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**** Our 19th Year in Business: 1985 - 2004 ****

Results of FCC Certification Testing
Performed in Accordance with the
United States Code of Federal Regulations,
Title 47 Chapter 1,
on the O.T.E. S.p.A. Model DTR100
50 Watt Double Sideband AM, 118 to 136.975 MHz
Ground to Air Communications Base Station Transceiver.
Equipment Class: TNB FCC ID # RM7DTR100REV2.1

by_____
Louis T. Gnecco, M.S.E.E., President
Certified Electromagnetic Compatibility Engineer: Cert.# EMC-000544-NE

January 8, 2004

Abstract

As requested by Purchase order # MI-121-PO-03 issued by Morcom International, Inc. of 14210-B Sullyfield Circle, Chantilly, Virginia 20151, during the period of December 12, 2003 to January 8, 2004 TEMPEST INC. performed the testing required to determine the compliance of the following device with the rules of the U.S. Federal Communications Commission:

Model DTR100 50 Watt, Double Sideband AM, 118 to 136.975 MHz,
Ground to Air Communications Base Station Transceiver,
Serial Number 03001
Equipment Class: TNB FCC ID #RM7DTR100REV2.1

The DTR-100 is made by OTE S.p.A, Via E. Barsanti 8, 50127 Firenze, Italy.
It is sold in the United States by Morcom International, Inc., 14210-B Sullyfield Circle, Chantilly, Virginia 20151.

The rules are published in the applicable sections of Title 47, Chapter 1 of the United States Code of Federal Regulations. They can be found at the following official US Government web site:

http://www.access.gpo.gov/cgi-bin/cfrassemble.cgi?title=199947

The following is a complete list of all the applicable requirements, and of the test procedures needed to determine compliance:
sec. 87.147 (a)
sec. 87.141 (b) test procedure: sec. 2.1047 (b)
sec. 87.131 (b) test procedure: sec. 2.1046 (a)
sec. 87.133 (a)(5) test procedure: sec. 2.1055 (a)(1), (b),(d)(1), and (d)(3)
sec. 87.135(a),(b) and sec. 87.156 (a) test procedure: sec. 2.1049(c)(1)
sec. 87.139 (d) test procedure: sec. 2.1051, sec. 2.1057(a)(1), (b), and (c)
sec. 87.147 (a),(d1,) (d2), (d3)

Per Section 13.4 k, no part 15 tests are required for the DTR-100 because it's digital circuits cannot be used to control any other devices.

Since the DTR-100 is not listed in section 1.1307 b , it is categorically excluded from the base station safety testing requirements of Part 87.

The DTR-100 is meant to be used in the following types of base stations: MA (aircraft, air carrier and private,) MA2 (private aircraft only) FAC (airport control tower) FAU (advisory (UNICOM) and FAS (aviation support.)

The DTR-100 passed all the tests. It complies with all applicable requirements of the United States Federal Communications Commission.

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References:

(a) TITLE 47, CHAPTER 1 OF THE UNITED STATES CODE OF FEDERAL REGULATIONS., see:
http://www.access.gpo.gov/nara/cfr/waisidx_99/47cfrv1_99.html

(b) Notice of Proposed Rulemaking: FCC-03-238

(c) "OTE DTR100/DT100 Technical Handbook 790266/01.05 Rev.2.1 – US Version." OTE S.p.A Issue 05 – November 2003

(d) "Test Plan for FCC Certification Testing in accordance with United States Code of Federal Regulations, Title 47 Chapter 1, of the O.T.E. S.p.A. Model DTR100 50 Watt Double Sideband AM, 118 to 136.975 MHz Ground to Air Communications Base Station Transceiver." TEMPEST INC. November 4, 2003.

1.0 Introduction.

As requested by Purchase order # MI-121-PO-03 issued by Morcom International, Inc. of 14210-B Sullyfield Circle, Chantilly, Virginia 20151, during the period of December 12, 2003 to January 8, 2004 TEMPEST INC. performed the testing required to determine the compliance of the following device with the rules of the United States Federal Communications Commission, as specified in References (a) and (b):

Model DTR100 50 Watt, Double Sideband AM, 118 to 136.975 MHz,
Ground to Air Communications Base Station Transceiver,
Serial number 03001
Equipment Class: TNB FCC ID# RM7DTR100REV2.1

made by

OTE S.p.A Via E. Barsanti 8, 50127 Firenze, Italy

and sold in the United States by Morcom International, Inc.

1.2 Test Location.

All testing was performed in the laboratory facilities of TEMPEST INC. 112 Elden St. Herndon,. Virginia 20170

1.3 Cognizant Personnel.

The following personnel are cognizant of the test:

Louis T. Gnecco, President
Paula Levin Gnecco, Vice President
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Morcom International, Inc. 14210-B Sullyfield Circle, Chantilly, Virginia 20151 (703) 263-9305 FAX: (703) 263-9308 mojeda@morcom.com

Mr. Andrew Leimer, Electronics Engineer
Office of Engineering & Technology, Federal Communications Commission Laboratory, 7435 Oakland Mills Road, Columbia Maryland 21046
301 362 3049 fax: 301 344 2050 aleimer@fcc.gov

2.0 Description of the DTR-100.

The DTR-100 is a Ground to Air Communications Base Station Transceiver, operating at 50 Watts exclusively with double sideband amplitude modulation (A3E,) in the 118 to 136.975 MHz frequency range.

It is meant to be used in the following types of base stations: MA (aircraft, air carrier and private,) MA2 (private aircraft only) FAC (airport control tower) FAU (advisory (UNICOM) and FAS (aviation support.) see sections 87.171 and 87.173

The DTR-100 has the following additional capabilities:

a) Operating over the extended frequency range of 108 to 156 MHz,
b) Differential 8-ary Phase Shift Keying (D8PSK) at 10.500 symbols/sec.
c) Gaussian Filtered Frequency Shift Keying (GFSK) at 19.2 kilobits/sec.

These capabilities are disabled through firmware, and the user has no interface to change or enable them.

Figure 1 depicts the DTR-100, and Appendix A presents its detailed specifications. Reference (c) is the equipment manual.

The DTR-100 falls under FCC Equipment Class: TNB
and has FCC Identification Number RM7DTR100REV2.1.

Since the DTR-100 is not listed in section 1.1307 b, it is categorically excluded from the base station safety testing requirements of Part 87.

Unless otherwise specified in this report, the DTR-100 was operated using its default settings.

3.0 Test Procedures and Results.

3.1 Requirements:

All testing was performed in accordance with the previously prepared Test Plan, Reference (d.) The applicable parts of Title 47, Chapter 1 of the United States Code of Federal Regulations, are listed below:

sec. 87.147 (a)
sec. 87.141 (b) test procedure: sec. 2.1047 (b)
sec. 87.131 (b) test procedure: sec. 2.1046 (a)
sec. 87.133 (a)(5) test procedure: sec. 2.1055 (a)(1), (b),(d)(1), and (d)(3)
sec. 87.135(a),(b) and sec. 87.156 (a) test procedure: sec. 2.1049(c)(1)
sec. 87.139 (d) test procedure: sec. 2.1051, sec. 2.1057(a)(1), (b), and (c)
sec. 87.147 (a),(d1,) (d2), (d3)

Per Section 13.4 k, no part 15 Receiver Certification Tests are required for the DTR-100 because its digital circuits cannot be used to control any other devices.

Since the DTR-100 is not listed in section 1.1307 b , it is categorically excluded from the base station safety testing requirements of Part 87.

3.2 Instruments.

Table 1 is a list of the instruments used. As shown in the table, these instruments included high power radio frequency attenuators, a radio frequency power meter capable of measuring both forward and reverse power, a 500 Watt, 50 Ω radio frequency dummy load, a high power audio oscillator, 100 MHz and 500 MHz oscilloscopes, a spectrum analyzer, a frequency counter, a temperature chamber, a variable transformer, and an a.c. voltmeter.

3.3 Modulation Test.

For this test the DTR-100 was set in the "ON LINE" mode . This disables the handset.

The DTR-100 was then tuned to its center frequency, 127 MHz, set to its highest output power, 50 Watts, and set for a maximum modulation of 100%. The default settings were used for all other options.

As shown in figures 3.3 and 3.3-P (pages. 16 and 17,) a pair of Singer high power attenuators were used to reduce the RF power by 55 dB.

To key the transmitter, pins 7 and 8 of the TELCO connector, on the rear of the DTR-100, were connected together.

A Tektronix 7904 oscilloscope, having a bandwidth of 500 MHz and an input impedance of 50 Ω, was used to display the attenuated signal.

A Hewlett-Packard 200AB high power audio oscillator was tuned to 2500 Hz and connected to the 600 Ω audio input of the DTR-100. This was done by means of pins 5 and 6 of the "TELCO" connector on the rear of the DTR-100.

The audio signal was monitored by a second oscilloscope with an input impedance of 1 MΩ. The power of the audio signal was set to +10 dBm, the highest level allowed by the DTR-100.

This was done by setting the peak amplitude of the audio signal to 3.46 Volts, as measured by the oscilloscope. This value was derived as follows:

$$\textbf{Power} = \frac{\textbf{Voltage}^2}{\textbf{Resistance}}$$

$$\textbf{Watts} = \frac{\textbf{Volts}^2}{\Omega}$$

$$+10 \text{ dBm} = 10 \text{ milliWatts} = 0.010 \text{ Watts} = V^2 / 600\ \Omega$$

$$V^2 = 600 \times 0.01 = 6$$

$$V = \sqrt{6} = 2.45 \text{ Volts rms}$$

$$2.45 \text{ V rms} / 0.707 = 3.46 \text{ Volts peak.}$$

The amplitude modulation of the DTR 100 did not exceed 100%.

The peak amplitude of the audio signal was then increased to 18 Volts (+ 17 dBm) and the modulation stayed at approximately 90%.

The DTR-100 meets the modulation requirements by a comfortable margin of at least 7 dB.

3.4 Power Output Test.

As shown in figures 3.4 and 3.4-P (pages 18 and 19,) a power meter and a Motorola T1013A 150 Watt, 50 Ohm, 1 GHz dummy load were used to measure the mean power output of the DTR-100.

The DTR-100 was placed in the OFF LINE mode and its frequency was set to 127 MHz. The output power was set to +47 dBm (50 Watts.) The default settings were used for all other options.

The DTR-100 was keyed using the push-to-talk switch on its handset.

A reading of 55 Watts or less is acceptable. The DTR-100 produced 48 Watts of forward power were measured in the direction of the dummy load, and less than 0.2 Watts in the reverse direction.

The DTR-100 meets the maximum power output requirements by a margin of 6 watts.

3.5 Frequency Stability Test.

Per verbal guidance from the Federal Communications Commission, the Frequency Stability Tests were performed over an ambient temperature range of -20 degrees Centigrade to +50 degrees Centigrade (-4 to +122 degrees Fahrenheit.)

As shown in figure 3.5 and 3.5-P (pages 20 and 21,) the DTR-100 was set in the ON LINE mode, disabling the handset. It was tuned to it's center frequency of 127 MHz, and set for its maximum power output of 50 Watts. A frequency counter and a power attenuator were used to measure the frequency stability at ambient temperatures that were varied in increments of ten degrees Centigrade from -20 to + 50 degrees Centigrade (-4 to + 122 degrees Fahrenheit.)

At each increment of 10 degrees Centigrade (18 degrees Fahrenheit):

a. The a.c. supply voltage was varied from 93.5 Volts rms to at least 126.5 Volts rms (85% to 115% of 110 Volts rms) using a variable transformer, and monitored by an a.c. voltmeter.

b. The DTR-100 was keyed on and off several times to measure transient effects.

c. The frequency counter was monitored and the frequency variation was recorded.

The maximum allowable frequency variation is +/- 20 Hz. The frequency of the DTR-100 did not vary by more than ± 4 Hz. Detailed results are presented in Table 2 (page 28.)

3.6 Bandwidth and Spurious Emissions Tests:

Per verbal direction from the FCC, the DTR-100 was tested while operating at the highest and lowest extremes of its frequency range, 118 MHz and 136.975 MHz.

For these tests the DTR-100 was again set in the "ON LINE" mode, disabling the handset. It was also set to its highest output power, 50 Watts, and set for a maximum modulation of 100%. The default settings were used for all other options.

3.6.1 Bandwidth Test:

The DTR-100 was first tuned to its lowest frequency, 118 MHz.

As shown in figures 3.6 and 3.6-P (pages. 22 and 23,) a pair of Singer high power attenuators were used to reduce the RF power by 55 dB.

To key the transmitter, pins 7 and 8 of the TELCO connector on the rear of the DTR-100, were connected together.

A Tektronix 7904 oscilloscope, having a bandwidth of 500 MHz and an input impedance of 50 Ω, was again used to display the attenuated signal.

A Hewlett-Packard 200AB high power audio oscillator was again tuned to 2500 Hz and connected to the 600 Ω audio input of the DTR-100. This was done by means of pins 5 and 6 of the "TELCO" connector on the rear of the DTR-100.

The audio signal was monitored by a second oscilloscope with an input impedance of 1 MΩ. The amplitude of the audio signal was increased to 1.5 Volts peak, the level that produced 50% modulation on the transmitted signal. This level was then increased by the required 16 dB, bringing it to 9.4 Volts. This produced an amplitude modulation of approximately 90%.

A Hewlett-Packard spectrum analyzer was then used to measure the - 23 dB (0.5%) bandwidth of the DTR-100, using the amplitude of the unmodulated signal as a reference. This was compared against the allowable limit shown in figure 3.6-L (page 24.)

As shown in figure 3.6-R (page 25,) the -23 dB bandwidth did not exceed the allowable limit of 25 kHz.

This test was repeated at 136.975 MHz, with the same results.

The DTR-100 passed this test.

3.6.2 Spurious Emissions Test.

Using the same procedures of section 3.6.1, the spectrum analyzer was also used to measure the spurious emissions. As shown in figure 3.6-L (page 24,) These emissions must be at least 43 dB below the level of the main carrier at frequencies more than 62.5 kHz beyond the carrier.

As shown in figure 3.6-R (page 25,) the DTR-100 also complies with this requirement.

The DTR-100 passed this test.

3.7 Summary of Results.

Table 2 (page 28) summarizes the results. The DTR-100 passed all tests.

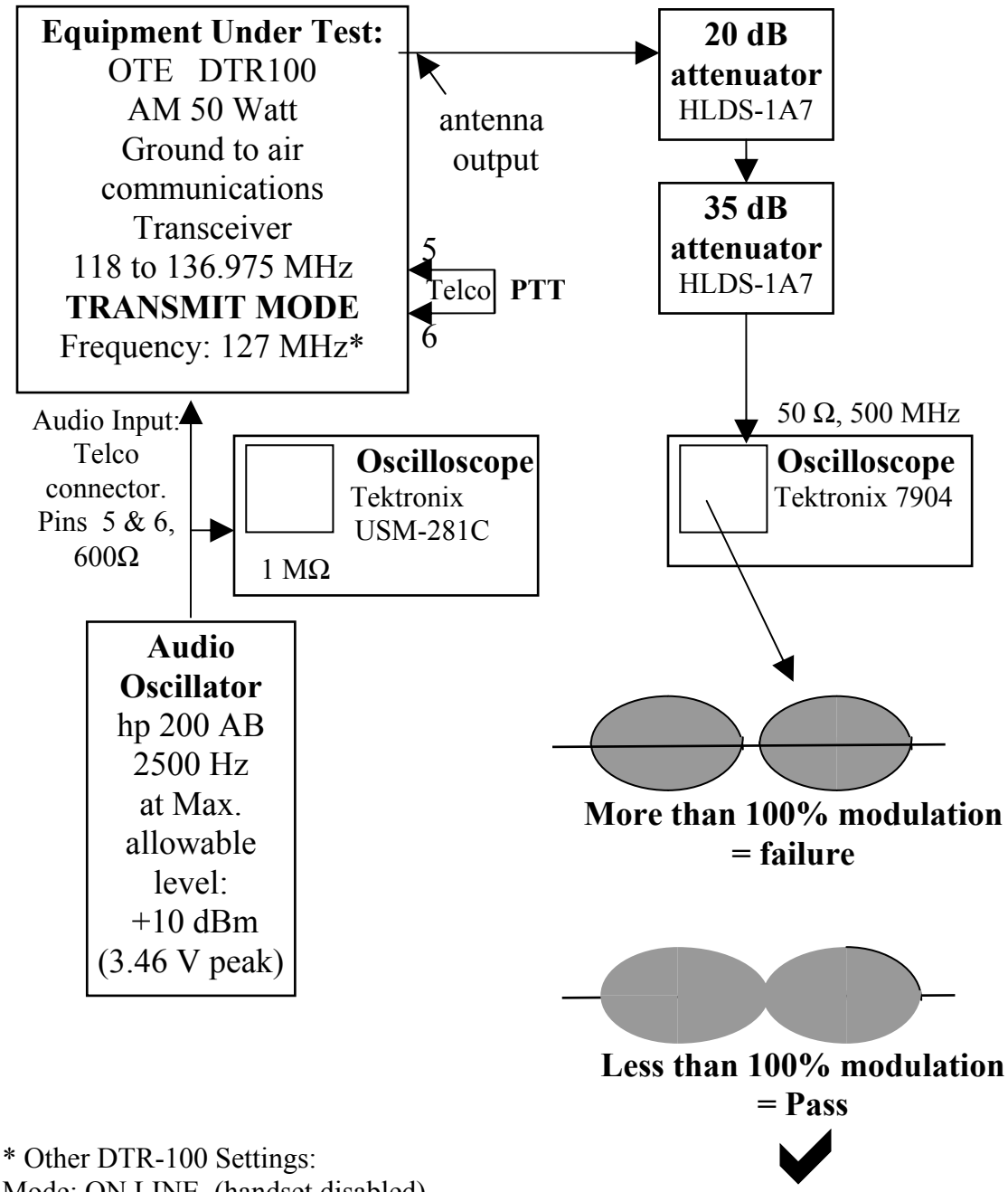
4.0 Conclusions.

The DTR-100 complies with all applicable requirements of the United States Federal Communications Commission.

Illustrations.

Figure 1: DTR-100.

Figure 3.3: Test Setup: Modulation Test.



* Other DTR-100 Settings:
Mode: ON LINE (handset disabled)
Modulation: 100%
Maximum audio input: +10 dBm (highest)
Telco connector Pins 7&8 (PTT) shorted to key the transmitter.
Default settings used for all other options.

Figure 3.3-P: Photograph of the Modulation Test.
(file “3-3-P.jpg”)

Figure 3.4: Test Setup: Power Output Test.

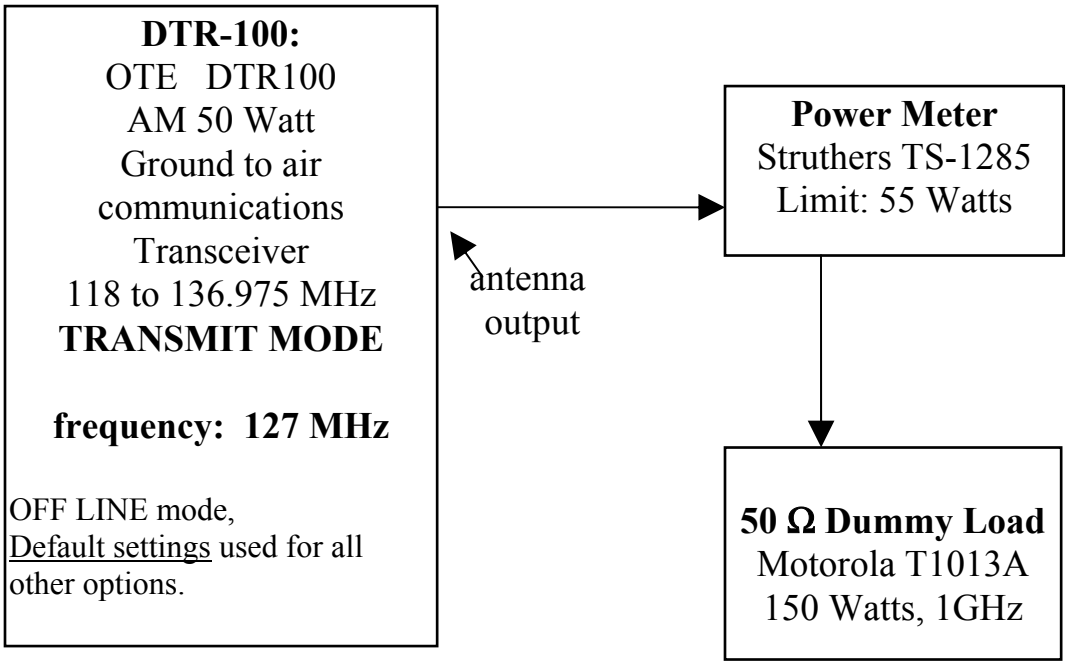


Figure 3.4-P: Photograph of the Power Output Test.
file “3-4-P.jpg”

Figure 3.5: Test Setup: Frequency Stability Test.

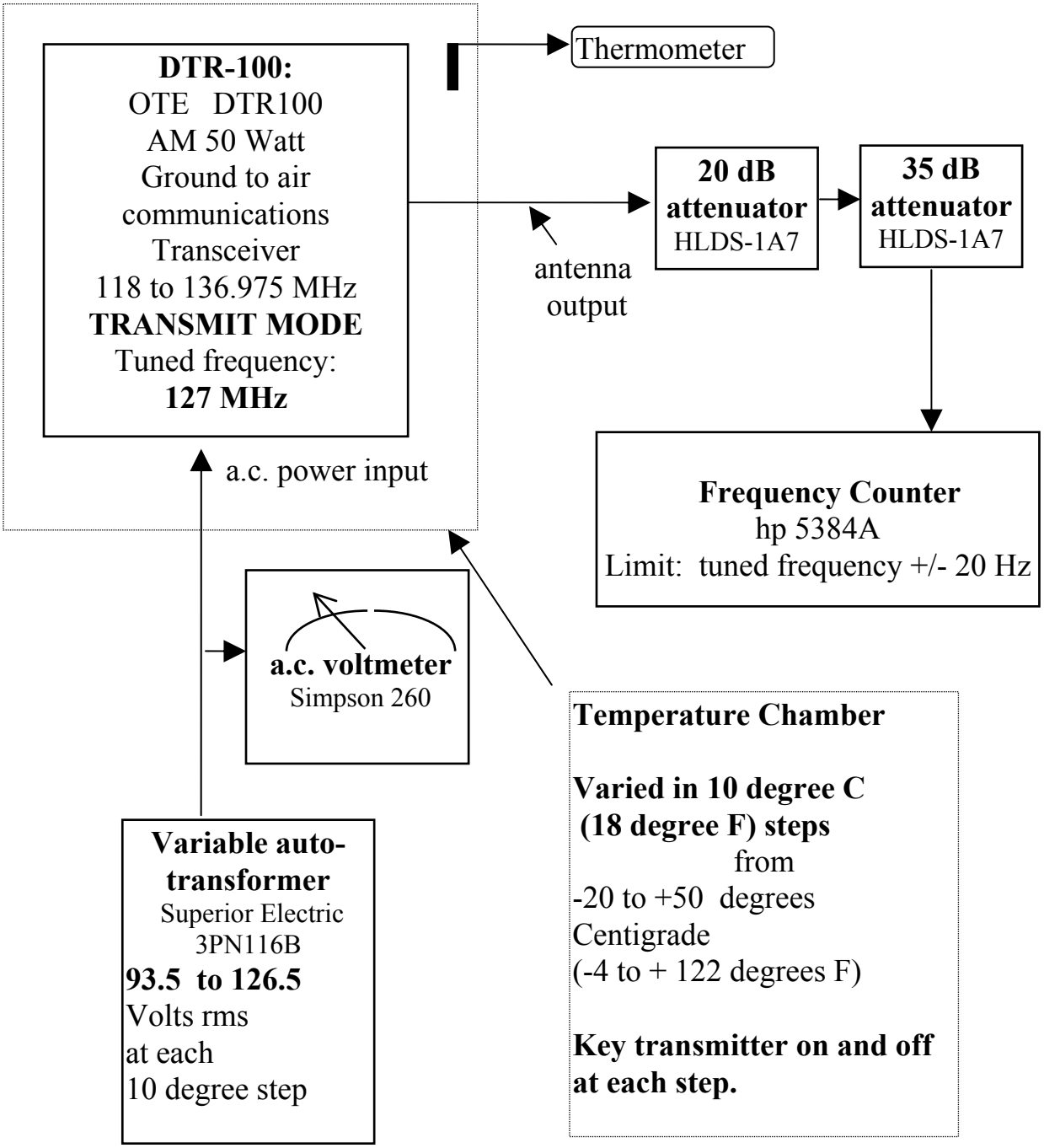


Figure 3.5-P: Photograph of the Frequency Stability Test.
(file "3-5-P.jpg")

Figure 3.6: Test Setup: Bandwidth Test and Spurious Emissions Test.

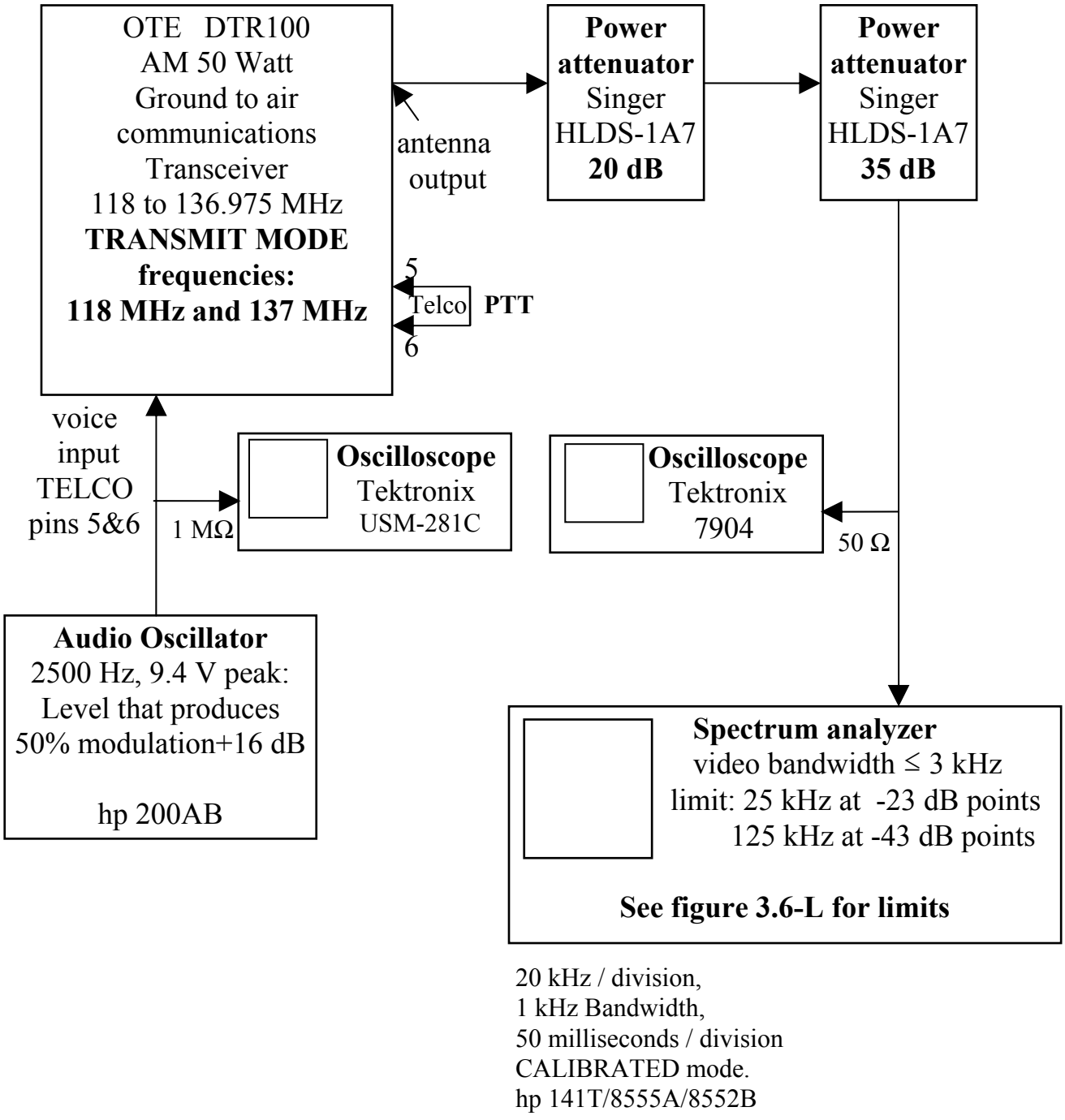


Figure 3.6-P: Photograph of the Bandwidth Test
and the Spurious Emissions Test.
(file “3-6-P.jpg “)

Figure 3.6-L: Limits for Bandwidth Test and Spurious Emissions Test.

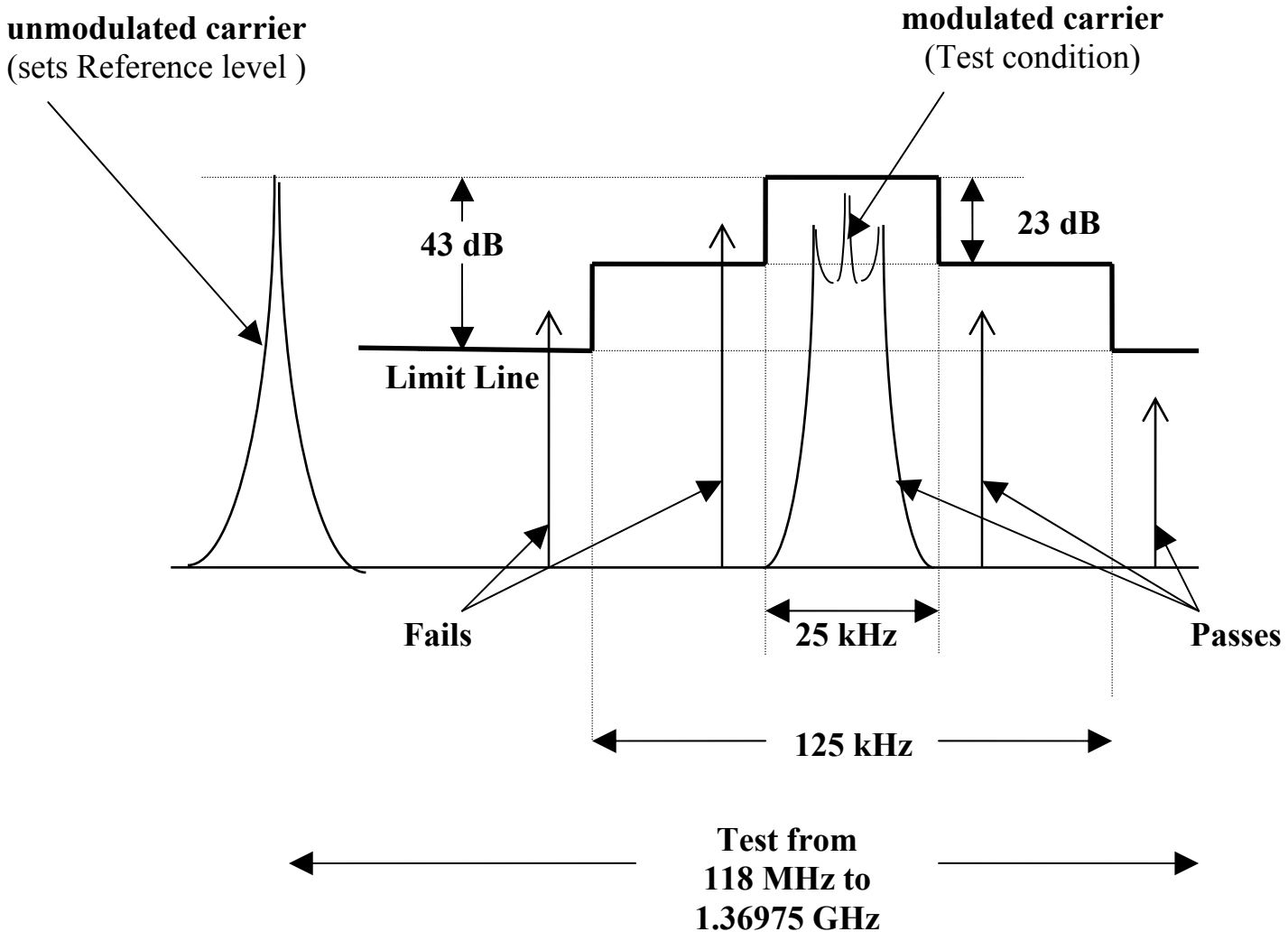
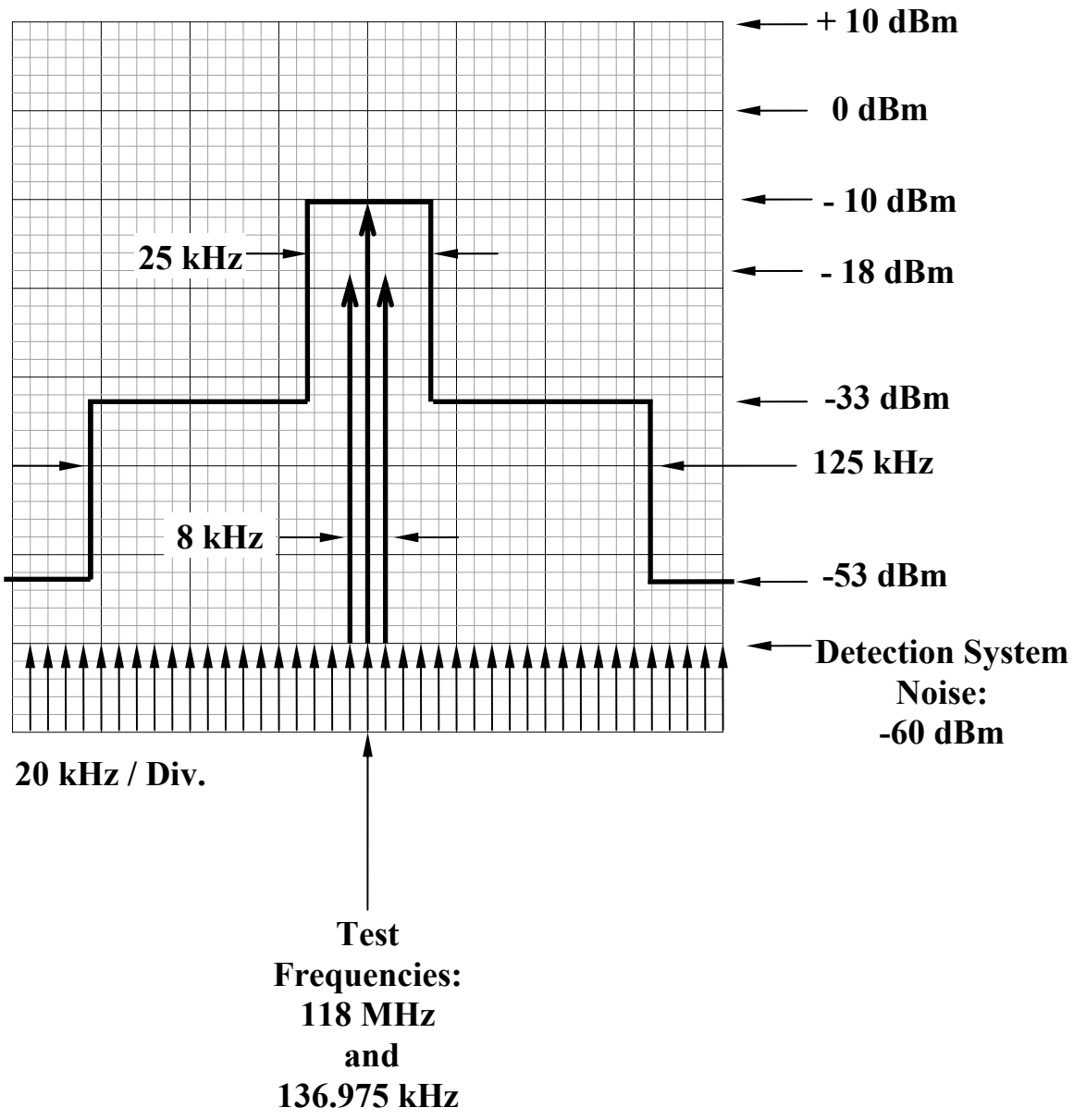


Figure 3.6-R: Results of the Bandwidth Test
and the Spurious Emissions Test.



Tables.

Table 1: Instruments

All instruments were calibrated within 2 months of the test.

Manufacturer	Model	Name	Serial No.
Hewlett-Packard	140S	Spectrum Analyzer Display	91000417
Hewlett-Packard	8555A	RF Section 1.5 MHz-40 GHz	TI# 358
Hewlett-Packard	8552B	IF Section	1650A11616
Hewlett-Packard	200AB	Audio Oscillator	0962A23987
Hewlett-Packard	5384A	Frequency counter	2313A00325
Superior Electric Company.	3PN116B	Variable Autotransformer 10 Amps, 120 V. 60 Hz.	PS-1
Tektronix	USM-281C	Oscilloscope System (Similar to 7623, ruggedized.)	675A
	OS-245(P)	Mainframe	"
	AM-6565/U	Vertical Amplifier	B042111
	AM-6565/U	Vertical Amplifier	B042112
	TD-1085/U	Time Base	C-57
Tektronix	7904	Oscilloscope System	B256682
	7A24	Vertical amplifier	B256682
	7B85	Time Base	B072464
	7A26	Vertical amplifier	B072536
	7B80	Time Base	B065431
TEMPEST INC.	9703	Temperature chamber	TI# TC-3
Simpson	260	Volt-Ohm meter	Prop. # 942
Singer	HLDS1-A7	Power Attenuator 20 dB @ 100 Watts 3 to 15 dB at 2 Watts	136
Singer	HLDS1-A7	Power Attenuator 20 dB @ 100 Watts 3 to 15 dB at 2 Watts	144
Struthers	TS-1285	Power Meter	21
Motorola	T1013A	Dummy Load 50 Ω, 150W, d.c.-1 GHz.	461
Canon	Sure Shot Owl	35mm camera.	3462328

Table 2: Summary of Results

3.3 Modulation Test: Requirement: less than 100% modulation
Result: DTR-100 produces 90% modulation
PASSES.

3.4 Power Output Test: Requirement: less than 55 Watts output power.
Result DTR-100 produces 48 Watts in the forward direction, under 0.2 Watts in the reverse direction.
PASSES.

3.5 Frequency Stability Test:
Requirement: Frequency variation <±20 Hz
Result: maximum variation is 4 Hz. as shown below. PASSES.

Temperature Degrees Centigrade	Frequency Variation. transmitter keyed repeatedly, a.c. voltage varied from 93.5 to 126.5 Volts rms.
-20	2 Hz
-10	2 Hz
0	2 Hz
+10	2 Hz
+20	4 Hz
+30	2 Hz
+40	2 Hz
+50	2 Hz

3.6 Bandwidth and Spurious Emissions Tests:
Requirement: -23 dB Bandwidth < 25 kHz
Result: -23 dB Bandwidth = 8 kHz
PASSES

Requirement: No Spurious Emissions within 43 dB below carrier level beyond a 125 kHz Bandwidth
Result: None found
PASSES

APPENDIX A: DETAILED SPECIFICATIONS OF THE DTR100

Frequency Range:	118 to 136.975 MHz
Frequency Stability:	± 1 ppm
Modulation Types:	Double Sideband Amplitude Modulation (A3E) only.
Maximum Transmit Power:	50 Watts. CW using ac power 40 Watts CW using dc power
impedance:	50Ω
VSWR: .	Meets specifications up to a VSWR of 2:1 Is stable up to a VSWR of 3:1 Works into a short circuit or an open circuit without damage.
Channel Spacing:	25 kHz for AM Double Sideband with phase shift keying (disabled in US version.) 8.33 kHz AM for Double Sideband only.
External Clock Input (optional):	10 MHz.
Electromagnetic Interference:	Meets CE Mark Requirements Meets EN 301 489-22
Intermodulation:	40 dB below carrier per EN 300 676
Conducted spurious emissions -active mode	
9 kHz -150 kHz	-46 dBm
150 kHz - 30 MHz	-46 dBm
30 MHz - 1 GHz	-36 dBm
1 - 4 GHz	-30 dBm
Power Requirements	Accepts 88 to 265 Volts a.c. 50 to 60 Hz. or 21 to 32 Volts d.c.
operating environment	-20 to +50 degrees C

storage environment	-40 to +70 degrees C
altitude	up to 15,000 ft
size	482.72 mm (19 in) wide, 133 mm (5 1/4 in.) high, 374 mm (14 3/4 in) deep
weight	13 kg
Summary:	
Power supply:	accepts 88 to 265 Volts a.c. 50 to 60 Hz. or 21 to 32 Volts d.c.
Power consumption, a.c.:	50 Watts Standby, 350 Watts Maximum.
Power consumption, d.c.:	50 Watts Standby, 270 Watts Maximum
Maximum Current draw, a.c.	: 3.5 A at 110 V , 2 A at 230 V.
Maximum Current draw, d.c. :	12.5 A at 21 V , 11A at 24V, 8.5 A at 32 V