

3.0 **REPORT OF MEASUREMENT**

Measurements were made to determine compliance with FCC Rules and Regulations Part 15, Subpart C. Limits for Unintentional Radiators are listed in Paragraph 15.109.

3.1 **Methods of Measurements - Radiated Signal Levels**

Emission levels were measured using the procedure set forth in ANSI C63.4 - 1991.

The field intensity measurements are made using standard techniques with a spectrum analyzer as the calibrated receiver. Preamplifier and filters are used with the analyzer when required.

The Hewlett Packard Model 8568B Spectrum Analyzer when calibrated to read signal level in:

$$0 \text{ dBm (50 ohms)} = 107 \text{ dB}\mu\text{V (50 ohms)}$$

The signal level ($\text{dB}\mu\text{V}$) = indicated signal level (dBm) + 107 dB. To obtain the signal level in $\text{dB}\mu\text{V/m}$ it is necessary to add the antenna factor in dB.

The receiver antenna used in these tests is the Ailtech Models DM-105-T1, T2 and T3 dipoles, A.H. Systems model SAS 200/540 biconical, model 3146 Log Periodic and Model 3115 Double Ridge Guide Horn. Each antenna was attached to a wooden collar which moves up and down on a wooden supported mast. The mast is 4.5 meters high and is self-supporting. The height of the collar with the antenna attached can be varied from 1 to 4 meters. Positioning of the collar is controlled by a nylon rope and pulley arrangement at the FIM location.

The EUT is placed on a wooden panel 1 meter wide and 1.5 meters long which rests on a wooden turn-table. (See 3.2). The top of the table is one meter above ground. The turn-table can be rotated 360°.

This antenna factor is shown graphically in the DM105 instruction manual, Figure 4-1 & 4-2 or from the EMCO Calibration data.

3.0 **REPORT OF MEASUREMENT** (Continued)

3.1 **Methods of Measurement - Radiated Signal Levels**

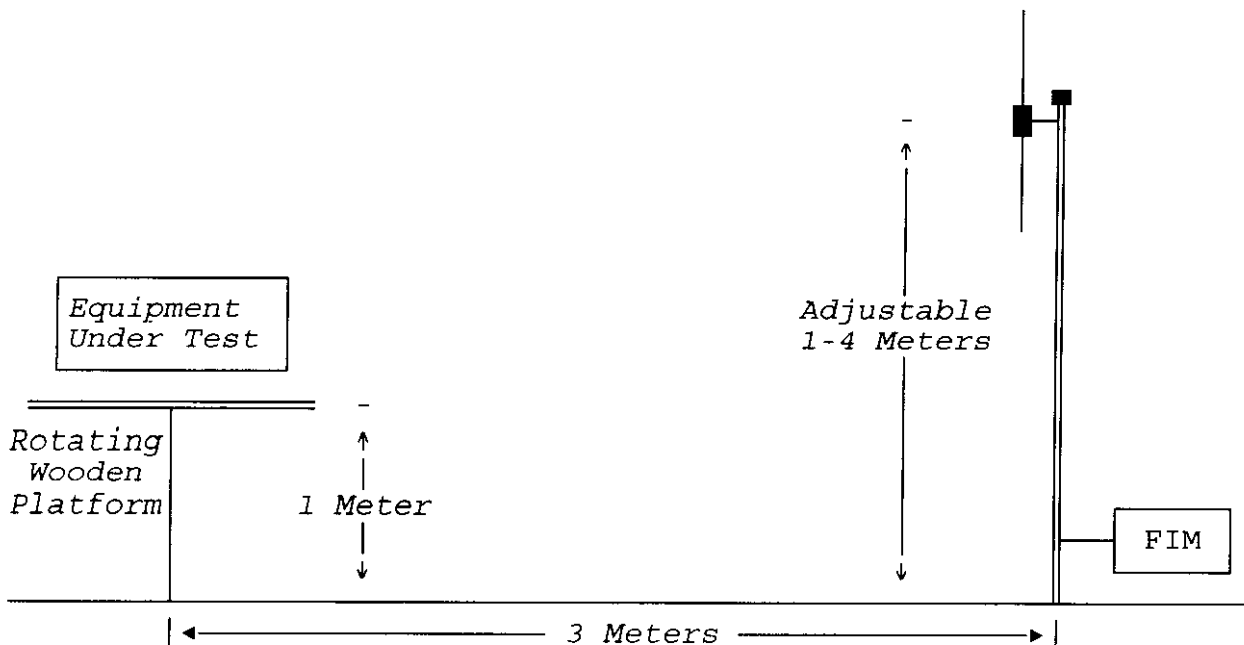
(Continued)

For each frequency measurement the antenna is adjusted to the correct length which is determined from the calibration ruler supplied with the antenna kit. Also, for each frequency measured, the FIM antenna is raised, lowered and adjusted for both vertical and horizontal polarity to obtain the maximum indication on the analyzer. The turn-table is rotated through 360° in azimuth to determine the direction of maximum emissions.

3.2 **EUT Configuration**

The EUT test configuration was per the requirements of ANSI C63.4 - 1991.. The Receiver/Controller with antenna and power cable attached were placed on a wooden table 1 meter high. The wooden table was placed on a steel flush mount turn table. The cables were spread out on a 3/4" piece of plywood 1 meter by 1.5 meters attached to the turn-table top. During this these cables were rearranged by a technician with long wooden dowel to maximize radiation. Both the Transmitter and Receiver were tested simultaneously with the system operating in a "cohered" configuration.

3.3 **Spurious Radiation Test Site (Per 2.1033(b)6)**



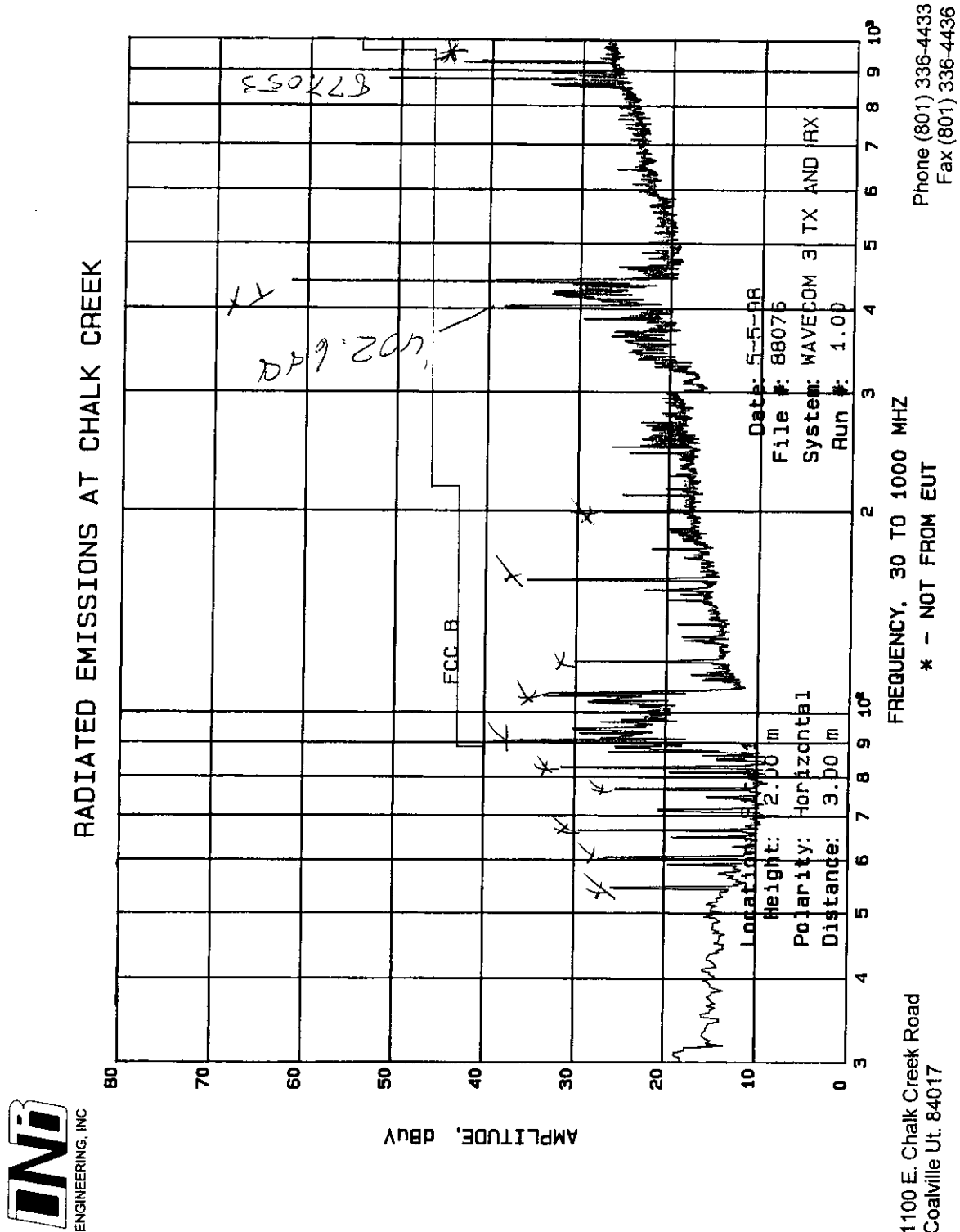
3.0

REPORT OF MEASUREMENT (Continued)

3.4

Radiated Data

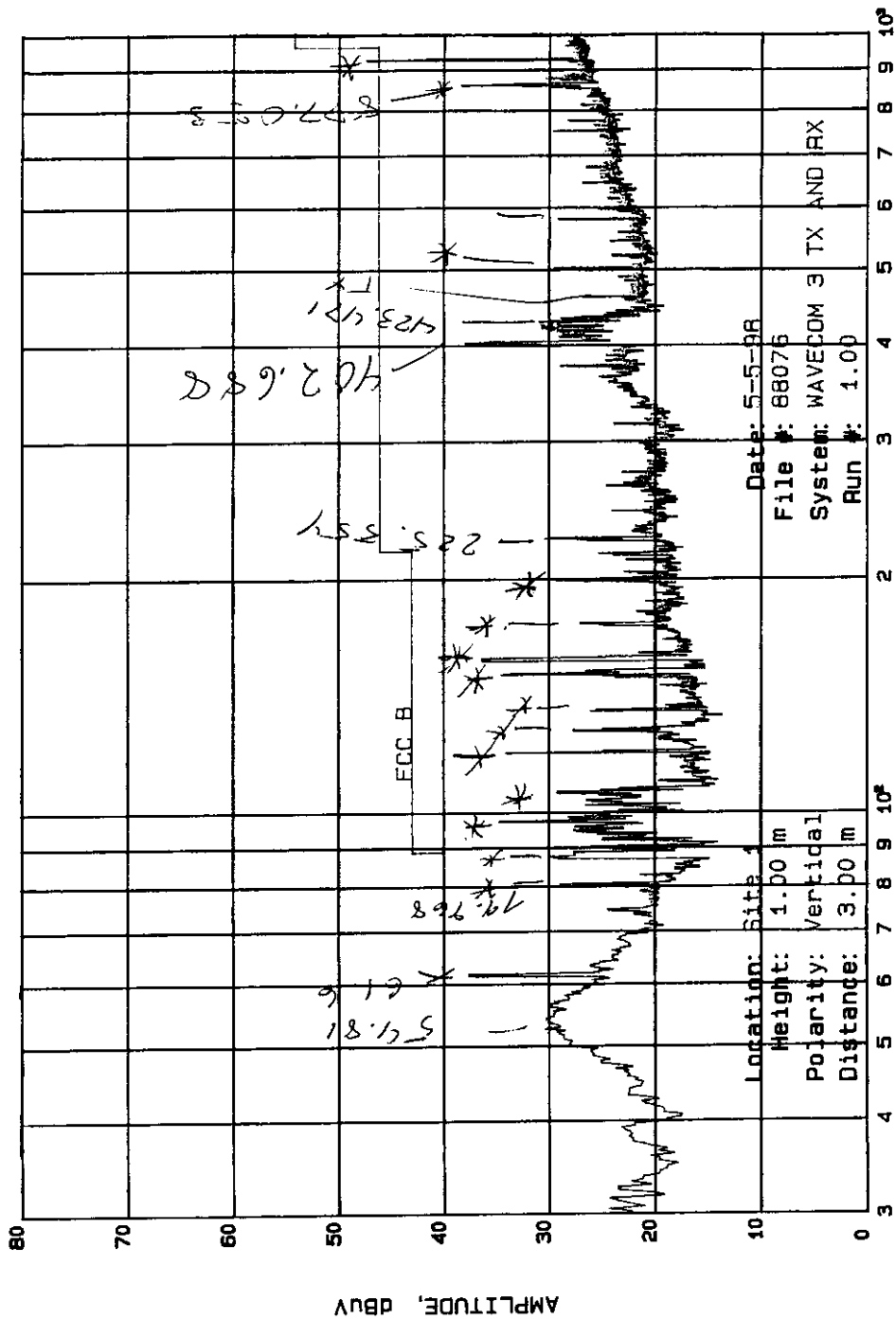
Radiated Emissions Plot (Horizontal Antenna Polarization)



Radiated Data

Radiated Emissions Plot (Vertical Antenna Polarization)

RADIATED EMISSIONS AT CHALK CREEK



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TABLE 2 - Test Results

Radiated signal measurements (Ref. Part 15, Subpart C, §15.63)

Page 1

DNB Engineering, Inc.
RADIATED EMISSIONS
Location #1 FCC Part 15 Class B

88076.XLS

Client:		RF LINK		File #		88076		Rep. : LES PAYNE							
Date:		5-May-98		Engr:		WEST		System: WAVECOM 3 TX AND RX							
Freq. (MHz)	Meas'd (dBuV)	Amp Factors (dB)	Cable Factors (dB)	Antenna Factors (dB)	Total Factors (dBuV/m)	Total (dBuV/m)	3 Meter FCC Limit	Delta (dB)	Azimuth (degree)	Height (m)	Hor/ Vert	HP/ R&S	Type Ave	Meas	Comments
54.814	42.5	26.6	1.7	10.0	-14.9	27.60	40.0	-12.40	0	1.00	V	R&S	QP	RUN 1	
61.600	35.3	26.6	1.8	8.1	-16.7	18.60	40.0	-21.40	50	1.00	V	R&S	QP	RUN 1	
79.968	34.6	26.6	1.9	6.6	-18.1	16.50	40.0	-23.50	200	1.00	V	R&S	QP	RUN 1	
225.554	34.5	25.7	3.1	16.7	-5.9	28.60	46.0	-17.40	112	1.00	V	R&S	QP	RUN 1	
402.688	41.7	26.5	4.9	17.3	-4.3	37.40	46.0	-8.60	50	1.00	V	R&S	QP	RUN 1	
402.688	39.1	26.5	4.9	17.3	-4.3	34.80	46.0	-11.20	193	1.00	H	R&S	QP	RUN 1	
423.471	31.5	26.6	5.0	17.8	-3.8	27.70	46.0	-18.30	235	1.00	V	R&S	QP	RUN 1	
877.053	46.0	27.2	7.3	23.4	3.5	49.50	61.0	-11.50	240	1.00	V	R&S	QP	RUN 1	
877.053	49.6	27.2	7.3	23.4	3.5	53.10	61.0	-7.90	320	1.00	H	R&S	QP	RUN 1	
										</					

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3.5 **Test Results**

See TABLE 2 of this document.

3.5.1 **Example of Typical Calculation**

Measurement Distance = 3 meters

Analyzer Reading	=	-85 dBm
Conversion to dB μ V	=	<u>+107 dB</u>
Signal level dB μ V	=	22 dB μ V
Antenna factor including cable loss	=	$\frac{13.5 \text{ dB}}{35.5 \text{ dB}\mu\text{V/m}}$
Field Strength dB μ V/m at 3 meters	=	35.5 dB μ V/m
	=	59.6 μ V/m

3.0

REPORT OF MEASUREMENT (Continued)

3.6

Conducted Data

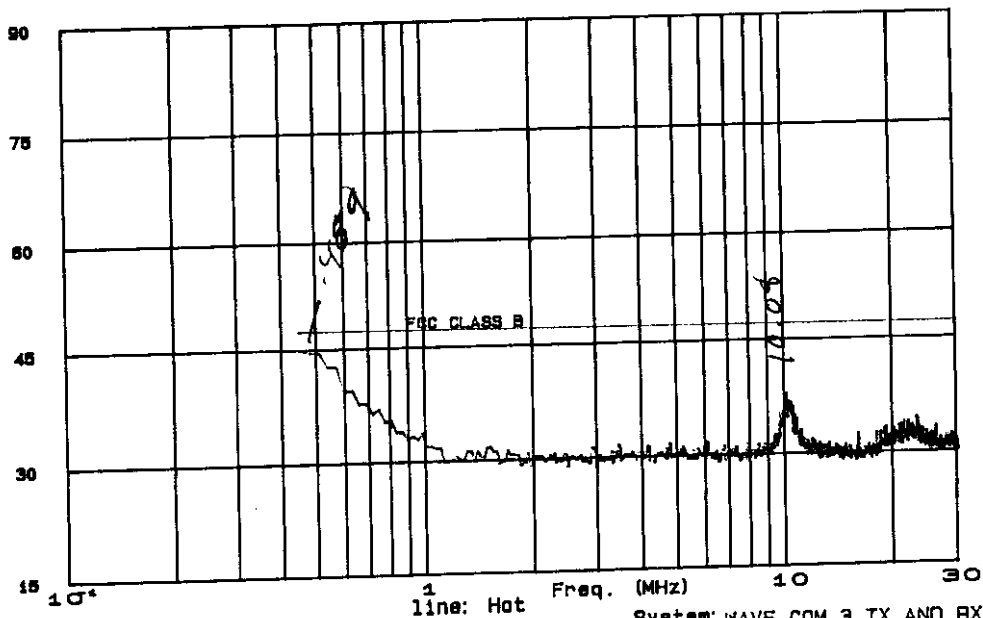
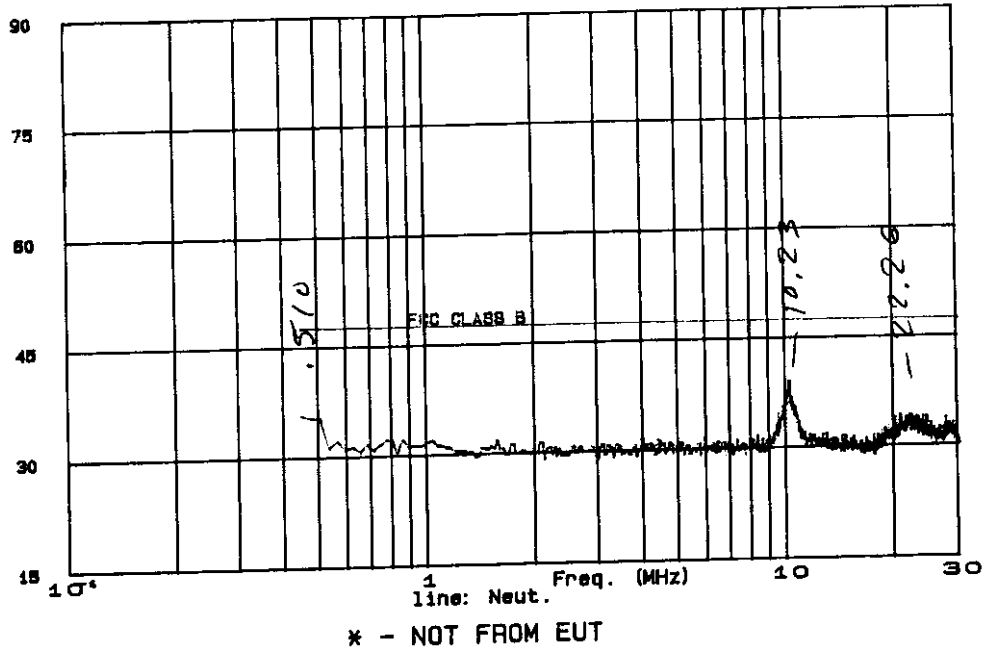
Conducted Emissions Plot



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CONDUCTED EMISSIONS



Location: Site 2
Date: 5-3-98
File #: 88076

System: WAVE COM 3 TX AND RX
Run #: 1.00
Unit on LISN: WAVE COM 3 TX AND RX

TABLE 3 - Test Results

Conducted signal measurements

Page 1

DNB Engineering, Inc.
CONDUCTED EMISSIONS
Location #2 FCC Part 15 Class B

88076.XLS

Client: _____		RF LINK		File #		88076		Rep : LES PAYNE	
Date : _____		3-May-98		Engr: _____		WEST		System: WAVECOM 3 TX AND RX	
Freq. (MHz)	Meas'd (dBuV)	LISN Factors (dB)	Cable Factors (dB)	Total Factors (dB)	FCC Limit (dBuV)	Meas		HP/ R&S	Comments
						Delta (dB)	Type		
							Ave		
							Peak		
							Q1		
							P1		
							P2		
							P3		
0.489	41.10	0.1	0.2	0.3	41.40	-6.60	QP	QP	RUN 1 110 VAC
10.230	39.70	0.7	0.8	1.5	41.20	-6.80	QP	P	RUN 1 110 VAC
10.080	38.20	0.7	0.8	1.5	39.70	-8.30	QP	P	RUN 1 110 VAC
23.260	35.10	1.6	1.2	2.8	37.90	-10.10	QP	P	RUN 1 110 VAC
22.260	34.90	1.6	1.2	2.8	37.70	-10.30	QP	P	RUN 1 110 VAC
0.510	35.80	0.1	0.2	0.3	36.10	-11.90	QP	P	RUN 1 110 VAC

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4.0

TEST SITE

The data and site photographs are presently on file, and have been accepted and approved by the Commission.

4.1

Certification Requirements

This is in reference to Federal Communications Commission Information Bulletin OCE 24 November 1971, Page 6, Section 10.4 Measurements Facilities.

A. *Description of Supporting Structures*

Supporting structures for measurement consists of a Steel flush mount turn-table, a fiberglass Mast and antenna mount adjustable 1 - 4 meters. Supporting structures used in accordance with ANSI C63.4 - 1991.

B. *List of Measuring Equipment Used:*

See attached list of test equipment. In general the instruments used were the Empire Device NF105, antenna kit, the Hewlett Packard 8566B series Spectrum Analyzer and the Hewlett Packard 54111D Digitizing Oscilloscope.

C. *Instrument Calibration:*

All equipment listed are calibrated by a certified metrology facility using standards traceable to NIST.

Each instrument is calibrated annually or more frequently if required.

All Equipment is calibrated to MIL-STD-45662. A monthly recall system is used to insure that all instruments are calibrated before the calibration period expires.