OPERATION MANUAL

MICROWAVE RADIO TEST SET

ME645A

SUPPLIER: ANRITSU AMERICA, INC.

MANUFACTURER: ANRITSU ELECTRIC CO., LTD.

SECTION 1

GENERAL INFORMATION

CONTENTS PAGE

1. INTRODUCTION

1.01 This operation manual contains all the information necessary to operate the Microwave Radio Test Set (MRTS) ME645A. Calibration, adjustment, trouble-shooting, repair and replaceable parts are covered in the separate Service Manual.

A. FEATURES

1.02 The MRTS is designed to meet the requirements of AT & T Company. Principal measurement items are power, frequency, amplitude response, return loss, noise figure, IF spectra, carrier resupply, fade margin, and DC voltage.

1.03 The MRTS has the following special features:

1.04 *Versatile Capabilities:* Most measurements can be made at the repeater site of a microwave relay system.

1.05 *Easy Operation:* In most cases the measurement item can be switched by merely pushing a single function switch for the desired item.
The power meter uses autoranging.
The RF sweep generator center frequency is set by thumb wheel switch.
The IF and RF sweep generator sweep width is selected in one operation.

1.06 *High Accuracy:* The power meter has a 4 digits digital indicator. The sensor is calibrated by an internal reference oscillator. The PCD in the IF sweep generator and the PLL in the RF sweep generator assure accurate, stable output frequencies.
The CW frequency and ΔF mode IF and RF source frequency markers are controlled by crystal oscillators.

* PCD: Pulse Counted Discriminator
PLL: Phase Lock Loop

1.07 *Alarm Signs:* When the controls, push button and adjusters are manipulated by an inproper procedure or misoperation an alarm signs (blinking of the LED Display or red lamp) tells that to the operator.

1.08 *Simple Construction:* The main units are the DISPLAYING UNIT and SENDING UNIT.
These units are connected by interface cable.

1.09 *Portable:* The compact size and light weight make the test set suitable for hand-carrying and transport by helicopter.

1.10 *High Reliability and Ruggedness:* ICs and LSIs are used extensively throughout to reduce the number of components to a minimum. The selection of parts having small failure rates increases reliability. A rugged mechanical designing is used throughout, considering the most severe transportation conditions.

1.11 *Microprocessor:* The internal microprocessor assures easy operation, high accuracy, and high reliability.

2. CONFIGURATION

A. Basic Configuration

2.01 MRTS ME645A for 4 and 6GHz band is the basic equipment, the units of which are listed below:

Table A—Basic Configuration

Description	Q'ty
Displaying Unit	1
Sending Unit	1
Furnished Ancillary Equipment	1 set

2.02 Furnished Ancillary Equipment List is as follows.

Table B—Furnished Ancillary Equipment List

No.	Descriptions	Q'ty	Model No. or Part No.
1	IF Power Head, 10 to 300MHz, 75Ω WECo 440*	1	IF POWER HEAD
2	RF Power Head, 0.1 to 11.7GHz, 50Ω, Type N(M)	1	RF POWER HEAD
3	Directional Detector, 3.65 to 11.7GHz	1	DIRECTIONAL DETECTOR
4	Coaxial Low Pass Filter, 4GHz, Type N(M-F)	1	MA62A
5	Coaxial Low Pass Filter, 6GHz, Type N(M-F)	1	MA63A
6	Leveling Cable Assembly A	1	FA6
7	Cable, BNC(M) to BNC(M) 2.5m	1	FA7-1
	Cable, BNC(M) to BNC(M) 0.13m	1	FA7-2
8	Power Head Cable (IF) black 2.5m	1	FA8-1
	Power Head Cable (RF) green 2.5m	1	FA8-2
9	Cable, WECo 440* to WECo 440* 2.5m	2	FA9
10	AC Power Cord yellow 7'6"	1	
11	Interface Cable between Displaying Unit and Sending Unit	1	FA11
12	Instruction Manuals (Operation Manual and Service Manual)	1 ea.	
13	P.C. Board Removal Tool	2	
14	Self-contained Card Extender	1 set	
15	Fuse (5A)	1	
16	Fuse (0.5A)	1	
17	Secondary Fuse (10A ... 2, 1.6A ... 3, 2A ... 1)	1 set	

Note: *WECo 440 or Equivalent

B. Options

2.03 In addition to the basic MRTS ME645A, the following options are available:

(1) ***Option 001:*** Conversion to add 11GHz capability
The addition of the 11GHz band is possible both in the original order or on a retrofit basis.
Furnished Ancillary Equipment for option 001: Coaxial low pass filter, 11GHz, Type N(M-F), MA71A.

(2) ***Option 002:*** Direct RF counting
Direct RF counting can be included only in the original order.

(3) ***Option 003:*** Conversion to add 2GHz capability
The addition of the 2GHz band is possible both in the original order or on a retrofit basis.
Furnished Ancillary Equipment for option 003:

a. Directional Detector (2GHz)

b. Coaxial low pass filter, 2GHz, Type N(M-F), MA64A

(4) ***Available Ancillary Equipment:*** The available ancillary equipment list is shown in Table C.

Table C—Available Ancillary Equipment (Optional Accessories)

No.	Description	Q'ty	Model or Part No.	Note
1	RF Coaxial Attenuator, 10 ±0.5dB, 2W, DC to 11.7GHz, VSWR<1.25, Type N(M-F)	1	757C-10	A
2	RF Coaxial Attenuator, 20 ±0.5dB, 2W, DC to 11.7GHz, VSWR<1.25, Type N(M-F)	1	757C-20	A
3	RF Coaxial Attenuator, 30 ±1dB, 2W, DC to 11.7GHz, VSWR<1.25, Type N(M-F)	1	757C-30	A
4	RF Coaxial Attenuator, 20 ±0.75dB, 20W, DC to 6.5GHz, VSWR<1.3, Type N(M-F)	1	768-20-SP	A
5	RF Coaxial Attenuator, Continuously variable 0 to 20dB, 3.65 to 6.5GHz, Type N(M-F)	1	793F-M-SP	A
6	IF Coaxial Attenuator, 3 ±0.3dB, DC to 95MHz, WECo 560* to 440*	1	MP531E	A
7	IF Coaxial Attenuator, 5 ±0.3dB, DC to 95MHz, WECo 560* to 440*	1	MP531F	A
8	IF Coaxial Attenuator, 10 ±0.3dB, DC to 95MHz, WECo 560* to 440*	1	MP531A	A
9	IF Coaxial Attenuator, 15 ±0.3dB, DC to 95MHz, WECo 560* to 440*	1	MP531B	A
10	IF Coaxial Attenuator, 20 ±0.5dB, DC to 95MHz, WECo 560* to 440*	1	MP531G	A
11	IF Coaxial Attenuator, 35 ±1dB, DC to 95MHz, WECo 560* to 440*	1	MP531H	A
12	IF Cable, WECo 358* to 440*, 2.5m	2	AA12	A
13	IF Cable, WECo 440* to BNC(M), 2.5m	1	AA13	A
14	IF Cable RG188A/U, WECo 440* to SEALECTRO P/N 52-024-0000, 2.5m	1	AA14	A
15	RF Cable, Type N(M) to Type N(M), 2.5m	2	AA15	A
16	Adapter, WECo 358* to 560*, Return Loss≧40dB	1	MP533A	A
17	Adapter, WECo 477* to 560*	1	MP537A	A
18	Adapter, WECo 560* to 560*	1	MA58A	A
19	Adapter, Type N(M) to WECo 560*, (Used for IF Power Head Calibration)	1	MA411A	A
20	Adapter, Type N(F) to Type N(F)	2	77	A
21	Adapter, Elbow, Type N(M) to Type N(F)	1	N-LA1014	A
22	Transition, Type N(F) to WR229 Waveguide, VSWR<1.04, 4GHz band	2	B40M-NA	A
23	Transition, 7mm connector to WR229 Waveguide, VSWR<1.02, 4GHz band	1	B40M-7A-SP	A
24	Transition, Type N(F) to WR159 Waveguide, VSWR<1.04, 6GHz band	2	D40M-NA	B
25	Transition, 7mm connector to WR159 Waveguide, VSWR<1.02, 6GHz band	1	D40M-7A-SP	B
26	Transition, Type N(F) to WR90 Waveguide, VSWR<1.04, 11GHz band	1	X40L-NA	C
27	Transition, 7mm connector to WR90 Waveguide, VSWR<1.02, 11GHz band	1	X40L-7A-SP	C
28	Filter 70MHz Band Pass, WECo 440* to 560* Insertion Loss 35dB (50MHz) 3dB (61MHz) 1.2dB (70MHz) 3dB (79MHz) 35dB (90MHz) Return Loss>26dB (64 to 76MHz, 75Ω)	1	MA49A	A
29	Filter 70MHz Low Pass, WECo 440* to 560* 61MHz Pass, 70MHz Suppress>60dB, 79MHz Reject>14dB	1	MA410A	A
30	Filter 74.1MHz Band Pass, WECo 440* to 560* Insertion Loss 35dB (54.1MHz) 3dB (65.1MHz) 1.2dB (74.1MHz) 3dB (83.1MHz) 35dB (94.1MHz) Return Loss>26dB (68.1 to 80.1MHz, 75Ω)	1	MA49B	D
31	Filter 74.1MHz Low Pass, WECo 440* to 560* 65.1MHz Pass, 74.1MHz Suppress>60dB, 83.1MHz Reject>14dB	1	MA410B	D
32	Filter Low Pass, Pass Band (0.5 to 0.7GHz, VSWR<1.17, Loss<1.5dB) Stop Band (1 to 1.4GHz, Loss>40dB), Type N(M-F)	1	MA56A	E
33	Filter Low Pass, Pass Band (0.7 to 1GHz, VSWR<1.17, Loss<1.5dB) Stop Band (1.4 to 2GHz, Loss>40dB), Type N(M-F)	1	MA57A	E
34	IF Amplifier, 35 to 45dB adjustable, 55 to 95MHz, Flatness<0.3dB, Po (Max.)>+5dBm with 3m DC Cable, WECo 560* to 560*	1	MA48A	A
35	IF Return Loss Bridge, 55 to 90MHz, Bridge Balance>55dB, Test port WECo 440*	1	MR54A	A
36	RF Return Loss Bridge, 2 to 12GHz, Directivity >44dB, Test port APC-7	1	SP2369	A
	Fixed Short, (for RF Return Loss Measurement Calibration)	1	5230	A
	Adapter, 7mm to Type N(M), (for RF Return Loss Measurement)	1	34AN50	A
37	Test Lead for D.V.M., Dual banana plug to alligator clip and pick	2	AA37	A
38	Splitting Pad 75Ω, Loss 6dB nominal, 50 to 95MHz, Connectors three WECo 560*	1	MA59A	A
39	Portable Test Rack, Displaying Unit and Sending Unit are stacked	1	MB23A	A or G
40	Soft Pack Carrying Cases, for Displaying Unit-1, for Sending Unit-1, for Auxiliary Equipment-1	3		A
41	Protective Shipping Cases, for Displaying Unit-1, for Sending Unit-1, for Auxiliary Equipment-1	3		F
42	IF Harmonic Filter, WECo 440* to 560*, Pass Band (70 to 74.1MHz, Loss<0.5dB, Return Loss>30dB), Stop Band (140 to 148.2MHz, Loss>40dB)	1	MA510A	A

Note

A: To be provided with all orders for the ME645A.
B: To be provided with orders for stations with TH-1, TH-3 and AR-6.
C: To be provided with orders for stations with 11GHz equipment.
D: To be provided with orders for TH-1 and AR-6.
F: To be provided with orders for TD-3, early vintage.
P: To be provided as requested.
G. To be provided as requested.
WECo 560, 440, 358, 477 or Equivalent

(1) AA34 Cable

3. SPECIFICATIONS

Table D—Specifications

1. POWER METER

(1) Absolute Measurement Accuracy	Within ±0.5dB, when using the 75Ω power head over the range 10 to 300MHz or the 50Ω power head over the range 100MHz to 11.7GHz, including the effects of ancillary equipment.
(2) Accuracy of Power Meter Alone	Within ±0.2dB
(3) Harmonics	Capable of maintaining its accuracy when measuring power at +10dBm in the presence of second harmonics down 12dB from the measured signal. RF band (50Ω) with low pass filter: 500 to 700MHz 700 to 1000MHz 2.11 to 2.18GHz 3.65 to 4.25GHz 5.8 to 6.5GHz 10.6 to 11.7GHz IF band (75Ω) with low pass filter: 70MHz and 74.1MHz
(4) Range	+10 to −30dBm without external pads or amplifiers.
(5) Resolution	0.01dB
(6) Overload Rating of the Power Head	Capable of withstanding continuously +20dBm without burnout or change in characteristics.
(7) Power Head Marking	Marked as to the maximum average power the power head are capable of withstanding without burnout or change in characteristics. Displaying unit: "+20dBm MAX" Power head: "CAUTION-MAX INPUT POWER +20dBm"
(8) Readout	Digital: A 4 digit LED display in dBm. Analog: 12dB full scale (calibrated in 0.5dB increments) peaking meter.
(9) Stability	Maximum drift of ±0.1dB for +10 to −25dBm and ±0.15dB for −25 to −30dBm, over a 2 hour period at 24°C room temperature.
(10) Drift Correction	Automatic with front panel pushbutton.

Table D (Cont)

(11) IF Power Head Return Loss (75Ω)	
14 to 50MHz	no less than 25dB
50 to 95MHz	no less than 30dB
95 to 300MHz	no less than 20dB
(12) RF Power Head Return Loss (50Ω)	
0.1 to 11.7GHz	no less than 20dB without filter
2.11 to 2.18GHz **3.65 to 4.25GHz** **5.8 to 6.5GHz**	no less than 23dB without filter
500 to 700MHz **700 to 1000MHz** **2.11 to 2.18GHz** **3.65 to 4.25GHz** **5.8 to 6.5GHz**	no less than 15dB with filter
10.6 to 11.7GHz	no less than 13dB with filter
(13) Response Time	Within 2 seconds after applying the input power to be measured.
(14) Spurious Signals	The power meter and head do not introduce AC or DC signals into the circuit being measured.
(15) Calibration Signal	The IF calibration source is energized or de-energized independent of any meter calibration through front panel CAL and rear panel CAL power Switch, ON and OFF push-button switches.
(16) Swept Amplitude Response Range of Power Head (Oscilloscope display only)	IF band: +12 to −12dBm RF band: +10 to −10dBm
(17) Detector Flatness (Power head acting as detector)	
Frequency Band *	Transmission Flatness for up to +10dBm
IF: 50 to 95MHz	± .025dB
RF: 2.11 to 2.18GHz	± .025dB
RF: 3.65 to 4.25GHz	± .025dB
RF: 5.8 to 6.5GHz	± .025dB
RF: 10.6 to 11.7GHz	± .05dB

* Requirements to be met over any 40MHz segment.

Table D (Cont)

(18) Detector (Power head) Harmonic Distortion	The IF detector flatness is less than ±0.03dB/±20MHz with second harmonic distortion 25dB below the measured signal (with low pass filtering for RF).
2. DIGITAL VOLT METER	
(1) Ranges	±0.1 to ±100VDC and ±100 to ±999VDC
(2) Accuracy	±0.3V on 100V range and ±3V on 999V range.
3. RETURN LOSS CIRCUITRY	
The return loss is measured combination with IF and RF Return Loss Bridges.	
(1) Ranges (oscilloscope display only)	
IF (75Ω)	0 to 20dB 10 to 30dB 20 to 40dB
RF (50Ω)	0 to 20dB 10 to 30dB
(2) Test Signal Power	
IF (75Ω)	−10dBm nominal
RF (50Ω)	−5dBm nominal
(3) Accuracy	IF R.L. measurement accuracy is (for test terminal of WECo 560–without adapter): within 1dB for 10 to 30dB R.L. within 2dB for 0 to 10dB R.L. and 30 to 40dB R.L. Return loss of adapter WECo 358 to WECo 560 (MP533A) is more than or equal to 40dB. RF R.L. measurement accuracy is within 3dB for up to 25dB and visible on the display for up to 30dB.
4. SPECTRUM ANALYZER	
(1) General Requirement	Provides a visual indication of the spectra of the total IF bands of fo ±32MHz with a dynamic range of over 70dB.
(2) Scan Width Selection IF Bands (fo = 70MHz & 74.1MHz. fo is centered on display)	±1MHz ±5MHz ±15MHz ±32MHz

Table D (Cont)

(3) Dynamic Range	70dB (±1MHz) 60dB (all other scan widths) 10dB sensitivity/cm of deflection
(4) Spurious	–60dBm (all scan widths except ±32MHz; Spurious at ±32MHz is –50dBm)
(5) Reference Selection	0dBm only
(6) XY Plotter Output	**Compatible** with existing Baseband Analyzer (S/A)
(7) Input Buffer Amplifier	Limits L.O. Leakage out at Input Port
(8) Sweep Speed	10ms/cm
5. DISPLAY CIRCUITRY	
(1) Vertical External Input	BNC Connector
(2) Common Mode Rejection	At least 50dB on vertical external input
(3) Vertical Sensitivity (a to d)	
(Type of Signal Input)	dB sensitivity per cm of deflection
a. IF (Detected)	0.05, 0.1, 0.5 and 1.0dB
b. RF (Detected)	0.1, 0.5 and 1.0dB
c. RF & IF Return Loss	2.5dB
d. External DC (Detected)	**50mV**/cm of deflection
(4) Vertical Bandwidth	Fixed at DC to 10kHz and no less than 310kHz for the external input.
(5) Input Network (both Vertical and Horizontal)	1MΩ (±10%) shunted by not more than 50pF.
(6) Horizontal External Input	BNC connector; single ended DC Coupled such that a positive going voltage causes beam deflection to the right.
(7) Horizontal Sensitivity (including external input)	Adjustable over the range from 0.5V to 2.0V per cm.
(8) Blanking	Blank on an external +3V pulse, regardless of intensity (TTL compatible)
(9) Z – Axis	BNC Connector accessible from the rear panel.

Table D (Cont)

(10) Out of Range Indication	Bright line display on CRT and LED (Vertical Sensitivity) lamp blink on and off when the power head input level is from −13 to −39.99dBm ±0.2dB.
(11) Horizontal Axis	Divided into 10 equally spaced 1cm divisions.
(12) Vertical Axis	Divided into 8 equally spaced 1cm divisions.
(13) Faceplate	Shatterproof safety-shield.
(14) Bezel	Accommodates camera adapters from major scope camera suppliers such as HP Models CO1-10369A, 10369A and 197A and Polaroid CU-5.
6. RF SWEEP GENERATOR	
(1) CW Mode	2GHz band: 2.11 to 2.18GHz (option 003) 4GHz band: 3.65 to 4.25GHz 6GHz band: 5.8 to 6.5GHz 11GHz band: 10.6 to 11.7GHz (option 001) (50Ω output impedance)
(2) Frequency Setting Accuracy	Within $\pm 1 \times 10^{-5}$
(3) ΔF Sweep Mode	Fixed sweep width sweep width: ±2, ±10, ±15, ±20MHz
(4) Leveled Power Output	Continuously adjustable over the following ranges: 0dBm to +10dBm (2, 4, 6GHz bands) 0dBm to +5dBm (11GHz band)
(5) Cable (RF Oscillator to Directional Detector)	Cable assembly is encased in a common sheath.
(6) Power Output Continuity	The Power Output does not vary more than 0.2dB when switching from a swept mode to the CW mode. in 2 and 4GHz bands, ΔF = ±10MHz in 6GHz band, ΔF = ±15MHz in 11GHz band, ΔF = ±20MHz
(7) Power Output Stability	Within ±0.05dB over any 15 minute interval and within ±0.1dB over any continuous 24 hour period.

Table D (Cont)

(8) Power Output Flatness	Frequency Band / Output Power / Output Flatness 2 and 4GHz bands — 0 to +10dBm — ±0.025dB/±10MHz 6GHz band — 0 to +10dBm — ±0.025dB/±20MHz 11GHz band — 0 to +5dBm — ±0.05dB/±20MHz
(9) Sweep Frequency	46Hz nominal
(10) Sweep Linearity	Within ±2.5% of the sweep width
(11) RF Frequency Markers	One pair of markers for each of the sweep modes, switch selectable in increments of 1MHz from 0 to 20MHz.
(12) RF Frequency Markers Accuracy	Within ±0.005%
(13) RF Generator Frequency Stability (a to d)	
a. With temperature	Maximum change in frequency is:
2 and 4GHz bands	±160kHz/°C from 0°C to 50°C
6GHz band	±200kHz/°C from 0°C to 50°C
11GHz band	±1.2MHz/°C from 0°C to 50°C
b. With line voltage	±1MHz max. for AC 103 to 127V variation
c. With output Power	
2, 4 and 6GHz bands	±1MHz max. for 0dBm to +10dBm change
11GHz band	±1MHz max. for 0dBm to +5dBm change
d. With time	±0.012% max. over a 15-minute interval and ±0.03% over any continuous 24 hour period.
(14) Aging	±0.03% for at least 10 years.
(15) Spurious Radiation	Less than −50dBm when output is delivering +10dBm (+5dBm for 11GHz band) into a resistive termination at any frequency. The harmonic radiation up to 11.7GHz is no greater in magnitude than the fundamental radiation. The unit is measured radially for radiation 12-inches from the cabinet using WR-430 waveguide for 2GHz band,WR-229 for 4GHz band, WR-159 for 6GHz band and WR-90 waveguide for 11GHz band.
(16) Harmonics	At least 40dB down.
(17) Spurious Signal (non harmonically related)	At least 64dB below the selected output power when terminated into 50Ω.

Table D (Cont)

(18) Residual Amplitude Modulation	At least 40dB below the output signal.
(19) Residual Frequency Modulation	
2, 4 and 6GHz bands	30kHz peak
11GHz band	50kHz peak
7. IF SWEEP GENERATOR	
(1) CW Mode	70MHz and 74.1MHz
(2) Frequency Setting Accuracy	Within $\pm 2 \times 10^{-5}$
(3) ΔF Sweep Mode	Fixed sweep width ±2, ±10, ±15, ±20MHz
(4) Leveled Power Output	Variable from −70dBm to +10dBm at a 75Ω output impedance.
(5) Continuously Variable	10dB range (+10dBm max.)
(6) Step Variable	70dB range, 1dB steps
(7) Power Output Stability	Within ±0.05dB/15 minute interval and within ±0.1dB/24 hour period.
(8) Power Output Flatness	Within ±0.025dB at ΔF sweep modes between 0 and +10dBm
(9) Sweep Frequency	46Hz nominal
(10) Sweep Linearity	Within ±2.5% of sweep width
(11) IF Frequency Markers	One pair of markers for each of the sweep modes switch selectable in increments of 1MHz between 0 and 20MHz.
(12) IF Frequency Markers Accuracy	±0.005%
(13) IF Generator Frequency Stability (a to d)	
a. With tempeature	±30kHz max./°C at 0°C to 50°C
b. With line voltage	±10kHz max. for AC 103 to 127V variation
c. With output power	±10kHz max. for 0 to +10dBm change
d. With time	±50kHz max. over a 15 minute interval ±100kHz max./24 hour period

Table D (Cont)

(14) Spurious Radiation	The radiation from the fundamental frequency from the IF oscillator is no greater than –100dBm when the output is delivering +10dBm into a resistive termination at any frequency. The harmonic radiation up to 300MHz shall be no greater in magnitude than the fundamental radiation. The unit is measured radially for radiation with a suitable field intensity meter, excited by a simple resonant dipole placed no more than 12 feet and no less than 8 feet from the finished chassis, with no additional shielding.
(15) Harmonics	The magnitude of the second and third harmonic of 50(54.1), 60(64.1), and 70(74.1)MHz present in the generator output is measured by means of a suitable selective analyzer. In addition, the second harmonic of 80(84.1) and 90(94.1)MHz is measured and their magnitudes relative to the fundamental, is no greater than the following:

Fundamental, f, MHz	$\frac{2f}{f}$	$\frac{3f}{f}$
50(54.1)	–40dB	–40dB
60(64.1)	–40dB	–40dB
70(74.1)	–40dB	–40dB
80(84.1)	–40dB	–
90(94.1)	–40dB	–

(16) Spurious Signal (non harmonically related)	At least 70dB below selected output power when terminated in 75Ω
(17) Residual Frequency Modulation	No greater than 1.5kHz peak
(18) Slope Adjusting Range	No less than ±0.1dB slope over 50 to 90 and 54.1 to 94.1 MHz range, front panel adjustment.
(19) Frequency Shift	The 70 and 74.1MHz CW frequencies are shifted by +300kHz and –300kHz for C/I measurements.
8. FREQUENCY COUNTER	
(1) Frequency Range	14 to 300MHz directly and without prescaling.
(2) Input Network	At least 1MΩ shunted by less than 20 pF (14 to 135MHz) and 50Ω (14 to 300MHz) switchable.
(3) Input Level	15mV to 5Vrms without need for level adjustment.
(4) Accuracy	±1 count ± Time Base oscillator stability.

Table D (Cont)

(5) Time Base Stability (a to c)	
a. Short term	a) At least 5 x 10^{-8} (after 15 minutes warm up) for a minimum of 2 hours and b) At least 5 x 10^{-9} per day after 24 hours continuous operation.
b. Aging	$\pm 1 \times 10^{-7}$ per year
c. With line voltage	1×10^{-9} for AC 103 to 127V
(6) Time Base Frequency	10MHz
(7) Time Base Output	1V peak-to-peak minimum across 50Ω (TTL compatible)
(8) Time Base Adjustment	A minimum of $\pm 5 \times 10^{-8}$
(9) Oven	Crystal oven remains on when the front panel power switch is turned off.
(10) Sample Rate	Minimum 0.08 seconds. Variable by steps of 0.08, 0.8, 2 seconds and hold.
(11) Gate Time	10, 1 and 0.1 seconds
(12) Resolution	0.1, 1 and 10Hz
RF Measurements (Option 002) (13) to (17)	
(13) RF Frequency Range	**2GHz band:** 2.11 to 2.18GHz (option 003) 4GHz band: 3.65 to 4.25GHz 6GHz band: 5.8 to 6.5GHz 11GHz band: 10.6 to 11.7GHz (option 001) directly without manual or external prescaling or tuning.
(14) Input Network	Over the specified frequency range the input impedance is a nominal 50Ω.
(15) Input Connector	Type "N" connector.
(16) Input Level	−20dBm to +7dBm
(17) Resolution	1kHz
9. ENVIRONMENTAL	
(1) Specification Compliant Ranges (a to c)	
a. Temperature	0°C to +50°C
b. Altitude	**0 to 10000 fe**et above sea level
c. Relative humidity	10% to 95%

Table D (Cont)

(2) Storage Range	–40°C to +60°C
(3) Warm up Time	a) 15 minutes from turn-on from an ambient of 24°C and b) 60 minutes from turn-on in an ambient of 24°C after being brought in from an environment of –18°C.
(4) Burn-in	96 hour operational burn-in at +50°C
(5) AC Input	Single phase 115 ±12V, 60Hz, ≦250VA power source.
(6) Shock and Vibration	MIL-STD-810B, Method 514.7 Procedure X, Sinusoidal Cycling only.
a. Shock	At room ambient conditions per MIL-STD-810B 20g, 10 milliseconds, sawtooth ascending pulse, two repetitions in each direction of three mutually perpendicular axis (12 drops).
b. Vibration	0.25 inches displacement, D.A., 5 to 9Hz and 1.0g from 9 to 100Hz. A sweep rate of two minutes per octave ascending and descending in each of three mutually perpendicular axis.
10. MECHANICAL & MISCELLANEOUS	
(1) Weight (including each carrying case)	
Displaying Unit	less than 40 lbs. (<19kg)
Sending Unit	less than 40 lbs. (<19kg)
Ancillary Equipment	less than 40 lbs. (<19kg)
(2) Dimensions (each unit)	16.8in.(426mm)W x 17.8in.(450mm)D x 5.7in.(145mm)H (except for controls, handles, etc.)
(3) AC Power Cord	The 7'6" detachable power cord is yellow and equipped with a NEMA 5-15P ground plug.
(4) Line Fuses	are accessible from the rear panel.
(5) Ground Loop	**The MRTS does not exhibit any** ground loop problems when in a back-to-back configuration. (RF & IF flatness requirements are met).:
(6) N Type Connectors	Internal dimensions and tolerances of mating surfaces meet MIL-C-39012. N connector shells and the nut on male connectors are stainless steel.

Table D (Cont)

(7) Repeater Bay Interfaces	The MRTS interfaces repeater bays with N-type connectors for 50Ω test points, and WECo 560A, or approved equivalent, jacks for 75Ω test points.
(8) Portable Test Rack	A collapsible mobile rack is available to support the MRTS. It does not restrict a view of the MRTS while in a kneeling position making adjustments on a repeater bay near floor level.