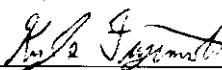




EXHIBIT 5
TECHNICAL TEST REPORT

FCC PART 15, SUBPART C
for
RADIO SHACK REMOTE CONTROL
Model: 15-1935

Prepared for
**RADIO SHACK, A DIVISION OF
TANDY CORPORATION
ONE TANDY CENTER,
100 THROCKMORTON STREET, SUITE 1300
FORTH WORTH, TEXAS 76102-2802**

Prepared by: 

KYLE FUJIMOTO

Approved by: 

SCOTT McCUTCHAN

**COMPATIBLE ELECTRONICS INC.
114 OLINDA DRIVE
BREA, CALIFORNIA 92823
(714) 579-0500**

DATE: AUGUST 20, 1998

	REPORT BODY	APPENDICES		TOTAL
		<i>A</i>	<i>B</i>	
PAGES	20	4	7	31

This report shall not be reproduced except in full, without the written approval of Compatible Electronics.

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LIST OF APPENDICES

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A	Test Setup Diagram and Photos
B	Antenna and Effective Gain Factors

LIST OF FIGURES

FIGURE	TITLE
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 procedure described in the test specification 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.

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

Device Tested: Radio Shack Remote Control
Model: 15-1935
S/N: Pre-Production

Modifications: The EUT was not modified during the testing.

Customer: RadioShack, A Division of Tandy Corporation
One Tandy Center, 100 Throckmorton Street, Suite 1300
Fort Worth, Texas 76102-2802

Manufacturer: Universal Electronics, Inc.
6101 Gateway Drive
Cypress, California 90630-4841

Test Date: July 20, 1998

Test Specifications: EMI requirements
FCC Title 47, Part 15, Subpart C.
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	Radiated RF Emissions, 10 kHz - 4400 MHz.	Complies with the limits of sections 15.205 and 15.231 of FCC Title 47, Part 15, Subpart C



1.

PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) test performed on the Radio Shack Remote Control Model: 15-1935. 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 limits of sections 15.205 and 15.231 of FCC Title 47, Part 15, Subpart C.

**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.

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

RadioShack, A Division of Tandy Corporation

Dwayne Campbell Manager, Engineering and Regulatory Affairs

Universal Electronics, Inc.

Jesse Mendez Electrical Engineer

Compatible Electronics Inc.

Kyle Fujimoto Test Engineer

Scott McCutchan Lab Manager

2.4 Date Test Sample was Received

The test sample was received on July 20, 1998.

2.5 Disposition of the Test Sample

The test sample was returned to Universal Electronics, Inc. on July 20, 1998.

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
NVLAP	National Voluntary Laboratory Accreditation Program

**3. APPLICABLE DOCUMENTS**

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

SPEC	TITLE
FCC Title 47, Part 15 1997	FCC Rules - Radio frequency devices (including digital devices).
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 THE TEST SAMPLE

4.1 Description of Test Configuration - EMI

The equipment under test (EUT) was placed on the wooden table. The EUT does not have any I/O ports and is battery operated. The antenna is a PCB trace.

Operating Conditions of the EUT

The EUT was investigated for emissions in the following operating mode:

1. The EUT was continuously transmitting.

Specifics of the EUT Tested

The Radio Shack Remote Control Model: 15-1935 was tested in three orthogonal axis. The emissions were found to be the highest when laying on its back and continuously transmitting. The final radiated data was taken at each transmit frequency as described above. All initial investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously.



4.1.1 **Cable Construction and Termination**

The EUT has no cables.

**5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT****5.1 EUT and Accessory List**

EQUIPMENT TYPE	MANU- FACTURER	MODEL	SERIAL NUMBER	FCC ID
RADIO SHACK REMOTE CONTROL (EUT)	UNIVERSAL ELECTRONICS, INC.	15-1935	Pre-Production	AAO1501935

5.2

EMI Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. CYCLE
Spectrum Analyzer	Hewlett Packard	8566B	3701A22262	December 9, 1997	1 Year
Preamplifier	Com Power	PA-102	1017	February 16, 1998	1 Year
Quasi-Peak Adapter	Hewlett Packard	85650A	3303A01688	June 23, 1998	1 Year
RF Attenuator	Com-Power	A-410	1602	November 25, 1997	1 Year
LISN	Com Power	LI-200	1764	January 3, 1998	1 Year
LISN	Com Power	LI-200	1771	January 3, 1998	1 Year
LISN	Com Power	LI-200	1775	January 3, 1998	1 Year
LISN	Com Power	LI-200	1780	January 3, 1998	1 Year
Biconical Antenna	Com Power	AB-100	1548	March 24, 1998	1 Year
Log Periodic Antenna	Com Power	AL-100	1117	December 11, 1997	1 Year
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 Amplifier	Com-Power	PA-122	001	March 31, 1998	N/A
Horn Antenna	Antenna Research	DRG-118/A	1053	December 8, 1995	N/A
Loop Antenna	Com-Power	AL-130	25309	February 5, 1998	1 Year



6. **TEST SITE DESCRIPTION**

6.1 **Test Facility Description**

Please refer to section 2.1 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.

7.1 RF Emissions

7.1.1 Radiated Emissions and Bandwidth 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 Com Power Microwave Amplifier Model: PA-122 was used for frequencies 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 4.4 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.

The -20 dB bandwidth was checked to see that it was within 0.25% of the fundamental frequency for each transmitter. A plot of the -20 dB bandwidth is on page 15A.

SECTION 7.1.1.1***RADIATED EMISSIONS DATA SHEETS***

**COMPATIBLE
ELECTRONICS**

FCC ID: AAO1501935

RADIATED EMISSIONS

COMPANY NAME: UNIVERSAL ELECTRONICS, INC. DATE: 7-20-98

EUT: RADIO SHARK REMOTE CONTROL EUT S/N: PRE-PRODUCTION

EUT MODEL: 15-1935 LOCATION: ☒ BREA ☐ SILVERADO ☐ AGOURA

SPECIFICATION: FCC 15.231 CLASS: TEST DISTANCE: 3M LAB: L

ANTENNA: ☒ LOOP ☒ BICONICAL ☒ LOG ☐ HORN POLARIZATION: ☒ VERT ☒ HORIZ

■ QUALIFICATION ☐ ENGINEERING ☐ MFG. AUDIT ENGINEER: *Kyle F.*

NOTES: SPURIOUS EMISSIONS

[illegible]

* CORRECTED READING = METER READING + ANTENNA FACTOR - EFFECTIVE GAIN

**** DELTA = CORRECTED READING - SPECIFICATION LIMIT**

BREA (714) 579-0500

SILVERADO (714) 589-0700

AGOURA (818) 597-0600


**COMPATIBLE
ELECTRONICS**
RADIATED EMISSIONS
FCC ID: AAO1501935
COMPANY NAME: UNIVERSAL ELECTRONICS, INC. **DATE:** 7-20-98
EUT: RADIO SHACK REMOTE CONTROL **EUT S/N:** PRE-PRODUCTION
EUT MODEL: 15-1935 **LOCATION:** ☒ BREA ☐ SILVERADO ☐ AGOURA

SPECIFICATION: FCC 15.231 **CLASS:** _____ **TEST DISTANCE:** 3M **LAB:** D
ANTENNA: ☐ LOOP ☐ BICONICAL ☒ LOG ☒ HORN **POLARIZATION:** ☒ VERT ☐ HORIZ

QUALIFICATION ☐ ENGINEERING ☐ MFG. AUDIT **ENGINEER:** KYLE F.
NOTES: Duty Cycle = 11.745% 20 LOG 11.745% = 18.6 dB Drop (AVG)

Frequency (GHz)	Peak Reading (dBuV)	Average Reading (dBuV)	Antenna Height (meters)	Azimuth (degrees)	Antenna Factor (dB)	Cable Loss (dB)	Amplifier Gain (dB)	* Corrected Reading (dBuV)	Delta ** (dB)	Spec Limit (dBuV)
.430	89.9	71.3	1.0	90	15.9	2.1	38.3	54.0	-26.3	80.3
.860	76.9	58.3	1.0	180	20.0	4.2	38.0	44.5	-15.8	60.3
1.290	57.7	39.1	1.0	90	22.3	4.2	32.9	32.7	-27.6	60.3
1.720	51.1	32.5	2.0	0	24.5	5.5	33.0	29.5	-24.5	54.0
2.150	55.1	36.5	2.0	270	26.4	4.8	33.1	34.9	-25.4	60.3
2.580	51.5	32.9	2.0	270	28.2	5.5	32.7	33.9	-26.4	60.3
3.010	49.6	31.0	1.0	270	29.7	6.4	32.4	34.7	-25.6	60.3
3.440	38.4	19.8	2.0	180	29.6	6.9	32.1	24.2	-29.8	54.0
3.870	38.0	19.4	1.0	180	29.5	8.2	31.8	25.3	-28.7	54.0
4.300	38.5	19.9	1.0	180	30.9	8.6	31.5	27.9	-26.1	54.0

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = CORRECTED READING - SPECIFICATION LIMIT

BREA (714) 579-0500

SILVERADO (714) 589-0700

AGOURA (818) 597-0600

**COMPATIBLE
ELECTRONICS RADIATED EMISSIONS**

FCC ID: AAO1501935

COMPANY NAME: UNIVERSAL ELECTRONICS, INC. DATE: 7-20-98EUT: RADIO SHACK Remote Control EUT S/N: PRE-PRODUCTIONEUT MODEL: 15-1935 LOCATION: ☒ BREA ☐ SILVERADO ☐ AGOURASPECIFICATION: FCC 15.231 CLASS: TEST DISTANCE: 3M LAB: D-ANTENNA: ☐ LOOP ☐ BICONICAL ☒ LOG ☒ HORN POLARIZATION: ☐ VERT ☒ HORIZ☒ QUALIFICATION ☐ ENGINEERING ☐ MFG. AUDIT ENGINEER: KYLE F.NOTES: Duty Cycle = 11.745% 20 loc 11.745% = 18.6dB down
(AVG)

Frequency (GHz)	Peak Reading (dBuV)	Average Reading (dBuV)	Antenna Height (meters)	Azimuth (degrees)	Antenna Factor (dB)	Cable Loss (dB)	Amplifier Gain (dB)	* Corrected Reading (dBuV)	Delta ** (dB)	Spec Limit (dBuV)
.430	102.2	83.6	1.0	270	15.9	2.1	58.3	63.3	-17.0	80.3
.860	76.3	57.7	3.5	270	20.0	4.2	38.0	43.9	-16.4	60.3
1.290	58.1	39.5	1.0	270	22.3	4.2	32.9	33.1	-27.2	60.3
1.720	47.3	28.7	1.0	90	24.5	5.5	33.0	25.7	-28.3	54.0
2.150	56.5	32.9	1.0	90	33.1	4.8	26.7	44.1	-16.2	60.3
2.580	51.5	32.9	1.5	270	32.7	5.5	28.2	42.9	-17.4	60.3
3.010	44.1	25.5	2.5	180	29.7	6.4	32.4	29.2	-31.1	60.3
3.440	40.4	21.8	1.0	90	29.6	6.9	32.1	26.2	-27.8	54.0
3.870	40.2	21.6	1.0	180	29.5	8.2	31.8	27.5	-26.5	54.0
4.300	39.0	20.4	1.0	180	30.9	8.6	31.5	28.4	-25.6	54.0

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = CORRECTED READING - SPECIFICATION LIMIT

BREA (714) 579-0500

SILVERADO (714) 589-0700

AGOURA (818) 597-0600

SECTION 7.1.1.2***PLOT OF THE -20DB BANDWIDTH
OF THE FUNDAMENTAL***

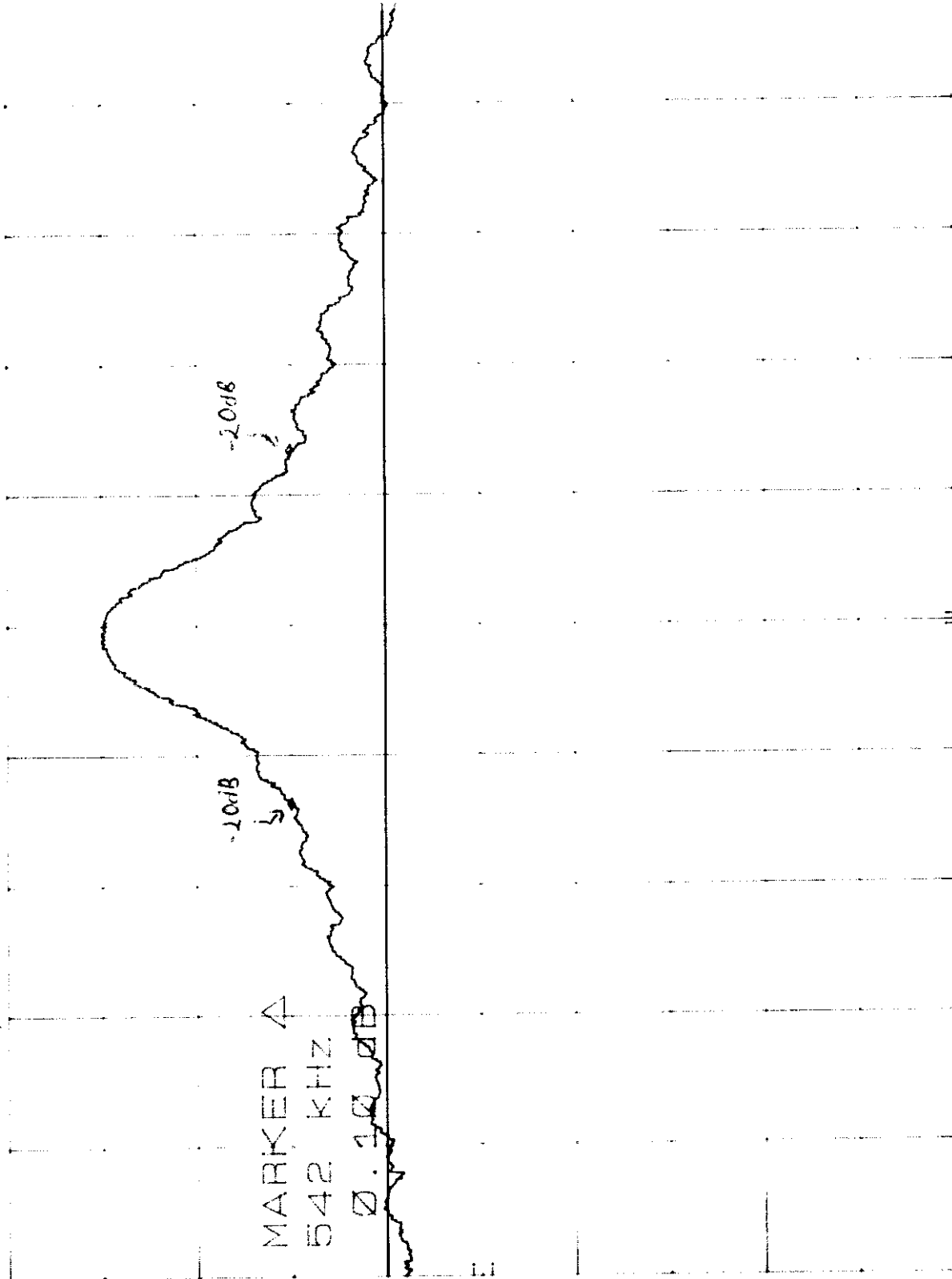
7-20-98

BANDWIDTH OF FUNDAMENTAL
REF 110.0 dBW ATTEN 20 dB

MARKER Δ 542 KHZ
0.10 dB

hp

10 dB/



DL
70.0
dBW

CORR'D

CENTER 429.96 MHz
RES BW 1 MHz

VBW 1 MHz

SPAN 2.00 MHz
SWP 20.0 msec

FCC ID: AAO1501935

PAGE 15A



8.

CONCLUSIONS

The Radio Shack Remote Control Model: 15-1935 meets all of the specification limits defined in FCC Title 47, Part 15, Subpart C, sections **15.205** and **15.231**.



APPENDIX A

TEST SETUP DIAGRAM AND PHOTOS

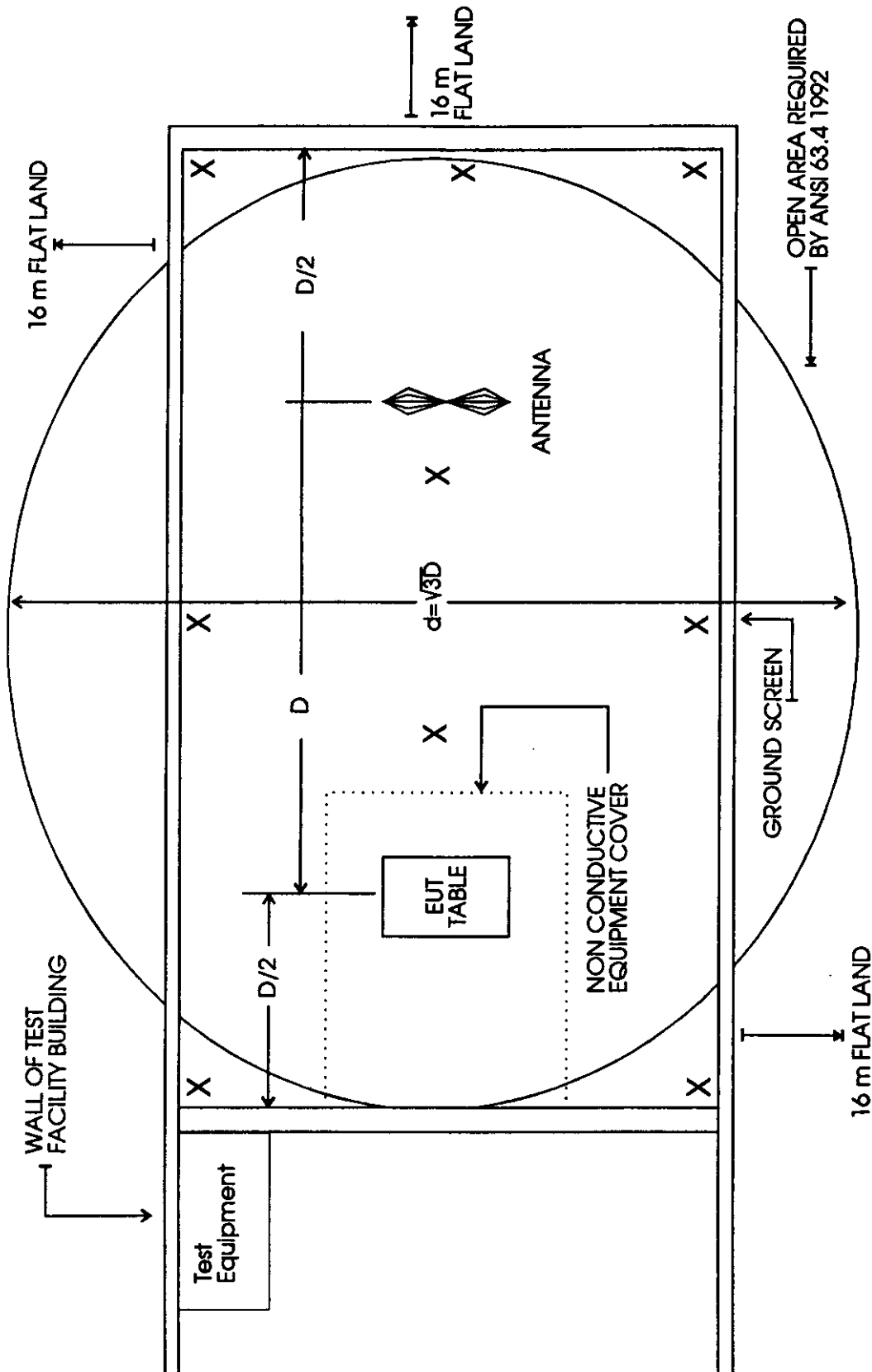
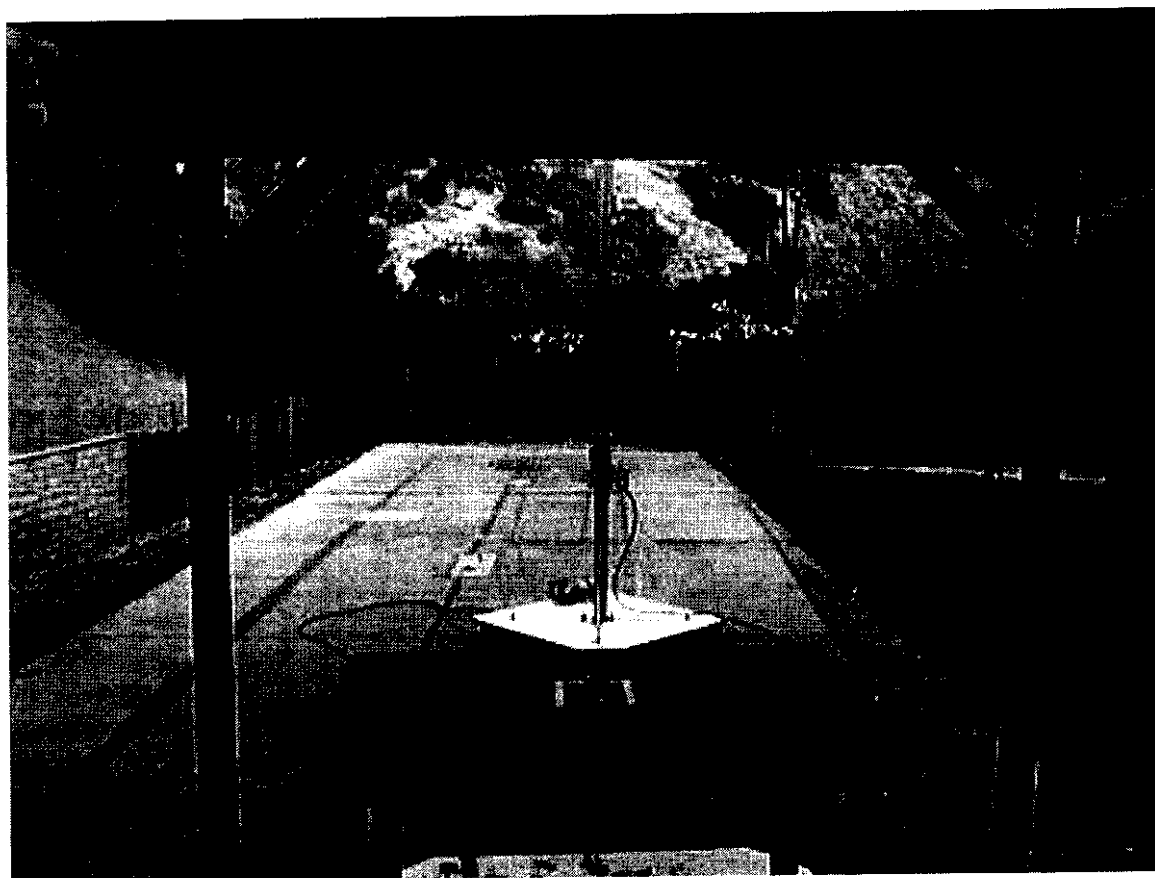


Figure 1: Plot Map and Layout of Test Site D



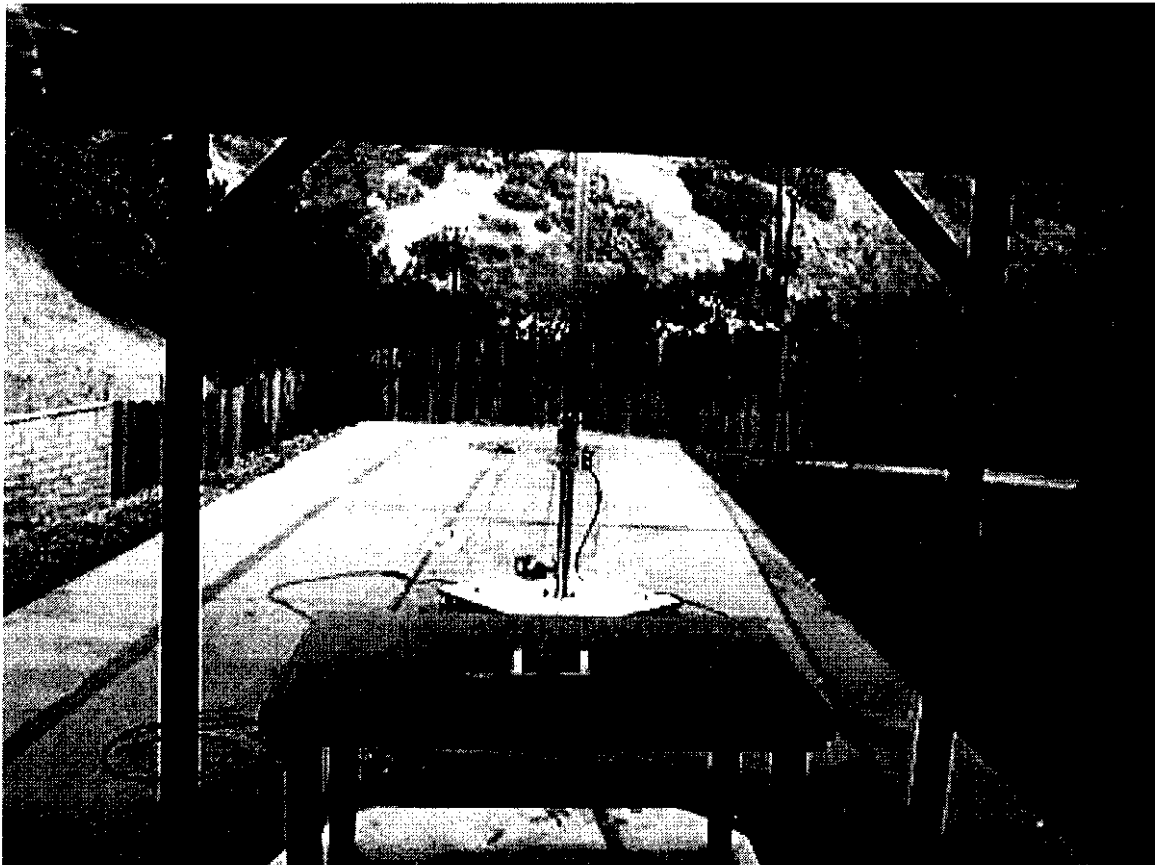
FRONT VIEW

UNIVERSAL ELECTRONICS, INC.
RADIO SHACK REMOTE CONTROL

Model: 15-1935

FCC SUBPART C - RADIATED EMISSIONS -7-20-98

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



REAR VIEW

UNIVERSAL ELECTRONICS, INC.
RADIO SHACK REMOTE CONTROL

Model: 15-1935

FCC SUBPART C - RADIATED EMISSIONS – 7-20-98

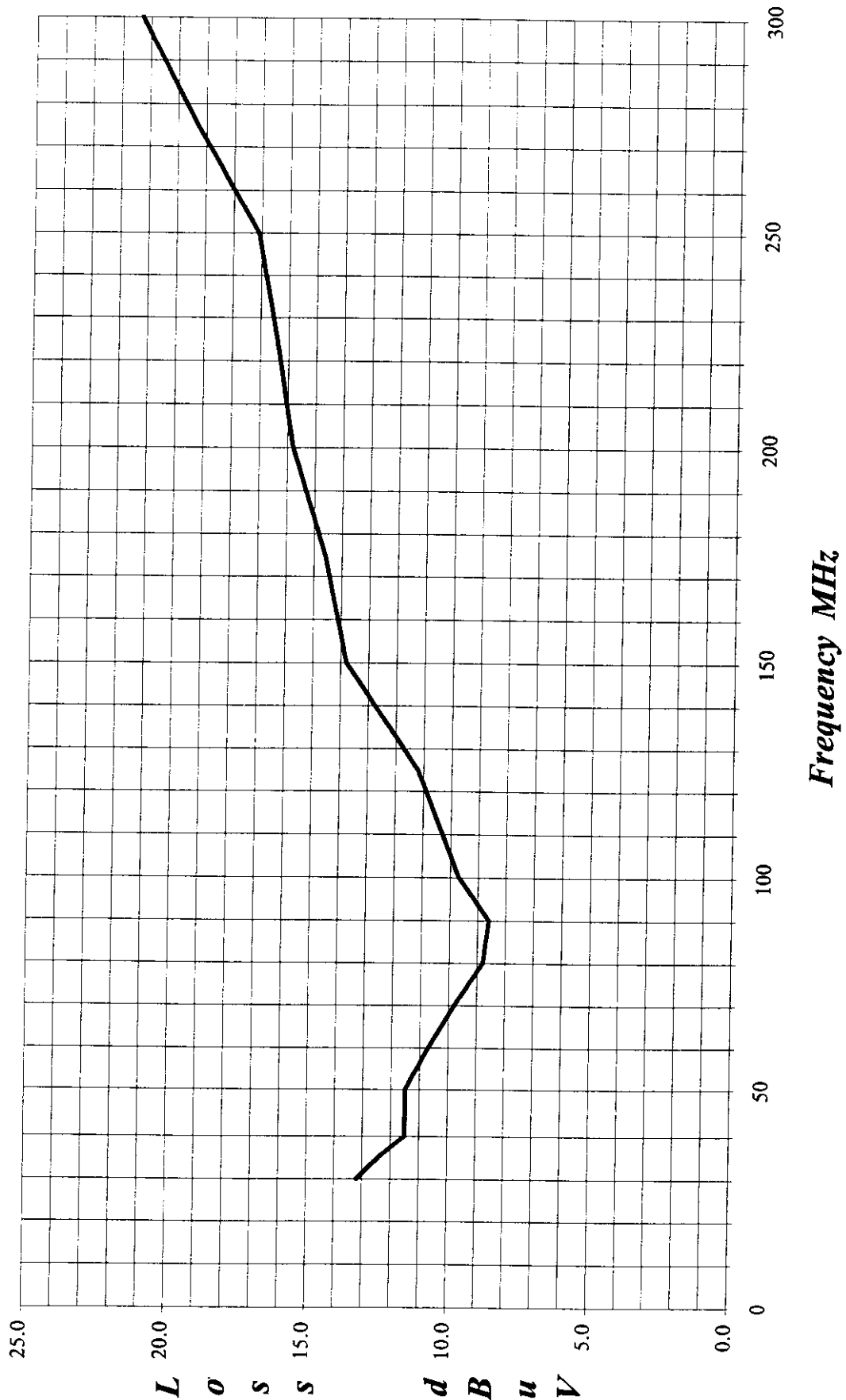
**PHOTOGRAPHS SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**

APPENDIX B***ANTENNA FACTORS AND
EFFECTIVE GAIN FACTORS***



Cat: 3/24/98

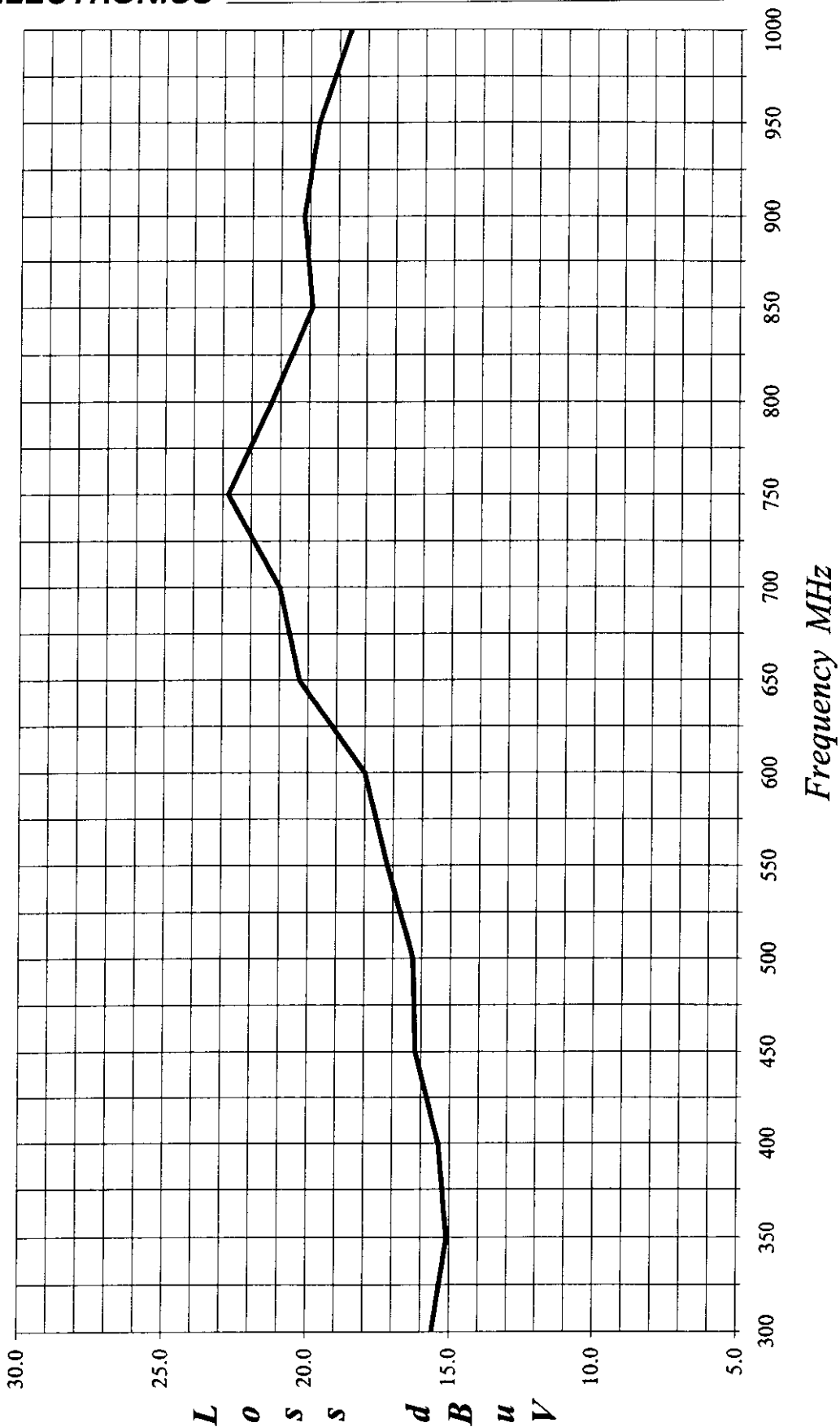
LAB "D" BICONICAL ANTENNA AB-100 S/N 01548





Cal: 12/11/97

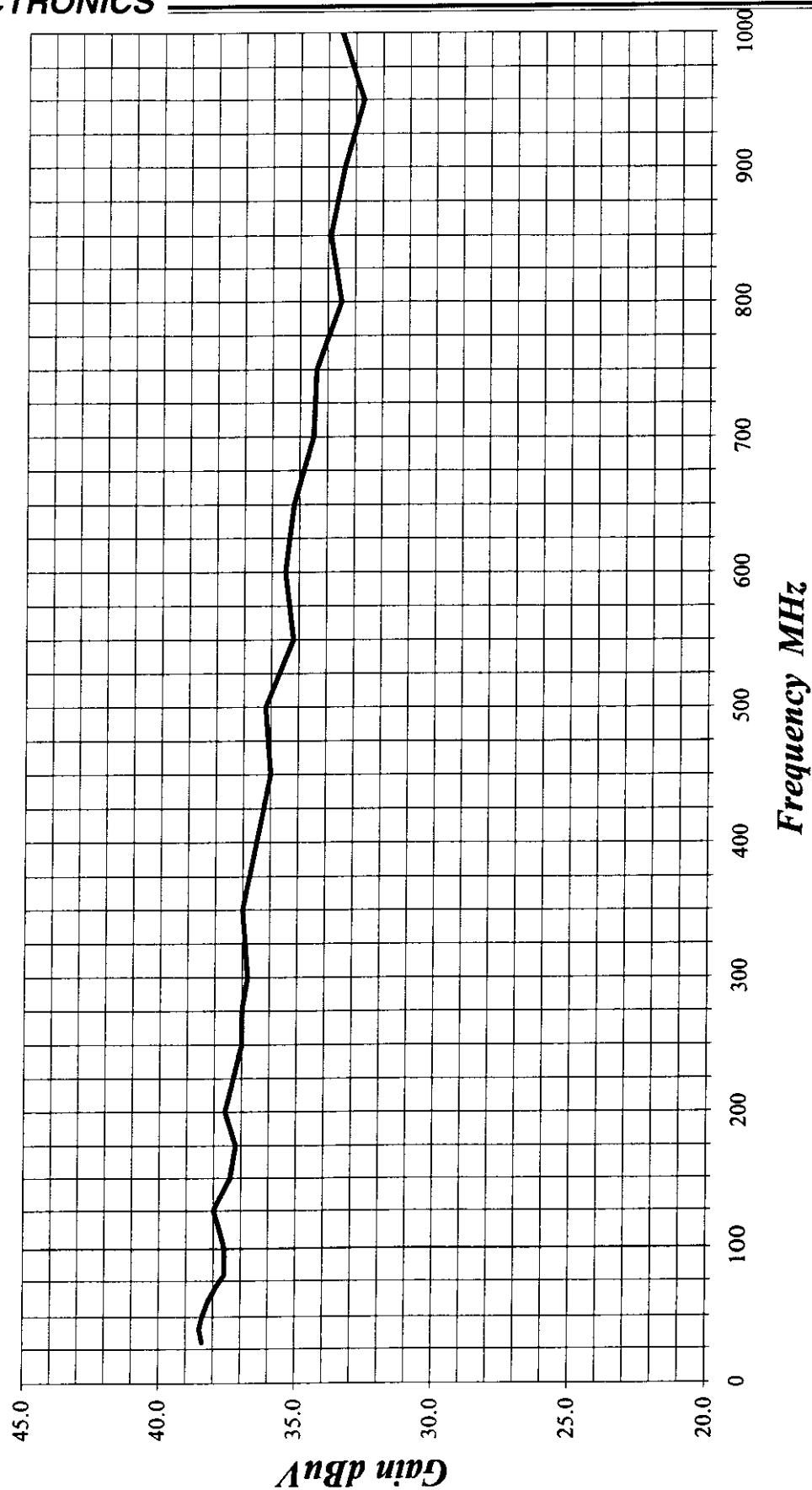
LAB "D" LOG PERIODIC ANTENNA AL-100 S/N 011117





Lab "D" Effective: 2/16/98 Effective Gain = Preamplifier Gain - Cable Loss

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



COM-POWER PA-122**MICROWAVE PREAMPLIFIER****S/N: 001****CALIBRATION DATE: MARCH 31, 1998**

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	33.0	8.0	31.4
1.1	33.0	8.5	30.5
1.2	32.9	9.0	31.4
1.3	32.9	9.5	32.6
1.4	32.8	10.0	33.1
1.5	32.7	10.5	32.1
1.6	33.0	11.0	31.0
1.7	33.0	11.5	31.0
1.8	33.1	12.0	30.9
1.9	32.9	12.5	30.9
2.0	33.1	13.0	30.4
2.5	32.7	13.5	31.0
3.0	32.4	14.0	29.3
3.5	32.1	14.5	28.5
4.0	31.8	15.0	27.6
4.5	31.5	15.5	27.6
5.0	31.6	16.0	27.3
5.5	32.0	16.5	29.3
6.0	31.6	17.0	30.4
6.5	32.0	17.5	31.1
7.0	31.4	18.0	29.7
7.5	32.0	18.5	29.3



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FCC ID: AAO1501935

11317 Frederick Avenue, Beltsville, MD 20705

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		
	(714) 587-9800	
	Antenna Calibration	
Antenna Type:	Loop Antenna	
Model:	AL-130	
Serial Number:	25309	
Calibration Date:	2/5/98	
Frequency MHz	Magnetic (dB/m)	Electric dB/m
0.01	-40.5	11.0
0.02	-41.6	9.9
0.03	-40.0	11.5
0.04	-40.3	11.2
0.05	-41.6	9.9
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	-41.8	9.7
0.2	-44.0	7.5
0.3	-41.6	9.9
0.4	-41.7	9.8
0.5	-41.7	9.8
0.6	-41.5	10.0
0.7	-41.5	10.0
0.8	-41.6	9.9
0.9	-41.6	9.9
1	-41.1	10.4
2	-40.7	10.8
3	-40.7	10.8
4	-40.9	10.6
5	-40.1	11.4
6	-40.0	11.5
7	-40.3	11.2
8	-39.8	11.7
9	-38.8	12.7
10	-40.8	10.7
12	-41.4	10.1
14	-41.4	10.1
15	-40.9	10.6
16	-40.8	10.7
18	-41.5	10.0
20	-41.5	10.0
25	-41.2	10.3
30	-41.4	10.1
Trans. Antenna Height	2 meter	
Receiving Antenna Height	2 meter	



EXHIBIT 7

SCHEMATICS AND DUTY CYCLE INFORMATION

Figure 1

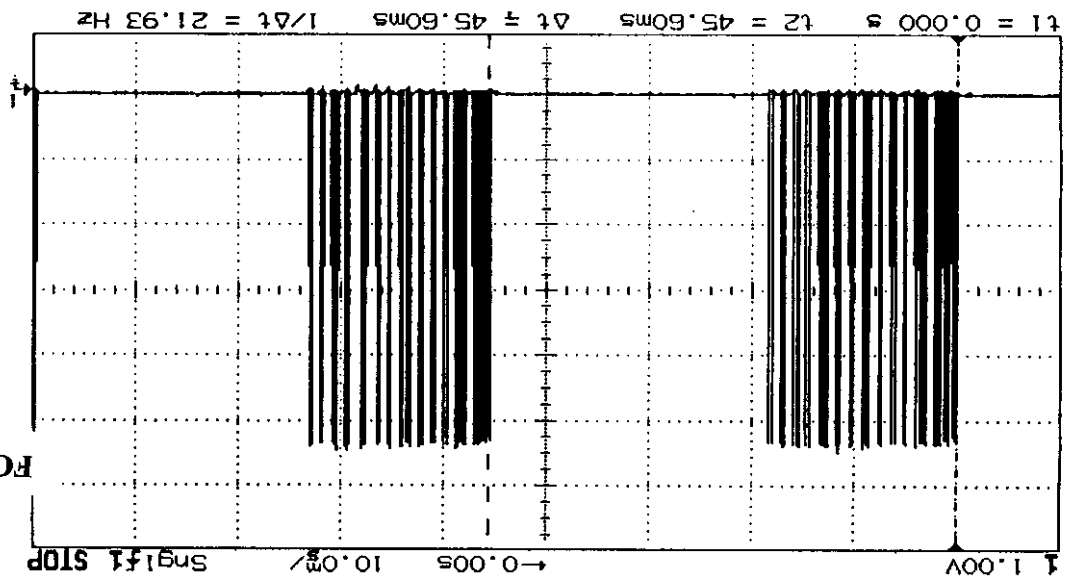


Figure 2

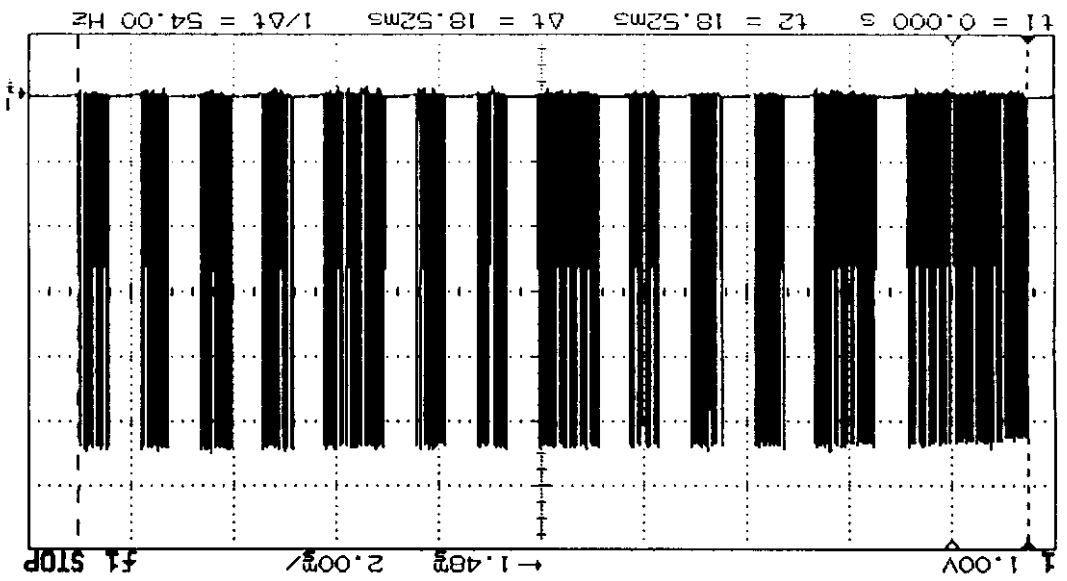
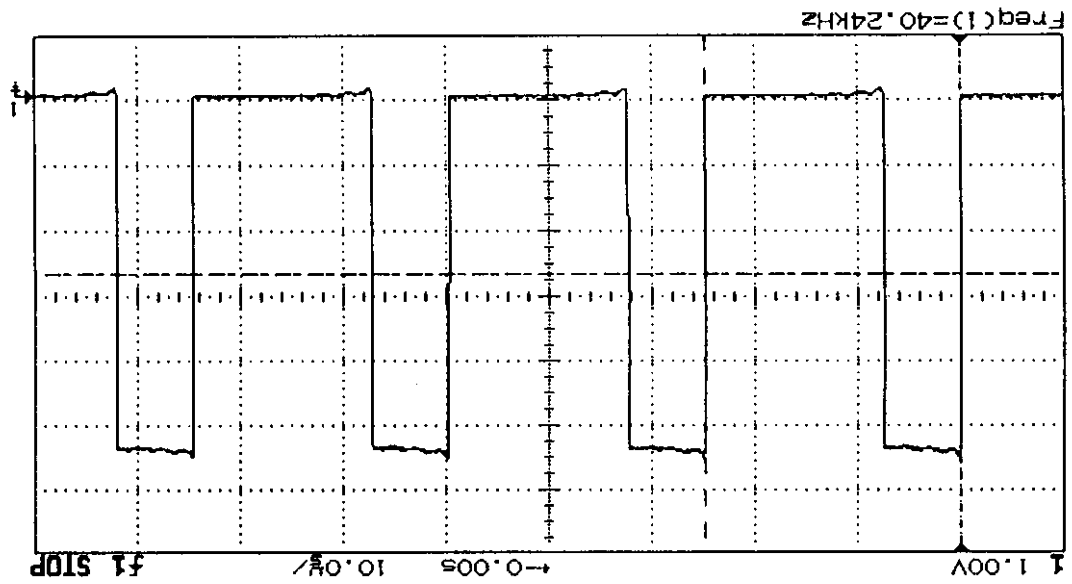


Figure 3



1. Duty Cycle Factor of Baseband Signal for 15-1935 RF Remote Control

The baseband signal modulating the 430.0 Mhz RF carrier is the same digital signal that drives the infrared LED in a remote control to operate audio/video systems. This signal is typically a 40Khz, low duty-cycle square waveform, modulated by a lower frequency code sequence specific for the device to be controlled. The duty cycle of the 40 KHz waveform must be low in order to optimize the emission efficiency of the infrared LED. A snapshot of the baseband signal for a Sony TV is shown in Figs. 1, 2, and 3 (attached). Fig. 1 shows the timing between two code sequences, separated by a blanking interval. Fig. 2 shows the pattern of a typical code sequence, and fig. 3 shows the 40 KHz carrier frequency of a code sequence. The duty cycle factor of the baseband signal will be calculated as the product of the duty cycles of all three waveforms.

Waveform of Fig. 1

$$T_{on} (max) = 22.8ms$$

$$T = 45.60ms$$

$$Duty Cycle (1) = [T_{on}(max) / T] = (22.8ms / 45.6ms) = 0.5$$

Waveform of fig. 2

$$T_{on} (max) = 18.52ms$$

$$T = 22.8ms$$

$$Duty Cycle (2) = [T_{on}(max) / T] = (18.52ms / 22.6ms) = 0.81$$

Waveform of Fig. 3

$$T_{on} (max) = 7.3us$$

$$T = 24.85us$$

$$Duty Cycle (3) = [T_{on}(max) / T] = (7.3us / 24.85us) = 0.29$$

$$Duty Cycle Factor = D.C. (1) * D.C. (2) * D.C. (3) * 100 = 0.5 * 0.81 * 0.29 * 100 = 11.745\%$$

2. The 15-1935 RF remote control has a built-in, internal antenna which is not user accessible. Therefore, the device meets the requirements of 15.203.