FCC PART 15, SUBPART C
IC RSS-247, ISSUE 1, MAY, 2015

TEST AND MEASUREMENT REPORT

For

Trimble Navigation Limited

935 Stewart Drive, Sunnyvale CA 94085, USA

FCC ID: JUP-95807WFBT
IC: 1756A-95807WFBT

Report Type:	**Product Type:**
CIIPC	WLAN+ Bluetooth Combo Module

Prepared By:	Todd Moy Test Engineer
Report Number:	R1509023-247 DTS
Report Date:	2015-10-07
Reviewed By:	Simon Ma RF Lead

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

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1509023-247 DTS	Initial	2015-10-07

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been compiled on behalf of *Trimble Navigation Ltd*., and their module, *FCC ID: JUP-95807WFBT, IC: 1756A-95807WFBT*, model number: LBEE1DARRC-519, which henceforth is referred to as the EUT (Equipment Under Test.) The EUT is an 802.11b/g mode and Bluetooth combination module.

1.2 Mechanical Description of EUT

The module measures approximately 9 mm(L) x 7.3 mm(W)x 1.1 mm(H) and weighs approximately 0.2g; The EUT measures approximately 140 mm (L) x 140mm (W) x 114mm (H) and weighs <1 kg.

The data gathered are from a production sample provided by the manufacturer, serial number: 55030S01127, assigned by customer.

1.3 Objective

This report is prepared on behalf of *Trimble Navigation Ltd.,* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission's and IC RSS-247, RSS-Gen rules.

The objective is to determine continue compliance with FCC Part 15.247 and IC RSS-247, RSS-Gen rules for AC Line Conducted Emissions and Radiated Spurious Emissions due to the purpose of adding a new host R2 and an antenna that is not covered in the original limited modular approval.

1.4 Related Submittal(s)/Grant(s)

None

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 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.

Based on CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

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:
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 C63.4-2009, ANSI C63.10-2013, 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 C63.10-2013 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.

2.2 EUT Exercise Software

The software used, CommSet: Trimble Communication Setup Program and COM1 TrimTest, provided by the client and was verified by Todd Moy to comply with the standard requirements being tested against.

2.3 Equipment Modifications

No modifications were made to the unit.

2.4 Local Support Equipment

No local support equipment was used with the unit.

2.5 EUT Internal Configuration Details

Manufacturer	Description	Model/Rev.	Serial Number
Murata	Wi-Fi/BT combo module	LBEE1DARRC-519	-

2.6 Power Supply and Line Filters

Manufacturer	Description	Model	Part Number
Delta Electronics, Inc.	AC to DC Adaptor	ADP-10HW A	-

2.7 Interface Ports and Cabling

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

3 Summary of Test Results

Results reported relate only to the product tested.

FCC/IC Rules	Description of Test	Results
FCC §15.203 IC RSS-Gen §8.3	Antenna Requirement	Compliant
FCC §15.247(i) IC RSS-102	RF Exposure	Compliant
FCC §15.207(a) IC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §15.209, §15.247(d) IC RSS-Gen §8.9, §8.10 & RSS-247 §5.5	Restricted Bands, Radiated Spurious Emissions	Compliant

4 FCC §15.203 & IC 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 IC 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. 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).

4.2 Antenna Description

Antenna Type	Maximum Antenna Gain (dBi) @ 2.4 GHz
Internal PCB	6.6

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

5.1 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 IC RSS-102 must be followed concerning the exposure of humans to RF field

According to IC RSS-102 Issue 5:

2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

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.

5.2 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

5.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	14.85
Maximum peak output power at antenna input terminal (mW):	30.549
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	6.6
Maximum Antenna Gain (numeric):	4.571
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.028
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.278

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0.28 mW/cm$^{2.}$ Limit is 1.0 mW/cm^2.

RF exposure evaluation exemption for IC:

14.85 dBm + 6.6 dBi = 21.45 dBm < $1.31\times10^{-2}f^{0.6834}$ = 2.7 W = 34.3 dBm

Therefore the RF exposure is exempted.

6 FCC §15.207 & IC RSS-Gen §8.8 - AC Line Conducted Emissions

6.1 Applicable Standards

As 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.

According to RSS GEN §8.8

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.

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

Note: Decreases with the logarithm of the frequency.

6.2 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 and IC RSS-Gen.

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.

6.3 Test Procedure

During the conducted emissions 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 readings are distinguished with an "Ave".

6.4 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:

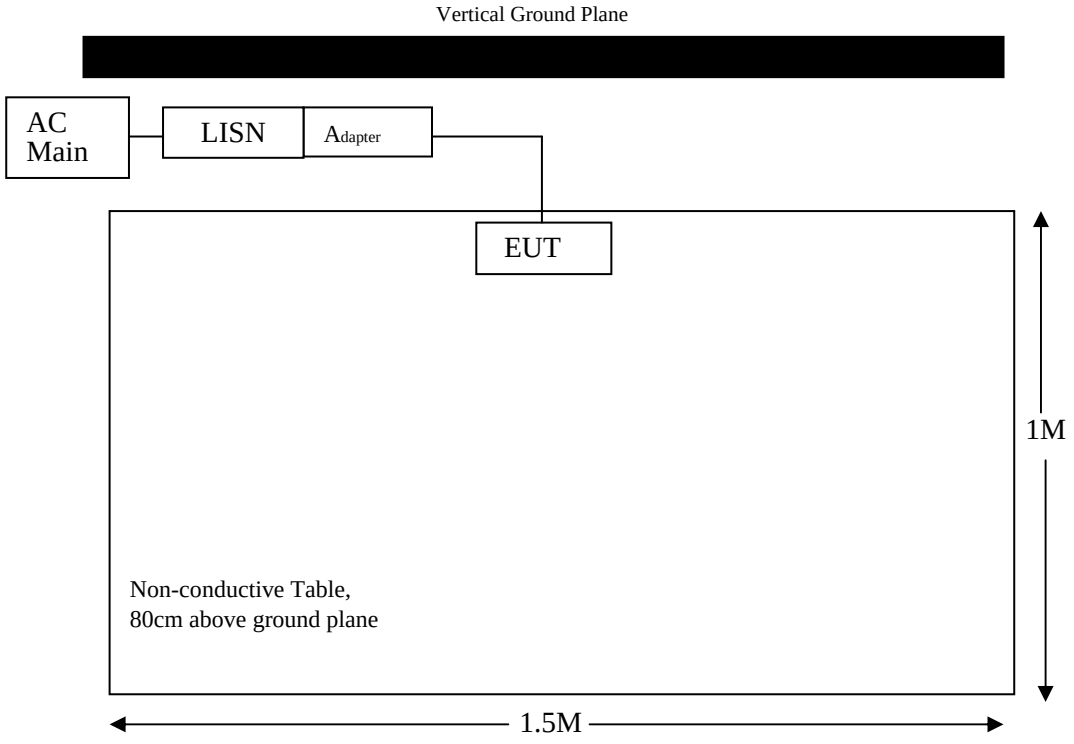
CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + 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

6.5 Test Setup Block Diagram



6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2014-01-20	2 year
Sunol Sciences	Controller, System	SC104V	011003-1	Cal. Not required	N/A
Keysight Technologies	RF Limiter	11867A	MY42242932	2014-12-17	1year
Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101963	2015-07-15	1year
Solar Electronics Company	High Pass Filter	Type 7930-100	7.93E+09	2015-03-06	1 Year
Suirong	30 ft conductive emission cable	LMR 400	-	2015-03-05	1 year
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160132	2015-04-07	1year

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

6.7 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	56 %
ATM Pressure:	101.2 kPa

The testing was performed by Todd Moy on 2015-09-14 in 5m chamber3.

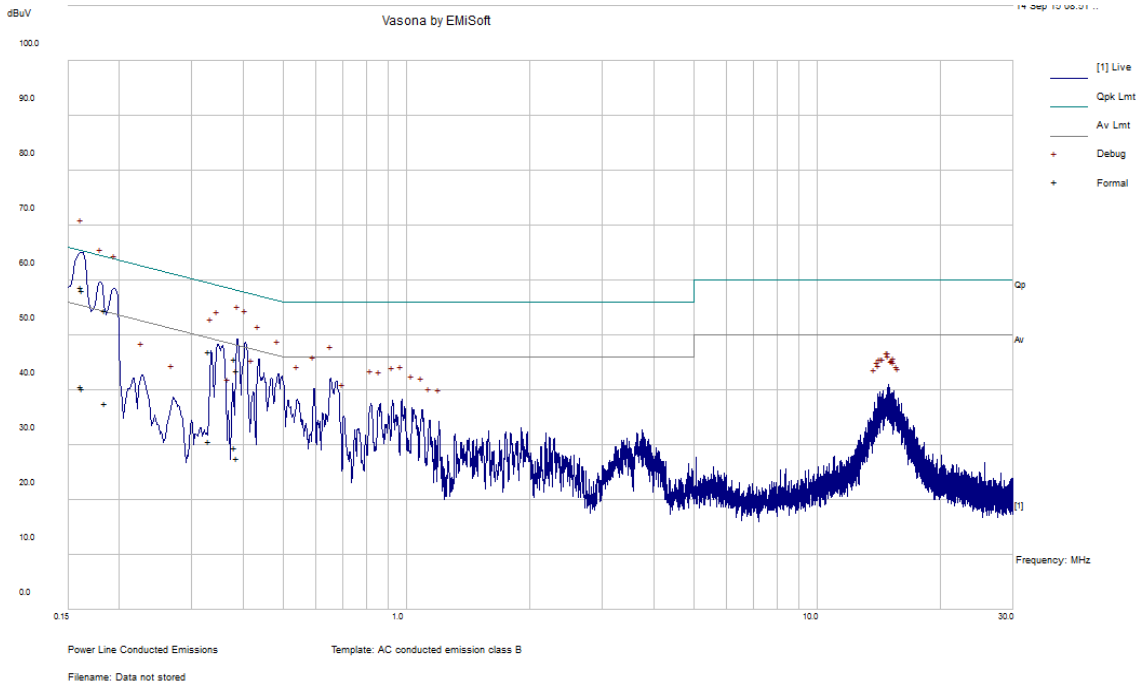
6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15C and IC RSS-Gen standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-6.51	0.162003	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

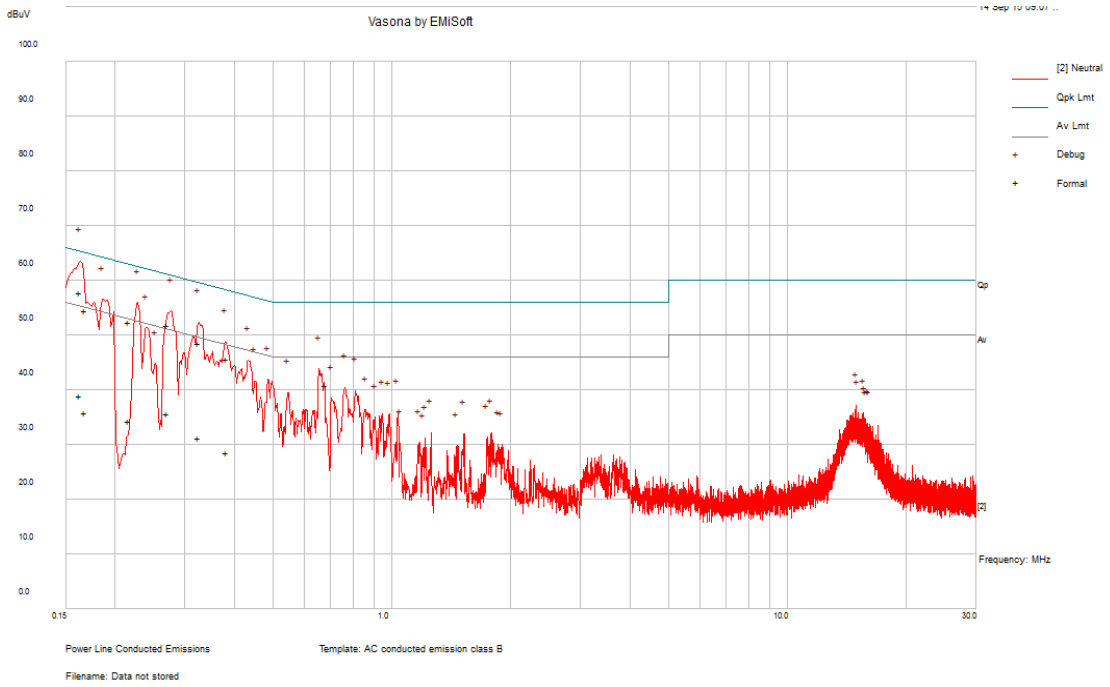
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.162003	58.85	Line	65.36	-6.51	QP
0.162622	58.21	Line	65.33	-7.12	QP
0.185178	54.47	Line	64.25	-9.78	QP
0.330661	47.04	Line	59.43	-12.40	QP
0.381728	45.68	Line	58.24	-12.56	QP
0.387664	43.54	Line	58.11	-14.57	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.162003	40.70	Line	55.36	-14.66	Ave
0.162622	40.22	Line	55.33	-15.10	Ave
0.185178	37.60	Line	54.25	-16.65	Ave
0.330661	30.74	Line	49.43	-18.69	Ave
0.381728	29.47	Line	48.24	-18.77	Ave
0.387664	27.64	Line	48.11	-20.48	Ave

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.162393	57.78	Neutral	65.34	-7.56	QP
0.27086	51.88	Neutral	61.09	-9.21	QP
0.216003	52.4	Neutral	62.97	-10.57	QP
0.167625	54.51	Neutral	65.08	-10.57	QP
0.325015	48.61	Neutral	59.58	-10.97	QP
0.381239	45.72	Neutral	58.25	-12.53	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.27086	24.53	Neutral	51.09	-15.44	Ave
0.162393	28.03	Neutral	55.34	-16.29	Ave
0.325015	20.1	Neutral	49.58	-18.34	Ave
0.216003	23.17	Neutral	52.97	-18.71	Ave
0.167625	24.83	Neutral	55.08	-19.22	Ave
0.381239	17.48	Neutral	48.25	-19.63	Ave

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

7.1 Applicable Standards

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): 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).

As per IC RSS-Gen 8.9,

> Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µv/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

As per IC 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.

As per IC RSS-Gen 8.10, Restricted bands, identified in Table 6, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply: (a) Fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of Table 6 except for apparatus complying under RSS-287; (b) Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; and (c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

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 used was the FCC 15 Subpart C and IC RSS-247, RSS-Gen 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 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 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 = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

7.4 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:

Margin = Corrected Amplitude – Limit

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Receiver	ESCI 1166.5950K03	100338	2014-01-20	2 year
-	10 dB attenuator	-	-	Each time[1]	-
Suirong	30 ft conductive emission cable	LMR 400	-	2015-03-05	1 year
HP	Pre-amp	8447D	2944A06639	2015-06-08	1 year
-	6 dB attenuator	-	-	Each time[1]	-
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2015-07-11	2 year
Agilent	Spectrum Analyzer	E4446A	MY48250238	2014-09-03	14 Months
-	SMA cable	-	C 006	Each time[1]	N/A
HP/ Agilant	Pre-amp	8449B OPT HO2	3008A0113	2015-05-19	1year
IW Microwave	High Frequency Cable	DC-1438	SPS-2303-3840-SPS	2014-09-24	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2year

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.*

7.6 Test Environmental Conditions

Temperature:	22-24º C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Todd Moy on 2015-09-08 in 5m chamber3.

7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C and IC RSS-247 standard's radiated emissions limits, and had the worst margin of:

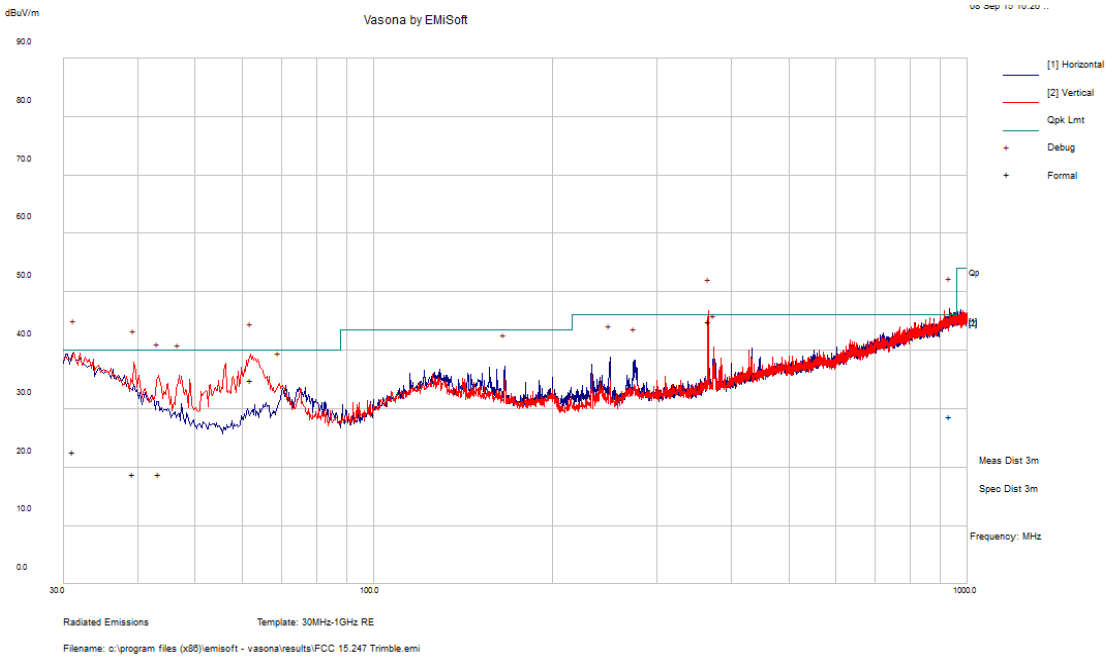
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-1.05	366.41625	Vertical	802.11g mode, 2412 MHz

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

7.8 Radiated Emissions Test Data and Plots

1) 30 MHz – 1 GHz

Worst-case mode; 802.11g, Low CH



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comments
366.41625	44.95	133	V	20	46	-1.05	QP
62.08075	34.93	102	V	337	40	-5.07	QP
932.7605	28.65	286	H	272	46	-17.35	QP
31.09825	22.54	225	H	321	40	-17.46	QP
39.26225	18.86	272	V	150	40	-21.14	QP
43.521	18.86	128	V	360	40	-21.14	QP

2)1–25 GHz

802.11b mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	70.05	156	209	V	29.042	2.865	0	101.957	-	-	Peak
2412	67.01	289	290	H	29.042	2.865	0	98.917	-	-	Peak
2412	65.71	149	220	V	29.042	2.865	0	97.617	-	-	Ave
2412	64.04	165	270	H	29.042	2.865	0	95.947	-	-	Ave
2390	27.51	156	209	V	29.042	2.865	0	59.417	74	-14.583	Peak
2390	27.01	289	290	H	29.042	2.865	0	58.917	74	-15.083	Peak
2390	13.5	149	220	V	29.042	2.865	0	45.407	54	-8.593	Ave
2390	13.59	165	270	H	29.042	2.865	0	45.497	54	-8.503	Ave
4824	48.49	0	100	V	32.472	4.297	35.858	49.401	74	-24.599	Peak
4824	47.05	0	100	H	32.472	4.297	35.858	47.961	74	-26.039	Peak
4824	34.48	0	100	V	32.472	4.297	35.858	35.391	54	-18.609	Ave
4824	33.57	0	100	H	32.472	4.297	35.858	34.481	54	-19.519	Ave
7236	47.59	0	100	V	36.692	5.675	36.011	53.946	81.957	-28.011	Peak
7236	46.87	0	100	H	36.692	5.675	36.011	53.226	78.917	-25.691	Peak
7236	32.18	0	100	V	36.692	5.675	36.011	38.536	77.617	-39.081	Ave
7236	32.17	0	100	H	36.692	5.675	36.011	38.526	75.947	-37.421	Ave
9648	46.15	0	100	V	37.771	8.704	36.044	56.580	81.957	-25.376	Peak
9648	46.52	0	100	H	37.771	8.704	36.044	56.950	78.917	-21.966	Peak
9648	32.75	0	100	V	37.771	8.704	36.044	43.180	77.617	-34.436	Ave
9648	32.76	0	100	H	37.771	8.704	36.044	43.190	75.947	-32.756	Ave
Middle Channel 2437 MHz											
2437	71.78	171	186	V	29.042	2.865	0	103.687	-	-	Peak
2437	66.81	227	181	H	29.042	2.865	0	98.717	-	-	Peak
2437	67.5	184	291	V	29.042	2.865	0	99.407	-	-	Ave
2437	61.1	86	100	H	29.042	2.865	0	93.007	-	-	Ave
4874	47.7	0	100	V	33.119	4.404	35.896	49.327	74	-24.673	Peak
4874	46.77	0	100	H	32.638	4.404	35.896	47.916	74	-26.084	Peak
4874	35.82	0	100	V	32.638	4.404	35.896	36.966	54	-17.034	Ave
4874	33.21	0	100	H	32.638	4.404	35.896	34.356	54	-19.644	Ave
7311	46.74	0	100	V	37.148	5.788	35.958	53.718	74	-20.282	Peak
7311	45.6	0	100	H	37.148	5.788	35.958	52.578	74	-21.422	Peak
7311	32.07	0	100	V	37.148	5.788	35.958	39.048	54	-14.952	Ave
7311	32.11	0	100	H	37.148	5.788	35.958	39.088	54	-14.912	Ave
9748	45.23	0	100	V	37.923	8.157	36.032	55.279	83.687	-28.408	Peak
9748	46.57	0	100	H	37.923	8.157	36.032	56.619	78.717	-22.098	Peak
9748	32.94	0	100	V	37.923	8.157	36.032	42.989	79.407	-36.418	Ave
9748	32.88	0	100	H	37.923	8.157	36.032	42.929	73.007	-30.078	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 2462 MHz											
2462	71.22	182	277	V	29.41	2.95	0.00	103.58	-	-	Peak
2462	66.4	339	286	H	29.41	2.95	0.00	98.76	-	-	Peak
2462	66.75	169	100	V	29.41	2.95	0.00	99.11	-	-	Ave
2462	61.43	106	100	H	29.41	2.95	0.00	93.79	-	-	Ave
2483.5	27.47	182	277	V	29.41	2.95	0.00	59.83	74	-14.17	Peak
2483.5	27.12	339	286	H	29.41	2.95	0.00	59.48	74	-14.52	Peak
2483.5	13.9	169	100	V	29.41	2.95	0.00	46.26	54	-7.74	Ave
2483.5	12.99	106	100	H	29.41	2.95	0.00	45.35	54	-8.65	Ave
4924	48.11	0	100	V	32.64	4.48	35.91	49.32	74	-24.68	Peak
4924	48.24	0	100	H	32.64	4.48	35.91	49.45	74	-24.55	Peak
4924	37.25	0	100	V	32.64	4.48	35.91	38.46	54	-15.54	Ave
4924	36.61	0	100	H	32.64	4.48	35.91	37.82	54	-16.18	Ave
7386	47.47	0	100	V	37.14	5.87	35.96	54.51	74	-19.49	Peak
7386	47	0	100	H	37.14	5.87	35.96	54.04	74	-19.96	Peak
7386	32.22	0	100	V	37.14	5.87	35.96	39.26	54	-14.74	Ave
7386	32.2	0	100	H	37.14	5.87	35.96	39.24	54	-14.76	Ave
9848	48.26	0	100	V	37.99	7.44	35.98	57.71	83.58	-25.87	Peak
9848	47.37	0	100	H	37.99	7.44	35.98	56.82	78.76	-21.94	Peak
9848	33.53	0	100	V	37.99	7.44	35.98	42.98	79.11	-36.13	Ave
9848	33.51	0	100	H	37.99	7.44	35.98	42.96	73.79	-30.83	Ave

802.11g mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	75.35	194	287	V	29.04	2.86	0	107.26	-	-	Peak
2412	69.48	99	100	H	29.04	2.86	0	101.39	-	-	Peak
2412	65.11	188	206	V	29.04	2.86	0	97.02	-	-	Ave
2412	61.12	284	278	H	29.04	2.86	0	93.03	-	-	Ave
2390	40.13	194	287	V	29.04	2.86	0	72.04	74	-1.96	Peak
2390	30.38	99	100	H	29.04	2.86	0	62.29	74	-11.71	Peak
2390	20.25	188	206	V	29.04	2.86	0	52.16	54	-1.84	Ave
2390	15.53	284	278	H	29.04	2.86	0	47.44	54	-6.56	Ave
4824	47.74	0	100	V	32.47	4.30	35.86	48.65	74	-25.35	Peak
4824	47.34	0	100	H	32.47	4.30	35.86	48.25	74	-25.75	Peak
4824	33.72	0	100	V	32.47	4.30	35.86	34.63	54	-19.37	Ave
4824	33.64	0	100	H	32.47	4.30	35.86	34.55	54	-19.45	Ave
7236	47.06	0	100	V	36.69	5.67	36.01	53.42	87.26	-33.84	Peak
7236	46.61	0	100	H	36.69	5.67	36.01	52.97	81.39	-28.42	Peak
7236	32.3	0	100	V	36.69	5.67	36.01	38.66	77.02	-38.36	Ave
7236	32.26	0	100	H	36.69	5.67	36.01	38.62	73.03	-34.41	Ave
9648	47.85	0	100	V	37.77	8.70	36.04	58.28	87.26	-28.98	Peak
9648	47.6	0	100	H	37.77	8.70	36.04	58.03	81.39	-23.36	Peak
9648	32.99	0	100	V	37.77	8.70	36.04	43.42	77.02	-33.60	Ave
9648	32.99	0	100	H	37.77	8.70	36.04	43.42	73.03	-29.61	Ave
Middle Channel 2437 MHz											
2437	73.95	175	257	V	29.04	2.86	0	105.86	-	-	Peak
2437	68.36	227	281	H	29.04	2.86	0	100.27	-	-	Peak
2437	63.07	166	151	V	29.04	2.86	0	94.98	-	-	Ave
2437	58.4	226	100	H	29.04	2.86	0	90.31	-	-	Ave
4874	47.58	0	100	V	33.12	4.40	35.90	49.21	74	-24.79	Peak
4874	46.86	0	100	H	32.64	4.40	35.90	48.01	74	-25.99	Peak
4874	32.75	0	100	V	32.64	4.40	35.90	33.90	54	-20.10	Ave
4874	32.59	0	100	H	32.64	4.40	35.90	33.74	54	-20.26	Ave
7311	47.05	0	100	V	37.15	5.79	35.96	54.03	74	-19.97	Peak
7311	45.79	0	100	H	37.15	5.79	35.96	52.77	74	-21.23	Peak
7311	31.75	0	100	V	37.15	5.79	35.96	38.73	54	-15.27	Ave
7311	31.74	0	100	H	37.15	5.79	35.96	38.72	54	-15.28	Ave
9748	46.31	0	100	V	37.92	8.16	36.03	56.36	85.86	-29.50	Peak
9748	46.17	0	100	H	37.92	8.16	36.03	56.22	80.27	-24.05	Peak
9748	32.08	0	100	V	37.92	8.16	36.03	42.13	74.98	-32.85	Ave
9748	32.24	0	100	H	37.92	8.16	36.03	42.29	70.31	-28.02	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 2462 MHz											
2462	74.15	181	282	V	29.41	2.95	0	106.51	-	-	Peak
2462	68.94	19	285	H	29.41	2.95	0	101.30	-	-	Peak
2462	62.59	177	131	V	29.41	2.95	0	94.95	-	-	Ave
2462	57.12	19	100	H	29.41	2.95	0	89.48	-	-	Ave
2483.5	34.63	181	282	V	29.41	2.95	0	66.99	74	-7.01	Peak
2483.5	30.95	19	285	H	29.41	2.95	0	63.31	74	-10.69	Peak
2483.5	16.03	177	131	V	29.41	2.95	0	48.39	54	-5.61	Ave
2483.5	13.92	19	100	H	29.41	2.95	0	46.28	54	-7.72	Ave
4924	47.55	0	100	V	32.64	4.48	35.91	48.76	74	-25.24	Peak
4924	47.16	0	100	H	32.64	4.48	35.91	48.37	74	-25.63	Peak
4924	32.97	0	100	V	32.64	4.48	35.91	34.18	54	-19.82	Ave
4924	32.9	0	100	H	32.64	4.48	35.91	34.11	54	-19.89	Ave
7386	46.75	0	100	V	37.14	5.87	35.96	53.79	74	-20.21	Peak
7386	46.81	0	100	H	37.14	5.87	35.96	53.85	74	-20.15	Peak
7386	32.36	0	100	V	37.14	5.87	35.96	39.40	54	-14.60	Ave
7386	32.35	0	100	H	37.14	5.87	35.96	39.39	54	-14.61	Ave
9848	47.39	0	100	V	37.99	7.44	35.98	56.84	86.51	-29.67	Peak
9848	46.85	0	100	H	37.99	7.44	35.98	56.30	81.30	-25.00	Peak
9848	32.91	0	100	V	37.99	7.44	35.98	42.36	74.95	-32.59	Ave
9848	32.94	0	100	H	37.99	7.44	35.98	42.39	69.48	-27.09	Ave