

KENWOOD

DM-81

DIP METER

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INTRODUCTION

A dip meter is used for adjustment of radio equipment and antennas. The DM-81 is a self-excited oscillator designed for external coupling to the equipment being tested. It features both inductive and capacitive coupling for measuring enclosed coils and toroidal coils (patent pending). This is not possible with conventional testing instruments.

The DM-81 has the following two functions:

Inductive coupling

As shown (Figure 1A), place the coil unit of the dip meter in close proximity to the circuit being measured.

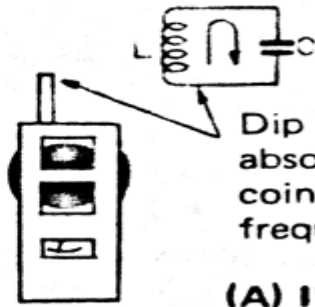
Adjust the dial. When the dip meter oscillation frequency coincides with the resonant frequency (tuned circuit), oscillating energy is absorbed by the circuit, thus decreasing the oscillation strength.

This strength is indicated on the meter. The pointer swings back momentarily at the resonant point. Since the meter pointer dips at a tuned point, this instrument is called a dip meter.

Capacitive coupling

This is a special feature of the DM-81 which is not found in any other dip meter. The resonant frequency can be checked simply by touching the capacitance probe to the hot side of the resonant circuit under test, instead of coupling the DM-81's coil and measuring inductively. The frequency is read directly on the dial. See Figure 1B.

Radio equipment is miniaturized and most coils are enclosed in metal shields. Also, toroidal coils are used in many types of radio equipment, and these coils do not couple to conventional dip meters. The DM-81 has solved this problem.



Dip meter oscillation energy is absorbed where its frequency coincides with resonant circuit frequency under measurement.

(A) INDUCTIVE COUPLING

Meter pointer deflection

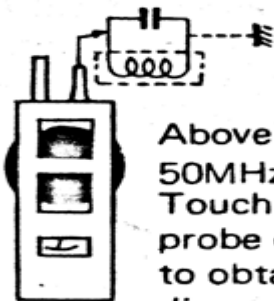
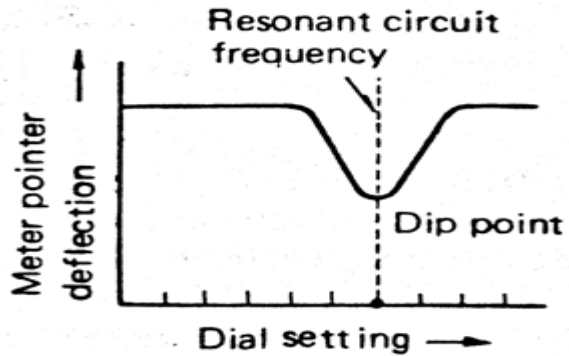
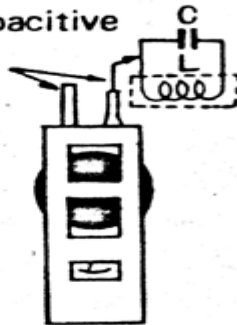


Oscillation frequency differs from resonant circuit frequency.



Oscillation frequency coincides with resonant circuit frequency.

Touch the hot side of the resonant circuit with the capacitive probe.



Above 50MHz
Touch the probe only to obtain a dip.



Below 50MHz.
Touch the probe, and a ground clip.

(B) CAPACITIVE COUPLING

Figure 1. Dip Meter Operation

FEATURES

1. Measurable frequency range is 700kHz to 250MHz in seven bands.
2. All seven dip meter coils, capacitive probe, earphone and ground clip lead, can be carried within the unit for easy transport and storage.
3. Convenient for both in indoor and outdoor measurements, all solid-state and built-in battery.
4. HC-25U and FT-243 sockets enable use as a crystal checker and marker generator.
5. Amplitude modulation is convenient in aligning receivers when using your DM-81 as a signal generator. Also, when used as the marker generator, amplitude modulation is helpful in precisely calibrating the dial scale even for a receiver having no BFO.
6. An FET and transistor are used in the meter circuit to provide extremely good sensitivity.
7. As an absorption frequency meter, your DM-81 is used both to align transmitters and measure field strength.
8. An earphone plug allows you to monitor transmitted signals.
9. A capacitive probe allows measurements without removing coil shields.
10. It is possible to measure resonant circuit frequencies of toroidal coils. This is not possible with conventional dip meters.

SPECIFICATIONS

Frequency range:	700kHz - 250MHz ($\pm 3\%$) A band 0.7 - 1.6MHz ($\pm 3\%$) B band 1.5 - 3.6MHz ($\pm 3\%$) C band 3.0 - 7.4MHz ($\pm 3\%$) D band 6.9 - 17.5MHz ($\pm 3\%$) E band 17 - 42MHz ($\pm 3\%$) F band 41 - 110MHz ($\pm 3\%$) G band 83 - 250MHz ($\pm 3\%$)
Modulation:	1 kHz (sine wave)
Power requirements:	Battery, 9V(006P)
Power consumption:	9 mA
Semi-conductors:	1 FET, 3 transistors, 3 diodes
Crystal oscillator element to be used:	HC-25U and FT-243
RF search terminal:	For measuring resonant frequency (capacitive coupling) and checking RF voltage using the supplied probe.
Earphone terminal:	Accepts crystal earphone with 3.5 ϕ plug for monitoring modulated tone.
Dimensions:	70W x 180H x 45D (mm)
Weight:	Approx. 690g (with accessories)
Accessories:	(1) Coils, A-G bands — 7 pieces (2) Probe — 1 piece (3) Ground clip — 1 piece (4) Crystal earphone — 1 piece (5) Battery, 006P — 1 piece

CAUTION: Do not apply a voltage exceeding 500V (DC + AC peak) to the probe.

CONTROLS

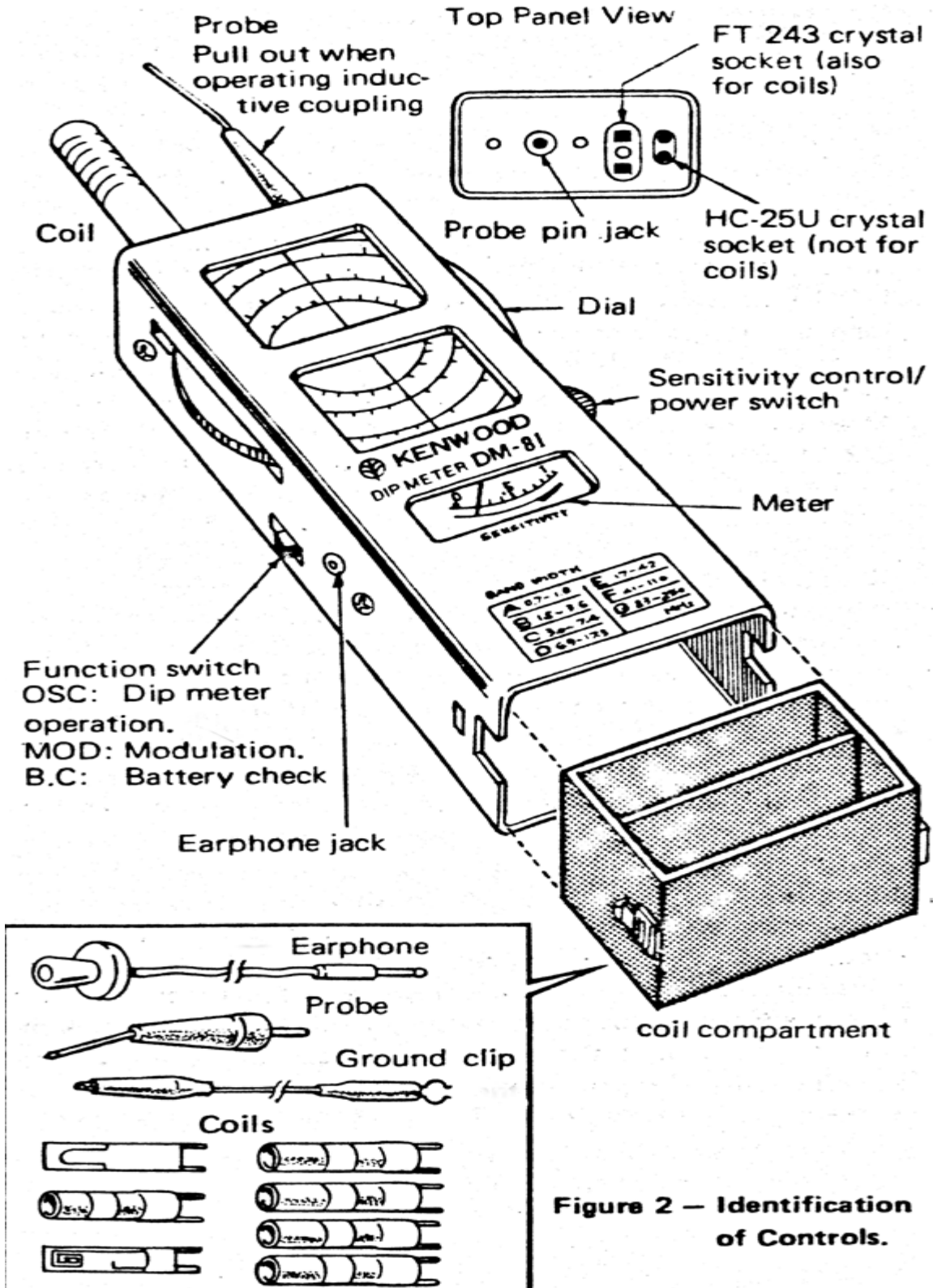


Figure 2 – Identification of Controls.

PRECAUTIONS

Battery and Oscillation Coil Loading

Taking the coil compartment out, you will find a battery snap connector inside the unit. Fit the snap to the battery. First lay the battery take-out ribbon into the battery holder, then install the battery in place. Place the supplied oscillation coils into the coil compartment and reinstall into the dip meter main body.

Verify that the battery is serviceable before operating your DM-81. First, turn the POWER switch on. Set the FUNCTION switch to "BATT CHECK". The battery is usable as long as the meter pointer is within the "B.C" zone. A low battery results in weak or unstable oscillation, no oscillation, or frequency error. Replace the battery when weak.

After use, be sure to turn the POWER switch off. If your DM-81 will not be used for a long period of time, remove the battery. You can easily remove it by pulling the take-out ribbon toward you. Never remove the case screws.

Obtaining a Dip Point

The closer the dip meter is brought to the resonant circuit being checked, the tighter the two are coupled and the deeper the dip point. However, the tuning point becomes so broad that you cannot find the correct resonant frequency. Therefore, it is advisable to move the dip meter a little away from the circuit.

Note that the A band has a large pull-in effect and therefore the dip point is broad.

Measuring Transistor Resonant Circuits

There is no load problem in measuring vacuum tube resonant circuits. In measuring some resonant (tuning) circuits in transistorized transmitters and receivers, the resonant point cannot always be found by the dipping load. In this event, temporarily disconnect the transistor or operate the given resonant circuit with power on and measure by absorption.

Caution in Measuring Transmitters

Your DM-81 is usable as an absorption frequency meter in measuring transmitter power amplifier tank circuits and similar stages producing high RF energy. In measurement, do not abruptly bring the dip meter close to the circuit as the transistors and other parts in the dip meter could be destroyed by excess RF energy. Bring it near the circuit slowly while observing the meter pointer.

Caution in Motor Pointer Deflection Change

The meter pointer may swing slightly as if indicating a dip, This results from a variation in oscillation signal strength while tuning the oscillator variable capacitor. Move the dip meter coil away from the circuit under measurement. The meter pointer will return to full scale for a real dip.

APPLICATIONS

Use as a Dip Meter

1. Select an oscillation coil covering the desired frequency range.
2. Install the coil into the socket on top of the dip meter.
3. Set the FUNCTION switch to "OSC".
4. Turn the power on.
5. Turn the SENSITIVITY control until the meter pointer reads at division 0.7. If not to division 0.7, turn the control fully counter-clockwise.
6. Bring the dip meter coil about 1 cm from the tuned circuit to be measured and slowly turn the dial. The oscillator signal energy will be absorbed by the tuned circuit at the resonant point and the meter will dip abruptly. See Figure 3.

Note: At first, couple the dip meter coil tightly to the given tuned circuit so that you can easily find the dip point. Then, bring the oscillation coil away until the dip is as narrow as possible, and readjust the dial precisely for an accurate dip point. Now read the correct frequency on the dial.

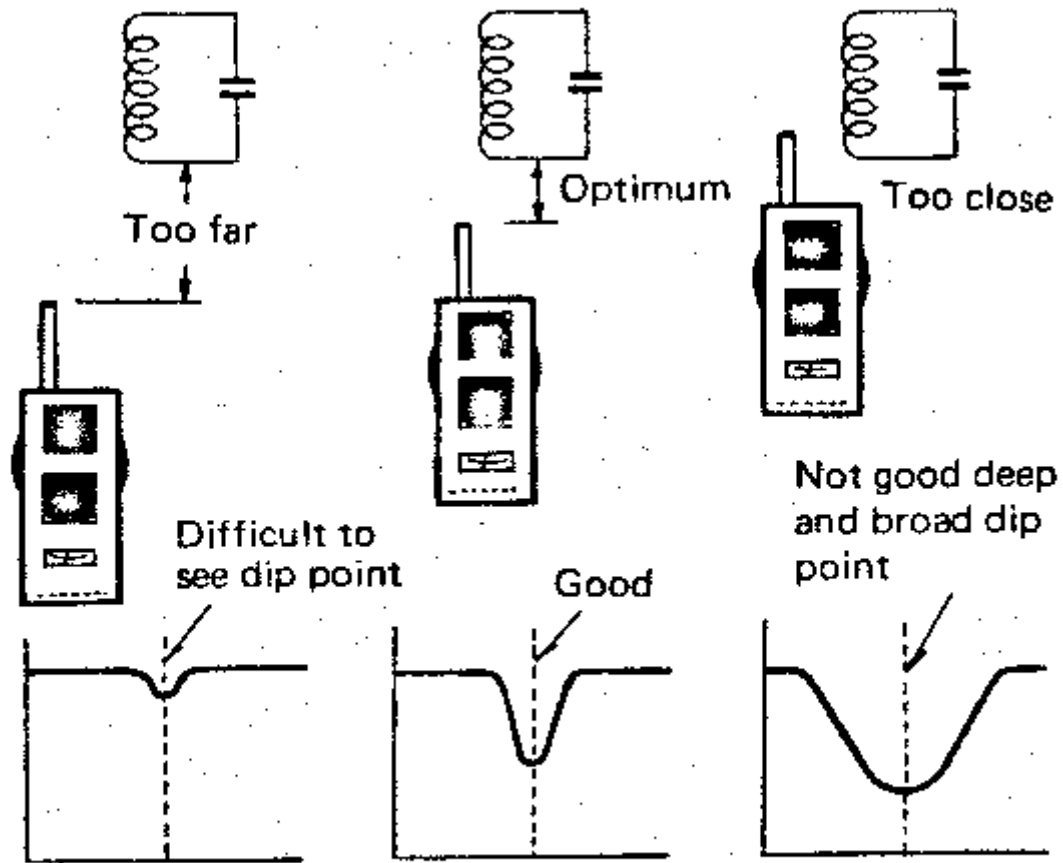


Figure 3 – Distance Adjustment for Accurate Dip Point

Other Frequency Measurements

Resonant circuit measurement

A basic measurement with your DM-81 is a frequency check of resonant (tuned) circuits comprised of coils and capacitors. In practice, the dip meter is brought near the coil to be measured as shown in Figure 1A. This illustrates a standard method of resonant frequency measurement.

Use of the capacitive probe

If a coil to be measured is located in a narrow place and cannot be coupled to the dip meter coil, or if a coil is enclosed in a shield, the probe can be used for accurate measurement. See Figure 4.

The dip point can be obtained by using the ground clip and probe for frequencies of about 50MHz or lower, and the probe only for about 50MHz and higher. Toroidal coils can be measured in the same manner. Note that the probe should be connected to the hot side (not the ground side) of the circuit. See connections (a) through (e) in the illustration. The dip point is sometimes critical depending on the circuit or frequency to be measured. An accurate dip point can be obtained by turning the dial slowly.

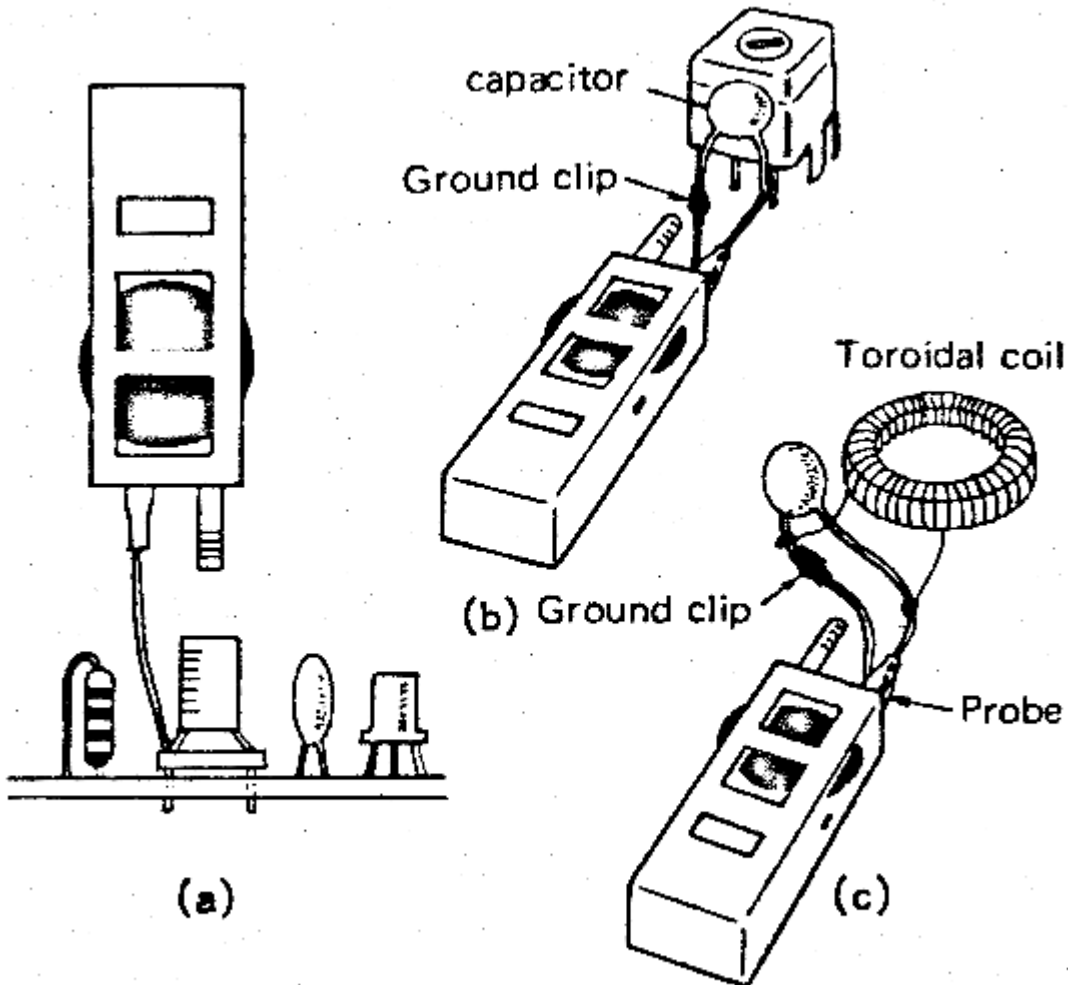


Figure 4: Use of the probe

Antenna resonant frequency measurement

Any antenna can be regarded as a kind of resonant circuit. Its resonant frequency, therefore, can be measured as illustrated in Figure 5. For measurement, connect a one-turn coil to the feed point at the center of the antenna.

Couple it with the dip meter coil. Now, you can obtain the antenna resonant frequency in a similar manner to APPLICATIONS Section A. For a vertical antenna or similar antennas for which the other feeder lead is grounded, place the one-turn coil between the antenna and ground.

Couple the one-turn coil to the dip meter until a dip point is obtained. Then, slowly separate the coil to measure the resonant frequency accurately.

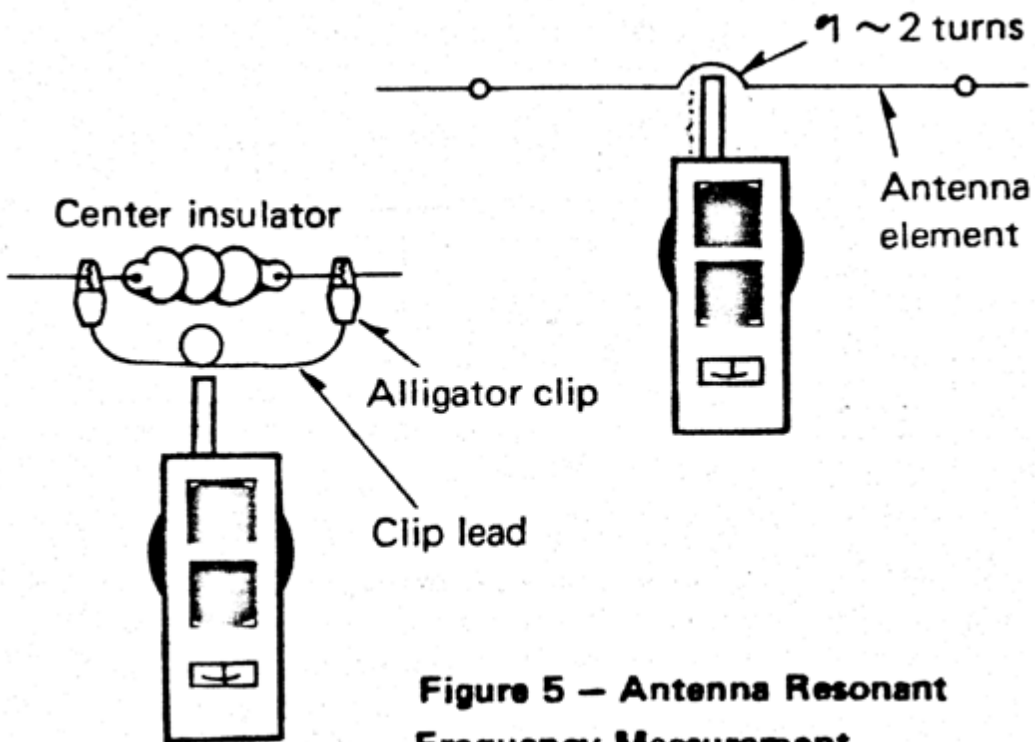


Figure 5 – Antenna Resonant Frequency Measurement.

Use as a Signal Generator

Your DM-81 can be used as a signal generator for aligning receivers and similar equipment. Couple the dip meter to the antenna circuit of the receiver as illustrated in Figure 6. The dip meter output carrier will enter the receiver. For aligning an AM receiver, set the FUNCTION switch to "MOD". The receiver will sound a 1kHz tone. Aligning SSB and CW receivers can be achieved by leaving the switch at "OSC" for no modulation. Adjust the capacitor trimmers and inductor cores for maximum receiver "S" meter reading or maximum speaker output.

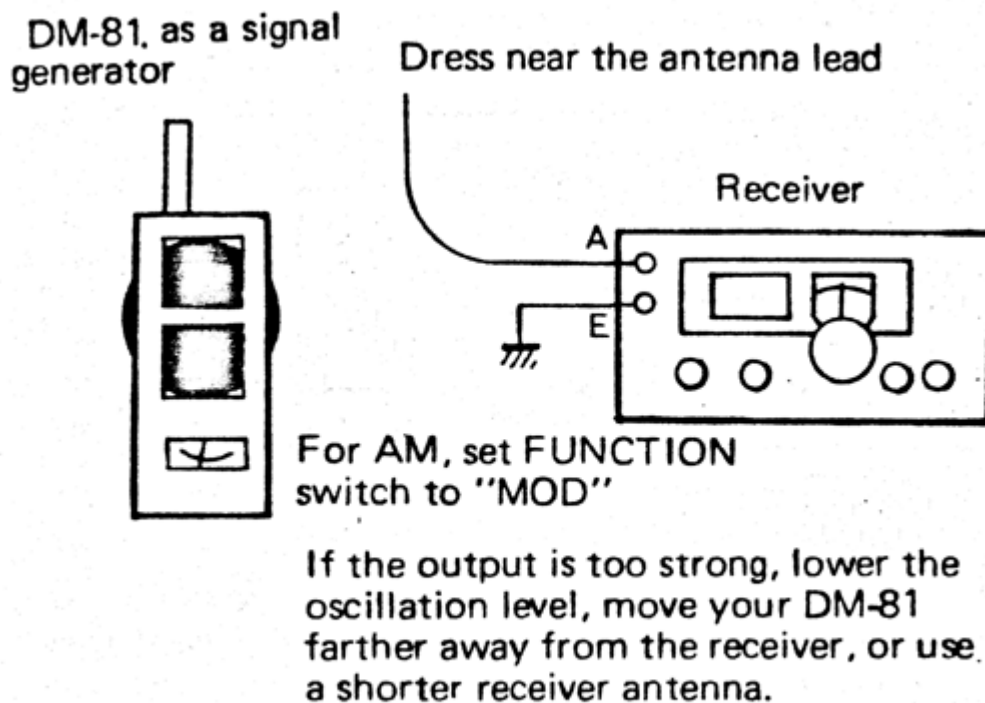


Figure 6 – Use as a Signal Generator.

Use as Crystal Checker and Marker Generator

Your DM-81 can be modified as a crystal checker by installing a crystal in place of the oscillation coil (see Figure 7).

You may use either HC-25U or FT-243 crystals. Also, an HC-6U crystal can be checked if plugged into the FT-243 socket. The oscillation signal strength may vary depending on the type and frequency of the crystal used. Adjust the dial for most stable oscillation.

In addition, your DM-81 is applicable as a marker generator by installing a marker crystal of 1MHz, 3.5MHz, or the like. The marker generator is useful for calibrating a receiver dial.

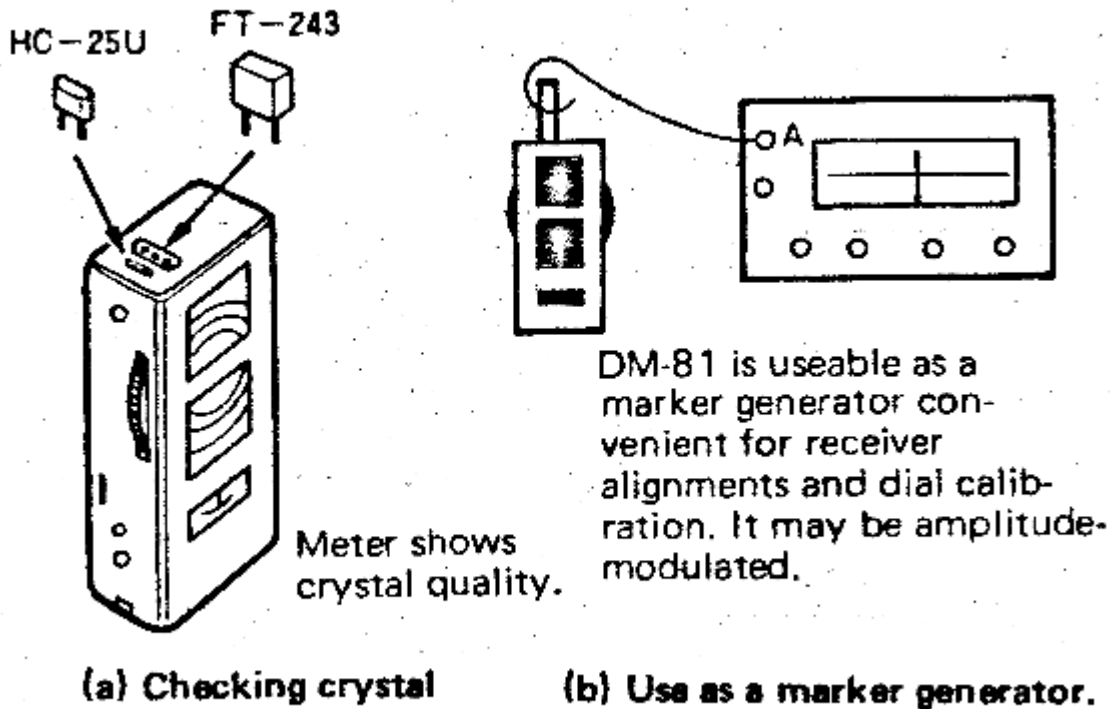


Figure 7 – Use as a Crystal-Controlled Signal Generator.

Use as an Absorption Frequency Meter

Install an oscillation coil covering the desired frequency range into the socket. Turn the SENSITIVITY control ON and adjust to the minimum meter deflection (just before the OFF position of the control), and set the FUNCTION switch to OSC. You can now use your DM-81 as an absorption frequency meter to receive external energy and indicate its frequency on the meter.

Figure 8a shows how to measure oscillator frequency. The oscillator coil is coupled with, or brought near, the absorption frequency meter coil. Adjust the dial for maximum meter deflection and read the oscillation frequency. Figure 8b shows the absorption frequency meter coupled to a transmitter tank coil. Its radiated energy can be measured in a similar manner to that of Figure 8a.

CAUTION: A transmitter power amplifier stage produces high RF energy. The absorption frequency meter should be brought near the tank coil slowly so the

meter pointer does not deflect off scale. The earphone allows you to monitor modulation.

WARNING: Tube type power amplifiers operate at high RF and DC potentials. Transistorized power amps also produce high RF levels. Observe normal safety procedures for high RF and DC circuits.

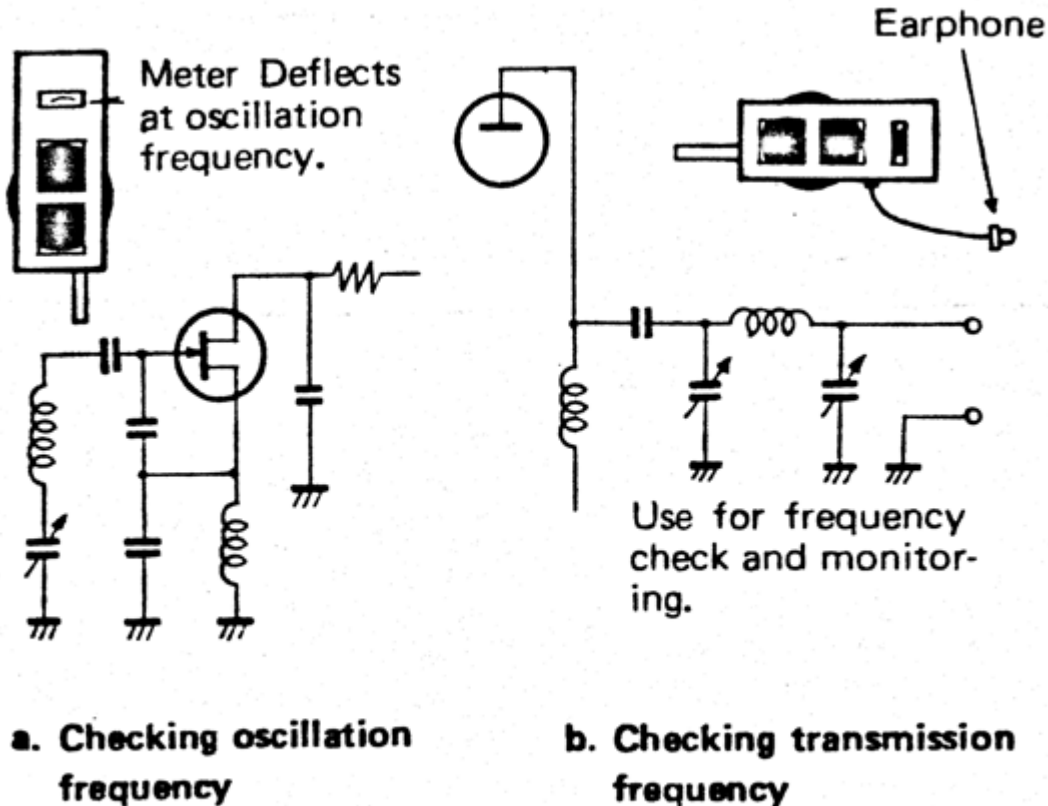


Figure 8 – Use as Absorption Frequency Meter.

Use as a Field-Strength Meter

Your DM-81 can be used to measure the field strength of a transmit antenna. Set up as directed in APPLICATIONS: "Use as Absorption frequency meter". In addition, couple to an antenna as in Figure 9. You can now measure field strength. This application is convenient for transmit antenna matching, radiation pattern adjustments, and similar uses.

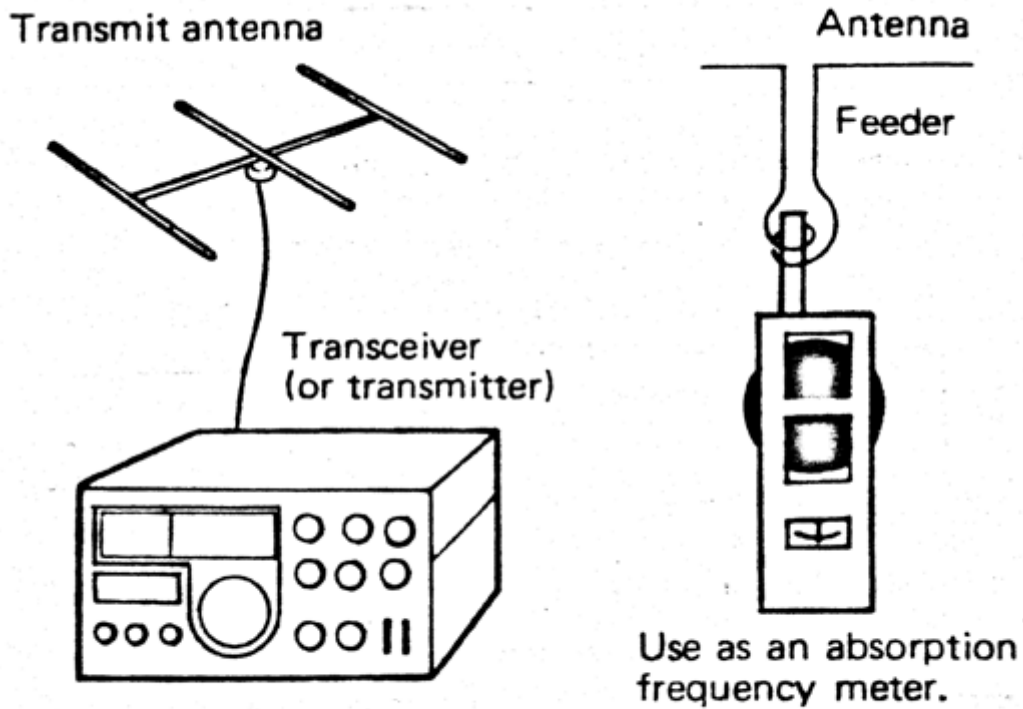


Figure 9 – Use as Field-Strength Meter.

Capacitance and Inductance Measurements

The value of an unknown inductor can be obtained in combination with a known capacitor by their resonant frequency, as illustrated in Figure 10. Likewise the value of an unknown capacitor can be calculated. The inductance (L), capacitance (C), and resonant frequency (f) are related as:

$$f = 1 / (2\pi \sqrt{LC})$$

This formula can be rewritten as

$$L = 25,400 / (f^2 C)$$

$$C = 25,400 / (f^2 L)$$

Where

L = inductance in μH
 C = capacitance in pF
 f = frequency in MHz

An inductance or capacitance can easily be calculated by substituting the known values into the above equations.

The oscillation coils supplied with your DM-81 are useful as the known inductor. Their inductances are

BAND	INDUCTANCE
A	1250 μH
B	160 μH
C	39 μH
D	8.4 μH
E	1.2 μH
F	0.22 μH
G	0.047 μH

In addition to all these applications, your DM-81 is usable in place of a receiver local oscillator in repairing or alignment, and is effective in other services as well. Also, your DM-81 can serve as a BFO for a receiver without one in receiving a CW or SSB signal. It is useful in a wide variety of situations. By fully understanding the principles of operation your DM-81's capabilities may be extended to other applications.

For an additional source of general information, the radio amateur's handbook is recommended.

a. Inductance measurement. b. Capacitance measurement.

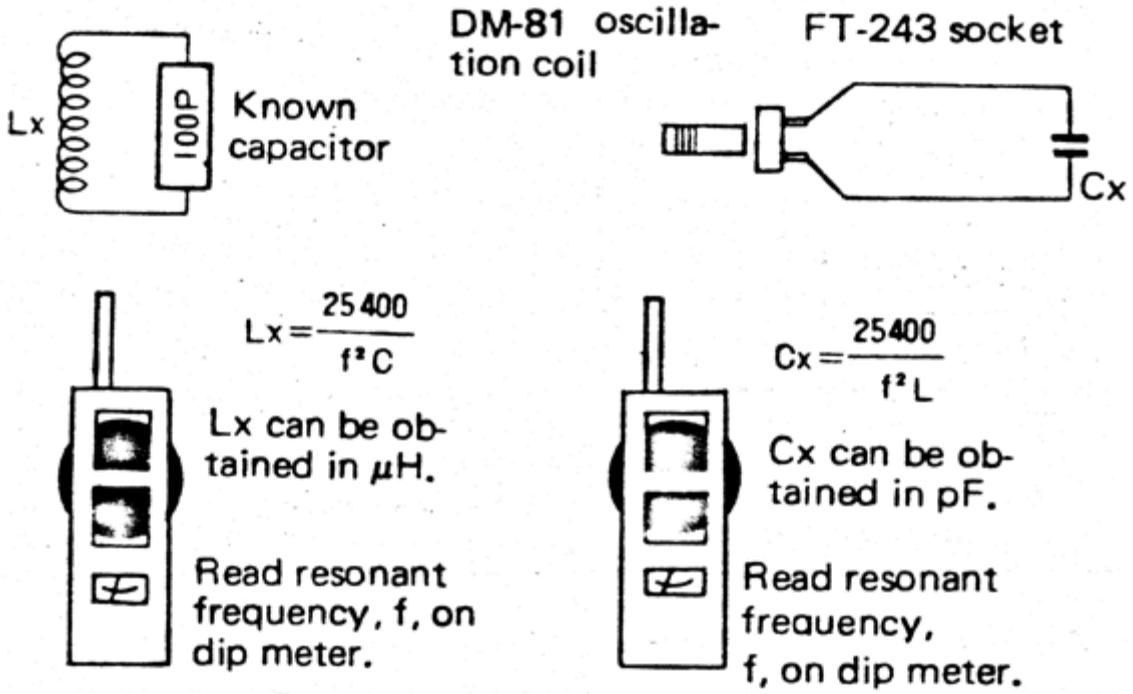


Figure 10 – Inductance and Capacitance Measurements.

ADJUSTMENT

VR1: 01 Bias adj.

By using G band, adjust VR1 so that the meter pointer deflection is maximum at 83MHz.

VR2: Meter zero adj.

Adjust VR2 so that the meter deflection is zero when the sensitivity control/power switch is set to just before the OFF position of the control.

VR3: Sensitivity adj.

Optimum position.

VR4: Battery voltage check adj.

Adjust VR4 so that the meter deflection comes to the left edge of the "B.C" zone at 7V when the FUNCTION switch is set to "B.C" position.

PARTS AND SERVICE

Ordering Spare Parts

When ordering replacement or spare parts for your equipment, be sure to specify the following:

Model and serial number.

Schematic number of the parts.

Printed circuit board number on which the part is located.

Part number and name, if known, and quantity desired.

Service

Should it ever become necessary to return this equipment for repair, pack in its original boxes and packing, and include a full description of the problems involved. Also include your telephone number. You need not return accessory items unless directly related to the service problem. Tag all returned items with your call for easy I.D.

Please mention the model and serial number of your unit in any correspondence, whether phone or written. For future reference, record this information in the space provided on the back cover of this manual.

NOTE:

When claiming warranty service, please include a photocopy of the bill of sale, or other proof of purchase showing the date of sale.

PARTS LIST**MAIN CHASSIS**

Ref. #	Part #	Description
	A01-0859-08	Case top
	A01-0860-08	Case bottom
	A09-0506-08	Coil case
	A10-0471-28	Chassis
	A29-0502-08	Top panel
	B20-0918-28	Dial scale
	B23-0602-08	Front glass
	B31-0719-08	Meter
	B40-0772-08	Name plate (serial #)
	B50-2920-00	Instruction manual
	C01-0191-08	Variable capacitor
	E11-0061-08	Pin jack
	E13-0101-05	Phone jack
	E18-0207-08	Crystal socket (FT-243)
	E18-0402-08	Crystal socket (HC-2511)

AMP UNIT (X73-1350-00)

Ref. #	Part #	Description
RESISTOR		
R11	RD14BB2E563J	Carbon resistor 56K Ω \pm 5% 1/4W
R12	RD14BB2E124J	Carbon resistor 120K Ω \pm 5% 1/4W
R13	RD14BB2E683J	Carbon resistor 68K Ω \pm 5% 1/4W
R14	RD14BB2E472J	Carbon resistor 4.7K Ω \pm 5% 1/4W
R15	RD14BB2E222J	Carbon resistor 2.2K Ω \pm 5% 1/4W
R16	RD14BB2E561J	Carbon resistor 560 Ω \pm 5% 1/4W
VR2	R12-2506-08	Semi-fixed resistor 5K Ω
VR3	R05-3002-08	Variable resistor (with SW) 10K Ω

	E29-0524-08	Probe
	E30-1839-08	Ground clip
	E91-0401-08	Battery snap
	F20-0619-08	Insulating plate
	H01-2914-08	Packing case (inside)
	H12-0533-08	Pad (formed styrene)
	H19-0507-08	Accessory box
	H25-0165-08	Polyethylene bag
	H25-0166-08	Polyethylene bag
	J19-0477-08	Battery holder
	J21-1460-08	Coil mounting hardware
	J21-1461-08	Variable capacitor mounting hardware
	J25-1279-08	Printed circuit board
	K29-0254-08	Push-button
	K29-0255-08	Dial
	L37-0017-08	Coil A
	L37-0018-08	Coil B
	L37-0019-08	Coil C
	L37-0020-08	Coil D
	L37-0021-08	Coil E
	L37-0022-08	Coil F
	L37-0369-08	Coil G

CAPACITOR		
C11	CE04W1C100	Electrolytic 10 μ F 16WV
SEMI-CONDUCTOR		
		FET 2SK19 (GR)
		Transistor 2SA719
		Zener diode RD-6, 2EB
MISCELLANEOUS		
	K29-0256-08	Knob
	J25-2888-08	Printed circuit board

HIGH FREQUENCY UNIT (XB4-1040-00)

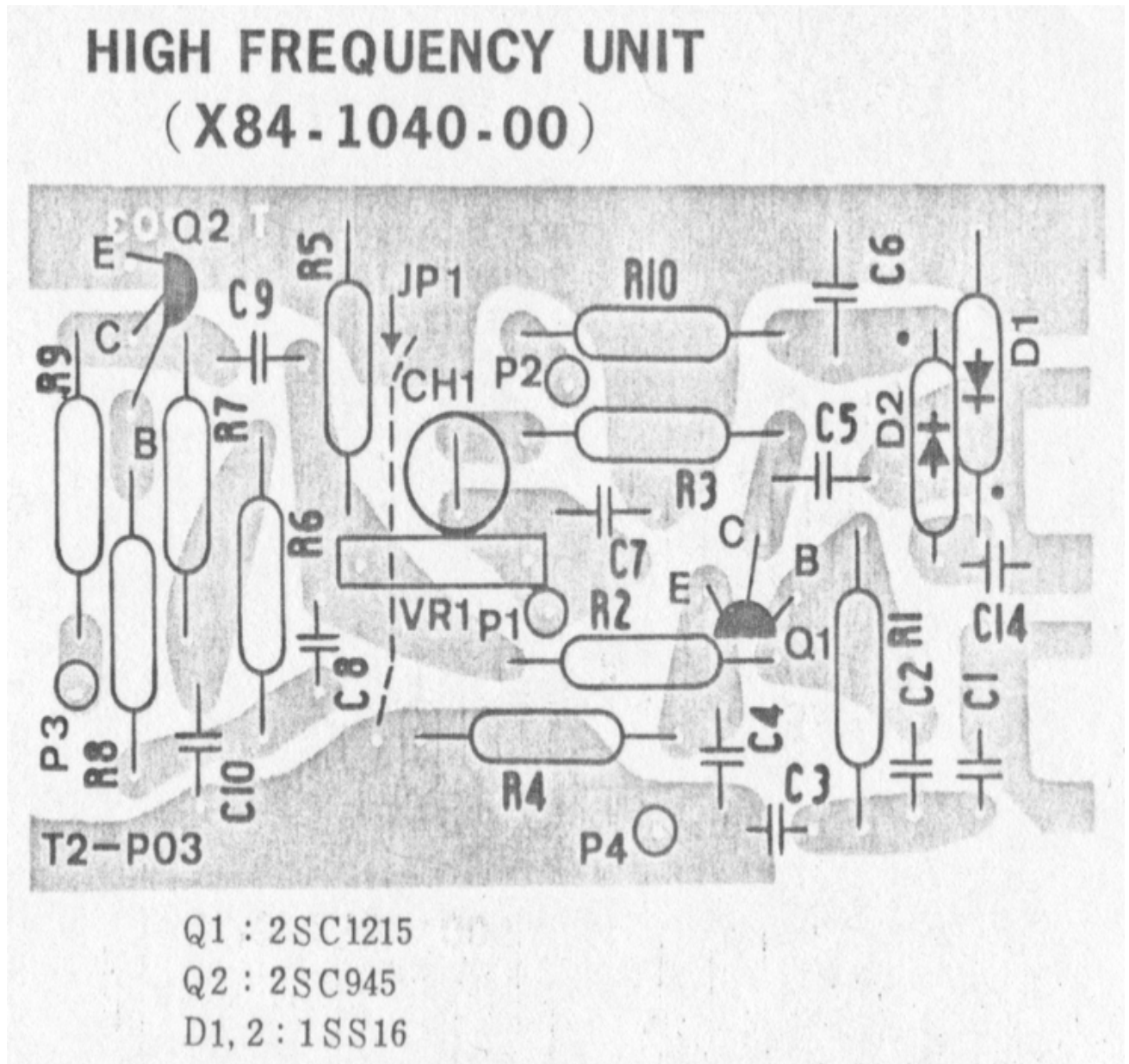
Ref. #	Part #	Description
RESISTOR		
R1	RD14BB2E562J	Carbon resistor 5.6K Ω \pm 5% 1/4W
R2,6,7	RD14BB2E124J	Carbon resistor 120K Ω \pm 5% 1/4W
R3	RD14BB2E222J	Carbon resistor 2.2K Ω \pm 5% 1/4W
R4	RD14BB2E471J	Carbon resistor 470 Ω \pm 5% 1/4W

		Battery 006P 9V
C12	CC45SL2H050C	Ceramic capacitor 5pF 500WV
C13	CK45D1H103M	Ceramic capacitor 0.01 μ F \pm 20%
R17	RD14BB2E393J	Carbon resistor 39K Ω \pm 5% $\frac{1}{4}$ W
VR4	R12-3513-08	Semi-fixed resistor 20K Ω B
	T18-0052-08	Earphone
	S32-2001-15	Slide switch
	X73-1350-00	AMP unit
	X84-1040-00	High frequency unit

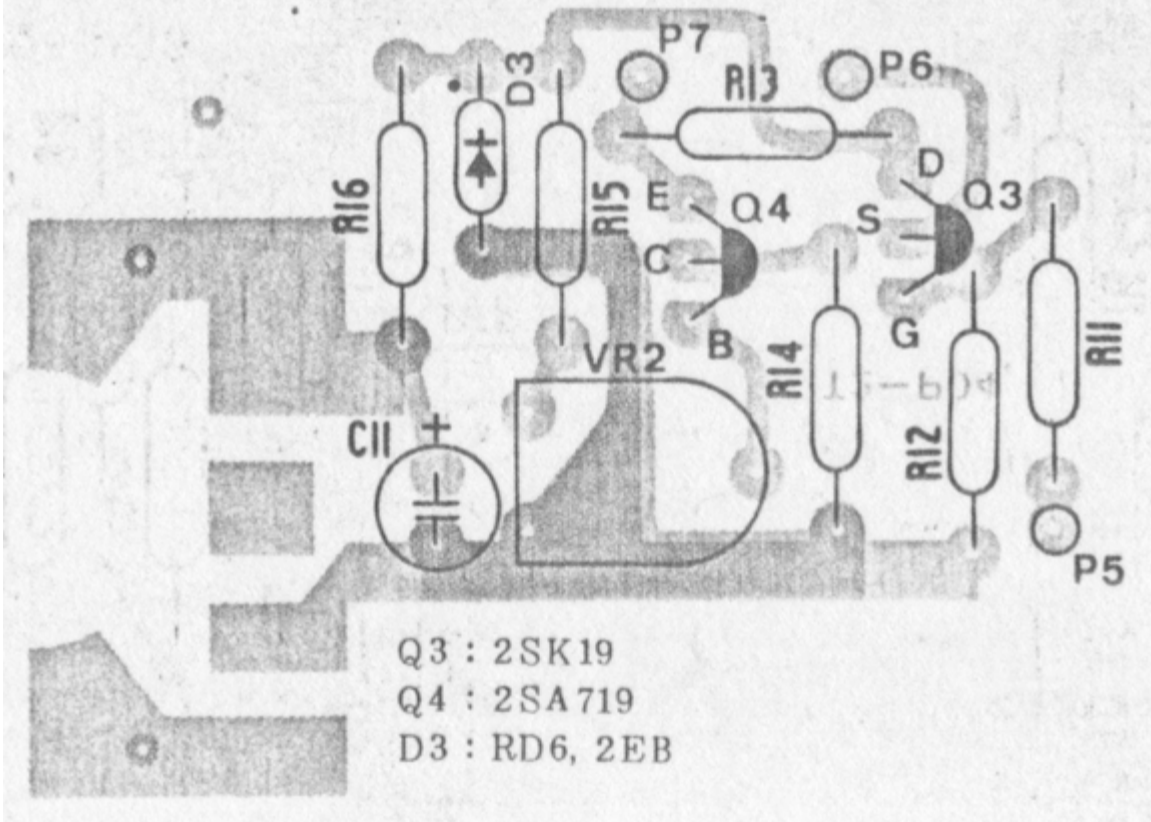
R5,8	RD14BB2E103J	Carbon resistor 10K Ω \pm 5% $\frac{1}{4}$ W
R9	RD14BB2E472J	Carbon resistor 4.7K Ω \pm 5% $\frac{1}{4}$ W
R10	RD14BB2E221J	Carbon resistor 220 Ω \pm 5% $\frac{1}{4}$ W
VR1	R12-3511-08	Semi-fixed resistor 20K Ω B
CAPACITOR		
C1	CC45SL1H470J	Ceramic 47pF \pm 5%
C2	CC45SL1H030C	Ceramic 3pF \pm 0.25pF
C3	CC45SL1H010C	Ceramic 1pF \pm 0.25pF
C4	CK45D1H103M	Ceramic 0.01 μ F \pm 20%
C5,7	CK45D1H102M	Ceramic 0.001 μ F \pm 20%
C6	CC45SL1H101J	Ceramic 100pF \pm 5%
C8-10	CQ92M1H472K	Mylar 4700pF \pm 10%
C14	CC45SL1H050C	Ceramic 5pF \pm 0.25pF
SEMI-CONDUCTOR		
Q1		Transistor 2SC1215 (S)

Q2		Transistor 2SC945 (K)
D1,2		Diode 1SS16
MISCELLANEOUS		
	L33-0262-08	Feri-inductor 2mH
	J25-2887-08	Printed circuit board

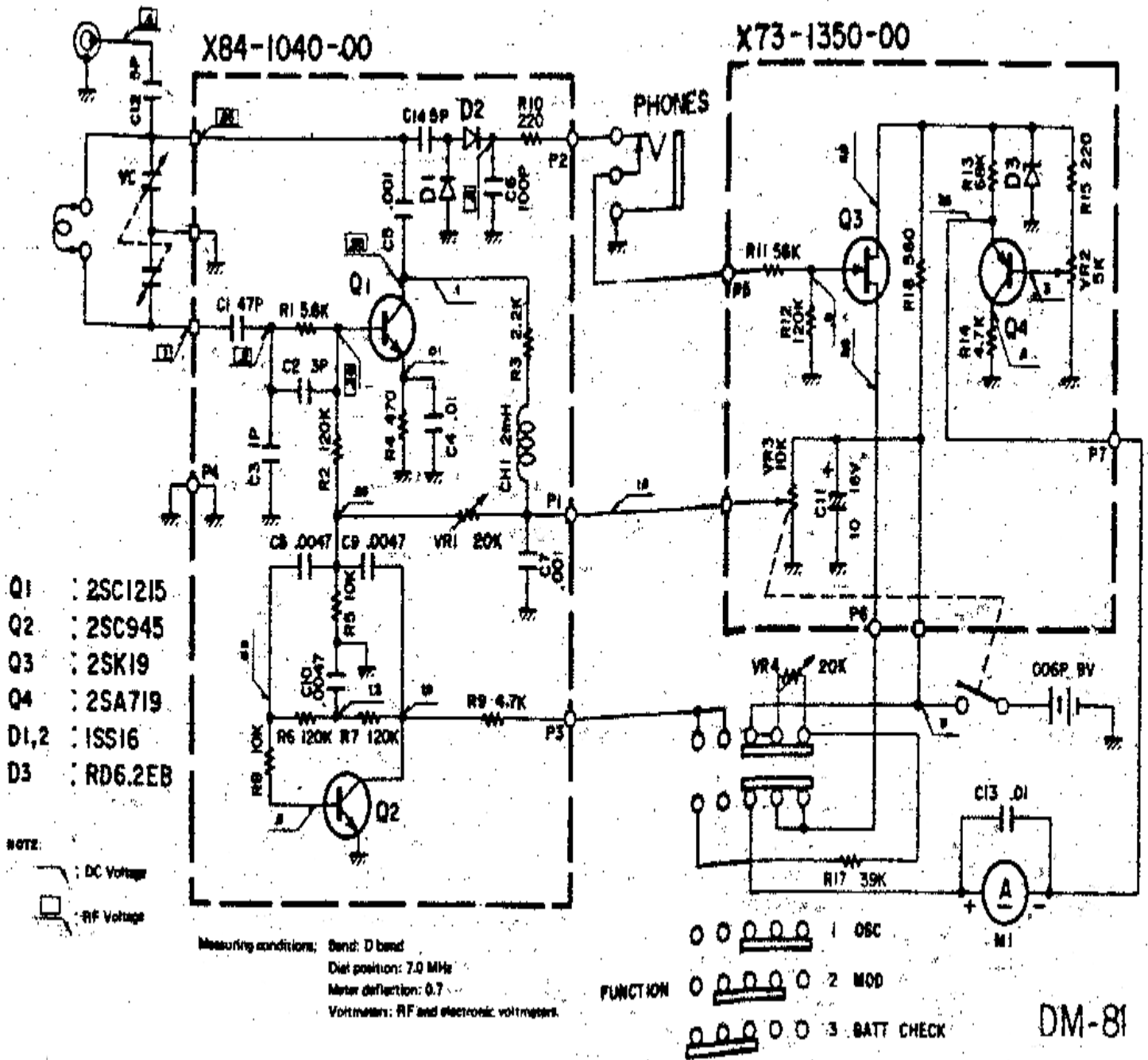
PRINTED CIRCUIT BOARDS



AMP UNIT (X73 - 1350 - 00)



SCHEMATIC DIAGRAM



Unless otherwise specified, resistors are 1/4W and ±5%. Also, the circuit elements may be changed without notice owing to a technical innovation.