessary phase shift so that the feedback voltage is regenerative. Heterodyne action takes place within the transistor, and a second if. signal of 520 kc is produced. In the R-1041A/ARN, the output signal is developed across collector load resistor R65 and coupled through capacitor C49 to the base of buffer amplifier Q13 (para 11); capacitor C48 is an rf bypass capacitor for the higher frequencies (original frequencies and the sum frequency). In the R-1041/ARN, the output signal is developed across filter T9 (para 12), the collector load for converter Q2.

b. Resistors R6 and R7 form a voltage divider to establish forward bias for transistor Q2. Resistor R10 is the emitter swamping resistor and, in conjunction with capacitor C13, forms a decoupling filter. In the R-1041A/ARN, capacitor C17 provides additional rf filtering.

11. Buffer Amplifier (R-1041A/ARN only)
(fig. 1 and 17)

Buffer amplifier Q13 isolates converter Q2 from the 520-kc if. bandpass filter and the if. amplifiers. The input signal is applied to the base of transistor Q13 through coupling capacitor C49. The amplified output signal is developed across filter T9 (para 12), the collector load for buffer amplifier Q13. Resistors R63 and R64 form a voltage divider to establish forward bias for transistor Q13; the bias voltage is applied to the base of transistor Q13 through isolation resistor R62. Resistor R5 is the emitter swamping resistor and, in conjunction with capacitor C25, forms a decoupling filter.

12. If. Bandpass Filter
(fig. 17 and 18)

The 520-kc if. bandpass filter consists of individual bandpass filters T9 and T10 and transformer T11. Each is tuned to 520 kc by a variable core. Resistors R8 and R9, in parallel with the coil of filter T9 and the primary of transformer T11, respectively, lower the Q of the tuned circuits to obtain a bandwidth of 80 kc. Coupling between the filters is through capacitors C19 and C20. The output from the 520-kc if. bandpass filter is developed across the secondary of transformer T11 and applied to first if. amplifier Q3.

13. If. Amplifiers

a. First If. Amplifier

(1) The modulated 520-kc if. signal is applied to the base of first if. amplifier Q3 from the secondary winding of transformer T11. Base bias for first if. amplifier Q3 is developed by the delayed agc circuit (para 15). The output from the collector is developed across the primary winding of transformer T12. The inductance of the primary winding together with its stray capacitance forms a tuned circuit, resonant to 520 kc. Resistor R15 broadens the frequency response of the transformer to prevent attenuation of the if. signal when the transformer becomes slightly detuned. Detuning occurs when the base input impedance of second if.

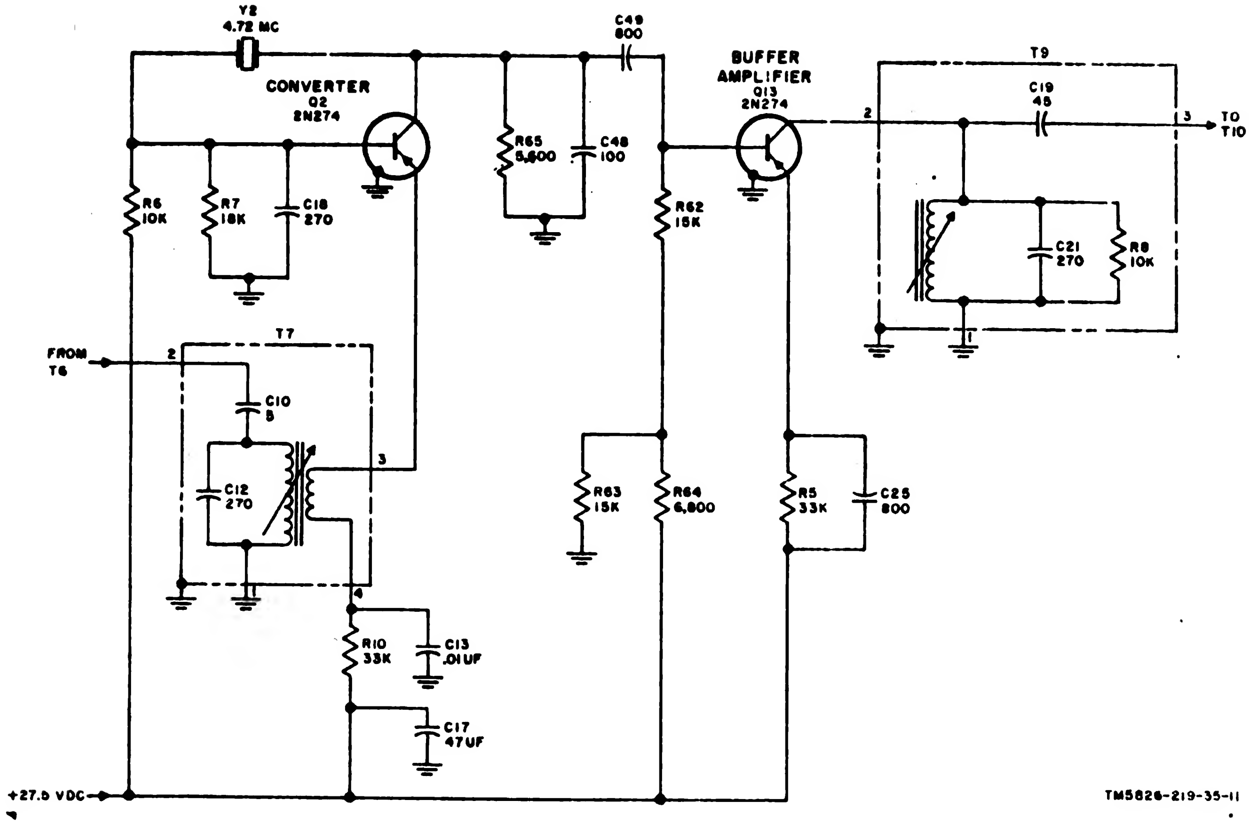


Figure 1. Converter and buffer amplifier, partial schematic diagram (R-1041A/ARN only).

amplifier Q4 changes because of agc action; this impedance change is reflected back into the primary winding of transformer T12.

(2) Resistors R13 and R14 form a voltage-divider network which establishes the emitter-collector operating voltage. Resistor R12 is the emitter swamping resistor and, in conjunction with capacitor C41, forms a decoupling filter.

b. *Second If. Amplifier.*

(1) Second if. amplifier Q4 amplifies the signal applied to its base from the secondary of transformer T12. The output signal is developed across the fixed-tuned primary of transformer T13; resistor R26, in parallel with the primary winding, broadens the frequency response of transformer T13. The signal applied to the base of transistor Q4 is controlled by the sensitivity control circuit (para 14). Base bias is applied from the delayed agc circuit (para 15).

(2) Resistors R18 and R19 form a voltage-divider network which establishes the emitter-collector operating voltage. Resistor R17 is the emitter swamping resistor and, in conjunction with capacitor C29, forms a decoupling filter.

c. *Third If. Amplifier.*

(1) Third if. amplifier Q5 amplifies the signal applied to its base from the secondary of transformer T13. The output signal is developed across the fixed-tuned primary of transformer T14 and is transformer coupled to detector CR3; resistor R27, in parallel with the primary winding, broadens the frequency response of transformer T14. Parallel-connected thermistor RT1 and resistor R25 provide a constant base resistance to compensate for temperature variations. If the temperature increases, the resistance of the thermistor decreases and shunts the increasing resistance of resis-

tor R25. If the temperature decreases, the thermistor resistance increases while the resistance of resistor R25 decreases. In this way, the base resistance remains relatively constant. In the R-1041A/ARN, additional temperature compensation is obtained from series-connected thermistor RT3 and resistor R66. Thermistor RT3 and resistor R66 are connected in parallel with the emitter-base junction of transistor Q5. The thermistor and resistor bypass (shunt) a portion of the emitter-base current around the emitter base junction. The resistance of the emitter-base junction varies inversely with the temperature changes. If the temperature increases, the emitter-base junction resistance decreases; however, since the resistance of thermistor RT3 also decreases, more current is bypassed around the emitter-base junction. The voltage dropped across the emitter-base junction decreases, thereby compensating for the increase in forward bias due to the buildup of electrons in the base region.

(2) Resistors R22 and R23 form a voltage-divider network to establish forward bias for transistor Q5. Capacitor C30 is an rf bypass capacitor in the base circuit. Resistor R24 is the emitter swamping resistor and, in conjunction with capacitor C31, forms a decoupling filter.

14. Sensitivity Control Circuit

The sensitivity control circuit enables the pilot to control the sensitivity of the receiver when input signal strengths vary appreciably. The sensitivity control circuits in the R-1041/ARN and most R-1041A/ARN's are similar and are discussed in *a* below. An alternate sensitivity control circuit is used in some of the R-1041A/ARN's; this circuit is discussed in *b* below.

a. Primary Sensitivity Control Circuit.

(1) *R-1041A/ARN* (fig. 17). The signal developed across the secondary winding of if. transformer T12 is applied across a voltage-divider network consisting of parallel-connected resistor R60 and thermistor RT4, dc blocking capacitor C27, diode CR2, filter capacitor C24, and resistor R16. The signal developed across diode CR2 is applied to the base of second if. amplifier transistor Q4 through dc blocking capacitor C27. Diode CR2 is effectively in series with the parallel resistance of resistor R60 and thermistor RT4 and resistor R16; therefore, the resistance of diode CR2 determines the strength of the signal applied to the base of transistor Q4. Diode CR2 acts as a variable resistor with its resistance determined by its conduction rate. Sensitivity control resistors R21 and R59 control the amount of positive voltage applied to the diode anode. With the remote sensitivity switch in the low position, variable resistor R59 is not grounded and variable resistor R21 determines the positive voltage applied to the diode anode. Diode CR2, resistors R20 and R57, and variable resistor R21 form a voltage-divider network between the +27.5-volt bus and ground. When variable resistor R21 is in the maximum clockwise position, maximum resistance is placed in series with the diode; under this condition, a very low voltage is applied to the diode, and the diode has a high resistance with respect to the resistance with which it is in series. Most of the input signal is developed across the diode and applied to the base of the transistor. When variable resistor R21 is in the maximum counterclockwise position, minimum resistance is placed in series with the diode; under this condition, a high voltage is applied to the diode and the diode has a small resistance with respect to the resistance with which it is in series. Therefore, only a small portion of the

input signal is developed across the diode and applied to the base of the transistor. With variable resistor R59 ungrounded (low sensitivity), variable resistor R21 is adjusted so that an input of 2,500 microvolts to the receiver will light the indicator lamp. With the remote sensitivity switch set to the high position, variable resistor R59 is grounded, causing the resistance at the junction of resistors R20 and R57 to decrease. This lowers the amount of voltage that can be applied to diode CR2, and the diode resistance increases. Under this condition, variable resistor R59 is adjusted so that an input of 250 microvolts to the receiver will light the indicator lamp. Capacitor C28 is an rf bypass capacitor that prevents the if. signal from being fed back into the +27.5-volts bus. Parallel-connected thermistor RT4 and resistor R60 provide a constant base resistance to compensate for temperature variations; this circuit functions the same as paralled-connected thermistor RT1 and resistor R25 (para 13*c*(1)).

(2) *R-1041/ARN* (fig. 18). The sensitivity control circuit in the R-1041/ARN is similar to the circuit discussed in (1) above, except that thermistor RT4 is not used and variable resistor R21 is connected between the +27.5-volt bus and ground. With the remote sensitivity switch in the low position, variable resistor R59 is not grounded; the amount of voltage applied to the anode of diode CR2 is determined by the setting of variable resistor R21. With the remote sensitivity switch in the high position, variable resistor R59 is connected to ground and the circuit functions as described in (1) above.

b. Alternate Sensitivity Control Circuit (fig. 2). The alternate sensitivity control is similar to the primary sensitivity control circuit discussed in *a*(1) above, except that thermistor RT4 is not used, variable resistor R21 is connected in parallel with resistor R60, and resistor R57 is connected directly to the +27.5-volt bus. With the remote sensitivity switch in the low position, resistor R59 is not grounded and a fixed voltage is applied to diode CR2. Under this condition, the conduction rate of diode CR2 is fixed and the setting of variable resistor R21 alone determines the amount of signal applied to the base of transistor Q4. With variable resistor R21 in the extreme clockwise position, minimum resistance is placed in series with diode CR2 and a larger portion of the input signal is developed across the diode and applied to the base of transistor Q4. With variable resistor R21 in the extreme counterclockwise position, maximum resistance is placed in series with diode CR2, resulting in a smaller signal being applied to the base of transistor Q4. With the remote sensitivity switch set to the high position, variable resistor R59 is grounded and controls the diode resistance as described in *a*(1) above.

Note: The alternate sensitivity control circuit is used in R-1041A/ARN's bearing the following serial numbers:
262, 295, 298, 375, 377, 401, 462, 473, 481, 493, 523, 525, 531, 537, 538, 540, 541, 544, 549, 550, 553, 554, 556, 559, 561, 562, 564, 565, 568, 570, through 573, 575, through 581, 583, through 596, 598 through 641, 643 through 647, 650 through 661, 664 through 694, 696, 697, 699, 701 through 703, and 705 through 709.

15. Delayed Automatic Gain Control Circuit (fig. 17 and 18)

The delayed automatic gain control circuit assures that the input to the receiver is strong enough to provide the 12.5-milliwatt output required to operate the indicator lamp before the gain of the first and second if. amplifiers is reduced. The delayed agc circuit consists of delayed agc rectifier CR4 and agc amplifier Q8. The output from agc amplifier Q8 establishes the forward bias for first and second if. amplifiers Q3 and Q4.

a. With no signal or with a weak signal input to the receiver, delayed agc rectifier CR4 is reverse biased. Reverse bias is applied to the cathode of rectifier CR4 through emitter swamping resistor R35 and detector load resistor R28. A positive

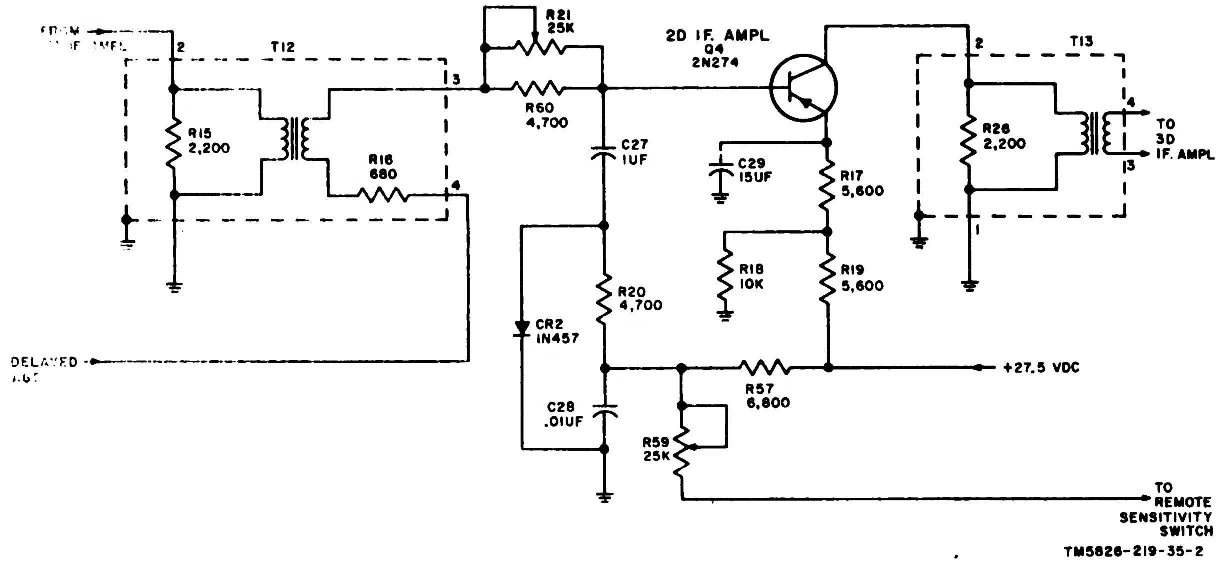


Figure 2. Alternate sensitivity control circuit.

voltage is applied to the anode of rectifier CR4 from the voltage divider consisting of resistors R33 and R34. The difference between the positive voltages applied to the cathode and anode of rectifier CR4 is such that the diode is reverse biased. With diode CR4 reverse biased, the voltage applied to the base of agc amplifier Q8 is set by voltage-divider resistors R33 and R34 and forward biases transistor Q8. Agc amplifier Q8, a dc amplifier, is conducting and develops a positive voltage (with respect to ground) across collector load resistor R36. Capacitor C36 charges through resistor R11 to the voltage level across resistor R36. The voltage present across capacitor C36 is applied to first and second if. amplifiers Q3 and Q4 to provide forward bias for the transistors.

b. When the signal voltage developed across detector load resistor R28 (para 16) overcomes the positive voltage applied to the cathode of delayed agc rectifier CR4, the diode conducts. Current flow from diode CR4 through resistor R34 increases the forward bias on agc amplifier Q8. The resultant increase of collector current causes the voltage dropped across collector load resistor R36 to increase. This action results in a more positive voltage being applied to the bases of first and second if. amplifiers Q3 and Q4, decreasing the forward bias applied to transistors Q3 and Q4; the transistors conduct less, causing a decrease in the receiver gain. The time constant of resistor R11 and capacitor C26 is such that the capacitor will not respond to instantaneous changes in the voltage dropped across resistor R36. Capacitor C24 is an rf bypass capacitor to prevent interaction between first and second if. amplifiers Q3 and Q4. Resistor R32 is a current-limiting resistor for diode CR4. Capacitor C34, in conjunction with resistor R33, filters the rectified output of diode CR4. In the R-1041A/ARN, capacitor C57 and emitter swamping resistor R35 form a decoupling filter.

16. Detector
(fig. 17 and 18)

The detector rectifies and filters the if. signal and develops an audio signal in its output. The detector circuit consists of diode CR3, resistor R28, and capacitor C32. When a modulated if. signal is applied to the detector circuit from the secondary of transformer T14, diode CR3 rectifies the signal. Resistor R28 and capacitor C32 filter the rectified if. signal and produce the audio output. The audio signal developed across detector load resistor R28 is coupled to first audio amplifier Q6 through capacitor C33 (para 17) and applied directly to the delayed agc circuit (para 15).

17. Audio Amplifiers
(fig. 17 and 18)

a. *First Audio Amplifier.* The audio output signal from detector load resistor R28 is coupled to the base of first audio amplifier Q6 through capacitor C33. The audio signal is amplified by transistor Q6, and the output is developed across collector load resistor R38 and applied to the base of second audio amplifier Q7 (*b* below). Resistors R29 and R30 form a voltage divider to establish forward bias for transistor Q6. Resistor R31 is the emitter swamping resistor and, in conjunction with capacitor C35, forms a decoupling filter to prevent degeneration.

b. *Second Audio Amplifier.* The output signal from first audio amplifier Q6 is coupled through resistor R37 and capacitor C36 and applied to the base of second audio amplifier Q7. Resistor R37 is a current-limiting resistor to prevent relatively large ouput signals from overdriving transistor Q7 which would cause distortion. A negative feedback developed by unbypassed emitter resistor R41 also aids in preventing the transistor from being overdriven during large signal inputs. Second audio amplifier Q7 amplifies the signal applied to it and produces enough current to drive output transformer T15 (para 18). Resistors R39 and R40 form a voltage-divider network to establish forward bias for transistor Q7. Resistor R42 is the emitter swamping resistor and, in conjunction with capacitor C37, forms a decoupling filter. Capacitor C47 is an rf bypass capacitor to eliminate transients which may be present on the output signal.

18. Audio Output Circuit
(fig. 17 and 18)

The audio ouput from second audio amplifier Q7 is coupled through transformer T15 and applied to the coarse volume control (audio attenuation switch) circuit (*a* below) and to the switching circuit (*b* below). Transformer T15 has two secondary windings, one for each output.

a. The coarse volume control provides five audio levels in its output. The circuit consists of audio attenuation switch S1 and resistors R43 through R48, R58, and R61. The resistors form a voltage divider between terminal 3 of transformer T15 and ground for positions 1 through 4 of switch S1. Resistors R46 through R48 and R61 are connected in series between transformer T15 and switch S1. One of the remaining resistors (R43 through R45 or R58) is also connected in the series-resistance circuit by switch S1; the audio output is connected in parallel with one of these resistors. Audio attenuation switch S1 determines the amount of resistance that will be used in the circuit. As switch S1 is changed from position 1 through position 4, less resistance is placed in series while a larger resistance is connected in parallel with the output. In position 5 of switch S1, no resistance is used. This will produce five audio output levels with minimum volume being obtained when switch S1 is in position 1 and maximum volume when switch S1 is in position 5. In the R-1041A/ARN, the output is taken from wiper contact 1 of switch S1 and applied to terminal C of connector J2. In the R-1041/ARN, the output is taken from wiper contact 6 of switch S1.

b. The output from secondary winding 4-6 of transformer T15 is applied to the switching circuit (para 19) through diode CR5. In the R-1041A/ARN, the signal is applied directly to the switching circuit. In the R-1041/ARN, the signal is applied to the switching circuit through connector J2; in this case, an external jumper wire (not shown) is connected between terminals H and K of connector J2 to complete the signal path.

19. Switching Circuit
(fig. 17 and 18)

The switching circuit controls operation of the remote indicator lamp on the aircraft instrument panel. With no signal applied to the switching circuit, light switches Q11 and Q12 have no current output and the indicator lamp is not lighted (*a* below). When a signal is received, light switches Q11 and Q12 provide the current output to light the indicator lamp (*b* below).

a. With no input signal, the normal condition of the switching circuit is: first shaping amplifier Q9, off (not conducting); second shaping amplifier Q10, on (conducting); and light switches Q11 and Q12, off. The quiescent condition of the switching circuit is set up by the voltage divider consisting of resistors R51 through R58. The voltage at the junction of resistors R51 and R53 is applied to the base of transistor Q10 to forward bias the transistor, causing it to conduct heavily. First shaping amplifier Q9 is held at cutoff by the reverse bias applied to the base through thermistor RT2 and the voltage dropped across common emitter resistor R50. Second shaping amplifier Q10 develops a positive voltage across collector load resistor R54. This positive voltage is applied to the bases of parallel-connected light switches Q11 and Q12, reverse biasing the transistors. Diode CR6 in the emitter circuit of light switches Q11 and Q12 drops a small voltage to keep the emitters less positive than the bases.

b. When a signal is received, the output from terminal 6 of transformer T15 is applied to first shaping amplifier Q9 through diode CR5. The audio signal is rectified by diode CR5 and filtered by capacitor C38 and thermistor RT2. The negative voltage developed across the filter network is applied to the base of transistor Q9, forward biasing the transistor. Transistor Q9 will now conduct, causing the voltage developed across collector load resistor R52 and common emitter resistor R50 to increase. The combination of the positive voltage developed across resistor R52, applied to the base of transistor Q10, and the negative voltage developed across resistor R50, applied to the emitter of transistor Q10, reverse biases the transistor and causes it to cut off as soon as transistor Q9 starts to conduct. With transistor Q10 cutoff, the positive voltage across resistor R54 is reduced, removing the reverse bias from light switches Q11 and Q12. Light switches Q11 and Q12 will now conduct, providing the ouput current to light the remote indicator lamp. The output current path is from the remote indicator lamps, through terminal J of connector J2, to the collectors of transistors Q11 and Q12.

c. Capacitor C40 provides a feedback path from the collector to the base of transistor Q9 to provide instantaneous switching action when turning transistor Q9 on or off. Thermistor RT2 provides temperature compensation for transistor Q9. Resistors R55 and R56 in the emitter circuits of transistor Q11 and Q12, respectively, are current-limiting resistors. In the R-1041/ARN and some of the R-1041A/ARN's, resistor R49 is connected in series with thermistor RT2.

20. Power Input Circuit (fig. 17 and 18)

a. Dc power (27.5 volts) is supplied to the receiver from the power source through pin E of connector J2. The input voltage is routed through a pi-type filter, consisting of coil L4 and capacitors C45 and C46, and fuse F1 to various circuits in the receiver. The pi-type filter prevents current variations caused by the switching circuit from entering the power supply, and it prevents noise in the power source from entering the receiver. The fuse provides protection if an overload occurs.

b. Dc power to the receiving circuits is applied through coil L2 and capacitor C38. Coil L2 and capacitor C38 form a filter which prevents alternating current variations from entering the power supply and switching circuit. Diode CR7 is connected from the power bus to ground to prevent receiver circuit damage if a voltage of opposite polarity is connected to the receiver.

c. Dc power to the switching circuit is applied through diode CR8. This diode prevents switching circuit damage if a voltage of opposite polarity is connected to the receiver.

d. In the R-1041A/ARN, an rf filter assembly consisting of feedthrough capacitors C50 through C53 and ceramic capacitor C54 prevents rf interference generated within the R-1041A/ARN from entering the power supply.

CHAPTER 3
TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

21. General Instructions.

The field and depot maintenance procedures in this manual *supplement* the procedures in the operator and organizational maintenance manual. The systematic troubleshooting procedure, which begins with the operational and localization checks that can be performed at an organizational level, is carried to a higher level in this manual. Paragraphs 24 through 29 describe *intraunit* (within the unit) field maintenance localizing and isolating procedures.

22. Organization of Troubleshooting Procedures

a. General. The first step in servicing a defective receiver is to localize the fault. Localization means tracing the fault to a major circuit or stage responsible for the abnormal condition. The second step is to isolate the fault. Isolation means tracing the fault to a defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing, and shorted transformers, can often be isolated by sight, smell, and hearing. The majority of faults, however, must be isolated by checking voltages and resistances.

b. Localization. The tests listed below will aid in localizing trouble to a major circuit or stage in the receiver.

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits. Visual signs should be observed and an attempt made to localize the fault to a major circuit, stage, or part.

(2) *Troubleshooting chart.* The symptoms listed in the troubleshooting chart (para 25*d*) provide additional information that will aid in localizing trouble to a major section of the receiver.

(3) *Signal substitution.* Signal substitution procedures (para 26) enable the repairman to localize a trouble quickly to a group of stages or to an individual stage. An audio oscillator, signal generator, frequency meter, and audio level meter are units of test equipment (para 23) that may be used in signal substitution procedures. Observe the cautions in paragraph 23 and follow the signal substitution procedures (para 26) closely so that damage to transistors may be avoided.

c. Isolation. After the trouble has been localized (*b* above), the methods in (1) through (4) below will aid in isolating the trouble to a defective circuit element.

(1) *Voltage measurements.* This equipment is transistorized. When measuring voltages, use tape or sleeving (spaghetti) to insulate the entire test prod, except for the extreme tip. A momentary short circuit can ruin the transistor. Use electronic multimeter vacuum-tube voltmeter (vtvm) for all voltage and resistance measurements.

(2) *Resistance measurements.* Make resistance measurements in this equipment only as directed on voltage and resistance diagrams or charts (para 29). Use the ohmmeter range specified on these diagrams or charts, otherwise the indications obtained will be inaccurate.

Caution: **Before using any ohmmeter to test transistors or transistor circuits, check the open-circuit voltage across the ohmmeter test leads. Do not use the ohmmeter if the open-circuit voltage exceeds 1.5 volts. Also, since the RX1 range normally connects the ohmmeter internal bat-**

tery directly across the test leads, the comparatively high current (50 mulliamperes (ma) or more) may damage the transistor under test. Generally the RX1 range of any ohmmeter should not be used when testing low-power transistors.

(3) *Intermittent troubles.* In all of the 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 in the receiver. Minute cracks in printed circuit boards can cause intermittent operation. A magnifying glass is often helpful in locating defects in printed boards. Continuity measurements of printed conductors may be made by using the same technique ordinarily used on hidden conventional wiring; observe ohmmeter precautions discussed in (2) above.

(4) *Resistor and capacitor color code diagrams.* Resistor and capacitor color code diagrams (fig. 14 and 15) are provided to aid maintenance personnel in determining the value, voltage rating, and tolerance of capacitors and resistors.

23. Test Equipment and Tools Required

The following chart lists test equipment and tools required for troubleshooting the R-1041(*)/ARN.

Cautions:

1. This equipment contains transistor circuits. If any test equipment item does not have an isolation transformer in its power supply circuit, connect one in the power input circuit. A suitable transformer is identified by FSN 5950-356-1779.

2. Never connect test equipment (other than multimeters and vtvm's) outputs directly to a transistor circuit; use a coupling capacitor.

3. Make test equipment connections carefully so that shorts will not be caused by exposed test equipment connectors. Tape or sleeve (spaghetti) test prods or clips as necessary to leave as little exposed as needed to make contact to the circuit under test.

4. The regulated dc power supply used to supply power to the receiver must have good voltage regulation and low alternating current (ac) ripple. Good regulation is important because the output voltage of a dc power supply which has poor regulation may exceed the maximum voltage rating of the transistors in the equipment being tested. A dc power supply that has poor ac filtering will create a false indication of poor filtering in the equipment being tested.

5. The transistorized equipment must be turned off, or the regulated dc power supply voltage set to zero, before switching the dc power supply on or off. The transient voltages created by switching the dc power supply on and off may exceed the *punch-through* rating of the transistors. Make sure that a normal load (such as a headset) is connected to the transistorized equipment before applying power.

Test Equipment	Common name
Adapter UG-274A/U	Adapter tee
Attenuator, Boonton 505A	6-db pad
Audio Oscillator TS-382(*)/U[a].	Audio oscillator
Frequency Meter AN/USM-26	Frequency meter
Generator, Signal AN/USM-44(*)[b].	Signal generator
Output Meter TS-585(*)/U[c]	Output meter
Multimeter ME-26(*)/U[d]	Vtvm
Multimeter TS-352(*)/U[e]	Multimeter
Power Supply PP-1104(*)/G[f] (or equivalent).	Power supply
R. R. Signal Generator Set AN/URM-25(*)[g].	Rf signal generator
Test Set, Radio AN/ARM-52	Test set
Test Set, Transistor TS-1836/U.	Transistor tester
Tool Kit, Radar and Radio Repairman TK-87/U.	----------------
Tool Kit, Supplementary Radar and Radio Repair TK-88/U.	----------------

[a] Indicates TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U.
[b] Indicates AN/USM-44 and AN/USM-44A.
[c] Indicates TS-585A/U, TS-585C/U, and TS-585D/U.
[d] Indicates ME-26A/U and ME-26B/U.
[e] Indicates TS-352/U, TS-352A/U, and TS-352B/U.
[f] Indicates PP-1104A/G and PP-1104B/G.
[g] Indicates AN/URM-25A, AN/URM-25B, AN/URM-25C, and AN/URM-25D.

Caution: **Do not attempt removal or replacement of parts before reading the instructions in paragraphs 30 and 31.**

24. Bench Test Procedure (fig. 3)

Bench tests of the receiver are performed with the receiver connected to the test set. The test set simulates the aircraft installation and contains the indicator and controls which are normally part of the aircraft. The test set supplies and controls input power to the receiver. The cable required for connecting the receiver to the test set is supplied with the test set. Perform the bench test given below until an abnormal indication is obtained and then refer to the troubleshooting chart (para 25*d*) or the signal substitution procedures (para 26) to further localize the trouble.

a. Interconnect the receiver, power supply, and test equipment as shown in figure 3.

b. Set the test set controls as follows:

Control	Position
POWER switch	OFF
KEYER switch	OFF
SENSITIVITY switch	HI
SYSTEMS switch	1 LIGHT
METER OUTPUT-PHONES OUTPUT switch.	METER OUTPUT
Meter-adjusting screw	Zero indication on meter

c. Adjust the output meter for an impedance of 150 ohms and set it on its lowest range.

d. Turn on the power supply and adjust it for 27.5 volts. Turn on the test set, signal generator, and audio oscillator. Allow a 3-minute warmup period before proceeding.

e. Set the receiver volume control to position 5.

f. Adjust the signal generator for an output frequency of 75 mc.

•*g.* Set the audio oscillator for a frequency of 1,300 cps. Adjust the audio oscillator output power to modulate the signal generator 90 percent.

h. Increase the power output of the signal generator until the 400 CPS indicator on the test set lights. The output of the signal generator should be approximately 500 microvolts, and the output meter should indicate at least 5 milliwatts of audio power when the indicator lights. Record the values indicated by the signal generator and the output meter.

i. Vary the audio oscillator frequency from 380 to 3,150 cps while observing the output meter. The audio output should not vary more than 2 decibels (db) from the reference obtained at 1,300 cps (*h* above). Reset the audio oscillator to 1,300 cps.

j. Set the receiver volume control one step counterclockwise. The output meter indication should be one-half the value recorded in *h* above. Each additional step counterclockwise on the receiver volume control should reduce the power output by half the value indicated for the previous control position.

k. Return the receiver volume control fully clockwise.

l. Place the SENSITIVITY control on the test set to the LO position.

m. Adjust the power output of the signal generator until the 400 CPS indicator on the test set lights. The output of the signal generator should be approximately 3,000 microvolts and the output meter should indicate at least 5 milliwatts of audio power when the indicator lights. Record the values indicated on the signal generator and the output meter.

n. Repeat the procedures given in *j* above; the output meter indication should be one-half the value recorded in *m* above.

25. Localizing Troubles

a. General. Procedures are outlined in the troubleshooting chart (*d* below) for localizing troubles to a major section of the receiver. Depending on the nature of the operational symptoms, one or more of the localizing procedures will be necessary.

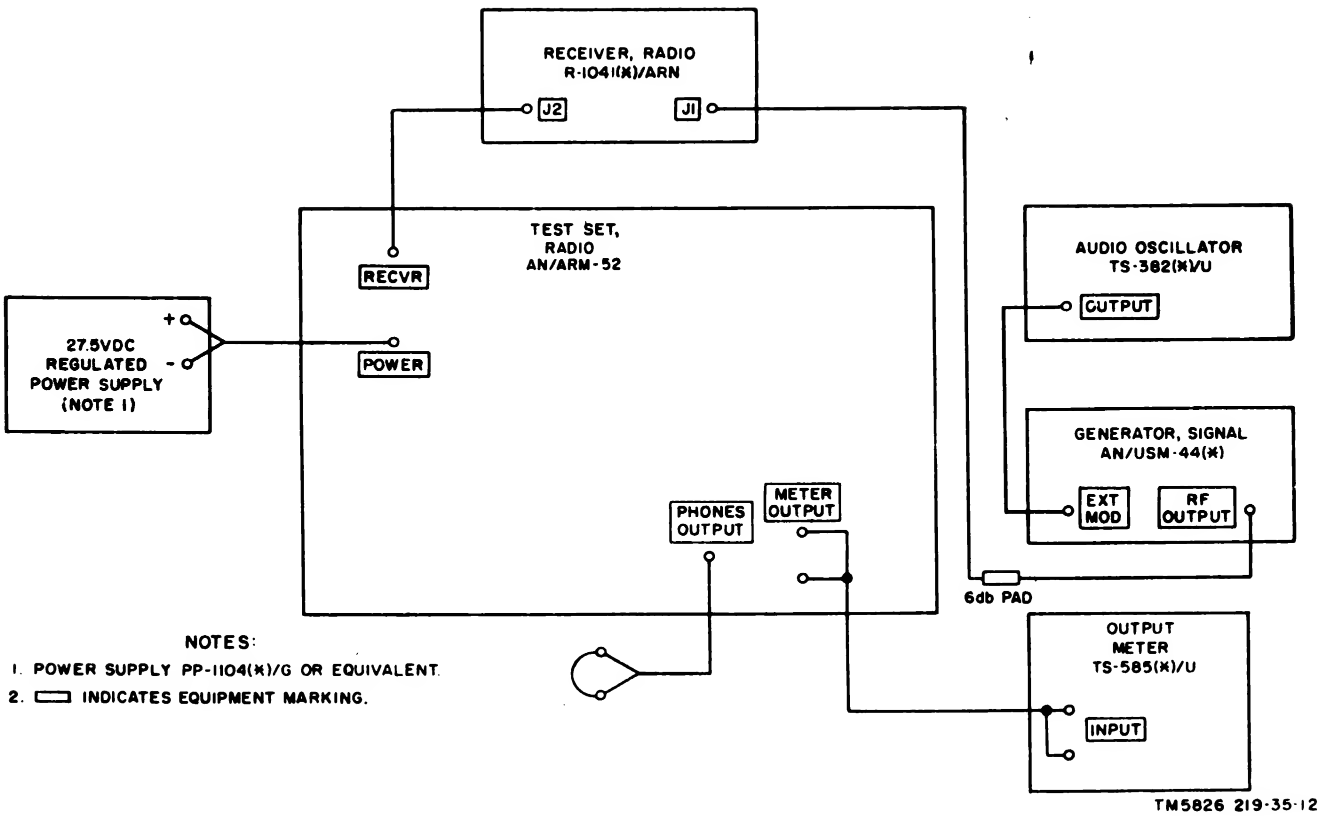


Figure 3. Bench test setup.

When use of the procedures results in localization of trouble to a particular stage, use the techniques outlined in paragraph 27 to isolate the trouble to a particular part. Parts locations are shown in figures 4 and 5 for the R-1041A/ARN and in figures 6 and 7 for the R-1041/ARN.

b. Use of Chart. The troubleshooting chart supplements the operational checks detailed in the bench test procedure (para 24). If previous operational checks have resulted in reference to a particular item of this chart, go directly to the referenced item. If no operational symptoms are known, perform the bench test given in paragraph 24.

c. Conditions for Tests. All checks outlined in the troubleshooting chart are to be conducted with the receiver connected to the bench test setup shown in figure 3.

d. Troubleshooting Chart.

Note: Bench test the receiver (para 24) unless trouble has already been localized.

Item	Indication	Probable trouble	Procedure
1	No output from receiver; meter on test set does not show any current indication.	Open fuse F1	Replace fuse; if replacement fuse blows, check for shorted capacitor C38, C42, C45, or C46, or diode CR7. On R-1041A/ARN, also check for shorted capacitor C17 or C52.
		Open coil L2, L4 (R-1041A/ARN only), or L5 (R-1041/ARN only).	Check resistance of coil (para 29b).
		Defective power connector J2.	Check pins A and E of connector J2; check wiring between connector J2 and printed circuit board.

Item	Indication	Probable trouble	Procedure
2	No output from receiver; meter on test set has a current indication.	Defective rf, if., or audio stage.	Perform signal substitution procedure (para 26) to localize trouble to a section or to an individual stage; then, perform isolating procedures (para 27) to locate defective part.
3	No output indication on output meter or headset for any position of receiver volume control; 400 CPS indicator on test set lights.	Defective transformer T15.	Check resistance of secondary winding 3-7 (para 29*b*).
		Defective switch S1 ---	Check switch; replace if defective.
		Shorted capacitor C53 (R-1041A/ARN only).	Check capacitor; replace if defective.
		Defective power connector J2.	Check pins A, B, and C of connector J2; check wiring between connector J2 and switch S1 and between switch S1 and printed circuit board.
4	No output indication on output meter or headset for one more positions of receiver volume control; 400 CPS indicator on test set lights.	Defective switch S1 or resistors R43 through R48, R58, or R61.	Check switch and resistors; replace defective part.
5	400 CPS indicator on test set does not light; normal output indication on output meter.	Defective transformer T15.	Check resistance of secondary winding 4-6 (para 29*b*).
		Defective part in switching circuits (Q9, Q11, or Q12).	Perform isolating procedure (para 27) to locate defective part.
		Defective power connector J2.	Check pin J of connector J2; in R-1041/ARN, also check pins H and K. Check wiring between connector and printed circuit board.
		Shorted capacitor C50 (R-1041A/ARN only).	Check capacitor; replace if defective.
6	400 CPS indicator on test set does not light; low output indication on output meter.	Receiver out of alignment.	Align receiver (para 36).
7	400 CPS indicator on test set is lighted continuously with no signal input to receiver.	Defective part in switching circuits (Q10, Q11, or Q12).	Perform isolating procedures (para 27) to locate defective part.

26. Signal Substitution

a. General. Signal substitution procedures help to localize troubles to a stage or group of stages in the receiver. An externally generated signal is substituted for the signal normally present in each stage. The test equipment required for the tests is listed in paragraph 23. After the trouble has been localized through the use of these procedures, use the techniques outlined in paragraph 27 to isolate the trouble to a particular part.

b. Procedure.

(1) Connect the test setup shown in figure 8.

(2) Set the controls on the test set to the positions given in paragraph 24*b*.

(3) Set the volume control on the receiver to position 5 and adjust variable resistor R59 (fig. 4 or 6) to its maximum counterclockwise position.

(4) Adjust the output meter for an impedance of 150 ohms and set it on its lowest range.

(5) Turn on the power supply and adjust its output to 27.5 volts. Turn on the test equipment and allow a 3-minute warmup period.

(6) Set the rf signal generator to the frequency and output microvolts specified in the signal chart (*c* below) for the test point to which the rf signal generator will be connected. Adjust the rf signal generator for 80-percent modulation at an audio rate of 400 cps.

Caution: Transistors in the receiver can be damaged by applica-

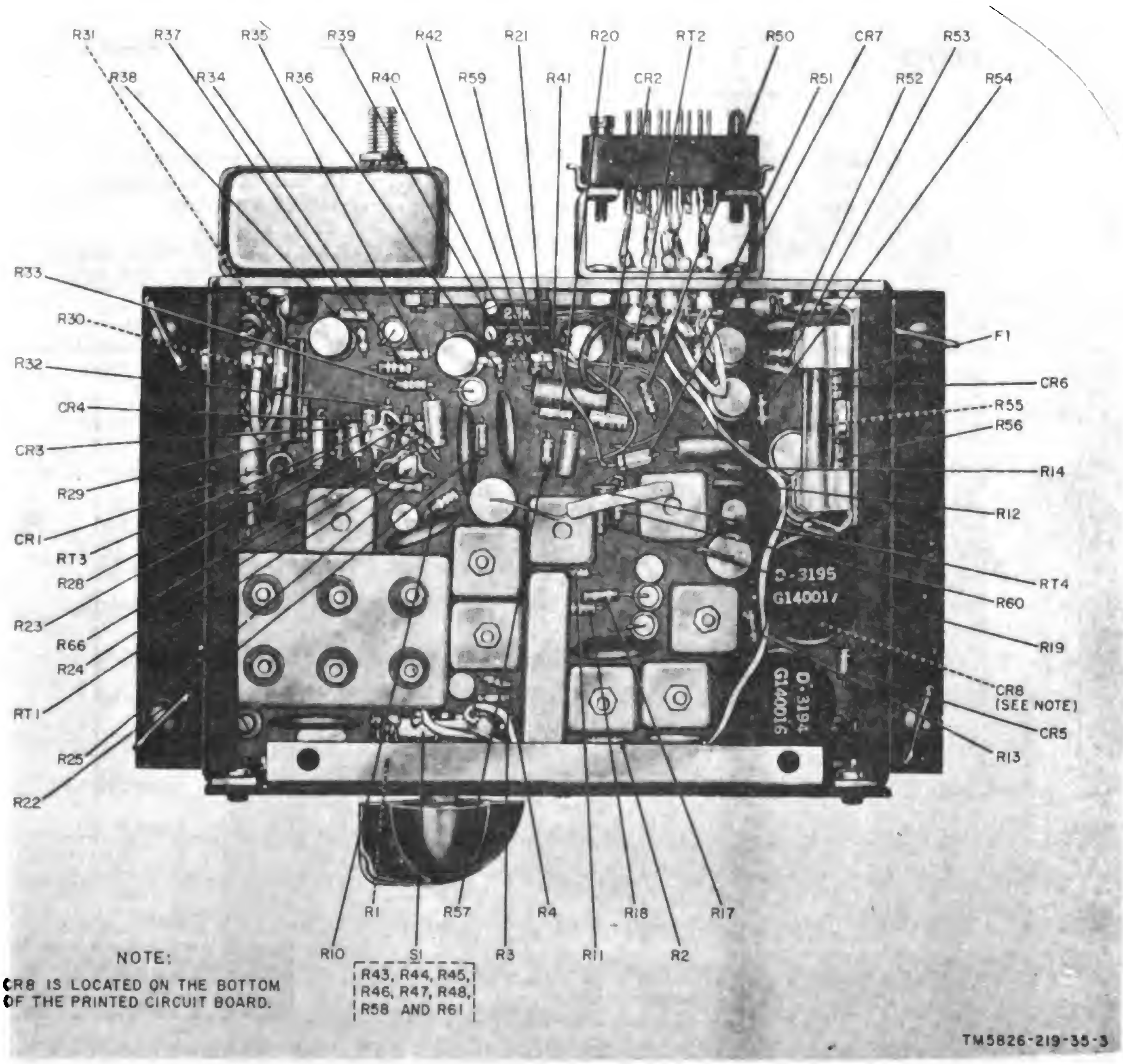


Figure 4. Receiver, Radio R-1041A/ARN, top view, location of diodes and resistors.

tion of excessive power. Do not exceed specified output values in the signal chart (c below). To avoid transistor damage when changing test points, disconnect the rf signal generator from the receiver and reset its frequency and output microvolts, as required, before connecting to the next test point.

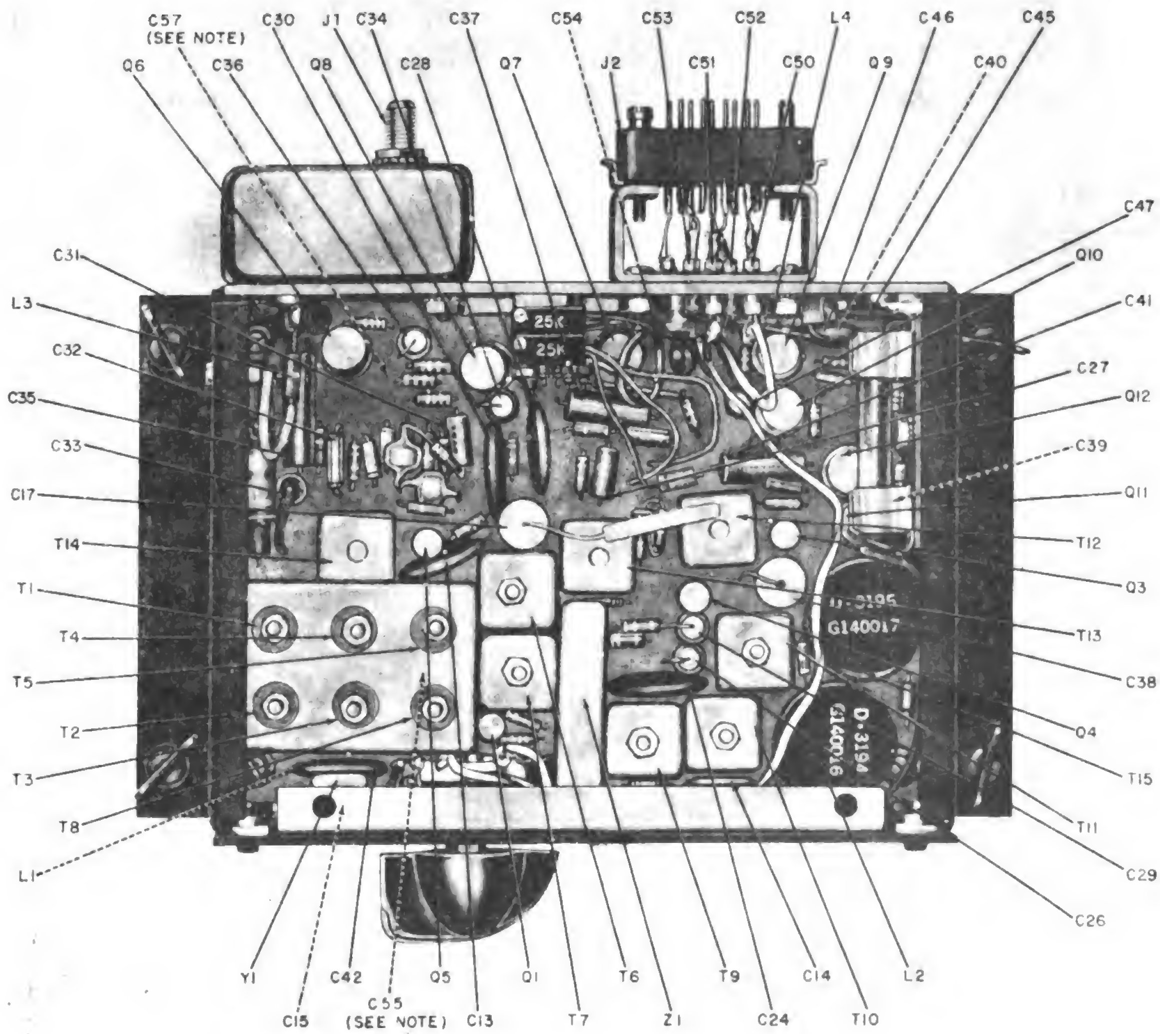
(7) Connect the rf signal generator to the test points specified in the signal chart (c below) in the sequence given. Connect the red test lead to the test point and connect the black test lead to the receiver case. Test point locations are shown in figure 9 for the R-1041A/ARN, and in figure 10 for the R-1041/ARN.

Note: **For the last test point (sequence 7) given in the signal chart in c below, replace the rf signal generator in the test setup with the signal generator.**

(8) For each test (c below), the output meter should indicate approximately 5 milliwatts of audio output.

c. Signal chart.

Sequence	Input point		Rf signal generator		Stages checked
	Test point	Item	Frequency	Output microvolts	
1	N	Q5 base ----	520 kc --------	560	Detector and audio.
2	K	Q4 base ----	520 kc --------	60	2d and 3d if. amplifiers.
3	H	Q3 base ----	520 kc --------	9	1st if. amplifier.
4	F	Q2 emitter --	520 kc --------	6.5	T9, T10, T11.
5	F	Q2 emitter --	4.2 mc ----	3.5	Converter and buffer amplifier (R-1041A/ARN only).
6	---------	T5-4 ------	4.2 mc ----	7.3	T5, T6, T7.
7	---------	T4-3 ------	75 mc ------	90	Oscillator (70.8 mc).



NOTE:

C55 AND C57 ARE LOCATED ON THE BOTTOM OF THE PRINTED CIRCUIT BOARD.

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Figure 5. Receiver, Radio R-1041A/ARN. top view, location of parts (less diodes and resistors).

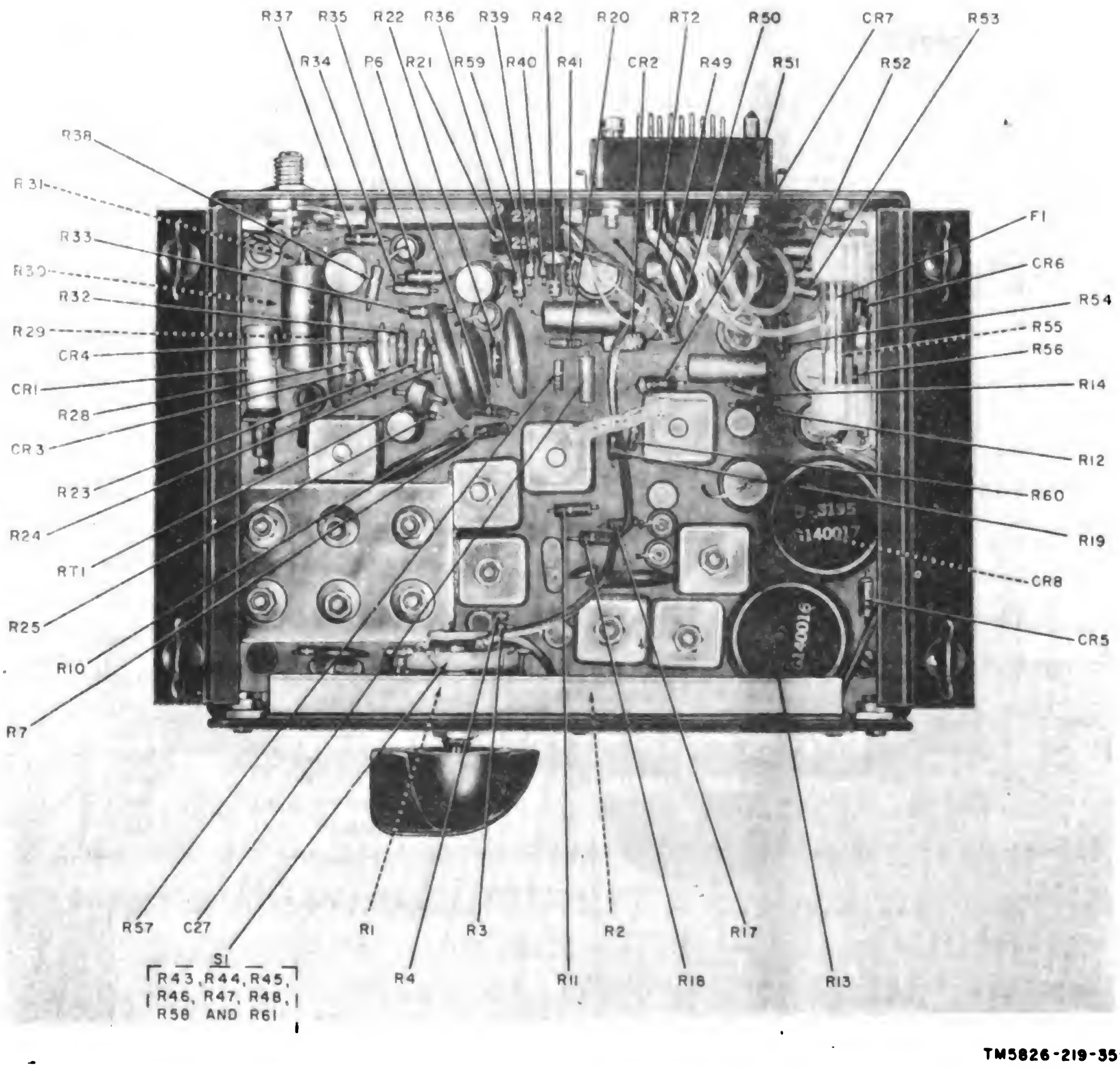

Figure 6. Receiver, Radio R-1041/ARN, top view, location of diodes and resistors.

27. Isolating Troubles

When trouble has been localized to a stage, either through bench testing (para 24) or signal substitution (para 26), use the following techniques to isolate the defective part.

a. Take voltage measurements at the test points indicated in the voltage charts (para 28).

b. If voltage readings are abnormal, take resistance readings (para 29) to isolate open and short circuits.

c. If signals are weak and all checks fail to indicate a defective part, check the alignment of the receiver (para 36).

28. Voltage Measurements

All voltages indicated in *a* and *b* below are positive with respect to ground and are measured with the vtvm. All measured voltages should be within 15 percent of the values given in the charts.

a. To measure voltages with no signal input to the receiver, connect the receiver

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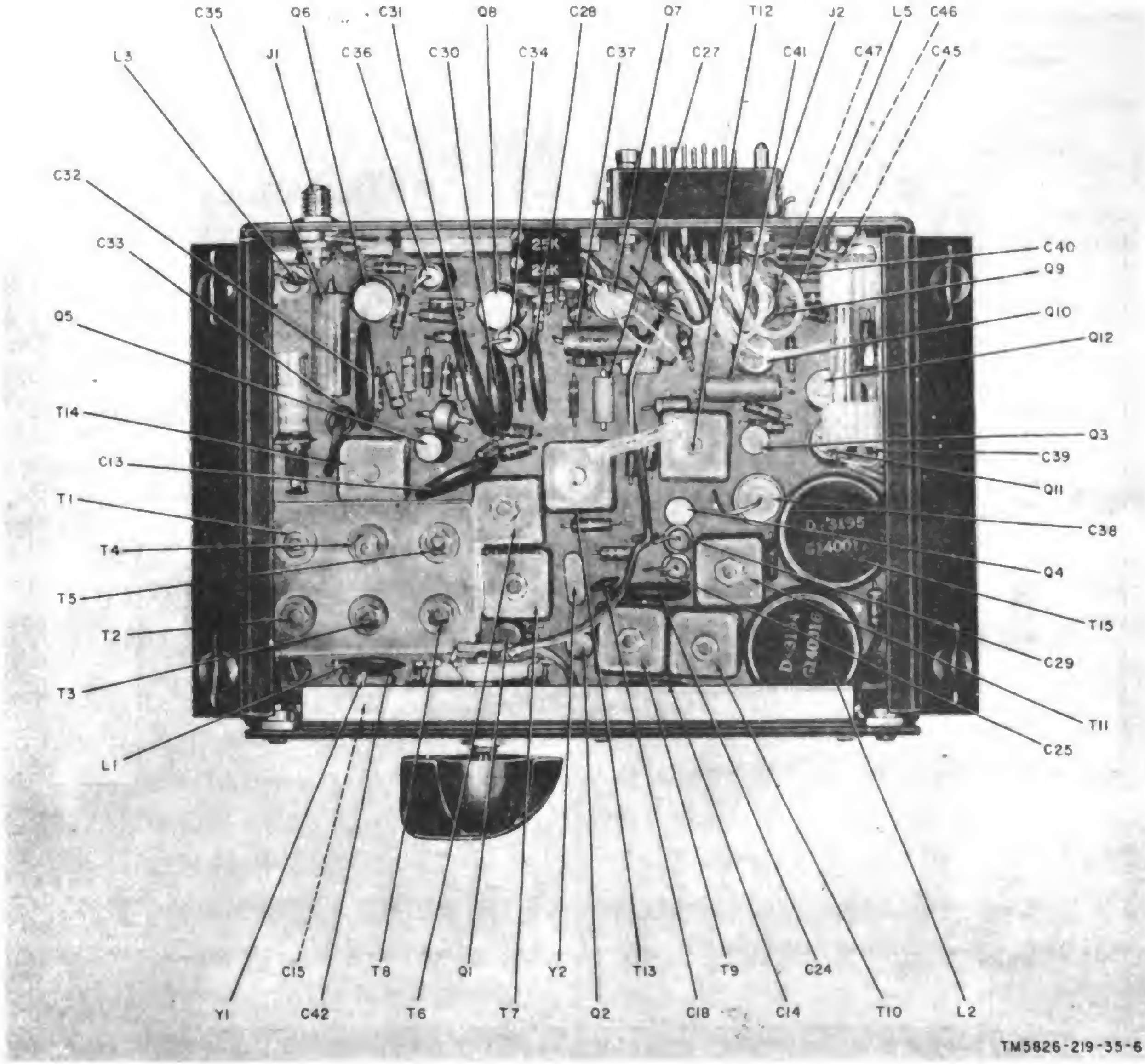


Figure 7. Receiver, Radio R-1041/ARN, top view, location of parts (less diodes and resistors).

to the test set and supply power to the test set as shown in figure 3. If all measurements are correct, check the dc voltage measurements with an input signal applied to the receiver (*b* below).

(1) *R-1041A/ARN* (fig. 9 and 17).

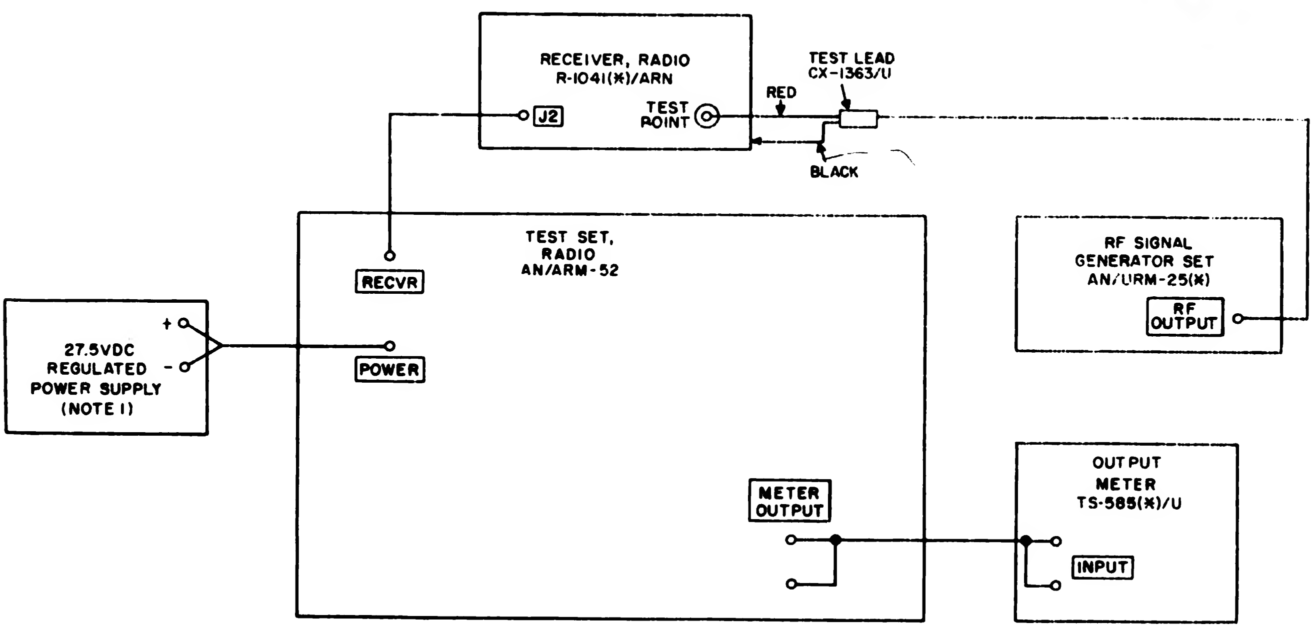
Transistor		Function	Collector		Base		Emitter	
Q	Type		Test point	Voltage	Test point	Voltage	Test point	Voltage
1	2N384	Oscillator ------------	A	0	B	15.9	C	16
2	2N274	Converter ------------	See note	----	See note	----	F	15.2
3	2N274[a]	First if. amplifier ------	G	0	H	6.2	J	6.7
4	2N274	Second if. amplifier ----	R	0	K	6.2	L	6.8
5	2N274	Third if. amplifier -----	M	0	N	15	P	15.3
6	2N464	First audio amplifier----	S	7.8	T	11.4	U	11.7

Transistor		Function	Collector		Base		Emitter	
Q	Type		Test point	Voltage	Test point	Voltage	Test point	Voltage
7	2N464	Second audio amplifier --	W	1.7	V	12	X	12.[illegible]
8	2N464	Agc amplifier ----------	Z	6.2	Y	21.7	AA	22
9	2N404	First shaping amplifier--	AD	21.1	AC	27	AB	27
10	2N404	Second shaping amplifier	AE	27	AH	26.5	AF	27
11	2N464	Light switch ----------	AK	0	AJ	27	AG	26.5
12	2N464	Light switch ----------	AL	0	AM	27	AN	26.5
13	2N274	Buffer amplifier --------	D	0	See note	------	See note	------

[a]Indicates Glove Industries, Inc., Part Number 40D1547.
Note: Inaccessible test point.

(2) *R-1041/ARN* (fig. 10 and 18).

Transistor		Function	Collector		Base		Emitter	
Q	Type		Test point	Voltage	Test point	Voltage	Test point	Voltage
1	2N384	Oscillator ------------	A	0	B	15.1	C	15.3
2	2N274	Converter ------------	D	0	E	13.9	F	14.0
3	2N274	First if. amplifier ------	G	0	H	6.25	J	6.5
4	2N274	Second if. amplifier ----	R	0	K	6.25	L	6.5
5	2N274	Third if. amplifier -----	M	0	N	13.4	P	13.7
6	2N464	First audio amplifier----	S	7.6	T	11.0	U	11.1
7	2N464	Second audio amplifier --	W	1.75	V	11.8	X	12.0
8	2N464	Agc amplifier ----------	Z	5.95	Y	21.7	AA	21.8
9	2N404	First shaping amplifier--	AD	20.7	AC	26.6	AB	26.6
10	2N404	Second shaping amplifier	AE	26.6	AH	26.1	AF	26.6
11	2N464	Light switch -----------	AK	0	AJ	26.6	AG	26.3
12	2N464	Light switch -----------	AL	0	AM	26.6	AN	26.3



NOTES:
1. POWER SUPPLY PP-1104(*)/G OR EQUIVALENT.
2. ▭ INDICATES EQUIPMENT MARKING.

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Figure 8. Signal substitution, bench test setup.

b. If all no-signal voltages are correct, apply a 75-mc input signal of 50,000 microvolts, amplitude-modulated at an audio rate of 1,300 cps, to the antenna input terminal. Connect the equipment as shown in figure 3.

(1) *R-1041A/ARN* (fig. 9 and 17).

Transistor		Function	Collector		Base		Emitter	
Q	Type		Test point	Voltage	Test point	Voltage	Test point	Voltage
1	2N384	Oscillator	A	0	B	15.1	C	16
2	2N274[a]	Converter	See note	----	See note	----	F	14.3
3	2N274	First if. amplifier	G	0	H	11.5	J	11.7
4	2N274	Second if. amplifier	R	0	K	11.4	L	11.7
5	2N274	Third if. amplifier	M	0	N	13.5	P	13.9
6	2N464	First audio amplifier	S	7.3	T	10.8	U	11
7	2N464	Second audio amplifier	W	1.5	V	13.2	X	11.5
8	2N464	Agc amplifier	Z	11.5	Y	19.7	AA	19.9
9	2N404	First shaping amplifier	AD	26	AC	25.8	AB	26
10	2N404	Second shaping amplifier	AE	24.5	AH	26	AF	26
11	2N464	Light switch	AK	24.7	AJ	24.5	AG	25
12	2N464	Light switch	AL	24.7	AM	24.5	AN	25
13	2N274	Buffer amplifier	D	0	See note	----	See note	----

[a] Indicates Glove Industries, Inc., Part Number 40D1547

Note: Inaccessible test point.

(2) *R-1041/ARN* (fig. 10 and 18).

Transistor		Function	Collector		Base		Emitter	
Q	Type		Test point	Voltage	Test point	Voltage	Test point	Voltage
1	2N384	Oscillator	A	0	B	14.7	C	14.9
2	2N274	Converter	D	0	E	13.4	F	13.6
3	2N274	First if. amplifier	G	0	H	13.3	J	13.6
4	2N274	Second if. amplifier	R	0	K	13.2	L	13.5
5	2B274	Third if. amplifier	M	0	N	12.9	P	13.0
6	2N464	First audio amplifier	S	7.0	T	11.0	U	11.1
7	2N464	Second audio amplifier	W	1.5	V	13.3	X	11.1
8	2N464	Agc amplifier	Z	13.3	Y	18.9	AA	19.0
9	2N404	First shaping amplifier	AD	25.1	AC	25.0	AB	25.2
10	2N404	Second shaping amplifier	AE	23.7	AH	25.3	AF	25.2
11	2N464	Light switch	AK	23.9	AJ	23.7	AG	24.0
12	2N464	Light switch	AL	23.9	AM	23.7	AN	24.1

29. Resistance Measurements

a. *Transistor Resistance Measurements.* Listed in the charts in (1) and (2) below are resistance measurements taken between the indicated test points and ground with the transistors connected in the circuit. The measurements are made with the vtvm. Where indicated, observe polarity when making measurements; in these cases, an incorrect polarity applied to the circuit can damage the transistors.

(1) *R-1041A/ARN* (fig. 9 and 17).

Transistor	Test points	Resistance (ohms)
Q1	A collector	0
	C emitter	3,300[a]
	B base	4,500
Q2	Collector[d]	------
	F emitter	31,000[ab]
	Base[d]	------
Q3	G collector	25
	J emitter	9,700[a]
	H base	8,000
Q4	R collector	25
	L emitter	9,000[a]
	K base	10,000

Transistor	Test points	Resistance (ohms)
Q5	M collector	24
	P emitter	1,000[ac]
	N base	3,300[c]
Q6	S collector	760
	U emitter	2,400[a]
	T base	3,800
Q7	W collector	240
	X emitter	2,000[a]
	V base	2,500
Q8	Z collector	1,250
	AA emitter	1,200
	Y base	3,000
Q9	AD collector	2,800
	AB emitter	3,300
	AC base	4,000
Q10	AE collector	2,600
	AF emitter	3,300
	AH base	3,250
Q11	AK collector	3,100
	AG emitter	3,600[a]
	AJ base	2,600
Q12	AL collector	3,100
	AN emitter	3,600[a]
	AM base	2,600
Q13	D collector	7.5
	Emitter[d]	------
	Base[d]	------

[a] Readings taken with ohmmeter positive potential connected to ground.

[b] The resistance reading at this test point is 16,500 for units with the following serial numbers: 258, 261, 264, 265, 266, 270, 271, 272, 273, 275, 277 through 283, 286, 287, 288, 290, 291, 293, 294, 297, 299 through 303, 305, 307, 308, 310, 312 through 361, 363 through 366, 368, 370, 372, 380, 382, 384 through 391, 393, 394, 395, 397, 402 through 406.

[c] The resistance reading at test point P is 5,500 and at test point N is 5,300 for units with the following serial numbers: 254, 258, 260, 261, 264 through 273, 275 through 283, 286, 287, 288, 290, 291, 293, 294, 297, 299 through 303, 305, 307, 308, 310, 312 through 361, 363 through 366, 368, 370 through 373, 378, 380 through 391, 393 through 397, 399, 400, 402 through 423, 425, 427, 428, 430, 431, 434 through 460, 464 through 472, 474 through 480, 482 through 492, 494, 495, 497 through 512, 514, 515, 516, 518 through 521.

[d] Inaccessible test point.

(2) *R-1041/ARN* (fig. 10 and 18).

Transistor	Test points	Resistance (ohms)
Q1	A collector	0
	C emitter	3,300[a]
	B base	4,600
Q2	D collector	6.8
	F emitter	16,500[a]
	E base	6,100
Q3	G collector	21.5
	J emitter	7,000[a]
	H base	7,000

Transistor	Test points	Resistance (ohms)
Q4	R collector	22.5
	L emitter	9,000[a]
	K base	8,700
Q5	M collector	22
	P emitter	5,500[a]
	N base	5,300
Q6	S collector	720
	U emitter	2,200[a]
	T base	3,700
Q7	W collector	240
	X emitter	1,900[a]
	V base	2,600
Q8	Z collector	1,250
	AA emitter	1,200
	Y base	3,000
Q9	AD collector	2,800
	AB emitter	3,300
	AC base	4,500
Q10	AE collector	2,600
	AF emitter	3,300
	AH base	3,200
Q11	AK collector	3,000
	AG emitter	3,600[a]
	AJ base	2,600
Q12	AL collector	3,000
	AN emitter	3,600[a]
	AM base	2,600

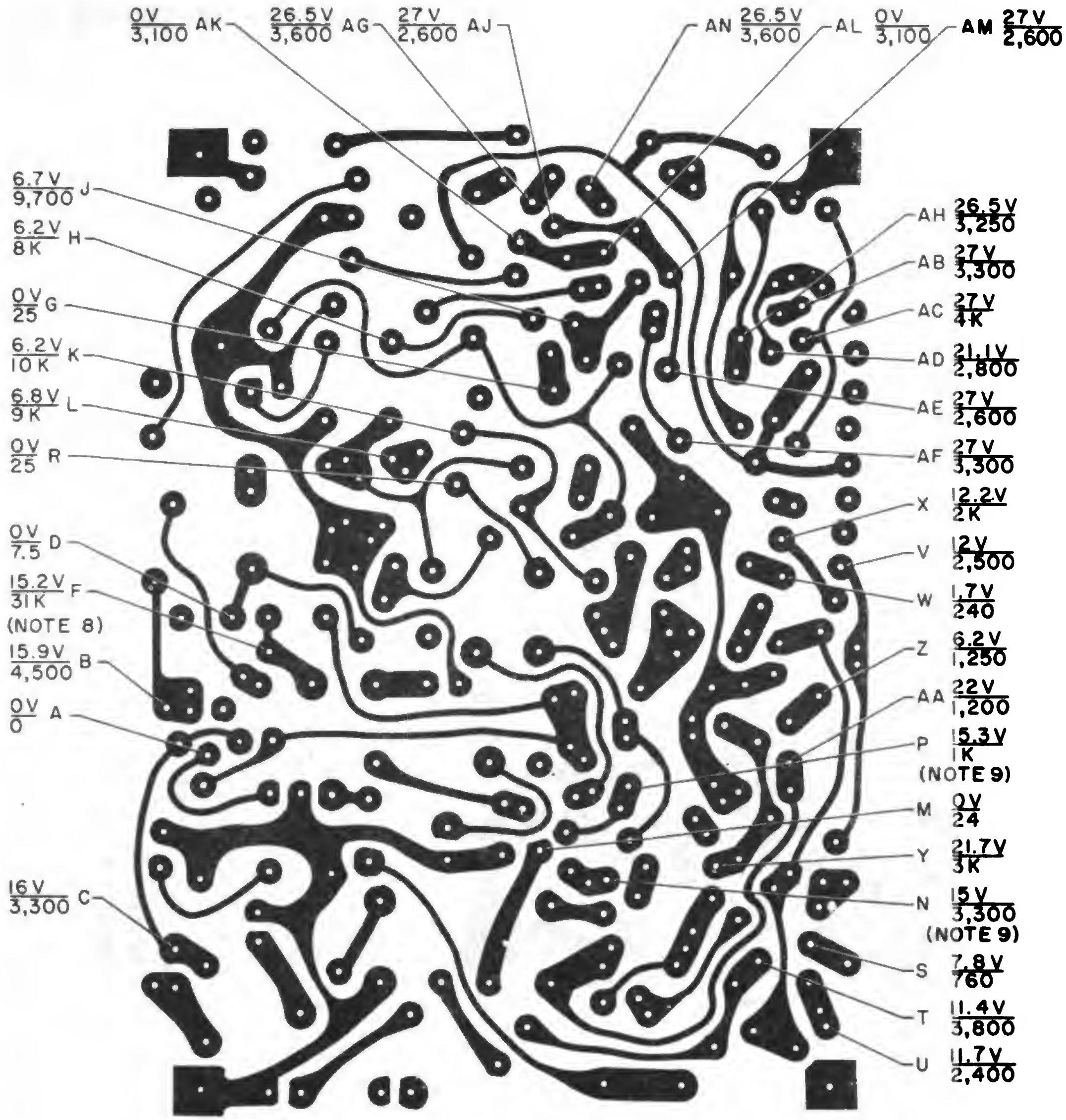
[a] Reading taken with ohmmeter positive potential connected to ground.

b. Dc Resistances of Transformers and Coils (fig. 17 and 18). The dc resistance of the transformer windings and the coils in the receiver are listed below.

Transformer or coil	Terminals	Ohms
T1	1-2	Less than 1
	1-3	Less than 1
	2-3	Less than 1
T2 and T3	1-2	Infinite
	1-3	Less than 1
	2-3	Infinite
T4	1-2	Less than 1
	1-3	Infinite
	2-3	Infinite
T5	1-2	Less than 1
	3-4	Less than 1
T6	1-2	Infinite
	1-3	Less than 1
	2-3	Infinite
T7	1-2	Infinite
	3-4	Less than 1

Transformer or coil	Terminals	Ohms
T8	1-2 1-3 2-3 4-5	Less than 1 Less than 1 Less than 1 Less than 1
T9 and T10	1-2 1-3 2-3	5.3 Infinite Infinite
T11	1-2 1-3 2-3	5.6 Infinite Infinite
T12	1-2 3-4	14 675
T13	1-2 3-4	14 3

Transformer or coil	Terminals	Ohms
T14	1-2 3-4	14 5.8
T15	1-2 3-7 4-6	300 80 110
L1		Less than 1
L2	1-2	120
L3		Less than 1
L4 (R-1041A/ ARN only).		Less than 1
L5 (R-1041/ ARN only).		Less than 1



NOTES

1. VIEW IS BOTTOM OF PRINTED BOARD.
2. ALL VOLTAGES ARE DC AND APPEAR ABOVE THE REFERENCE LINE.
3. ALL RESISTANCES ARE IN OHMS UNLESS FOLLOWED BY K (1,000 OHMS) AND APPEAR BELOW THE REFERENCE LINE.
4. RESISTANCE MEASUREMENTS ARE MADE WITH POLARITY GIVEN IN THE RESISTANCE CHART.
5. DC VOLTAGE MEASUREMENTS ARE MADE WITH RESPECT TO GROUND, NO SIGNAL INPUT AND +27.5 VOLTS APPLIED TO TERMINAL "E" OF J2.
6. VACUUM TUBE VOLTMETER USED FOR ALL RESISTANCE AND DC VOLTAGE MEASUREMENTS
7. TOLERANCE ±15 PERCENT.
8. THE RESISTANCE READING AT TEST POINT F IS 16,500 OHMS FOR UNITS WITH THE FOLLOWING SERIAL NUMBERS: 258, 261, 264 THRU 266, 270 THRU 273, 275, 277 THRU 283, 286, 287, 288, 290, 291, 293, 294, 297, 299 THRU 303, 305, 307, 308, 310, 312 THRU 361, 363 THRU 366, 368, 370, 372, 380, 382, 384 THRU 391, 393, 394, 395, 397, 402 THRU 406.
9. THE RESISTANCE READING AT TEST POINT P IS 5,500 OHMS AND AT TEST POINT N IS 5,300 OHMS FOR UNITS WITH THE FOLLOWING SERIAL NUMBERS: 254, 258, 260, 261, 264 THRU 273, 275 THRU 283, 286, 287, 288, 290, 291, 293, 294, 297, 299 THRU 303, 305, 307, 308, 310, 312 THRU 361, 363 THRU 366, 368, 370 THRU 373, 378, 380 THRU 391, 393 THRU 397, 399, 400, 402 THRU 423, 425, 427, 428, 430, 431, 434 THRU 460, 464 THRU 472, 474 THRU 480, 482 THRU 492, 494, 495, 497 THRU 512, 514, 515, 516, 518 THRU 521.

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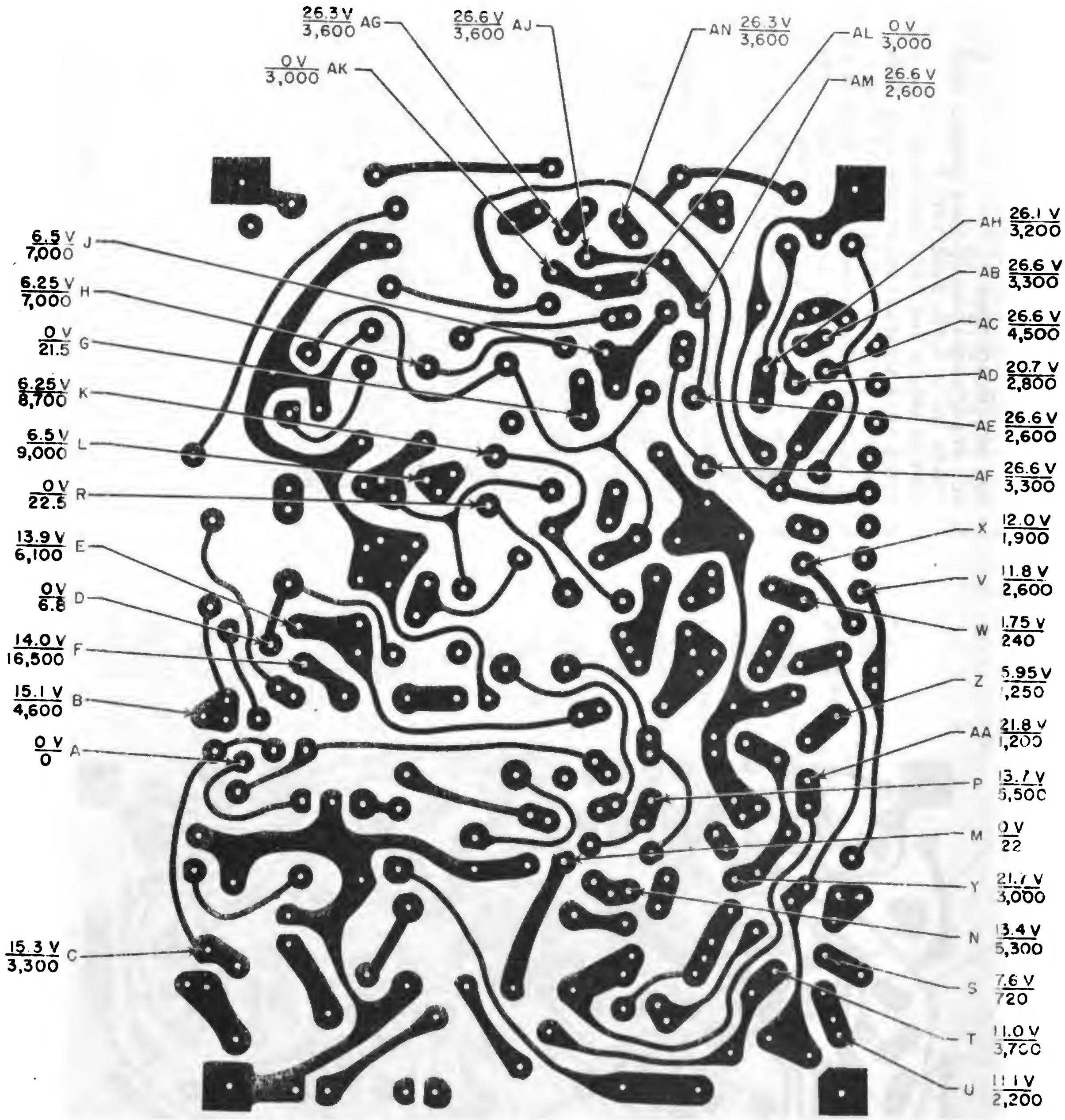
Figure 9. Voltage and resistance measurements and test point location diagram, R-1041A/ARN.



NOTES:

1. — VIEW IS BOTTOM OF PRINTED BOARD.
2. — ALL VOLTAGES ARE DC AND APPEAR ABOVE THE REFERENCE LINE.
3. — ALL RESISTANCES ARE IN OHMS UNLESS FOLLOWED BY K (1,000 OHMS) AND APPEAR BELOW THE REFERENCE LINE.
4. — RESISTANCE MEASUREMENTS ARE MADE WITH POLARITY GIVEN IN THE RESISTANCE CHART.
5. — DC VOLTAGE MEASUREMENTS ARE MADE WITH RESPECT TO GROUND, NO SIGNAL INPUT AND + 27.5 VOLTS APPLIED TO TERMINAL "E" OF J2.
6. — VTVM USED FOR ALL RESISTANCE AND DC VOLTAGE MEASUREMENTS.
7. — TOLERANCE ± 15 PERCENT.

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Figure 10. Voltage and resistance measurements and test point location diagram, R-1041/ARN.

CHAPTER 4

REPAIRS AND ADJUSTMENTS

30. General Parts Replacement Techniques

Most of the parts in the R-1041(*)/ARN are mounted on the printed circuit board which is repaired or replaced by fourth echelon maintenance personnel. Switch S1 and resistors R43 through R48, R58, and R61 (coarse volume control) are mounted on the front panel. Fuse F1 and its holder are mounted on the right side of the receiver. Connectors J1 and J2, bandpass filter FL-BP1, variable resistors R21 and R59 (sensitivity controls), and the rf filter assembly are mounted on the rear of the receiver. The following precautions should be observed when replacing any of the parts mounted on the front panel or the wrap around panel.

a. When the feedthrough capacitors on the rf filter assembly are being soldered, be careful to prevent the glass portion of the capacitor from cracking when the center conductor gets hot. Grasp the central lead with a pair of pliers between the glass bead and the eye of the terminal before applying heat.

b. Use a pencil-type soldering iron with a 25-watt maximum capacity. If only ac-operated irons are available, use an isolating transformer. Do not use a soldering gun; damaging voltages can be induced in components.

31. Repairs

a. To replace any of the parts mounted on the receiver wraparound panel, it is only necessary to remove the top and bottom covers. Remove the screws securing the top and bottom covers and slide the covers off the receiver.

b. To replace switch S1 or any of its associated resistors, remove the front panel to gain access to the part. Remove the covers (*a* above) and then remove the screws that secure the receiver front panel.

32. Adjustment of Sensitivity Controls

Note: Some models of the R-1041A/ARN have holes in the top cover for access to the sensitivity controls for adjustment. If the receiver does not have access holes, remove the top cover (para 31*a*).

a. Connect the receiver, power supply, and test equipment as shown in figure 3.

b. Set the test set controls as follows:

Control	Position
POWER switch	OFF
KEYER switch	OFF
SENSITIVITY switch	LO
SYSTEMS switch	1 LIGHT
METER OUTPUT-PHONES OUTPUT switch.	METER OUTPUT
Meter-adjusting screw	Zero indication on meter.

c. Adjust the output meter for an impedance of 150 ohms and set it on its lowest range.

d. Turn on the power supply and adjust the power supply voltage to 27.5 volts. Turn on the test set, signal generator, and audio oscillator. Allow a 3-minute warm-up period before proceeding.

e. Set the receiver volume control to position 5.

f. Adjust the signal generator for an output frequency of 75 mc. Set the audio oscillator for a frequency of 1,300 cps and adjust its output power to modulate the signal generator 90 percent.

g. Adjust the signal generator for an output of 3,000 microvolts (5,000 microvolts for the R-1041/ARN). Observe the 400 CPS indicator on the test set and adjust variable resistor R21 as indicated in (1) or (2) below. When variable resistor R21 is properly adjusted, the output meter should indicate at least 5 milliwatts.

(1) If the 400 CPS indicator is lighted, adjust variable resistor R21 (fig. 4 or 6) counterclockwise until the indicator light goes out and then slowly adjust resistor R21 clock-

wise until the 100 CPS indicator lights.

(2) If the 100 CPS indicator is not lighted, slowly adjust variable resistor R21 clockwise until the indicator lights.

h. Decrease the signal generator output to 500 microvolts.

i. Set the test set SENSITIVITY switch to the HI position.

j. Observe the 400 CPS indicator on the test set and adjust variable resistor R59 as indicated in (1) or (2) below. When variable resistor R59 is properly adjusted, the output meter should indicate at least 5 milliwatts.

(1) If the 400 CPS indicator is lighted, adjust variable resistor R59 (fig. 4 or 6) counterclockwise until the indicator light goes out and then slowly adjust variable resistor R59 clockwise until the 400 CPS indicator lights.

(2) If the 400 CPS indicator is not lighted, slowly adjust variable resistor R59 clockwise until the indicator lights.

CHAPTER 5

FOURTH ECHELON MAINTENANCE

Section I. TROUBLESHOOTING

33. General Maintenance Information

Fourth echelon maintenance of the R-1041(*)/ARN consists of repair of the printed circuit board, alignment of the receiver, and testing of repaired equipment. Use the troubleshooting techniques given in paragraphs 24 through 29 to localize and isolate the faulty part; the test equipment required is listed in paragraph 23. Before attempting to replace any part mounted on the printed circuit board, read the printed circuit board repair procedures given in paragraph 34.

34. Repair of Printed Circuit Board

The parts mounted on the printed circuit board are covered with epoxy which must be removed (*b*(1) below) before a part can be replaced. After the epoxy has been removed, replace the defective part as indicated in *c* and *d* below; then cover the new part with epoxy (*b*(2) below). The materials required for replacing epoxy are given in *a* below. For additional soldering techniques, refer to TB SIG 222.

a. Materials Required.

(1) Epoxy (Dennis No. 1162A or 1162B, or Hysol No. 12007).

(2) Trichlorethylene.

(3) Small stiff-bristle brush.

b. Procedures for Removing and Replacing Epoxy in Receiver.

Warning: **When using trichlorethylene and epoxy, work in a well-ventilated area and avoid inhalation of vapors. Prevent contact with skin and wash hands thoroughly after using. Maintain good housekeeping and personal hygiene standards.**

(1) *Removal.* To remove a part from the receiver, it is necessary to remove the epoxy coating surrounding the part. The only tool necessary to remove the epoxy is a small electric hand soldering iron, 37 or 47 watts, with a 1/8-inch diameter chisel tip. The iron is used as though it were a small hand chisel, and the epoxy is removed with short, light, scooping strokes, removing a layer of epoxy with each pass. Epoxy debris may be cleared away with a small stiff-bristle brush moistened in trichlorethylene.

(2) *Replacement.* When parts in the receiver set are replaced, new epoxy must be applied to the affected areas. The epoxy is a two-part material and must be thoroughly mixed according to the directions on the container. After mixing the epoxy, apply it to the areas as necessary and allow to air cure for a minimum of 24 hours.

c. Soldered Parts Removal.

(1) When circuit troubleshooting discloses a defective part, replace it by unsoldering the leads and resoldering the new part in place. Never use soldering guns or heavy-duty soldering irons for soldering operations in transistor circuits or on printed boards. The excessive heat will damage the diodes and transistors, and can cause the printed wiring on the board to curl away from the dielectric. Use only a light-duty 20- to 25-watt soldering iron with no leakage current. To check a soldering iron for leakage, connect one lead of the TS-352(*)/U to ground (water pipe or powerline ground) and the other lead to the tip of the soldering iron. Set the TS-352(*)/U range switch to the 250-volt scale. Allow the soldering iron to reach correct operating temperature and note the meter reading. Reverse the ac plug of the soldering iron and again note the meter reading. If the meter indicates for

either position of the ac plug, the iron has leakage. If any doubt exists about leakage, use an isolation transformer. If an isolation transformer is not available, remove the ac plug of the soldering iron from the ac receptacle after the iron has reached soldering temperature and perform the soldering operation. When the iron cools, reheat by reinserting the ac plug into the ac receptacle. Be sure cold-soldered joints do not result when soldering components into the circuit. If a small-tipped low-wattage iron is not available, a piece of No. 10-AWG copper wire wrapped around the tip of a higher-wattage iron and protruding beyond the tip of the iron can be used.

(2) Before removing or replacing a defective part, visually inspect the printed circuit board to determine the location of all diodes and transistors. Be sure no part of the soldering iron makes contact with any of the diodes or transistors while performing soldering operations. The heat from the iron will damage any diode or transistor with which it comes in contact. Replacement of a part, such as a capacitor or resistor, can be facilitated by cutting the leads within one-eighth inch of the board and removing the body of the part. The ends of the leads can then be removed by touching the soldering iron to the soldered joints and removing the leads with a pair of long-nosed pliers, or by shaking the board to free the leads after the solder has become molten. Be especially careful during this operation; during manufacture, the leads are usually crimped after insertion in the holes. The crimped ends must be removed carefully in order to prevent damage to the printed circuit board. When removing the leads, never apply more heat than required to cause solder to flow. Excessive heat will cause the printed circuit wiring to raise from the board.

Caution: **When soldering diode or transistor leads, solder quickly; where space permits, use a heat sink (such as long-nosed pliers) between the soldered joint and the part. Excessive heat can damage the diode or transistor.**

d. Soldered Parts Replacement. Prepare the replacement part by shaping its leads to conform with the spacing of the holes in the board. Make certain the holes are clear of solder and the solder areas are clean. Insert the leads of the component through the holes in the board. Apply a small amount of a noncorrosive liquid soldering flux to the joints to be soldered with a toothpick or similar applicator. Before applying solder, thoroughly clean and tin the point of a 20- to 25-watt iron. After tinning, apply a small amount of solder to the tip of the iron and shake out all excess solder at the tip. Apply the tip to the joint to be soldered long enough to permit the solder remaining on the tip to flow into the joint. Do not use an excessive amount of solder or soldering flux, or the molten solder may spread to adjacent connections and cause short circuits. The excess lead lengths should be cut off close to the solder globules formed by the soldering operation after the joints have cooled. To prevent corrosion, remove all excess soldering flux from the joints and the adjacent board areas.

Section II. ALIGNMENT

35. Test Equipment and Materials Required for Alignment

The following chart lists the test equipment and materials required for alignment of the receiver:

Test equipment	Common name
Adapter UG-274A/U--------	Adapter tee
Attenuator, Boonton 505A ---	6-db pad
Audio Oscillator TS-382(*)/U[a].	Audio oscillator

Test equipment	Common name
Frequency Meter AN/USM-26	Frequency meter
Generator, Signal AN/USM-44(*)[b].	Signal generator
Output Meter TS-585(*)/U[c] --	Output meter
Power supply PP-1104(*)/G[d] (or equivalent).	Power supply
R. F. Signal Generator Set AN/URM-25(*)[e].	Rf signal generator
Test Set, Radio AN/ARM-52	Test set
470-ohm, 1/2-watt resistor (2 each).	470-ohm resistor
1500-ohm, 1/2-watt resistor (2 each).	1,500-ohm resistor

[a] Indicates TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F-U.
[b] Indicates AN/USM-44 and AN/USM-44A.
[c] Indicates TS-585A/U, TS-585B/U, TS-585C/U, and TS-585D/U.
[d] Indicates PP-1104A/U and PP-1104B/U.
[e] Indicates AN/URM-25A, AN/URM-25B, AN/URM-25C, and AN/URM-25D.

36. Alignment Procedure

Two different test setups are required for alignment of the receiver. The test setup shown in figure 8 is used for alignment of the 520-kc if. bandpass filter (para 37); the test setup shown in figure 11 is used for alignment of the oscillator (para 38), 4.2-mc bandpass filter (para 39), and preselector (para 40). Prepare the receiver and test equipment as follows:

a. Connect the receiver, power supply, test set, and audio output meter as shown in figure 8. Set the test set controls as follows:

Control	Position
POWER switch	OFF
KEYER switch	OFF
SENSITIVITY switch	HI
SYSTEMS switch	1 LIGHT
METER OUTPUT-PHONES OUTPUT switch.	METER OUTPUT
Meter-adjusting screw	Zero indication on meter

b. Connect the frequency meter, audio oscillator, signal generator, and rf signal generator to the ac power source.

c. Turn on the power supply and adjust its output to 27.5 volts and then turn on the remainder of the test equipment. Allow a 3-minute warmup period before proceeding.

d. Set the volume control on the receiver to position 5.

e. If the complete receiver is to be aligned, perform the procedures in paragraphs 37 through 40 in the sequence given. If only a section of the receiver requires alignment, proceed directly to the required procedure. Connect the test equipment (*b* above) to the test setup referenced in the alignment procedure being performed.

f. After completing the required alignment procedures, turn off all equipment and disconnect the receiver from the test setup.

37. Alignment of 520-Kc If. Bandpass Filter

a. Adjust the output meter (fig. 8) for an impedance of 150 ohms and set it on its lowest range.

b. Set the rf signal generator for 520 kc and adjust the audio oscillator for an output of 400 cps. Adjust the rf signal gen-generator to obtain 80-percent modulation.

c. Connect the red test lead to test point F (fig. 9 or 10) and connect the black test lead to the receiver case (ground).

d. Adjust the rf signal generator output for a 5-milliwatt reading on the output meter. Adjust variable resistor R59 (fig. 4 or 6) for a maximum indication on the output meter.

Note: During the alignment procedure, adjust the rf signal generator output level as required to maintain an indication of 5 milliwatts on the output meter.

e. Connect a 470-ohm resistor across the tuned primary winding (terminals 1 and 2) of transformer T11 (fig. 17 or 18); connect another 470-ohm resistor across filter T10 (terminals 1 and 2).

f. Adjust the core of bandpass filter T9 (fig. 5 or 7) for a maximum indication on the output meter.

g. Remove the 470-ohm resistor from bandpass filter T10 and connect it to bandpass filter T9 (terminals 1 and 2). Adjust the core of transformer T10 for a maximum indication on the output meter.

h. Remove the 470-ohm resistor from transformer T11 and connect it to bandpass filter T10 (terminals 1 and 2). Adjust the core of transformer T11 for a maximum indication on the output meter.

i. To check for proper alignment of the 520-kc if. bandpass filter, remove the two loading resistor (*j* and *k* above) and adjust the rf signal generator output level for an indication of 5 milliwatts on the output meter. Double the rf signal generator output and adjust the signal generator frequency below and above 520 kc and note the frequencies where the output is 5 milliwatts; the frequencies should be 480 kc or below and 560 kc or above, respectively.

38. Alignment of Oscillator

a. Connect the test setup shown in figure 11.

b. Adjust the output meter to provide a 150-ohm load and to indicate 30 milliwatts.

c. Set the signal generator for an output of 75 mc; use the frequency meter to check the signal generator frequency. Adjust the aduio oscillator for an output of 400 cps and adjust the signal generator for 90-percent modulation.

d. Adjust the core of transformer T8 (fig. 5 or 7) until an output is observed on the output meter. Rotate the core adjustment clockwise until the output indication drops off abruptly. This indicates that oscillations have ceased.

e. Rotate the core adjustment of transformer T8 counterclockwise slowly until the output reappears. Continue to rotate the core one complete turn. This represents the point of maximum stability for the oscillator.

39. Alignment of 4.2-Mc Bandpass Filter

a. Adjust the output meter (fig. 11) to provide a 150-ohm load and set it on its lowest range.

b. Set the signal generator for an output of 75 mc; use the frequency meter to check the signal generator frequency. Adjust the audio oscillator for an output of 400 cps and adjust the signal generator for 90-percent modulation.

c. Connect a 470-ohm resistor across the secondary winding (terminals 3 and 4) of transformer T7 (fig. 17 or 18). Connect a 1,500-ohm resistor across the output (terminals 1 and 3) of filter T6.

d. Adjust the signal generator output for an indication of 5 milliwatts on the output meter.

Note: During the alignment procedure, adjust the signal generator output level as required to maintain an indication of 5 milliwatts on the output meter.

e. Adjust the core of transformer T5 (fig. 5 or 7) for a maximum indication on the output meter.

f. Remove the 1,500-ohm resistor from bandpass filter T6 and connect it across the secondary winding (terminals 1 and 2) of transformer T5. Adjust the core of transformer T6 for a maximum indication on the output meter.

g. Remove the 470-ohm resistor from transformer T7. Connect a 1,500-ohm resistor across the output (terminals 1 and 3) of filter T6. Leave the 1,500-ohm resistor across the secondary winding of transformer T5 connected.

h. Adjust the core of transformer T7 for a maximum indication on the output meter.

i. Disconnect the 1,500-ohm resistors from transformer T5 and filter T6.

40. Alignment of Preselector

a. Perform the procedures given in paragraph 39*a* through *d*.

b. Adjust the cores of bandpass filters T1, T2, T3, and T4 (fig. 5 or 7), in the sequence given, for maximum indication on the output meter.

c. After peaking bandpass filters T1 through T4, rotate each core adjustment one-quarter turn counterclockwise. The audio output should not decrease more than 1 or 2 db.

d. Disconnect the resistors from filter T6 and transformer T7.

CHAPTER 6
DEPOT INSPECTION STANDARDS

41. Applicability of Depot Inspection Standards

The tests outlined in this chapter are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet the standards given in these tests.

42. Applicable References

a. *Repair Standards.* Applicable procedures of the depot performing this test and its general standards for repaired electronics equipment form a part of the requirements for testing this equipment.

b. *Technical Publication.* Operation and organizational maintenance of this equipment is contained in TM 11-5826-219-12.

c. *Modification Work Orders.* Perform all modification work orders applicable to this equipment before making the tests specified. DA Pam 310-4 lists all available MWO's.

43. Test Facilities Required

The following equipments, or suitable equivalents, will be employed in determining compliance with the requirements of this Depot Inspection Standard.

a. *Test Equipment.*

Nomenclature	Federal stock No.
Generator, Signal AN/USM-44(*)[a].	6625-669-0258
Audio Oscillator TS-382(*)/U[b].	6625-192-5094
Output Meter TS-585(*)/U[c]	6625-244-0501
Frequency Meter AN/USM-26	6625-692-6553
Power Supply PP-1104(*)/G[d]	6130-542-6385
Test Set, Radio AN/ARM-52	6625-753-1954

[a] Indicates AN/USM-44 and AN/USM-44A.
[b] Indicates TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U.
[c] Indicates TS-585A/U, TS-585B/U, TS-585C/U, and TS-585D/U.
[d] Indicates PP-1104A/G and PP-1104B/G.

b. *Materials.*

Material	Federal stock No.	Quantity
Adapter UG-274A/U	5935-201-2411	1 ea
Attenuator, Boonton 505A (6-db pad).	------------	1 ea
Coaxial Cable RG-58C/U	6145-542-6092	4 ft
Connector UG-88E/U	5935-823-0833	2 ea
Connector IPC-4600	5935-170-5361	2 ea
Connector, plug, electrical.	5935-283-7130	1 ea
Wire, electrical, stranded, #10AWG.	6145-160-5110	20 ft

44. General Test Requirements

Most of the tests will be performed under the conditions given below and illustrated in figure 11. Testing will be simplified if connections and panel control settings are made initially and modifications are made as required for the individual tests.

a. Connect the test setup shown in figure 11.

b. Set the controls on the test set as follows:

Control	Position
POWER switch	OFF
KEYER switch	OFF
SENSITIVITY switch	HI
SYSTEMS switch	1 LIGHT
METER OUTPUT-PHONES OUTPUT switch.	METER OUTPUT
Meter-adjusting screw	Zero indication on meter

c. Turn on the power supply and adjust its output to 27.5 volts. Turn on the remainder of the test equipment. Allow at least 1 hour for all equipment to reach stabilized temperatures.

d. Adjust the output meter for an impedance of 150 ohms and set it on its lowest range.

45. Sensitivity Test

a. Set the receiver volume control to position 5.

b. Adjust the signal generator for an

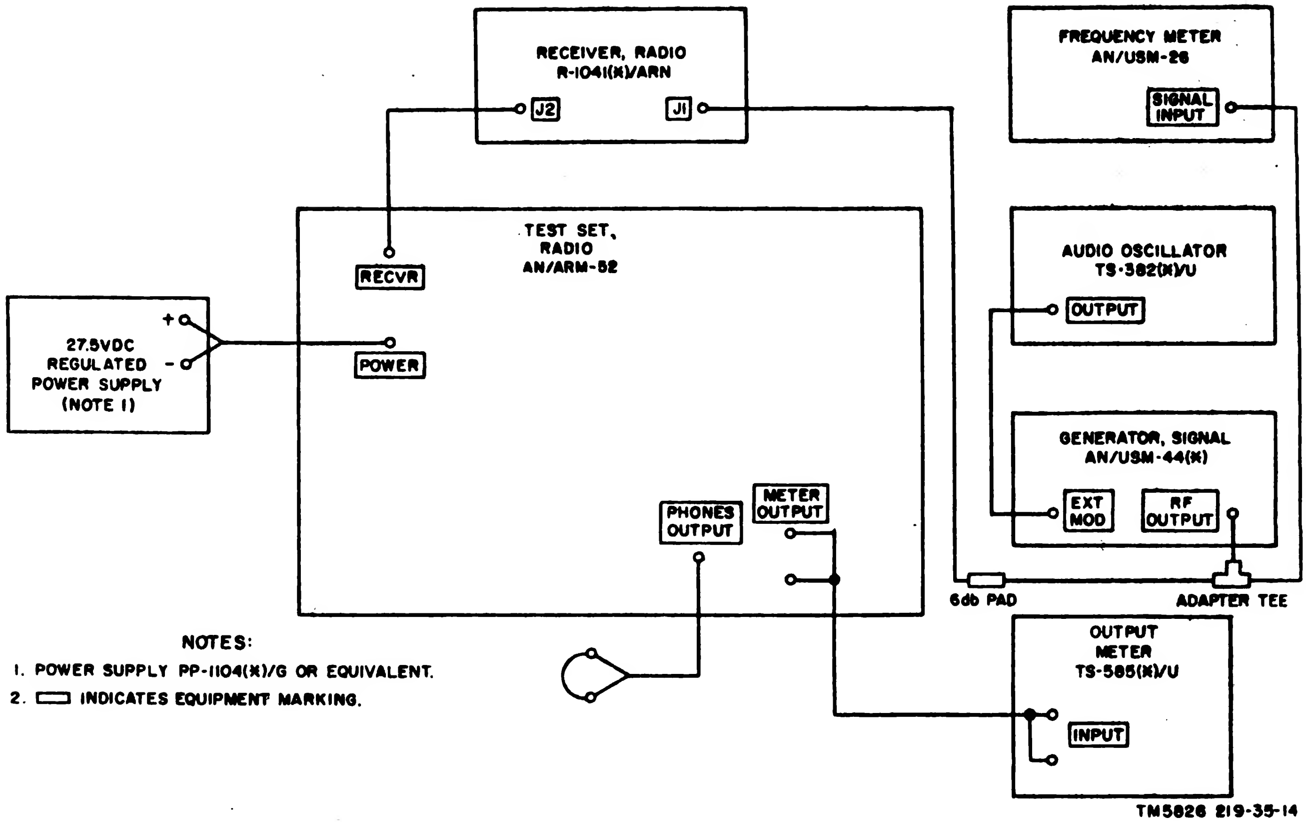

Figure 11. Connections for final testing.

output frequency of 75 mc. Set the audio oscillator for a frequency of 1,300 cps and adjust its output power to modulate the signal generator 90 percent.

c. Increase the signal generator output until the 400 CPS indicator on the test set lights. The signal generator output should not exceed 500 microvolts and the output meter should indicate a minimum of 5 milliwatts; note the output meter indication for future use.

d. Vary the audio oscillator frequency from 380 cps to 3,150 cps. The output indicated on the output meter should not vary more than 2 db from the output indication noted in *c* above.

e. Readjust the audio oscillator frequency to 1,300 cps.

f. Rotate the receiver volume control one step counterclockwise and note the output meter indication. The output meter should indicate one-half the value noted in *c* above. Continue rotating the volume control counterclockwise and note the output meter indication for each position; the output meter should indicate one-half the value noted for the previous control position.

g. Return the receiver volume control to position 5.

h. Place the test set SENSITIVITY switch to the LO position.

i. Increase the signal generator output until the 400 CPS indicator on the test set lights. The signal generator output should not exceed 3,000 microvolts and the output meter should indicate a minimum of 5 milliwatts; note the output meter indication.

j. Repeat the procedure given in *f* above; the output meter indication should be one-half the value recorded in *i* above.

46. Selectivity Test

a. Set the receiver volume control to position 5.

b. Adjust the signal generator for an output frequency of 75 mc. Set the audio oscillator for a frequency of 1,300 cps and adjust its output power to modulate the signal generator 90 percent.

c. Adjust the signal generator output for an indication of 5 milliwatts on the output meter.

d. Turn the signal generator to 75.04 mc. Note the attenuator setting and increase the signal generator output until the output meter again indicates 5 milliwatts. The increase in the signal generator output should be approximately 6 db.

e. Repeat the procedure given in *d* above; use a frequency of 74.96 mc.

f. Repeat the procedure given in *d* above; use frequencies of 75.150 mc and 74.850 mc. For these frequencies, the increase in signal generator output should be approximately 60 db.

47. Automatic Gain Control Test

a. Set the receiver volume control to position 5.

b. Adjust the signal generator for an output frequency of 75 mc. Set the audio oscillator for a frequency of 1,300 cps and adjust its output power to modulate the signal generator 90 percent.

c. Adjust the signal generator output for an indication of 12.5 milliwatts on the output meter. Note the output meter db indication.

d. Increase the signal generator output by 40 db. The indication on the output meter should not increase more than 6 db from the indication noted in *c* above.

48. Audio Attenuation Test

a. Set the receiver volume control to position 5.

b. Adjust the signal generator for an output frequency of 75 mc. Set the audio oscillator for a frequency of 1,300 cps and adjust its output power to modulate the signal generator 90 percent.

c. Adjust the signal generator output for an indication of 10 db on the output meter.

d. Rotate the receiver volume control one step counterclockwise. The output meter should indicate approximately 4 to 5 db lower than the indication obtained in c above.

e. Repeat the procedure given in *d* above for all steps of the volume control. Each step should provide an output indication approximately 4 to 5 db lower than the previous step; for the four steps, the total minimum decrease in the output level should be 18 db.

49. Image Frequency Test

a. Set the receiver volume control to position 5.

b. Adjust the signal generator for an output frequency of 75 mc. Set the audio oscillator for a frequency of 1,300 cps and adjust its output power to modulate the signal generator 90 percent.

c. Increase the signal generator output until the 400 CPS indicator on the test set lights. The signal generator output should not exceed 500 microvolts and the output meter should indicate a minimum of 5 milliwatts.

d. Increase the signal generator output to obtain an indication of 1 milliwatt on the output meter. Note the signal generator output voltage.

e. Tune the signal generator to 66.6 mc.

f. Tune the audio oscillator to 400 cps and adjust its output power to modulate the signal generator 30 percent.

g. Increase the signal generator output to obtain an indication of 1 milliwatt on the output meter. The signal generator output voltage should be 60 db above or 1,000 times greater than the output voltage noted in *d* above. For example, if the output voltage noted in *d* above was 100 microvolts, then the present signal generator output voltage should be 100,000 microvolts or greater.

50. Keyed 4-Cps Test
(fig. 12)

a. Connect the equipment as shown in figure 12, except as follows:

(1) Connect the output from the audio oscillator to the EXT MOD input jack on the signal generator.

(2) Do not connect the test cable to the KEYER OUTPUT 4 CPS jack.

b. Set the METER OUTPUT-PHONES OUTPUT switch on the test set to the PHONES OUTPUT position.

c. Set the receiver volume control to position 5.

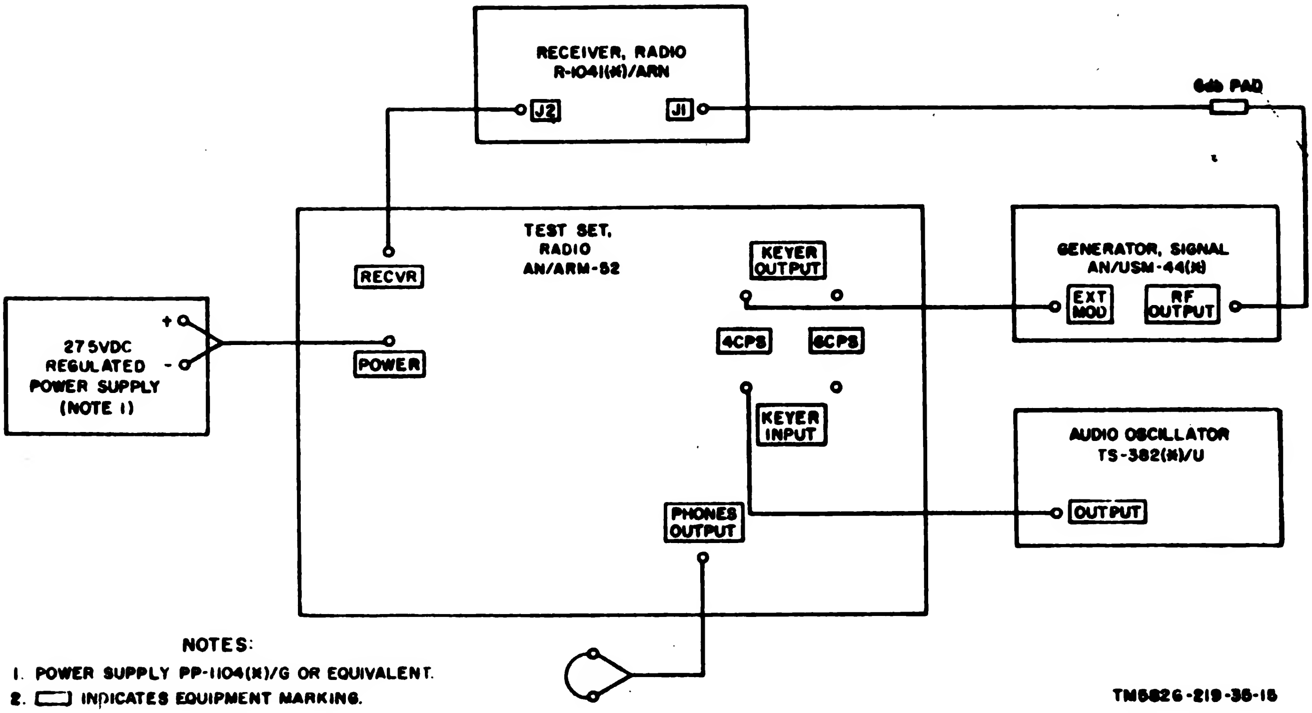

Figure 12. Test setup for keyed 4-cps test.

d. Adjust the signal generator for an output frequency of 75 mc. Set the audio oscillator for a frequency of 1,300 cps and adjust its output power to modulate the signal generator 90 percent.

e. Reconnect the test equipment as follows:

(1) Disconnect the audio oscillator from the signal generator.

(2) Connect the audio oscillator output to the KEYER INPUT 4 CPS jack.

(3) Connect the test set output from the KEYER OUTPUT 4 CPS jack to the EXT MOD input jack on the signal generator.

f. Set the test set KEYER switch to the ON position.

g. Increase the signal generator output until the 400 CPS indicator on the test set lights. The signal generator output should be approximately 250 microvolts; the 400 CPS indicator should flash and the audio tone should be interrupted at the keying rate of 4 cps.

h. Set the test set SENSITIVITY switch to the LO position.

i. Repeat the procedure given in *g* above; the signal generator output should be approximately 2,500 microvolts.

51. Keyed 6-Cps Test (fig. 13)

a. Connect the equipment as shown in figure 13.

b. Set the receiver volume control to position 5.

c. Adjust the signal generator for an output frequency of 75 mc. Set the audio oscillator for a frequency of 1,300 cps and adjust its output power to modulate the signal generator 90 percent.

d. Set the test set SENSITIVITY switch to the HI position.

e. Increase the signal generator output until the 400 CPS indicator on the test set lights. The signal generator output should be approximately 250 microvolts; the 400 CPS indicator should flash and the audio tone should be interrupted at the keying rate of 6 cps.

f. Slowly increase the signal generator output to approximately 70 millivolts. The indicator light and the audio tone should follow the keying rate of the test set as the signal input to the receiver is increased.

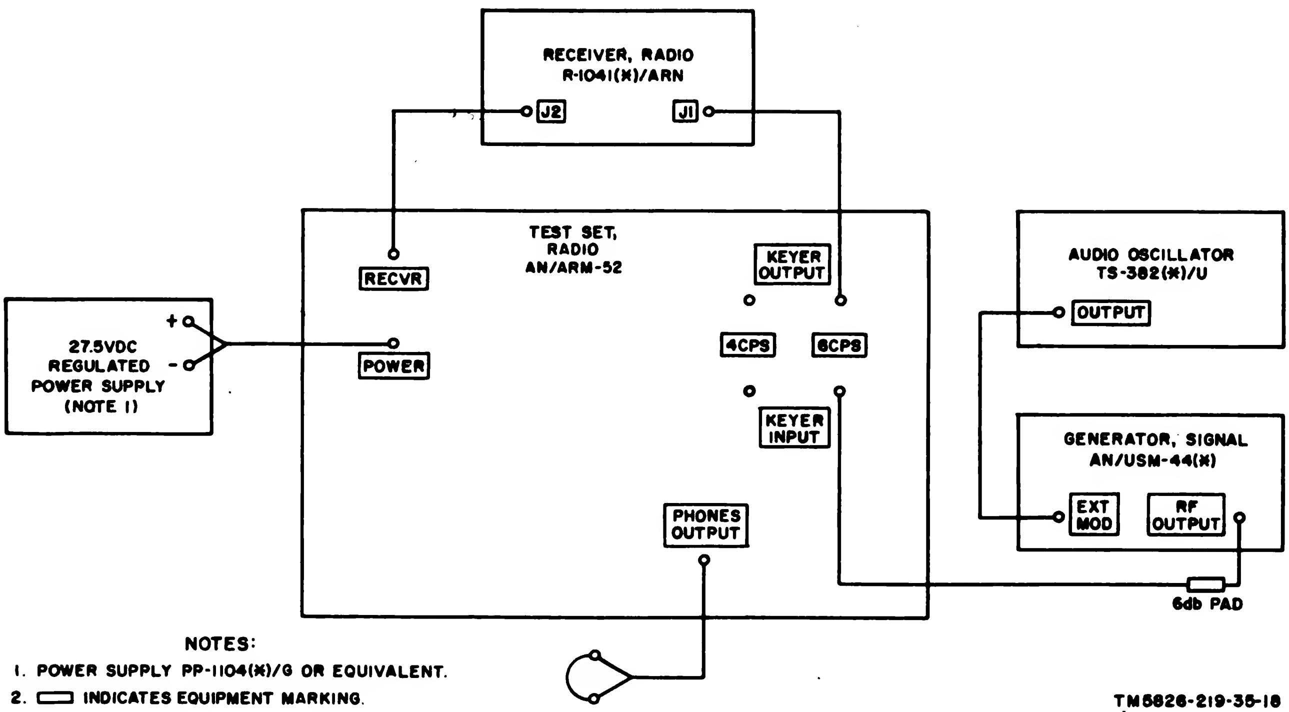

Figure 13. Test setup for keyed 6-cps test.

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APPENDIX

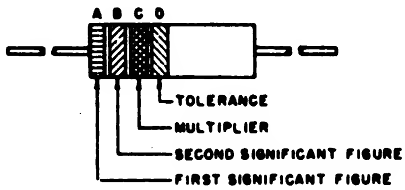
REFERENCES

Following is a list of references available to the field and depot maintenance repairmen of the R-1041(*)/ARN:

DA Pamphlet 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 4, 6, 7, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TB SIG 222	Solder and Soldering.
TM 11-5017	Output Meters TS-585A/U, TS-585B/U, TS-585C/U, and TS-585D/U.
TM 11-5057	Frequency Meter AN/USM-26.
TM 11-5126	Power Supplies PP-1104A/G and PP-1104B/G.
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U.
TM 11-5551A	R. F. Signal Generator Set AN/URM-25A.
TM 11-5551B	R. F. Signal Generator Set AN/URM-25B.
TM 11-5551C	Instruction Book for R. F. Signal Generator Set AN/URM-25C.
TM 11-5551D	R. F. Signal Generator Set AN/URM-25D.
TM 11-5826-219-12	Operator and Organizational Maintenance Manual: Receivers, Radio R-1041/ARN and R-1041A/ARN.
TM 11-6625-200-12	Operator and Organizational Maintenance Manual: Multimeters ME-26A/U and ME-26B/U.
TM 11-6625-261-12	Operator's and Organizational Maintenance Manual: Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U.
TM 11-6625-391-12	Operator and Organizational Maintenance Manual: Test Set, Radio AN/ARM-52.
TM 11-6625-508-10	Operator's Manual: Signal Generators AN/USM-44 and AN/USM-44A.
TM 11-6625-539-15	Operator, Organizational, Field and Depot Maintenance Manual: Test Set, Transistor TS-1836/U.

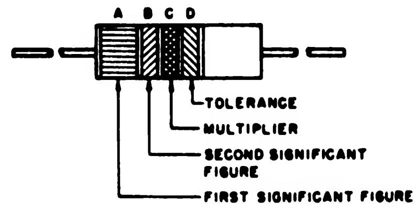
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS



BAND A— Double Width Signifies Wire-wound Resistor

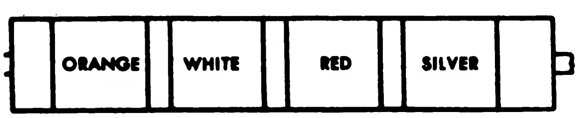
COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING

BAND

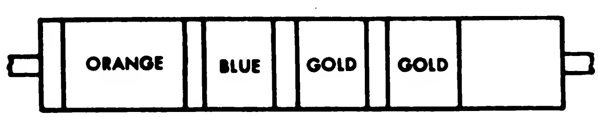
A B C D*



3 9 X100 ± 10%

BAND

A B C D*



3 6 X0.1 ± 5%

NOMINAL RESISTANCE	3,900 Ohms	3.6 Ohms
RESISTANCE TOLERANCE	± 10 percent	± 5 percent

STD-R2

*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

Figure 14. Color code marking for MIL-STD resistors.

By Order of Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-31 requirements for Field Maintenance Instructions for all Fixed and Rotor Wing Aircraft.

U.S. GOVERNMENT PRINTING OFFICE: 1992 - 311-831/60943

LOR CODE TABLES

NCE	CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
CB	CM	CN	CY	CB	CM	CM	CM
± 20%		A				−55° to +70°C	10–55 cps
	B	E		B			
± 2%	C		C			−55° to +85°C	
	D			D	300		
	E					−55° to +125°C	10–2,000 cps
	F				500		
						−55° to +150°C	
± 5%							
± 10%							

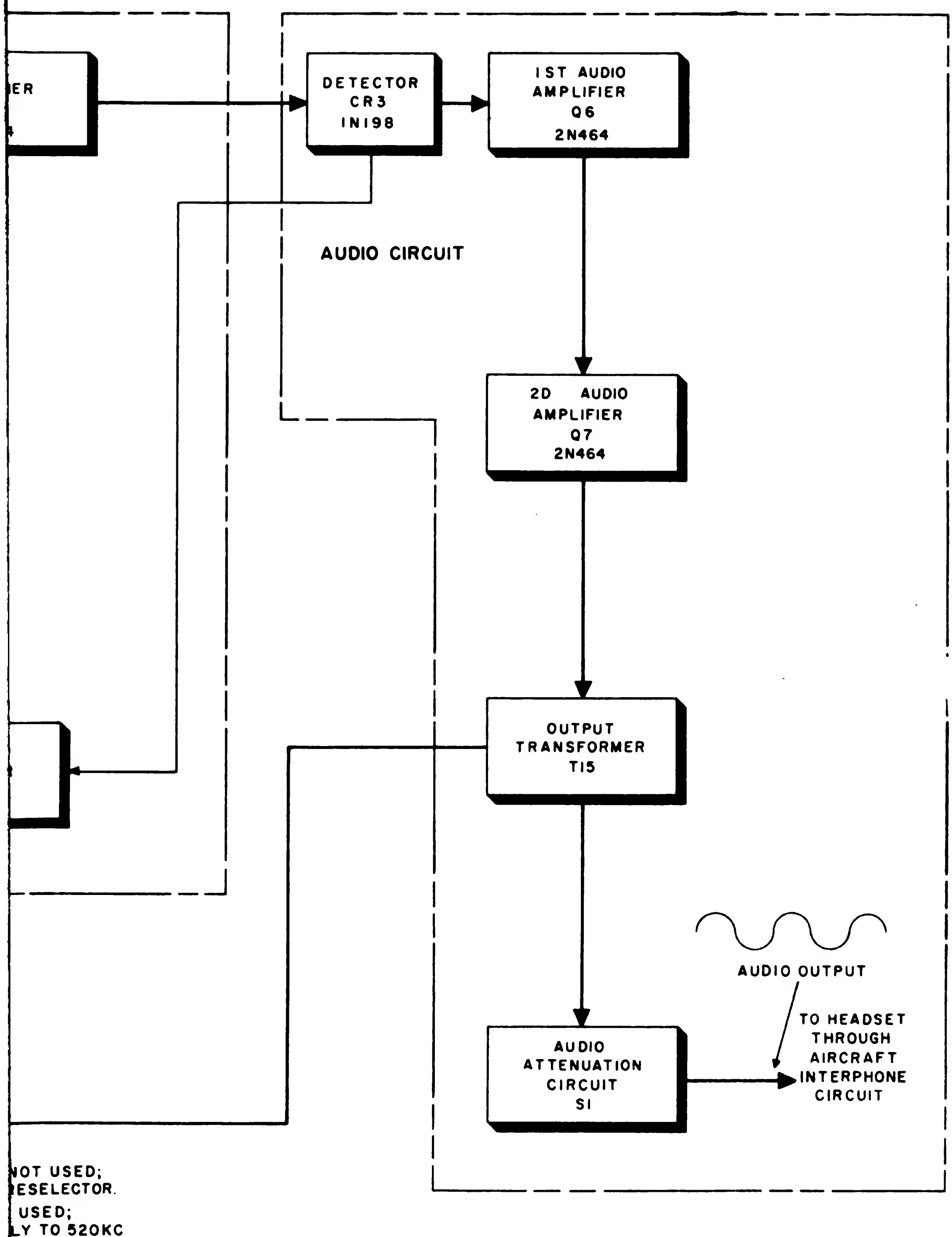
TABLE III – For use with Group III, Temperature Compensating, Style CC

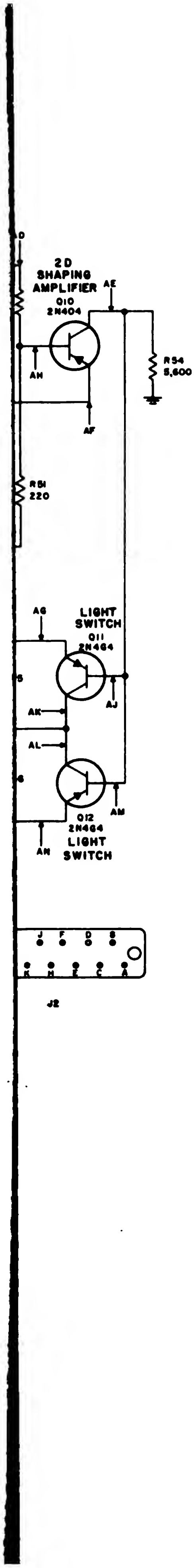
COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE Capacitances over 10uuf	CAPACITANCE TOLERANCE Capacitances 10uuf or less	MIL ID
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		± 5%	± 0.5uuf	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

multiplied to obtain the capacitance in uuf.

MIL–C–5, MIL–C–91, MIL–C–11272, and MIL–C–10950 respectively.

nated in MIL–C–11015.


ER
DETECTOR CR3 IN198
IST AUDIO AMPLIFIER Q6 2N464
AUDIO CIRCUIT
2D AUDIO AMPLIFIER Q7 2N464
OUTPUT TRANSFORMER T15
AUDIO OUTPUT
TO HEADSET THROUGH AIRCRAFT INTERPHONE CIRCUIT
AUDIO ATTENUATION CIRCUIT S1
NOT USED;
ESELECTOR.
USED;
LY TO 520KC
TM5826-219-35-1



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, 1/4 WATT. CAPACITANCES ARE IN UUF.
2 VALUE OF THERMISTOR IS FOR ROOM TEMPERATURE (+25 DEGREES C).
3 CLOCKWISE ROTATION OF POTENTIOMETERS R21 AND R59 INCREASE SENSITIVITY.
4. SWITCH S1 CANNOT BE SET TO THE 1-7 POSITION.
5. SWITCH S1 SHOWN AT MAX. ATTENUATION IS VIEWED FROM THE REAR SIDE AWAY FROM KNOB.
6. ☐ INDICATES EQUIPMENT MARKING.
7. CALL OUTS INDICATE TEST POINTS USED FOR VOLTAGE AND RESISTANCE MEASUREMENTS.
6. UNITS WITH THE FOLLOWING SERIAL NUMBERS DO NOT USE THERMISTOR RT4, RESISTOR R60 HAS A VALUE OF 4,700 OHMS AND RESISTOR R21 IS CONNECTED AS A VARIABLE SHUNT ACROSS R60, R57 IS CONNECTED DIRECTLY TO B+ AND CAPACITOR C31 HAS A VALUE OF 1.0 UF: 262, 295, 375, 377, 401, 462, 473, 481, 493, 525, 537, 540, 541, 544, 549, 550, 553, 554, 556, 559, 564, 565, 568, 571 THRU 573, 575 THRU 581, 584, 585, 587, 605, 617 THRU 641, 643 THRU 647, 650 THRU 661, 664 THRU 694, 696, 697, 699, 701 THRU 703, 705 THRU 709, 562.
9. UNITS WITH THE FOLLOWING SERIAL NUMBERS ARE THE SAME AS (6) ABOVE EXCEPT CAPACITOR C47 IS NOT USED: 298, 523, 531, 539, 561, 570, 563, 586, 566 THRU 596, 598 THRU 604, 606 THRU 616.
10. UNITS WITH THE FOLLOWING SERIAL NUMBERS HAVE THESE DIFFERENCES: CAPACITOR C47 AND THERMISTOR RT4 ARE NOT USED, CAPACITOR C31 HAS A VALUE OF 1.0 UF, THE VALUES OF RESISTORS R60 AND R37 WERE SELECTED AT ASSEMBLY AND ARE LISTED BELOW. NON-STANDARD VALUES OF RESISTANCE ARE COMPUTED VALUES OF PARALLEL RESISTOR NETWORKS.

R60 • SHORTED: 274, 284, 367, 374, 392, 429, 433, 513, 517, 530, 545, 546, 566, AND 567.	R37 • SHORTED : 284 AND 461.
	R37 • 4,700 OHMS: 274, 367, 566, AND 567
	R37 • 3,900 OHMS: 513
R60 • 145 OHMS: 529	R37 • 3,300 OHMS: 536, 546, AND 558.
R60 • 427 OHMS: 535 AND 547.	R37 • 1,000 OHMS: 524
R60 • 680 OHMS: 398	R37 • 470 OHMS : 374, 517, AND 530.
R60 • 825 OHMS: 362, 524, AND 536.	R37 • 434 OHMS : 433
R60 • 1,085 OHMS: 558	R37 • 427 OHMS : 535 AND 547.
R60 • 4,700 OHMS: 461	R37 • 419 OHMS : 429
R37 • 2,200 OHMS: 362, 392, AND 529.	R37 • 411 OHMS : 398 AND 545.

11. UNITS WITH THE FOLLOWING SERIAL NUMBERS HAVE THESE DIFFERENCES: THERMISTOR RT4 IS NOT USED, RESISTOR R60 HAS A VALUE OF 4,700 OHMS. A 270 OHM RESISTOR, R49, IS USED IN SERIES WITH THERMISTOR RT2, A .01 UF CAPACITOR, C56, IS ADDED FROM BASE OF TRANSISTOR Q6 TO GROUND, CAPACITOR C31 HAS A VALUE OF 1.0 UF, RESISTOR R28 HAS A VALUE OF 3,300 OHMS, RESISTOR R37 HAS A VALUE OF 470 OHMS, CAPACITOR C15 HAS A VALUE OF .001 UF, CAPACITOR C32 HAS A VALUE OF .05 UF, THERMISTOR RT3 AND RESISTOR R66 ARE NOT USED. CAPACITOR C57 IS NOT USED. 254, 260, 267 THRU 269, 276, 371, 373, 378 381, 363, 396, 399, 400, 407 THRU 423, 425, 427 ^28, 430, 431, 434 THRU 460, 464 THRU 472, 474 THRU 480, 482 THRU 492, 494, 495, 497 THRU 512, 514 THRU 516, 516 THRU 521.
12. UNITS WITH THE FOLLOWING SERIAL NUMBERS ARE THE SAME AS THOSE LISTED UNDER (11) ABOVE EXCEPT RESISTOR R10 HAS A VALUE OF 18 K OHMS AND CAPACITOR C31 HAS A VALUE OF .05 UF: 261, 265, 270 THRU 272, 275, 278, 293, 294, 297, 299, 310, 312 THRU 361, 363 THRU 366, 368, 370, 372, 380, 382, 364 THRU 391, 393 THRU 395, 397, 402 THRU 406.
13. UNITS WITH THE FOLLOWING SERIAL NUMBERS ARE THE SAME AS (12) ABOVE EXCEPT CAPACITORS C56 AND C17 ARE NOT USED. 262, 263, 287, 288, 291, 300 THRU 303, 305, 307, 306.
14. UNITS WITH THE FOLLOWING SERIAL NUMBERS ARE THE SAME AS (13) ABOVE EXCEPT CAPACITOR C55 IS NOT USED AND AN RF GROUND STRAP ON THE BOTTOM SIDE OF THE PRINTED CIRCUIT BOARD IS NOT USED. 258, 264, 286, 273, 277, 279 THRU 261, 286, 290.

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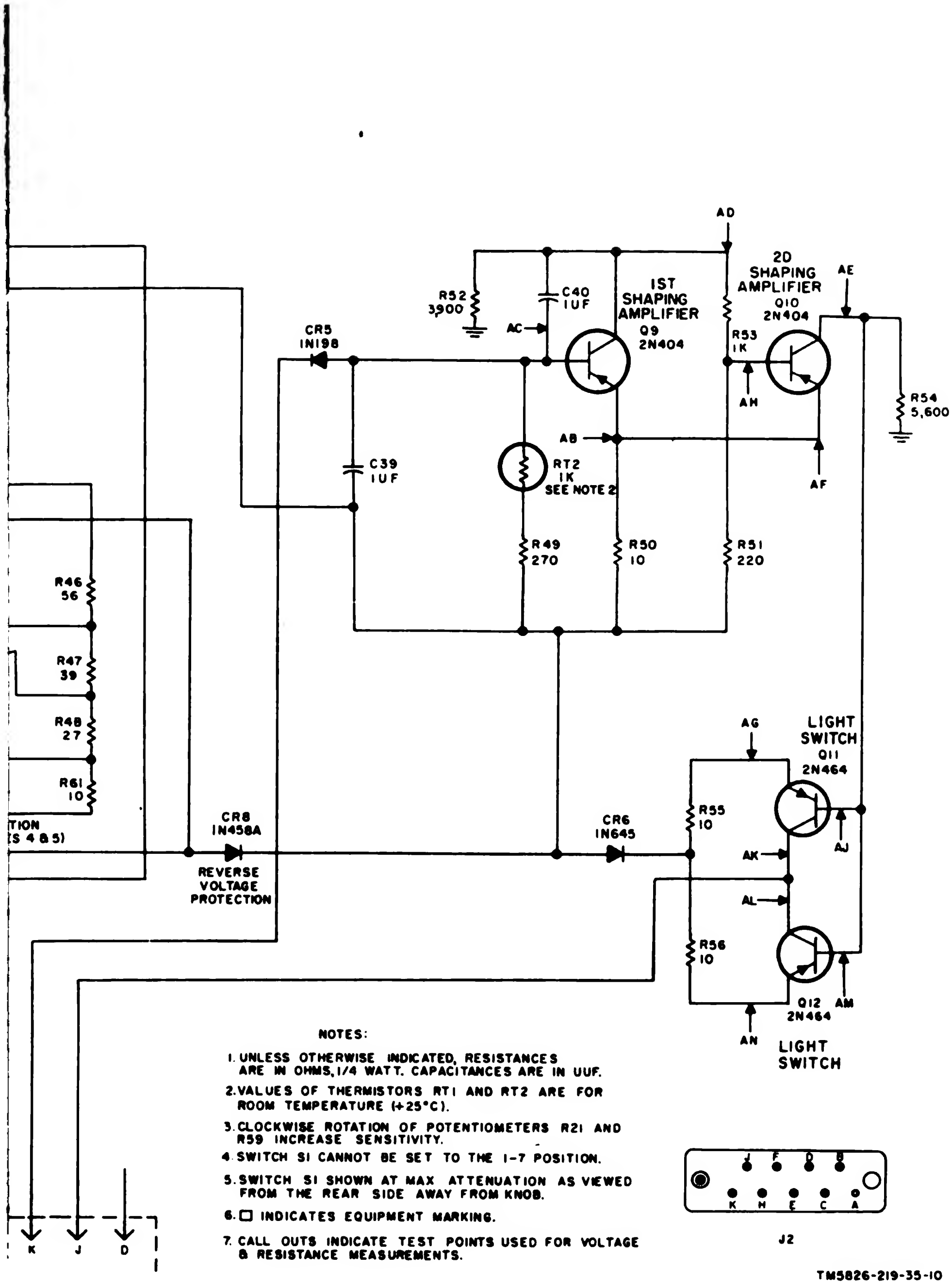

NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, 1/4 WATT. CAPACITANCES ARE IN UUF.
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6. ☐ INDICATES EQUIPMENT MARKING.
7. CALL OUTS INDICATE TEST POINTS USED FOR VOLTAGE & RESISTANCE MEASUREMENTS.

PIN : 028218-000