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MEMBER ACIL

FCC/IC Test Report
on

Polhemus G4 RF Transceiver/USB Dongle
Model: G4

Customer Name:	Alken, Inc. dba Polhemus
Customer P.O:	10320
Date of Report:	December 23, 2010
Test Report No:	R-5306N-1, Rev. A
Test Start Date:	May 4, 2010
Test Finish Date:	December 23, 2010
Test Technician:	M. Seamans
Laboratory Supervisor:	T. Hannemann
Branch Manager:	S. Wentworth
Report Prepared By:	J. Ramsey

Technical Information

Applicant		Manufacturer	
Name:	Alken, Inc. dba Polhemus	Name:	Polhemus
Address:	40 Hercules Drive	Address:	40 Hercules Drive
City, State, Zip:	Colchester, VT 05445	City, State, Zip:	Colchester, VT 05445
Date of Report:	November 30, 2010		

Test Specification:

FCC Rules and Regulations Part 15, Subpart C, Para. 15.247

Radio Standards Specification, RSS-210, Issue 7, June, 2007 and RSS-GEN, Issue 2, June 2007

Test Procedure: ANSI C63.4:2003, FCC Public Notice DA 00-705

Test Sample Description

TEST SAMPLE: G4 RF Transceiver/USB Dongle

BRANDNAME: Polhemus

MODEL(s): G4

FCC ID: YJUG4USB01

IC: 9183A-G4USB01

TYPE: 2.4 GHz Frequency Hopping Spread Spectrum Transmitter

POWER REQUIREMENTS: 5 VDC via USB Port of host PC

FREQUENCY BAND OF OPERATION: 2400 to 2483.5 MHz

ANTENNA: Integral PCB Antenna with Gain of 0 dBi

Support Equipment

Description	Manufacturer	Model Number	Serial Number
Netbook PC	Acer	NAV50	LUSALOD2760080E9FD1601

Tests Required/Performed

FCC Part 15, Subpart C	Industry Canada RSS-210 Issue 7, June 2007	Test Method	Test Results
15.247(a)(1)	A8.1(b)	Channel Separation	Complied
15.247(a)(1)	A8.1(a)	20 dB Bandwidth	Complied
15.247(a)(1) (iii)	A8.1 (d)	Number of Hopping Channels and Time of Occupancy	Complied
15.247(b)(1)	A8.4 (2)	Peak Conducted Output Power	Complied
15.247 (d)	A8.5	Out of Band Conducted Spurious/Band Edge Emissions	Complied
15.247(d)	A8.5	Restricted Band/Band Edge Transmitter Radiated Emissions	Complied
15.207	RSS GEN 7.2.2	Conducted Emissions, 150 kHz to 30 MHz	Complied
N/A	RSS GEN 7.2.3/4.10	Receiver Spurious Emissions	Complied

General Test Requirements

1. The measurement procedures of ANSI C63.4:2003 were utilized as specified in FCC Part 15, Subpart C, Section 15.31(a)(3) and IC RSS-GEN Section 4.1.
2. All radiated emissions measurements were performed on an Open Area Test Site (OATS), listed with the FCC and IC, in accordance with FCC Section 15.31(d) and IC Section 4.2.
3. All measurements were performed at the specified 3 meter test distance as required by FCC Section 15.31(f) and IC Section 7.25.
4. The EUT was rotated throughout 360 degrees for all radiated emissions measurements as specified in FCC Section 15.31(f)(5) and IC Section 4.3(h).
5. All readily accessible EUT controls were adjusted in such a manner as to maximize the level of emissions in accordance with FCC Section 15.31(g) and IC Section 4.3(h).
6. Appropriate accessories were attached to all EUT ports during the performance of radiated emissions measurements as required by FCC Section 15.31(i) and IC Section 4.3(d).
7. The EUT operated over the frequency range of 2400 MHz to 2483.5 MHz. Testing was performed with the device operating at 3 frequencies, 1 at the top, 1 in the middle and 1 at the bottom of the range of operation in accordance with FCC Section 15.31(m) and IC Section 4.3(f)(g).
8. The frequency spectrum was investigated from the lowest frequency generated in the device up to the 10^{th} harmonic of the highest fundamental frequency in accordance with FCC Section 15.33(a)(1) and IC Section 4.9.

Certification and Signatures

We certify that this report is a true representation of the results obtained from the tests of the equipment stated. We further certify that the measurements shown in this report were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.

Scott Wentworth
Branch Manager
NVLAP Approved Signatory

Todd Hannemann
Laboratory Supervisor
NARTE Certified: ATL-0255-T

Non-Warranty Provision
The testing services have been performed, findings obtained and reports prepared in accordance with generally accepted laboratory principles and practices. This warranty is in lieu of all others, either expressed or implied.

Non-Endorsement
This test report contains only findings and results arrived at after employing the specific test procedures and standards listed herein. It is not intended to constitute a recommendation, endorsement or certification of the product or material tested. This test report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

Revision History

Revisions to this document are listed below; the latest revised document supersedes all previous issues of this document.

Revision	Date	Pages Affected
-	November 29, 2010	Original Release
A	December 23, 2010	All

Requirements and Test Results

Requirement:
FCC Section 15.247 (a)(1)
Channel Separation and 20 dB Bandwidth
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

IC Section A8.1(b)
Frequency Hopping Systems
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

- Results:
  The maximum 20 dB bandwidth of the hopping channel was 1.2 MHz. The carrier frequencies were separated by 4.005 MHz which exceeds the 20 dB bandwidth and complies with the requirements specified above.

Requirements and Test Results (con't)

FCC Section 15.247 (a)(1)(iii)/IC RSS-210, Section A8.1(d)
Number of Channels and Occupancy Time

Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

- Results

  The frequency hopping system uses 20 Channels. The average time of occupancy did not exceed 0.4 seconds in an 8 second period which meets the above requirements.

Requirements and Test Results (con't)

FCC Section 15.247 (b)(1) and (4)
Peak Conducted Output Power
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(4) The conducted output power limit specified in Paragraph (b) of Section 15.247 is based on the use of antenna with directional gains that do not exceed 6 dBi. Except as shown in Paragraph (c) of Section 15.247, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in Paragraph (b)(1), (b)(2) and (b)(3) of Section 15.247, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

IC Section A8.4(2)
Transmitter Output Power and e.i.r.p. Requirements
For frequency hopping systems operating in the band 2400-2483.5 MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A8.4(5) of RSS-210, the e.i.r.p. shall not exceed 4 W.

- Results
  The maximum peak conducted output power of the frequency hopping system was measured to be -0.44 dBm (0.9 milliwatts) which meets the 0.125 W conducted power limit. The frequency hopping system utilizes a transmitting antenna with a directional gain of 0 dBi. Therefore the frequency hopping system also meets the specifed e.i.r.p requirements.

Requirements and Test Results (con't)

FCC Section 15.247 (d)
Spurious Emissions
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Paragraph (b)(3) of Section 15.247, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

IC Section A8.5
Out-of-Band Emissions
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Section A8.4(4) of RSS-210, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 of RSS-210 is not required.

- Results
  The antenna conducted spurious emissions complied with the above requirement.

Requirements and Test Results (con't)

FCC Section 15.247 (d)
Field Strength of Transmitter Spurious Radiation

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Section 15.209(a)
Radiated Emission Limits, General Requirements
Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 3.

IC RSS-210, 2.9(b)
General Field Strength Limits
Table 3 shows the general field strength limits of unwanted emissions, where applicable, for transmitters operating in accordance with the provisions specified in this RSS.

Table 1 - Radiated Emission Limits

Frequency of Emission (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 to 88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960	500	3

- Results:
  No radiated harmonic or spurious emissions were observed in any restricted band of operation and radiated emissions from the EUT complied with the limits specified in Table 1. Compliance at the band edges was verified.

Requirements and Test Results (con't)

Field Strength Measurement & Calculation:

The following spectrum analyzer settings were used:

RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f ≤ 1 GHz

VBW ≥ RBW

Detector Function = Peak

Trace = Max Hold

Sweep = Auto

The maximized peak field strength of the emission was calculated as follows.

$P_C = M_R + C_F$

Where:
P_C = Corrected Peak Reading in dBµV/m
M_R = Uncorrected Meter Reading in dBµV
C_F = Correction Factor in dB (Pre-Amp + Antenna Factor + Cable Loss)

The average field strength of the emission was obtained as follows:

All instrument settings were as specified above but with the VBW reduced to 10 Hz. The corrected peak reading was then compared to the average limit specified in 15.209. If the dwell time per channel of the hopping frequency was less than 100 msec, then the reading obtained with the 10 Hz VBW was further adjusted by a duty cycle correction factor derived from 20log (dwell time/100 msec).

$A_F = P_C - D_F$

Where:

A_F = Average Field Strength in dBµV/m
P_C= Corrected Peak Reading in dBµV/m
D_F = Duty Cycle Factor in dB (if applicable)

Requirements and Test Results (con't)

Requirement:
FCC Section 15.207(a) - Conducted Limits
For an intentional radiator the radio frequency voltage that is conducted back onto the power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits shown in Table 2, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of the paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

IC RSS-GEN, Section 7.2.2:
Transmitter and Receiver AC Power Lines Conducted Emission Limits
The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

For an intentional radiator that is ac powered, the radio frequency voltage that is conducted back onto the power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network.

Table 2 - Conducted Emission Limits

Frequency of Emission (MHz)	**Conducted Limit (dBµV)**	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50
*Decreases with the logarithm of the frequency		

- Results:
  Withy the EUT operating and plugged into the USB port of the host computer, the conducted emissions on the AC input to the host computer were measured and did not exceed the limits specified in Table 2.

Requirements and Test Results (con't)

RSS-Gen , 4.10/7.2.3
Receiver Spurious Emissions

Receiver Spurious Radiated Emission Limits, General Requirements
The radiated spurious emissions from a receiver shall not exceed the field strength levels specified in Table 3. The receiver shall be operated in the normal receive mode near the mid point of the band.

RSS-Gen, 6.0(a)
General Field Strength Limits

Table 3 shows the general field strength limits of spurious emissions for receivers,

Table 3 - Radiated Emission Limits

Frequency of Emission (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 to 88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960	500	3

- Results:
  No receiver spurious emissions were observed and EUT complied with the limits specified in Table 3.

Requirements and Test Results (con't)

15.247 (i) RF Exposure

Spread Spectrum Transmitters operating under 15.247 are categorically excluded from routine environmental evaluation for demonstrating RF exposure compliance with respect to MPE or SAR limits however per 15.247(i) must be operated in a manner that ensures the public is not exposed to RF energy levels in access of the commission's guidelines. The user/installation manual contains the proper cautionary statements and specifies that the device be installed and operated so that a minimum separation distance of 20m will maintained Based on the transmitter power and maximum antenna gain (see calculation below) the 20cm separation distance exceeds the calculated distance for acceptable MPE power density levels to meet both the Occupational/Controlled Exposure and the General Population/Uncontrolled Exposure requirements of 1.1310. The calculation below uses the more stringent General Population MPE Limits.

$$S = \frac{PG}{4Dsq}$$

D = Minimum Separation Distance in cm

S = Max allowed Power Density in mW/cmsq

Per 1.1310 For Frequency of 2400MHz = 1mW/cmsq

Power = Max Power Input to Antenna = 0.9mW

Gain = Max Power Gain of Antenna = 0dBi = 1 numeric

$$1\text{mW/cmsq} = \frac{0.9 \times 1}{4\ (3.14) \times Dsq} = \frac{0.9000000}{12.56 \times Dsq}$$

$$Dsq = \frac{0.9}{12.56 \times 1} = 0.0717$$

D = sq. root 0.0717 = 0.268cm

RSS 102 RF Exposure

Per RSS-102, Section 2.5 transmitters operating in the 2.2 GHz to 3GHz range are exempt from routine SAR and RF Exposure evaluation provided that the output power is less than or equal to 20 mW for general public use and 100 mW for controlled use and the maximum e.i.r.p is less than or equal to 5 W. The EUT operates above 1.5GHz with a maximum ouput power less than 20 mW and a maximum e.i.r.p. of less than 5W.

Equipment List

FCC Section 15.247(a)(1) / IC Section A8.1(b)
Channel Separation

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
3130	NARDA	20DB ATTENUATOR	DC - 18 GHz	768-20	1/11/2010	1/11/2011
4895	AGILENT / HP	SPECTRUM ANALYZER	9kHz – 22GHz	8593EM	12/29/2009	12/29/2010

FCC Section 15.247(a)(1) / IC Section A8.1(b)
20 dB Bandwidth

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
3130	NARDA	20DB ATTENUATOR	DC - 18 GHz	768-20	1/11/2010	1/11/2011
4895	AGILENT / HP	SPECTRUM ANALYZER	9kHz – 22GHz	8593EM	12/29/2009	12/29/2010

FCC Section 15.247 (a)(1)(iii) / IC Section A8.1(d)
Number of Channels and Occupancy Time

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
3130	NARDA	20DB ATTENUATOR	DC - 18 GHz	768-20	1/11/2010	1/11/2011
4895	AGILENT / HP	SPECTRUM ANALYZER	9kHz – 22GHz	8593EM	12/29/2009	12/29/2010

FCC Section 15.247 (a)(1) / IC Section A8.4(2)
Peak Conducted Output Power

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
3130	NARDA	20DB ATTENUATOR	DC - 18 GHz	768-20	1/11/2010	1/11/2011
4895	AGILENT / HP	SPECTRUM ANALYZER	9kHz – 22GHz	8593EM	12/29/2009	12/29/2010

FCC Section 15.207 / RSS GEN 7.2.2
Conducted Emissions, 150 kHz to 30 MHz

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
4027	SOLAR ELECTRONICS	LINE IMPEDANCE STABILIZATION NETWORK	10 kHz - 30 MHz	9252-50-R-24BNC	1/14/2010	1/14/2011
5136	NARDA	10DB ATTENUATOR	DC - 12.4 GHz	757C-10	8/18/2009	8/18/2010
R425B	AGILENT / HP	SPECTRUM ANALYZER	100 Hz - 26.5 GHz	E7405A;A	5/11/2009	6/11/2010

FCC Section 15.247 (d)/ IC Section A8.5

Out of Band / Band Edge Conducted Spurious Emissions

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
3130	NARDA	20DB ATTENUATOR	DC - 18 GHz	768-20	1/11/2010	1/11/2011
R425B	AGILENT / HP	SPECTRUM ANALYZER	100 Hz - 26.5 GHz	E7405A;A	5/11/2009	6/11/2010

FCC Section 15.247 (d)*/* RSS GEN 7.2.3

Field Strength of Transmitter Spurious Radiation/Receiver Spurious Emissions

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1034	AGILENT / HP	SIGNAL GENERATOR	10 MHz - 20 GHz	8341B	6/26/2009	6/26/2010
3001	EMPIRE DEVICES	TUNED DIPOLE ANTENNA	200 MHz - 400 MHz	T2	12/3/2007	12/3/2010
3117	BK PRECISION	DC POWER SUPPLY	0-30 Vdc, 3.0 A	1630	Calibrate Before Use	
3430	MCS	HORN ANTENNA	18 GHz - 26.5 GHz	K-5039	1/14/2010	1/14/2011
4003	TENSOR	DOUBLE RIDGE GUIDE	1 - 18 GHz	4015	3/9/2010	3/9/2011
4029	RETLIF	OPEN AREA TEST SITE	3 / 10 Meters	RNH	Inspect Before Use	
4029B	RETLIF	TEST SITE ATTENUATION	3 / 10 Meters	RNH	6/25/2009	6/25/2010
4984A	MICROLAB / FXR	HIGH GAIN HORN	1.0 - 1.7 GHz	L638A	1/14/2010	1/14/2011
4984B	MICROLAB / FXR	HIGH GAIN HORN	1.7 - 2.6 GHz	R638A	1/14/2010	1/14/2011
4984C	MICROLAB / FXR	HIGH GAIN HORN	2.6 - 3.95 GHz	S638A	1/14/2010	1/14/2011
4984D	MICROLAB / FXR	HIGH GAIN HORN	3.95 - 5.85 GHz	H638A	1/14/2010	1/14/2011
4984E	MICROLAB / FXR	HIGH GAIN HORN	5.8 - 8.2 GHz	C638A	1/14/2010	1/14/2011
4984F	MICROLAB / FXR	HIGH GAIN HORN	8.2 - 12.4 GHz	X638A	1/14/2010	1/14/2011
4984G	MICROLAB / FXR	HIGH GAIN HORN	12.4 GHz - 18 GHz	Y638A	1/14/2010	1/14/2011
5072	MITEQ	PRE-AMPLIFIER	18 GHz-40 GHz	JS4-18004000-30	12/11/2009	12/11/2010
530A	MARCONI	SIGNAL GENERATOR	10 kHz - 1.2 GHz	2023	8/19/2009	8/19/2010
8165	EMCO	BICONILOG	26 - 2000 MHz	3142	11/12/2009	11/12/2010
R425B	AGILENT / HP	SPECTRUM ANALYZER	100 Hz - 26.5 GHz	E7405A;A	5/11/2009	6/11/2010

Radiated Band Edge Emissions

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
3258	EMCO	DOUBLE RIDGE GUIDE	1 - 18 GHz	3115	1/14/2010	1/14/2011
4029	RETLIF	OPEN AREA TEST SITE	3 / 10 Meters	RNH	8/21/2009	8/21/2012
4029B	RETLIF	TEST SITE ATTENUATION	3 / 10 Meters	RNH	6/25/2009	12/25/2010
5070	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 40 GHz	ESIB40	1/14/2009	3/14/2011
5070F	MICRO-COAX	COAXIAL CABLE	10 kHz - 18 GHz	UFB311A2-0720-50U50U	1/5/2010	1/5/2011

FCC Section 15.247(a)(1) / IC Section A8.1(b)
Channel Separation
Test Photographs

Test Setup

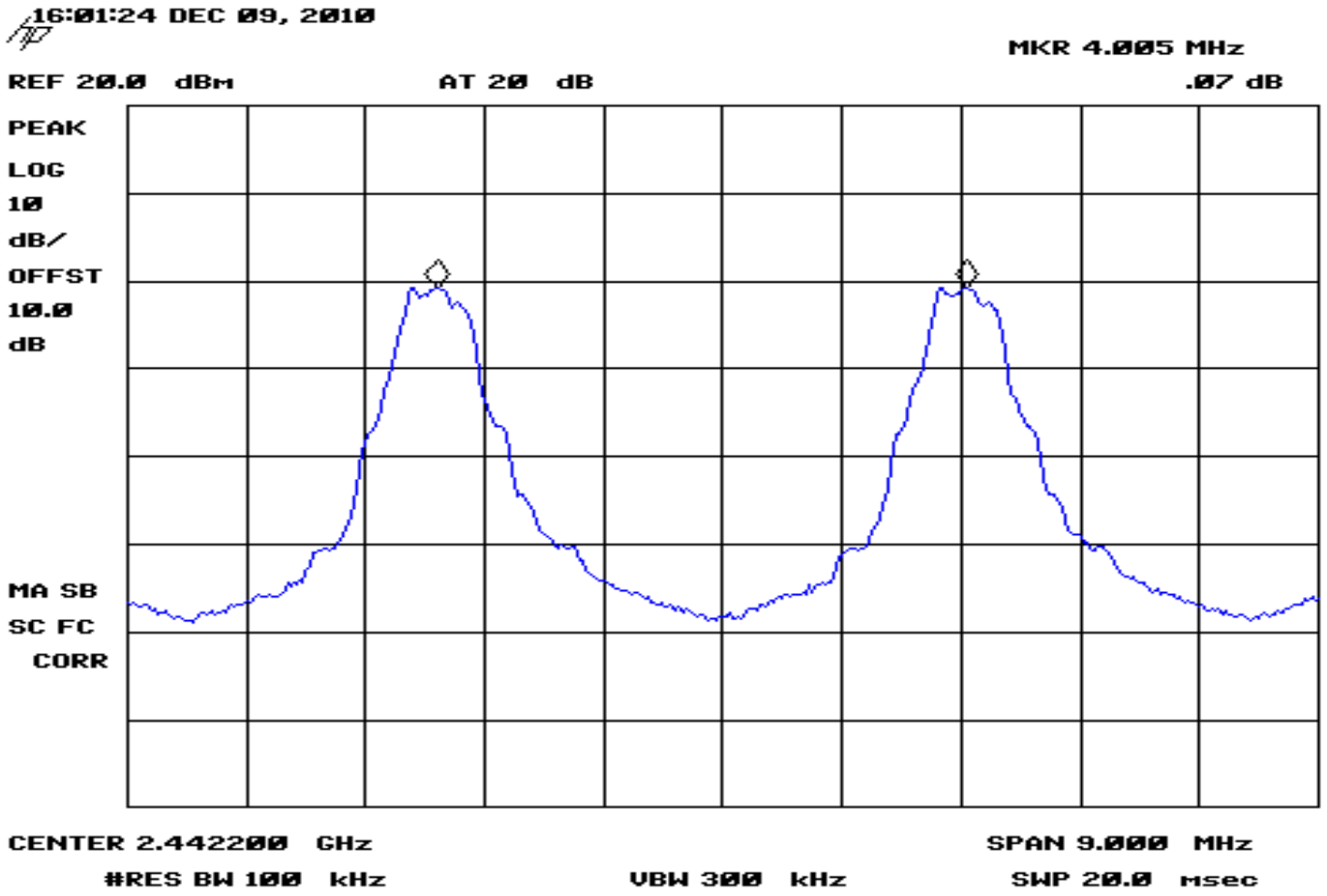
Test Setup

FCC Section 15.247(a)(1) / IC Section A8.1(b)
Channel Separation
Test Data

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Carrier Frequency Separation**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(a)(1)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Frequency Tested: Frequency Hopping 2402.0-2483.5 MHz; Frequency Separation: 4.0050 MHz				



FCC Section 15.247(a)(1) / IC Section A8.1(a)
20 dB Bandwidth
Test Photographs

Test Setup

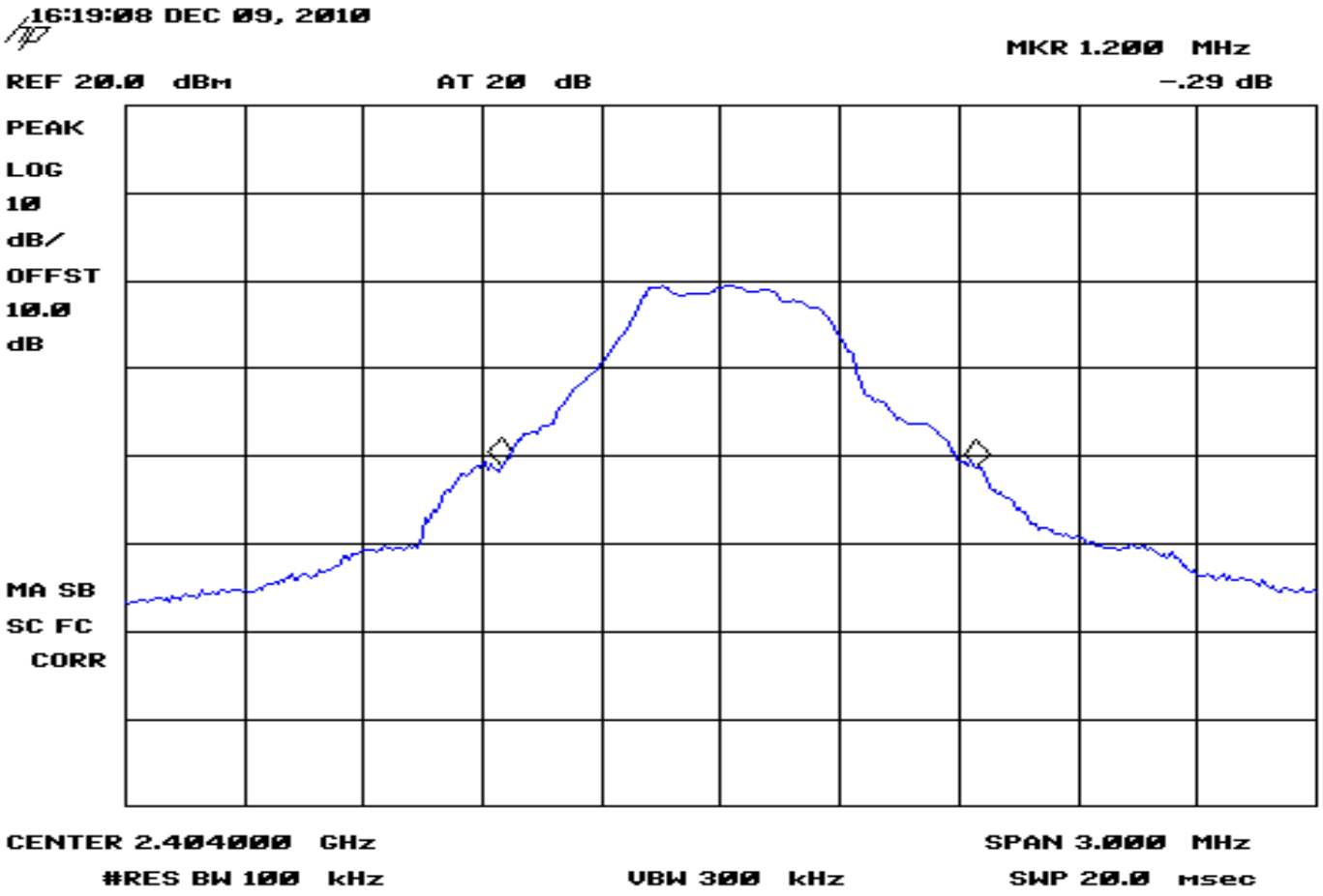
Test Setup

FCC Section 15.247(a)(1) / IC Section A8.1(a)
20 dB Bandwidth
Test Data

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

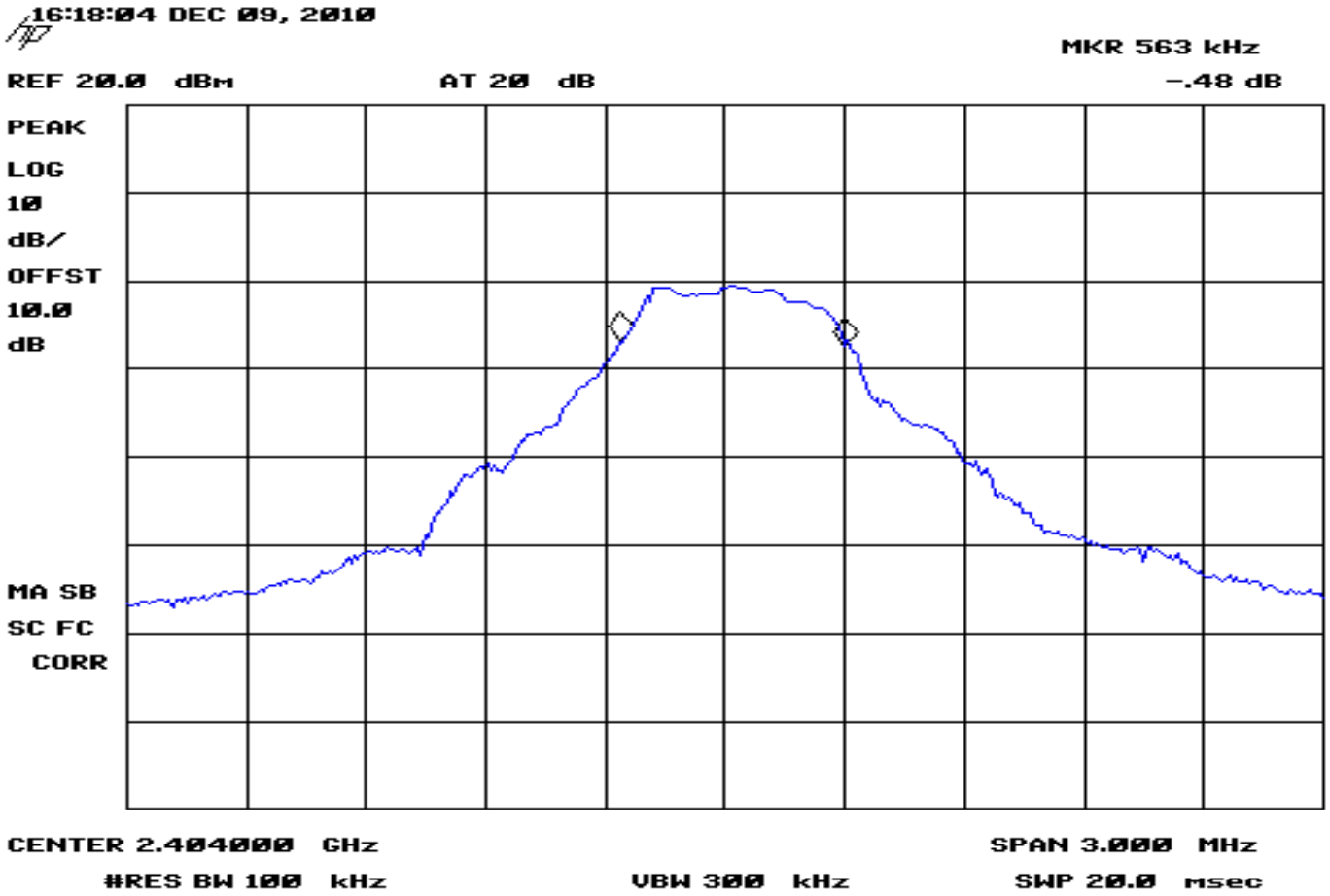
Test Method:	**20 dB Bandwidth**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(a)(1)(i)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Frequency Tested: 2.40400 GHz 20dB Bandwidth: 1.20 MHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

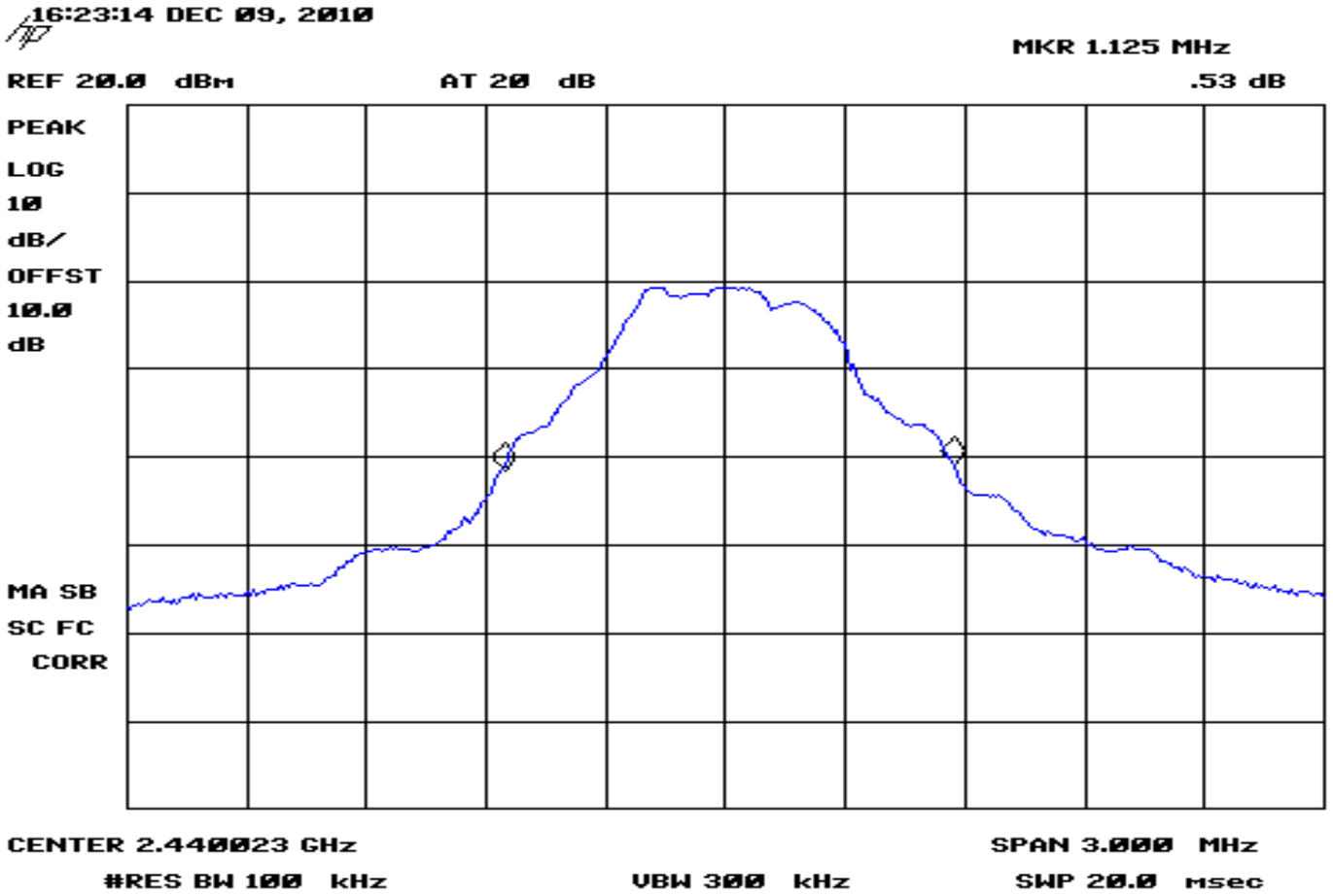
Test Method:	**6 dB Bandwidth**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(a)(1)(i)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Frequency Tested: 2.40400 GHz 6dB Bandwitdh: 563 kHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

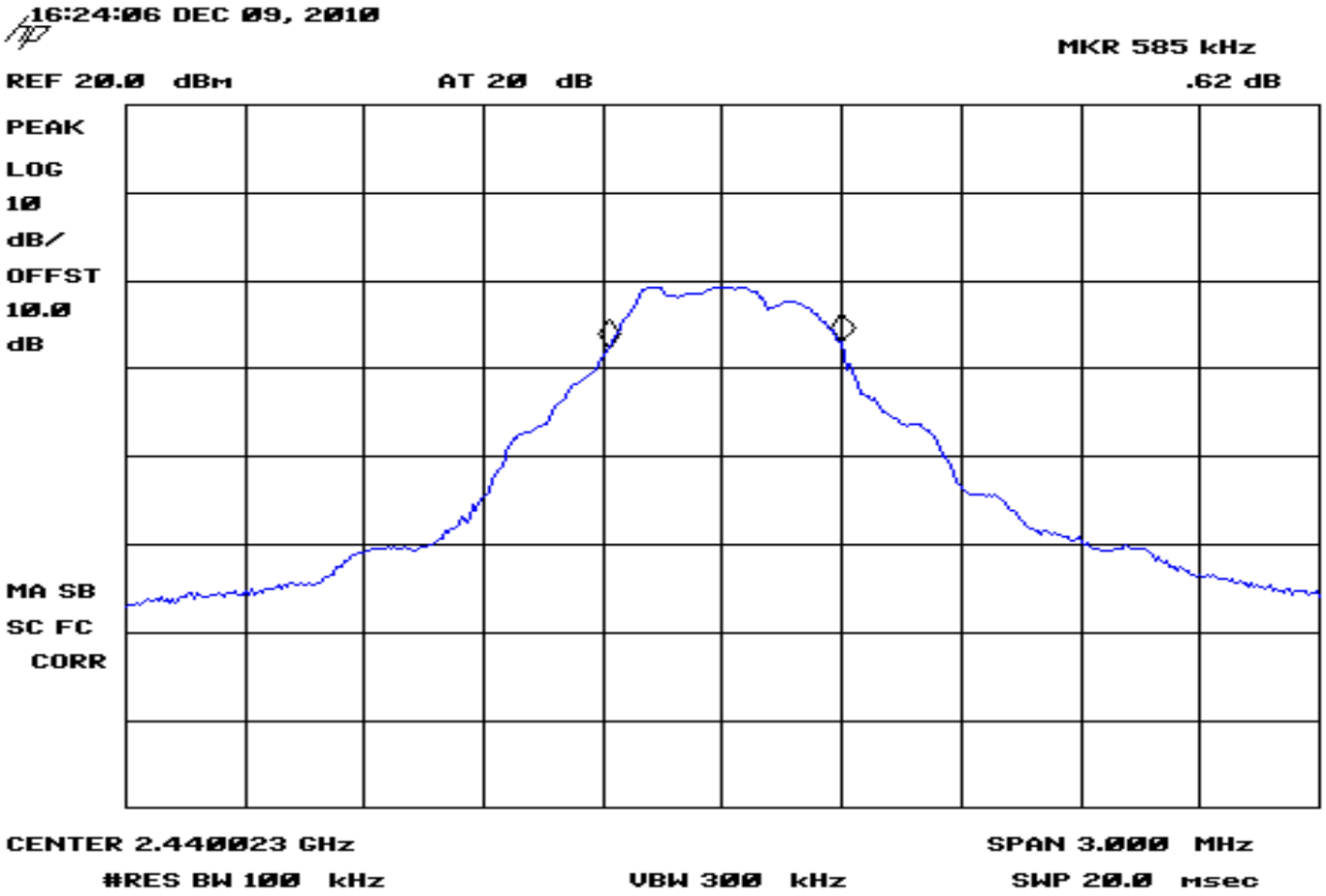
Test Method:	**6 dB Bandwidth**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(a)(1)(i)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Frequency Tested: 2.440023 GHz 20dB Bandwidth: 1.125 MHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

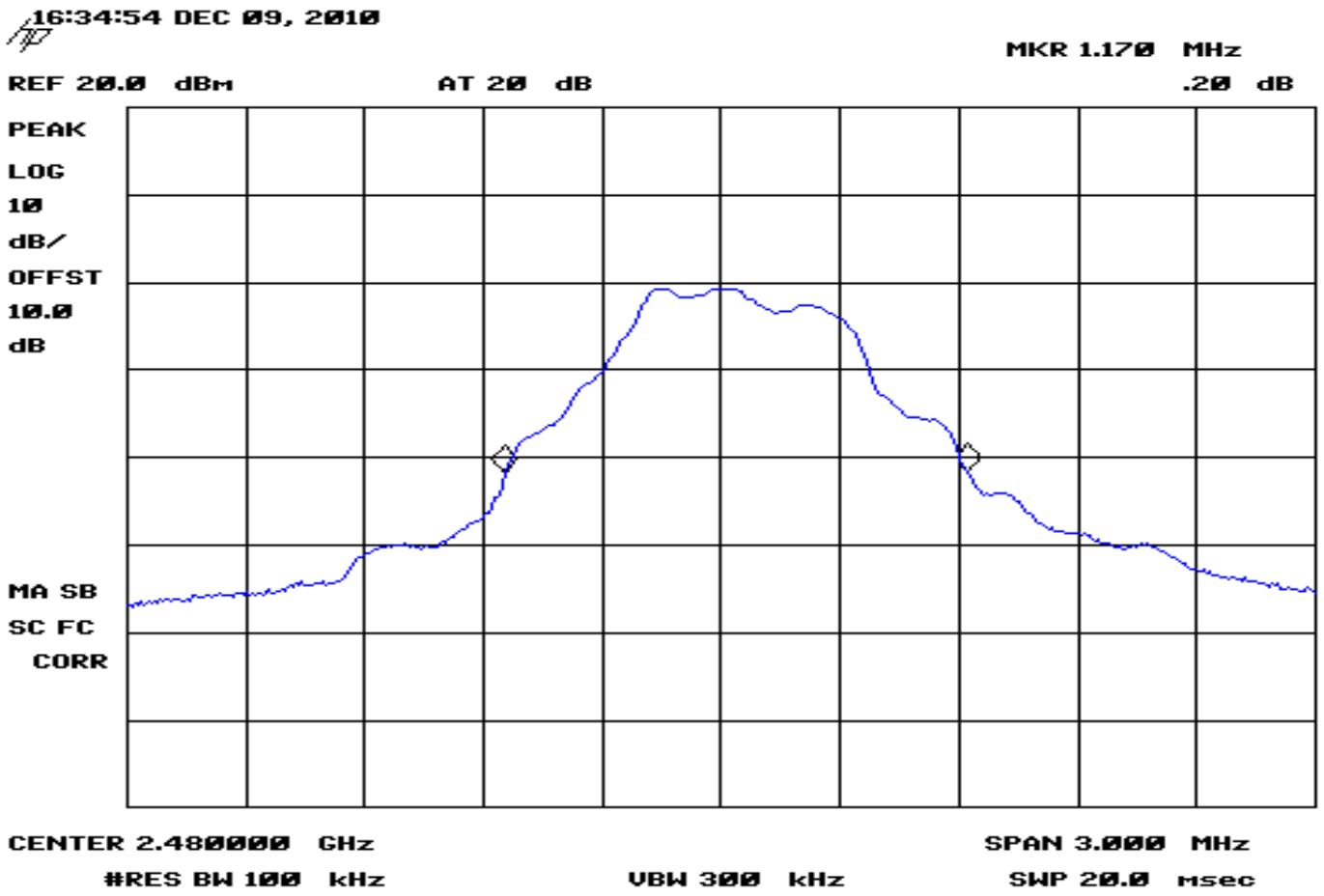
Test Method:	**6 dB Bandwidth**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(a)(1)(i)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Frequency Tested: 2.440023 GHz 6dB Bandwidth: 585 kHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

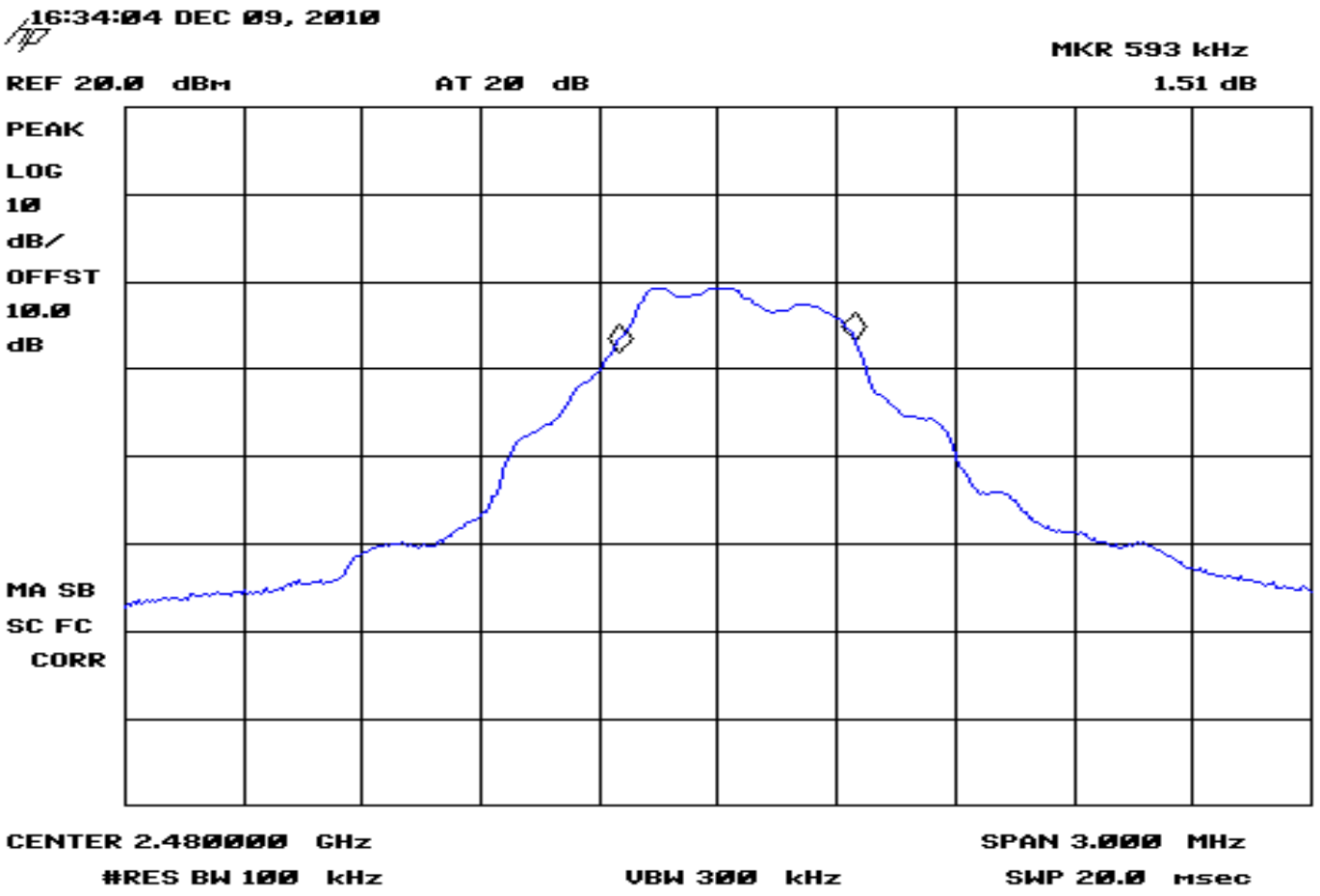
Test Method:	**6 dB Bandwidth**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(a)(1)(i)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Frequency Tested: 2.48000 GHz 20dB Bandwidth: 1.17 MHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**6 dB Bandwidth**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(a)(1)(i)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Frequency Tested: 2.48000 GHz 6dB Bandwidth: 593 kHz				



FCC Section 15.247 (a)(1))(iii) / IC Section A8.1(d)
Number of Channels and Occupancy Time
Test Photographs

Test Setup

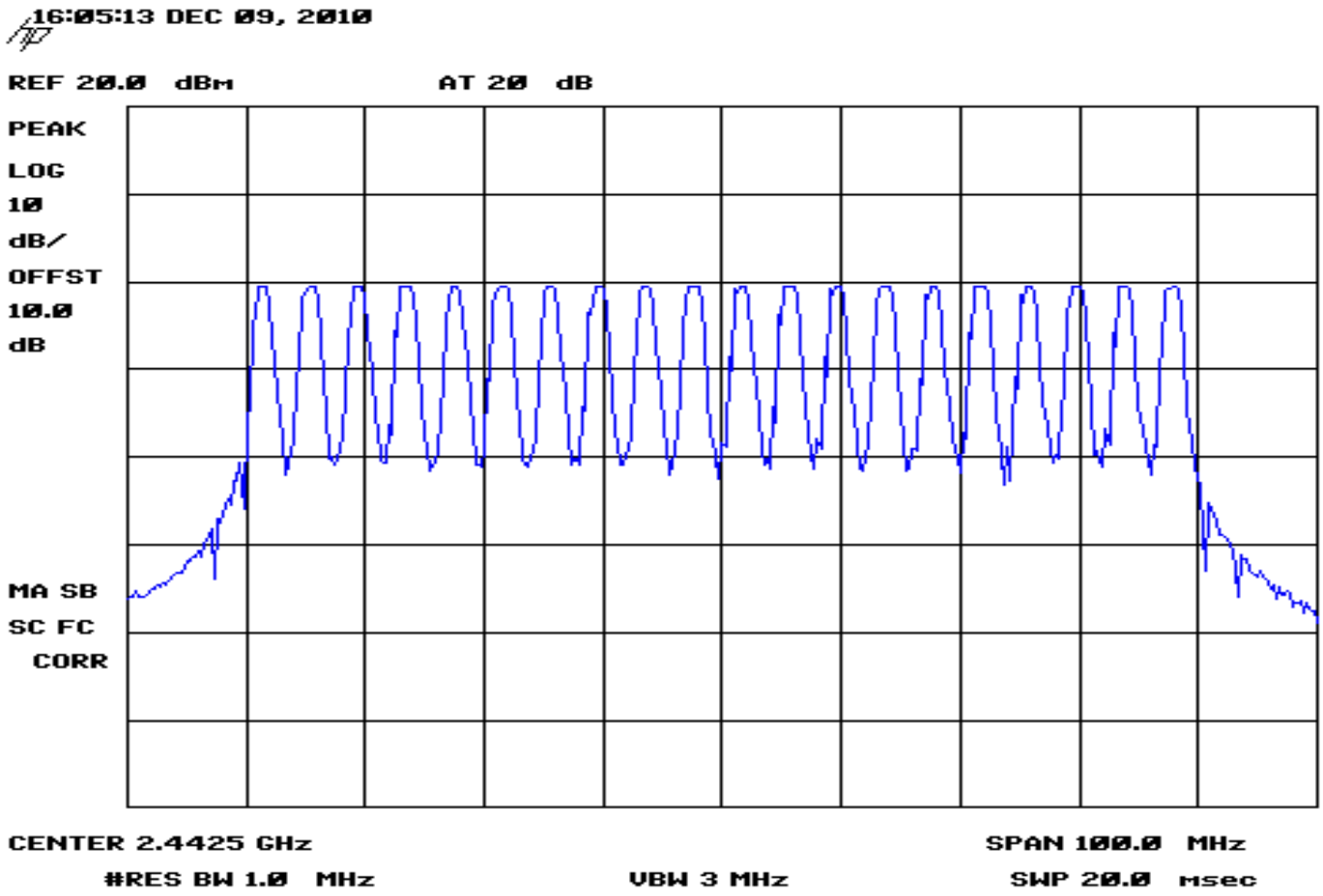
Test Setup

FCC Section 15.247 (a)(1))(iii) / IC Section A8.1(d)
Number of Channels and Occupancy Time
Test Data

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

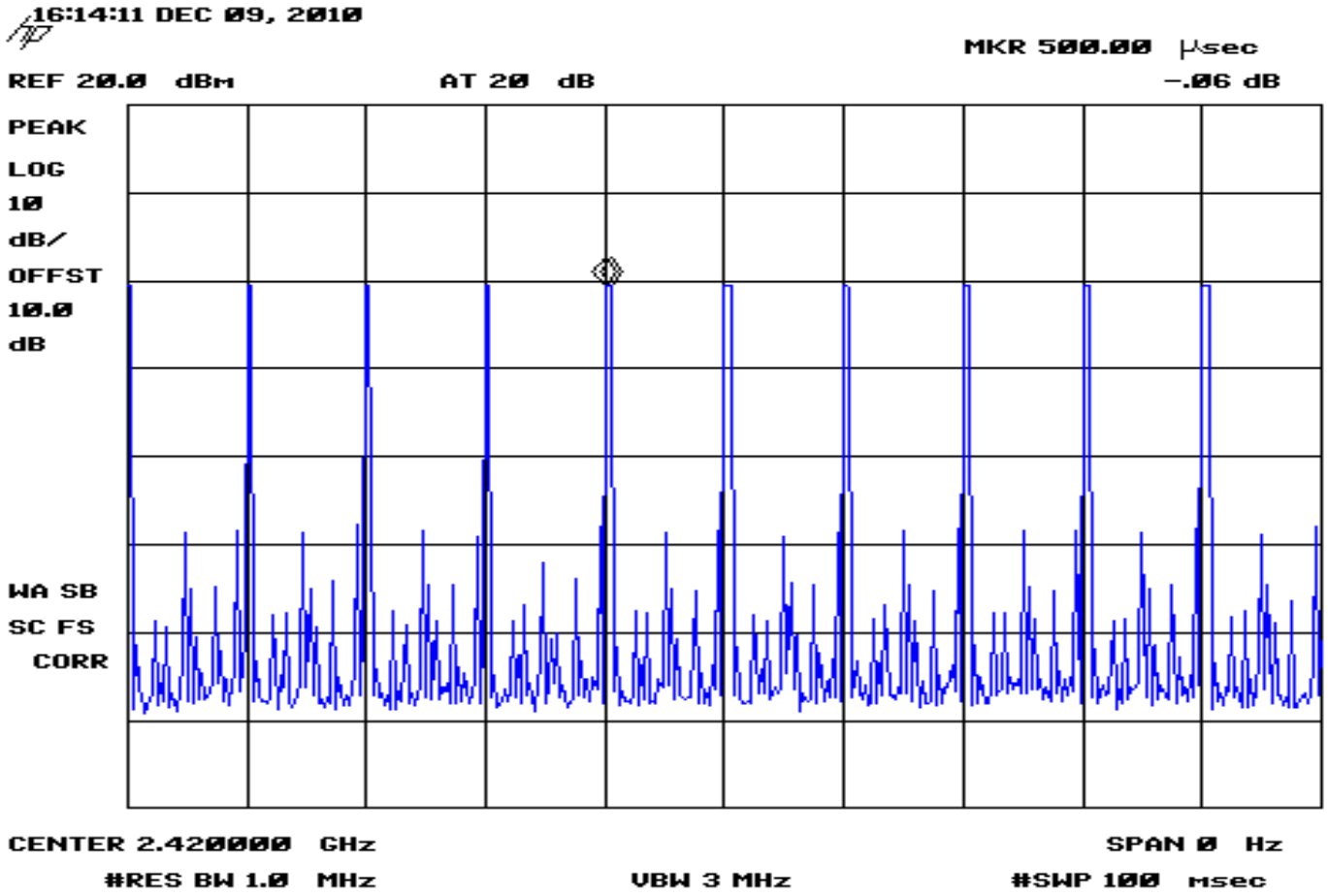
Test Method:	**Number of Hopping Frequencies**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(a)(1)(i)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Frequency Tested: Frequency Hopping 2402.0-2483.5 MHz, Number of Hopping Frequencies: 20				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Time of Occupancy(Dwell Time)**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(a)(1)(i)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Frequency Hopping: Dwell Time in 8 Second Period; 400 ms				



FCC Section 15.247 (b)(1) / IC Section A8.4(2)
Peak Conducted Output Power
Test Photographs

Test Setup

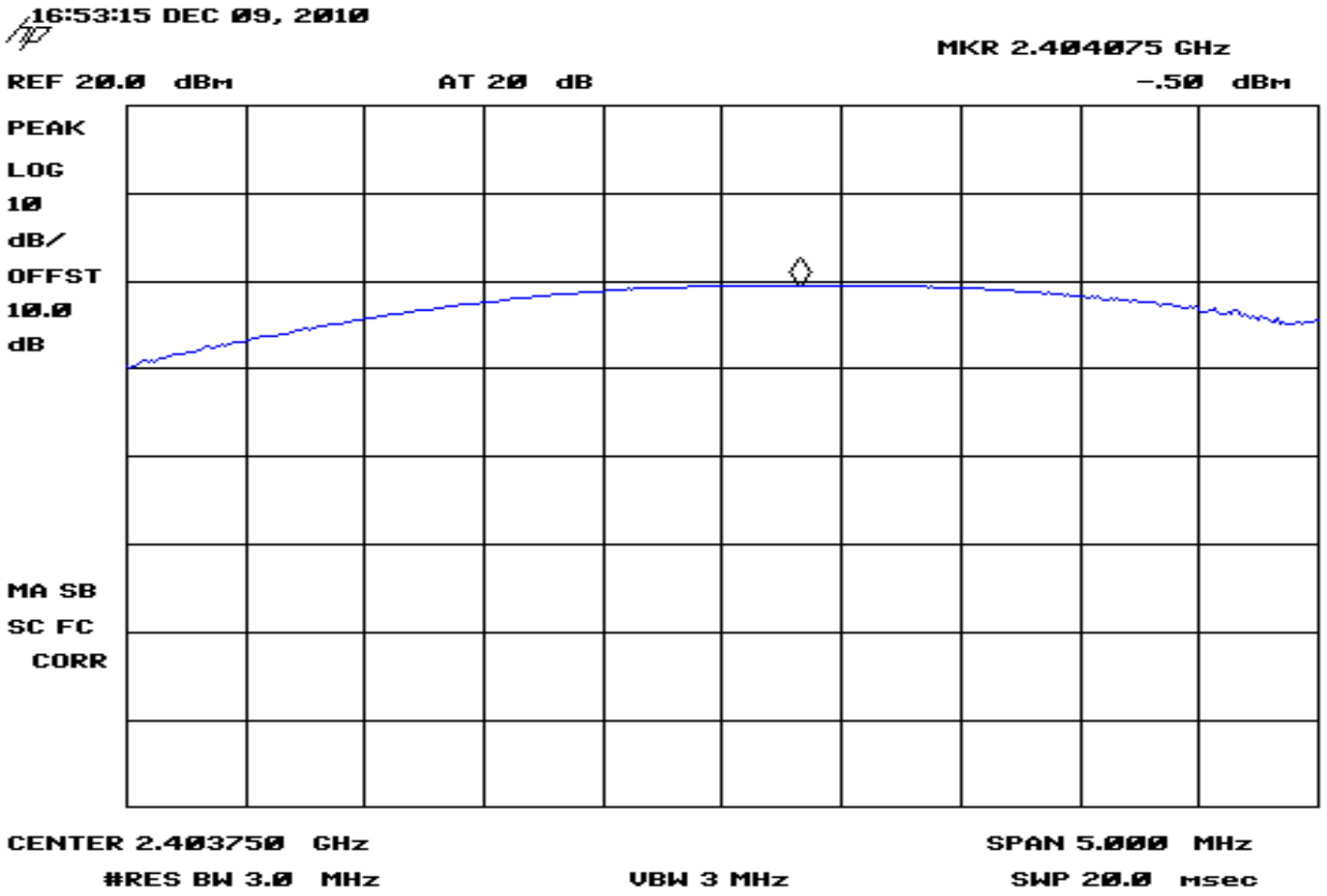
Test Setup

FCC Section 15.247 (b)(1) / IC Section A8.4(2)
Peak Conducted Output Power
Test Data

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

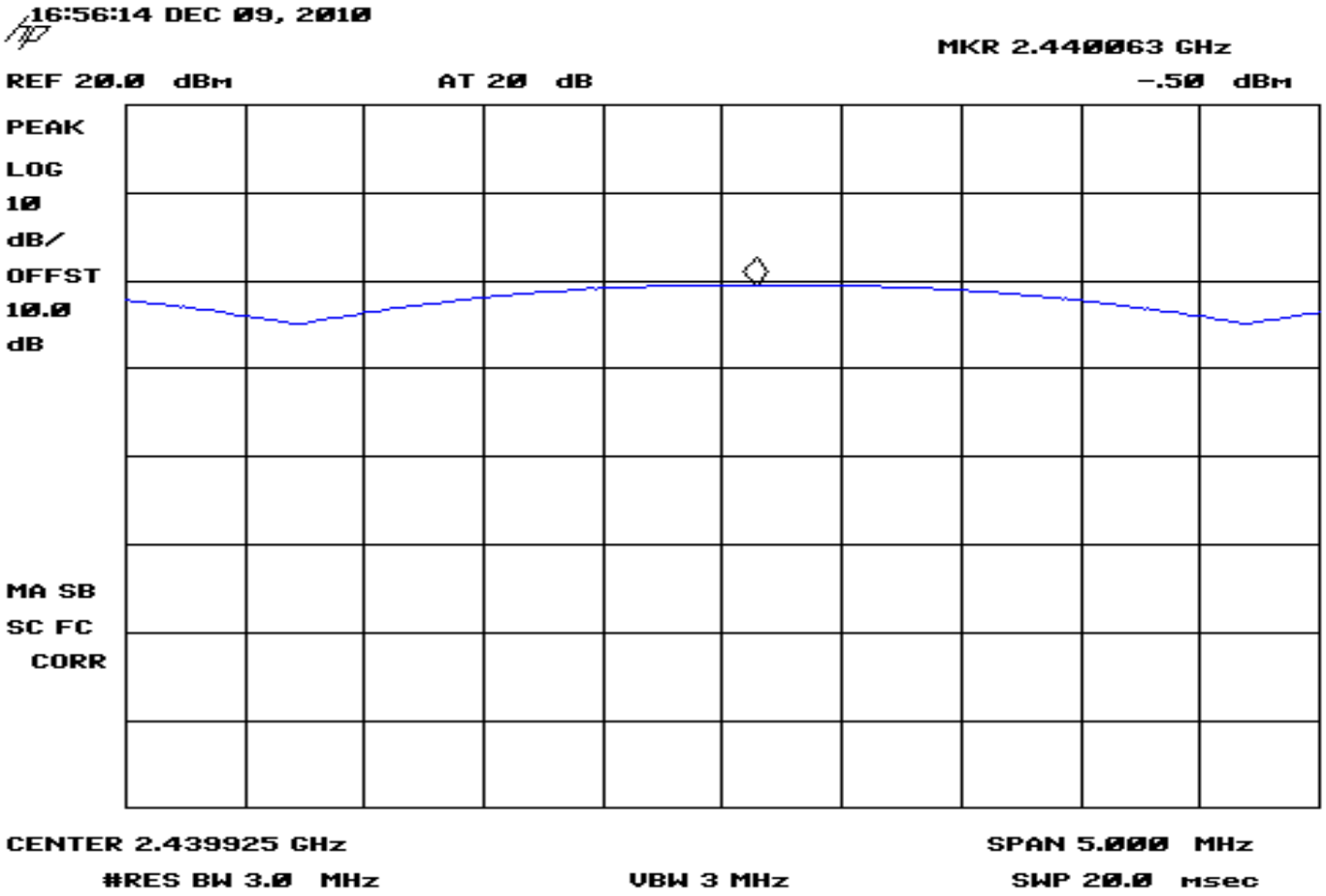
Test Method:	**Peak Power Output**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(b)(1)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Transmitting at 2.403750 GHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

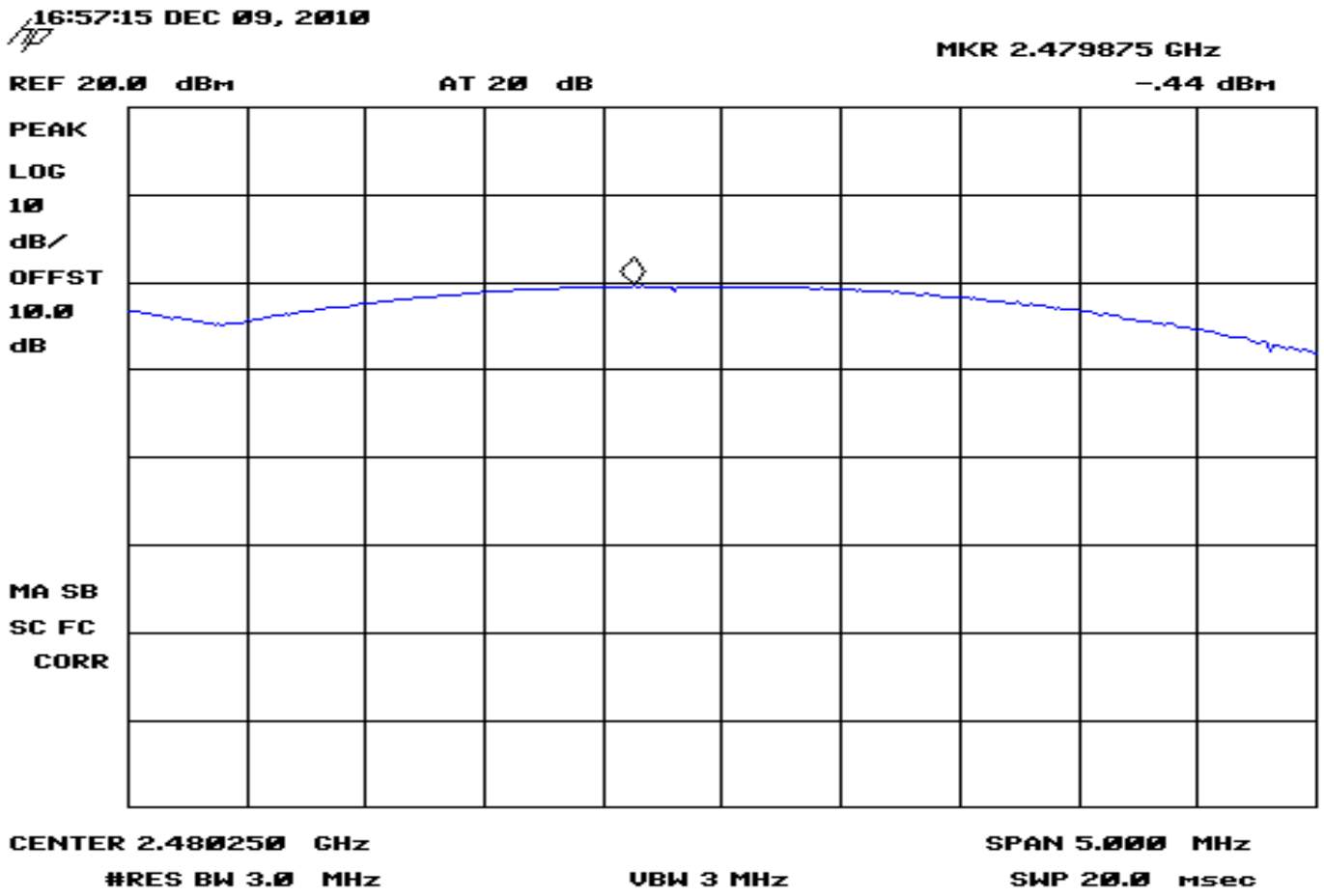
Test Method:	**Peak Power Output**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(b)(1)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Transmitting at 2.439925 GHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Peak Power Output**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(b)(1)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	Transmitting at 2.480250 GHz				



FCC Section 15.247 (d)/ IC Section A8.5
Out of Band Spurious Emissions
Test Photographs

Test Setup

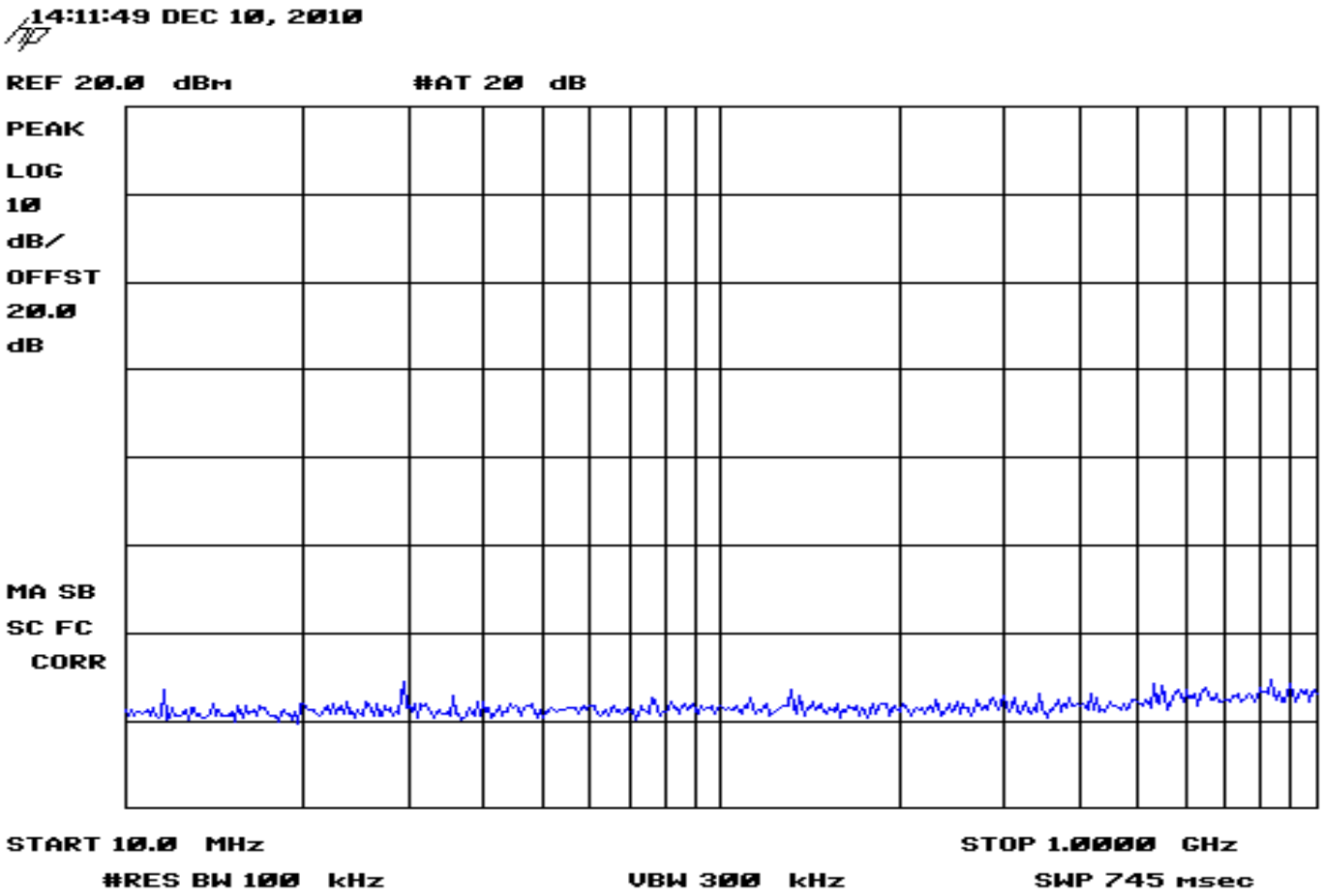
Test Setup

FCC Section 15.247 (d)/ IC Section A8.5
Out of Band Spurious Emissions
Test Data

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

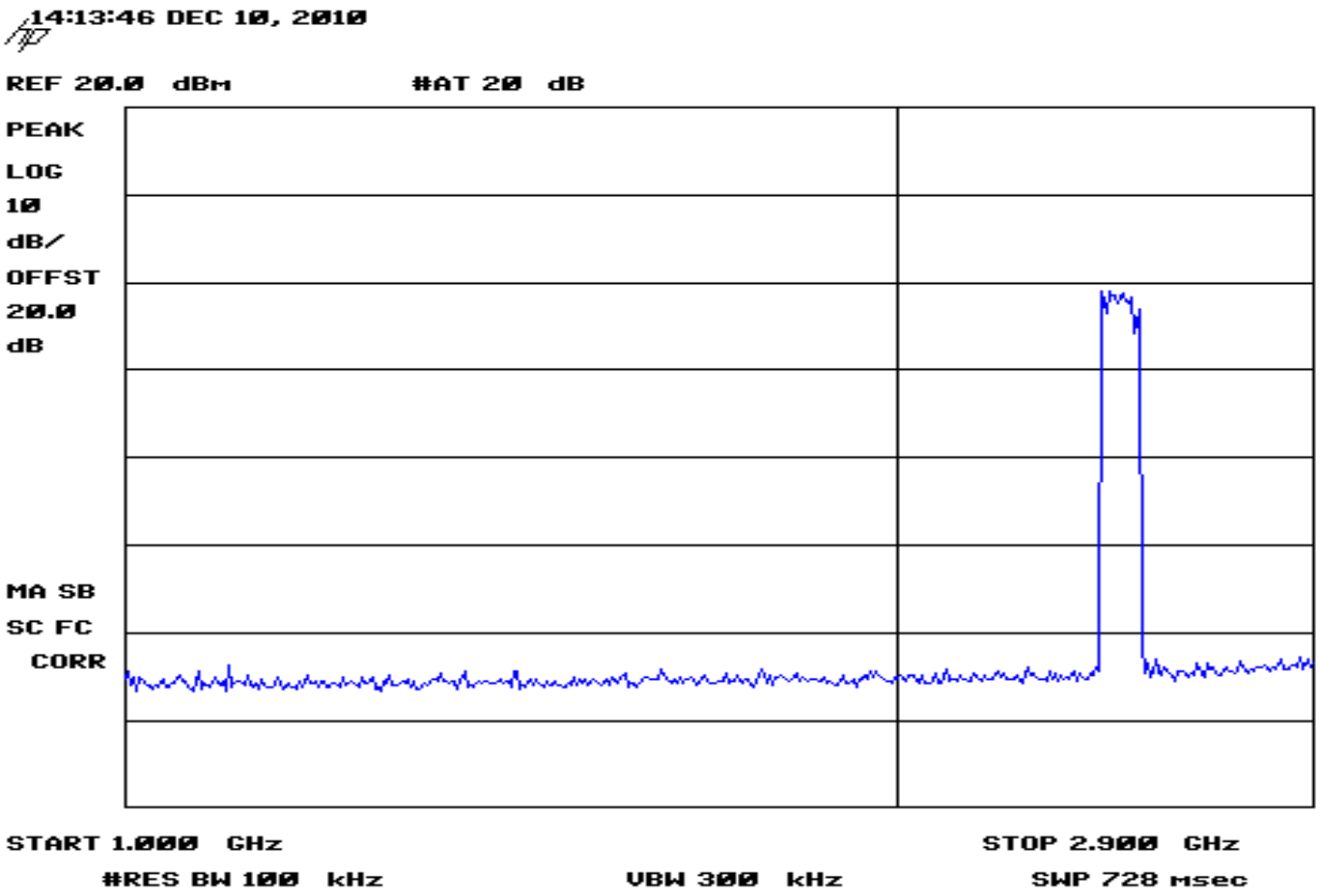
Test Method:	**Out of Band 10MHz to 25GHz**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(c)		**Date:**	12/10/2010
Operating Mode:	Transmitting				
Notes:					



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

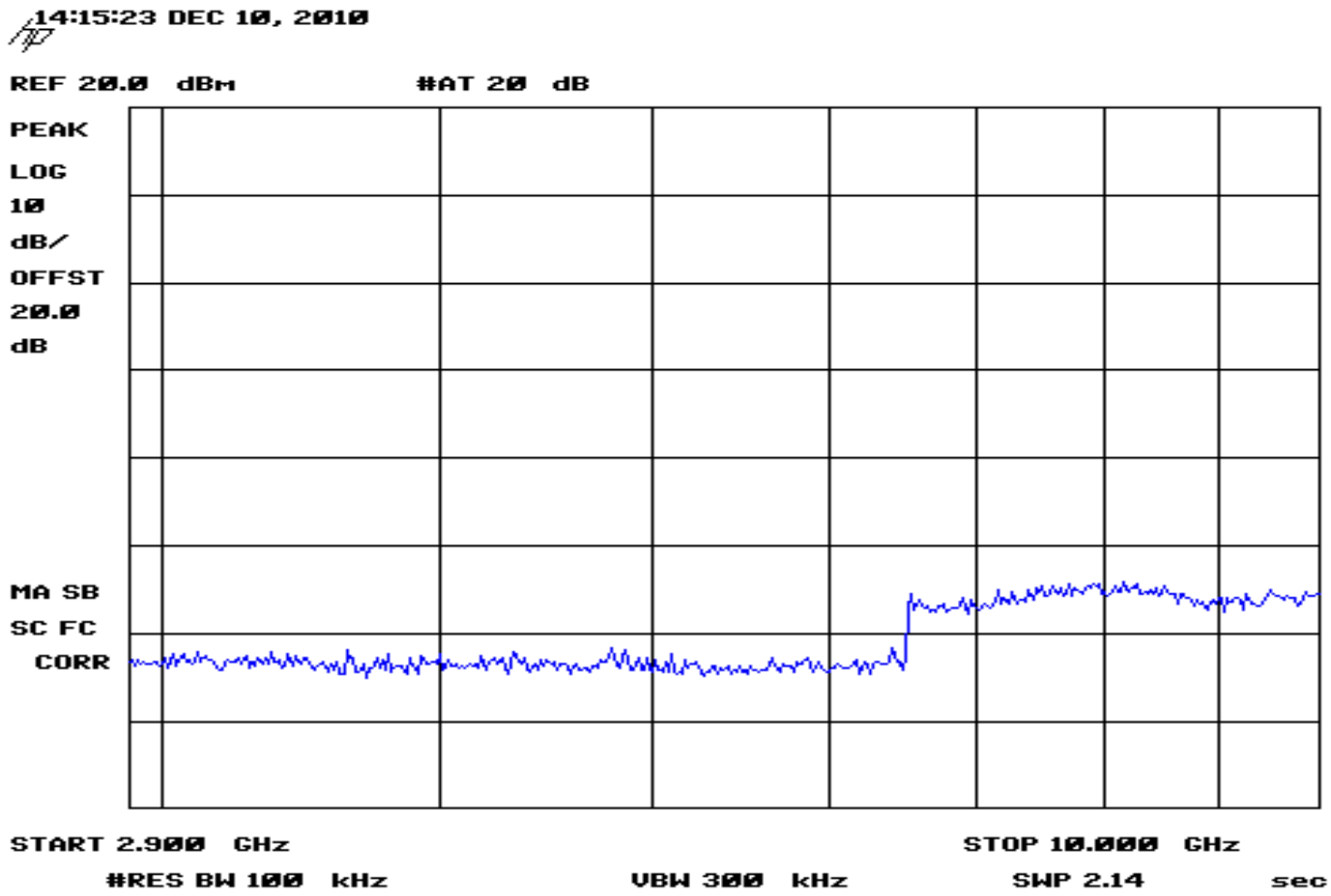
Test Method:	**Out of Band 10MHz to 25GHz**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(c)		**Date:**	12/10/2010
Operating Mode:	Transmitting				
Notes:					



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

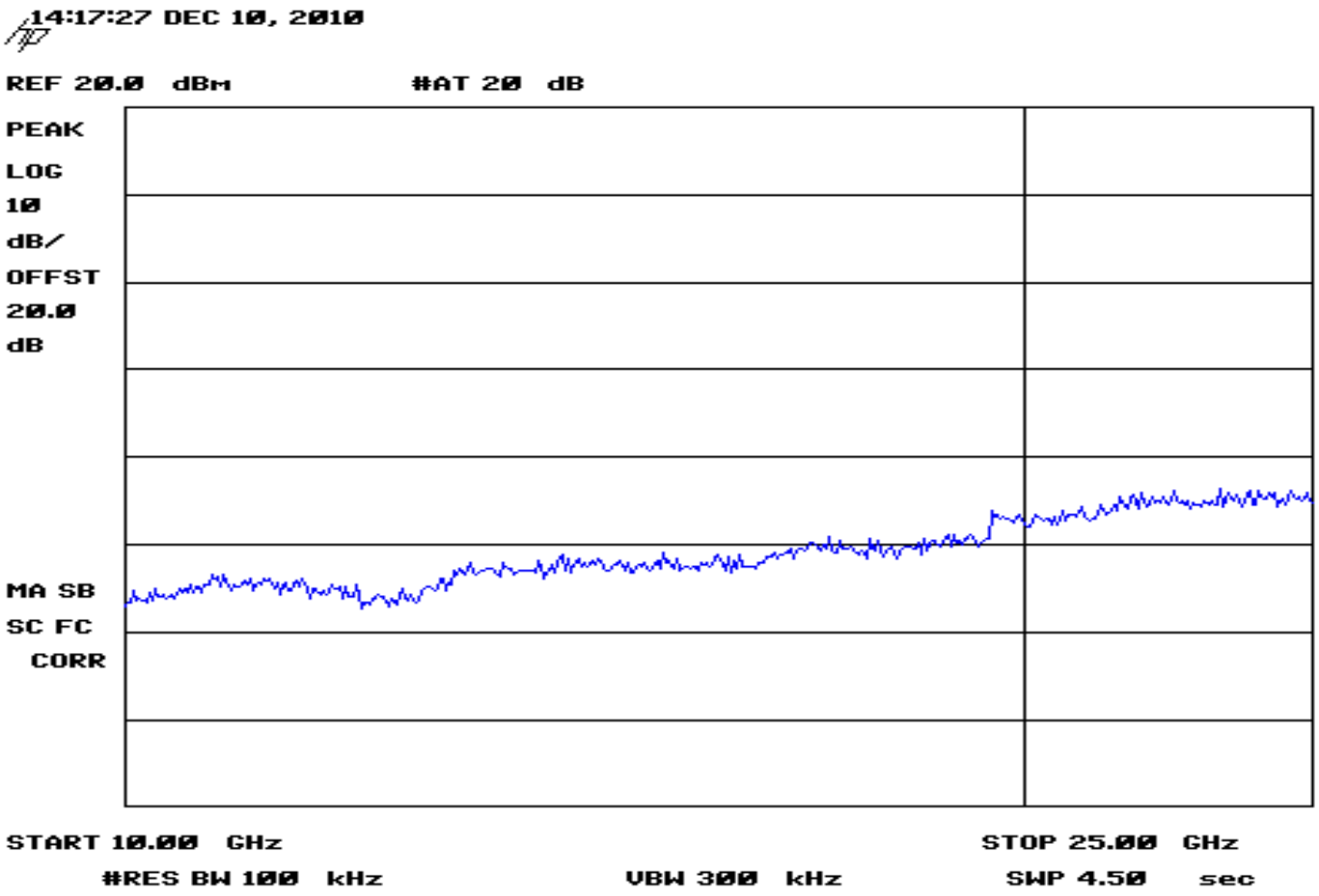
Test Method:	**Out of Band 10MHz to 25GHz**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(c)		**Date:**	12/10/2010
Operating Mode:	Transmitting				
Notes:					



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

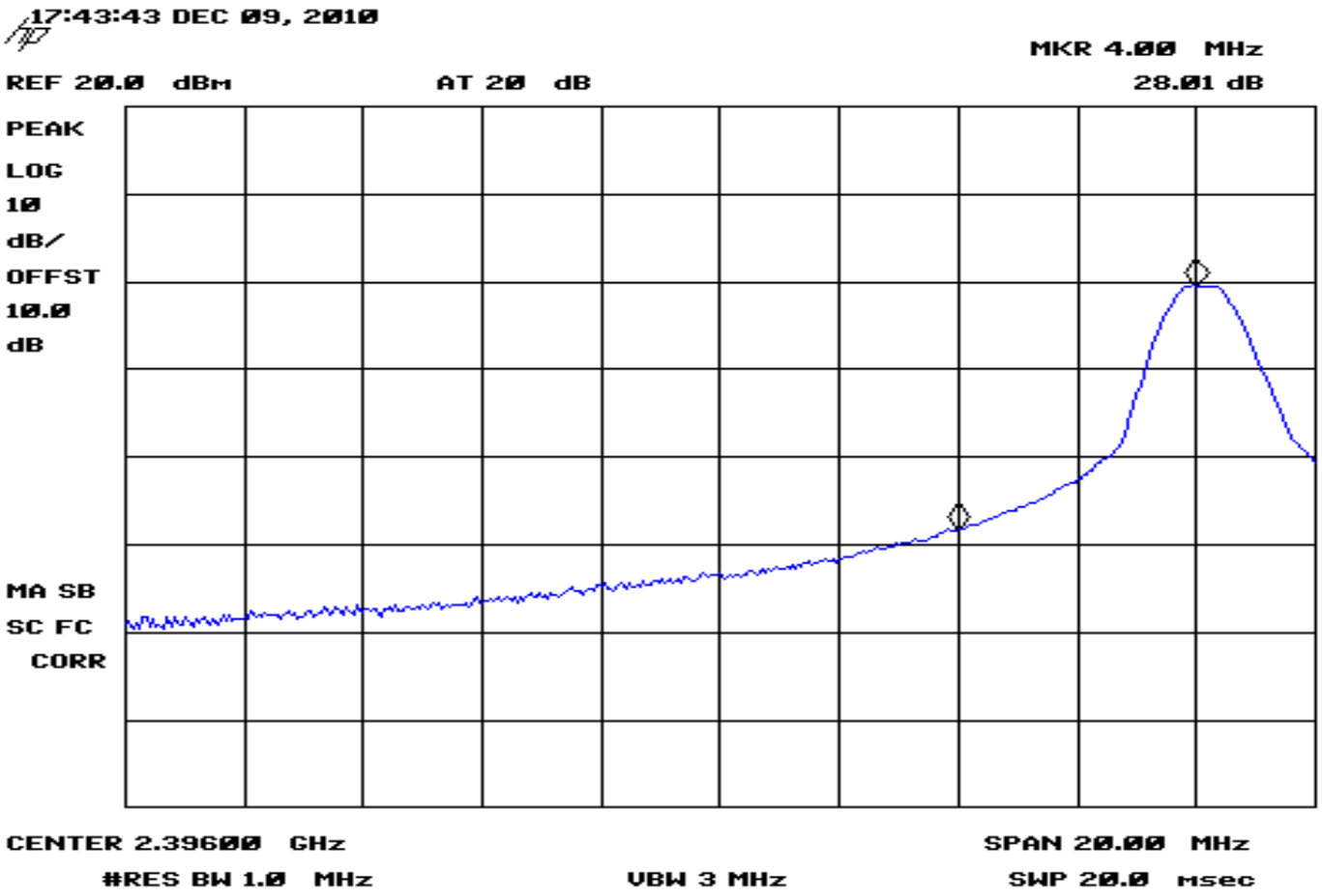
Test Method:	**Out of Band 10MHz to 25GHz**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(c)		**Date:**	12/10/2010
Operating Mode:	Transmitting				
Notes:					



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

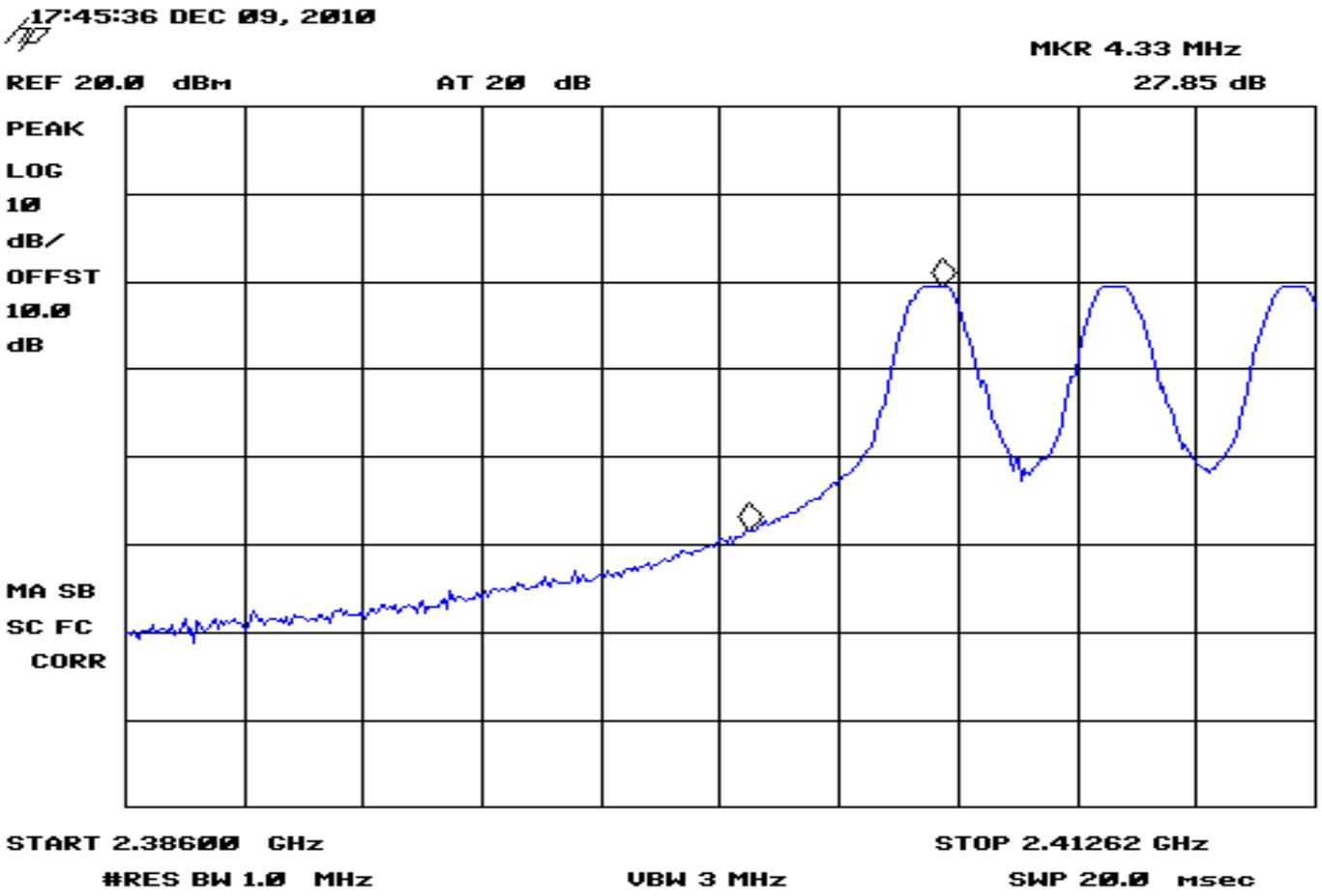
Test Method:	**Band-edge Compliance**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(c)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	No Frequency Hopping				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

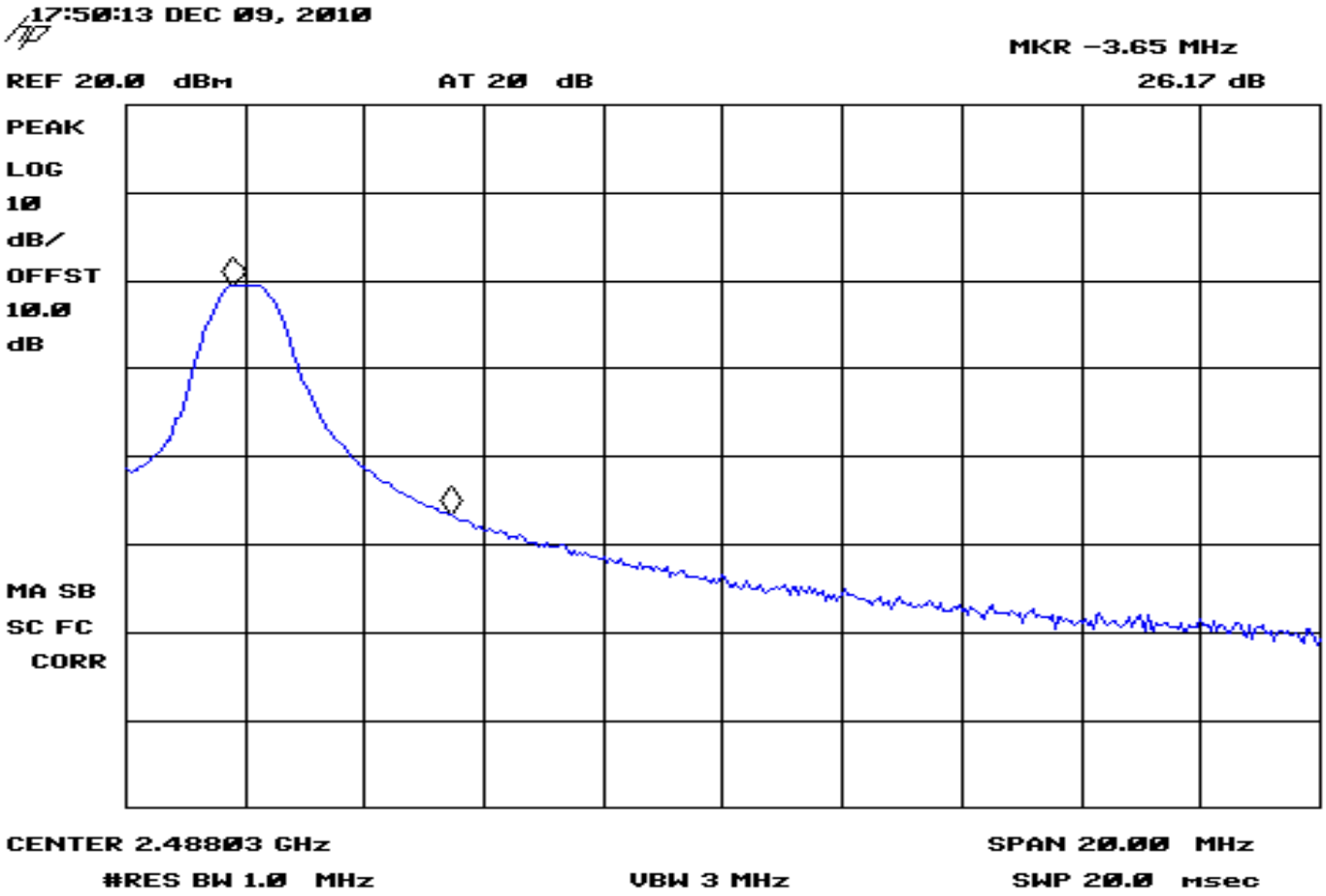
Test Method:	**Band-edge Compliance**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(c)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:					



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

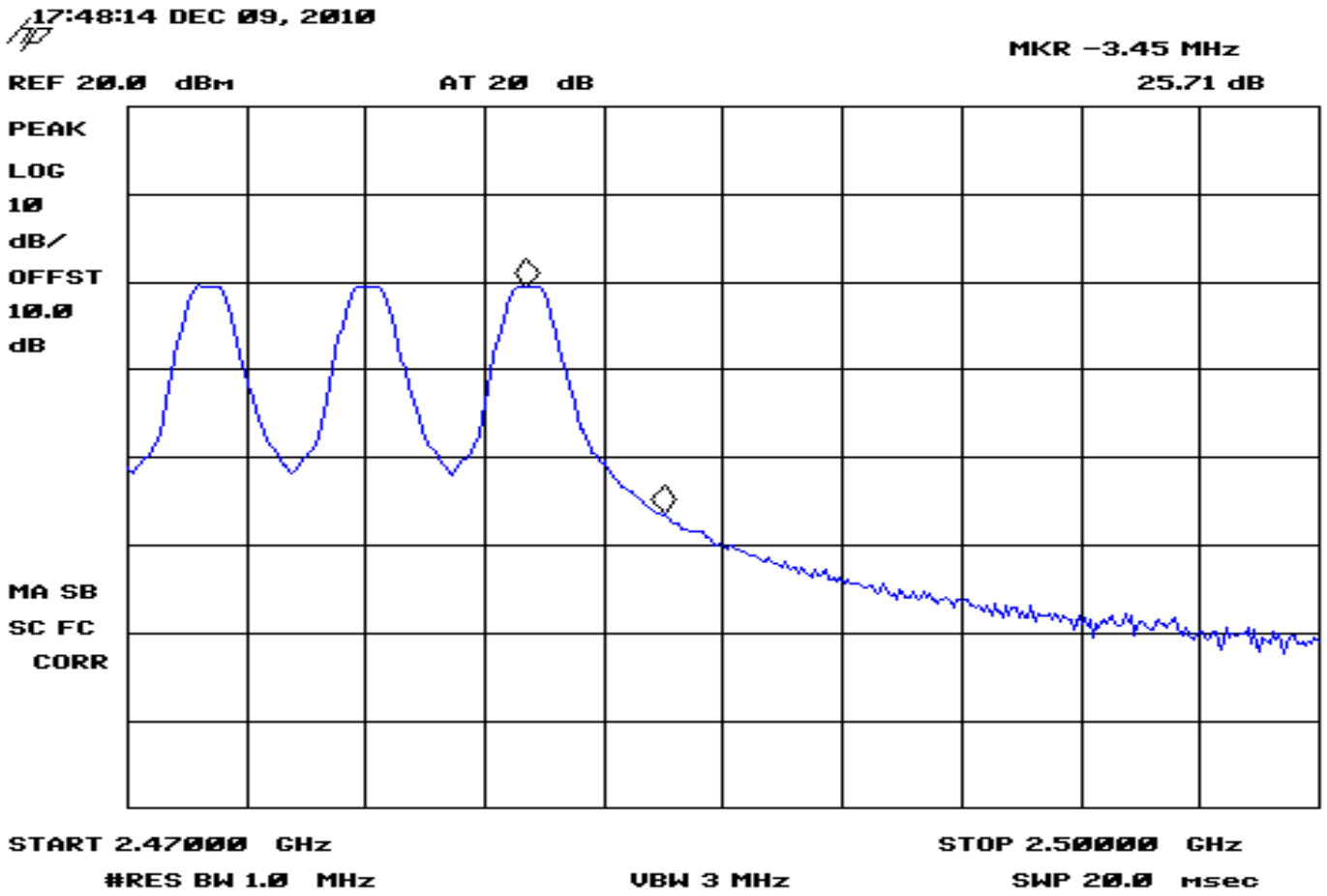
Test Method:	**Band-edge Compliance**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(c)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:	No Frequency Hopping				



RETLIF TESTING LABORATORIES

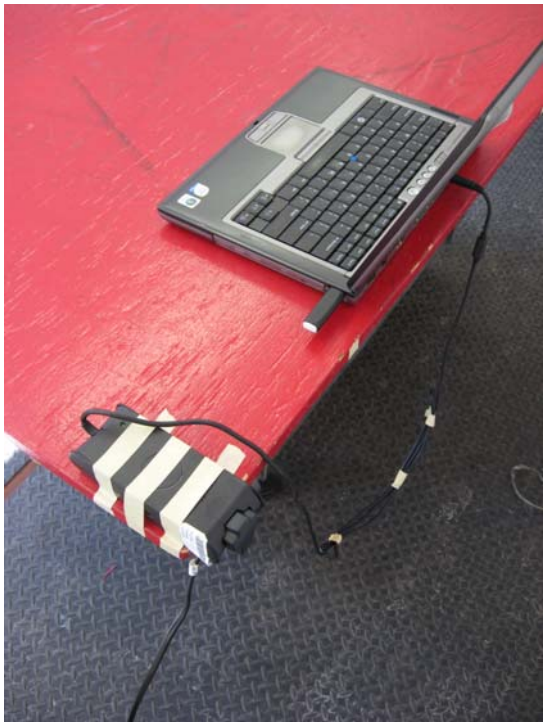
EMISSIONS DATA SHEET

Test Method:	**Band-edge Compliance**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	T. Hannemann
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.247(c)		**Date:**	12/9/2010
Operating Mode:	Transmitting				
Notes:					



FCC Section 15.207/ RSS GEN 7.2.2
Conducted Emissions, 150 kHz to 30 MHz
Test Photographs

EUT Configuration

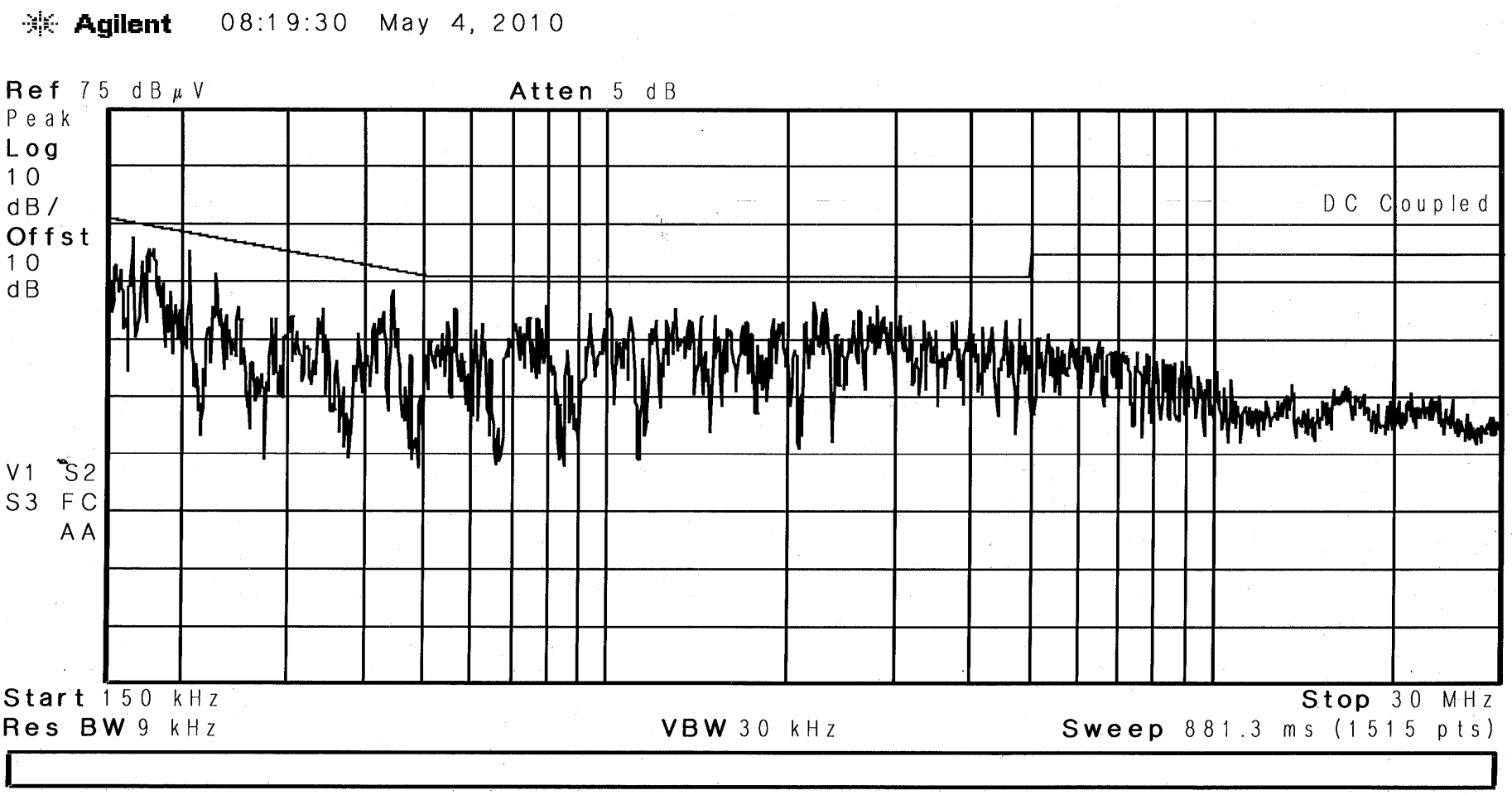

Test Setup

FCC Section 15.207/ RSS GEN 7.2.2
Conducted Emissions, 150 kHz to 30 MHz
Test Data

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

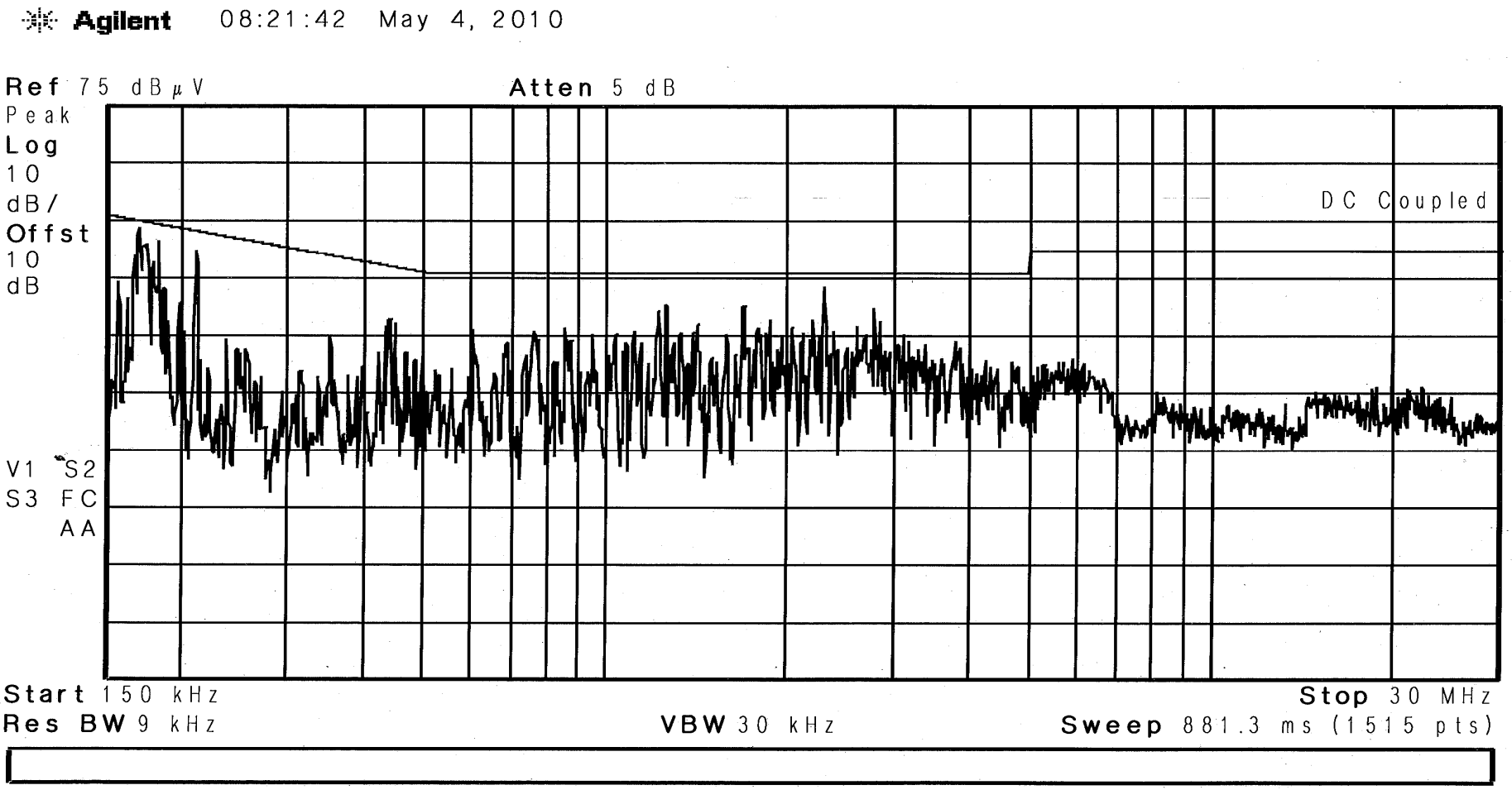
Test Method:	**Conducted Emissions**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	M. Seamans
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.207		**Date:**	5/4/2010
Operating Mode:	Transmitting				
Notes:	Lead Tested: 120 VAC 60 Hz Hot on Host PC; Peak Readings to Average Limits.				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Conducted Emissions**				
Customer:	Polhemus	**Test Sample:**	G4 RF Transceiver/ USB Dongle	**Job No:**	R-5306N-1
Model No:	G4	**Serial No:**	N/A	**Technician:**	M. Seamans
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.207		**Date:**	5/4/2010
Operating Mode:	Transmitting				
Notes:	Lead Tested: 120 VAC 60 Hz Neutral on Host PC; Peak Readings to Average Limits.				



FCC Section 15.247 (d)
Field Strength of Spurious Radiation

RSS GEN 7.2.3
Receiver Spurious Emissions

Test Photographs

Test Setup

25 to 1000 MHz

1 to 1.7 GHz

1.7 to 2.6 GHz

2.6 to 3.95 GHz

3.95 to 5.8 GHz

5.2 to 8.2 GHz

8.2 to 12.4 GHz

12.4 to 18 GHz

18 to 25 MHz

FCC Section 15.247 (d)
Field Strength of Transmitter Spurious Radiation/Bandedge
Test Data

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Transmitter Spurious Emissions 30 MHz - 25 GHz**		
Customer	Polhemus	**Job No.**	R-5306N-1
Test Sample	G4 RF Transceiver/ USB Dongle		
Model No.	G4	**Serial No.**	N/A
Test Specification:	FCC Part 15 Subpart C 15.247		
Operating Mode:	Transmitting at 2.40375 GHz		
Technician:	M. Seamans	**Date:**	May 12, 2010
Notes:	Test Distance: 3 Meters		

Test Frequency	Antenna Position	Turntable Position	Uncorrected Reading	Correction Factor	Corrected Reading					Limit at 3 Meters
MHz	(H/V) - Height	Degrees	dBuV	dB	dBuV/m					dBuV/m
30.00	-	-	-	-	-					40.0
|	-	-	-	-	-					|
88.00	-	-	-	-	-					40.0
88.00	-	-	-	-	-					43.5
|	-	-	-	-	-					|
216.00	-	-	-	-	-					43.5
216.00	-	-	-	-	-					46.0
|	-	-	-	-	-					|
960.00	-	-	-	-	-					46.0
960.00	-	-	-	-	-					54.0
|	-	-	-	-	-					|
25000.00	-	-	-	-	-					54.0

No emissions were observed above the noise floor of the test equipment which was a minimum of 10 dB below the specified limits throughout the frequency range.

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Transmitter Spurious Emissions 30 MHz - 25 GHz**		
Customer	Polhemus	**Job No.**	R-5306N-1
Test Sample	G4 RF Transceiver/ USB Dongle		
Model No.	G4	**Serial No.**	N/A
Test Specification:	FCC Part 15 Subpart C 15.247		
Operating Mode:	Transmitting at 2.439925 GHz		
Technician:	M. Seamans	**Date:**	May 12, 2010
Notes:	Test Distance: 3 Meters		

Test Frequency	Antenna Position	Turntable Position	Uncorrected Reading	Correction Factor	Corrected Reading					Limit at 3 Meters
MHz	(H/V) - Height	Degrees	dBuV	dB	dBuV/m					dBuV/m
30.00	-	-	-	-	-					40.0
|	-	-	-	-	-					|
88.00	-	-	-	-	-					40.0
88.00	-	-	-	-	-					43.5
|	-	-	-	-	-					|
216.00	-	-	-	-	-					43.5
216.00	-	-	-	-	-					46.0
|	-	-	-	-	-					|
960.00	-	-	-	-	-					46.0
960.00	-	-	-	-	-					54.0
|	-	-	-	-	-					|
25000.00	-	-	-	-	-					54.0

No emissions were observed above the noise floor of the test equipment which was a minimum of 10 dB below the specified limits throughout the frequency range.

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Transmitter Spurious Emissions 30 MHz - 25 GHz**		
Customer	Polhemus	**Job No.**	R-5306N-1
Test Sample	G4 RF Transceiver/ USB Dongle		
Model No.	G4	**Serial No.**	N/A
Test Specification:	FCC Part 15 Subpart C 15.247		
Operating Mode:	Transmitting at 2.48025 GHz		
Technician:	M. Seamans	**Date:**	May 12, 2010
Notes:	Test Distance: 3 Meters		

Test Frequency	Antenna Position	Turntable Position	Meter Reading	Correction Factor	Corrected Reading					Limit at 3 Meters
MHz	(H/V) - Height	Degrees	dBuV	dB	dBuV/m					dBuV/m
30.00	-	-	-	-	-					40.0
|	-	-	-	-	-					|
88.00	-	-	-	-	-					40.0
88.00	-	-	-	-	-					43.5
|	-	-	-	-	-					|
216.00	-	-	-	-	-					43.5
216.00	-	-	-	-	-					46.0
|	-	-	-	-	-					|
960.00	-	-	-	-	-					46.0
960.00	-	-	-	-	-					54.0
|	-	-	-	-	-					|
25000.00	-	-	-	-	-					54.0

No emissions were observed above the noise floor of the test equipment which was a minimum of 10 dB below the specified limits throughout the frequency range.

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Band-edge Compliance**		
Customer	Polhemus	**Job No.**	R-5306N-1
Test Sample	G4 RF Transceiver/ USB Dongle		
Model No.	G4	**Serial No.**	N/A
Test Specification:	FCC Part 15 Subpart C 15.247		
Operating Mode:	Continuously Transmitting at band edge		
Technician:	T.Hannemann	**Date:**	December 22, 2010
Notes:	Test Distance: 3 Meters Average Detector		

Test Frequency	Antenna Position	Turntable Position	Uncorrected Reading	Correction Factor	Corrected Reading					Limit at 3 Meters
MHz	(H/V) - Height	Degrees	dBuV	dB	dBuV/m					dBuV/m
2400.00	V-1m	0.0	10.00	29.88	39.88	*				54.0
2483.50	V-1m	0.0	10.00	30.31	40.31	*				54.0

* Measurement represents the noise floor of the measurement instrument, as no EUT emissions were observed.

RSS GEN 7.2.3
Receiver Spurious Emissions
Test Data

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Receiver Spurious Emissions 30 MHz - 25 GHz**		
Customer	Polhemus	**Job No.**	R-5306N-1
Test Sample	G4 RF Transceiver/ USB Dongle		
Model No.	G4	**Serial No.**	N/A
Test Specification:	RSS-Gen 7.2		
Operating Mode:	Receiving at 2.40375 GHz		
Technician:	M. Seamans	**Date:**	May 12, 2010
Notes:	Test Distance: 3 Meters		

Test Frequency	Antenna Position	Turntable Position	Uncorrected Reading	Correction Factor	Corrected Reading					Limit at 3 Meters
MHz	(H/V) - Height	Degrees	dBuV	dB	dBuV/m					dBuV/m
30.00	-	-	-	-	-					40.0
|	-	-	-	-	-					|
88.00	-	-	-	-	-					40.0
88.00	-	-	-	-	-					43.5
|	-	-	-	-	-					|
216.00	-	-	-	-	-					43.5
216.00	-	-	-	-	-					46.0
|	-	-	-	-	-					|
960.00	-	-	-	-	-					46.0
960.00	-	-	-	-	-					54.0
|	-	-	-	-	-					|
25000.00	-	-	-	-	-					54.0

No emissions were observed above the noise floor of the test equipment which was a minimum of 10 dB below the specified limits throughout the frequency range.

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Receiver Spurious Emissions 30 MHz - 25 GHz**		
Customer	Polhemus	**Job No.**	R-5306N-1
Test Sample	G4 RF Transceiver/ USB Dongle		
Model No.	G4	**Serial No.**	N/A
Test Specification:	RSS-Gen 7.2		
Operating Mode:	Receiving at 2.439925 GHz		
Technician:	M. Seamans	**Date:**	May 12, 2010
Notes:	Test Distance: 3 Meters		

Test Frequency	Antenna Position	Turntable Position	Uncorrected Reading	Correction Factor	Corrected Reading					Limit at 3 Meters
MHz	(H/V) - Height	Degrees	dBuV	dB	dBuV/m					dBuV/m
30.00	-	-	-	-	-					40.0
|	-	-	-	-	-					|
88.00	-	-	-	-	-					40.0
88.00	-	-	-	-	-					43.5
|	-	-	-	-	-					|
216.00	-	-	-	-	-					43.5
216.00	-	-	-	-	-					46.0
|	-	-	-	-	-					|
960.00	-	-	-	-	-					46.0
960.00	-	-	-	-	-					54.0
|	-	-	-	-	-					|
25000.00	-	-	-	-	-					54.0

No emissions were observed above the noise floor of the test equipment which was a minimum of 10 dB below the specified limits throughout the frequency range.

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Receiver Spurious Emissions 30 MHz - 25 GHz**		
Customer	Polhemus	**Job No.**	R-5306N-1
Test Sample	G4 RF Transceiver/ USB Dongle		
Model No.	G4	**Serial No.**	N/A
Test Specification:	RSS-Gen 7.2		
Operating Mode:	Receiving at 2.48025 GHz		
Technician:	M. Seamans	**Date:**	May 12, 2010
Notes:	Test Distance: 3 Meters		

Test Frequency	Antenna Position	Turntable Position	Meter Reading	Correction Factor	Corrected Reading					Limit at 3 Meters
MHz	(H/V) - Height	Degrees	dBuV	dB	dBuV/m					dBuV/m
30.00	-	-	-	-	-					40.0
|	-	-	-	-	-					|
88.00	-	-	-	-	-					40.0
88.00	-	-	-	-	-					43.5
|	-	-	-	-	-					|
216.00	-	-	-	-	-					43.5
216.00	-	-	-	-	-					46.0
|	-	-	-	-	-					|
960.00	-	-	-	-	-					46.0
960.00	-	-	-	-	-					54.0
|	-	-	-	-	-					|
25000.00	-	-	-	-	-					54.0

No emissions were observed above the noise floor of the test equipment which was a minimum of 10 dB below the specified limits throughout the frequency range.