

TIMCO ENGINEERING INC.

849 NW State Road 45
Newberry, Florida 32669
<http://www.timcoengr.com>
888.472.2424 F 352.472.2030 email: sid@timcoengr.com



Test Report

Product Name: WIRELESS LAN

FCC ID: QJ7-JLM051690

Applicant:

**COMMUNICATIONS DEVELOPMENT LLC
2003 WESTERN AVENUE
Suite 400
SEATTLE, WA 98121**

Date Receipt: JANUARY 9, 2004

Date Tested: FEBRUARY 13, 2004

APPLICANT: COMMUNICATIONS DEVELOPMENT LLC
FCC ID: QJ7-JLM051690
REPORT #: D\DaTaLinc_\1418GUT3\1418GUT3TestReport.doc

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TABLE OF CONTENTS FOR A DIRECT SEQUENCE SPREAD SPECTRUM

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EXHIBIT INCLUDED:

REQUEST FOR CONFIDENTIALITY LETTER
BLOCK DIAGRAM
SCHEMATICS
USERS MANUAL
LABEL SAMPLE
LABEL LOCATION
EXTERNAL PHOTOGRAPHS
INTERNAL PHOTOGRAPHS
OPERATIONAL DESCRIPTION
TEST SET UP PHOTOGRAPHS

APPLICANT: COMMUNICATIONS DEVELOPMENT LLC
FCC ID: QJ7-JLM51690
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FEBRUARY 13, 2004

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

SUBJECT: COMMUNICATIONS DEVELOPMENT LLC

FCC ID: QJ7-JLM051690

To Whom It May Concern:

The attached application is for a direct sequence spread spectrum assembly, made up of the Bridge/Radio, and several antennas and coaxial cable (3 dB of loss).

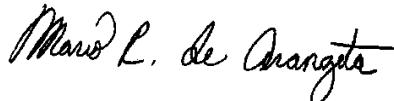
COMMUNICATIONS DEVELOPMENT LLC purchases standard antennas from their manufacturers. The radio uses a unique connector a reverse SMA. COMMUNICATIONS DEVELOPMENT LLC equipment is only professionally installed.

Antennas Tested: Cushcraft PC-2415 (13.9 dBi yagi)
Maxrad MFB2408 (8 dBi omni)
Maxrad MYP24014PTNF (14 dBi yagi)
Maxrad MHWS2400MSMARP (2 dBi omni)

We are including with this application omni directional antennas from the same manufacturer. These are of the same construction as tested but with lower gains than the ones tested

Should you have any questions or require any further information with regards to this, please feel free to contact me.

Sincerely,



Mario R. de Aranzeta C.E.T.

MRD/sh
Encl.

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EMC Equipment List

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/26/01	3/26/04
3-Meter OATS	TEI	N/A	N/A	Listed 1/13/03	1/13/06
Biconnical Antenna	Eaton	94455-1	1057	CAL 3/18/03	3/18/05
Biconnical Antenna	Eaton	94455-1	1096	CAL 10/1/01	10/1/03
Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/26/01	4/26/03
Double-Ridged Horn Antenna	Electro-Metrics	RGA-180	2319	CAL 2/17/03	2/17/05
LISN	Electro-Metrics	ANS-25/2	2604	CAL 10/9/01	10/9/03
LISN	Electro-Metrics	EM-7820	2682	CAL 3/12/03	3/12/05
Log-Periodic Antenna	Eaton	96005	1243	CAL 5/8/03	5/8/05

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TEST PROCEDURE

GENERAL: This report shall NOT be reproduced except in full without the written approval of TIMCO ENGINEERING, INC.

POWER LINE CONDUCTED INTERFERENCE: The procedure used was ANSI STANDARD C63.4-2000 using a 50 uH LISN. Both lines were observed with the UUT transmitting. The bandwidth of the spectrum analyzer was 10kHz with an appropriate sweep speed. The ambient temperature of the UUT was 76°F with a humidity of 55%.

BANDWIDTH 6.0 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW)=1.0 MHz and the video bandwidth (VBW) =1.0 MHz and the span set as shown on plot.

POWER OUTPUT: The RF power output was measured at the antenna feed point using a peak power meter.

ANTENNA CONDUCTED EMISSIONS: The RBW=100 kHz, VBW=300 kHz and the span set to 10.0MHz and the spectrum was scanned from 30 MHz to the 10th Harmonic of the fundamental. Above 1.0 GHz the resolution bandwidth was 1.0MHz and the VBW = 3.0MHz and the span set to 50 MHz.

RADIATION INTERFERENCE: The test procedure used was ANSI STANDARD C63.4-2000 using a HEWLETT PACKARD spectrum analyzer with a pre-selector. The bandwidth (RBW) of the spectrum analyzer was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was = 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The ambient temperature of the UUT was 53°F with a humidity of 17%.

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APPLICANT: COMMUNICATIONS DEVELOPMENT LLC

FCC ID: QJ7-JLM051690

NAME OF TEST: POWER LINE CONDUCTED INTERFERENCE

RULES PART NO.: 15.107(a)

REQUIREMENTS:	QUASI-PEAK	AVERAGE
.15 - 0.5 MHz	66-56 dBuV	56-46 dBuV
0.5 - 5.0	56	46
5.0 - 30.	60	50

TEST PROCEDURE: ANSI STANDARD C63.4-2000. The spectrum was scanned from .15 to 30 MHz.

TEST DATA:

THE PLOTS ON THE FOLLOWING PAGES REPRESENT THE EMISSIONS TAKEN FOR THIS DEVICE.

TEST RESULTS: Both lines were observed. The measurements indicate that the unit DOES appear to meet the FCC requirements for this class of equipment.

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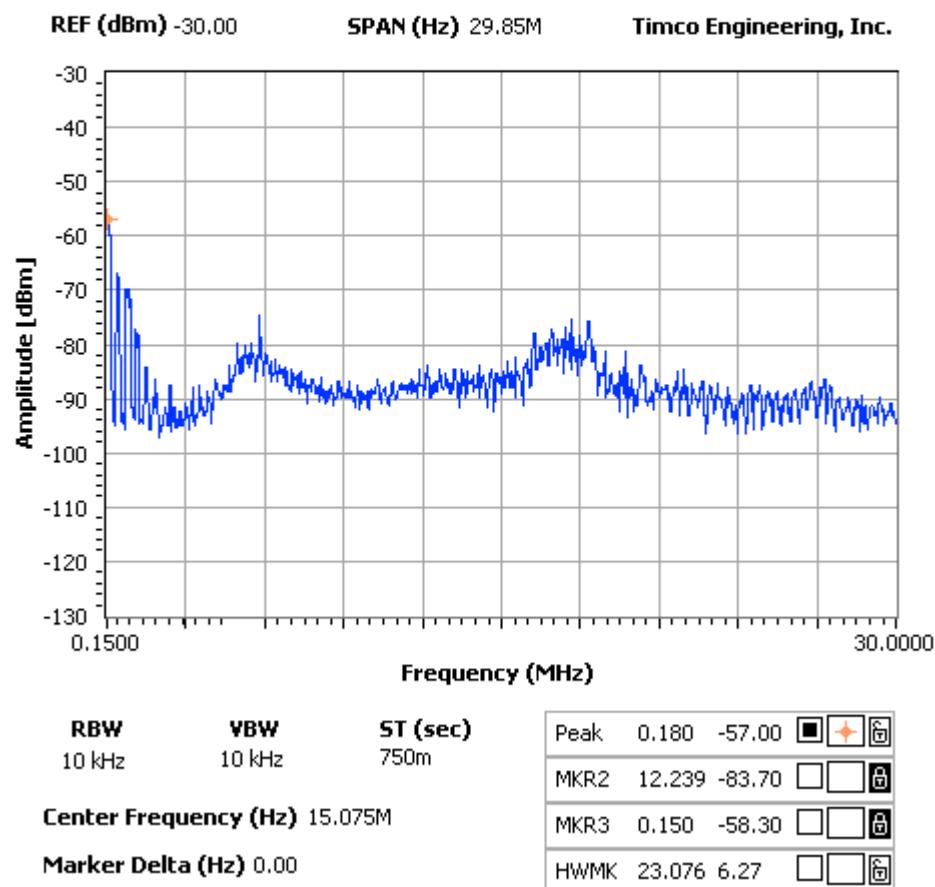
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NOTES:

Line 1 Job:1418GUT3



APPLICANT: COMMUNICATIONS DEVELOPMENT LLC

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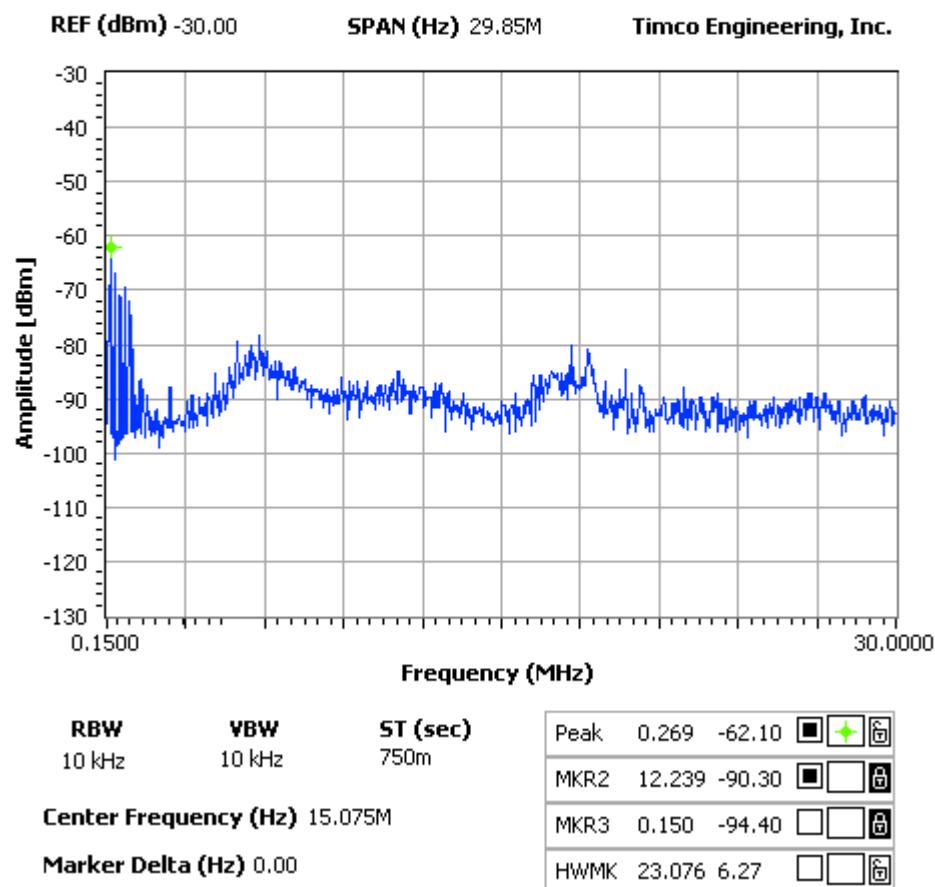
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NOTES:

Line 2 job:1418GUT3



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FCC ID: QJ7-JLM051690

NAME OF TEST: 6.0dB BANDWIDTH

RULES PART NO.: 15.247(a)(2)

REQUIREMENTS: The 6.0dB bandwidth must be greater than 500 kHz.

MEASUREMENT: The 6.0dB bandwidth measured @ 2412 MHz was 11.7 MHz.

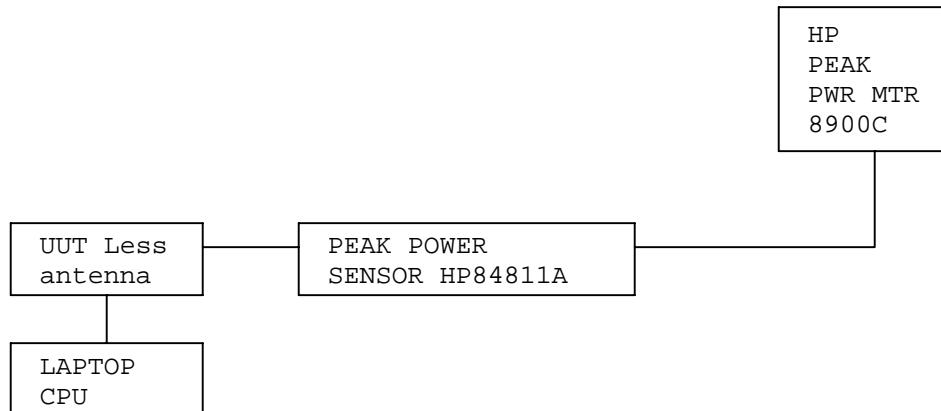
DATA: See the following plots. Three places in the band were Measured and the worst case presented.

NAME OF TEST: POWER OUTPUT

RULES PART NO.: 15.247(b) 1.0 Watt or +30 dBm (conducted).

MEASUREMENT: 158.0 mWatts or 22.0 dBm @ 2412.0MHz

15.247(c) Method of Measuring RF Power output: The Peak power Sensor was connected in place of the antenna.



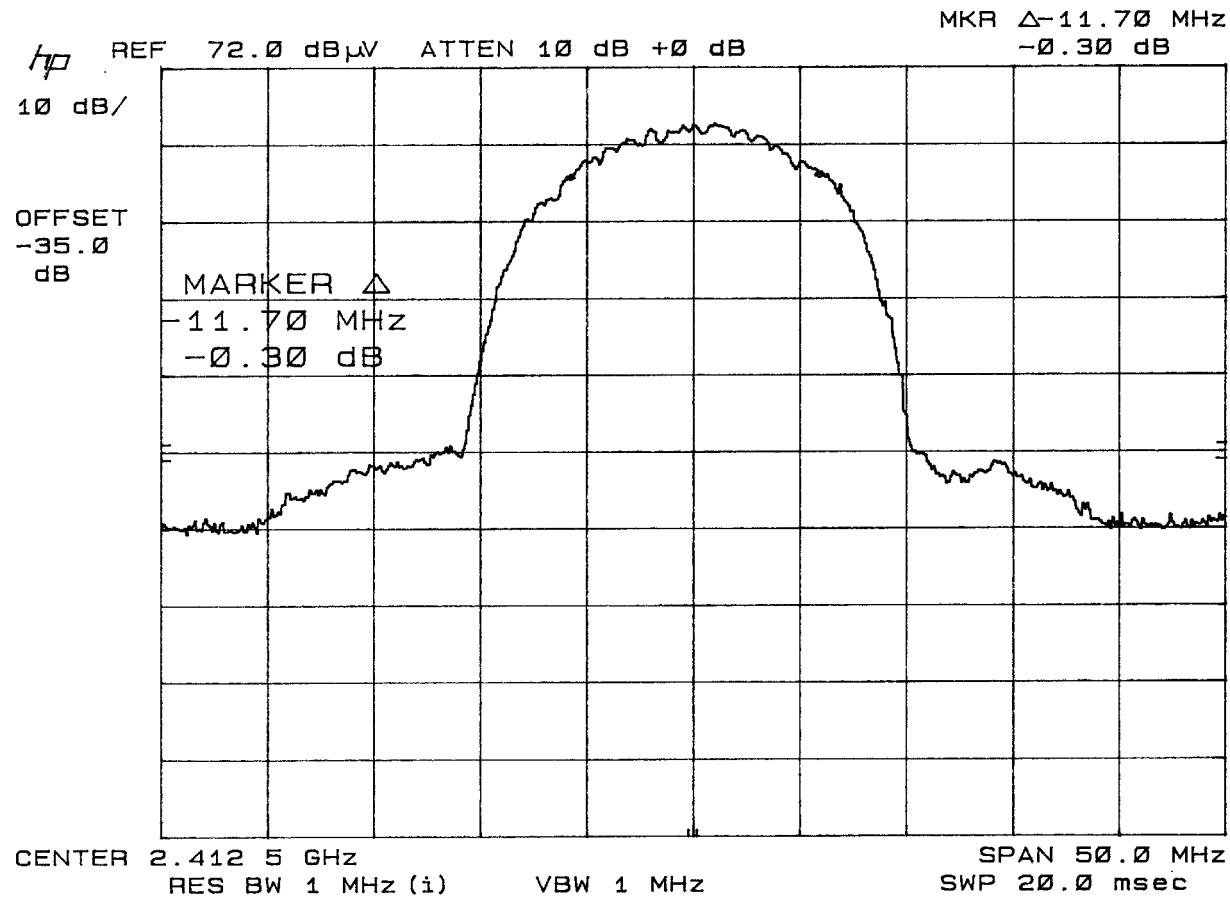
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NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

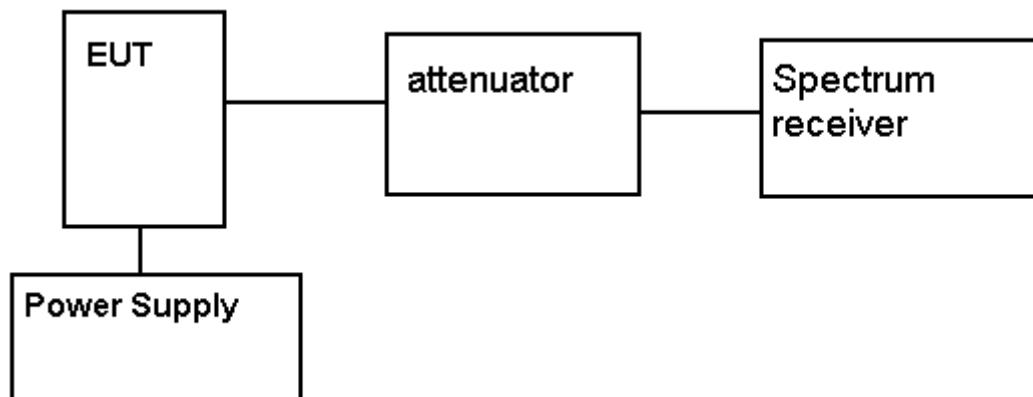
REQUIREMENTS: Emissions must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

TEST DATA:

TF (MHz)	EF (MHz)	dB below carrier
2412	2412	0
	299	64.3
	601.3	60.6
	1507	67.5
	1606	57.4
	1808	41.7
	2038	53
	2371	55.4
	2453	62.7
	2787	69.5
	4075	53.3
	4823	71.3

NOTE: THE SPECTRUM WAS SCANNED TO THE TENTH HARMONIC, THREE CHANNELS WERE MEASURED AND THE WORST CASE IS REPORTED ABOVE.

15.247(c) Method of Measuring RF Conducted Spurious Emissions



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15.247(c), 15.205 &15.209(b) Field strength of spurious emissions:

REQUIREMENTS:

FIELD STRENGTH of Fundamental:	FIELD STRENGTH of Harmonics	S15.209
902-928MHz	30 - 88 MHz 40 dBuV/m @3M	
2.4-2.4835GHz	88 -216 MHz 43.5	
	216 -960 MHz 46	
	54 dBuV/m @3m	ABOVE 960 MHz 54dBuV/m

EMISSIONS RADIATED OUTSIDE OF THE SPECIFIED FREQUENCY BANDS, EXCEPT FOR HARMONICS, SHALL BE ATTENUATED BY AT LEAST 20 dB BELOW THE LEVEL OF THE FUNDAMENTAL OR TO THE GENERAL RADIATED EMISSION LIMITS IN 15.209, WHICHEVER IS THE LESSER ATTENUATION.

REQUIREMENTS: Emissions that fall in the restricted bands (15.205) must be less than 54 dBuV/m otherwise the spurious and harmonics must be attenuated by at least 20 dB.

TEST DATA: Maxrad MFB 2408 (8 dBi omni)

Tuned Frequency	Emission Frequency	Meter Reading	Ant. Polarity	Coax Loss	Correction Factor	Field Strength	Margin
MHz	MHz	dBuV		dB	dB	dBuV/m	dB
2,412.0	2,414.00	81.7 Pk	V	1.87	29.28	112.85	14.52
2,412.0	4,824.00	30.9 Pk	V	2.65	34.04	67.59	6.41
2,412.0	4,824.00	17.3 Ave	V	2.65	34.04	53.99	0.01
2,437.0	2,438.00	82.4 Pk	V	1.88	29.31	113.59	13.78
2,437.0	4,874.00	32.5 Pk	V	2.66	34.20	69.36	4.7
2,437.0	4,874.00	17.0 Ave	V	2.66	34.20	53.80	0.2
2,462.0	2,463.40	83.0 Pk	V	1.89	29.35	114.24	13.13
2,462.0	4,923.90	35.1 Pk	V	2.68	34.36	72.14	1.86
2,462.0	4,923.90	16.9 Ave	V	2.68	34.36	53.94	0.06

TEST DATA: Cushcraft PC-2415 (13.9 dBi yagi)

Tuned Frequency	Emission Frequency	Meter Reading	Ant. Polarity	Coax Loss	Correction Factor	Field Strength	Margin
MHz	MHz	dBuV		dB	dB	dBuV/m	dB
2,412.0	2,037.60	31.0 Pk	V	1.72	28.75	61.47	38.47
2,412.0	2,370.60	33.1 Pk	V	1.85	29.22	64.17	9.83
2,412.0	2,370.60	21.8 Ave	V	1.85	29.22	52.87	1.13
2,412.0	2,412.00	88.8 Pk	V	1.86	29.28	119.94	7.43
2,437.0	2,438.00	89.3 Pk	V	1.88	29.31	120.49	6.88
2,437.0	2,063.00	30.4 Pk	V	1.73	28.79	60.92	39.57
2,462.0	2,462.00	88.7 Pk	V	1.88	29.35	119.93	7.44
2,462.0	2,088.00	31.0 Pk	V	1.74	28.82	61.56	38.37

East

NOTE: THE SPECTRUM WAS SCANNED TO THE TENTH HARMONIC.

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TEST DATA: Maxrad yagi antenna (14 dBi)

Tuned Frequency	Emission Frequency	Meter Reading	Ant. Polarity	Coax Loss	Correction Factor	Field Strength	Margin
MHz	MHz	dBuV		dB	dB	dBuV/m	dB
2,412.0	2,038.00	26.0	V	1.72	28.75	56.47	38.57
2,412.0	2,603.00	14.2	V	1.94	29.63	45.77	49.27
2,412.0	2,412.00	83.9	V	1.86	29.28	115.04	12.33
2,412.0	4,075.00	11.1	V	2.42	32.92	46.44	7.56
2,437.0	2,063.00	28.8	V	1.73	28.79	59.32	
2,437.0	2,334.00	17.5	V	1.83	29.17	48.50	5.50
2,437.0	2,437.00	83.4	V	1.87	29.31	114.58	12.79
2,437.0	2,561.00	16.4	V	1.92	29.53	47.85	46.73
2,437.0	2,675.00	13.7	V	1.97	29.79	45.46	8.54
2,437.0	4,125.00	9.6	V	2.44	32.93	44.97	9.03
2,462.0	2,087.00	31.6	V	1.73	28.82	62.15	30.98
2,462.0	2,462.00	81.9	V	1.88	29.35	113.13	14.24
2,462.0	2,609.00	15.4	V	1.94	29.64	46.98	46.15
2,462.0	2,681.00	10.8	V	1.97	29.80	42.57	11.43

TEST DATA: Maxrad dipole antenna (2 dBi omni

Tuned Frequency	Emission Frequency	Meter Reading	Ant. Polarity	Coax Loss	Correction Factor	Field Strength	Margin
MHz	MHz	dBuV		dB	dB	dBuV/m	dB
2,412.0	1,000.00	17.5	V	1.20	25.20	43.90	10.10
2,412.0	1,050.00	15.8	V	1.23	25.37	42.40	11.61
2,412.0	1,262.00	16.2	V	1.33	26.09	43.62	52.62
2,412.0	2,037.00	21.1	V	1.71	28.75	51.56	44.68
2,412.0	2,412.00	85.1	V	1.86	29.28	116.24	11.13
2,412.0	2,786.00	20.1	V	2.01	30.03	52.14	1.86
2,412.0	4,075.00	19.8 Pk	V	2.42	32.92	55.14	18.86
2,412.0	4,075.0	16.1 Av	V	2.42	32.92	51.44	2.56
2,412.0	4,824.00	10.3 Pk	V	2.65	34.04	46.99	7.01
2,437.0	1,990.00	23.9 Pk	V	1.70	28.66	54.26	19.74
2,437.0	2,063.00	30.1	V	1.73	28.79	60.62	34.36
2,437.0	2,437.00	83.8	V	1.87	29.31	114.98	12.39
2,437.0	4,000.00	14.1 Pk	V	2.40	32.90	49.40	4.60
2,462.0	1,595.00	22.0 Pk	V	1.50	27.24	50.74	3.26
2,462.0	1,800.00	15.0	V	1.60	27.98	44.58	48.35
2,462.0	1,900.00	10.0	V	1.65	28.34	39.99	52.99
2,462.0	2,000.00	20.0	V	1.70	28.70	50.40	42.58
2,462.0	2,087.00	32.0	V	1.73	28.82	62.55	30.43
2,462.0	2,462.00	81.7	V	1.88	29.35	112.93	14.44
2,462.0	4,175.00	16.5	V	2.45	32.94	51.89	2.11

East

NOTE: THE SPECTRUM WAS SCANNED TO THE TENTH HARMONIC.

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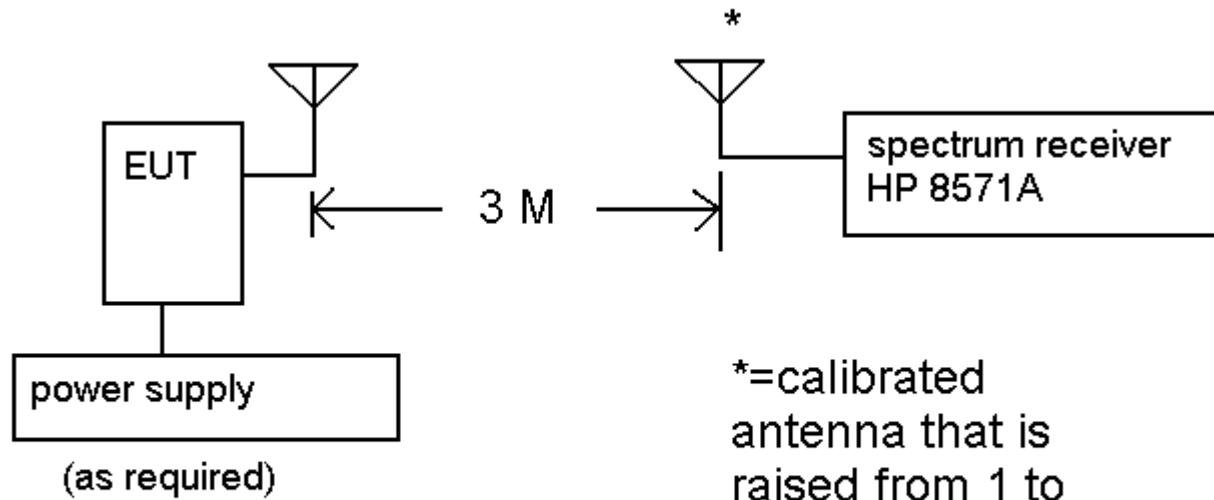
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Method of Measuring Radiated Spurious Emissions



EUT is rotated on a 80 cm high table.

METHOD OF MEASUREMENT: The procedure used was ANSI STANDARD C63.4-2000 & the FCC/OET Guidance on Measurements for Direct Sequence Spread Spectrum Systems - Public Notice 54797 Dated July 12, 1995. Measurements were made at the open field test site of TIMCO ENGINEERING INC. located at 849 N.W. State Road 45, Newberry, FL 32669.

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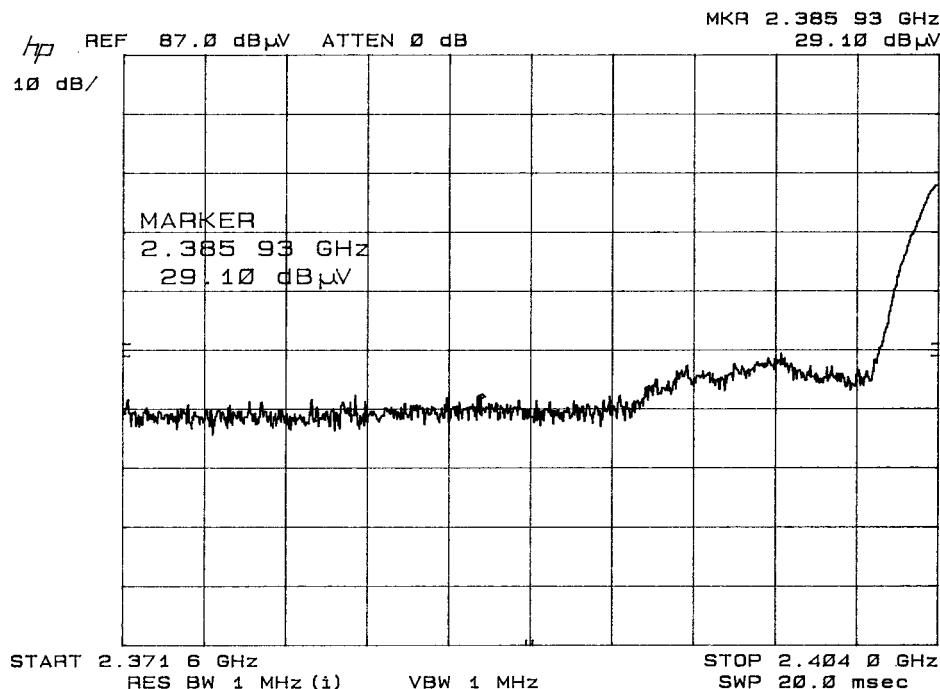
NAME OF TEST: RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

REQUIREMENTS: Emissions that fall in the restricted bands (15.205). These emissions must be less than or equal to 500 μ V/m (54 dB μ V/m).

TEST PROCEDURE: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Peak	Average
29.1 from plot	19.2 dB μ V from plot
+ 29.24 dB ACF	29.24 dB ACF
+ 1.86 dB Coax loss	1.86 dB Coax loss
60.20 dB μ V	50.30 dB μ V

Cushcraft antenna



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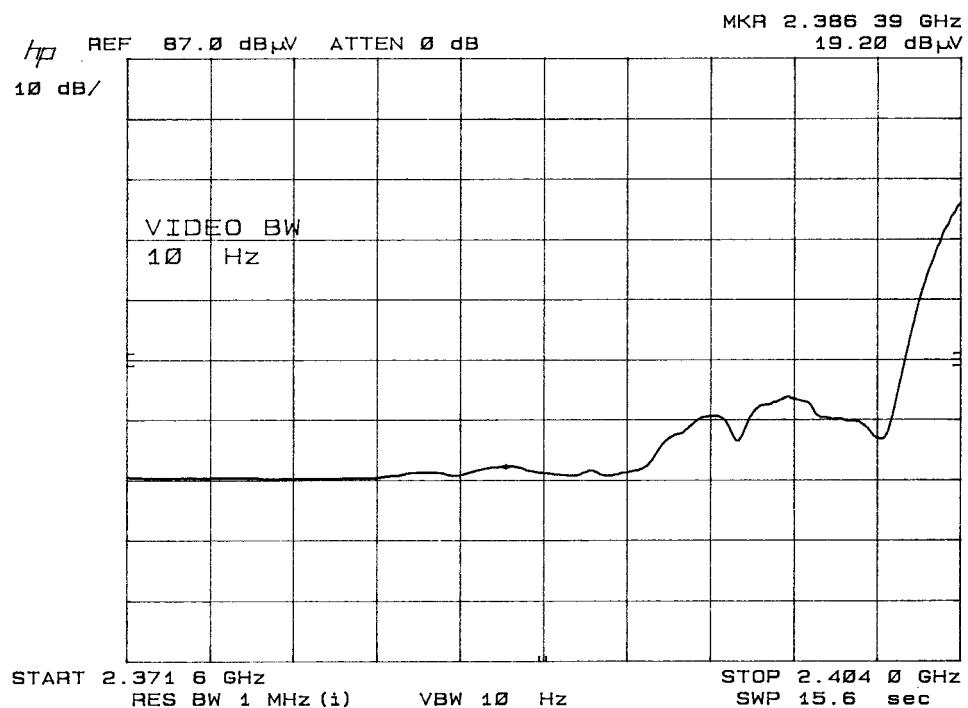
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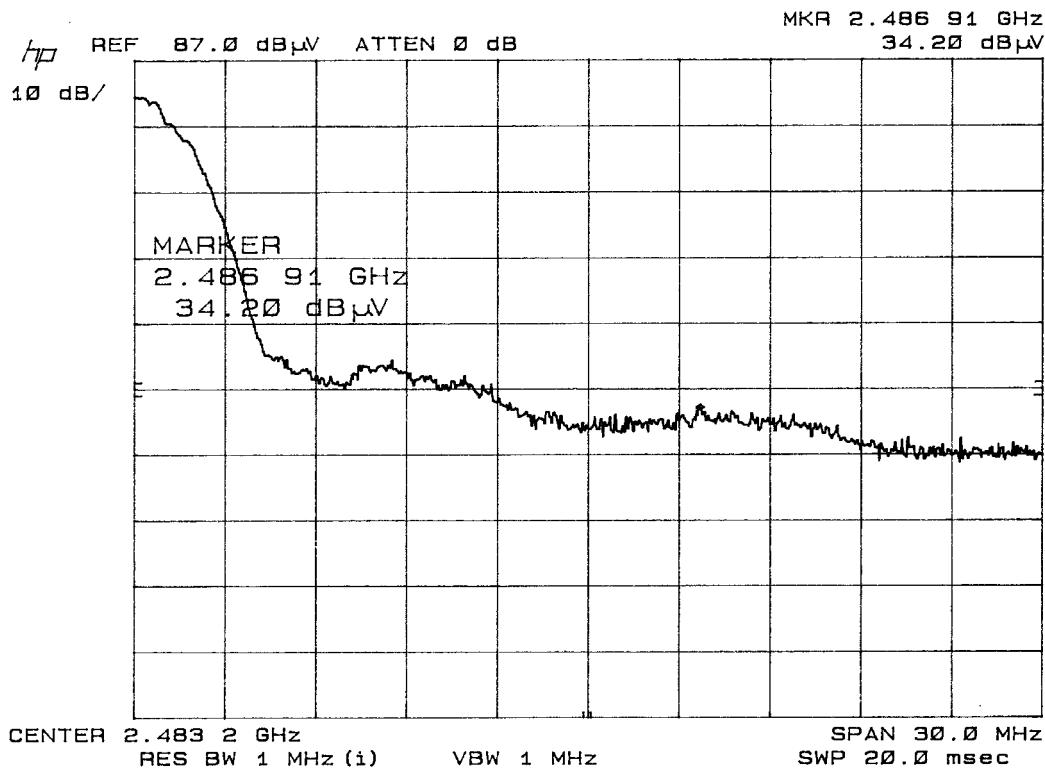
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TEST PROCEDURE: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Peak	Average
34.2 dB μ V from plot	22.3 dB μ V from plot
+ 29.38 dB ACF	29.38 dB ACF
+ 1.89 dB Coax loss	1.89 dB Coax loss
65.47 dB μ V	53.57 dB μ V

Cushcraft antenna



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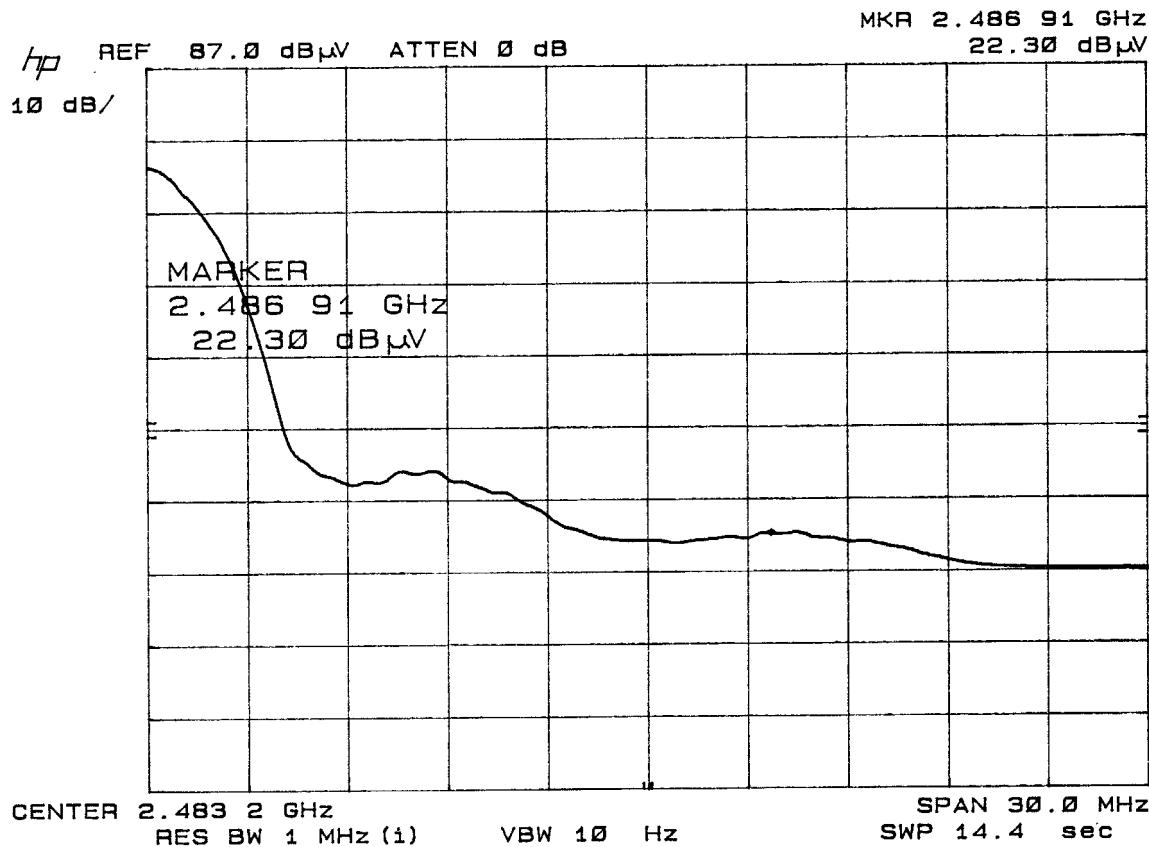
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Newberry, Florida 32669

<http://www.timcoengr.com>

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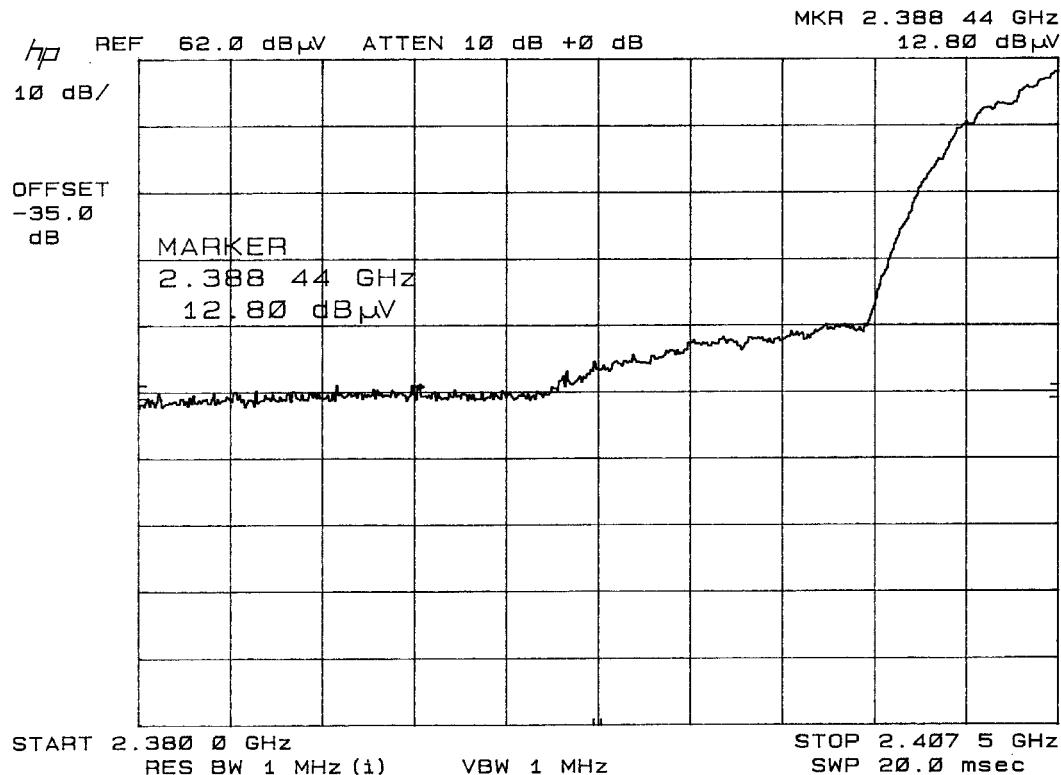
NAME OF TEST: RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

REQUIREMENTS: Emissions that fall in the restricted bands (15.205). These emissions must be less than or equal to 500 uV/m (54 dBuV/m).

TEST PROCEDURE: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Peak	Average
29.1 from plot	19.2 dBuV from plot
+ 29.24 dB ACF	29.24 dB ACF
+ 1.86 dB Coax loss	1.86 dB Coax loss
60.20 dBuV	50.30 dBuV

Maxrad 8 dBi omni



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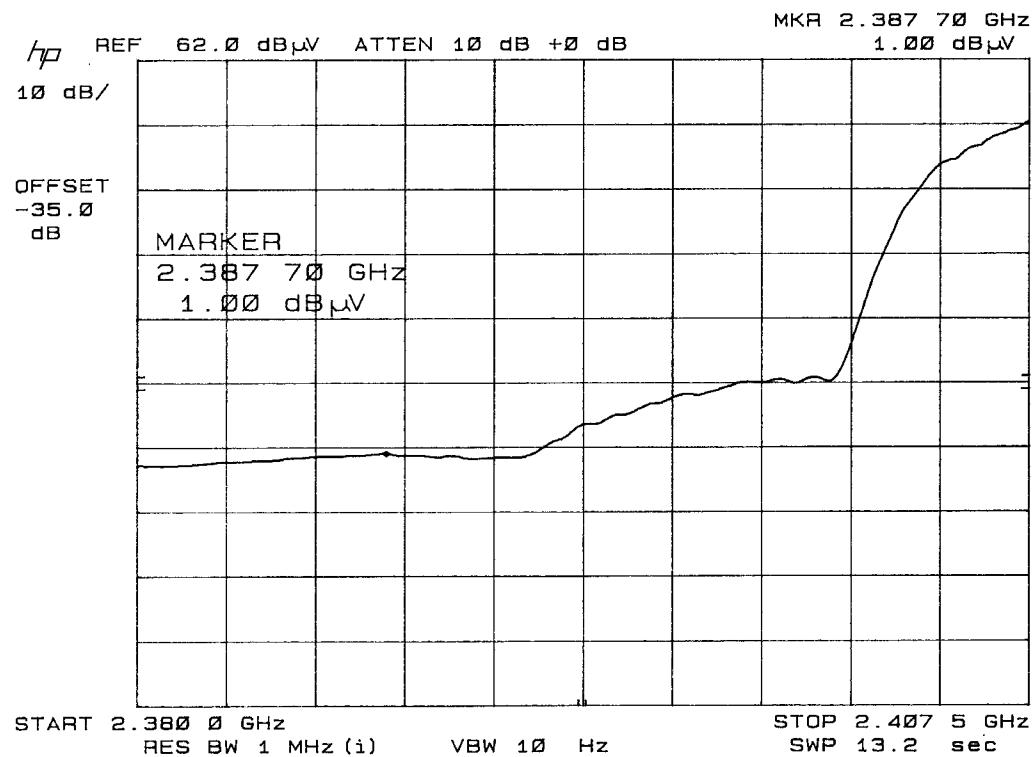
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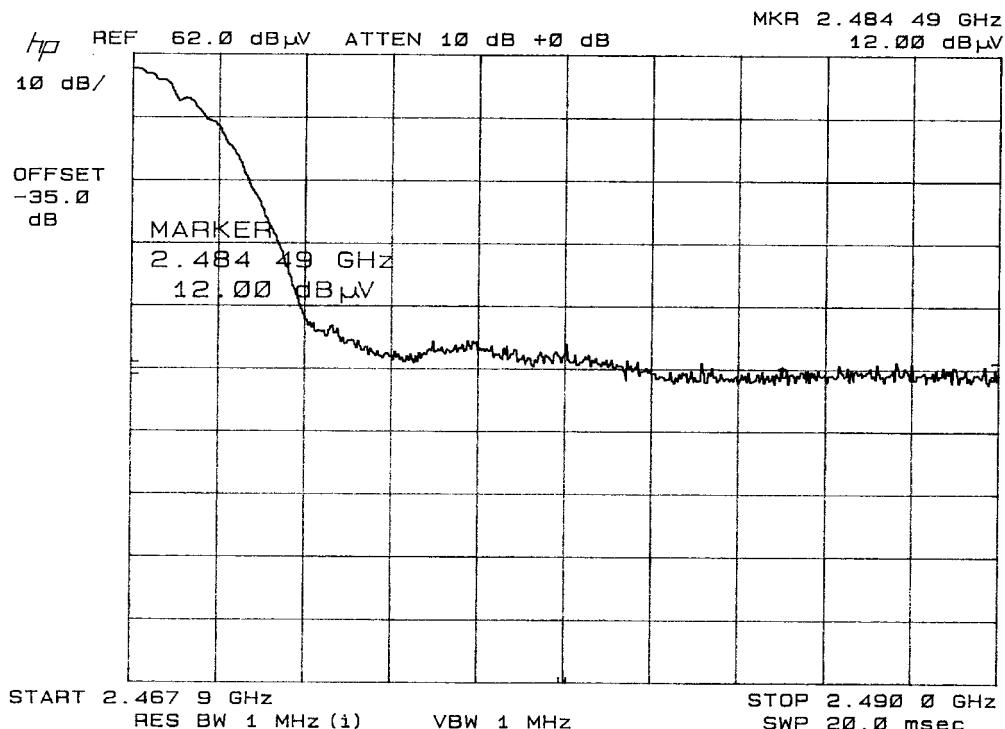
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TEST PROCEDURE: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Peak	Average
12.00 dB μ V from plot	1.00 dB μ V from plot
20.00 dB Atten.	20.00 dB Atten.
+ 29.38 dB ACF	29.38 dB ACF
+ 1.89 dB Coax loss	1.89 dB Coax loss
63.27 dB μ V	52.27 dB μ V

Maxrad 8dBi omni



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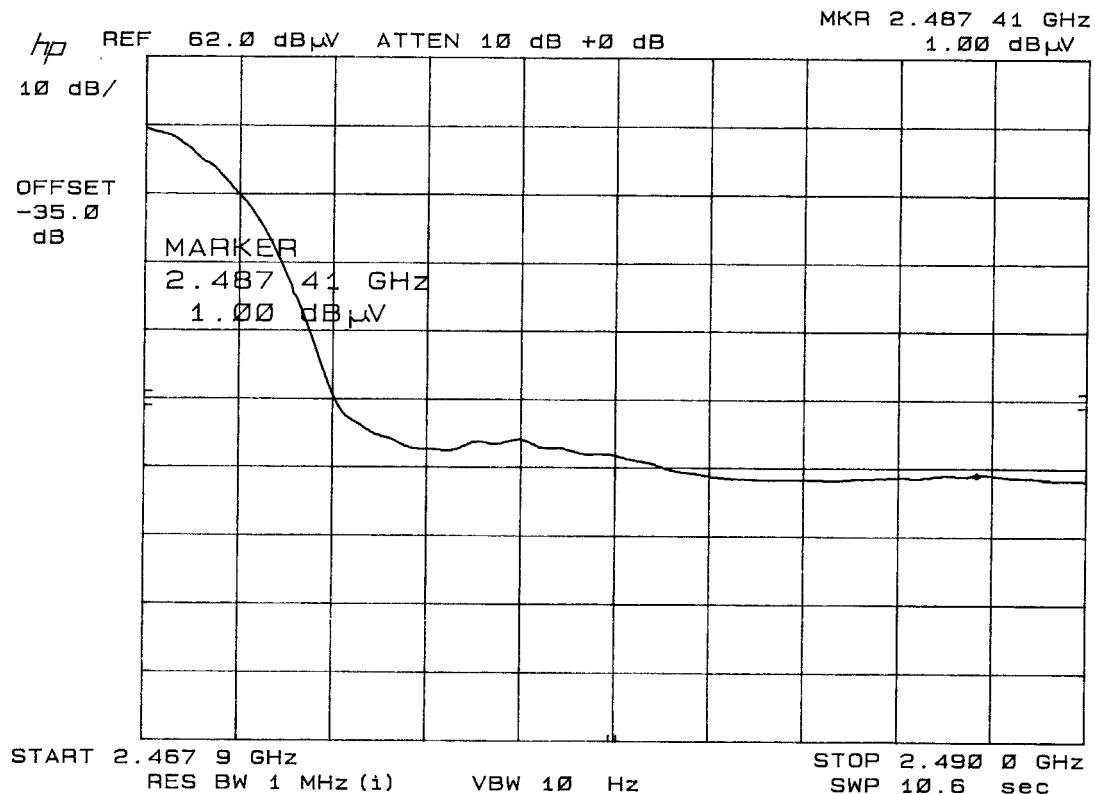
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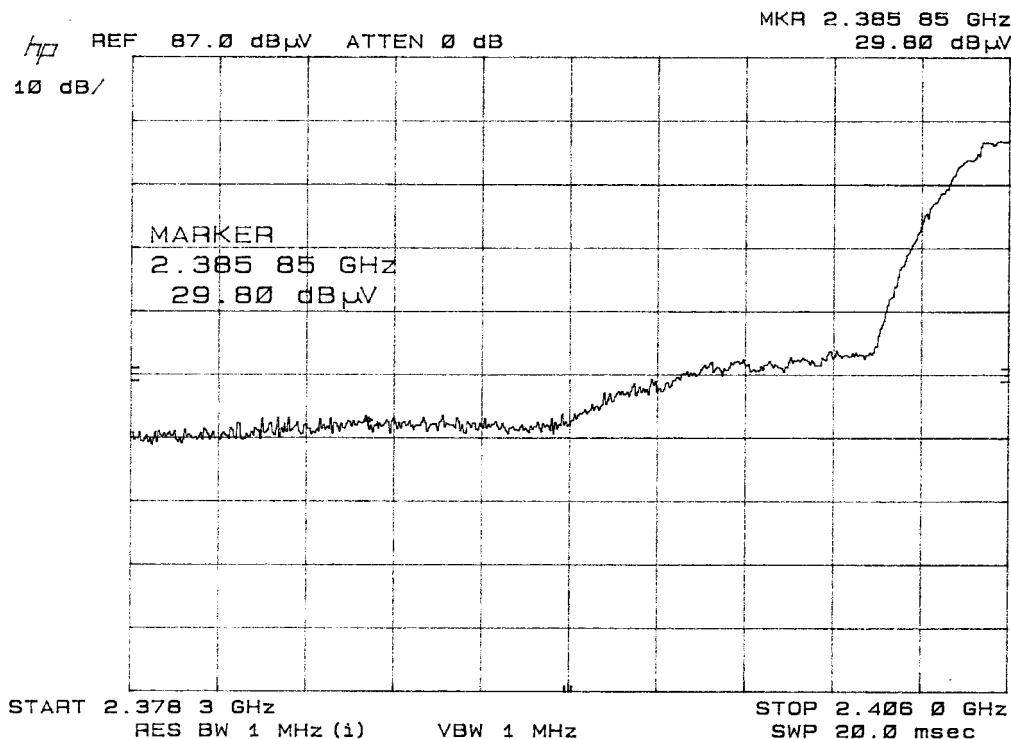
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TEST PROCEDURE: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Peak		Average	
29.8	from plot	19.2	dBuV from plot
+ 29.24 dB	ACF	29.24	dB ACF
+ 1.86 dB	Coax loss	1.86	dB Coax loss
60.90 dBuV		50.30 dBuV	

Maxrad yagi antenna



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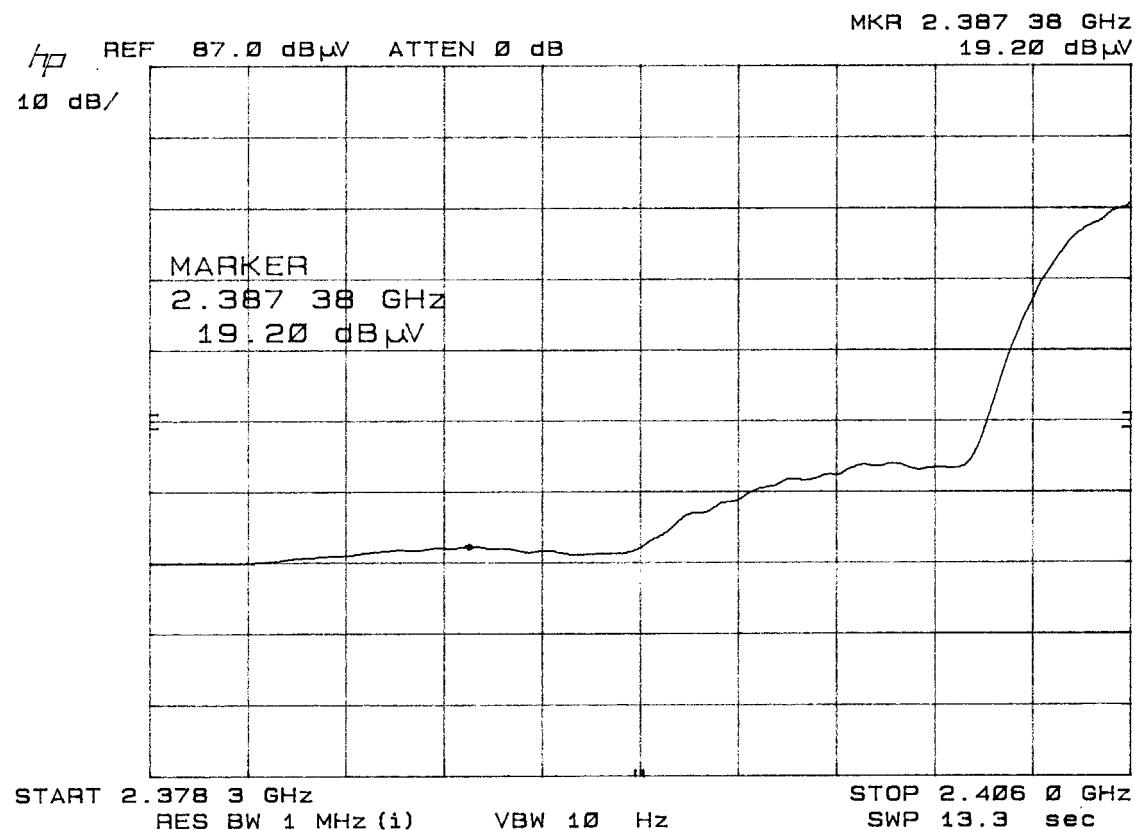
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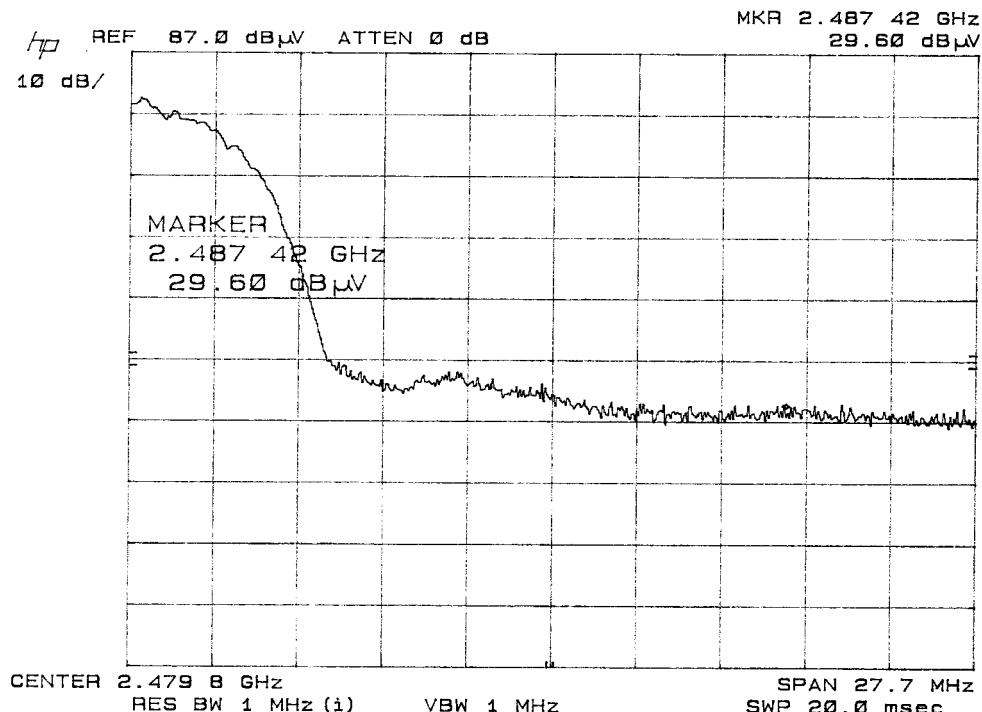
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TEST PROCEDURE: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Peak	Average
29.6 dB μ V from plot	18.1 dB μ V from plot
+ 29.38 dB ACF	29.38 dB ACF
+ 1.89 dB Coax loss	1.89 dB Coax loss
60.87 dB μ V	49.37 dB μ V

Maxrad yagi antenna



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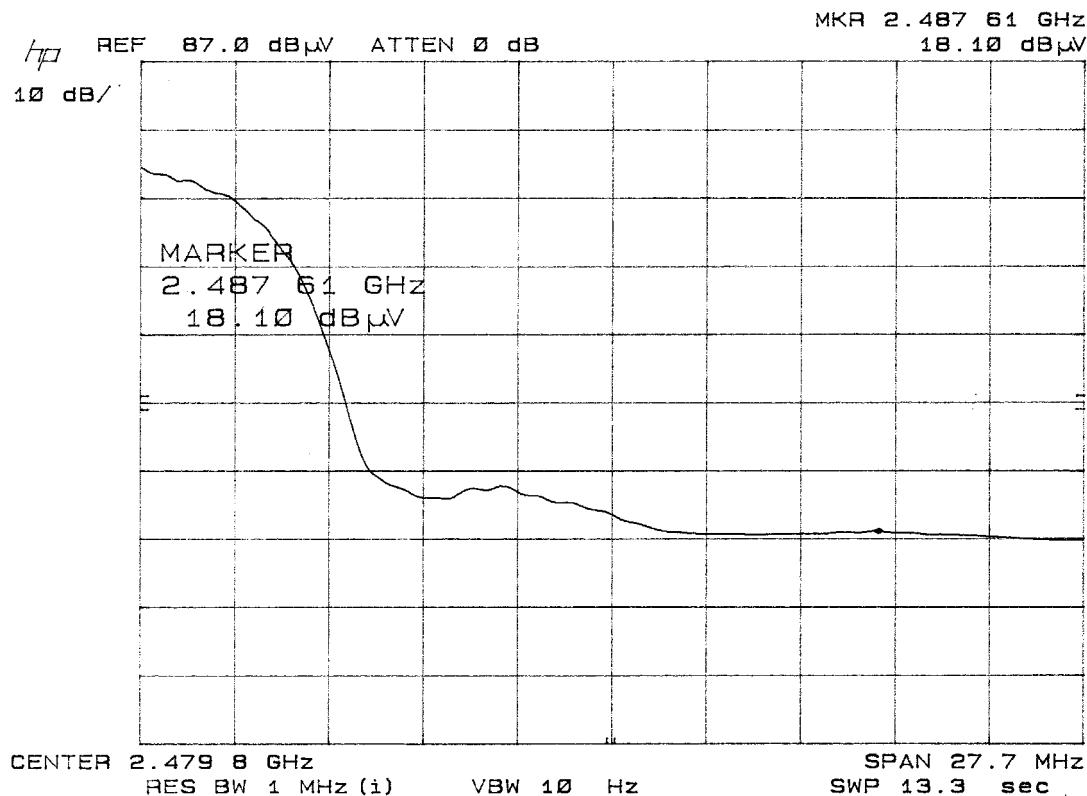
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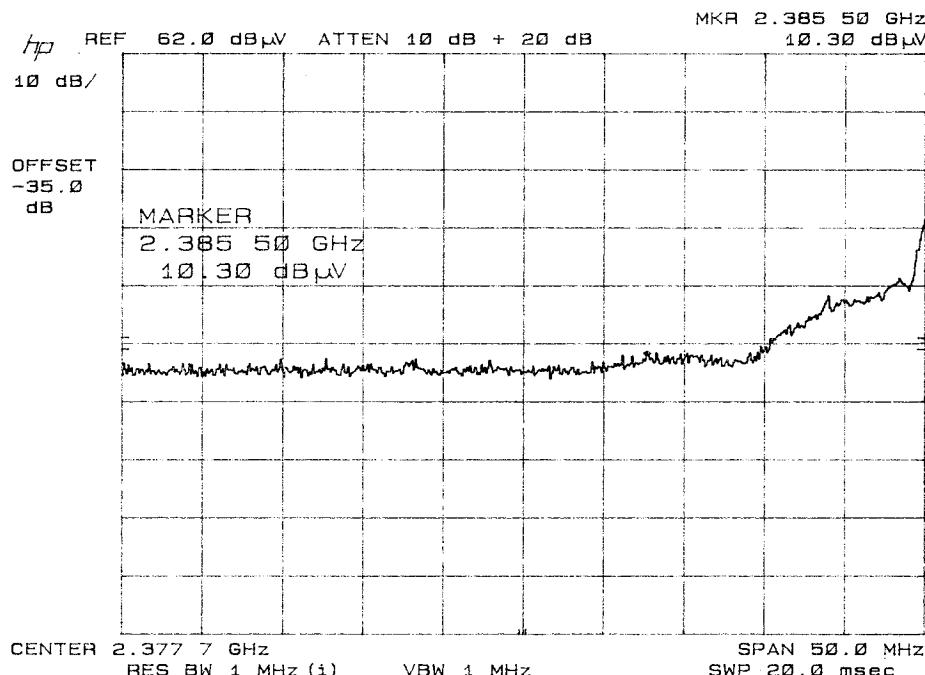
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TEST PROCEDURE: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Peak	Average
10.30 dB μ V from plot	-0.50 dB μ V from plot
20.00 dB Atten.	20.00 dB Atten.
+ 29.24 dB ACF	29.24 dB ACF
+ 1.86 dB Coax loss	1.86 dB Coax loss
61.40 dB μ V	50.60 dB μ V

Maxrad 2 dBi omni antenna



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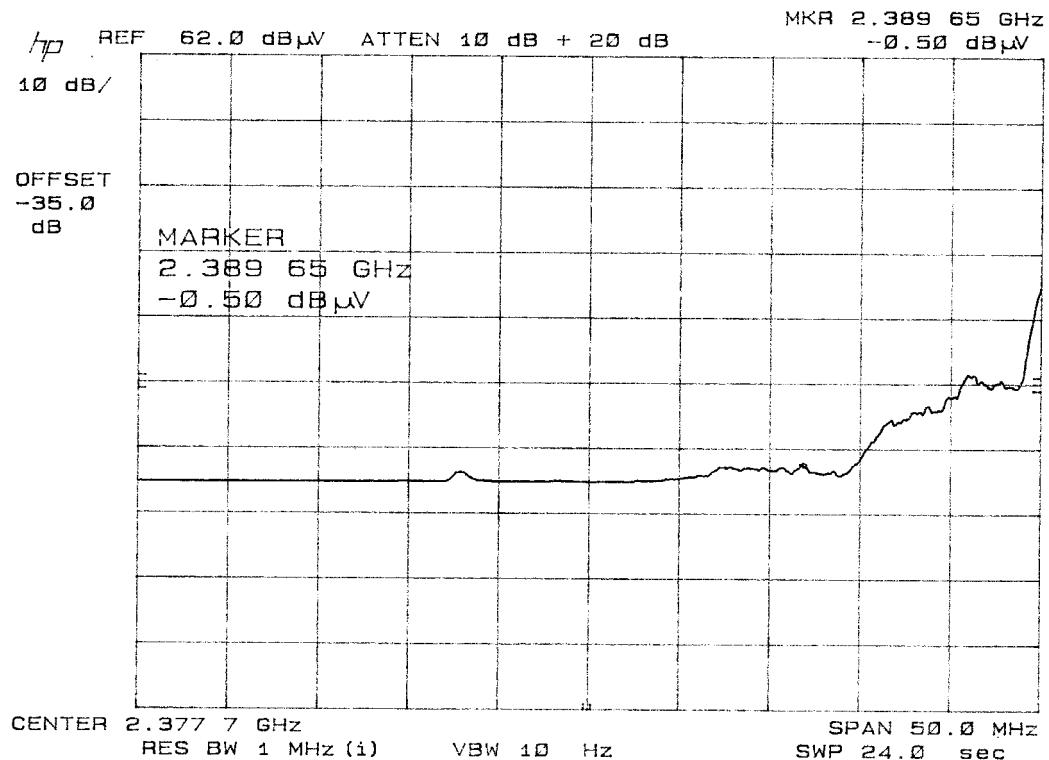
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Maxrad 2 dBi omni antenna



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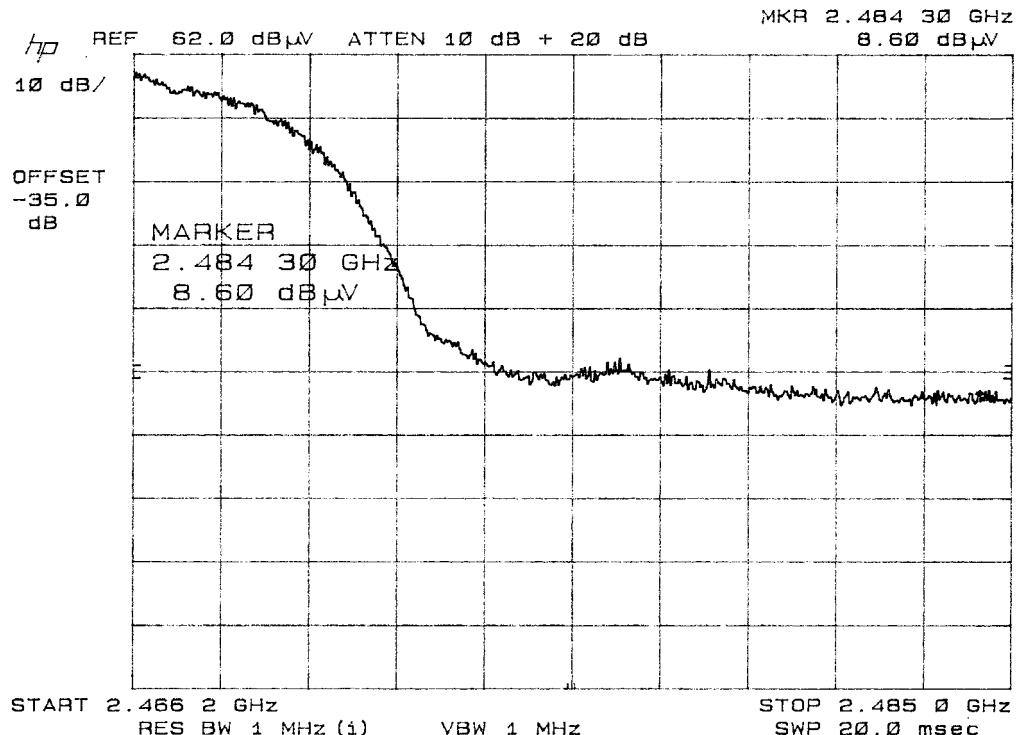
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TEST PROCEDURE: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Peak	Average
08.60 dBuV from plot	-2.70 dBuV from plot
20.00 dB Atten.	20.00 dB Atten.
+ 29.38 dB ACF	29.38 dB ACF
+ 1.89 dB Coax loss	1.89 dB Coax loss
59.87 dBuV	48.57 dBuV

Maxrad 2 dBi omni antenna



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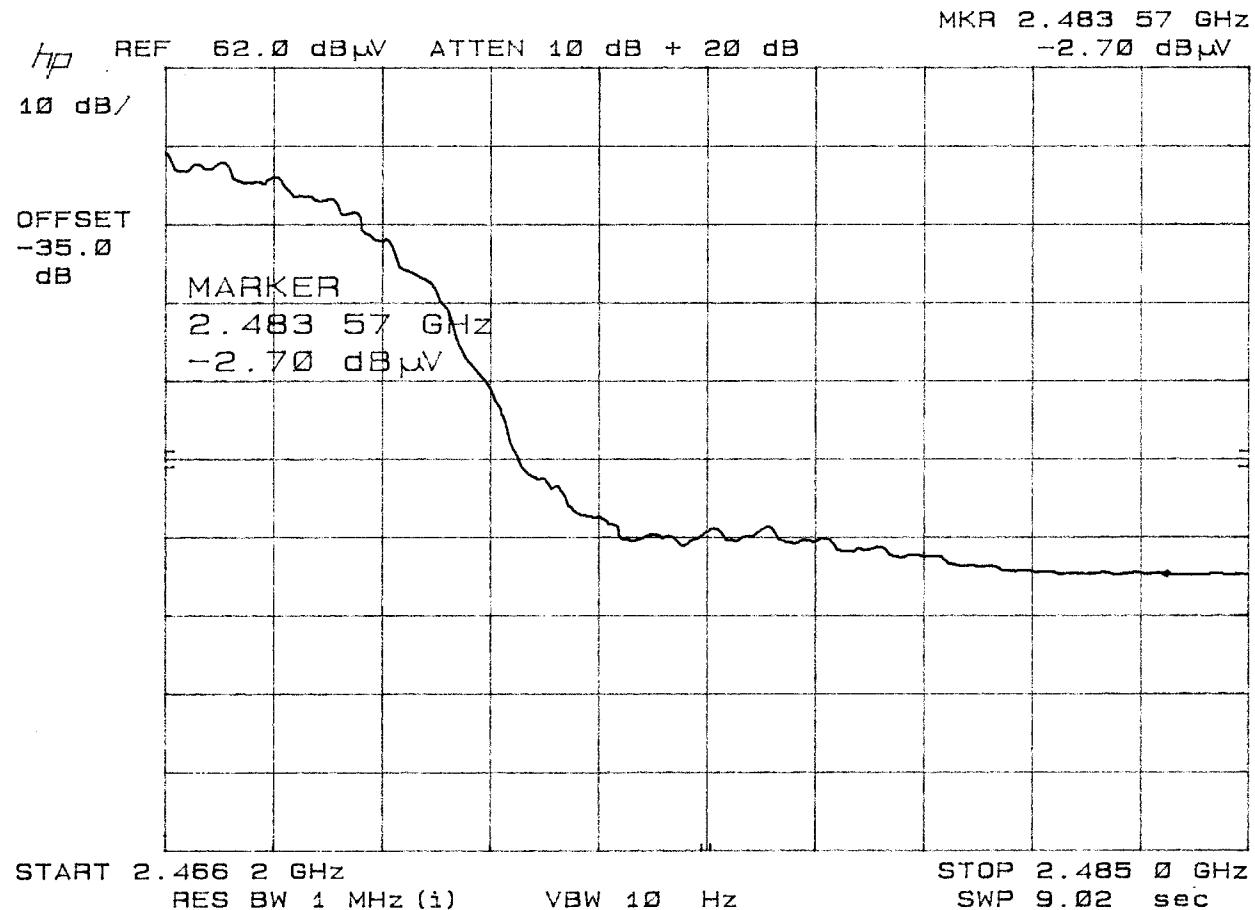
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Maxrad 2 dBi omni antenna



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APPLICANT: COMMUNICATIONS DEVELOPMENT LLC

FCC ID: QJ7-JLM051690

NAME OF TEST: POWER SPECTRAL DENSITY

RULES PART NO.: 15.247(d)

REQUIREMENTS: The peak level measured must be no greater than +8.0dBm.

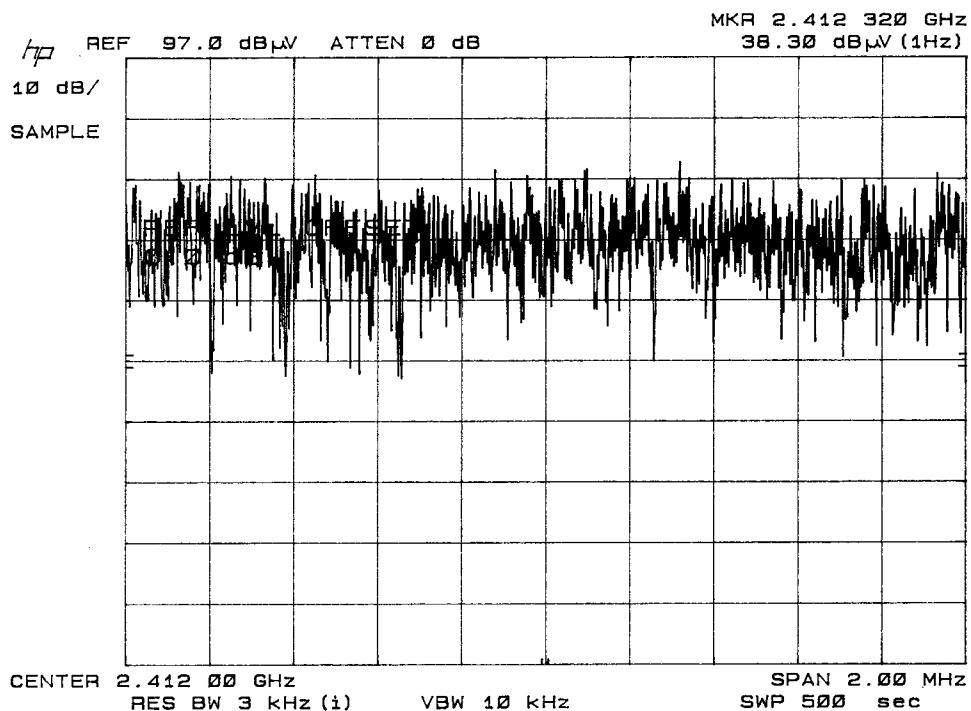
DATA: SEE THE FOLLOWING PLOT. THREE PLACES IN THE BAND WERE
MEASURED
AND THE WORST CASE PRESENTED.

The level at 2432.94 MHz was -71.90 dBm.

+20 dB Attn.
+35 dB Correction Factor

+55 dB
+38.8 dB_uV from plot
-107 CF to dBm

-13.2 dBm



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FCC RF Exposure Requirements

General information:

Device category: Mobile and fixed per Part 2.1091.

Environment: General Population/Uncontrolled Exposure

Mobile and fixed devices that operate in the 2.4 GHz ISM band authorized under 15.247 of this chapter are subject to routine environmental evaluation for RF exposure.

Antenna:

The manufacturer specifies the following antennas or those of same manufacture with lower gain to be used with this device.

Configuration	Antenna p/n	Type	Max. Gain (dBi)
Mobile Fixed	Cushcraft PC-2414	yagi	13.9
"	Maxrad MYP24014PTNF	yagi	14
"	Maxrad MYP24010PTNF	yagi	10
"	Maxrad MFB2408	omni	8
"	Maxrad MFB2406	omni	6
"	Maxrad MHWS2400MSMARP	omni	2
"	Maxrad MAXC24505	omni	5

Operating configuration and exposure conditions:

The conducted output power is 158 mWatts.

Mobile or Fixed Operation: The maximum antenna gain that will be used is 14 dBi. A coaxial cable of type LMR 240 or LMR 400 with an associated loss of 3 dB for lengths of 25 or 50 feet respectively. Shorter coax lengths with the highest gain antennas will require a 3 dB attenuator be installed internally to the unit.

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Definition of terms:

D - Duty factor and the same as PC percent on time (taken as 100%).

W - power in Watts

Wexp - power corrected for duty cycle and percent on time

CL - coax loss

P - power corrected for coax loss

S - power density from OET 65 (set to 1 for frequencies above 1500 MHz).

R - distance in cm required for compliance

Compensation for on time in either 6 or 30 minutes

$$W := 0.158 \quad \text{power in Watts} \quad D := 1 \quad \text{Duty Factor in decimal \% (1=100%)}$$

$$E := 30.0 \quad \text{exposure time in minutes} \quad U := 30 \quad (\text{use 6 for controlled and 30 for uncontrolled})$$

$$W_{\text{exp}} := W \cdot D \cdot \left(\frac{E}{U} \right) \quad PC := \frac{E}{U}$$

$$PC = 1 \quad \text{percent on time}$$

$$W_{\text{exp}} = 0.158 \quad \text{Watts}$$

Compensation for coax loss of 3 dB

$$P := W \cdot 10^{\frac{C_{\text{loss}}}{10}} \quad C_{\text{loss}} := -3 \quad \text{dB}$$

$$P = 0.079 \quad \text{Watts}$$

$$P_o := 79 \quad \text{mWatts} \quad dB_d := 12 \quad \text{antenna gain} \quad f := 1500 \quad \text{Frequency in MHz}$$

$$G := dB_d + 2.15 \quad \text{gain in dBi}$$

$$G_n := 10^{\frac{G}{10}} \quad \text{gain numeric} \quad S := \frac{f}{1500} \quad \text{controlled exposure}$$

300 for controlled

1500 for uncontrolled

$$G_n = 26.002 \quad S = 1$$

$$R := \sqrt{\frac{(P_o \cdot G_n)}{(4 \cdot \pi \cdot S)}}$$

$$R_{\text{inches}} := \frac{R}{2.54}$$

$$R = 12.785 \quad \text{distance in centimeters}$$

required for compliance

$$R_{\text{inches}} = 5.034$$

Conclusion:

The device complies with the MPE requirements by providing a safe separation distance of less than 13 cm between the antenna and any radiating structure, and any persons when operated normally.

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