



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

TEST AND MEASUREMENT REPORT

For

Viptela, Inc.

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**FCC ID: 2AI2U100WMAC
IC: 22152-100WMAC**

Report Type: CIIPC Report	Product Type: Wi-Fi Module
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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “*” (Rev.2)

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R16051915-247	Original Report	2016-12-05
1	R16051915-247 Rev A	updates	2016-12-07

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been compiled on behalf of *Viptela, Inc.* and their product, *FCC ID: 2AI2U100WMAC, IC: 22152-100WMAC*, *model number: WLE900VX*, which henceforth is referred to as the EUT (Equipment under Test.) The EUT is a Wi-Fi Module operates in 2.4 GHz and 5 GHz bands.

1.2 Mechanical Description of EUT

The EUT measures approximately 50.95 mm (L) x 30 mm (W) x 3.2 mm (H).

The test data gathered are from typical production sample, serial number: R16051915-1 assigned by BACL.

1.3 Objective

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

The objective is to determine compliance with FCC Part 15.247 and ISED RSS-247 rules Spurious Emissions and RF exposure.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, 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

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	$\pm 5\%$
RF output power, conducted	$\pm 0.57\text{ dB}$
Power Spectral Density, conducted	$\pm 1.48\text{dB}$
Unwanted Emissions, conducted	$\pm 1.57\text{dB}$
All emissions, radiated	$\pm 4.0\text{ dB}$
AC power line Conducted Emission	$\pm 2.0\text{ dB}$
Temperature	$\pm 2^\circ\text{ C}$
Humidity	$\pm 5\%$
DC and low frequency voltages	$\pm 1.0\%$
Time	$\pm 2\%$
Duty Cycle	$\pm 3\%$

1.7 Test Facility Registrations

BACL's 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 3279.02), 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 3279.03) 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 & Fixed Radio Services;
4. All Scope 4-Licensed Maritime & 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 3279.01) 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 & 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 & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
 - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
 - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
 - o Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC
US -EU EMC & Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA)
APEC Tel MRA -Phase I & 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 & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
 - o ENERGY STAR Recognized Test Laboratory – US EPA
 - o 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 and FCC KDB 558074 D01 DTS Meas Guidance v03r05.

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

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

Terminal

2.3 Equipment Modifications

N/A

2.4 Local Support Equipment

N/A

2.5 EUT Internal Configuration Details

Manufacturer	Description	Model
Sierra Wireless	Module	MC7354
Compex	Wi-Fi Module	WLE900VX

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & ISED Rules	Description of Test	Results
FCC §15.203 ISED RSS-Gen §8.3	Antenna Requirement	Compliant
FCC §2.1091, §15.247(i) ISED RSS-102	RF Exposure	Compliant ¹
FCC §2.1051, §15.247 (d) ISED RSS-247 §5.5	Spurious Emissions at Antenna Port	N/A ¹
FCC §2.1053, §15.205, §15.209, §15.247 (d) ISED RSS-247 §5.5 RSS-Gen §8.9 & §8.10	Restricted Bands	N/A ¹
FCC §15.247(a)(2) ISED RSS-247 §5.2 (1)	Radiated Spurious Emissions	Compliant ¹
FCC §15.247(b)(3) ISED RSS-247 §5.4 (4)	6 dB&99% Emission Bandwidth	N/A ¹
FCC §15.247(d) ISED RSS-247 §5.5	Maximum Peak Output Power	N/A ¹
FCC §15.247(e) ISED RSS-247 §5.2 (2)	100 kHz Bandwidth of Frequency Band Edge	N/A ¹
FCC §15.203 ISED RSS-Gen §8.3	Power Spectral Density	N/A ¹

Compliant¹: Co-Location configuration.

N/A¹: share with the original report, FCC ID: TK4WLE900VX, IC: 7849A-WLE900VX

4 FCC §15.203 & 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 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

The antennas used by the EUT are permanent attached antennas.

Antenna	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
Wi-Fi Port 1	2400-2500	2.63
Wi-Fi Port 2	2400-2500	4.54
Wi-Fi Port 3	2400-2500	3.91
Wi-Fi Port 1	5150-5850	4.60
Wi-Fi Port 2	5150-5850	6.69
Wi-Fi Port 3	5150-5850	5.25

5 FCC §15.247(i), §2.1091(i) & ISED 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

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

2.4 GHz Wi-Fi

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>24.3</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>269.1535</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2437</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>4.5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>2.8184</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.151</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

2.4 GHz Wi-Fi and WWAN bands can transmit simultaneously. Per FCC KDB 447498, when RF sources have difference frequencies, the fraction of the FCC power density limit shall be determined and the sum of all fractional components shall be less than 1.

Technology	Frequency (MHz)	Max Cond. Power (dBm)	Max Cond. Power (W)	Max Antenna Gain (dBi)	Duty Cycle	Average EIRP (dBm)	Average EIRP (mW)	Power Density @ 20 cm (mW/cm^2)	FCC MPE Limit (mW/cm^2)
GPRS 2UL	824-849	33.0	1.995	1.8	0.250	28.78	754.988	0.150	0.549
EDGE 2UL	824-849	28.0	0.631	1.8	0.250	23.78	238.748	0.048	0.549
EDGE 3UL	824-849	26.2	0.417	1.8	0.375	23.74	236.609	0.047	0.549
EDGE 4UL	824-849	25.0	0.316	1.8	0.500	23.79	239.315	0.048	0.549
GPRS 2UL	1850-1910	30.0	1.000	6.7	0.250	30.68	1169.338	0.233	1
EDGE 2UL	1850-1910	27.0	0.501	6.7	0.250	27.68	586.057	0.117	1
EDGE 3UL	1850-1910	25.2	0.331	6.7	0.375	27.64	580.806	0.116	1
EDGE 4UL	1850-1910	24.0	0.251	6.7	0.500	27.69	587.449	0.117	1
CDMA BC0	824-849	25.0	0.316	1.8	1.000	26.80	478.630	0.095	0.549
CDMA BC1	1850-1910	25.0	0.316	6.7	1.000	31.70	1479.108	0.294	1
CDMA BC10	817-824	25.0	0.316	1.8	1.000	26.80	478.630	0.095	0.544
UMTS	824-849	24.0	0.251	1.8	1.000	25.80	380.189	0.076	0.549
UMTS	1710-1755	24.0	0.251	6.4	1.000	30.40	1096.478	0.218	1
UMTS	1850-1910	24.0	0.251	6.7	1.000	30.70	1174.898	0.234	1
LTE	704-716	24.0	0.251	3.5	1.000	27.50	562.341	0.112	0.469
LTE	777-787	24.0	0.251	3.5	1.000	27.50	562.341	0.112	0.518
LTE	824-849	24.0	0.251	1.8	1.000	25.80	380.189	0.076	0.549
LTE	1710-1755	24.0	0.251	6.4	1.000	30.40	1096.478	0.218	1
LTE	1850-1910	24.0	0.251	6.7	1.000	30.70	1174.898	0.234	1
LTE	1850-1915	24.0	0.251	6.7	1.000	30.70	1174.898	0.234	1

Worst case Co-location RF Exposure

Frequency Band	Max Conducted Power(dBm)	Evaluated Distance (cm)	Worst-Case MPE (mW/cm ²)	MPE Limit (mW/cm ²)	Worst-Case MPE Ratios	Sum of MPE Ratios	Limit
2.4 GHz Wi-Fi	24.3	20	0.151	1.0	15.1 %	44.5 %	100 %
1850-1910 MHz CDMA BC1	25.0	20	0.294	1.0	29.4 %		

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

6.1 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) and RSS-Gen 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 ($\mu\text{v/m}$ 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 license-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.

6.2 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.

The spacing between the peripherals was 10 centimeters.

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

6.3 Test Procedure

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:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000 MHz:

- (1) Peak: $\text{RBW} = 1\text{MHz} / \text{VBW} = 1\text{MHz} / \text{Sweep} = \text{Auto}$
- (2) Average: $\text{RBW} = 1\text{MHz} / \text{VBW} = 10\text{Hz} / \text{Sweep} = \text{Auto}$

6.4 Corrected Amplitude & Margin Calculation

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

$$\text{CA} = \text{Ai} + \text{AF} + \text{CL} - \text{Atten} - \text{Ga}$$

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

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

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

6.5 Test Equipment List and Details

BACL Asset #	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
124	Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100044	2015-07-23	2 years
424	Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	1 year
323	Sunol Sciences	Controller, System	SC104V	011003-1	Cal. Not required	N/A
317	Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2015-07-11	2 years
187	A.R.A.	Antenna, Horn	DRG-118/A	1132	2015-09-21	2 years
661	-	SMA Cable	-	-	N/A ¹	N/A ¹
238	HP	Pre- Amp	8447D	2944A06639	2016-06-28	1 year
691	Wireless Solutions	Conducted Emission Cable	LMR 400	691	2016-06-29	1 year
778	IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960KPS	2016-08-05	1 year
-	-	SMA cable	-	C0001	Each time ¹	N/A
32	Agilent	Pre-Amplifier	8449B	3008A01978	2016-09-02	1 year

Note¹: 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.

6.6 Test Environmental Conditions

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

The testing was performed by Jin Yang from 2016-10-20 at 5 meter 3.

6.7 Summary of Test Results

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

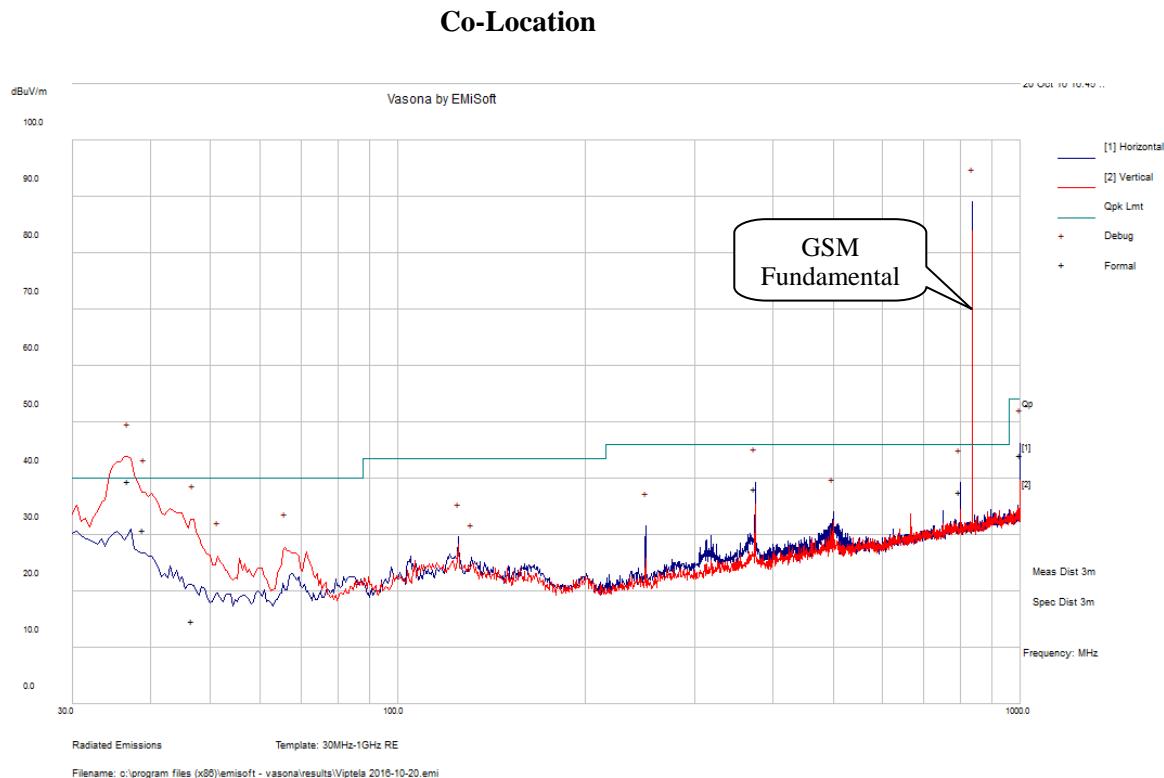
Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Mode
-0.38	36.87325	Vertical	Co-Location

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

6.8 Radiated Emissions Test Results

1) 30 MHz – 1 GHz Worst Case, Measured at 3 meters, Co-Location

Wi-Fi 2437 MHz with GSM 836.6 MHz



Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
36.87325	39.62	100	V	332	40	-0.38	QP
38.968	30.82	109	V	218	40	-9.18	QP
374.992	38.2	100	H	350	46	-7.8	QP
799.9873	37.62	100	H	341	46	-8.38	QP
46.7735	14.84	294	V	109	40	-25.16	QP
1000	44.22	104	H	59	54	-9.78	QP

2) 1–25 GHz Measured at 3 meters

Frequency (MHz)	S.A. Reading (dB μ V)	Test Antenna		Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dB μ V/m)	FCC/IC		Comments
		Polarity (H/V)	Factor (dB/m)				Limit (dB μ V/m)	Margin (dB)	
Co-Location. Wi-Fi 2437 MHz and GSM 836.6 MHz									
1673.2	52.04	H	25.519	4.180	38.67	43.069	74	-30.931	PK
1673.2	39.5	H	25.519	4.180	38.67	30.529	54	-23.471	AV
1673.2	52.17	V	25.519	4.180	38.67	43.199	74	-30.801	PK
1673.2	39.46	V	25.519	4.180	38.67	30.489	54	-23.511	AV
4874	56.76	H	33.068	7.820	37.78	59.868	74	-14.132	PK
4874	43.16	H	33.068	7.820	37.78	46.268	54	-7.732	AV
4874	54.29	V	33.068	7.820	37.78	57.398	74	-16.602	PK
4874	42.96	V	33.068	7.820	37.78	46.068	54	-7.932	AV