




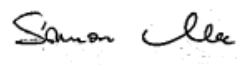
FCC PART 15, SUBPART C TEST AND MEASUREMENT REPORT

For

CentraLite Systems Inc.

1000 Cody Road South, Suite A,
Mobile, Alabama 36695, USA

FCC ID: T3L-SS019

Report Type: Original Report	Product Type: 3 Series Micro-Door Sensor
Prepared By: Bo Li	
Report Number: R1504273-247	
Report Date: 2015-06-11	
Reviewed By: Lead Engineer	
Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164	

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by A2LA*, NIST, or any agency of the Federal Government.

* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*" 6-10

TABLE OF CONTENTS

1	General Description.....	5
1.1	Product Description for Equipment Under Test (EUT)	5
1.2	Mechanical Description of EUT	5
1.3	Objective.....	5
1.4	Related Submittal(s)/Grant(s)	5
1.5	Test Methodology	5
1.6	Measurement Uncertainty	5
1.7	Test Facility	6
2	System Test Configuration.....	7
2.1	Justification.....	7
2.2	EUT Exercise Software.....	7
2.3	Special Equipment	7
2.4	Equipment Modifications.....	7
2.5	Local Support Equipment	7
2.6	EUT Internal Configuration Details.....	7
2.7	Interface Ports and Cables	8
2.8	Power Supply List and Details.....	8
3	Summary of Test Results	9
4	FCC §15.247(i) & §2.1091 – RF Exposure.....	10
4.1	Applicable Standard.....	10
4.2	MPE Prediction.....	10
4.3	MPE Results	10
5	FCC §15.203 – Antenna Requirements.....	11
5.1	Applicable Standard.....	11
5.2	Antenna Description	11
6	FCC §15.205, §15.209 & §15.247(d) – Spurious Radiated Emissions	12
6.1	Applicable Standard.....	12
6.2	Test Setup	13
6.3	Test Procedure	13
6.4	Corrected Amplitude & Margin Calculation.....	14
6.5	Test Equipment List and Details.....	14
6.6	Test Environmental Conditions	14
6.7	Summary of Test Results	15
6.8	Radiated Emissions Test Results	16
7	FCC§15.247(a)(2) – 6 dB & 99% Emission Bandwidth	19
7.1	Applicable Standard.....	19
7.2	Measurement Procedure.....	19
7.3	Test Equipment List and Details.....	19
7.4	Test Environmental Conditions	19
7.5	Test Results and Plots	20
8	FCC §15.247(b) – Peak Output Power Measurement	21
8.1	Applicable Standard.....	21
8.2	Measurement Procedure.....	21
8.3	Test Equipment List and Details.....	21
8.4	Test Environmental Conditions	21
8.5	Test Results.....	22
9	FCC §15.247(d) – 100 kHz Bandwidth of Band Edges.....	23
9.1	Applicable Standard.....	23
9.2	Measurement Procedure.....	23

9.3 Test Equipment List and Details..... 23

9.4 Test Environmental Conditions 23

9.5 Test Results..... 23

10 FCC §15.247(e) – Power Spectral Density..... 25

10.1 Applicable Standard..... 25

10.2 Measurement Procedure..... 25

10.3 Test Equipment List and Details..... 25

10.4 Test Environmental Conditions 25

10.5 Test Results..... 26

11 Exhibit A – FCC Equipment Labeling Requirements..... 27

11.1 FCC ID Label Requirements 27

11.2 FCC ID Label and Location..... 27

12 Exhibit B – Test Setup Photographs 28

12.1 Radiated Emission below 1 GHz Front View 28

12.2 Radiated Emission below 1 GHz Rear View 28

12.3 Radiated Emission above 1 GHz Front View 29

12.4 Radiated Emission above 1 GHz Rear View 29

13 Exhibit C – EUT Photographs..... 30

13.1 EUT Top View..... 30

13.2 EUT Rear View 30

13.3 EUT Open Case View..... 31

13.4 Main Board Top View 31

13.5 Main Board Rear View 32

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1504273-247	Original Report	2015-06-11

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *CentraLite Systems, Inc.*, and their product *FCC ID: T3L-SS019; model name: Voyager, model number: 3320-L*, as the "EUT" (Equipment Under Testing) as referred to in this report. The EUT is a 3 Series Micro-Door Sensor operates in 2405-2480 MHz..

1.2 Mechanical Description of EUT

The EUT measures approximately 2.67 cm (L) x 1.524 cm (W) x 0.4699 cm (H) and weighs 0.085 kg.

Note: The EUT was tested without enclosure.

The test data gathered are from typical production sample, serial number: R1504273-01 assigned by BACL.

1.3 Objective

This report is prepared on behalf of *CentraLite Systems, Inc.* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission's rules.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2009 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB 558074 D01 DTS Meas Guidance v03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

The following calculation follows the procedures as set forth in clause 7.2.3, ETSI TR 100 028-1 V1.4.1 (2001-12), the expression of Uncertainty in Radiated RF Testing is in accordance to ISO/IEC 17025 and TR 100 028-1 V1.4.1 (2001-12).

The expanded Measurement Uncertainty value having a confidence factor of 95%, is within a range of 5.48 dB. This means that the value of conducted RF carrier power test will be within +/- 2.74 dB of the measuring radiated emissions power versus the expected value.

The expected value is defined as the power at the antenna of the Transmitter under Test.

1.7 Test Facility

Bay area compliance Laboratories Corp. (BACL) is:

1- An independent Commercial Test Laboratory accredited to **ISO 17025: 2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminaires and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65: 1996** by **A2LA** to certify:

1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.

2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.

3. Radio Communication Equipment for Singapore.

4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.

5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).

6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s), Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.10-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

<http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b>

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2009 and FCC KDB 558074 D01 DTS Meas Guidance v03r02.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the occupied bandwidth, peak power, spurious emission, band edge and PSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

EUT was exercised using putty.exe and verified by Bo Li.

2.3 Special Equipment

There were no special accessories required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070
Dell	Laptop	Latitude D 610	-

Note: Signal generator is used before every testing to verify the parameter of cables and filters.

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
Silicon Labs	SkyWorks ZigBee Radio	EM357/SE2432L	-
Silicon Labs	CPU	Si4355	-

2.7 Interface Ports and Cables

Description	Length	From	To
10-pin cable	0.2 M	Debug Adapter	EUT
USB cable	1M	Debug Adapter	Laptop
Ethernet Cable	1M	Debug Adapter	Laptop

2.8 Power Supply List and Details

No power supplies were required for the EUT.

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.247(i), §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	N/A ²
§15.205, §15.209, §15.247(d)	Restricted Bands, Radiated Spurious Emissions	Compliant
§15.247 (d)	Conducted Transmitter Spurious Emission	N/A ¹
§15.247(a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Peak Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

¹ The EUT did not have an antenna port.

² The EUT was battery powered.

4 FCC §15.247(i) & §2.1091 – RF Exposure

4.1 Applicable Standard

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission’s guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* (180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

4.3 MPE Results

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>7.688</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>5.872</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2440</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>2.2</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.660</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.00194</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.00194 mW/cm². Limit is 1.0 mW/cm²

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.2 Antenna Description

The EUT uses a trace antenna, which complies with the antenna requirement. And the antenna gain is 2.2 dBi. Please refer to the internal photos.

6 FCC §15.205, §15.209 & §15.247(d) – Spurious Radiated Emissions

6.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a) and RSS-210: Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5.35 – 5.46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 – 167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per FCC §15.247 (d) 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 this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

6.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2009. The specification used was the FCC 15 Subpart C.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

6.3 Test Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 11: Emissions in non-restricted frequency bands and section 12: Emissions in restricted frequency bands. As well as ANSI C63.10: 2009 as described below:

For the radiated emissions test, the EUT host, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

- (1) Peak: RBW = 1MHz / VBW = 3MHz / Sweep = Auto
- (2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

6.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

$$CA = Ai + AF + CL + Atten - Ga$$

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

The “Margin” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

6.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/A	N/A
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2014-09-17	1 year
Hewlett Packard	Pre-amplifier 1GHz-26.5GHz	8447D	2944A06639	2015-03-20	1 year
HP/ Agilent	Pre Amplifier	8449B OPT HO2	3008A0113	2015-03-12	1 year
E-meca	10dB Attenuator	18N-10-294	64671	N/A	N/A
Micro Tronics	Band Reject Filter	BRM50701	160	N/A	N/A
IW Microwave	SMA-Cable	SPS-2303-3840-SPS	DC1438	N/A	N/A
Hewlett Packard	N-Type Cable	-	692	N/A	N/A
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2014-11-13	1 year
Eaton	Antenna, Horn	96001	2617	2014-11-18	1 year
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100044	2014-07-17	1 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

6.6 Test Environmental Conditions

Temperature:	22° C
Relative Humidity:	52 %
ATM Pressure:	101.9 kPa

The testing was performed by Bo Li on 2015-05-18 in 5 m chamber 3.

6.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel
-4.92	249.98775	Horizontal	Middle

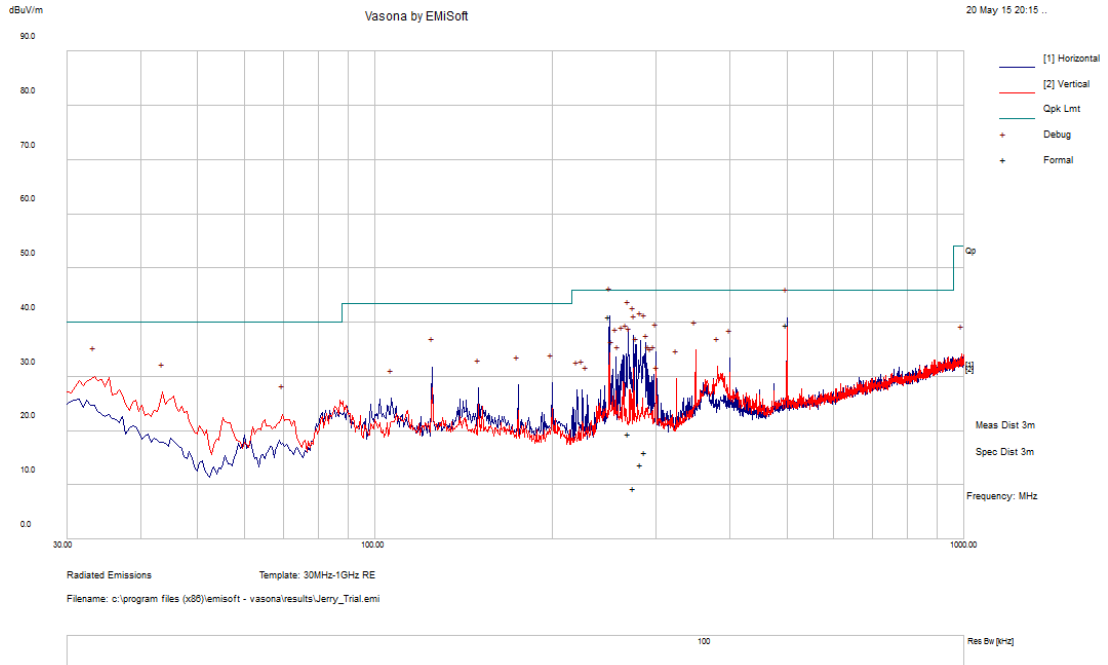
1-25 GHz:

Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel
-0.557	2483.5	Vertical	High

Please refer to the following table and plots for specific test result details

6.8 Radiated Emissions Test Results

1) 30 MHz–1 GHz, Measured at 3 meters



Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Detector (PK/QP/Ave)
249.98775	41.08	H	116	326	46	-4.92	QP
499.99425	39.55	H	191	61	46	-6.45	QP
268.91	19.61	H	175	57	46	-26.39	QP
274.72	9.54	H	400	-1	46	-36.46	QP
282.3895	13.83	H	301	309	46	-32.17	QP
287.38625	16.02	H	143	240	46	-29.98	QP

Note: Middle channel is chosen because it has the highest power value and therefore is the worst case.

2) 1-25 GHz, Measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2405 MHz, measured at 3 meters											
2405	71.03	97	100	V	28.383	2.865	0	102.278	-	-	Peak
2405	65.51	318	100	H	28.417	2.865	0	96.792	-	-	Peak
2405	68.94	97	100	V	28.383	2.865	0	100.188	-	-	Ave
2405	63.34	318	100	H	28.417	2.865	0	94.622	-	-	Ave
2390	26.81	97	100	V	28.383	2.865	0	58.058	74	-15.942	Peak
2390	26.15	318	100	H	28.417	2.865	0	57.432	74	-16.568	Peak
2390	12.63	97	100	V	28.383	2.865	0	43.878	54	-10.122	Ave
2390	12.27	318	100	H	28.417	2.865	0	43.552	54	-10.448	Ave
4810	59.84	275	100	V	32.897	4.297	35.663	61.371	74	-12.629	Peak
4810	58.13	51	100	H	32.897	4.297	35.663	59.661	74	-14.339	Peak
4810	49.49	275	100	V	32.897	4.297	35.663	51.021	54	-2.979	Ave
4810	47.36	51	100	H	32.897	4.297	35.663	48.891	54	-5.109	Ave
7215	53.73	271	100	V	37.444	5.675	36.064	60.785	82.278	-21.493	Peak
7215	53.46	271	100	H	37.442	5.675	36.064	60.513	76.792	-16.279	Peak
7215	42.43	271	100	V	37.444	5.675	36.064	49.485	80.188	-30.703	Ave
7215	42.3	271	100	H	37.442	5.675	36.064	49.353	74.622	-25.269	Ave
9620	48.77	272	100	V	38.830	8.704	35.900	60.404	82.278	-21.874	Peak
9620	45.81	0	100	H	38.834	8.704	35.900	57.448	76.792	-19.344	Peak
9620	35.88	272	100	V	38.830	8.704	35.900	47.514	80.188	-32.674	Ave
9620	31.87	0	100	H	38.834	8.704	35.900	43.508	74.622	-31.114	Ave
Middle Channel 2440 MHz, measured at 3 meters											
2440	73.88	95	100	V	28.383	2.865	0	105.128	-	-	Peak
2440	67.45	319	100	H	28.417	2.865	0	98.732	-	-	Peak
2440	71.67	95	100	V	28.383	2.865	0	102.918	-	-	Ave
2440	65.25	319	100	H	28.417	2.865	0	96.532	-	-	Ave
4880	53.35	273	100	V	33.119	4.404	35.896	54.977	74	-19.023	Peak
4880	49.68	263	100	H	33.354	4.404	35.896	51.542	74	-22.458	Peak
4880	41.96	273	100	V	33.119	4.404	35.896	43.587	54	-10.413	Ave
4880	36.67	263	100	H	33.354	4.404	35.896	38.532	54	-15.468	Ave
7320	47.39	222	100	V	37.242	5.788	35.958	54.462	74	-19.538	Peak
7320	48.43	287	100	H	37.356	5.788	35.958	55.616	74	-18.384	Peak
7320	34.06	222	100	V	37.242	5.788	35.958	41.132	54	-12.868	Ave
7320	34.7	287	100	H	37.356	5.788	35.958	41.886	54	-12.114	Ave
9760	46.32	0	100	V	38.908	8.157	36.032	57.354	85.128	-27.774	Peak
9760	46.05	0	100	H	38.913	8.157	36.032	57.089	78.732	-21.643	Peak
9760	31.73	0	100	V	38.908	8.157	36.032	42.764	82.918	-40.154	Ave
9760	31.76	0	100	H	38.913	8.157	36.032	42.799	76.532	-33.733	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 2480 MHz, measured at 3 meters											
2480	62.67	95	100	V	29.764	2.950	0	95.384	-	-	Peak
2480	57.55	319	100	H	28.785	2.950	0	89.285	-	-	Peak
2480	60.34	95	100	V	28.764	2.950	0	92.054	-	-	Ave
2480	55.12	319	100	H	28.785	2.950	0	86.855	-	-	Ave
2483.5	34.17	95	100	V	28.373	2.950	0	65.493	74	-8.507	Peak
2483.5	30.74	319	100	H	28.785	2.950	0	62.475	74	-11.525	Peak
2483.5	22.12	95	100	V	28.373	2.950	0	53.443	54	-0.557	Ave
2483.5	18.42	319	100	H	28.785	2.950	0	50.155	54	-3.845	Ave
4960	49.83	61	100	V	33.531	4.404	35.909	51.856	74	-22.144	Peak
4960	47.41	0	100	H	33.556	4.404	35.909	49.461	74	-24.539	Peak
4960	36.94	61	100	V	33.531	4.404	35.909	38.966	54	-15.034	Ave
4960	33.5	0	100	H	33.556	4.404	35.909	35.551	54	-18.449	Ave
7440	45.46	0	100	V	37.242	5.869	35.963	52.608	74	-21.392	Peak
7440	45.32	0	100	H	37.238	5.869	35.963	52.464	74	-21.536	Peak
7440	31.12	0	100	V	37.242	5.869	35.963	38.268	54	-15.732	Ave
7440	31.09	0	100	H	37.238	5.869	35.963	38.234	54	-15.766	Ave
9920	45.09	0	100	V	39.036	7.657	35.976	55.807	75.384	-19.577	Peak
9920	45.62	0	100	H	39.052	7.657	35.976	56.353	69.285	-12.932	Peak
9920	31.11	0	100	V	39.036	7.657	35.976	41.827	72.054	-30.227	Ave
9920	31.1	0	100	H	39.052	7.657	35.976	41.833	66.855	-25.022	Ave

Note: The power setting is 8 for the low and middle channels and -4 for the high channel.

7 FCC§15.247(a)(2) – 6 dB & 99% Emission Bandwidth

7.1 Applicable Standard

According to FCC §15.247(a)(2) , systems using digital modulation techniques may operate in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

7.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8: DTS bandwidth

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
IW Microwave	SMA-Cable	SPS-2303-3840-SPS	DC1438	N/A	N/A
Agilent	Analyzer, Spectrum	E4440A	US 422221851	2014-11-13	1 year
Eaton	Antenna, Horn	96001	2617	2014-11-18	1 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

7.4 Test Environmental Conditions

Temperature:	22° C
Relative Humidity:	52 %
ATM Pressure:	101.9 kPa

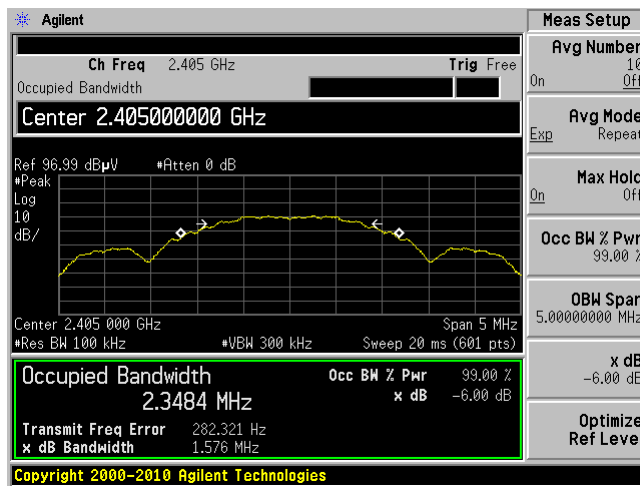
The testing was performed by Bo Li on 2015-05-18 in 5 m chamber 3.

7.5 Test Results and Plots

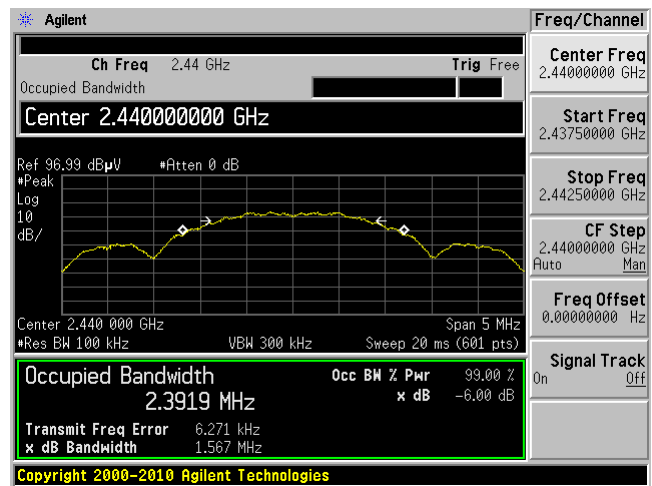
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2405	1.576	2.3484	> 0.5	Compliant
Middle	2440	1.567	2.3919	> 0.5	Compliant
High	2480	1.585	2.3970	> 0.5	Compliant

Please refer to the following plots for detailed test results

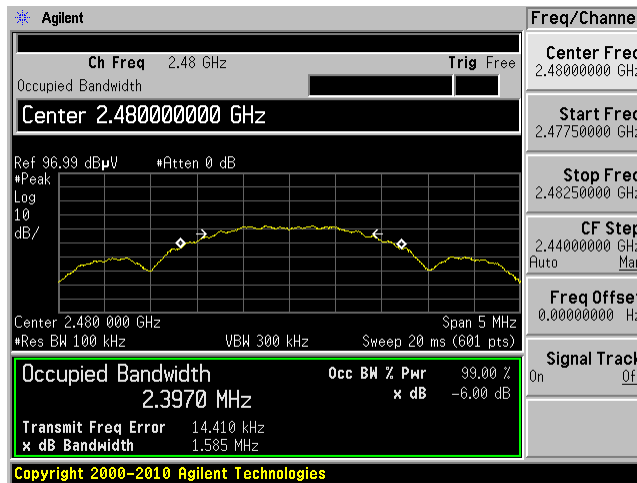
Low channel: 2405 MHz



Middle channel: 2440 MHz



High Channel 2480 MHz



Note: These measurements were taken at the worst case, with the measuring antenna polarized vertically.

8 FCC §15.247(b) – Peak Output Power Measurement

8.1 Applicable Standard

According to FCC §15.247(b) for systems using digital modulation in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands: 1 Watt.

8.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 9: Fundamental emission output power

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science	System Controller	SC99V	122303-1	N/R	N/R
IW Microwave	SMA-Cable	SPS-2303-3840-SPS	DC1438	N/A	N/A
Agilent	Spectrum Analyzer	E4440A	MY44303352	2014-11-13	1 year
EMCO	Antenna, Horn	3115	9511-4627	2015-01-15	1 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

8.4 Test Environmental Conditions

Temperature:	22° C
Relative Humidity:	52 %
ATM Pressure:	101.9 kPa

The testing was performed by Bo Li on 2015-05-18 in 5 m chamber 3.

8.5 Test Results

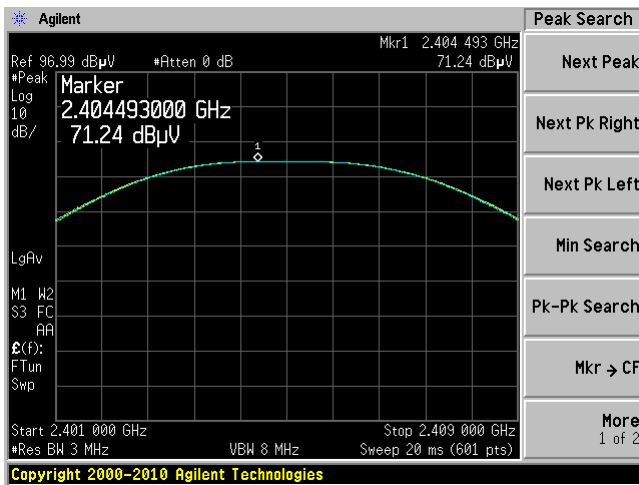
Frequency (MHz)	S.A. Reading (dBμV)	Test Antenna Factor (dB/m)	Cable Loss (dB)	Cord. Reading (dBμV/m)	EIRP (dBm)	Antenna Gain (dBi)	Output Power (dBm)	Limit (dBm)	Power Setting
2405	71.24	28.383	-2.865	102.488	7.228	2.200	5.028	30	8
2440	73.9	28.383	-2.865	105.148	9.888	2.200	7.688	30	8
2480	62.76	28.764	-2.950	94.474	-0.786	2.200	-2.986	30	-4

The field strength converts to conducted power should be as following:

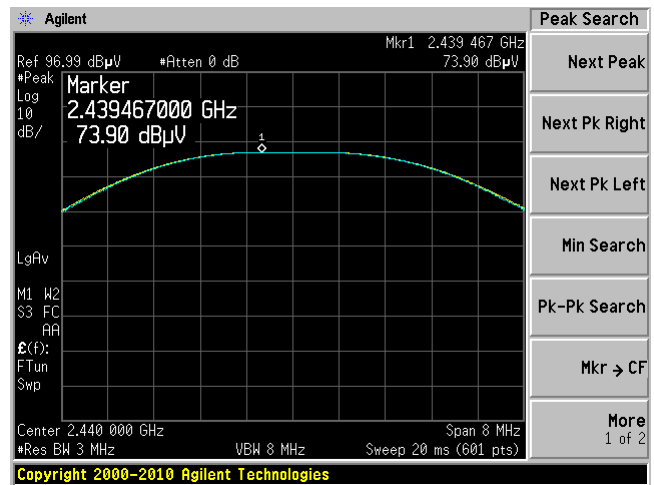
$E \text{ (dB}\mu\text{V/m)} = \text{EIRP [dBm]} + 95.26$ for the distance at 3 meters.

Please refer to the following plots:

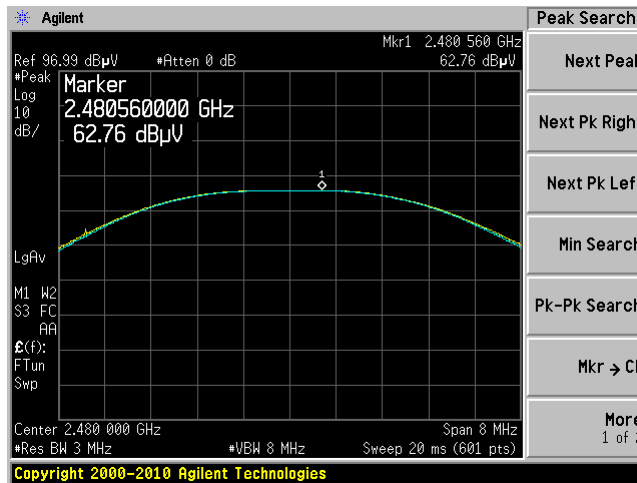
Low channel: 2405 MHz



Middle channel: 2440 MHz



High Channel 2480 MHz



Note: These measurements were taken at the worst case, with the measuring antenna polarized vertically.

9 FCC §15.247(d) – 100 kHz Bandwidth of Band Edges

9.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

9.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v03r01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 13: Band-edge measurements

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
IW Microwave	SMA-Cable	SPS-2303-3840-SPS	DC1438	N/A	N/A
Agilent	Analyzer, Spectrum	E4440A	US 422221851	2014-11-13	1 year
Eaton	Antenna, Horn	96001	2617	2014-11-18	1 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

9.4 Test Environmental Conditions

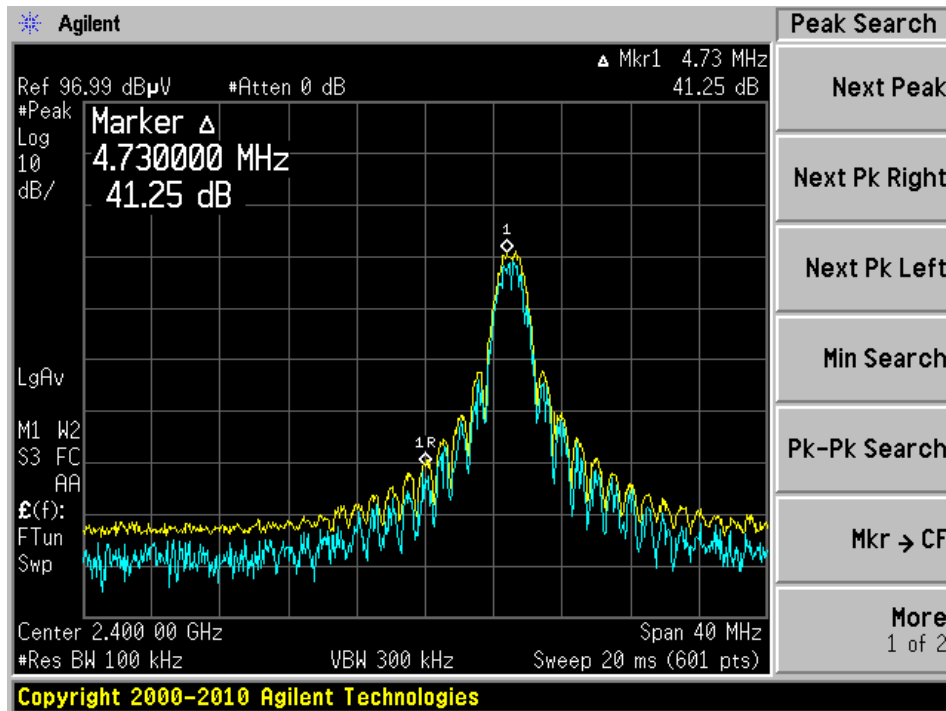
Temperature:	22° C
Relative Humidity:	52 %
ATM Pressure:	101.9 kPa

The testing was performed by Bo Li on 2015-05-18 in 5 m chamber 3.

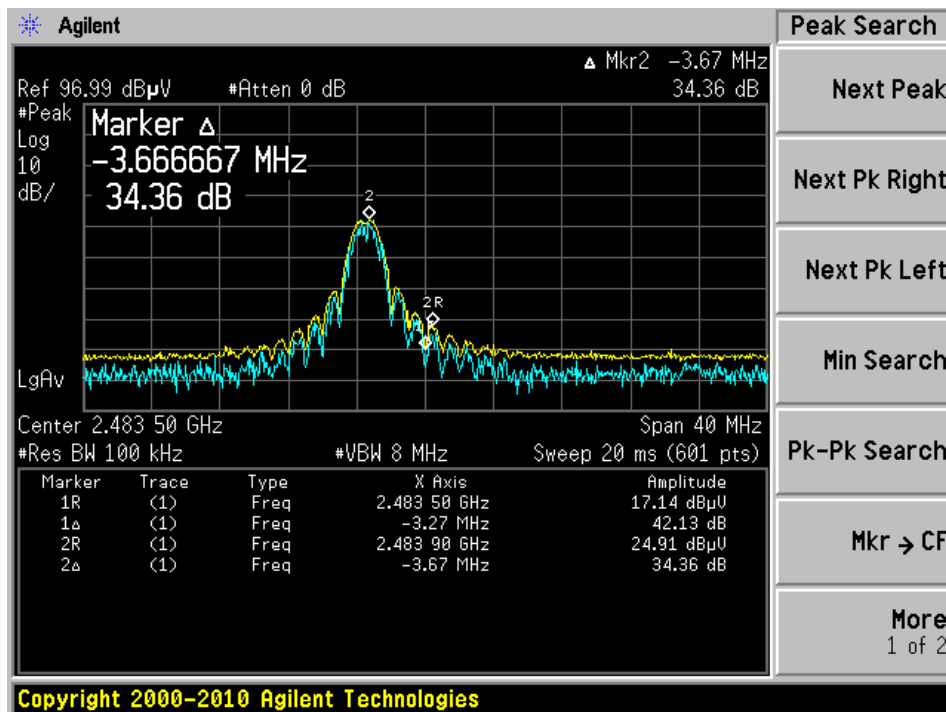
9.5 Test Results

Please refer to following pages for plots of band edge.

Low Channel 2405 MHz



High Channel 2480 MHz



Note: These measurements were taken at the worst case, with the measuring antenna polarized vertically.

10 FCC §15.247(e) – Power Spectral Density

10.1 Applicable Standard

According to FCC §15.247(e) , for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

10.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v03r01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10: Maximum power spectral density level in the fundamental emission

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
IW Microwave	SMA-Cable	SPS-2303-3840-SPS	DC1438	N/A	N/A
Agilent	Analyzer, Spectrum	E4440A	US 422221851	2014-11-13	1 year
Eaton	Antenna, Horn	96001	2617	2014-11-18	1 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

10.4 Test Environmental Conditions

Temperature:	22° C
Relative Humidity:	52 %
ATM Pressure:	101.9 kPa

The testing was performed by Bo Li on 2015-05-18 in 5 m chamber 3.

10.5 Test Results

Frequency (MHz)	S.A. Reading (dBμV)	Test Antenna Factor (dB/m)	Cable Loss (dB)	Cord. Reading (dBμV/m)	EIRP (dBm/3kHz)	Antenna Gain (dBi)	PSD (dBm)	Limit
2405	55.55	28.383	-2.865	86.798	-8.462	2.200	-10.662	8
2440	57.23	28.383	-2.865	88.478	-6.782	2.200	-8.982	8
2480	45.39	28.764	-2.950	77.104	-18.156	2.200	-20.356	8

The field strength converts to conducted power should be as following:

$$E \text{ (dB}\mu\text{V/m)} = \text{EIRP [dBm]} + 95.26 \text{ for the distance at 3 meters.}$$

Please refer to the following plots for detailed test results:

Low channel: 2405 MHz



Middle channel: 2440 MHz



High Channel 2480 MHz



Note: These measurements were taken at the worst case, with the measuring antenna polarized vertically.