

*FCC PART 15, SUBPART C  
TEST METHOD: ANSI C63.4-1992*

*for*  
REMOTE COMMAND UNIT 418 MHZ  
P/N: RT-418-CMD

Prepared for

LINX TECHNOLOGIES  
575 SE ASHLEY PLACE  
GRANTS PASS, OREGON 97526

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KYLE FUJIMOTO

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DATE: APRIL 26, 1999

	REPORT BODY	APPENDICES				TOTAL
		<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	
PAGES	15	2	2	10	6	35

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## TABLE OF CONTENTS

Section / Title	PAGE
<b>GENERAL REPORT SUMMARY</b>	<b>4</b>
<b>SUMMARY OF TEST RESULTS</b>	<b>4</b>
<b>1. PURPOSE</b>	<b>5</b>
<b>2. ADMINISTRATIVE DATA</b>	<b>6</b>
2.1 Location of Testing	6
2.2 Traceability Statement	6
2.3 Cognizant Personnel	6
2.4 Date Test Sample was Received	6
2.5 Disposition of the Test Sample	6
2.6 Abbreviations and Acronyms	6
<b>3. APPLICABLE DOCUMENTS</b>	<b>7</b>
<b>4. Description of Test Configuration</b>	<b>8</b>
4.1 Description of Test Configuration - EMI	8
<b>5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT</b>	<b>10</b>
5.1 EUT and Accessory List	10
5.2 EMI Test Equipment	11
<b>6. TEST SITE DESCRIPTION</b>	<b>12</b>
6.1 Test Facility Description	12
6.2 EUT Mounting, Bonding and Grounding	12
<b>7. Test Procedures</b>	<b>13</b>
7.1 Radiated Emissions (Spurious and Harmonics) Test	13
7.2 Bandwidth of the Fundamental	14
<b>8. CONCLUSIONS</b>	<b>15</b>



**LIST OF APPENDICES**

<b>APPENDIX</b>	<b>TITLE</b>
A	Modifications to the EUT
B	Additional Models Covered Under This Report
C	Diagrams, Charts and Photos <ul style="list-style-type: none"><li>• Test Setup Diagrams</li><li>• Radiated Emissions Photos</li><li>• Antenna and Effective Gain Factors</li></ul>
D	Data Sheets

**LIST OF FIGURES**

<b>FIGURE</b>	<b>TITLE</b>
1	Plot Map And Layout of Test Site



## GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form unless done so in full with the written permission of Compatible Electronics.

This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Device Tested: Remote Command Unit 418 MHz  
P/N: RT-418-CMD  
S/N: N/A

Product Description: See Expository Statement.

Modifications: The EUT was not modified during the testing.

Manufacturer: Linx Technologies  
575 SE Ashley Place  
Grants Pass, Oregon 97526

Test Date: April 19, 1999

Test Specifications: EMI requirements  
FCC Title 47, Part 15 Subpart C, Sections 15.205 and 15.231

Test Procedure: ANSI C63.4: 1992

Test Deviations: The test procedure was not deviated from during the testing.

## SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 450 kHz - 30 MHz	This test was not performed because the EUT runs off one 3.0 V battery only and cannot be powered by any device that runs off of the AC public mains.
2	Radiated RF Emissions, 10 kHz - 4200 MHz	Complies with the of FCC Title 47, Part 15 Subpart C, sections 15.205 and 15.231



## 1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Remote Command Unit 418 MHz P/N: RT-418-CMD. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 1992. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the specification limits defined by FCC Title 47, Part 15, Subpart C, sections 15.205, and 15.231.



## 2. ADMINISTRATIVE DATA

### 2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

### 2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

### 2.3 Cognizant Personnel

Linx Technologies

Paul True	President
Steve Montgomery	Director of Engineering

Compatible Electronics Inc.

Kyle Fujimoto	Test Engineer
Scott McCutchan	Lab Manager

### 2.4 Date Test Sample was Received

The test sample was received on April 19, 1999.

### 2.5 Disposition of the Test Sample

The test sample was returned to Linx Technologies on April 26, 1999.

### 2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network



### 3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
FCC Title 47, Subpart C.	FCC Rules - Radio frequency devices (including digital devices) – Intentional Radiators.
ANSI C63.4 1992	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.



#### **4. DESCRIPTION OF TEST CONFIGURATION**

##### **4.1 Description of Test Configuration - EMI**

Setup and operation of the equipment under test.

Specifics of the EUT and Peripherals Tested

The Remote Command Unit 418 MHz P/N: RT-418-CMD (EUT) was tested as a stand alone unit and tested in three different orthogonal axis. The EUT was continuously transmitting during the test. The antenna is a Linx Technologies “Splatch” series permanently attached internal element. The EUT turns immediately after the button is released.

Final radiated data was taken in the mode above.



#### 4.1.1 Cable Construction and Termination

There were no cables attached to the EUT



## 5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

### 5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	PART NUMBER	SERIAL NUMBER	FCC ID
REMOTE COMMAND UNIT 418 MHZ (EUT)	LINX TECHNOLOGIES	RT-418-CMD	N/A	OJM-LTRT418CMD



## 5.2 EMI Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Spectrum Analyzer	Hewlett Packard	8566B	3638A08784	Nov. 16, 1998	May 16, 1999
Preamplifier	Com Power	PA-102	1017	Feb. 16, 1998	Feb. 16, 1999
Quasi-Peak Adapter	Hewlett Packard	85650A	3303A01688	June 23, 1998	June 23, 1999
Biconical Antenna	Com Power	AB-100	1548	Oct. 15, 1998	Oct. 15, 1999
Log Periodic Antenna	Com Power	AL-100	1117	Oct. 15, 1998	Oct. 15, 1999
Antenna Mast	Com Power	AM-100	N/A	N/A	N/A
Turntable	Com Power	TT-100	N/A	N/A	N/A
Computer	Hewlett Packard	HP98561A	2522A05178	N/A	N/A
Printer	Hewlett Packard	2225A	2925S33268	N/A	N/A
Plotter	Hewlett Packard	7440A	8726K38417	N/A	N/A
Microwave Preamplifier	Hewlett Packard	8449B	3008A008766	Jan. 30, 1999	Jan. 30, 2000
Horn Antenna	Antenna Research	DRG-118/A	1053	Dec. 8, 1995	N/A
Loop Antenna	Com-Power	AL-130	25309	April 13, 1999	April 13, 2000



## **6. TEST SITE DESCRIPTION**

### **6.1 Test Facility Description**

Please refer to section 2.1 and 7.1 of this report for EMI test location.

### **6.2 EUT Mounting, Bonding and Grounding**

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.



## 7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

### 7.1 Radiated Emissions (Spurious and Harmonics) Test

The spectrum analyzer was used as a measuring meter along with the quasi-peak adapter. Amplifiers were used to increase the sensitivity of the instrument. The Com Power Preamplifier Model: PA-102 was used for frequencies from 30 MHz to 1 GHz, and the Hewlett Packard 8449B Microwave Preamplifier was used for frequencies above 1 GHz. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps. The quasi-peak adapter was used only for those readings which are marked accordingly on the data sheets. The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
10 kHz to 150 kHz	200 Hz	Active Loop Antenna
150 kHz to 30 MHz	9 kHz	Active Loop Antenna
30 MHz to 300 MHz	120 kHz	Biconical Antenna
300 MHz to 1 GHz	120 kHz	Log Periodic Antenna
1 GHz to 4.2 GHz	1 MHz	Horn Antenna

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 1992. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance to obtain final test data.

### 7.2 Bandwidth of the Fundamental



The -20 dB bandwidth was checked to see that it was within 0.25% of the fundamental frequency for the transmitter. A plot of the -20 dB bandwidth is in Appendix D.



## 8. CONCLUSIONS

The Remote Command Unit 418 MHz P/N: RT-418-CMD meets all of the specification limits defined in FCC Title 47, Part 15, Subpart C, sections 15.205 and 15.231.





**APPENDIX A**

***MODIFICATIONS TO THE EUT***



## MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC 15.231 specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

Modifications:

No modifications were made to the EUT.





**APPENDIX B**

***ADDITIONAL MODELS COVERED  
UNDER THIS REPORT***



## **ADDITIONAL MODELS COVERED UNDER THIS REPORT**

USED FOR THE PRIMARY TEST

Remote Command Unit 418 MHz  
P/N: RT-418-CMD  
S/N: N/A

There were no additional models covered under this report.





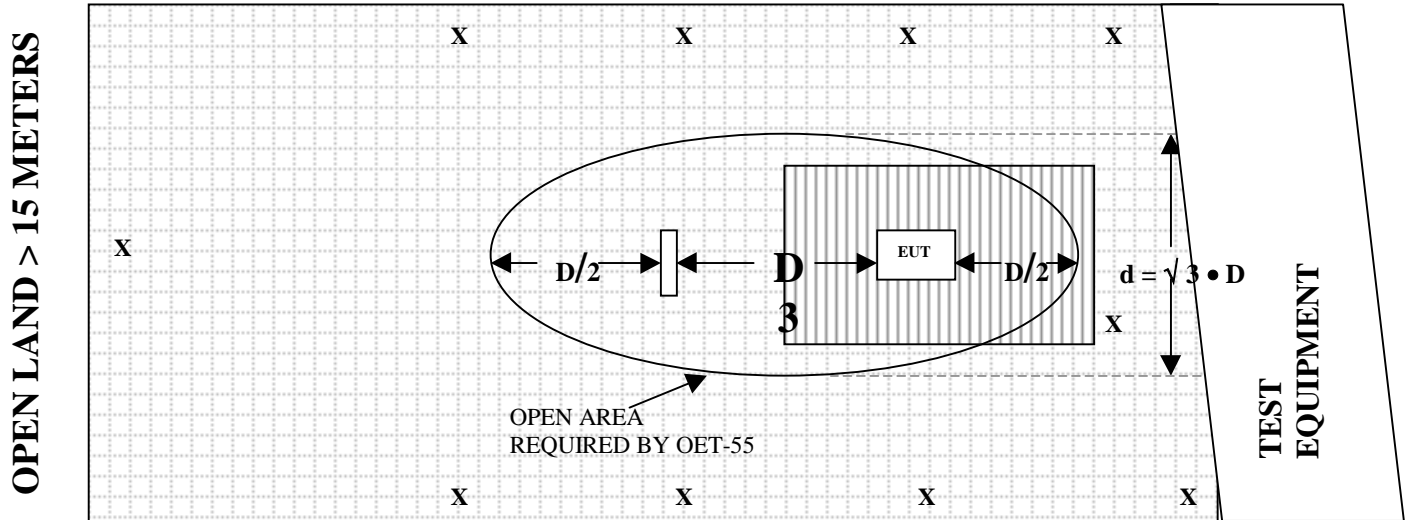
**APPENDIX C**

***DIAGRAMS, CHARTS AND PHOTOS***



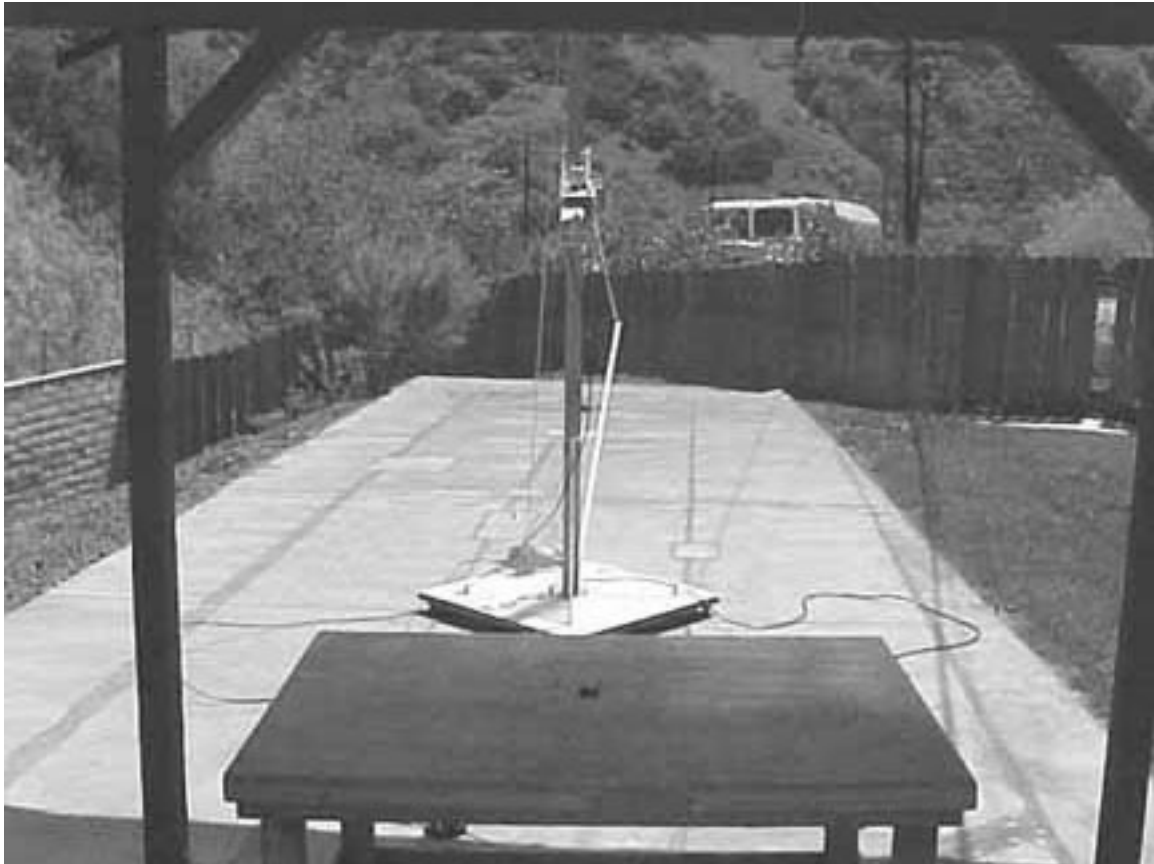
# FIGURE 1: PLOT MAP AND LAYOUT OF RADIATED SITE

OPEN LAND > 15 METERS



OPEN LAND > 15 METERS





**FRONT VIEW**

LINX TECHNOLOGIES  
REMOTE COMMAND UNIT 418 MHZ  
P/N: RT-418-CMD  
FCC SUBPART C - RADIATED EMISSIONS – 4-19-99

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**





**REAR VIEW**

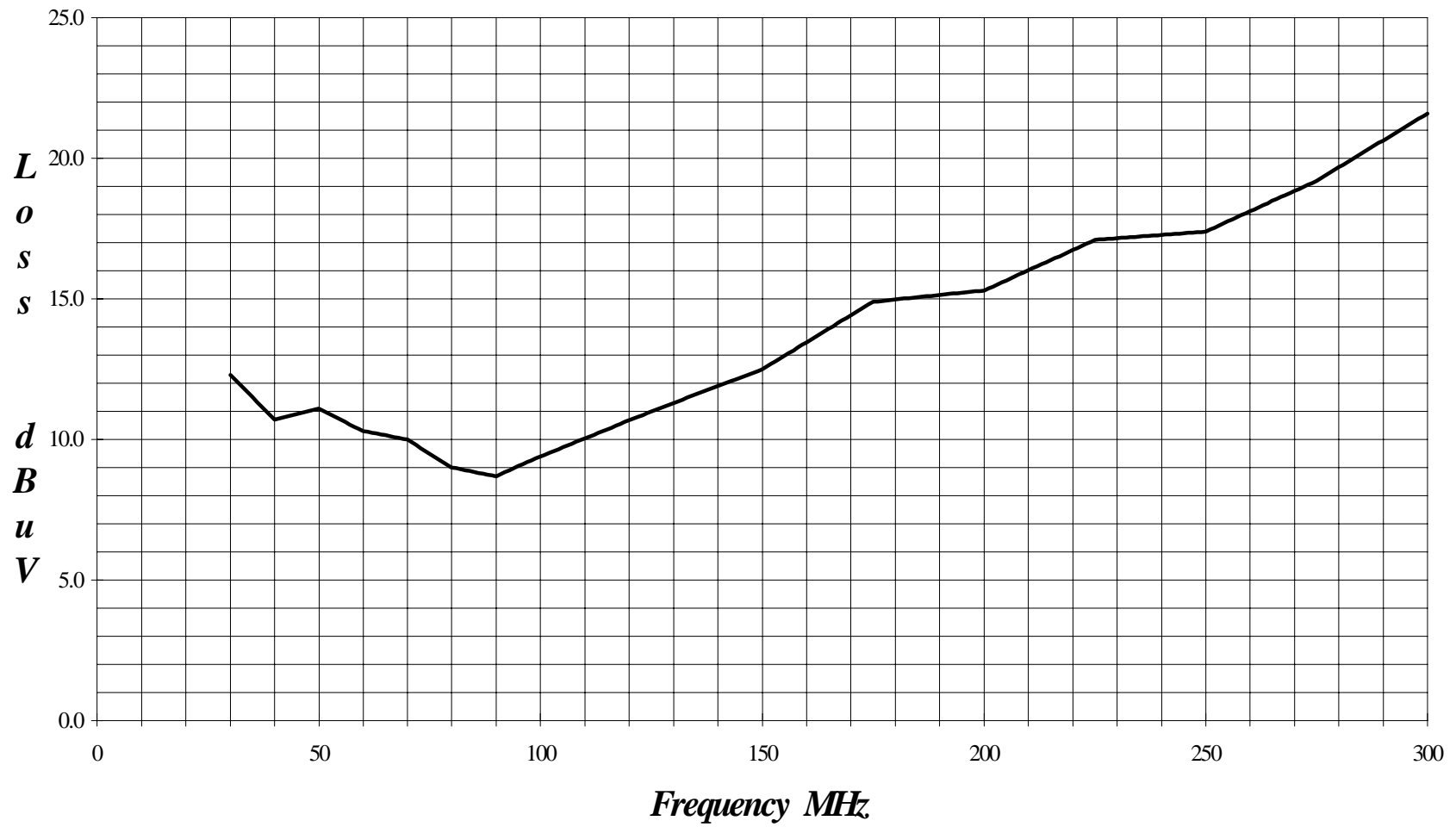
LINX TECHNOLOGIES  
REMOTE COMMAND UNIT 418 MHZ  
P/N: RT-418-CMD  
FCC SUBPART C - RADIATED EMISSIONS – 4-19-99

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**



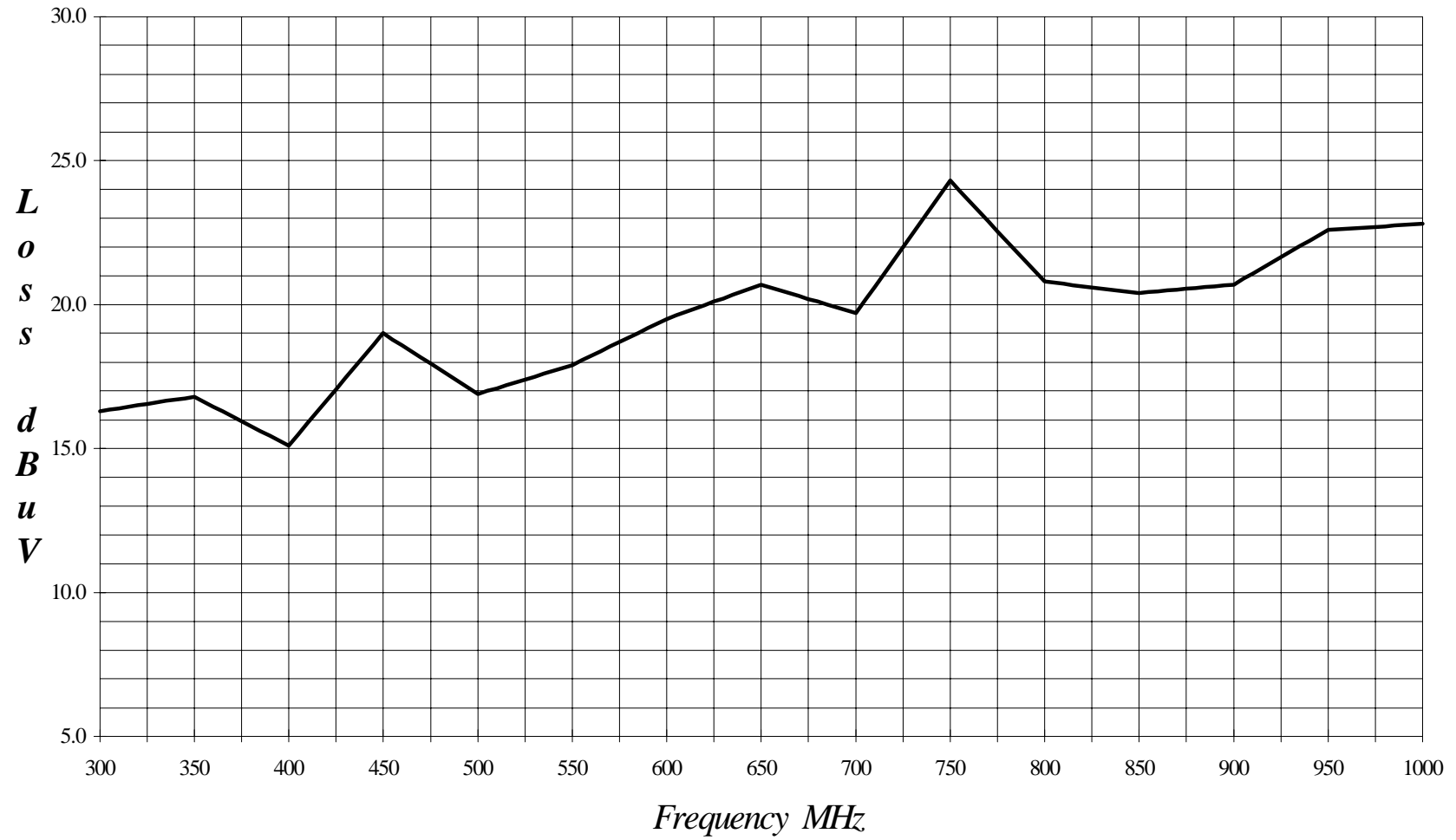
Cal: 10/15/98

***LAB 'D' BICONICAL ANTENNA AB-100 S/N 01548***



*Cal: 10/15/98*

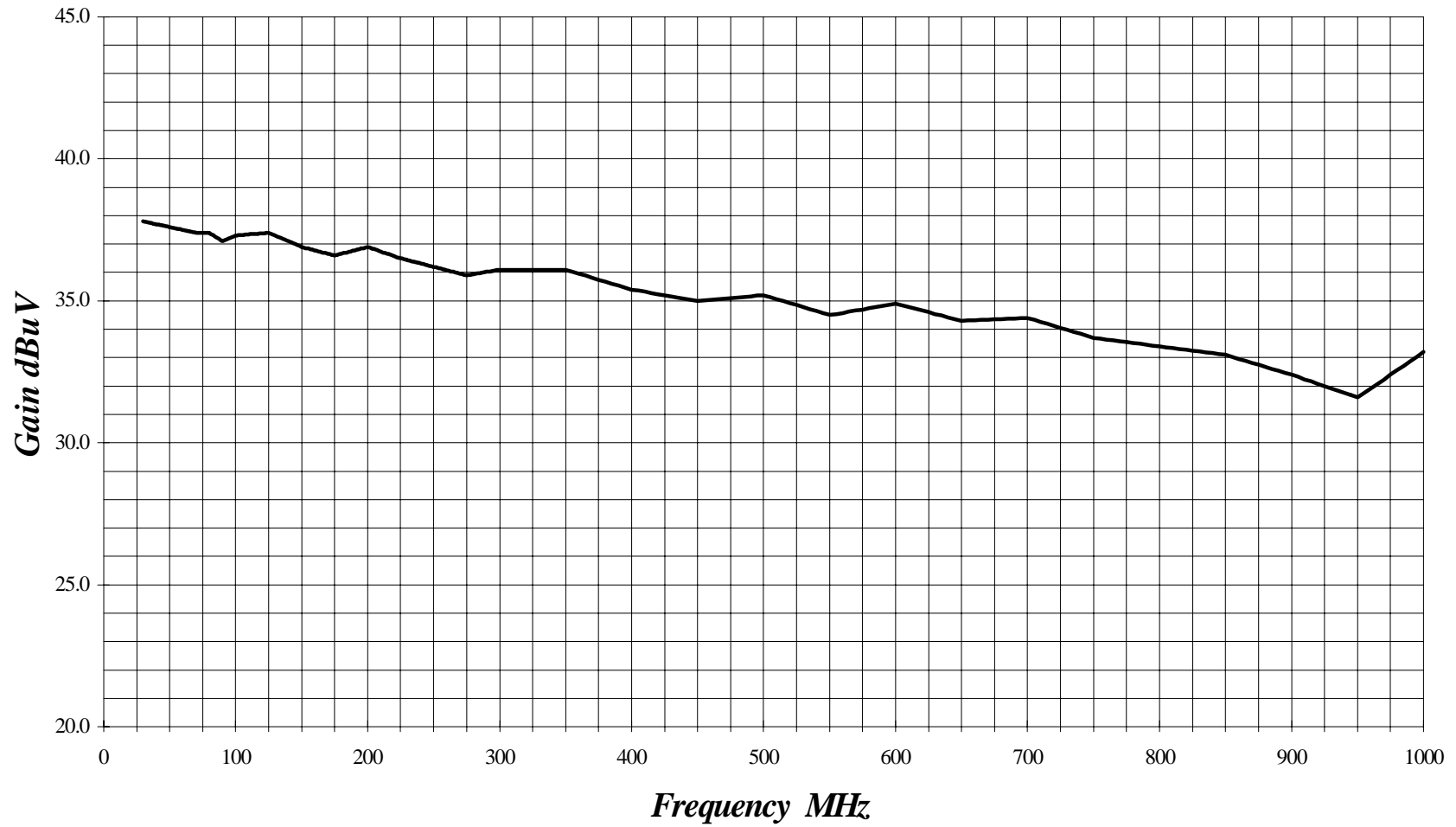
***LAB "D" LOG PERIODIC ANTENNA AL-100 S/N 01117***



*Lab "D" Effective: 1/16/99*

*Effective Gain = Preamplifier Gain – Cable Loss*

***PREAMPLIFIER EFFECTIVE GAIN AT 3 METERS PA-102 S/N: 1017***



HEWLETT PACKARD 8449B

MICROWAVE PREAMPLIFIER

S/N: 3008A008766

CALIBRATION DATE: JANUARY 30, 1999

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	36.9	9.5	34.3
1.1	36.3	10.0	33.7
1.2	36.4	10.5	34.1
1.3	36.2	11.0	33.7
1.4	36.3	11.5	34.0
1.5	35.7	12.0	33.9
1.6	35.9	12.5	34.4
1.7	35.7	13.0	32.9
1.8	35.6	13.5	31.6
1.9	35.5	14.0	31.8
2.0	35.4	14.5	31.9
2.5	35.6	15.0	32.2
3.0	35.2	15.5	32.8
3.5	35.2	16.0	32.4
4.0	34.3	16.5	32.1
4.5	34.1	17.0	32.3
5.0	34.3	17.5	30.3
5.5	33.0	18.0	31.5
6.0	34.1	18.5	31.2
6.5	34.5	19.0	32.2
7.0	34.3	19.5	32.0
7.5	33.9	20.0	32.0
8.0	34.5	20.5	33.2
8.5	34.5	21.0	30.9
9.0	34.4	22.0	32.1



# E-FIELD ANTENNA FACTOR CALIBRATION

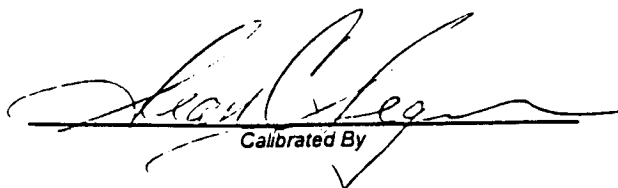
$$E(\text{dB V/m}) = V_o(\text{dB V}) + AFE(\text{dB/m})$$

Model number : DRG-118/A

Frequency GHz	AFE dB/m	Gain dBi
1	22.3	8.0
2	26.7	9.5
3	29.7	10.1
4	29.5	12.8
5	32.3	12.0
6	32.4	13.4
7	36.1	11.0
8	37.4	10.9
9	36.8	12.5
10	39.5	10.7
11	39.6	11.5
12	39.8	12.0
13	39.7	12.8
14	41.8	11.3
15	41.9	11.9
16	38.1	16.3
17	41.0	13.9
18	46.5	8.9

Serial number : 1053  
Job number : 96-092  
Remarks : 3 meter calibration  
Standards : LPD-118/A, TE-1000

Temperature : 72° F  
Humidity : 56 %  
Traceability : A01887  
Date : December 08, 1995

  
Calibrated By

# Com-Power Corporation

(949) 587-9800

## Antenna Calibration

Antenna Type:		Loop Antenna	
Model:		AL-130	
Serial Number:		25309	
Calibration Date:		4/13/99	
Frequency MHz	Magnetic (dB/m)	Electric dB/m	
0.01	-40.6	10.9	
0.02	-41.5	10.0	
0.03	-39.9	11.6	
0.04	-40.2	11.3	
0.05	-41.5	10.0	
0.06	-41.1	10.4	
0.07	-41.3	10.2	
0.08	-41.6	9.9	
0.09	-41.7	9.8	
0.1	-41.7	9.8	
0.2	-44.0	7.5	
0.3	-41.6	9.9	
0.4	-41.6	9.9	
0.5	-41.7	9.8	
0.6	-41.5	10.0	
0.7	-41.4	10.1	
0.8	-41.5	10.0	
0.9	-41.6	9.9	
1	-41.2	10.3	
2	-40.5	11.0	
3	-40.8	10.7	
4	-41.0	10.5	
5	-40.5	11.0	
6	-40.5	11.0	
7	-40.7	10.8	
8	-40.8	10.7	
9	-40.1	11.4	
10	-40.4	11.1	
12	-41.0	10.5	
14	-42.1	9.4	
15	-42.3	9.2	
16	-42.7	8.8	
18	-41.0	10.5	
20	-41.1	10.4	
25	-43.4	8.1	
30	-45.3	6.2	

Trans. Antenna Height	2 meter
Receiving Antenna Height	2 meter



**APPENDIX D**

***DATA SHEETS***



[illegible]



## RADIATED EMISSIONS (FCC SUBPART C, SECTION 15.231)

<b>COMPANY</b>	LINX TECHNOLOGIES	<b>DATE</b>	4/19/99
<b>EUT</b>	Remote Command Unit 418 MHz	<b>ANTENNAS</b>	HORN
<b>PART NUMBER</b>	RT-418-CMD	<b>POLARIZATION</b>	SEE BELOW
<b>DUTY CYCLE</b>	48% = 6.3 dB Average Drop	<b>TEST DISTANCE</b>	3 METERS
<b>EUT MODE</b>	TRANSMITTING AT 418 MHz	<b>LAB</b>	D

[illegible]



## RADIATED EMISSIONS (FCC SUBPART C, SECTION 15.231)

<b>COMPANY</b>	LINX TECHNOLOGIES	<b>DATE</b>	4/19/99
<b>EUT</b>	Remote Command Unit 418 MHz	<b>ANTENNAS</b>	HORN
<b>PART NUMBER</b>	RT-418-CMD	<b>POLARIZATION</b>	SEE BELOW
<b>DUTY CYCLE</b>	48% = 6.3 dB Average Drop	<b>TEST DISTANCE</b>	3 METERS
<b>EUT MODE</b>	TRANSMITTING AT 418 MHz	<b>LAB</b>	D

[illegible]

Test location: Compatible Electronics  
Customer : LINK TECHNOLOGIES  
Manufacturer : SAME  
EUT name : REMOTE COMMAND UNIT 418 MHz  
Specification: Fcc\_B Test distance: 3.0 mtrs  
Distance correction factor( $20 \cdot \log(\text{test}/\text{spec})$ ) : 0.00  
Test Mode :

SPURIOUS EMISSIONS  
TEMPERATURE 66 DEGREES F.  
RELATIVE HUMIDITY 74%  
TESTED BY: Kyle Fujimoto

NO SPURIOUS EMISSIONS FOUND FROM 10 kHz - 4200 MHz  
IN EITHER POLARIZATION FOR THE EUT

-20dB BANDWIDTH OF THE FUNDAMENTAL

MKR  $\Delta$  309 KHz

REF 110.0 dB $\mu$ V ATTN 20 dB

0.00 dB

hp

10 dB/

MARKER  $\Delta$

309 KHz

DL  
104.4  
dB $\mu$ V

0.00 dB

CORR'D

CENTER 418.00 MHz

RES BW 1 MHz

VBW 1 MHz

SPAN 1.00 MHz

SWP 20.0 msec

