

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.

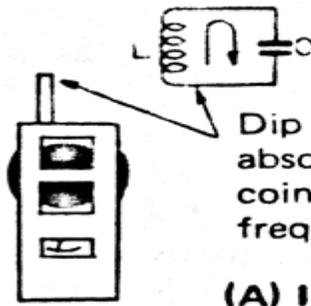
Adjust the dial. When the dip meter oscillation frequency coincides with the resonant frequency (tuned circuit), oscillating energy is absorbed by the circuit, thus decreasing the oscillation strength.

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

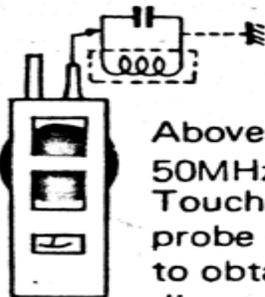
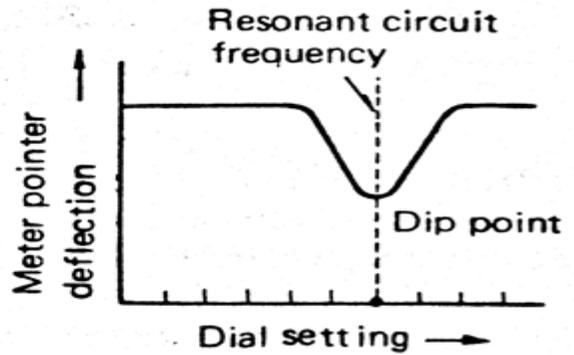
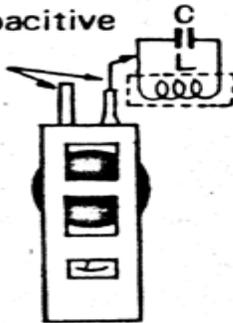


Oscillation frequency differs from resonant circuit frequency.



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

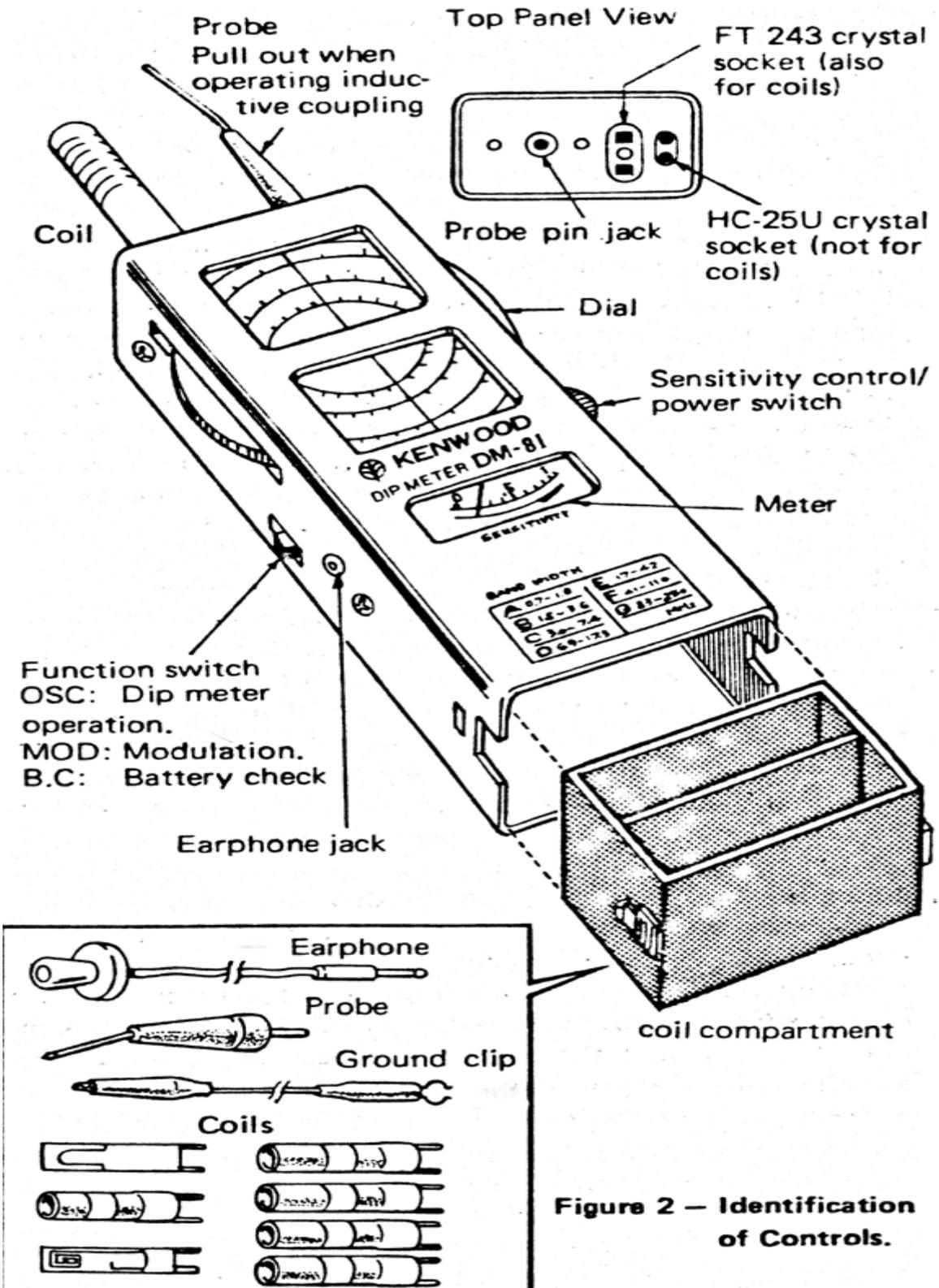


Figure 2 – Identification of Controls.

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.

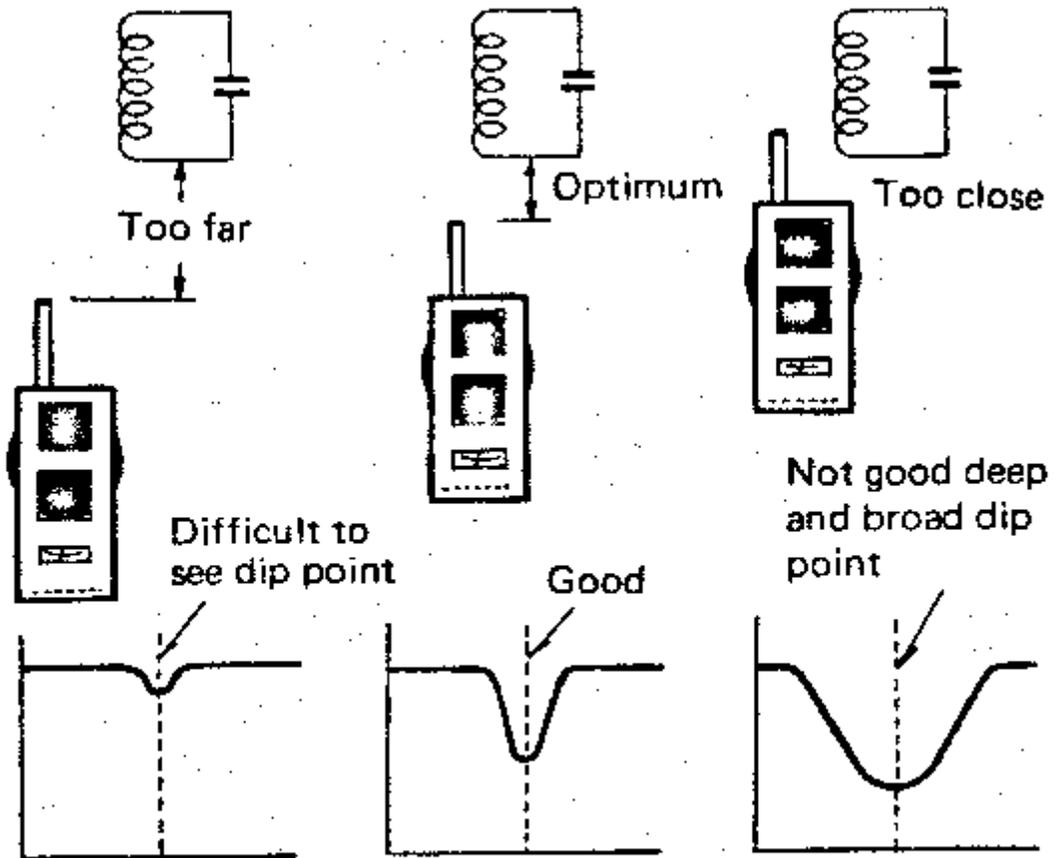


Figure 3 – Distance Adjustment for Accurate Dip Point

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.

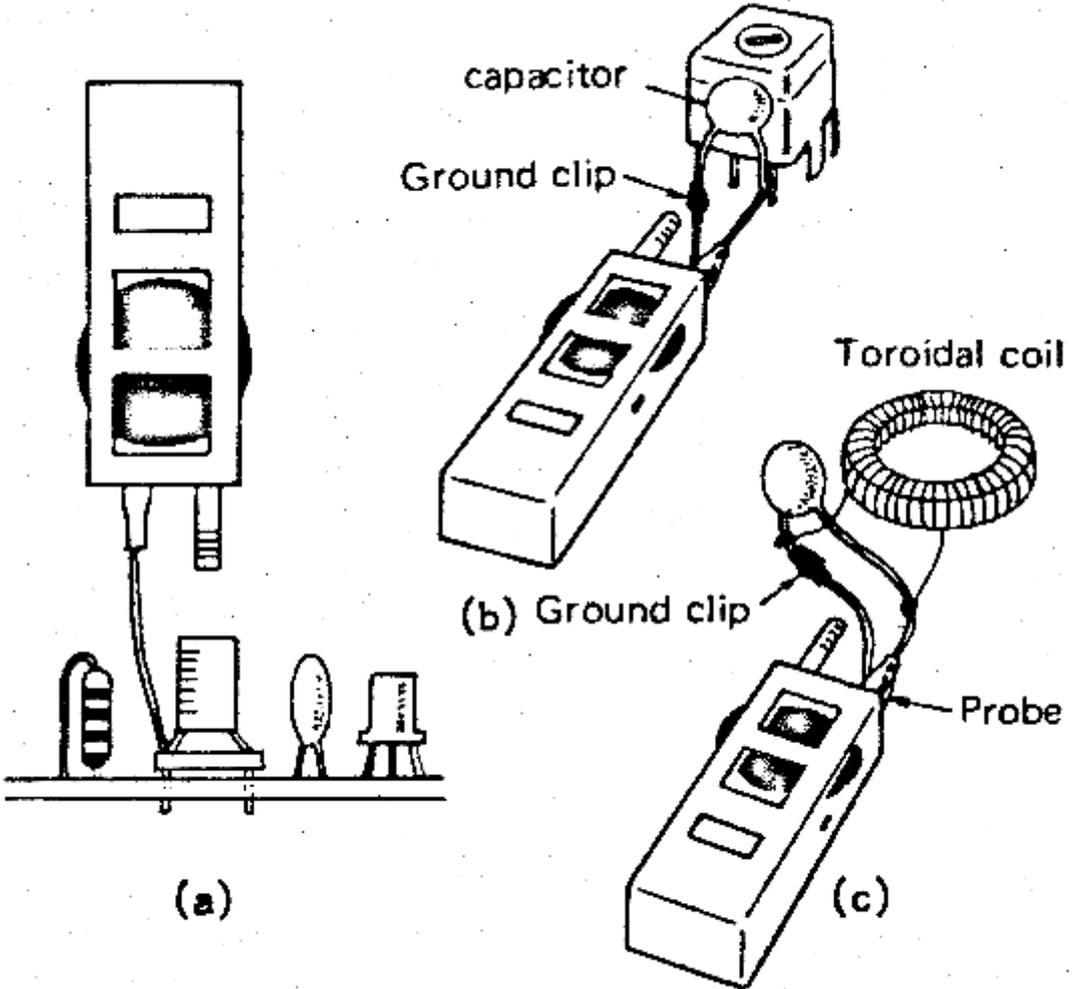


Figure 4: Use of the probe

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.

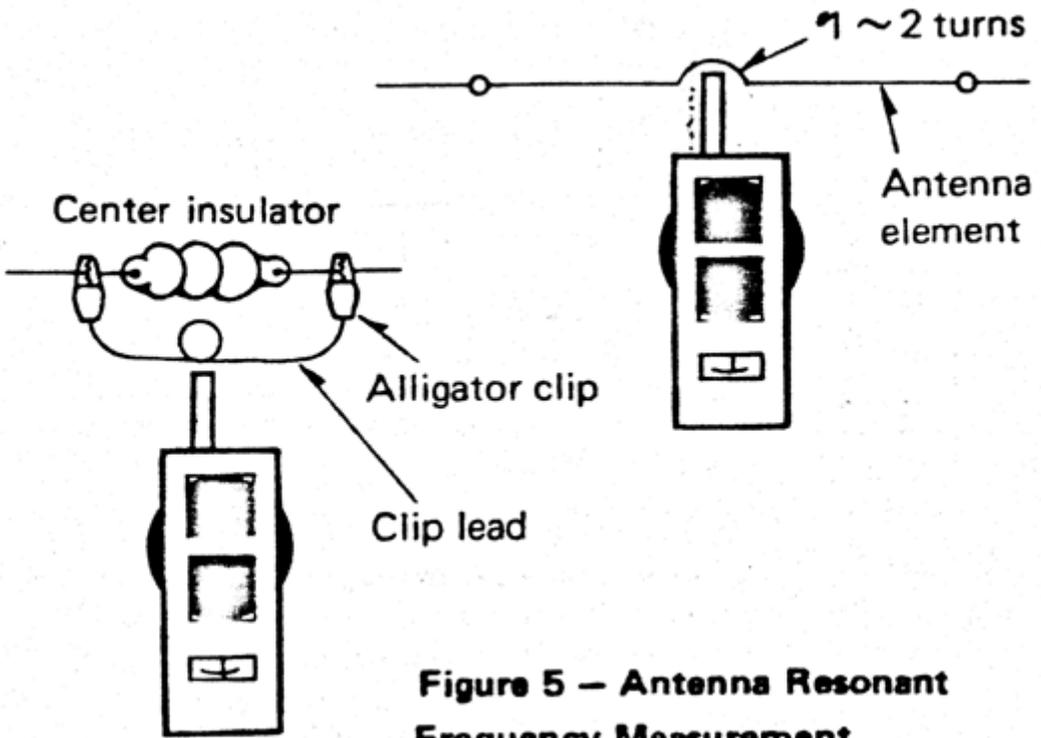


Figure 5 – Antenna Resonant Frequency Measurement.

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.

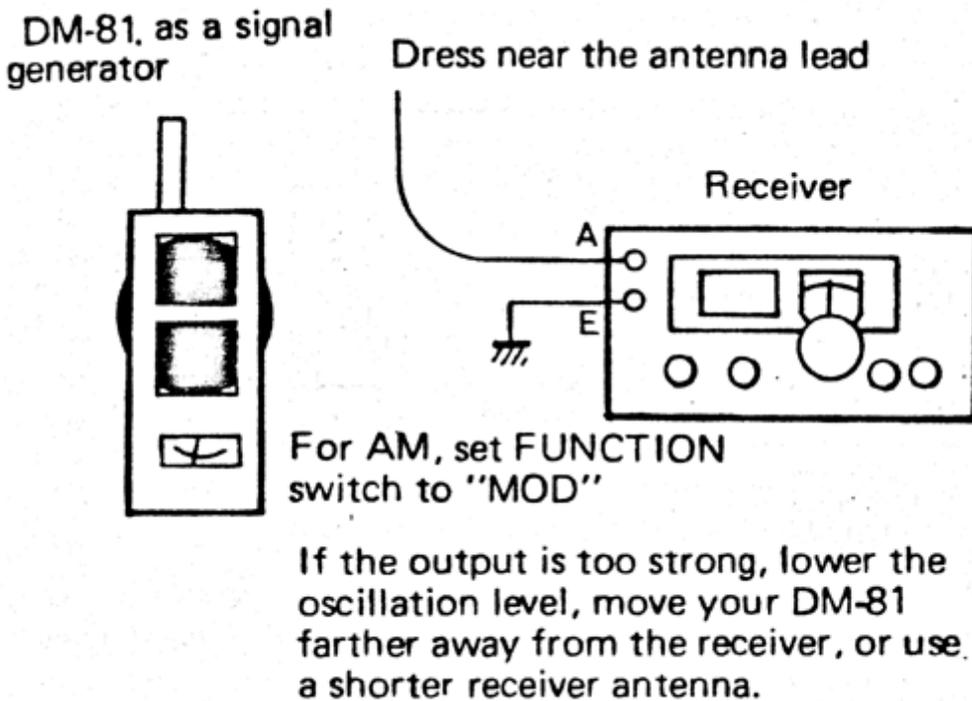


Figure 6 – Use as a Signal Generator.

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.

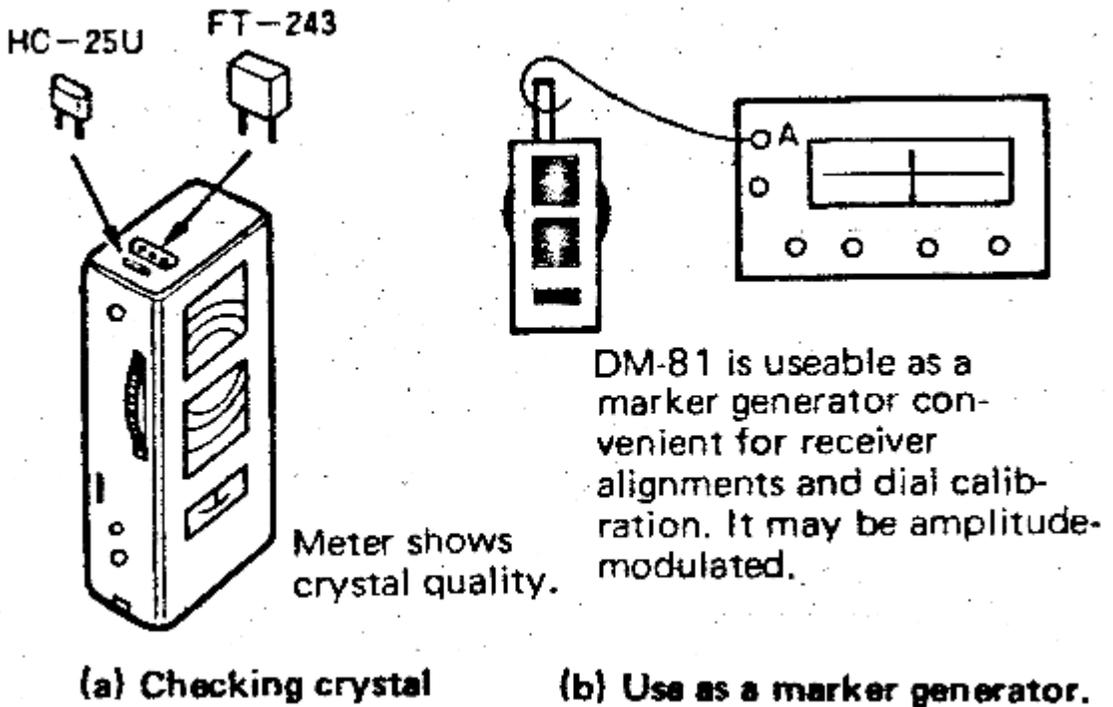


Figure 7 – Use as a Crystal-Controlled Signal Generator.

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 shows 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.

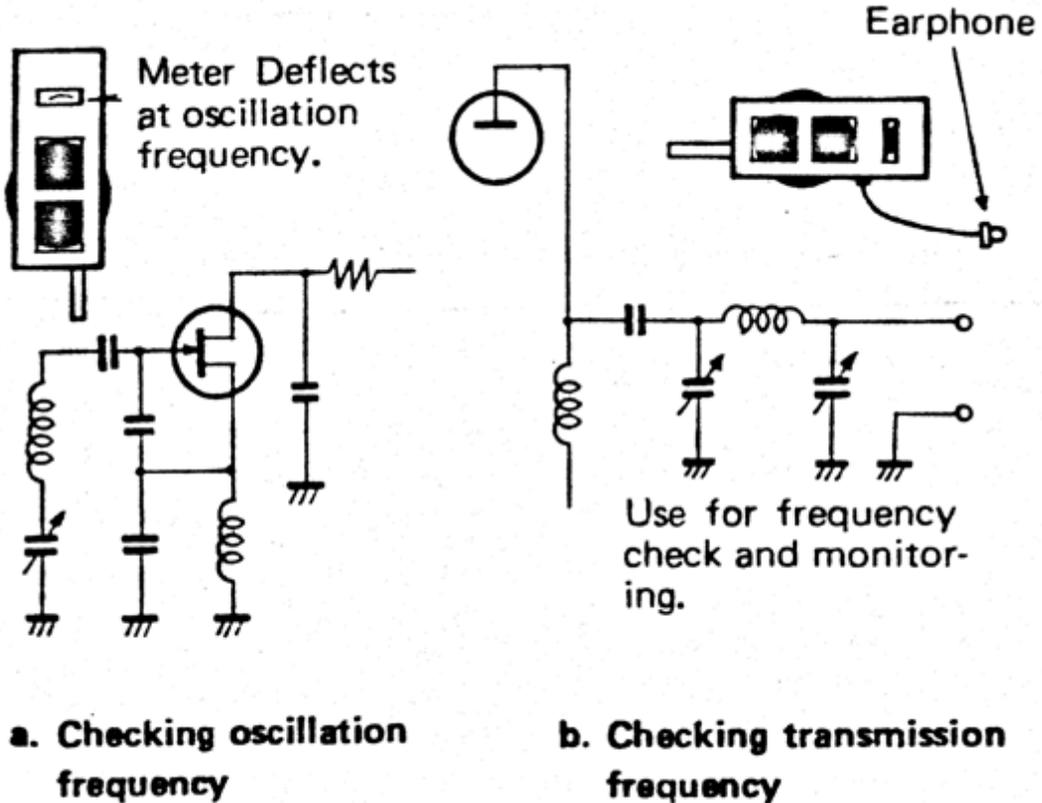
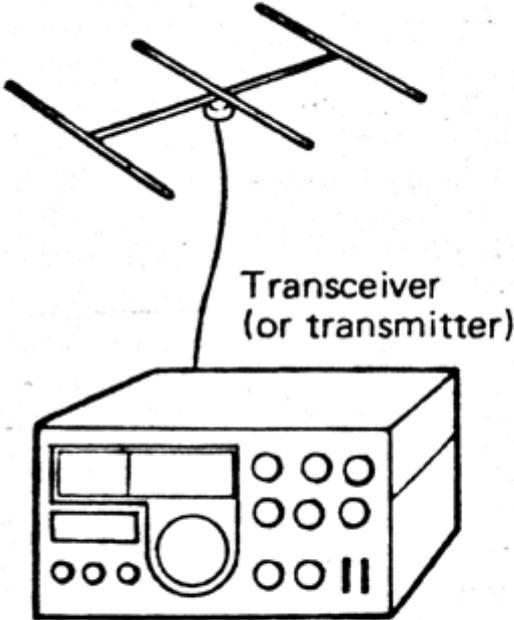


Figure 8 – Use as Absorption Frequency Meter.

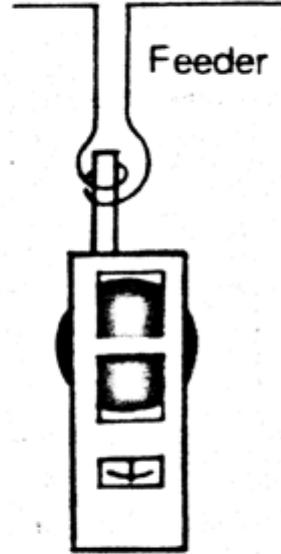
Use as a Field-Strength Meter

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.

Transmit antenna



Antenna



Use as an absorption frequency meter.

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