FCC PART 15, SUBPART C

TEST AND MEASUREMENT REPORT

For

ABB, Inc.

3055 Orchard Drive,

San Jose, CA 95134, USA

FCC ID: P9J-642401

Report Type:	Product Type:
Class II Permissive Change Report	Bluefin 2G Wi-Fi Module

Prepared By:	Xiao Lin Test Engineer
Report Number:	R1704217 FCC
Report Date:	2018-01-25
Reviewed By:	Jin Yang RF Lead

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732-9164

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1704217 FCC	Class II Permissive Change Report	2018-01-25

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *ABB, Inc.*, and their product model: Bluefin 2G, FCC ID: P9J-642401 or the "EUT" as referred to in this report. Model: Tropos 6420 is the host product, which consists of the EUT, Model: Bluefin 5G (FCC ID: P9J-645801), and Model: TeleOS 9111B (FCC ID: P9J-T900).

1.2 Objective

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

The objective is to determine compliance with FCC Part 15.247 rules to allow colocation for multiple radio module installed in host product, Model: Tropos 6420.

1.3 Related Submittal(s)/Grant(s)

N/A

1.4 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 v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, and FCC KDB 789033 D02 General U-NII Test Procedures New Rules v02r01: Guidelines For Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E.

1.5 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 %

1.6 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.

1.7 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: (Innovation, Science and Economic development Canada - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & 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:
  - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC US -EU EMC & Telecom MRA CAB (NB)
  - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - Low Voltage Directive (LVD) 2014/35/EU
- 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 Media Development Authority - IMDA) APEC Tel MRA -Phase I & 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;
  - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- 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 v04 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04.

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 Graphical User Interface provided by ABB, Inc., and was verified by Jose Martinez to comply with the standard requirements being tested against.

2.3 Equipment Modifications

The output of PoE had to be grounded to pass radiated emissions below 1000 MHz. Please refer to test setup photo for details.

2.4 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	E5430	100PYW1

2.5 Support Equipment

There was no support equipment that came with the EUT.

2.6 Interface Ports and Cabling

Cable Descriptions	Length (m)	From	To
Cat5e Cable	< 1	Laptop	Input PoE
Cat5e Cable	< 1	Output PoE	EUT MGT port

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
FCC §15.207	AC Power Line Conducted Emissions	Compliant
FCC §2.1091	RF Exposure	Compliant
FCC §15.209, §15.247(d)	Radiated Spurious Emissions	Compliant

4 FCC §2.1091 - RF Exposure

According to FCC §2.1091 (Mobile Devices) RF exposure is calculated.

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 (minute)
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

Note: f = frequency in MHz
* = Plane-wave equivalent power density

4.1 MPE Prediction

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

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

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.2 Test Results

For transmission with 900 MHz, 2.4 GHz, and 5 GHz

2.4 GHz (FCC ID: P9J-642401)

Maximum peak output power at antenna input terminal (dBm):	28.27
Maximum peak output power at antenna input terminal (mW):	671.43
Prediction distance (cm):	40
Predication frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	7.5
Maximum Antenna Gain (numeric):	5.623
Power density of prediction frequency at prediction distance (mW/cm^2):	0.188
FCC limit (mW/cm^2):	1.00

5 GHz (FCC ID: P9J-645801)

Maximum peak output power at antenna input terminal (dBm):	27.98
Maximum peak output power at antenna input terminal (mW):	628.058
Prediction distance (cm):	40
Predication frequency (MHz):	5745
Maximum Antenna Gain, typical (dBi):	8
Maximum Antenna Gain (numeric):	6.31
Power density of prediction frequency at prediction distance (mW/cm^2):	0.197
FCC limit (mW/cm^2):	1.00

900 MHz (FCC ID: P9J-T900)

Maximum peak output power at antenna input terminal (dBm):	29.99
Maximum peak output power at antenna input terminal (mW):	997.70
Prediction distance (cm):	40
Predication frequency (MHz):	902.4
Maximum Antenna Gain, typical (dBi):	3.00
Maximum Antenna Gain (numeric):	1.9953
Power density of prediction frequency at prediction distance (mW/cm^2):	0.099
FCC limit (mW/cm^2):	0.6016

The sum of the ratio of MPE values to their respective limits is 0.55.

Results

For the different combination of transmitters, a separation distance of 40 cm complies with the MPE simultaneous transmission limit of ≤ 1.0.

5 FCC §15.207 - AC Line Conducted Emissions

5.1 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.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note1	56 to 46 Note2
0.5-5	56	46
5-30	60	50

Note1: Decreases with the logarithm of the frequency.
Note2: A linear average detector is required

5.2 Test Setup

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

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.

5.3 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 cords of support equipment were connected to LISN-2.

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

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

5.4 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:

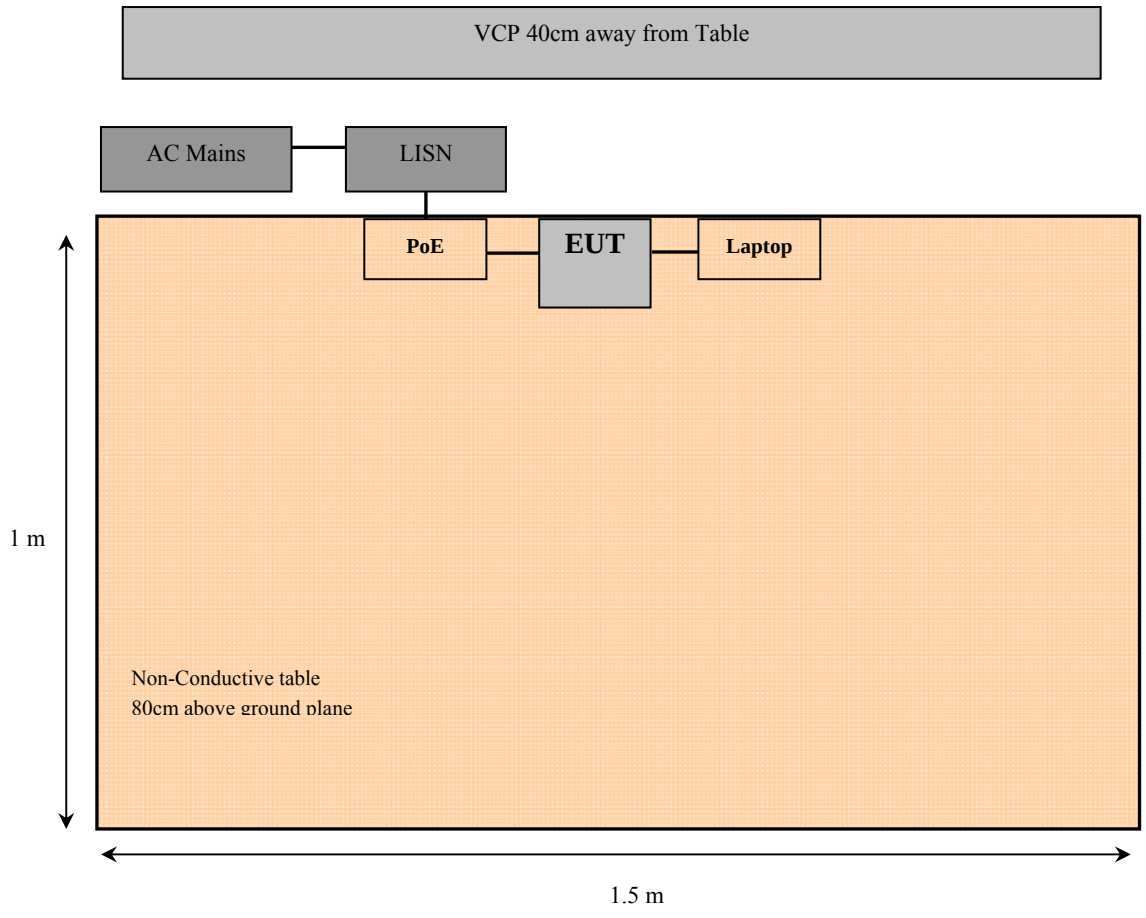
CA = Ai + CL + Atten

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

5.5 Test Setup Block Diagram



5.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 years
Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101964	2016-07-22	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150203	2017-03-13	1 Year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
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 per the A2LA requirements, traceable to the NIST.*

5.7 Test Environmental Conditions

Temperature:	18º C
Relative Humidity:	42 %
ATM Pressure:	101.31 kPa

The testing was performed by Jose Martinez on 2017-04-28 in ground plane test site.

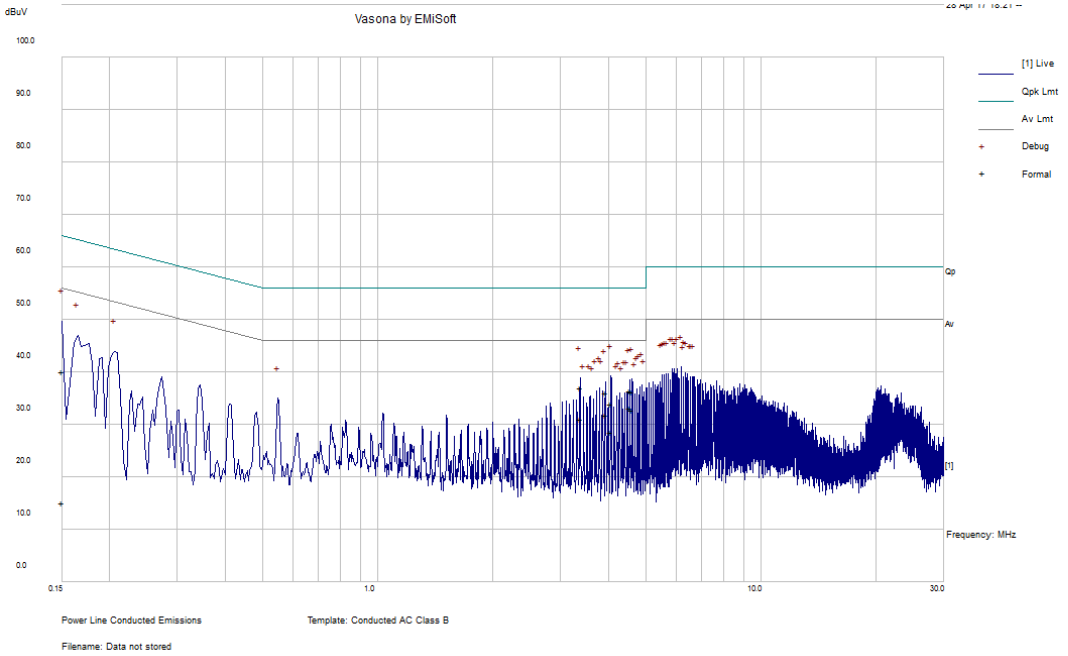
5.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15C and 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)**
-12.84	4.551426	Line	0.15-30

5.9 Conducted Emissions Test Plots and Data

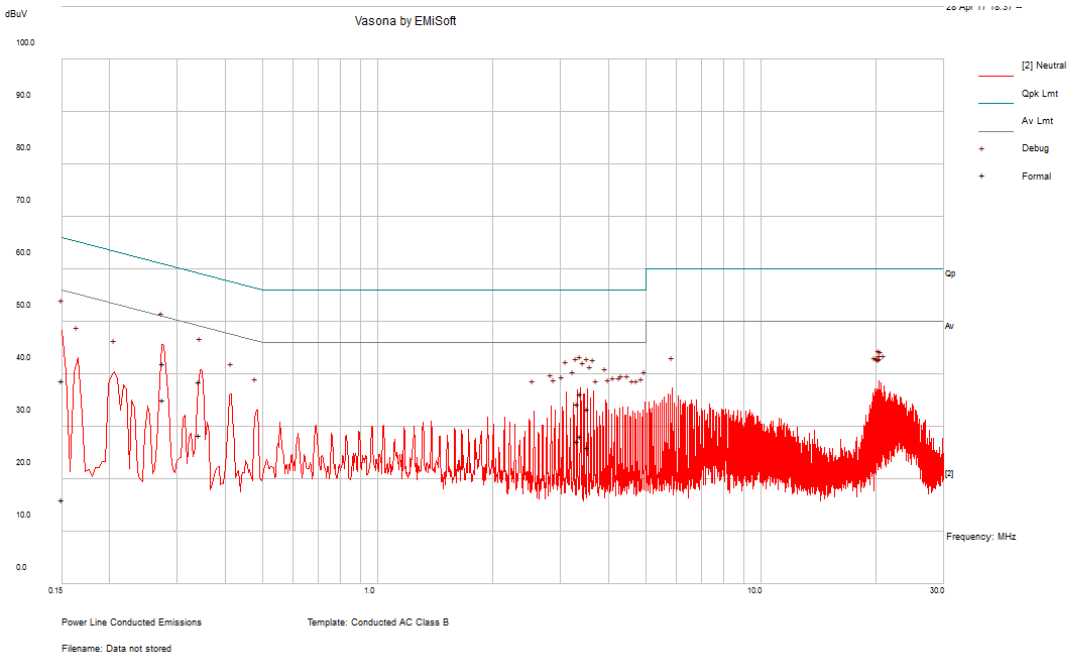
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.15003	40.14	Line	66	-25.86	QP
4.063024	34.05	Line	56	-21.95	QP
3.376842	37.11	Line	56	-18.89	QP
4.618634	36.22	Line	56	-19.78	QP
4.551426	36.53	Line	56	-19.47	QP
3.93022	36.12	Line	56	-19.88	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.15003	15.22	Line	56	-40.78	Ave.
4.063024	28.57	Line	46	-17.43	Ave.
3.376842	31.01	Line	46	-14.99	Ave.
4.618634	32.78	Line	46	-13.22	Ave.
4.551426	33.16	Line	46	**-12.84**	Ave.
3.93022	31.84	Line	46	-14.16	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.275606	41.96	Neutral	60.95	-18.99	QP
0.150346	38.83	Neutral	65.98	-27.15	QP
0.34267	38.51	Neutral	59.14	-20.62	QP
3.385589	36.3	Neutral	56	-19.7	QP
3.526372	33.49	Neutral	56	-22.51	QP
3.316526	34.41	Neutral	56	-21.59	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.275606	35.15	Neutral	50.95	-15.8	Ave.
0.150346	16.18	Neutral	55.98	-39.8	Ave.
0.34267	28.34	Neutral	49.14	-20.8	Ave.
3.385589	28.2	Neutral	46	-17.8	Ave.
3.526372	26.12	Neutral	46	-19.88	Ave.
3.316526	27.31	Neutral	46	-18.69	Ave.

6 FCC §15.209, §15.247(d) - Spurious Radiated Emissions

6.1 Applicable Standards

As per FCC §15.35(b): 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 §15.205(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 §15.209(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 §15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the

intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

6.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15.209, FCC 15.247, FCC 15.407 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.

6.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords were 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 was set 3 meter away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 1.5 meter above the ground plane, the table was rotated for 360 degrees to find out the highest emission. The receiving antenna's polarity changed between horizontal and vertical.

The spectrum analyzer or receiver was 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

6.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 year
Agilent	Analyzer, Spectrum	E4440A	US45303156	2017-02-24	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2015-07-11	2 years
EMCO	Antenna, Horn	3115	9511-4627	2016-01-28	2 years
HP	Amplifier, Pre	8449B	3147A00400	2016-05-20	1 year
IW	Armored High Frequency Cable	DC 1531	KPS-1501A3960KPS	2016-08-05	1 year
-	SMA cable	-	C0002	Each time[1]	N/A
-	N-Type Cable	-	C00013	2016-04-28	1 year
-	N-Type Cable	-	C00014	2016-05-28	1 year
HP	Pre-Amplifier	8447D	2443A04374	2016-06-28	1year
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2015-10-22	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-01	2015-09-01	2 years
Wisewave	Amplifier, Low Noise	ALN-33144030-01	11424-01	2016-05-16	1 year
Wisewave	Amplifier, Low Noise	ALN-22093530-01	12263-01	2016-05-16	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R
-	5725-5875 MHz Notch Filter	-	-	N/R	N/R
Wainwright Instruments	Band Reject Filter	WRCGV900/930-880/950-40/8SS	-	N/R	N/R
-	2.4GHz Notch Filter	-	-	N/R	N/R

[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.*

6.5 Test Location, Date, Personnel and Environmental Conditions

Temperature:	23° C
Relative Humidity:	42 %
Barometric Pressure:	102.7 kPa

The testing was performed by Jose Martinez from 2017-04-24 to 2017-04-27 in 5m3 chamber.

6.6 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15.209, 15.247 standards' radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting		
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**
-3.68	800.0025	Vertical

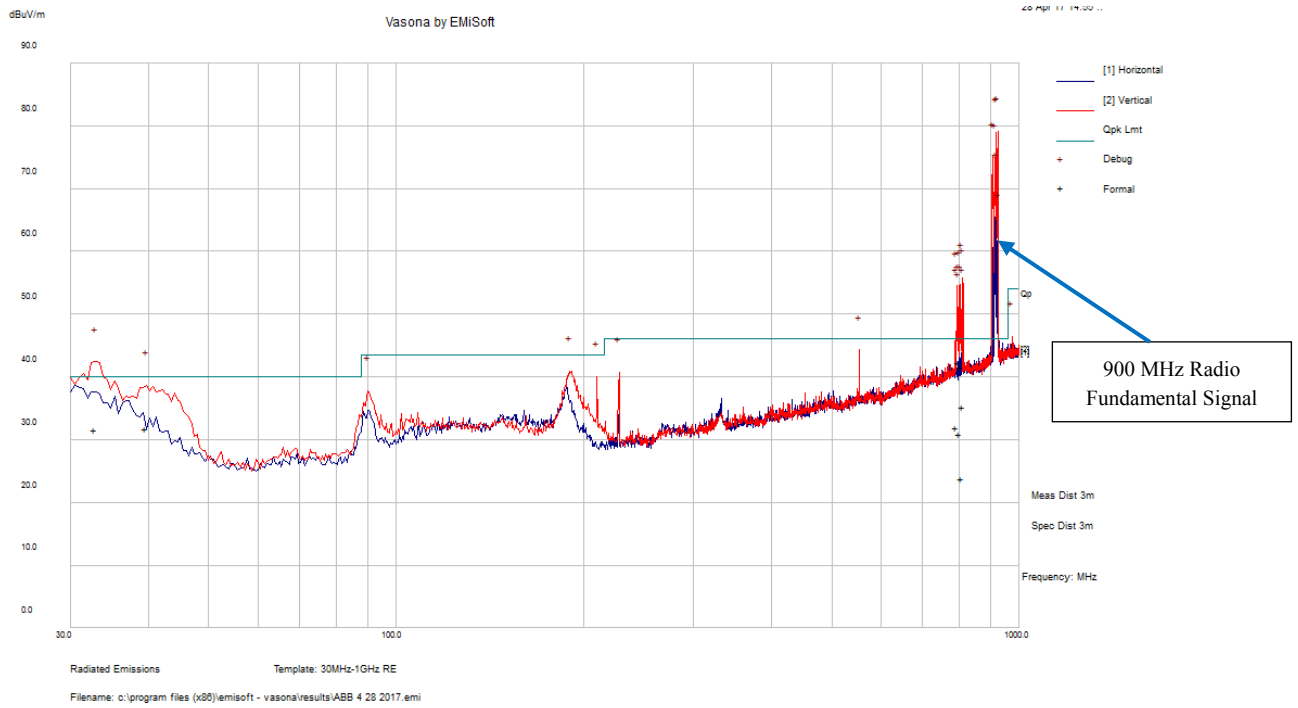
1-40 GHz:

Mode: Transmitting		
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**
-2.54	1291	Vertical

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

6.7 Radiated Emissions Test Results Data

1) 30 MHz - 1 GHz Radio Co-location, Measured at 3 meters

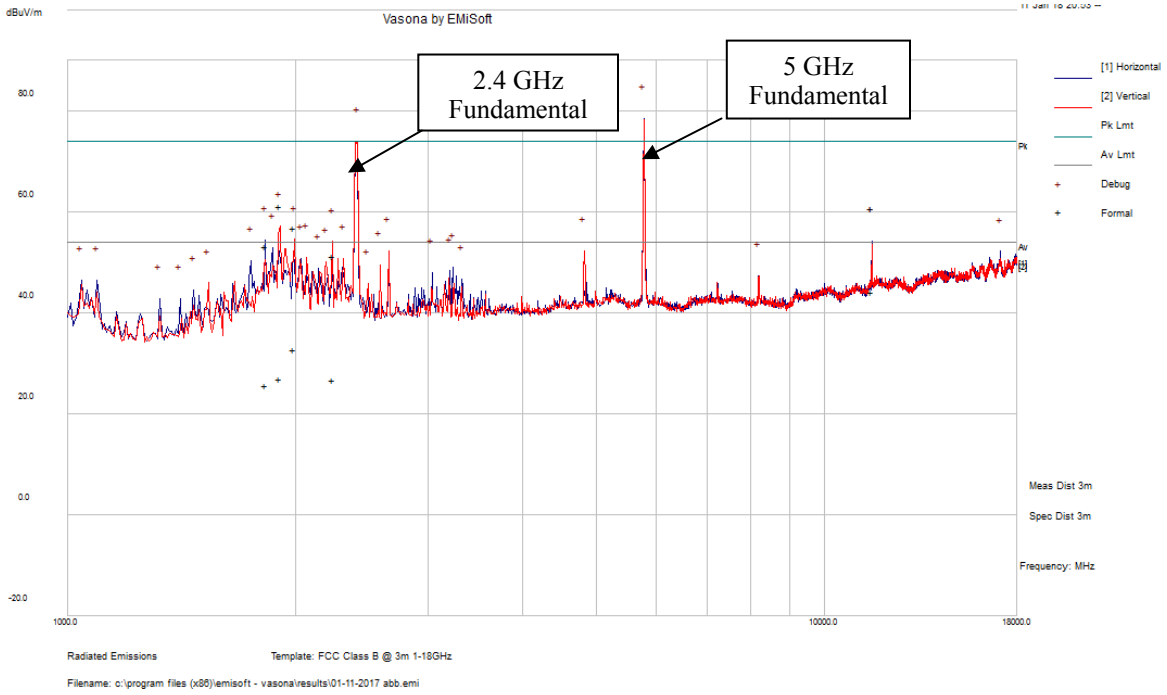


Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
809.7098	23.85	121	V	120	46	-22.15	QP
812.6438	35.2	159	V	320	46	-10.8	QP
802.4548	30.91	290	V	125	46	-15.09	QP
793.7163	31.92	123	V	20	46	-14.08	QP
800.0025	42.32	185	V	195	46	-3.68	QP
805.3245	41.69	244	V	253	46	-4.31	QP
32.83925	31.66	124	V	87	40	-8.34	QP
39.61925	31.72	140	V	241	40	-8.28	QP

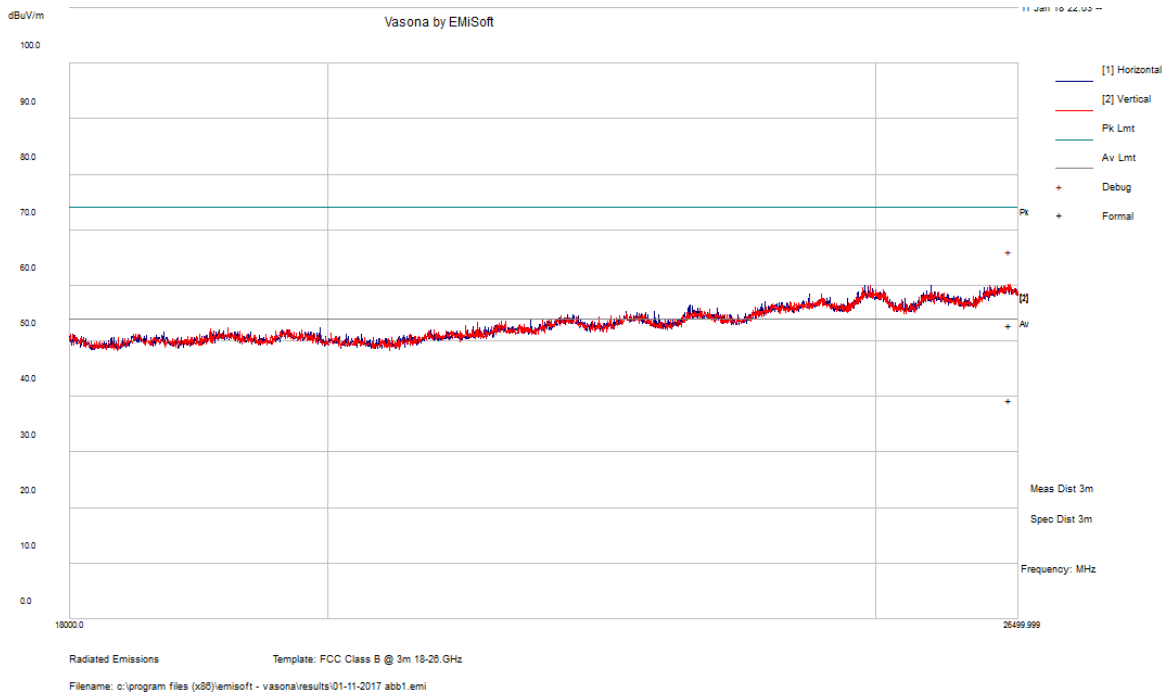
Note: the output of PoE was grounded, please refer to test setup photo for details.

2) 1–40 GHz Radio Co-location, Measured at 3 meters

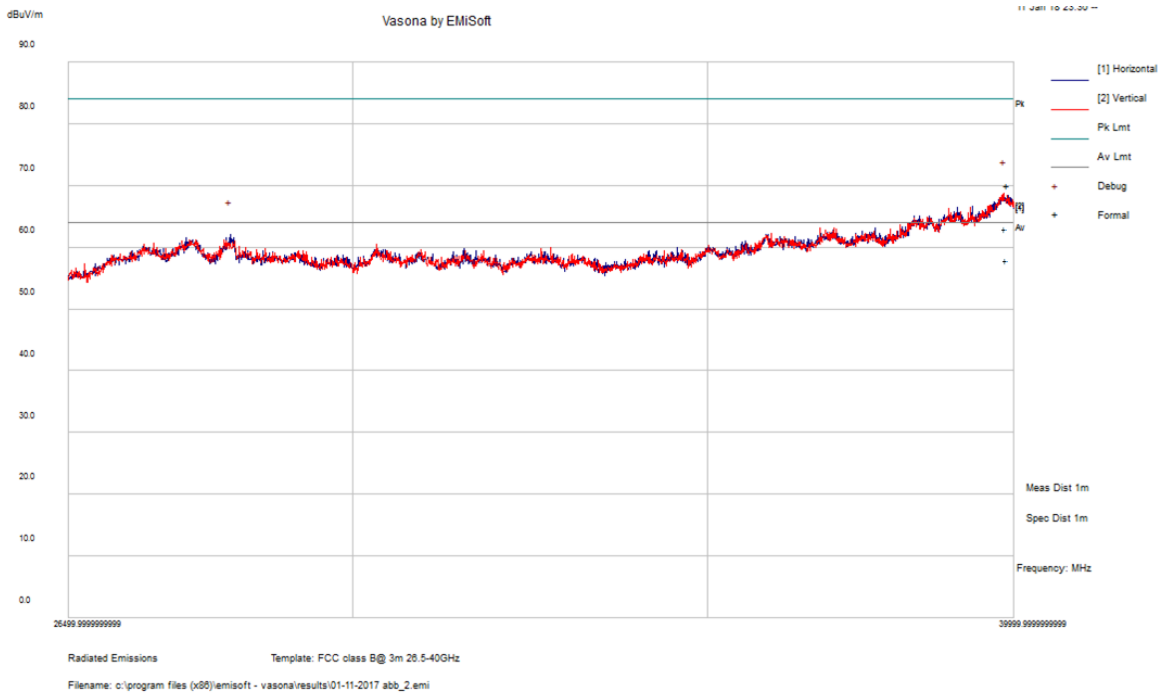
1-18 GHz



18-26.5 GHz



26.5-40 GHz



Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments (PK/Ave)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Radio Co-location											
1291	52.12	0	100	H	25.34	3.44	17.84	63.06	74.00	-10.94	PK
1291	40.36	0	228	H	25.34	3.44	17.84	51.30	54.00	-2.70	Ave
1291	52.53	0	130	V	25.34	3.44	17.84	63.47	74.00	-10.53	PK
1291	40.52	0	287	V	25.34	3.44	17.84	51.46	54.00	-2.54	Ave
2747	51.75	0	100	H	28.90	5.20	39.47	46.38	74.00	-27.62	PK
2747	39.03	0	100	H	28.90	5.20	39.47	33.66	54.00	-20.34	Ave
2747	51.44	0	100	V	28.90	5.20	39.47	46.07	74.00	-27.93	PK
2747	39.12	0	100	V	28.90	5.20	39.47	33.75	54.00	-20.25	Ave
6275	47.64	0	218	H	34.59	8.29	38.23	52.29	74.00	-21.71	PK
6275	35.39	0	100	H	34.59	8.29	38.23	40.04	54.00	-13.96	Ave
6275	47.86	0	280	V	34.59	8.29	38.23	52.51	74.00	-21.49	PK
6275	35.75	0	100	V	34.59	8.29	38.23	40.40	54.00	-13.60	Ave
10080	47.46	0	100	H	38.39	13.12	38.33	60.64	74.00	-13.36	PK
10080	35.16	0	100	H	38.39	13.12	38.33	48.34	54.00	-5.66	Ave
10080	47.56	360	300	V	38.39	13.12	38.33	60.74	74.00	-13.26	PK
10080	35.12	0	248	V	38.39	13.12	38.33	48.30	54.00	-5.70	Ave

Note 1: Any emissions above 12 GHz were the noise floor.
Note 2: Duty Cycle Correction Factor has been added to the measurements.
Note 3: The worst-case configuration from each radio was enabled for the co-location configuration during testing.

--- END OF REPORT ---