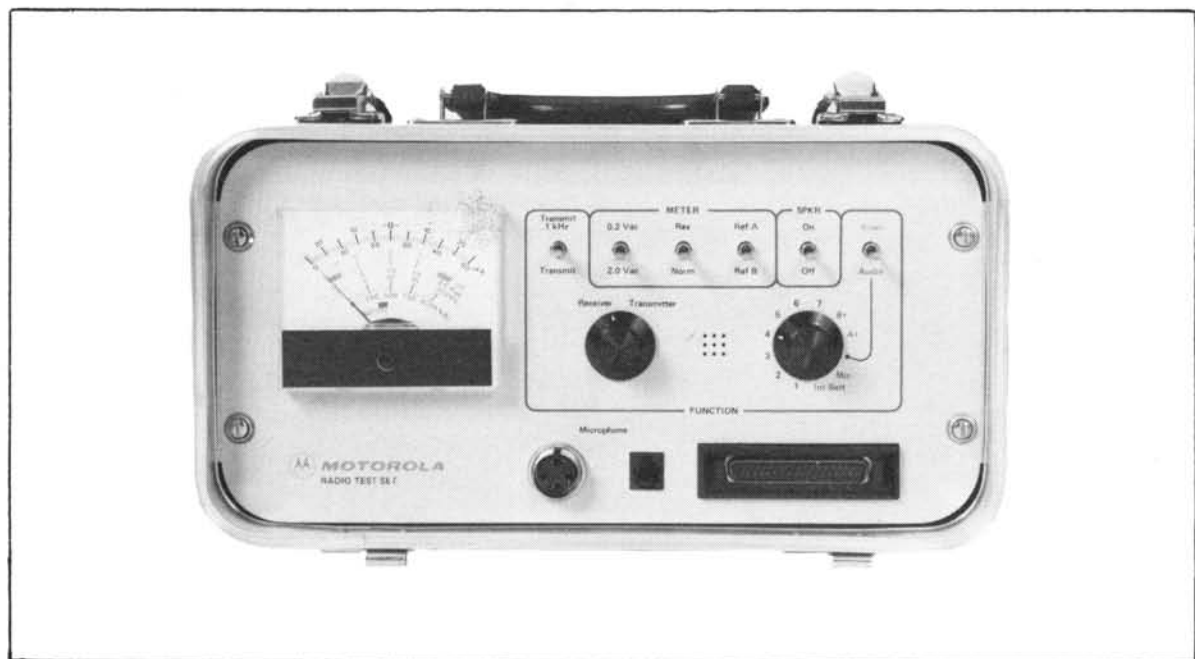




# Radio Test Set

## R-1033A



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## SPECIFICATIONS

### RADIO TEST SET

#### MODELS: R-1033A

RTL-4118A (R-2001 module)

RTL-4119A (R-2200 module)

**Alignment:** Metering facilities for alignment of receiver and transmitter through a single metering cable.

**Receiver output:** Accurate measurements of audio output for receiver quieting or SINAD measurements. Self contained speaker permits audio monitoring.

**Meter:** 0-50 microamps  $\pm 2\%$  full scale accuracy.

**AC Voltmeter:** Measures audio input to transmitter and audio output of receiver.

Two ranges: 0 to 0.2 Vac

0 to 2.0 Vac

**Sinad Input:** 0.5V to 12V RMS

**Frequency Response:**  $\pm 1$ db from 200Hz to 5000Hz

**Input Impedance:** 100K ohms on 2V range

10K ohms on .2V range

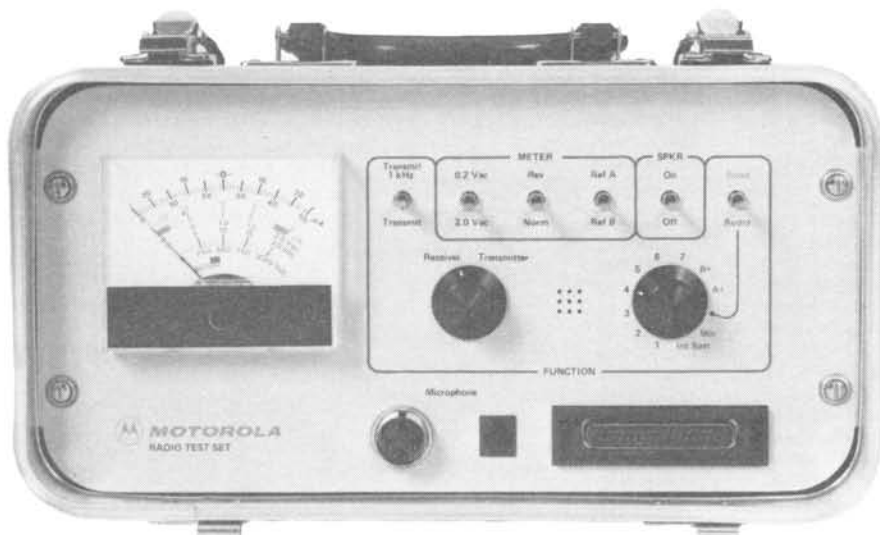
**Power Supply:** One 9v alkaline battery (60-82728J01), not included.

**Storage Temperature:**  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

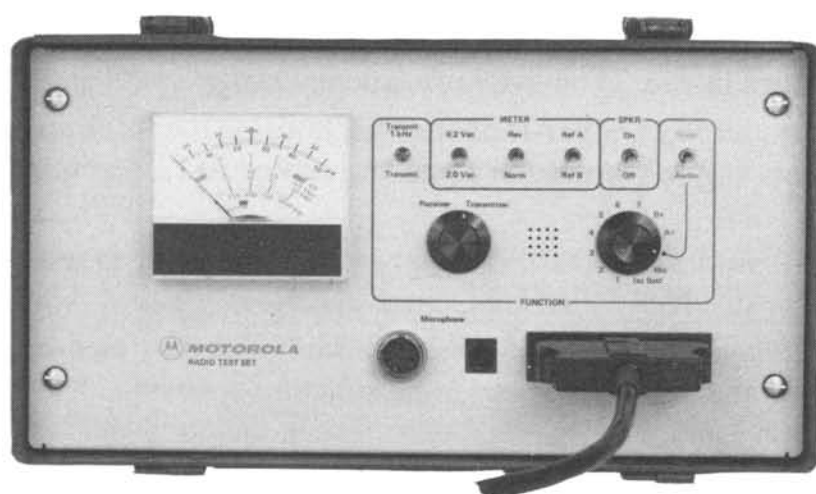
**Operating Temperature:**  $0^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$

**Size:**  $7\frac{3}{4}"$  (H) x  $12\frac{3}{4}"$  (W) x 6" (D)

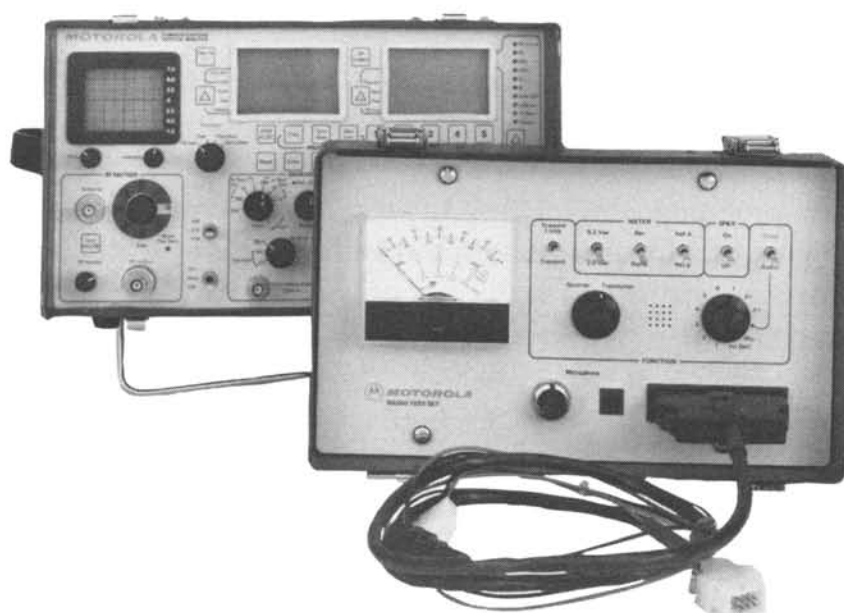
**Weight:** 8 lbs.



Model R-1033A



Model RTL-4118A



Model RTL-4119A

## **INTRODUCTION**

The Radio Test Set provides the metering facilities for alignment of receivers and transmitters in the 25-960MHz frequency range.

The R-1033 model has leather-look molded housing ideal for portable use. This model provides ample storage for metering cables and a test microphone in the top cover.

The RTL-4118 model is the radio test set module that may be used in place of the front cover for the R-2001 series Communications System Analyzer.

The RTL-4119 model is the radio test set module that may be used in place of the front cover for the R-2200 series Communications Service Monitor.

## **DESCRIPTION**

The radio test set measures all standard metering points for Motorola radios with metering capabilities. The test set provides metering capabilities for measuring receiver sensitivity either by the 20db quieting method or by the EIA Sinad method.

The unit provides a multiple Push to Talk (PTT) feature allowing the user to key the radio using a momentary switch with or without a 1000Hz modulation tone. Also included is a standard 4 prong microphone socket and a modular type microphone socket.

The unit has a built-in speaker which allows receiver audio monitoring (bridging mode only).

The unit has an interlock feature which eliminates battery drain when the radio metering cable is disconnected. The unit is powered by one 9V alkaline battery (60-82728J01) which is not included in the model.

The unit has been human engineered to provide maximum service efficiency. All switches are grouped for fast review and setting. Meter scales are color coordinated with switch controls to reduce confusion of which scale to read.

The main metering input connector mates with a spring locked connector which is small, lightweight and easy to connect. The spring locking prevents accidental cable disconnect.

## **ACCESSORY CABLES**

The following are available accessory test cables for servicing different radio products.

RTK-4042A Metering cable for MOTRAC, MOTRAN, MOCOM 70, MITREK radios.

RTK-4043A Metering cable for MICOR, MSR2000, SYNTOR, SYNTOR-X radios.

RTK-4044A Metering cable for MAXAR radios.

RPX-4028A Adapter, use with RTK-4044A to test certain higher power MAXAR radios.

RTK-4045A Metering cable for MOSTAR and TRAXAR radios.

RTK-4046A Metering cable for MSF5000 fixed stations.

RTK-4047A Metering cable for MICOR fixed stations.

## **FUNCTION OF CONTROLS, CONNECTORS, AND METER**

### **Meter**

The meter is a 50 microamp full scale movement with seven scales.

1. 0-50 microamp for readings in test positions.
2. (-25)-0-(+25) microamps (zero center) for discriminator alignment.
3. 0-1000Vdc for B+ of tube type final amplifiers.
4. 0-20Vdc for Mic dc and receiver A+.
5. 0-(-20) db for 12db SINAD measurements.
6. 0-.2Vac and 0-2Vac scales for measuring 20db quieting.
7. Battery OK range for checking condition of internal battery.

### **Transmit 1kHz/Transmit Switch**

Momentarily keys radio under test with 1kHz modulation/Momentarily keys radio under test with no modulation.

### **0.2Vac/2Vac Switch**

Selects AC voltmeter sensitivity. Scales are set 20db apart to facilitate making 20db quieting receiver measurements.

### **Rev/Norm Switch**

Selects meter polarity.

### **Ref A/Ref B Switch**

Selects meter reference A or reference B for meter select positions 1 thru 5 while servicing certain radios. Meter select position 6 will show the Ref A to Ref B voltage on the 20Vdc scale (polarity is Ref A positive with switches in Norm and in Ref A). Switch also selects M5 (Ref A) and M7 (Ref B) while in meter select position 7 for those radios which require an M5-M7 switch.

### **SPKR On/Off Switch**

Activates radio test set internal speaker; allows receiver audio monitoring. In "On" position, the test set presents a 65 ohm load to the radio under test. In "Off" position, the test set presents no load to the radio under test.

### **Sinad/Audio Switch**

Selects either receiver Sinad meter (blue scale), or Audio voltmeter (red scale). Refer to application sections on Sinad and 20db quieting.

### **Receiver/Transmitter Switch**

Selects metering mode of test set to meter or control either the receiver or the transmitter of the radio under test.

### **Meter Select Switch (12 position-continuous rotation)**

Positions 1 thru 7, meters radio test points as described in particular radio manual.

B + , measures PA B + voltage on the 1000Vdc scale.

A + , measures A + to radio on the 20Vdc scale.

Position 10 (Sinad/Audio), while in receiver mode connects receiver audio output to either the Sinad circuit or to the Audio ac meter as determined by the Sinad/Audio switch. While in transmitter mode, position 10 may be used to measure Mic audio input on the Audio ac meter.

Mic, measures microphone dc on 20Vdc scale.

Int Batt, indicates condition of internal battery.

### **Microphone Input**

Two microphone input sockets are provided for functional voice tests. One is a standard 4 prong microphone socket (Motrac type) and the other is a modular type microphone socket (Mostar type).

### **Test Cable Connector**

All connections to the radio under test are made via the 37 pin "D" connector on the front panel. This connector mates with a spring locked connector on the metering cable, which prevents accidental disconnect. The internal battery is connected by an interlock jumper in each cable kit. If the radio test set is not in use for an extended period of time, it is recommended to remove the cable kit or to set the meter select switch in a position where the battery is disconnected.

#### **NOTE**

Battery is connected in meter select positions 4, 10 (Sinad/Audio), and Int. Batt.

## **ALIGNMENT AND CALIBRATION PROCEDURE**

#### **NOTE**

Before making any adjustment, check the condition of the internal battery. A metering cable must be connected to the radio test set for this test and for all the following procedures.

### **Meter 4, Zero Center**

Set the Receiver/Transmitter switch to Receiver and the Meter Select switch to meter position 4. Adjust R70 (Meter 4 Zero) for zero center meter indication.

### **Internal 1000 Hz Oscillator Frequency**

Connect a frequency counter to pins 1 and 2 (common) of the four pin microphone connector (Motrac type). Set the Receiver/Transmitter switch to Transmitter. Actuate the Transmit 1 kHz/Transmit switch to Transmit 1 kHz and adjust R45 (Oscillator Frequency) for 1000 Hz.



## Audio Meter

Connect an audio oscillator to pins 1 and 2 (common) of the four pin microphone connector (Motrac type). Make the following switch settings:

Receiver/Transmitter	to Transmitter
Meter Select	to Sinad/Audio
Sinad/Audio	to Audio
0.2Vac/2.0Vac	to 2.0Vac

Adjust the audio oscillator for an output of 1000 Hz at 1.0 volt RMS. Adjust R55 (Audio meter) for a reading of 1.0 volt. Decrease the output of the audio oscillator to 0.1 volt RMS. Set the 0.2Vac/2.0Vac switch to 0.2Vac, the meter should read 0.1Vac.

## Sinad Circuit

The Sinad circuit is factory calibrated and normally it should not require any field adjustment. However, should any adjustments be required, follow the alignment procedure carefully.

Adjustment of the notch filters requires a stable frequency source settable within 0.1 Hz. An audio synthesizer, such as the R-1100A, or an audio oscillator and a frequency counter should be used.

Connect the audio source to pins 1 and 2 (common) of the four pin microphone connector (Motrac type). Make the following switch settings:

Receiver/Transmitter	to Receiver Meter
Meter Select	to Sinad/Audio
Sinad/Audio	to Sinad

Adjust the audio source for an output of 996 Hz  $\pm 0.1$  Hz at 2.0 volts RMS. Adjust R17 (Notch 1) for minimum meter reading.

Adjust the audio source for an output of 1002 Hz  $\pm 0.1$  Hz at 2.0 volts RMS. Adjust R25 (Notch 2) for minimum meter reading. This completes the filter adjustment.

To complete the Sinad circuit adjustment, a 12db Sinad audio signal is required. One method is to use a "known good" radio and an rf signal generator. Using an audio distortion analyzer, such as a Hewlett-Packard 334A, set up a 12db Sinad condition on the radio.

Connect the radio test set to the radio using the appropriate metering cable. The radio test set switches remain as set above.

Remove the rf input to the radio and adjust the squelch to allow the radio to roar. Adjust the radio noise output for approximately 1 volt RMS at the speaker terminals. Adjust R78 (Noise Set) so that the meter indicates in the center of the solid blue region near full scale. Apply the modulated (1000 Hz) rf signal to the

radio, adjust for a 12db Sinad output. Adjust R29 (Sinad) so that the center of the meter-needle flutter reads 12db on the blue scale. Remove the rf input from radio and readjust R78 (Noise Set) for the center of the solid blue region near full scale.

Repeat these last two steps until the meter reads  $12\text{db} \pm 0.5\text{db}$  with the rf signal applied to the radio and the meter reads in the center of the solid blue region near full scale on noise.

## APPLICATION NOTE

### 1. Receiver sensitivity by 20db quieting method.

To measure 20db quieting, the radio test set switches are in the following positions:

Receiver/Transmitter	to Receiver
.2Vac/2Vac	to 2Vac
Rev/Norm	to Norm
SPKR on/off	as desired
Sinad/Audio	to Audio
Meter Select	to position 10 (Sinad/Audio)

With no rf input to the receiver, unsquelch the radio and note the noise voltage reading on the 2Vac scale; adjust for mid scale or higher. Connect an on channel signal with no modulation to the rf input of the receiver and slowly increase the input signal. As the rf input is increased, the noise output of the receiver will decrease. Switch to the .2Vac position and adjust the rf level to give the same meter deflection as there was with no rf signal present. The level of the rf signal in microvolts is the 20db quieting sensitivity of the receiver.

While making the 20db quieting measurement, it will be noted that the meter "flickers". This is due to the random nature of noise, and so the reading must be interpreted by the operator.

## APPLICATION NOTE

### 2. Receiver sensitivity by Sinad method.

The Sinad circuit is specifically designed for making Sinad measurements on receivers. Special circuit design speeds and simplifies the Sinad measurement by eliminating all distortion meter adjustments.

The notch filter is internally set to the 1000 Hz tone used in Sinad measurements, and an automatic gain control eliminates the need for setting input gain to the meter.

The automatic gain control feature permits the Sinad circuitry to be used as a receiver alignment tool, providing rapid alignment of receivers for optimum performance.

Sinad is an acronym for the ratio of **Signal plus Noise and Distortion** to **Noise and Distortion**. Sinad is similar to a 20db quieting measurement but since modulation is present, Sinad is generally considered to give a better figure of merit for receiver sensitivity. The Sinad measurement simulates the reception of voice and 12db Sinad is considered an acceptable threshold for intelligibility.

To measure Sinad, the radio test set switches are in the following positions:

Receiver/Transmitter	to Receiver
Rev/Norm	to Norm
SPKR on/off	as desired
Sinad/Audio	to Sinad
Meter Select	to position 10 (Sinad/Audio)

In order to make a Sinad measurement, an rf signal generator with the capability of  $1000 \pm 5$  Hz modulation at 3kHz deviation is necessary. Since the Radio Test Set uses a very sharp notch filter to make the Sinad measurement, it may be necessary to adjust the 1000 Hz modulation frequency. To adjust the signal generator 1000 Hz source, apply enough rf signal to a good receiver to insure full quieting (ex. 1000 microvolts). The meter should read well into the blue range at the left edge of the Sinad scale. If not, adjust the 1000 Hz source frequency for a minimum meter indication.

To perform the Sinad measurement, unsquelch the receiver and adjust the volume control for full rated audio; meaningful results may be obtained with the volume set to a comfortable listening level.

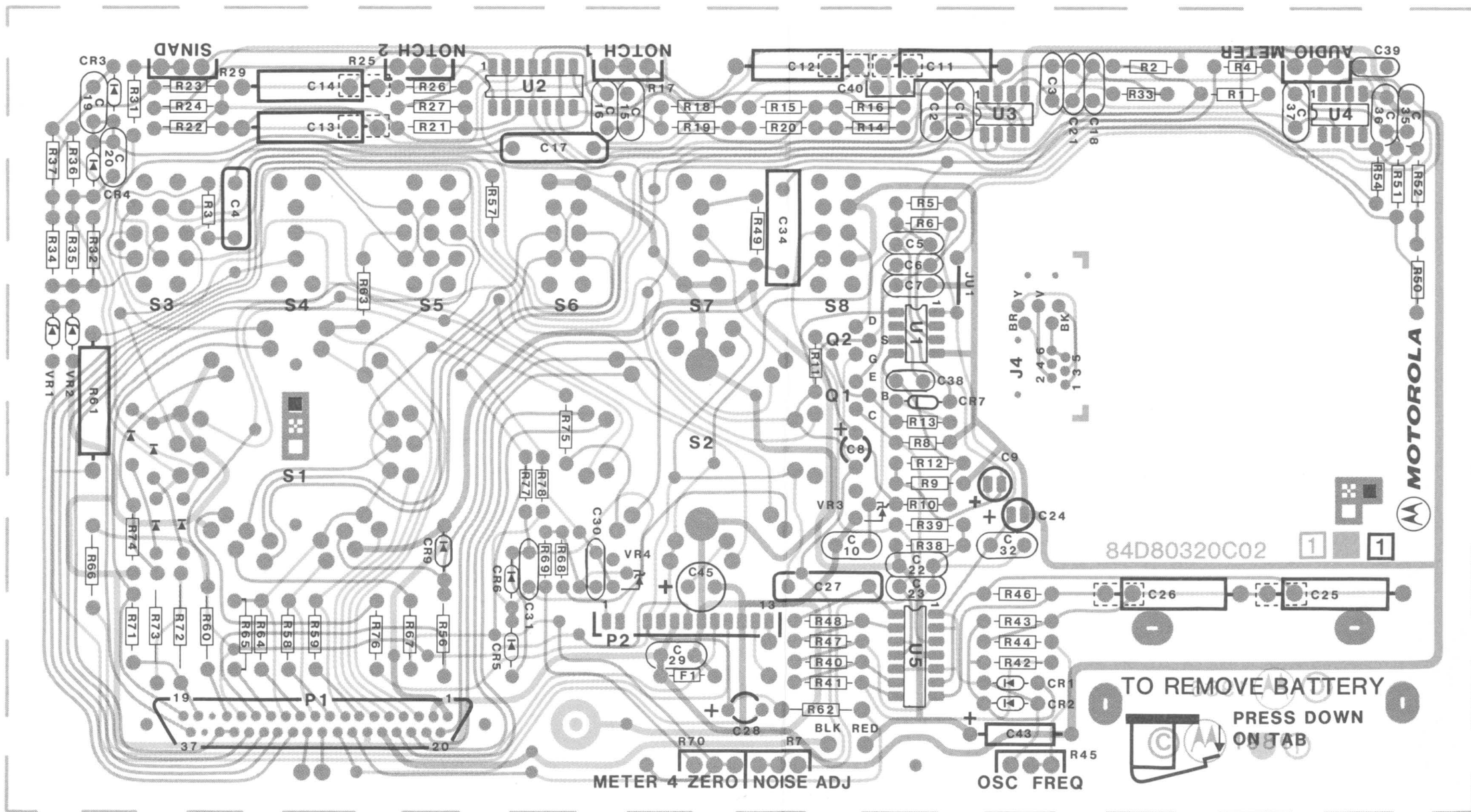
With no rf input to receiver, the meter should read in the blue range of the right end of the Sinad scale. Slowly increase the rf input to the receiver. The needle should begin to come off the right end of the scale as the rf level is increased. Adjust the rf level for a reading of 12db. The level of the rf signal in microvolts is the 12db Sinad sensitivity of the receiver.

While making the Sinad measurement, it will be noted that the meter "flickers", this is due to the random nature of noise, and so the reading must be interpreted by the operator.

## APPLICATION NOTE

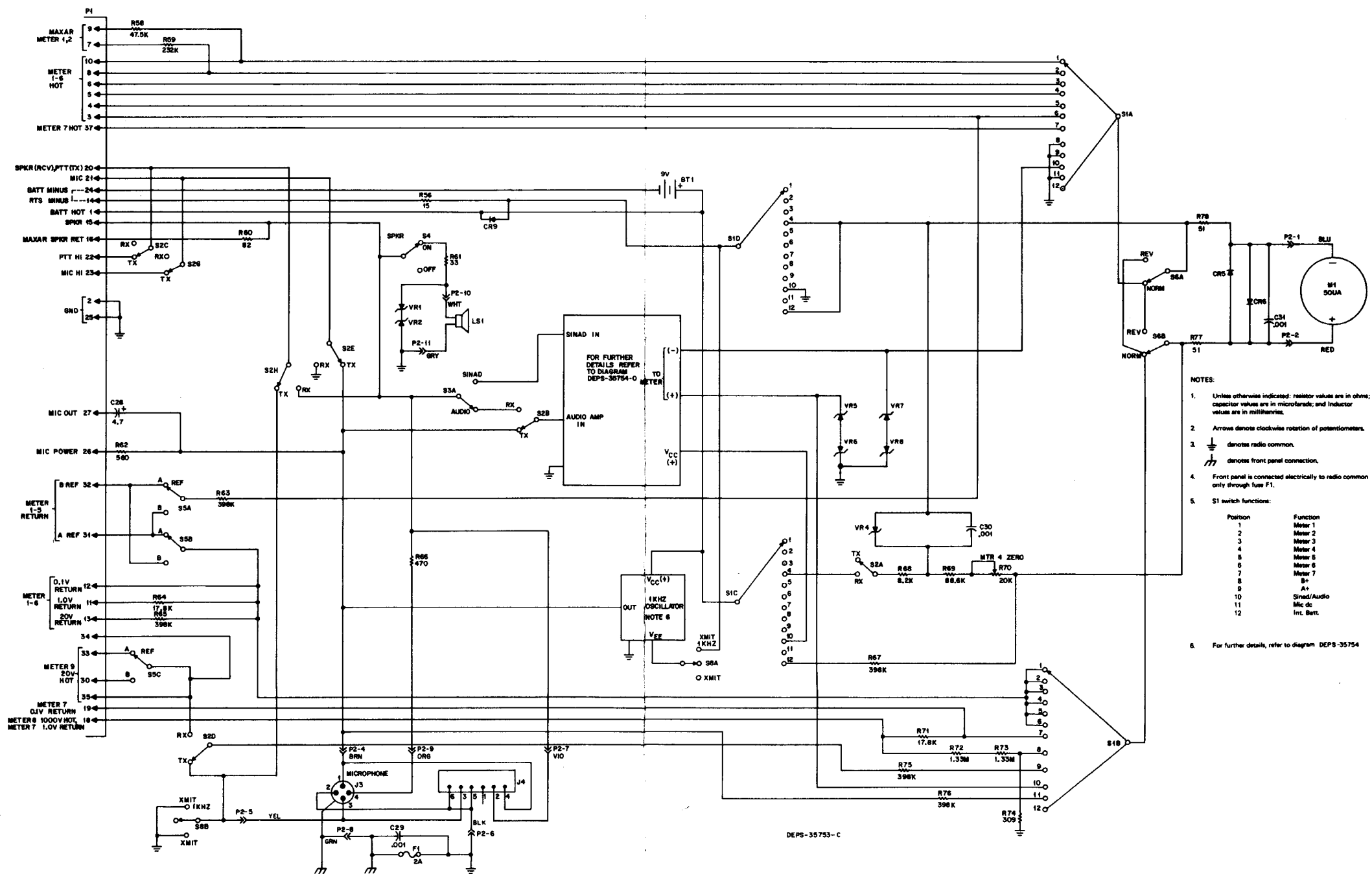
### 3. Meter point testing

	RADIO TYPE					
	MOTRAC and similar radios	MICOR and similar radios	MAXAR	MOSTAR, TRAXAR	MSF5000 Fixed Station	MICOR Fixed Station
METERING CABLE	RTK4042A	RTK4043A	RTK4044A, RPX4028A for certain higher power MAXAR's	RTK4045A	RTK4046A	RTK4047A
TEST SET SWITCHES	As required for transmitter or receiver testing.					
Receiver *** Transmit						
Transmit 1kHz *** Transmit	PTT (1kHz) or PTT (no mod) as desired.					
0.2Vac *** 2.0Vac	Use for 20dbQ measurement or for Mic audio input.					
Rev *** Norm	As required, refer to radio manual.					
Ref A (M5) *** Ref B (M7)	Not functional	As required, refer to radio manual.	Selects M5 or M7 while in meter select pos. 7.	Not functional.	Not functional.	As required refer to radio manual.
SPKR On *** Off	As desired, for receiver audio monitoring.					
Sinad *** Audio	Refer to sections on receiver sensitivity measurements.					
Meter Select	As required, refer to radio manual.					



SOLDER SIDE • BD-DEPS - 35758-C  
 COMPONENT SIDE • BD-DEPS - 35759-C  
 OL-DEPS - 35760-C

Note: R56 is not used on issue "O" circuit boards.



- NOTES:
- Unless otherwise indicated: resistor values are in ohms; capacitor values are in microfarads; and inductor values are in millihenries.
  - Arrows denote clockwise rotation of potentiometers.
  - $\text{---}$  denotes radio common.
  - $\text{---}$  denotes front panel connection.
  - Front panel is connected electrically to radio common only through fuse F1.
  - S1 switch functions:
- | Position | Function   |
|----------|------------|
| 1        | Meter 1    |
| 2        | Meter 2    |
| 3        | Meter 3    |
| 4        | Meter 4    |
| 5        | Meter 5    |
| 6        | Meter 6    |
| 7        | Meter 7    |
| 8        | B+         |
| 9        | A+         |
| 10       | Sine/Audio |
| 11       | Mic dc     |
| 12       | Int. Batt. |
6. For further details, refer to diagram DEPS-35754

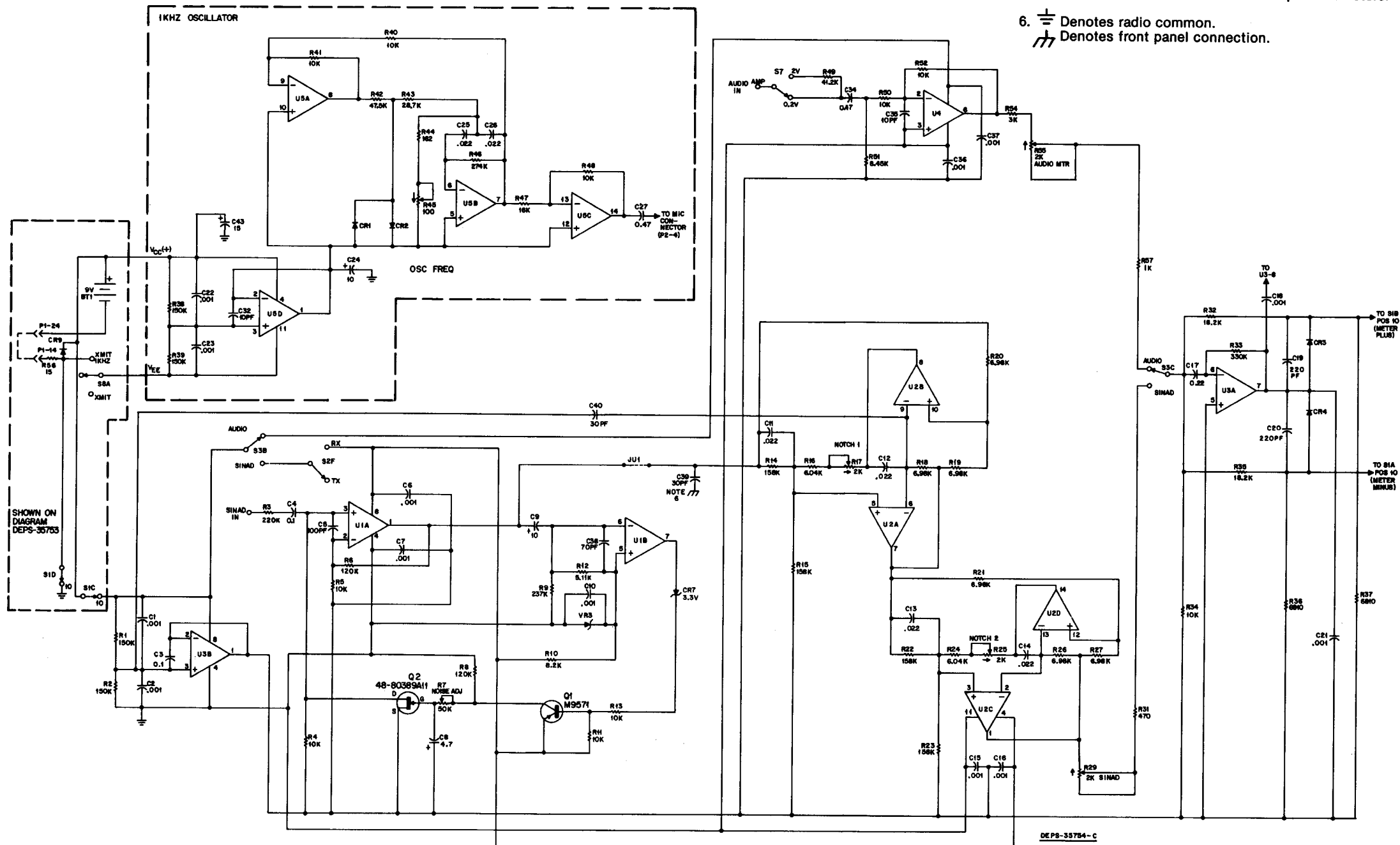
# NOTES:

1. Unless otherwise indicated: resistor values are in ohms; capacitor values are in microfarads; and Inductor values are in millihenries.
2. Integrated circuits on this board are linear devices.
3. IC types and connections for this board are as follows:

Reference Designation	Type	VCC	GND	MFGR'S Description
U1, 3	21K71	8	4	Dual Op Amp
U2, 5	20A80	4	11	Quad op amp
U4	20A96	7	4	Op Amp

5. Arrows denote clockwise rotation of potentiometers.

6.  $\frac{1}{\infty}$  Denotes radio common.  
 $\nabla$  Denotes front panel connection.



SCHEMATIC, CIRCUIT DETAIL



# parts list

R-1033A Radio Test Set  
RTL-4118A Radio Test Set Module  
RTL-4119A Radio Test Set Module

PL-8328-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>capacitor, fixed; <math>\pm 10\%</math>; 100 V:</b> unless otherwise stated
C1, 2	21-82187B29	.001 uF
C3	8-11017A17	0.14 F $\pm 5\%$ ; 50 V
C4	8-82905G07	0.1 uF $\pm 10\%$ ; 50 V
C5	21-82610C58	100 pF $\pm 5\%$ ; 500 V
C6, 7	21-82187B29	.001 uF
C8	23-84538G02	4.7 uF $\pm 20\%$ ; 20 V
C9	23-84665F01	10 uF $\pm 10\%$ ; 25 V
C10	21-82187B29	.001 uF
C11 thru 14	21-80397A11	.022 uF $\pm 5\%$ ; 100 V
C15, 16	21-82187B29	.001 uF
C17	8-82906J20	0.22 uF $\pm 10\%$ ; 250 V
C18	21-82187B29	.001 uF
C19, 20	21-83162H12	220 pF
C21 thru 23	21-82187B29	.001 uF
C24	23-84665F01	10 uF $\pm 100-10\%$ ; 25 V
C25, 26	21-80397A11	.022 $\pm 5\%$ ; 100 V
C27	8-84637L42	0.47 uF
C28	23-84538G02	4.7 uF $\pm 20\%$ ; 20 V
C29, 30, 31	21-82187B29	.001 uF
C32	21-82133G01	10 pF $\pm 5\%$ ; 500 V
C34	8-84637L42	0.47 uF
C35	21-82133G01	10 pF $\pm 5\%$ ; 500 V
C36, 37	21-82187B29	.001 uF
C38	21-861435	70 pF
C40	21-82877B18	30 pF
C43	23-84665F09	15 uF $\pm 150-10\%$ ; 25 V
BT1	60-82728J01	<b>battery; alkaline:</b> 9 V
		<b>diode: (see note)</b>
CR1, 2	48-83654H01	silicon
CR3 thru 6	48-82466H13	silicon
CR7	48-82256C26	silicon, 3.3 V Zener
CR9	48-82466H13	silicon
		<b>fuse:</b>
F1	65-82896B04	2 amp
		<b>connector, receptacle:</b>
J2	15-80346A81 39-10184A59 28-84320K01	HOUSING, 10-contact CONTACT, 10 used KEY, polarizing
J3	9-830418 2-482070 4-7699	female; 4-contact (MIC) NUT, ring (MIC) WASHER, microphone
J4	9-80145D01 84-80389A72 42-80389A67	female; 6-contact (modular) board, PC (modular connector) retainer, modular connector
LS1	50-80389A10	<b>speaker:</b> 32 ohm
M1	72-80389A01	<b>meter:</b> 50 uA
		<b>connector, plug:</b>
P1	28-80389A56	male; 37-contact
P2	28-80181B07	male; 10-contact
P3	9-5517A01	female; clip battery
		<b>transistor: (see note)</b>
Q1	48-869571	PNP; type M9571
Q2	48-80389A11	field-effect

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>resistor, fixed; <math>\pm 1\%</math>; 1/8 W:</b> unless otherwise stated:
R1, 2	6-10621E06	150k
R3	6-124B06	220k $\pm 5\%$ ; 1/4 W
R4, 5	6-124A73	10k $\pm 5\%$ ; 1/4 W
R6	6-124A99	120k $\pm 5\%$ ; 1/4 W
R7	18-83452F17	50k variable
R8	6-124A99	120k $\pm 5\%$ ; 1/4 W
R9	6-10621E25	237k
R10	6-124A71	8.2k $\pm 5\%$ ; 1/4 W
R11	6-124A73	10k $\pm 5\%$ ; 1/4 W
R12	6-10621C63	5.11k
R13	6-124A73	10k $\pm 5\%$ ; 1/4 W
R14, 15	6-84640C75	158k $\pm 1/2\%$
R16	6-10621C70	6.04k
R17	18-83452F01	variable; 2k
R18, 19, 20, 21	6-84640C97	6.98k $\pm 1/2\%$
R22, 23	6-84640C75	158k $\pm 1/2\%$
R24	6-10621C70	6.04k
R25	18-83452F01	variable; 2k
R26, 27	6-84640C97	6.98k $\pm 1/2\%$
R29	18-83452F01	variable; 2k
R31	6-124A41	470 $\pm 5\%$ ; 1/4 W
R32	6-10621D17	18.2k
R33	6-124B10	330k $\pm 5\%$ ; 1/4 W
R34	6-10621C91	10k
R35	6-10621D17	18.2k
R36, 37	6-10621C75	6810
R38, 39	6-10621E06	150k
R40, 41	6-10621C91	10k
R42	6-10621D57	47.5k
R43	6-10621D88	100k
R44	6-10621B06	121
R45	18-83452F05	variable; 200
R46	6-10621E31	274k
R47	6-124A78	16k $\pm 5\%$ ; 1/4 W
R48	6-124A70	7.5k $\pm 5\%$ ; 1/4 W
R49	6-10621D51	41.2k
R50	6-10621C91	10k
R51	6-13755C84	8450
R52	6-10621C91	10k
R53		NOT USED
R54	6-124A60	3k $\pm 5\%$ ; 1/4 W
R55	18-83452F01	variable; 2k
R56	6-125A05	15 $\pm 5\%$ ; 1/2 W
R57	6-10621B94	1k
R58	6-10621D57	47.5k
R59	6-10621E24	232k
R60	6-125A23	82 $\pm 5\%$ ; 1/2 W
R61	6-127A13	33 $\pm 5\%$ ; 2 W
R62	6-125A43	560 $\pm 5\%$ ; 1/2 W
R63	6-84444A48	398k
R64	6-10621D16	17.8k
R65	6-84444A48	398k
R66	6-125A41	470 $\pm 5\%$ ; 1/2 W
R67	6-84444A48	398k
R68	6-124A71	8.2k $\pm 5\%$ ; 1/4 W
R69	6-10621D82	86.6k
R70, 78	18-83452F15	variable; 20k
R71	6-10621D16	17.8k
R72, 73	6-84444A65	1.33 meg; 1/4 W
R74	6-10621B45	309; 1/4 W
R75, 76	6-84444A48	398k
R77, 78	6-124A18	51 $\pm 5\%$ ; 1/4 W

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>switch:</b>
S1	40-80389A02	12-position (rotary)
S2	40-80389A03	2-position; 8-pole (rotary)
S3	40-80389A06	3 PDT
S4	40-80389A04	SPDT
S5	40-80389A06	3 PDT
S6	40-80389A05	DPDT
S7	40-80389A04	SPDT
S8	40-80389A08	DPDT (momentary — center off)
		<b>integrated circuit: (see note)</b>
U1	51-84621K71	dual op-amplifier
U2	51-84561L75	quad op-amplifier
U3	51-84621K71	dual op-amplifier
U4	51-84320A96	high-slew-rate op-amplifier
U5	51-84320A80	quad op-amplifier
		<b>voltage regulator:</b>
VR1, 2	48-83461E03	Zener type; 3.3 V
VR3, 4	51-80365A11	Zener type; 2.49 V
VR3, 4	51-80365A11	Zener type; 2.49 V
VR5 thru 8	48-82256C25	Zener type; 12 V
<b>mechanical parts</b>		
<i>Test Set Module Assembly for R-1033A</i>		
	2-7019	NUT, 4-40 x 1/4" x 3/32"
	2-132616	NUT, 6-32" x 1/4" x 3/32"; 6 used
	4-82234D01	RING, retainer; 4 used
	29-5321	LUG, solder (meter); 2 used
	29-128018	LUG, solder (front panel)
	36-80389A88	KNOB; 2 used
	15-80389A59	HOUSING, connector support
	43-80389A89	BUSHING, spacer; 4 used
	42-82325L01	RETAINER, speaker
	46-82233D04	STUD, 1/4 turn; 4 used
	64-80389A51	PANEL, front
	42-80389A57	HOLDER, battery (p.c. mount)
	43-80347A55	BUSHING, spacer; 2 used
<i>Case Assembly for R-1033A</i>		
	1-80350A85	CASE ASSEMBLY, test set
	2-80389A69	NUT, clip on; 4 used
	2-80389A73	NUT, acorn, 4-40 nylon; 4 used
	3-2951	SCREW, 4-40 x 14"; 4 used
	4-80349A37	WASHER, wear
	41-80349A36	SPRING, ejector
	42-80349A38	RECEPTACLE, clip-on
	43-868874	SPLIT, ring
	46-80389A94	STUD, 1/4 turn
	55-80389A98	BAIL, wireform
<i>Test Set Module Assembly for RTL-4118A/RTL-4119A</i>		
	2-7019	NUT, 4-40 x 1/4" x 3/32"
	2-132616	NUT, 6-32" x 1/4" x 3/32"; 6 used
	29-5321	LUG, solder (meter); 2 used
	29-128018	LUG, solder (front panel)
	36-80389A88	KNOB; 2 used
	15-80389A59	HOUSING, connector support
	43-80389A89	BUSHING, spacer; 4 used
	42-82325L01	RETAINER, speaker
	42-80389A57	HOLDER, battery (p.c. mount)
	43-80347A55	BUSHING, spacer; 2 used
	46-80389A38	STUD, 1/4 turn; 4 used
	04-80349A36	SPRING; 4 used
	04-80349A37	WASHER, wear; 4 used
	43-868874	RING, split; 4 used
	64-80389A53	PANEL, front (RTL-4118A)
	01-80389A20	COVER ASSEMBLY (RTL-4118A)
	64-80389A52	PANEL, front (RTL-4119A)
	01-80389A40	COVER ASSEMBLY (RTL-4119A)

**note:** For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

END OF DOCUMENT

PARTS LIST