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FCC Certification Test Report

FCCID: VZ6-BH3-M1

MEDTRONIC-ZEPHYR TECHNOLOGIES

BIOHARNESSS 3 (BH3-M1)

WLL REPORT# **14608-01 Rev 3**
June 30, 2016
Re-issued September 8, 2017

Prepared for:

Medtronic-Zephyr Technologies
1 Annapolis Street - Suite 200
Annapolis, MD, 21401 USA

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY

Testing Certificate AT-1448

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For the
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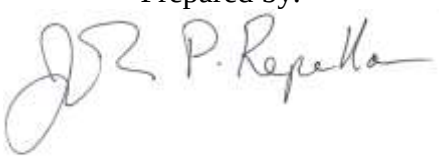

John P. Repella
EMC & Wireless Manager

Reviewed by:

Steven D. Koster
President

Abstract

This report has been prepared on behalf of Medtronic-Zephyr Technologies to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.249 (10/2014) of the FCC Rules. This Certification Test Report documents the test configuration and test results for Medtronic-Zephyr Technologies BH3-M1.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Testing Certificate AT-1448 as an independent FCC test laboratory.

The Medtronic-Zephyr Technologies BH3-M1 complies with the limits for an Intentional Radiator device under FCC Part 15.249.

Revision History	Reason	Date
Rev 0	Initial Release	June 30, 2016
Rev 1	Corrected the FCC ID	April 7, 2017
Rev 2	Corrected the report data to address comments	June 2, 2017
Rev 3	Corrected the FCC ID	September 8, 2017

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1 Introduction

1.1 Compliance Statement

The Medtronic-Zephyr Technologies BH3-M1 complies with the limits for an Intentional Radiator device under FCC Part 15.249 (10/2014).

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed in accordance with C63.10 and the 2014 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Medtronic-Zephyr Technologies 1 Annapolis Street - Suite 200 Annapolis, MD, 21401 USA
Purchase Order Number:	RB2060A
Quotation Number:	69512

1.4 Test Dates

Testing was performed on the following date(s):	5/23/2016, 6/11/16, 6/29/2016, 6/30/2016

1.5 Test and Support Personnel

Washington Laboratories, LTD	John P. Repella
Customer Representative	Daniel Bartlett

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**ere**s**
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**c**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**d**eci**B**el
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga - prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo - prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega - prefix for 10^6 multiplier
m	**m**eter
µ	**m**icro - prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**umber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 Equipment Under Test

2.1 EUT Identification & Description

The BioModule™ sensor is wireless and rechargeable and, when combined with the BioModule™ holder and snap ECG electrodes, becomes the BioPatch™ device. It continuously collects a patient's physiologic data and transmits to a central station every 60 seconds. The BioModule™ device provides a 30-second, single-lead ECG that records either automatically or on demand when a patient's heart or respiration rate crosses clinician-assigned thresholds. The BioModule device communicates wirelessly, via Android™*-based handheld devices.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Medtronic-Zephyr Technologies
FCC ID:	VZ6-BH3-M1
Model(s):	BioModule (BH3-M1)
FCC Rule Parts:	§15.249
Frequency Range:	2404.8 - 2475MHz
Maximum Output Power:	208357.7µV/m @ 3 meters
Modulation:	
Occupied Bandwidth:	3.103MHz
Keying:	Automatic, manual
Type of Information:	Data
Number of Channels:	15
Power Output Level	Fixed
Antenna Connector	none
Antenna Type	Internal Trace
Interface Cables:	None
Power Source & Voltage:	Battery powered
TX Spurious	3151.2 uV/m Peak @ 3 meters (4809.60 MHz) 122.6 uV/m Average @ 3 meters (4809.60 MHz)

2.2 Test Configuration

The Medtronic-Zephyr Technologies BH3-M1 was configured with the transmitter constantly on the low, middle or high channel as appropriate for test. A sample operating normally was used to determine the EUT duty cycle.

2.3 Testing Algorithm

The Medtronic-Zephyr Technologies BH3-M1 was programmed for continuous operation with customer provided software. The Zephyr Configuration Tool SW (V1.0.24.0) allows the engineer to set the power levels, transmit and receive mode, transmit channel, and modulation or continuous wave functionality.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Certificate AT-1448 as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

ANSI C63.10 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

ANSI/TIA/EIA-603-C Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 (R2002) with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation1 and Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm\sqrt{\frac{a^2}{div_a{}^2} + \frac{b^2}{div_b{}^2} + \frac{c^2}{div_c{}^2} + ...}$$

Where u_c = standard uncertainty

a, b, c,.. = individual uncertainty elements

$Div_{a, b, c}$ = the individual uncertainty element divisor based on the probability distribution

Divisor = 1.732 for rectangular distribution

Divisor = 2 for normal distribution

Divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where U = expanded uncertainty

k = coverage factor

$k \leq 2$ for 95% coverage (ANSI/NCSL Z540-2 Annex G)

u_c = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 2 below.

Table 2: Expanded Uncertainty

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	±2.63 dB
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	±4.55 dB

2.7 Test Equipment

Table 3 shows a list of the test equipment used for measurements along with the calibration information.

Table 3: Test Equipment List

Test Name:	**Radiated Emissions**	Test Date:	**06/25/2016**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
644	SUNOL SCIENCES CORPORATION - JB1 925-833-9936	BICONALOG ANTENNA	8/14/2017
559	HP - 8447D	AMPLIFIER	2/20/2017
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	6/6/2017
626	ARA - DRG-118/A	ANTENNA HORN	4/7/2018
528	AGILENT - E4446A	3Hz - 44GHZ ANALYZER SPECTRUM	7/15/2016
Rental	AGILENT E7405A	100Hz – 26.5GHZ ANALYZER SPECTRUM	9/28/2016

3 Test Results

3.1 Duty Cycle Correction

Measurements may be adjusted where pulsed RF is utilized to find the average level associated with a quantity. This calculation is applied to limits for pulsed licensed and unlicensed devices.

Standard measurement techniques for unlicensed intentional radiators under 47CFR Part 15, call for duty cycle measurements compared to a 100 millisecond period

Duty cycle correction = on time/100 milliseconds

The EUT under normal operating conditions has 3.9ms on time per 2513ms. Therefore the maximum duty cycle correction is calculated as follows:

Duty Cycle correction = 20*log (3.9e-3/100e-3) = -28.2dB

The following Figures show the plots of the modulated carrier. The spectrum analyzer was set to Zero Span and the video triggered to collect the pulse train of the modulation. Calculations of the duty cycle correction factor were obtained from the worst case transmission burst.

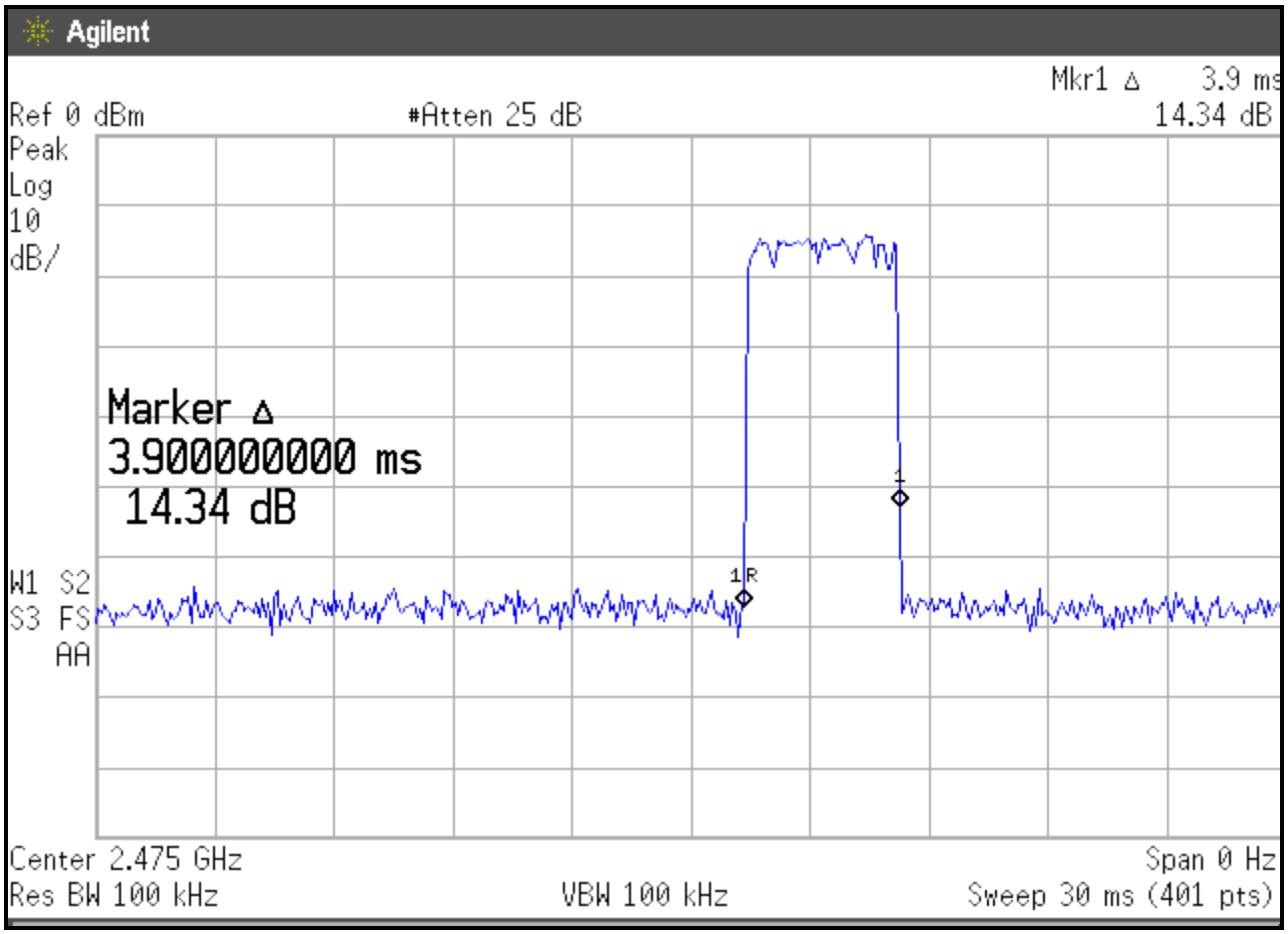

Figure 1: Duty Cycle (Single Burst)

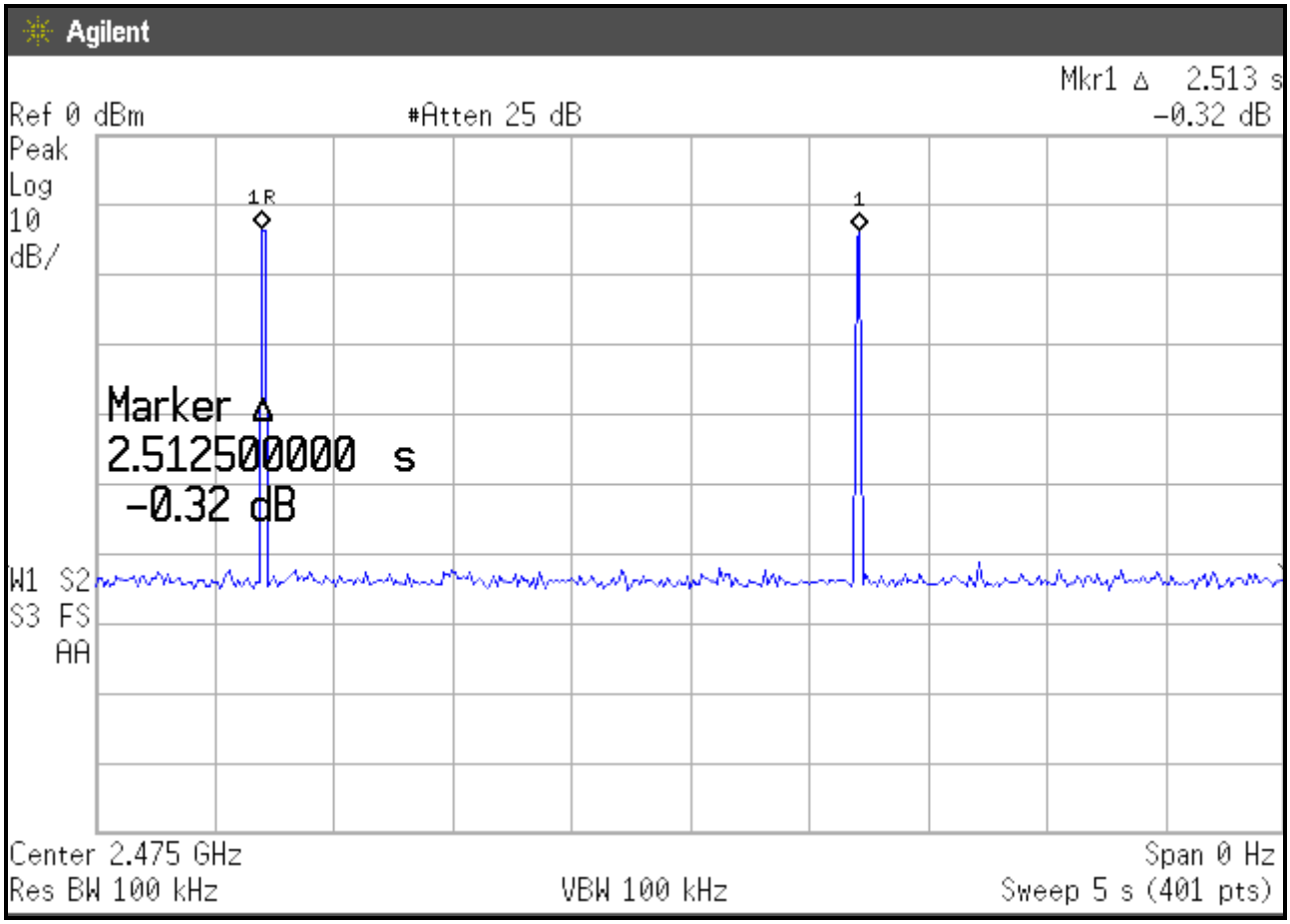

Figure 2: Duty Cycle (TX on time in 5s)

3.2 Occupied Bandwidth: (FCC Part §2.1049)

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer. Table 4 provides a summary of the Occupied Bandwidth Results.

Table 4: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
2405MHz	3.102MHz	N/A	Pass
2440MHz	3.075MHz	N/A	Pass
2475MHz	3.030MHz	N/A	Pass

At full modulation, the occupied bandwidth was measured as shown:

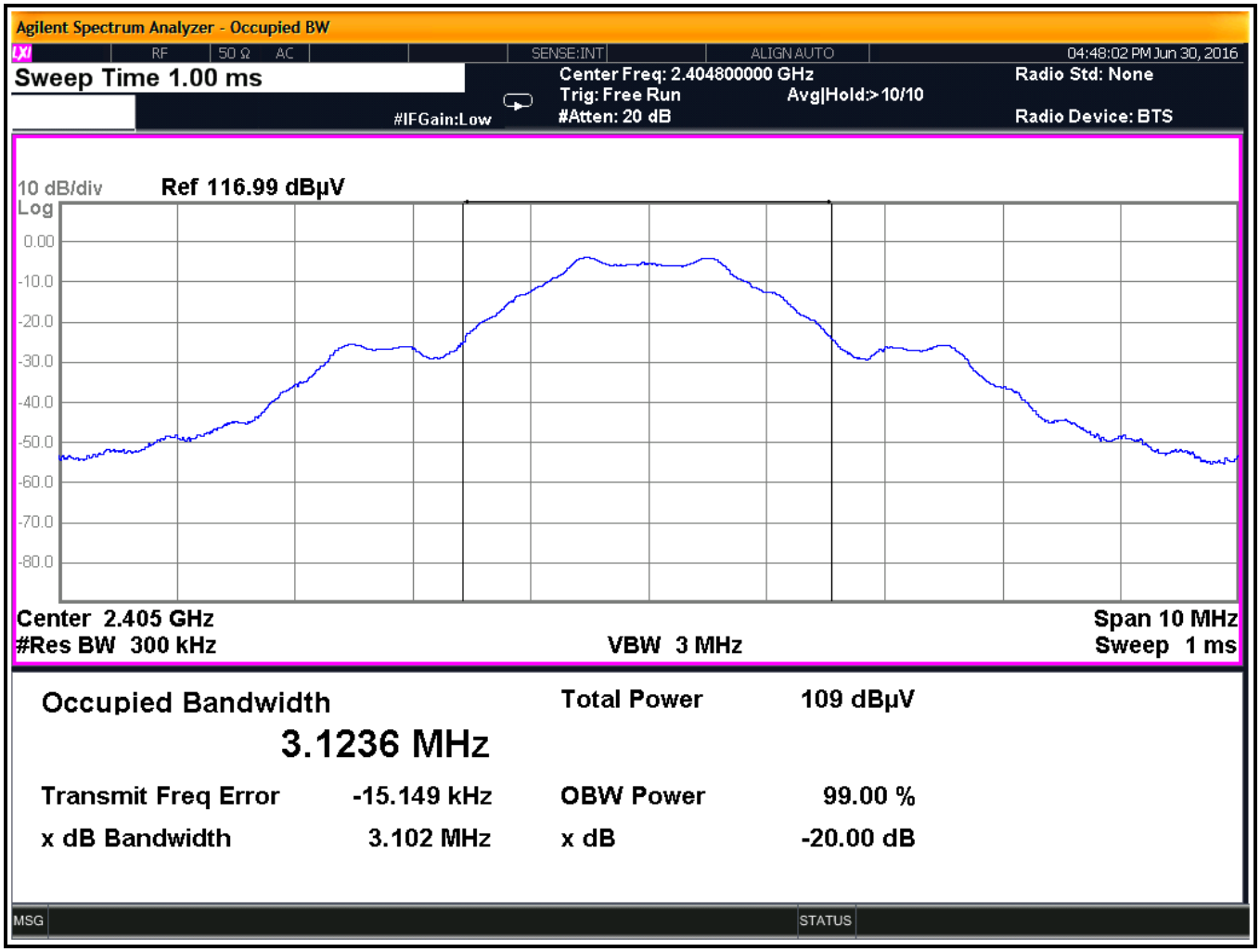

Figure 3: Occupied Bandwidth LC

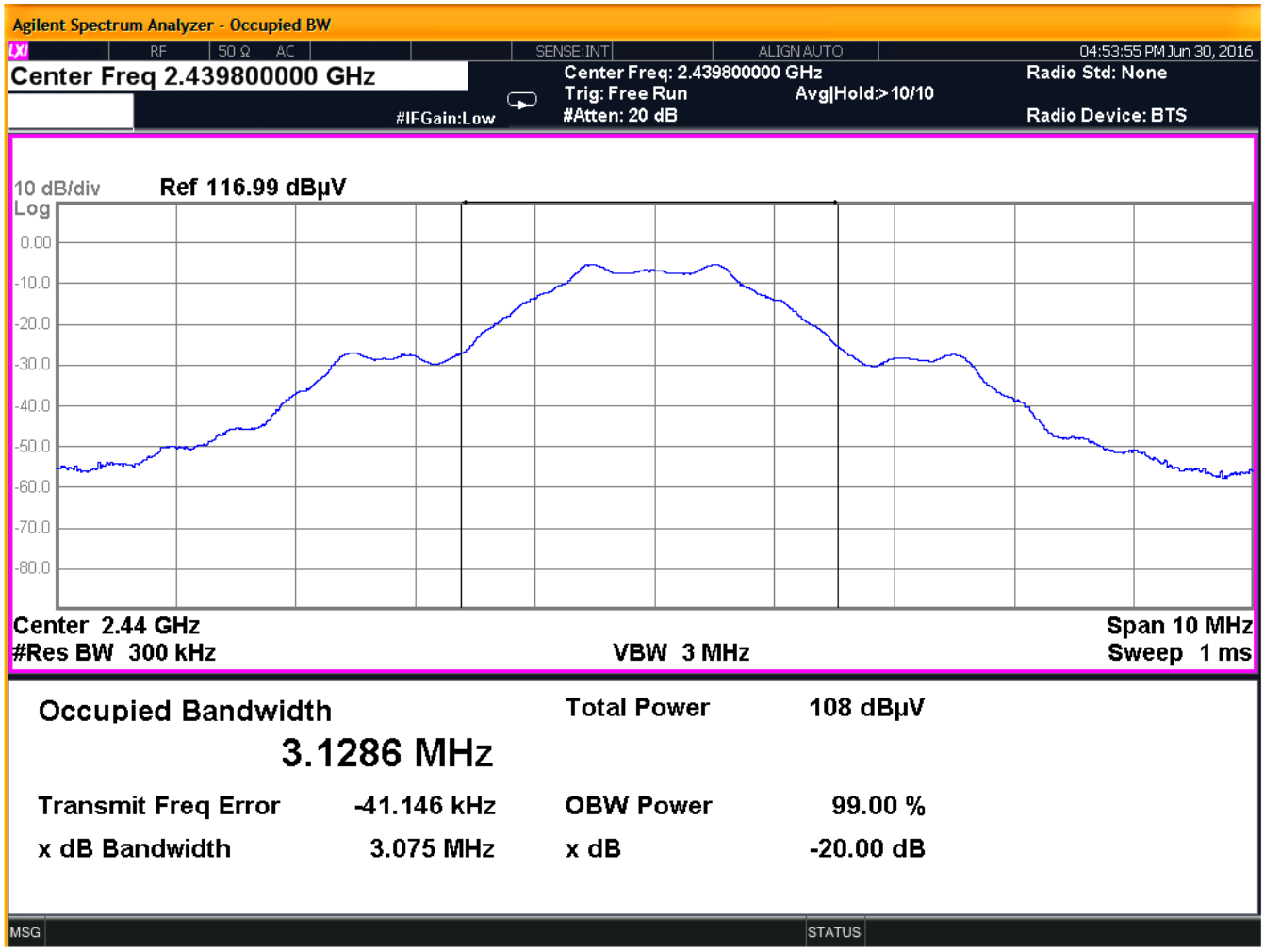

Figure 4: Occupied Bandwidth CC

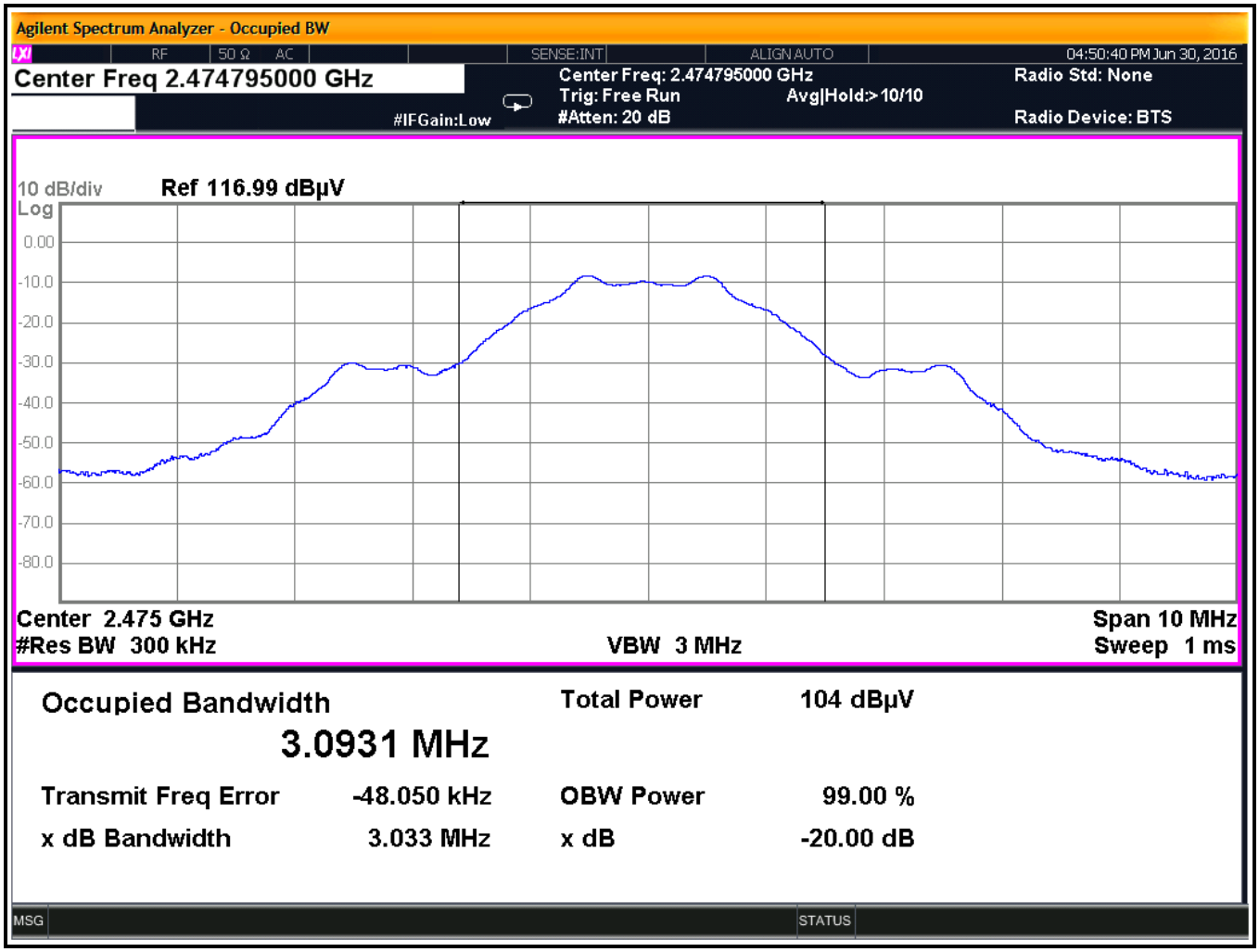

Figure 5: Occupied Bandwidth HC

3.3 Conducted Emissions

3.3.1 Requirements

Test Arrangement: Floor Standing

Compliance Standard: FCC Part 15 (10/2014), Class B

FCC Compliance Limits		
Frequency	**Quasi-peak**	**Average**
0.15-0.5MHz	66 to 56dBµV	56 to 46dBµV
0.5 to 5MHz	56dBµV	46dBµV
0.5-30MHz	60dBµV	50dBµV

3.3.2 Test Procedure Summary

The requirements of FCC Part 15 (10/2014) and ICES-003 call for the EUT to be placed on an 80 cm high 1 X 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω/50 mH Line Impedance Stabilization Network bonded to a 3 X 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power was supplied to the peripherals through a second LISN. The peripherals were placed on the table in accordance with ANSI C63.4-2012. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak, peak, or average as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth. For average measurements the post-detector filter was set to 10 Hz.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed.

3.3.3 Measurement Method

All emission measurements herein were performed according to the referenced standard. Calibration checks are made periodically to verify proper performance of the measuring instrumentation.

3.3.4 Conducted Data Reduction and Reporting

To convert the raw spectrum analyzer conducted data into a form that can be compared with the limits, it is necessary to account for various calibration factors that are supplied with the LISN's and other measurement accessories. These factors are included into the LISN correction factor (LISN corr.) column of the table and in the cable factor (Cable Loss) column of the table. The LISN correction (in dB) and the Cable Loss (in dB) is algebraically added to the raw Spectrum Analyzer Voltage in dBµV to obtain the Conducted RF Electric Voltage in dBµV. This level is then compared to the limit.

Example: Spectrum Analyzer Voltage: VdBµV

LISN Correction Factor: LISN Corr. dB

Cable Correction Factor: Cable Loss dB

RF Electric Voltage Level: EdBuV = V dBµV + LISN Corr. dB + Cable Loss dB

3.3.5 Results Summary

The system complied with the emission requirements throughout the test. Testing was performed in charging mode at 115VAC. The unit is not capable of transmitting during the charging mode.

Test Date(s): 6/25/2016 Test Engineer/Technician: John P. Repella

3.3.6 Areas of Concern

None

3.3.7 Test Data

Table 5 provides the test results for phase and neutral line power line conducted emissions.

Table 5: Conducted Emissions Limits

NEUTRAL

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.159	42.1	22.8	10.2	0.2	52.5	33.2	65.5	55.5	-13.1	-22.3
0.438	21.9	13.1	10.2	0.3	32.3	23.6	57.1	47.1	-24.8	-23.5
0.483	25.0	17.7	10.2	0.3	35.5	28.2	56.3	46.3	-20.8	-18.1
0.532	23.2	10.9	10.2	0.3	33.7	21.4	56.0	46.0	-22.3	-24.6
12.812	21.7	12.8	11.2	0.4	33.4	24.5	60.0	50.0	-26.6	-25.5
13.473	24.2	15.0	11.3	0.5	36.0	26.8	60.0	50.0	-24.0	-23.2

PHASE

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
			#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.177	41.7	31.3	10.2	0.1	51.9	41.5	64.6	54.6	-12.7	-13.1
0.226	33.1	21.0	10.2	0.1	43.4	31.2	62.6	52.6	-19.2	-21.4
0.267	27.4	16.8	10.2	0.1	37.7	27.1	61.2	51.2	-23.5	-24.1
0.487	25.4	17.8	10.2	0.2	35.8	28.2	56.2	46.2	-20.4	-18.1
13.311	25.8	17.9	11.3	0.4	37.4	29.5	60.0	50.0	-22.6	-20.5
13.811	25.9	18.0	11.3	0.4	37.6	29.7	60.0	50.0	-22.4	-20.3

3.4 Radiated Emissions: (FCC Part §2.10539)

The EUT must comply with the radiated emission limits of 15.249(a). The limits are as shown in the following table.

Table 6: Radiated Emissions Limits

Fundamental Frequency	Field Strength of Fundamental (µV/m)	Field Strength of Harmonics (µV/m)
902 – 928 MHz	50,000	500
2400 – 2483.5 MHz	50,000	500
5725 – 5875 MHz	50,000	500
24.00 – 24.25 GHz	250,000	2500

3.4.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured. Readings under 1000MHz were performed using a Quasi-Peak Detector function. Average readings were calculated based on the peak reading minus the Duty Cycle correction.

The unit was examined in three orthogonals.

The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	1MHz (Peak)

Emissions were measured to the 10th harmonic of the transmit frequency. Worst case emission levels are reported. For the center Channel only one orientation is shown representing worst case emissions.

The following is a sample calculation used in the data tables for calculating the final field strength of spurious emissions and comparing these levels to the specified limits.

Sample Calculation:

Spectrum Analyzer Voltage (SA Level): V dBµV

Antenna Factor (Ant Corr): AFdB/m

Cable Loss Correction (Cable Corr): CCdB

Duty Cycle Correction (Average) DCCdB

Amplifier Gain: GdB

Electric Field (Corr Level): EdBµV/m = VdBµV + AFdB/m + CCdB + DCCdB - GdB

Table 7: Radiated Emission Test Data (Fundamental)

Low Channel

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Duty Cycle Correction (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
2404.8	V	0.00	3.28	66.13	32.6	0.0	86801.6	500000.0	-15.2	peak
2404.8	V	0.00	3.28	66.16	32.6	-28.2	3388.7	50000.0	-23.4	AVG
2404.8	V	270.00	3.10	67.57	32.6	0.0	102453.8	500000.0	-13.8	peak
2404.8	V	270.00	3.10	67.57	32.6	-28.2	3985.9	50000.0	-22.0	AVG
2404.8	V	0.00	0.00	71.81	32.6	0.0	166927.5	500000.0	-9.5	peak
2404.8	V	0.00	0.00	71.81	32.6	-28.2	6494.2	50000.0	-17.7	AVG
2404.8	H	45.00	3.92	71.48	32.6	0.0	160704.4	500000.0	-9.9	peak
2404.8	H	45.00	3.92	71.48	32.6	-28.2	6252.1	50000.0	-18.1	AVG
2404.8	H	180.00	3.90	72.10	32.6	0.0	172594.9	500000.0	-9.2	peak
2404.8	H	180.00	3.90	72.10	32.6	-28.2	6714.7	50000.0	-17.4	AVG
2404.8	H	0.00	0.00	69.50	32.6	0.0	127946.3	500000.0	-11.8	peak
2404.8	H	0.00	0.00	69.50	32.6	-28.2	4977.7	50000.0	-20.0	AVG

Center Channel

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Duty Cycle Correction (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
2435.00	V	0.00	3.57	73.21	32.9	0.0	202551.7	500000.0	-7.8	Peak
2435.00	V	0.00	3.57	73.21	32.9	-28.2	7880.2	50000.0	-16.0	Ave
2435.00	V	90.00	3.65	67.66	32.9	0.0	106914.3	500000.0	-13.4	peak
2435.00	V	90.00	3.65	67.66	32.9	-28.2	4159.5	50000.0	-21.6	Ave
2435.00	H	45.00	3.92	71.82	34.1	0.0	196589.5	500000.0	-8.1	Peak
2435.00	H	45.00	3.92	71.82	34.1	-28.2	7648.2	50000.0	-16.3	Ave
2435.00	H	135.00	3.90	68.10	34.1	0.0	128103.3	500000.0	-11.8	peak
2435.00	H	135.00	3.90	68.10	34.1	-28.2	4983.8	50000.0	-20.0	Ave

High Channel

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Duty Cycle Correction (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
2475.00	V	45.00	3.90	72.08	33.2	0.0	184633.1	500000.0	-8.7	Peak
2475.00	V	45.00	3.90	72.08	33.2	-28.2	7183.1	50000.0	-16.9	Ave
2475.00	V	10.00	3.50	69.69	33.2	0.0	140219.8	500000.0	-11.0	peak
2475.00	V	10.00	3.50	69.69	33.2	-28.2	5455.2	50000.0	-19.2	Ave
2475.00	V	90.00	3.80	74.74	33.2	0.0	250789.6	500000.0	-6.0	peak
2475.00	V	90.00	3.80	74.74	33.2	-28.2	9756.8	50000.0	-14.2	Ave
2475.00	H	180.00	3.60	75.38	33.2	0.0	269966.3	500000.0	-5.4	Peak
2475.00	H	180.00	3.60	75.38	33.2	-28.2	10502.9	50000.0	-13.6	Ave
2475.00	H	180.00	3.70	76.14	33.2	0.0	294652.1	500000.0	-4.6	peak
2475.00	H	180.00	3.70	76.14	33.2	-28.2	11463.3	50000.0	-12.8	Ave
2475.00	H	190.00	3.20	66.80	33.2	0.0	100533.2	500000.0	-13.9	peak
2475.00	H	190.00	3.20	66.80	33.2	-28.2	3911.2	50000.0	-22.1	Ave

Table 8: Radiated Spurious Emission Test Data

Receive Mode/ Charging

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
49.72	V	180.00	1.00	45.78	-15.8	31.6	100.0	-10.0	
50.29	V	180.00	1.00	42.58	-16.0	21.3	100.0	-13.4	
59.41	V	180.00	1.00	48.04	-16.7	37.1	100.0	-8.6	
113.36	V	90.00	1.00	38.79	-10.1	27.3	150.0	-14.8	laptop
182.40	V	90.00	1.00	46.32	-11.8	53.2	150.0	-9.0	laptop
218.50	V	45.00	1.20	45.00	-12.3	43.0	200.0	-13.3	laptop
243.65	V	0.00	1.20	54.88	-11.3	151.7	200.0	-2.4	laptop
304.10	V	0.00	1.20	50.11	-9.6	105.9	200.0	-5.5	laptop
425.60	V	0.00	1.40	42.87	-6.3	67.5	200.0	-9.4	
486.40	V	0.00	1.40	39.94	-4.7	57.7	200.0	-10.8	
49.78	H	135.00	4.00	37.65	-15.8	12.3	100.0	-18.2	
59.41	H	135.00	4.00	40.30	-16.7	15.2	100.0	-16.4	
113.36	H	180.00	4.00	36.51	-10.1	21.0	150.0	-17.1	
182.68	H	180.00	4.00	41.79	-11.8	31.6	150.0	-13.5	laptop
218.40	H	180.00	4.00	40.29	-12.3	25.0	200.0	-18.1	laptop
243.50	H	225.00	3.50	48.27	-11.3	70.9	200.0	-9.0	laptop
304.20	H	225.00	3.50	48.80	-9.6	91.1	200.0	-6.8	laptop
425.10	H	90.00	3.50	36.76	-6.3	33.3	200.0	-15.6	laptop
486.40	H	90.00	3.00	38.20	-4.7	47.2	200.0	-12.5	

Battery Powered Transmit

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
49.70	V	180.00	1.00	45.30	-15.8	29.9	100.0	-10.5	
50.26	V	180.00	1.00	42.58	-16.0	21.3	100.0	-13.4	
59.60	V	180.00	1.00	48.04	-16.6	37.2	100.0	-8.6	
425.20	V	0.00	1.40	41.90	-6.3	60.2	200.0	-10.4	
482.60	V	0.00	1.40	39.80	-4.8	56.0	200.0	-11.1	
49.78	H	135.00	4.00	37.20	-15.8	11.7	100.0	-18.6	
50.36	H	135.00	4.00	36.50	-16.1	10.5	100.0	-19.6	
59.80	H	135.00	4.00	41.20	-16.6	17.0	100.0	-15.4	
113.40	H	180.00	4.00	37.20	-10.1	22.7	150.0	-16.4	
485.98	H	90.00	3.00	38.10	-4.7	46.6	200.0	-12.7	

Harmonics Low Channel

Unit Upright										
4809.60	V	90.00	3.70	65.96	4.0	0.0	3151.2	5000.0	-4.0	peak
4809.60	V	90.00	3.70	65.96	4.0	-28.2	122.6	500.0	-12.2	AVG
Unit flat										
4809.60	V	270.00	3.60	62.59	4.0	0.0	2137.8	5000.0	-7.4	peak
4809.60	V	270.00	3.60	62.59	4.0	-28.2	83.2	500.0	-15.6	AVG
Unit on side										
4809.60	V	90.00	3.60	65.40	4.0	0.0	2954.5	5000.0	-4.6	peak
4809.60	V	90.00	3.60	65.40	4.0	-28.2	114.9	500.0	-12.8	AVG
Unit Upright										
4809.60	H	180.00	3.40	62.73	4.0	0.0	2172.6	5000.0	-7.2	peak
4809.60	H	180.00	3.40	62.73	4.0	-28.2	84.5	500.0	-15.4	AVG
Unit flat										
4809.60	H	180.00	3.52	63.79	4.0	0.0	2454.6	5000.0	-6.2	peak
4809.60	H	180.00	3.52	63.79	4.0	-28.2	95.5	500.0	-14.4	AVG
Unit on side										
4809.60	H	270.00	3.80	59.45	4.0	0.0	1489.3	5000.0	-10.5	peak
4809.60	H	270.00	3.80	59.45	4.0	-28.2	57.9	500.0	-18.7	AVG
Unit Upright										
7214.40	V	180.00	4.00	54.95	11.0	0.0	1984.8	5000.0	-8.0	peak
7214.40	V	180.00	4.00	54.95	11.0	-28.2	77.2	500.0	-16.2	AVG
Unit flat										
7214.40	V	180.00	3.10	51.94	11.0	0.0	1403.5	5000.0	-11.0	peak
7214.40	V	180.00	3.10	51.94	11.0	-28.2	54.6	500.0	-19.2	AVG
Unit on side										
7214.40	V	270.00	3.60	51.51	11.0	0.0	1335.7	5000.0	-11.5	peak
7214.40	V	270.00	3.60	51.51	11.0	-28.2	52.0	500.0	-19.7	AVG
Unit Upright										
7214.40	H	90.00	3.67	53.73	11.0	0.0	1724.7	5000.0	-9.2	peak
7214.40	H	90.00	3.67	53.73	11.0	-28.2	67.1	500.0	-17.4	AVG
Unit flat										
7214.40	H	90.00	3.60	49.67	11.0	0.0	1080.7	5000.0	-13.3	peak
7214.40	H	90.00	3.60	49.67	11.0	-28.2	42.0	500.0	-21.5	AVG
Unit on side										
7214.40	H	90.00	3.60	51.80	11.0	0.0	1381.0	5000.0	-11.2	peak
7214.40	H	90.00	3.60	51.30	11.0	-28.2	50.7	500.0	-19.9	AVG

Harmonics Center Channel

4870.00	V	90.00	3.50	65.37	-7.0	0.0	833.0	5000.0	-15.6	
4870.00	V	90.00	3.50	65.37	-7.0	-28.2	32.4	500.0	-23.8	
4870.00	V	45.00	3.70	60.32	-7.0	0.0	465.8	5000.0	-20.6	
4870.00	V	45.00	3.70	60.32	-7.0	-28.2	18.1	500.0	-28.8	
4870.00	V	90.00	3.75	64.41	-7.0	0.0	745.9	5000.0	-16.5	
4870.00	V	90.00	3.75	64.41	-7.0	-28.2	29.0	500.0	-24.7	
4870.00	V	10.00	3.56	60.01	-7.0	0.0	449.4	5000.0	-20.9	
4870.00	V	10.00	3.56	60.01	-7.0	-28.2	17.5	500.0	-29.1	

Harmonics High Channel

Unit Upright										
4950.00	V	270.00	3.87	62.64	4.3	0.0	2215.2	5000.0	-7.1	peak
4950.00	V	270.00	3.87	62.64	4.3	-28.2	86.2	500.0	-15.3	AVG
Unit on side										
4950.00	V	90.00	3.60	59.57	4.3	0.0	1555.7	5000.0	-10.1	peak
4950.00	V	90.00	3.60	59.57	4.3	-28.2	60.5	500.0	-18.3	AVG
Unit flat										
4950.00	V	270.00	3.10	61.29	4.3	0.0	1896.4	5000.0	-8.4	peak
4950.00	V	270.00	3.10	61.29	4.3	-28.2	73.8	500.0	-16.6	AVG
Unit Upright										
4950.00	H	180.00	3.80	61.53	4.3	0.0	1949.5	5000.0	-8.2	peak
4950.00	H	180.00	3.80	61.53	4.3	-28.2	75.8	500.0	-16.4	AVG
Unit on side										
4950.00	H	90.00	2.82	63.73	4.3	0.0	2511.4	5000.0	-6.0	peak
4950.00	H	90.00	2.82	63.73	4.3	-28.2	97.7	500.0	-14.2	AVG
Unit flat										
4950.00	H	90.00	3.90	60.80	4.3	0.0	1792.3	5000.0	-8.9	peak
4950.00	H	90.00	3.90	60.80	4.3	-28.2	69.7	500.0	-17.1	AVG
Unit Upright										
7425.00	V	90.00	3.40	50.86	10.7	0.0	1199.1	5000.0	-12.4	peak
7425.00	V	90.00	3.40	50.86	10.7	-28.2	46.7	500.0	-20.6	AVG
Unit on side										
7425.00	V	270.00	3.95	46.49	10.7	0.0	725.1	5000.0	-16.8	peak
7425.00	V	270.00	3.95	46.49	10.7	-28.2	28.2	500.0	-25.0	AVG

Unit flat										
7425.00	V	270.00	3.20	48.26	10.7	0.0	888.9	5000.0	-15.0	peak
7425.00	V	270.00	3.20	48.26	10.7	-28.2	34.6	500.0	-23.2	AVG
Unit Upright										
7425.00	H	90.00	3.31	48.97	10.7	0.0	964.7	5000.0	-14.3	peak
7425.00	H	90.00	0.31	48.97	10.7	-28.2	37.5	500.0	-22.5	AVG
Unit on side										
7425.00	H	90.00	4.00	46.09	10.7	0.0	692.4	5000.0	-17.2	peak
7425.00	H	90.00	4.00	46.09	10.7	-28.2	26.9	500.0	-25.4	AVG
Unit flat										
7425.00	H	100.00	3.20	46.10	10.7	0.0	693.2	5000.0	-17.2	peak
7425.00	H	100.00	3.20	46.10	10.7	-28.2	27.0	500.0	-25.4	AVG

3.5 Radiated Band Edge Compliance

FCC Pt 15.249 (d) states “Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.”

The plots below show that the emissions at the band edges are attenuated by > 50dB down from the peak fundamental reading. The display line in the plot shows the part 15.209 limit of 54dBuV/m (500uV/m). Readings were taken in a 100 kHz RBW.

The EUT complies with this requirement at the band edges.

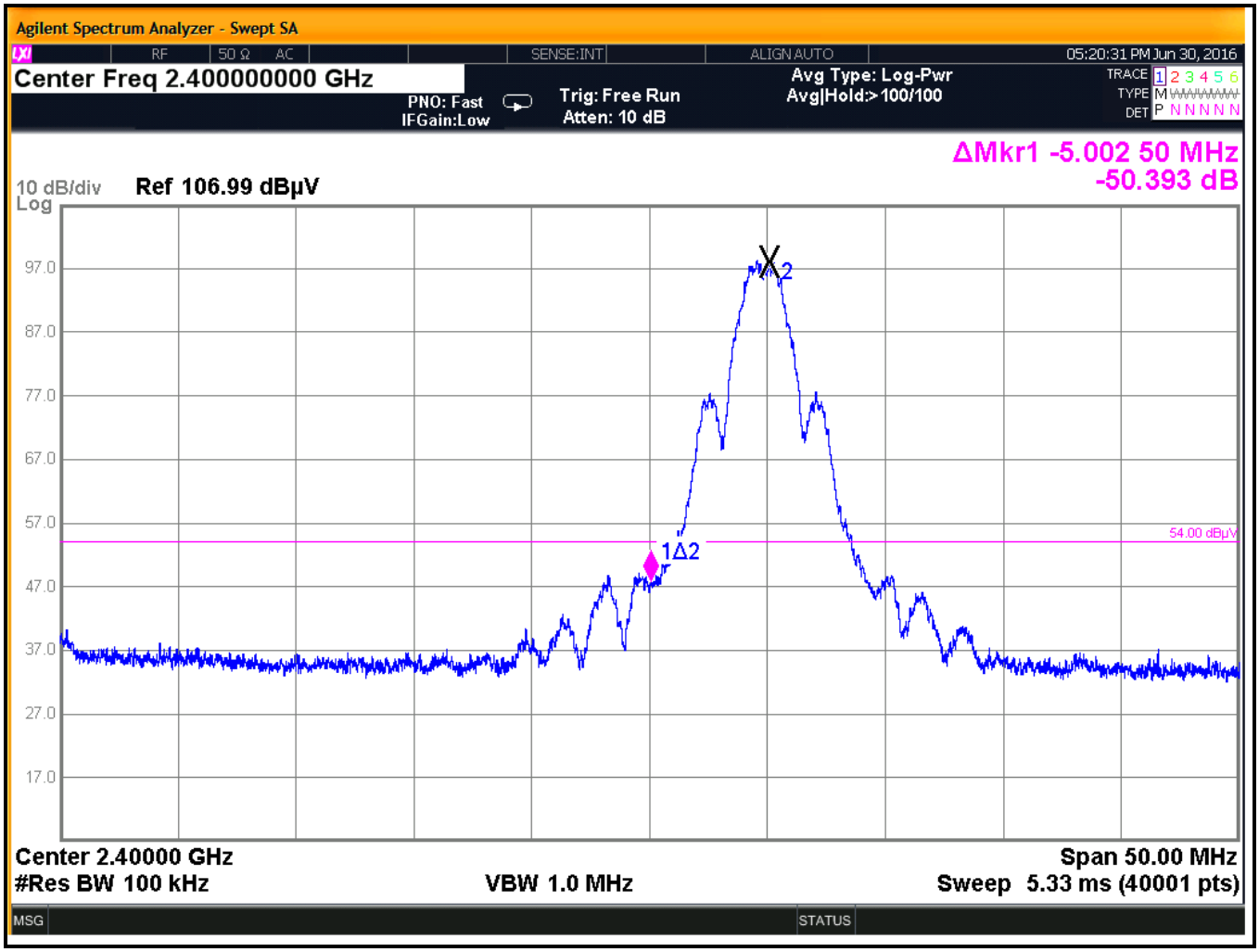

Figure 6: Radiated Band Edge Compliance Lower Edge

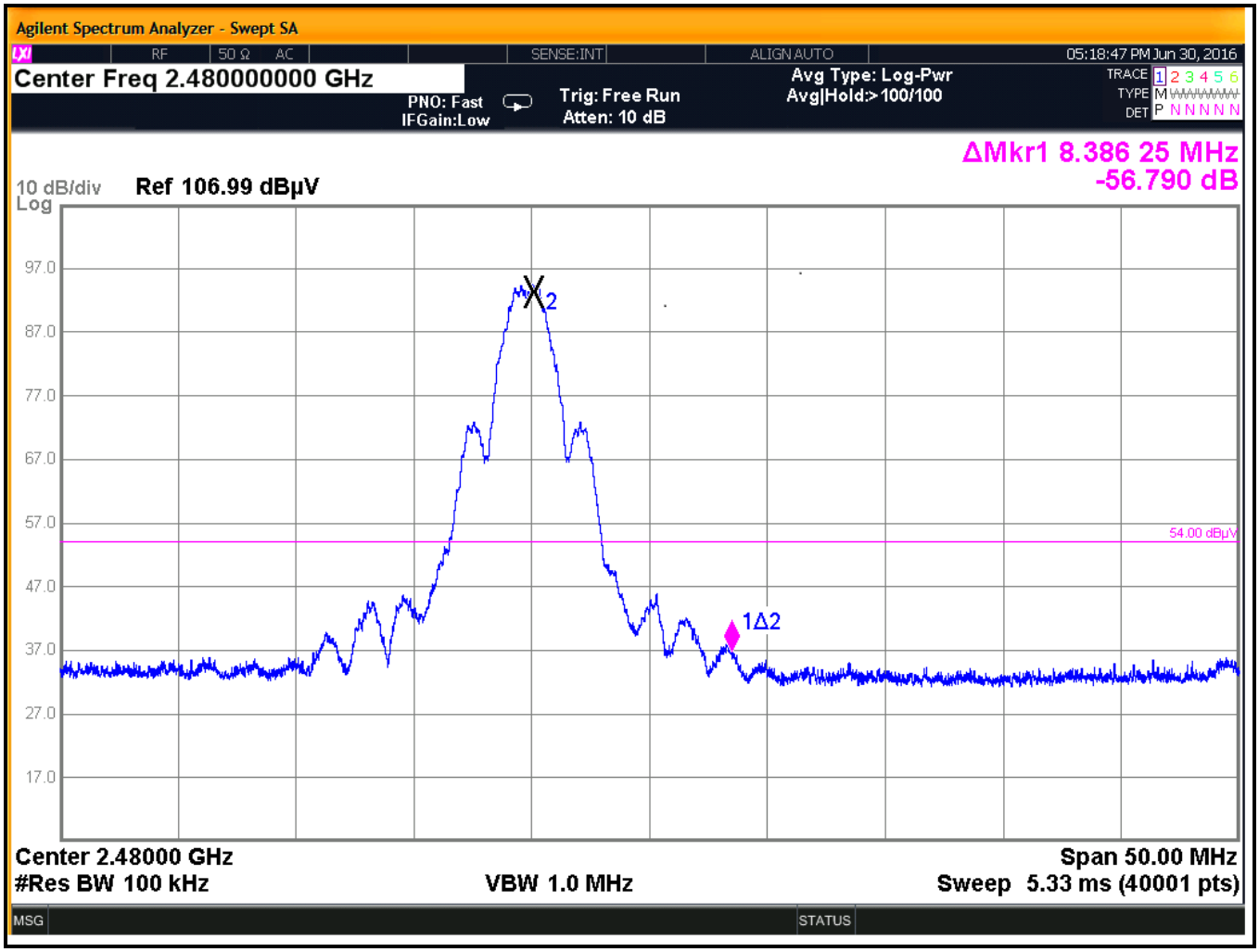

Figure 7: Radiated Band Edge Compliance Upper Edge

