FCC PART 15, SUBPART C
ISED RSS-247, ISSUE 1, MAY 2015
ISED RSS-GEN ISSUE 4, NOVEMBER 2014

TEST AND MEASUREMENT REPORT

For

FORM Lifting, Inc.

555 West 5th Street, 35th Floor,

Los Angeles, CA 90013, USA

FCC ID: 2AIZQFC1000
IC: 21686-FC1000

Report Type:	**Product Type:**
Original Report	Smart weightlifting collar

Prepared By	Jin Yang Test Engineer
Report Number	R1606107-247
Report Date	2016-08-15
Reviewed By	Bo Li RF Supervisor

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1606107-247	Original	2016-08-15

General Description

Product Description for Equipment Under Test (EUT)

This test and measurement report has been compiled on behalf of *FORM Lifting, Inc.,* and their product, *FCC ID: 2AIZQFC1000, IC: 21686-FC1000,* model number: *FC1000*, which henceforth is referred to as the EUT (Equipment Under Test), the product is a weightlifting collar with Bluetooth Low Energy.

Mechanical Description of EUT

The EUT measures approximately *12 cm (L) x 9 cm (W) x 5 cm (H)* and weighs approximately *0.23kg.*

The data gathered are from a typical production sample provided by the manufacturer with serial number: R1606107-1.

Objective

This report is prepared on behalf of *FORM Lifting, Inc.*in accordance with Part 2, Subpart J, and Part 15, Subparts A, B and C of the Federal Communication Commission's rules and RSS-247 Issue 1, May 2015.

The tests were performed in order to determine the compliance of the EUT with FCC Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209, 15.247 and RSS-247, RSS-gen rules.

Related Submittal(s)/Grant(s)

No.

Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB 558074 D01 DTS Meas Guidance v03r05: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

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.

Measurement Uncertainty

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 º C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

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 Luminares 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:
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 C63.10-2013, ANSI C63.4-2014, 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=8430d44f1f47cf2996124343c704b3678l6b

System Test Configuration

Justification

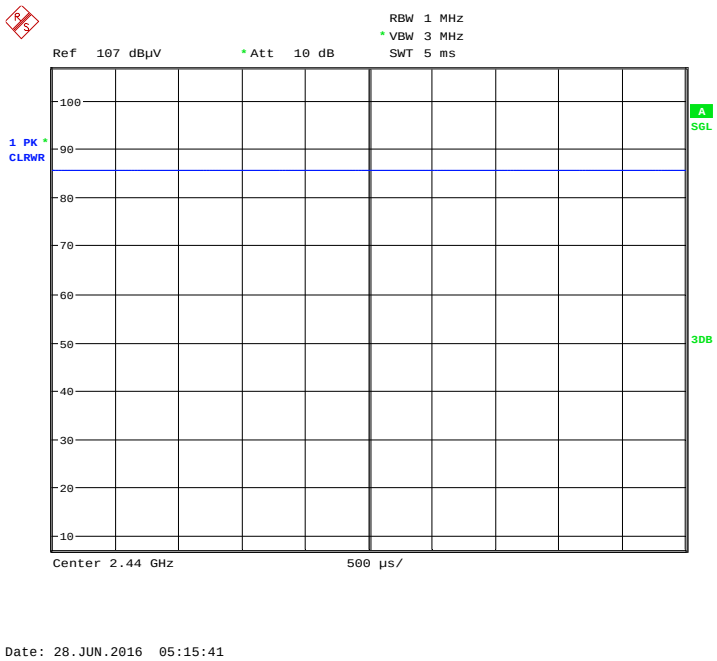
The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v03r05.

EUT Exercise Software

The worst condition (maximum power with 100% duty cycle) was setting by the software as following table:

Mode	DTM Setup Software	nRFgo Studio		
BLE	Test Frequency	2402 MHz	2440 MHz	2480 MHz
	Data Rate	/	/	/
	Power Level	/	/	/

Duty Cycle (100%)



Special Equipment

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

Equipment Modifications

No modifications were made to the EUT.

Local Support Equipment

Manufacturer	Description	Type	Serial Number
Dell	Laptop	E6410	/

EUT Internal Configuration Details

Manufacturer	Description	Type	Serial Number
/	MCU	N51822	/

Interface Ports and Cables

Cable Description	Length (cm)	To	From
USB Cable	92	Adapter	EUT

Power Supply List and Details

Manufacturer	Description	Type	Serial Number
Apple	USB Power Adapter	A1357	/

Summary of Test Results

Results reported relate only to the product tested.

FCC & ISED Rules	Description of Test	Results
FCC §15.203 RSS-Gen §8.3	Antenna Requirement	Compliant
FCC §15.207(a) RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §15.247(i) RSS-102	RF Exposure	Compliant
FCC §15.247 (d) RSS-247 §5.5	Spurious Emissions at Antenna Port	Not Applicable
FCC §15.205 RSS-Gen §8.10	Restricted Bands	Compliant
FCC §15.209, §15.247 (d) RSS-247 §5.5 RSS-Gen §8.9	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) RSS-247 §5.2 RSS-Gen §6.6	6 dB & 99% Emission Bandwidth	Compliant
FCC §15.247(b)(3) RSS-247 §5.4	Maximum Peak Output Power	Compliant
FCC §15.247(d) RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e) RSS-247 §5.2	Power Spectral Density	Compliant

Not Applicable: this unit does not have the RF connector, all the testing was performed with radiated method.

FCC §15.203 & ISED RSS-Gen §8.3 - Antenna Requirements

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.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to RSS-Gen §8.3: Transmitter Antenna for Licence-Exempt Radio Apparatus

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. 9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

Antenna Connector Construction

Antenna Type/Pattern	Antenna Gain @ 2.4 GHz
PCB	2 dBi

FCC §15.247(i) & ISED RSS §102 - RF Exposure

Applicable Standards

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

Before equipment certification is granted, the procedure of RSS-102 must be followed concerning the exposure of humans to RF field.

According to RSS-102 Issue 5 § (2.5.2)

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

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 (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

MPE Results

Maximum tune-up peak output power at antenna input terminal (dBm):	-2.0
Maximum tune-up peak output power at antenna input terminal (mW):	0.63
Prediction distance (cm):	20
Prediction frequency (MHz):	2480
Maximum Antenna Gain, typical (dBi):	2.0
Maximum Antenna Gain (numeric):	1.58
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0002
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0002 mW/cm^2. Limit is 1.0 mW/cm^2.

RF exposure evaluation exemption for ISED

The max tune-up peak conducted output power is -2.0 dBm at 2480 MHz and the antenna gain is 2.0 dBi, so the e.i.r.p is 0 dBm (0.001W).

Exemption from Routine Evaluation Limit is:
$1.31 \times 10^{-2} f^{0.6834}$ W = $1.31 \times 10^{-2} \times 2480^{0.6834}$ W = 2.74 W > 0.001W

So the device is compliance exemption from Routine Evaluation Limits –RF exposure Evaluation.

Result: The device meets exemption limits at greater than 20 cm distance as a mobile device specified in RSS-102 § 2.5.2.

FCC §15.207& ISED RSS-Gen §8.8 - AC Power Line Conducted Emissions

Applicable Standards

Per FCC §15.207 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this 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 frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 1
0.5-5	56	46
5-30	60	50

Note 1 Decreases with the logarithm of the frequency.

Per RSS-Gen §8.8 AC Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits in Table 3.
Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 3 below. The more stringent limit applies at the frequency range boundaries.
The conducted emissions shall be measured in accordance with the reference publication mentioned in Section 3.

Table 3 - AC Power Lines Conducted Emission Limits		
Frequency range (MHz)	Conducted limit (dBμV)	
	Quasi-Peak	Average**
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

Note:
* The level decreases linearly with the logarithm of the frequency.
** A linear average detector is required.

Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013 measurement procedure. The specification used was FCC §15.207/ RSS-247/RSS-Gen limits.

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

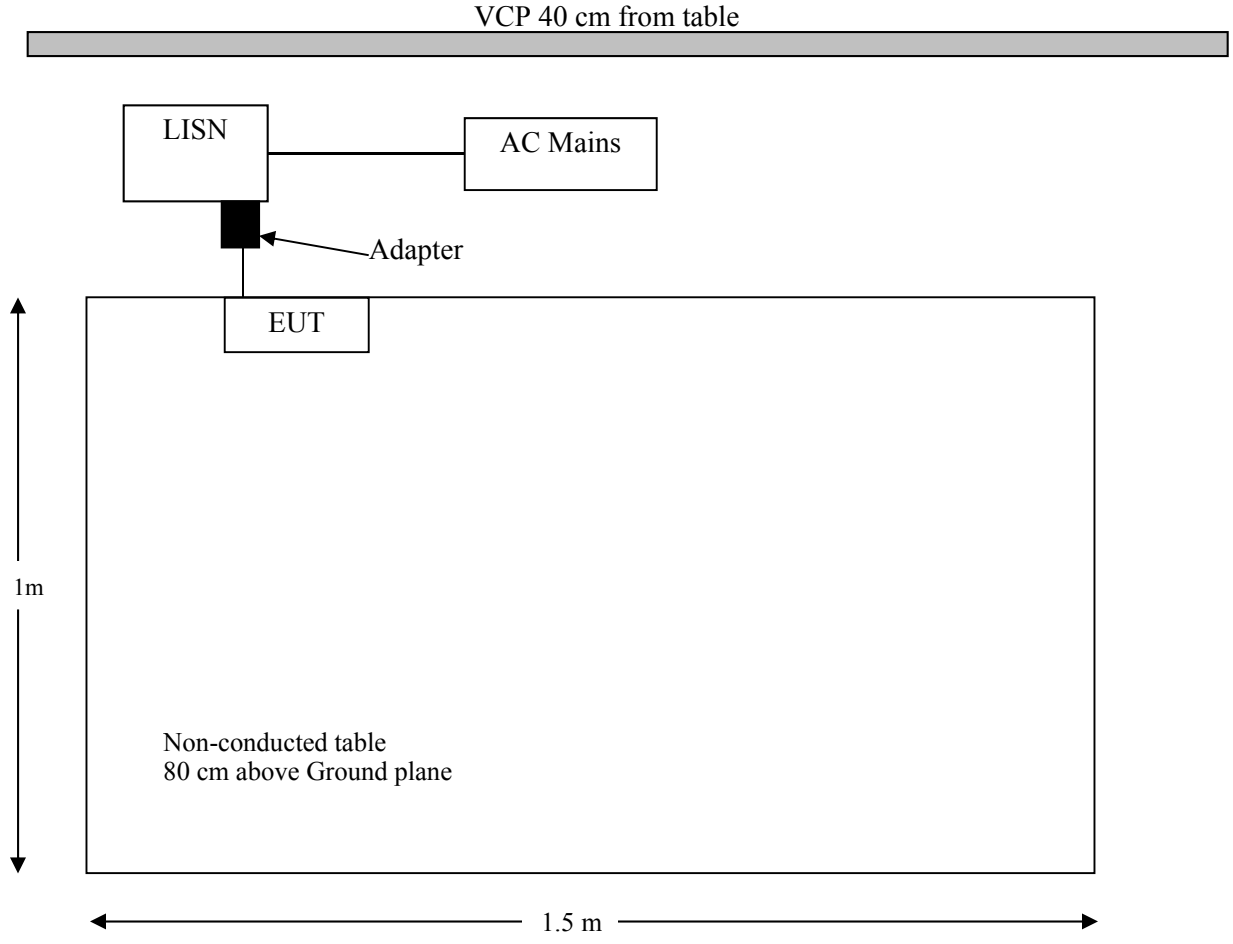
The adapter was connected with LISN-1 which provided 120 V / 60 Hz AC power.

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a "QP." Average readings are distinguished with an "Ave".

Test Setup Block Diagram



Corrected Amplitude & Margin Calculation

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

CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBµV = Indicated Reading (32.5 dBµV) + Cable Loss (3.7 dB) + Attenuator (10 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:

Margin = Corrected Amplitude - Limit

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160130	2016-04-12	2017-04-12
Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101962	2015-07-15	2016-07-15
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150203	2016-02-26	2017-02-26
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2018-02-04
Wireless Solutions	Conducted Emission Cable	LMR 400	691	2015-07-02	2016-07-02

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

Test Environmental Conditions

Temperature:	25º C
Relative Humidity:	46 %
ATM Pressure:	101.7 kPa

The testing was performed by Jin Yang on 2016-06-22.

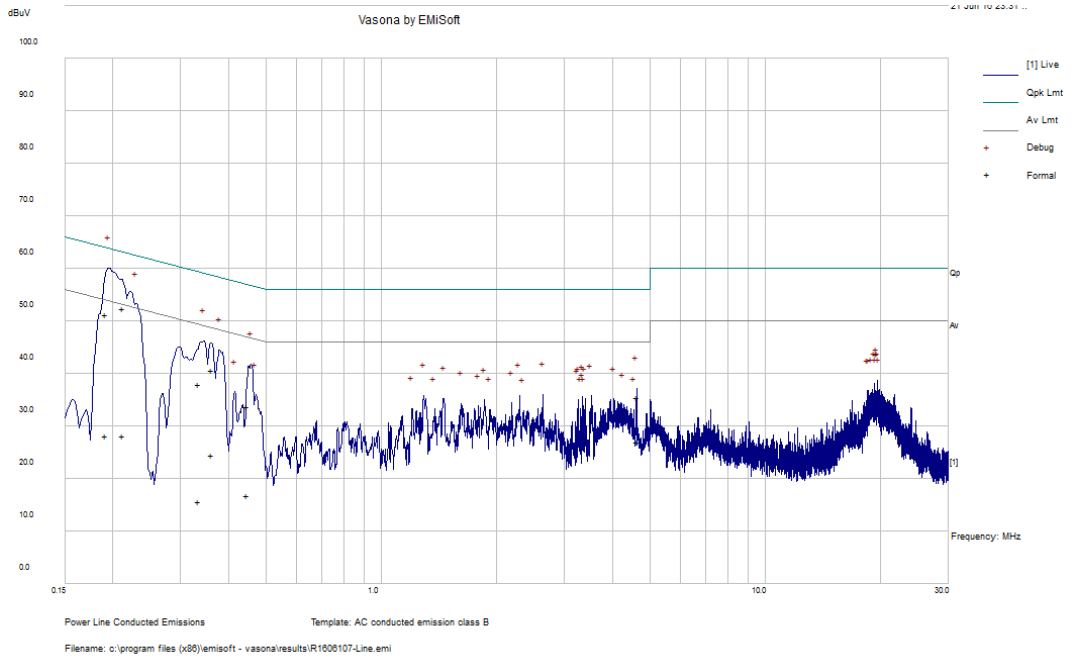
Summary of Test Results

According to the recorded data, the EUT complied with FCC 15.207/RSS-Gen, and the worst margin reading of:

Connection: AC120 V/60 Hz			
Margin (dB)	**Frequency (MHz)**	**Conductor (Live/Neutral)**	**Range (MHz)**
-10.72	0.212307	Line	0.15-30

Conducted Emissions Test Plots and Data

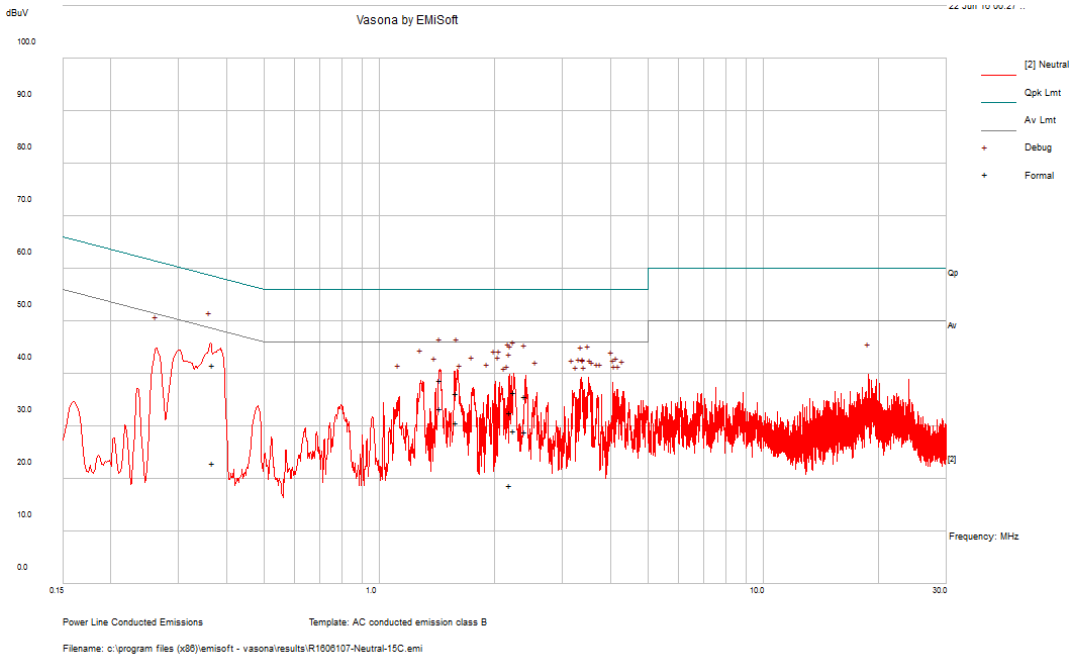
AC 120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.191064	51.18	Line	63.99	-12.81	QP
0.212307	52.39	Line	63.11	-10.72	QP
0.33548	37.93	Line	59.31	-21.38	QP
0.362987	40.61	Line	58.66	-18.05	QP
0.447854	33.70	Line	56.91	-23.21	QP
4.626404	35.55	Line	56.00	-20.45	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.191064	28.18	Line	53.99	-25.81	Ave.
0.212307	28.15	Line	53.11	-24.96	Ave.
0.33548	15.80	Line	49.31	-33.51	Ave.
0.362987	24.65	Line	48.66	-24.01	Ave.
0.447854	16.93	Line	46.91	-29.98	Ave.
4.626404	27.10	Line	46.00	-18.90	Ave.

AC 120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.367887	41.76	Neutral	58.55	-16.79	QP
1.440309	38.79	Neutral	56.00	-17.21	QP
1.590747	36.2	Neutral	56.00	-19.80	QP
2.236096	36.52	Neutral	56.00	-19.48	QP
2.190986	32.7	Neutral	56.00	-23.30	QP
2.391734	35.63	Neutral	56.00	-20.37	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.367887	23.03	Neutral	48.55	-25.52	Ave.
1.440309	33.44	Neutral	46.00	-12.56	Ave.
1.590747	30.72	Neutral	46.00	-15.28	Ave.
2.236096	29.12	Neutral	46.00	-16.88	Ave.
2.190986	18.79	Neutral	46.00	-27.21	Ave.
2.391734	28.99	Neutral	46.00	-17.01	Ave.

FCC §15.247(d), §15.209 & ISED RSS-247 §5.5, RSS-Gen §8.9, §8.10 - Spurious Radiated Emissions

Applicable Standards

Per FCC §15.247 (d); §15.209; §15.205; RSS-247 §5.5; RSS-Gen §8.9, §8.10

Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart C and RSS-247.

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.

Test Procedure

For the radiated emissions test, the adapter 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 for below 1GHz and 1.5 meter for above 1GHz 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:

30 MHz-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

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 dBµV/m = Indicated Reading (32.5 dBµV) + 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:

Margin = Corrected Amplitude - Limit

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2015-06-18	2 year
Agilent	Spectrum Analyzer	E4440A	US45303156	2016-01-19	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Science Corp	Antenna, Biconi-Log	JB3	A020106-2	2015-07-11	2 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2year
Agilent	Pre-amplifier	8447D	2944A10187	2016-03-23	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	2015-08-05	1 year
IW Microwave	High Frequency Cable	DC-1438	SPS-2303-3840-SPS	2015-09-23	1 year
Hewlett-Packard	5 ft N-type RF cable	-	1268	2016-06-15	1 year
Hewlett	Pre-Amplifier	8449B	3008A01978	2015-12-11	1year
Keysight Technologies	RF Limiter	11867A	MY42243052	2016-01-18	2 year
PASTERNACK	Attenuator	6 dB	PE7390-6	2015-07-11	1 year

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL *attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.*

Test Environmental Conditions

Temperature:	25º C
Relative Humidity:	48 %
ATM Pressure:	101.6 kPa

The testing was performed by Jin Yang on 2016-06-22 in 5m chamber 3.

Summary of Test Results

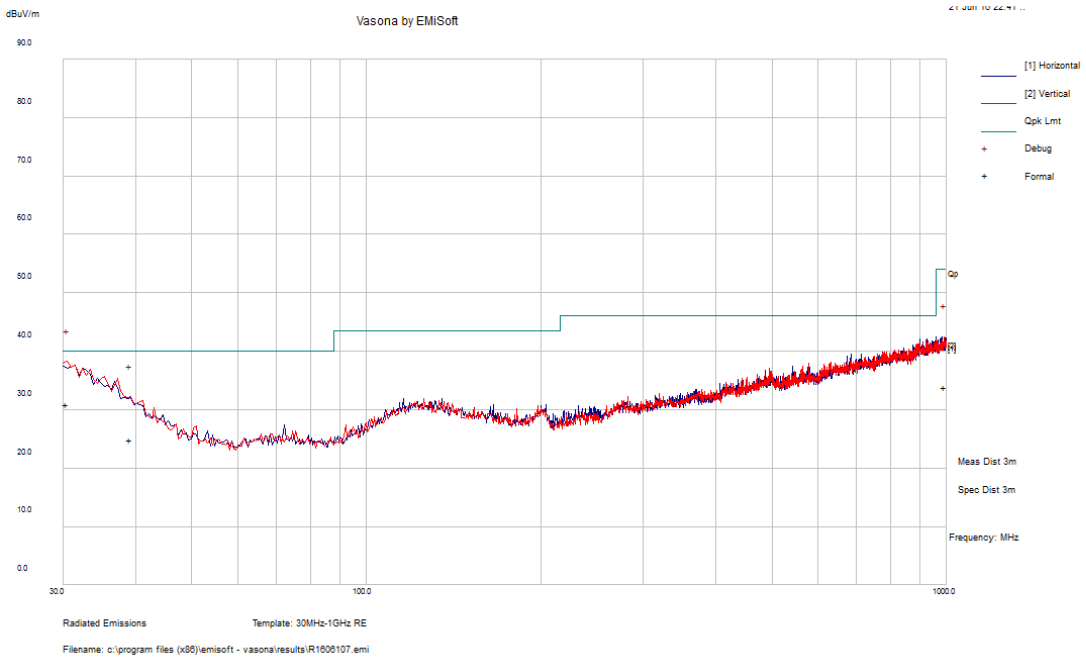
According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Section 15.205, 15.209, 15.247and RSS-247/RSS-Gen standard's radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode**
-2.09	2400	Horizontal	BLE

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

Test Results

1) 30 MHz – 1 GHz Worst Case, Measured at 3 meter



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
30.43	30.94	138	V	39	40	-9.06	QP
39.21	24.87	174	V	186	40	-15.13	QP
991.66	33.94	166	V	339	54	-20.06	QP

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)	Limit (dBµV/m)	Margin (dB)	Detector
			Height (cm)	Polarity (H/V)	Factor (dB/m)						
Low Channel 2402 MHz											
2402	95.65	199	197	H	29.05	5.22	35.20	94.72	N/A	N/A	Peak
2402	93.79	199	197	H	29.05	5.22	35.20	92.86	N/A	N/A	Ave
2402	91.17	264	313	V	29.05	5.22	35.20	90.24	N/A	N/A	Peak
2402	89.03	264	313	V	29.05	5.22	35.20	88.10	N/A	N/A	Ave
2400	68.59	199	197	H	29.04	5.22	35.20	67.65	74.00	-6.35	Peak
2400	52.85	199	197	H	29.04	5.22	35.20	51.91	54.00	-2.09	Ave
2314.81	56.04	199	197	H	28.48	5.27	35.14	54.65	74.00	-19.35	Peak
2314.81	38.93	199	197	H	28.48	5.27	35.14	37.54	54.00	-16.46	Ave
2370.13	56.91	199	197	H	28.85	5.22	35.18	55.80	74.00	-18.20	Peak
2370.13	38.77	199	197	H	28.85	5.22	35.18	37.66	54.00	-16.34	Ave
4804	53.67	164	132	H	32.48	7.88	36.64	57.39	74.00	-16.61	Peak
4804	44.49	164	132	H	32.48	7.88	36.64	48.21	54.00	-5.79	Ave
7206	46.87	352	316	H	36.72	10.45	36.42	57.62	74.00	-16.38	Peak
7206	35.48	352	316	H	36.72	10.45	36.42	46.23	54.00	-7.77	Ave
9608	47.15	6	302	H	37.78	11.37	36.66	59.64	74.00	-14.36	Peak
9608	35.79	6	302	H	37.78	11.37	36.66	48.28	54.00	-5.72	Ave
Middle Channel 2440 MHz											
2440	95.64	199	189	H	29.19	5.22	35.23	94.82	N/A	N/A	Peak
2440	93.67	199	189	H	29.19	5.22	35.23	92.85	N/A	N/A	Ave
2440	89.75	257	264	V	29.19	5.22	35.23	88.93	N/A	N/A	Peak
2440	87.65	257	264	V	29.19	5.22	35.23	86.83	N/A	N/A	Ave
4880	53.28	134	164	H	32.60	7.93	36.63	57.18	74.00	-16.82	Peak
4880	43.51	134	164	H	32.60	7.93	36.63	47.41	54.00	-6.59	Ave
7320	46.96	355	314	H	37.15	10.67	36.43	58.35	74.00	-15.65	Peak
7320	34.85	355	314	H	37.15	10.67	36.43	46.24	54.00	-7.76	Ave
9760	46.21	8	306	H	37.89	11.46	36.69	58.87	74.00	-15.13	Peak
9760	35.99	8	306	H	37.89	11.46	36.69	48.65	54.00	-5.35	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
			Height (cm)	Polarity (H/V)	Factor (dB/m)						
High Channel 2480 MHz											
2480	94.90	198	134	H	29.34	5.22	35.26	94.20	N/A	N/A	Peak
2480	92.81	198	134	H	29.34	5.22	35.26	92.11	N/A	N/A	Ave
2480	91.02	255	294	V	29.34	5.22	35.26	90.32	N/A	N/A	Peak
2480	88.89	255	294	V	29.34	5.22	35.26	88.19	N/A	N/A	Ave
2483.5	62.14	198	134	H	29.35	5.35	35.26	61.58	74.00	-12.42	Peak
2483.5	39.74	198	134	H	29.35	5.35	35.26	39.18	54.00	-14.82	Ave
2490.65	58.34	198	134	H	29.38	5.39	35.27	57.84	74.00	-16.16	Peak
2490.65	40.99	198	134	H	29.38	5.39	35.27	40.49	54.00	-13.51	Ave
4960	52.55	165	161	H	32.85	7.97	36.59	56.78	74.00	-17.22	Peak
4960	42.63	165	161	H	32.85	7.97	36.59	46.86	54.00	-7.14	Ave
7440	45.69	358	310	H	37.04	10.82	36.45	57.10	74.00	-16.90	Peak
7440	35.36	358	310	H	37.04	10.82	36.45	46.77	54.00	-7.23	Ave
9920	45.94	0	298	H	38.00	11.54	36.70	58.78	74.00	-15.22	Peak
9920	35.74	0	298	H	38.00	11.54	36.70	48.58	54.00	-5.42	Ave

FCC §15.247(a)(2) & ISED RSS-247 §5.2, RSS-Gen §6.6 - 6 dB & 99% Occupied Bandwidth

Applicable Standards

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

According to RSS-247 5.2 (1), DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The minimum 6 dB bandwidth shall be 500 kHz for bands 902 -928 MHz and 2400 – 2483.5 MHz.

Measurement Procedure (Radiated Test)

The measurements are based on ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v03r05.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2016-01-19	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2year
Hewlett	Pre-Amplifier	8449B	3008A01978	2015-12-11	1year
IW Microwave	High Frequency Cable	DC-1438	SPS-2303-3840-SPS	2015-09-23	1 year
Hewlett-Packard	5 ft N-type RF cable	-	1268	2016-06-15	1 year

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

Test Environmental Conditions

Temperature:	24º C
Relative Humidity:	49 %
ATM Pressure:	101.6 kPa

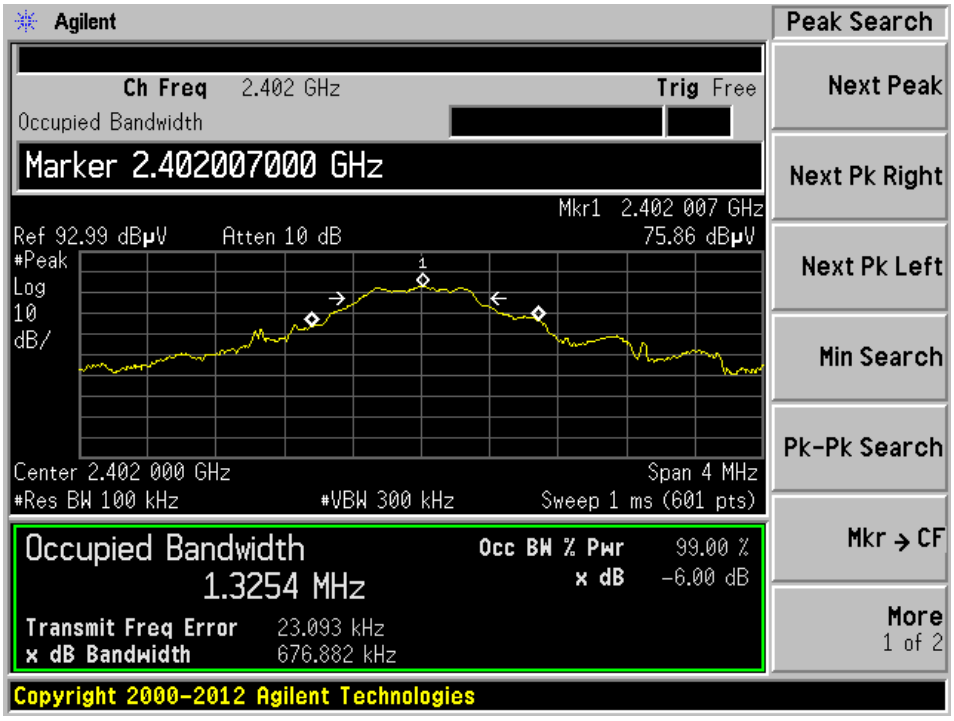
The testing was performed by Jin Yang on 2016-08-12 in 5m chamber 3.

Test Results

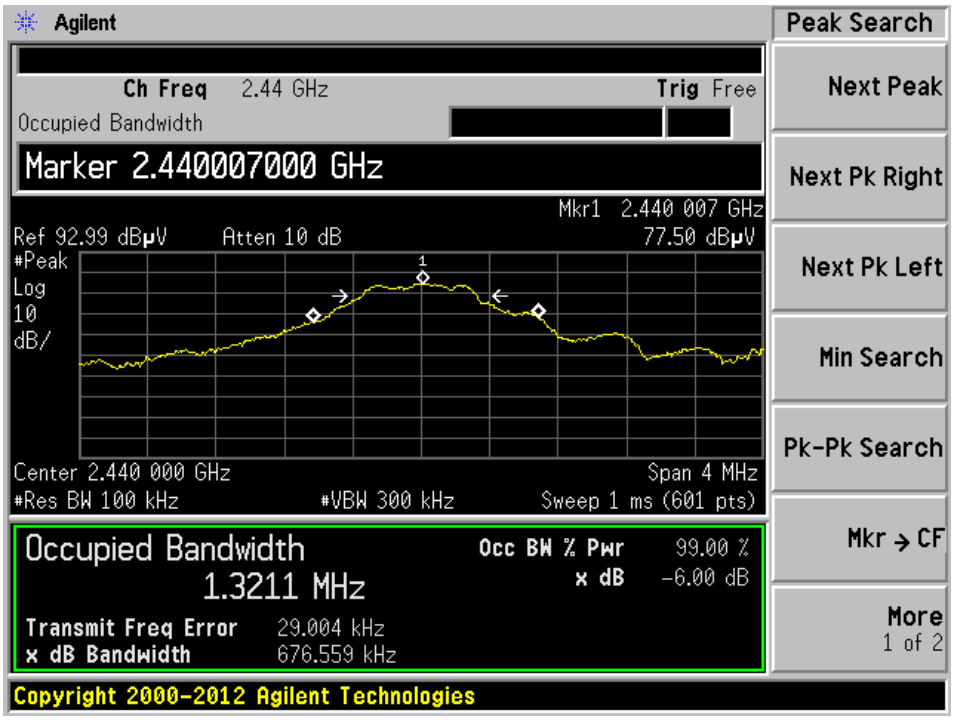
Compliant. Please refer to the following table and plots

Test Mode	Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
BLE	Low	2402	1.3254	0.6769	≥ 0.5
	Middle	2440	1.3211	0.6766	≥ 0.5
	High	2480	1.2002	0.6906	≥ 0.5

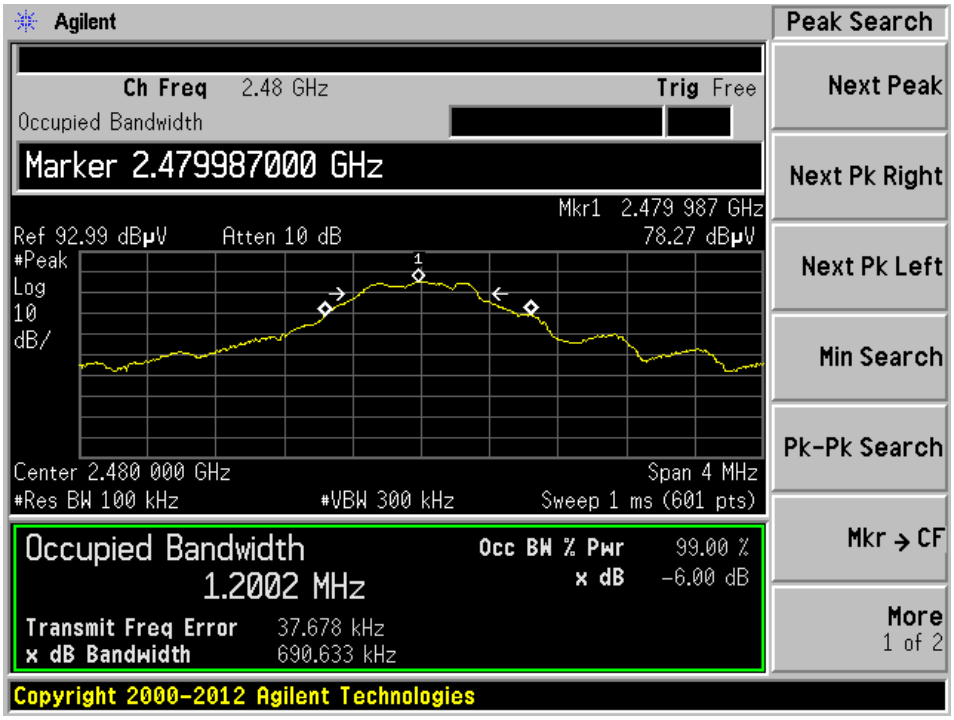
Low Channel



Middle Channel



High Channel



FCC §15.247(b) & ISED RSS-247 §5.4 – Output Power Measurement

Applicable Standards

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.

According to RSS-247 §5.4 (4), for DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

Measurement Procedure

The measurements are based on ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v03r05.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2016-01-19	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2year
Hewlett	Pre-Amplifier	8449B	3008A01978	2015-12-11	1year
IW Microwave	High Frequency Cable	DC-1438	SPS-2303-3840-SPS	2015-09-23	1 year
Hewlett-Packard	5 ft N-type RF cable	-	1268	2016-06-15	1 year

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

Test Environmental Conditions

Temperature:	25º C
Relative Humidity:	48 %
ATM Pressure:	101.6 kPa

The testing was performed by Jin Yang on 2016-06-22 in 5m chamber 3.

Test Results

Compliant

Test Mode	Frequency (MHz)	Field Strength (dBμV/m)	EIRP (dBm)	Antenna Gain (dBi)	Conducted Output Power (dBm)	Limit (dBm)
BLE	2402	94.72	-0.58	2.0	-2.58	30
	2440	94.82	-0.48	2.0	-2.48	30
	2480	94.20	-1.10	2.0	-3.10	30

Note: EIRP[dBm] = E[dBμV/m]-95.3 when distance is 3 meter
EIRP[dBm] = Conducted Output Power[dBm] + Antenna Gian [dBi]

Where: E is the field strength in dBμV/m
EIRP is the equivalent isotropically radiated power in dBm

FCC §15.247(d) & ISED RSS-247 §5.5 - 100 kHz Bandwidth of Band Edges

Applicable Standards

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).

For RSS-247 §5.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Measurement Procedure (Radiated Test)

The measurements are based on ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v03r05.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2016-01-19	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2year
Hewlett	Pre-Amplifier	8449B	3008A01978	2015-12-11	1year
IW Microwave	High Frequency Cable	DC-1438	SPS-2303-3840-SPS	2015-09-23	1 year
Hewlett-Packard	5 ft N-type RF cable	-	1268	2016-06-15	1 year

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

Test Environmental Conditions

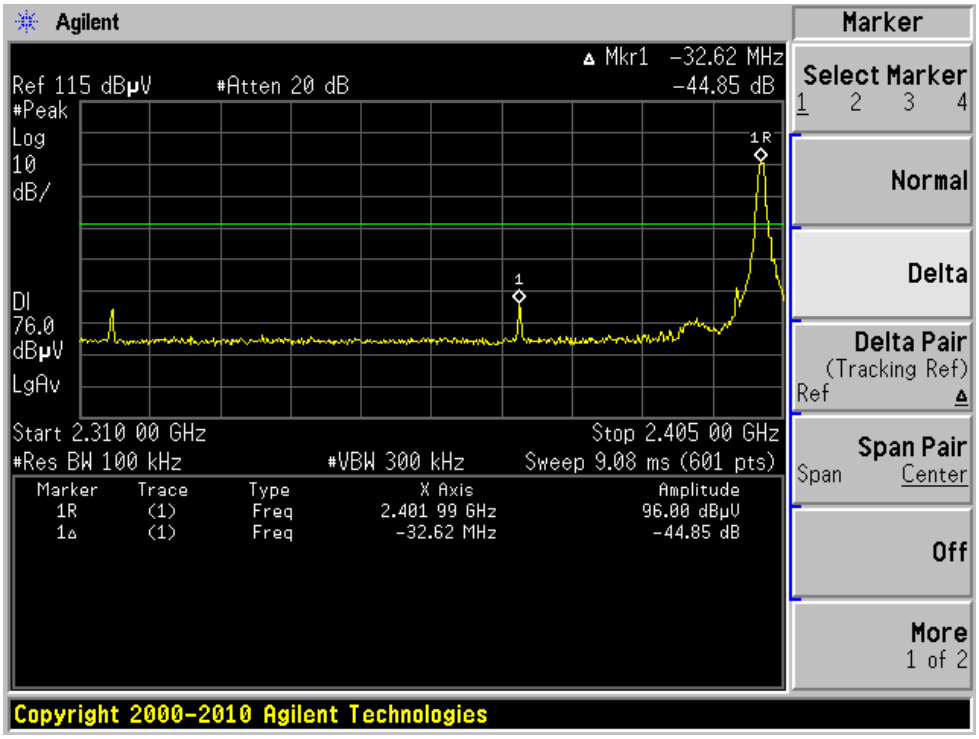
Temperature:	25º C
Relative Humidity:	48 %
ATM Pressure:	101.6 kPa

The testing was performed by Jin Yang on 2016-06-22 in 5m chamber 3.

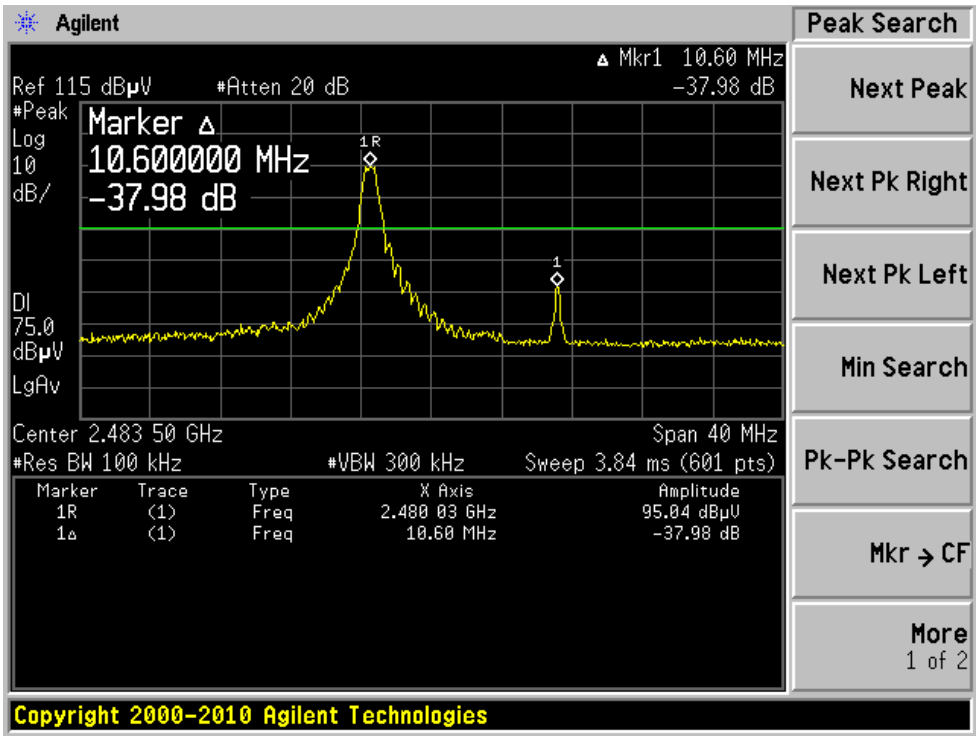
Test Results

Compliant. Please refer to following plots.

Band Edge – Left Side



Band Edge – Right Side



FCC §15.247(e) & ISED ICC RSS-247 §5.2 - Power Spectral Density

Applicable Standards

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.

According to RSS-247 §5.2(2), DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to the bands 902-928 MHz and 2400- 2483.5 MHz1 : The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

Measurement Procedure

The measurements are based on ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v03r05.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2016-01-19	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2year
Hewlett	Pre-Amplifier	8449B	3008A01978	2015-12-11	1year
IW Microwave	High Frequency Cable	DC-1438	SPS-2303-3840-SPS	2015-09-23	1 year
Hewlett-Packard	5 ft N-type RF cable	-	1268	2016-06-15	1 year

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

Test Environmental Conditions

Temperature:	25º C
Relative Humidity:	48 %
ATM Pressure:	101.6 kPa

The testing was performed by Jin Yang on 2016-06-22 in 5m chamber 3.

Test Results

Compliant. Please refer to the following table and plots

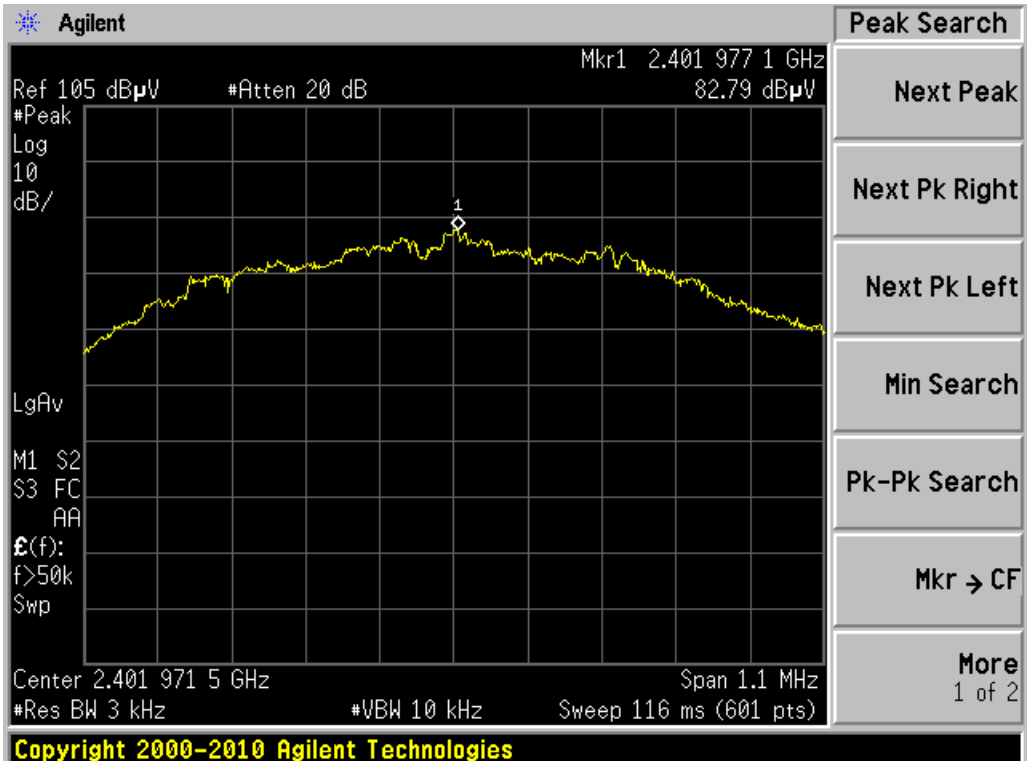
Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Detector
			Height (cm)	Polarity (H/V)	Factor (dB/m)				
2402	82.79	199	197	H	29.05	5.22	35.20	81.86	Peak
2440	82.64	199	189	H	29.19	5.22	35.23	81.82	Peak
2480	82.30	198	134	H	29.34	5.22	35.26	81.60	Peak

Test Mode	Frequency (MHz)	Field Strength (dBµV/m)	EIRP (dBm)	Antenna Gain (dBi)	Equivalent PSD (dBm/3kHz)	Limit (dBm/3kHz)
BLE	2402	81.86	-13.44	2.0	-15.44	≤8
	2440	81.82	-13.48	2.0	-15.48	≤8
	2480	81.60	-13.70	2.0	-15.70	≤8

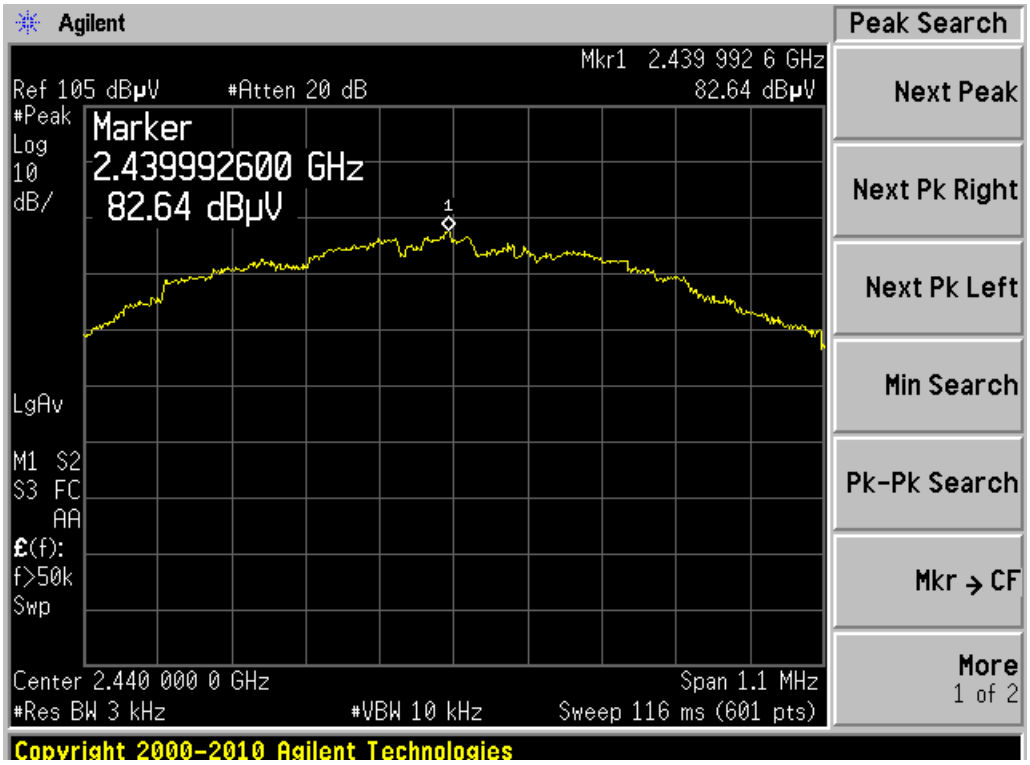
Note: EIRP[dBm] = E[dBµV/m] -95.3 when the distance is 3 meter
EIRP[dBm] = Conducted Output Power[dBm] + Antenna Gian[dBi]

Where: E is the field strength in dBµV/m
EIRP is the equivalent isotropically radiated power in dBm

Power Spectral Density, Low Channel



Power Spectral Density, Middle Channel



Power Spectral Density, High Channel