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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT MAINTENANCE

RADAR TEST SET

AN/UPM-60A

HEADQUARTERS, DEPARTMENT OF THE ARMY
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RADAR TEST SET AN/UPM-60A

CHAPTER 1

THEORY

Section I. BLOCK DIAGRAM

1. Scope

a. Manual.

(1) This manual covers field and depot maintenance for Radar Test Set AN/UPM-60A. It includes instructions appropriate to third, fourth, and fifth echelons for troubleshooting, testing, alining, and repairing the equipment, replacing maintenance parts, and repairing specified maintenance parts. It also lists test equipment for third, fourth, and fifth echelon maintenance. Detailed functions of the equipment are covered in the theory section.

(2) The complete technical manual for this equipment includes two other publications—

TM 11-6625-228-12.
TM 11-6625-228-12P.

(3) Forward comments concerning this manual to the Commanding Officer, U. S. Army Signal Publications Agency, Fort Monmouth, N. J.

Note. **For applicable forms and records, see paragraph 2, TM 11-6625-228-12.**

b. Theory.

(1) *Signal paths in power-meter operation* (fig. 1).

(*a*) When the test set is used to measure the output power of a radar transmitter, input signals are coupled to the input-output waveguide section through the RF connector and through a calibrated variable attenuator (AT2) to a temperature compensated power monitor. The power monitor consists of a bridge circuit and a power-level indicating meter calibrated in milliwatts and dbm (decibels relative to 1 milliwatt).

(*b*) The radio frequency (RF) shutter prevents the output Dower of the radar transmitter from reaching the klystron oscillator. The frequency meter (Z2) is detuned to insure an accurate power reading.

(2) *Signal paths in frequency-meter operation* (fig. 1).

(a) When the test set is used as a frequency meter, an absorption type frequency meter is tuned to resonance. The resonant frequency meter cavity causes a reduction of power level in the microwave section. This reduction of power at the resonant frequency shows up as a dip on the power meter (power monitor bridge). The resonant frequency (in megacycles) is indicated directly on a front panel counter which is geared to the tuning mechanism of the cavity.

(b) When measuring the frequency of a radar transmitter, the signal path is the same as described in (1) (*a*) above. When a sharp deflection occurs on the power meter, the frequency meter is tuned to the transmitter frequency. The frequency of the transmitter can be determined by reading the frequency on the WAVEMETER FREQUENCY dial.

(c) When measuring an external signal of unknown frequency, the signal path and method are the same as described in (*b*) above.

(d) When measuring the frequency of the klystron oscillator, the output signals from the klystron oscillator pass through the power set attenuator (AT3) to the RF shutter; this allows the klystron signals to reach the frequency meter (Z2), the power monitor bridge, and the RF connector. The frequency of the

klystron oscillator is measured when the frequency meter (Z2) causes a sharp deflection on the power meter.

(3) *Signal paths in signal-generator operation* (fig. 1).

(*a*) When the test set is used to measure the frequency of a radar receiver, synchronizing signals from the radar set are coupled to the INPUT SYNC jack, and thus produce delayed and undelayed triggers at jacks J10 and J11 respectively. The undelayed trigger is used to synchronize an oscilloscope with the test set and radar set. The delayed trigger produces sawtooth signals which modulate the klystron oscilator. Synchronized FM microwave signals from the klystron oscillator are attenuated by the POWER SET attenuator (AT3) to a 1-milliwatt reference level, and are allowed by the RF shutter to reach the frequency meter, power monitor bridge, and the RF connector. The microwave signals of known frequency and power are coupled from the RF connector to the radar receiver, producing false echoes which will appear as a target on the oscilloscope. When the wavemeter (Z2) is tuned to the frequency of the microwave signal, a dip will appear on the peak of the false target The WAVEMETER FREQUENCY dial will indicate the frequency to which the radar receiver is tuned.

(*b*) To measure the frequency bandwidth of a radar receiver, the signal generator is tuned to the radar receiver frequency, producing a false target as described in *(a)* above. The wavemeter is detuned and the peak of the false target is marked on the oscilloscope screen. The output of the signal generator is reduced to .5 milliwatts (-3 dbm) and the peak of the false target is marked on the oscilloscope screen. The second marking represents the half-power points. The output of the signal generator is increased to 1 milliwattt. The bandwidth of the radar receiver can be determined by noting on the WAVEMETER FREQUENCY dial when the frequency dip falls at the two halfpower points near the ends of the band-pass curve (false target). The difference between the readings obtained at the two points is the frequency bandwidth of the radar receiver.

(*c)* To measure the sensitivity of a radar receiver, the signal generator is tuned to the radar receiver frequency, producing a false target as described in (*a*) above. The output power of the signal generator is set at 1 milliwatt (0 dbm). When the grass (noise) level of the radar receiver has been set correctly, the ATTENUATOR control is increased (signal generator power decreases) until the false target just disappears into the grass level. The receiver sensitivity figure is obtained by adding the POWER DBM dial reading, attenuation losses introduced in coupling the signal to the receiver, and the dbm correction figure of the test set. The total figure is the minimum power level in dbm below 1-milliwatt at the receiver input necessary to produce a minimum discernable signal indication.

2. Block Diagram Discussion

(fig. 1)

The radar test set is a power meter, frequency meter, and microwave signal generator used to test the performance of radar transmitters and receivers. Signal paths and wave forms are shown the block diagram (fig. 1) and are described in *a* through *aa* below. The timing of the waveforms developed is illustrated in figure 2 and discussed in paragraph 3. For more detailed circuit information, refer to paragraphs 4 through 27 and to figure 62.

a. Crystal Detector. Crystal detector CR1 is mounted in a section of waveguide that is iriscoupled to the input-output waveguide. A type 1N26 silicon rectifier crystal detects RF power fed into the RF connector on the front panel. The resultant positive video output from the crystal is fed to the pulse amplifiers.