TIMCO ENGINEERING, Inc.

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FCC PART 15.247 AND IC RSS-210

TEST REPORT

DIGITAL SPREAD SPECTRUM

Applicant	PROXENSE, LLC.
Address	1013 N. State Road 7
	Royal Palm Beach, Fl. 33411 USA
FCC ID	X9S-BE1000
IC	9282A-BE1000
Model Number	BE1000
Product Description	Beacon with 3dBi folded dipole antenna
Date Sample Received	7/21/2010
Date Tested	7/21/2010
Tested By	Richard Block
Approved By	Mario R. de Aranzeta
Report Number	1677AT10TestReport_Ant 2.doc
Test Results	☒ PASS ☐ FAIL

ACCREDITED

Testing Certificate # 0955-01

TABLE OF CONTENT

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 items 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 C.E.T.
Compliance Engineer/ Lab. Supervisor

Date: 7/28/2010

GENERAL INFORMATION

DUT Specification

Applicable Standard	FCC Part 15.247, IC RSS-210 and RSS-GEN		
DUT Description	Beacon with 3dBi folded dipole antenna		
FCC ID	X9S-BE1000		
IC	9282A-BE1000		
Model	BE1000		
Operating Frequency	TX: 2405-2480 MHz		
DUT Power Source	☐ 110–120Vac/50– 60Hz		
	☒ DC Power PoE (Power over Ethernet)		
	☐ Battery Operated Exclusively		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable
Antenna Connector	SMA		
Antenna	5.12 dBi folded dipole		
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.		
Test Conditions	Temperature: 26ºC Relative humidity: 50%		
Test Exercise	The DUT was placed in continuous transmit mode of operation.		

Test Supporting Equipment

Supporting Device	Manufacturer	Model / FCC ID	Serial Number
N/A			

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 3/10/10	3/10/12
AC Voltmeter	HP	400FL	2213A14499	CAL 3/23/09	3/23/11
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 6/10/09	6/10/11
Frequency Counter	HP	5385A	3242A07460	CAL 5/26/09	5/26/11
Hygro-Thermometer	Extech	445703	0602	CAL 1/30/09	1/30/11
Modulation Analyzer	HP	8901A	3435A06868	CAL 5/26/09	5/26/11
Digital Multimeter	Fluke	FLUKE-77-3	79510405	CAL 5/18/09	5/18/11
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 11/21/09	11/21/11
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 11/22/09	11/22/11
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 11/21/09	11/21/11
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 11/24/09	11/24/11
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/10	4/25/12

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 plus 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:			
Freq (MHz)	Meter Reading	+ ACF	+ CL = FS
33	20 dBuV	+ 10.36 dB	+ 0.5 = 30.86 dBuV/m @ 3m

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 10 kHz 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)=1 MHz 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 30 MHz 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. Emissions attenuated more than 20 dB below the permissible value are not reported.

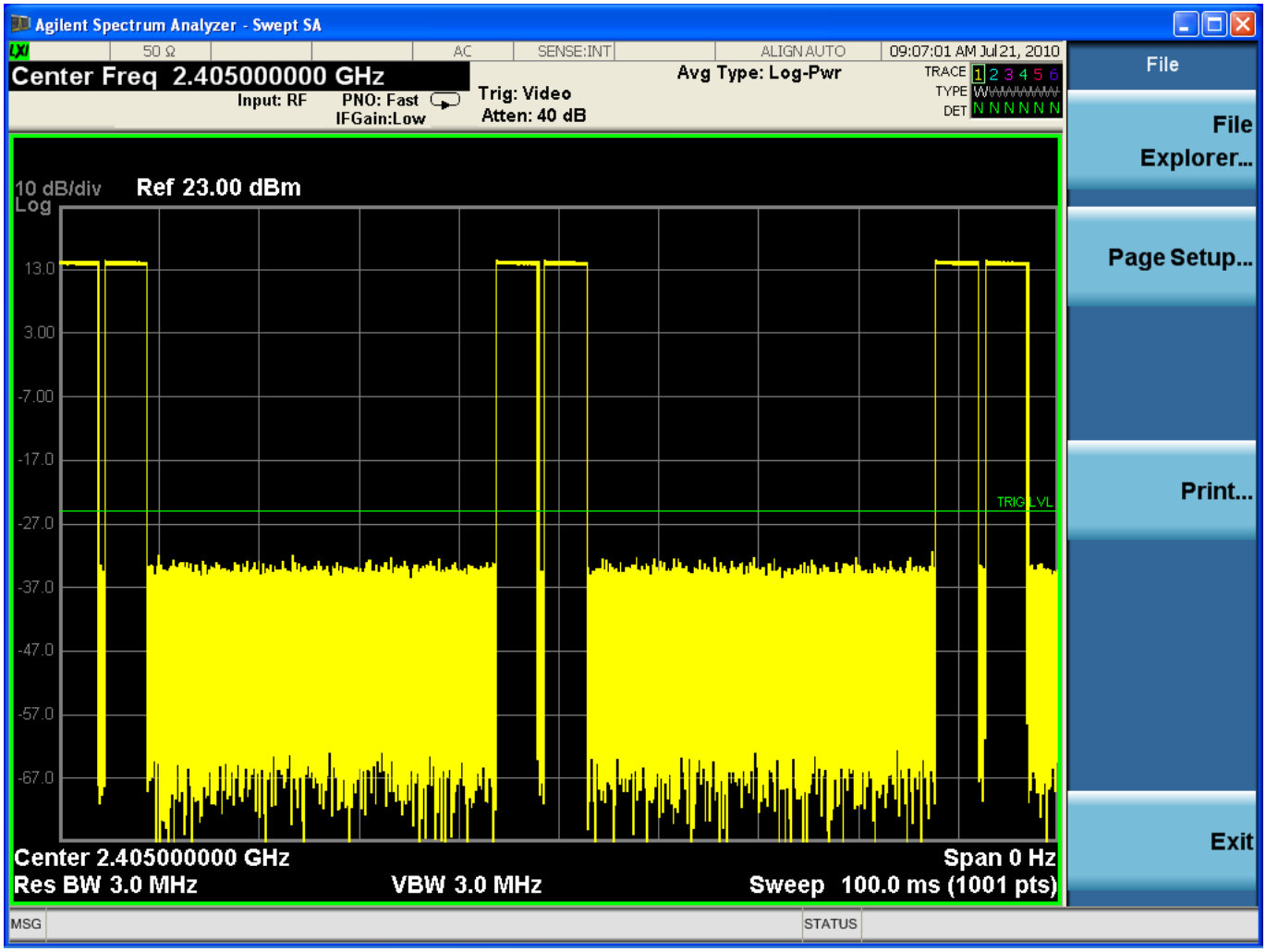
CALCULATION OF DUTY CYCLE

The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero (0) frequency span. A plot is then made of the pulse train with a sweep time of 100 milliseconds. This sweep determines the duration of the pulse train. This sweep allows the determination of the number of and type of pulses, i.e. long & short. Plots are then made showing the duration of each type of pulse and its duration. From the 100-millisecond plot, the number of a given type of pulse is then multiplied by the duration of that type pulse. This allows the calculation of the amount of time the DUT is on within 100 ms.

Long Pulse	0
Short Pulse	6(4.260 ms)
On Time	25.560 ms
Length of Pulse Train	100 ms
Total	0.2556

dB = 20*log(ON TIME)/PERIOD
dB = 20*log(25.56/100)
dB = 20*log(0.2556)
dB = -11.9

See the following plots.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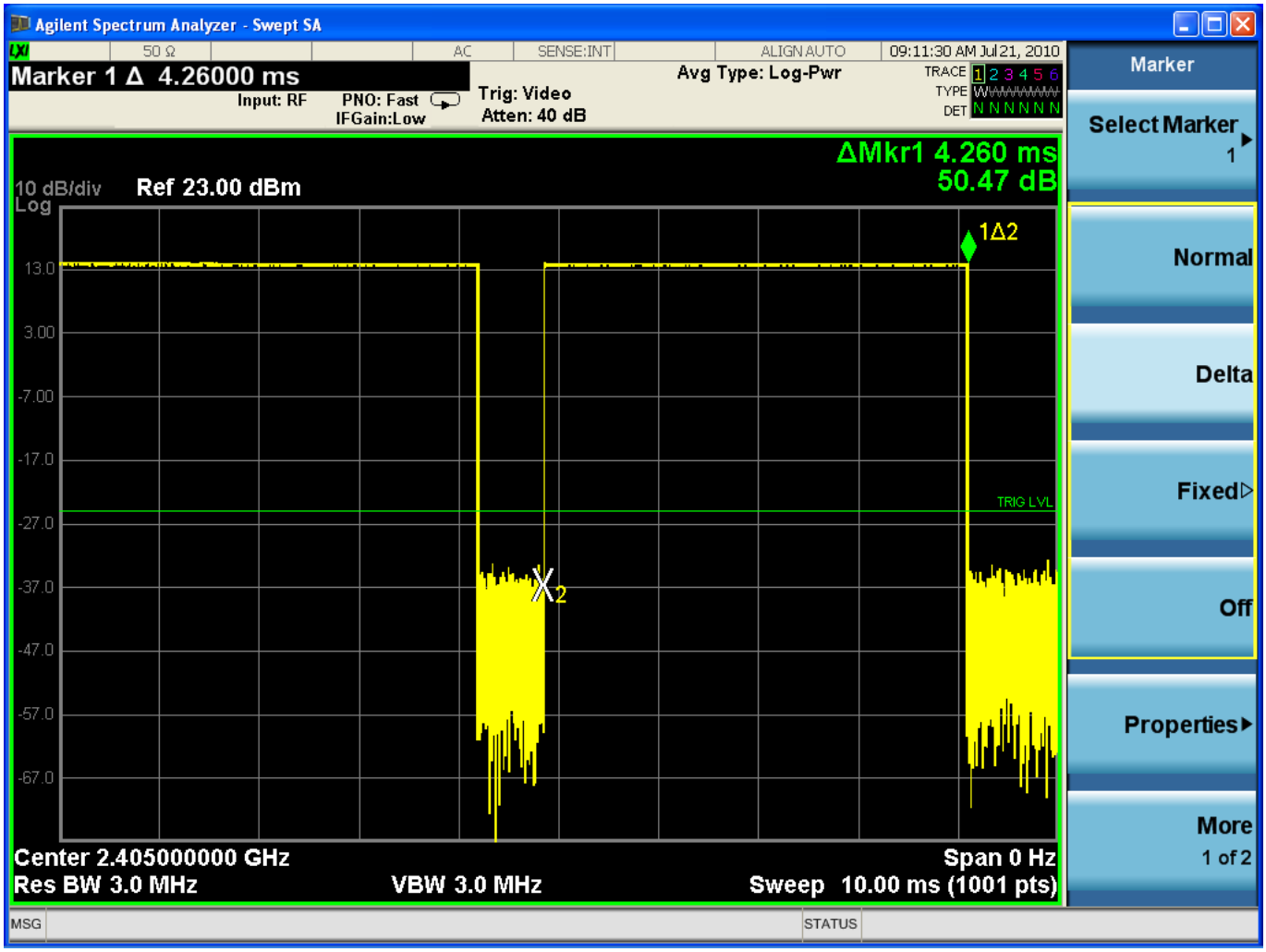
09:07:01 AM Jul 21, 2010
Center Freq 2.405000000 GHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Video
Atten: 40 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE
DET N N N N N
10 dB/div
Log
Ref 23.00 dBm
13.0
3.00
-7.00
-17.0
-27.0
-37.0
-47.0
-57.0
-67.0
TRIG LVL
Center 2.405000000 GHz
Res BW 3.0 MHz
VBW 3.0 MHz
Span 0 Hz
Sweep 100.0 ms (1001 pts)
File
File Explorer...
Page Setup...
Print...
Exit
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
50 Ω
AC
SENSE:INT
ALIGN AUTO
09:11:30 AM Jul 21, 2010
Marker 1 Δ 4.26000 ms
Input: RF
PNO: Fast
IFGain:Low
Trig: Video
Atten: 40 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE
DET N N N N N
ΔMkr1 4.260 ms
50.47 dB
10 dB/div
Log
Ref 23.00 dBm
13.0
3.00
-7.00
-17.0
-27.0
-37.0
-47.0
-57.0
-67.0
1Δ2
TRIG LVL
Center 2.405000000 GHz
Res BW 3.0 MHz
VBW 3.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)
MSG
STATUS
Marker
Select Marker
1
Normal
Delta
Fixed
Off
Properties
More
1 of 2

RADIATION INTERFERENCE

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

Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) µV/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) µV/m @ 30 meters
1705 kHz to 30 MHz	29.54 dBµV/m @ 30 meters
30 – 88	40.0 dBµV/m @ 3 meters
80 – 216	43.5 dBµV/m @ 3 meters
216 – 960	46.0 dBµV/m @ 3 meters
Above 960	54.0 dBµV/m @ 3 meters
Part 15.247	
Fundamental 902 – 928 MHz	127.37 dBµV/m @ 3 meters
Fundamental 2.4 – 2.4835 MHz	127.37 dBµV/m @ 3 meters
Harmonics	54.0 dBµV/m @ 3 meters

Any emissions that fall in the restricted bands (15.205) must be less than or equal to to 54 dBuV/m. Spurious emissions not in a restricted band must be 20 dBc. Harmonics were checked through the 10th harmonic.

Test Data: All values are peak unless noted.

Maximum conducted output power 21.8 dBm

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB	Peak or Average
2,405.00	2,405.00	70.9	H	3.18	32.25	11.90	94.43	32.95	
2,405.00	2,405.00	86.3	V	3.18	32.25	11.90	109.83	17.55	
2,405.00	4,810.00	21.3	H	4.91	34.10	11.90	48.41	5.59	Average
2,405.00	4,810.00	25.2	V	4.91	34.10	11.90	52.31	1.69	Average
2,405.00	4,810.00	31.1	H	4.91	34.10	11.90	58.21	15.79	Peak
2,405.00	4,810.00	37.0	V	4.91	34.10	11.90	64.11	9.89	Peak
2,405.00	7,215.00	16.2	H	5.73	36.04	11.90	46.07	7.93	Average
2,405.00	7,215.00	17.1	V	5.73	36.04	11.90	46.97	7.03	Average
2,405.00	7,215.00	26.9	H	5.73	36.04	11.90	56.77	17.23	Peak
2,405.00	7,215.00	27.8	V	5.73	36.04	11.90	57.67	16.33	Peak
2,405.00	9,620.00	6.6	H	6.79	36.72	11.90	38.21	15.79	Average
2,405.00	9,620.00	8.3	V	6.79	36.72	11.90	39.91	14.09	Average

TEST DATA CONTD.

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB	Peak or Average
2,405.00	9,620.00	15.7	H	6.79	36.72	11.90	47.31	26.69	Peak
2,405.00	9,620.00	17.9	V	6.79	36.72	11.90	49.51	24.49	Peak
2,405.00	12,025.00	4.3	H	7.82	38.72	11.90	38.94	15.06	
2,405.00	12,025.00	6.0	V	7.82	38.72	11.90	40.64	13.36	
2,440.00	2,440.00	76.1	H	3.21	32.34	11.90	99.75	27.63	
2,440.00	2,440.00	83.4	V	3.21	32.34	11.90	107.05	20.33	
2,440.00	4,880.00	21.8	H	4.94	34.10	11.90	48.94	5.06	Average
2,440.00	4,880.00	25.9	V	4.94	34.10	11.90	53.04	0.96	Average
2,440.00	4,880.00	32.9	H	4.94	34.10	11.90	60.04	13.96	Peak
2,440.00	4,880.00	37.4	V	4.94	34.10	11.90	64.54	9.46	Peak
2,440.00	7,320.00	19.5	V	5.79	36.06	11.90	49.45	4.55	Average
2,440.00	7,320.00	20.5	H	5.79	36.06	11.90	50.45	3.55	Average
2,440.00	7,320.00	29.8	V	5.79	36.06	11.90	59.75	14.25	Peak
2,440.00	7,320.00	31.1	H	5.79	36.06	11.90	61.05	12.95	Peak
2,440.00	9,760.00	3.8	V	6.83	36.86	11.90	35.59	18.41	Average
2,440.00	9,760.00	17.2	H	6.83	36.86	11.90	48.99	5.01	
2,440.00	9,760.00	20.4	V	6.83	36.86	11.90	52.19	21.81	Peak
2,440.00	12,200.00	-2.3	V	7.94	38.86	11.90	32.60	21.40	Average
2,440.00	12,200.00	7.5	H	7.94	38.86	11.90	42.40	11.60	
2,440.00	12,200.00	8.7	V	7.94	38.86	11.90	43.60	30.40	Peak
2,475.00	2,475.00	75.1	H	3.23	32.44	11.90	98.87	28.51	
2,475.00	2,475.00	83.4	V	3.23	32.44	11.90	107.17	20.21	
2,475.00	4,950.00	19.3	H	4.98	34.10	11.90	46.48	7.52	Average
2,475.00	4,950.00	21.5	V	4.98	34.10	11.90	48.68	5.32	Average
2,475.00	4,950.00	30.0	H	4.98	34.10	11.90	57.18	16.82	Peak
2,475.00	4,950.00	31.5	V	4.98	34.10	11.90	58.68	15.32	Peak
2,475.00	7,425.00	16.2	H	5.86	36.09	11.90	46.25	7.75	Average
2,475.00	7,425.00	17.7	V	5.86	36.09	11.90	47.75	6.25	Average
2,475.00	7,425.00	26.8	V	5.86	36.09	11.90	56.85	17.15	Peak
2,475.00	7,425.00	26.9	H	5.86	36.09	11.90	56.95	17.05	Peak
2,475.00	9,900.00	3.5	H	6.87	37.00	11.90	35.47	18.53	Average

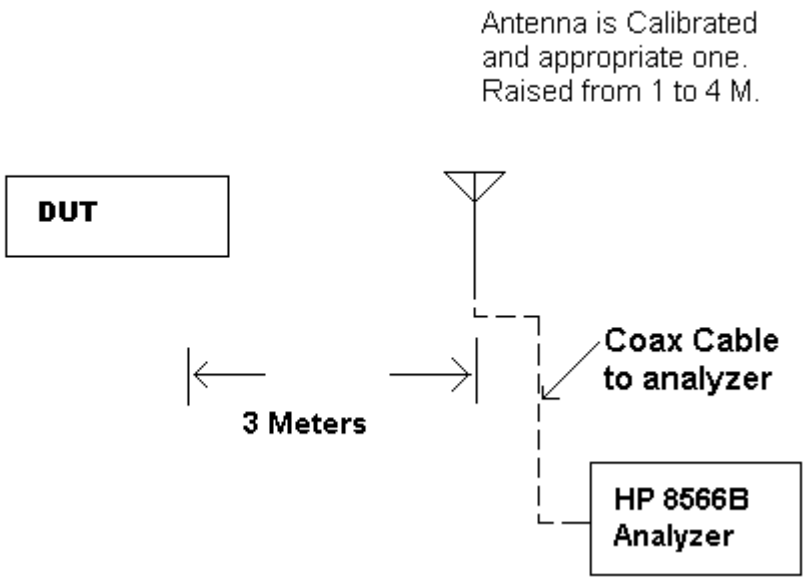
TEST DATA CONTD.

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB	Peak or Average
2,475.00	9,900.00	14.1	H	6.87	37.00	11.90	46.07	27.93	Peak
2,475.00	9,900.00	15.6	V	6.87	37.00	11.90	47.57	6.43	
2,475.00	12,375.00	-5.2	H	8.06	39.00	11.90	29.96	24.04	Average
2,475.00	12,375.00	-4.4	V	8.06	39.00	11.90	30.76	23.24	Average
2,475.00	12,375.00	7.2	H	8.06	39.00	11.90	42.36	31.64	Peak
2,475.00	12,375.00	8.1	V	8.06	39.00	11.90	43.26	30.74	Peak

Maximum conducted output power 2.2 dBm

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB	Peak or Average
2,480.00	2,480.00	56.5	H	3.24	32.45	11.90	80.29	47.09	
2,480.00	2,480.00	64.0	V	3.24	32.45	11.90	87.79	39.59	
2,480.00	4,960.00	10.0	H	4.98	34.10	11.90	37.18	16.82	
2,480.00	4,960.00	10.8	V	4.98	34.10	11.90	37.98	16.02	
2,480.00	7,440.00	10.4	H	5.86	36.09	11.90	40.45	13.55	
2,480.00	7,440.00	10.6	V	5.86	36.09	11.90	40.65	13.35	
2,480.00	9,920.00	6.2	V	6.88	37.02	11.90	38.20	15.80	
2,480.00	9,920.00	6.6	H	6.88	37.02	11.90	38.60	15.40	
2,480.00	12,400.00	4.5	H	8.08	39.02	11.90	39.70	14.30	
2,480.00	12,400.00	4.9	V	8.08	39.02	11.90	40.10	13.90	

Method of Measuring Radiated Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI standard C63.4-2003 & the FCC/OET Guidance on Measurements for Spread Spectrum Systems – Public Notice DA 00-705 dated March 30th, 2000.

POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: Part 15.207, RSS-210, RSS-GEN
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
* Decrease with logarithm of frequency		

Test Data: N/A: Device is powered by PoE (Power over Ethernet)

OCCUPIED BANDWIDTH

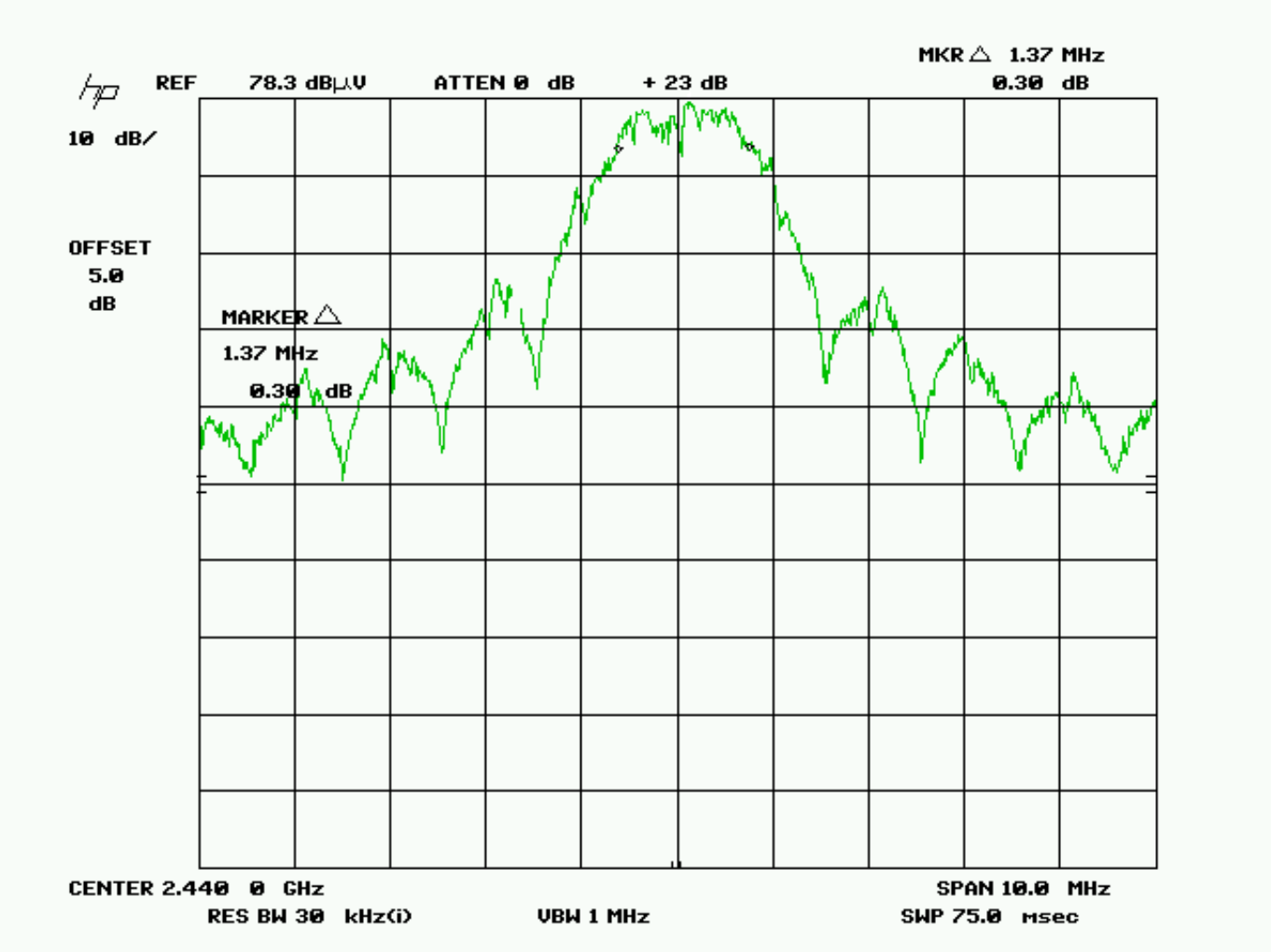
Rules Part No.: 15.247(a)(2), RSS-210, RSS-GEN

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

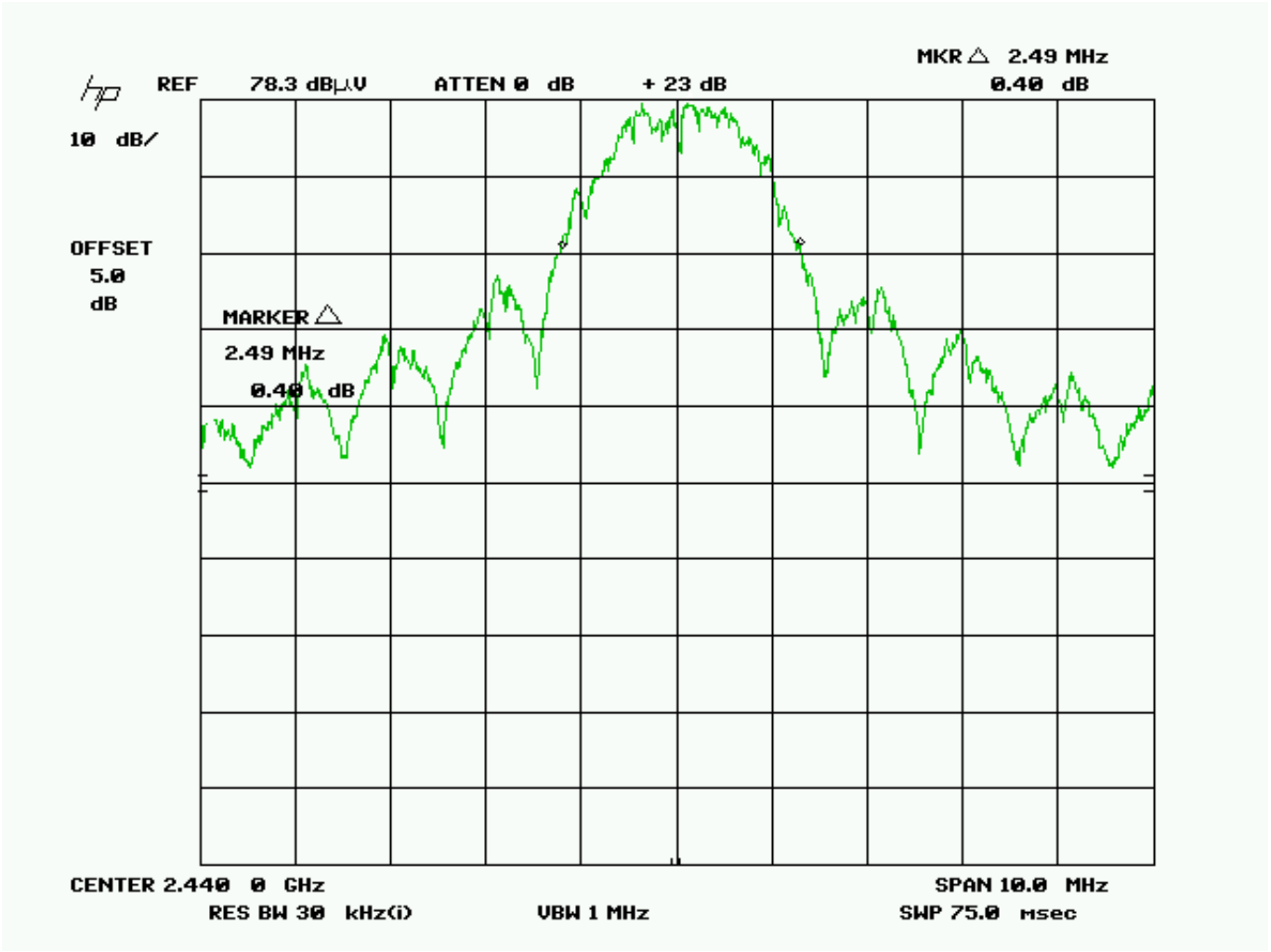
Test Data:

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

6 dB Bandwidth



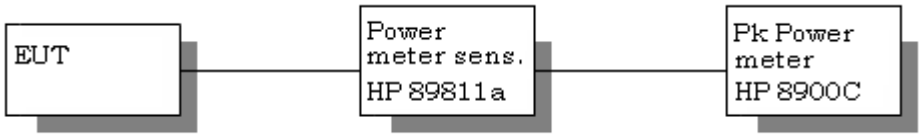
20 dB Bandwidth



POWER OUTPUT

Rules Part #: 15.247(b) 1 Watt conducted, 4W ERP

TEST SET UP:



Harmonics were checked through the 10th harmonic

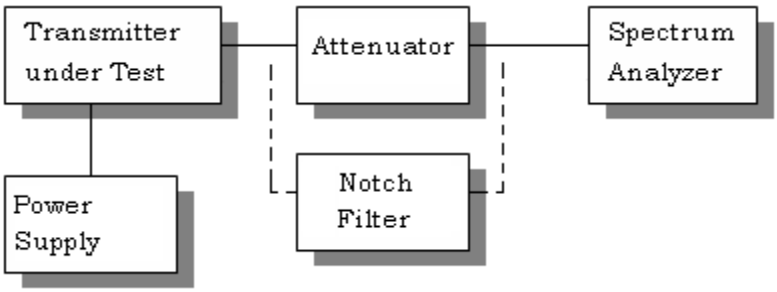
Test Results:

Frequency MHz	Po dBm	Po Watts
2405	22.2	0.166
2440	21.8	0.151
2475	21.6	0.145
2480	2.2	0.002

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.

15.247(c) Method of Measuring RF Conducted Spurious Emissions



Test Data:

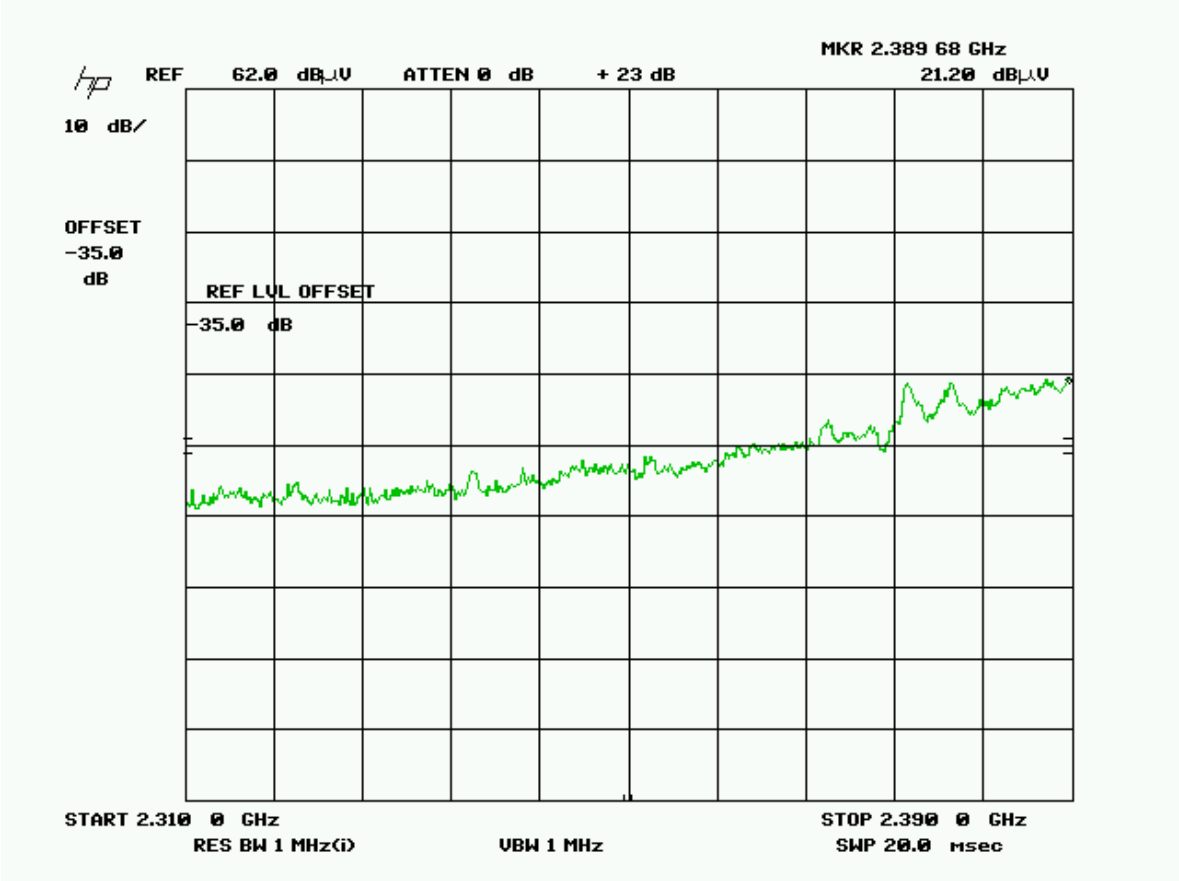
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Emission dBc
2405	2405	124.9	0.0
2405	4810	52.2	72.7
2405	7215	54.0	70.9
2405	9620	52.5	72.4
2405	12025	53.1	71.8
2405	14430	57.3	67.6
2405	16835	59.5	65.4
2405	19240	62.0	62.9
2405	21645	63.3	61.6
2440	2440	123.9	0.0
2440	4880	52.2	71.7
2440	7320	54.0	69.9
2440	9760	52.5	71.4
2440	12200	53.1	70.8
2440	14640	57.3	66.6
2440	17080	59.5	64.4
2440	19520	62.0	61.9
2440	21960	63.3	60.6
2475	2475	123.7	0.0
2475	4950	53.5	70.2
2475	7425	53.2	70.5

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).

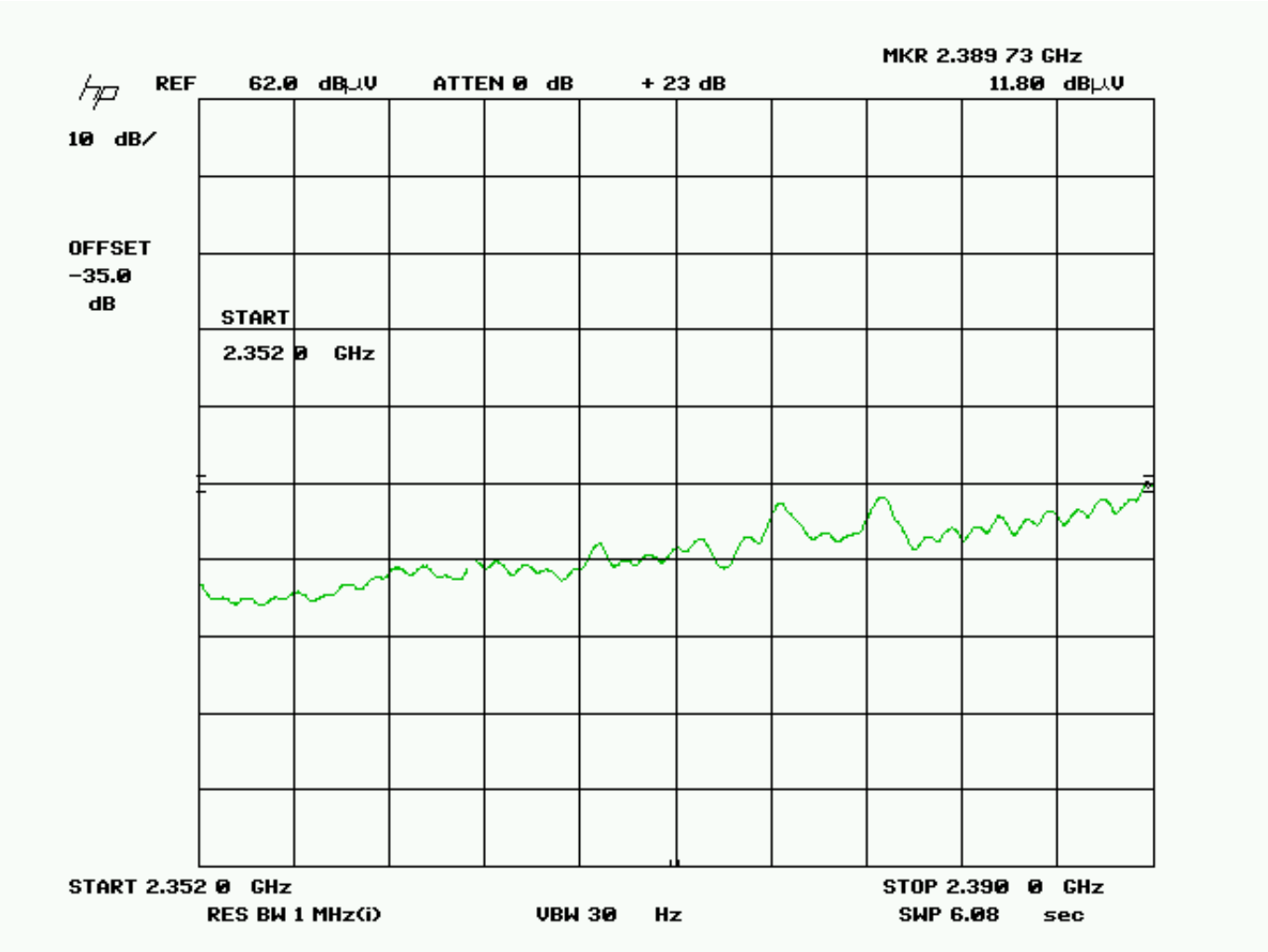
Test Procedure: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Lower adjacent restricted band – Peak



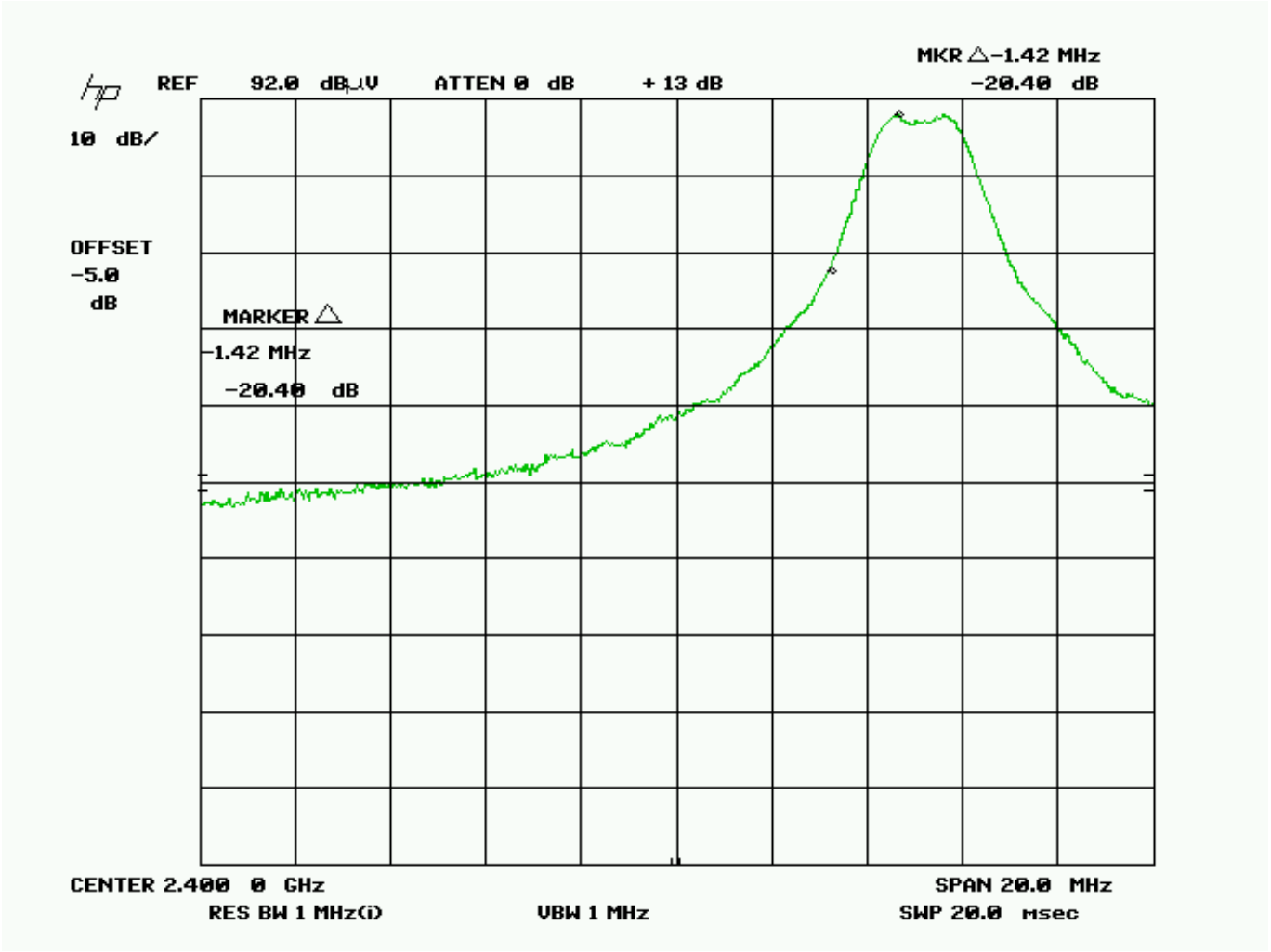
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB
2,405.00	2,389.68	21.2	V	3.17	32.21	11.90	44.68	29.32

Lower adjacent restricted band – Average

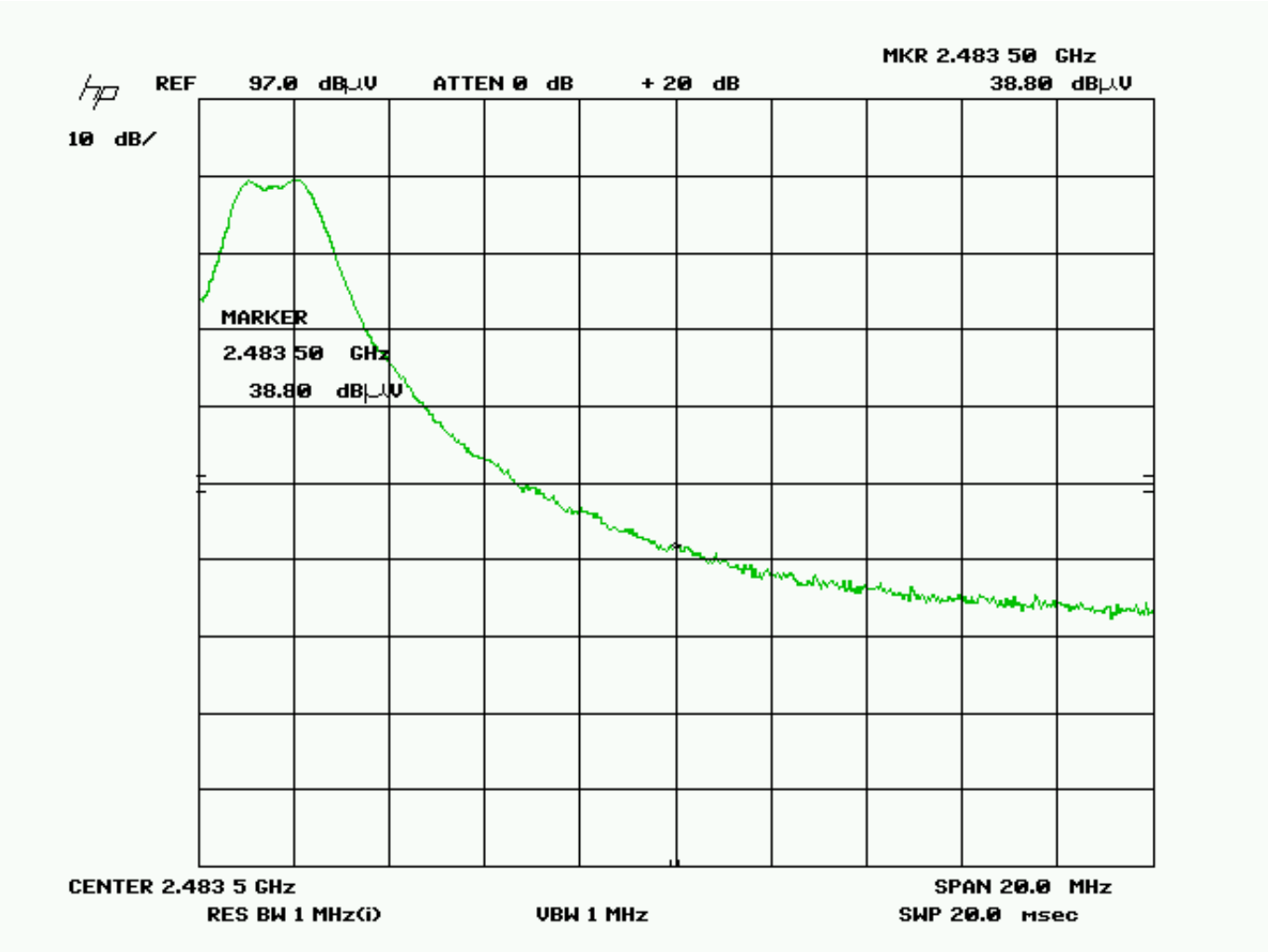


Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB
2,405.00	2,389.73	11.8	V	3.17	32.21	11.90	35.28	18.72

Lower Band edge

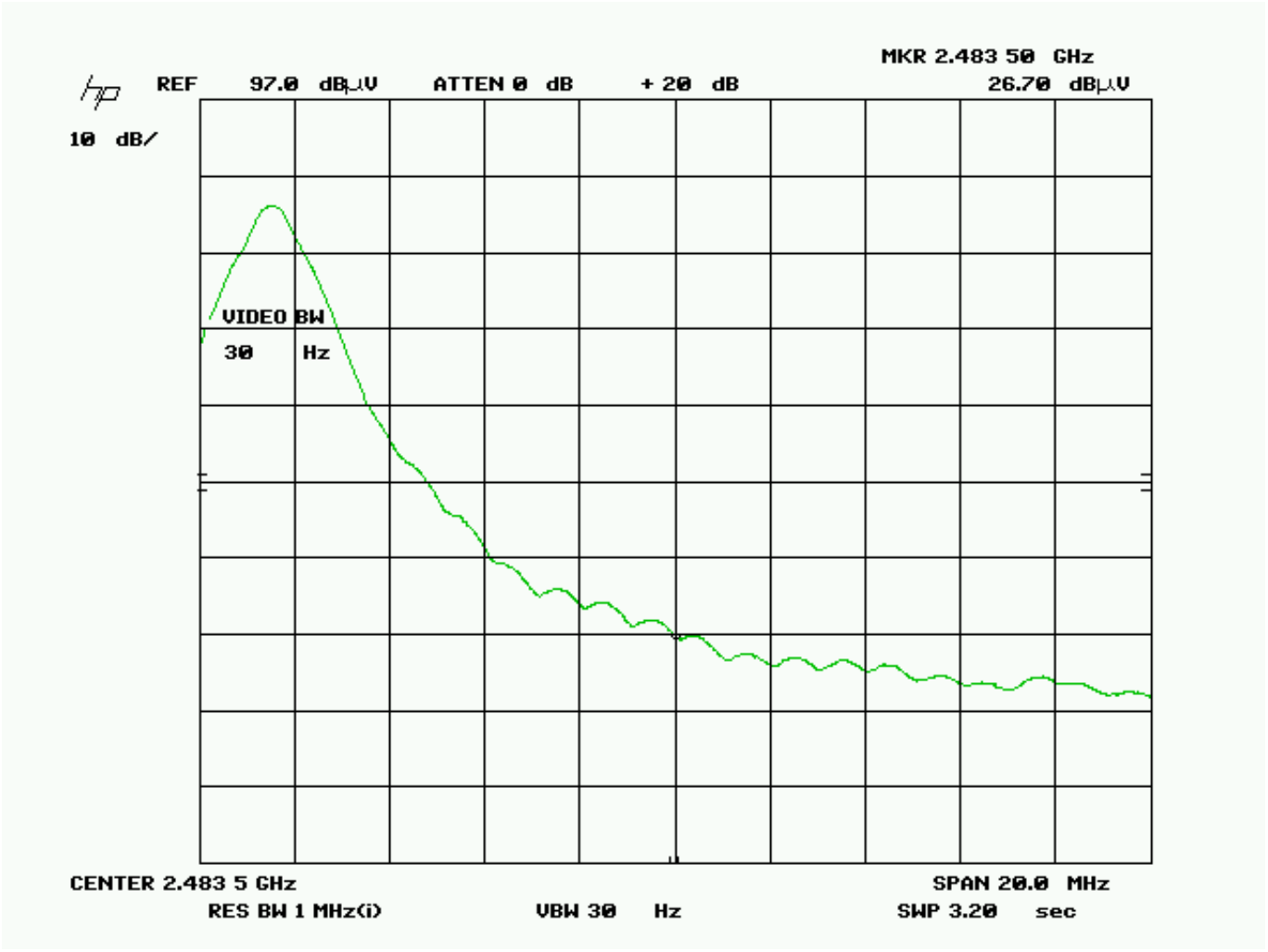


Upper Bandedge 2475 MHz Peak



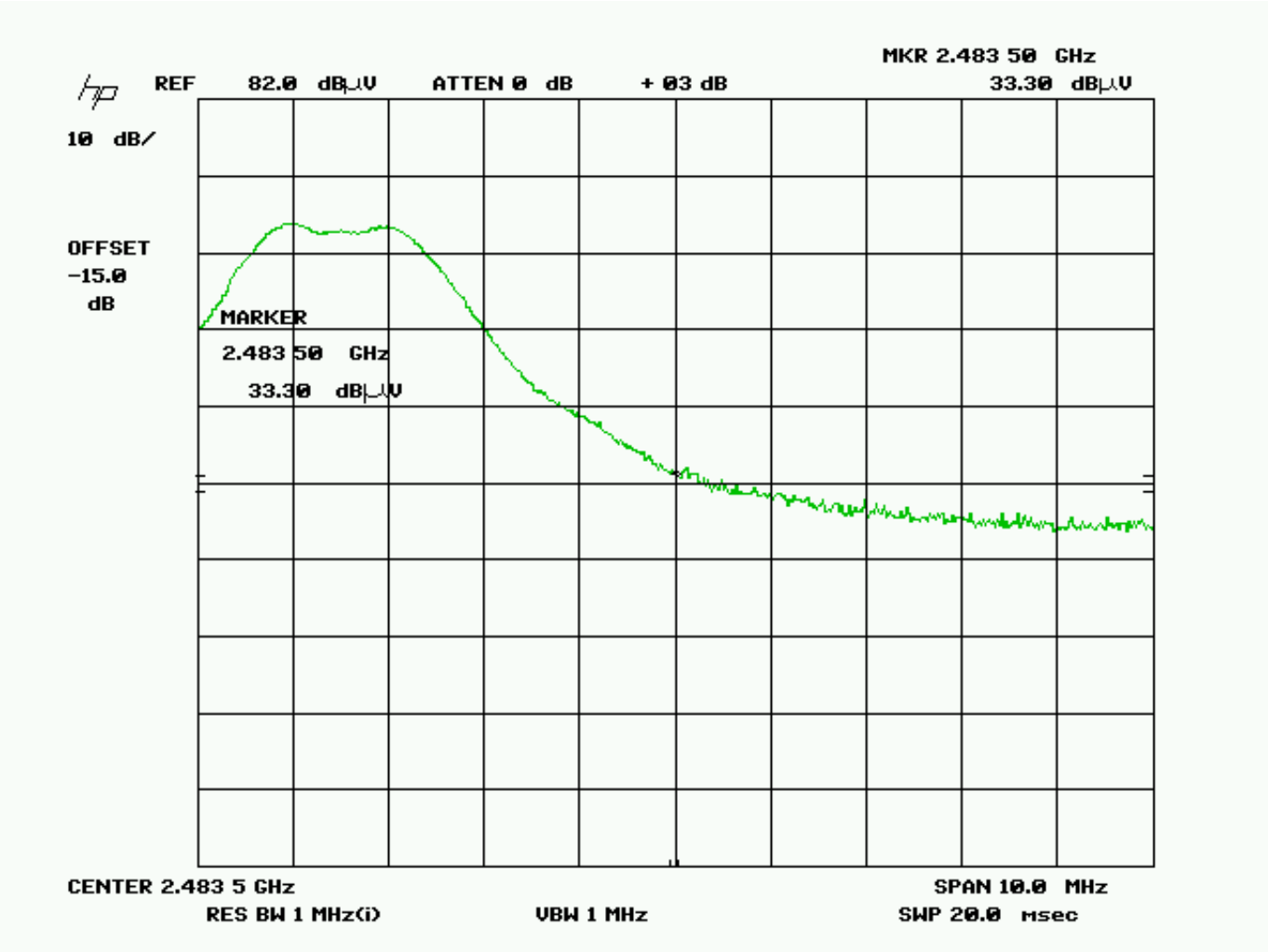
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB
2,475.00	2,483.50	38.8	V	3.24	32.46	11.90	62.60	11.40

Upper Bandedge 2475 MHz Average



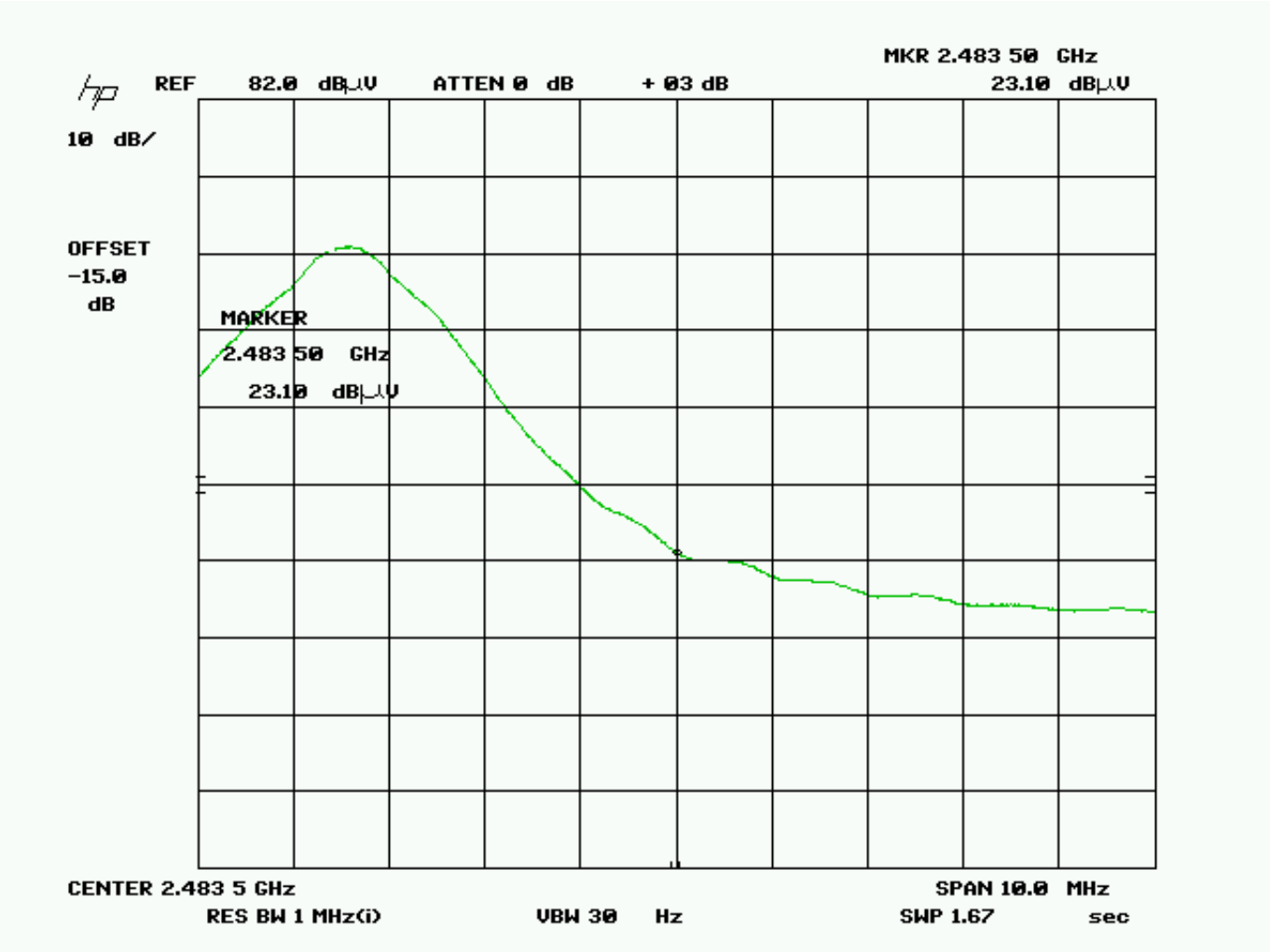
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB
2,475.00	2,483.50	27.1	V	3.24	32.46	11.90	50.90	3.10

Upper Bandedge 2480 MHz Peak



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB
2,480.00	2,483.57	33.7	V	3.24	32.46	11.90	57.50	16.50

Upper Bandedge 2480 MHz Average



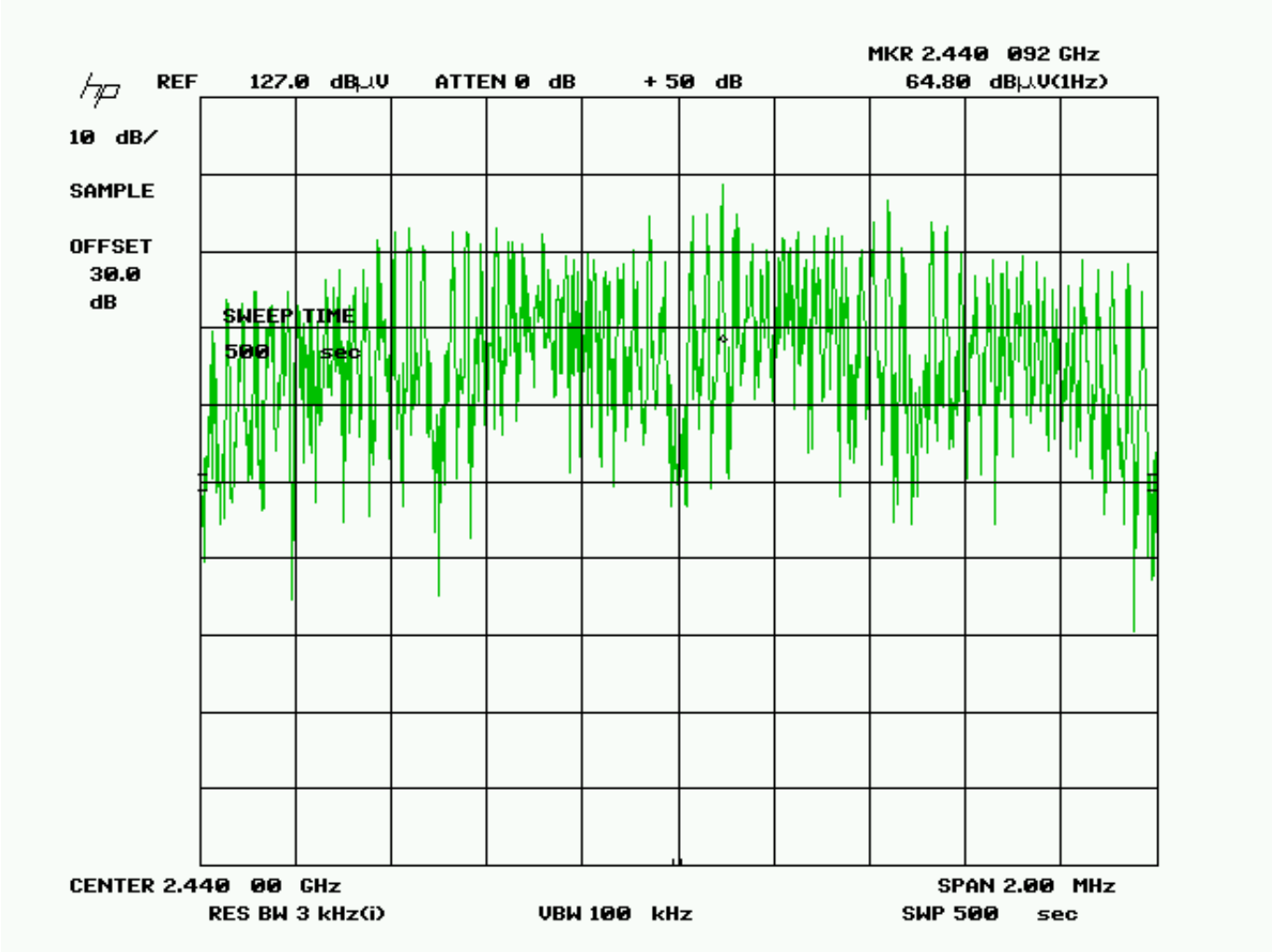
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBuV/m	Margin dB
2,480.00	2,483.50	23.1	V	3.24	32.46	11.90	46.90	7.10

POWER SPECTRAL DENSITY

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

Requirements: The peak level measured must be less than +8.0 dBm.

Test Data: SEE THE FOLLOWING PLOT



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

64.8 dBuV
+35 dB CF for 1 Hz to 3 kHz RBW
99.8 dBuV
-7.2 dBm

RADIATED EMISSIONS TEST SETUP PHOTO