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FCC PART 15.247 AND IC RSS-210

TEST REPORT

DIGITAL SPREAD SPECTRUM

Applicant	SAGRAD, INC.	
Address	4325 WOODLAND PARK AVENUE SUITE 101	
	WEST MELBOURNE, FL 32904	
FCC ID	VRA-SG9011024	
IC Certification	7420A-SG9011024	
Model Number	SG901-1024	
Product Description	WIRELESS LAN MODULE	
Date Sample Received	10/24/2007	
Date Tested	10/25/2007	
Tested By	Mario de Aranzeta	
Approved By	Mario de Aranzeta	
Report Number	3418UT7TestReport.doc	
Test Results	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**



Testing Certificate # 0955-01



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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the item(s) tested.

Summary

The device under test does:

- fulfill the general approval requirements as identified in this test report
- not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.



Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Authorized Signatory Name: *Mario de Aranzeta*

Mario de Aranzeta C.E.T.
Compliance Engineer/ Lab. Supervisor

Date: 11/28/2007

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GENERAL INFORMATION

DUT Specification

Applicable Standard	FCC Part 15.247 and IC RSS-210				
DUT Description	2.4 GHz 802.11b and g product				
FCC ID	VRA-SG9011024				
IC Certification	7420A-SG9011024				
Model Number	SG901-1024				
Operating Frequency	TX: 2412 to 2462	RX: Same			
No. of Channels	11				
Modulations	CCK, OFDM				
DUT Power Source	<input type="checkbox"/> 110–120Vac/50– 60Hz				
	<input type="checkbox"/> DC Power				
	<input checked="" type="checkbox"/> Battery Operated Exclusively				
Test Item	<input type="checkbox"/> Prototype	<input checked="" type="checkbox"/> Pre-production	<input type="checkbox"/> Production		
Type of Equipment	<input type="checkbox"/> Fixed	<input checked="" type="checkbox"/> Mobile	<input type="checkbox"/> Portable		
Antenna Connector	IPEX MHF- connector				
Antennas	Internal or external antennas				
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.				
Test Conditions	Temperature: 26°C Relative humidity: 50%				
Test Exercise	The DUT was placed in continuous transmit mode of operation.				
Modifications	None				

Test Supporting Equipment

Supporting Device	Manufacturer	Model / FCC ID	Serial Number
Laptop	DELL	PP01L	
Extender/adapter card	Proprietary	None	None

Antenna information

Internal: GigaAnt A5887 surface mount antenna
 External: 2.1 dBi vertical dipole (Laird)
 External: 2.1 dBi printed antenna (Tetrafab)

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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 3/20/07	3/19/10
3-Meter OATS	TEI	N/A	N/A	Listed 1/11/06	1/10/09
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listred 5/11/07	5/10/10
Antenna: Biconnical	Eaton	94455-1	1057	CAL 12/12/05	12/12/07
Antenna: Biconnical	Eaton	94455-1	1096	CAL 10/11/06	10/11/08
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	CAL 7/18/07	7/18/09
Analyzer Blue Tower Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 5/17/07	5/17/09
Analyzer Blue Tower RF Preselector	HP	85685A	2926A00983	CAL 5/17/07	5/17/09
Analyzer Blue Tower Spectrum Analyzer	HP	8568B	2928A04729 2848A18049	CAL 5/17/07	5/17/09
LISN	Electro-Metrics	ANS-25/2	2604	CAL 10/5/06	10/5/08
LISN	Electro-Metrics	EM-7820	2682	CAL 7/23/07	7/23/09
Antenna: Log-Periodic	Eaton	96005	1243	CAL 12/14/05	12/14/07

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TEST PROCEDURES

Radiation Interference: ANSI C63.4-2003 using a spectrum analyzer, a preselector, a quasi-peak adapter, and an appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz with an appropriate sweep speed and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3 MHz above 1 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

Formula Of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer and the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

$$\begin{array}{llll}
 \text{Freq (MHz)} & \text{Meter Reading} & + \text{ACF} & + \text{CL} = \text{FS} \\
 33 & 20 \text{ dBuV} & + 10.36 \text{ dB} & + 0.5 = 30.86 \text{ dBuV/m @ 3m}
 \end{array}$$

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 using a 50uH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30 MHz.

Occupied Bandwidth: A small sample of the transmitter output was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to -10 dBm per division.

Bandwidth 6.0dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW)=1MHz and the video bandwidth (VBW) =3 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 MHz and the spectrum was scanned from 30MHz to the 10th Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

ANSI C63.4-2003 10.1 Measurement Procedures: The DUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The DUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

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RADIATION INTERFERENCE

Rules Part No.: 15.247, 15.209, RSS-210

Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) μ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μ V/m @ 30 meters
1705 kHz to 30 MHz	29.54 dB μ V/m @ 30 meters
30 – 88	40.0 dB μ V/m @ 3 meters
80 – 216	43.5 dB μ V/m @ 3 meters
216 – 960	46.0 dB μ V/m @ 3 meters
Above 960	54.0 dB μ V/m @ 3 meters
Part 15.249	
Fundamental 902 – 928 MHz	127.37 dB μ V/m @ 3 meters
Fundamental 2.4 – 2.4835 MHz	127.37 dB μ V/m @ 3 meters
Harmonics	54.0 dB μ V/m @ 3 meters

Any emissions that fall in the restricted bands (15.205) must be less than or equal to to 54 dB μ V/m. Spurious emissions not in a restricted band must be 20 dBc.

Test Data: 802.11b

External antenna (Laird)

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB μ V	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dB μ V/m	Margin dB	
2,412.0	2,412.00	60.9	V	3.19	32.27	96.36	31.02	
2,412.0	4,824.00	16.1	V	4.91	34.10	55.11	18.89	peak
2,412.0	4,824.00	14.6	V	4.91	34.10	53.61	0.39	average
2,437.0	2,437.00	60.8	V	3.21	32.34	96.35	31.03	
2,437.0	4,874.00	16.4	V	4.94	34.10	55.44	18.56	peak
2,437.0	4,874.00	14.5	V	4.94	34.10	53.54	0.46	average
2,437.0	9,748.00	6.7	V	6.82	36.85	50.37	3.63	
2,462.0	2,462.00	60.9	V	3.22	32.40	96.52	30.86	
2,462.0	4,924.00	16.1	V	4.96	34.10	55.16	18.84	
2,462.0	4,924.00	17.9	V	4.96	34.10	56.96	17.04	peak
2,462.0	4,924.00	14.5	V	4.96	34.10	53.56	0.44	average

Harmonics were measured to the 10th harmonic

All field strength values are peak except values marked as average.

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Test Data cont'd: 802.11g

External antenna (Laird)

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,412.00	60.7	V	3.19	32.27	96.16	31.22	
2,412.0	4,824.00	14.4	V	4.91	34.10	53.41	0.59	
2,437.0	2,437.00	61.1	V	3.21	32.34	96.65	30.73	
2,437.0	4,874.00	14.4	V	4.94	34.10	53.44	0.56	
2,462.0	2,462.00	61.1	V	3.22	32.40	96.72	30.66	
2,462.0	4,924.00	20.4	V	4.96	34.10	59.46	14.54	peak
2,462.0	4,924.00	6.6	V	4.96	34.10	45.66	8.34	average

All field strength values are peak except values marked as average.

Test Data cont'd: 802.11g

Internal antenna

Tuned Frequency MHz	Emission Frequency MHz	Meter Readin g dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,412.00	59.5	V	3.19	32.27	94.96	32.42	
2,412.0	4,824.00	10.0	V	4.91	34.10	49.01	4.99	
2,437.0	2,437.00	59.6	V	3.21	32.34	95.15	32.23	
2,437.0	4,874.00	11.0	V	4.94	34.10	50.04	3.96	
2,462.0	2,462.00	59.6	V	3.22	32.40	95.22	32.16	
2,462.0	4,824.00	13.3	V	4.91	34.10	52.31	1.69	

All field strength values are peak except values marked as average.

Test Data cont'd: 802.11b

Internal antenna

Tuned Frequency MHz	Emission Frequency MHz	Meter Readin g dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,412.00	58.6	V	3.19	32.27	94.06	33.32	
2,412.0	4,824.00	13.7	V	4.91	34.10	52.71	1.29	
2,437.0	2,437.00	58.6	V	3.21	32.34	94.15	33.23	
2,437.0	4,874.00	13.5	V	4.94	34.10	52.54	1.46	
2,462.0	2,462.00	58.0	V	3.22	32.40	93.62	33.76	
2,462.0	4,924.00	15.7	V	4.96	34.10	54.76	19.24	peak
2,462.0	4,924.00	14.6	V	4.96	34.10	53.66	0.34	average

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Test Data: 802.11b

External antenna (Tetrafab)

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol. V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,412.00	60.0	V	3.19	32.27	95.46	31.92	
2,412.0	4,824.00	15.7	V	4.91	34.10	54.71	19.29	Peak
2,412.0	4,824.00	14.7	V	4.91	34.10	53.71	0.29	Ave
2,437.0	2,354.00	12.5	V	3.15	32.12	47.77	79.61	
2,437.0	2,437.00	59.5	V	3.21	32.34	95.05	32.33	
2,437.0	4,874.00	15.0	V	4.94	34.10	54.04	19.96	Peak
2,437.0	4,874.00	13.0	V	4.94	34.10	52.04	1.96	Ave
2,462.0	2,462.00	59.0	V	3.22	32.40	94.62	32.76	
2,462.0	4,924.00	17.0	V	4.96	34.10	56.06	17.94	Peak
2,462.0	4,924.00	14.7	V	4.96	34.10	53.76	0.24	Ave

Harmonics were measured to the 10th harmonic

All field strength values are peak except values marked as average.

Test Data: 802.11g

External antenna (Tetrafab)

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,412.00	60.8	V	3.19	32.27	96.26	31.12	
2,412.0	4,820.00	15.2	V	4.91	34.10	54.21	19.79	Peak
2,412.0	4,820.50	3.0	V	4.91	34.10	42.01	11.99	Ave
2,437.0	2,437.00	61.3	V	3.21	32.34	96.85	30.53	
2,437.0	4,870.00	14.4	V	4.94	34.10	53.44	0.57	
2,462.0	2,462.00	60.0	V	3.22	32.40	95.62	31.76	
2,462.0	4,924.00	16.6	V	4.96	34.10	55.66	18.34	Peak
2,462.0	4,924.00	2.5	V	4.96	34.10	41.56	12.44	Ave

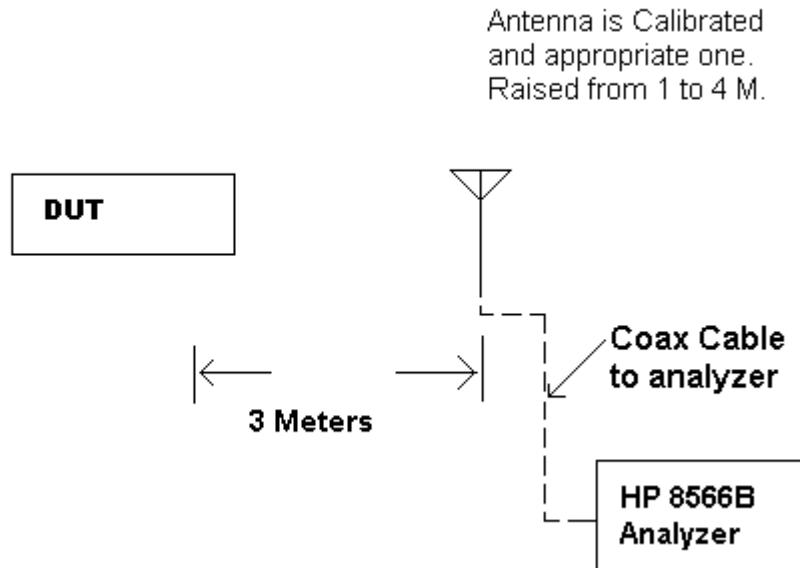
APPLICANT: SAGRAD, INC.

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Method of Measuring Radiated Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI C63.4-2003 & the FCC/OET Guidance on Measurements for Direct Sequence Spread Spectrum Systems – Public Notice 54797 Dated July 12, 1995, DTS measurement, published on: April 16, 2007.

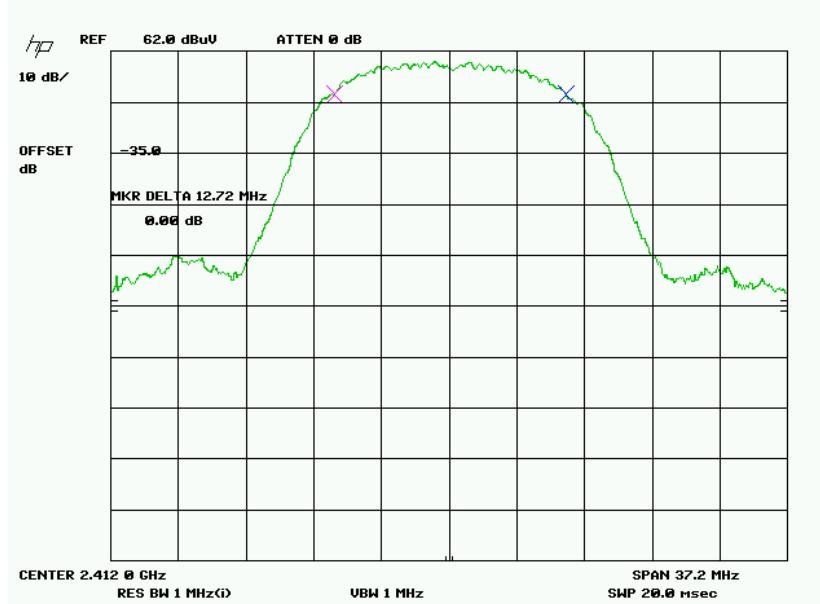
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OCCUPIED BANDWIDTH

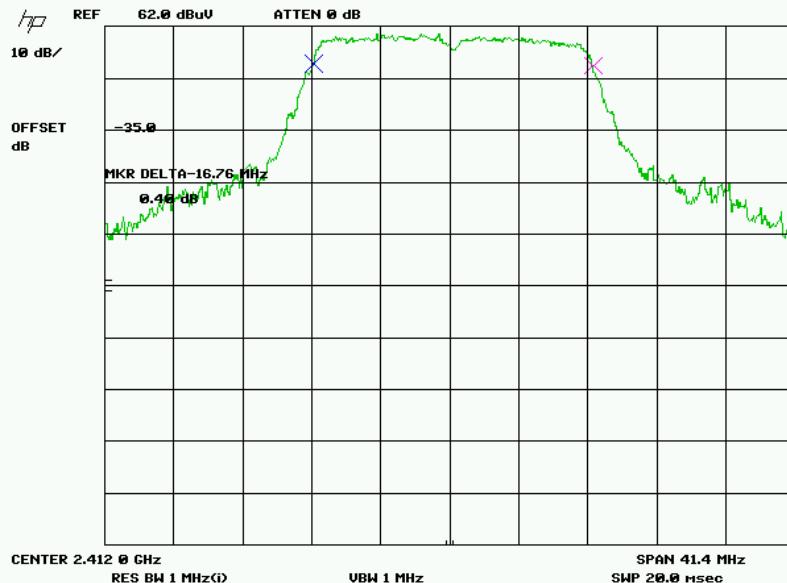
Rules Part No.: 15.247(a)(2, RSS-210

Requirements: The 6 dB bandwidth must be greater than 500 kHz.

Test Data: 802.11b



802.11g



Three places in the band were measured and the worst case reported.

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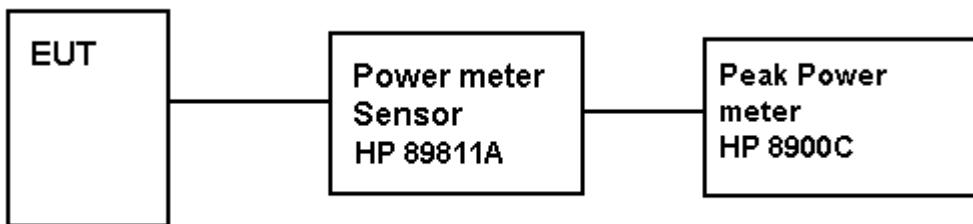
IC CERT#: 7420A-SG9011024

REPORT: W:\S\SGRAD\3418UT7\3418UT7TestReport.doc

POWER OUTPUT

Rules Part #: 15.247(b), RSS-210 - 1.0 Watt conducted, 4 Watts ERP

TEST SET UP:



Test Results:

Conducted output power:

802.11g

Frequency MHz	Power dBm
2412	14
2437	15
2462	15

802.11b

Frequency MHz	Power dBm
2412	11
2437	12
2462	10.5

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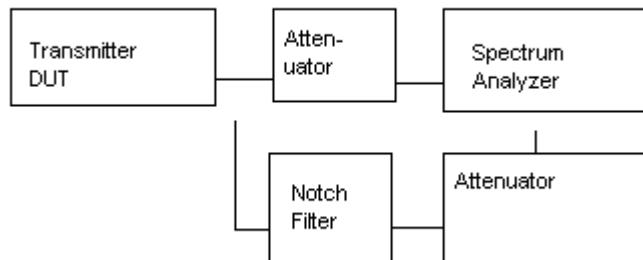
SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Requirements: Emissions must be at least 20dB down from the emission level of the fundamental as measured with a 100 kHz RBW.

Test Data:

Tuned Freq. MHz	Emission Freq. MHz	dB below carrier	Tuned Freq. MHz	Emission Freq. MHz	dB below carrier
2412	1807	46.4	2412	1808.6	46.1
802.11b	2332	49.2	802.11g	2333	49.1
	2496	50.5		2487.7	48.3
	4824	57.1			
			2437	1846	45.1
2437	1844	46		2360	47.4
	2357	48.5		2519	50.4
	2519	50.7			
	4874	58	2462	1883	45
				2383	44.5
2462	1882	48.6		2536.5	47.3
	2382	45			
	2543	50			
	4924	58			

15.247(c) Method of Measuring RF Conducted Spurious Emissions



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POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: 15.207

Requirements:

Frequency (MHz)	Quasi Peak Limits (dBuv)	Average Limits (dBuV)
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5.0 – 30	60	50

Test Data: The attached graphs represent the emissions read for power line conducted for this device. Both lines were observed.

The device has no provisions for operating from the mains.

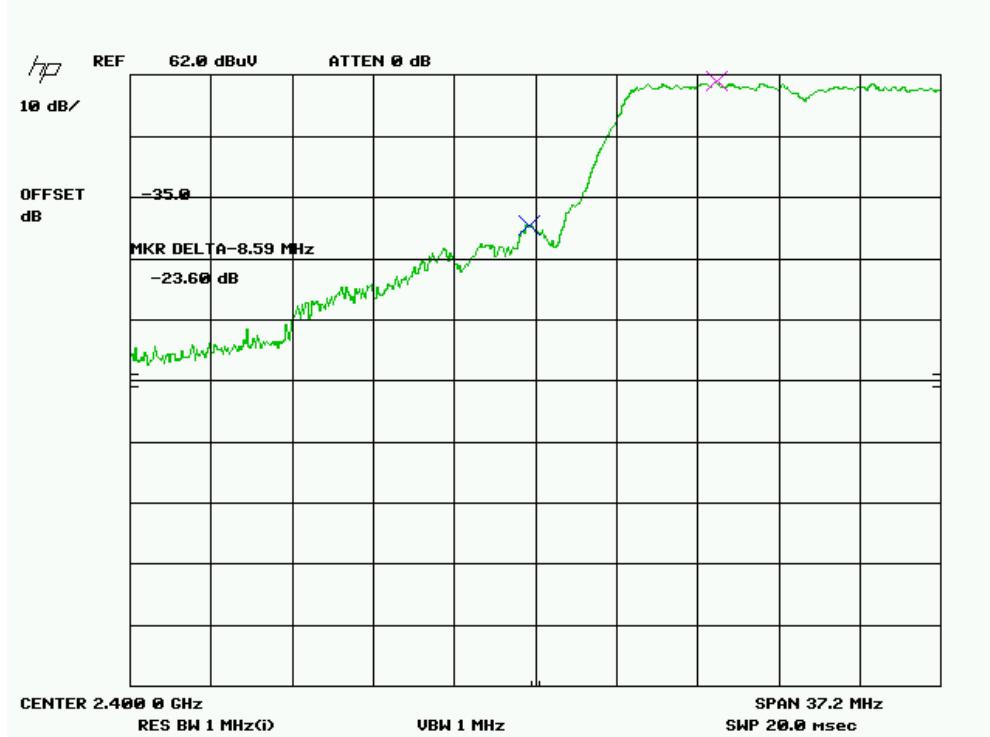
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RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

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.

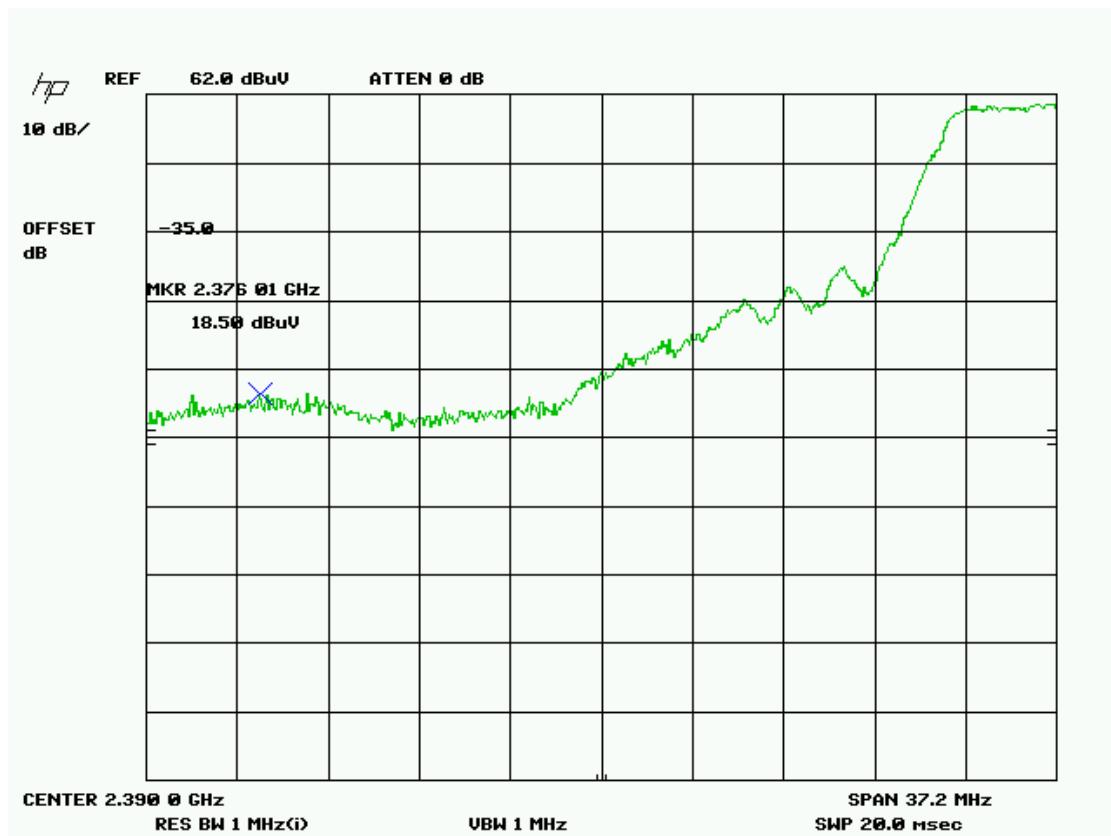
lower band edge with external antenna (Laird) and in 802.11g mode



Meets 20 dBc

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lower restricted band with external antenna (Laird) and in 802.11g mode



Lower

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,376.00	18.5	V	3.16	32.18	53.84	20.16	peak

Upper

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,462.0	2,483.50	23.6	V	3.24	32.46	59.30	14.70	peak
2,462.0	2,483.50	13.0	V	3.24	32.46	48.70	5.30	average

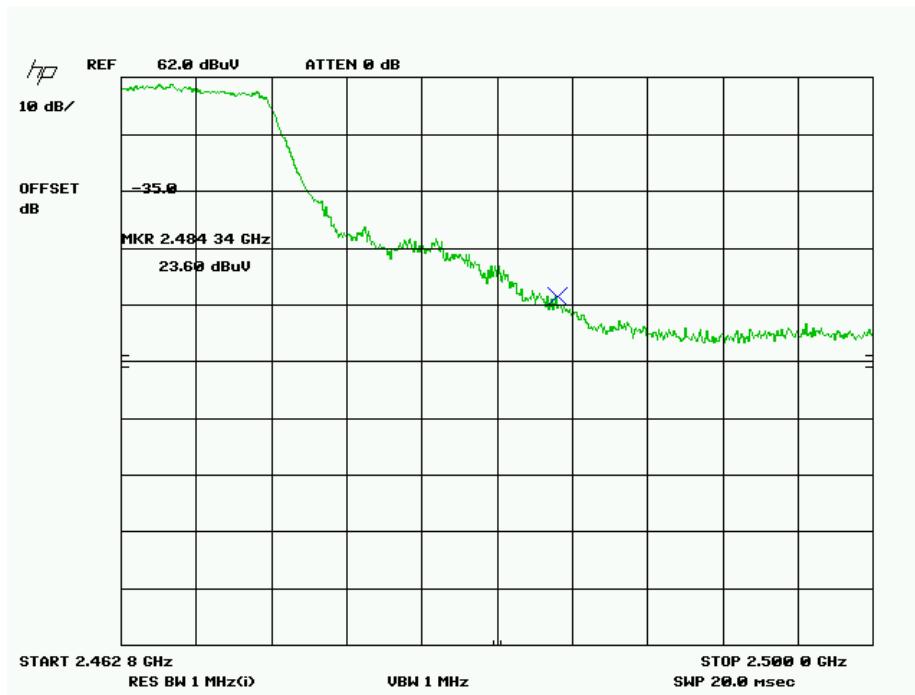
APPLICANT: SAGRAD, INC.

FCC ID: VRA-SG9011024

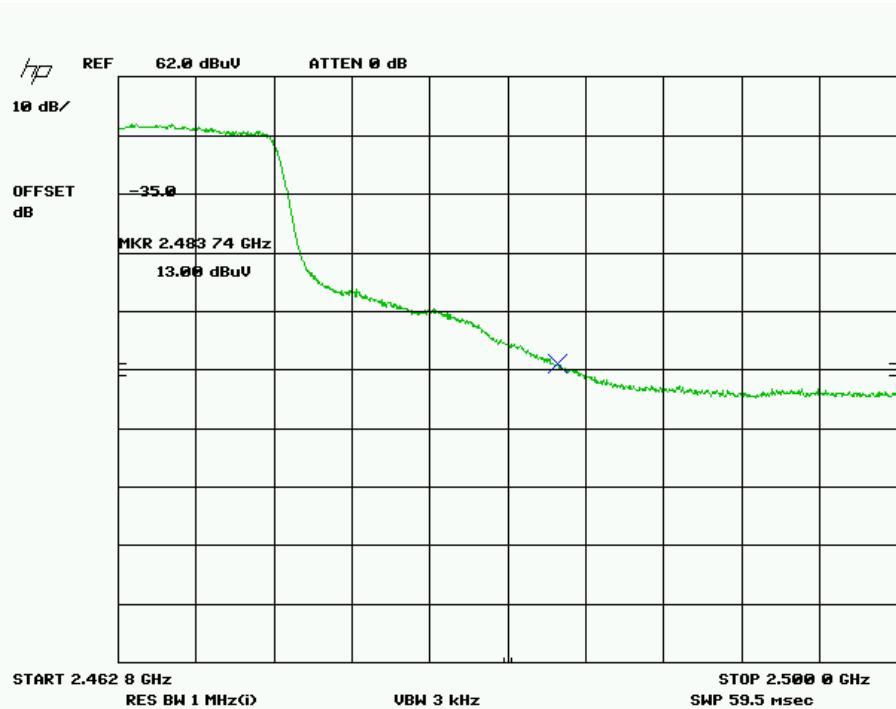
IC CERT#: 7420A-SG9011024

REPORT: W:\S\SAGRAD\3418UT7\3418UT7TestReport.doc

upper band edge with external antenna (Laird) in 802.11g mode
Peak



Average



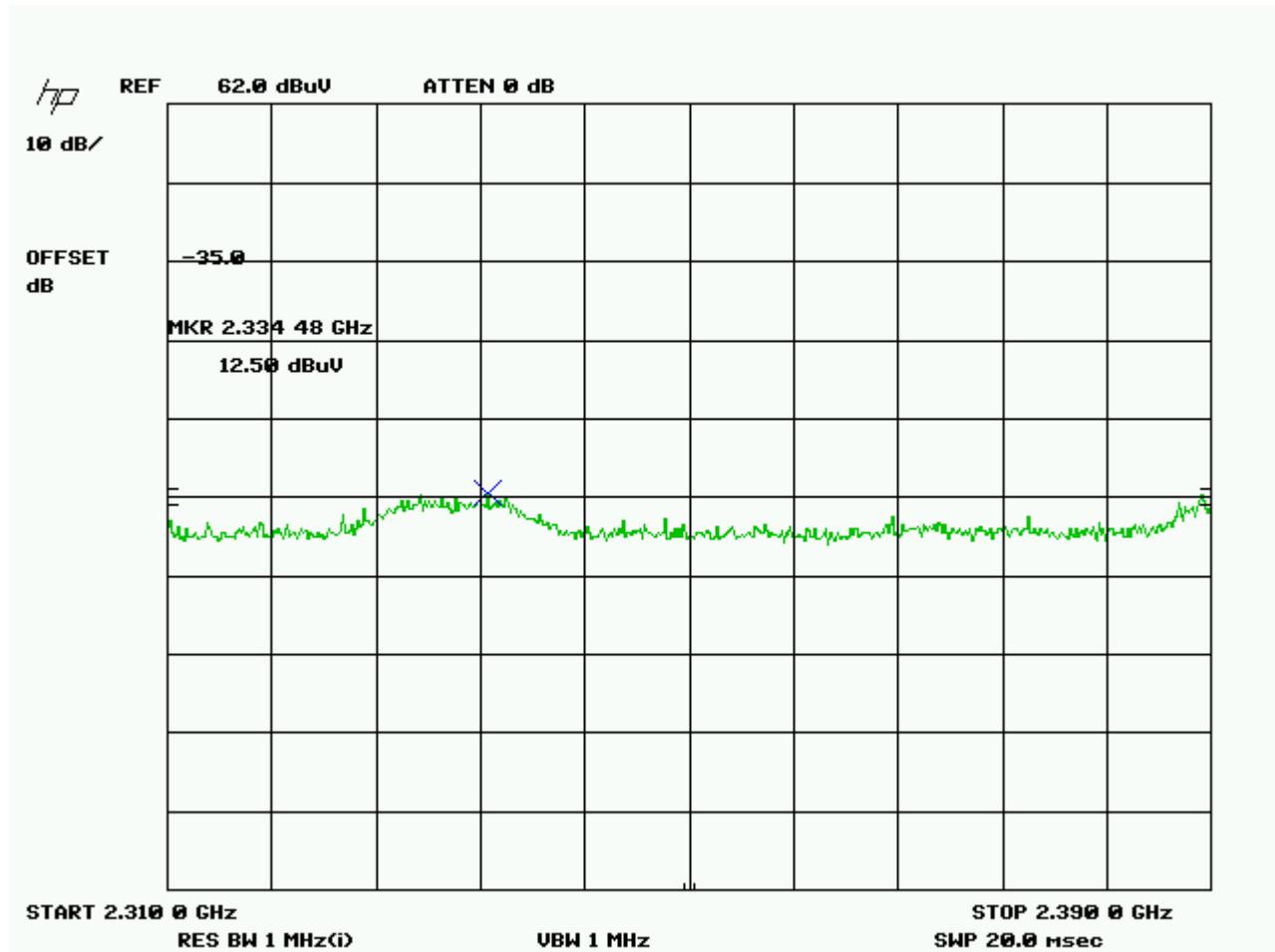
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Lower band edge with external antenna (Tetrafab) in 802.11b mode
Peak



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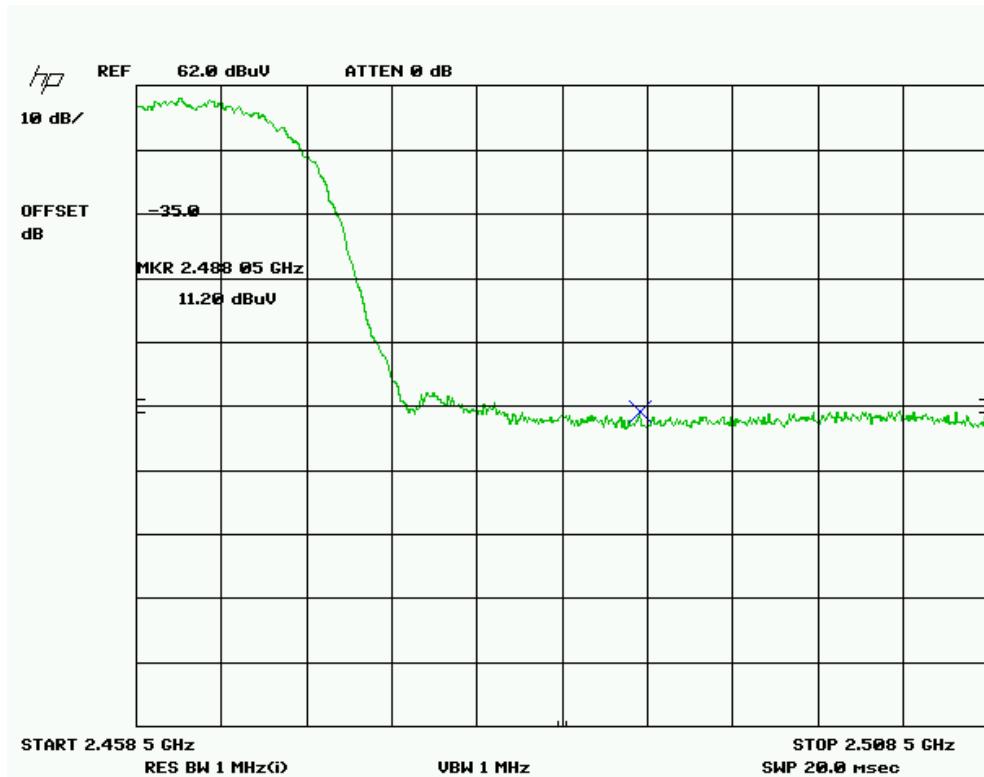
Lower adjacent restricted band external antenna (Tetrafab).
 Peak



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol. V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,334.50	12.5	V	3.13	32.07	47.70	6.3	Peak

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 IC CERT#: 7420A-SG9011024
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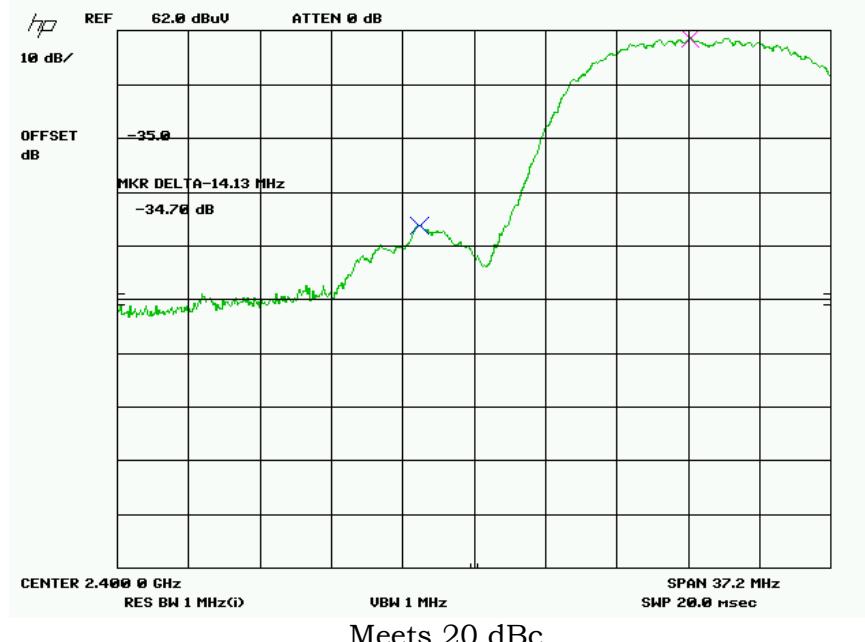
Upper band edge with external antenna (Tetrafab) in 802.11b mode
 Peak



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol. V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,462.0	2,488.00	11.2	V	3.24	32.47	46.91	7.09	

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lower bandedge in 802.11 b mode with external antenna (Laird)



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Field strength calculations: 802.11 b mode with external antenna (Laird)

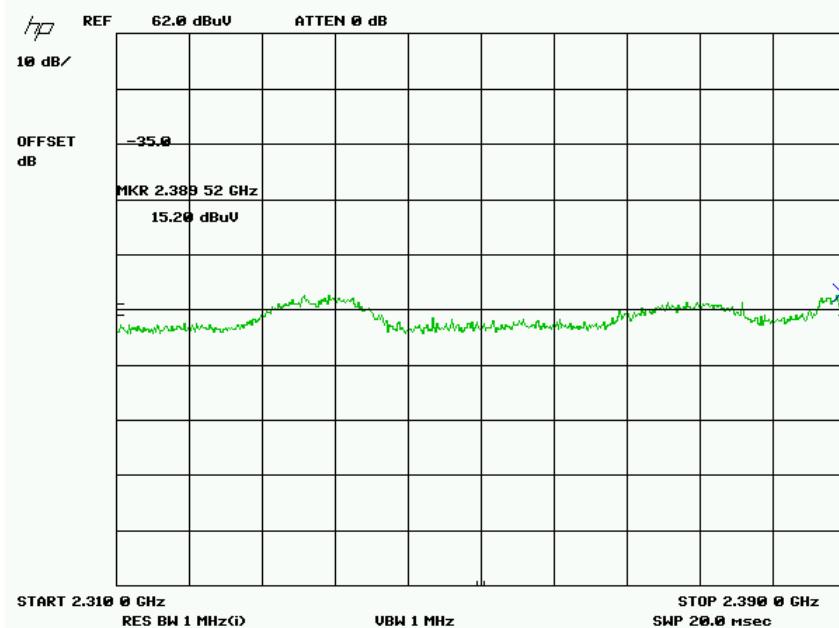
Lower

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,389.50	15.2	V	3.17	32.21	50.58	3.42	peak

Upper

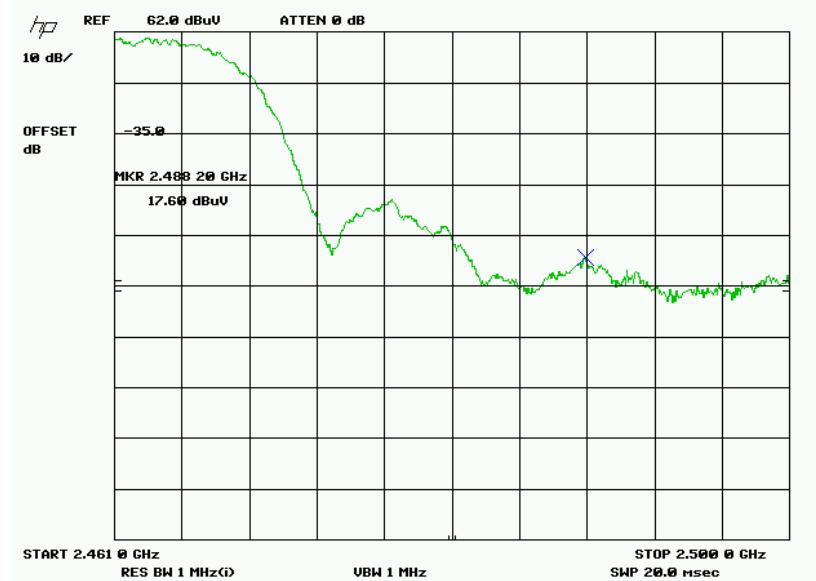
Tuned Frequency MHz	Emission Frequency MHz	Meter Readin g dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,462.0	2,488.20	17.6	V	3.24	32.47	53.31	0.69	peak

lower restricted band in 802.11 b mode with external antenna (Laird)



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upper restricted band in 802.11 b mode with external antenna (Laird)



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Field strength calculations: 802.11 g mode with internal antenna

Lower

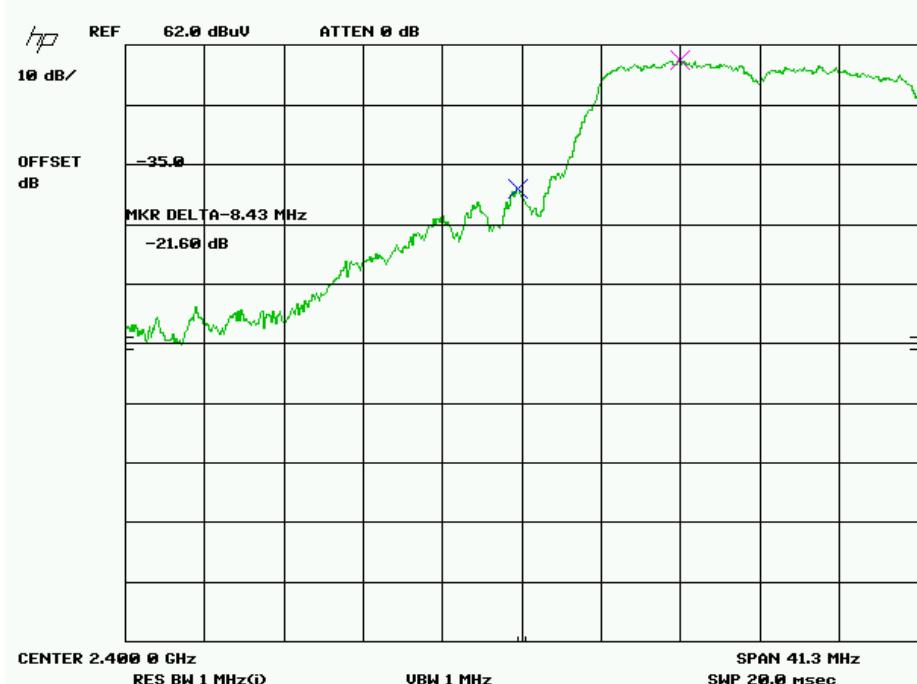
All Field strength values are peak except values marked 0.5 MHz values are average

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,390.00	22.4	V	3.17	32.21	57.78	16.22	peak
2,412.0	2,390.50	7.6	V	3.17	32.22	42.99	11.01	average

Upper

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,462.0	2,483.50	22.1	V	3.24	32.46	57.80	16.2	peak
2462.0	2483.50	8.7	V	3.24	32.46	44.4	9.60	average

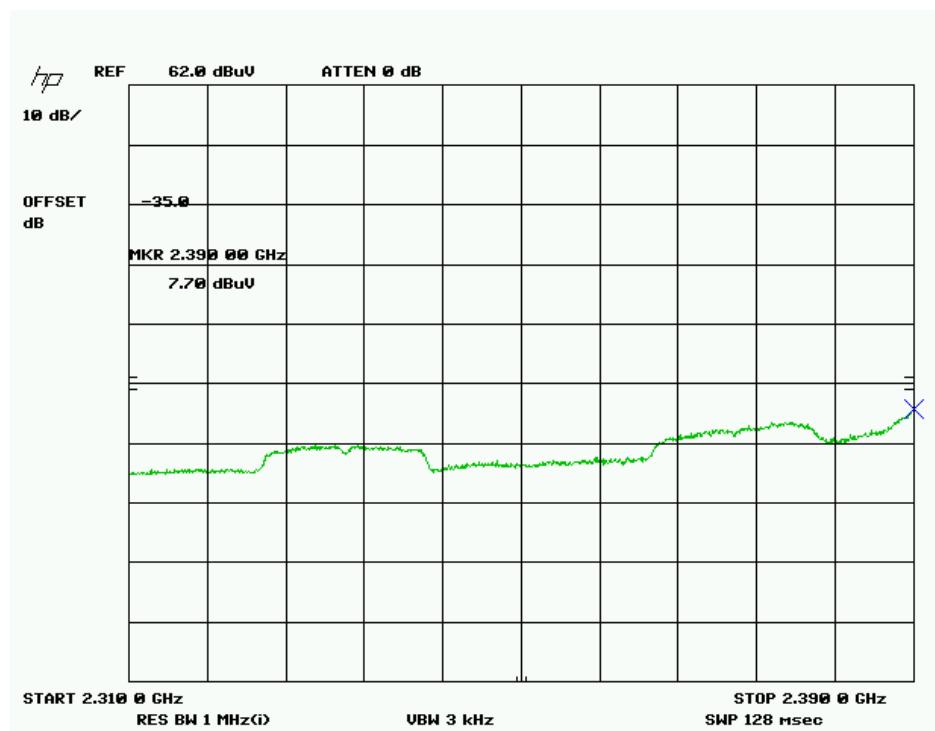
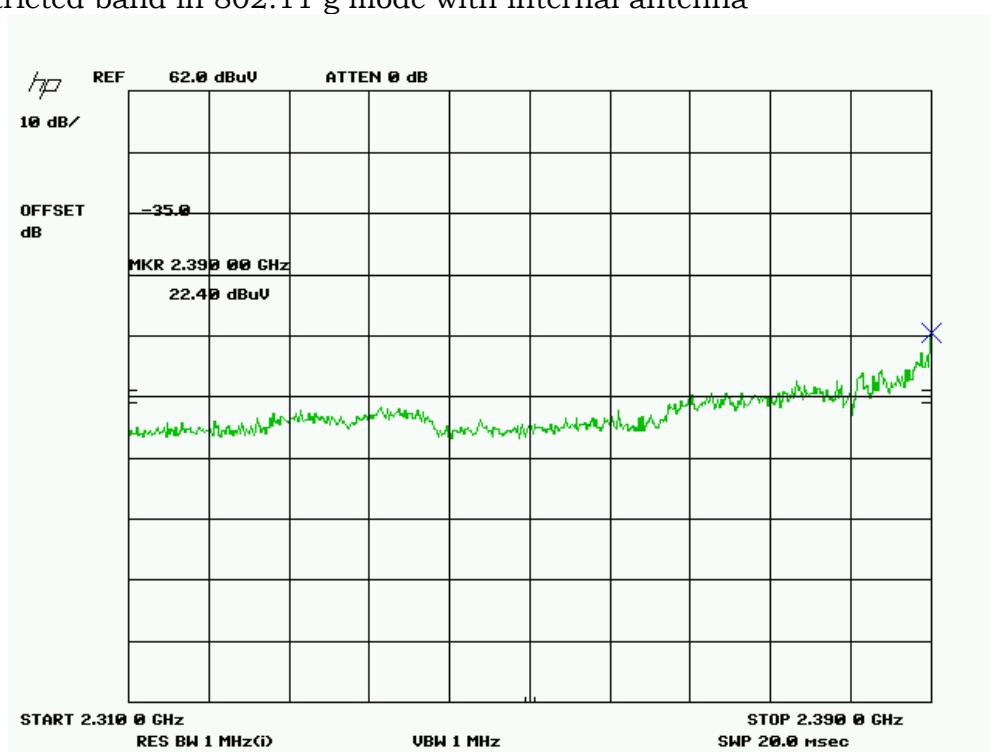
lower bandedge in 802.11 g mode with internal antenna



Meets 20 dBc

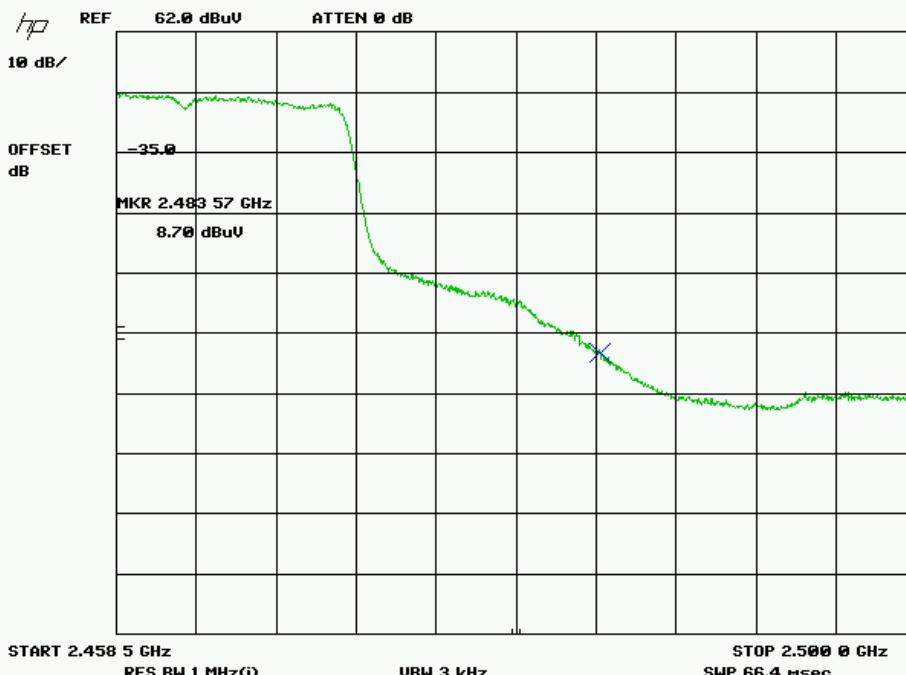
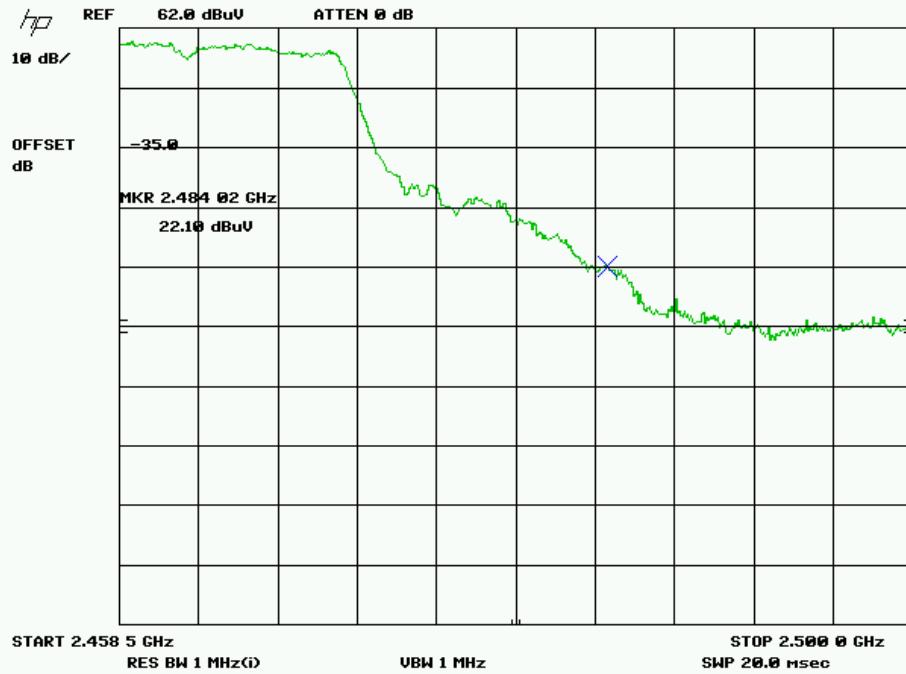
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lower restricted band in 802.11 g mode with internal antenna



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upper restricted band in 802.11 g mode with internal antenna



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Field strength calculations: 802.11 b mode with internal antenna

Lower

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
2,412.0	2,374.80	12.7	V	3.16	32.17	48.03	5.96

Upper

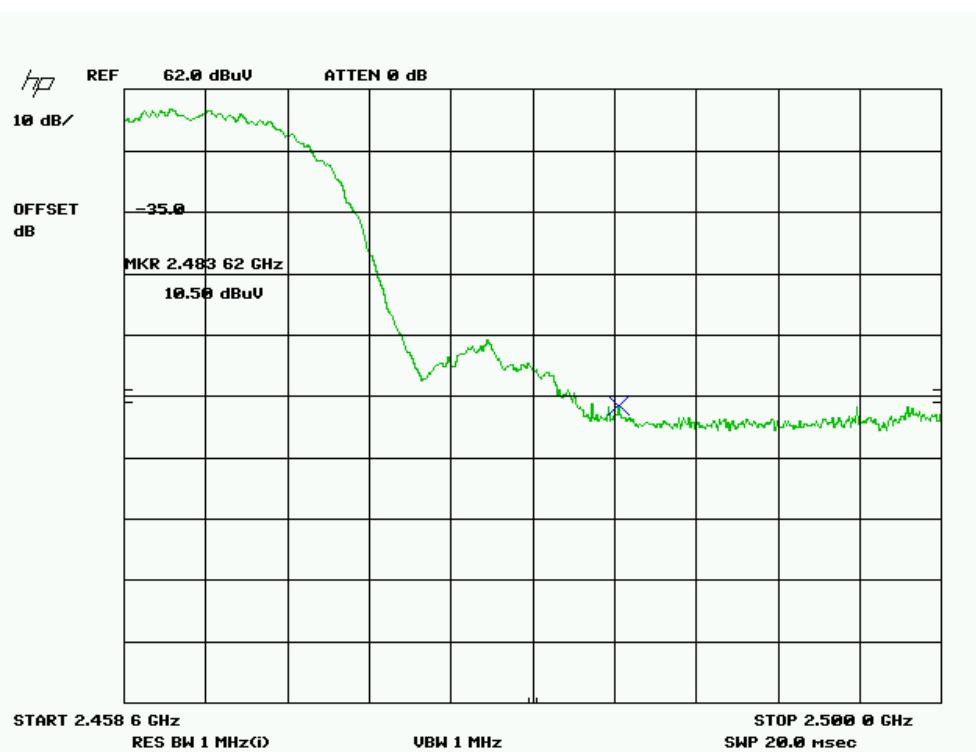
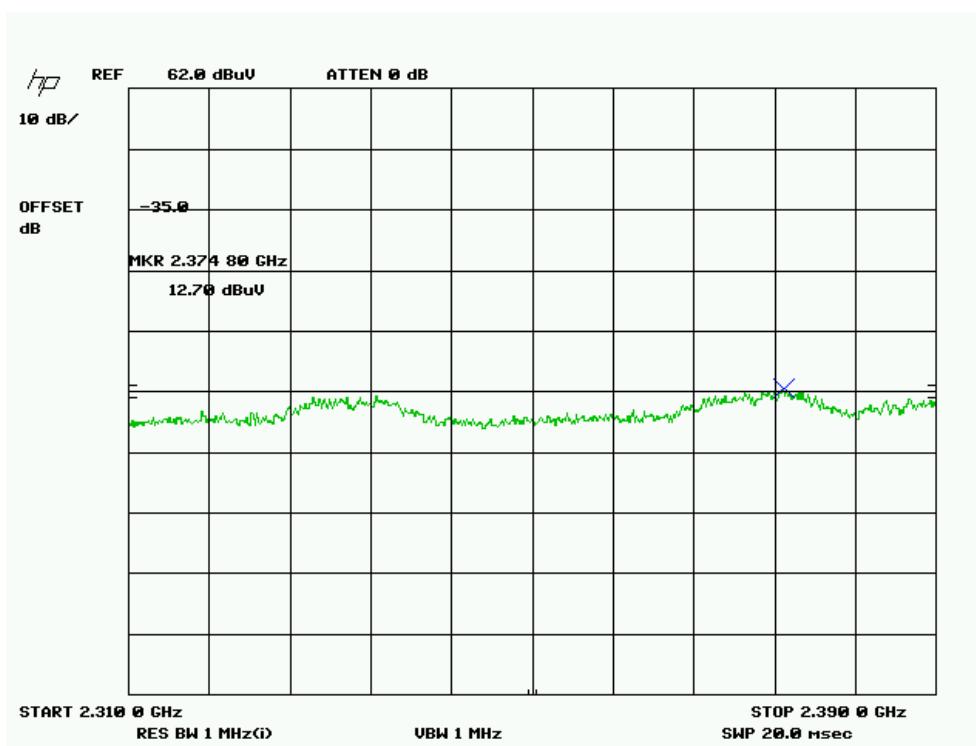
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
2,462.0	2,483.50	10.5	V	3.24	32.46	46.20	7.80

lower bandedge in 802.11 b mode with internal antenna



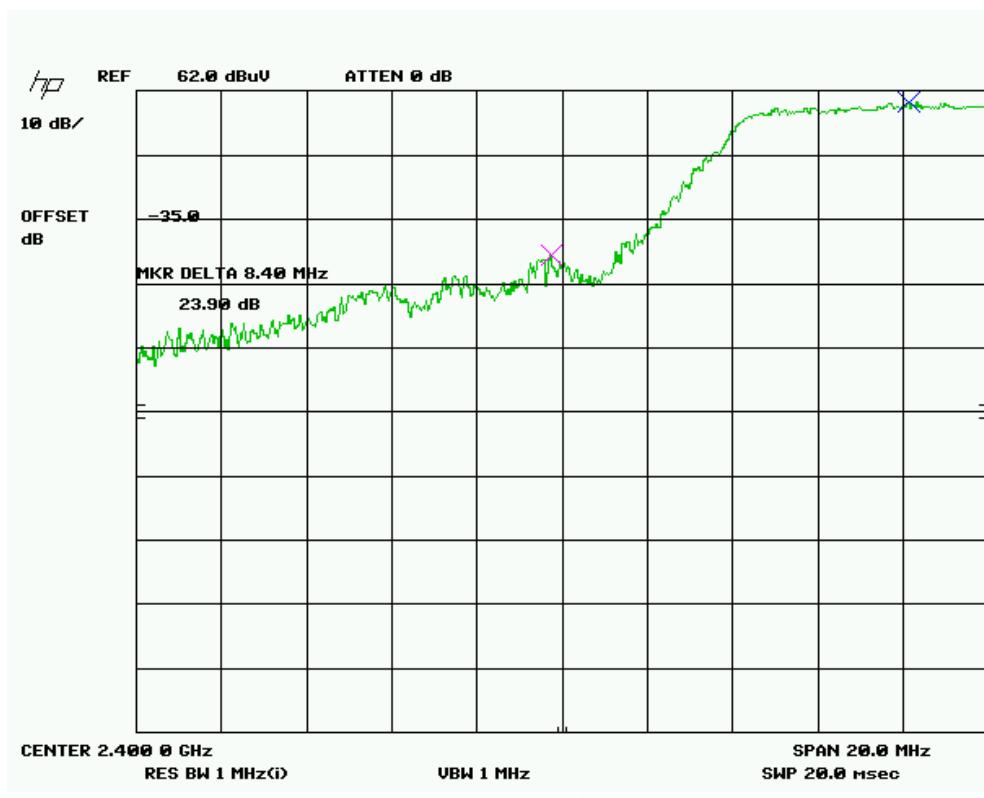
Meets 20 dBc

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lower band edge with external antenna (Tetrafab) in 802.11g mode
Peak



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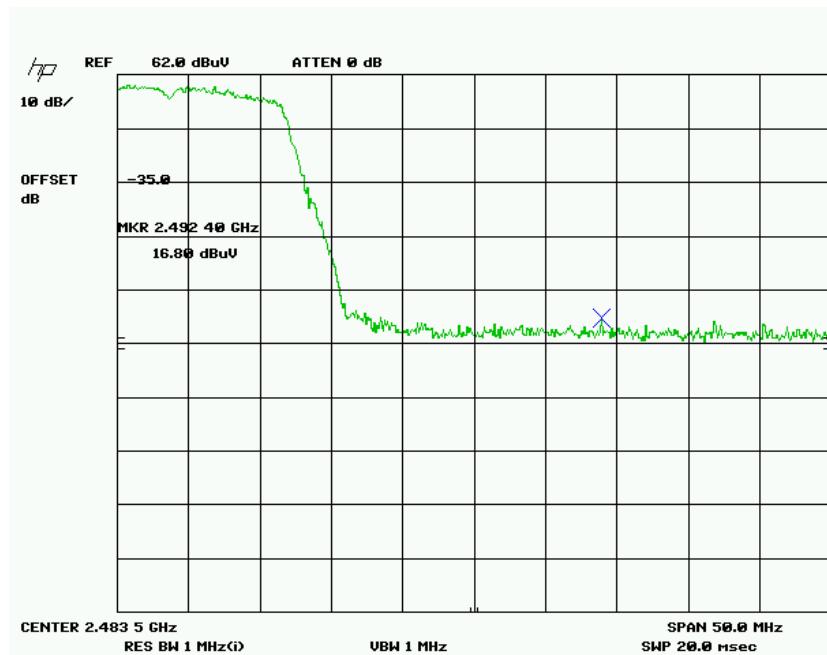
lower adjacent restricted band with external antenna (Tetrafab) in 802.11g mode
 Peak



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol. V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,412.0	2,389.50	23.2	V	3.17	32.21	58.58	15.42	Peak
2,412.0	2,390.50	7.6	V	3.17	32.22	42.99	11.01	Ave

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upper adjacent restricted band with external antenna (Tetrafab) in 802.11g mode
 Peak



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol. V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	
2,462.0	2,492.40	16.8	V	3.24	32.48	52.52	1.48	

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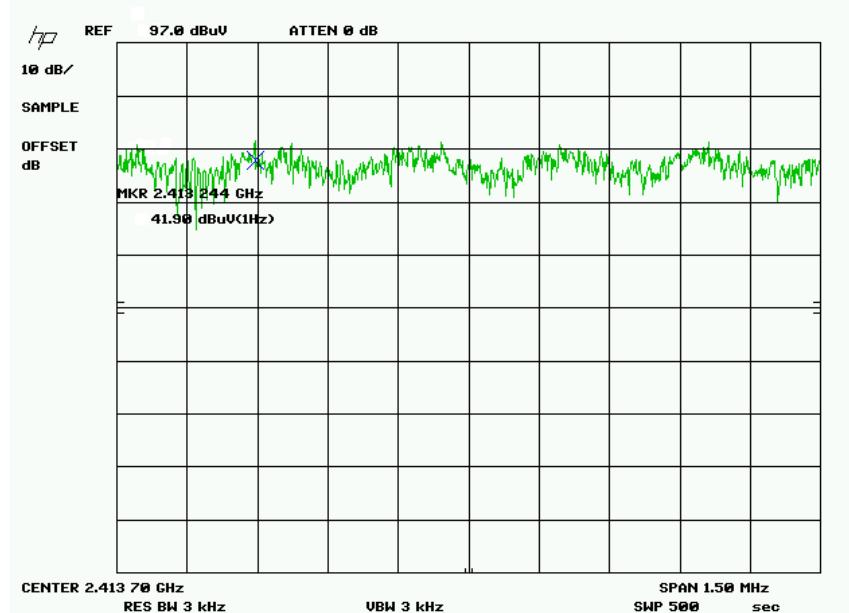
POWER SPECTRAL DENSITY

Rules Part No.: 15.247(d), RSS-210

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

Test Data: SEE THE FOLLOWING PLOTS

802.11g



41.9 dBuV from plot

35.0 dB CF to 3 kHz

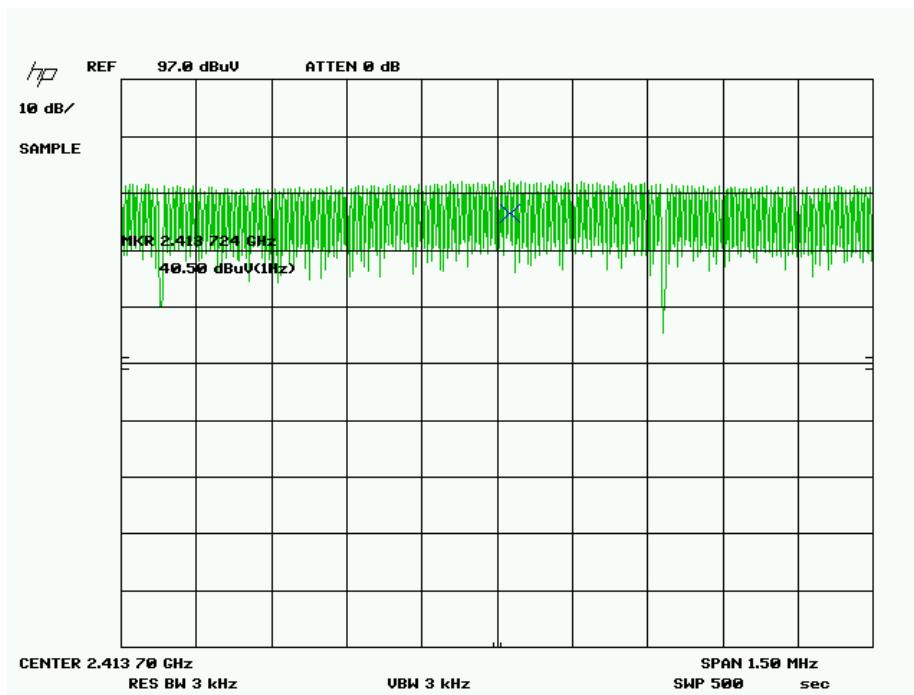
-107 dB CF to dBm

-30.1 dBm

Three places in the band were measured and the worst case reported.

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802.11b



40.5 dBuV from plot
 35.0 dB CF to 3 kHz
-107 dB CF to dBm
 -31.5 dBm

Three places in the band were measured and the worst case reported.

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