

REPORT OF MEASUREMENTS

GDO 98 Door Receiver

FCC ID: EF4 AAE00406

The enclosed documents reflect the requirements contained generally within the code of Federal Regulations, Title 47, Parts 2 and 15 as most recently published October 1, 1997 and all other applicable revisions made by the Commission since that time.

The specific rule sections for which the enclosed documents demonstrate compliance or rely upon to demonstrate compliance with the Commission's application and technical standards are as follows:

15.101-15.111 Subpart B, Unintentional Radiators.

Test Procedure C63.4-1992, Section 12: Unintentional Radiators was used for all measurement techniques.

In accord with Section 2.948 of the Commission's Rules, a Test Site submittal dated January 27, 1998 is on file with the commission and a Letter of Acceptance dated March 13, 1998 (File 31040/SIT) is a portion of the Commission's records.

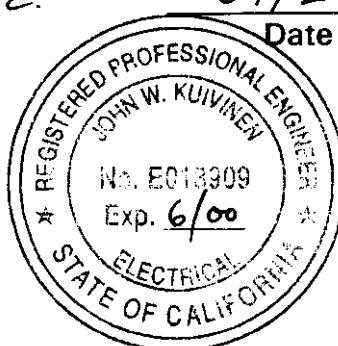
All of the information contained within this documentation is true, correct, and complete to the best of my knowledge.

John W. Kuivinen P.E.

John W. Kuivinen, P.E.
Regulatory Compliance Engineer

04/23/98

Date



LINEAR CORPORATION
FCC ID: EF4 AAE00406

**MEASUREMENT OF RADIO FREQUENCY EMISSION
OF CONTROL AND SECURITY ALARM DEVICES
FCC RULES PART 15, C63.4-1992 TEST PROCEDURE**

I. INTRODUCTION

As part of a continuing series of quality control tests to ensure compliance with all applicable Rules and Regulations, this enclosure details the test procedures for certain radio control devices. Testing was performed at a test site located on the property of Linear Corporation, 2055 Corte del Nogal, Carlsbad, CA., 92009.

II. MEASUREMENT FACILITY DESCRIPTION

The test facility is a specially prepared area adequately combining the desirability of an interference free location with the convenience of nearby 120 volt power outlets, thus completely eliminating the incidence of inverter hash, so often a problem with field measurements.

III. DESCRIPTION OF SUPPORTING STRUCTURES

For Measuring Equipment - The antenna is supported on a trolley that can be raised and lowered on a mast by means of remote control to any level between 1 meter and 4 meters above the ground. For measurements at 3 meters, an antenna height (center of dipole) of about 1 meter generally yields the greatest field strength. For measurements at 1 meter, an antenna height equal to the device under test generally yields the greatest field strength. Usually, horizontal polarization yields the greatest field strength for both 1 and 3 meter measurements.

For Equipment Under Test (EUT): The equipment to be tested is supported by a wooden turntable at a height of eighty centimeters. A two axis swivel at the top of the turntable permits the unit under test to be manually oriented in the position of maximum received signal strength. The turntable can be rotated by remote control.

Test Configuration - All transmitters were located eighty centimeters above ground, at a distance of three meters from the antenna. They were each oriented for maximum radiation by rotating the turntable. The antenna was then moved vertically along the mast for optimum reception in both horizontal and vertical planes. Where no emissions were found, the antenna was also moved to one meter distance to improve system sensitivity.

All receivers were located eighty centimeters above ground, at a distance of three meters from the antenna. They were each oriented for maximum radiation by rotating the turntable. The antenna was then moved vertically along the mast for optimum reception in both horizontal and vertical planes. Generally, emissions were very close

to the observed spectrum analyzer noise floor, making accurate measurement difficult because of the analyzer detector's characteristic of adding signal and noise. To better observe and measure emissions well above the noise floor, the antenna was moved in to one meter. This provides a theoretical 9.54 dB improvement in received field strength, but a possible shift from far field to near field antenna characteristics may introduce an unknown error in measurement.

All transmitters and receivers tested are typical of production units.

A Hewlett-Packard spectrum analyzer consisting of an 8562A mainframe is used for the field strength meter. A set of Ailtech DM-105 series dipoles are used for the receiving antennas up to 1 GHz. An A.H. Systems model SAS-200/511 log periodic antenna is used from 1 to 5 GHz. Since the published antenna factor includes the small amount of balun loss, this factor is not included in the equations for correcting measured values. The cable loss is added to the raw data. For measurements up to 1 GHz, a Hewlett-Packard 8447D broadband RF preamplifier is inserted between the antenna cable and spectrum analyzer input to ensure adequate system sensitivity while measuring.

From 1 GHz to 3 GHz, a Mini-Circuits ZFL-2000 broadband RF preamplifier is used instead of the HP 8447D. In many cases, the antenna is moved in to a distance of 1 meter to enhance test range sensitivity after the 3 meter data is observed. A theoretical 9.54dB improvement is realized. Please see Excel data spreadsheet for details. For a particular device and frequency, the EUT to antenna distance is specified in the Report of Measurements.

Correction of Measured Values - The spectrum analyzer calibration is in units of dBm absolute. Published antenna factor, measured cable loss and preamplifier gain are in units of dB. All equipment is referenced to a 50 ohm characteristic impedance; therefore, any impedance terms will factor out of any calculations. Also, balun loss is included in the antenna factor, so this term will not appear in any calculation.

To obtain field strength, the reference (50 ohm system) $1 \mu\text{V} = 0 \text{ dBuV} = -107 \text{ dBm}$ is used.

For a given frequency: antenna factor, cable loss, preamplifier gain (if used) and a 9.54 dB gain factor (3 meters to 1 meter field strength conversion) when required are factored into the spectrum analyzer reading, resulting in a field strength in units of dBm.

Field strength reading (dBm) + 107 dB = dBuV, using $0 \text{ dBuV} = 1 \mu\text{V}/\text{meter}$ at a specified distance as reference.

All of the equipment was calibrated to NBS-traceable factory specifications prior to the date of measurement.

IV MEASUREMENT PROCEDURE

Receivers

1. Place receiver on test stand, apply power.
2. Tune the antenna to the operating frequency to be measured.
3. Tune the spectrum analyzer.
4. Cohere the Receiver (Superregenerative Receivers Only)

Tune the RF Generator to the center frequency of the superregenerative receiver under test. Apply a signal level of -20 dBm at a distance of approximately two meters. Use an Ailtech antenna of the correct tuned frequency to radiate the cohering signal. Vary the signal frequency to insure that the maximum spurious emissions are recorded.

While radiating a signal, monitor the output levels at the analyzer looking for the largest peak from the unintentional radiator's spurious output.

Record the highest levels near the center frequency but be careful not to record the signal generator as an emission from the receiver.

5. Record the Emission Levels

Retune the antenna to the exact frequency of measurement. Adjust the antenna height and polarization for peak field strength. Rotate the turntable to orient the receiver for maximum emissions and record the frequency and level on the Report of Measurements.

Record an image of spectrum analyzer display for the Report of Measurements, if required.

Spectrum Analyzer Control Settings:

Tuning:	As required
Bandwidth:	100 KHz
Scan Width:	100 KHz/div (may be different when tuning or adjusting display for photographs)
Input Attenuator:	10 dB
Scan Time:	50 msec sweep
IF Mode:	Log 10 dB/division
Reference Level:	-10 dBm
Video Filter:	OFF
Scan Mode:	Internal
Scan Trigger:	Auto

FIELD STRENGTH CALCULATIONS (FCC)

DESCRIPTION: Class B Digital Device - FCC Limits

ITEM TESTED: GDO 98, Test Sample No. 1

Linear Corp.

N/A

EF4 AAAE0406

PRODUCT ID:

DATE: 14 April 1998

REFERENCE DOCUMENT: SECTION 15.109 (a)

1 μ V/M at 3 meters = 0 dBuV = -107 dBm (reference level).

Field Strength in dBm = dBuV - 107 dBm.

Field Strength in dBuV = dBm + 107 dBm.

Please refer to tables for Antenna Factors not already listed

Preampl gain (1 to 1300 MHz) = 26dB and (1300-2000 MHz)=21 dB.

For 1 meter to 3 meter conversion use 9.54dB.

Since $\text{dBuV} = 20 \log (\mu\text{V/M})$, $\mu\text{V/M} = \text{Antilog} (\text{dBuV}/20)$.

DISTANCE AT WHICH MEASURED: 3 Meters, 0.8 Meter above ground

A	B	C	D	E	F	G	H	I	K	L	G	H	O	P	
Tuned Frequency MHz	Emission Frequency MHz	Ant. Type	Ambient Level dBm	FCC Limit dBm	Meter Reading dBm	Antenna Factor dB	Cable Loss dB	Amp Gain dB	Dist Fac	Field Strength dBm/mtr	dBuV/mtr	UV/mtr	FCC Limit UV/M	dB FCC	FREQ. MHz
30.00	Bi.CON.	-110.34	-47.66	#N/A	15.90	0.30	26.00	9.54	#N/A	#N/A	#N/A	#N/A	100.00	#N/A	30.00
40.00	Bi.CON.	-112.84	-45.16	#N/A	13.30	0.40	26.00	9.54	#N/A	#N/A	#N/A	100.00	100.00	#N/A	40.00
50.65	Bi.CON.	-117.44	-40.56	-70.50	8.70	0.40	26.00	9.54	-96.94	10.06	3.18	100.00	100.00	-29.94	50.65
52.68	Bi.CON.	-117.44	-40.56	-67.50	8.70	0.40	26.00	9.54	-93.94	13.06	4.50	100.00	100.00	-26.94	52.68
54.73	Bi.CON.	-117.44	-40.56	-71.50	8.70	0.40	26.00	9.54	-97.94	9.06	2.84	100.00	100.00	-30.94	54.73
56.82	Bi.CON.	-117.44	-40.56	-72.00	8.70	0.40	26.00	9.54	-98.44	8.56	2.68	100.00	100.00	-31.44	56.82
57.87	Bi.CON.	-117.44	-40.56	-76.50	8.70	0.40	26.00	9.54	-102.94	4.06	1.60	100.00	100.00	-35.94	57.87
58.00	Bi.CON.	-117.44	-40.56	#N/A	8.70	0.40	26.00	9.54	#N/A	#N/A	#N/A	100.00	100.00	#N/A	58.00
60.00	Bi.CON.	-117.54	-40.46	#N/A	8.50	0.50	26.00	9.54	#N/A	#N/A	#N/A	100.00	100.00	#N/A	60.00
78.07	Bi.CON.	-117.54	-40.46	-72.50	8.50	0.50	26.00	9.54	-99.04	7.96	2.50	100.00	100.00	-32.04	78.07
85.15	Bi.CON.	-117.54	-40.46	-73.00	8.50	0.50	26.00	9.54	-99.54	7.46	2.36	100.00	100.00	-32.54	85.15
86.20	Bi.CON.	-117.54	-40.46	-72.00	8.50	0.50	26.00	9.54	-98.54	8.46	2.65	100.00	100.00	-31.54	86.20
90.00	Bi.CON.	-117.04	-40.96	#N/A	8.90	0.60	26.00	9.54	#N/A	#N/A	#N/A	100.00	100.00	#N/A	90.00
100.00	Bi.CON.	-115.84	-42.16	#N/A	10.10	0.60	26.00	9.54	#N/A	#N/A	#N/A	100.00	100.00	#N/A	100.00
110.00	Bi.CON.	-114.24	-40.24	#N/A	11.70	0.60	26.00	9.54	#N/A	#N/A	#N/A	150.00	150.00	#N/A	110.00
120.00	Bi.CON.	-112.24	-42.24	#N/A	13.60	0.70	26.00	9.54	#N/A	#N/A	#N/A	150.00	150.00	#N/A	120.00
130.00	Bi.CON.	-111.44	-43.04	#N/A	14.40	0.70	26.00	9.54	#N/A	#N/A	#N/A	150.00	150.00	#N/A	130.00
140.00	Bi.CON.	-111.34	-43.14	#N/A	14.40	0.80	26.00	9.54	#N/A	#N/A	#N/A	150.00	150.00	#N/A	140.00
150.00	Bi.CON.	-110.84	-43.64	#N/A	14.90	0.80	26.00	9.54	#N/A	#N/A	#N/A	150.00	150.00	#N/A	150.00

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160.00	Bi.CON.	-110.94	#N/A	14.80	0.80	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	160.00
170.00	Bi.CON.	-110.94	#N/A	14.70	0.90	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	170.00
180.00	Bi.CON.	-111.54	#N/A	14.10	0.90	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	180.00
190.00	Bi.CON.	-111.34	#N/A	14.30	0.90	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	190.00
200.00	Bi.CON.	-111.34	#N/A	14.30	0.90	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	200.00
210.00	Bi.CON.	-110.74	#N/A	14.90	0.90	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	210.00
220.00	Bi.CON.	-110.54	#N/A	15.00	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	220.00
230.00	Bi.CON.	-110.94	#N/A	14.60	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	230.00
240.00	Bi.CON.	-107.24	#N/A	15.30	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	240.00
250.00	Bi.CON.	-109.94	#N/A	15.60	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	250.00
260.00	Bi.CON.	-109.64	#N/A	15.90	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	260.00
270.00	Bi.CON.	-107.84	#N/A	17.70	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	270.00
280.00	Bi.CON.	-107.24	#N/A	18.30	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	280.00
290.00	Bi.CON.	-107.14	#N/A	18.40	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	290.00
300.00	Bi.CON.	-104.64	#N/A	21.00	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	300.00
310.00	T2 ANT.	-107.14	#N/A	18.40	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	310.00
320.00	T2 ANT.	-106.84	#N/A	18.70	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	320.00
330.00	T2 ANT.	-106.54	#N/A	19.00	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	330.00
340.00	T2 ANT.	-106.14	#N/A	19.40	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	340.00
350.00	T2 ANT.	-105.94	#N/A	19.60	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	350.00
360.00	T2 ANT.	-105.64	#N/A	19.90	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	360.00
370.00	T2 ANT.	-105.34	#N/A	20.20	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	370.00
380.00	T2 ANT.	-105.14	#N/A	20.40	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	380.00
390.00	T2 ANT.	-104.84	#N/A	20.70	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	390.00
400.00	T3 ANT.	-103.44	#N/A	22.10	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	400.00
410.00	T3 ANT.	-103.24	#N/A	22.30	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	410.00
420.00	T3 ANT.	-103.04	#N/A	22.50	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	420.00
430.00	T3 ANT.	-102.84	#N/A	22.70	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	430.00
440.00	T3 ANT.	-102.64	#N/A	22.90	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	440.00
450.00	T3 ANT.	-102.44	#N/A	23.10	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	450.00
460.00	T3 ANT.	-102.24	#N/A	23.30	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	460.00
470.00	T3 ANT.	-102.14	#N/A	23.40	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	470.00
480.00	T3 ANT.	-101.94	#N/A	23.60	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	480.00
490.00	T3 ANT.	-101.74	#N/A	23.80	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	490.00
500.00	T3 ANT.	-101.54	#N/A	24.00	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	500.00
510.00	T3 ANT.	-101.34	#N/A	24.20	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	510.00
520.00	T3 ANT.	-101.24	#N/A	24.30	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	520.00
530.00	T3 ANT.	-101.04	#N/A	24.50	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	530.00
540.00	T3 ANT.	-100.94	#N/A	24.60	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	540.00
550.00	T3 ANT.	-100.74	#N/A	24.80	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	550.00
560.00	T3 ANT.	-100.64	#N/A	24.90	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	560.00
570.00	T3 ANT.	-100.44	#N/A	25.10	1.00	26.00	9.54	#N/A	150.00	#N/A	150.00	#N/A	570.00

A Actual frequency range of testing is from 30 to 1.0 GHz.


Arthur W. Kuehne
TESTED BY

4/23/98
DATE

FILE NAME: AAE00406_1.XLS
ENGINEER:
FCC DATA

DATE

DISK NAME: FCC DATA

Page 2 of 2

FIELD STRENGTH CALCULATIONS (FCC)

DESCRIPTION: Receivers 285-320 MHz
ITEM TESTED: GDO 98, Superregenerative Receiver, No. 1
MANUFACTURER: LINEAR CORP.
TRADE NAME: N/A
PRODUCT ID: EF4 AAE00408
DATE: 04/14/98

REFERENCE DOCUMENT: SECTION 15.108(a)

1 μ V/M at 3 meters = 0 dB μ V = -107 dBm (reference level).
Field Strength in dBm = dB μ V - 107 dBm.
Field Strength in dB μ V = dBm + 107 dBm.

Please refer to tables for Antenna Factors not already listed
Preamp Gain (.1 to 1300 MHz) = 28dB and (1300-2000 MHz) = 21 dB.
For 1 meter to 3 meter conversion use 9.54dB.
Since dB μ V = 20 Log (μ V/M), μ V/M = Antilog (dB μ V/20).

DISTANCE AT WHICH MEASURED: 3 Meters, 0.8 Meter above ground

A	B	C	D	E	F	G	H	I	K	L	G	H	O	P
Tuned Frequency	Emission Frequency	Ambient Level	FCC Limit	Meter Reading	Antenna Factor	Cable Loss	Amp Gain	Distr. Fac.	Field Strength	FCC Limit	dB: FCC	FREQ.		
MHz	MHz	dBm	dBm	dBm	dB	dB	dB	dB	dBm/mtr	dBm/mtr	dB	MHz		
317.38	-108.04	-42.94	-76.00	17.5	1.2	27.2	9.64	-93.04	13.98	4.89	200.00	-32.08	317.38	
318.00	-108.34	-43.64	#N/A	18.2	1.2	27.2	9.54	#N/A	#N/A	200.00	#N/A	318.00		
318.88	-107.84	-44.14	-74.00	18.7	1.2	27.2	9.54	-90.84	16.16	6.43	200.00	-28.86	318.88	
636.00	-99.74	-62.24	#N/A	25.6	1.7	26.5	9.54	#N/A	#N/A	200.00	#N/A	636.00		
964.00	-95.74	-56.24	#N/A	28.1	2.2	26.5	9.54	#N/A	#N/A	200.00	#N/A	964.00		
1272.00	-81.94	-52.08	#N/A	26.4	2.6	20.4	9.54	#N/A	#N/A	500.00	#N/A	1272.00		
1580.00	-91.54	-52.48	#N/A	28.2	3.0	22.2	9.54	#N/A	#N/A	500.00	#N/A	1580.00		
1808.00	-88.14	-56.88	#N/A	28.7	3.3	20.6	9.54	#N/A	#N/A	600.00	#N/A	1808.00		

The spectrum was searched from 25 to 2000 MHz per 15.33(b)
No other emissions were observed except those shown on this page.

John W. Kummer 4/23/98
TESTED BY

TESTED BY _____
ENGINEER _____
FILE NAME: AAE006_2.xls DATE _____
DISK NAME: FCC DATA

15.107(a,c) COMPLIANCE MEASUREMENTS

Measurement procedure in accordance with C63.4-1992.

Conducted Measurements: 450 KHz to 30 MHz

Operating Frequency: 318 MHz

Instrumentation: Spectrum Analyzer: HP8562A
Powerline Filter: Corcom 10ER3
10Amp 120/250 VAC 50/60 Hz.
Power Mains Network (LISN): Solar 8012-50-R-24-BNC

The AAE00406 superregenerative receiver is powered from an internal class II isolation transformer.

The receiver and microcontroller combination operates on 24 VAC at an average current drain of less than 50 mA. The conducted emissions from this receiver were very low and no significant conducted emissions in the range of 450 KHz to 30 MHz were observed.

A short BNC to BNC cable connected the LISN output port to the spectrum analyzer.

In accord with Section 2.948 of the Commission's Rules, a Test Site submittal dated January 27, 1998 is on file with the commission and a Letter of Acceptance dated March 13, 1998 (File 31040/SIT) is a portion of the Commission's records.

The tests were performed at Linear Corporation, 2055 Corte Del Nogal, Carlsbad, CA. 92009.

John W. Kuivinen, P.E.
Regulatory Compliance Engineer

4/23/98

Date

LINEAR CORPORATION
FCC ID: EF4 AAE00406

**Summary of Test Results
in accord with FCC Part 15, Subpart B**

Equipment Model: GDO 98 Door Receiver

Receiver Tested to 15.101(b): Complies

Test Conditions: Radiated Section 15.109(a)

Receiver Spurious at 3 meters:
(Highest Emission) 4.5 uV/Mtr (-26.9 dB below limit)

Frequency: 52.68 MHz

Attestation:

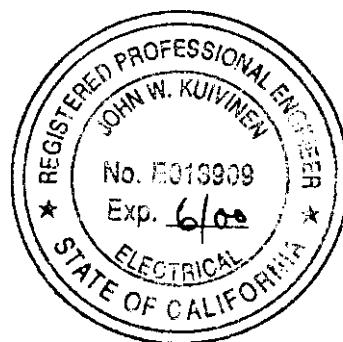
The radio apparatus identified in the application has been subject to all the applicable test conditions specified in Parts 2 and 15 of the FCC Rules and Regulations and all of the requirements of the Rules and Regulations have been met.

Regulatory Compliance Engineer

John W. Kuivinen, P.E.



Date: 4/23/98



7.1	Freq. of Operation:	318 MHz
7.3	Receiver Radiated Spurious:	Complies - See Report of Emissions
7.4	Conducted Emissions:	Complies - See Report of Emissions
8.0	Self Certification:	N/A
9.0	AC Wireline Conducted Emissions:	Complies - See Report of Emissions
10.0	Terminated Measurement Method:	N/A
11.0	Radiated Measurement Method:	C63.4-1992
11.1	Measuring Distance:	3 meters
11.2	Open Field Test Site:	Complies, FCC Site Acceptance dated 3/98
11.3	Equipment Test Platform:	0.8 meters, rotary turntable
12.0	DC Power Consumption Methods:	N/A
13.0	Near Field Measurement for < 30 MHz:	N/A
14.0	Test Report Submission:	See Attached