

TEST REPORT NO. RSI-5101E

ELECTROMAGNETIC EMISSION EVALUATION

OF THE

LUTRON ELECTRONICS

MODEL NO. RAMC-XC

FCC PART 15, SUBPART C §15.231

JANUARY 1999

JPZ 00009

PREPARED FOR:

*Lutron Electronics
7200 Suter Road
Coopersburg, PA 18036*

**RADIATION
SCIENCES**



INCORPORATED

3131 Detwiler Rd. • Harleysville, PA 19438 • (215) 256-4133



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PREPARED FOR:

Lutron Electronics
7200 Suter Road
Coopersburg, PA 18036

SUBMITTED BY:

Radiation Sciences Inc.
3131 Detwiler Road
Harleysville, PA 19438

PREPARED BY:

Thomas Koester
Thomas Koester
EMC Test Engineer

REVIEWED BY:

D. J. Signore
Daniel J. Signore
President

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**ADMINISTRATIVE DATA****TEST PERFORMED:**

Measurements of radiated RF emissions.

PURPOSE OF TEST:

To evaluate the ElectroMagnetic Emission (EME) characteristics of the Equipment Under Test with respect to Subpart B and C of Part 15 of the Federal Communications Commission (FCC) Rules for intentional and unintentional radiators.

EQUIPMENT UNDER TEST (EUT):

Model Number: **RAMC-XC**

Serial Number: None

CONTRACT:

Purchase Order Number: NP-98661

TEST PERIOD:

22 January 1999

TEST FACILITY:

Radiation Sciences Incorporated (RSI), EMC Test Laboratory, located at: 651 North Cannon Avenue, Lansdale, PA 19446.

TEST PERSONNEL AND COORDINATORS:**Radiation Sciences Inc.**

T. Koester

D. Signore

Lutron Electronics

R. Black

S. Thompson

**SUMMARY OF TEST RESULTS**

The Model # RAMC-XC, configured as described herein, **FULLY COMPLIES WITH THE REQUIREMENTS SET FORTH IN SUBPART B AND C OF PART 15 OF THE FEDERAL COMMUNICATIONS COMMISSION (FCC) RULES FOR INTENTIONAL AND UNINTENTIONAL RADIATORS.**



1.0 INTRODUCTION

This document is a report of tests to determine the EME characteristics of the **Model # RAMC-XC** presented by **Lutron Electronics** of Coopersburg, Pennsylvania.

The purpose of the testing was to evaluate the EMC characteristics of the test sample with respect to Subpart B and C of Part 15 of the FCC Rules for intentional and unintentional radiators.

Test setups and procedures are described in **RSI's Test Procedures 4963E** (see Appendix B) and test results are summarized herein on graphs.

All test procedures used meet the requirements of the American National Standards Institute Procedure C63.4: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz", dated 17 July 1992.



2.0 DESCRIPTION OF THE TEST SAMPLE:

The **RAMC-XC** is a master control keypad which is table top or wall mounted and contains a super-heterodyne receiver, a transmitter and an antenna. It is used to know the state of and also turn on or turn off dimmers and/or switches in an integrated lighting control system.

The final value of resistor (R45) used during the test was 22ohms.

The receiver down converts a 418MHz carrier frequency using a 407.3MHz local oscillator producing a 10.7MHz IF SIGNAL. The signal is further processed to decode data. The transmitter uses a SAW oscillator and power amplifier, which is keyed on/off to produce the modulated carrier. Each master control keypad contains a micro controller running at 4MHz to ensure that all transmissions stop within 5 seconds of the button release or within 5 seconds on the beginning of the transmission or a transmission actuated automatically shall cease transmission within 5 seconds after activation. Modulation is AM, specifically On/Off Keyed (OOK) or sometimes called Amplitude Shift Keyed (ASK) data at 15.625kbps. The antenna cannot be modified or easily replaced by the user.

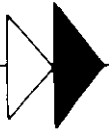
The **RAMC-XC** derives power from two AAA batteries which power a DC-DC converter that produces a 5V DC output.



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3.0 TEST INSTRUMENTATION

<u>RSI INV #</u>	<u>DESCRIPTION</u>	<u>MANUFACTURER</u>	<u>MODEL #</u>	<u>SERIAL #</u>	<u>LAST CAL DATE</u>	<u>CAL DUE DATE</u>	<u>C Y C L E</u>	<u>T Y P E</u>
31	SPEC ANALYZER	ADVANTEST	R3271	J003583	4/10/1998	4/10/1999	12	C
75	ANTENNA	TENSOR	4108	204	1/6/1999	1/6/2000	12	C
80	ANTENNA	AMP.RES.ASSOC.	AT1000	4094-025	1/7/1999	1/7/2000	12	C
91	ANTENNA	EMCO	3115	2023	12/18/1998	6/18/1999	6	V
391	RECEIVER	Rohde & Schwarz	ESVP	861744/015	1/4/1999	1/4/2000	12	C



4.0 TEST RESULTS

4.1 Conducted Power Line Measurements

Conducted power line measurements were not recorded for the test sample since it receives power from two AAA batteries.



4.2 Radiated Emission Measurements, Paragraphs §15.33, §15.35, §15.109, §15.205, §15.209 and §15.231

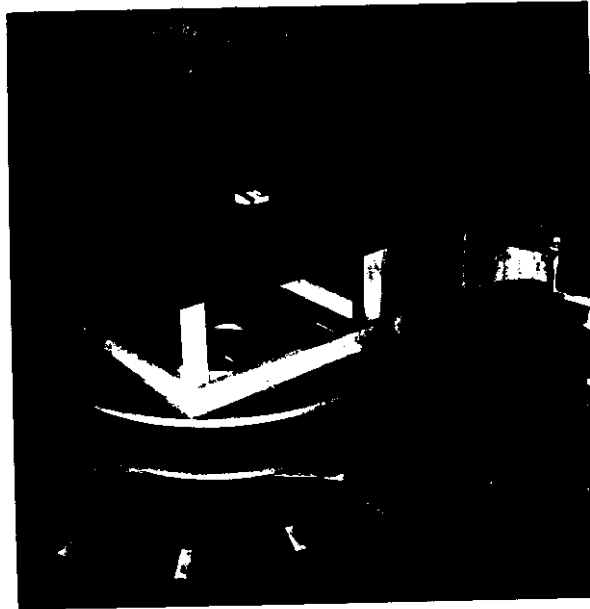
See figure 1 for a test setup photograph and figure 2 for a photograph of the fundamental frequency bandwidth. Radiated emission measurements were recorded for the test sample at a distance of 3 meters, unless otherwise stated. The results of field strength measurements are illustrated on figures 3 for unintentional radiators and figures 4 and 5 for intentional radiators. Radiated emissions were measured with the antenna in both the horizontal and vertical polarizations. The antenna was raised 1 to 4 meters in height and the equipment under test (EUT) was rotated 360° to maximize the emission.

For unintentional radiators, the emissions from the EUT was scanned from 30MHz to 2000MHz since its local oscillator is 407.3MHz.

For intentional radiators the field strength of emissions of the EUT were measured out to the tenth harmonic of the carrier frequency. The carrier frequency is 418MHz. The bandwidth of the emission shall be no wider than .25% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

An average factor of 20dB was applied to the level of the fundamental emission when compared to the FCC limit.

ALL LEVELS COMPLY WITH APPLICABLE LIMITS.

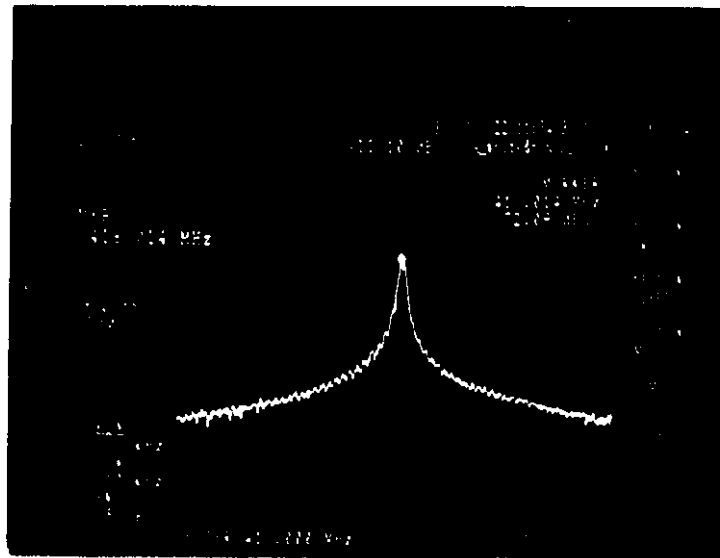


TEST SETUP PHOTOGRAPH

FIGURE 1



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PHOTOGRAPH OF FUNDAMENTAL FREQUENCY BANDWIDTH

FIGURE 2



5.0 CONCLUSIONS

The evaluation of the **Model # RAMC-XC**, configured as described herein, indicated that the unit complies with the requirements set forth in Subpart B and C of Part 15 of the **FCC Rules** for unintentional and intentional radiators.

1. The EUT meets the radiated emission limits for unintentional radiators set forth in §15.109. The closest measurement was 10dB under the limit.
2. The EUT meets the radiated emission limits for intentional radiators set forth in §15.205, §15.209 and §15.231. The closest measurement was 2.5dB under the limit.
3. The EUT meets the bandwidth requirements set forth in §15.231 (c).

Certification by the Federal Communications Commission (**FCC**) is required. This report, **RSI's Test Procedure 4963E** and **FCC Form 731** must be submitted to the **FCC** for approval.



RADIATION SCIENCES INC.

APPENDIX A

DATA SHEETS



Test Personnel: Thomas Koester
Date: 1/22/99

Company: Lutron Electronics
Model # RAMC-XC
Serial # None

Radiated Emission for Unintentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Field Strength @ 3m (uV/m)	Limits @ 3m (uV/m)	Margin (dB)	Remarks
30	Vert	1.00	0	7.4	12.1	0.9	20.4	40.0	10	100	-19.6	
140	Vert	1.00	0	2.7	12.3	1.3	16.3	43.5	7	150	-27.2	
330	Vert	1.00	0	1.0	16.1	2.4	19.5	46.0	9	200	-26.5	
407.37	Vert	1.2	323	14.0	16.2	2.9	33.1	46.0	45	200	-12.9	
814.73	Vert	1.25	119	5.1	22.7	4.1	31.9	46.0	39	200	-14.1	
1000	Vert	1.00	0	5.0	25.0	4.4	34.4	54.0	52	500	-19.6	
30	Horiz	1.00	0	5.6	12.1	0.9	18.6	40.0	9	100	-21.4	
140	Horiz	1.00	0	3.5	12.3	1.3	17.1	43.5	7	150	-26.4	
330	Horiz	1.00	0	1.0	16.1	2.4	19.5	46.0	9	200	-26.5	
407.37	Horiz	1.01	50	14.1	16.2	2.9	33.2	46.0	46	200	-12.8	
814.73	Horiz	1.00	36	9.1	22.7	4.1	35.9	46.0	62	200	-10.1	
1000	Horiz	1.00	47	5.0	24.6	4.4	34.0	54.0	50	500	-20.0	

FIGURE 3



Company: Lutron Electronics
Model # RAMC-XC
Serial # None

Test Personnel: Thomas Koester
Date: 1/22/99

Radiated Emission for Intentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Antenna Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Distance Factor (dB)	Cable Loss (dB)	Averaging Factor (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Field Strength @ 3m (uV/m)	Limits @ 3m (uV/m)	Margin (dB)
418.0	Vert	1.31	47	78.2	16.7	0.0	2.9	-20.0	77.8	80.3	7762	10332	-2.5
836.0	Vert	1.44	91	28.5	22.7	0.0	4.2	-20.0	35.4	61.9	59	1250	-26.5
1254	Vert	1.00	140	35.9	25.0	-9.5	0.8	-20.0	32.2	61.9	41	1250	-29.7
1672	Vert	1.00	200	28.0	26.5	-9.5	0.8	-20.0	25.8	54.0	20	500	-28.2
2090	Vert	1.00	200	16.0	28.0	-9.5	0.8	-20.0	15.3	61.9	6	1250	-46.6
2508	Vert	1.00	150	31.9	29.2	-9.5	0.9	-20.0	32.5	61.9	42	1250	-29.4
2926	Vert	1.00	30	24.6	30.5	-9.5	0.9	-20.0	26.5	61.9	21	1250	-35.4
3344	Vert	1.00	250	11.4	31.5	-9.5	0.9	-20.0	14.3	54.0	5	500	-39.7
3762	Vert	1.00	310	18.4	32.2	-9.5	0.9	-20.0	22.0	54.0	13	500	-32.0
4180	Vert	1.00	50	13.5	33.2	-9.5	1.0	-20.0	18.2	54.0	8	500	-35.8
418.0	Horiz	1.30	340	68.4	16.4	0.0	2.9	-20.0	67.7	80.3	2427	10332	-12.6
836.0	Horiz	1.47	269	31.5	23.0	0.0	4.2	-20.0	38.7	61.9	86	1250	-23.2
1254	Horiz	1.00	150	37.7	25.0	-9.5	0.8	-20.0	34.0	61.9	50	1250	-27.9
1672	Horiz	1.00	130	31.5	26.5	-9.5	0.8	-20.0	29.3	54.0	29	500	-24.7
2090	Horiz	1.00	50	17.6	28.0	-9.5	0.8	-20.0	16.9	61.9	7	1250	-45.0
2508	Horiz	1.00	180	28.8	29.2	-9.5	0.9	-20.0	29.4	61.9	30	1250	-32.5
2926	Horiz	1.00	50	18.7	30.5	-9.5	0.9	-20.0	20.6	61.9	11	1250	-41.3
3344	Horiz	1.00	0	5.3	31.5	-9.5	0.9	-20.0	8.2	54.0	3	500	-45.8
3762	Horiz	1.00	0	5.0	32.2	-9.5	0.9	-20.0	8.6	54.0	3	500	-45.4
4180	Horiz	1.00	0	4.6	33.2	-9.5	1.0	-20.0	9.3	54.0	3	500	-44.7

FIGURE 4



Test Personnel: Thomas Koester
Date: 1/22/99

Company: Lutron Electronics
Model # RAMC-XC
Serial # None

Bandwidth of Fundamental Frequency

	Frequency (MHz)	Measurement (dBuV/m)
Center Frequency	418.0	72.09
20 dB down	417.984	51.56
20 dB down	418.044	50.34

The bandwidth is 60 KHz



RADIATION SCIENCES INC.

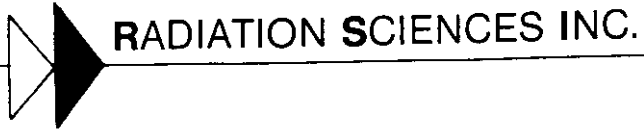
APPENDIX B

RADIATION SCIENCES INC.

TEST REPORT NO. RSI-4963E

OPEN AREA TEST SITE

FCC PART 15 AND 18



RADIATION SCIENCES INC.

RSI-4963E

RADIATION SCIENCES INCORPORATED

3131 DETWILER ROAD

HARLEYSVILLE, PENNSYLVANIA 19438

OPEN AREA TEST SITE

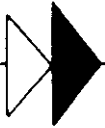
FCC PART 15 AND 18

1 SEPTEMBER 1998

PREPARED BY:

A handwritten signature in cursive script, reading "Daniel J. Signore".

Daniel J. Signore
President
Radiation Sciences Inc.

**RADIATION SCIENCES INC.****RADIATION SCIENCES INCORPORATED****651 CANNON AVENUE****LANSDALE, PENNSYLVANIA 19446****(215) 256-4133****MEASUREMENT FACILITY AND EQUIPMENT**

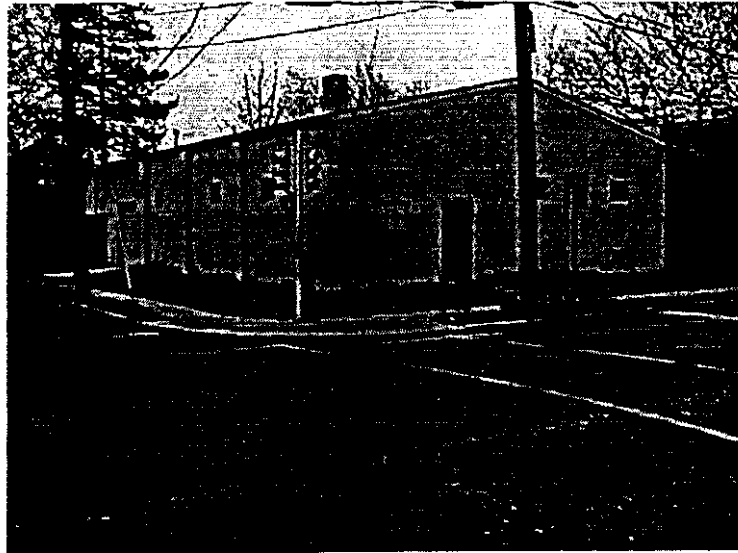
Location: 651 Cannon Avenue
Lansdale, Pennsylvania 19446

Description: Figures 1 and 2 presents photographs of the free-field area. The site is enclosed, free of large metal objects except for a ground plane. Dimensions are shown on Figure 3.

Test Equipment: Radiation Sciences has a full compliment of electromagnetic interference (EMI) test equipment. For FCC Parts 15 and 18 testing, the following primary equipment is used:

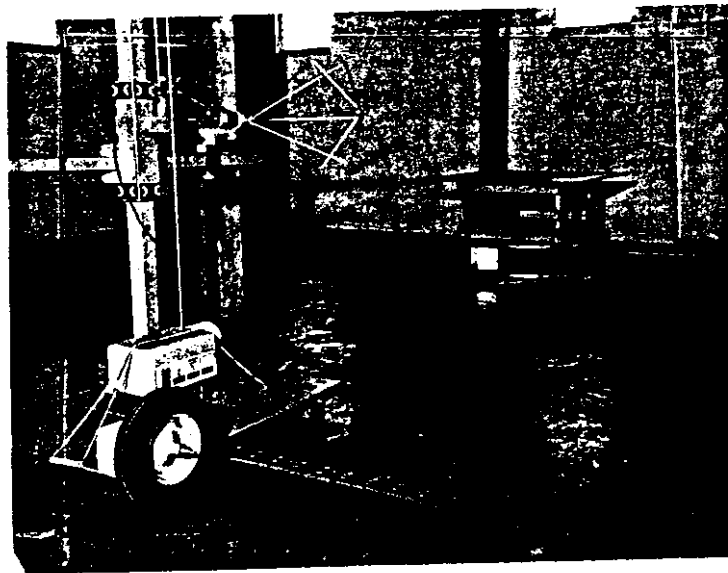
- a. Receiver - Rhode - Schwarz ESH3
Rhode - Schwarz ESVP
- b. Spectrum Analyzer - Advantest R3271
- c. Antennas:
 - Tensor 4108 Biconical
 - Antenna Research AT1000 Log Periodic
 - EMCO 3115 Double Ridged Guide
- d. Line Impedance Stabilization Network
 - Solar 8028-50-TS-24-BNC
 - Solar 8610-50-TS-100-N*
- e. Turntable - EMCO 1067/061704
- f. Antenna Tower - EMCO 1050/1051

* Modified per ANSI C63.4-1992



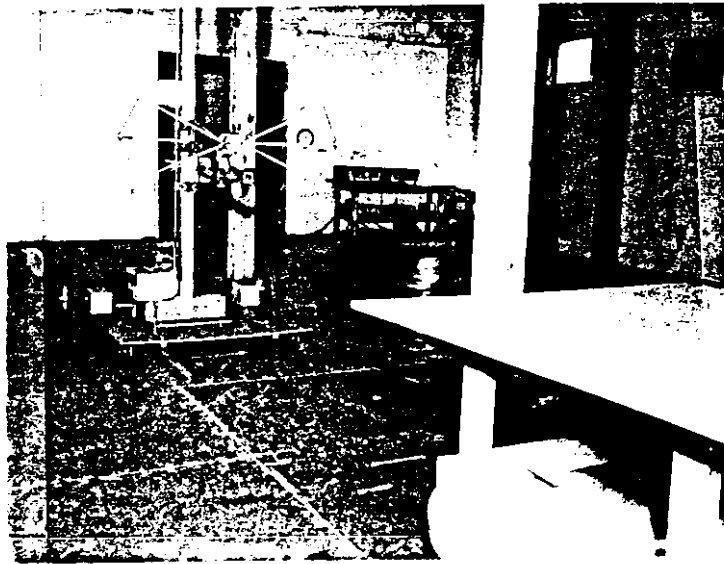
OATS SITE EXTERIOR

FIGURE 1



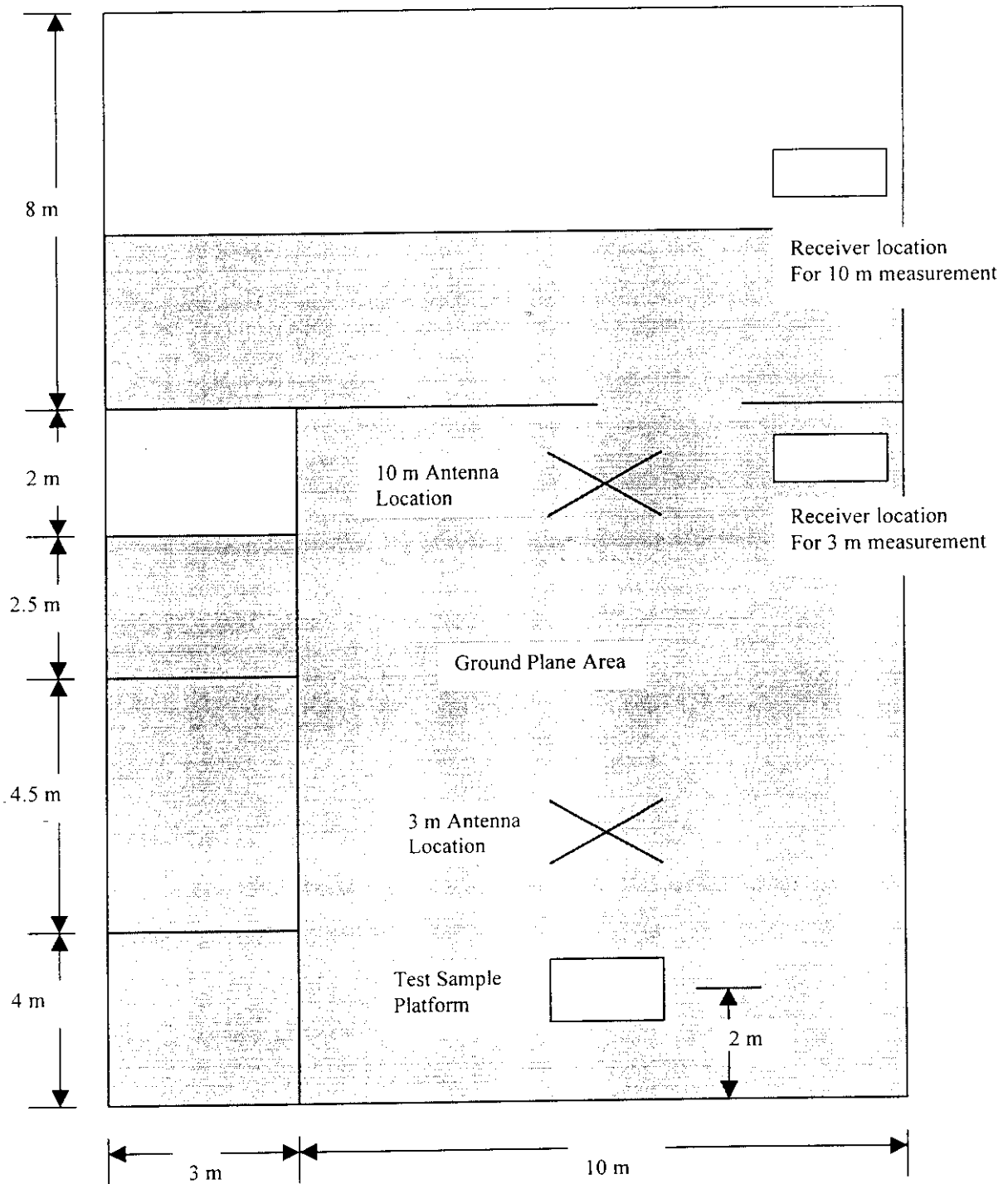
OATS TEST SITE INTERIOR

FIGURE 2



OATS TEST SITE INTERIOR

FIGURE 2 A



OATS TEST SITE LAYOUT

FIGURE 3

**SITE ATTENUATION MEASUREMENTS**

Period of Measurements: 26 January 1998 through 30 January 1998.

Test Procedures: ANSI C63.4-1992

- Test Antenna position per Figures 6 and 7 of ANSI C63.4-1992.
- Tests performed using the equipment listed in Table 1. All measuring instruments are calibrated at least annually in accordance with 150-25.
- Requirements selected for Dipole antennas and ideal test site.

Figures 4 through 7 and Data Sheets 2 through 4 present the results of site attenuation measurements.

CONDUCTED EMISSION TEST SITE

All conducted emission measurements will be performed in the open area test site with 2M X 2M vertical ground plane in accordance with ANSI C63.4-1992. Tabletop devices will be placed on a platform raised 80cm above the conducting floor. Floor standing devices will be placed either directly on the conducting floor or on insulating material as appropriate. Figure 8 illustrates the set up and Figure 9 is a photograph of the setup.

TABLE 1

TEST INSTRUMENTATION

<u>RSI</u> <u>INV</u> <u>#</u>	<u>D</u> <u>E</u> <u>P</u> <u>T</u>	<u>DESCRIPTION</u>	<u>MANUFACTURER</u>	<u>MODEL #</u>	<u>SERIAL #</u>	<u>LAST</u> <u>CAL</u> <u>DATE</u>	<u>CAL</u> <u>DUE</u> <u>DATE</u>	<u>C</u> <u>Y</u> <u>C</u> <u>L</u> <u>E</u>	<u>T</u> <u>Y</u> <u>P</u> <u>E</u>
fc 31	E	SPEC ANALYZER	ADVANTEST	R3271	J003583	1/29/98	1/29/99	12	C
fc 71	E	ANTENNA	EMPIRE	DM-105-T1	NSN			DC	
fc 75	E	ANTENNA	TENSOR	4108	204	6/28/97	6/28/98	12	C
fc 79	E	ANTENNA	EMPIRE	DM-105-T2	NSN			DC	
fc 80	E	ANTENNA	AMP.RES.ASSOC.	AT1000	4094-025	6/30/97	6/30/98	12	C
fc 88	E	ANTENNA	EMPIRE	DM-105-T3	NSN			DC	
fc 91	T	ANTENNA	EMCO	3115	2023	8/18/97	2/18/98	6	V
fc 243	E	LISN -MODIFIED	SOLAR	8610-50-TS-100-N	905838			UC	
fc 244	E	LISN -MODIFIED	SOLAR	8610-50-TS-100-N	905839			UC	
fc 245	E	LISN	SOLAR	8028-50-TS-24-BNC	830525	7/16/97	7/16/98	12	C
fc 246	E	LISN	SOLAR	8028-50-TS-24-BNC	830526	7/16/97	7/16/98	12	C
fc 390	E	RECEIVER	ROHDE-SCHWARZ	ESH 3	861742/012 ?CHECK	6/23/97	6/23/98	12	C
fc 391	E	RECEIVER	ROHDE-SCHWARZ	ESVP	861744/015	6/23/97	6/23/98	12	C
fc 103	E	Antenna set	EMCO	3121	0245	12/23/97	6/23/98	6	V

3 Meter Vertical Evaluation

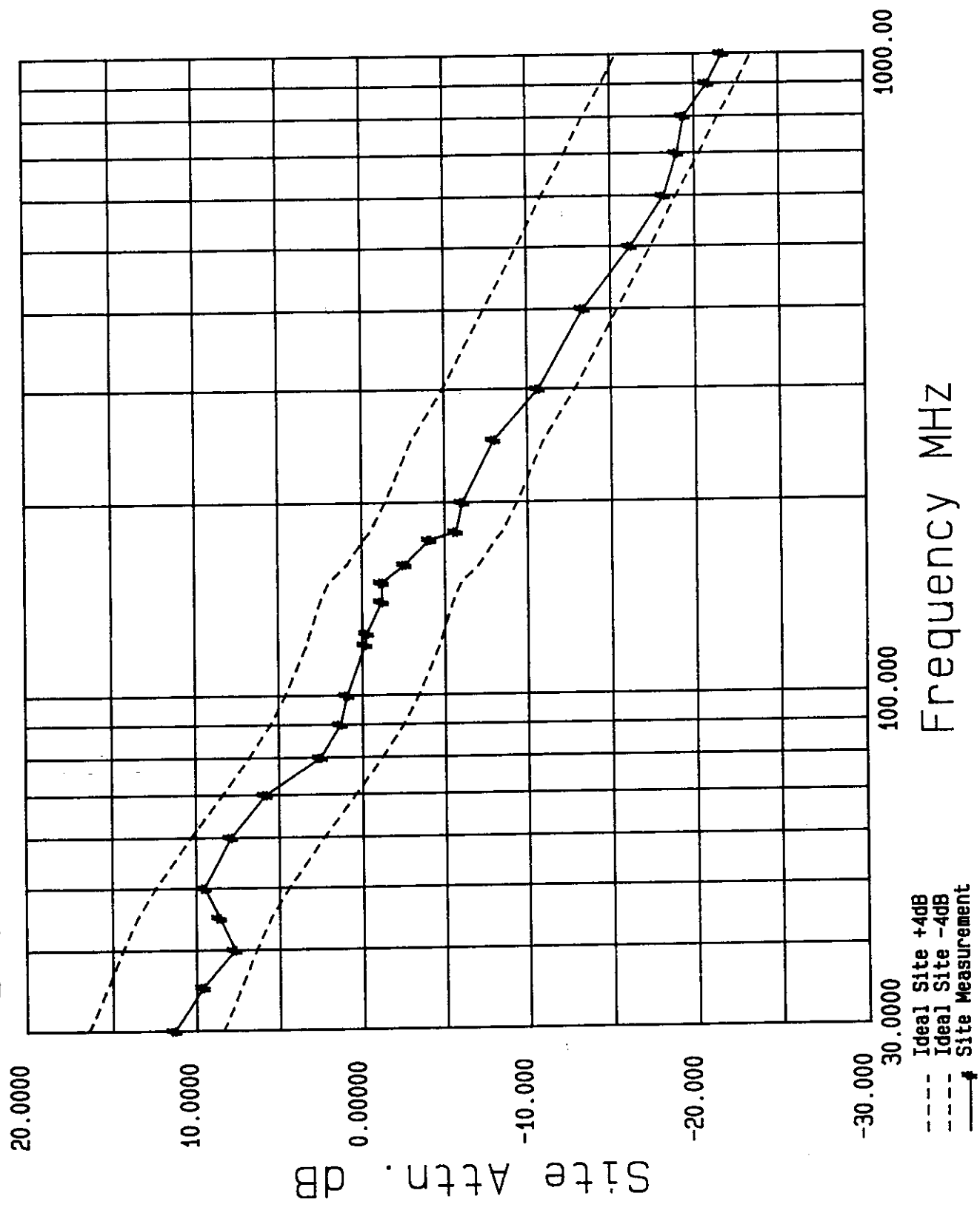


FIGURE 4

3 Meter Horizontal Evaluation

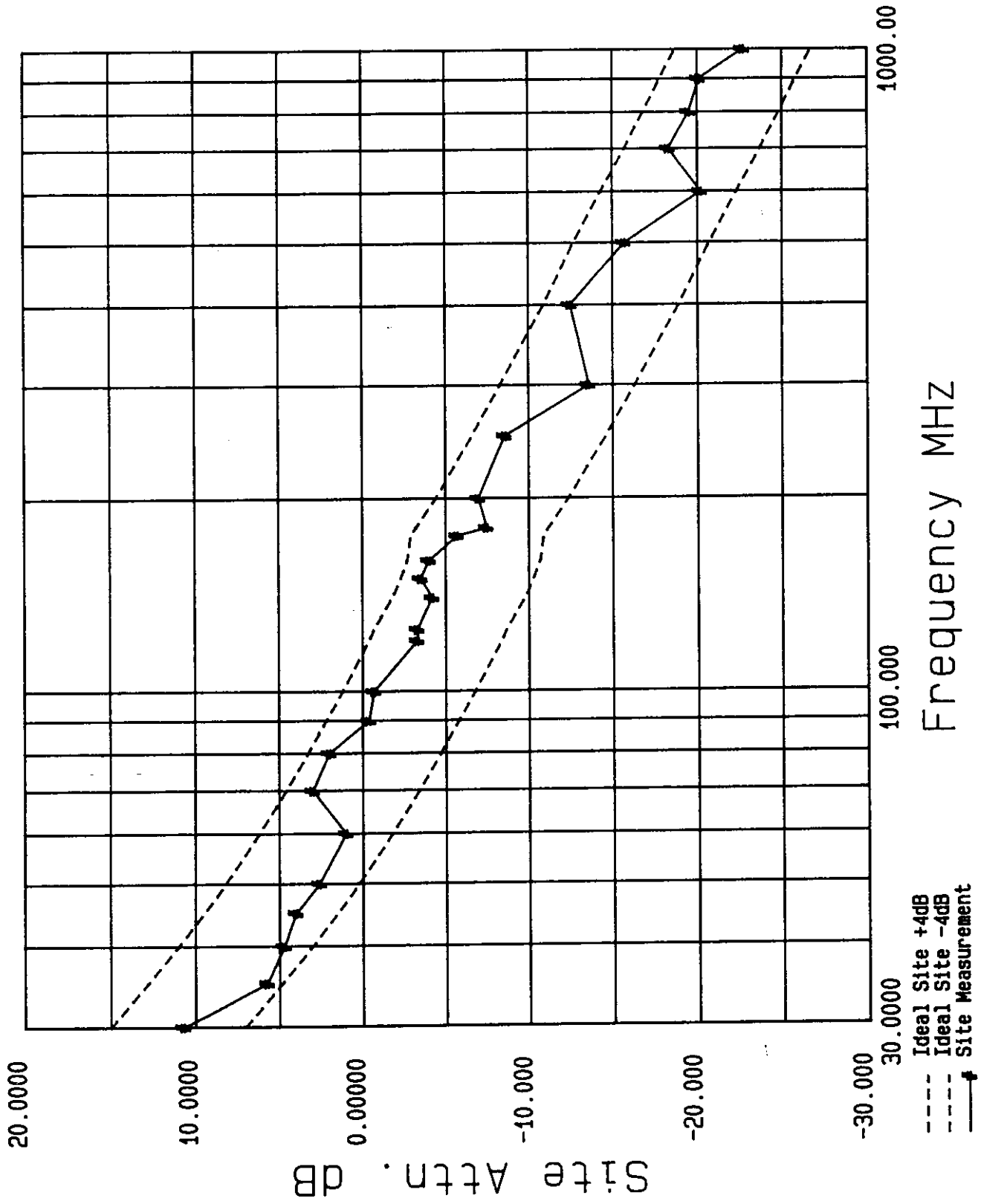


FIGURE 5

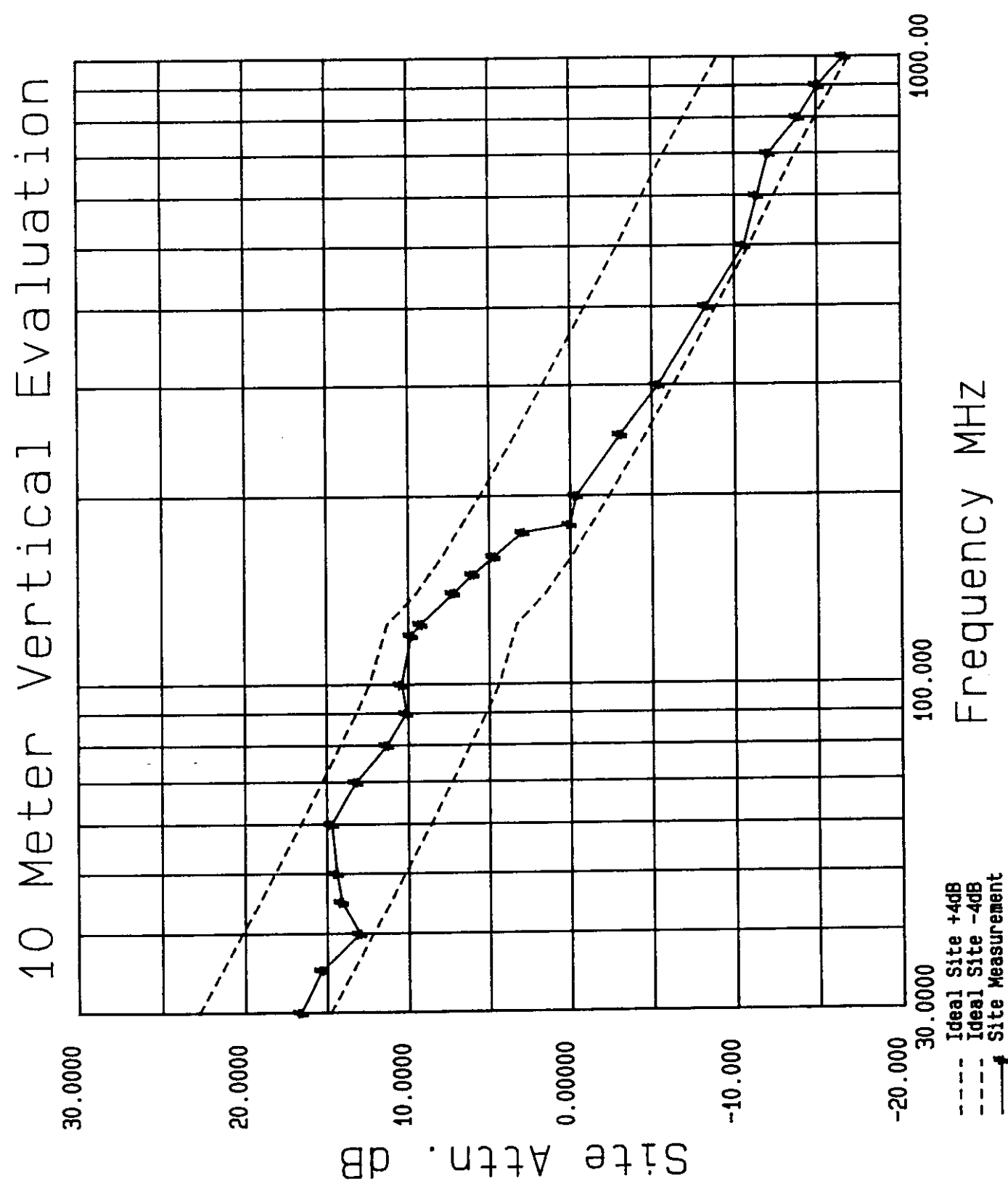


FIGURE 6

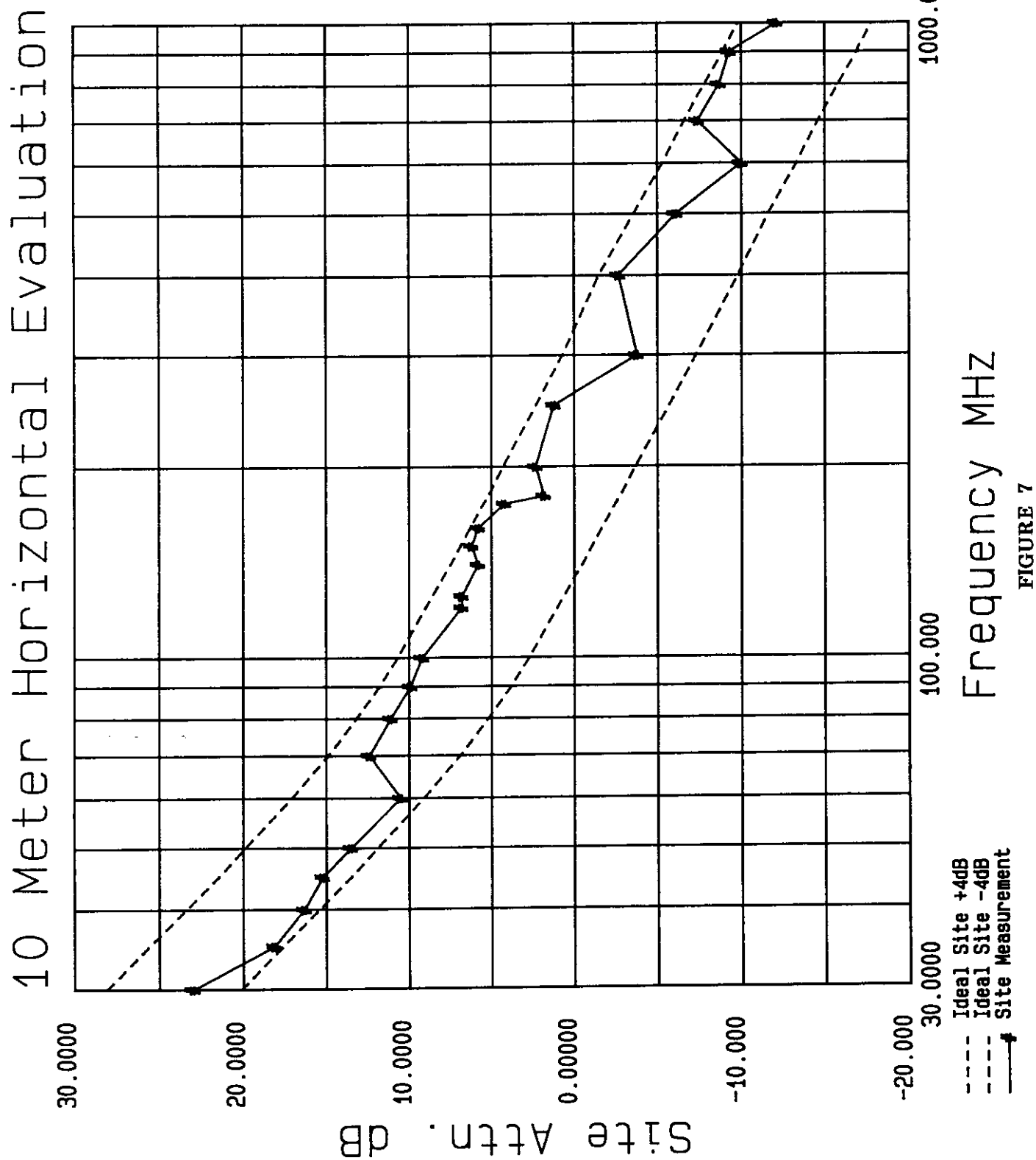


FIGURE 7

3 Meter Vertical

Frequency (MHz)	Direct (dBuV)	Site (dBuV)	AFt (dB)	AFr (dB)	AFd (dB)	AN (dB)	Theo. (dB)	Diff. (dB)
30	69.0	58.3	0.0	-3.5	2.9	11.3	12.4	-1.1
35	68.7	57.2	1.3	-2.0	2.6	9.6	11.3	-1.7
40	68.5	57.2	2.5	-1.0	2.1	7.7	10.4	-2.7
45	68.6	55.1	3.3	0.0	1.6	8.6	9.5	-0.9
50	68.4	52.2	4.2	1.0	1.5	9.5	8.4	1.1
60	68.4	50.0	6.0	2.5	2.0	7.9	6.3	1.6
70	68.3	50.4	7.1	3.5	1.5	5.8	4.4	1.4
80	68.1	51.5	8.2	5.0	0.9	2.5	2.8	-0.3
90	68.0	50.8	9.2	6.0	0.7	1.3	1.5	-0.2
100	67.7	49.7	10.0	7.0	0.1	0.9	0.6	0.3
120	67.6	47.4	12.0	8.6	-0.2	-0.2	-0.7	0.5
125	67.5	46.7	12.3	9.0	-0.2	-0.3	-0.9	0.6
140	67.4	45.2	13.2	10.0	0.2	-1.2	-1.5	0.3
150	67.3	43.8	13.8	10.5	0.4	-1.2	-2.0	0.8
160	67.0	43.9	14.0	11.2	0.5	-2.6	-3.1	0.5
175	66.9	44.7	15.0	11.5	-0.2	-4.1	-4.1	0.0
180	66.9	45.5	15.3	12.2	-0.4	-5.7	-4.5	-1.2
200	66.7	43.4	16.1	13.3	0.0	-6.1	-5.4	-0.7
250	66.1	41.0	18.0	15.1	0.0	-8.0	-7.0	-1.0
300	65.7	40.1	19.5	16.8	0.0	-10.7	-8.9	-1.8
400	65.0	34.1	22.0	22.3	0.0	-13.4	-11.4	-2.0
500	64.1	31.3	24.0	25.0	0.0	-16.2	-13.4	-0.3
600	62.8	29.1	25.4	26.5	0.0	-18.2	-14.9	-3.3
700	62.2	27.1	27.0	27.1	0.0	-19.0	-16.3	-2.7
800	61.9	24.1	28.0	29.2	0.0	-19.4	-17.4	-2.0
900	60.9	21.7	29.0	31.0	0.0	-20.8	-18.5	-2.3
1000	60.9	18.6	30.0	34.0	0.0	-21.7	-19.4	-2.3

DATA SHEET 1

3 Meter Horizontal

Frequency (MHz)	Direct (dBuV)	Site (dBuV)	AFt (dB)	AFr (dB)	AFd (dB)	AN (dB)	Theo. (dB)	Diff. (dB)
30	62.8	52.5	0.0	-3.5	3.1	10.7	11.0	-0.3
35	62.8	53.8	1.3	-2.0	4.0	5.7	8.8	-3.1
40	62.7	52.4	2.5	-1.0	4.1	4.7	7.0	-2.3
45	62.6	52.0	3.3	0.0	3.3	4.0	5.5	-1.5
50	62.4	51.8	4.2	1.0	2.8	2.6	4.2	-1.6
60	62.1	51.6	6.0	2.5	1.0	1.0	2.2	-1.2
70	61.9	48.7	7.1	3.5	-0.4	3.0	0.6	2.4
80	61.8	47.6	8.2	5.0	-1.0	2.0	-0.7	2.7
90	61.6	47.8	9.2	6.0	-1.0	-0.4	-1.8	1.4
100	61.5	46.4	10.0	7.0	-1.2	-0.7	-2.8	2.1
120	61.4	44.5	12.0	8.6	-0.4	-3.3	-4.4	1.1
125	61.4	43.6	12.3	9.0	-0.2	-3.3	-4.7	1.4
140	61.3	42.4	13.2	10.0	-0.1	-4.2	-5.8	1.6
150	61.2	41.3	13.8	10.5	-0.9	-3.5	-6.3	2.8
160	61.2	41.5	14.0	11.2	-1.5	-4.0	-6.7	2.7
175	61.2	42.2	15.0	11.5	-1.8	-5.7	-6.9	1.2
180	61.2	42.2	15.3	12.2	-1.0	-7.5	-7.2	-0.3
200	60.8	38.6	16.1	13.3	0.0	-7.0	-8.4	1.4
250	60.6	36.1	18.0	15.1	0.0	-8.6	-10.6	2.0
300	60.1	37.4	19.5	16.8	0.0	-13.6	-12.3	-1.3
400	59.8	28.0	22.0	22.3	0.0	-12.5	-14.9	2.4
500	59.8	26.5	24.0	25.0	0.0	-15.7	-16.7	1.0
600	59.9	28.2	25.4	26.5	0.0	-20.2	-18.3	-1.9
700	58.9	23.1	27.0	27.1	0.0	-18.3	-19.7	1.4
800	56.9	19.2	28.0	29.2	0.0	-19.5	-20.8	1.3
900	56.5	16.6	29.0	31.0	0.0	-20.1	-21.8	1.7
1000	56.3	15.0	30.0	34.0	0.0	-22.7	-22.7	0.0

DATA SHEET 2

10 Meter Vertical

Frequency (MHz)	Direct (dBuV)	Site (dBuV)	AFt (dB)	AFr (dB)	AFd (dB)	AN (dB)	Theo. (dB)	Diff. (dB)
30	91.0	77.9	0.0	-3.5	0.0	16.6	18.8	-2.2
35	90.9	76.3	1.3	-2.0	0.0	15.3	17.4	-2.1
40	90.9	76.4	2.5	-1.0	0.0	13.0	16.2	-3.2
45	90.8	73.4	3.3	0.0	0.0	14.1	15.1	-1.0
50	90.7	71.1	4.2	1.0	0.0	14.4	14.2	0.2
60	90.4	67.2	6.0	2.5	0.0	14.7	12.6	2.1
70	90.0	66.2	7.1	3.5	0.0	13.2	11.3	1.9
80	90.0	65.5	8.2	5.0	0.0	11.3	10.2	1.1
90	89.9	64.6	9.2	6.0	0.0	10.1	9.2	-9.0
100	89.8	62.4	10.0	7.0	0.0	10.4	8.4	2.0
120	89.6	59.2	12.0	8.6	0.0	9.8	7.5	2.3
125	89.5	59.0	12.3	9.0	0.0	9.2	7.3	1.9
140	89.5	59.1	13.2	10.0	0.0	7.2	5.5	1.7
150	89.4	59.1	13.8	10.5	0.0	6.0	4.7	2.0
160	89.3	59.4	14.0	11.2	0.0	4.7	3.9	0.8
175	89.1	59.7	15.0	11.5	0.0	2.9	3.0	-0.1
180	89.1	61.6	15.3	12.2	0.0	0.0	2.7	-2.7
200	88.9	59.9	16.1	13.3	0.0	-0.4	1.6	-2.0
250	88.8	58.8	18.0	15.1	0.0	-3.1	-0.6	-2.5
300	88.4	57.5	19.5	16.8	0.0	-5.4	-2.3	-3.1
400	88.1	52.1	22.0	22.3	0.0	-8.3	-4.9	-3.4
500	88.0	49.6	24.0	25.0	0.0	-10.6	-6.9	-3.7
600	87.8	47.3	25.4	26.5	0.0	-11.4	-8.4	-3.0
700	87.2	45.2	27.0	27.1	0.0	-12.1	-9.7	-2.4
800	86.3	43.0	28.0	29.2	0.0	-13.9	-10.9	-3.0
900	85.5	40.6	29.0	31.0	0.0	-15.1	-12.0	-3.1
1000	84.1	36.8	30.0	34.0	0.0	-16.7	-13.0	-3.7

DATA SHEET 3

10 Meter Horizontal

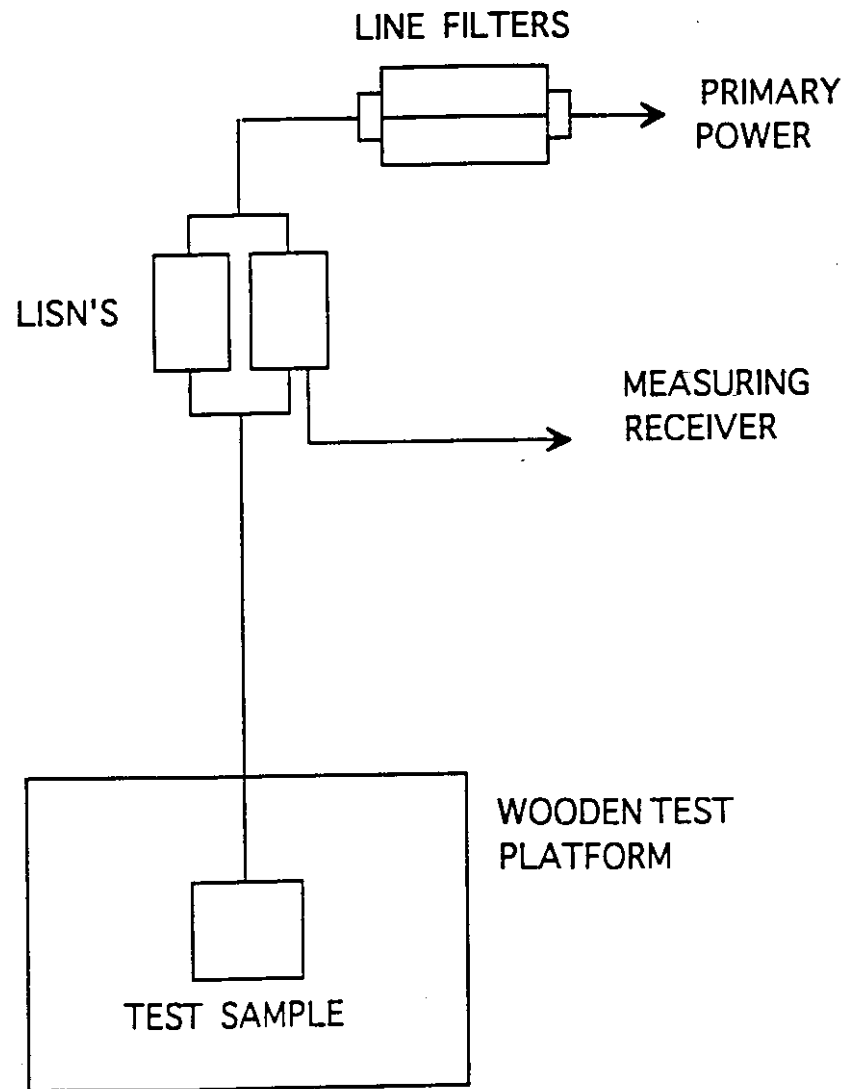
Frequency (MHz)	Direct (dBuV)	Site (dBuV)	AFt (dB)	AFr (dB)	AFd (dB)	AN (dB)	Theo. (dB)	Diff. (dB)
30	83.0	63.5	0.0	-3.5	0.0	23.0	24.1	-1.1
35	83.0	65.6	1.3	-2.0	0.0	18.1	21.6	-3.5
40	82.9	65.1	2.5	-1.0	0.0	16.3	19.4	-3.1
45	82.8	64.3	3.3	0.0	0.0	15.2	17.5	-2.3
50	82.7	64.0	4.2	1.0	0.0	13.5	15.9	-2.4
60	82.5	63.5	6.0	2.5	0.0	10.5	13.1	-2.6
70	82.1	59.1	7.1	3.5	0.0	12.4	10.9	1.5
80	82.0	57.7	8.2	5.0	0.0	11.1	9.2	1.9
90	81.8	56.7	9.2	6.0	0.0	9.9	7.8	2.1
100	81.7	55.5	10.0	7.0	0.0	9.2	6.7	2.5
120	81.5	54.1	12.0	8.6	0.0	6.8	5.0	1.8
125	81.5	53.4	12.3	9.0	0.0	6.8	4.6	2.2
140	81.4	52.4	13.2	10.0	0.0	5.8	3.5	2.3
150	81.3	50.8	13.8	10.5	0.0	6.2	2.9	3.3
160	81.3	50.3	14.0	11.2	0.0	5.8	2.3	3.5
175	81.2	50.5	15.0	11.5	0.0	4.2	1.5	2.7
180	81.2	51.9	15.3	12.2	0.0	1.8	1.2	0.6
200	81.0	49.3	16.1	13.3	0.0	2.3	0.3	2.0
250	80.7	46.4	18.0	15.1	0.0	1.2	-1.7	2.9
300	80.3	47.8	19.5	16.8	0.0	-3.8	-3.3	-0.5
400	80.0	38.4	22.0	22.3	0.0	-2.7	-5.8	3.1
500	79.9	37.0	24.0	25.0	0.0	-6.1	-7.6	1.5
600	79.8	37.9	25.4	26.5	0.0	-10.0	-9.3	-0.7
700	79.4	32.7	27.0	27.1	0.0	-7.4	-10.6	3.2
800	77.6	29.1	28.0	29.2	0.0	-8.7	-11.8	3.1
900	76.5	25.8	29.0	31.0	0.0	-9.3	-12.9	3.6
1000	75.2	23.3	30.0	34.0	0.0	-12.1	-13.8	1.7

DATA SHEET 4



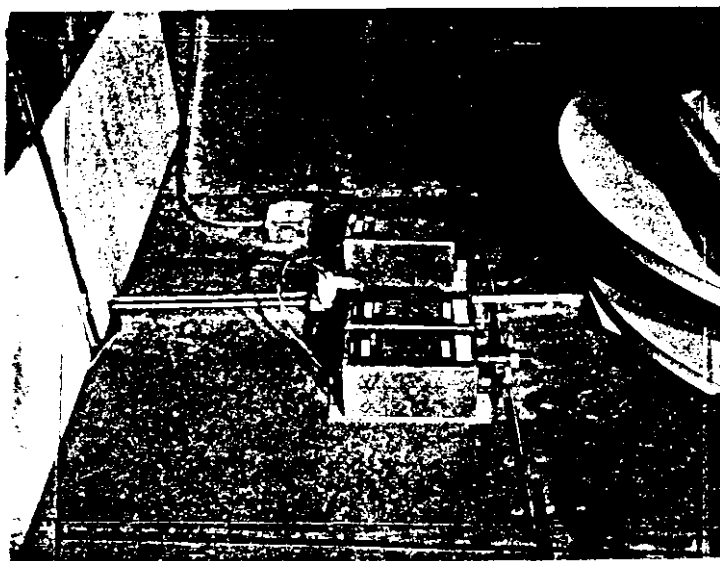
RADIATION SCIENCES INC.

VERTICAL GROUND PLANE



CONDUCTED EMISSION TEST SETUP (TOP VIEW)

FIGURE 8



CONDUCTED EMISSION TEST SETUP PHOTOGRAPH

FIGURE 9



RADIATION SCIENCES INC.

APPENDIX C

RSI CERTIFICATIONS



RADIATION SCIENCES INC.

RADIATION SCIENCES INC.
EMI/EMC CERTIFICATIONS AND
ACCREDITATIONS

The following pages show the RSI certifications achieved. These certifications were gained via a demonstration of RSI's Electromagnetic Interference capabilities during on-site audits by the noted agencies.

It is RSI's charter to maintain the highest EMI quality standards, produce the most accurate data in the industry, and to provide knowledgeable EMI engineering to all customers at all times.

The attached "Certs" are submitted with pride and attest to RSI's standing and years of experience in the EMI community.

Daniel J. Signore
President
Radiation Sciences Inc.



<u>Certificate</u>	<u>Issued For</u>	<u>Issued By</u>
Defense Contract Agency	MIL-STD-461, 462	DCMC
European Community	CE Mark Testing	International Tech. Inc.
Federal Communications Commission	FCC Testing	FCC
American Association for Laboratory Accreditation	FCC and General EMI/EMC Testing & ISO 25 accreditation	A2LA
Certification and Engineering Bureau, Canada	Industry Canada EMI Product Certifications	Certification and Engineering Bureau, Canada
National Security Agency	TEMPEST Test Services	NSA
The National Association of Radio and Telecommunications Inc.	EMI/EMC Testing MIL-STD-461, 462, D0160 etc.	NARTE

Defense Contract Management Command

Philadelphia

Mr. Daniel Signore, President
Radiation Sciences

This Statement of Qualification is presented to you to give evidence that the Radiation Sciences Quality System has successfully met the intent of the M9 L-9-452084 military specification.

Your qualification to this standard is based upon DCMC Philadelphia's review of your documented procedures along with verification that your Inspection System meets the requirements of that specification for both adequacy and compliance.

David Bruckner
ALAN D. CARTRELL

COLONEL, USA

COMMANDER, DCMC Philadelphia

Issue Date: Oct. 7, 1998

David Bruckner

DCMC 2AR

Certificate of Assessment

Presented by
Interference Technology International, Inc.

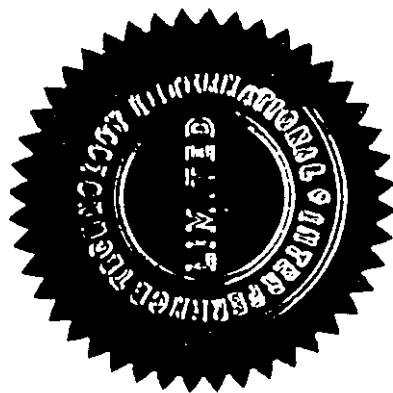


Radiation Sciences
3131 Detwiler Road
Harleysville, PA 19438

Certificate # 3153

The assessment was performed in accordance with ISO Guide 25 defining the general international requirements for the competence of calibration and testing laboratories and with ITI assessment criteria LAC0196.

*This approval is granted for specifications implementing the EU Directive on EMC
(89/336/EEC and amendments). The scope of approval is given in the
Schedule of Assessment supplied with this certificate.*



John P. Flood, Manager
NA Laboratory Network

29th October 1996

Date

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
Telephone: 301-725-1585 (ext-218)
Facsimile: 301-344-2050

June 18, 1998

IN REPLY REFER TO
31040/SIT
1300F2

Radiation Sciences Incorporated
3131 Detwiler Road
Harleysville, PA 19438

Attention: Michael Welty

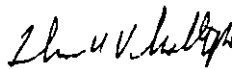
Re: Measurement facility located at Lansdale
(3 and 10 meter site)

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for certification or notification under Parts 15 or 18 of the Commission's Rules. Our list will also indicate that the facility complies with the radiated and AC line conducted test site criteria in ANSI C63.4-1992. Please note that this filing must be updated for any changes made to the facility, and at least every three years the data on file must be certified as current.

Per your request, the above mentioned facility has also been added to our list of those who perform these measurement services for the public on a fee basis. An up-to-date list is available on the Internet at the FCC Website www.fcc.gov under Electronic Filing.

Sincerely,



Thomas W. Phillips
Electronics Engineer
Customer Service Branch



**THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION**

ACCREDITED LABORATORY

A2LA has accredited

RADIATION SCIENCES INC.
Harleysville, PA

for technical competence in the field of

Electrical (EMC) Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC Guide 25-1990 "General Requirements for the Competence of Calibration and Testing Laboratories" (equivalent to relevant requirements of the ISO 9000 series of standards) and any additional program requirements in the identified field of testing.

Presented this 4th day of August, 1998.



President
For the Accreditation Council
Certificate Number 842.01
Valid to August 31, 2000

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation



Industry Canada Industrie Canada

Certification and Engineering Bureau
1241 Clyde Avenue
Ottawa, Ontario
K2C 1Y3

Tel. No. (613) 952-3650
Fax. No. (613) 952-1088

April 29, 1998

Our File: 46327- 3045
Submission: 22053O

Mr. Michael Welty
Radiation Sciences Incorporated
3131 Detwiler Rd.
Harleysville, PA 19438

Dear Mr. Welty,

The Bureau has received your test report for the Open Area Test Site located at Harleysville, PA dated April 20, 1998. I have reviewed the report and find it complies with RSP 100, Issue 7, section 3.3 Description of Open Area Test Site.

The site is acceptable to Industry Canada for the performance of radiated measurements. Please reference the file number " **IC 3045** " in the body of all test reports containing measurements made on this site. This reference number is the indication to Industry Canada Certification Officers that the site is on file. Your company has been added to our published list of filed sites on the Bureau's web page. It is located at: <http://spectrum.ic.gc.ca/~cert/> Please keep the contact information current by notifying us if it changes or is in error.

Keep informed of the latest Industry Canada regulations by visiting the Bureau's site on the World Wide Web;

<http://spectrum.ic.gc.ca/~cert/>
or the Industry Canada main site at;
<http://strategis.ic.gc.ca>

Whenever major construction or repairs to the site are completed, a re-submission of the site attenuation characteristics will be required.

Yours sincerely,

Brian Kasper

Brian Kasper
Head, EMC and Standards
Certification and Engineering Bureau



NATIONAL SECURITY AGENCY
FORT GEORGE G. MEADE, MARYLAND 20755-6000

Serial: V2-006-95
Date: 27 January 1995

Radiation Sciences, Inc.
Attn: Mr. Daniel J. Signore
3131 Detwiler Road
Harleysville, PA 19438

Dear Mr. Signore:

Congratulations! We are pleased to inform you that the National Security Agency has endorsed the Radiation Sciences, Inc. Test Service Facility Process under the auspices of the revised Endorsed TEMPEST Test Services Program (ETTSP).

In accordance with the ETTSP procedures, please find enclosed for your review and execution two original Memoranda of Agreement (MOAs). Please have both originals signed and dated, keep one of the originals for your files, and forward one original back to us for our files.

This endorsement is subject to the terms and conditions specified in Memorandum of Agreement Number RADSC/HV/PA/TS between the National Security Agency Information Systems Security Organization and Radiation Sciences, Inc.

The Radiation Sciences, Inc. Test Service facility will continue its present listing on the Endorsed TEMPEST Test Services List (ETTSL) in the INFOSEC Products and Services Catalogue.

We look forward to continuing our association with your company. Congratulations, once again, on your noteworthy accomplishment!

Sincerely,

A handwritten signature in black ink, appearing to read "William J. Marshall", is positioned above the typed name.

WILLIAM J. MARSHALL
Chief
Commercial Solutions & Enabling Technologies

Encl:
a/s

Certified Electromagnetic Compatibility Engineer

Given under our hand this
1st day of June, 1989

Certificate Number: EMC-000239-NE

Date of Expiration: July 31, 1993



The National Association of Radio and Telecommunications Engineers, Inc.

finds

Daniel J. Signore

has demonstrated knowledge, proficiency, education, and experience in Electromagnetic Compatibility and Electromagnetic Interference and is hereby certified to this discipline as a fully qualified Electromagnetic Compatibility Engineer.

Issued in accordance with NARTE administrative rules, guidelines, and in accordance with memoranda of agreement and guidelines as prescribed by specified elements of government and industry.

Ray D. Thrower

Ray D. Thrower, President

John B. Holmberg

John B. Holmberg, Certification Chairman

