

ELECTRICAL & ELECTRONIC  
**T**EST **E**QUIPMENT **D**ATA  
HANDBOOK

**VOLUME 2**

**FREQUENCY MEASURING  
EQUIPMENT**

**FREDERICK RESEARCH CORPORATION**

2601 UNIVERSITY BOULEVARD, WEST  
WHEATON, MARYLAND



## TO THE USERS OF THIS HANDBOOK:

In recognition of the many problems associated with the selection of electrical-electronic test equipment for specific applications, Frederick Research Corporation has compiled a series of volumes which contain test equipment descriptions. The items described in the volumes are primarily those used by government agencies and contractors. At the request of the government, and in the interest of providing users with the desired information without the necessity of costly search and compilation, this firm has made this unclassified data available to government agencies and contractors for many years.

The United States Senate has twice cited the Frederick Research Corporation in the Congressional Record (1955 and 1960) for its achievements in efforts to save the government millions of dollars by avoiding duplication in government purchases and promoting the development and utilization of the best test equipment at the lowest cost consistent with quality. We believe that the material in these volumes should provide a means for users to review their test equipment requirements with a minimum expenditure of funds and technical man-hours.

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## AIDS TO USE OF THE VOLUMES

This series of volumes has been prepared for the purpose of aiding engineers and other personnel in the selection of electrical-electronic test equipment to satisfy numerous test requirements. Thus, the format of the descriptive sheets has been specifically designed to provide the concise equipment data necessary for the selection procedure - functional description, electromechanical characteristics, reference source data, and other pertinent information. All data is as complete and current as the information available at the time the equipment description was prepared.

To save the maximum amount of time and to facilitate easy location of a particular item, the complete series has been divided into volumes based upon the accepted functional classification of equipment types. Thus, all equipments performing a specific type of test, monitoring, or measurement function are contained in one volume. For example, all equipments performing Voltage and Current Measuring functions are contained in Volume 1. Where the number of equipment descriptions in a particular class is insufficient to warrant an entire book, more than one volume (class) of equipment descriptions may be included in one book. For example, Volumes 5, 6, 7, 8 and 9 are contained in one book. The volumes are separated by green divider sheets.

Conversely, where the number of equipment descriptions is so large that a single book would be cumbersome, the volume will consist of two or more parts. For instance, Volume 10 is sufficiently large to warrant its division into parts.

Within each functional class and its subclasses, the descriptive sheets are arranged in alpha-numerical order based upon the equipment designation, e. g., ME-6B/U, ME-6D/U, ME-30/U, TS-375/U, and similarly until all descriptions in one particular class are covered.

The definitions and index of the functional classification categories and subclassifications will be found on the following pages. The alpha-numerical arrangement is provided to aid the user in his search for items in the event that only item nomenclature is known.

As an example of use of the Handbook, assume specific test requirements arise which dictate the use of a vacuum tube voltmeter (VTVM). To determine if there is an equipment having the necessary characteristics, locate the List of Handbook Volumes on Page iii in any

of the Handbook volumes and note that voltage and current measuring equipments are located in Volume 1.

In Volume 1 turn to the Electronics Test Equipment Functional Classifications to find the functional class under which VTVM's appear. From the listing, it is seen that voltage measuring equipments are assigned the functional class of 1.1 and that VTVM's are most likely included in the subclass 1.1.1 Electronic Voltmeter. A check of the functional class definitions provided on Page vii will verify this.

Next, turn to the yellow divider, 1.1 Voltage Measuring Equipment, and proceed in that section to the equipment descriptions assigned the functional class 1.1.1. All VTVM descriptions will appear in alpha-numerical order within this section. Alpha-numerical listings of equipment descriptions within each subclass are provided in the Table of Contents.

Data on specific pieces of test equipment may also be quickly located. For instance, assume that one wanted to look up the characteristics of the ME-6D/U Electronic Multimeter. First, locate the correct volume as in the above example, which in this case is again Volume 1. In Volume 1 refer to the Alpha-Numerical Index, locate the item and note its functional class as being 1.1.1. Next, turn to the yellow divider 1.1 Voltage Measuring Equipment and proceed in that section to the descriptions assigned the functional class 1.1.1. The ME-6D/U is placed alpha-numerically in this class, physically located between the ME-6B/U and the ME-30/U.

A standard data format is used throughout the Handbook. Once the user has become familiar with this format, he will find it easy to locate specific data on a given instrument as well as convenient for the comparison of several instruments.

## LIST OF HANDBOOK VOLUMES

Title	Volume
Voltage and Current Measuring Equipment	1
Frequency Measuring Equipment	2
Waveform Measuring and/or Analyzing Equipment	3
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Field Strength and Intensity Measuring Equipment	5
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ELECTRONICS TEST EQUIPMENT  
FUNCTIONAL CLASSIFICATION

2. FREQUENCY MEASURING EQUIPMENT

2.1 Heterodyne Type Frequency Meter

2.1.1 Lumped Constant Tuned, Heterodyne Type Frequency Meter

2.1.2 Cavity Tuned, Heterodyne Type Frequency Meter

2.1.3 Synthesizer, Heterodyne Type Frequency Meter

2.1.4 Frequency Deviation Meter

2.1.5 Frequency Shift Indicator

2.2 Absorption (Reaction) Type Frequency Meter

2.2.1 Lumped Constant Tuned, Absorption Type Frequency Meter

2.2.2 Cavity Tuned, Absorption Type Frequency Meter

2.2.3 Transmission Line Tuned, Absorption Type Frequency Meter

2.3 Transmission Type Frequency Meter

2.3.1 Lumped Constant Tuned, Transmission Type Frequency Meter

2.3.2 Cavity Tuned, Transmission Type Frequency Meter

2.3.3 Transmission Line Tuned, Transmission Type Frequency Meter

2.4 Counting Type Frequency Meter

2.4.1 Pulse Recurrence, Counting Type Frequency Meter

2.4.2 Scalar, Counting Type Frequency Meter

2.5 Frequency Indicator

2.5.1 Resonant Circuit Type Frequency Indicator

2.5.2 Null Frequency Indicator

2.6 Electromechanical Frequency Meter

2.6.1 Vibrating Reed Meter

2.6.2 Stroboscope

2.6.3 Tachometer



ELECTRONICS TEST EQUIPMENT  
FUNCTIONAL CLASSIFICATION - DEFINITIONS

- 2.       **FREQUENCY MEASURING EQUIPMENT**  
Equipment used for indicating or measuring the frequency or pulse repetition rate of an electrical signal.
- 2.1      **HETERODYNE TYPE FREQUENCY METER**  
An instrument for measuring frequency, depending for its operation on the production of a difference frequency (zero beat) between the signal under test and an internally generated signal.
  - 2.1.1    **LUMPED CONSTANT TUNED, HETERODYNE TYPE FREQUENCY METER**  
A device for measuring frequency, depending for its operation on the use of a tuned electrical circuit consisting of lumped values of inductance and capacitance.
  - 2.1.2    **CAVITY TUNED, HETERODYNE TYPE FREQUENCY METER**  
A device for measuring frequency, depending for its operation on the use of an enclosure whose resonant frequency is determined by its internal dimensions.
  - 2.1.3    **SYNTHESIZER, HETERODYNE TYPE FREQUENCY METER**  
A device for measuring frequency, utilizing a synthesized crystal based signal for the internally generated signal.
  - 2.1.4    **FREQUENCY DEVIATION METER**  
An instrument that indicates the number of cycles a transmitter has drifted from its assigned carrier frequency.
  - 2.1.5    **FREQUENCY SHIFT INDICATOR**  
A device which indicates the shifting of the carrier frequency (in an automatic code transmission) back and forth between two distinct frequencies to designate mark and space, instead of keying the carrier on and off.
- 2.2      **ABSORPTION (REACTION) TYPE FREQUENCY METER**  
An instrument for measuring frequency, depending for its operation on the use of a tuned electrical circuit or cavity to absorb and/or reflect the energy from the signal source under test. (Includes wavemeters.)
  - 2.2.1    **LUMPED CONSTANT TUNED, ABSORPTION TYPE FREQUENCY METER**  
A device for measuring frequency, depending for its operation on the use of a tuned electrical circuit consisting of lumped values of inductance and capacitance.

ELECTRONICS TEST EQUIPMENT  
FUNCTIONAL CLASSIFICATION - DEFINITIONS

- 2.2.2 CAVITY TUNED, ABSORPTION TYPE FREQUENCY METER  
A device used for measuring frequency, depending for its operation on the use of an enclosure with a conductive inner wall whose resonant frequency is determined by its internal dimensions. (Includes echo boxes.)
- 2.2.3 TRANSMISSION LINE TUNED, ABSORPTION TYPE FREQUENCY METER  
A device for measuring frequency, depending for its operation on the use of a tuned length of Lecher wire or coaxial cavity.
- 2.3 TRANSMISSION TYPE FREQUENCY METER  
An instrument for measuring frequency, depending for its operation on the use of a tuned electrical circuit, or cavity, to transmit the energy from the signal source under test to a detecting load.
- 2.3.1 LUMPED CONSTANT TUNED, TRANSMISSION TYPE FREQUENCY METER  
A device for measuring frequency depending for its operation on the use of a tuned electrical circuit consisting of lumped values of inductance and capacitance.
- 2.3.2 CAVITY TUNED, TRANSMISSION TYPE FREQUENCY METER  
A device for measuring frequency, depending for its operation on the use of an enclosure, with a conductive inner wall, whose resonant frequency is determined by its internal dimensions.
- 2.3.3 TRANSMISSION LINE TUNED, TRANSMISSION TYPE FREQUENCY METER  
A device for measuring frequency, depending for its operation on the use of a tuned length of Lecher wire or coaxial cavity.
- 2.4 COUNTING TYPE FREQUENCY METER  
An instrument for measuring frequency, depending for its operation on the use of pulse counting techniques to indicate the number, and/or rate, of regularly recurring electrical signals applied to its input circuits.
- 2.4.1 PULSE RECURRENCE, COUNTING TYPE FREQUENCY METER  
A device for measuring frequency, depending for its operation on the use of a direct current ammeter calibrated in pulses per second.

ELECTRONICS TEST EQUIPMENT  
FUNCTIONAL CLASSIFICATION - DEFINITIONS

- 2.4.2 **SCALAR, COUNTING TYPE FREQUENCY METER**  
A device used to measure frequency, depending for its operation on the use of electronic circuits for counting and gating electrical signals to indicate the number, and/or rate, of these signals.
- 2.5 **FREQUENCY INDICATOR**  
A device which presents visually the frequency of an electrical signal.
- 2.5.1 **RESONANT CIRCUIT TYPE FREQUENCY INDICATOR**  
A device used to indicate frequency, depending for its operation on the frequency-versus-reactance characteristics of two series resonant circuits. The circuit is so arranged that the deflecting torque is independent of the amplitude of the signal to be measured.
- 2.5.2 **NULL FREQUENCY INDICATOR**  
A device used to indicate frequency, depending for its operation on the heterodyning of two electrical signals to give a zero beat indication.
- 2.6 **ELECTROMECHANICAL FREQUENCY METER**  
A frequency indicating mechanism depending for operation on the resonant properties of mechanical devices, or a meter used to indicate frequency of operation based on electromechanical means.
- 2.6.1 **VIBRATING REED METER**  
A frequency meter consisting of reeds, each having a different natural frequency.
- 2.6.2 **STROBOSCOPE**  
A device to indicate frequency of operation by creating the optical illusion of slowing down or stopping a moving pattern which is illuminated at a known frequency with flashes of light.
- 2.6.3 **TACHOMETER**  
An instrument used to measure frequency of mechanical systems by the determination of angular velocity.



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2.1.1	AN/URM-79	Frequency Meter
2.1.1	AN/URM-80	Frequency Meter
2.1.1	AN/URM-81	Frequency Meter
2.1.1	BC-221-(*)	Frequency Meter
2.1.1	BC-1066-A	Radio Receiver
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2.2.2	AN/UPM-30	Radar Test Set
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2.3.3	FR-52(XW)/U	Wavemeter
2.3.3	FR-53(XW)/U	Wavemeter
2.3.3	FR-54(XW)/U	Wavemeter
2.3.3	FR-55(XW)/U	Wavemeter
2.3.3	TS-69A/AP	Frequency Meter
<b>2.4</b>	<b>COUNTING TYPE FREQUENCY METERS</b>	
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Designation	Name	Functional Classification
TS-311B/UP	Echo Box	2.2.2
TS-323/UR	Frequency Meter	2.1.1
TS-328/U	Frequency Meter	2.6.1
TS-328A/U	Frequency Meter	2.6.1
TS-328B/U	Frequency Meter	2.6.1
TS-349/UP	Echo Box	2.2.2
TS-354/UP	Frequency Meter Set	2.2.1
TS-480/U	Frequency Meter	2.2.1
TS-488/UP	Echo Box	2.2.2
TS-488A/UP	Echo Box	2.2.2
TS-494/U	Frequency Meter	2.6.1
TS-501/UP	Echo Box	2.2.2
TS-544/UP	Echo Box	2.2.2
TS-545/UP	Echo Box	2.2.2
TS-598/U	Pulse Tester	2.4.1
TS-598A/U	Pulse Tester	2.4.1
14ABA-1	Echo Box	2.2.2
Berkeley 554	Events-Per-Unit-Time (EPUT) Meter	2.4
Browning RH-10	Calibrator Set WWV	2.5.2
El Tronics CA-2523	Video Pulse Counter	2.4.1
Frahm MF 9	Frequency Meter	2.6.1
General Radio 631B	Strobotac	2.6.2
General Radio 720-A	Frequency Meter	2.1
General Radio 724-B	Frequency Meter	2.2.1
Hewlett-Packard 521G	Electronic Counter	2.4
Hewlett-Packard 522B	Electronic Counter	2.4

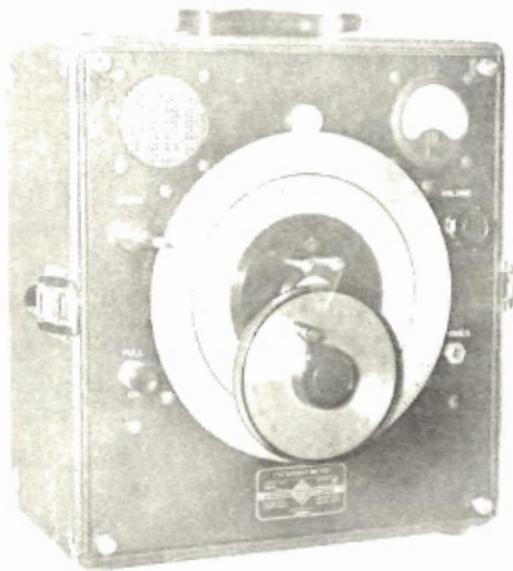
## ALPHA-NUMERICAL INDEX (Continued)

Designation	Name	Functional Classification
Hewlett-Packard 523DR	Electronic Counter	2.4
Sperry T-101007	Oscilloscope Tachometer	2.6.3
Sperry T-101073	Analyzer, Sine Wave Generator	2.1

2.1 HETERODYNE TYPE FREQUENCY METERS



FREQUENCY METER  
MODEL 720-A  
(General Radio Company)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained instrument used to measure frequency in the supersonic range. Strong beat notes can be heard through headphones, a dynamic speaker, or may be indicated on a meter. Frequency is indicated on a calibrated dial.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Power Supply General Radio 1261-A is used for AC operation. This power supply is electrically and mechanically interchangeable with the battery power supply used for DC operation.

**ELECTROMECHANICAL DESCRIPTION:**

Circuit Information: The principal elements of the instrument are a calibrated oscillator, a crystal detector, and a 3-stage amplifier. A butterfly circuit allows simultaneous variation of inductance and capacitance in the oscillator stage without sliding contacts. The oscillator is tunable over a frequency

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.: Commercial		
F.I.L.N.:	FUNCTIONAL CLASS. NO.: 2.1		
- Electronics Test Equipment -			Model 720-A

FREQUENCY METER MODEL 720-A  
(General Radio Company)

**ELECTROMECHANICAL DESCRIPTION:** (Continued)

range of from 100 to 200 megacycles per second and produces harmonics up to 3000 megacycles per second. For measurements below 100 megacycles per second, harmonics of the unknown frequencies are used. A highly sensitive adjustable antenna allows the test set to be used for most applications without connecting the unit to the source being measured.

Power Supply: Burgess Battery 6TA60.

Frequency Range: 10 to 3000 megacycles per second, 100 to 200 megacycles per second on fundamental frequencies.

Bandwidth: 50 kilocycles per second.

Accuracy:  $\pm 0.1\%$ .

**MANUFACTURERS' OR CONTRACTORS' DATA:**

General Radio Company, Cambridge 39, Massachusetts, approximate unit cost, \$455.00.

**TUBE COMPLEMENT:**

1 1N5-GT/G, 1 1D8-GT, 1 958-A.

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Catalog.

**EQUIPMENT SUPPLIED:**

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter General Radio 720-A	metal		14	12-1/2	10-1/2	27-1/2
1	Battery Burgess 6TA60						

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
	Frequency Meter General Radio 720-A					

Model 720-A - Electronic Test Equipment -

ANALYZER, SINE WAVE GENERATOR  
Part No. T-101073  
(Sperry Gyroscope Company)



**FUNCTIONAL DESCRIPTION:**

An equipment designed to perform subassembly bench tests on the sine wave generator of Radar Synchronizer SN-57/APQ-31. The analyzer simulates the actual operating conditions encountered by the sine wave generator and compares the frequency of the generator oscillator circuit with a self-contained frequency standard.

**RELATIONSHIP TO OTHER EQUIPMENT:**

**ELECTROMECHANICAL DESCRIPTION:**

**Circuit Information:** A three-stage gate generator circuit in the analyzer produces the negative gate which is necessary for operation of the sine wave generator. This circuit includes a free-running multivibrator, a trigger generator, and a gate multivibrator. The free-running multivibrator produces the voltage for excitation of the trigger generator; the pulse outputs of the trigger generator trigger the gate multivibrator which supplies the negative gate for the sine wave generator.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-043380		
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG. : Commercial		
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1		
	- Electronics Test Equipment -		Sperry T-101073

ANALYZER, SINE WAVE GENERATOR  
Part No. T-101073  
(Sperry Gyroscope Company)

ELECTROMECHANICAL DESCRIPTION: (Continued)

Circuit Information: (Continued)

A switching arrangement permits either normal operation of the sine wave generator or operation with the gate tube held at cutoff. During normal operation the generator output may be monitored and adjusted by the use of additional test equipment. During operation with the gate tube at cutoff, the sine wave output of the generator is mixed with a reference signal in the analyzer. This reference signal is produced by a crystal controlled oscillator which is stabilized by a cathode follower circuit. The beat difference frequency produced by mixing the two signals is indicated by the opening and closing of an electronic eye on the front panel of the analyzer.

Power Supply: 115 volts, AC, 400 cycles per second, single-phase, 220 watts; 27.5 volts, DC, 35 watts.

Internal Power Output:  $\pm 150$  volts, DC; +300 volts, DC.

Reference Signal Frequency: 163.882 kilocycles per second  $\pm 0.005\%$ .

Voltmeters: "AC Input" meter: Measures 115 volt, AC, input to the analyzer; "DC Input" meter: Measures 27.5 volt, DC, input to the analyzer; "DC Volts" meter; Monitors the DC voltages produced by the internal power supplies of the analyzer.

MANUFACTURERS' OR CONTRACTORS' DATA:

Sperry Gyroscope Company, Division of the Sperry-Rand Corporation, Great Neck, Long Island, New York; Contract AF 33(038)14787.

TUBE COMPLEMENT:

1 JAN-6E5; 2 JAN-6AS7G; 1 JAN-GL1641; 1 JAN-5R4GY; 2 JAN-12AU7; 1 JAN-5Y3GT; 1 JAN-6Y6G; 3 JAN-6J6; 1 JAN-2C51; 1 JAN-OB2; 1 JAN-6SK7; 1 JAN-6SA7; 1 JAN-6J5; 1 JAN-6AC7.

REFERENCE DATA AND LITERATURE:

TO 33D5-5-53-1 (Operation and Service Instructions).  
TO 33D5-5-53-4 (Illustrated Parts Breakdown).

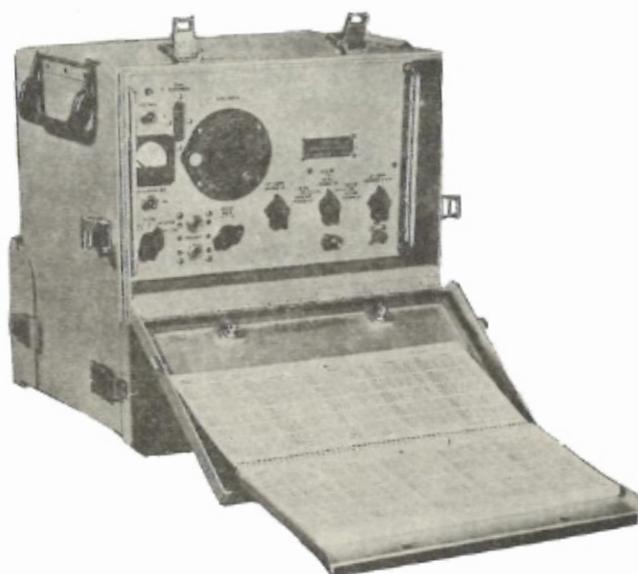
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
Sperry T-101073 - Electronics Test Equipment -						





## FREQUENCY METER AN/URM-32



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained, crystal controlled heterodyne type meter used for field and depot testing of continuous wave or modulated carrier wave RF transmitters and signal generators. A single calibrated control and a calibrated chart are used in making frequency measurements. Crystal check points are provided on the chart. A voltmeter mounted on the front panel checks B+ and A+ voltages. Two internal frequency calibrating crystals are included.

### RELATIONSHIP TO OTHER EQUIPMENT:

The AN/URM-32 is a replacement for SCR-211, TS-174/U, TS-175/U, TS-323/UR and Navy type LM.

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** The unknown signal is heterodyned with that of a variable frequency oscillator. The resulting beat frequency signal is audio-modulated by a combination audio amplifier and modulator to give an aural indication when sine wave signals are being measured. As zero-beat is approached by variation of the frequency of the variable frequency oscillator, the aural indication will diminish until it disappears at zero-beat. The VFO is then heterodyned to the nearest crystal check point of the crystal oscillator, and a correction knob is used to make these two signals zero-beat when the VFO indicates the check frequency,

(Continued)

	AIR FORCE	NAVY	ARMY
<b>TYPE CLASS.</b>			
<b>STOCK NOS.</b>	7CAC-318208-425		
<b>PROCUREMENT INFO.:</b>	Spec. No. SCL-1341, dated 15 January 1951		
<b>PROCUREMENT COG.:</b>	USA	DESIGN COG.: USA, SCEL	
<b>F.I.I.N.:</b>	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		AN/URM-32

## FREQUENCY METER AN/URM-32

### ELECTROMECHANICAL DESCRIPTION: (Continued)

by applying a tuning correction to the VFO. Then the original operation of heterodyning to the unknown signal is repeated. In this way, required accuracy is maintained.

**Power Supply:** 115 volts, DC, from 2 batteries BA-419/U, and 6 volts, DC, from 1 battery BA-412/U. (Has provisions for receiving power from Power Supply PP-1243/U.)

**Frequency Range:** 125 kilocycles per second to 1000 megacycles per second.

**Type of Transmission:** Continuous Wave, Modulated Carrier Wave.

**Internal Modulation Frequency Range:** 600 to 1200 cycles per second (900 ± 300 cycles per second).

**B+ Voltage:** + 121.5 volts, DC.

**A+ Voltage:** +5.4 volts, DC.

**RF Input:** 0.1 volt, maximum.

**RF Output:** 100 microvolts minimum into 50 ohms.

**Audio Output Impedance:** 600 ohms.

**Accuracy:** ±0.01% of indicated frequency.

**Stability:** ± 0.01%.

**Temperature Range:** -20°C. to +55°C., operational; -62°C. to +71°C., nonoperational.

**Humidity Range:** Up to 95%, operational.

**Altitude Range:** Up to 10,000 feet, operational; up to 50,000 feet, nonoperational.

**Internal Crystals:** 1 and 5 megacycles per second.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Radio Frequency Laboratories, Powerville Road, Boonton 7, New Jersey; USA Contract DA-36-039-sc-15385, 28 June 1951; DA-36-039-sc-64450, 3 June 1954.

### TUBE COMPLEMENT:

1 JAN-6C4W, 1 JAN-5814A, 2 JAN-12AT7WA, 1 JAN-OB2.

### REFERENCE DATA AND LITERATURE:

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
AN/URM-32 - Electronics Test Equipment -						

FREQUENCY METER AN/URM-32

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter AN/URM-32	Alumi- num	7CAC-318208-425	13-3/8	11-1/4	14-1/2	50
1	Antenna AT-564( )/U						
1	Adapter Connector UG-641/U						
1	Battery BA-412/U						
2	Battery BA-419/U						
1	Calibration Book						
1	Cord CD-307-A						
1	Cord CG-409E/U						
1	Head Set HS-33						
- Electronics Test Equipment -							AN/URM-32



## FREQUENCY METER AN/URM-79



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, heterodyne type frequency meter used to measure frequencies and to calibrate field radio receivers and transmitters. A blinker light (or earphones for an audible indication) is used for making accurate zero-beat settings. All controls, dials, connections, and carrying handles are located on the front panel. The equipment is designed for rack mounting or for use as a table model with tilt base for ease of viewing.

### RELATIONSHIP TO OTHER EQUIPMENT:

AN/URM-79 is the overall nomenclature for FR-4/U.

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** A temperature-stabilized crystal oscillator provides a 10 kilocycles frequency for use in the test circuit. The operating frequency of the oscillator, 1250 kilocycles, is divided into 10 kilocycles frequency used for test

(Continued)

	AIR FORCE	NAVY	ARMY
<b>TYPE CLASS.</b>	Standard		
<b>STOCK NOS.</b>	7CAC-526166		3F3317-79
<b>PROCUREMENT INFO.:</b> SigC Spec. MIL-F-11068			
<b>PROCUREMENT COG.:</b> Army		<b>DESIGN COG.:</b> Army, SSL	
<b>F.I.I.N.:</b>		<b>FUNCTIONAL CLASS. NO.:</b> 2.1.1	
- Electronics Test Equipment -			AN/URM-79

## FREQUENCY METER AN/URM-79

### ELECTROMECHANICAL DESCRIPTION: (Continued)

signals. The basic operation of the frequency meter is as follows: An unknown signal and the test signal are fed into a measure mixer; the two signals are heterodyned in the mixer and the difference or beat frequency that results passes through a 15 to 20 kilocycle hand-pass filter; this signal is amplified and visually compared with a 15 to 20 kilocycle signal supplied by an interpolation oscillator; the interpolation oscillator is a high stability, modified tuned-grid oscillator which can be adjusted to provide a single closed pattern on the oscilloscope screen. When a single closed Lissajous figure is obtained on the screen, the frequency of the oscillator is equal to the difference frequency. By reading the dials of the interpolation oscillator and using the calibration charts which are supplied, the unknown frequency may be determined. Included in the circuit are several frequency multipliers, a proxy oscillator, and a zero mixer, all of which extend the range of the frequency meter and make indirect measurements possible.

**Power Supply:** 115 or 230 volts  $\pm 10\%$ , AC, 50 to 1000 cycles per second, single phase, 136 watts.

**Frequency Range:** 100 kilocycles per second to 20 megacycles per second in seven bands.

#### Oscillator Frequencies:

**Proxy:** 100 to 250 kilocycles per second.

**Crystal:** 1250 kilocycles per second.

**Blocking:** 10 kilocycles per second.

**Interpolation:** 15 to 20 kilocycles per second.

**Frequency Multiplication:** 2 to 80 times proxy oscillator frequency.

**Harmonic Selector:** 9th through 26th harmonic of 10 kilocycles per second.

**Type of Reception:** Continuous Wave.

**RF Output:** 100 microvolts minimum across 51 ohms on any harmonic.

**Audio Power Output:** 2 milliwatts minimum across 600 ohms.

**Frequency Stability:** 0.0001%.

**Accuracy:**  $\pm 0.001\%$  of frequency calibration.

**Method of Interpolation:** Built-in oscilloscope.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Sparks-Withington, Jackson, Michigan; Army Order 14231-PH-51; Approximate Cost per Unit, \$850.00.

### TUBE COMPLEMENT:

7 JAN-6AU6, 8 JAN-12AT7, 2 JAN-5654, 3 JAN-5670, 3 JAN-5725, 3 JAN-5751, 1 JAN-2BP1, 1 JAN-OA2, 1 JAN-5Y3GT, 1 JAN-6Y6G.

### REFERENCE DATA AND LITERATURE:

TO 16-35FR4-6 (Instruction Book).

FREQUENCY METER AN/URM-79

SHIPPING DATA:

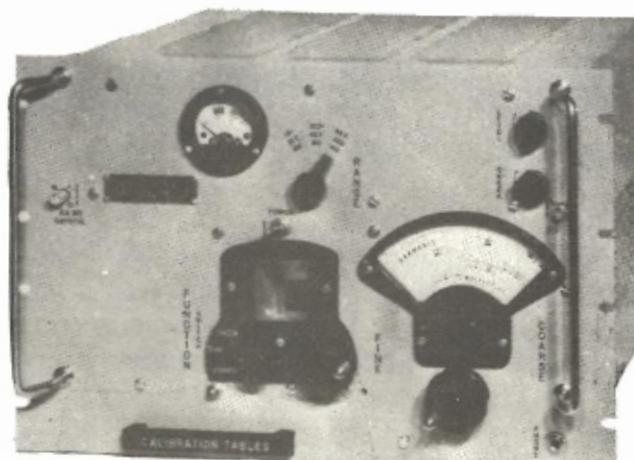
No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter AN/URM-79	6.9	22	26-1/4	20-3/4	155

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter AN/URM-79		7CAC-526166 3F3317-79				146
	Including:						
1	Frequency Meter FR-4/U		7CAC-170275-9652	15-3/4	19	18-1/8	86
1	Transit Case CY-1509/U	Wood		20-3/4	26-1/8	22-7/16	
1	Cord CG-409/U		7CAC-170265-26	60 long			
1	Adapter Connector UG-924/U						
2	Instruction Book			10-1/4	7-7/8		
2	Set Calibration Charts (including one spare)						
1	Set Spare Tubes						
5	Spare Fuse						
1	Spare Crystal CR-36/U						



## FREQUENCY METER AN/URM-80



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, heterodyne type frequency meter used for calibrating the frequency of radio receivers and transmitters. Provision is made for attachment of headphones. All controls, dials, connections, and a set of carrying handles are located on the front panel. This equipment is designed for rack mounting or use as a table model with tilt base for ease of viewing.

### RELATIONSHIP TO OTHER EQUIPMENT:

AN/URM-80 is the overall nomenclature for FR-5/U.

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: 115 or 230 volts,  $\pm 10\%$ , AC, 50 to 1000 cycles per second, single phase.

Frequency Range: 10 to 100 megacycles per second.

Type of Reception: Continuous Wave.

Standard Frequency Available: 3.6 megacycles per second  $\pm 0.0001\%$ .

Calibration: Internal permanent film scale, multiplying book supplied.

Type of Connectors: BNC.

Frequency Stability: 0.0001%.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-318205		3F2743-5
PROCUREMENT INFO.:	SigC Spec, MIL-F-11069		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, SSL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.:		2.1.1
- Electronics Test Equipment -			AN/URM-80

FREQUENCY METER AN/URM-80

ELECTROMECHANICAL DESCRIPTION: (Continued)

Accuracy:  $\pm 0.001\%$  of frequency calibration.

Temperature Range:  $-20^{\circ}\text{C}$ . to  $+52^{\circ}\text{C}$ .

MANUFACTURERS' OR CONTRACTORS' DATA:

Lavoie Laboratories, Morganville, New Jersey; Army Contract Nos. W 36-039-sc-44586 and DA 36-039-sc-36527; Order No. 99-PH-52.

TUBE COMPLEMENT:

2 JAN-6AK6, 1 JAN-6AH6, 6 JAN-6AU6, 1 JAN-6C4, 7 JAN-12AT7, 1 JAN-5814, 6 JAN-6BA6/W, 3 JAN-6BN6, 1 JAN-OB2, 1 JAN-OA2, 2 JAN-6X4/W.

REFERENCE DATA AND LITERATURE:

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

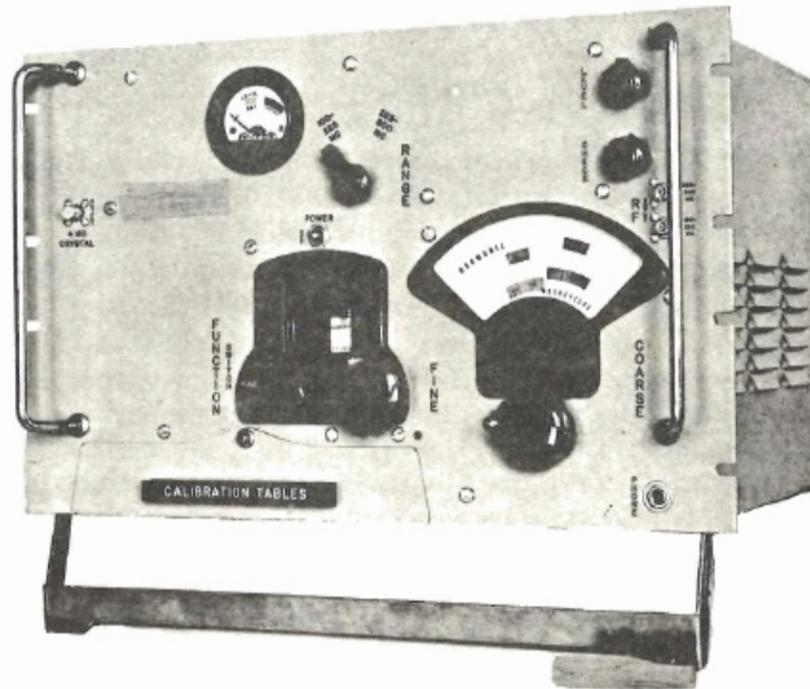
EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter AN/URM-80		7CAC-318205				
	Including:		3F2743-5				
1	Frequency Meter FR-5/U		7CAC-170275-9653	12-1/4	19	15	60
1	Technical Manual						
1	Set Calibration Charts						
1	Meter Case CY-1501/U						
1	Cord CG-409/U						

AN/URM-80

- Electronics Test Equipment -

## FREQUENCY METER AN/URM-81



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, heterodyne type frequency meter used for calibrating the frequency of radio receivers and transmitters. Provision is made for attachment of headphones. All controls, dials, connections, and a set of carrying handles are located on the front panel. The equipment is designed for rack mounting or use as a table model with tilt base for ease of viewing.

### RELATIONSHIP TO OTHER EQUIPMENT:

AN/URM-81 is the overall nomenclature for FR-6/U.

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** The incoming signal whose frequency is unknown is mixed with that of a variable-tuned interpolation oscillator added to a harmonic of a fixed crystal oscillator. The resulting IF signal is amplified by a band-pass IF amplifier and passed through a harmonic sequence selector which eliminates some

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS,	Standard		
STOCK NOS,	7CAC-318208-36		
PROCUREMENT INFO.:	Spec. MIL-F-10636 (SigC) & Am. 1		
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, SSL
F. I. L. N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		AN/URM-81

## FREQUENCY METER AN/URM-81

### ELECTROMECHANICAL DESCRIPTION: (Continued)

of the undesirable harmonics and passes the desired harmonic. A cavity-type filter eliminates most of the remaining undesirable harmonics and amplifies the desired harmonic. An LC type audio-modulator modulates the filtered and amplifier IF signal. This audio-modulated signal is detected and amplified. The resulting audio signal is applied to the headphones jack. Maximum aural indication is obtained by tuning the interpolation oscillator to a frequency which, when mixed with the incoming signal's frequency, will give the exact IF which will be passed by the IF amplifier, selector, and filter without attenuation. In order to obtain the exact frequency of the unknown signal, the reading from the interpolation oscillator must be multiplied by a harmonic factor. In order to facilitate this calculation, a calibration chart is provided on microfilm inside the equipment. As the oscillator is adjusted, the calibration chart is mechanically brought into view to correspond with the oscillator setting. An optical magnifying system enables the operator to accurately determine the unknown frequency.

Self calibration at a standard frequency is provided from the output of an internal crystal oscillator, which is substituted for the unknown signal for that purpose.

Power Supply: 115 or 230 volts,  $\pm 10\%$ , AC, 50 to 1000 cycles per second, single phase.

Frequency Range: 100 to 500 megacycles per second.

Type of Reception: Continuous Wave.

Fundamental Frequency Range: 4.166 to 4.34 megacycles per second.

Standard Frequency Available: 4.0 megacycles per second  $\pm 0.0001\%$ .

Type of Connectors: BNC.

Calibration: Internal permanent film scale, multiplying book supplied.

Frequency Stability: 0.0001%.

Accuracy:  $\pm 0.001\%$  of frequency calibration.

Temperature Range:  $-20^{\circ}\text{C.}$  ( $-4^{\circ}\text{F.}$ ) to  $+52^{\circ}\text{C.}$  ( $+125^{\circ}\text{F.}$ ).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Lavoie Laboratories, Morganville, New Jersey; Army Order 102-PH-52.

### TUBE COMPLEMENT:

1 JAN-6AK6, 5 JAN-6AH6, 6 JAN-6AU6, 4 JAN-12AT7, 1 JAN-5814, 1 JAN-6BA6/W, 3 JAN-6BN6, 1 JAN-OB2, 1 JAN-OA2, 2 JAN-6X4/W.

### REFERENCE DATA AND LITERATURE:

FREQUENCY METER AN/URM-81

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter AN/URM-81		7CAC-318208-36				
	Including:						
1	Frequency Meter FR-6/U		7CAC-170275-96515	12-1/4	19	15	60
1	Meter Case CY-1501/U						
1	Cord CG-409/U						
1	Technical Manual						
1	Set Calibration Charts						
- Electronics Test Equipment -							AN/URM-81



FREQUENCY METER BC-221-(\* )



FUNCTIONAL DESCRIPTION:

An accurate, general purpose, portable and self-contained instrument of the heterodyne type used to measure and calibrate the frequency of transmitters, oscillators, signal generators, receivers having a beat-frequency oscillator with zero-beat adjustment, and other test equipment. Resonance is indicated by zero-beat notes heard in the headset and frequency is determined by the dial settings and the associated calibration charts.

RELATIONSHIP TO OTHER EQUIPMENT:

Part of Frequency Meter Set SCR-211-(\*).

ELECTROMECHANICAL DESCRIPTION:

Power Supply: Six volts supplied by four 1.5 volt Batteries BA-23 and 135 volts supplied by six 22.5 volt Batteries BA-2.

Type of Reception: Continuous Wave.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-318208-45	F16-Q-124920-100	2C1501.1
PROCUREMENT INFO.:	Army Spec. 71-811-E		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, SSL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		BC-221-(* )

FREQUENCY METER BC-221-(\* )

ELECTROMECHANICAL DESCRIPTION: (Continued)

Fundamental Frequency Range: 125 to 250 kilocycles per second and 2000 to 4000 kilocycles per second.

Calibrated Frequency Range: 125 kilocycles per second to 20 megacycles per second.

RF Output (Functioning as a Test Oscillator): 2 milliwatts.

Accuracy:  $\pm 0.025\%$  of indicated frequency.

Temperature Range:  $-30^{\circ}$  C. to  $+50^{\circ}$  C., operating.

MANUFACTURERS' OR CONTRACTORS' DATA:

Bendix Aviation Corporation, Red Bank, New Jersey.

Allen D. Cardwell, Plainville, Connecticut.

Philco Corporation, Philadelphia 26, Pennsylvania.

Rauland-Borg Corporation, Chicago 18, Illinois.

Zenith Radio Corporation, Chicago, Illinois.

(Manufacturer is dependent upon the model.)

TUBE COMPLEMENT:

1 JAN-76, 1 JAN-77, 1 JAN-6A7; or 1 JAN-76, 1 JAN-6SJ7Y, 1 JAN-6A7; or 1 JAN-7G7, 1 JAN-7B8, 1 JAN-7A4; or 1 JAN-6K8, 2 JAN-6SJ7; or 1 JAN-6K8, 1 JAN-6SJ7, 1 JAN-6SJ7Y. (Tube Complement is dependent upon the model.)

REFERENCE DATA AND LITERATURE:

TM 11-300 (Instruction Book).

TO 16-40SCR211-5 (Instruction Book).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
BC-221-(* ) - Electronics Test Equipment -						

FREQUENCY METER BC-221-(\* )

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter BC-221-(A-T) — or —	Metal	2C1501	14	10-1/2	9-3/4	18.6
1	Frequency Meter BC-221-(AA-AN)	Metal or Wood	7CAC-318208-45 F16-Q-124920-100 2C1501.1	12-1/2	10	9-1/2	19.2
1	Bag BG-81-A (all models except B&O) — or —	Can-vas	7CAC-078250  2Z481A	15	11-1/2	10-1/2	
1	Bag BG-81-B (B&O only)	Can-vas	1690-286097500  2Z481B	15-1/2	11	11	
1	Calibration Book M-117-(P-AN) — or —		6D7047.2				
2	Calibration Book M-117-(A-L) (1 Spare)		6D7047				
1	Crystal Unit DC-9-AJ (All models except AK, AL, AN) — or —		2X185.1-1000AJ	2	1-5/16		
1	Crystal Unit DC-9-A (AK, AL, AN only)		2X185.1-1000A	2	1-5/16		
1	Set Screw Wrench, L- Shaped, 0.076 max. dia., (A, B, C, D, E, M) or		7900-859441  6R55230				

FREQUENCY METER BC-221-(\* )

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Set Screw Wrench, L- Shaped, 0.094 (F, J, K, L, N, O, P-T, AA-AN)		7900-059443  6R55231.1				
1	Carrying Strap ST-19-A (all models)		7CBA-ST19A  2Z9019A	65 long	2		
1	Set Spare Tubes						
2	Technical Manual TM11-300						

(\* ) Refers to Models A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL, AN,

BC-221-(\* )

- Electronics Test Equipment -

## RADIO RECEIVER BC-1066-A



### FUNCTIONAL DESCRIPTION:

A portable, self-contained general purpose, calibrated radio receiver which can be used to check the frequency and operation of radio equipment. It consists of two separate oscillating detector circuits, either one of which may be fed into a two-stage audio amplifier. The input and internally generated signals are heterodyned to give an audio signal which is used to indicate resonance.

### RELATIONSHIP TO OTHER EQUIPMENT:

Superseded by BC-1066-B; part of IE-46-A. Radio Receiver BC-1066-B covers a wider range of frequencies at the high end of the G band than does Radio Receiver BC-1066-A.

One Headset HS-33, one Headset Adapter MC-385, one Frequency Meter BC-906-A or B equipments required, but not supplied.

Used to test Prime Equipments such as SCR-595-A, 595-AE, 695, 695-A, 695-AZ, 695-B, and 695-C.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-218964000		2C-5066-A
PROCUREMENT INFO.:	Dwg. No. ES-C-4516-A		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, C&N
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		BC-1066-A

**RADIO RECEIVER BC-1066-A**

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: Three 45 volt Batteries (BA-53-A) and one 1.5 volt Battery (BA-35-A).  
 Frequency Range: 150 to 225 megacycles per second.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Philco Corporation, Philadelphia, Pennsylvania.

**TUBE COMPLEMENT:**

2 JAN-957, 1 JAN-1D9GT.

**REFERENCE DATA AND LITERATURE:**

AN 16-40BC1066-2 (Maintenance Instructions).  
 TO 16-55-345 (Spare Parts List).

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Radio Receiver BC-1066-A	Wood	1690-218964000  2C5066A	8	8	13-1/2	17.0
1	Canvas Cover		  2Z3351-17	8-3/4	8-3/4	14	.75
1	Instruction Book F/BC-1066		  2C5066A/81				
						Total:	17.75

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Radio Receiver, BC-1066-A (Domestic Packed)	1.84	13-1/2	13-1/2	17-1/2	30

BC-1066-A - Electronics Test Equipment -

## RADIO RECEIVER BC-1066-B



### FUNCTIONAL DESCRIPTION:

A portable, self-contained, general purpose, calibrated radio receiver which can be used to check the frequency and operation of radio equipment. It consists of two separate oscillating detector circuits, either one of which may be fed into a two-stage audio amplifier. The input and internally generated signals are heterodyned to give an audio signal which is used to indicate resonance.

### RELATIONSHIP TO OTHER EQUIPMENT:

Supersedes BC-1066-A; same as BC-1066-A except for extension of frequency range. One Headset HS-33, one Headset Adapter MC-385, one Frequency Meter BC-906-C or D and one Signal Generator I-196-A or B are required but not supplied. Used to test Prime Equipment such as AN/APW-5, AN/APW-6, AN/TPN-1, and AN/TPN-3.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-681058		2C5066-B
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, C&N	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		BC-1066-B

**RADIO RECEIVER BC-1066-B**

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: Three 45 volt Batteries (BA-53-A) and one 1.5 volt Battery (BA-35-A).  
 Frequency Range: 150 to 235 megacycles per second.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Philco Corporation, Philadelphia, Pennsylvania; Order No. 3348-W-43; Contract No. 40-45, 10/13/44; Approximate Cost per Unit, \$44.00.

**TUBE COMPLEMENT:**

2 JAN-957, 1 JAN-108GT.

**REFERENCE DATA AND LITERATURE:**

AN 16-400BC1066-2 (Maintenance Instruction).  
 TO 16-55-345 (Spare Parts List).  
 TO 08-10-154 (Operation and Maintenance Instructions for IE-46-B).

**EQUIPMENT SUPPLIED:**

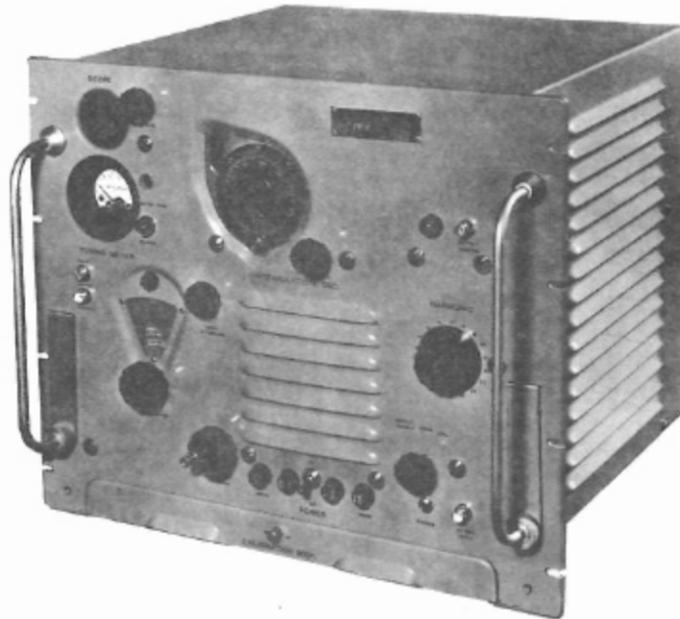
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Radio Receiver BC-1066-B	Wood	7CAC-681058 2C5066-B	8	8	13-1/2	17.25
1	Canvas Cover		2Z3351-17	8-3/4	8-3/4	14	.75
1	Instruction Book F/BC-1066		2C5066B/81				
						Total:	18.00

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Radio Receiver, BC-1066-B (Shelf Package - Water Resistant Carton)	1.50	12	12	18	21

BC-1066-B - Electronics Test Equipment -

## FREQUENCY METER FR-4/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, heterodyne type frequency meter used to measure frequencies and to calibrate field radio receivers and transmitters. A blinker light (or earphones for an audible indication) is used for making accurate zero-beat settings. All controls, dials, connections, and carrying handles are located on the front panel. It is designed for rack mounting or for use as a table model with tilt base for ease of viewing.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: 115 or 230 volts  $\pm 10\%$ , AC, 50 to 1000 cycles per second, single phase, 136 watts.

Frequency Range: 100 kilocycles per second to 20 megacycles per second in seven bands. (Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-170275-9652		
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, SSL
F. I. I. N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		FR-4/U

FREQUENCY METER FR-4/U

ELECTROMECHANICAL DESCRIPTION: (Continued)

Oscillator Frequencies:

Proxy: 100 to 250 kilocycles per second.

Crystal: 1250 kilocycles per second.

Blocking: 10 kilocycles per second.

Interpolation: 15 to 20 kilocycles per second.

Frequency Multiplication: 2 to 80 times proxy oscillator frequency.

Harmonic Selector: 9th through 26th harmonic of 10 kilocycles, per second.

Type of Reception: Continuous wave.

RF Output: 100 microvolts minimum across 51 ohms on any harmonic.

Audio Power Output: 2 milliwatts minimum across 600 ohms.

Frequency Stability: 0.0001%.

Accuracy:  $\pm 0.001\%$  of frequency calibration.

Method of Interpolation: Built-in oscilloscope.

MANUFACTURERS' OR CONTRACTORS' DATA:

Sparks-Withington, Jackson, Michigan; Army Contract No. DA-36-039-SC-5642;  
Approximate Cost per Unit, \$850.00.

TUBE COMPLEMENT:

7 JAN-6AU6, 8 JAN-12AT7, 2 JAN-5654, 3 JAN-5670, 3 JAN-5725, 3 JAN-5751,  
1 JAN-2BP1, 1 JAN-OA2, 1 JAN-5Y3GT, 1 JAN-6Y6G.

REFERENCE DATA AND LITERATURE:

TO 16-35FR4-6 (Instruction Book).

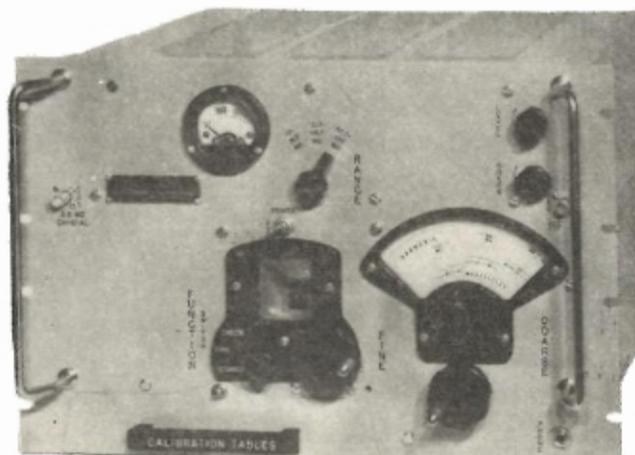
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
FR-4/U						





## FREQUENCY METER FR-5/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, heterodyne type frequency meter used for calibrating the frequency of radio receivers and transmitters. Provision is made for attachment of headphones. All controls, dials, connections, and a set of carrying handles are located on the front panel. Designed for rack mounting or use as a table model with tilt base for ease of viewing.

### RELATIONSHIP TO OTHER EQUIPMENT:

This meter is part of Frequency Meter Set AN/URM-5, but can be used independently as an end item.

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: 115 or 230 volts,  $\pm 10\%$ , AC, 50-1000 cycles per second, single phase.

Frequency Range: 10 to 100 megacycles per second.

Type of Reception: Continuous Wave.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-170275-4653		
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, SSL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		FR-5/U

FREQUENCY METER FR-5/U

ELECTROMECHANICAL DESCRIPTION: (Continued)

Standard Frequency Available: 3.6 megacycles per second  $\pm 0.0001\%$ .  
 Calibration: Internal permanent film scale, multiplying book supplied.  
 Type of Connectors: BNC.  
 Frequency Stability: 0.0001%.  
 Accuracy:  $\pm 0.001\%$  of frequency calibration.  
 Temperature Range:  $-4^{\circ}$  F. to  $125^{\circ}$  F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Lavoie Laboratories, Morganville, New Jersey; Army Contract Nos. W 36-039-sc-44586 and DA 36-039-sc-36527.

TUBE COMPLEMENT:

2 JAN-6AK6, 1 JAN-6AH6, 6 JAN-6AU6, 1 JAN-6C4, 7 JAN-12AT7, 1 JAN-5814,  
 6 JAN-6BA6/W, 3 JAN-6BN6, 1 JAN-0B2, 1 JAN-0A2, 2 JAN-6X4/W.

REFERENCE DATA AND LITERATURE:

EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-5/U Including:		7CAC-170275-4653	12-1/4	19	15	60
1	Technical Manual						
1	Set Calibration Charts						

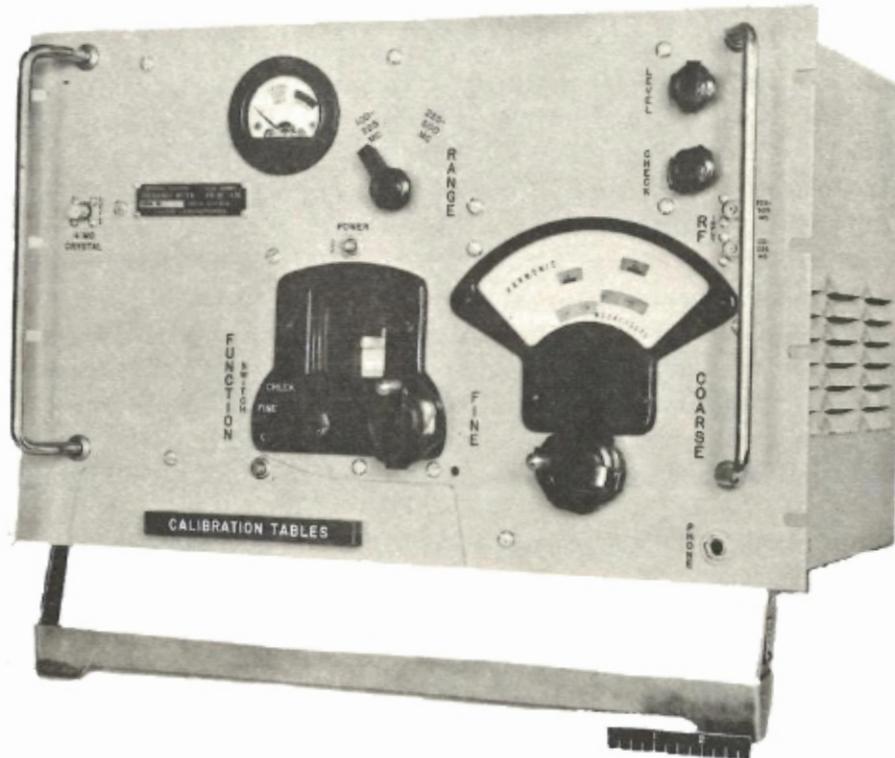
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

FR-5/U

- Electronics Test Equipment -

## FREQUENCY METER FR-6/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, heterodyne type frequency meter used for calibrating the frequency of radio receivers and transmitters. Provision is made for attachment of headphones. All controls, dials, connections and a set of carrying handles are located on the front panel. Designed for rack mounting or use as a table model with tilt base for ease of viewing.

### RELATIONSHIP TO OTHER EQUIPMENT:

This meter is part of Frequency Meter Set AN/URM-5, but can be used independently as an end item.

### ELECTROMECHANICAL DESCRIPTION:

Circuit Information: The incoming signal whose frequency is unknown is mixed with that of a variable-tuned interpolation oscillator added to a harmonic of a fixed  
(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-170275-96515		
PROCUREMENT INFO.:	Spec. MIL-F-10636 (SigC) & Am. 1		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, SSL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		FR-6/U

## FREQUENCY METER FR-6/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

crystal oscillator. The resulting IF signal is amplified by a band-pass IF amplifier and passed through a harmonic sequence selector which eliminates some of the undesirable harmonics and passes the desired harmonic. A cavity-type filter eliminates most of the remaining undesirable harmonics and amplifies the desired harmonic. An LC type audio-modulator modulates the filtered and amplifier IF signal. This audio-modulated signal is detected and amplified. The resulting audio signal is applied to the headphones jack. Maximum aural indication is obtained by tuning the interpolation oscillator to a frequency which when mixed with the incoming signal's frequency will give the exact IF which will be passed by the IF amplifier, selector, and filter without attenuation. The tuning knob of the interpolation oscillator is mechanically coupled to a drum containing a roll of microfilm on which a calibration chart has been printed. This is read through an optical magnifying system to the required accuracy.

Self calibration at a standard frequency is provided from the output of an internal crystal oscillator, which is substituted for the unknown signal for that purpose.

Power Supply: 115 or 230 volts,  $\pm 10\%$ , AC, 50 to 1000 cycles per second, single phase.

Frequency Range: 100 to 500 megacycles per second.

Type of Reception: Continuous Wave.

Fundamental Frequency Range: 2.67 to 2.745 megacycles per second.

Standard Frequency Available: 4.0 megacycles per second  $\pm 0.0001\%$ .

Type of Connectors: BNC.

Calibration: Internal permanent film scale, multiplying book supplied.

Frequency Stability: 0.0001%.

Accuracy:  $\pm 0.001\%$  of frequency calibration.

Temperature Range:  $-4^{\circ}$  F. to  $+125^{\circ}$  F.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Lavoie Laboratories, Morganville, New Jersey; Army Contract No. W-36-039-sc-36522.

### TUBE COMPLEMENT:

1 JAN-6AK6, 5 JAN-6AH6, 6 JAN-6AU6, 4 JAN-12AT7, 1 JAN-5814, 1 JAN-6BA6/W, 3 JAN-6BN6, 1 JAN-0B2, 1 JAN-0A2, 2 JAN-6X4/W.

### REFERENCE DATA AND LITERATURE:

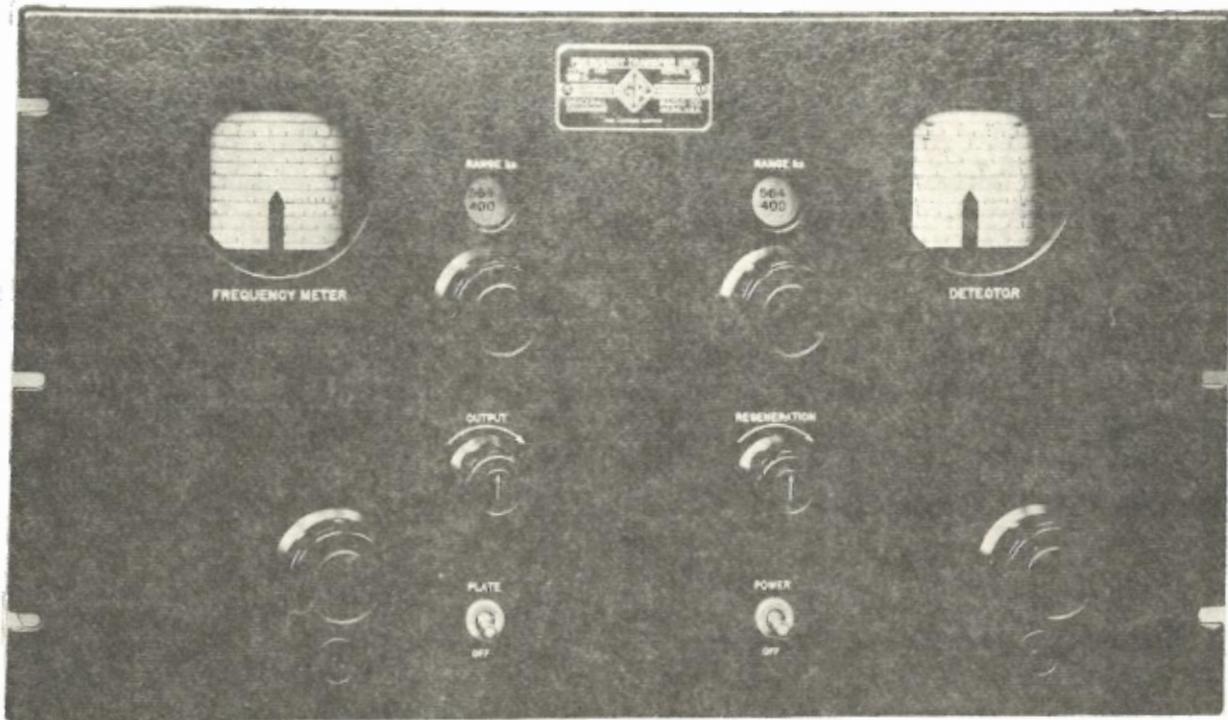
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
FR-6/U						





## FREQUENCY METER FR-43/URM-18



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, frequency transfer unit used in transferring an unknown frequency for measurement against a frequency standard, or for transferring a frequency of known value (determined against the standard) to an output circuit. The approximate value of an unknown frequency, or the approximate value of a desired frequency in the output circuit can be read directly. When used with a frequency standard, it provides means for rapidly identifying the harmonics of the standard; for accurately matching the heterodyne frequency meter to the unknown frequency; for use as a substitute source in measuring frequencies under conditions of noise, fading or of intermittent operation of the transmitter; and for obtaining a frequency of any desired value, accurately known in terms of the frequency standard. The frequency transfer unit can also be used as a calibrated frequency meter and detector. A direct-reading frequency scale is provided for the fundamental and selected harmonic ranges, covering 20 to 1 in frequency.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-318208-38		
PROCUREMENT INFO.:	Army Order 6898-Phila 51-04.		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, SSL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		FR-43/URM-18

## FREQUENCY METER FR-43/URM-18

### RELATIONSHIP TO OTHER EQUIPMENT:

Part of Frequency Meter Group OA-166/URM-18 which is part of Frequency Calibrator-Meter Set AN/URM-18; it can be used as an individual item of test equipment. Similar to General Radio Type 1106-A.

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** This unit consists of a heterodyne frequency meter (with harmonic generating circuits and output control) and a heterodyne detector (with audio-frequency amplifier and regeneration control).

**Power Supply:** 115 volts  $\pm 10\%$  or 230 volts  $\pm 10\%$ , AC, 50 to 60 cycles per second, single phase, 40 watts.

**Frequency Range:** 100 to 2,000 kilocycles per second in three ranges: 1 kilocycle intervals from 100 to 400 kilocycles per second, 5 kilocycle intervals from 400 to 1000 kilocycles per second, 10 kilocycle intervals from 1000 to 2000 kilocycles per second.

**Input Impedance:** 50 to 65 ohms.

**Output Impedance:** 600 ohms.

**Accuracy:**  $\pm 0.1\%$ .

### MANUFACTURERS' OR CONTRACTORS' DATA:

General Radio Company, Cambridge, Massachusetts; Approximate Cost per Unit, \$900.00, October 1951.

### TUBE COMPLEMENT:

3 JAN-6SJ7, 1 JAN-6J5GT, 1 JAN-6SN7GT, 1 JAN-6H6, 1 JAN-6X5GT, 1 JAN-0D3.

### REFERENCE DATA AND LITERATURE:

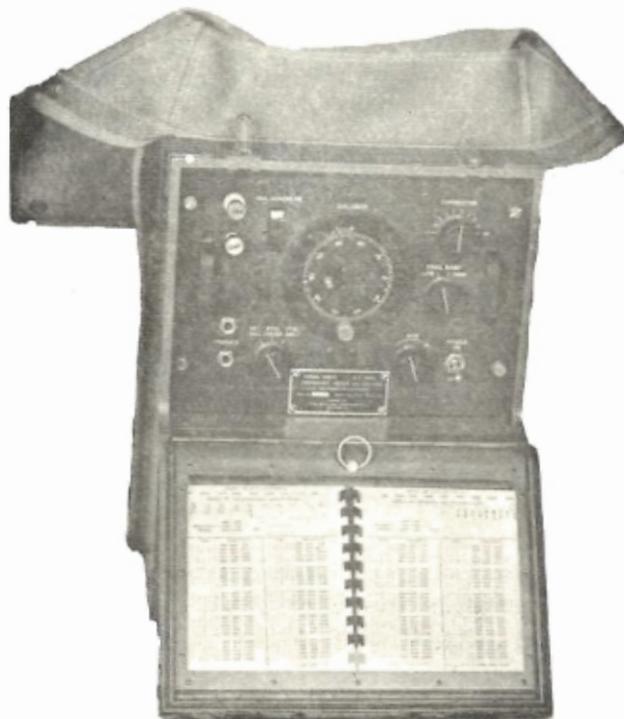
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
FR-43/URM-18 - Electronics Test Equipment -						





FREQUENCY METER SET, SCR-211-AC



**FUNCTIONAL DESCRIPTION:**

An accurate, general purpose, portable and self-contained instrument of the heterodyne type used to measure and calibrate the frequency of transmitters, oscillators, signal generators, receivers having a beat-frequency oscillator with zero-beat adjustment, and other test equipment.

Resonance is indicated by zero-beat notes heard in the headset and frequency is determined by the dial settings and the associated calibration charts.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Similar to Models A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AE, AF, AG, AH, AJ, AK, and AL except for minor differences in mechanical dimensions, weight, etc.

Equipment required but not supplied: One Headset HS-33; One Cord CD-307-A; One Headset Adapter MC-385-AC.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-212126000		6C1411.6AC
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, SSL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		SCR-211-AC

## FREQUENCY METER SET, SCR-211-AC

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: Four 1.5 volt Batteries (BA-23), six 22.5 volt Batteries (BA-2).

Type of Reception: Continuous Wave.

Fundamental Frequency Range: 125 to 250 kilocycles per second and 2,000 to 4,000 kilocycles per second.

Calibrated Frequency Range: 125 kilocycles per second to 20 megacycles per second.

Accuracy, Overall: 0.01% or 25 cycles per second, whichever is greater within the specified temperature range.

Operating Temperature Range:  $-30^{\circ}$  C. to  $+50^{\circ}$  C.

Radio Frequency Output (Functioning as a Test Oscillator): 2 millivolts.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Rauland-Borg Corporation, 3515 West Addison Street, Chicago 18, Illinois.

### TUBE COMPLEMENT:

1 JAN-6SJ7, 1 JAN-6SJ7Y, 1 JAN-6K8.

### REFERENCE DATA AND LITERATURE:

AN08-40SCR211-2 (Maintenance Instructions).

TM 11-300 (Technical Manual).

TO 16-40SCR211-5 (Instruction Book).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
SCR-211-AC - Electronics Test Equipment -						

FREQUENCY METER SET, SCR-211-AC

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter Set SCR-211-AC (Complete)	Wood	1690-212126000  2C1411.6AC	15	10-1/2	9-3/4	43.0
1	Frequency Meter BC-221-AC	Alum- inum	7CAC-318208-45 F16-Q-124920-100 2C1501.1				
1	Crystal Unit DC-9-M, or DC-9-P, or DC-9-AD		2X185.1-1000AJ	1-1/2	1-1/4 dia.		
1	Calibration Book M-117-AC		6D7047.2				
1	Instruction Book						
1	Bristo Wrench No. 8	Steel	7900-059443  6R55231.1	1-25/32	33/64		
1	Strap ST-19-A	Cot- ton Web- ing	7CBA-ST19A  2Z9019A	65	2		0.8
1	Spare Tube Set						
1	Bag BG-81-AC	Can- vas	7CAC-078250  2Z481A	15	11-1/2	10-1/2	2.0
- Electronics Test Equipment -							SCR-211-AC



## FREQUENCY METER SET SCR-211-J



### FUNCTIONAL DESCRIPTION:

An accurate, general purpose, portable and self-contained instrument of the heterodyne type used to measure and calibrate the frequency of transmitters, oscillators, signal generators, receivers having a beat-frequency oscillator with zero-beat adjustment, and other test equipment.

Resonance is indicated by zero-beat notes heard in the headset and frequency is determined by the dial settings and the associated calibration charts.

### RELATIONSHIP TO OTHER EQUIPMENT:

Similar to Models A, B, C, D, E, F, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, and AL except for minor differences in mechanical dimensions, weight, etc.

Equipment required but not supplied: One Headset HS-33, on Cord CD-307-A, one Headset Adapter MC-385-J.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-212095020		2C1411.6
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, SSL
F.I.I.N.:	FUNCTIONAL CLASS. NO.:		2.1.1
- Electronics Test Equipment -			SCR-211-J

## FREQUENCY METER SET SCR-211-J

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: Four 1.5 volt Batteries (BA-23), six 22.5 volt Batteries (BA-2).

Type of Reception: Continuous Wave.

Fundamental Frequency Range: 125 to 250 kilocycles per second and 2,000 to 4,000 kilocycles per second.

Calibrated Frequency Range: 125 kilocycles per second to 20 megacycles per second.

Accuracy, Over-all: 0.01% or 25 cycles per second, whichever is greater, within the specified temperature range.

Operating Temperature Range:  $-30^{\circ}$  C. to  $+50^{\circ}$  C.

Radio Frequency Output (functioning as a test oscillator): 2 millivolts.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Zenith Radio Corporation, Chicago, Illinois, Order No. 967-Chi-42, 29 March 1942.

### TUBE COMPLEMENT:

1 JAN-76, 1 JAN-6SJ7Y, 1 JAN-6A7.

### REFERENCE DATA AND LITERATURE:

AN08-40SCR211-2 (Maintenance Instructions).

TM 11-300 (Technical Manual).

SIG 8-SCR-211 (Spare Parts List).

TO 16-40SCR211-5 (Instruction Book).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
SCR-211-J - Electronics Test Equipment -						

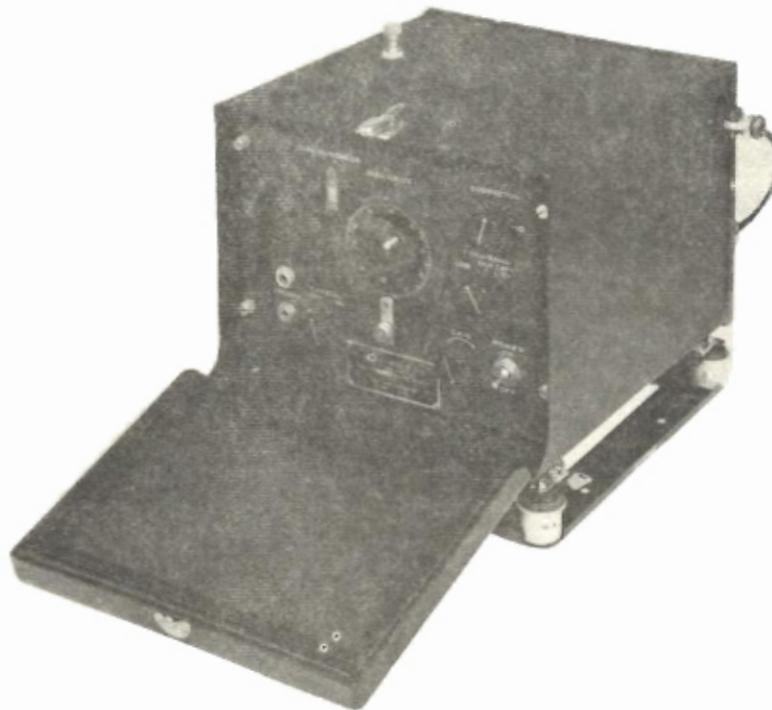
FREQUENCY METER SET SCR-211-J

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter Set SCR-211-J (Complete)	Alum- inum	1690-212095020 2C1411.6	13-1/8	10-1/8	9-7/16	38 (Total)
1	Frequency Meter BC-211-J	Alum- inum	1690-212318000 2C1501				
1	Crystal Unit DC-9-J		2X185.1-1000AJ	1-1/2 long	1-1/4 dia.		
2	Calibration Book M-117-J		6D7047				
1	Instruction Book						
1	Bag BG-81-J	Can- vas	7CAC-078250 2Z481A	15	11-1/2	10-1/2	2.0
1	Bristo Wrench No. 8	Steel	7900-059443 6R55231.1	1-25/32	33/64		
1	Strap ST-19-A	Cot- ton Web- bing	7CBA-ST19A 2Z9019-A	65 long	2 wide		0.8
2	Spare Tube Set						
- Electronics Test Equipment -							SCR-211-J



## FREQUENCY METER TS-164/AR



### FUNCTIONAL DESCRIPTION:

An accurate, general purpose and self-contained instrument of the heterodyne type used to measure and calibrate the frequency of transmitters, oscillators, signal generators, receivers having a beat-frequency oscillator with zero-beat adjustment, and other test equipment. This frequency meter may also be used for checking receivers having modulated carrier wave and phone reception only.

Resonance is indicated by zero-beat notes heard in the headset and frequency is determined by the dial settings and the associated calibration charts.

### RELATIONSHIP TO OTHER EQUIPMENT:

Frequency Meter TS-164/AR is identical in electrical and operating characteristics to Frequency Meter Set SCR-211-(\*). Frequency Meter TS-164/AR is designed for permanent installation and obtains its power for operation from Radio Receiver (Continued)

(\*) Refers to Models C, D, F, J, K, L, M, N, O, P, R, T, AA, AC, AE, AF, AG, AH, AJ, or AL.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Obsolete		
STOCK NOS.	7CAC-318208-445		3F4325-164
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, C&N
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		TS-164/AR

## FREQUENCY METER TS-164/AR

### RELATIONSHIP TO OTHER EQUIPMENT: (Continued)

BC-348-(\*) instead of from dry batteries as Frequency Meter Set SCR-211-(\*). Frequency Meter Set SCR-211-(\*) may be converted into Frequency Meter TS-164/AR by removing the frequency meter section from its old-type case and installing it, with its associated calibration book, into Case CY-182/AR. A shock-proof Mounting MT-269/AR and a four-prong plug and cable, Cord CX-243/AR, are the additional items which, with Case CY-182/AR, comprise the conversion kit, which is presently being procured to convert battery operated sets into Frequency Meter TS-164/AR.

A headset is necessary for the operation of the TS-164/AR.

### ELECTROMECHANICAL DESCRIPTION:

**Power Supply:** All power required for operation of this equipment is supplied from Radio Receiver BC-348-(\*). Two sources of voltage are supplied, one of 28 volts direct current and the other of 210 volts direct current. The total current is 1 ampere at 28 volts and 45 milliamperes at 210 volts.

**Type of Reception:** Continuous Wave.

**Fundamental Frequency Range:** 125 to 250 kilocycles per second and 2000 to 4000 kilocycles per second.

**Calibrated Frequency Range:** 125 kilocycles per second to 20 megacycles per second.

**Accuracy, Overall:**  $\pm 0.01\%$  or 25 cycles per second, whichever is greater, within the specified temperature range.

**Operating Temperature Range:**  $-28.8^{\circ}\text{C}$ . to  $+50^{\circ}\text{C}$ .

### MANUFACTURERS' OR CONTRACTORS' DATA:

Vendo Company, 7400 East 12th Street, Kansas City 8, Missouri; Order No. 61-DAY-45SE; Approximate Cost per Unit, \$250.00.

### TUBE COMPLEMENT:

1 JAN-76, 1 JAN-77, 1 JAN-6A7; or 1 JAN-76, 1 JAN-6SJ7Y, 1 JAN-6A7; or 1 JAN-6SJ7, 1 JAN-6SJ7Y, 1 JAN-6K8; or 1 JAN-6K8, 2 JAN-6SJ7; or 2 JAN-6SJ7Y, 1 JAN-6K8; or 2 JAN-6K8, 1 JAN-6SJ7Y. (Depends on which BC-211 model is used.)

### REFERENCE DATA AND LITERATURE:

AN 16-35TS164-2 (Maintenance Instructions).

TO 16-55-148 (Spare Parts List).

(\*) Refers to Models C, D, F, J, K, L, M, N, O, P, R, T, AA, AC, AE, AF, AG, AH, AJ, or AL.

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter, TS-164/AR with accessories	0.78	10-1/2	12	10-3/4	45

TS-164/AR

- Electronics Test Equipment -

FREQUENCY METER TS-164/AR

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter Set TS-164/AR (Complete)		7CAC-318208-445  3F4325-164				
1	Frequency Meter BC-221-(* )	Alum- inum	1690-212318000  2C1501(* )				
1	Calibration Book MC-177-(* )		  6D7047(* )				
1	Crystal Unit DC-9-(* )		  2X185.1-1000	1-1/2	1-1/4 dia.		
1	Set of Spare Tubes (See Tube Comple- ment)						
1	Case CY-182/AR		7CAC-176572-46  3H772-182	7-1/2	11-1/2	10	
1	Cord Assembly CX-243/AR		  3E6000-243				
1	Mounting MT-269/AR		7CAC-586595  2Z6763-269	10-1/2	11		
2	Bulb S-6 (One Spare)		8800-508080  2Z5879-17				
2	Tube OC3/VR-105 (One Spare)		8800-508080  2JOC3/VR-105				
3	Ballast Tube (One Spare)		3300-394184166  3Z6925-3.13				
(* ) Refers to Models C, D, F, J, K, L, M, N, O, P, R, T, AA, AC, AE, AF, AG, AH, AJ, or AL.							
- Electronics Test Equipment -						TS-164/AR	

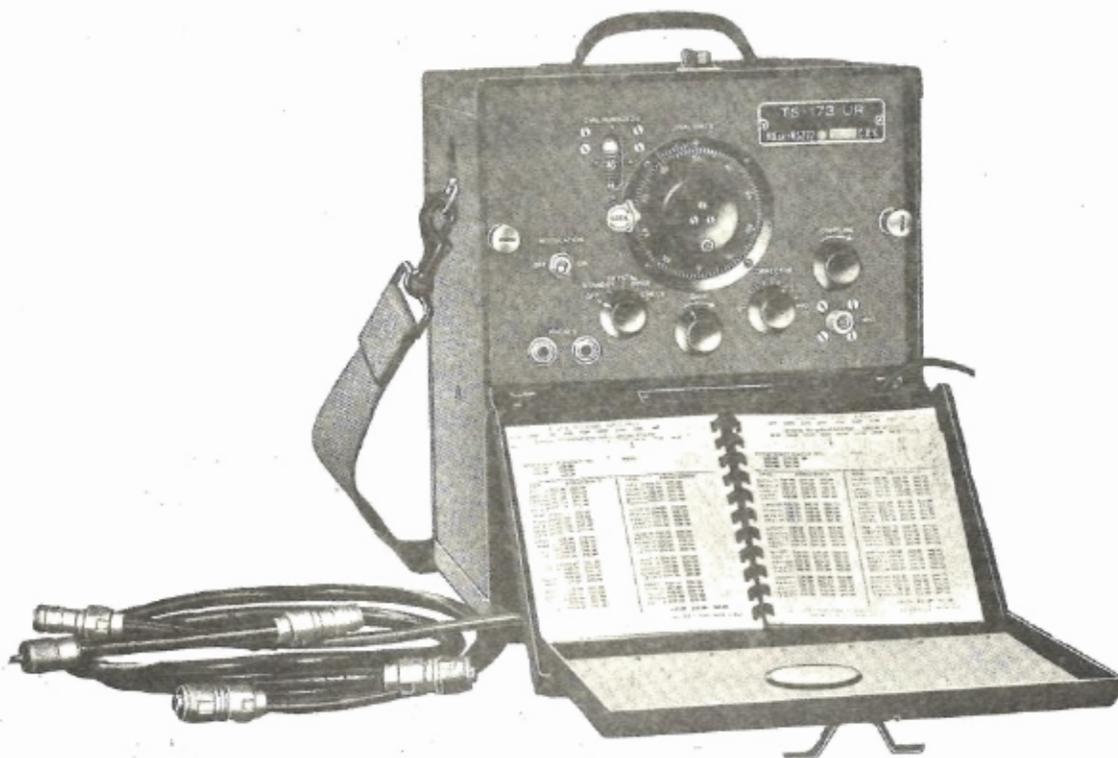
FREQUENCY METER TS-164/AR

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Bristo Wrench No. 6 (4 Spline)	Steel	7900-859441  6R55230				
1	Bristo Wrench No. 8 (6 Spline)	Steel	7900-059443  6R55231.1				
						Total:	40

(\* Refers to Models C, D, F, J, K, L, M, N, O, P, R, T, AA, AC, AE, AF, AG, AH, AJ, or AL.

## FREQUENCY METER TS-173/UR



### FUNCTIONAL DESCRIPTION:

An accurate, general purpose, portable, self-contained instrument of the heterodyne type used to measure and calibrate the frequency of transmitters, oscillators, signal generators, receivers having a beat-frequency oscillator with zero-beat adjustments, and other test equipments.

Resonance is indicated by zero-beat notes heard in the headset and frequency is determined by the dial settings and the associated calibration charts.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

#### Power Supply:

Battery Operation: 135 volts supplied by six 22.5 volt Battery BA-2, and 6 volts supplied by four 1.5 volt Battery BA-23.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.		F16-Q-303815-200	3F4325-173
PROCUREMENT INFO.:	Navy Spec. No. RE-13A930		
PROCUREMENT COG.:	Navy	DESIGN COG.:	Navy, BuShips
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		TS-173/UR

## FREQUENCY METER TS-173/UR

### ELECTROMECHANICAL DESCRIPTION: (Continued)

#### AC Operation:

Power Supply Unit, PP-79/UR: Input, 115 volts  $\pm 10\%$ , 50 to 60 cycles; Output, 150 volts DC and 6.3 volts AC.

Power Consumption: 15 watts.

Frequency Range: 90 to 450 megacycles per second.

Crystal Frequency: 5 megacycles per second.

Type of Transmission: Amplitude Modulated or Continuous Wave.

Modulation Data: 60% at 1000 cycles per second.

Output Voltage: 465 microvolts to 0.1 volt.

Audio Power Output: 4 milliwatts at minimum coupling setting; above 75 milliwatts at maximum coupling setting.

Input Impedance: 50 ohms, radio frequency.

Output Impedance: 50 ohms, radio frequency; 600 ohms audio frequency.

Sensitivity: At maximum coupling setting the meter can detect a radio frequency signal of 20 microvolts minimum input with an audio output power of 4 to 75 milliwatts, depending upon the frequency.

Accuracy:  $\pm 0.005\%$ .

### MANUFACTURERS' OR CONTRACTORS' DATA:

Hoffman Radio Corporation, Los Angeles 7, California; Contract No. NXsa-76139.

Allan D. Cardwell Manufacturing Corporation, Brooklyn, New York; Contract No. NXsr-65277, dated 6 June 1944; Approximate Cost per Unit, \$509.00.

### TUBE COMPLEMENT:

3 JAN-9002, 2 JAN-9001, 1 JAN-6X5G, 1 JAN-0D3/VR-150.

### REFERENCE DATA AND LITERATURE:

NAVSHIPS 900,644 (Instruction Book).

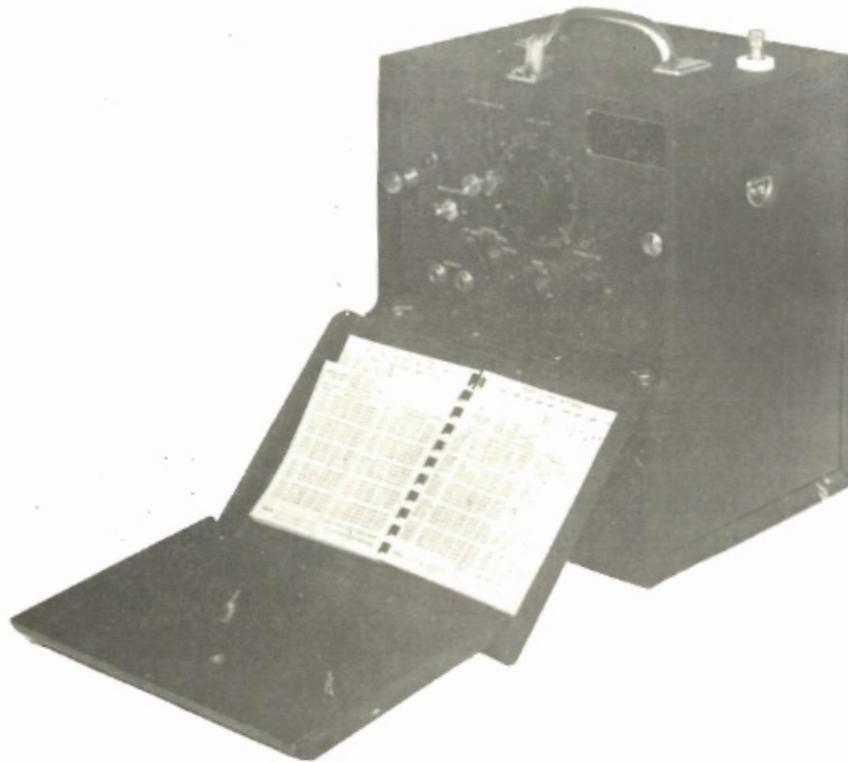
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter TS-173/UR with Spares (Domestic Packed)	2.9	15	12	12	63
TS-173/UR - Electronics Test Equipment -						





## FREQUENCY METER TS-174/U



### FUNCTIONAL DESCRIPTION:

A general purpose, portable, self-contained, crystal-controlled, heterodyne-type frequency meter used for field testing of continuous wave, modulated carrier wave or pulsed radio frequency transmitters and signal generators.

A vernier dial and calibrated chart are used in making frequency measurements. Crystal check points are provided at one megacycle per second intervals along the fundamental frequency range of the oscillator.

### RELATIONSHIP TO OTHER EQUIPMENT:

Being replaced by Frequency Meter TS-323/UR.

The following equipment is required but not supplied: One antenna, 18 inches of stiff copper wire, and one Headset (HS-30).

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: Four 1.5 volt Batteries, (BA-23), and six 22.5 volt Batteries, (BA-2).  
(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Limited Standard		
STOCK NOS.	7CAC-318203-2	R16-AN-TS-174/U	3F4325-174
PROCUREMENT INFO.:	Army Spec. Nos. 271-5074 and 71-5056-A		
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, SSL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		TS-174/U

## FREQUENCY METER TS-174/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulse.  
 Type of Transmission: Continuous Wave, Modulated Carrier Wave.  
 Frequency Range, Input: 20 to 250 megacycles per second.  
 Fundamental Frequency: 20 to 40 megacycles per second.  
 Signal Power Range, Input: 20 millivolts to 2 volts.  
 Input: Small adjustable antenna.  
 Signal Output: 50 microvolts to 20 millivolts modulated at 1000 cycles per second.  
 Accuracy: 0.05% (at crystal frequency).  
 Temperature Range:  $-40^{\circ}$  C. to  $+55^{\circ}$  C.  
 Vernier Dial: 100 divisions.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Allen D. Cardwell Manufacturing Corporation, Plainville, Connecticut; Order No. 1010-DAY-45RC; Order No. 1097-45-SP, 25 April 1945; Approximate Cost per Unit, \$300.00.

### TUBE COMPLEMENT:

1 JAN-6SJ7-Y, 1 JAN-6K8, 1 JAN-6SJ7.

### REFERENCE DATA AND LITERATURE:

AN 08-35TS174-2 (Maintenance Instructions).  
 TO 16-35TS-174-2 (Technical Order).  
 TO 17-55-143 (Spare Parts List).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter TS-174/U (Packed Moisture Fungus Proofed)	3	13	29	135	60

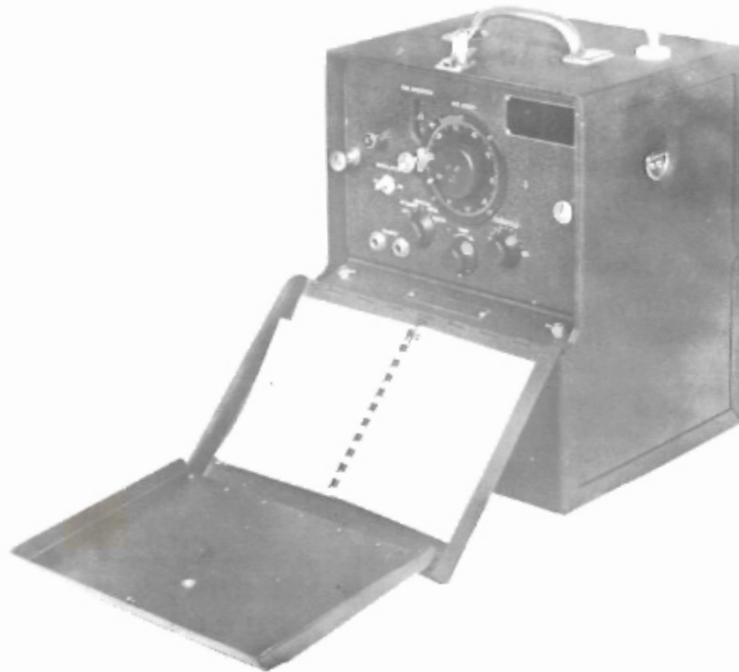
FREQUENCY METER TS-174/U

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-174/U (Complete)	Metal	7CAC-318203-2 R16-AN-TS-174/U 3F4325-174	14	10-1/4	9-3/4	42 in- cluding batter- ies and spare parts
1	Calibration Book		6D7047-174				
1	Crystal Unit DC-O-AJ		2X185.1-1000				
1	Battery Tray		7CCA-A2040 3B407				
1	Bristol Wrench No. 6		7900-859441 6R55230				
2	Tube, Type 6SJ7 (Spare)		3300-234725000 2J6SJ7				
2	Tube, Type JAN-6SJ7-Y (Spare)		3300-234735000 2J6SJ7-Y				
2	Tube, Type JAN 6K8 (Spare)		3300-234600000 2J6K8				
2	Instruction Book		6D9810-174				



## FREQUENCY METER TS-174A/U



### FUNCTIONAL DESCRIPTION:

A general purpose, portable, self-contained, crystal-controlled, heterodyne-type frequency meter used for field testing of continuous wave or modulated carrier wave radio frequency transmitters and signal generators.

A vernier dial and calibrated chart are used in making frequency measurements. Crystal check points are provided at 1 megacycle per second intervals in the frequency range of 20 to 250 megacycles.

### RELATIONSHIP TO OTHER EQUIPMENT:

Being replaced by Frequency Meter TS-323/UR.

Similar to TS-174/U except for items supplied.

Equipment required but not supplied: One Headset, HS-30.

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: Four 1.5 volt batteries, type BA-23, and six 22.5 volt batteries, type BA-2.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Limited Standard		
STOCK NOS.			3F4325-174A
PROCUREMENT INFO.:	Army Spec. No. 71-5074A		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, SSL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		TS-174A/U

## FREQUENCY METER TS-174A/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

Type of Reception: Continuous Wave, Modulated Carrier Wave.  
 Type of Transmission: Continuous Wave, Modulated Carrier Wave.  
 Frequency Range, Input: 20 to 250 megacycles per second.  
 Fundamental Frequency: 20 to 40 megacycles per second.  
 Signal Power Range, Input: 20 millivolts to 2 volts.  
 Input Impedance: Antenna Probe.  
 Signal Output: 50 microvolts to 20 millivolts modulated at 1000 cycles per second.  
 Calibration Accuracy:  $\pm 0.05\%$  (at any frequency from 20 to 250 megacycles per second).  
 Temperature Range:  $-40^{\circ}$  C. to  $+55^{\circ}$  C.  
 Drum and Disc Dial: 100 divisions.  
 Vernier Dial: Tenths of a division.

### MANUFACTURERS' OR CONTRACTORS' DATA:

#### TUBE COMPLEMENT:

1 JAN-6SJ7-Y, 1 JAN-6K8, 1 JAN-6SJ7.

#### REFERENCE DATA AND LITERATURE:

AN 08-35TS174-2 (Maintenance Instructions).  
 TO 16-35TS-174-2 (Technical Order).  
 TO 16-55-143 (Spare Parts List).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter, TS-174A/U (Shelf Package - Water Resistant Carton)	1.67	20	13	12	31

TS-174A/U

- Electronics Test Equipment -

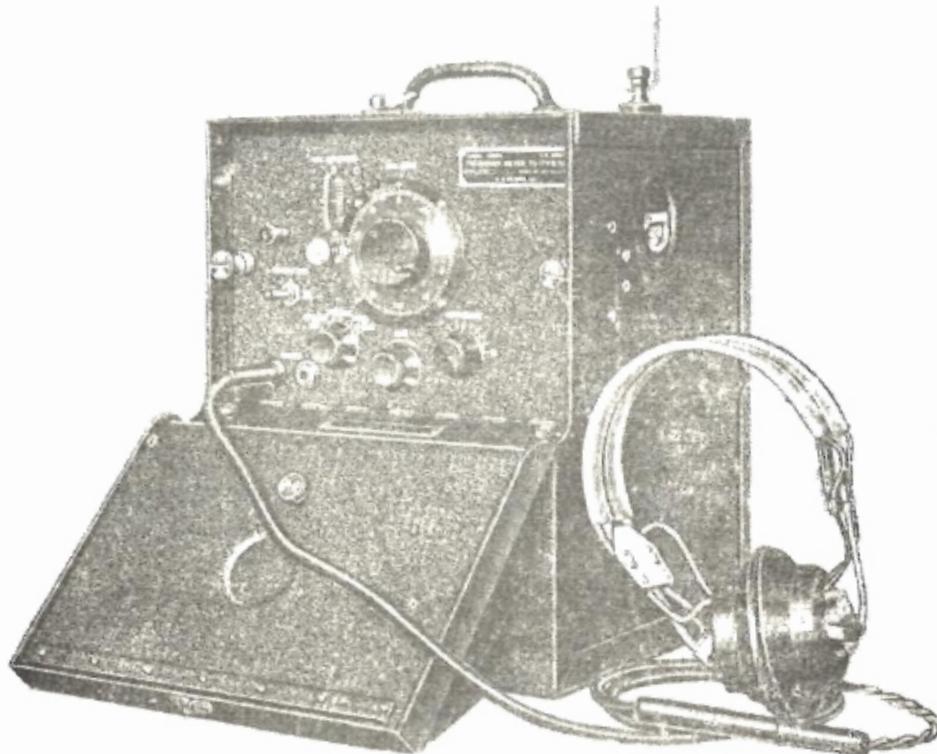
FREQUENCY METER TS-174A/U

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-174A/U (Complete)	Alum- inum	3F4325-174A	15-1/2	12	11	
1	Calibration Book		6D7047-174				
1	Crystal Unit DC-9-AJ		2X185.1-1000				
1	Battery Tray		3300-304429710 3B407				
1	Bristol Wrench No. 6		7900-859441 6R55230				
2	Tube JAN-6SJ7		3300-234725000 2J6SJ7				
2	Tube JAN-6SJ7-Y		3300-234735000 2J6SJ7-Y				
2	Tube JAN-6K8		3300-234600000 2J6K8				
1	Cord CG-55/U		1690-132336059 1F430-55				
1	Cord CG-56/U		7CAC-170265-485 1F430-56				
1	Adapter UG-201/U		2Z308-201				



## FREQUENCY METER TS-174B/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained, crystal-controlled, heterodyne type meter, used for field and depot testing of continuous wave or modulated carrier wave radio frequency transmitters and signal generators. It is designed to measure frequency of a radiated RF signal or to radiate radio frequency energy in its frequency range. It is used mainly to calibrate field radio receivers and transmitters by direct comparison with the variable frequency oscillator of the frequency meter.

A vernier dial and calibrated chart are used in making frequency measurements. Crystal check points are provided at 1 megacycle per second intervals.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

Circuit Information: A rod antenna is used when receiving a transmitted signal. A coaxial or twisted-pair antenna is used if it is necessary to use this meter in the

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			3F4325-174B
PROCUREMENT INFO.:			
PROCUREMENT COG.: Army		DESIGN COG.: Army, SSL	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.1.1	
- Electronics Test Equipment -			TS-174B/U

## FREQUENCY METER TS-174B/U

### ELECTROMECHANICAL DESCRIPTION:

presence of high-power radio interference, or when transmitting to a receiver. An incoming signal is mixed with that of a variable frequency oscillator and the resulting beat frequency signal is amplified in an audio amplifier. The amplified audio signal is transmitted to a pair of headphones. The frequency of the variable frequency oscillator is varied until the audible signal fades out, at which time there is no difference frequency. The calibration of frequency variation is in terms of the incoming signal.

The variable frequency oscillator can also be used to transmit, either alone, or beating with the crystal oscillator, or modulated by the audio amplifier which in this case acts as an audio oscillator, or both.

**Power Supply:** One Battery BA-411/U (5.5 volts, DC) and one Battery BA-420/U (121.5 volts, DC).

**Frequency Range:** 20 to 250 megacycles per second.

**Fundamental Frequency Range:** 20 to 40 megacycles per second.

**Crystal Frequency Range:** 1000 kilocycles per second (and harmonics).

**Type of Transmission or Reception:** Continuous Wave, Modulated Carrier Wave.

**Modulation:** 900 cycles per second (when used).

**RF Signal Input Range:** 20 millivolts to 2 volts.

**RF Signal Output Range:** 15,000 microvolts at any fundamental frequency in the calibrated range. 300 microvolts at any point from 40 to 250 megacycles per second.

**Audio Power Output:** 0.5 milliwatt, Minimum.

**RF Input Impedance:** Antenna Probe.

**Audio Output Impedance:** 250 ohms.

**Calibration Accuracy:**  $\pm 0.04\%$  under extreme operating conditions when corrected at the nearest check point.  $\pm 0.02\%$  under normal operating conditions.

**Temperature Range:**  $-40^{\circ}$  C. to  $+55^{\circ}$  C.

**Drum and Disc Dial:** 100 divisions.

**Vernier Dial:** Tenths of a division.

### MANUFACTURERS' OR CONTRACTORS' DATA:

O.S. Peters Company, Washington, D. C.; Army Order No. 1903-Phila-50.

### TUBE COMPLEMENT:

1 JAN-6SJ7-Y, 1 JAN-6SJ7, 1 JAN-6K8.

### REFERENCE DATA AND LITERATURE:

TM 11-5044 or TO 16-35TS174-5 (Operating and Maintenance Instructions).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter, TS-174B/U (Export Packed)	4	22	18	16	70

TS-174B/U

- Electronics Test Equipment -





## FREQUENCY METER TS-175/U



### FUNCTIONAL DESCRIPTION:

A general purpose, portable, self-contained, crystal-controlled, heterodyne-type frequency meter used for field testing of continuous wave, modulated carrier wave, radio frequency transmitters and signal generators.

A vernier dial and calibrated chart are used in making frequency measurements. Crystal check-points are provided at 5 megacycle per second intervals along the fundamental range of the oscillator.

### RELATIONSHIP TO OTHER EQUIPMENT:

The following is required but not supplied: One Headset HS-33 (the internal impedance must be approximately 600 ohms).

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: Four 1.5 volt Batteries, (BA-23), and six 22.5 volt Batteries, (BA-2).  
Type of Reception: Continuous Wave, Modulated Carrier Wave.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Limited Standard		
STOCK NOS.	7CAC-318203-235	R16-AN-TS-175/U	3F4325-175
PROCUREMENT INFO.:	Spec. MIL-F-4289 (USAF)		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, SSL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		TS-175/U

## FREQUENCY METER TS-175/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

Type of Transmission: Continuous Wave, Modulated Carrier Wave.

Frequency Range, Input: 85 to 1000 megacycles per second.

Fundamental Frequency: 85 to 200 megacycles per second.

Input Signal: 20 millivolts to 2 volts across small adjustable antenna.

Signal Output: 100 microvolts to 20 millivolts modulated at 1000 cycles per second.

Accuracy:  $\pm 0.05\%$  (at crystal frequency).

Temperature Range:  $-40^{\circ}$  C. to  $+55^{\circ}$  C.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Allen D. Cardwell Manufacturing Corporation, Plainville, Connecticut; Order No. 1065-45-SP; 27 March 1945; Approximate Cost per Unit, \$331.00.

Columbus Electronics Incorporated, 229 South Waverly Street, Yonkers, New York; Order No. 11691-P-50-2; Approximate Cost per Unit, \$660.00.

### TUBE COMPLEMENT:

1 JAN-9002, 1 JAN-6K8, 1 JAN-6C8G.

### REFERENCE DATA AND LITERATURE:

AN16-35TS175-2 (Instruction Book).

TO16-35TS175-5 (Instruction Book).

TO16-35TS175-21 (Eliminate Audio Oscillator).

TO16-55-144 (Spare Parts List).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter TS-175/U (Complete) (Packed VPP, MFD).	3	13	13-7/10	29	60
TS-175/U - Electronics Test Equipment -						

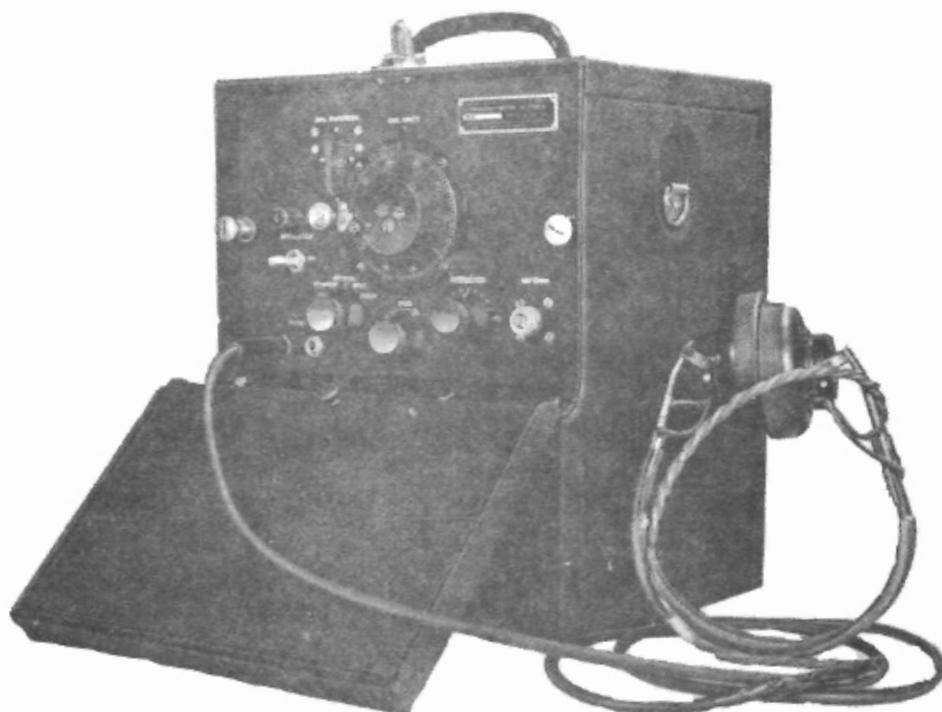
FREQUENCY METER TS-175/U

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-175/U (Complete)		7CAC-318203-235 R16-AN-TS-175/U 3F4325-175	14-1/2	9-3/4	10-3/16	18
1	Antenna AT-66/U		7CCA-WFA1400 R16-A-4934-34 3F3988-66	10 long			0.2
1	Cord CG-55/U		7CAC-170265-345 R16-AN-CG-55/U 1F430-55.60	60 long			0.7
1	Cord CG-56/U		7CAC-170265-485 R16-AN-CG-56/U 1F430-56.6	6 long			
1	Bristol Wrench No. 6	Steel	7900-859441  6R55230	1-27/32	21/32		
2	Tubes, Type 9002 (1 Spare)						
2	Tubes, Type 6K8 (1 Spare)						
2	Tubes, Type 6C8G (1 Spare)						
1	Calibration Book		6D7047-175				
1	Crystal Unit CR-1A/AR		R16-C-38594-500 2X4-5000				
1	Instruction Book		6D9810-175				



## FREQUENCY METER TS-175B/U



### FUNCTIONAL DESCRIPTION:

A general purpose, portable, self-contained, crystal-controlled, heterodyne-type frequency meter used for field testing of continuous wave or modulated carrier wave radio frequency transmitters and signal generators.

A vernier dial and calibrated chart are used in making frequency measurements. Crystal check-points are provided at 5 megacycle per second intervals in the frequency range of the oscillator.

### RELATIONSHIP TO OTHER EQUIPMENT:

Equipment required but not supplied: One Headset HS-30.

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: One 6-volt Battery BA-411/U and one 135-volt Battery BA-420/U.

Frequency Range: 85 to 1000 megacycles per second.

Fundamental Frequency: 85 to 200 megacycles per second.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			3F4325-175B
PROCUREMENT INFO.:			
PROCUREMENT COG.: Army		DESIGN COG.: Army, SSL	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.1.1	
- Electronics Test Equipment -			TS-175B/U

## FREQUENCY METER TS-175B/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

Crystal Frequency: 5000 kilocycles per second.

Type of Reception: Continuous Wave, Modulated Carrier Wave.

Type of Transmission: Continuous Wave, Modulated Carrier Wave.

Modulation: 900  $\pm$ 300 cycles per second.

RF Output: Minimum of 100 microvolts at any frequency in the calibrated range.

Audio Power Output: Minimum of 1 milliwatt.

Accuracy:  $\pm 0.04\%$  (at crystal frequency).

Temperature Range:  $-40^{\circ}$  C. to  $+55^{\circ}$  C.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Columbus Electronics Incorporated, 229 South Waverly Street, Yonkers, New York; Approximate Cost per Unit, \$660.00.

### TUBE COMPLEMENT:

1 JAN-9002, 1 JAN-6K8, 1 JAN-6C8G.

### REFERENCE DATA AND LITERATURE:

TM 11-5050 (Instruction Book).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter TS-175B/U (Complete)	2.6	20	15	15	50

TS-175B/U

- Electronics Test Equipment -

FREQUENCY METER TS-175B/U

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-175B/U		3F4325-175B/U	12-1/2	9-1/4	10	25
1	Antenna AT-66A/U		3F3988-66-66	12 long			.155
1	Cord CG-55C/U		3E5999A-1-2	60 long			.750
1	Cord CG-56A/U		3E5999A-1-1	8 long			.218
1	Bristol Wrench No. 6	Steel	7900-859441 6R55230	1-3/4 long			
2	Tube Type 9002 (1 Spare)						
2	Tube Type 6K8 (1 Spare)						
2	Tube Type 6C8G (1 Spare)						
1	Calibration Book		6D7047-175	5-5/8	4-7/8	1/2	.310
1	Crystal Unit CR-1A/AR		R16-C-38594-500 2X4-5000				
1	Instruction Book			10-1/4	7-7/8	1/4	.012



## FREQUENCY METER TS-175C/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained, crystal-controlled, heterodyne-type frequency meter used for field testing continuous wave or modulated carrier wave radio frequency transmitters and signal generators. A vernier dial and a calibrated chart are used in making frequency measurements. Crystal check points are provided at 5-megacycle intervals in the frequency range of the oscillator.

### RELATIONSHIP TO OTHER EQUIPMENT:

The TS-175C/U is similar to the TS-175B/U except for minor circuit changes, tube complement, and maintenance parts. The TS-175B/U is similar to the TS-175A/U and TS-175/U except for minor circuit improvements. The TS-175A/U is similar to the TS-175/U except for tube complement.

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: 6 volts, Battery BA-411/U; 1.35 volts, Battery BA-420/U.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.: USA, SCEL, SSL		
F.I.L.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
- Electronics Test Equipment -			TS-175C/U

## FREQUENCY METER TS-175C/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

Frequency Range: 85 to 1000 megacycles per second.  
 Fundamental Frequency: 85 to 200 megacycles per second.  
 Crystal Frequency: 5000 kilocycles per second.  
 Type of Reception: Continuous wave, modulated carrier wave.  
 Type of Transmission: Continuous wave, modulated carrier wave.  
 Modulation: 900  $\pm$ 300 cycles per second.  
 RF Output: Minimum of 100 microvolts at any frequency in the calibrated range.  
 Audio Power Output: Minimum of 1 milliwatt.  
 Accuracy:  $\pm$ 0.04% (at crystal frequency).  
 Temperature Range: -40°C to +55°C.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Colortone Electronics, Incorporated, New York, New York, Contract No. 10634-PHILA-54-34(61).

### TUBE COMPLEMENT:

2 12AT7, 1 9002, 1 CR-18/U.

### REFERENCE DATA AND LITERATURE:

TS-175B/U:

Dept of Army TM 11-5050.

TS-175A/U:

USAF TO 33A1-5-33-1.

USAF TO 33A1-5-33-2.

USAF TO 33A1-5-33-3.

USAF TO 33A1-5-33-4.

TS-175/U:

AN 16-35TS175-2.

TO 16-35TS175-5.

USAF TO 16-35TS175-21.

USAF TO 16-55-144.

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter TS-175C/U		20	15	15	50
TS-175C/U - Electronic Test Equipment -						

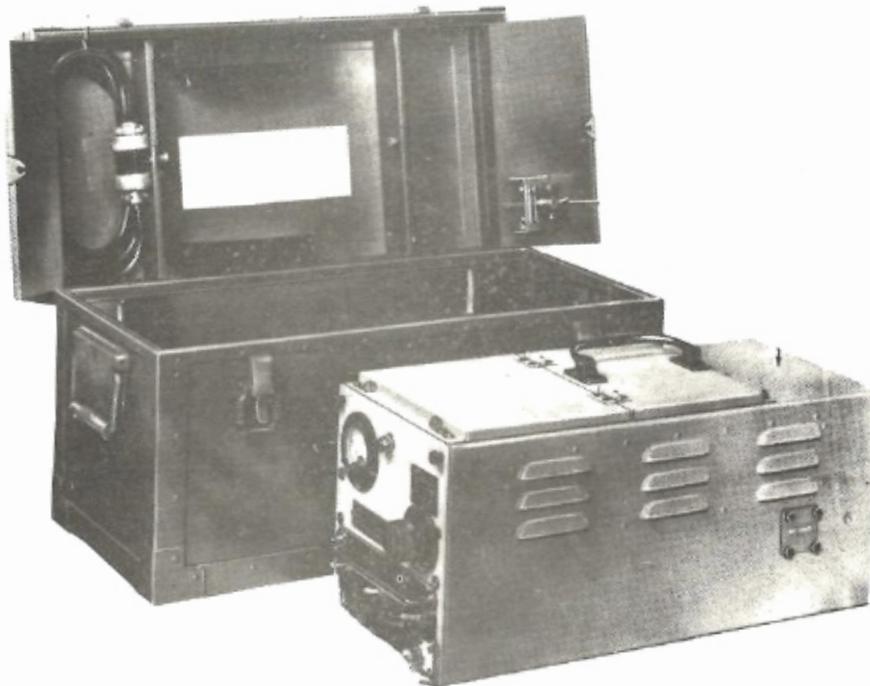
FREQUENCY METER TS-175C/U

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-175C/U	metal		12-1/2	9-1/4	10	25
1	Antenna AT-66A/U		3F3988-66-66 (USA)	12" long			0.155
1	Cord CG-55D/U		3E5999A-1-2 (USA)	60" long			0.750
1	Cord CG-56A/U		3E5999A-1-1 (USA)	8" long			0.218
1	Bristol Wrench No. 6		7900-859441 (USAF) 6R552 30 (USA)	1-3/4" long			
2	Tube Type 9002 (1 Spare)						
2	Tube Type 6K8 (1 Spare)						
2	Tube Type 6C8 (1 Spare)						
1	Calibration Book		6D7047-175 (USA)	5-5/8	4-7/8	1/2	0.310
1	Crystal Unit CR-1A/AR		R16-C-38594- 500 (USN) 2X4-5000 (USA)				
1	Instruction Book			10-1/4	7-7/8	1/4	0.012



## FREQUENCY METER TS-186C/UP



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, crystal-controlled, heterodyne-type meter designed to measure the frequencies of transmitters, oscillators, and signal generators. The meter is intended to operate with both visual and aural indication of signals by means of a beat-indicating meter, headphones, and a video output jack for observation on an oscilloscope, if desired. A vernier tuning dial and an associated calibration chart are used when making frequency measurements. This meter is used in field and depot testing.

### RELATIONSHIP TO OTHER EQUIPMENT:

This meter is electrically and mechanically interchangeable with Frequency Meters TS-186/UP, TS-186A/UP, and TS-186B/UP. The TS-186C/UP meter has improved power transformer design.

### ELECTROMECHANICAL DESCRIPTION:

Circuit Information: Radio frequency input is received from a waveguide where it

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-318208-77		3F4325-186C
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Navy	DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		TS-186C/UP

## FREQUENCY METER TS-186C/UP

### ELECTROMECHANICAL DESCRIPTION:

is adapted to a coaxial cable. It enters a detector mixer where it is mixed with the output of a heterodyne oscillator. From there the difference signal is amplified in an audio amplifier. There is a crystal oscillator which is used to check the frequency calibration of the heterodyne oscillator, by taking the place of the input signal. This checking is done at definite check points near the frequency at which measurement will be made. A DC milliammeter helps to indicate zero beat as well as measure the grid current of the crystal oscillator, the cathode current of the detector mixer, the cathode current of the heterodyne oscillator, and the cathode current of the indicator. A selector switch determines which value will be measured. The indicator circuit causes a dip in the meter near zero beat, but since it does not respond to frequencies less than 100 cycles per second, a pair of headphones is necessary to determine actual zero beat. The video output is made available through a video jack leading from the detector mixer to feed a usable signal to an outside oscilloscope.

Power Supply: 115 volts  $\pm 10\%$ , AC, 50 to 1000 cycles per second, 70 watts.

Frequency Range: 100 to 10,000 megacycles per second.

Fundamental Frequency Range: 500 to 1250 megacycles per second.

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulsed.

Dial Calibration: 16,500 dial divisions.

Signal Input: 500 microvolts to 1 volt.

Audio Signal Output: 10 microwatts to 20 watts.

Sensitivity: A 1000 microvolt input signal within the range of 500 to 1250 megacycles per second produces an audio-output signal of 20 milliwatts.

Audio Amplifier Range: 100 to 100,000 cycles per second.

Accuracy:  $\pm 0.01\%$  (Crystal:  $\pm 0.002\%$ ).

RF Impedance (Input): RF Antenna pick-up.

RF Impedance (Output): RF Antenna.

Audio Output Impedance: 250 ohms (to match headset impedance).

Temperature Range:  $-40^{\circ}$  C. to  $+55^{\circ}$  C.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Federal Manufacturing and Engineering Corporation, Brooklyn 5, New York; Navy Contract No. NObsr-49229, dated 16 June 1950.

### TUBE COMPLEMENT:

1 JAN-2C40, 1 JAN-6SN7, 1 JAN-2C51, 1 JAN-5Y3GT/G, 4 JAN-6SJ7, 2 JAN-0D3/VR-150.

### REFERENCE DATA AND LITERATURE:

NavShips 91376 (Instruction Book).

TO 16-35TS186-15 (Instruction Book).

FREQUENCY METER TS-186C/UP

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-186C/UP Including:	Aluminum and Wood	7CAC-318208-77 3F4325-186C	9-1/2	8-1/2	20	42.5
1	Coaxial Adapter J-104		3300-325004095 N16-A-15630-7051 3F2-1	1-5/8	1-5/8	2-7/16	0.2
1	Power Cable NT-62412		7CAC-170264432 N17-C-48236-2051 3E7350.1-86	84 long			0.8
2	Instruction Book NavShips 91376						1.5
1	Transit Case CY-556A/UP	Aluminum and Wood	16-C-170001-335	13	11-1/2	23	22.0
						Total:	67.0

SHIPPING DATA:

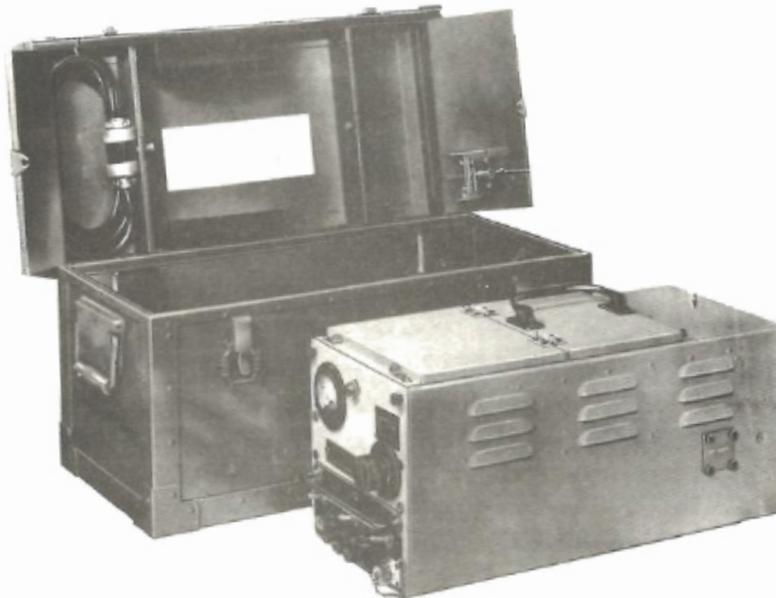
No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter TS-186C/UP (Export Packed - Water Resistant Carton)	6.8	18-1/2	18-1/2	34-1/4	97

- Electronics Test Equipment -

TS-186C/UP



## FREQUENCY METER TS-186D/UP



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, crystal-controlled, heterodyne-type meter designed to measure the frequencies of transmitters, oscillators, and signal generators. The meter is intended to operate with both visual and aural indication of signals by means of a beat-indicating meter, headphones, and a video output jack for observation on an oscilloscope, if desired. A vernier tuning dial and an associated calibration chart are used when making frequency measurements. This meter is used in field and depot testing.

### RELATIONSHIP TO OTHER EQUIPMENT:

Similar to TS-186C/UP except that detector mixer tube Type 12AT7 is used in the TS-186D/UP and Type CC51 is used in the TS-186C/UP.

### ELECTROMECHANICAL DESCRIPTION:

Circuit Information: Radio frequency input is received from a waveguide where it is adapted to a coaxial cable. It enters a detector mixer where it is mixed with

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-526215		3F4325-186D
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Navy	DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2, 1, 1		
	- Electronics Test Equipment -		TS-186D/UP

## FREQUENCY METER TS-186D/UP

### ELECTROMECHANICAL DESCRIPTION: (Continued)

the output of a heterodyne oscillator. From there the difference signal is amplified in an audio amplifier. There is a crystal oscillator which is used to check the frequency calibration of the heterodyne oscillator, by taking the place of the input signal. This checking is done at definite checkpoints near the frequency at which measurement will be made. A DC milliammeter helps to indicate zero beat as well as measure the grid current of the crystal oscillator, the cathode current of the detector mixer, the cathode current of the heterodyne oscillator, and the cathode current of the indicator. A selector switch determines which value will be measured. The indicator circuit causes a dip in the meter near zero beat, but since it does not respond to frequencies less than 100 cycles per second, a pair of headphones is necessary to determine actual zero beat. The video output is made available through a video jack leading from the detector mixer to feed a usable signal to an outside oscilloscope.

Power Supply: 115 volts  $\pm 10\%$ , AC, 50 to 1000 cycles per second, single phase, 70 watts.

Frequency Range: 100 to 10,000 megacycles per second.

Fundamental Frequency Range: 500 to 1250 megacycles per second.

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulsed.

Dial Calibration: 16,500 dial divisions.

Signal Input: 500 microvolts to 1 volt.

Audio Signal Output: 10 microwatts to 20 watts.

Sensitivity: A 1000 microvolt input signal within the range of 500 to 1250 megacycles per second produces an audio-output signal of 20 milliwatts.

Audio Amplifier Range: 100 to 100,000 cycles per second.

Accuracy of Frequency Measurements:  $\pm 0.01\%$  (Crystal:  $\pm 0.002\%$ ).

Audio Output Impedance: 600 ohms (to match headset impedance).

Temperature Range:  $-40^{\circ}\text{C.}$  to  $+55^{\circ}\text{C.}$

Humidity Range: 0 to 95% relative humidity.

Pressure Range: Up to 10,000 feet.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Federal Manufacturing and Engineering Corporation, 199 Steuben Street, Brooklyn 5, New York; Navy Contract No. NObSR-52270, dated 23 February 1951.

### TUBE COMPLEMENT:

1 JAN-2C40, 1 JAN-6SN7, 1 JAN-12AT7, 1 JAN-5Y3GT/G, 4 JAN-6SJ7, 2 JAN-OD3/VR-150.

### REFERENCE DATA AND LITERATURE:

NAVSHIPS 91592 (Instruction Book).

33A1-5-38-1 (Operation and Service Instructions with Parts List).

FREQUENCY METER TS-186D/UP

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter TS-186D/UP (Export Packed - Water Resistant Carton)	6.8	18-1/2	18-1/2	34-1/4	97

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-186D/UP	Aluminum and Wood	7CAC-526215 3F4325-186D	9-1/2	8-1/2	20	42.5
1	Coaxial Adapter J-104		3300-325004095 N16-A-15630-7051 3F2-1	1-5/8	1-5/8	2-7/16	0.2
1	Power Cable CWI-62412		7CAC-170264432 N17-C-48236-2051 3E7350.1-86	84 long			0.8
2	Instruction Book NavShips 91592						1.5
1	Transit Case CY-556A/UP	Aluminum and Wood	16-C-170001-335	13	11-1/2	23	22.0
						Total:	67.0



## FREQUENCY METER TS-323/UR



### FUNCTIONAL DESCRIPTION:

A general purpose, portable, self-contained, crystal-controlled, heterodyne-type frequency meter used for field testing of continuous wave, modulated carrier wave, or pulsed radio frequency transmitters and signal generators.

A vernier dial and calibrated chart are used in making frequency measurements. Crystal check-points are provided at one megacycle per second intervals along the fundamental range of the oscillator.

### RELATIONSHIP TO OTHER EQUIPMENT:

Recommended in place of TS-174/U.

Similar to Gertsch Products Inc. (11846-48 Mississippi Avenue, Los Angeles 25, California) Model FM-1.

Used to test Radar Sets such as AN/APT-6 and AN/FRN-12A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-318208-845	R16-AN-TS-323-UR	3F4325-323
PROCUREMENT INFO.:	Navy Spec. No. RE13A930A; Spec. MIL-F-4147A (Aer)		
PROCUREMENT COG.:	Navy	DESIGN COG.:	Navy, BuAer
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.1		
	- Electronics Test Equipment -		TS-323/UR

## FREQUENCY METER TS-323/UR

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: Two Batteries, BA-203/U (6 volts), three Batteries, BA-59 (45 volts), or External Power Pack, PP-106/U.

Type of Reception and Transmission: Continuous Wave, Modulated Carrier Wave.

Frequency Range: 20 to 480 megacycles per second.

Fundamental Frequency Range: 20 to 40 megacycles per second.

Accuracies: 0.005% (standard conditions); 0.01% (service conditions).

Audio: 20 milliwatts at check points.

Modulation: 30% to 90% between 800 to 1200 cycles per second.

Radio Frequency Output: 50 to 1000 microvolts.

Sensitivity: 50,000 microvolts signal gives audio beat note output of 10 milliwatts, range 2,500 to 500,000 microvolts.

Temperature Range: +5° F. to +122° F.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Hoffman Radio Corporation, Los Angeles, California; Contract No. NXsa-76139, August 1945; Approximate Cost per Unit, \$525.00.

The Daven Company, 195 Central Avenue, Newark 4, New Jersey; Contract No. N383s-59463, MIPR-R51-5320N, R51-5232, and R51-5383N.

### TUBE COMPLEMENT:

1 JAN-9001, 1 JAN-9002, 2 JAN-6AK5, 1 JAN-6C4.

### REFERENCE DATA AND LITERATURE:

AN 08-35TS323-2 (Maintenance Instructions).

TO 16-35TS323-12 (Maintenance Instructions).

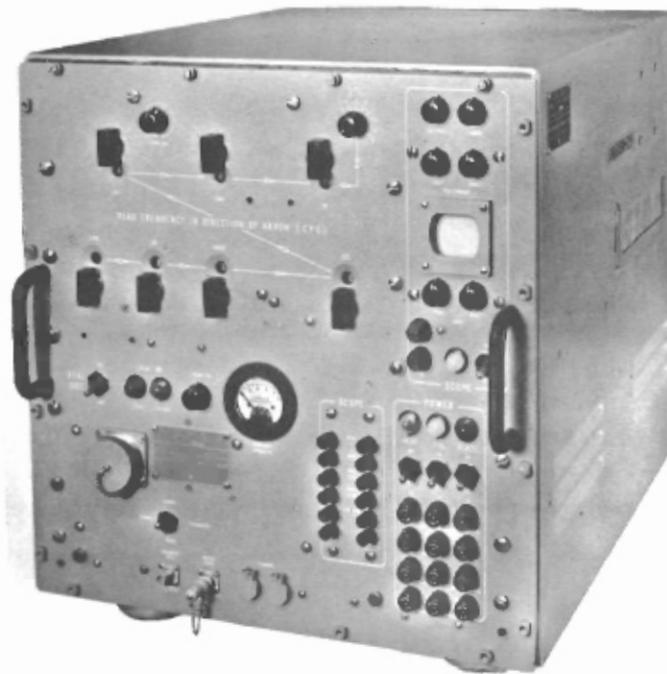
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
TS-323/UR - Electronics Test Equipment -						





## FREQUENCY METER AN/USM-29



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, synthesizing type meter used for calibrating the frequency of radio transmitters and receivers. Indication is on 8 dials arranged in decade for direct reading in cycles per second, kilocycles per second, and megacycles per second. An oscilloscope screen provides visual indication of the signal. This meter is used in field and depot testing. Headphone jacks are located on the front panel. A jack is provided at the rear of the equipment for input from an external crystal oscillator when the internal crystal oscillator is not used.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

Circuit Information: The signal is synthesized by mixing harmonics and sub-harmonics of the output of a crystal oscillator unit with the output of an interpolation

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-526373-5		
PROCUREMENT INFO.:	Spec. MIL-F-15627(Ships) dated 15 August 1950		
PROCUREMENT COG.:	Navy	DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.1.3		
	- Electronics Test Equipment -		AN/USM-29

## FREQUENCY METER AN/USM-29

### ELECTROMECHANICAL DESCRIPTION: (Continued)

oscillator. There are two beat frequency detectors, an oscilloscope, and a heterodyne beat detector and indicator. The output signal is available at a connector on the front panel and is also supplied internally to the beat indicator detectors. This meter either furnishes a signal of known frequency or measures an unknown frequency.

Power Supply: 105 to 125 volts, AC, single phase, 50 to 1000 cycles per second. 400 watts, heaters off; 550 watts, heaters on.

Frequency Range: 15 kilocycles per second to 30 megacycles per second.

Input Signal: In Headphones: 0.001 volts, maximum.

In Meter: 0.01 volts, maximum.

Output Signal:

1 volt, minimum, into 50 ohms between 6 and 30 megacycles per second.

1 volt, minimum, into 500 ohms between 15 kilocycles per second and 6 megacycles per second.

Input Impedance: 1000 ohms in parallel with 90 micromicrofarads.

Accuracy:

$\pm 0.0001\%$   $\pm 10$  cycles per second of indicated frequency when using the internal crystal oscillator.

$\pm 10$  cycles per second of the accuracy of indication of an external crystal oscillator, when one is used.

$\pm 4$  cycles per second of calibrated frequency at room temperature.

Spurious Response: 60 decibels below signal level.

Harmonics: 30 decibels below signal level at 6 to 30 megacycles per second, 10 decibels below signal level at 0.015 to 6 megacycles per second.

Temperature Range:  $-20^{\circ}\text{C.}$  to  $+55^{\circ}\text{C.}$

### MANUFACTURERS' OR CONTRACTORS' DATA:

Hoffman Laboratories, Inc., Los Angeles, California; Navy Contract No. NObsr-52722.

### TUBE COMPLEMENT:

5 JAN-12AU7, 3 JAN-12AT7, 28 JAN-6AK5, 8 JAN-6AK6, 13 JAN-6AS6, 1 JAN-2BP1, 1 JAN-6X4, 1 JAN-1Z2, 4 JAN-6AH6, 2 JAN-5R4GY, 1 JAN-6AS7G, 1 JAN-12AX7, 1 JAN-5651.

### REFERENCE DATA AND LITERATURE:

TO 16-30USM29-5 (Instruction Book).

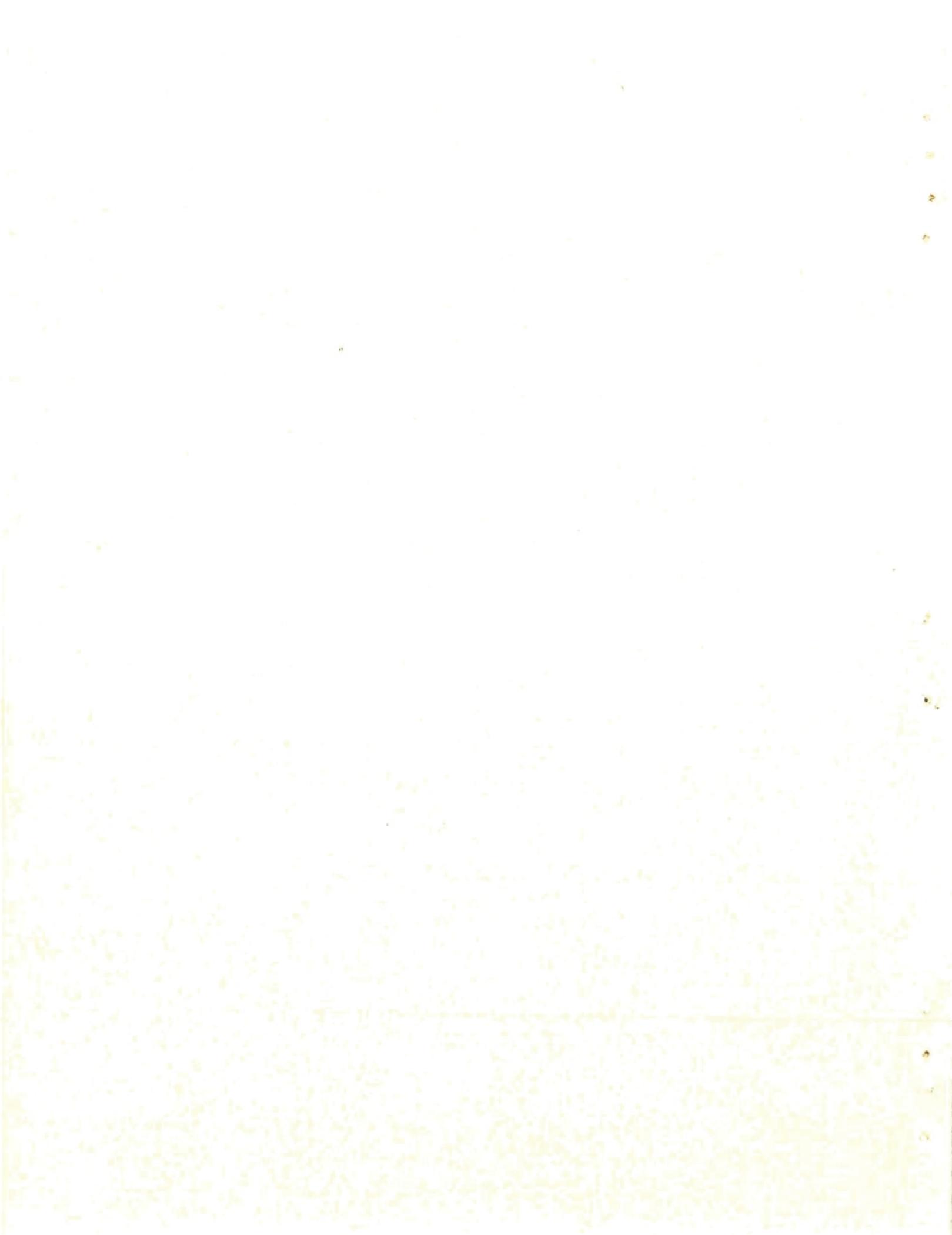
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter AN/USM-29	13.6	27-1/2	26-1/2	32-1/2	292
1	Equipment Spare Parts	3.1	11-1/2	15-5/8	29-5/8	110





2. 2      ABSORPTION (REACTION) TYPE FREQUENCY METERS



## WAVEMETER FR-39/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, tuned-circuit, absorption type meter in which inductance and capacitance are varied simultaneously. It is used to measure the frequencies of oscillators. Indication is on a direct reading engraved meter dial calibrated in megacycles per second and on an incandescent lamp which glows when the meter is tuned to resonance with the frequency to be measured. It is used for organizational, field, and depot testing.

### RELATIONSHIP TO OTHER EQUIPMENT:

This meter is similar to General Radio Type 758-A Wavemeter.

### ELECTROMECHANICAL DESCRIPTION:

Circuit Information: When coupled to an oscillator of about 2 watts output, this meter will indicate the oscillator's output frequency in the following way: the meter's tunable tank circuit will oscillate when tuned to the output frequency of the

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-979571	F16-W-47062-7551	2C8358A
PROCUREMENT INFO.:	Army Spec. 71-3379		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, CSL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.1		
	- Electronics Test Equipment -		FR-39/U

## WAVEMETER FR-39/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

oscillator. This will cause the lamp to glow because the tank circuit's developed voltage will be a maximum at that point. The dial is so calibrated that a pointer attached to the tuning knob will indicate the frequency at which the lamp glows.

Power Supply: None.

Frequency Range: 55 to 400 megacycles per second.

Type of Reception: Continuous wave and Pulsed.

Accuracy:  $\pm 2\%$  of indicated frequency.

### MANUFACTURERS' OR CONTRACTORS' DATA:

General Radio Company, Cambridge, Massachusetts; Approximate Cost per Unit, \$40.00, October 1951.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

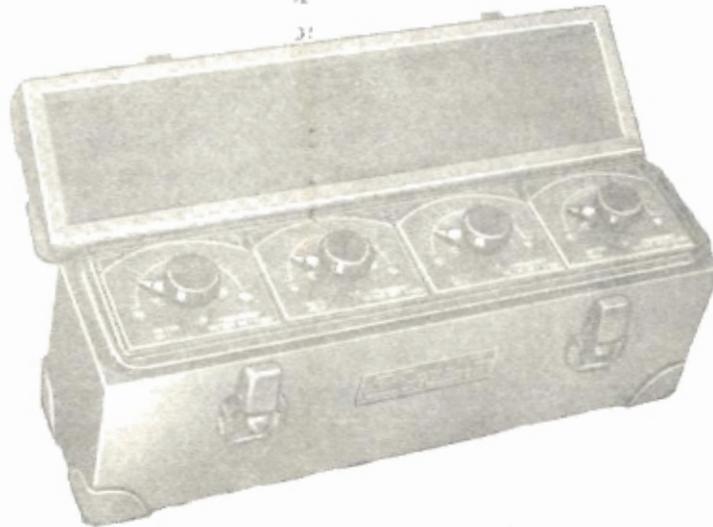
### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-39/U	Bake- lite & trans- parent plastic	7CAC-979571 F16-W-47062-7551 2C8358A	5	5	4-3/4	1.625
2	Spare Indicator Lamp						

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
FR-39/U - Electronics Test Equipment -						

FREQUENCY METER SET I-129-B  
(WAVEMETER, I-129-B)



**FUNCTIONAL DESCRIPTION:**

A portable, self-contained instrument consisting of four absorption-type meters carried in a case, and designed to measure the frequency of any oscillator or other radio frequency source. The set is used to determine the fundamental frequency of an oscillator, or to pick the correct harmonics from a harmonic crystal oscillator or frequency multiplier.

A resonance indicating device must be connected to the circuit under test so that a change in the losses of the circuit being measured will produce a change in the indicator.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Models A and B are identical except for frequency ranges. Model BM is similar to Model B except that Model BM has a pilot lamp indicator loop added which indicates resonance of meter with transmitted signal.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1600-326210000		3F2729-B
PROCUREMENT INFO.:	Sig. Corps Spec. No. 71-1388, Dwg. No. 1606		
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, CSL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.1		
	- Electronics Test Equipment -		I-129-B

**FREQUENCY METER SET I-129-B  
(WAVEMETER, I-129-B)**

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range: 1.5 to 41 megacycles per second in four ranges: 1.5 to 3.5 megacycles per second, 3.5 to 8.0 megacycles per second, 8.0 to 18.5 megacycles per second, 18.0 to 41.0 megacycles per second.

Type of Reception: Continuous Wave or Pulsed.

Accuracy:  $\pm 3\%$ .

**MANUFACTURERS' OR CONTRACTORS' DATA:**

James Millen Manufacturing Company, Malden, Massachusetts, Order Nos. 30949-Phila-43 and 14988-Phila-43; Approximate Cost per Unit, \$21.00.

**TUBE COMPLEMENT:**

None.

**REFERENCE DATA AND LITERATURE:**

TM 11-304 (Technical Manual).

TO 16-401129-5 (Instruction Book).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
I-129-B - Electronics Test Equipment -						

FREQUENCY METER SET I-129-B  
(WAVEMETER, I-129-B)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter, I-129-B Including:		1600-326210000 3F2729-B				
1	Frequency Meter (1.5 to 3.5 megacycles per second)			4-1/2	2-1/2	3	0.3125
1	Frequency Meter (3.5 to 3.8 megacycles per second)			4-1/2	2-1/2	3	0.3125
1	Frequency Meter (8 to 18.5 megacycles per second)			4-1/2	2-1/2	3	0.3125
1	Frequency Meter (18 to 41 megacycles per second)			4-1/2	2-1/2	3	0.3125
1	Carrying Case	Ply- wood		12-7/8	5-1/8	3-1/8	2.2500
1	Technical Manual TM 11-304						
- Electronics Test Equipment -							I-129-B



## FREQUENCY METER SET I-129-BM



### FUNCTIONAL DESCRIPTION:

A portable, self-contained instrument consisting of four absorption-type meters carried in a case, and designed to measure the frequency of any oscillator or other radio frequency source. The set is used to determine the fundamental frequency of an oscillator, or to pick the correct harmonics from a harmonic crystal oscillator or frequency multiplier.

A resonance indicating device must be connected to the circuit under test so that a change in the losses of the circuit being measured will produce a change in the indicator.

### RELATIONSHIP TO OTHER EQUIPMENT:

Models A and B are identical except for frequency ranges. Model BM is similar to Model B except that Model BM has a pilot lamp indicator loop added which indicates resonance of meter with transmitted signal.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	1600-326198000		3F2729-BM
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, CSL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.1		
- Electronics Test Equipment -			I-129-BM

FREQUENCY METER SET I-129-BM

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Type of Reception: Continuous Wave or Pulsed.

Frequency Range: 1.5 to 41 megacycles per second in four ranges: 1.5 to 3.5 megacycles per second, 3.5 to 8.0 megacycles per second, 8.0 to 18.5 megacycles per second, 18.0 to 41.0 megacycles per second.

Accuracy:  $\pm 3\%$ .

MANUFACTURERS' OR CONTRACTORS' DATA:

James Millen Manufacturing Company, 150 Exchange Street, Malden, Massachusetts.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

TM 11-304 (Technical Manual).

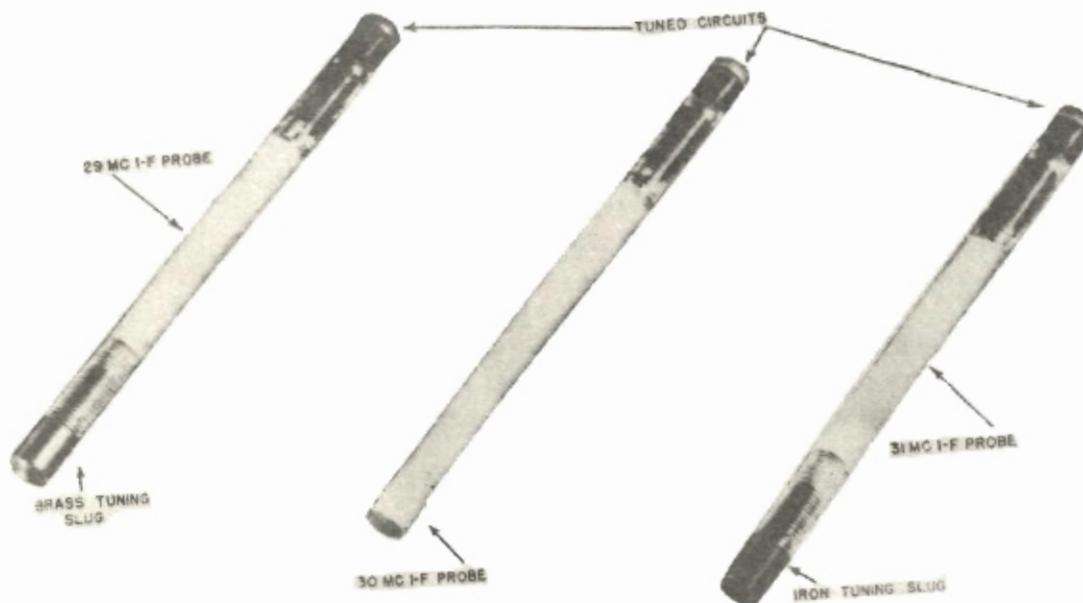
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
I-129-BM - Electronics Test Equipment -						





## FREQUENCY METER SET TS-354/UP



### FUNCTIONAL DESCRIPTION:

A portable set of absorption-type frequency meters designed to check the tuning of receiver intermediate frequency circuits within a frequency range of 29, 30, and 31 megacycles per second.

Consists of three absorption frequency meters or intermediate frequency (i-f) test probes. One probe, i-f test probe (30), has a tuned circuit adjusted to resonance at 30 megacycles built into one end of a polystyrene rod. The other two probes of the set have similar tuned circuits adjusted to 29 and 31 megacycles, respectively. When testing i-f amplifiers with a frequency-modulated test oscillator, the three test probes provide three spot-frequency indication on the indicating oscilloscope which are useful in estimating the resonant frequency and bandwidth of the i-f circuits.

The opposite ends of the 29 and 31 megacycle per second probes contain metal "tuning wand" slugs which can be used to check the tuning of individual coils.

All indications appear on the associated test equipment.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-801319-2168		3F4325-354
PROCUREMENT INFO.:	Army Dwg. Nos. C-11503-A through F		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, SigC	
F.I.I.N.:	FUNCTIONAL CLASS. NO.:		2.2.1
- Electronics Test Equipment -			TS-354/UP

FREQUENCY METER SET TS-354/UP

RELATIONSHIP TO OTHER EQUIPMENT:

Part of Radar Test Set AN/TPM-7.

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 29, 30, and 31 megacycles per second.

Accuracy:  $\pm 0.1$  megacycle per second.

MANUFACTURERS' OR CONTRACTORS' DATA:

F. W. Sickles Company, 165 Front Street, Chicopee, Massachusetts; Order No. 199-MPD-45; Approximate Cost per Unit, \$4.00.

Electronic Specialties, RFD No. 2, Plainfield, New Jersey; Order No. 21781-P-50; 20 June 1950; Approximate Cost per Unit, \$3.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

TO 16-35TS354-2 (Operating Instructions).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter Set TS-354/UP	.003	5	1	1	1/2
TS-354/UP - Electronics Test Equipment -						

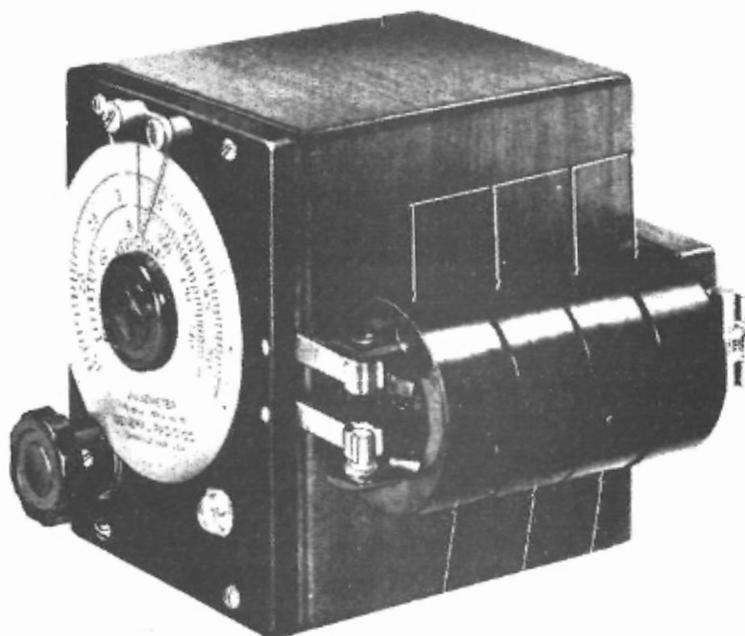
FREQUENCY METER SET TS-354/UP

EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter Set TS-354/UP Including:		7CAC-801319-2168  3F4325-354				
1	Intermediate Frequency Test Probe (29) TFI-1SK/29	Poly- sty- rene rod with cop- per slug		4-1/2 long	5/16 dia.		1/2 oz.
1	Intermediate Frequency Test Probe (30) TFI-1SK/30	Poly- sty- rene rod		4-1/2 long	5/16 dia.		1/4 oz.
1	Intermediate Frequency Test Probe (31) TFI-1SK/31	Poly- sty- rene rod with pow- dered iron slug		4-1/2 long	5/16 dia.		3/8 oz.
- Electronics Test Equipment -							TS-354/UP



FREQUENCY METER TS-480/U  
(WAVEMETER, TS-480/U)



**FUNCTIONAL DESCRIPTION:**

A portable, self-contained, general purpose, absorption type frequency meter used to measure the frequency of radio frequency oscillations. This meter may also be used to indicate the presence of harmonic and parasitic oscillations, to neutralize amplifiers, and to indicate the presence of stray radio frequency fields.

Resonance is indicated by maximum brightness of a small incandescent lamp.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Similar to General Radio Type 566A.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range: 0.5 to 150 megacycles per second in five ranges, (0.5 to 1.6, 1.6 to 5.0, 5.0 to 16.0, 16.0 to 50.0, 50.0 to 150.0 megacycles per second).

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	1600-328530020	R16-W-2123	3F26004-2
PROCUREMENT INFO.:	Army Spec. No. 71-3351		
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, CSL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.1		
	- Electronics Test Equipment -		TS-480/U

FREQUENCY METER TS-480/U  
(WAVEMETER, TS-480/U)

ELECTROMECHANICAL DESCRIPTION: (Continued)

Type of Reception: Continuous Wave and Pulsed.

Accuracy:  $\pm 2\%$  for 0.5 to 16 megacycles per second.

$\pm 3\%$  for 16 to 150 megacycles per second.

MANUFACTURERS' OR CONTRACTORS' DATA:

General Radio Company, 275 Massachusetts Avenue, Cambridge 39, Massachusetts; Order No. 11046-Phila-47-77, Order No. 25425-Phila-49-2; Approximate Cost per Unit, \$75.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

TM 11-5042 (Technical Manual).

TO 16-35TS480-5 (Instruction Book).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter TS-480/U Complete (Export Packed)	0.256	9	7	7	5.5

TS-480/U - Electronics Test Equipment -

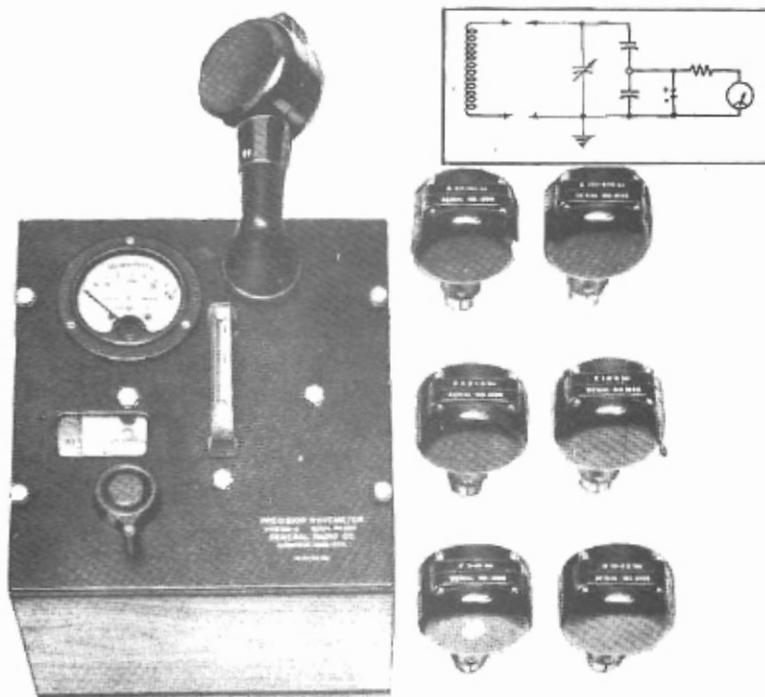
FREQUENCY METER TS-480/U  
(WAVEMETER, TS-480/U)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-480/U	Wood	1600-328530020 R16-W-2123 3F26004-2	5-7/8	4-3/4	5-3/4	3.0
2	Indicator Lamp 1.35 v, 0.062 amps (1 Spare)						
1	Carrying Case						
2	Technical Manual TM 11-5042						
1	Coil, RF (0.5-1.6 mc)	Bake- lite	3C1084Z60	7/8 long	2 dia.		
1	Coil, RF (1.6-5 mc)	Bake- lite	3C1084Z60-1	7/8 long	2 dia.		
1	Coil, RF (5-16 mc)	Bake- lite	3C1084Z60-2	7/8 long	2 dia.		
1	Coil, RF (16-50 mc)	Bake- lite	3C1084Z60-3	7/8 long	2 dia.		
1	Coil, RF (50-150 mc)	Bake- lite	3C1084Z60-4	7/8 long	2 dia.		
- Electronics Test Equipment -							TS-480/U



**FREQUENCY METER  
PRECISION WAVEMETER, TYPE 724-B  
(General Radio Company)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose tuned circuit absorption type precision wavemeter used for frequency measurements where more precise heterodyne methods are not necessary nor convenient. Applications would include the preliminary lining up of radio transmitters and checking the frequency span of oscillators. Resonance is indicated by a peak value reading on the galvanometer. The capacitor setting is indicated on a dial and drum and controlled from the front of the panel. The calibration is supplied in the form of a table of calibrated points. Linear interpolation between these points is used to obtain settings for other frequencies.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Used to test Radar Sets, AN/CPN-11A, AN/CPN-11B, AN/CPN-12A, and AN/CPN-12B.

**ELECTROMECHANICAL DESCRIPTION:**

Circuit Information: Consists of a precision capacitor, a resonance indicator and a  
(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.		CAG-60098-A	
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.: Commercial		
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.1		
- Electronics Test Equipment -			Type 724-B

FREQUENCY METER  
PRECISION WAVEMETER, TYPE 724-B  
(General Radio Company)

**ELECTROMECHANICAL DESCRIPTION:**

set of inductors. The capacitor is a worm-drive type with 7500 divisions for the entire degree angular rotation of the capacitor rotor. The plates are shaped to give an approximately linear variation in frequency with scale setting. A germanium crystal rectifier is used with a microammeter to indicate resonance. The indicator is coupled to the tuned circuit through a capacitive voltage divider. The inductors are coils wound on steatite forms and enclosed in molded phenolic cases. Seven coils are used to cover the frequency range. The coils are plug-in types and can be rotated to give varying degrees of coupling without moving the wavemeter.

Power Supply: None.

Frequency Range: 10 kilocycles per second to 50 megacycles per second.

Accuracy:  $\pm 0.25\%$ .

Precision Setting of Capacitor: Better than one part in 25,000.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

General Radio Company, Cambridge, Massachusetts; Approximate Cost per Unit, \$295.00, January 1953.

**TUBE COMPLEMENT:**

1 JAN-1N34 (Germanium Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Catalog "M", 1951.

**SHIPPING DATA:**

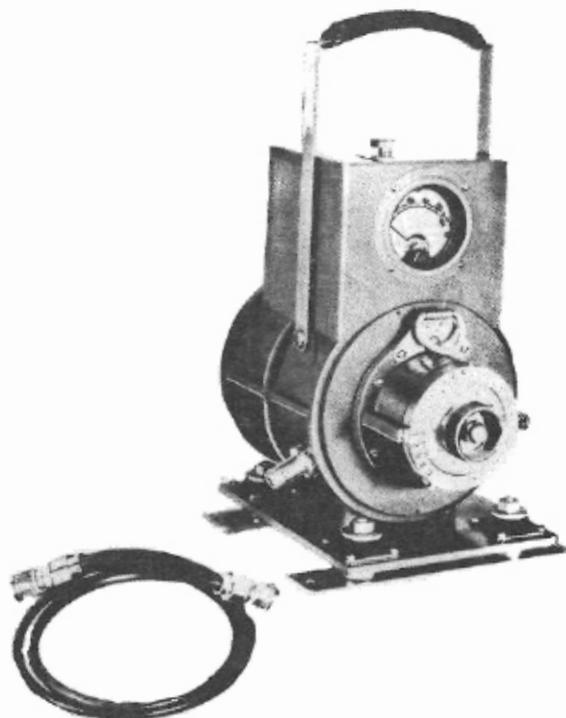
No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, Coils, Calibration Chart, and Carrying Case	7.4	21	29	21	73

Type 724-B - Electronics Test Equipment -





**RADAR TEST SET AN/UPM-30  
(TEST SET, RADAR AN/UPM-30)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, and self-contained, hand-tuned, microwave coaxial type echo box or resonant cavity. It will indicate relative power output of the radar transmitter, the frequency and general effectiveness of the radar system. Resonance is indicated by meter deflections, and a calibration chart is used to translate dial readings into frequency values. A visual indication of system performance appears on the radar screen.

The following tests are most often performed: (1) relative indication (from day to day) of transmitter power output, (2) measurement of transmitter and local oscillator frequencies, (3) analysis of transmitter frequency spectrum, (4) checking on erratic operation, double moding and frequency pulling, (5) measurement of pulse duration, (6) checking of receiver AFC action, measurement of TR box and receiver recovery time, (7) measurement of standing wave ratio, of transmission line losses, and other factors.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.			
PROCUREMENT INFO.:	BuShips Specs. CS 1241A and Ships-R-81		
PROCUREMENT COG.:		DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		AN/UPM-30

RADAR TEST SET AN/UPM-30  
(TEST SET, RADAR AN/UPM-30)

RELATIONSHIP TO OTHER EQUIPMENT:

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.  
 Frequency Range: 1150 to 1350 megacycles per second.  
 Type of Reception and Transmission: Pulse.  
 Decay: 3.5 decibels per microsecond.  
 Sensitivity: 1 decibel power loss for 50 yards ring time.  
 Temperature Coefficient: -0.105% ring time per degree F. at 68° F.  
 Accuracy: ±5 megacycles per second of indicated frequency.  
 Temperature Range: -65.2° F. to +140° F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Johnson Service Company, Milwaukee, Wisconsin; Contract Nos. NObsr-43457 and NObsr-49254; Approximate Cost per Unit, \$2030.80, dated January 1952.

TUBE COMPLEMENT:

1 JAN-1N21B (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

NAVSHIPS 41213 (Instruction Book).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	One each Radar Test Set AN/UPM-30 including one box of accessories and two instruction books. (Export Packed)	4.7	25	17-1/2	18-1/2	80
AN/UPM-30 - Electronics Test Equipment -						

RADAR TEST SET AN/UPM-30  
(TEST SET, RADAR AN/UPM-30)

EQUIPMENT SUPPLIED:

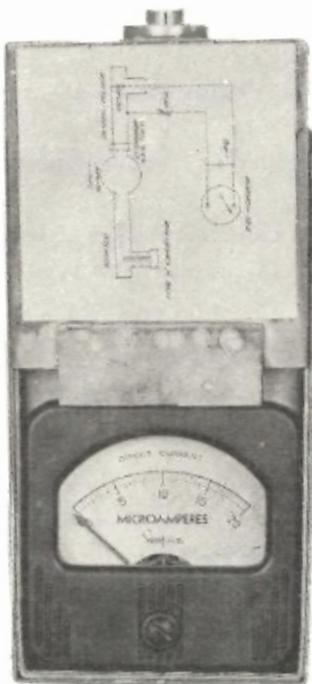
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Radar Test Set AN/UPM-30 Including:						
1	Echo Box TS-545/UP		7CAC-177651 F16-Q-30475-200 3F4325-545	11-9/16	8-1/16	9-5/8	25.25
1	Separable Shock-Mounted Base			2-1/4	8-3/4	8-1/4	4.00
1	Case CY-1139/UPM-30	Steel		17	14-1/4	14-5/8	
1	Cord CG-92B/U		7CAC-170265-2 3E6016-92B-120	120 long			1.50
1	Pickup Antenna or						
1	Directional Coupler						
3	Crystal Rectifier 1N21B		3300-234137010 2J1N21B				
1	Carrying Strap						0.20
1	Spanner Wrench (1 inch)		7900-868570 6R57528				0.01
1	Socket Wrench		3300-680712410 6R57420-2				0.25
1	Accessory Box			3-7/8	8-1/2	9-1/8	8.00
2	Instruction Book NAVSHIPS 91213						

- Electronics Test Equipment -

AN/UPM-30



## WAVEMETER AN/USM-22



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, miniature, cavity-type frequency meter used as a go-no-go check for radar beacons that operate at its frequency. Indication is on a meter dial. It is used in organizational testing.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** A directional coupler inserted into the waveguide transmits the output of the set being tested to a reference cavity which acts as a narrow band-pass filter. Output of the cavity is rectified by a crystal and causes indication on a microammeter. This indication will be a maximum at the reference frequency, affording an accurate check on the frequency indication of the transmitter output at one point.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.			
PROCUREMENT INFO.:	Spec. MIL-W-4351; USAF Dwg. No. 50C13668B, 51D12954		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, C&N	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2.		
	- Electronics Test Equipment -		AN/USM-22

WAVEMETER AN/USM-22

ELECTROMECHANICAL DESCRIPTION: (Continued)

Power Supply: None.

Frequency Range: 9310 megacycles per second, fixed. (Beacon Cavity, 1Q24A).

Meter Range: 0 to 20 microamperes.

Accuracy:  $\pm 0.00322\%$  of reference frequency.  $\pm 0.3$  megacycle per second of reference frequency.

Temperature Range:  $-50^{\circ}$  C. to  $+60^{\circ}$  C. (non-operating).

MANUFACTURERS' OR CONTRACTORS' DATA:

Development Model: Communications and Navigation Laboratory, Weapons Components Division, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, on E. O. 101-100.

TUBE COMPLEMENT:

1 JAN-1N23B (Crystal).

REFERENCE DATA AND LITERATURE:

TO 16-30USM22-4 (Illustrated Parts Breakdown).

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter AN/USM-22 Including:			4-5/8	6-5/16	4-1/4	4.5
1	Wavemeter FR-60/USM-22	Steel		3-3/4	5-3/4	2-1/2	3.0
1	Case CY-960/USM-22	Aluminum		4-5/8	6-5/16	4-1/4	1.5

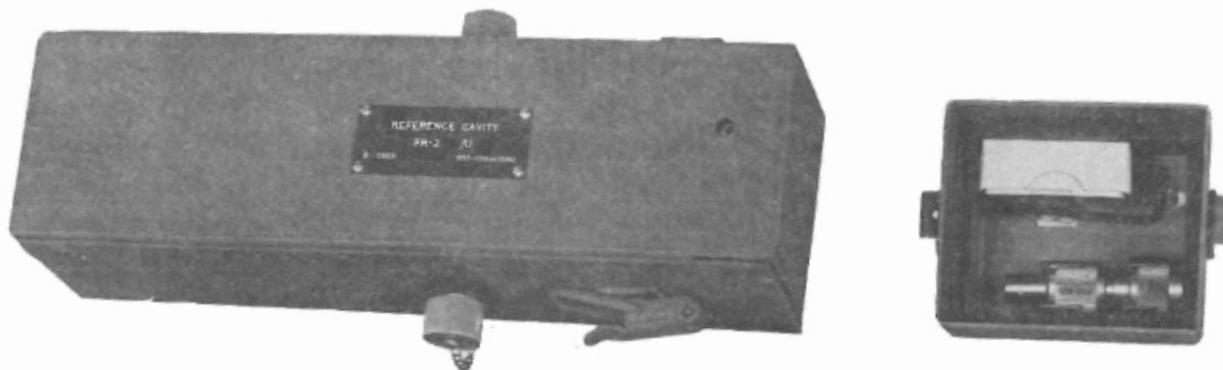
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

AN/USM-22

- Electronics Test Equipment -

REFERENCE CAVITY FR-2/U  
(CAVITY TUNED, FR-2/U)



FUNCTIONAL DESCRIPTION:

A portable, general purpose, hermetically sealed reference cavity of the absorption type used as a secondary standard of frequency for testing beacon equipment. The cavity is tuned by means of a calibrated plunger.

RELATIONSHIP TO OTHER EQUIPMENT:

ELECTROMECHANICAL DESCRIPTION:

Frequency Range: 2400 to 3400 megacycles per second.

Type of Reception: Continuous Wave and Pulse.

Accuracy:  $\pm 0.1$  megacycle per second.

Resetability:  $\pm 0.05$  megacycle per second.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Development		
STOCK NOS.	7CAC-177657		3F47800-16.2
PROCUREMENT INFO.: USAF Drawing No. 1596			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, C&N	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.2.2	
- Electronics Test Equipment -			FR-2/U

REFERENCE CAVITY FR-2/U  
(CAVITY TUNED, FR-2/U)

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, 66 Court Street, Brooklyn 2, New York; Approximate Cost per Unit, \$900.00 (1946); Contract No. W-33-038-ac-15142 for development model.

General Electric Company, Schenectady, New York; Approximate Cost per Unit, \$800.00 (11/22/48); Contract No. W-33-038-ac-16195; G. E. Type T7600504.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Reference Cavity FR-2/U	Steel	7CAC-177657 3F47800-16.2	2-3/16	4-5/8	11-3/8	3
1	Crystal Rectifier						
1	Allen Wrench						

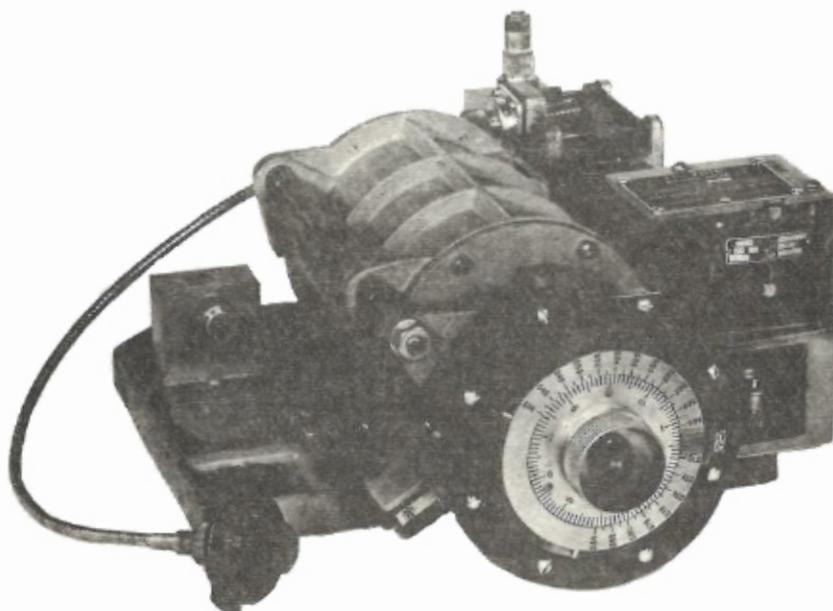
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

FR-2/U

- Electronics Test Equipment -

**ECHO BOX FR-7/UP  
(CAVITY, TUNED, FR-7/UP)**



**FUNCTIONAL DESCRIPTION:**

A portable general purpose manually or electrically tuned high "Q" resonant cavity. It is used as a built-in component of a radar set to facilitate operational checking immediately prior to the operation of the set. Typical checks made by this echo box include transmitter power, spectrum width, operating frequency, TR box recovery time, receiver recovery time, and overall performance. Indication is provided on two attenuator dials and a tuning dial incorporated in the equipment.

**RELATIONSHIP TO OTHER EQUIPMENT:**

**ELECTROMECHANICAL DESCRIPTION:**

**Circuit Information:** A length of RG-9A/U Coaxial Cable, fitted with necessary adapters, connects the radar directional coupler to the echo box input waveguide. The waveguide couples the incoming radar pulse to the cavity. Tuning is accomplished by means of a movable plunger. When cavity length is correct

(Continued)

	AIR FORCE	NAVY	ARMY
<b>TYPE CLASS.</b>			
<b>STOCK NOS.</b>		16-C-67665-7301	
<b>PROCUREMENT INFO.:</b>	Spec. SHIPS-R-244, dated 15 August 1951		
<b>PROCUREMENT COG.:</b>	USN	DESIGN COG.: USN, BuShips	
<b>F.I.I.N.:</b>	FUNCTIONAL CLASS. NO.:		2.2.2
	- Electronics Test Equipment -		FR-7/UP

ECHO BOX FR-7/UP  
(CAVITY, TUNED, FR-7/UP)

ELECTROMECHANICAL DESCRIPTION: (Continued)

for the particular radar carrier frequency, the cavity resonates. This oscillation appears as an input to the radar receiver and is indicated on the radar scope until it is damped below the receiver noise level. A portion of the resonating signal is coupled to another waveguide which carries it through an attenuator to a crystal rectifier. The resulting video signal is connected to a microammeter which indicates a maximum reading when the cavity is properly tuned.

Power Supply: None required.

Frequency Range: 5440 to 5835 megacycles per second.

Attenuator Calibration: Outer dial makes a complete revolution for 10 revolutions of the inner dial. The inner dial has 10 major scale divisions.

Microammeter Range: 0 to 50 to 100 microamperes.

Transmitter Power-Ring Time Relationship: Ring time is increased 62 yards for each 1-decibel increase in transmitter output power.

Temperature-Ring Time Relationship: Ring time decreases 1% for each 10° F. rise in temperature.

Accuracy: ±3 megacycles per second.

MANUFACTURERS' OR CONTRACTORS' DATA:

Johnson Service Company, Milwaukee 2, Wisconsin; Type Nr.SA-16440; USN Contract No. NObsr-52274, dated 12 March 1951.

Raytheon Manufacturing Company, Foundry Avenue, Waltham, Massachusetts; Type Nr.RX-3040; USN Contract No. NObsr-59632.

TUBE COMPLEMENT:

1 JAN-1N23B (Rectifier).

REFERENCE DATA AND LITERATURE:

NAVSHIPS 91446.

NAVSHIPS 91724(A) (Instruction Book for AN/SPS-4).

SHIPPING DATA:

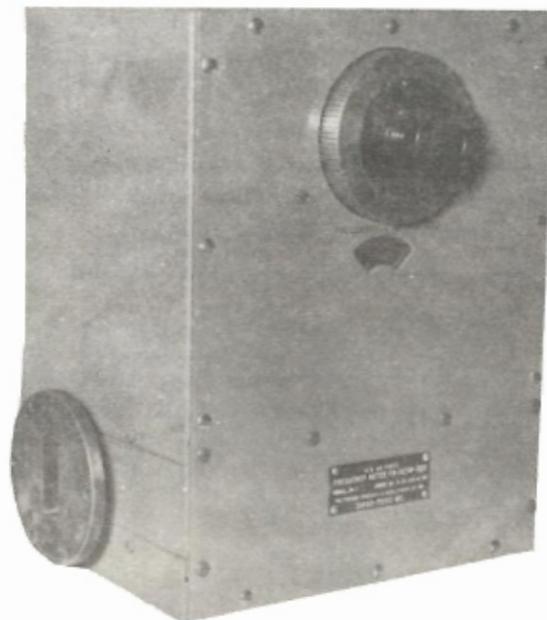
No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box FR-7/UP	2	9-1/4	16	23-1/2	62

FR-7/UP - Electronics Test Equipment -





## FREQUENCY METER FR-15(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 5850 to 7050 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 555A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		FR-15(XW)/U

## FREQUENCY METER FR-15(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 5850 to 7050 megacycles per second.

Accuracy:  $\pm 0.03\%$  (absolute);  $\pm 0.005\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-50/U;  $1-1/2'' \times 3/4''$ .

Loaded "Q": 8600 to 19,500 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.3 (throughout frequency range).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

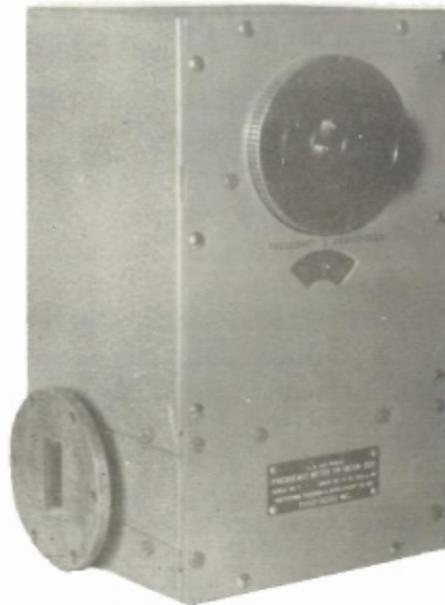
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-15(XW)/U (Complete)	Aluminum		10-1/4	9	7-1/4	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter FR-15(XW)/U (Domestic Packed)	1.15	14	13	1	20

FR-15(XW)/U - Electronics Test Equipment -

## FREQUENCY METER FR-16(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 7050 to 8200 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 556A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO. : 2.2.2		
	- Electronics Test Equipment -		FR-16(XW)/U

## FREQUENCY METER FR-16(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 7050 to 8200 megacycles per second.

Accuracy:  $\pm 0.03\%$  (absolute);  $\pm 0.005\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-50/U;  $1-1/2" \times 3/4"$ .

Loaded "Q": 9800 to 19,200 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.3 (throughout frequency range).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

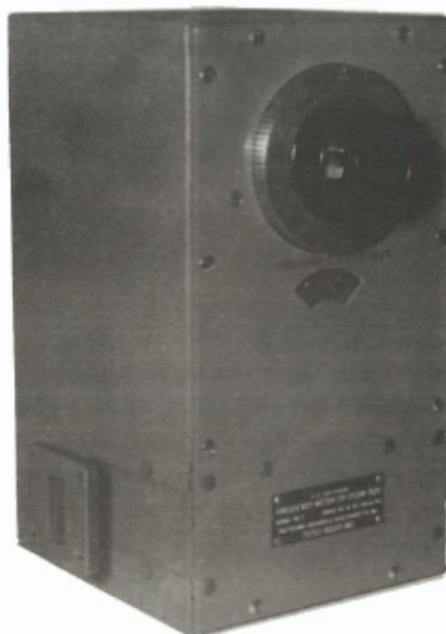
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-16(XW)/U (Complete)	Aluminum		9-3/4	6-1/2	6-1/2	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter FR-16(XW)/U (Domestic Packed)	0.81	14	10	10	20

FR-16(XW)/U - Electronics Test Equipment -

## FREQUENCY METER FR-17(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 7050 to 8200 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 557A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		FR-17(XW)/U

## FREQUENCY METER FR-17(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 7050 to 8200 megacycles per second.

Accuracy:  $\pm 0.03\%$  (absolute);  $\pm 0.005\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-51/U;  $1-1/4'' \times 5/8''$ .

Loaded "Q": 10, 100 to 18, 000 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.3 (throughout frequency range).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-17(XW)/U (Complete)	Aluminum		9-5/8	6-1/4	6-9/16	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter FR-17(XW)/U (Domestic Packed)	0.88	14-1/2	10	10-1/2	20

FR-17(XW)/U

- Electronics Test Equipment -

## FREQUENCY METER FR-18(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 8200 to 10,000 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 558A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		FR-18(XW)/U

FREQUENCY METER FR-18(XW)/U

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 8200 to 10,000 megacycles per second.

Accuracy:  $\pm 0.03\%$  (absolute);  $\pm 0.005\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-51/U;  $1-1/4" \times 5/8"$ .

Loaded "Q": 9500 to 18,000 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.3 (throughout frequency range).

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-18(XW)/U (Complete)	Aluminum		9-1/8	6-5/16	5-13/16	15

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter FR-18(XW)/U (Domestic Packed)	0.75	13	10-1/2	9-1/2	20

FR-18(XW)/U

- Electronics Test Equipment -

## FREQUENCY METER FR-19(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 8200 to 10,000 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 559A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		FR-19(XW)/U

FREQUENCY METER FR-19(XW)/U

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range: 8200 to 10,000 megacycles per second.

Accuracy:  $\pm 0.03\%$  (absolute);  $\pm 0.005\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-52/U; 1" x 1/2".

Loaded "Q": 9600 to 16,800 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.3 (throughout frequency range).

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

**TUBE COMPLEMENT:**

None.

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Handbook of Maintenance Instructions.

**EQUIPMENT SUPPLIED:**

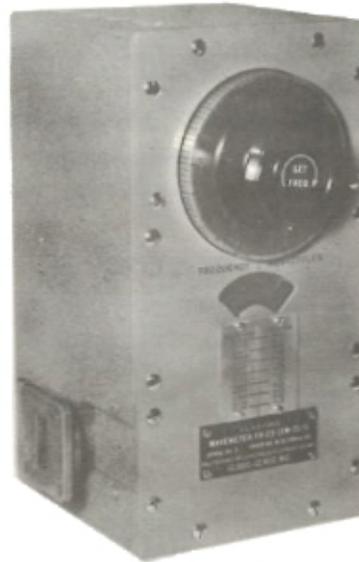
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-19(XW)/U (Complete)	Aluminum		9	6-1/4	5-7/8	15

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter FR-19(XW)/U (Domestic Packed)	0.75	13	10	10	20

FR-19(XW)/U - Electronics Test Equipment -

## WAVEMETER FR-29(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 10,000 to 12,400 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 565A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1606		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		FR-29(XW)/U

## WAVEMETER FR-29(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 10,000 to 12,400 megacycles per second.

Accuracy:  $\pm 0.06\%$  (absolute);  $\pm 0.01\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.5$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-52/U; 1" x 1/2".

Loaded "Q": 5150 to 13,800 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.30 (throughout the frequency range).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-29(XW)/U (Complete)	Alum- inum		8-3/8	5-1/2	5-11/16	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-29(XW)/U (Domestic Packed)	0.63	12	9-1/2	9-1/2	20

FR-29(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-30(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 12,400 to 15,000 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. .566A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1606		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		FR-30(XW)/U

## WAVEMETER FR-30(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 12,400 to 15,000 megacycles per second.

Accuracy:  $\pm 0.06\%$  (absolute);  $\pm 0.01\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.5$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-107/U; 0.622" x 0.311".

Loaded "Q": 9200 to 15,100 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.30 (throughout frequency range).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-30(XW)/U (Complete)	Aluminum		8-1/8	5-3/4	5-13/16	15

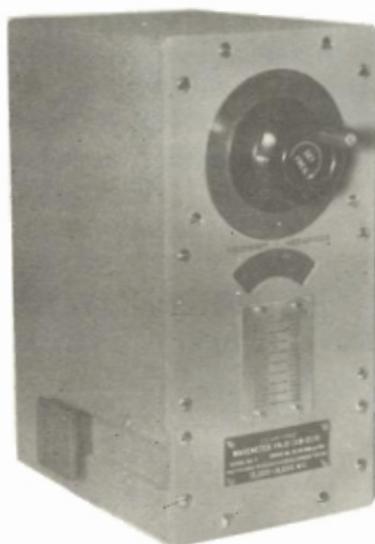
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-30(XW)/U (Domestic Packed)	0.63	12	9-1/2	9-1/2	20

FR-30(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-31(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 15,000 to 18,000 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 567A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1606		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		FR-31(XW)/U

## WAVEMETER FR-31(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 15,000 to 18,000 megacycles per second.

Accuracy:  $\pm 0.06\%$  (absolute);  $\pm 0.01\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.5$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-107/U; 0.622" x 0.311".

Loaded "Q": 11,000 to 18,000 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.30 (throughout frequency range).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-31(XW)/U (Complete)	Aluminum		9	5-3/8	6-15/16	15

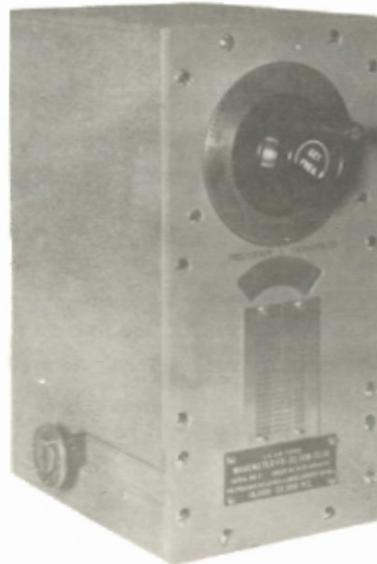
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-31(XW)/U (Domestic Packed)	0.71	13	9	10-1/2	20

FR-31(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-32(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 18,000 to 22,000 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 568A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, Rome	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.2.2	
- Electronics Test Equipment -			FR-32(XW)/U

## WAVEMETER FR-32(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 18,000 to 22,000 megacycles per second.

Accuracy:  $\pm 0.1\%$  (absolute);  $\pm 0.015\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 1.0$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-66/U; 0.420" x 0.170".

Loaded "Q": 10,600 to 15,200 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.30 (throughout frequency range).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-32(XW)/U (Complete)	Aluminum		8-3/4	5-3/8	6-3/4	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-32(XW)/U (Domestic Packed)	0.68	12-1/2	9	10-1/2	20

FR-32(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-33(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 22, 000 to 26, 500 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power - measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 569A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, Rome	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.2.2	
- Electronics Test Equipment -			FR-33(XW)/U

## WAVEMETER FR-33(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 22,000 to 26,500 megacycles per second.

Accuracy:  $\pm 0.1\%$  (absolute);  $\pm 0.015\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 1.0$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-66/U; 0.420" x 0.170".

Loaded "Q": 4850 to 11,500 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.30 (throughout frequency range).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-33(XW)/U (Complete)	Aluminum		8-1/2	5	6-11/16	15

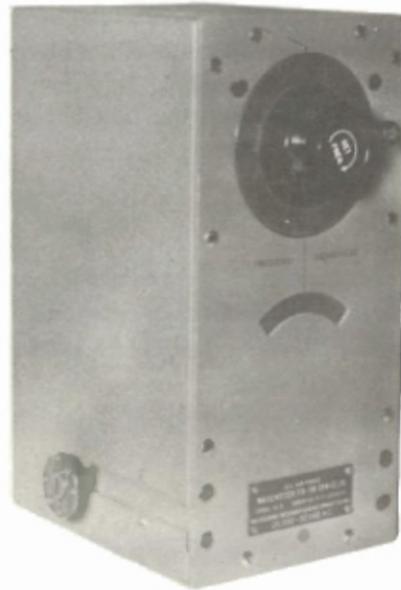
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-33(XW)/U (Domestic Packed)	0.68	12-1/2	9	10-1/2	20

FR-33(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-34(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 26,500 to 32,000 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 570A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, Rome	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.2.2	
- Electronics Test Equipment -			FR-34(XW)/U

WAVEMETER FR-34(XW)/U

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range: 26,500 to 32,000 megacycles per second.

Accuracy:  $\pm 0.15\%$  (absolute);  $\pm 0.02\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 2.0$  megacycles per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-96/U; 0.280" x 0.140".

Loaded "Q": 4900 to 13,300 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.3 (throughout frequency range).

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

**TUBE COMPLEMENT:**

None.

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Handbook of Maintenance Instructions.

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-34(XW)/U (Complete)	Aluminum		8-5/8	5-1/2	6-3/4	15

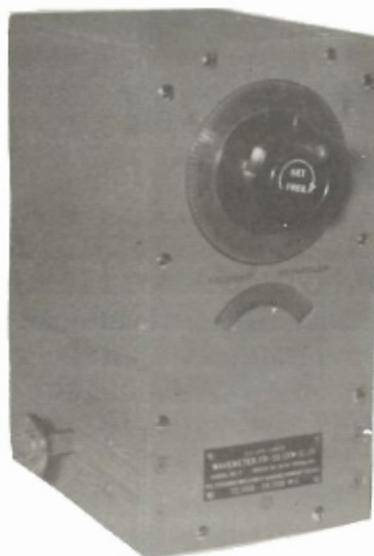
**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-34(XW)/U (Domestic Packed)	0.72	12-1/2	9-1/2	10-1/2	20

FR-34(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-35(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the absorption type designed to measure the frequency of radio frequency signals in the range from 32,000 to 39,000 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 571A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, Rome	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.2.2	
- Electronics Test Equipment -			FR-35(XW)/U

## WAVEMETER FR-35(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None Required.

Frequency Range: 32,000 to 39,000 megacycles per second.

Accuracy:  $\pm 0.15\%$  (absolute);  $\pm 0.02\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 2.0$  megacycles per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-96/U; 0.280" x 0.140".

Loaded "Q": 4000 to 9250 (varies with frequency).

Voltage Standing Wave Ratio: Less than 1.3 (throughout frequency range).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-35(XW)/U (Complete)	Aluminum		8-3/8	4-3/8	5-7/8	15

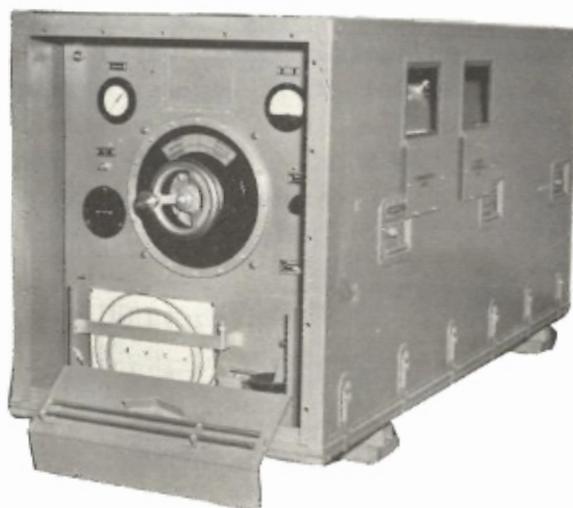
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-35(XW)/U (Domestic Packed)	0.5	12	8	9	20

FR-35(XW)/U

- Electronics Test Equipment -

## ECHO BOX FR-41(XW)/U



### FUNCTIONAL DESCRIPTION:

A transportable, self-contained, hand-tuned, ringing cavity primarily designed to make a quick, rough analysis of the overall performance of a radar set.

It may be used to tune the radar local-oscillator, make comparative measurements of transmitted power, make measurements of frequency spectrum of the transmitted pulse, check recovery time of radar T/R box and receiver, check for multiple moding of radar transmitter, check transmitter frequency pulling, and check the performance of the magnatron.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 130 to 154 megacycles per second.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Spec. Exhibit No. WLENG-1167, Dwg. No. 1596		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		FR-41(XW)/U

## ECHO BOX FR-41(XW)/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

Accuracy:  $\pm 0.1$  megacycles per second.

Loaded "Q": Approximately 10,000 (varies with frequency).

Ringtime: Approximately 336 microseconds when system level difference is 120 decibels.

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval of time known as the ringtime, is then picked up by the radar receiver and appears on the indicator scope as a saturated echo.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polarad Electronics Company, 100 Metropolitan Avenue, Brooklyn 11, New York; USAF Contract No. AF 28(099)-53, 15 April 1949; Approximate Cost of Development Model, \$4000.00.

### TUBE COMPLEMENT:

1 JAN-1N21 (Crystal).

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Instructions.

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
FR-41(XW)/U - Electronics Test Equipment -						

## ECHO BOX FR-41(XW)/U

## EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box FR-41(XW)/U	Alum- inum faced Ply- wood		29	26-1/4	64	650
1	RF Cord			96 long			
1	Antenna Assembly	Brass		3-1/2	39-1/2	3-1/4	
6	Crystal Rectifier JAN-1N21						
1	Trouble Shooting Chart			11	8-1/2		
1	Wrench			8	2-1/4	3/16	
1	Wrench			7	1-7/8	3/16	
1	Wrench			5	1-1/4	3/16	
1	Transit Case						
- Electronics Test Equipment -							
							FR-41(XW)/U

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4

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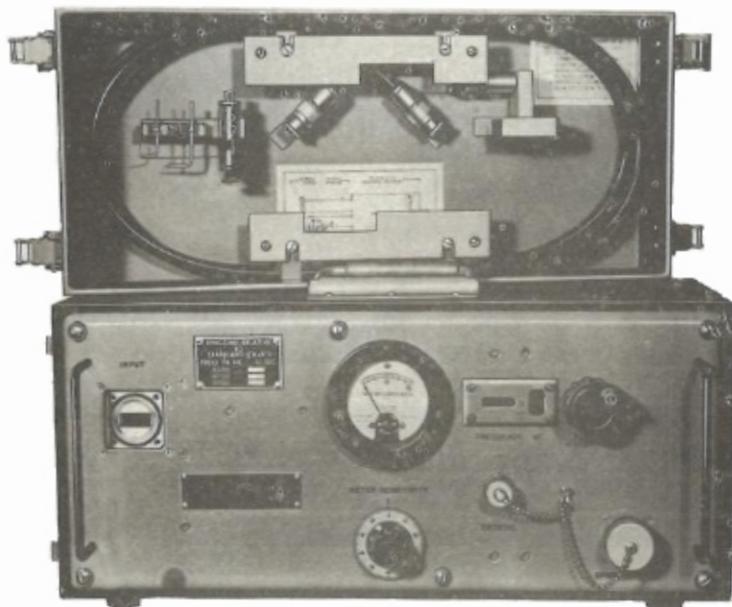
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## TUNED CAVITY FR-72/UP



### FUNCTIONAL DESCRIPTION:

A portable general purpose ringing cavity used in checking the performance of radar equipment. The cavity is designed to determine overall performance; to measure average power output of radar transmitters, and to determine their frequency spectrum; to check for multiple moding of radar transmitters, and transmitter pulling; and to check the speed of recovery of TR box and receiver.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** The echo box contains a precise-dimensioned, silver-plated, steel cylinder, resonant cavity. The position of a piston within the cylinder determines the frequency of the tuned cavity. The cavity operates as a sharply tuned resonant circuit in which inductance and capacitance are tuned to resonance at the frequency of the energy being measured. Energy is stored in the resonant

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-276520		
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, WADC, Arm.
F.I.I.N.:		FUNCTIONAL CLASS. NO.:	2.2.2
	- Electronics Test Equipment -		FR-72/UP

## TUNED CAVITY FR-72/UP

### ELECTROMECHANICAL DESCRIPTION: (Continued)

cavity in the form of damped oscillations. The shape and character of the pattern on the radar indicator, as this stored energy discharges back to the receiver, indicate the condition of the radar receiver. Part of the stored energy is rectified and measured by a microammeter on the front panel of the set.

Power Supply: None required. (Power is supplied by transmitter under test.)

Frequency Range: 8500 to 9000 megacycles per second.

Accuracy:  $\pm 8$  megacycles at band ends.

$\pm 1$  megacycle at center band.

Meter Range: 0 to 20 microamperes.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Kearfott Company, Inc., Western Manufacturing Division, 14844 Oxnard Street, Van Nuys, California.

### TUBE COMPLEMENT:

1 JAN-1N23B (Crystal Diode).

### REFERENCE DATA AND LITERATURE:

TO 33D5-8-7-1 (Operation and Service Instructions).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box FR-72/UP	3.4	16	26	14	50

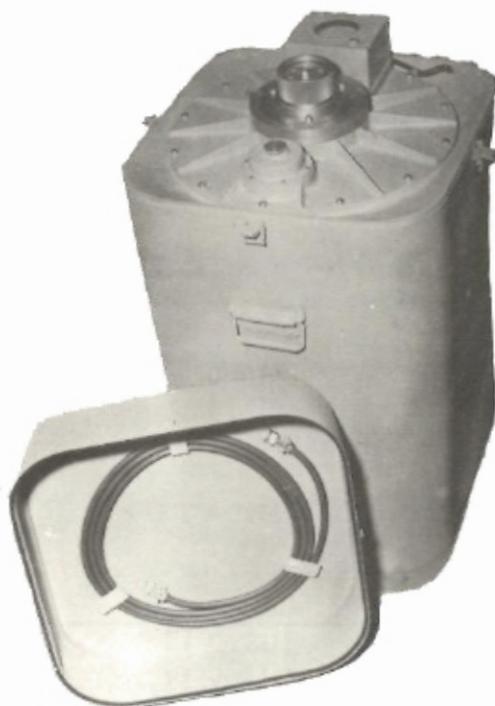
### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Tuned Cavity FR-72/UP	Metal	7CAC-276520	19	7	12	30
1	Connecting Cable CG-92A/U		7CAC-170265-425	96 long			
1	Transition UG-446/U						

FR-72/UP

- Electronics Test Equipment -

## TUNED CAVITY FR-73/UP



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring absorption type cavity, designed to measure the frequency of radio frequency signals transmitted by radars operating in its range. Resonance is achieved at the frequency to be measured by variation of the length of the cavity. It is manually tuned by a mechanical coupling to the indicating dial knob. Resonance is indicated by a maximum reading of an externally connected DC milliammeter. Frequency is read directly in megacycles per second from the meter dials. Provisions are made for mounting the milliammeter, capacitor, spare crystal holder, and desiccator.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

Circuit Information: Waveguide input is coupled to the cavity through an inductive loop. The cavity exhibits its lowest possible impedance at resonance. Another (Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.			
PROCUREMENT INFO.:	Navy Spec. Ships-T-502 (BuShips)		
PROCUREMENT COG.:	Navy	DESIGN COG.:	Navy, BuShips
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		FR-73/UP

TUNED CAVITY FR-73/UP

ELECTROMECHANICAL DESCRIPTION: (Continued)

inductive loop removes part of the energy from the cavity. A crystal detector rectifies the energy removed and the rectified signal is brought to terminals for connection to the indicating device.

Power Supply: None.

Frequency Range: 1215 to 1370 megacycles per second.

Type of Reception: Continuous Wave and Pulsed.

Power Input: 1 watt average.

MANUFACTURERS' OR CONTRACTORS' DATA:

Johnson Service Company, Milwaukee, Wisconsin; Navy Contract No. NObSr-57108; Johnson Dwg. No. 50592.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Tuned Cavity FR-73/UP	Aluminum		22-1/2	32-5/8	22-1/2 dia.	120

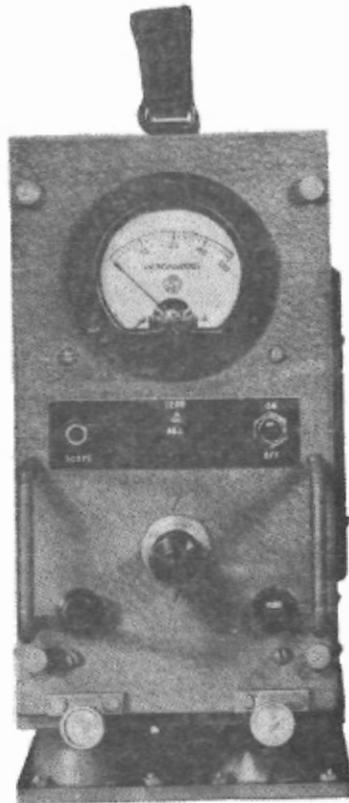
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Case Radio Parts FR-73/UP	22.8	32	46	32	248

FR-73/UP

- Electronics Test Equipment -

## RADAR TEST EQUIPMENT OAA-2



### FUNCTIONAL DESCRIPTION:

A portable, general purpose instrument which may be used as a frequency meter, as an indicator of relative output at the radar antenna, to detect double pulsing, and to generate signals which are electrically equivalent to received radar echoes. Frequency is indicated by referring dial settings to a calibrated chart. A relative indication of the signal input power is given by the meter at resonance. A video output jack is provided for connection to an oscilloscope for visual presentation of the received pulses.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

Circuit Information: Consists of a tunable quarter wave resonant cavity of high "Q", a detector and a vacuum tube microammeter.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Navy	DESIGN COG.:	Navy, BuShips
F. I. I. N.:	FUNCTIONAL CLASS. NO. : 2. 2. 2		
- Electronics Test Equipment -			OAA-2

RADAR TEST EQUIPMENT OAA-2

ELECTROMECHANICAL DESCRIPTION: (Continued)

Power Supply: 115 volts,  $\pm 10$  volt, AC, single phase, 60 cycles per second, 15 watts.

Frequency Range: 150 to 240 megacycles per second.

Ring Time: 50 microseconds, approximately, equivalent to an apparent range of 5000 yards.

Accuracy:  $\pm 0.5$  megacycles per second.

MANUFACTURERS' OR CONTRACTORS' DATA:

Gilfillan Brothers, Inc., Los Angeles, California; Contract Nos. NXsr-10810, NXsr-45459, NXsr-41013, NXsr-33633, NXsr-60073.

TUBE COMPLEMENT:

1 JAN-955, 1 JAN-6SQ7, 1 JAN-6X5GT.

REFERENCE DATA AND LITERATURE:

SHIPS 227 (Instruction Book).

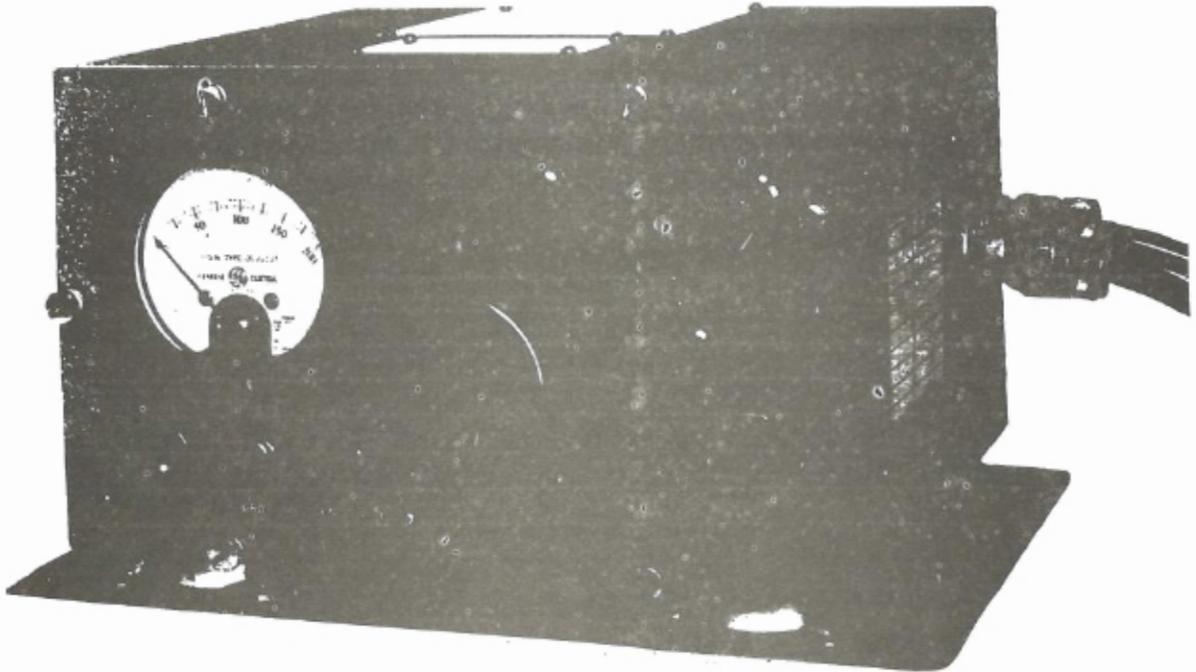
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
OAA-2 - Electronics Test Equipment -						





RADAR TEST EQUIPMENT OAO-2



FUNCTIONAL DESCRIPTION:

A portable, general purpose, echo box used to measure frequency and relative power output in radar transmitters. Frequency is indicated by referring dial settings to a calibrated chart. A relative indication of the signal input power is given by the meter at resonance. A video output jack is provided for connection to an oscilloscope for visual presentation of the received pulses.

RELATIONSHIP TO OTHER EQUIPMENT:

ELECTROMECHANICAL DESCRIPTION:

Circuit Information: Consists of a tunable quarter wave resonant cavity of high "Q", a detector and a vacuum tube voltmeter.

Power Supply: 115 volts, AC, 60 cycles per second, single phase, 11 watts.

Frequency Range: 105 to 125 megacycles per second.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Navy	DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2, 2, 2		
- Electronics Test Equipment -			OAO-2

## RADAR TEST EQUIPMENT OAO-2

### ELECTROMECHANICAL DESCRIPTION: (Continued)

Ring Time: 50 microseconds (normal), or an apparent range of 8000 yards or more.

Meter Range: 0 to 200 microamperes.

Accuracy:  $\pm 0.25$  megacycles per second.

### MANUFACTURERS' OR CONTRACTORS' DATA:

The Liebel-Flarsheim Company, Cincinnati 2, Ohio; Contract No. NXsr-53325, dated 14 March 1944.

### TUBE COMPLEMENT:

1 JAN-955, 1 JAN-6SQ7, 1 JAN-6X5GT.

### REFERENCE DATA AND LITERATURE:

SHIPS 269 (Instruction Book).

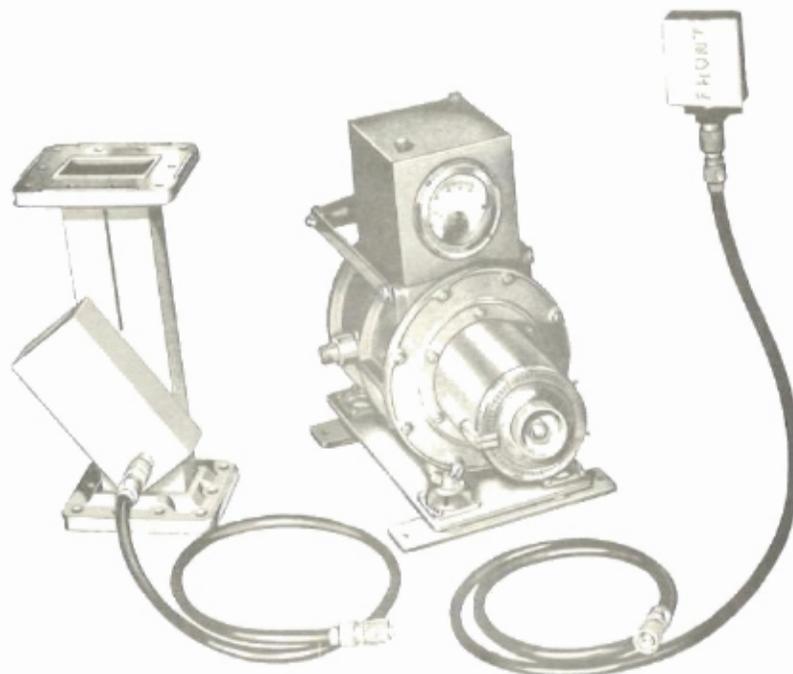
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Radar Test Equipment OAO-2	1.2	9-3/4	15-1/4	14	33
1	Set of Equipment Spares	1.69	10	18-1/2	15-3/4	11
OAO-2 - Electronics Test Equipment -						





RADAR TEST EQUIPMENT OBU  
(ECHO BOX TEST SET OBU)



**FUNCTIONAL DESCRIPTION:**

A portable echo box test set designed for frequency and relative power measurements during the testing and adjusting of radar sets. Rough spectrum analysis can also be performed by this equipment. Coupling of the test set to the radar system can be made constant by the use of the directional coupler or pickup dipole antenna furnished with each set.

**RELATIONSHIP TO OTHER EQUIPMENT:**

All models of this equipment have similar functions and performance characteristics. They differ in the type of directional coupler provided with each model.

**ELECTROMECHANICAL DESCRIPTION:**

Circuit Information: The cast metal tuned cavity is provided with a tuning mechanism which is manually actuated. A calibrated dial associated with the tuning mechanism. (Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.		Standard	
STOCK NOS.		F16-Q-207585-200	
PROCUREMENT INFO.:			
PROCUREMENT COG.: USN		DESIGN COG.: USN, BuShips	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2, 2, 2	
- Electronics Test Equipment -			OBU

RADAR TEST EQUIPMENT OBU  
(ECHO BOX TEST SET OBU)

ELECTROMECHANICAL DESCRIPTION: (Continued)

knob can be converted to give megacycle indications. A coupled loop, a rectifier, and a microammeter make power measurements possible. The microammeter indicates the average rectified current from which relative power may be computed.

Power Supply: None required.

Frequency Range: 2900 to 3100 megacycles per second.

Sensitivity: 80 yards per decibel.

Loaded Q: 47,000 (approximate).

Temperature Range:  $-40^{\circ}\text{C}$ . (+13.7% change in ring time) to  $+60^{\circ}\text{C}$ . ( $+140^{\circ}\text{F}$ .)  
(-6.7% change in ring time).

Type of Reception and Transmission: Pulse.

Waveguide:

Attenuation Factor: 20 decibels (Model 1). 27 decibels (Models 2 and 3). 18 decibels (Model 4).

MANUFACTURERS' OR CONTRACTORS' DATA:

Maguire Industries, Inc., Electronics Division, Greenwich, Connecticut; Contract No. NXsr-51561, 13 March 1944 (Models 1 and 2).

Johnson Service Company, Milwaukee, Wisconsin; Contract No. NXsr-65336, 15 June 1944 (Model 3); Contract No. NXsr-83396, 26 November 1944 (Model 4).

TUBE COMPLEMENT:

1 JAN-1N21B (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

NAVSHIPS 308-B (Instruction Book for Model 3).

NAVSHIPS 310-A (Instruction Book for Models 1 and 2).

NAVSHIPS 345-A (Instruction Book for Model 4).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Radar Test Equipment OBU	2.53	24-3/4	16-1/4	14-1/2	77
OBU - Electronics Test Equipment -						

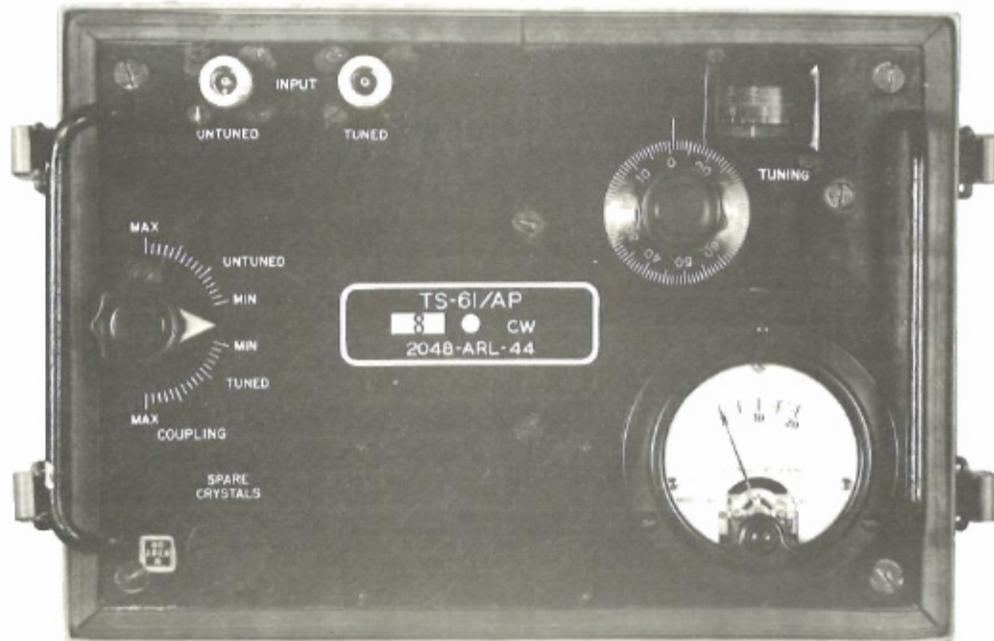
RADAR TEST EQUIPMENT OBU  
(ECHO BOX TEST SET OBU)

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Radar Test Equipment OBU		F16-Q-207585-200				
	Including:						
1	Test Set Assembly 14ABA-1			10-3/4	7-5/8	11-1/4	18.5
1	Directional Coupler 47AAL (Model 1) 47AAM (Model 2) 47AAN (Model 3) 47AAP (Model 4)			1-3/4 1-1/2 1-1/2 1-1/2	3/8 3 3 3		
1	Antenna Assembly 66ANV (Models 1 and 2) 66AJG (Models 3 and 4)						
1	Cable W-101			60 long			0.75
1	Cable W-102			36 long			0.75
1	Shock Mounting			10	8	2-1/8	6.00
1	Accessory Box			10-1/2	11-1/4	3-1/8	9.25
1	MR Parts Case			7-1/2	8-1/2	3	7.00 (full)
2	Instruction Book						
- Electronics Test Equipment -							OBU



## TEST SET TS-61/AP



### FUNCTIONAL DESCRIPTION:

A portable, self-contained, hand-tuned echo box or ringing cavity designed to make rapid, rough analysis of the overall performance of various radar equipment, to determine the frequency of radio frequency transmitters, to measure relative power output, to detect multiple moding of magnetrons, to check the speed of recovery of a radar T/R box and receiver and to give an indication of the signal-to-noise ratio of receivers.

All visual indications of system performance appear on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections.

### RELATIONSHIP TO OTHER EQUIPMENT:

Similar to TS-110/AP except for frequency range.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-801319-2238	R16-AN-TS-61-AP	3F4325-61
PROCUREMENT INFO.:	USAF Spec. No. 71-5071		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, ARL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-61/AP

## TEST SET TS-61/AP

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** The signal input is the radio frequency signal coming from the transmitter under test. (A non-calibrated attenuator is provided in the input circuit to the echo box to prevent over-loading the crystal and meter.) The signal from the transmitter is re-radiated by the echo box for a short interval, known as the ring-time, is picked up by the radar receiver antenna and appears as a fixed echo on the receiver-indicator.

**Power Supply:** None required.

**Frequency Range, Input:** 3140 to 3360 megacycles per second.

**Type of Reception:** Continuous Wave, Modulated Carrier Wave, Pulsed.

**Impedance, Input:** 50 ohms.

**Ring-time:** 2.5 statute miles (4400 yards) with radars transmitting on the order of 50 kilowatts Peak Power and having a good receiver.

**Decay:** 2.3 decibels per microsecond.

**Operating "Q":** 35,000.

**Accuracy:** Frequency,  $\pm 10$  megacycles per second; relative power,  $\pm 3$  decibels.

Over the ringing range this test set has no extraneous responses nor any holes in its ring-time characteristic. (This accuracy for frequency is at mid-band and is based on a temperature of 25° C. at a humidity of 65%. The accuracy of relative frequency measurements is  $\pm 2$  megacycles per second at a differential of 60 megacycles per second.)

**Temperature Range:** -40° C. to +88° C.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Western Electric Company, New York, New York; Order Nos. 797-DAY-45A, 2218-DAY-45AR; Contract No. 2218-45-AR, 24 June 1945; Approximate Cost per Unit, \$521.00.

### TUBE COMPLEMENT:

1 JAN-1N21B (Crystal Rectifier).

### REFERENCE DATA AND LITERATURE:

TO 16-55-49 (Spare Parts List).

TO 16-35TS61-2 (Maintenance Instructions).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Test Set TS-61/AP and accessories (MFP and Export Packed)	4.25	15	26-1/2	18-1/2	74
TS-61/AP - Electronics Test Equipment -						

TEST SET TS-61/AP

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-61/AP (Complete)		7CAC-801319-2238 R16-AN-TS-61-AP 3F4325-61	7-31/32	11-11/16	10-5/8	9.0
1	Antenna Assembly AS-107/AP		7CBY-B0409403 R16-ANTS-107/AP 3F4043-107	28-7/8	4-1/2	1	0.5
1	Connecting Cord CG-92/U		7CAC-170265-465 R16-C-3851 1F430-92.72	76-1/4	25/32		0.9
1	Impedance Matching Adapter UG-8/AP		8850-101600 R16-R-2436-3 2ZK308-8.1				
1	Allen Wrench "L" shaped TL 1567/U		7900-859480 6R57400-6	1/16 across flats			
1	Wrench, Hex		7900-859490 6R57400	5/64 across flats			
1	Carrying Case	Metal					
3	Crystal Rectifier 1N21B (Spares)		3300-234137020 2J1N21B	3	3	1	0.1
2	Instruction Book		6D9810-61				



TEST SET TS-62/AP  
(TEST SET, RADAR, TS-62/AP)



**FUNCTIONAL DESCRIPTION:**

A portable and self-contained manually tuned echo box or resonance chamber designed for rapid, rough analysis of overall performance of various radar equipment operating in the 9320 to 9420 megacycle per second frequency band. It will determine the frequency of continuous wave, modulated carrier wave, or pulsed radio frequency transmitters, measure relative power output, detect double moding of magnetrons, and give an indication of the signal-to-noise ratio of receivers.

All visual indications of system performance appear on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by microammeter deflections.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Similar to TS-218/UP except for frequency range.  
Being replaced by Echo Box TS-488/UP.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Limited Standard		
STOCK NOS.	7CAC-177683	R16-AN-TS-62-AP	3F4325-62
PROCUREMENT INFO.:	USAF Spec. No. 71-5072-A		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, ARL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-62/AP

TEST SET TS-62/AP  
(TEST SET, RADAR, TS-62/AP)

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulse.

Frequency Range, Input: 9320 to 9420 megacycles per second. (Frequency is referred to a calibrated point on the scale). (The frequency range of units with serial numbers 1 to 100 is 9200 to 9530 megacycles per second).

Signal Input: The radio frequency output signal coming from the transmitter under test. (A non-calibrated attenuator is provided in the input circuit to the echo box to prevent over-loading the crystal and meter).

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval, known as the ring-time, is picked up by the radar receiver antenna and appears as a fixed echo on the receiver-indicator.

Input Impedance: 50 ohms.

Ring-time: 2.5 statute miles.

Accuracy: Frequency,  $\pm 3$  megacycles per second; relative power,  $\pm 3$  decibels (at room temperature only). Over the ringing range this test set has no extraneous responses nor any holes in its ring-time characteristic. (This accuracy for frequency is at mid-band and is based on a temperature of  $20^{\circ}$  C. at a relative humidity of 65%. The accuracy of relative-frequency measurements is  $\pm 2$  megacycles per second at a differential of 60 megacycles per second).

Decay: 3 decibels per microsecond.

Operating "Q": 50,000 to 80,000.

Sensitivity: Dipole must be placed close to transmitter antenna unless directional coupler is available (directional coupler coupling recommended).

Temperature Range:  $-40^{\circ}$  F. to  $+120^{\circ}$  F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Western Electric Company, New York, New York; Contract Nos. 120-DAY-45, 22 July 1944; Approximate Cost per Unit, \$640.00; 801-DAY-45, 16 November 1944; Approximate Cost per Unit, \$636.00; 768-DAY-45, 17 February 1945; Approximate Cost per Unit, \$528.00; 870-DAY-45, 26 January 1945; Approximate Cost per Unit, \$528.00; Order No. 862-AF-SPD, 1946; Approximate Cost per Unit, \$640.00; Western Electric Code No. X-63628A; Designed by Bell Telephone Laboratories.

TUBE COMPLEMENT:

1 JAN-1N23 (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

AN 16-35TS62-3 (Maintenance Instructions).

TO 16-55-51 (Spare Parts List).

TEST SET TS-62/AP  
(TEST SET, RADAR, TS-62/AP)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Test Set TS-62/AP (Complete)		7CAC-177683 R16-AN-TS-62/AP 3F4325-62	6-1/32	18-1/4	11-3/8	10
1	Antenna Assembly AS-106/AP		7CAC-045745 R16-AN-AS-106/AP 2A264-106	28-7/8	4-1/2		1.0
2	Cord CG-92/U		7CAC-170265-465 R16-C-3851 1F430-92.72	72 long	25/32 dia.		0.9
1	Allen Wrench "L" shaped TL-567/U		7900-859480  6R57400-6	1/16 across flats			
1	Allen Wrench, Hex, No. 8		7900-859490  6R57400	5/64 across flats			
1	Allen Wrench, Hex, No. 10		7900-859500  6R55496				
1	Carrying Case						
1	Instruction Book AN16-35TS62-3		6D9810-62				
1	Crystal Rectifier 1N23B		2J1N23B				

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Test Set, TS-62/AP, (Domestic Packed)	2.6	12	25.5	15	45



TEST SET TS-91/TPS-1  
(TEST SET, RADAR, TS-91/TPS-1)



FUNCTIONAL DESCRIPTION:

A general purpose, portable, hand-tuned, high-Q resonant cavity or echo box designed to make a quick, rough analysis of the overall performance of a radar system, to determine the frequency of continuous wave, modulated carrier or pulsed radio frequency transmitters, to measure relative power output, to detect double moding of magnetrons, and to give an indication of the signal-to-noise ratio of receivers.

All visual indications of system performance appear on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance, relative power, and spectrum are indicated by meter deflections.

RELATIONSHIP TO OTHER EQUIPMENT:

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-177650		3F4325-91
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Navy	DESIGN COG.:	Navy, BuShips
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2, 2, 2		
	- Electronics Test Equipment -		TS-91/TPS-1

TEST SET TS-91/TPS-1  
(TEST SET, RADAR, TS-91/TPS-1)

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range, Input: 1050 to 1110 megacycles per second (frequency is referred directly to a calibrated scale).

Signal Range, Input: The radio frequency output signal coming from the transmitter under test. (A non-calibrated attenuator in the input circuit to the echo box prevents overloading the crystal and meter.)

Impedance, Input: Dipole pick-up to 50 ohm coaxial cable.

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval, known as the ring-time, is picked up by the radar receiver antenna and appears as a fixed echo on the receiver-indicator.

Ring-time: 10 statute miles.

Operating "Q": About 55,000.

Decay: Decibels per microsecond about 0.53 (will vary some with temperature).

Accuracy: Frequency,  $\pm 3$  megacycles per second; relative power,  $\pm 3$  decibels. Over the ringing range this test set has no extraneous responses nor any holes in its ring-time characteristic. This accuracy for frequency is at the mid-band and is based on a temperature of 25° C. at 65% humidity. The accuracy of relative frequency measurements is  $\pm 2$  megacycles per second at a differential frequency of 60 megacycles per second.

Temperature Range: -40° F. to +120° F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Western Electric Company, New York, New York; Order No. 195-MPD-43, Western Electric Code No. X-63623; Approximate Cost per Unit, \$450.00.

TUBE COMPLEMENT:

1 JAN-1N21B or -1N22 (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

TM 11-1547-A (Technical Manual).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
TS-91/TPS-1	- Electronics Test Equipment -					





TEST SET TS-110/AP  
(TEST SET, RADAR, TS-110/AP)



**FUNCTIONAL DESCRIPTION:**

A portable, self-contained, hand-tuned echo box or ringing cavity designed to make rapid, rough analysis of the overall performance of various radar equipment, to determine the frequency of radio frequency transmitters, to measure relative power output, to detect multiple moding of magnetrons, to check the speed of recovery of a radar T/R box and receiver, and to give an indication of the signal-to-noise ratio of receivers.

All visual indications of system performance appear on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Similar to Echo Box TS-61/AP except for frequency range.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-177655	R16-AN-TS-110/AP	3F4325-110
PROCUREMENT INFO.:	USAF Spec. 371-5080 and Spec. MIL-T-4288		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, ARL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-110/AP

TEST SET TS-110/AP  
(TEST SET, RADAR, TS-110/AP)

**ELECTROMECHANICAL DESCRIPTION:**

**Circuit Information:** The signal input is the radio frequency output signal coming from the transmitter under test. (A non-calibrated attenuator is provided in the input circuit to the echo box to prevent over-loading the crystal and meter.) The signal from the transmitter is re-radiated by the echo box for a short interval, known as the ring-time, is picked up by the radar receiver antenna and appears as a fixed echo on the receiver-indicator.

**Power Supply:** None required.

**Frequency Range, Input:** 2400 to 2700 megacycles per second. (Frequency is referred to a calibrated point on the scale.)

**Type of Reception:** Continuous Wave, Modulated Carrier Wave, Pulsed.

**Meter Range:** 50 microampere meter-movement with arbitrary scale.

**Impedance, Input:** 50 ohms.

**Ring-Time:** 2.5 statute miles.

**Operating "Q":** Approximately 40,000.

**Decay:** Approximately 2.3 decibels per microsecond.

**Accuracy:** Frequency,  $\pm 3$  megacycles per second; relative power,  $\pm 3$  decibels. Over the ringing range this test set has no extraneous responses nor any holes in its ring-time characteristic. (This accuracy for frequency is at mid-band and is based on a temperature of 25° C. at a relative humidity of 65%. The accuracy of relative-frequency measurements is  $\pm 2$  megacycles per second at differential frequency of 60 megacycles per second.)

**Temperature Range:** -40° C. to +48° C.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Western Electric Company, New York, New York; Contract No. 2006-45-RA, 1 March 1945 and Contract No. 2111-45-RA, 31 March 1945; Approximate Cost per Unit, \$453.00.

**TUBE COMPLEMENT:**

1 JAN-1N21B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

TO 16-55-50 (Spare Parts List).

TO 16-35TS61-2 (Maintenance Instructions).

TO 16-35TS110-1 (Instruction Book).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Test Set, TS-110/AP and accessories (Domestic Packed)	0.94	12	15	9	30

TS-110/AP

- Electronics Test Equipment -

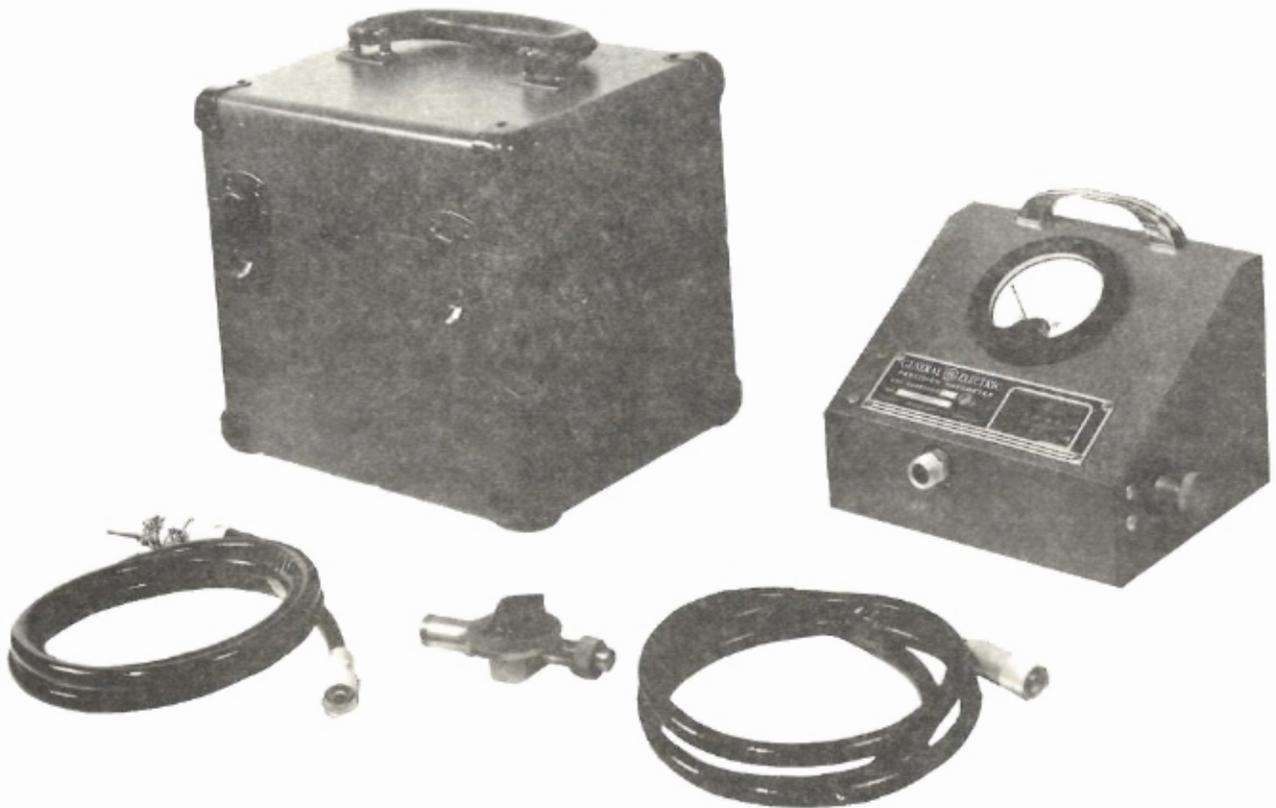
TEST SET TS-110/AP  
(TEST SET, RADAR, TS-110/AP)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Test Set TS-110/AP (Complete)		7CAC-177655 R16-AN-TS-110/AP 3F4325-110	10-5/8	11-11/16	7-31/32	9
1	Antenna Assembly AS-159/AP		7CAC-045130 R16-AN-AS-159/AP 3F4043-159	27-7/8	4-1/2		0.5
1	Cord CG-92/U		7CAC-170265-465  1F430-92.72	76-1/4 long	25/32		0.9
3	Crystal Recti- fier 1N21B (Spares)		3300-234137020	3	3	1	0.1
1	Impedance Matching Adapter						
1	Carrying Case						
1	Allen Wrench "L" Shaped TL-567/U		7900-859480  6R57400-6	1/16 across flats			
1	Allen Wrench, Hex, No. 8		3300-680668000	5/16 across flats			
2	Instruction Books AN16-35TS61-3						



## WAVEMETER TS-111/CP



### FUNCTIONAL DESCRIPTION:

A portable, self-contained, precision, microwave wavemeter of the absorption type designed to measure or check the frequency of continuous wave, modulated carrier wave, or pulsed "S" band radar ground beacons.

A direct current microammeter is used to indicate resonance. Frequency is then read directly from a calibrated micrometer. A jack is provided at the rear of the wavemeter for aural or visual monitoring.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

Frequency Range, Input: 3000 to 3600 megacycles per second.

Accuracy:  $\pm 0.1\%$ , relative;  $\pm 1$  megacycle per second at 3256, 3293, and 3308 megacycles per second (beacon frequency), absolute;  $\pm 3$  megacycles per second (all other frequencies).

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-979579-4	R16-AN-TS-111-CP	3F4325-111
PROCUREMENT INFO.:	USAF Spec. No. 371-5081		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, C&N
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-111/CP

## WAVEMETER TS-111/CP

### ELECTROMECHANICAL DESCRIPTION: (Continued)

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulse.

Power Input Range: 1.0 to 25 milliwatts.

Sensitivity: 6 milliwatts for full scale deflection at 3300 megacycles per second.  
(0.25 milliwatts minimum radio frequency input).

Impedance, Input: 50 ohms.

Attenuator Range: An attenuator is provided in the meter circuit for controlling the power input to the indicating meter, range 10 to 25 decibels loss.

Temperature Range:  $-55^{\circ}$  C. to  $+50^{\circ}$  C.

"Q" at 10 Centimeters: 800.

### MANUFACTURERS' OR CONTRACTORS' DATA:

General Electric Company, Dayton 2, Ohio; Order No. 703-45-RA, 25 October 1944; Order No. 2014-45-AR, 15 March 1945; G.E. Catalog No. 824880-G-2. Approximate Cost per Unit, \$392.00. Also in production at Galvin Manufacturing Company.

### TUBE COMPLEMENT:

1 JAN-1N21 (Crystal Rectifier).

### REFERENCE DATA AND LITERATURE:

CO AN 16-35TS111-2-M (Maintenance Instructions).

TO 16-55-154 (Spare Parts List).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, TS-111/CP and accessories. (Vapor Proof Packed)	4.6	21	19	21	86

TS-111/CP

- Electronics Test Equipment -

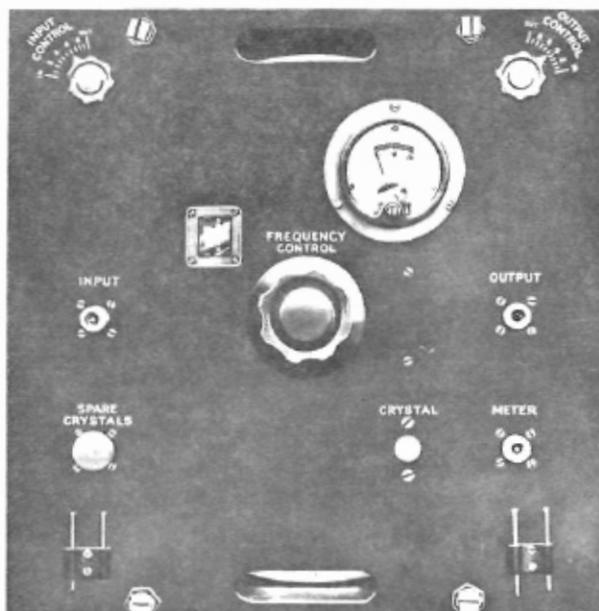
WAVEMETER TS-111/CP

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter TS-111/CP	Metal	7CAC-979579-4 3F4039-1.1	6	9	7	7.5
1	Attenuator CN-15/CP		7CAC-075604 2Z396-15	1-1/2	4	1-3/4	0.4375
1	Cord CG-244/AP or CG-99/AP*		1690-154431650 1F430-244.60	60 long	3/4 dia.		0.75
1	Cord CG-100/U or CG-114/U*		1690-154431160 1F430-100.60	60 long	3/4 dia.		0.625
1	Case CY-167/CP	Ply-wood	7CAC-176572-34 3F2529-167	12	11	9-1/2	9.625 empty 19.3125 full
1	Adapter (Spare) UG-8/AP		8850-101600 2ZK308-8.1	2-1/16	5/8 dia.		0.0938
3	Radio Frequency Plug (Spare) UG-21/U or UG-12/U*		8850-467455 2Z7390-21	1-5/8	3/4 dia.		0.1875
1	Plug (Spare) PL-259		8850-460402 2Z7226-259	1-1/2	3/4 dia.		0.0625
5	Crystals (4 Spare) 1N22 or 1N21B		3300-234137075 or 3300-234137020 2J 1N22 or 2J 1N21B	7/8	5/16 dia.		0.0625
1	Calibration Chart		6D10105-12				
1	Instruction Book, CO AN16-35TS111-2-M		6D9810-111				
*Non-waterproof plugs and/or cords.							
- Electronics Test Equipment -							TS-111/CP



TEST SET TS-172/UP  
(TEST SET, RADAR, TS-172/UP)



**FUNCTIONAL DESCRIPTION:**

A general purpose, portable, hand-tuned, high-Q resonant cavity or echo box designed to make a quick, rough analysis of the overall performance of a radar system, to determine the frequency of continuous wave, modulated carrier or pulsed radio frequency transmitters, to measure relative power output, to detect double moding of magnetrons, and to give an indication of the signal-to-noise ratio of receivers.

All visual indications of system performance appear on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance, relative power, and spectrum are indicated by meter deflections.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Test Set TS-172/UP is similar to TS-91/TPS-1 except for frequency range.

May be replaced by Test Set TS-545/UP where greater stability is desired, and a lower ring-time is satisfactory.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-117653		3F4325-172
PROCUREMENT INFO.:	Navy Spec. No. RE9496		
PROCUREMENT COG.:	Navy, BuShips	DESIGN COG.:	Navy, BuShips
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-172/UP

TEST SET TS-172/UP  
(TEST SET, RADAR, TS-172/UP)

RELATIONSHIP TO OTHER EQUIPMENT:

One Oscilloscope TS-34A/AP required when radar under test is not provided with an A-scan oscilloscope.

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range, Input: 1215 to 1360 megacycles, the radio frequency signal coming from the transmitter under test. (A non-calibrated attenuator in the input circuit to the echo box prevents overloading the crystal and meter.)

Impedance, Input: Dipole pick-up to 50 ohm coaxial cable.

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval, known as the ring-time, is picked up by the radar receiver antenna and appears as a fixed echo on the receiver-indicator.

Ring-time: 10 statute miles.

Accuracy: Frequency,  $\pm 5$  megacycles per second; relative power,  $\pm 3$  decibels. Over the ringing range this test set has no extraneous responses nor any holes in its ring-time characteristic. This accuracy for frequency is at the mid-band and is based on a temperature of  $25^{\circ}$  C. at 65% humidity. The accuracy of relative frequency measurements is  $\pm 2$  megacycles per second at a differential frequency of 60 megacycles per second.

Temperature Range:  $-40^{\circ}$  F. to  $+120^{\circ}$  F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Western Electric Company, New York, New York; Contract No. NXss-38866; Western Electric Code No. X-66162A; Approximate Cost per Unit, \$485.00. Designed by Bell Telephone Laboratories. Western Electric Drawing No. 409059.

TUBE COMPLEMENT:

1 JAN-1N21B or -1N22 (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

CO-AN-16-35TS172-3-M (Maintenance Instructions).

TM 11-1219 (Technical Manual).

TO 16-55-193 (Spare Parts List).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Test Set, TS-172/UP (Packed MFP, VPP, for overseas)	6.7	21	22	25	80.0

TS-172/UP - Electronics Test Equipment -

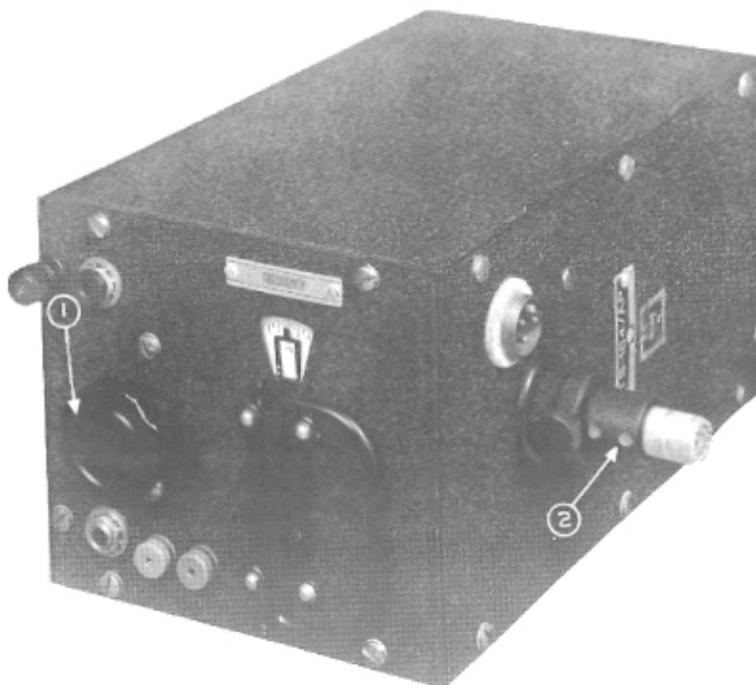
TEST SET TS-172/UP  
(TEST SET, RADAR, TS-172/UP)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Test Set TS-172/UP (Complete)		7CAC-117653 3F4325-172	15	15	18-1/2	21.0
1	Cord CG-99/AP		1F430-99.72	72 long			0.3
1	Cord CG-99/AP		1F430-99.48	48 long			0.2
1	Cord CG-99/AP		7CAC-170265-39 1F430-99.6	6 long			0.1
1	Cord CG-280/UP		1800-154431920 1F430-280	48 long			0.2
1	Case CY-131/UP		7CAC-175393 3F2529-131	19-3/4	17-3/8	17-3/8	18.2
2	Technical Manuals TM 11-1219						
						Total:	40.0



TEST SET TS-184/AP  
(CAVITY, TUNED, TS-184/AP)



**FUNCTIONAL DESCRIPTION:**

A portable and self-contained, hand-tuned, echo box and attenuator designed to make a quick, rough analysis of the overall performance of a radar system. It will determine or check the absolute frequency, system sensitivity, antenna and loop performance, and antenna-lobe pattern of Radar Set AN/APS-13. When used with Multimeter TS-352/U, the unit will align transmitter to operating frequency, align receiver to transmitter frequency, align antenna trimmers to load, and adjust receiver gain and regulation controls to optimum setting. When used with Reflectometer TS-204/AP, it will perform standing wave ratio measurements on the antenna system.

Frequency is indicated and read directly from a calibrated dial. An external meter or headset is connected to an output jack and is used to indicate resonance.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Limited Standard		
STOCK NOS.	7CAC-801319-2165	R16-AN-TS-184-AP	3F4325-184
PROCUREMENT INFO.:	USAF Spec. No. R-7101		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, ARL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2.		
	- Electronics Test Equipment -		TS-184/AP

TEST SET TS-184/AP  
(CAVITY, TUNED, TS-184/AP)

RELATIONSHIP TO OTHER EQUIPMENT:

TS-184/AP is interchangeable with TS-184A/AP except for frequency range and type of attenuator.

TS-184/AP is replaced by TS-184A/AP.

Similar to TS-228/AP except for frequency range.

ELECTROMECHANICAL DESCRIPTION:

Power Supply: 28 volts DC (obtained from equipment under test).

Frequency Range, Input: 410 to 470 megacycles per second.

Power Range, Input: 500 watts maximum peak power (consists of the radio frequency output signal coming from the transmitter under test).

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval of time, known as the ring-time, and appears as a saturated echo on the receiver-indicator. A calibrated attenuator is incorporated within the echo box for relative power measurements.

Calibrated Attenuator: Up to 30 decibels loss.

Accuracy: Frequency at 415 megacycles per second,  $\pm 0.1$  megacycle per second.

All other frequencies,  $\pm 1$  megacycle per second. Loop performance,  $\pm 2$  decibels.

Impedance, Input: 52 ohms,  $\pm 20\%$ .

Impedance, Output: The output of the echo box is fed to the receiver through a 50 ohm coaxial cable.

Decay Time: 3 decibels per microsecond for echo box.

"Q": Approximately 30,000.

Temperature Range:  $-40^{\circ}\text{F.}$  to  $+122^{\circ}\text{F.}$

MANUFACTURERS' OR CONTRACTORS' DATA:

Radio Corporation of America, Victor Division, Camden, New Jersey; Contract No. 737-44; Approximate Cost per Unit, \$548.00; Order No. 657-DAY-45RA, 18 October 1944. Sub-contractor: Maguire Industries, Division of General Electronics, 242 West Putnam Avenue, Greenwich, Connecticut; Approximate Cost per Unit, \$218.00.

TUBE COMPLEMENT:

1 JAN-6J6.

REFERENCE DATA AND LITERATURE:

IB-4002-1 (Manuscript of Instructions supplied by RCA).

AN 16-35TS184-3 (Maintenance Instructions).

TO 16-54-149 (Spare Parts List).

TEST SET TS-184/AP  
(CAVITY, TUNED, TS-184/AP)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Test Set TS-184/AP Including:		7CAC-801319-2165 3F4325-184	5-1/2	6	10-9/16	30
1	Cord, CX-223/AP (with Tee Connector) Including:	Water-proof flexible	1690-322850033 3E6000-223	120 long			
2	Lamp LM-38		8800-465850 2Z5938				
1	Probe Antenna Assembly AS-123/AP		1690-327387702 3F4043-123	Probe: 3/16 dia.	x 7		
1	Cord CG-104/AP		7CAC-997700 1F430-104	420 long			
1	Cord CD-800		1600-321855365 3E1800-120	121 long			
1	Case CY-152/AP	Ply-wood	1690-328630008 3F2529-152	13	6-1/2	18-3/8	12
1	Tube Type 6J6		3300-234560000 2J6J6				

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Test Set, TS-184/AP, 3 each (Domestic Packed)	13.4	23	24	24	150

- Electronics Test Equipment -

TS-184/AP



TEST SET TS-184A/AP  
(TEST SET, RADAR, TS-184A/AP)



**FUNCTIONAL DESCRIPTION:**

A portable and self-contained hand-tuned echo box and attenuator designed to make a quick, rough analysis of the overall performance of a radar system. It will determine or check the absolute frequency, system sensitivity, antenna and loop performance, and antenna-lobe pattern of Radar Set AN/APS-13. When used with Voltmeter IS-189, the unit will align transmitter to operating frequency, align receiver to transmitter frequency, align antenna trimmers to load, and adjust receiver gain and other controls to optimum setting. When used with Reflectometer TS-204/AP it will perform standing wave ratio measurements on the antenna system.

Frequency is indicated and read directly from a calibrated dial. An external meter or headset is connected to an output jack and is used to indicate resonance.

**RELATIONSHIP TO OTHER EQUIPMENT:**

TS-184A/AP is interchangeable with TS-184/AP except for frequency range and type of attenuator.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.		R16-AN-TS-184A/AP	3F4325-184A
PROCUREMENT INFO.:	USAF Spec. No. R7101		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, ARL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-184A/AP

TEST SET TS-184A/AP  
(TEST SET, RADAR, TS-184A/AP)

RELATIONSHIP TO OTHER EQUIPMENT: (Continued)

TS-184A/AP replaces the TS-184/AP.

Similar to TS-228/AP except for frequency range.

Equipment required but not furnished: One Headset HS-33(600 ohms impedance) and one Voltmeter IS-189 (50 volt and 100 microampere range).

ELECTROMECHANICAL DESCRIPTION:

Power Supply: 28 volts direct current (obtained from equipment under test).

Frequency Range, Input: 400 to 430 megacycles per second.

Power Range, Input: 500 watts maximum peak power (consists of the radio frequency output signal coming from the transmitter under test).

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval of time, known as the ring-time, and appears as a saturated echo on the receiver-indicator. A calibrated attenuator is incorporated within the echo box for relative power measurements.

Calibrated Attenuator: Up to 100 decibel loss.

Accuracy: Frequency at 415 megacycles per second,  $\pm 0.1$  megacycles per second.

All other frequencies,  $\pm 1$  megacycle per second. Loop performance,  $\pm 2$  decibels.

Impedance, Output: The output of the echo box is fed to the receiver through a 50 ohm coaxial cable.

Decay Time: 4.52 decibels per microsecond.

"Q": Approximately 2500.

Temperature Range:  $-40^{\circ}$  F. to  $+122^{\circ}$  F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Radio Corporation of America, Victor Division, Camden, New Jersey; R. C. A. Specification Nos. AS-5852 and AS-5845; Order No. 738-DAY-44; 1944; Approximate Cost per Unit, \$584.00.

TUBE COMPLEMENT:

1 JAN-6J6.

REFERENCE DATA AND LITERATURE:

IB-4002-1 (Manuscript of Instructions supplied by R. C. A.).

AN 16-35TS184-3 (Maintenance Instructions).

TO 16-55-149 (Spare Parts List).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	TS-184A/AP and accessories (Domestic Packed)	2.4	17	11	23.5	54
TS-184A/AP - Electronics Test Equipment -						

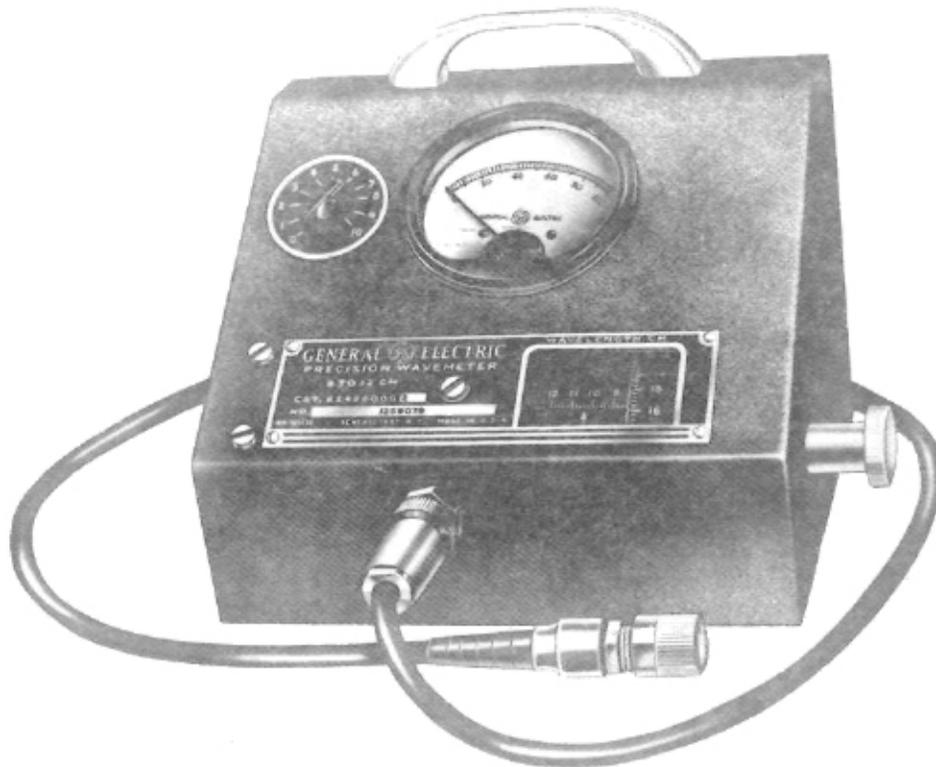
TEST SET TS-184A/AP  
(TEST SET, RADAR, TS-184A/AP)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Test Set TS-184A/AP (Complete) Including:		3F4325-184A	6-7/8	11-3/4	10	28
1	Cord CX-267/AP (With tee con- nector) includ- ing only:	Rub- ber cov- ered	1690-322975059 3E6000-267	120 long			
2	Lamps LM-38		8800-46850 2Z5938				
1	Probe Antenna AS-147/AP Including only:	Cast Alum- inum	7CAC-045975 3F4043-147	8-1/2	1-1/2	2-5/8	
1	Cord CG-137/AP (Probe Antenna)		7CAC-170265-575 1F430-137	420 long			
1	Cord CD-800		1600-150430774 3E1800-120	120 long			
1	Case CY-192/AP Including only:	Alum- inum	1690-326136948 3F2623-192	8	18-7/8	13	
2	Allen wrenches "L" shaped TL-567/U		7900-859480 6R57400-6	1/16 across flats			
1	Tube Type 6J6		3300-234560000 2J6J6				
2	Books of Maintenance Instructions		6D9810-184				



WAVEMETER TS-192/CPM-4  
(WAVEMETER TS-192/CPM-4)



**FUNCTIONAL DESCRIPTION:**

A portable and self-contained radio frequency wavemeter of the absorption type, designed to measure or check the frequency of continuous wave, modulated carrier wave or pulsed radar transmitters, signal generators and local oscillators.

A 0 to 100 direct current microammeter is used to indicate resonance. Frequency is then read directly from a calibrated vernier dial.

**RELATIONSHIP TO OTHER EQUIPMENT:**

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range: 2500 to 3750 megacycles per second.

Signal Input: 1 milliwatt (average). TS-192/CPM-4 connects to the antenna waveguide through the radio frequency probe (TS-194/CPM-4). This probe provides a loss of about 67 decibels.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-979578-7		3F4325-192
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-192/CPM-4

WAVEMETER TS-192/CPM-4  
(WAVEMETER TS-192/CPM-4)

**ELECTROMECHANICAL DESCRIPTION:** (Continued)

Input Impedance: 50 ohms (Type- "N" connector).

Accuracy: ±3 megacycles per second, absolute.

Temperature Range: -40° F. to +135° F.

Sensitivity: Not more than 2 milliwatts for full scale deflection.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

General Electric Company, Schenectady, New York; Contract No. W-3435-SC-264;  
Approximate Cost per Unit, \$83. 70.

**TUBE COMPLEMENT:**

1 JAN-1N21B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

TO 16-30CPS1-7 (Maintenance Instructions for AN/CPS-1).

TM 11-1544 (Technical Manual).

**EQUIPMENT SUPPLIED:**

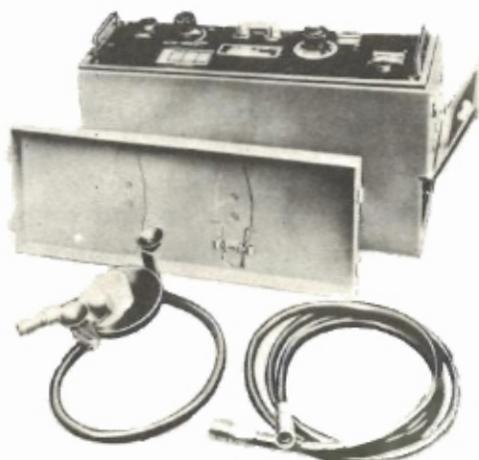
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter TS-192/CPM-4 (Complete)	Metal	7CAC-979578-7  3F4325-192	6.5	9	7	7
1	Cable RG-21/U		3300-132335602  1F425-21	118 long			
2	Technical Manual TM 11-1544						

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter TS-192/CPM-4 (Shelf Package - Water Resistant)	1.57	13	15	14	8

TS-192/CPM-4 - Electronics Test Equipment -

ECHO BOX TS-218/UP  
(CAVITY, TUNED, TS-218/UP)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, hand-tuned ringing cavity designed to make a quick, rough analysis of the overall performance of a radar system, to determine the frequency of continuous wave, modulated carrier wave or pulsed radio frequency transmitters, to measure relative power output, to detect double moding of magnetrons, to give an indication of the signal-to-noise ratio of receivers, and to make spectrum analysis of radar transmitters.

All visual indications of system performance appear on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections.

**RELATIONSHIP TO OTHER EQUIPMENT:**

TS-218/UP differs from TS-218A/UP in construction and method of suppressing unwanted modes.

TS-218/UP is identical with TS-225/MPN-1.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Limited Standard		
STOCK NOS.	7CAC-177677	F16-C-67673-7850	3F4325-218
PROCUREMENT INFO.:	Navy Spec. No. R-7448		
PROCUREMENT COG.:	Navy	DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-218/UP

ECHO BOX TS-218/UP  
(CAVITY, TUNED, TS-218/UP)

RELATIONSHIP TO OTHER EQUIPMENT: (Continued)

Similar to TS-62/AP except for frequency range.  
Superseded by TS-488/UP.

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range, Input: 8920 to 9250 megacycles per second (Frequency is referred to a calibrated point on the scale).

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulse.

Signal, Input: Provided by radio frequency output signal from the transmitter under test. (A non-calibrated attenuator is provided in the input circuit to the echo box to prevent over-loading the crystal and meter).

Impedance, Input: Dipole pick-up to 50-ohm coaxial cable.

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval, known as the ring-time, is picked up by the radar receiver antenna and appears as a fixed echo on the receiver-indicator.

Ring-time: 2 statute miles.

Decay: 4.5 to 6 decibels per microsecond.

Accuracy: Frequency,  $\pm 3$  megacycles per second; Relative Power,  $\pm 3$  decibels. Over the ringing range this test set has no extraneous responses nor any holes in its ring-time characteristic. (This accuracy for frequency is at mid-band and is based on a temperature of 25° C. at 65% relative humidity. The accuracy of relative frequency measurements is  $\pm 2$  megacycles per second at a differential frequency of 60 megacycles per second).

Temperature Range: -40° F. to +120° F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Western Electric Company, 120 Broadway, New York, New York; Western Electric Company Code No. X-63630A, Contract No. W-28-003-SC-887, W-28-004-SC; Bell Telephone Laboratory Drawing No. X-63630, Order No. 5000-DAY-45. Western Electric Company Order No. 5029-45GR, 13 March 1945, Spec. X-63630A; Approximate Cost per Unit \$636.00.

TUBE COMPLEMENT:

1 JAN-1N23B (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

CO AN16-35TS218-2-M (Maintenance Instructions).

TM 11-1232 (Technical Manual).

TO 16-35TS218-3 (Maintenance Instructions).

TO 16-55-328 (Spare Parts List).

ECHO BOX TS-218/UP  
(CAVITY, TUNED, TS-218/UP)

**EQUIPMENT SUPPLIED:**

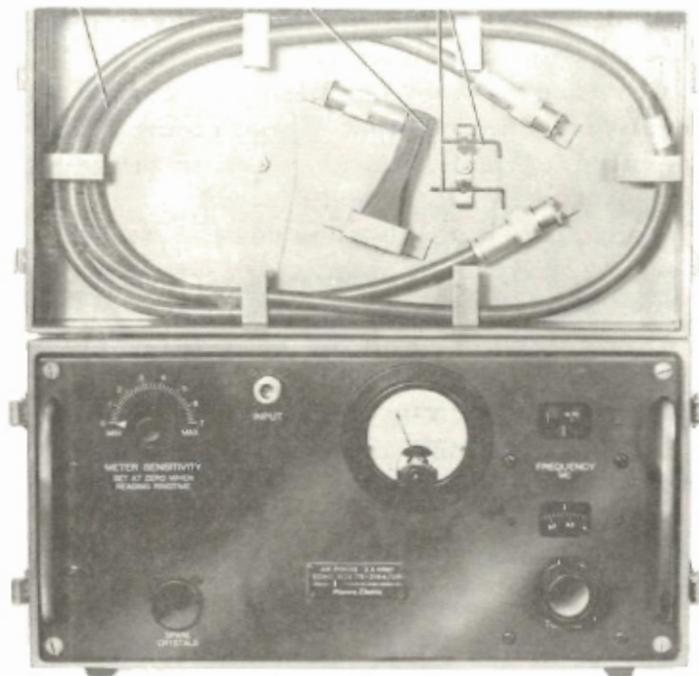
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-218/UP (Complete)	Alum- inum	7CAC-177677 F16-C-67673-7850 3F4325-218	11-3/8	18-1/4	6-1/32	10
1	Pick-up Di- pole Antenna Assembly AS-106/AP		7CAC-045745  2A264-106	4-1/2	28-7/8		1
1	Calibration Curve						
1	Connecting Cord CG-92/U		7CAC-170265465  1F430-92.72	72 long			0.9
5	Crystal Rectifier JAN-1N23B (4 spares)		3300-234137350  2J1N23B	1	2	2	0.1
2	Wrench, Hex						
1	Instruction Book TM 11-1232						

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box TS-218/UP, with accessories (Domestic Packed)	6.66	30	24	16	50
- Electronics Test Equipment -						TS-218/UP



**ECHO BOX TS-218A/UP  
(CAVITY, TUNED, TS-218A/UP)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, hand-tuned ringing cavity designed to make a quick, rough analysis of the overall performance of a radar system, to determine the frequency of continuous wave, modulated carrier wave or pulsed radio frequency transmitters, to measure relative power output, to detect double moding of magnetrons, to give an indication of the signal-to-noise ratio of receivers, and to make spectrum analysis of radar transmitters. Echo Box TS-218A/UP may also be used as a direct reading frequency meter.

All visual indications of system performance appear on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections.

**RELATIONSHIP TO OTHER EQUIPMENT:**

It is an electrically and mechanically improved redesign of TS-218/UP but not mechanically interchangeable. It is to replace TS-218/UP. It is superseded by TS-488/UP.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Limited Standard		
STOCK NOS.	7CAC-177679	F16-T-20135-6251	3F4325-218A
PROCUREMENT INFO.:	Navy Spec. No. R-7448		
PROCUREMENT COG.:	Navy	DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-218A/UP

ECHO BOX TS-218A/UP  
(CAVITY, TUNED, TS-218A/UP)

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range, Input: 8920 to 9250 megacycles per second (Frequency is referred to a calibrated point on the scale).

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulse.

Signal Input: The radio frequency output signal coming from the transmitter under test. (A non-calibrated attenuator is provided in the input circuit to the echo box to prevent over-loading the crystal and meter).

Input Impedance: Dipole pick-up to 50-ohm coaxial cable.

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval, known as the ring-time, is picked up by the radar receiver antenna and appears as a fixed echo on the receiver-indicator.

Ring-time: 2 statue miles.

Ring-time Accuracy:  $\pm 4\%$  across band.

Ring-time Uniformity: Adjusted to  $+1/2$  microsecond of agreed standard (The ring-time is linear over the entire frequency range within  $\pm 3-1/2\%$ ).

Decay: 6 decibels per microsecond.

Accuracy: Frequency,  $\pm 5$  megacycles per second; Relative Power,  $\pm 3$  decibels. Over the ringing range this test set has no extraneous responses nor any holes in its ring-time characteristic. (This accuracy for frequency is at mid-band and is based on a temperature of  $25^{\circ}$  C. at 65% humidity. The accuracy of relative frequency measurements is  $\pm 2$  megacycles per second at a differential frequency of 60 megacycles per second).

Temperature Range:  $-40^{\circ}$  F. to  $+120^{\circ}$  F.

Crystal Current: Ratio not to exceed 2:1 across band.

MANUFACTURERS' OR CONTRACTORS' DATA:

Western Electric Company, New York, New York; Order No. 2686-CEGSA-44; Western Electric Company Dwg. No. X-63630-B, Contract No. W-28-003-SC-887; Approximate Cost per Unit, \$336.00. Also manufactured by the General Communication Company, 534 Commonwealth Avenue, Boston 15, Massachusetts; Contract No. NObsr-39200.

TUBE COMPLEMENT:

1 JAN-1N23B (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

TM 11-1232 (Operating Manual).

TO 16-55-328 (Spare Parts List).

ECHO BOX TS-218A/UP  
(CAVITY, TUNED, TS-218A/UP)

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-218A/UP (Complete)	Alum- inum	7CAC-177679 F16-T-20135-6251 3F4325-218A	12	8	15-1/2	16.8
1	Horn Antenna AT-68/UP		7CAC-045705  3F3988-68	3-1/4	1	1-7/8	0.4
1	Patch Cord CG-359/U		7CWX-BA460803  1F430-359.96				
1	Connecting Cord CG-92/U		7CAC-170265-42  1F430-92.96	96 long			1.2
5	Crystal Rectifier 1N23B		3300-234137350  2J1N23B				
2	Wrench, Hex						

**SHIPPING DATA:**

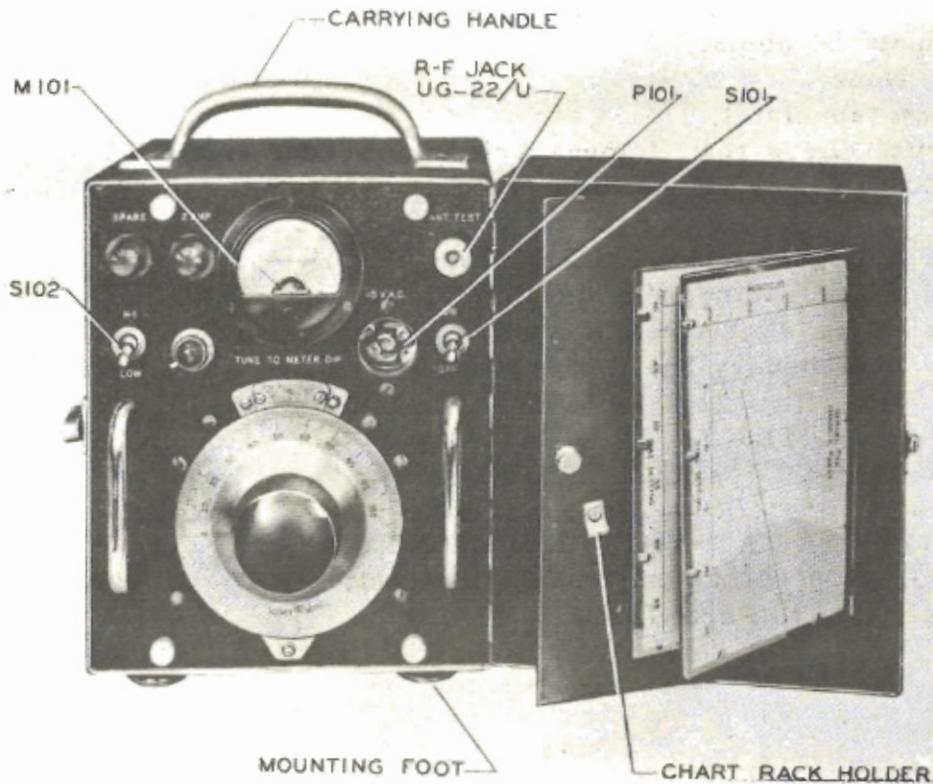
No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box TS-218A/UP (Domestic Packed)	0.62	14-3/4	13	21	50

- Electronics Test Equipment -

TS-218A/UP



## WAVEMETER TS-247/APM-48



### FUNCTIONAL DESCRIPTION:

A portable frequency meter of the absorption type (cavity, tuned) designed to measure the frequency of radio frequency radar transmitters and signal generators.

Resonance is indicated by a sharp dip in the reading of the indicating microammeter. Vernier dial settings are referred to a calibrated chart for frequency determination.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: 0.25 amperes at 115 volts alternating current, 50 to 1600 cycles per second. Approximately 6 watts.

Type of Reception: Continuous Wave, Pulse.

Frequency Range, Input: 215 to 275 megacycles per second.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-979571-7		3F4325-247
PROCUREMENT INFO.:	USAF Spec. No. 371-5087		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Arm.	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-247/APM-48

## WAVEMETER TS-247/APM-48

### ELECTROMECHANICAL DESCRIPTION:

Sensitivity: 2 volts peak for a 20% meter deflection for Continuous Wave operation.

Impedance, Input: 50 ohms.

Signal Output: None.

Accuracy: 0.2% (absolute).

Frequency Drift: Less than 1 megacycle per second from  $-55^{\circ}$  F. to  $+135^{\circ}$  F.

Temperature Range:  $-67^{\circ}$  F. to  $+122^{\circ}$  F.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Harvey Radio Laboratory, Inc., 447 Concord Avenue, Cambridge, Massachusetts;  
 Order Nos. 785-DAY-45-RA, 13 November 1944; 937-DAY-45, 20 December 1944;  
 2066-DAY-45, 24 February 1945; Approximate Cost per Unit, \$191.00.

### TUBE COMPLEMENT:

1 JAN-9002.

### REFERENCE DATA AND LITERATURE:

CO-AN 16-35TS247-2-M (Maintenance Instructions).

TO 16-55-210 (Spare Parts List).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter TS-247/APM-48 with tube installed and accessories. (MFP, VPP)	4	20	14	23	75

TS-247/APM-48 - Electronics Test Equipment -

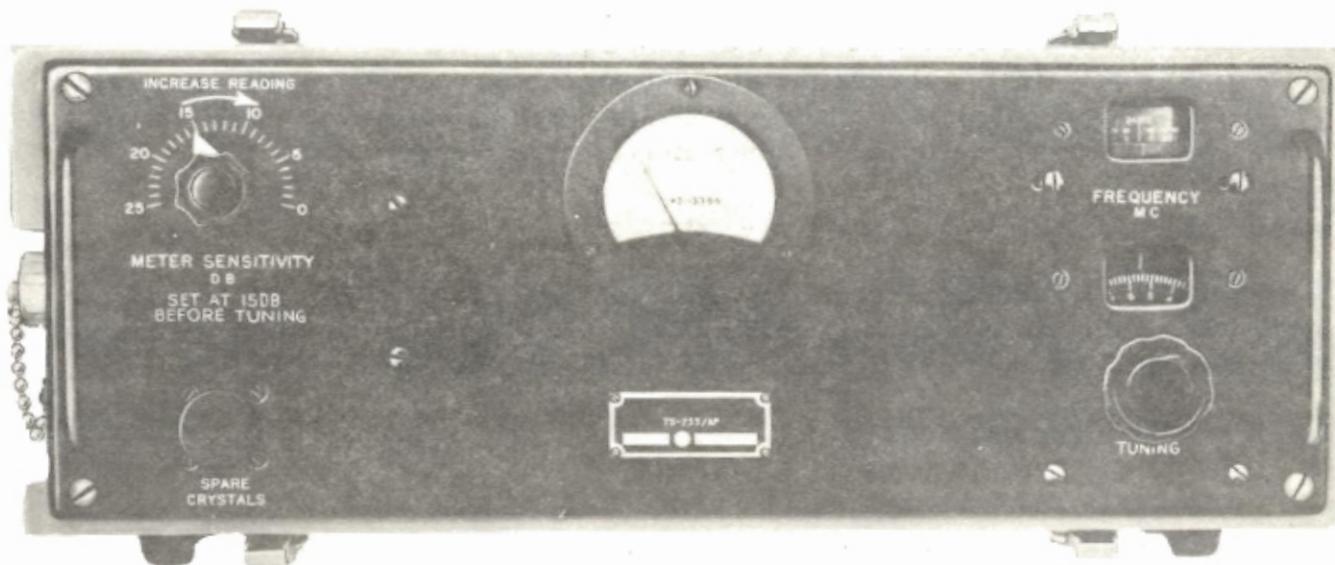
WAVEMETER TS-247/APM-48

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter TS-247/APM-48 (Complete)	Steel	7CAC-979571-7 3F4325-247	9	13	. 8	19.5
1	Antenna AT-82/UP	Brass	7CAC-045950 2A203-82	20-1/2			.125
1	Cord CX-656/U		7CAC-170264-7 3E6000-656-72	72 long			.437
1	Cord CG-100/U		1F430-100.51	51 long			.625
1	Adapter UG-179/AP		3300-286054549 2Z308-179	2	3/4	3/4	
1	Case CY-325/APM-48	Wood	1690-328630362 3F2529-325	13-5/8	17	9-7/8	14
1	Book of Maintenance Instructions		6D9810-247				
5	Fuses, Little Fuse 4AG (2 ampere, 250 volts)		8800-358900 3Z2602.7	1-3/16	9/32 dia.		
1	Tube Type JAN-9002		2J9002				
						Total:	35

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100

ECHO BOX TS-255/AP  
(CAVITY, TUNED, TS-255/AP)



FUNCTIONAL DESCRIPTION:

A portable, self-contained, hand-tuned ringing cavity designed to make a rapid, rough analysis of the overall performance of a radar system, to determine the frequency of radio frequency transmitters, to measure relative power output, to detect frequency pulling and AFC action, to detect multiple moding of magnetrons.

All visual indications of system performance appear on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections.

RELATIONSHIP TO OTHER EQUIPMENT:

ELECTROMECHANICAL DESCRIPTION:

Circuit Information: The signal from the radar transmitter is re-radiated by the echo box for a short interval known as the ring-time, is picked up by the radar

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-177685		3F4325-255
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Arm.
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
- Electronics Test Equipment -			TS-255/AP

ECHO BOX TS-255/AP  
(CAVITY, TUNED, TS-255/AP)

ELECTROMECHANICAL DESCRIPTION: (Continued)

receiver antenna and appears as a fixed echo on the receiver-indicator.

Power Supply: None required.

Frequency Range: 23,660 to 24,285 megacycles per second.

Type of Reception: Continuous Wave or Pulsed.

Ring-time: Equivalent to approximately 3000 yards when connected through a 20 decibel directional coupler to a system having a 3/8 microsecond pulse length, 25 kilowatt peak power, and a 90 dbm receiver sensitivity.

Accuracy:  $\pm 2\%$ .

Temperature Range:  $-40^{\circ}$  F. to  $+130^{\circ}$  F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Western Electric Company, 120 Broadway, New York, New York; Contract No. 2156-45-AR, 5 March 1945; Approximate Cost per Unit, \$1718.00.

TUBE COMPLEMENT:

1 JAN-1N26 (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box TS-255/AP (Export Packed)	4.8	15-3/4	33-1/2	15-3/4	60

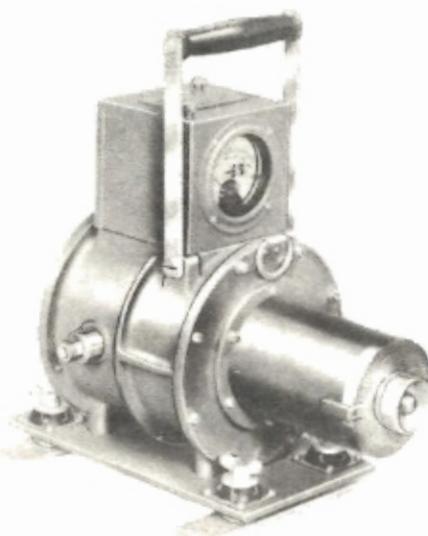
TS-255/AP

- Electronics Test Equipment -





**ECHO BOX TS-270/UP  
(CAVITY, TUNED, TS-270/UP)**



**FUNCTIONAL DESCRIPTION:**

A portable, self-contained, hand-tuned ringing cavity primarily designed to make a quick, rough analysis of the overall performance of a radar system. It will check the frequency of the radar transmitter and receiver local oscillator. In addition, it will perform a spectrum analysis, make rough relative power measurements, and check T/R recovery time.

A visual indication of system performance appears on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections of an internal microammeter.

**RELATIONSHIP TO OTHER EQUIPMENT:**

TS-270/UP is identical in construction with TS-270A/UP except for the tuning dial. TS-270B/UP is similar in all characteristics to TS-270A/UP except fabricated of aluminum alloy instead of brass.

TS-270/UP is similar to the Navy type Echo Boxes 14ABA, 14ABA-1, OBU, and AN Type TS-275/UP except for frequency range.

Equipment required but not supplied: One Antenna Assembly AS-23/AP and one Antenna AT-67/AP.

TS-270/UP is superseded by TS-270B/UP.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Obsolete		
STOCK NOS.	1690-329001405	R16-AN-TS-270/UP	3F4325-270
PROCUREMENT INFO.:	Mil. Spec. No. E3221, Army Spec. No. 71-2398		
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, ESL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-270/UP

ECHO BOX TS-270/UP  
(CAVITY, TUNED, TS-270/UP)

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range, Input: 2630 to 2970 megacycles per second.

Signal Input: The input consists of the radio frequency output signal from the radar transmitter.

Input Impedance: 50 ohm type - "N" connector. The unit will be connected to a directional coupler within the transmitter waveguide.

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval known as the ringing time, is then picked up by the radar receiver and appears on the indicator scope as a saturated echo.

Sensitivity: 90 yards change in ringing time per decibel change in power.

Accuracy, Frequency:  $\pm 3$  megacycles per second at low humidity.

Input Voltage Standing Wave Ratio: Less than 1.10.

Loaded "Q": Approximately 47,000.

Radar Performance Measurements:  $\pm 3$  decibels.

Temperature Range:  $-40^{\circ}$  F. to  $+140^{\circ}$  F.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Johnson Service Company, Milwaukee, Wisconsin; Contract No. N5SR-8624, 26 April 1945; Approximate Cost per Unit, \$688.00. Contract No. W-28-099-ac-47, 19 July 1948; Order No. 2417-MPD-45.

Lavoie Laboratory, Matawan & Freehold Road, Morganville, New Jersey, 5040-45GR, 19 June 1945; Approximate Cost per Unit, \$422.00.

**TUBE COMPLEMENT:**

1 JAN-1N21B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

TM 11-1086 (Technical Manual).

CO 16-35TS270-2-M (Maintenance Instructions).

TO 16-55-214 (Spare Parts List).

TO 16-35TS270-5 (Installation, Operation, and Maintenance).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box, TS-270/UP, with Shock mounting, connecting cable, equipment spare parts case and accessory box. (Domestic packed)	3.4	16-1/4	14-1/2	24-3/4	73
TS-270/UP - Electronics Test Equipment -						

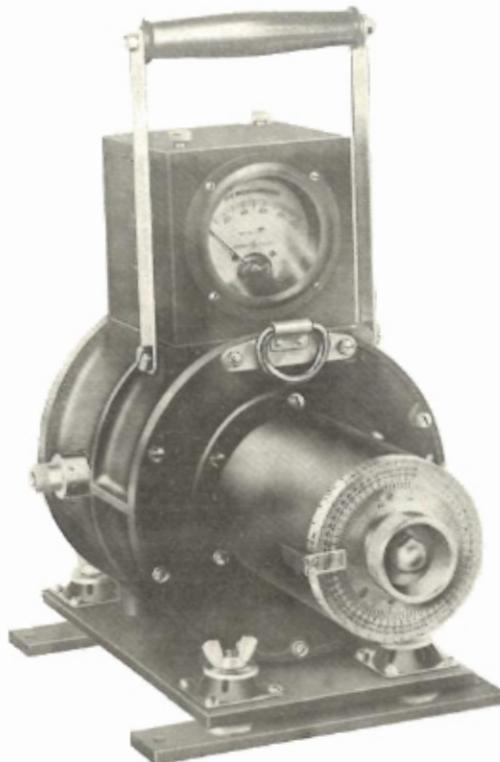
ECHO BOX TS-270/UP  
(CAVITY, TUNED, TS-270/UP)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-270/UP (Complete)		1690-329001405 R16-ANTS-270/UP 3F4325-270	12-1/4	8	14-5/8	25.75
1	Accessory Box containing the following:	Steel		3-1/8	10-1/2	11-1/4	9.00 (full)
1	Socket Wrench (5/8" hex)	Steel	3300-680712410  6R57420.2	2-1/2 long	7/8 dia.	3	0.28
1	Spanner Wrench	Steel	7900-868570  6R57528	4	3/4	0.19	0.08
1	Positioning Plunger Gauge	Steel	8042-24943  3F48800	0.06	1-1/4	4.38	0.05
1	Connecting Cable Assembly CG-55/U		7CAC-170265-206  1F4J2-2.120	120 long	0.44 dia.		1.50
1	Equipment Spare Parts Case			7-1/2	8-1/2	3	7.00 (full)
1	Carrying Strap		7CJS-8680  2Z9052-70	0.06	2	48	0.25
1	Instruction Book AN08- 35TS-270-2			1/4	8	10-1/2	0.65
1	Technical Manual TM 11-1086			1/4	8	10-1/2	0.65
4	Tube JAN-1N21B (3 spares)		3300-234137020  2J1N21B	3			0.1
1	Carrying Case	Wood		15-3/4	10	19	18.00 (full)



ECHO BOX TS-270A/UP  
(CAVITY, TUNED, TS-270A/UP)



**FUNCTIONAL DESCRIPTION:**

A portable, self-contained, hand-tuned ringing cavity primarily designed to make a quick, rough analysis of the overall performance of a radar system. It will check the frequency of the radar transmitter and receiver local oscillator. In addition, it will perform a spectrum analysis, make rough relative power measurements, and check T/R recovery time.

A visual indication of system performance appears on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections of an internal microammeter.

**RELATIONSHIP TO OTHER EQUIPMENT:**

TS-270/UP is identical in construction with TS-270A/UP except for the tuning dial. TS-270B/UP is similar in all characteristics to TS-270A/UP except fabricated of aluminum alloy instead of brass.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-329001408		3F4325-270A
PROCUREMENT INFO.:	Army Spec. No. 71-2398		
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, ESL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-270A/UP

**ECHO BOX TS-270A/UP  
(CAVITY, TUNED, TS-270A/UP)**

**RELATIONSHIP TO OTHER EQUIPMENT: (Continued)**

TS-270A/UP is similar to the Navy type Echo Boxes 14ABA, 14ABA-1, OBU, and AN Type TS-275/UP except for frequency range.

Equipment required but not supplied: One Antenna Assembly AS-23/AP and one Antenna AT-67/AP.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range, Input: 2630 to 2970 megacycles per second.

Signal Input: The input consists of the radio frequency output signal from the radar transmitter.

Input Impedance: 50 ohm type - "N" connector. The unit will be connected to a directional coupler within the transmitter waveguide.

Signal Output: The signal from the transmitter is re-radiated by the echo box for a short interval, known as the ringing time, is then picked up by the radar receiver and appears on the indicator scope as a saturated echo.

Sensitivity: 90 yards change in ringing time per decibel change in power.

Accuracy: Frequency  $\pm 3$  megacycles per second.

Input Voltage Standing Wave Ratio: Less than 1.10.

Loaded "Q": Approximately 47,000.

Radar Performance Measurements:  $\pm 3$  decibels.

Temperature Range:  $-40^{\circ}$  F. to  $+140^{\circ}$  F.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Johnson Service Company, Milwaukee, Wisconsin; Order No. 5040-DAY-45-GR, 2417-MPD-45.

**TUBE COMPLEMENT:**

1 JAN-1N21B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

TM 11-1086 (Technical Manual).

CO 16-35TS270-2-M (Maintenance Instructions).

TO 16-55-214 (Spare Parts List).

TO 16-35TS270-5 (Installation, Operation and Maintenance).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box, TS-270A/UP with Shock mounting, connecting cable, equipment spare parts case and accessory box. (Domestic Packed)	3.4	16-1/4	14-1/2	24-3/4	73

TS-270A/UP

- Electronics Test Equipment -

**ECHO BOX TS-270A/UP  
(CAVITY, TUNED, TS-270A/UP)**

**EQUIPMENT SUPPLIED:**

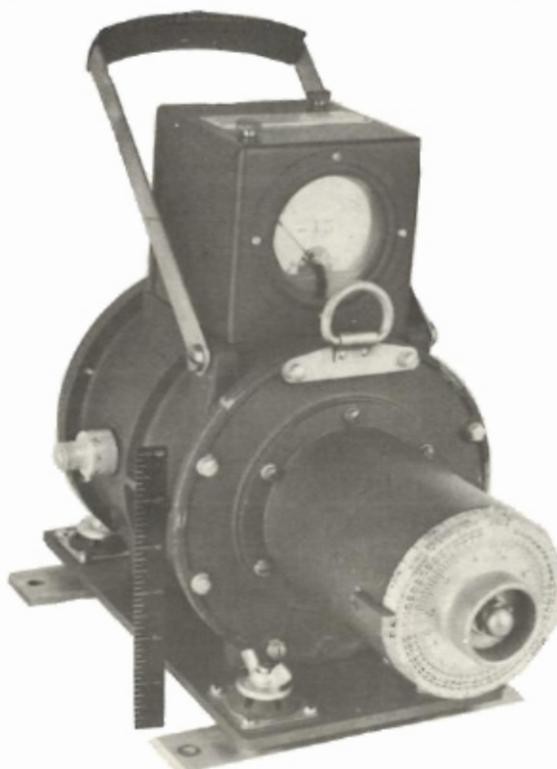
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-270A/UP (Complete)		1690-329001408  3F4325-270A	12-1/4	8	14-5/8	25.75
1	Accessory Box containing the following:	Steel		3-1/8	10-1/2	11-1/4	9.00 (full)
1	Socket Wrench (5/8" hex)	Steel	3300-680712410  6R57420.2	2-1/2 long	7/8 dia.	3	0.28
1	Spanner Wrench	Steel	7900-868570  6R57528	4	3/4 dia.	19/100	0.08
1	Positioning Plunger Gauge	Steel	8042-24943  3F48800	6/100	1-1/4	4-38/100	0.05
1	Connecting Cable Assem- bly CG-55/U		7CAC-170265-206  1F4J2-2.120	120 long	44/100		1.50
1	Equipment Spare Parts Case			7-1/2	8-1/2	3	7.00 (full)
4	Tube JAN-1N21B (3 spares)		3300-234137020  2J1N21B	3			1.00
1	Strap (Carrying)		7CJS-8680  2Z9052-70	6/100	2	48	0.25
1	Technical Manual TM 11-1086			1/4	8	10-1/2	0.65
1	Instruction Book AN08- 3575TS-270-2			1/4	8	10-1/2	0.65
1	Carrying Case	Wood		15-3/4	10	19	18.00 (full)

- Electronics Test Equipment -

TS-270A/UP



ECHO BOX TS-270B/UP  
(CAVITY, TUNED, TS-270B/UP)



**FUNCTIONAL DESCRIPTION:**

A portable, self-contained, hand-tuned ringing cavity primarily designed to make a quick, rough analysis of the overall performance of a radar system. It will check the frequency of the radar transmitter and receiver local oscillator. In addition, it will perform a spectrum analysis, make rough relative power measurements, and check T/R recovery time.

A visual indication of system performance appears on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections of an internal microammeter.

**RELATIONSHIP TO OTHER EQUIPMENT:**

TS-270/UP is identical in construction with TS-270A/UP except for the tuning dial. TS-270B/UP is similar in all characteristics to TS-270A/UP except fabricated of aluminum alloy instead of brass.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-177659	F16-C-67646-6141	3F4325-270B
PROCUREMENT INFO.:	Army Spec. No. 71-2398		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, ESL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-270B/UP

ECHO BOX TS-270B/UP  
(CAVITY, TUNED, TS-270B/UP)

RELATIONSHIP TO OTHER EQUIPMENT: (Continued)

TS-270B/UP is similar to the Echo Boxes 14ABA, 14ABA-1, OBU, and TS-275/UP except for frequency range.

ELECTROMECHANICAL DESCRIPTION:

Circuit Information: The signal from the transmitter under test is re-radiated by the echo box for a short interval known as the ring-time, is then picked up by the radar receiver and appears on the indicator scope as a saturated echo.

Power Supply: None required.

Frequency Range, Input: 2630 to 2970 megacycles per second.

Type of Reception: Continuous Wave or Pulsed.

Impedance, Input: 50 ohm type-"N" connector. The unit will be connected to a directional coupler within the transmitter waveguide.

Sensitivity: 90 yards change in ringing time per decibel change in power.

Input Voltage Standing Wave Ratio: Less than 1.10.

Loaded "Q": Approximately 47,000.

Accuracy: Frequency,  $\pm 3$  megacycles per second.

Temperature Range:  $-40^{\circ}$  F. to  $+140^{\circ}$  F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Johnson Service Company, Milwaukee, Wisconsin; Approximate Cost per Unit, \$700.00.

Thomas A. Edison, West Orange, New Jersey; R-49-89SC, dated 9 November 1948, and R-49-221SC, dated 18 March 1949; Approximate Cost per Unit, \$704.00.

TUBE COMPLEMENT:

1 JAN-1N21B (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

TM 11-1086 (Technical Manual).

TO 16-35TS270-5 (Installation, Operation, and Maintenance).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Test Set Assembly with Shock Mounting, Connecting cable, equipment spare parts case and accessory box. (Domestic Packed)	4.6	21-1/2	15-1/4	24-1/8	61
TS-270B/UP - Electronics Test Equipment -						

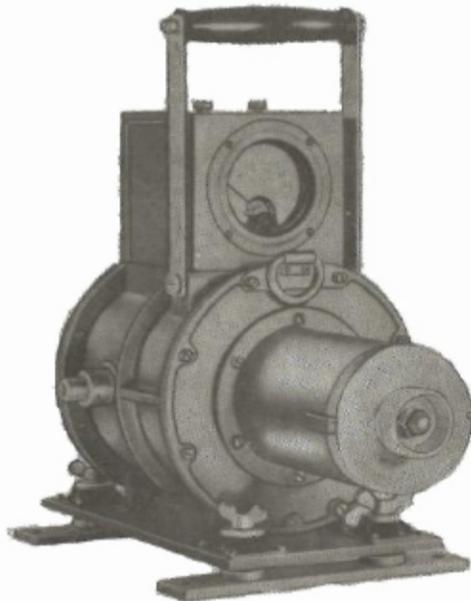
ECHO BOX TS-270B/UP  
(CAVITY, TUNED, TS-270B/UP)

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-270B/UP (Complete)		7CAC-177659 F16-C-67646-6141 3F4325-270B	12-1/2	7-1/4	14-1/2	11.25
1	Accessory Box containing the following:	Steel		3-1/8	10-1/2	11-1/4	9.00 (full)
1	Socket Wrench (5/8" Hex)	Steel	3300-680712410  6R57420.2	22/25	2-1/2	3	0.28
1	Spanner Wrench	Steel	7900-868570  6R57528	19/100	3/4	4	0.08
1	Positioning Plunger Gauge	Steel	8042-24943  3F48800	3/50	1-1/4	4-19/50	0.05
1	Connecting Cable Assembly CG-55/U		7CAC-170265-206  1F4J2-2.120	120 long	0.44		1.5
1	Carrying Strap		7CJS-8680  2Z9052-70	3/50	2	48	0.25
3	Crystal Recti- fier 1N21B (3 Spares)		3300-234137020  2J1N21B	3/10	3/10	41/50	0.1
3	Calibration Charts						
2	Temperature Calibration Charts						
1	Technical Manual TM 11-1086			1/4	8	10-1/2	0.65
1	Carrying Case	Ply- wood		15-3/4	10	19	18.00 (full)
- Electronics Test Equipment -							TS-270B/UP



ECHO BOX TS-275/UP  
(CAVITY, TUNED, TS-275/UP)



**FUNCTIONAL DESCRIPTION:**

A hand-tuned ringing cavity primarily designed to make a quick rough analysis of the overall performance of a radar system. It will check the frequency of the radar transmitter and receiver local oscillator. In addition, it will perform a spectrum-analysis, make rough relative power measurements, and check T/R recovery time.

A visual indication of system performance appears on the radar receiver-indicator. Resonance and relative power are indicated by meter deflections of an internal microammeter. The dial tuning rate is about 13 megacycles per second per revolution.

**RELATIONSHIP TO OTHER EQUIPMENT:**

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range: 3330 to 3770 megacycles per second as a wavemeter; 3400 to  
(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.		F-16-Q-304216-200	3F4325-275
PROCUREMENT INFO.:	Spec. MIL-E-16076 (Ships) dated 15 February 1951.		
PROCUREMENT COG.:	Navy	DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-275/UP

ECHO BOX TS-275/UP  
(CAVITY, TUNED, TS-275/UP)

**ELECTROMECHANICAL DESCRIPTION:** (Continued)

3700 megacycles per second as an echo box.

**Signal Range, Input:** The input consists of the radio frequency output signal from the radar transmitter.

**Input Impedance:** 50 ohm type "N" connector. The unit will be connected to a directional coupler within the transmitter waveguide.

**Signal Output:** The signal from the transmitter is reradiated by the echo box for a short interval known as the ring-time, is then picked up by the radar receiver and appears on the indicator scope as a saturated echo.

**Sensitivity:** 50-yard change in ringing time per decibel change in power.

**Accuracy:** Frequency,  $\pm 3$  megacycles per second. Radar performance measurements,  $\pm 3$  decibels.

**Loaded "Q":** 4700.

**Ring-time:** 4000 yards under specified conditions.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Johnson Service Company, 509 E. Michigan, Milwaukee, Wisconsin; Navy Contract Nos. N5sr-5934, 6 June 1945; NObsr-43119, 18 November 1948; NObsr-49123, 11 May 1950; NXsr-65336; NObsr-57091, 21 November 1951; Approximate Cost per Unit, \$319.00.

**TUBE COMPLEMENT:**

4 JAN-1N21B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

NavShips 900, 825 (Instruction Book).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box TS-275/UP with spares and accessories (Domestic Packed)	3.12	24-1/2	16-1/4	14-1/2	75
TS-275/UP - Electronics Test Equipment -						

ECHO BOX TS-275/UP  
(CAVITY, TUNED, TS-275/UP)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-275/UP with shock mount		F16-Q304216-200 3F4325-275	12-5/8	7	10-1/2	23.5
1	RF Cable Assembly (RG-8/U, UG-21/U) or		7CAC-170265-206 N16-C-11586-1041 1F4J2-2.120	120 long			
1	RF Cable Assembly CG-717/U		N16-C-11616-4121	120 long			
1	Wrench, Spanner 1 inch		7900-868570  6R57528				
1	Wrench, Socket 5/8 inch hex, T handle		3300-680712410  6R57420.2				
1	Carrying Strap		7CJS-8680 N16-S-690501-110 2Z9052-70				
1	Plunger Positioning Gauge		N41-G-148-2320				
1	Accessory Box			11-1/4	3-1/8	10-1/2	9.0 full



**FREQUENCY METER TS-285/GP  
(WAVEMETER TS-285/GP)**



**FUNCTIONAL DESCRIPTION:**

A compact, self-contained, battery-powered, precision frequency meter of the absorption type, designed primarily as a portable instrument to provide quick and accurate readings of frequency with a minimum use of operating controls. This instrument is especially adapted for use as a receiver-monitor to identify the frequency of an oscillator.

It includes a built-in vacuum-tube voltmeter and a calibration chart which is used to convert tuning-dial readings into frequency values.

Phones may be used as a means of identifying the type of modulation present and also as an aural aid in measuring frequencies by adjusting the frequency meter to zero beat.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Similar to Lavoie Model 150-S.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-329001465	F16-W-47063-2101	3F4325-285
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, SSL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2.		
- Electronics Test Equipment -			TS-285/GP

**FREQUENCY METER TS-285/GP  
(WAVEMETER TS-285/GP)**

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: 1-1/2 volts supplied by one Battery, BA-35 (1.5 volts) and 45 volts supplied by one Battery, BA-59 (45 volts).

Frequency Range: 90 to 210 megacycles per second. Continuous frequency coverage is provided without the necessity of range selection.

Type of Reception: Modulated Carrier Wave, Continuous Wave.

Approximate "Q": 3000.

Accuracy: ±1 megacycle per second.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Lavoie Laboratories, Morganville, New Jersey; Order No. 493-MPD-45; Approximate Cost per Unit, \$184.00.

**TUBE COMPLEMENT:**

1 JAN-1S5, 1 JAN-3S4, 1 JAN-9S7.

**REFERENCE DATA AND LITERATURE:**

TM 11-2640 (Technical Manual).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
TS-285/GP - Electronics Test Equipment -						

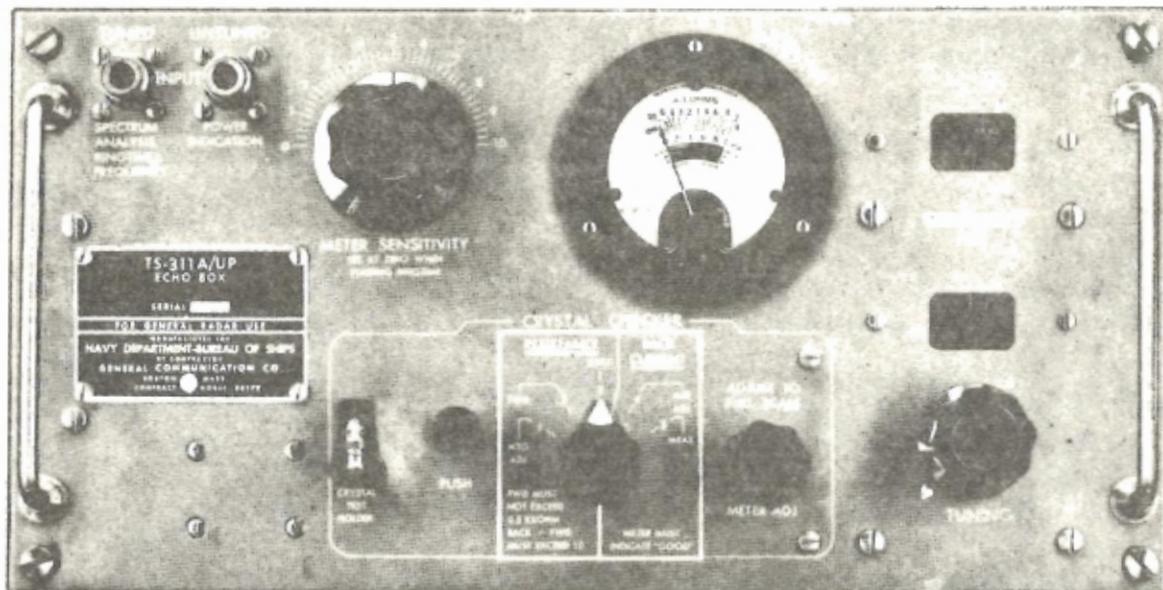
FREQUENCY METER TS-285/GP  
(WAVEMETER TS-285/GP)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-285/GP	Steel	1690-329001465 3F4325-285				
1	Carrying Case			7-1/2	7-3/4	11	
1	Set of Spare Tubes:						
	JAN-957		3300-235685000 2J957				
	JAN-1S5		3300-234155000 2J1S5				
	JAN-3S4		3300-234275000 2J3S4				
2	Technical Manual TM 11-2640						
1	Flexible Probe		3F3706	4			
1	Coaxial Cable RG-5/U		1F4A2-42.48	48 long			
1	Calibration Chart						
						Total:	23
- Electronics Test Equipment -							TS-285/GP



## ECHO BOX TS-311A/UP



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, sharp tuning, high Q resonant cavity designed to make a quick routine analysis of the overall performance of radar systems. The most often performed tests are: (1) relative indication (from day-to-day) of transmitter power output, (2) measurement of transmitter and local oscillator frequencies, (3) analysis of transmitter frequency spectrum, (4) checking on erratic operation, double moding and frequency pulling, (5) measurement of pulse duration, (6) checking of receiver AFC action, measurement of T/R box and receiver recovery time, (7) measurement of standing wave ratio, of transmission line losses, and other factors. Frequency is read directly from two dials calibrated in megacycles per second. A visual indication of system performance appears on the radar screen of the set under test. An untuned input receptacle permits the signal picked up by the horn antenna to by-pass the cavity and be fed directly, through an attenuator, to the crystal diode, thereby helping to detect the presence of RF energy without having to tune the echo box.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-177676	F16-Q-304286-200	3F4325-311A
PROCUREMENT INFO.:	Navy Specs. CS-533, CS-269, CS-200		
PROCUREMENT COG.:	Navy	DESIGN COG.:	Navy, BuShips
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-311A/UP

ECHO BOX TS-311A/UP

FUNCTIONAL DESCRIPTION: (Continued)

A crystal checker unit is part of the main unit and is used for checking rectifier crystals in the field, by measuring the forward and backward resistances as well as the back current.

RELATIONSHIP TO OTHER EQUIPMENT:

ELECTROMECHANICAL DESCRIPTION:

Power Supply: (Crystal checker), 1.5 volts, DC, from one 1.5 volt Battery BA-2030/U.

Frequency Range: 8730 to 8910 megacycles per second.

Loaded "Q": 50,000 approximately.

Input Impedance: 51 ohms.

Accuracy:  $\pm 5$  megacycles per second.

Stability: 0.14 megacycles per second per degree centigrade, maximum.

MANUFACTURERS' OR CONTRACTORS' DATA:

General Communication Company, Boston, Massachusetts; Contract No. NObsr-30172, dated 28 June 1946; Contract No. NObsr-39201, dated 19 May 1947; Contract No. NObsr-42101, dated 30 January 1948; Contract No. NObsr-42413, dated 21 June 1948.

TUBE COMPLEMENT:

1 JAN-1N23A (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

NAVSHIPS 91111 (Instruction Book).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

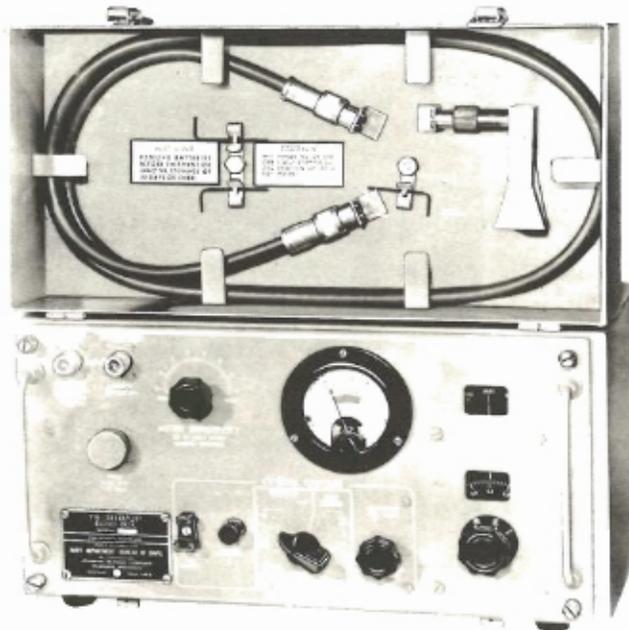
TS-311A/UP

- Electronics Test Equipment -





## ECHO BOX TS-311B/UP



### FUNCTIONAL DESCRIPTION:

A portable general purpose hand tuned ringing cavity designed to make a quick, rough analysis of the overall performance of a radar system. It will check the frequency of the radar transmitter and receiver local oscillator. In addition, it will perform a spectrum analysis, make rough relative power measurements, check transmit-receiver recovery time, measure pulse duration, and check on erratic operation, double moding, and frequency pulling. A visual indication of system performance appears on the radar receiver indicator. Frequency is indicated from two calibrated dials in megacycles. Resonance and relative power are indicated by meter deflections on an internal microammeter.

A crystal checker unit is part of the main unit and is used for field checking rectifier crystals by measuring the forward and backward resistance as well as the back current.

### RELATIONSHIP TO OTHER EQUIPMENT:

Similar to Echo Box TS-311A/UP except a spare crystal holder assembly has been added to the panel.

Commercial counterpart is the Johnson Service Company, Echo Box SA-18200.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			3F4325-311B
PROCUREMENT INFO.:	Dwg. No. 50536, Outline dwg. No. 18401; Spec. MIL-E-16164 (Ships)		
PROCUREMENT COG.:	DESIGN COG.: USN, BuShips		
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-311 B/UP

## ECHO BOX TS-311B/UP

### ELECTROMECHANICAL DESCRIPTION:

Power Supply (crystal checker); One 1.5 volt, DC, dry cell battery type BA-2030/U.

Frequency Range: 8730 to 8910 megacycles per second.

Loaded Q: 50,000 approximately.

Input Impedance: 51 ohms.

Accuracy:  $\pm 5$  megacycles per second.

Stability: 0.14 megacycle per second per degree centigrade, maximum.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Johnson Service Co., 507 E. Michigan St., Milwaukee 2, Wisconsin; Navy Contract No. NObsr-52618, March 27, 1952; Approximate Cost per Unit, \$62.00, 1955.

### TUBE COMPLEMENT:

1 JAN-1N23A (crystal rectifier).

### REFERENCE DATA AND LITERATURE:

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box TS-311B/UP	2.6	15-1/4	22	13-1/2	36

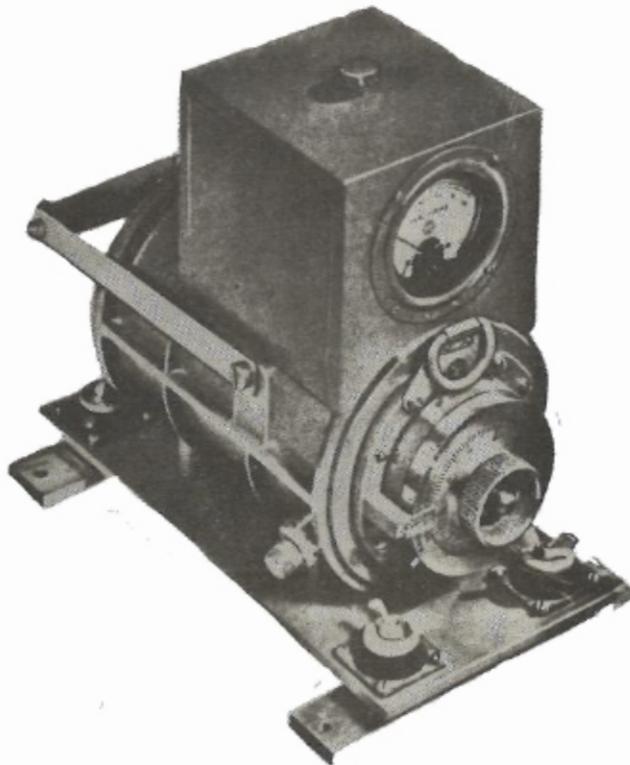
### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-311B/UP		3F4325-311B	11	16	8-1/2	20-3/4
1	Pick Up Antenna AT-68/UP		7CAC-045705 16-A-52545-1626 3F3968-68	2-1/8	1-1/8	3-3/8	1/4
1	Antenna Cable RG-9A/U		15-C-12200-525	96 long			1-1/4
3	Allen Wrench						
2	Instruction Book						

TS-311B/UP

- Electronics Test Equipment -

ECHO BOX TS-349/UP  
(CAVITY, TUNED, TS-349/UP)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, hand-tuned ringing cavity designed to make a quick, rough analysis of the overall performance of a radar system. It will check the frequency of the radar transmitter and receiver local oscillator. In addition, it will perform a spectrum analysis, make rough relative power measurements, check T/R recovery time, measure pulse duration, and check on erratic operation, double moding, and frequency pulling.

A visual indication of system performance appears on the radar receiver indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections on an internal microammeter.

**RELATIONSHIP TO OTHER EQUIPMENT:**

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.		F16-C-67630-3791	3F4325-349
PROCUREMENT INFO.:	Navy Spec. 16B10 (RE)		
PROCUREMENT COG.:	Navy	DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-349/UP

**ECHO BOX TS-349/UP  
(CAVITY, TUNED, TS-349/UP)**

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None.  
 Frequency Range: 910 to 980 megacycles per second.  
 Sensitivity: 65 yards change in ring-time per decibel change in power.  
 Meter Scale: 0 to 100 microamperes.  
 Type of Connector: N Type Jack.  
 Temperature Range: -20° C. to +60° C. operational.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Johnson Service Company, Milwaukee 2, Wisconsin; Contract Nos. N5sr-13590, 17 September 1945; NObsr-39148, 21 March 1947; NObsr-39352, 24 June 1947.

**TUBE COMPLEMENT:**

1 JAN-1N21B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

NavShips 900, 884 (Instruction Book).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box TS-349/UP Complete with accessories and equipment spares.	3.9	24-3/4	18-1/4	16	80

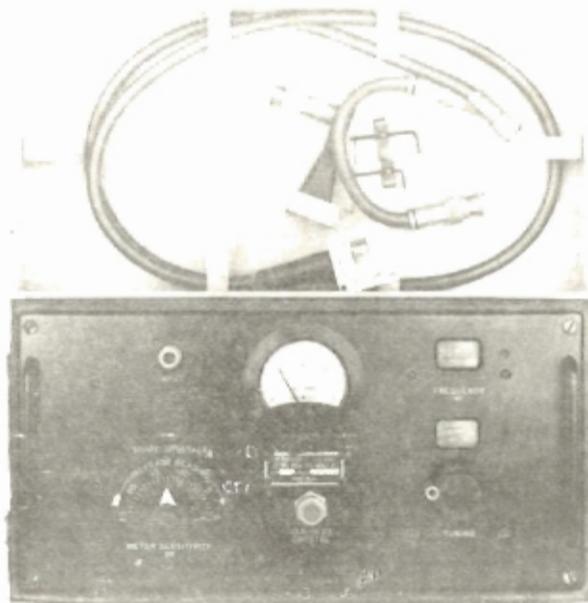
TS-349/UP

- Electronics Test Equipment -





ECHO BOX TS-488/UP  
(CAVITY, TUNED, TS-488/UP)



FUNCTIONAL DESCRIPTION:

A portable, general purpose, field-type unit used to provide a simple and rapid means of determining the overall system performance of radar sets. Used to make comparative measurements of the average power output of the radar transmitter, detection of faults in the radar system, and determination of the frequency spectrum of the radar transmitter. Resonance is indicated by meter deflections and frequency is read directly on the tuning dial.

RELATIONSHIP TO OTHER EQUIPMENT:

ELECTROMECHANICAL DESCRIPTION:

Circuit Information: Consists of a pickup antenna dipole, a tunable resonant cavity, a coupling loop, a crystal rectifier, and a direct current microammeter used as an output meter.

Power Supply: None required.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-177680	F16-C-67674-1021	3F4325-488
PROCUREMENT INFO.:	USAF Spec. No. R-7476, USAF Exhibit WLENG-115		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-488/UP

ECHO BOX TS-488/UP  
(CAVITY, TUNED, TS-488/UP)

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

Frequency Range: 8990 to 9610 megacycles per second.

Type of Reception: Continuous Wave or Pulsed.

Ring-time: 24.5 microseconds through 20 decibel directional coupler to a 50 kilowatt radar with a 1/2 microsecond pulse width and a -90 dbm receiver sensitivity. 4000 yards through 20 decibels directional coupler to a 25 kilowatt radar with a 1/4 microsecond pulse width and a -90 dbm receiver sensitivity.

Decay Rate: Not greater than 3.5 decibels per megacycle per second.

Frequency Accuracy: Mid-band (9300 megacycles per second),  $\pm 0.5$  megacycles per second. Difference between errors at frequencies 60 megacycles per second apart,  $\pm 2.0$  megacycles per second. The maximum frequency error over the range of 8990 to 9610 megacycles per second is  $\pm 7.0$  megacycles per second. (These accuracies are measured at 77° F.)

Temperature Range: -54° C. to +60° C.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Fairchild Camera and Instrument Corporation, 88-06 Van Wyck Boulevard, Jamaica 1, New York; Contract No. W33-038ac-21315, May 1948; Approximate Cost per Unit, \$678.44; Contract No. AF33(038)16280; Approximate Cost per Unit, \$578.00, 1950; Contract No. AF 12479, 2 May 1950; Approximate Cost per Unit, \$644.00.

**TUBE COMPLEMENT:**

1 JAN-1N23B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

- TO 16-35TS488-3 (Maintenance Instructions).
- TO 16-35TS488-4 (Parts Catalog).
- TO 16-35TS488-11 (Operating Instructions).
- TO 16-35TS488-12 (Service Instructions).
- TO 16-35TS488-13 (Overhaul Instructions).
- TO 16-35TS488-14 (Parts Breakdown).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box TS-488/UP (Domestic Packed)	3.7	17	25	15	48

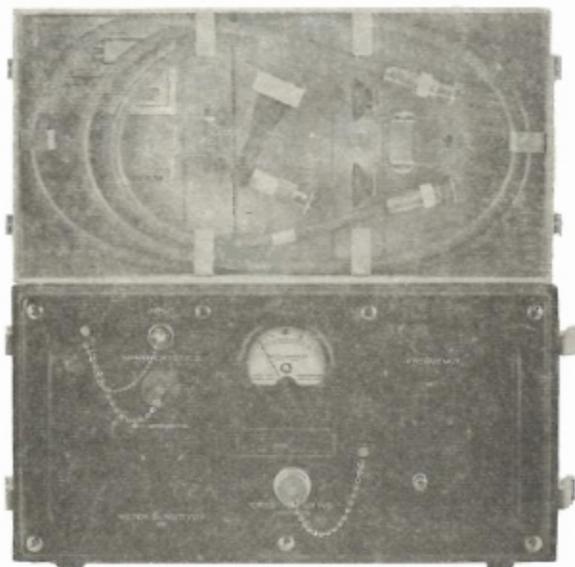
TS-488/UP

- Electronics Test Equipment -





**ECHO BOX TS-488A/UP  
(CAVITY, TUNED, TS-488A/UP)**



**FUNCTIONAL DESCRIPTION:**

A portable general purpose, field-type, hand tuned unit used to provide a simple and rapid means of determining the overall system performance of radar sets. It is used to make the following radar equipment checks: comparative measurement of the average power output of the radar transmitter, determination of the frequency spectrum, multiple moding, and frequency pulling of the radar transmitter, and the speed of recovery of radar T-R box and receiver. Resonance is indicated by meter deflections and frequency is read directly on the tuning dial.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Similar to TS-488/U except the "A" model includes shock requirements.

**ELECTROMECHANICAL DESCRIPTION:**

Circuit Information: Consists of a pickup antenna dipole, a tunable resonant cavity, a coupling loop, a crystal rectifier, and a direct current microammeter used as an output meter. A transmitted pulse from the radar is fed into the echo box. The RF energy is stored in the resonant cavity during the transmitting cycle in the form of damped oscillations. At the completion of the transmitting cycle, the

(Continued)

	AIR FORCE	NAVY	ARMY
<b>TYPE CLASS.</b>	Standard		
<b>STOCK NOS.</b>	7CAC-177678		3F4325-488A
<b>PROCUREMENT INFO.:</b> USAF Spec. R-7476-A, and Am 2 dtd 5 Nov. 1951			
<b>PROCUREMENT COG.:</b> USAF		<b>DESIGN COG.:</b> USAF, RADC	
<b>F.I.I.N.:</b>		<b>FUNCTIONAL CLASS. NO.:</b> 2.2.2	
- Electronics Test Equipment -			TS-488A/UP

**ECHO BOX TS-488A/UP**  
**(CAVITY, TUNED, TS-488A/UP)**

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

energy is reradiated back into the radar receiver where it appears as a signal on the indicator. The shape and character of the pattern shows the condition of the radar receiver. A portion of the energy stored in the echo box resonant cavity is rectified and measured on the output meter on the echo box panel. The meter serves as a tuning indicator for the echo box and also provides a comparative power output measurement for the radar transmitter.

Power Supply: None required.

Frequency Range: 8990 to 9610 megacycles per second.

Type of Reception: Continuous Wave or Pulsed.

Ring-Time: 25 microseconds or 4000 yards with a transmitted pulse width of 3/8 microsecond.

Q: Approximately 60,000.

Frequency Accuracy: Difference between errors at frequencies 60 megacycles per second apart: 1.5 megacycles per second. The maximum frequency error over the range of 8990 to 9610 megacycles per second is  $\pm 8.0$  megacycles per second. (These accuracies are measured at 77°F.)

Meter Range: 0 to 20 microamperes.

Meter Sensitivity Control: 0 to 25 decibels in 1 decibel divisions.

Temperature Range: -54°C. (-65°F.) to +60°C. (+140°F.).

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Aeromotive Equipment Corporation, 1632 - B Central Street, Kansas City 10, Missouri; Contract AF 33(600)21642; Aeromotive Part No. 7200.

**TUBE COMPLEMENT:**

1 JAN-1N23B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

TO 33A1-3-71-1 (Operating Instructions).

TO 33A1-3-71-2 (Service Instructions).

TO 33A1-3-71-3 (Overhaul Instructions).

TO 33A1-3-71-4 (Illustrated Parts Breakdown).

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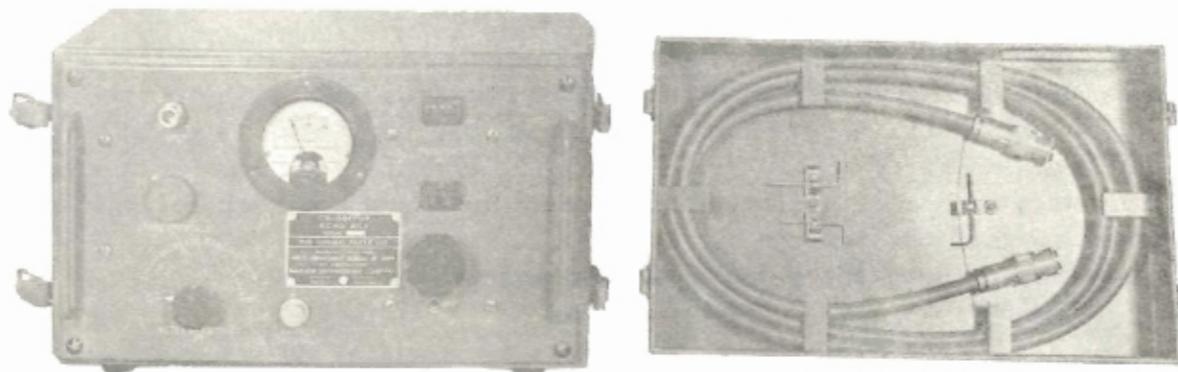
No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box TS-488A/UP (Domestic Packed)	3.7	17	25	15	48

TS-488A/UP - Electronics Test Equipment -





## ECHO BOX TS-501/UP



### FUNCTIONAL DESCRIPTION:

A portable, self-contained, high "Q" tunable cavity primarily designed to make a quick, rough analysis of the overall performance of a radar system. It will check the frequency of the radar transmitter and receiver local oscillator. In addition, it will perform a spectrum analysis, make rough relative power measurements and adjust the various radio frequency controls on radar equipment.

A visual indication of system performance appears on the radar receiver-indicator. Frequency is indicated directly by referring to the dial settings. Resonance and relative power are indicated by meter deflections of an internal microammeter.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 6250 to 6900 megacycles per second.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	1800-330092030	F16-Q-304610-200	3F4325-501
PROCUREMENT INFO.:	BuShips Spec. No. MIL-E-15369, and Spec. No. CS-675		
PROCUREMENT COG.:	Navy	DESIGN COG.: Navy, BuShips	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
	- Electronics Test Equipment -		TS-501/UP

## ECHO BOX TS-501/UP

### ELECTROMECHANICAL DESCRIPTION: (Continued)

**Signal Range, Input:** The input consists of the radio frequency output signal from the radar transmitter.

**Impedance, Input:** 51 ohms.

**Signal Output:** The signal from the transmitter is re-radiated by the echo box for a short interval known as the ring-time, is then picked up by the radar receiver and appears on the indicator scope as a saturated echo.

**Sensitivity:** 50 yards change in ring-time per decibel change in power.

**Ring-time:** 5000 yards when measured with a radar system having a receiver sensitivity of -120 dbm, a peak power output of 250 kilowatts, a repetition rate of 600 and a pulse width of 0.37 microsecond, and the echo box is coupled to the radar system with a 20 decibel directional coupler and a 3 decibel patch cord.

**Meter Attenuator:** 0 to 25 decibels.

**Accuracies:** Frequency,  $\pm 5$  megacycles per second.

Ring-time,  $\pm 4\%$  across the band.

Ring-time Uniformity,  $\pm 0.5$  microseconds of agreed standard.

**Temperature Range:**  $-40^{\circ}$  F. to  $+150^{\circ}$  F.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Barlow Electrical Mfg. Company, Inc., 57 State Street, Paterson 3, New Jersey;  
Contract Nos. NOBsr-39218, 18 June 1947; NOBsr-42428, 30 June 1948; Approximate Cost per Unit, \$1200.00.

### TUBE COMPLEMENT:

1 JAN-1N23 (Crystal Rectifier).

### REFERENCE DATA AND LITERATURE:

NavShips 91191 (Instruction Book).

TO 16-35TS501-1 (Operation and Service Instructions).

### SHIPPING DATA:

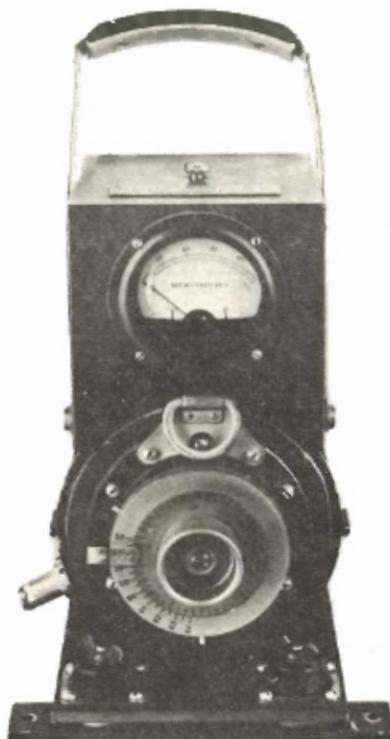
No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Echo Box TS-501/UP (Domestic Packed)	1.8	15-1/4	16-1/4	14	36
1	Equipment Spare Parts (Domestic Packed)	0.44	14	13-1/2	4	17

TS-501/UP - Electronics Test Equipment -





ECHO BOX TS-544/UP  
(CAVITY, TUNED, TS-544/UP)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, hand-tuned ringing cavity designed to make a quick, rough analysis of the overall performance of a radar system, to determine the frequency output of radio frequency transmitters, to measure relative power output, to detect multiple moding of magnetrons and to give an indication of the signal-to-noise ratio of receivers.

All visual indications of system performance appear on the radar receiver-indicator. Resonance and relative power are indicated by meter deflections.

**RELATIONSHIP TO OTHER EQUIPMENT:**

**ELECTROMECHANICAL DESCRIPTION:**

Circuit Information: The signal from the transmitter is re-radiated by the echo box for a short interval known as the ring-time, is picked up by the radar receiver antenna and appears as a fixed echo on the receiver-indicator.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.		F16-C-67622-4691	3F4325-544
PROCUREMENT INFO.:	USAF Spec. No. R-7484-A, Dwg. No. 426		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2. 2. 2		
	- Electronics Test Equipment -		TS-544/UP

ECHO BOX TS-544/UP  
(CAVITY, TUNED, TS-544/UP)

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

Power Supply: None required.

Frequency Range: 580 to 620 megacycles per second.

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulsed.

Input Impedance: 50 ohms.

Ring-time:

Approximately 36.5 microseconds with a radar having the following characteristics:

Peak Power Output: 200 kilowatts.

Repetition Rate: 200 cycles per second.

Pulse Length: 1.5 microseconds.

Receiver Sensitivity: 90 decibels below one milliwatt.

Loss in cord connecting directional coupler to input jack of echo box: 2 decibels.

Decay: Approximately 2.9 decibels per microsecond.

Input Voltage Standing Wave Ratio: Less than 1.10.

Accuracy: 0.5 megacycles per second.

Temperature Range: -54° C. to +71° C.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Johnson Service Company, Milwaukee, Wisconsin; USAF Contract No. W28-099-ac-181, June 1946; Approximate Cost per Unit, \$1200.00.

**TUBE COMPLEMENT:**

1 JAN-1N21B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

Preliminary Instruction Book.

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
TS-544/UP - Electronics Test Equipment -						

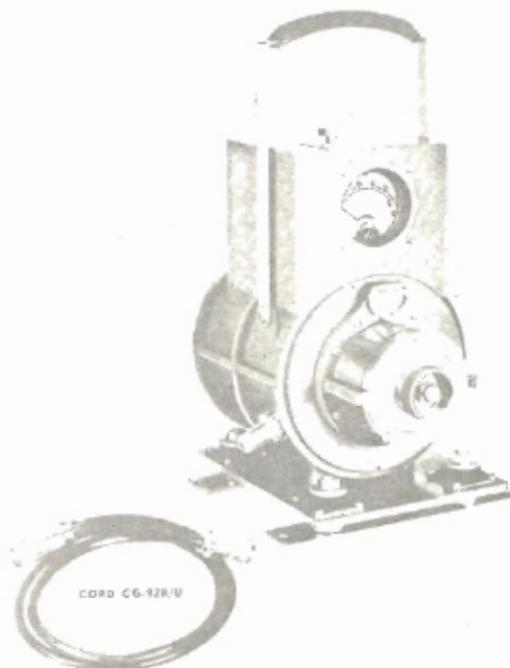
ECHO BOX TS-544/UP  
(CAVITY, TUNED, TS-544/UP)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-544/UP (Complete)	Alum- inum	F16-C-67622-4691 3F4325-544	10-1/2	8-1/2	13	8.00
1	Cable CG-92A/U		7CAC-170265-465 1F430-92.96	96 long			1.50
3	Rectifier Crystal 1N21B		3300-234137020 2J1N21B				
1	Shock Mounted Base			2-1/4	8	15	3.25
1	Dial Socket Wrench	Steel		5/8 hex			
1	Spanner Wrench	Steel		1			
1	Carrying Strap	Cot- ton Web- bing		54 long	1 wide		
1	Adapter UG-8/AP		8850-101600				



**ECHO BOX TS-545/UP  
(CAVITY, TUNED, TS-545/UP)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, and self-contained hand-tuned microwave coaxial type echo box or resonant cavity. It will indicate relative power output of the radar transmitter, the frequency and general effectiveness of the radar system. Resonance is indicated by meter deflections, and a calibration chart is used to translate dial readings into frequency values. A visual indication of system performance appears on the radar screen.

The following tests are most often performed: (1) relative indication (from day to day) of transmitter power output, (2) measurement of transmitter and local oscillator frequencies, (3) analysis of transmitter frequency spectrum, (4) checking on erratic operation, double moding and frequency pulling, (5) measurement of pulse duration, (6) checking of receiver AFC action, measurement of TR box and receiver recovery time, (7) measurement of standing wave ratio, of transmission line losses, and other factors.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-177651	F16-Q-304675-200	3F4325-545
PROCUREMENT INFO.:	Navy Spec. No. CS-914, CS-746.		
PROCUREMENT COG.:	DESIGN COG.: Navy, BuShips		
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2. 2. 2		
	- Electronics Test Equipment -		TS-545/UP

ECHO BOX TS-545/UP  
(CAVITY, TUNED, TS-545/UP)

RELATIONSHIP TO OTHER EQUIPMENT:

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 1150 to 1350 megacycles per second.

Type of Reception and Transmission: Pulse.

Decay: 3.5 decibels per microsecond.

Sensitivity: 1 decibel power loss for 50 yards ring-time.

Temperature Coefficient: -0.105% ring-time per degrees F. at 68° F.

Accuracy ±5 megacycles per second of indicated frequency.

Temperature Range: -65.2° F. to +140° F.

MANUFACTURERS' OR CONTRACTORS' DATA:

Johnson Service Company, Milwaukee, Wisconsin; Contract Nos. NObsr-39392, dated 30 June 1947, NObsr-42382, dated 24 June 1948, NObsr-49089, dated 6 April 1950; Approximate Cost per Unit, \$2030.80, dated January 1952.

TUBE COMPLEMENT:

1 JAN-1N21B (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

NavShips 41213 (Instruction Book).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	One each Echo Box TS-545/UP including one box of accessories and two instruction books. (Export Packed)	4.7	25	17-1/2	18-1/2	80

TS-545/UP - Electronics Test Equipment -

ECHO BOX TS-545/UP  
(CAVITY, TUNED, TS-545/UP)

**EQUIPMENT SUPPLIED:**

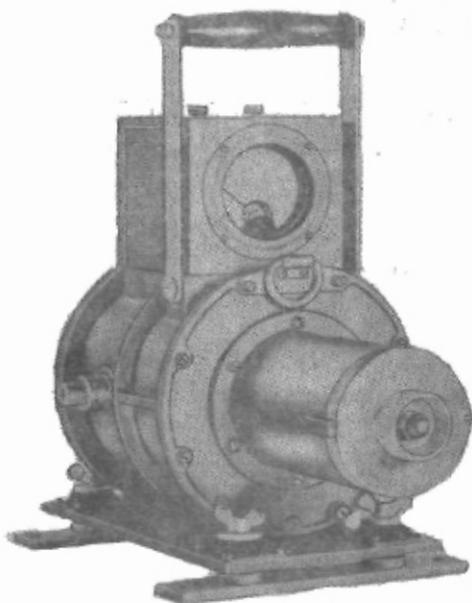
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Echo Box TS-545/UP		7CAC-177651  3F4325-545	11-9/16	8-1/16	9-5/8	25.25
1	Separable Shock-Mounted Base			2-1/4	8-3/4	8-1/4	4.00
1	Cord CG-92B/U		7CAC-170265-2  3E6016-92B-120	120 long			1.50
1	Pickup Antenna or						
1	Directional Coupler						
3	Crystal Rectifier 1N21B		3300-234137020  2J1N21B				
1	Carrying Strap		7CJS-8680 N16-S-690501-110 2Z9052-70				0.20
1	Spanner Wrench (1 inch)		7900-868570  6R57528				0.01
1	Socket Wrench		3300-680-712410  6R57420.2				0.25
1	Accessory Box			3-7/8	8-1/2	9-1/8	8.00
2	Instruction Book NavShips 91213						

- Electronics Test Equipment -

TS-545/UP



## ECHO BOX 14ABA-1



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, hand tuned ringing cavity designed to make a quick, rough analysis of the overall performance of a radar system. It will check the frequency of the radar transmitter and receiver local oscillator. In addition, it will perform a spectrum analysis, make rough relative power measurements, check transmit-receive recovery time, measure pulse duration, and check on erratic operation, double moding, and frequency pulling.

A visual indication of system performance appears on the radar receiver-indicator. Frequency is indicated by referring dial settings to a calibrated chart. Resonance and relative power are indicated by meter deflections on an internal microammeter.

### RELATIONSHIP TO OTHER EQUIPMENT:

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard Minor		
STOCK NOS.		N16-C-67649-8237	
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Navy	DESIGN COG.:	Navy, BuShips
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.2		
- Electronics Test Equipment -			14ABA-1

ECHO BOX 14ABA-1

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None.

Frequency Range: 2830 to 3170 megacycles per second.

Sensitivity: 80 yards change in ring-time per decibel change in power.

Meter Scale: 0 to 100 microamperes.

Type of Connector: N type Jack.

MANUFACTURERS' OR CONTRACTORS' DATA:

Johnson Service Company, Milwaukee, Wisconsin.

TUBE COMPLEMENT:

1 JAN-1N21A (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

CO 16-35TS270-2-M (Maintenance Instructions).

SHIPPING DATA:

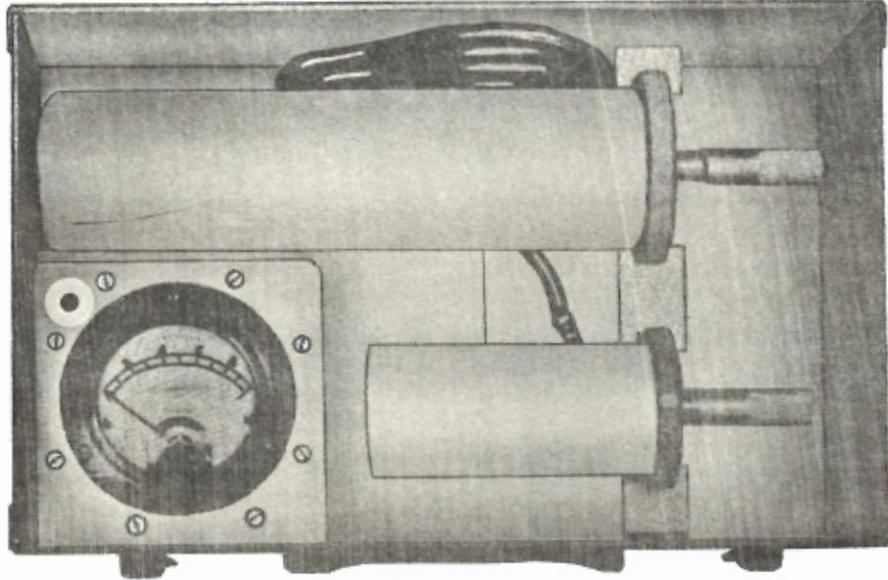
No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

14ABA-1 - Electronics Test Equipment -





## WAVEMETER TEST SET AN/UPM-2



### FUNCTIONAL DESCRIPTION:

A portable, general purpose absorption wavemeter designed to measure frequencies in the 80 to 1220 megacycles per second range. Test results are obtained by means of a meter and a calibration chart.

### RELATIONSHIP TO OTHER EQUIPMENT:

The AN/UPM-2 can be used in conjunction with an oscilloscope for visual determination of resonance.

### ELECTROMECHANICAL DESCRIPTION:

The test set incorporates two tunable quarter-wave resonant lines which cover overlapping portions of the frequency band. Each frequency meter is tuned by a micrometer having 1000 scale divisions. A calibration chart is used to convert the scale divisions into frequency readings. When the wavemeter is tuned to the unknown frequency, a dip in the panel meter reading is observed. Similarly, when an oscilloscope is employed as a tuning indicator, minimum deflection is observed.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.:		USN
F. I. I. N.:	FUNCTIONAL CLASS. NO.:		2. 2. 3
- Electronics Test Equipment -			AN/UPM-2

WAVEMETER TEST SET AN/UPM-2

ELECTROMECHANICAL DESCRIPTION: (Continued)

an AN type coaxial male plug on the meter cable mates an AN type coaxial female jack on either frequency meter. The antenna plugs into the top of either unit and is clamped in position with a knurled, threaded collar which is part of the antenna. A telephone type video jack is provided.

Frequency Meters:

TS-211/UPM-2: 80 to 360 megacycles per second.

TS-212/UPM-2: 330 to 1220 megacycles per second.

Accuracy:  $\pm 1$  megacycle per second.

Sensitivity: 5 milliwatts.

Meter: 0 to 1 milliamp DC.

MANUFACTURERS' OR CONTRACTORS' DATA:

G. Kalart Company, Stamford, Connecticut, Contract No. NXsa-64107 dated 1944; NXsr-53379 dated 25 Oct 1944.

TUBE COMPLEMENT:

2 1N25.

REFERENCE DATA AND LITERATURE:

AN-08-30/UPM-2.

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
	Wavemeter Test Set AN/UPM-2					
AN/UPM-2 - Electronic Test Equipment -						

WAVEMETER TEST SET AN/UPM-2

EQUIPMENT SUPPLIED:

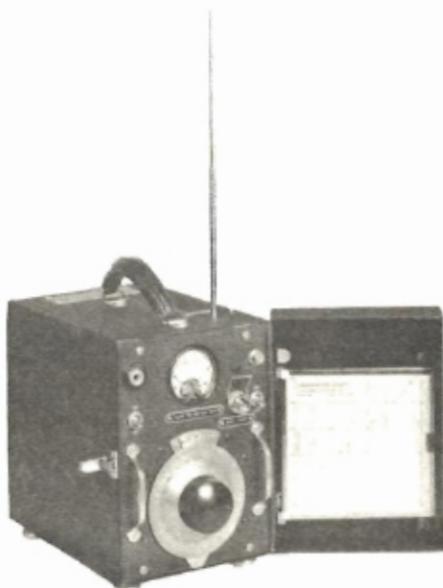
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter Test Set AN/UPM-2 Including:	metal	1800-266506498 (USAF) F16-Q- 121570-100 (USN) 3F4325-214 (USA)				
1	Frequency Meter TS-211/UPM-2			4-3/4	3	12-5/16	3.75
1	Frequency Meter TS-212/UPM-2			4-1/2	2-1/2	7-9/16	2.5
1	Carrying Case CY-194/UPM-2			5-5/8	8-3/4	13-1/16	11.1
1	Antenna AT-63/UPM-2			5-5/16	11/16 dia.		0.1
5	Crystal Recti- fier 1N25 (Spares)						
- Electronics Test Equipment -							AN/UPM-2

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FREQUENCY METER BC-906-A  
(WAVEMETER, BC-906-A)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained absorption-type meter used to determine the frequency of continuous wave, modulated carrier wave or pulsed radar transmitters and local oscillators. Also used to calibrate, check sensitivity and align receivers operating in the proper frequency range.

Resonance is indicated by a dip of the microammeter reading and frequency is determined by the dial setting and the associated calibration charts.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Model A is replaced by Model B.

Provision is made for external use of the microammeter only in Model E.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: One 45 volt Battery BA-53-A; one 1.5 volt Battery BA-35-A.

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulse.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-212508000	ASO-R16-1-2135	2C1546A
PROCUREMENT INFO.:	USAF Exhibit No. ARL-93		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, ARL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.3		
	- Electronics Test Equipment -		BC-906-A

FREQUENCY METER BC-906-A  
(WAVEMETER, BC-906-A)

ELECTROMECHANICAL DESCRIPTION: (Continued)

Frequency Range: 160 to 200 megacycles per second.

Accuracy:  $\pm 0.5$  megacycles per second.

Input: Marconi-Type Antenna.

Temperature Range:  $-13^{\circ}$  F. to  $+122^{\circ}$  F.

Auxiliary Features: Phone jacks are provided for audio monitoring on all models.

MANUFACTURERS' OR CONTRACTORS' DATA:

Washington Institute of Technology, Washington, D. C.; Approximate Cost, \$75.00.

TUBE COMPLEMENT:

1 JAN-1S5.

REFERENCE DATA AND LITERATURE:

TO 16-55-348 (Spare Parts List).

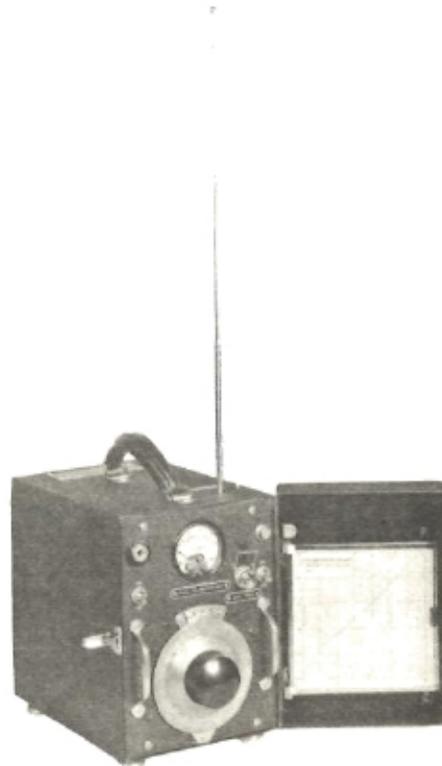
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter BC-906-A and accessories. (Domestic Packed)	1.91	14.5	12	19	40
BC-906-A - Electronics Test Equipment -						





FREQUENCY METER BC-906-B  
(WAVEMETER BC-906-B)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained absorption-type meter used to determine the frequency of continuous wave, modulated carrier wave or pulsed radar transmitters and local oscillators. It is also used to check sensitivity, calibrate and align receivers operating in its frequency range.

Resonance is indicated by a dip of the microammeter reading, and frequency is determined by the dial setting and the associated calibration charts.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Part IE-56-A, and IE-56-B.

Model B is replaced by later models.

Provision is made for external use of the microammeter in Model E only.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-212518000		2C1546B
PROCUREMENT INFO.:	USAF Exhibit No. ARL-93		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, ARL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.3		
	- Electronics Test Equipment -		BC-906-B

FREQUENCY METER BC-906-B  
(WAVEMETER BC-906-B)

ELECTROMECHANICAL DESCRIPTION:

Power Supply: One 45 volt Battery BA-53-A and one 1.5 volt Battery BA-35-A.

Type of Reception: Continuous Wave, Modulated Carrier Wave, Pulse.

Frequency Range: 160 to 220 megacycles per second.

Accuracy:  $\pm 0.5$  megacycle per second.

Input: Marconi-Type Antenna.

Temperature Range:  $-13^{\circ}$  F. to  $+122^{\circ}$  F.

Auxiliary Features: Phone jacks are provided for audio monitoring on all models.

MANUFACTURERS' OR CONTRACTORS' DATA:

Washington Institute of Technology, Washington, D. C.; Order No. 1200-WF-42;  
Approximate Cost per Unit, \$75.00.

TUBE COMPLEMENT:

1 JAN-1S5.

REFERENCE DATA AND LITERATURE:

TO 16-40BC906-2 (Maintenance Instructions).

SHIPPING DATA:

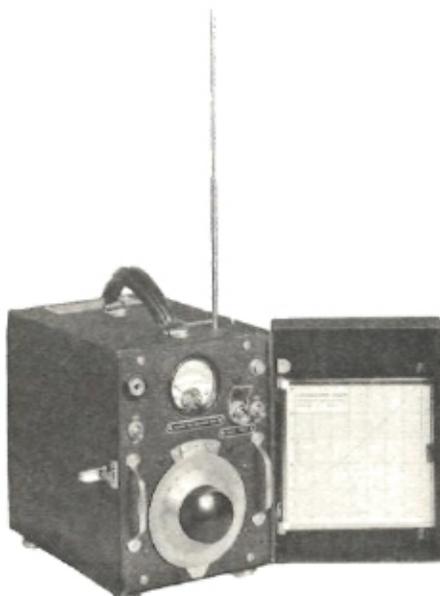
No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter BC-906-B and Accessories (Domestic Packed)	1.91	14-1/2	12	19	40

BC-906-B - Electronics Test Equipment -





FREQUENCY METER BC-906-C  
(WAVEMETER, BC-906-C)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained absorption-type meter used to determine the frequency of continuous wave, modulated carrier wave or pulsed radar transmitters and local oscillators. Also used to calibrate, check sensitivity and align receivers operating in the proper frequency range.

Resonance is indicated by a dip of the microammeter reading and frequency is determined by the dial setting and the associated calibration charts.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Model C is replaced by Model D.

Provision is made for external use of the microammeter only in Model E.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: One 45 volt Battery BA-53-A; one 1.5 volt Battery BA-35-A.

Type of Reception: Continuous Wave, Modulated Carrier Wave and Pulse.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-212520000	R16-1-2135	2C1546C
PROCUREMENT INFO.:	USAF Dwg. No. ES-C-4448, USAF Exhibit No. ARL-93.		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, C&N	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.3		
	- Electronics Test Equipment -		BC-906-C

FREQUENCY METER BC-906-C  
(WAVEMETER, BC-906-C)

ELECTROMECHANICAL DESCRIPTION: (Continued)

Frequency Range: 150 to 225 megacycles per second.

Accuracy:  $\pm 0.5$  megacycles per second.

Input: Marconi-type Antenna.

Temperature Range:  $-13^{\circ}$  F. to  $+122^{\circ}$  F.

Auxiliary Features: Phone jacks are provided for audio monitoring on all models.

MANUFACTURERS' OR CONTRACTORS' DATA:

Philco Corporation, Philadelphia, Pennsylvania; Order Nos. 811-WF-42 and 3348-WF-43; Approximate Cost, \$75.00.

TUBE COMPLEMENT:

1 JAN-1S5.

REFERENCE DATA AND LITERATURE:

CO-AN08-40BC906-2 (Maintenance Instructions).

TO 16-55-348 (Spare Parts List).

TO 16-40 BC906-2 (Maintenance Instructions).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter BC-906-C and accessories. (Domestic Packed)	1.91	14.5	12	19	40
BC-906-C - Electronics Test Equipment -						

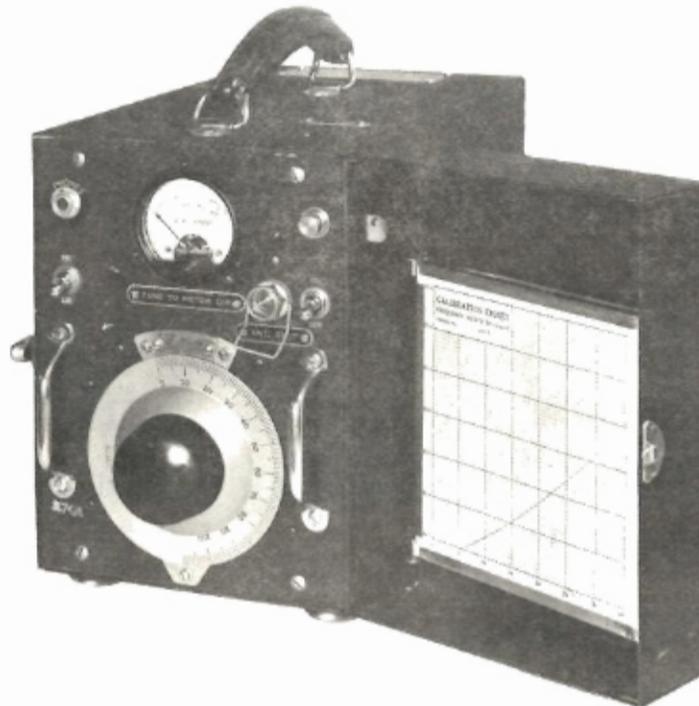
FREQUENCY METER BC-906-C  
(WAVEMETER, BC-906-C)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter BC-906-C (Complete)	Metal	1690-212520000 R16-1-2135 2C1546C	6-1/2	9-1/4	12-3/8	17.8
1	Antenna AN-108-C (Extendable Type)	Brass	7CAC-045900 R16-PH-358-1667 2A275-108	20	0.218		
1	Calibration Chart			5-5/8	5-1/2		
1	Tube JAN-1S5		3300-234155000  2J1S5	2-1/8	3/4		
1	Transportation Case	Wood		14	17-3/4	10	15.2
1	Instruction Book AN0840BC906-2		2C154C/B1				
						Total;	33.0
- Electronics Test Equipment -							
							BC-906-C



FREQUENCY METER BC-906-D  
(WAVEMETER BC-906-D)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained, absorption-type meter used to determine the frequency of continuous wave, modulated carrier wave or pulsed radar transmitters and local oscillators. Also used to calibrate, check sensitivity and align receivers operating in the proper frequency range.

Resonance is indicated by a dip of the microammeter reading and frequency is determined by the dial setting and the associated calibration charts.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Model D is replaced by Model E.

Provision is made for external use of the microammeter only in Model E.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: One 45 volt Battery BA-53-A; one 1.5 volt Battery BA-35-A.

Type of Reception: Continuous Wave, Modulated Carrier Wave and Pulse.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-318208-55	ASO-R16-W-2121	2C1546D
PROCUREMENT INFO.:	USAF Dwg. No. ES-C-4448, USAF Spec. No. 271-1789-A		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, C&N
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.3		
	- Electronics Test Equipment -		BC-906-D

FREQUENCY METER BC-906-D  
(WAVEMETER BC-906-D)

ELECTROMECHANICAL DESCRIPTION: (Continued)

Frequency Range: 160 to 220 megacycles per second.

Accuracy:  $\pm 0.5$  megacycles per second.

Input: Marconi-type Antenna.

Temperature Range:  $-13^{\circ}$  to  $+122^{\circ}$  F.

Auxiliary Features: Phone jacks are provided for audio monitoring on all models.

MANUFACTURERS' OR CONTRACTORS' DATA:

Philco Corporation, Philadelphia, Pennsylvania; Order Nos. 811-WF-42 and 3348-WF-43; Contract No. 7916-WF-43; Approximate Cost per Unit, \$75.00.

TUBE COMPLEMENT:

1 JAN-1S5.

REFERENCE DATA AND LITERATURE:

CO AN08-40BC906-2 (Maintenance Instructions).

TO 16-55-348 (Spare Parts List).

TO 16-40BC906-2 (Maintenance Instructions).

TC 16-40BC906-21 (Recalibration of Frequency Meter).

TO 16-40BC906-21A (Supplement-Recalibration of Frequency Meter).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter BC-906-D with accessories. (Domestic packed)	1.91	14.5	12	19	40

BC-906-D

- Electronics Test Equipment -

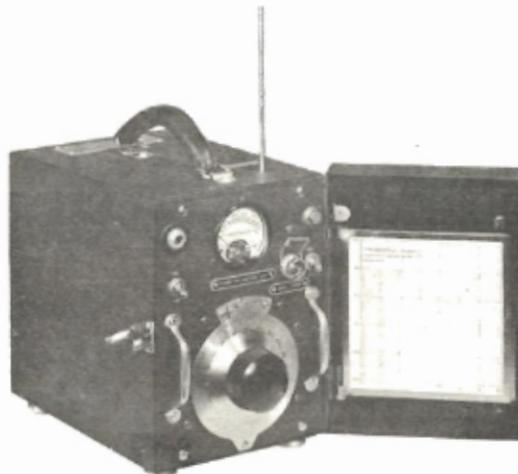
FREQUENCY METER BC-906-D  
(WAVEMETER BC-906-D)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter BC-906-D (Complete)	Metal	7CAC-318208-55 R16-W-2121 2C1546D	6-1/2	9-1/4	12-3/8	17.8
1	Antenna AN-108-D (Extendable Type)	Brass	7CAC-045900 R16-PH-358-1667 2A275-108				
1	Calibration Chart			5-5/8	5-1/2		
1	Tube JAN-1S5		3300-234155000 2J1S5	2-1/8	3/4		
1	Transportation Case	Wood		14	17-3/4	10	15.2
1	Instruction Book		2C154C/B1				
						Total:	33.0



**FREQUENCY METER BC-906-E  
(WAVEMETER BC-906-E)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained absorption-type meter used to determine the frequency of continuous wave, modulated carrier wave or pulsed radar transmitters and local oscillators. Also used to calibrate, check sensitivity and align receivers operating in the proper frequency range.

Resonance is indicated by a dip of the microammeter reading and frequency is determined by the dial setting and the associated calibration charts.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Provision is made for external use of the microammeter only in Model E.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: One 45 volt Battery BA-53-A; one 1.5 volt Battery BA-35-A.

Type of Reception: Continuous Wave, Modulated Carrier Wave and Pulse.

Frequency Range: 150 to 234 megacycles per second.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-318208-545	ASO-R16-AYS-BC-906-E	2C1546E
PROCUREMENT INFO.:	USAF Dwg. No. ESC-4448, USAF Spec. No. 271-1789-A		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, C&N	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.3		
	- Electronics Test Equipment -		BC-906-E

FREQUENCY METER BC-906-E  
(WAVEMETER BC-906-E)

ELECTROMECHANICAL DESCRIPTION: (Continued)

Accuracy:  $\pm 0.5$  megacycles per second.

Input: Marconi-type Antenna.

Temperature Range:  $-13^{\circ}$  F. to  $+122^{\circ}$  F.

Auxiliary Features: Phone jacks are provided for audio monitoring on all models.

Microammeter Range: 0 to 500 microamperes.

MANUFACTURERS' OR CONTRACTORS' DATA:

Philco Corporation, Philadelphia, Pennsylvania; Contract No. W-3435-sc-13;  
Order No. 19-MPD-43; Approximate Cost, \$75.00. Medco Company Mfg. Dwg.  
No. A-1013.

TUBE COMPLEMENT:

1 JAN-1S5.

REFERENCE DATA AND LITERATURE:

AN08-40BC906-2 (Maintenance Instructions).

TM 11-2623 (Technical Manual).

TM 11-1200 (Technical Manual).

TO 16-40BC906-2 (Maintenance Instructions).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter BC-906-E and accessories. (Domestic Packed)	1.91	14.5	12	19	40
BC-906-E - Electronics Test Equipment -						

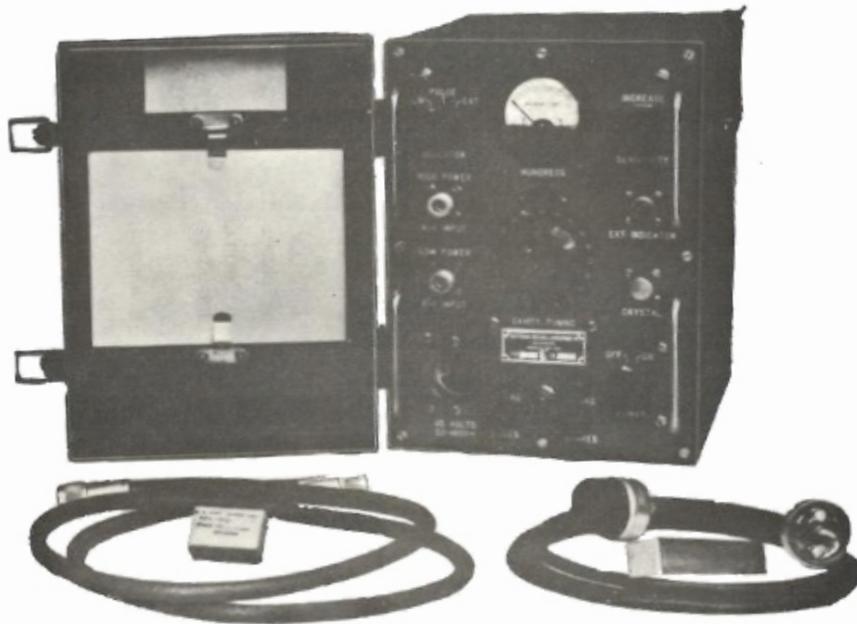
FREQUENCY METER BC-906-E  
(WAVEMETER BC-906-E)

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs. )
				H	W	D	
1	Frequency Meter BC-906-E (Complete)		7CAC-318208-545 R16-AYS-BC-906-E 2C1546E	6-1/2	9-1/4	12-3/8	17.8
1	Antenna AN-108-E (Extendable type)		7CAC-045900 R16-PH-358-1667 2A275-108	20	0.218		
1	Calibration Chart			5-5/8	5-1/2		
1	Tube JAN-1S5		3300-234155000  2J1S5	2-1/2	3/4		
1	Transportation Case	Wood		14	17-3/4	10	15.2
1	Instruction Book AN0840BC906-2		2C154C/B1				
Total							33.0
- Electronics Test Equipment -							BC-906-E



FREQUENCY METER FR-3(XA)/U  
(WAVEMETER, FR-3(XA)/U)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained, precision calibrated coaxial cavity of the absorption type designed to measure the frequency of radio frequency signals.

Resonance is indicated by a dip on a microammeter and the reading of a calibrated dial is converted to frequency by reference to an individual calibration chart. A crystal demodulator is included which provides a means for viewing video signals on a synchroscope.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Similar to Polytechnic Research and Development Company Type 560.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: 103.5 to 126.5 volts, 50 to 1600 cycles per second, 50 watts.

Type of Reception: Continuous Wave, Pulsed.

Frequency Range: 2400 to 3400 megacycles per second.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Development		
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, C&N	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.3		
	- Electronics Test Equipment -		FR-3(XA)/U

FREQUENCY METER FR-3(XA)/U  
(WAVEMETER, FR-3(XA)/U)

ELECTROMECHANICAL DESCRIPTION: (Continued)

Calibration Accuracy:  $\pm 0.2$  megacycles per second at the calibration temperature of approximately 20° C. (An absolute accuracy of approximately  $\pm 0.7$  megacycles per second is maintained for the temperature range of -40° C. to +55° C.)

Loaded "Q" of Cavity: Approximately 3000.

Radio Frequency Power Range:

Pulse Power: Approximately 1 milliwatt to 25 watts peak with the average power not exceeding one watt (44 decibels range).

Continuous Wave Power: Approximately 1 milliwatt to 1 watt (30 decibels range) with average power not exceeding 1 watt.

Pulse Amplifier Characteristics:

Pulse Width: 1 microsecond to square-wave.

Repetition Rate: 250 to 10,000 pulses per second.

Operating Altitude Range: The equipment will operate satisfactorily at altitudes from sea level (29.9 inches of mercury) to approximately 10,000 feet above sea level (20.6 inches of mercury).

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, 202 Tillery Street, Brooklyn 1, New York; Development Contract No. W-33-038-ac-15142; Approximate Cost per Unit, \$1725.00, Estimated Cost in Quantity, Procurement \$600.00; Manufacturer's Drawing No. D674.

TUBE COMPLEMENT:

1 JAN-6AL5, 1 JAN-6J6, 1 JAN-6SJ7, 1 JAN-6SN7W, 1 JAN-6X5, 1N21B (Crystal Rectifier).

REFERENCE DATA AND LITERATURE:

Manufacturers' Operating Instructions.

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
FR-3(XA)/U - Electronics Test Equipment -						





## FREQUENCY METER FR-14(XW-1)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated coaxial line cavity of the absorption type designed to measure the frequency and power of radio frequency signals in the range from 3950 to 5850 megacycles per second.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 554A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.3		
- Electronics Test Equipment -			FR-14(XW-1)/U

FREQUENCY METER FR-14(XW-1)/U

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 3950 to 5850 megacycles per second.

Accuracy: 0.03% (absolute); 0.005% relative accuracy over any adjacent band of 60 megacycles per second.  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Loaded "Q": 400 to 1600 (Varies with frequency).

Voltage Standing Wave Ratio: Less than 1.3 (throughout frequency range).

Waveguide Type and Dimensions: RG-49/U; 2" x 1".

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; Contract No. W28-099-ac-142; Manufacturer's Drawing No. D10053; Approximate Cost per Unit, \$965.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-14(XW-1)/U	Aluminum		11-1/2	6-1/4	7-13/16	15

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter FR-14(XW-1)/U (Domestic Packed)	1.03	15-1/2	10	11-1/2	20

FR-14(XW-1)/U - Electronics Test Equipment -

## WAVEMETER, FR-48(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated coaxial line cavity of the absorption type designed to measure the frequency of radio frequency signals. Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barreter. The power-indicating device must indicate the power level in the coaxial line on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 577A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, Rome	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.2.3	
- Electronics Test Equipment -			FR-48(XW)/U

WAVEMETER, FR-48(XW)/U

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 550 to 1000 megacycles per second.

Accuracy: 0.03%,  $\pm 0.2$  megacycles per second (absolute);  $\pm 0.2$  megacycles per second relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second relative accuracy over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Voltage Standing Wave Ratio: Approximately 1.10 to 1.60 (Varies with frequency).

Loaded "Q": Such that the band pass at half power points is approximately 1 megacycle per second.

Termination: UG-23B/U coaxial connector. (3/8" coax).

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099ac-142; Manufacturer's Drawing No. D12621; Approximate Cost per Unit, \$700.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

Manufacturer's Brochure.

EQUIPMENT SUPPLIED:

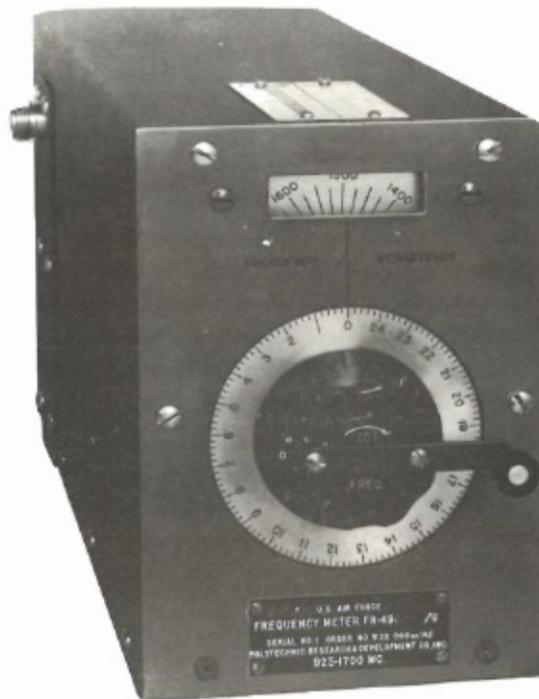
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-48(XW)/U (Complete)	Aluminum		7-5/8	8-1/2	18-1/8	15

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-48(XW)/U (Domestic Packed)	1.75	11-1/2	12	22	20

FR-48(XW)/U - Electronics Test Equipment -

## WAVEMETER FR-49/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated coaxial line cavity of the absorption type designed to measure the frequency of radio frequency signals.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the coaxial line on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 578A.  
Part of Radar Test Set AN/UPM-13.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1800-328531000		
PROCUREMENT INFO.:	USAF Exhibit No. ENG-232		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.3		
	- Electronics Test Equipment -		FR-49/U

WAVEMETER FR-49/U

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 925 to 1700 megacycles per second.

Accuracy: 0.03%,  $\pm 0.2$  megacycle per second (absolute);  $\pm 0.2$  megacycle per second relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second relative accuracy over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Voltage Standing Wave Ratio: 1.10 to 1.45 (varies with frequency).

Loaded "Q": 825-1150 (varies with frequency).

Termination: UG-23B/U Coaxial Connector. (3/8" coaxial).

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Manufacturer's Drawing No. D13112; Approximate Cost per Unit, \$700.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

Manufacturer's Brochure.

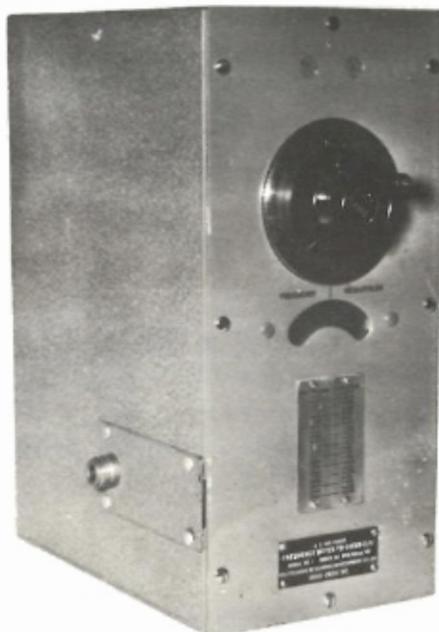
EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-49/U (Complete)	Aluminum	1800-328531000	6-1/2	5-3/4	13-13/16	15

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-49/U (Domestic Packed)	1.01	10-1/2	9-1/2	17-1/2	15

## WAVEMETER FR-50(XW-1)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated coaxial line cavity of the absorption type designed to measure the frequency and power of radio frequency signals.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power - measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the transmission line on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 579A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, Rome	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2. 2. 3	
- Electronics Test Equipment -		FR-50(XW-1)/U	

WAVEMETER FR-50(XW-1)/U

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range: 1650 to 2600 megacycles per second.

Accuracy: 0.03%,  $\pm 0.2$  megacycle per second (absolute);  $\pm 0.2$  megacycle per second relative accuracy over any adjacent band of 60 megacycles per second. 0.1 megacycle per second relative accuracy over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Voltage Standing Wave Ratio: 1.07 to 1.2 (varies with frequency).

Loaded "Q": 2400 to 5500 (varies with frequency).

Termination: UG-23B/U coaxial connector (3/8").

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Manufacturer's Drawing No. D14236; Approximate Cost per Unit, \$700.00.

**TUBE COMPLEMENT:**

None.

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Handbook of Maintenance Instructions.

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-50(XW-1)/U	Aluminum		11-1/4	6-1/4	9-1/4	15

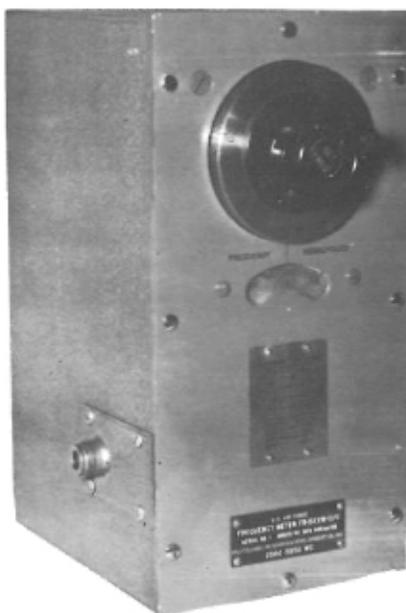
**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter FR-50(XW-1)/U (Domestic Packed)	1.13	15	10	13	20

FR-50(XW-1)/U

- Electronics Test Equipment -

## WAVEMETER FR-51(XW-1)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated coaxial line cavity of the absorption type designed to measure the frequency of radio frequency signals.

Resonance is indicated by a minimum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the transmission line on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 580A.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO. : 2.2.3		
	- Electronics Test Equipment -		FR-51(XW-1)/U

WAVEMETER FR-51(XW-1)/U

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 2400 to 3950 megacycles per second.

Accuracy: 0.03%,  $\pm 0.2$  megacycle per second (absolute);  $\pm 0.2$  megacycle per second relative accuracy over any adjacent band of 60 megacycles per second; 0.1 megacycle per second relative accuracy over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Voltage Standing Wave Ratio: 1.15 to 1.45 (varies with frequency).

Loaded "Q": 1670 to 4700 (varies with frequency).

Termination: UG-23B/U Coaxial Connector (3/8").

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Manufacturer's Drawing No. D14861; Approximate Cost per Unit, \$700.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-51(XW-1)/U	Aluminum		10-1/16	6	7-9/16	15

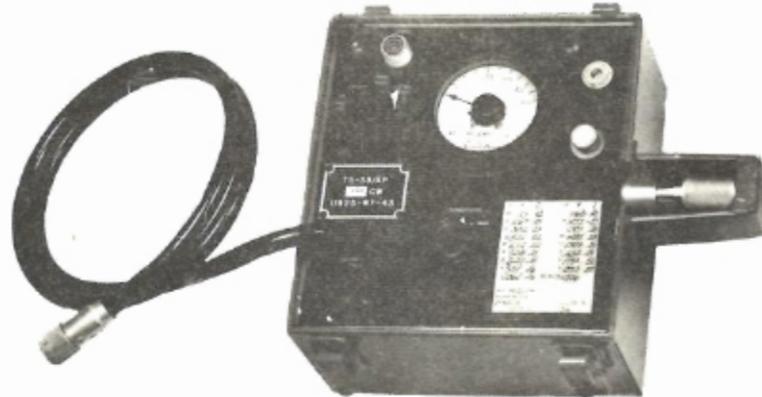
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-51(XW-1)/U (Domestic Packed)	0.93	14	10	11-1/2	20

FR-51(XW-1)/U

- Electronics Test Equipment -

## FREQUENCY METER TS-33/AP



### FUNCTIONAL DESCRIPTION:

A portable and self-contained radio frequency wavemeter used to measure or check the frequency of continuous wave, modulated carrier wave, or pulsed "X" band radar transmitters, signal generators and beating oscillators. May also be used to indicate transmitter power, detect double moding and erratic operation of magnetrons, measure rectified crystal current and repeller voltage and when used in conjunction with an oscilloscope, provide for viewing the shapes of transmitter pulses from T/R boxes or antennae and measuring pulsed frequencies at lower input levels than would be possible with the TS-33/AP alone.

Resonance is indicated by a sharp dip in the reading of the resonance indicating meter. Micrometer head readings are converted to frequency values by consulting a calibrated chart.

### RELATIONSHIP TO OTHER EQUIPMENT:

Superseded by Frequency-Power Meter TS-230/AP.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-979580	ASO-R16-W-1950	3F2742-33
PROCUREMENT INFO.:	USAF Spec. No. 371-5028		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, ARL
F.I.I.N.:	FUNCTIONAL CLASS. NO. : 2.2.3		
	- Electronics Test Equipment -		TS-33/AP

## FREQUENCY METER TS-33/AP

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Type of Reception: Continuous Wave, Modulated Carrier Wave, or Pulse.

Frequency Range, Input: 8700 to 9500 megacycles per second.

Accuracies:  $\pm 0.031\%$ ; average accuracy in measuring 60 megacycles per second differentials,  $\pm 0.8\%$  of differential.  $\pm 3$  megacycles per second (absolute).  $\pm 5$  megacycles per second (relative).

Power Input: (Continuous Wave) 0.25 milliwatts to 0.8 watts (-6 to +29 decibels reference to 1 milliwatt).

Signal Range, Input: The continuous wave and pulse-power inputs for a 16-micro-ampere meter-deflection with an average crystal are as follows: Minimum - Continuous Wave, 0.2 milliwatts (.7 dbm). Pulse wave, 150 milliwatts (duty cycle 0.0002 sec./sec.). Maximum - Continuous wave, 2 watts. Pulse wave, 1000 watts (duty cycle 0.002 sec./sec.). Pulse wave, 2000 watts (duty cycle 0.001 sec./sec.).

Sensitivity: Continuous wave 0.2 milliwatt minimum; Pulsed 2 milliwatts.

Impedance, Input: 50 ohms.

Signal Output: Video signal to test oscilloscope.

Temperature Range:  $-40^{\circ}$  F. to  $+160^{\circ}$  F.

Direct Current Meter Range: 0 to 5 milliamperes; 0 to 500 volts.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Western Electric Company, New York, New York; Signal Corps Order No. 11925-WF-43 and Navy Order No. NA(s)-429; Western Electric Code No. X-61717A; Approximate Cost per Unit, \$473.00, 26 August 1946; Designed by Bell Telephone Laboratories, Order No. 768-DAY-45, 17 February 1945, Approximate Cost per Unit, \$473.00; Order No. 870-DAY-45, 26 January 1945, Approximate Cost per Unit, \$473.00.

### TUBE COMPLEMENT:

1 JAN-1N21B or 1 JAN-1N22 (Crystal Rectifier).

### REFERENCE DATA AND LITERATURE:

CO-AN08-35TS33-2 (Maintenance Instructions).

TO 16-35TS33-2 (Operation Instructions).

TO 16-55-105 (Spare Parts List).

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Three in a box, Frequency Meters TS-33/AP, (Moisture and Fungus Proofed)	3.4	11	15	37	67

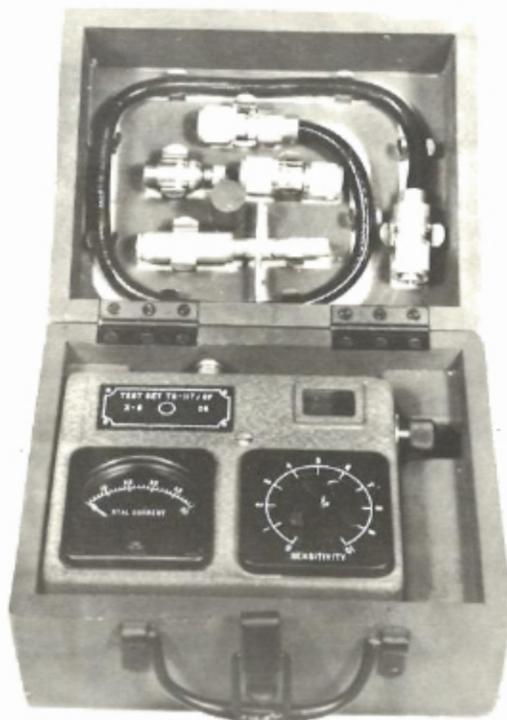
TS-33/AP

- Electronics Test Equipment -





WAVEMETER TEST SET TS-117/GP  
(WAVEMETER, TS-117/GP)



**FUNCTIONAL DESCRIPTION:**

A portable, self-contained, absorption type, frequency meter designed to measure the frequency of pulsed or continuous wave oscillators operating within its frequency and power limits. It may also be used for relative field-strength measurements and for tuning up Klystrons and similar devices.

Resonance is indicated by a direct current microammeter. Frequency determination is made by consulting a calibrated chart for the veeder-counter setting at resonance. The meter face and sensitivity controls are graduated for relative power measurements.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Used to test Radar Sets such as AN/APN-60 and AN/CPS-6B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-979578	R16-AN-TS-117/GP	3F4325-117
PROCUREMENT INFO.:	Army Spec. No. 171-2223		
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, ESL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.2.3		
	- Electronics Test Equipment -		TS-117/GP

WAVEMETER TEST SET TS-117/GP  
(WAVEMETER, TS-117/GP)

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.  
 Type of Reception: Continuous Wave, Pulse.  
 Frequency Range, Input: 2400 to 3400 megacycles per second.  
 Frequency Range, Output: Video: The rectified radio frequency signal may be viewed on an oscilloscope or test meter by connecting to the output jack of this instrument.  
 Accuracy:  $\pm 0.5$  megacycles per second (at beacon frequency of 3256 megacycles per second);  $\pm 0.1\%$  at all other frequencies.  
 Calibration Accuracy:  $\pm 3$  megacycles per second (as transmission-type meter);  $\pm 6$  megacycles per second (as absorption-type meter).  
 Power Range: 100 to 1000 microwatts.  
 Sensitivity: 500 microwatts.  
 Impedance, Input: 50 ohms.  
 Impedance, Output: Approximately 90 ohms to meter.  
 "Q": Approximately 1000 to 2000.  
 Temperature Range:  $-40^{\circ}$  C. to  $+48.8^{\circ}$  C.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Sperry Gyroscope Company, Great Neck, New York; Order Nos. 2338-MPD-45 and 2538-MPD-45; Manufacturer's Type No. MKS22; Approximate Cost per Unit, \$168.74; Developed by ESL and Sperry Gyroscope Company.

Lavoie Laboratories, Mataway and Freebold Road, Morganville, New Jersey; Order No. 5040-45, 19 June 1945; Approximate Cost per Unit, \$325.00. Navy Order No. 49-41-SC, 27 October 1948; Approximate Cost per Unit, \$423.00. Office of Chief of Signal Corps; Order No. 49-7189, 11 March 1949; Approximate Cost per Unit, \$423.00.

**TUBE COMPLEMENT:**

1 JAN-IN21B (Crystal Rectifier).

**REFERENCE DATA AND LITERATURE:**

TM 11-2538 and C1 (Technical Manual).  
 TO 16-35TS117-3 (Maintenance Instructions).  
 TO 16-35TS117-5 (Instruction Book).  
 SIG 7-TS-117/GP (Spare Parts List).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter Test Set, TS-117/GP, and accessories. (Packed in Water Resistant Carton)	0.69	10	12	10	9.5
TS-117/GP - Electronics Test Equipment -						





2.3 TRANSMISSION TYPE FREQUENCY METERS

## FREQUENCY METER FR-63/U

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** The circuit consists of an input amplifier followed by a series of clipping and limiting amplifiers, and a frequency indicating circuit composed of a capacitor, a diode, and a DC microammeter. The clippers and limiters convert the input signal to a square waveform.

**Power Supply:** 105 to 125 volts or 210 to 250 volts, AC, 50 to 60 cycles per second, single phase, 50 watts.

**Frequency Range:** 25 to 60,000 cycles per second in six ranges. Full scale values are 200, 600, 2000, 6000, 20,000, 60,000 cycles per second.

**Input Voltage:** 0.25 to 150 volts.

**Input Resistance:** 500,000 ohms for all ranges. One side is grounded.

**Input Waveform:** Readings are independent of waveform as long as dissymmetry of positive and negative portions of the wave is less than 8:1.

**Accuracy:**  $\pm 2\%$  of full scale  $+2$  cycles per second), for all ranges. When operating on the 60,000 cycle per second range, with less than 0.5 volt input, the accuracy becomes  $\pm 3\%$  of full scale.

**Mounting:** Standard 19 inch relay rack panel; walnut end frames are available to convert to table mounting at extra cost.

### MANUFACTURERS' OR CONTRACTORS' DATA:

General Radio Company, Cambridge, Massachusetts; Approximate Cost per Unit, \$285.00, October 1951.

### TUBE COMPLEMENT:

1 JAN-6H6, 1 JAN-6V6, 2 JAN-6SJ7, 1 JAN-6SQ7, 1 JAN-6SN7-GT, 1 JAN-0A3/VR-75, 1 JAN-6X5, 1 JAN-6J5, 1 Amperite-3-4.

### REFERENCE DATA AND LITERATURE:

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter, FR-63/U	Steel		5-1/4	19	11-1/4	19.5

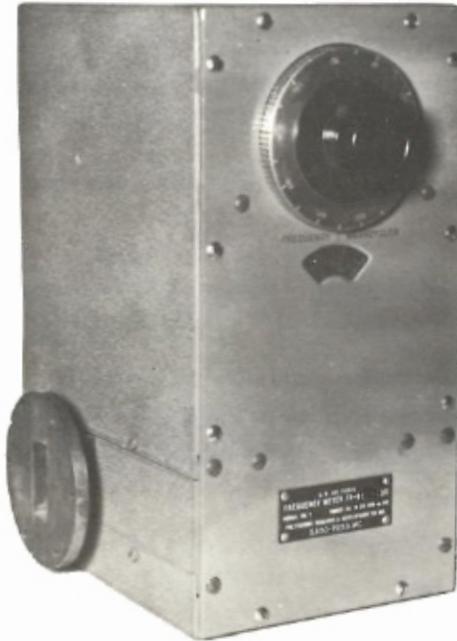
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

FR-63/U

- Electronics Test Equipment -

FREQUENCY METER FR-9/U  
(WAVEMETER FR-9/U)



FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power - measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power - indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 555B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Sub-Standard		
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330, Exhibit No. WLEN-2088, Watson Lab.		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.2		
	- Electronics Test Equipment -		FR-9/U

FREQUENCY METER FR-9/U  
(WAVEMETER FR-9/U)

**ELECTROMECHANICAL DESCRIPTION:**

Frequency Range: 5850 to 7050 megacycles per second.

Power Supply: None required.

Waveguide Type and Dimensions: RG-50/U, 1-1/2" x 3/4".

Accuracy: ±0.03% (absolute); ±0.005% relative accuracy over any adjacent band of 60 megacycles per second; ±0.1 megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of -40° C. to +65° C. with a relative humidity up to 100%.

Loaded "Q": 6,950 to 14,500. (Varies with frequency).

Insertion Loss: 6.7 to 10.6 decibels. (Varies with frequency).

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Polytechnic Research and Development Company, 202 Tillery Street, Brooklyn 1, New York; Contract No. W-28099-ac-142; Approximate Cost per Unit, \$1000.00.

**TUBE COMPLEMENT:**

None.

**REFERENCE DATA AND LITERATURE:**

Manufacturers' Handbook of Maintenance Instructions.

**EQUIPMENT SUPPLIED:**

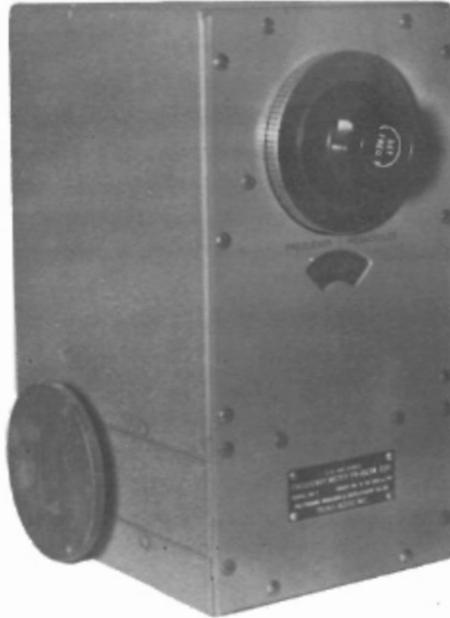
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter, FR-9/U (Complete)	Aluminum		10-1/4	6-1/4	7-13/16	15
1	Case CY-788/U	Aluminum					

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter, FR-9/U, (Domestic Packed)	0.97	14	10	12	20

FR-9/U - Electronics Test Equipment -

FREQUENCY METER FR-10(XW)/U



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 7050 to 8200 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

**RELATIONSHIP TO OTHER EQUIPMENT:**

The frequency meter must be used in conjunction with a power - measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 556B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.2.		
	- Electronics Test Equipment -		FR-10(XW)/U

## FREQUENCY METER FR-10(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None.

Frequency Range: 7050 to 8200 megacycles per second.

Accuracy:  $\pm 0.03\%$  (absolute);  $\pm 0.005\%$ , relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained at a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-50/U;  $1-1/2" \times 3/4"$ .

Loaded "Q": 7100 to 12,300 (varies with frequency).

Insertion Loss: 5.8 to 8.3 decibels (varies with frequency).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-10(XW)/U (Complete)	Aluminum		9-13/16	6-1/4	7-3/4	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter, FR-10(XW)/U (Domestic Packed)	0.9	13-1/2	10	11-1/2	20

FR-10(XW)/U - Electronics Test Equipment -

## FREQUENCY METER FR-11(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 7050 to 8200 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 557B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.2		
	- Electronics Test Equipment -		FR-11(XW)/U

**FREQUENCY METER FR-11(XW)/U**

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range: 7050 to 8200 megacycles per second.

Accuracy:  $\pm 0.03\%$  (absolute);  $\pm 0.005\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-51/U; 1-1/4" x 5/8".

Loaded "Q": 6200 to 12,500 (varies with frequency).

Insertion Loss: 7.6 to 10.0 decibels (varies with frequency).

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

**TUBE COMPLEMENT:**

None.

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Handbook of Maintenance Instructions.

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-11(XW)/U (Complete)	Aluminum		9-11/16	6-1/4	7-3/4	15

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter, FR-11(XW)/U, (Domestic Packed).	0.9	13-1/2	10	11-1/2	20
FR-11(XW)/U - Electronics Test Equipment -						

## FREQUENCY METER FR-12(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 8200 to 10,000 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 558B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.2		
	- Electronics Test Equipment -		FR-12(XW)/U

## FREQUENCY METER FR-12(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 8200 to 10,000 megacycles per second.

Accuracy:  $\pm 0.03\%$  (absolute);  $\pm 0.005\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-51/U; 1-1/4" x 5/8".

Loaded "Q": 7700 to 13,800 (varies with frequency).

Insertion Loss: 6.6 to 8.5 decibels (varies with frequency).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-12(XW)/U (Complete)	Aluminum		9-1/8	6-1/4	7-3/16	15

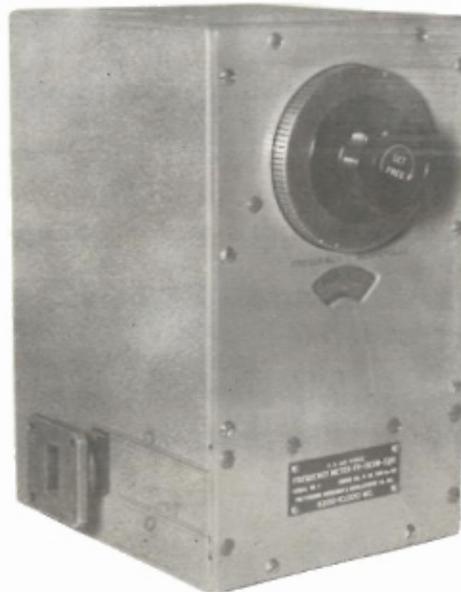
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter FR-12(XW)/U (Domestic Packed)	0.83	13	10	11	20

FR-12(XW)/U

- Electronics Test Equipment -

## FREQUENCY METER FR-13(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 8200 to 10,000 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 559B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1330		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.2		
	- Electronics Test Equipment -		FR-13(XW)/U

## FREQUENCY METER FR-13(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 8200 to 10,000 megacycles per second.

Accuracy:  $\pm 0.03\%$  (absolute);  $\pm 0.005\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-52/U;  $1" \times 1/2"$ .

Loaded "Q": 6000 to 11,500 (varies with frequency).

Insertion Loss: 5.0 to 7.4 decibels (varies with frequency).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-13(XW)/U (Complete)	Aluminum		8-3/4	6	7-1/8	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter FR-13(XW)/U (Domestic Packed).	0.8	12-1/2	10	11	20

FR-13(XW)/U - Electronics Test Equipment -

## WAVEMETER FR-22(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 15,000 to 18,000 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 567B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1606		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.2		
	- Electronics Test Equipment -		FR-22(XW)/U

WAVEMETER FR-22(XW)/U

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 15,000 to 18,000 megacycles per second.

Accuracy:  $\pm 0.06\%$  (absolute);  $\pm 0.01\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.05$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-107/U; 0.622" x 0.311".

Loaded "Q": 6200 to 11,100 (varies with frequency).

Insertion Loss: 6.0 to 10 decibels (varies with frequency).

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-22(XW)/U (Complete)	Aluminum		9	5-3/8	7-5/8	15

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-22(XW)/U (Domestic Packed)	0.78	13	9	11-1/2	20

FR-22(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-23(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 10,000 to 12,400 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 565B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1606		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO. : 2.3.2		
	- Electronics Test Equipment -		FR-23(XW)/U

**WAVEMETER FR-23(XW)/U**

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Frequency Range: 10,000 to 12,400 megacycles per second.

Accuracy:  $\pm 0.06\%$  (absolute);  $\pm 0.01\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.5$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-52/U; 1" x 1/2".

Loaded "Q": 4760 to 10,180 (varies with frequency).

Insertion Loss: 4.0 to 6.9 decibels (varies with frequency).

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

**TUBE COMPLEMENT:**

None.

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Handbook of Maintenance Instructions.

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-23(XW)/U (Complete)	Aluminum		8-3/8	5	6	15

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-23(XW)/U (Domestic Packed)	0.63	12	9	10	20

FR-23(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-24(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 12,400 to 15,000 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 566B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1606		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, Rome	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.2		
	- Electronics Test Equipment -		FR-24(XW)/U

WAVEMETER FR-24(XW)/U

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 12,400 to 15,000 megacycles per second.

Accuracy:  $\pm 0.06\%$  (absolute);  $\pm 0.01\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.5$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-107/U; 0.622" x 0.311".

Loaded "Q": 3700 to 9000 (varies with frequency).

Insertion Loss: 5.2 to 7.0 decibels (varies with frequency).

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

EQUIPMENT SUPPLIED:

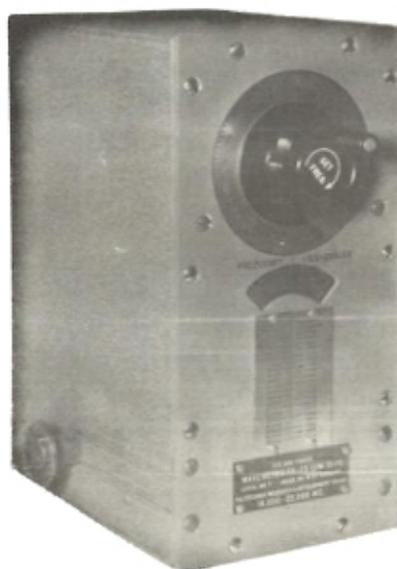
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-24(XW)/U (Complete)	Aluminum		8-1/8	5-3/4	6-5/8	15

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-24(XW)/U (Domestic Packed)	0.69	12	9-1/2	10-1/2	20

FR-24(XW)/U - Electronics Test Equipment -

## WAVEMETER FR-25(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 18,000 to 22,000 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 568B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.: USAF Dwg. No. 1606			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, Rome	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.3.2	
- Electronics Test Equipment -			FR-25(XW)/U

## WAVEMETER FR-25(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 18,000 to 22,000 megacycles per second.

Accuracy:  $\pm 0.1\%$  (absolute);  $\pm 0.015\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 1.0$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-66/U; 0.420" x 0.170".

Loaded "Q": 4600 to 8000 (varies with frequency).

Insertion Loss: 5.1 to 9.2 decibels (varies with frequency).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-25(XW)/U (Complete)	Aluminum		8-3/4	5-3/8	7-3/8	15

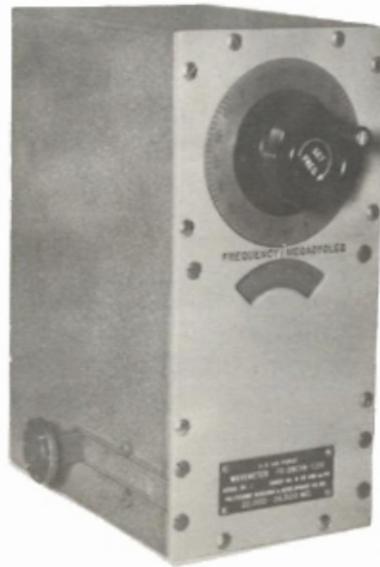
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-25(XW)/U (Domestic Packed)	0.8	12-1/2	10	11	20

FR-25(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-26(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 22,000 to 26,500 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 569B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1606		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.2		
	- Electronics Test Equipment -		FR-26(XW)/U

## WAVEMETER FR-26(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 22,000 to 26,500 megacycles per second.

Accuracy:  $\pm 0.1\%$  (absolute);  $\pm 0.015\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 1.0$  megacycle per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-66/U; 0.420" x 0.170".

Loaded "Q": 2100 to 4150 (varies with frequency).

Insertion Loss: 2.5 to 5.7 decibels (varies with frequency).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-26(XW)/U (Complete)	Aluminum		8-1/2	5	7-1/4	15

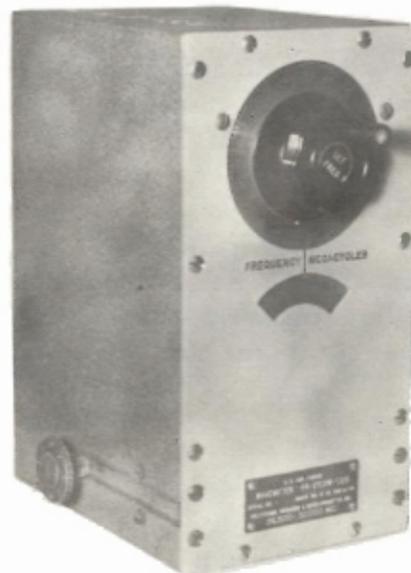
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-26(XW)/U (Domestic Packed)	0.72	12-1/2	9	11	20

FR-26(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-27(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 26,500 to 32,000 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 570B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1606		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO. : 2.3.2		
	- Electronics Test Equipment -		FR-27(XW)/U

WAVEMETER FR-27(XW)/U

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 26,500 to 32,000 megacycles per second.

Accuracy:  $\pm 0.15\%$  (absolute);  $\pm 0.02\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 2.0$  megacycles per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-96/U; 0.280" x 0.140".

Loaded "Q": 2650 to 5400 (varies with frequency).

Insertion Loss: 3.7 to 9.0 decibels (varies with frequency).

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-27(XW)/U (Complete)	Aluminum		8-5/8	5-1/2	7-3/16	15

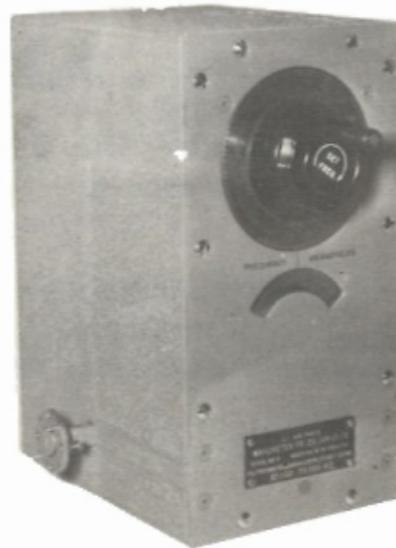
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-27(XW)/U (Domestic Packed)	0.72	12-1/2	9-1/2	11	20

FR-27(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-28(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated frequency measuring cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 32,000 to 39,000 megacycles per second.

Resonance is indicated by a maximum reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 571B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	USAF Dwg. No. 1606		
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F. I. I. N.:	FUNCTIONAL CLASS. NO. : 2.3.2		
	- Electronics Test Equipment -		FR-28(XW)/U

## WAVEMETER FR-28(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 32,000 to 39,000 megacycles per second.

Accuracy:  $\pm 0.15\%$  (absolute);  $\pm 0.02\%$  relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 2.0$  megacycles per second over any adjacent band of 8 megacycles per second.

The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Waveguide Type and Dimensions: RG-96/U; 0.280" x 0.140".

Loaded "Q": 1370 to 3700 (varies with frequency).

Insertion Loss: 3.0 to 6.9 decibels (varies with frequency).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Approximate Cost per Unit, \$1000.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-28(XW)/U (Complete)	Aluminum		8-9/16	4-1/2	6-3/16	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-28(XW)/U (Domestic Packed)	0.61	12-1/2	8-1/2	10	20

FR-28(XW)/U - Electronics Test Equipment -

FREQUENCY METER FR-8(XW)/U



FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and precalibrated coaxial line cavity of the transmission type designed to measure the frequency of radio frequency signals.

Resonance is indicated by a peak reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power - indicating device must indicate the power level in the waveguide on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 554B. (Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, Rome	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.3.3	
- Electronics Test Equipment -			FR-8(XW)/U

## FREQUENCY METER FR-8(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 3950 to 5850 megacycles per second.

Accuracy: 0.03% (absolute); 0.005% relative accuracy over any adjacent band of 60 megacycles per second; 0.1 megacycle per second relative accuracy over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range or  $-40^{\circ}\text{C.}$  to  $+65^{\circ}\text{C.}$  with a relative humidity up to 100%.

Insertion Loss: 5.2 to 14.0 decibels (varies with frequency).

Loaded "Q": 680 to 1450 (varies with frequency).

Waveguide Type and Dimensions: RG-49/U, 2" x 1".

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142, 8 May 1946; Manufacturer's Drawing No. D10290; Approximate Cost per Unit, \$965.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturers' Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-8(XW)/U (Complete)	Aluminum		11-1/2	6-7/8	8-7/8	15

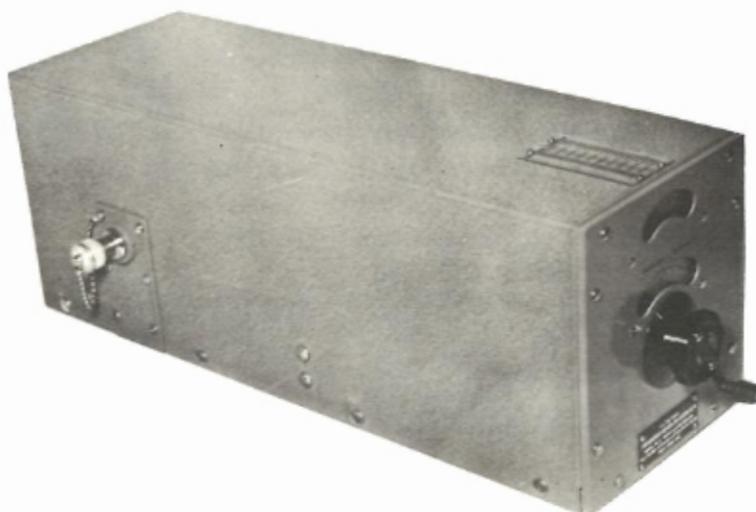
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter, FR-8(XW)/U (Domestic Packed)	1.08	15-1/2	11	12	20

FR-8(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-52(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated coaxial line cavity of the absorption type designed to measure the frequency of radio frequency signals.

Resonance is indicated by a peak reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the coaxial line on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 577B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.3		
	- Electronics Test Equipment -		FR-52(XW)/U

## WAVEMETER FR-52(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 550 to 1000 megacycles per second.

Accuracy: 0.03%,  $\pm 0.2$  megacycle per second (absolute);  $\pm 0.2$  megacycle per second relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second relative accuracy over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Insertion Loss: Approximately 3.5 to 5 decibels (varies with frequency).

Loaded "Q": Such that the band pass at half power points is approximately 1 megacycle per second.

Termination: UG-23B/U Coaxial Connector. (3/8").

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Manufacturer's Drawing No. D10012; Approximate Cost per Unit, \$700.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

Manufacturer's Brochure.

### EQUIPMENT SUPPLIED:

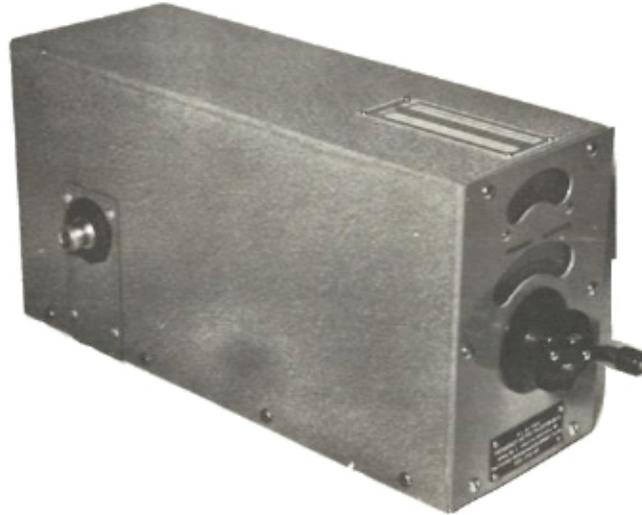
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-52(XW)/U (Complete)	Aluminum		6-5/8	8-3/4	18-3/16	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-52(XW)/U (Domestic Packed)	1.67	10-1/2	12-1/2	22	20

FR-52(XW)/U - Electronics Test Equipment -

WAVEMETER FR-53(XW)/U



FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained, and pre-calibrated coaxial line cavity instrument of the transmission type designed to measure the frequency and power of radio frequency signals.

Resonance is indicated by a peak reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

RELATIONSHIP TO OTHER EQUIPMENT:

The frequency meter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the coaxial line on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 578B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF; Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.3		
	- Electronics Test Equipment -		FR-53(XW)/U

WAVEMETER FR-53(XW)/U

ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 950 to 1700 megacycles per second.

Accuracy: 0.03%, ±0.2 megacycle per second (absolute); ±0.2 megacycle per second relative accuracy over any adjacent band of 60 megacycles per second; ±0.1 megacycle per second relative accuracy over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range of -40° C. to +65° C. with a relative humidity up to 100%.

Insertion Loss: 2.1 to 8.0 decibels (varies with frequency).

Loaded "Q": 850 to 1150 (varies with frequency).

Termination: UG-23B/U Coaxial Connector (3/8").

MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Manufacturer's Drawing No. D10727; Approximate Cost per Unit, \$700.00.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-53(XW)/U (Complete)	Aluminum		6-5/8	6	14	15

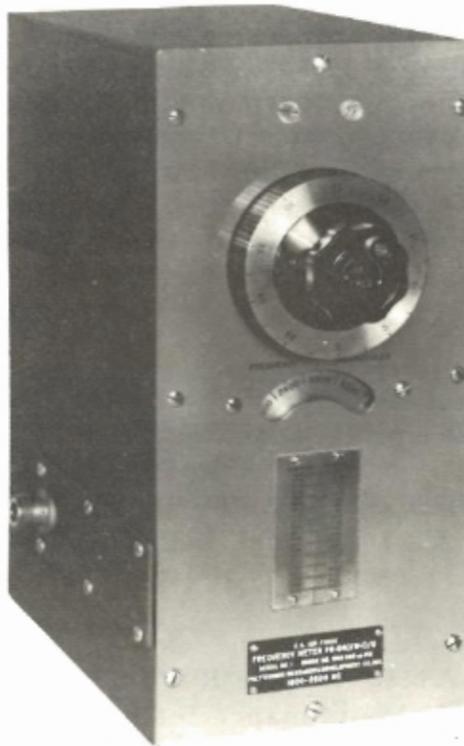
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-53(XW)/U (Domestic Packed)	1.21	10-1/2	10	20	20

FR-53(XW)/U

- Electronics Test Equipment -

WAVEMETER FR-54(XW)/U



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained and pre-calibrated coaxial line cavity of the transmission type designed to measure the frequency of radio frequency signals.

Resonance is indicated by a peak reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

**RELATIONSHIP TO OTHER EQUIPMENT:**

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the transmission line on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 579B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO. : 2.3.3		
- Electronics Test Equipment -			FR-54(XW)/U

## WAVEMETER FR-54(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 1600 to 2600 megacycles per second.

Accuracy: 0.03%,  $\pm 0.2$  megacycle per second (absolute);  $\pm 0.2$  megacycle per second relative accuracy over any adjacent band of 60 megacycles per second;  $\pm 0.1$  megacycle per second relative accuracy over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Insertion Loss: 5.5 to 7.8 decibels (varies with frequency).

Loaded "Q": 1300 to 1800 (varies with frequency).

Termination: UG-23B/U Coaxial Connector. (3/8" coaxial).

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Manufacturer's Drawing No. D14155; Approximate Cost per Unit, \$700.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturer's Handbook of Maintenance Instructions.

Manufacturer's Brochure.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-54(XW)/U (Complete)	Aluminum		11-1/4	6-1/4	9-1/4	15

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-54(XW)/U (Domestic Packed)	1.05	14	10	13	20

FR-54(XW)/U

- Electronics Test Equipment -

## WAVEMETER FR-55(XW)/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, self-contained and pre-calibrated coaxial line cavity of the transmission type designed to measure the frequency of radio frequency signals in the range from 2400 to 3950 megacycles per second.

Resonance is indicated by a peak reading of an external indicating device and frequency is read directly in megacycles per second from the frequency meter dials.

### RELATIONSHIP TO OTHER EQUIPMENT:

The wavemeter must be used in conjunction with a power-measuring and indicating device such as a crystal detector, bolometer, thermistor, or barretter. The power-indicating device must indicate the power level in the transmission line on a power-level meter or oscilloscope. For some power-measuring methods, an amplifier may be required to amplify the signal sufficiently to deflect the meter pointer.

Similar to Polytechnic Research and Development Company Type No. 580B.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, Rome
F.I.I.N.:	FUNCTIONAL CLASS. NO.:		
	- Electronics Test Equipment -		FR-55(XW)/U

## WAVEMETER FR-55(XW)/U

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 2400 to 3950 megacycles per second.

Accuracy: 0.03%,  $\pm 0.2$  megacycle per second (absolute);  $\pm 0.2$  megacycle per second relative accuracy over any adjacent band of 60 megacycles per second; 0.1 megacycle per second relative accuracy over any adjacent band of 8 megacycles per second. The above accuracies are maintained over a temperature range of  $-40^{\circ}$  C. to  $+65^{\circ}$  C. with a relative humidity up to 100%.

Insertion Loss: 6 to 9.8 decibels (varies with frequency).

Loaded "Q": 1600 to 3140 (varies with frequency).

Termination: UG-23B/U Coaxial Connector (3/8").

### MANUFACTURERS' OR CONTRACTORS' DATA:

Polytechnic Research and Development Company, Inc., 202 Tillery Street, Brooklyn 1, New York; USAF Development Contract No. W28-099-ac-142; Manufacturer's Drawing No. D14651; Approximate Cost per Unit, \$700.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

Manufacturers' Handbook of Maintenance Instructions.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy ) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Wavemeter FR-55(XW)/U (Complete)	Alum- inum		10	6	7-9/10	15

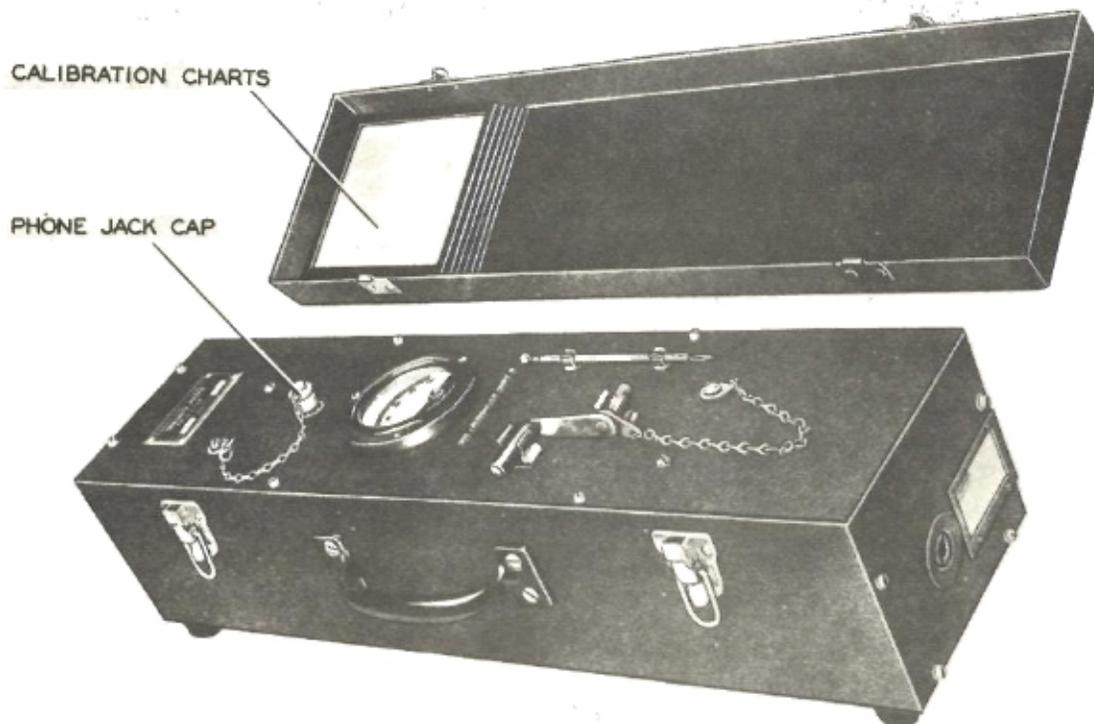
### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Wavemeter, FR-55(XW)/U (Domestic Packed)	0.93	14	10	11-1/2	20

FR-55(XW)/U

- Electronics Test Equipment -

FREQUENCY METER TS-69A/AP  
(WAVEMETER TS-69A/AP)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, self-contained frequency meter of the transmission type designed to measure the frequency of continuous wave or modulated carrier wave radar transmitters.

Resonance is indicated by a direct current microammeter. Frequency is then read from a Veeder-Root counter dial position and associated charts.

**RELATIONSHIP TO OTHER EQUIPMENT:**

TS-69A/AP is the same as TS-69/AP except for mechanical construction.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: None required.

Type of Reception: Continuous Wave, Modulated Carrier Wave.

Frequency Range: 350 to 1000 megacycles per second.

Voltage Input: 25 millivolts at antenna connector (minimum).

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-327878748	F16-W47066-1116	3F4325-69A
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.:	USAF, ARL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.3.3		
- Electronics Test Equipment -			TS-69A/AP

**FREQUENCY METER TS-69A/AP  
(WAVEMETER TS-69A/AP)**

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

Accuracy:  $\pm 0.1\%$  at 350 megacycles per second.  $\pm 0.25\%$  at 1000 megacycles per second.

Input Impedance: Type SO239 Connector with telescopic antenna or probe antenna. AS-122/AP with six feet of RG-8/U Cable.

Temperature Range:  $-40^{\circ}$  F. to  $+131^{\circ}$  F.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Cover Dual Signal Systems, Inc., 5215 Ravenswood Avenue, Chicago 40, Illinois;  
Order No. 633-DAY-44, 28 February 1945, Approximate Cost per Unit, \$180.00.

**TUBE COMPLEMENT:**

1N21-B (Crystal Unit).

**REFERENCE DATA AND LITERATURE:**

TO 16-35TS69-2 (Maintenance Instructions).

TO 16-55-20 (Spare Parts List).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter, TS-69A/AP including accessories. (Packed for Export Shipment)	3.10	13	31	13	52
TS-69A/AP - Electronics Test Equipment -						

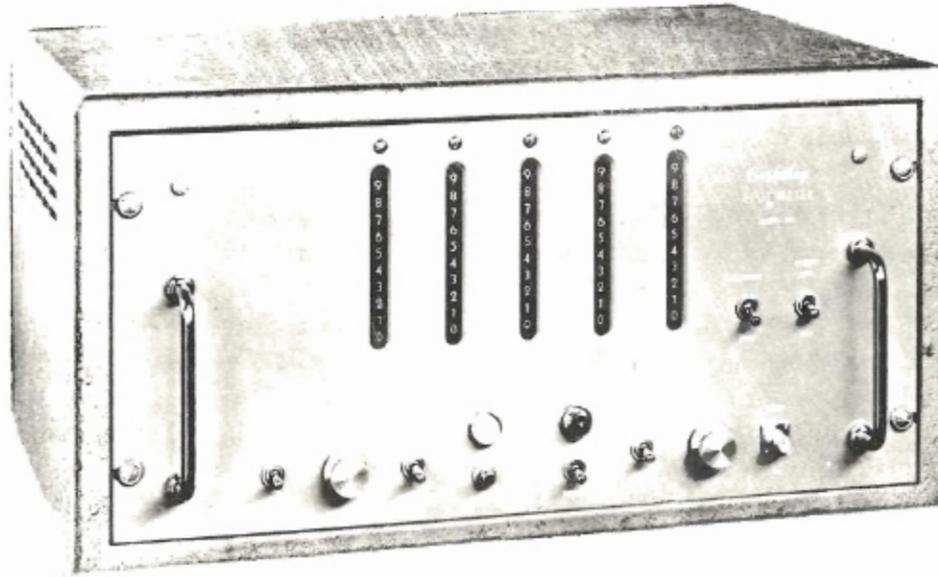




2.4      COUNTING TYPE FREQUENCY METERS



EVENTS-PER-UNIT-TIME (EPUT) METER  
Berkeley Model 554  
(Beckman Instruments, Inc.)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, high-speed, electronic counting instrument which automatically counts and displays the number of events that occur during a precise time interval. The EPUT meter has a high counting rate which makes it useful for accurate measurements on high-speed, rotating machinery where mechanical counters are inadequate. The accuracy of  $\pm 1$  count makes the EPUT meter useful as a secondary frequency standard for the calibration of laboratory variable frequency oscillators at any point within the EPUT meter counting range. Other applications are in ballistics studies, in the rapid and accurate determination of the frequency characteristics of networks such as filters and resonant circuits, and in the determination of elastic constants of materials by measuring their natural frequency of vibration. The instrument may be used as a precision electronic tachometer, as a secondary frequency standard when used with an oscillator, or for the rapid determination and direct reading of unknown signal frequencies. The result of the count is displayed on the front panel in direct-reading decimal form with the proper digits illuminated by panel lamps.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.:		Commercial
F.I.L.N.:	FUNCTIONAL CLASS. NO.:		2.4
- Electronics Test Equipment -			Model 554

EVENTS-PER-UNIT-TIME (EPUT) METER MODEL 554  
(Beckman Instruments, Inc.)

RELATIONSHIP TO OTHER EQUIPMENT:

The EPUT Meter Berkeley 554 is similar in appearance and function to Universal Counter and Timer Berkeley 5500, EPUT Meter Berkeley 556, and EPUT Meter Berkeley 5558. Model 5500 has the additional function of a time interval meter. Model 556 uses a 60 cycles per second power source to derive its time base. Model 5558 will count from 0 to 1,000,000 events per second and has an overcontrolled reference crystal. The Berkeley 554 has been superseded for most purposes by the Berkeley 7150.

ELECTROMECHANICAL DESCRIPTION:

Circuit Information: The basic circuit design of the EPUT meter includes an input circuit, an electronic gate which is opened and closed by a crystal-controlled time base, and a series of electronic decade-counting units. The input signal may be derived from a photocell, a sine-wave generator, or any changing voltage of sufficient amplitude. The events occurring at an unknown rate produce input signals which are, in turn, amplified and properly shaped by the input circuit. These pulses are then admitted through the electronic gate to the bank of 5 counting units. The gate is opened by a signal from the time base, remains open for an accurately controlled interval of time, and is closed by a second signal from the time base. The number of events that have occurred during that time interval are displayed on the illuminated panel of the electronic counting units. If operated automatically, this result will be displayed from 1 to 5 seconds, depending on the setting of the readout time control, and the instrument will then automatically recycle. If operated manually, the result will be displayed indefinitely until the RESET-START button is depressed to obtain another reading. The input circuit will accept a signal of any wave shape and of amplitude 0.2 to 20 volts rms. Input terminals are connected through a 0.05 microfarads capacitor to a 250-kilohm grid resistor. The input circuit consists of a 2-stage amplifier and a trigger circuit. The differentiated output signal from this trigger is fed through the input gate to the series of 5 plug-in decimal counting units. The accuracy of each single measurement of events-per-unit-time depends upon the accuracy of the time base and upon the total number of events or counts received. The time base which controls the input gate derives its accuracy from a 100,000-cycles per second crystal-controlled oscillator. This frequency is divided by a factor of  $10^5$  through a series of "locked-in" one-shot multivibrators, resulting in an output of one pulse per second. The supply voltage for the time base is electronically regulated so that stability against line voltage variation is insured. The EPUT meter has provisions for self-check of its circuitry. Everything except its reference crystal may be automatically self-checked for a period of one second.

**EVENTS-PER-UNIT-TIME (EPUT) METER MODEL 554**  
(Beckman Instruments, Inc.)

**ELECTROMECHANICAL DESCRIPTION:** (Continued)

Power Supply: 105 to 130 volts, 50 to 60 cycles per second, single-phase, 175 watts.

Range: 20 to 100,000 cycles per second.

Accuracy: Plus or minus one event.

Stability of Standard Crystal: Better than 5 parts in  $10^5$  and for short term, 1 part in  $10^5$ ; with temperature compensated crystal, 1 pulse per minute.

Time Base: 1 second, providing a direct reading of frequency with conversion.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Beckman Instruments, Inc., Richmond, California, approximate unit cost, \$775.00.

**TUBE COMPLEMENT:**

NI

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Catalog.

**EQUIPMENT SUPPLIED:**

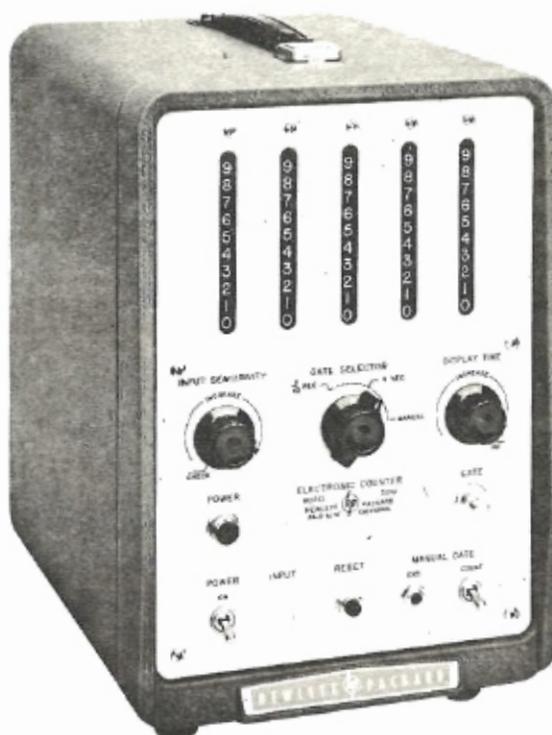
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Events-Per-Unit-Time (EPUT) Meter Berkeley 554	metal		20-3/4	10-1/2	15	70

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
	Events-Per-Unit-Time (EPUT) Meter Berkeley 554					
- Electronic Test Equipment -						Model 554



ELECTRONIC COUNTER  
MODEL 521G  
(Hewlett-Packard Company)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose instrument used to count and display events that occur during a selected period of time. The events may be any mechanical, electrical, or optical occurrence which can be related to frequency. The events can occur either regularly or with random distribution. The instrument is used for measurement of frequency and electrical events. In addition the equipment may also measure speed, weight, pressure and acceleration, when used with the proper transducer. The instrument is direct reading. Test results are displayed on a 5-place decimal register calibrated in cycles per second. The display time can be adjusted for a definite period, or readings can be held until manually reset.

**RELATIONSHIP TO OTHER EQUIPMENT:**

NI

**ELECTROMECHANICAL DESCRIPTION:**

Circuit Information: The instrument consists essentially of an input amplifier  
(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.:		Commercial
F.I.L.N.:	FUNCTIONAL CLASS. NO.: 2.4		
- Electronics Test Equipment -			Model 521G

**ELECTRONIC COUNTER MODEL 521G**  
(Hewlett-Packard Company)

**ELECTROMECHANICAL DESCRIPTION:** (Continued)

circuit, an electronic gate which is controlled by power line frequency and a series of electronic counters. In manual gate operation, the instrument counts while the electronic gate is open and displays the total count when the electronic gate is closed. The electronic gate can also be operated externally. To insure accuracy of gate time provision is made for a self-check of the line frequency.

Power Supply: 115 or 230 volts, AC, 50 to 60 cycles per second, 160 watts.

Frequency Range: 1 cycle per second to 1.2 megacycles per second.

Accuracy:  $\pm 1$  count  $\pm$  accuracy of timing frequency (approximately  $\pm 0.1\%$ ).

Display Capacity: 99,999.

Input Requirements: 0.2 volt rms minimum, or output from 1P41 phototube (or equal) attenuator can be used to reduce sensitivity to 100 volts rms.

Input Impedance: 1 megohm shunted by 50 micromicrofarads, approximately (500,000 ohms on PHOTOTUBE jack).

Gate Time: 0.1 and 1 second.

Display Time: Variable from gate time selected to 15 seconds in increments of selected gate time.

External Standard: Can be operated from 10 to 100 cycles per second at any multiple of 10 cycles per second.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Hewlett-Packard Company, 275 Page Mill Road, Palo Alto, California.

**TUBE COMPLEMENT:**

NI

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Catalog.

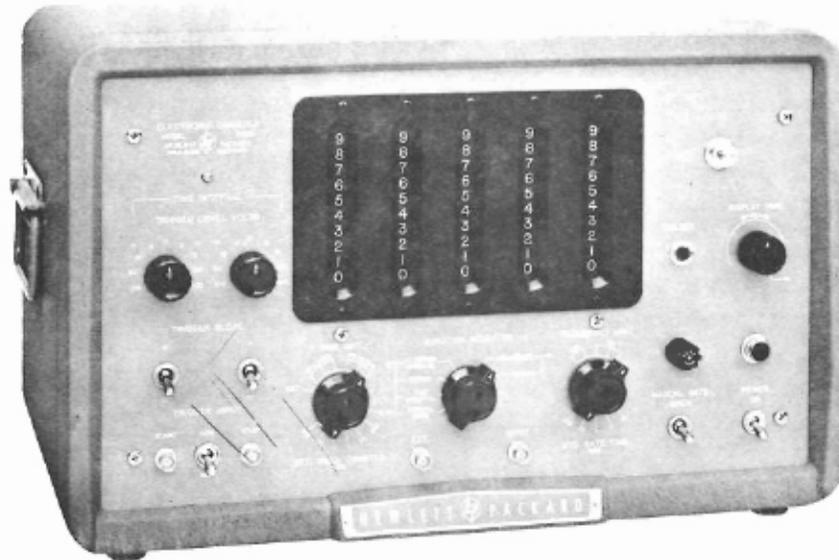
**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Electronic Counter Hewlett-Packard 521G					41
Model 521G - Electronic Test Equipment -						





**ELECTRONIC COUNTER  
MODEL 522B  
(Hewlett-Packard Company)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose device used to indicate frequency, period, interval, and the ratio of two external frequencies by counting one frequency and using the second frequency as a time base (as in converting return time of a radar echo into nautical miles). Test results are indicated by means of a counter.

**RELATIONSHIP TO OTHER EQUIPMENT:**

The electronic counter is similar to Frequency Meter FR-67/U.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: 115 or 230 volts, 50 to 60 cycles per second, 260 watts.

**Frequency Measurement:**

Range: 10 cycles per second to 120 kilocycles per second.

Accuracy:  $\pm 1$  count  $\pm$  stability (10 pulses per minute per week or better).

Registration: 5 places; output pulse available to actuate trigger circuit for mechanical register to provide increased count capacity.

(Continued)

	AIR FORCE	NAVY	ARMY
<b>TYPE CLASS.</b>			
<b>STOCK NOS.</b>			
<b>PROCUREMENT INFO.:</b>			
<b>PROCUREMENT COG.:</b>	DESIGN COG.: Commercial		
<b>F.I.L.N.:</b>	FUNCTIONAL CLASS. NO.: 2.4		
- Electronics Test Equipment -			MODEL 522B

ELECTRONIC COUNTER MODEL 522B  
(Hewlett-Packard Company)

ELECTROMECHANICAL DESCRIPTION: (Continued)

Input Requirements: 0.2 volts rms minimum.

Input Impedance: Approximately 1 megohm, 50 micromicrofarads shunt.

Gate Time: 0.001, 0.01, 1, 10 seconds; may be extended to any multiple of 1 or 10 seconds by manual control; panel neon lamp indicates that gate is open.

Display: Time variable from 0.1 to 10 seconds in steps of gate time selected; display can be held indefinitely if desired; reads in cycles per second or kilocycles per second with the decimal point indicated.

Period Measurement:

Range: 0.00001 cycles per second to 10 kilocycles per second; output pulse available to actuate trigger circuit for mechanical register to extend range to lower frequency.

Accuracy:  $\pm 0.3\%$   $\pm$  stability (10 pulses per minute per week or better) for measurement of one period; for more than one period accuracy is  $\pm 0.3\%$  divided by number of periods  $\pm$  stability.

Registration: 5 places; output pulse available to actuate trigger circuit for mechanical register to provide increased count capacity.

Input Requirements: 0.2 volts rms minimum; direct-coupled input.

Input Impedance: Approximately 1 megohm, 50 micromicrofarads shunt.

Gate Time: 1 or 10 cycles of unknown frequency; may be extended to any number of cycles of unknown frequency by manual control; limited to frequencies lower than 50 or 60 cycles per second.

Standard Frequency Counted: 1, 10, 100 cycles per second; 1, 10, 100 kilocycles per second; external.

Display: Time variable from 0.1 to 10 seconds in steps of the period being measured; display can be held indefinitely if desired; reads in seconds or microseconds with the decimal point indicated.

Time Interval Measurement:

Range: 10 microseconds to 100,000 seconds (27.8 hours).

Accuracy:  $\pm 1$  period of the standard frequency counted  $\pm$  stability (10 pulses per minute per week or better).

Registration: 5 places; output pulse available to actuate trigger circuit for mechanical register to provide increased count capacity.

Input Requirements: 1 volt peak minimum; direct-coupled input.

Input Impedance: Approximately 250,000 ohms, 50 micromicrofarads shunt.

Start and Stop: Independent or common channels.

Trigger Slope: Positive or negative on start and/or stop channels.

Trigger Amplitude: Continuously adjustable on both channels from -100 to  $\pm 100$  volts.

Standard Frequency Counted: 1, 10, 100 cycles per second; 1, 10, 100 kilocycles per second; external.

Display: Time variable from 0.1 to 10 seconds in steps of the period being measured; display can be held indefinitely if desired; reads in seconds or microseconds with the decimal point indicated.

**ELECTRONIC COUNTER MODEL 522B**  
(Hewlett-Packard Company)

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Hewlett-Packard Company, Palo Alto, California, approximate unit cost, \$915. 00.

**TUBE COMPLEMENT:**

NI

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Catalog 23-A, 1957.

**EQUIPMENT SUPPLIED:**

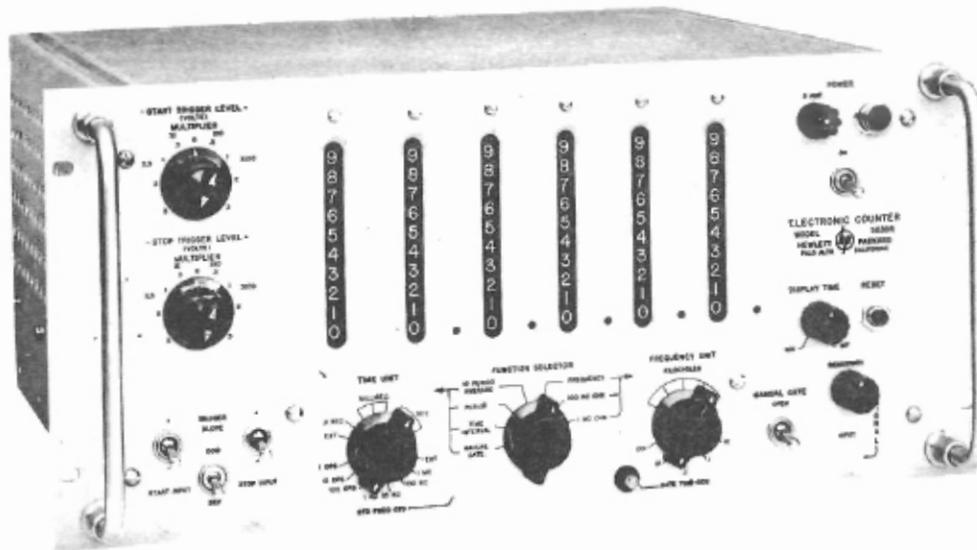
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Electronic Counter Model 522B	metal		20-1/2	12-1/2	14-1/4	52
2	Cable			44" long			

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Electronic Counter Hewlett-Packard 522B	6.9	27	21	21	72
- Electronic Test Equipment -						Model 522B



**ELECTRONIC COUNTER  
MODEL 523DR  
(Hewlett-Packard Company)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, rack-mounted electronic counter combined with an accurate time base generator to provide an equipment that will automatically count and display the number of events that occur during a selected time interval. These events include any electrical, mechanical, or optical occurrence that can be converted into charging voltages. The events can occur either regularly or with random distribution. The equipment may be used for measurements of frequency, period, time interval, and phase angle. The equipment may also be used to determine the number of events per unit time as well as the ratio of two phenomena. Accurate frequency outputs permits use of the instrument as a secondary frequency standard. The instrument is direct reading. Test results are displayed on a 6-place decimal register with the proper digits illuminated by panel lamps. The register is calibrated in terms of microseconds. The display can be adjusted for a finite period of time or can be held until manually reset.

	AIR FORCE	NAVY	ARMY
TYPE CLASS,			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:		DESIGN COG.:	Commercial
F. I. I. N.:		FUNCTIONAL CLASS. NO. : 2.4	
- Electronics Test Equipment -			Model 523DR

ELECTRONIC COUNTER MODEL 523DR  
(Hewlett-Packard Company)

RELATIONSHIP TO OTHER EQUIPMENT:

The Electronic Counter Hewlett-Packard 523DR is identical to the Electronic Counter Hewlett-Packard 523CR except for method of measured data display.

ELECTROMECHANICAL DESCRIPTION:

Circuit Information: The unit is comprised essentially of an input amplifier, an electronic gate, a time base generator and a series of electronic decade counting units. During frequency measurements the unknown signal to be measured is applied to the signal gate. The signal gate is opened and closed by signals received from the time base generator. The output from the signal gate is then applied to the counter circuit where the number of events which occurred during the opening and closing of the signal gate is totalized and displayed. Accuracy is determined by the stability of the time base generator and the  $\pm 1$  count error inherent in the instrument. In period measurements the unknown frequency opens and closes the signal gate for either one period or for ten periods and a standard frequency from the time base generator is applied to the counter circuits. Time interval measurements are similar to period measurements except that the triggering point on the signal waveform or waveforms is adjustable. The adjustment permits independent variation of a marker output for measurements on a single waveform.

Power Supply: 115 or 230 volts  $\pm 10\%$ , AC, 50 to 60 cycles per second, 350 watts.  
Frequency Measurement:

Range: 10 cycles per second to 1.2 megacycles per second.

Accuracy:  $\pm 1$  count  $\pm$  stability.

Input Sensitivity: 0.1 volt to 150 volts rms maximum, adjustable.

Input Trigger Levels: + or - slope, -300 to +300 volts, stop channel may be used so that only signals meeting conditions set by trigger level controls are counted.

Gate Time: 0.001, 0.01, 0.1 and 10 seconds.

Units Indicated: Kilocycles per second.

Period Measurement:

Range: 0.0001 cycles per second to 100 kilocycles per second.

Accuracy (Sine Waves):

10 Period:  $\pm 0.003\%$   $\pm 1$  count  $\pm$  stability at 1 volt rms input;  $\pm 0.03\%$   $\pm 1$  count  $\pm$  stability at 0.1 volt rms input.

1 Period:  $\pm 0.03\%$   $\pm 1$  count  $\pm$  stability at 1 volt rms input;  $\pm 0.3\%$   $\pm 1$  count  $\pm$  stability at 0.1 volt rms input.

Accuracy (Any Waveshape): The error, in microseconds, is equivalent to 0.0025 divided by the signal slope (volts per microsecond)  $\pm 1$  count  $\pm$  stability.

Input Requirements: 0.1 volt rms minimum, direct coupled.

Measurement Period: 1 or 10 cycles of unknown.

Standard Frequency Counted: 1, 10, 100 cycles per second, 1, 10, 100 kilocycles per second, 1 megacycle per second.

ELECTRONIC COUNTER MODEL 523DR  
(Hewlett-Packard Company)

ELECTROMECHANICAL DESCRIPTION: (Continued)

Units Indicated: Seconds, milliseconds, microseconds.

Time Interval Measurement:

Range: 1 microsecond to  $10^6$  seconds.

Accuracy (Pulse Input):  $\pm 1$  count  $\pm$  stability.

Input Requirements: 0.1 volt rms minimum AC or DC coupled.

Start and Stop Input: Separate channels with independent controls, separate or common input.

Marker Output: 2 pulses 5 microseconds duration, +20 volts peak.

Trigger Slope: Positive or negative on start and stop channels.

Trigger Amplitude: Variable from -300 to +300 volts.

Standard Frequency Counted: 1, 10, 100 cycles per second, 1, 10, 100 kilocycles per second, 1 megacycle per second; external.

Units Indicated: Seconds, milliseconds, microseconds.

Phase Measurement:

Range: 1 cycle per second to 20 kilocycles per second, AC coupled.

Input Requirements: 50 to 10 volts rms, sinusoidal signal.

Accuracy:  $\pm 0.1$  degree  $\pm 1$  microsecond counting internal 1 megacycle per second frequency standard.

Ratio Measurement:

Display:  $f_1/f_2$ , or  $10f_1/f_2$  as an interger with accuracy of  $\pm 1$ .

$f_1$  Range: 10 cycles per second to 1 megacycle per second.

$f_2$  Range: 0.0001 cycle per second to 100 kilocycles per second.

Input Impedance: 1 megohm shunted by 50 micromicrofarads, approximately.

Registration Capacity: 999999 at rates to 120,000 per second.

Stability: 2 parts per 1,000,000 per week.

Display Time: Variable from 0.1 to 10 seconds, or held until manually reset.

Self Check: Automatic count of 100 kilocycles per second and 1 megacycle per second.

Output Frequencies: 1, 10, 100 cycles per second, 1, 10 kilocycles per second rectangular wave, 100 kilocycle and 1 megacycle per second sine wave.

External Standard: 100 kilocycles per second from external primary standard can be applied to instrument for higher accuracy.

MANUFACTURERS' OR CONTRACTORS' DATA:

Hewlett-Packard Company, 275 Page Mill Road, Palo Alto, California; approximate cost per unit, \$1285.00.

TUBE COMPLEMENT:

NI

REFERENCE DATA AND LITERATURE:

Manufacturer's Catalog.

**ELECTRONIC COUNTER MODEL 523DR**  
(Hewlett-Packard Company)

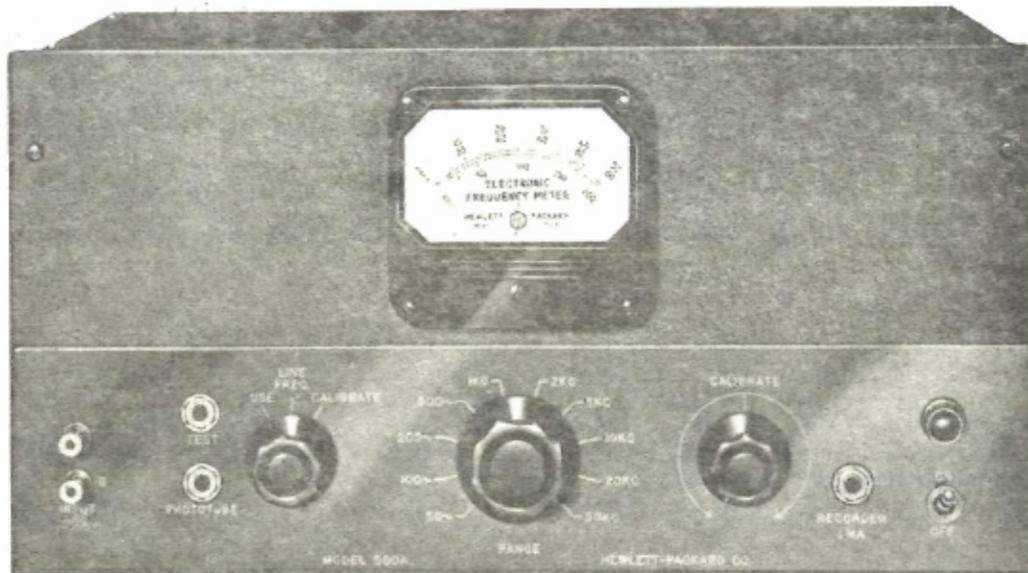
**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Electronic Counter Hewlett-Packard 523DR	metal		8-3/4	19	16	48
2	Cable Assemblies Hewlett-Packard AC-16K						

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Electronic Counter Hewlett-Packard 523DR and accessories					85
Model 523DR - Electronic Test Equipment -						

## ELECTRONIC FREQUENCY METER FR-21/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose equipment used to measure the frequency of an alternating voltage of any source in the sonic and supersonic ranges. The instrument, utilizing auxiliary equipment, can be used to measure the frequency difference between two RF signals and as a tachometer to measure the speed and rate of vibration of rotating machinery. Measurements are indicated directly on a calibrated meter.

### RELATIONSHIP TO OTHER EQUIPMENT:

A 1-milliamp Esterline-Angus Automatic Recorder is used in conjunction with the FR-21/U for a continuous frequency record. The FR-21/U is the military designation for Hewlett-Packard 500A.

### ELECTROMECHANICAL DESCRIPTION:

Circuit Information: The frequency meter consists of a wide-band amplifier with a limiting circuit, an electronic switch, a constant current supply, a frequency-

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.:		USN
F.I.L.N.:	FUNCTIONAL CLASS. NO.:		2.4.1
- Electronics Test Equipment -			FR-21/U

## ELECTRONIC FREQUENCY METER FR-21/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

discriminating circuit, and an output meter and rectifier. The input signal is amplified and used to switch the constant current to alternate load resistors. The voltage developed across the resistors is applied to a condenser, and the output meter indicates the average value of the rectified charging current. The meter reading is proportional to the number of pulses per second and hence proportional to the frequency of the input signal.

Power Supply: 115 or 230 volts  $\pm 10\%$ , 50 to 60 cycles per second, 65 watts.

Frequency Range: 10 cycles per second to 50 kilocycles per second in 10 ranges.

Input Impedance: 300,000 ohms.

Input Voltage Range: 0.5 to 200 volts.

Accuracy:  $\pm 2\%$  of full scale;  $\pm 1\%$  for line voltage variation of  $\pm 10\%$ .

### MANUFACTURERS' OR CONTRACTORS' DATA:

Hewlett-Packard Company, Palo Alto, California, Contract No. NObsr-40780, approximate unit cost, \$210.00

### TUBE COMPLEMENT:

NI

### REFERENCE DATA AND LITERATURE:

Manufacturer's Catalog.

### EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Electronic Frequency Meter FR-21/U	metal		19	8-3/4	12	20

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Electronic Frequency Meter FR-21/U					35

FR-21/U - Electronic Test Equipment -

FREQUENCY COUNTER FR-65/TSM-9



**FUNCTIONAL DESCRIPTION:**

A general purpose equipment used for high-speed frequency measurements. The instrument is used to measure transmitter and oscillator frequency, to calibrate audio oscillators, to establish frequencies for determining filter characteristics, to monitor frequency drift, to read random events per unit time, and to serve as a frequency standard. Frequencies up to 8 places can be indicated. The first 6 places are indicated on neon bank lamps and the last 2 places are indicated by means of meters. Events occurring in periods up to 8 places can be measured.

**RELATIONSHIP TO OTHER EQUIPMENT:**

The Frequency Counter FR-65/TSM-9 is the service designation for Hewlett-Packard 524A. The Hewlett-Packard 520A is built into and is a part of FR-65/TSM-9.

**ELECTROMECHANICAL DESCRIPTION:**

Circuit Information: The frequency counter operates on pulse-counting techniques.

The unknown frequency is applied through a wide-band squaring amplifier to a

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.:		USN
F. I. L. N.:	FUNCTIONAL CLASS. NO.: 2.4.1		
- Electronics Test Equipment -			FR-65/TSM-9

## FREQUENCY COUNTER FR-65/TSM-9

### ELECTROMECHANICAL DESCRIPTION: (Continued)

gate controlled by a time-base generator. When the gate is open, the unknown frequency is applied directly to the counting circuits. When the gate is closed, the counting circuits automatically display the counted frequency in cycles per second or the period in microseconds. Time base circuits are controlled by a crystal oscillator. Direct counting is used for high frequencies and period measurement is used for low frequencies. When the equipment is set for high-frequency counting, the unknown frequency is measured during exact time intervals. When set for low-frequency period measurement, the equipment measures the duration of one low-frequency cycle in microseconds. In this measurement, a 10 cycles per second frequency sample is taken to determine the period.

Power Supply: 115 volts  $\pm 10\%$ , 50 to 60 cycles per second, 400 watts.

Frequency Range: 0.1 cycles per second to 10 megacycles per second.

Counting Rate: 10 megacycles per second maximum.

Count Period: 0.001, 0.01, 0.1, 1, and 10 seconds.

Accuracy:  $\pm 1$  count  $\pm 2$  pulses per minute per week.

Period Measurement: Within 0.03% up to 300 cycles per second, within 1 microsecond between 300 cycles per second and 10 kilocycles per second.

External 100 Kilocycles Per Second Standard Input: 1 volt across 1 megohm shunted by 30 micromicrofarads required for higher accuracy.

Input Voltage: 2 volts, peak, minimum.

Input Impedance: Approximately 100,000 ohms shunted by 30 micromicrofarads.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Hewlett-Packard Company, Palo Alto, California, approximate unit cost, \$2000.00.

### TUBE COMPLEMENT:

NI

### REFERENCE DATA AND LITERATURE:

Manufacturer's Catalog 21-A.

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Counter FR-65/TSM-9					260
FR-65/TSM-9 - Electronic Test Equipment -						





**PULSE TESTER TS-598/U**  
**(ANALYZER, ELECTRICAL PULSE, TS-598/U)**



**FUNCTIONAL DESCRIPTION:**

A general purpose, portable, field maintenance, relay test set used to measure the pulse repetition frequency (speed) and the duty cycle (per cent make) of pulses arriving in either a continuous series or a short series of five or more pulses. Input pulses drive a relay which repeats to a meter network to give the proper readings. Provision is made to measure battery, ground or loop pulses. A meter is used to give the proper indication.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Used to test prime equipments such as Radio Receiving Set AN/ARW-40 and Radio Transmitting Set AN/ARW-41.

**ELECTROMECHANICAL DESCRIPTION:**

Power Supply: 26 volts DC,  $\pm 6$  volts. Power consumption approximately 0.5 watts. Pulse Recurrence Frequency Range: 0 to 15 pulses per second.

(Continued)

	AIR FORCE	NAVY	ARMY
<b>TYPE CLASS.</b>	Limited Standard		
<b>STOCK NOS.</b>	7CAC-801319-42		
<b>PROCUREMENT INFO.:</b> USAF Spec. No. MIL-P-5177, Dwg. No. 1061			
<b>PROCUREMENT COG.:</b> USAF		<b>DESIGN COG.:</b> USAF, ARL	
<b>F.I.I.N.:</b>		<b>FUNCTIONAL CLASS. NO.:</b> 2.4.1	
- Electronics Test Equipment -			TS-598/U

**PULSE TESTER TS-598/U**  
**(ANALYZER, ELECTRICAL PULSE, TS-598/U)**

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

"Per Cent Make": 10 to 90%.

Accuracy: Pulse Repetition Frequency:  $\pm 5\%$ .

"Per Cent Make":  $\pm 5\%$ .

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Automatic Electric Company, 1033 Van Buren Street, Chicago, Illinois; Order No. 1211-DAY-45-SF; Approximate Cost per Unit, \$300.00.

**TUBE COMPLEMENT:**

None.

**REFERENCE DATA AND LITERATURE:**

AN 16-35TS598-2 (Operation and Maintenance Instructions).

TO 16-35TS598-4 (Parts Catalog).

AN 16-35TS598-11 (Operating Instructions).

AN 16-35TS598-12 (Service Instructions).

AN 16-35TS598-13 (Overhaul Instructions).

AN 16-35TS598-14 (Parts Breakdown).

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Pulse Tester TS-598/U (Complete)	Alum- inum	7CAC-801319-42	6	11-1/2	6	7.0

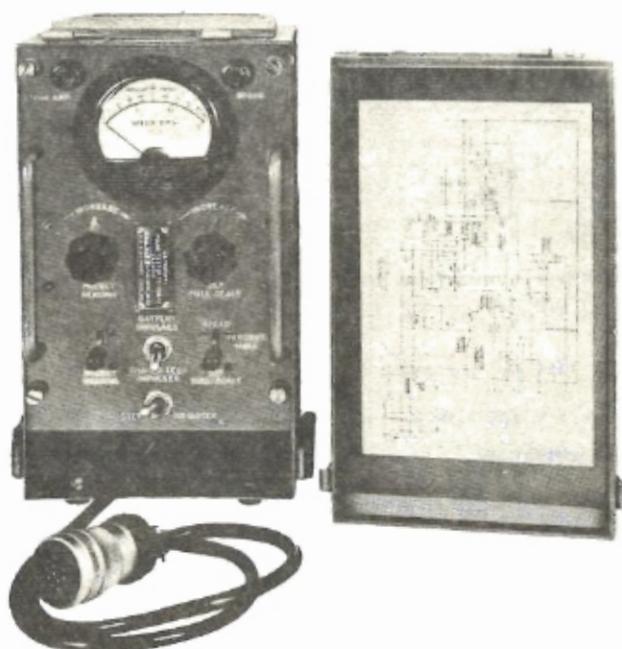
**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

TS-598/U

- Electronics Test Equipment -

PULSE TESTER TS-598A/U  
(ANALYZER, ELECTRICAL PULSE, TS-598A/U)



**FUNCTIONAL DESCRIPTION:**

A special purpose portable field maintenance test set used to measure the pulse repetition frequency (speed) and the duty cycle (percent make) of pulses arriving in either a continuous series or a short series of five or more pulses. Battery, ground, and loop pulses can be measured.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Similar to TS-598/U except for circuitry differences.

**ELECTROMECHANICAL DESCRIPTION:**

**Circuit Information:** The input pulses drive a relay which repeats pulses to a meter network. The milliammeter gives a direct indication of the characteristics of the incoming pulses. To measure a short burst of 5 or 10 pulses, provision is made so that the meter can be preset to the approximate rate at which the pulses will occur.

**Power Supply:** 26 volts  $\pm$ 4 volts, DC. Power consumption is approximately 0.5 watt.

**Pulse Repetition Frequency:**

Scale Calibration: 0 to 15 pulses per second.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-038385		
PROCUREMENT INFO.: Spec. MIL-P-5177			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, WADC, ARL	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.4.1	
- Electronics Test Equipment -			TS-598A/U

**PULSE TESTER TS-598A/U**  
**(ANALYZER, ELECTRICAL PULSE, TS-598A/U)**

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

Normal Operating Range: 8 to 12 pulses per second.

**"Percent Make":**

Scale Calibration: 0% to 100%.

Normal Operating Range: 30% to 70%.

**Accuracy:**

Pulse Repetition Frequency:  $\pm 5\%$  (8 to 12 pulses per second).

"Percent Make":  $\pm 5\%$  (30% to 70% make scale).

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Elk Electronic Laboratories Inc., 333 West 52nd Street, New York 19, New York; USAF Contract No. AF 33(600)5236, dated 4 August 1951; Approximate Cost per Unit, \$263.00.

**TUBE COMPLEMENT:**

None.

**REFERENCE DATA AND LITERATURE:**

TO 33A1-10-21-11 (Operation and Service Instructions).

TO 33A1-10-21-24 (Parts Breakdown).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Pulse Tester TS-598A/U (Complete)	Aluminum	7CAC-038385	6	11-1/2	6	7

TS-598A/U

- Electronics Test Equipment -

VIDEO PULSE COUNTER  
CAA MODEL NO. CA-2523  
(El Tronics Inc.)



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, test instrument used for indicating average repetition rate of pulses varying in shape and amplitude and occurring at random intervals. The meter is calibrated in pulses per second. The instrument is designed for standard rack mounting.

**RELATIONSHIP TO OTHER EQUIPMENT:**

**ELECTROMECHANICAL DESCRIPTION:**

**Circuit Information:** The pulses are shaped by a voltage divider circuit and a clipper, then amplified and fed into two scaling stages which reduce the count to 1/4 the input rate. The output of the scaling circuit is coupled to a diode step counter whose positive output voltage is proportional to the input frequency. This output voltage is fed to the input of a vacuum tube voltmeter circuit that gives an indication proportional to the voltage from the counter and thus proportional to the frequency.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.: Commercial		
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.4.1		
- Electronics Test Equipment - El Tronics CA-2523			

VIDEO PULSE COUNTER  
CAA MODEL NO. CA-2523  
(El Tronics Inc.)

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

A calibrating circuit is included in the counter employing the power line frequency as a standard. The power supply provides relatively constant plate, bias and filament voltage due to the voltage regulating transformer that is incorporated in the circuit. Selenium rectifiers are used in the power supply. Input signals are fed through a BNC coaxial receptacle.

**Power Supply:** 115 volts or 230 volts, AC, 60 cycles per second, single phase, 50 volt-amperes.

**Frequency Range:** Pulse Repetition Rate Range: 0 to 30,000 pulses per second in 7 ranges. 0 to 30, 0 to 100, 0 to 300, 0 to 1000, 0 to 3000, 0 to 10,000, and 0 to 30,000 pulses per second (switch controlled).

**Input Impedance:** 47,000 ohms.

**Sensitivity:** +3 volts to +300 volts and -3 volts to -300 volts.

**Minimum Signal Necessary to Trigger Counter:** 0.4 volts.

**Minimum Pulse Spacing:** 4 microseconds.

**Voltage Divider:** Reduces input signal by 0.1 (to prevent triggering of the counter by spurious responses).

**Counting Accuracy:**  $\pm 5\%$  above 3/10 full scale deflection.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

El Tronics Inc., 2647 North Howard Street, Philadelphia 33, Pennsylvania; Approximate Cost per Unit, \$507.00 in lots of 25, \$681.00 in lots of 10, \$983.00 in lots of 5. Specification: CAA-R-969.

**TUBE COMPLEMENT:**

6 JAN-6AG5, 1 JAN-6H6, 1 JAN-6SN7GT, 1 JAN-OA2, 1 JAN-991, 1-NE16 Glow Lamp.

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Instruction Book.

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Video Pulse Counter CAA Model No. CA-2523 (Domestic Packed) (Export Packed)					48 56
El Tronics CA-2523 - Electronics Test Equipment -						

VIDEO PULSE COUNTER  
 CAA MODEL NO. CA-2523  
 (El Tronics Inc.)

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Video Pulse Counter CAA Model No. CA-2523			5-1/4	19	13	35
- Electronics Test Equipment - El Tronics CA-2523							



## ANTENNA TEST SET AN/UPM-34



### FUNCTIONAL DESCRIPTION:

A portable test instrument used in test flight operations for the determination of the antenna constant over a known distance. The test set is designed to count the cycles of a sine or square wave input signal by means of a mechanical counter. A remote "Start-Stop" switch permits the starting and stopping of the counting process. Results can be used to adjust the ground speed voltage slope by means of a calibrated potentiometer.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** The test set contains a frequency divider circuit and a pulse shaping circuit. The frequency divider circuit consists of four stages, each of which reduces the input frequency by a factor of 2. Thus the frequency is cut down in a 16 to 1 ratio. Feedback is utilized to reduce the frequency division from a factor of 16 to 15. The pulse shaping circuit actuates the mechanical counter which registers one digit for every fifteen input pulses.

**Power Supply:** 115 volts  $\pm$  10%, AC, 50 to 1000 cycles per second, single-phase, 80 watts minimum.

**Frequency Range:** 25 to 300 cycles per second.

**Type of Reception:** Will accept a sine wave or pulse signal of 30 to 300 millivolts

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Tentative Standard		
STOCK NOS.	7CAC-801318-484		
PROCUREMENT INFO.:			
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, WADC, C&N	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.4.2	
- Electronics Test Equipment -			AN/UPM-34

**ANTENNA TEST SET AN/UPM-34**

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

at 25 to 300 cycles per second.

Counter Calibration: 1 to 99,999 cycles.

Accuracy: 0.01%.

Operating Temperature: -40°C (-40°F) to +55°C (+131°F).

Amplitude: 30 millivolts rms minimum to 300 millivolts rms maximum.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

General Precision Laboratory, Inc., 63 Bedford Road, Pleasantville, New York;  
Development Contract W 33(038)-ac-14192; Production Contract AF 33(604)5821;  
Approximate Cost per Unit, \$ 1150.00.

**TUBE COMPLEMENT:**

6 JAN-5751WA, 1 JAN-5814WA, 1 JAN-6AU6WA, 1 JAN-5R4WGY, 1 JAN-6XW4,  
1 JAN-5651, 2 JAN-6005, 1 JAN-6080.

**REFERENCE DATA AND LITERATURE:**

TO 33AA20-2-1 (Operation Instructions).

TO 33AA20-2-2 (Service Instructions).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

**EQUIPMENT SUPPLIED:**

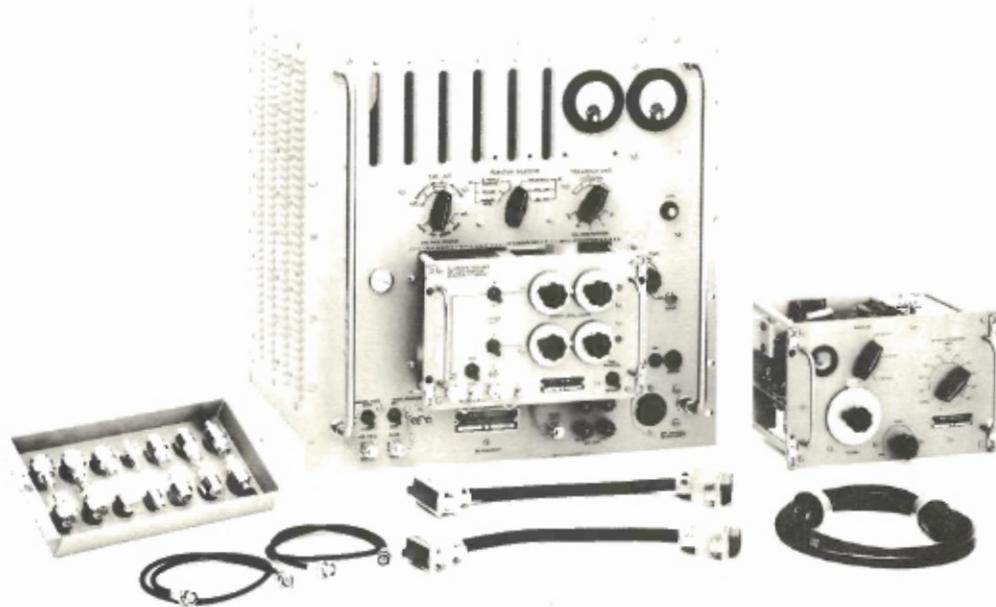
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Antenna Test Set AN/UPM-34		7CAC-801318-484	10	18-1/2	15	41
	Including:						
1	Test Set, Antenna TS-791/UPM-34			8	16-5/8	11	24-1/2
1	Cable, Special Purpose, Electrical CX-2362/UPM-34			120 long			1

(Continued)





## FREQUENCY METER AN/USM-26



### FUNCTIONAL DESCRIPTION:

A general purpose instrument used for frequency and time interval measurements. It is used for measuring transmitter oscillator and crystal frequencies, electronic, electrical and mechanical time interval, pulse length and repetition rates, frequency ratios and frequency drifts.

### RELATIONSHIP TO OTHER EQUIPMENT:

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** The counting circuit consists of a signal gate, a time base section, a gate section and the counters. Frequencies to be measured are supplied through the signal gate to the counters. When the signal gate is open, cycles are passed on to the counter circuits. When the gate is closed, the counters display the counted value. The signal gate is operated by the time base section which is the frequency standard for the equipment. The gate section opens and closes the signal gate and also controls the display time and resets the counter to zero. Time interval measurements are made by reversing the above process and counting the cycles of the crystal oscillator output which occurs during the unknown

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Tentative Standard		
STOCK NOS.	7CAC-318200	F16-Q-123650-200	
PROCUREMENT INFO.:	Spec. MIL-F-7847 (Aer), dated 15 December 1951		
PROCUREMENT COG.:	USN	DESIGN COG.: USN, BuAer	
F.I.I.N.:	FUNCTIONAL CLASS. NO.:		2.4.2
- Electronics Test Equipment -			AN/USM-26

## FREQUENCY METER AN/USM-26

### ELECTROMECHANICAL DESCRIPTION: (Continued)

time interval. Measurements are displayed on six decade indicators calibrated in kilocycles, microseconds, milliseconds or seconds, according to control setting.

Power Supply: 115 volts,  $\pm 11.5$  volts, AC, 50 to 1000 cycles per second, single-phase.

Frequency Range: 10 cycles per second to 100 megacycles per second.

Type of Reception: Continuous Wave, Pulsed.

Time Interval Range: 1.0 microsecond to 10,000,000 seconds.

Input Impedance: 1.0 megohm shunted by 40 micromicrofarads.

Input Signal Requirements:

Frequency Count Measurements:

\ Sine Waves:

Frequency	Minimum Amplitude
1.0 cycle per second to 1.0 megacycle per second	0.2 volt rms
1.0 megacycle per second to 2.0 megacycles per second	0.3 volt rms
2.0 megacycles per second to 4.0 megacycles per second	0.5 volt rms
4.0 megacycles per second to 8.0 megacycles per second	0.8 volt rms
8.0 megacycles per second to 10 megacycles per second	1.0 volt rms

Pulses: Capable of counting 0.1 microsecond pulses with an amplitude of 2.0 volts and repetition period of 0.2 microsecond or greater.

Accuracy:

Frequency Measurements:

Frequency Range:	Maximum Error
1.0 to 3000 cycles per second	$\pm 0.03\%$
3000 cycles per second to 10 megacycles per second	$\pm 0.001\%$

Timer Interval Measurements:  $\pm 0.00\%$

### MANUFACTURERS' OR CONTRACTORS' DATA:

Hewlett-Packard Company, Palo Alto, California; Navy Contract No. NOas52-1095-r, dated 25 November 1953; Contract No. N383s-1966A, dated 28 April 1954; Contract No. NOas54-901, 25 June 1954.

### TUBE COMPLEMENT:

1 JAN-OB2WA, 1 JAN-5Y3WGTA, 3 JAN-5R4WGA, 7 JAN-6AH6, 6 JAN-6AU6WA, 5 JAN-6CB6, 3 JAN-12AT7WA, 2 JAN-5654/6AK5W, 1 JAN-5687, 7 JAN-5725/-6AS6W, 2 JAN-5727/2D21W, 3 JAN-5726/6AL5W, 1 JAN-5844, 38 JAN-5963, 2 JAN-6005/6AQ5W, 2 JAN-6080WA, 63 G-11A Crystal diodes.

### REFERENCE DATA AND LITERATURE:

AN16-30USM26-1 (Operating Instructions).

AN16-30USM26-2 (Service Instructions).

AN16-30USM26-3 (Overhaul Instructions).

AN16-30USM26-4 (Illustrated Parts Breakdown).

FREQUENCY METER AN/USM-26

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	FR-38A/U and Accessories except MX-1636/U	13	26-3/4	30-1/4	29	270
2	MX-1637/U and MX-1636/U	2	12-1/4	15-1/4	11	20

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter AN/USM-26		7CAC-318200 F16-Q-123650-200				
	Including:						
1	Frequency Meter FR-38A/U	Aluminum		19-7/32	19	18-5/8	109
1	Frequency Converter Unit MX-1637/U	Aluminum		6-3/8	10	6-1/8	5
1	Time Interval Unit MX-1636/U	Aluminum		6-3/8	10	6-1/8	4
1	Transit Case CY-1424/USM-26	Aluminum		22-1/2	23-3/4	23-1/4	41
1	Transit Case CY-1563/USM-26	Aluminum		8-1/8	12	7-7/8	5
1	Power Cable CX-337/U			72			0.6
2	Video Cord CG-530/U			48			0.2

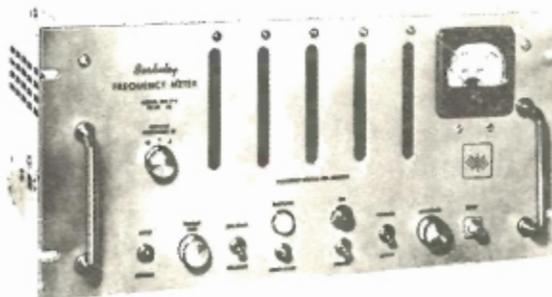
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FREQUENCY METER AN/USM-26

EQUIPMENT SUPPLIED: (Continued)

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Test Cable CX-2927/USM- 26			13-1/2			0.4
1	Test Cable CX-2928/USM- 26			13-1/2			0.3
2	Connector Adapter UG-201A/U			1-5/16	25/32		0.1
2	Connector Adapter UG-255/U			1-11/32	5/8		0.1
2	Connector Adapter UG-273/U			1-5/16	23/32		0.1
2	Connector Adapter UG-282/U			2-1/8	5/8		0.1
2	Connector Adapter UG-349/U			1-9/16	19/32		0.1
2	Connector Adapter UG-914/U			1-9/32	7/16		0.03
2	Connector Adapter UG-1034/U			1-1/2	25/32		0.1
AN/USM-26 - Electronics Test Equipment -							

## FREQUENCY METER FR-67/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, high speed electronic counter combined with an accurate time base to provide an instrument that will automatically count and display the number of events that occur during a precise time interval. These events may be any mechanical, electrical, or optical occurrences that can be converted into charging voltages. These events can occur either regularly or with random distribution. This meter may be used as a precision electronic tachometer, a secondary frequency standard when used with an oscillator, a device for the rapid determination and direct reading of unknown signal frequencies, a calibrator and recorder of FM telemetering systems, or simply as a multi-purpose general laboratory instrument. It is suitable for use by relatively untrained technical personnel.

This instrument is direct reading. Results are presented directly in digital form. Operation may be automatic or manual. On automatic operation, the instrument switches automatically from counting to display and recycles continuously. Display time is adjustable. On manual operation, single readings may be taken manually

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-NL47493-7121		
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, SSL
F.I.I.N.:		FUNCTIONAL CLASS. NO.:	2.4.2
- Electronics Test Equipment -			FR-67/U

## FREQUENCY METER FR-67/U

### FUNCTIONAL DESCRIPTION: (Continued)

or by remote control. In this case, results are displayed until the "reset-start" button is pressed to obtain another reading.

Provision is made for mounting in a standard 19-inch relay rack.

### RELATIONSHIP TO OTHER EQUIPMENT:

This meter is similar to Berkeley Scientific Corp., Model 554, Modification B, Events-Per-Unit-Time Meter.

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** Circuitry consists of an input amplifier circuit, an electronic gate which is opened and closed by a crystal controlled time base, and a series of electronic decade counting units.

**Power Supply:** 105 to 130 volts, AC, 50 to 60 cycles per second, single phase, 175 watts.

**Counting Rate Range:** 20 to 100,000 events per second.

**Time Base Fundamental Crystal Frequency:** 100 kilocycles per second.

**Input Requirements:** Any wave shape, amplitude 0.2 to 20 volts rms. Input terminals connect through 0.05 microfarad capacitor to 250,000 ohm grid resistor.

Maximum DC voltage input is 600 volts. Maximum AC voltage input is 50 volts.

**Maximum Sensitivity:** 0.2 volts, rms.

**Display Time:** Continuously variable one to five seconds.

**Time Base:** 0.1, 1.0, and 10 seconds.

**Accessory Socket Connections:** +310 volts, DC, unregulated; 6.3 volts, AC. Contacts available for remote start. Direct connection made to input amplifier. (250,000 ohm grid resistor).

**Accuracy:**  $\pm 1$  event.

**Stability:** Standard crystal better than 5 parts in 100,000. Short term, 1 part in 100,000.

### MANUFACTURERS' OR CONTRACTORS' DATA:

Berkeley Scientific Corp., Richmond, California; Approximate Cost per Unit, \$950.00.

### TUBE COMPLEMENT:

2 JAN-6AU6, 12 JAN-12AU7, 2 JAN-6AS6, 1 JAN-12BH7, 1 JAN-5U4G, 1 JAN-6Y6G, 1 JAN-OB2, 1 JAN-CR-42/U (Crystal Oscillator).

### REFERENCE DATA AND LITERATURE:

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
FR-67/U	- Electronics Test Equipment -					

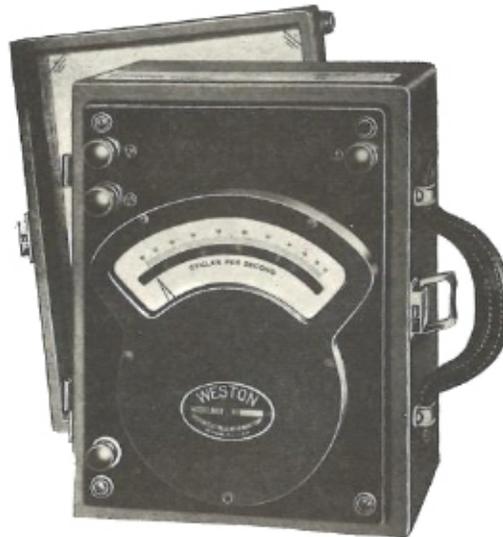




## 2.5 FREQUENCY INDICATORS



## FREQUENCY METER FR-40/GSM-1



### FUNCTIONAL DESCRIPTION:

A portable, general purpose, test instrument used in calibrating and testing the performance of power line frequency meters. May also be used to check the frequency of an AC power source. Indication is on a dial calibrated in cycles per second.

### RELATIONSHIP TO OTHER EQUIPMENT:

Similar to Weston Model 339 Frequency Meter.

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** This equipment is a crossed-coil, ironvane, ratiotype meter. The pointer is attached to a soft iron core which is mounted on a shaft with no control spring or other zeroing mechanism. The relative strengths of the magnetic fields of the two coils are determined by the reactor-capacitor combination.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	1690-326241735		3F2789-6
PROCUREMENT INFO.:	Army Spec. NO. 71-1689		
PROCUREMENT COG.:	Army	DESIGN COG.: Army, CSL	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.5.1		
	- Electronics Test Equipment -		FR-40/GSM-1

## FREQUENCY METER FR-40/GSM-1

### ELECTROMECHANICAL DESCRIPTION: (Continued)

When the frequency increases, the current through one coil decreases and increases in the other. This causes a shifting in the direction of the resultant magnetic field and causes the pointer to move to the right of the scale. The opposite effect occurs when the frequency is decreased.

Power Supply: 115 volts,  $\pm 15$  volts, AC, 50 to 70 cycles per second, single phase.

Frequency Range: 50 to 70 cycles per second.

Type of Reception: Continuous Wave.

Scale: 5-1/4 inches.

Scale Divisions: 100.

Accuracy:  $\pm 0.5\%$ .

### MANUFACTURERS' OR CONTRACTORS' DATA:

Weston Electrical Instrument Corporation, Newark 5, New Jersey; Approximate Cost per Unit, \$435.00.

### TUBE COMPLEMENT:

None.

### REFERENCE DATA AND LITERATURE:

TM 11-2535B. (Instruction Book).

### EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter FR-40/GSM-1	Wood	1690-326241735 3F2789-6	8-3/16	10-7/16	8-1/4	23

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
FR-40/GSM-1 - Electronics Test Equipment -						

## SIGNAL COMPARATOR AN/UPM-36



### FUNCTIONAL DESCRIPTION:

A portable special purpose equipment used to compare the frequencies of incoming signals on two input lines; one is a reference line, and the other is a comparison line. Frequency relations are indicated by the rotation rate of a break in a ring-shaped pattern on the face of a cathode ray tube. A stationary pattern indicates that both frequencies are identical; any difference between the two is indicated by the fact that the break rotates in either a clockwise or counterclockwise direction depending upon whether the comparison line is at a higher or lower frequency than the reference line. Sense and magnitude of the difference in frequencies can be determined.

### RELATIONSHIP TO OTHER EQUIPMENT:

Used to test Radar Set AN/APN-81 ( ).

### ELECTROMECHANICAL DESCRIPTION:

**Circuit Information:** A crystal controlled oscillator produces a fundamental frequency of 128 KC. Two frequency divider circuits divide this signal; the first, to either 8 KC or 4 KC; the second divides the output of the first, either 8 KC or 4 KC, by 54.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Tentative Standard		
STOCK NOS.	7CAG-210585		
PROCUREMENT INFO.: MIL-C-4689			
PROCUREMENT COG.: USAF		DESIGN COG.: USAF, WADC, C&N	
F.I.I.N.:		FUNCTIONAL CLASS. NO.: 2.5.2	
- Electronics Test Equipment -			AN/UPM-36

SIGNAL COMPARATOR AN/UPM-36

MANUFACTURERS' OR CONTRACTORS' DATA:

General Precision Laboratory, Incorporated, 63 Bedford Road, Pleasantville, New York; Contract AF 33(604)5821, 27 April 1953; Approximate Cost per Unit, \$1066.39.

REFERENCE DATA AND LITERATURE:

- TO 33A1-8-9-1 (Operating Instructions).
- TO 33A1-8-9-2 (Service Instructions).
- TO 33A1-8-9-4 (Illustrated Parts Breakdown).

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Signal Comparator AN/UPM-36	4.9	16-1/2	20-3/4	24-3/4	73

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Signal Comparator AN/UPM-36		7CAC-210585				
	Including:						
1	Signal Comparator CM-56/UPM-36			7-15/16	16-5/8	13-1/8	26
1	Case			10	18-1/2	12-1/2	11
1	Cover			9-1/4	17-1/4	3-5/8	6
(Continued)							
- Electronics Test Equipment -							AN/UPM-36

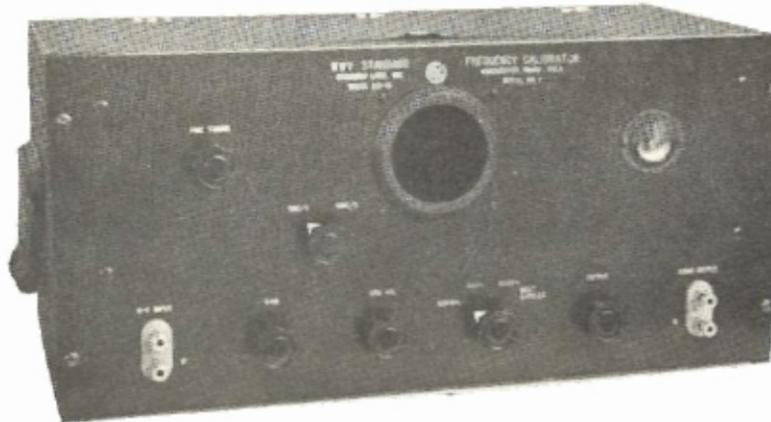
SIGNAL COMPARATOR AN/UPM-36

EQUIPMENT SUPPLIED: (Continued)

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Special Purpose Electrical Cable Assembly CX-2365/UPM-36			240 long			4
1	Special Purpose Electrical Cable Assembly CX-2366/UPM-36			120 long			2
1	Power Cord CX-337/U			72 long			0.5



**CALIBRATOR SET  
 WWV FREQUENCY CALIBRATOR  
 MODEL NO. RH-10, 5, and 10 MCS  
 (Browning Laboratories, Inc.)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose, test instrument designed for receiving transmissions from Radio Station WWV and employing these as primary frequency standards for the frequency calibration of radio sets. The zero beat method is used with a speaker making the beat note audible when zero beat is approached. A cathode ray indicator is employed for the final determination of zero beat.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Used to test Radio Sets AN/APN-84 and AN/CPN-2A.

**ELECTROMECHANICAL DESCRIPTION:**

Circuit Information: Consists of a high "Q" antenna transformer, a tuned radio frequency amplifier, converter, oscillator, two IF stages, detector, selective amplifier, output stages and a cathode ray zero beat indicator.

Power Supply: 115 volts  $\pm 10\%$ , AC, 85 volt amperes input.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.: Commercial		
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.5.2		
	- Electronics Test Equipment -		Model RH-10

**CALIBRATOR SET  
 WWV FREQUENCY CALIBRATOR  
 MODEL NO. RH-10, 5, and 10 MCS  
 (Browning Laboratories, Inc.)**

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

Frequency Range: 5 and 10 megacycles per second (standard radio frequencies received from Radio Station WWV).

Internally Modulated Frequencies: 440 and 4000 cycles (used as primary standards for calibrating audio frequencies).

Sensitivity: Better than 1/2 microvolt on any band.

Selectivity: 10 decibels down at 5 kilocycles off resonance.

Rejection Ratio: More than 50 decibels.

Output Voltage: 0 to 5 volts, adjustable.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Browning Laboratories Inc., Winchester, Massachusetts; Approximate Cost per Unit, \$250.00.

**TUBE COMPLEMENT:**

1 RTMA-6SJ7, 3 RTMA-6SK7, 1 RTMA-6SA7, 1 RTMA-6SN7, 1 RTMA-6J5, 1 RTMA-6SQ7, 1 RTMA-0D3, 1 RTMA-5Y3, 1 RTMA-6U5.

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Circular No. 6415

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Calibrator Set Model RH-10			9	19	11	30

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

Model RH-10 - Electronics Test Equipment -

2.6 ELECTROMECHANICAL FREQUENCY METERS



## FREQUENCY METER TS-328/U



### FUNCTIONAL DESCRIPTION:

A general purpose, portable, vibrating reed type frequency meter consisting of nine vibrating reeds used to check the pulse repetition frequency of radar systems. Dial is marked from 380 to 420 cycles per second indicated in 5 cycle increments. Two jacks are provided for connection to meter binding posts.

### RELATIONSHIP TO OTHER EQUIPMENT:

Similar to J. B. T. Instrument Company Model No. 33FX or 33F. Same as Navy Type 22451.

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Meter Rating: 70 ohms per volt at 400 cycles per second.

Frequency Range: 380 to 420 cycles per second, in 5 cycle increments.

Input Voltage: 100 to 130 volts AC, single phase.

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.	Standard		
STOCK NOS.	7CAC-526165	F17-M-25103-7706	3F4325-328
PROCUREMENT INFO.:	Navy Spec. No. KS-9868, Army Spec. No. 7525		
PROCUREMENT COG.:	Army	DESIGN COG.:	
F.I.I.N.:	FUNCTIONAL CLASS. NO.:		
	- Electronics Test Equipment -		TS-328/U

FREQUENCY METER TS-328/U

ELECTROMECHANICAL DESCRIPTION: (Continued)

Power Input: 1.75 watts.

Accuracy:  $\pm 0.3\%$ .

MANUFACTURERS' OR CONTRACTORS' DATA:

J. B. T. Instrument Company, 441 Chapel Street, New Haven 8, Connecticut;  
 Model No. 33Fp; Contract No. NXsr-38866; Approximate Cost per Unit, \$32.50  
 Western Electric Drawing No. BL-105975.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

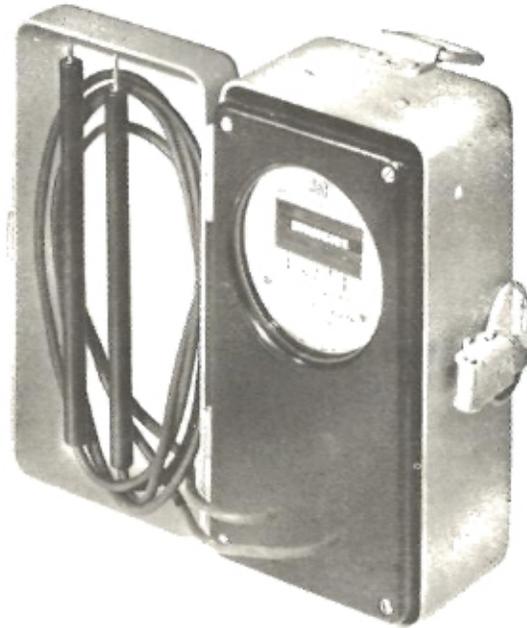
EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-328/U Including:	Bake-lite	7CAC-526165 3F4325-328	5-13/16	3-1/16	2-33/64	0.75
1	Case (J. B. T. Instrument Co. No. CA-15)	Leather		6-1/4	4-3/4	3-1/4	0.25
2	Test Lead			48 long			

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter, TS-328/U in Leather Case, Including Test Probes. (Overseas Packed, MFP, VPP)	0.37	7-1/2	7-3/4	11	4
TS-328/U - Electronics Test Equipment -						

## FREQUENCY METER TS-328A/U



### FUNCTIONAL DESCRIPTION:

A general purpose, portable, vibrating reed type frequency meter consisting of nine vibrating reeds for checking 400 cycle power sources. The frequency of the line voltage is indicated by that reed which vibrates with maximum amplitude. If two reeds vibrate with equal amplitude, the line frequency is midway between that of the two reeds. If the meter shows no indication, the line frequency is not in the range of the instrument.

### RELATIONSHIP TO OTHER EQUIPMENT:

Similar to J. B. T. Instruments Model 33FX, Model 33F, or Model 33-FP-9M.  
 Similar to Navy Type 22451.

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 380 to 420 cycles per second. Dial marked in 5 cycle increments.  
 (Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAC-526165		3F4325-328A
PROCUREMENT INFO.:			
PROCUREMENT COG.:	Army	DESIGN COG.:	Army, SSL
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.6.1		
	- Electronics Test Equipment -		TS-328A/U

FREQUENCY METER TS-328A/U

ELECTROMECHANICAL DESCRIPTION: (Continued)

Voltage Range: 100 to 130 volts AC.

Meter Rating: 70 ohms per volt at 400 cycles per second.

Accuracy:  $\pm 0.3\%$  at 77° F., with sine wave input.

Temperature Coefficient: Approximately 0.000075 per degree F., inverse.

MANUFACTURERS' OR CONTRACTORS' DATA:

J. B. T. Instruments, Inc., 441 Chapel Street, New Haven 8, Connecticut, Model 33-FP-9M; Order No. 4615-Phila-52-04-NY; Approximate Cost per Unit, \$49.25, January 1953.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-328A/U Including:	Metal	7CAC-526165 3F4325-328A	6-3/8	4	3-9/32	1.75
2	Test Lead			48 long			

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Frequency Meter TS-328A/U (Export Packed)	0.37	11	7-3/4	7-1/2	4.75

TS-328A/U

- Electronics Test Equipment -

## FREQUENCY METER TS-328B/U



### FUNCTIONAL DESCRIPTION:

A portable, general purpose vibrating reed-type frequency meter for checking 400-cycle power sources. The meter dial displays nine reeds each tuned to particular frequency. The reed will vibrate when the line frequency is resonant to a reed frequency.

### RELATIONSHIP TO OTHER EQUIPMENT:

The TS-328B/U is similar to the TS-328A/U except for changes in components and in case dimensions. The TS-328A/U is similar to the TS-328/U except that the case of the A model is constructed of aluminum instead of bakelite and the meter has been changed from a square to a round style. The TS-328B/U has been replaced by Test Set, Electrical Power TS-934( )/U.

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None

Frequency Range: 380 to 420 cycles per second. Dial marked in 5-cycle increments.  
(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.:		USA, SCEL, SSL
F. I. I. N.:	FUNCTIONAL CLASS. NO.:		2.6.1
- Electronics Test Equipment -			TS-328B/U

## FREQUENCY METER TS-328B/U

### ELECTROMECHANICAL DESCRIPTION: (Continued)

Alternating Voltage Range: 100 to 130 volts.

Meter Rating: 70 ohms per volt at 400 cycles per second.

Accuracy:  $\pm 0.3\%$  at 77°F, with sine wave input.

Power Consumption: 1.75 watts.

Temperature Coefficient: Approximately 0.000075 per degree F, inverse.

### MANUFACTURERS' OR CONTRACTORS' DATA:

The Winslow Company, Newark, New Jersey, Contract No. 10971-PHILA-54-54.

### TUBE COMPLEMENT:

None

### REFERENCE DATA AND LITERATURE:

SC Form 567.

### EQUIPMENT SUPPLIED:

Quant. Per Eq't	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-328B/U	aluminum	7CAC-318208-648(USAF)	6-1/8	3-1/4	3-1/4	
1	Case						
2	Lead, Test			42" long			

### SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
	Frequency Meter TS-328B/U					

TS-328B/U - Electronic Test Equipment -

## FREQUENCY METER TS-494/U



### FUNCTIONAL DESCRIPTION:

A vibrating reed frequency meter capable of measuring the frequency of signal generators and oscillators within its frequency range. It contains two pin jacks on the panel to connect to the output of the frequency to be measured.

### RELATIONSHIP TO OTHER EQUIPMENT:

Part of Test Set, TS-364A/APX-15.

### ELECTROMECHANICAL DESCRIPTION:

Power Supply: None required.

Frequency Range: 49 to 51 cycles per second, calibrated in 1/2 cycle divisions.

Type of Reception: Continuous Wave.

Signal Input: 10 volts, AC.

Calibration Accuracy:  $\pm 0.5\%$ .

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:	Dwg. No. 061. AF Purchase Plan No. 45-5201.		
PROCUREMENT COG.:	USAF	DESIGN COG.: USAF, C&N	
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.6.1		
	- Electronics Test Equipment -		TS-494/U

FREQUENCY METER TS-494/U

MANUFACTURERS' OR CONTRACTORS' DATA:

James G. Biddle Company, Philadelphia 7, Pennsylvania.

TUBE COMPLEMENT:

None.

REFERENCE DATA AND LITERATURE:

CO-AN 16-30APX15-2-M (Maintenance Instructions for AN/APX-15).

EQUIPMENT SUPPLIED:

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Over-all Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter TS-494/U	Alum- inum		5	4-1/2	5-1/2	1.5
5	Spare Fuse						
1	Case	Alum- inum					

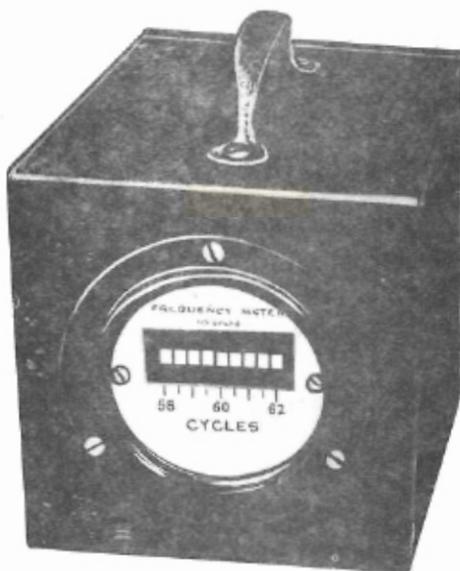
SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Over-all Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

TS-494/U

- Electronics Test Equipment -

**FREQUENCY METER  
FRAHM MF 9  
(Jas. G. Biddle Company)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose vibrating-reed type instrument for checking the frequency of a 60-cycle power source. The frequency of the line voltage is indicated by the reed which vibrates with maximum amplitude. If two reeds vibrate with equal amplitude the frequency is midway between that of the two reeds. If the meter shows no indication, the line voltage frequency is not within the range of the instrument.

**RELATIONSHIP TO OTHER EQUIPMENT:**

This instrument is similar to Frequency Meter TS-494/U except for frequency range.

**ELECTROMECHANICAL DESCRIPTION:**

**Circuit Information:** The circuitry of this instrument consists of a standard electromagnetic vibrator. Current from the line under test causes the armature to vibrate at a rate corresponding to the circuit frequency. This mechanical vibration is transmitted to the reed comb on which are mounted nine reeds calibrated

(Continued)

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.			
PROCUREMENT INFO.:			
PROCUREMENT COG.:			DESIGN COG. : Commercial
F. I. L. N.:			FUNCTIONAL CLASS. NO. : 2.6.1
- Electronics Test Equipment -			MF 9

FREQUENCY METER FRAHM MF 9

ELECTROMECHANICAL DESCRIPTION: (Continued)

for different values. This causes the reed which is tuned to the frequency of the armature vibration to vibrate in resonance and provide a meter indication.  
 Power Supply: None  
 Frequency Range: 58 to 62 cycles per second in increments of 0.5 cycles per second.  
 Alternating Voltage Range: 100 to 130 volts, single-phase.  
 Meter Rating: 100 ohms per volt at 60 cycles per second.  
 Reed Comb: Brass with nine reeds.  
 Accuracy:  $\pm 0.5\%$  of indicated frequency.

MANUFACTURERS' OR CONTRACTORS' DATA:

Jas. G. Biddle Company, Philadelphia, Pennsylvania.

TUBE COMPLEMENT:

NA

REFERENCE DATA AND LITERATURE:

Manufacturer's Catalog.

EQUIPMENT SUPPLIED:

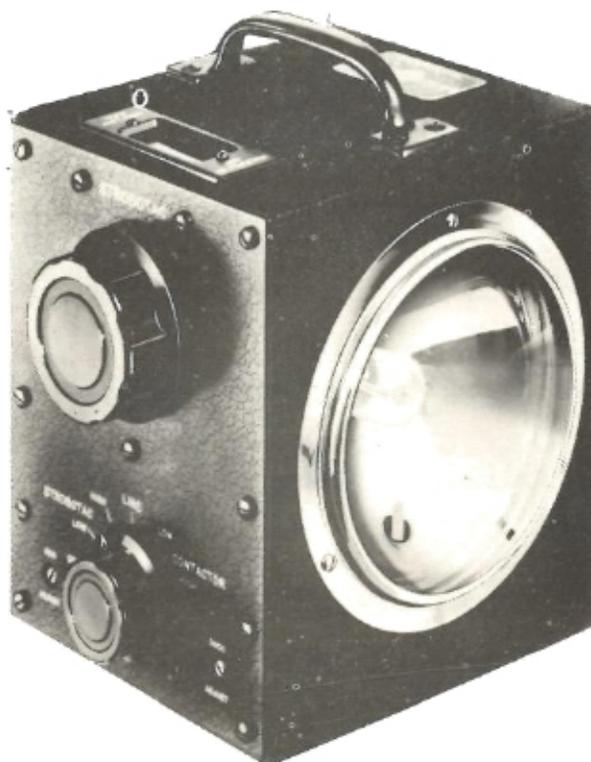
Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Frequency Meter Frahm MF 9	bake-lite		5	5	5	2
1	Extension Cord						

SHIPPING DATA:

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
	Frequency Meter Frahm MF 9					

MF 9 - Electronic Test Equipment -

**STROBOTAC  
MODEL NO. 631B  
(General Radio Company)**



**FUNCTIONAL DESCRIPTION:**

A portable, general purpose test equipment used for measuring the speed of rotating, reciprocating, or vibrating mechanisms by permitting them to be viewed intermittently under a flashing light at approximately the same revolutions per minute which produces the optical effect of a slowing down or stopping motion. It can be used for checking the calibration of tachometers or other similar applications. Calibrated to read speed directly in revolutions per minute.

**RELATIONSHIP TO OTHER EQUIPMENT:**

Used to test the A-4 Gun-Bomb-Rocket Sight, the MD-1 and the MA-2 Fire Control Systems, the type K-4 Computer Bomb Ballistics Data, the type S-4 Shoran Bombing Navigational System, the AN/APG-41, the AN/APA-57 and the AN/APG-32.

	AIR FORCE	NAVY	ARMY
TYPE CLASS.			
STOCK NOS.	7CAD-775000	CAG-60175	
PROCUREMENT INFO.:			
PROCUREMENT COG.:	DESIGN COG.: Commercial		
F.I.I.N.:	FUNCTIONAL CLASS. NO.: 2.6.2		
- Electronics Test Equipment - GR Model No. 631B			

**STROBOTAC**  
**MODEL NO. 631B**  
 (General Radio Company)

**ELECTROMECHANICAL DESCRIPTION:**

**Circuit Information:** The light source is a strobotron lamp mounted in a parabolic reflector. The frequency of a self-contained electronic pulse generator determines the flashing speed which is dial controlled. Speed can be controlled by the AC line frequency or by an external oscillator or switch type contactor. Speeds outside the scale range can be had by using multiples of the flashing speed.

**Power Supply:** 115 volts,  $\pm 10\%$ , AC, single phase, 60 cycles per second, 35 watts.  
**Range:** 600-14,400 revolutions per minute (fundamental) up to 100,000 revolutions per minute (with multiples).

**Duration of Flash:** Between 5 and 10 microseconds.

**Accuracy:**  $\pm 1\%$  when standardized by comparison with power-line frequency.

**MANUFACTURERS' OR CONTRACTORS' DATA:**

General Radio Company, Cambridge, Massachusetts; Approximate Cost per Unit, \$140.00, January 1953.

**TUBE COMPLEMENT:**

1 Strobotron Type 631-P1, 1 RETMA-6X5GT/G, 1 RETMA-6N7GT/G.

**REFERENCE DATA AND LITERATURE:**

Manufacturer's Catalog M, 1951.

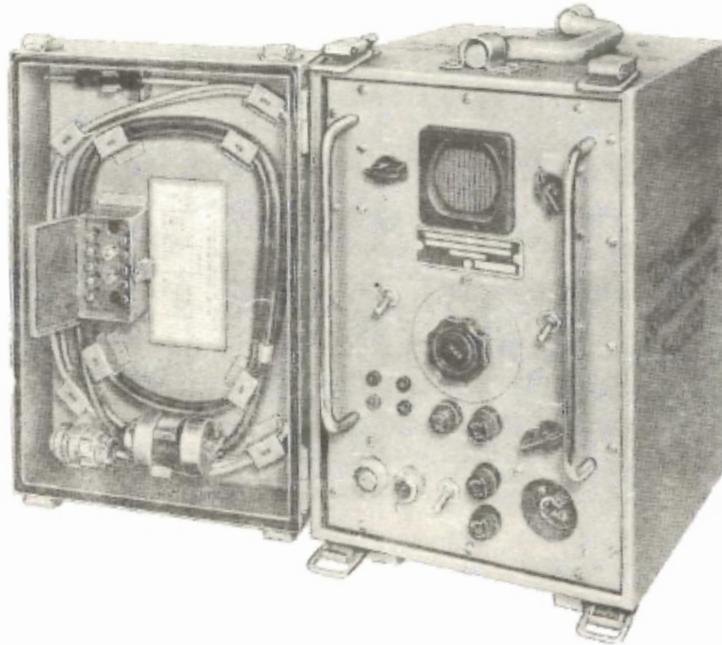
**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	
1	Strobotac, Model No. 631B	0.8	9-1/4	11-3/4	12-7/8	12

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock Numbers (USAF) (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Strobotac Model No. 631B	Metal	7CAD-775000 CAG-60175	7-1/2	8-3/4	9-7/8	9.5
1	Line Connector Cord			84 long			
1	Plug for connecting external contactor						

**OSCILLOSCOPE TACHOMETER**  
**Part No. T-101007**  
**(Sperry Gyroscope Company)**



**FUNCTIONAL DESCRIPTION:**

A portable instrument designed to check and measure the rotational speed of the constant speed motor in the tracking computer of the A-1 Bombing-Navigational Computer System. The unit measures the difference between the speed of the motor and a precise 3600 cycles per second standard. Provision is also made to measure the speed of the motor between 3300 and 3900 rpm.

**RELATIONSHIP TO OTHER EQUIPMENT:**

**ELECTROMECHANICAL DESCRIPTION:**

**Circuit Information:** The tachometer circuit consists of switches, resistors, capacitors, tubes, transformers, fuses, a tuning fork, a multivibrator, and a cathode ray tube. Connections with the unit under test are accomplished by means of

(Continued)

	AIR FORCE	NAVY	ARMY
<b>TYPE CLASS.</b>			
<b>STOCK NOS.</b>	7CAC-797050		
<b>PROCUREMENT INFO.:</b>			
<b>PROCUREMENT COG.:</b>	<b>DESIGN COG.:</b> Commercial		
<b>F.I.I.N.:</b>	<b>FUNCTIONAL CLASS. NO.:</b> 2.6.3		
- Electronics Test Equipment - Sperry Part No. T-101007			

OSCILLOSCOPE TACHOMETER  
Part No. T-101007  
(Sperry Gyroscope Company)

**ELECTROMECHANICAL DESCRIPTION: (Continued)**

cables and test leads. The horizontal sweep of the cathode ray signal is triggered by selecting either the tuning fork or the multivibrator in the tachometer. The tuning fork is an accurate frequency standard which measures exactly 3600 rpm, while the multivibrator covers a range from 3300 to 3900 rpm. A potentiometer is used to vary the signal frequency of the multivibrator. The comparison signal selected from either of these two sources is applied as a synchronizing voltage to a sawtooth sweep amplifier which is set to a predetermined frequency. From there it is passed through a variable-gain amplifier to the cathode ray tube. A transformer is used to amplify the applied vertical signal from the unit under test. Reading of the two signals is given on the cathode ray tube. When the signal indication ceases to drift across the cathode ray tube the tachometer and the unit under test are synchronized.

Power Supply: 115 volts, AC, 400 cycles per second, single-phase.

Accuracy: 0.0003% at 35°C. (95°F.). (Temperature thermostatically controlled above 0°C. (32°F.).

**MANUFACTURERS' OR CONTRACTORS' DATA:**

Sperry Gyroscope Company, Great Neck, Long Island, New York.

**TUBE COMPLEMENT:**

1 JAN-2BP1, 2 JAN-6J6, 1 JAN-2D21, 2 JAN-6X4, 1 JAN-OA2.

**REFERENCE DATA AND LITERATURE:**

TO 33D5-5-10-1 (Operation and Service Instructions).

TO 33D5-5-10-4 (Parts Breakdown).

**SHIPPING DATA:**

No. of Boxes	Contents & Identification	Volume (Cu. Ft.)	Overall Dimensions (inches)			Weight Packed (Lbs.)
			H	W	D	

Sperry Part No. T-101007- Electronics Test Equipment -

OSCILLOSCOPE TACHOMETER  
 Part No. T-101007  
 (Sperry Gyroscope Company)

**EQUIPMENT SUPPLIED:**

Quant. Per Eq'pt	Name and Nomenclature	Case Mat'l	Stock (USAF) Numbers (Navy) (Army)	Overall Dimensions (inches)			Weight (Lbs.)
				H	W	D	
1	Oscilloscope Tachometer Sperry Part No. T-101007	Alumi- num	7CAC-797050	14	13	9	
1	Power Cable 115 Volts						
1	Signal Input Cable						
						Total:	30
- Electronics Test Equipment -Sperry Part No. T-101007							



