FCC PART 15.225
ISED RSS-210, ISSUE 9, AUGUST 2016

TEST AND MEASUREMENT REPORT

For

Intel Corporation

2200 Mission College Blvd,
Santa Clara, CA 95054, USA

FCC ID: 2AB8ZND26
IC: 1000X-ND26

Report Type:	**Product Type:**
Original Report	Smart Watch

Prepared By:	Frank Wang Test Engineer
Report Number:	R1705182-225
Report Date:	2017-06-23
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1705182-225	Original	2017-06-23

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been compiled on behalf of *Intel Corporation.,* and their product model number: *SBF81*, FCC ID: 2AB8ZND26, IC: 1000X-ND26 which henceforth is referred to as the EUT (Equipment under Test.) The EUT is a wearable smart watch with 802.11 b/g/n20 Wi-Fi, BT/BLE and NFC.

1.2 Mechanical Description of EUT

The EUT measures approximately 4.7625 cm (L) x 4.445 cm (W) x 1.5875 cm (H) and weight 0.052 kg.

The data gathered are from a typical production sample provided by the manufacturer with serial number: SCDV15HR716000H assigned by Intel Corporation.

1.3 Objective

This report is prepared on behalf of *Intel Corporation,* in accordance with Part 2, Subpart J, and Part 18, Subparts B and C of the Federal Communication Commission's rules. The objective is to determine compliance with FCC Part 15.225.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment DSS with FCC ID: 2AB8ZND26, IC:1000X-ND26
FCC Part 15, Subpart C, Equipment DTS with FCC ID: 2AB8ZND26, IC: 1000X-ND26

1.5 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.

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.

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 %

1.7 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
  - 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  - 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  - 3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  - 1 All Scope 1-Licence-Exempt Radio Frequency Devices;
  - 2 All Scope 2-Licensed Personal Mobile Radio Services;
  - 3 All Scope 3-Licensed General Mobile and Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime and Aviation Radio Services;
  - 5 All Scope 5-Licensed Fixed Microwave Radio Services
  - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes and Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D. A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I and Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - Radio and Teleterminal Equipment (RandTTE) Directive 1995/5/EC
    US -EU EMC and Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA)
  APEC Tel MRA -Phase I and Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I and Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013.

2.2 EUT Exercise Software

The test firmware used Android Debug Bridge command lines provided by *Intel Corporation*, the software complies with the standard requirements being tested against.

2.3 Equipment Modifications

N/A

2.4 Local Support Equipment

Manufacturer	Description	Model
Lenovo	Laptop	20332

2.5 EUT Internal Configuration Details

Manufacturer/Product Type	Description	Model No.	Serial No.
Intel	Main Board	-	-
Dongguan Amperex Technology Limited	Battery	J39470	-

2.6 Power Supply and Line Filter

N/A

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
Micro USB Cable	< 1 m	Laptop	EUT
RF Cable	< 1 m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC and ISED Rules	Description of Test	Results
FCC §15.203 ISED RSS-Gen §8.3	Antenna Requirement	Compliant
§15.207 ISED RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
§15.225 (a) (b) (c) (d) ISED -RSS-210 Annex B.6.a	Radiated Field Strength (9kHz – 30MHz, 30MHz-1GHz)	Compliant
§15.225 (e) ISED -RSS-210 Annex B.6	Frequency Tolerance	Compliant
§15.215 (c) ISED RSS-Gen §6.6	20 dB Bandwidth	Complaint

4 FCC §15.203 and ISED RSS-Gen §8.3 - Antenna Requirements

4.1 Applicable Standards

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 ISED RSS-Gen §8.3: Transmitter Antenna

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. 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).

4.2 Antenna Description

The antennas used by the EUT are permanent attached antennas.

Radio Antenna	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
NFC	13.56	-7.432

4 FCC §15.207 and ISED RSS-Gen §8.8 – AC Line Conducted Emissions

4.1 Applicable Standards

As per FCC §15.207 and ISED RSS-Gen §8.8:

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 (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

4.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013. The specification used was FCC §15.207

External I/O cables were draped along the edge of the test table and bundle when necessary.
The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V/ 60 Hz AC power.

4.3 Test Procedure

During the conducted emission test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cord of the support equipment was connected to LISN-2.

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 reading is distinguished with an “Ave”.

4.4 Corrected Amplitude and 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:

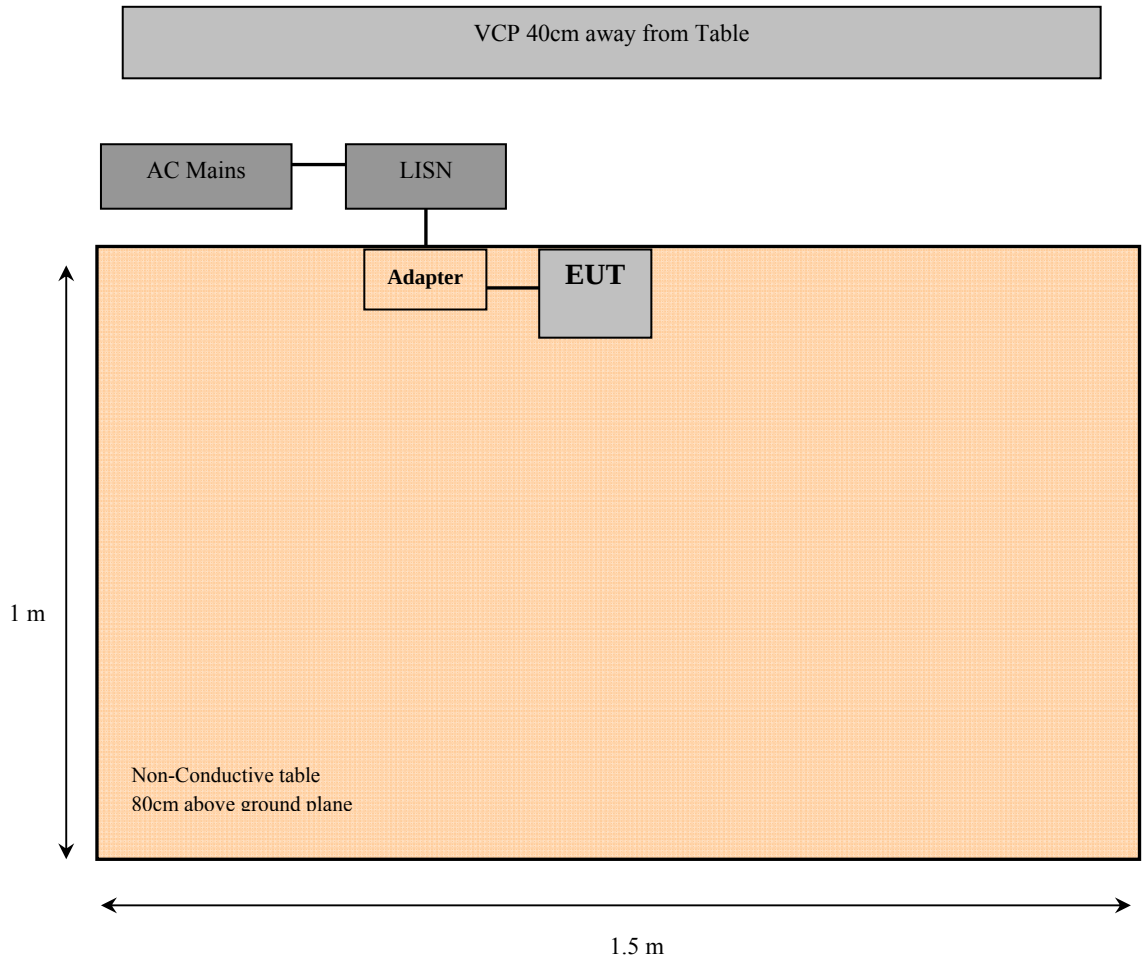
CA = Ai + AF + CL + Atten – Ga

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:

Margin = Corrected Amplitude – Limit

4.5 Test Setup Block Diagram



4.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2016-07-22	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2017-03-09	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	2017-03-05	1 year
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160131	2017-04-25	1year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

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

4.7 Test Environmental Conditions

Temperature:	22º C
Relative Humidity:	42%
ATM Pressure:	102 kPa

The testing was performed by Frank Wang on 2017-06-07 in site.

4.8 Summary of Test Results

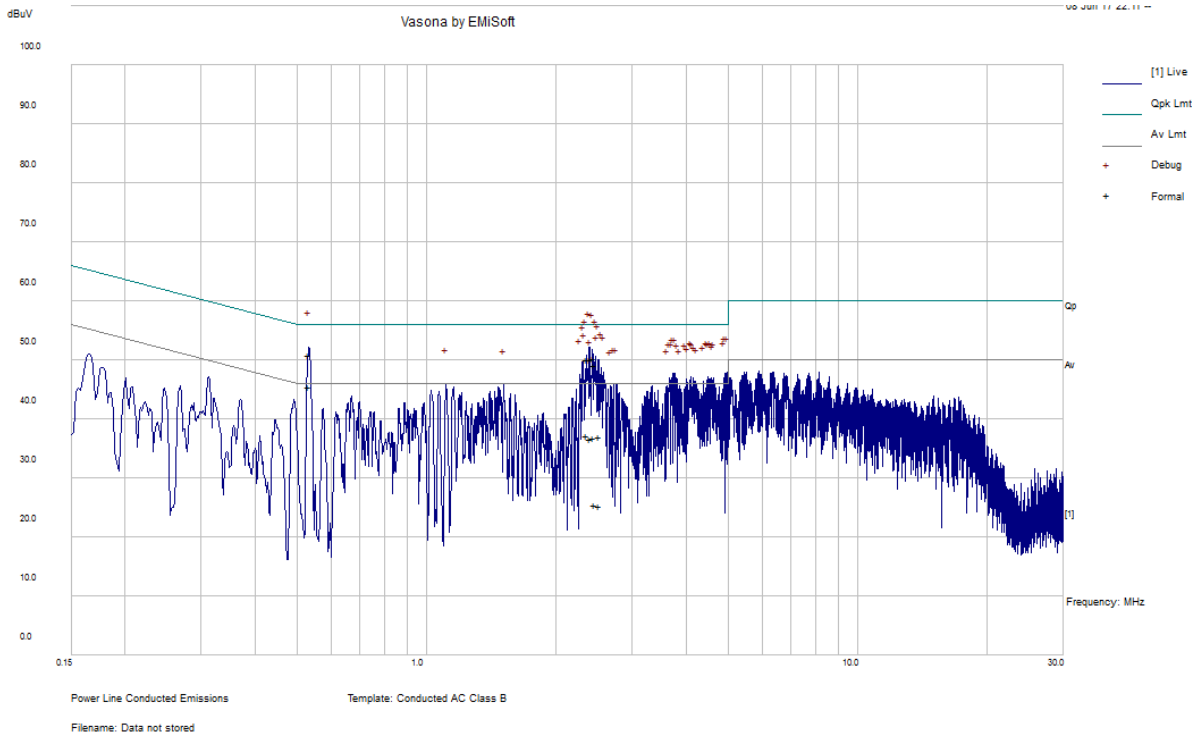
According to the data hereinafter, the EUT complied with the FCC 15C standard's radiated emissions limits, and had the worst margin of:

Connection: AC/DC adapter connected to 120 V/ 60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-0.49	0.534786	Line	0.15-30
-17.65	0.538272	Neutral	0.15-30

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

4.9 Conducted Emissions Test Plots and Data

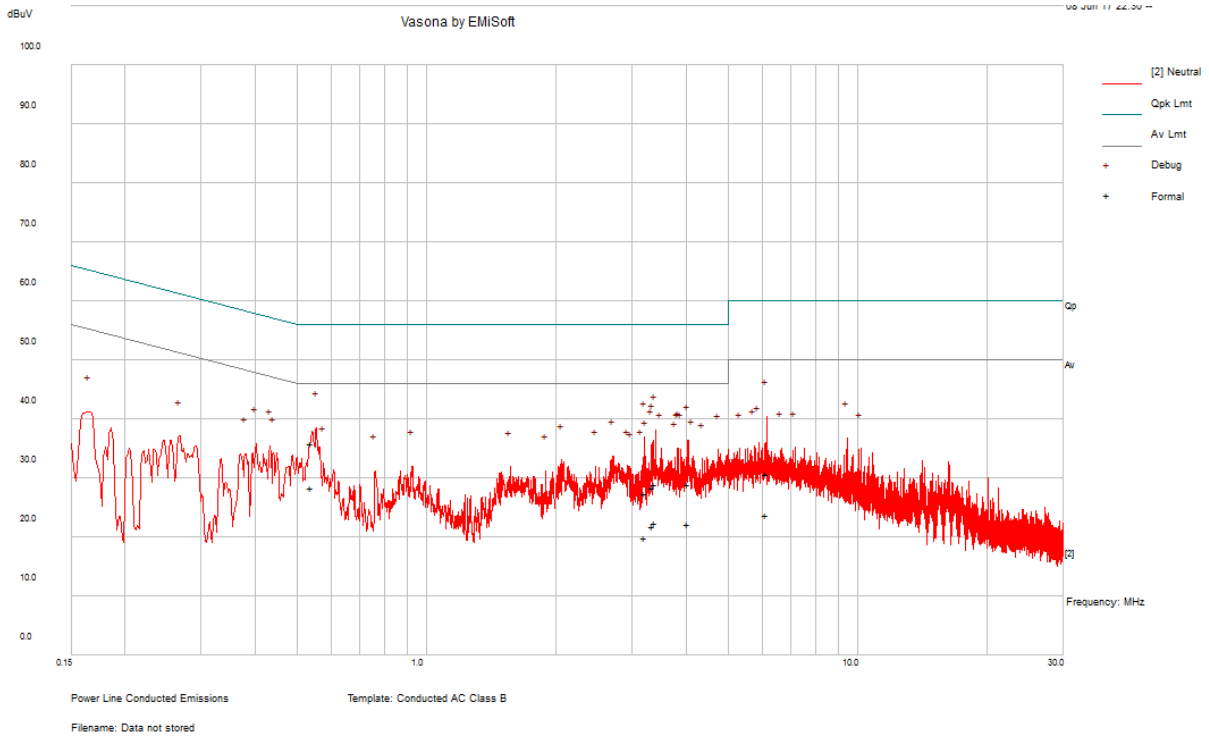
120VAC/60Hz Line



Frequency (MHz)	Cord. Reading (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.534786	50.8	Line	56	-5.2	QP
2.397877	50.18	Line	56	-5.82	QP
2.438618	50.39	Line	56	-5.61	QP
2.351472	50.18	Line	56	-5.82	QP
2.450427	49.16	Line	56	-6.84	QP
2.513153	37.09	Line	56	-18.91	QP

Frequency (MHz)	Cord. Reading (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.534786	45.51	Line	46	**-0.49**	Ave.
2.397877	36.64	Line	46	-9.36	Ave.
2.438618	36.89	Line	46	-9.11	Ave.
2.351472	37.15	Line	46	-8.85	Ave.
2.450427	25.53	Line	46	-20.47	Ave.
2.513153	25.35	Line	46	-20.65	Ave.

120VAC/60Hz Neutral



Frequency (MHz)	Cord. Reading (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.538272	35.85	Neutral	56	-20.15	QP
3.385237	28.97	Neutral	56	-27.03	QP
3.206146	27.53	Neutral	56	-28.47	QP
6.127826	30.62	Neutral	60	-29.38	QP
3.338965	28.39	Neutral	56	-27.61	QP
4.031696	29.03	Neutral	56	-26.97	QP

Frequency (MHz)	Cord. Reading (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.538272	28.35	Neutral	46	**-17.65**	Ave.
3.385237	22.46	Neutral	46	-23.54	Ave.
3.206146	19.96	Neutral	46	-26.04	Ave.
6.127826	23.8	Neutral	50	-26.2	Ave.
3.338965	21.89	Neutral	46	-24.11	Ave.
4.031696	22.29	Neutral	46	-23.71	Ave.

5 FCC §15.225(a), (b), (c), (d) §15.209 and ISED-RSS-210 Annex B.6.a– Radiated Field Strength

5.1 Applicable Standards

As per FCC §15.225 and ISED-RSS-210 Annex B.6.a Operation within the band 13.110-14.010 MHz

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

As per FCC §15.209(a): 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 §15.35:

The conducted and radiated emission limits shown in this part are based on the following, unless otherwise specified elsewhere in this part:

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the

International Electrotechnical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.

Note: For pulse modulated devices with a pulse-repetition frequency of 20 Hz or less and for which CISPR quasi-peak measurements are specified, compliance with the regulations shall be demonstrated using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, using the same measurement bandwidths that are indicated for CISPR quasi-peak measurements.

5.2 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 utilized was the FCC §15.225, §15.209 limits.

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.

5.3 Test Procedure

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 was fixed at around 2 meters, 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 perpendicular and parallel.

The spectrum analyzer or receiver is set as:

Below 150 kHz:

RBW = 200 Hz / VBW = 600 kHz / Sweep = Auto / Average

From 150 kHz to 30 MHz:

RBW = 9 kHz / VBW = 27 kHz / Sweep = Auto / Average

5.4 Corrected Amplitude and 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:

Margin = Corrected Amplitude – Limit

5.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 years
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
EMCO	Antenna, Loop Passive	6512	34167	2016-05-12	2 years
IW	Armored High Frequency Cable	DC 1531	KPS-1501A3960KPS	2016-08-05	1 year
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2015-07-11	2 years
HP	Pre-Amplifier	8447D	2944A06639	2016-06-28	1 year

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

5.6 Test Environmental Conditions

Temperature:	20-25º C
Relative Humidity:	40-45 %
ATM Pressure:	101.2-103.5 kPa

The testing was performed by Frank Wang on 2017-06-08 in 5m3.

5.7 Summary of Test Results

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

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization**	**Range**
-20.24	31.6305	Vertical	30 MHz-140 MHz

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

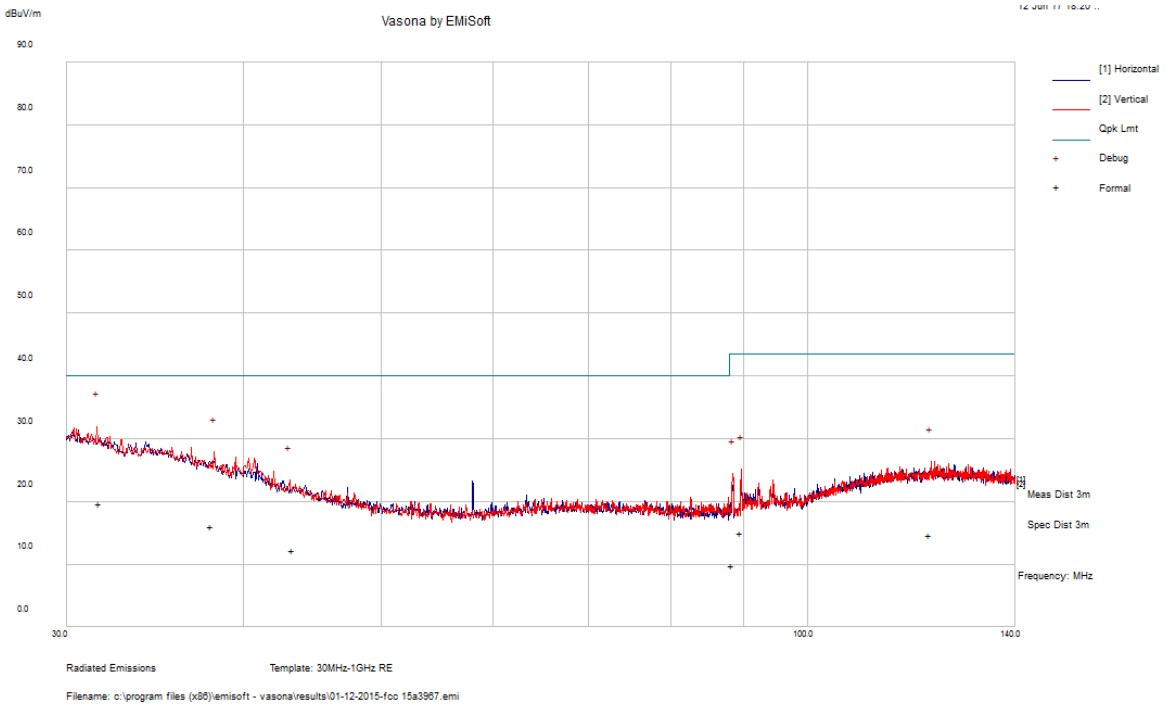
5.8 Radiated Field Strength Test Data and Plots

9 kHz to 30 MHz:

Frequency (kHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments
			Height (cm)	Polarity	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
13.56 MHz Fundamental											
13.56	21.3	90	100	Perp.	34.8	0.689	19.85	36.939	143.08	-106.141	QP
13.56	28.7	0	100	Parallel	34.8	0.689	19.85	44.339	143.08	-98.741	QP
13.553	8.9	100	100	Perp.	34.8	0.689	19.85	24.539	109.55	-85.011	QP
13.553	14.6	350	100	Parallel	34.8	0.689	19.85	30.239	109.55	-79.311	QP
13.567	10.3	100	100	Perp.	34.8	0.689	19.85	25.939	109.55	-83.611	QP
13.567	16.3	50	100	Parallel	34.8	0.689	19.85	31.939	109.55	-77.611	QP
13.11	5.2	175	100	Perp.	34.8	0.689	19.85	20.839	99.59	-78.751	QP
13.11	4.8	25	100	Parallel	34.8	0.689	19.85	20.439	99.59	-79.151	QP
13.71	6	0	100	Perp.	34.8	0.689	19.85	21.639	99.59	-77.951	QP
13.71	6.9	0	100	Parallel	34.8	0.689	19.85	22.539	99.59	-77.051	QP

*Because the test is done in 1 meter and the limit is for 30 meter, the distance correction factor 59.08 has been added into the Limit.

30 MHz to 1 GHz Radiated Field Strength:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comments (PK/QP/Ave.)
31.6305	19.76	193	V	105	40	**-20.24**	QP
37.92375	16.09	369	V	266	40	-23.91	QP
43.325	12.19	352	V	25	40	-27.81	QP
121.8685	14.72	340	V	112	43.5	-28.78	QP
89.70925	15.07	317	V	315	43.5	-28.43	QP
88.4605	9.78	250	V	107	43.5	-33.72	QP

Note: Emissions with frequencies greater than 135.6 MHz are greater than the 10th Harmonic and thus can be ignored (§15.33: Frequency Range of Radiated Measurement).

6 FCC §15.225(e) and ISED-RSS-210 Annex B.6– Frequency Tolerance

6.1 Applicable Standards

As per FCC §15.225(e) and ISED-RSS-210 Annex B.6: Operation within the band 13.110-14.010 MHz

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.2 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2016-06-10	1 year
EMCO	Antenna, Loop Passive	6512	34167	2016-05-12	2 years
Fluke Corp	Multimeter, Digital	233	23790031	2016-07-13	1 year
Tenney	Chamber, Environmental	TUJR	27445-06	2017-02-24	1 year
Valhalla	Analyzer, Digital Power	2101	3-3428	2016-09-16	1 year

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

6.3 Test Environmental Conditions

Temperature:	20-25° C
Relative Humidity:	30-32 %
ATM Pressure:	102.1-105.1 kPa

The testing was performed by Frank Wang in 2017-06-09 at RF Site.

6.4 Test Results

Normal Voltage

Temperature °C	Operating Frequency (MHz)	Measured Frequency (MHz)	Frequency Tolerance	Limit	Result
0	13.56	13.560288	0.002%	±0.01%	Pass
10	13.56	13.5602925	0.002%	±0.01%	Pass
20	13.56	13.560288	0.002%	±0.01%	Pass
30	13.56	13.5602835	0.002%	±0.01%	Pass
40	13.56	13.5602715	0.002%	±0.01%	Pass
45	13.56	13.56025	0.0018%	±0.01%	Pass

Note: This device is battery operated.

7 FCC §15.215(c) and RSS-Gen §6.6 – 20dB Bandwidth

7.1 Applicable Standards

As per FCC §15.215(c):

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

As per RSS-Gen §6.6:

The emission bandwidth (×dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated × dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3× the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3×RBW.

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

7.2 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 utilized was the FCC §15.225, §15.209 limits.

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.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2016-06-10	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
EMCO	Antenna, Loop Passive	6512	34167	2016-05-12	2 years
Suirong	30 ft conductive emission cable	LMR 400	-	2016-06-29	1 year
Sonoma Instrument	Amplifier	315	303125	2016-07-23	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:	20-25° C
Relative Humidity:	30-32 %
ATM Pressure:	102.1-105.1 kPa

The testing was performed by Frank Wang from 2017-06-09 at RF Site.

7.5 Test Results

Permitted Operating Frequency Range (MHz)	20dB Bandwidth (Hz)	Result
13.553-13.567	651	Compliant

20 dB Bandwidth