FCC PART 15, SUBPART C
ISED RSS-310, ISSUE 4, JULY 2015

TEST AND MEASUREMENT REPORT

For

SpotterRF, LLC.

720 Timpanogos Parkway,

Orem, UT 84097, USA

FCC ID: CO6-CK-UNL
Model: CK10

Report Type:	**Product Type:**
Original Report	Ground Surveillance Radar

	Frank Wang
Prepared By:	Test Engineer
Report Number:	R1608262-249
Report Date:	2016-10-28
	Bo Li
Reviewed By:	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	R1608262-249	Original Report	2016-10-28

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *SpotterRF, LLC.* and their product model: CK10, FCC ID: CO6-CK-UNL, or the "EUT" as referred to in this report. It is ground surveillance radar operates in 24-24.25 GHz.

1.2 Mechanical Description of EUT

The EUT measures approximately 23 cm (L) x 17.5 cm (W) x 4.5 cm (H) and weight 0.516 kg.

The test data gathered are from typical production sample, serial number: R1608262-1 assigned by BACL

1.3 Objective

This report is prepared on behalf of *SpotterRF, LLC,* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission's rules and IC RSS-310, Issue 4, July 2015.

The objective is to determine compliance with FCC Part 15.249 and ISED RSS-310 rules for AC Line and Radiated Spurious Emissions.

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.

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 Registrations

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

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

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

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

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 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):
  - 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 2004/108/EC US-EU EMC & Telecom MRA CAB
  - 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:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;
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Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of A2LA *R222 - Specific Requirements - EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 30th day of August 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2018

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

2 System Test Configuration

2.1 Justification

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

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

2.2 EUT Exercise Software

The test utility used was GUI provided SpotterRF, the software was verified by *Frank Wang* to comply with the standard requirements being tested against.

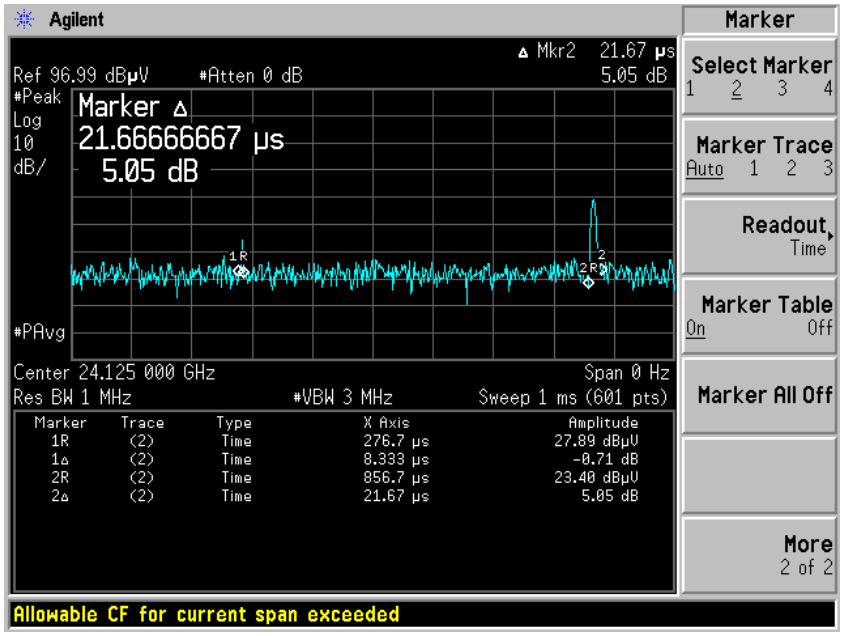
2.3 Duty Cycle Correction Factor

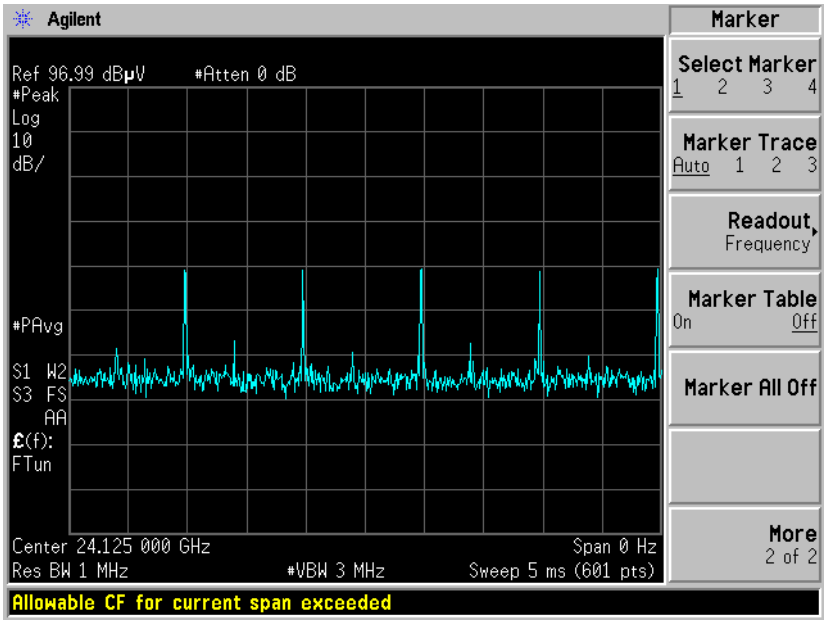
On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
0.15	5	3.0	30.46

Duty Cycle = On Time (ms)/ Period (ms)

Duty Cycle Correction Factor (dB): $\delta(\mathrm{dB}) = 20\log\left[\sum\left(nt_1 + mt_2 + \ldots + \xi t_x\right)/T\right]$

Please refer to the following plots.





2.4 Equipment Modifications

N/A

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude D630
Spotter RF	P.O.E.	POE-IN-J-01

2.6 EUT Internal Configuration Details

N/A

2.7 Support Equipment

No support equipment was included with the EUT.

2.8 Interface Ports and Cabling

Cable Description	Length (m)	To	From
Ethernet Cable	<1.0	EUT	POE
Ethernet Cable	>1.0	POE	Laptop

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 §15.207 ISED RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
ISED RSS-102	RF Exposure	Compliant
FCC §2.1053, §15.205, §15.209, §15.249 ISED RSS-310 §3.10 RSS-Gen §8.9 & §8.10	Radiated Spurious Emissions	Compliant
FCC §15.215(C) ISED RSS-Gen §6.6	Emission Bandwidth	Compliant

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.

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 isotopically 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 (GHz)	Maximum Antenna Gain (dBi)
Internal Antenna	24-24.25	16

5 ISED RSS-102 RF Exposure

5.1 Applicable Standard

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 MHzFootnote6 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 $22.48/f^{0.5}$ 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 x 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 than5 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.

For Channel 1 24.07-24.22 GHz:

EIRP=19.38 dBm=86.69 mw<5w

For Channel 2 24.09-24.24 GHz:

EIRP=17.51 dBm=56.36 mw<5w

Thus, this device can be exempted from RF Exposure evaluation.

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

6.1 Applicable Standards

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

6.2 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 and ISED RSS-Gen §8.8 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.

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 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”.

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:

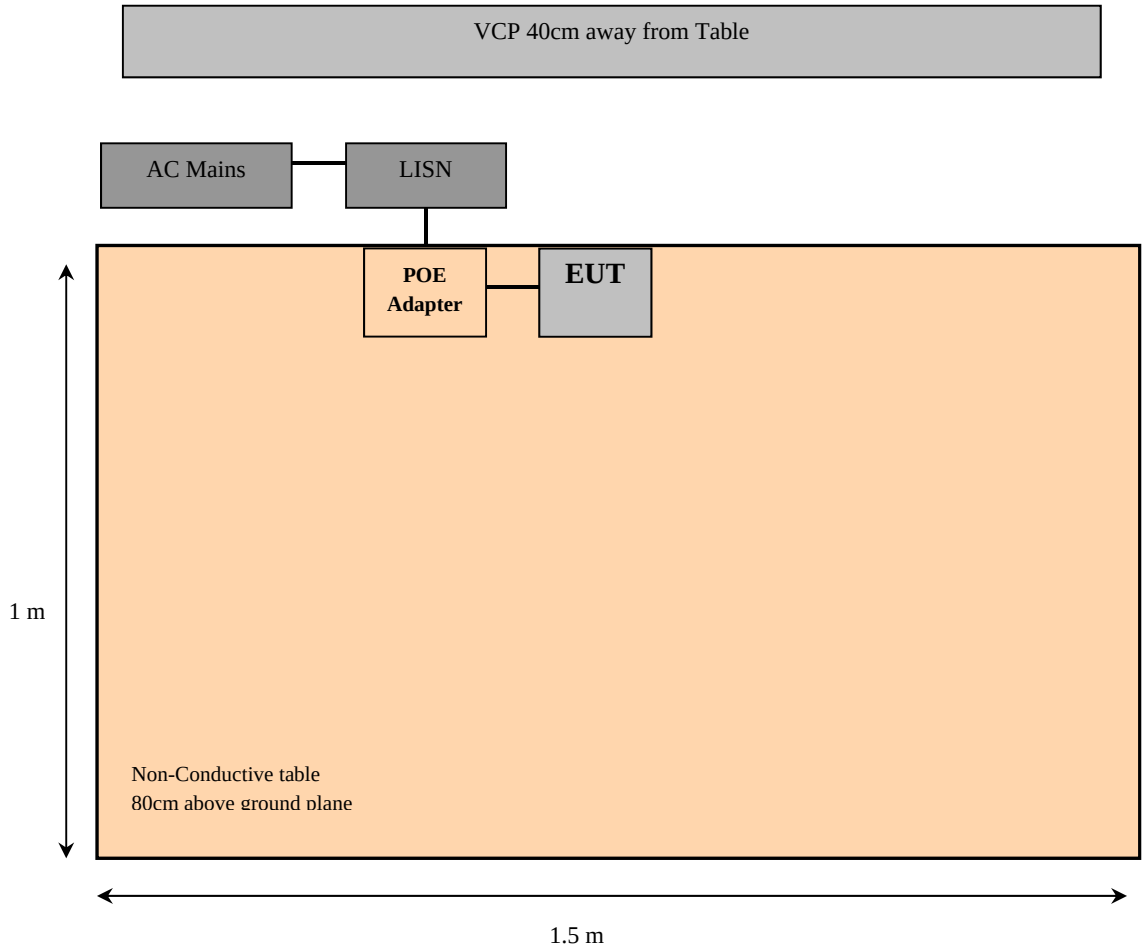
CA = Ai + CL + Atten

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	EMI Test Receiver	ESCI 1166.5950K03	100044	2016-06-24	1 year
Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101963	2016-07-15	1year
Keysight Technologies	RF Limiter	11867A	MY42242931	2015-12-15	1year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2016-03-06	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/R
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2016-04-11	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:	22 ºC
Relative Humidity:	43 %
ATM Pressure:	101.8 kPa

The testing was performed by Frank Wang on 2016-09-08 in the 5m chamber3

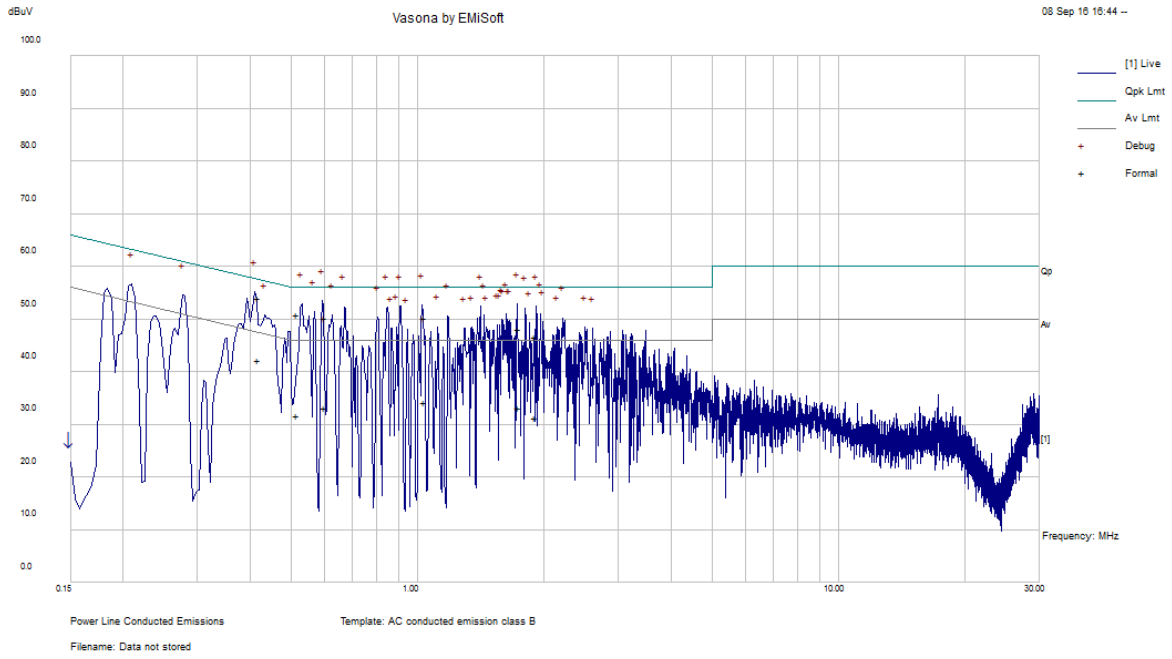
6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15C and ISED 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 (Live/Neutral)**	**Range (MHz)**
-3.47	0.417721	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

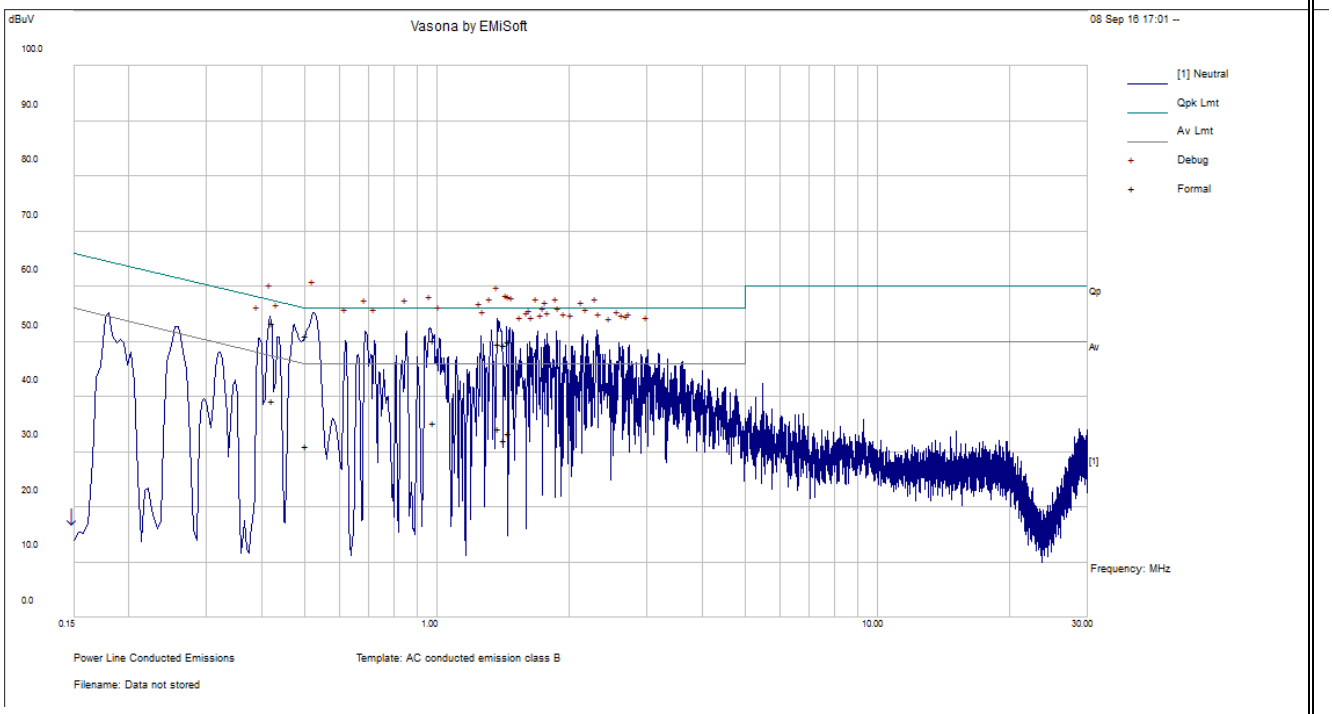
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.417721	54.03	Line	57.49	**-3.47**	QP
0.601519	50.39	Line	56	-5.61	QP
1.737833	48.19	Line	56	-7.81	QP
0.517941	51.06	Line	56	-4.94	QP
1.036857	50.4	Line	56	-5.6	QP
1.901788	46.67	Line	56	-9.33	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.417721	42.23	Line	47.49	-5.26	Ave.
0.601519	33.28	Line	46	-12.72	Ave.
1.737833	33.31	Line	46	-12.69	Ave.
0.517941	31.73	Line	46	-14.27	Ave.
1.036857	34.3	Line	46	-11.7	Ave.
1.901788	31.44	Line	46	-14.56	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.505654	51.24	Neutral	56	-4.76	QP
1.385087	49.76	Neutral	56	-6.24	QP
0.422736	53.52	Neutral	57.39	-3.87	QP
1.421978	49.47	Neutral	56	-6.53	QP
1.454321	50.22	Neutral	56	-5.78	QP
0.981467	50.24	Neutral	56	-5.76	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.505654	31.24	Neutral	46	-14.76	Ave.
1.385087	34.28	Neutral	46	-11.72	Ave.
0.422736	39.32	Neutral	47.39	-8.08	Ave.
1.421978	32.16	Neutral	46	-13.84	Ave.
1.454321	33.5	Neutral	46	-12.5	Ave.
0.981467	35.43	Neutral	46	-10.57	Ave.

7 FCC §15.209, §15.249 & ISED RSS-310 §3.10, RSS-Gen §8.9, §8.10 - Spurious Radiated Emissions

7.1 Applicable Standards

Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

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-310 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 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 0.8 meter and 1.5 meter above the ground plane for below and above 1000 MHz measurements, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna’s polarity should be 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

For the conducted band-edge measurement, EUT was connected to the measurement instrument (PSA) directly via RF cable. The PSA setting was as below,

Detector: Peak/RBW = 100 kHz / VBW = 300 kHz / 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 Test Receiver	ESCI 1166.5950K03	100044	2016-06-24	1 year
Agilent	Analyzer, Spectrum	E4446A	MY48250238	2015-10-22	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	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/R
-	SMA cable	-	C0002	Each time[1]	N/A
IW Microwave	High Frequency Cable	DC-1438	SPS-2303-3840-SPS	2016-01-18	1 year
Hewlett	Pre-Amplifier	8449B	3008A01978	2016-05-22	1year
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2015-10-22	2 year
Wisewave	Antenna, Horn	ARH-2823-02	10555-02	2013-09-20	3 year
OML	Diplexer for Agilent Spectrum Analyzer	DPL.26	N/A	N/A[1]	N/A
OML	WR-12 Harmonic Mixer with Horn Antenna	M12HWD	130529-1	N/A[1]	N/A
OML	WR19 Harmonic Mixer with Horn Antenna	M19HWD	U60313-1	N/A[1]	N/A
OML	WR08 Harmonic Mixer with Horn Antenna	M08HWD	F60313-1	N/A[1]	N/A
OML	G Band Harmonic Mixer with Horn Antenna	M05HWD	G60106-1	N/A[1]	N/A

Note[1]: equipment 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

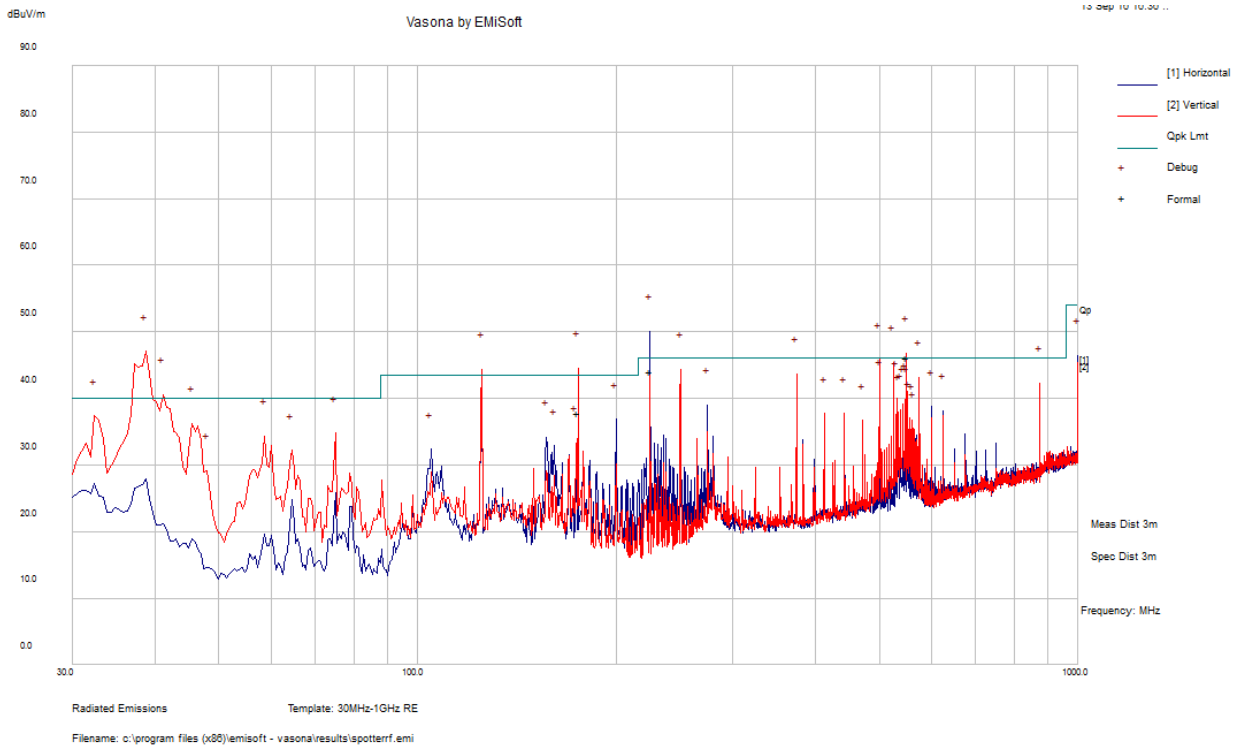
Temperature:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 kPa

The testing was performed by Frank Wang from 2016-09-06 5m chamber 3.

7.7 Radiated Emissions Test Results

Transmit mode: Sweeping mode.

1) 30 MHz – 1 GHz Worst Case, 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
38.975	22.43	239	V	43	40	-17.57	QP
224.9943	44.14	146	H	249	46	-1.86	QP
174.995	37.91	100	V	133	43.5	-5.59	QP
550.0035	45.99	100	V	352	46	-0.01	QP
41.36825	32.49	101	V	148	40	-7.51	QP

2) 1–18 GHz Measured at 3 meters

Channel 1: 24.07-24.22 GHz

Frequency (GHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
17.292	44.94	0	100	H	43.945	16.96	37.12	68.73	74.00	-5.27	PK
17.292	20.01	0	100	H	43.945	16.96	37.12	43.79	54.00	-10.21	AV
17.32	44.90	0	100	V	43.986	16.96	37.12	68.73	74.00	-5.27	PK
17.32	19.97	0	100	V	43.986	16.96	37.12	43.79	54.00	-10.21	AV

Channel 2: 24.09-24.24 GHz

Frequency (GHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
17.292	44.83	0	100	H	43.945	16.96	37.12	68.62	74.00	-5.38	PK
17.292	19.90	0	100	H	43.945	16.96	37.12	43.68	54.00	-10.32	AV
17.32	44.74	0	100	V	43.986	16.96	37.12	68.57	74.00	-5.43	PK
17.32	19.81	0	100	V	43.986	16.96	37.12	43.63	54.00	-10.37	AV

3) 18-100 GHz Measured at 1 meter

Channel 1 24.07-24.22 GHz

Frequency (GHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp (dB)	Distance Factor (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)					Limit (dBµV/m)	Margin (dB)	
24	43.84	0	181	H	36.177	18.90	35.541	9.5	53.88	74.00	-20.12	PK
24	43.96	0	196	V	36.177	18.90	35.541	9.5	54.00	74.00	-20.00	PK
24.075	66.66	0	181	H	36.41	18.90	0	9.5	112.47	127.96	-15.49	PK
24.075	68.62	0	196	V	36.41	18.90	0	9.5	114.43	127.96	-13.53	PK
37.14	48.46	0	100	H	41.109	24.65	24.2	9.5	80.52	87.96	-7.44	PK
37.13	47.33	0	100	V	41.109	24.65	24.2	9.5	79.39	87.96	-8.57	PK
40.53	23.48	0	100	H	34.5	0.00	0	9.5	48.48	74	-25.52	PK
40.67	23.68	0	100	V	34.5	0.00	0	9.5	48.68	74	-25.32	PK
62	27.01	0	100	H	41.109	0.00	0	9.5	58.62	74	-15.38	PK
63.15	26.29	0	100	V	41.109	0.00	0	9.5	57.90	74	-16.10	PK
90.08	24.88	0	100	H	41.109	0.00	0	9.5	56.49	74	-17.51	PK
90	25.15	0	100	V	41.109	0.00	0	9.5	56.76	74	-17.24	PK

Frequency (GHz)	Antenna Polarity (H/V)	Peak Cord. Reading (dBµV/m)	Duty Cycle Correction Factor (dB)	Average Cord. Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)
24	H	53.88	30.46	23.42	54.00	-30.58
24	V	54.00	30.46	23.54	54.00	-30.46
24.075	H	112.47	30.46	82.01	107.96	-25.95
24.075	V	114.43	30.46	83.97	107.96	-23.99
37.14	H	80.52	30.46	50.06	67.96	-17.90
37.13	V	79.39	30.46	48.93	67.96	-19.03
40.53	H	48.48	30.46	18.02	54	-35.98
40.67	V	48.68	30.46	18.23	54	-35.77
62	H	58.62	30.46	28.17	54	-25.83
63.15	V	57.90	30.46	27.45	54	-26.55
24	H	56.49	30.46	26.04	54	-27.96
24	V	56.76	30.46	26.30	54	-27.70

Channel 2 24.09-24.24 GHz

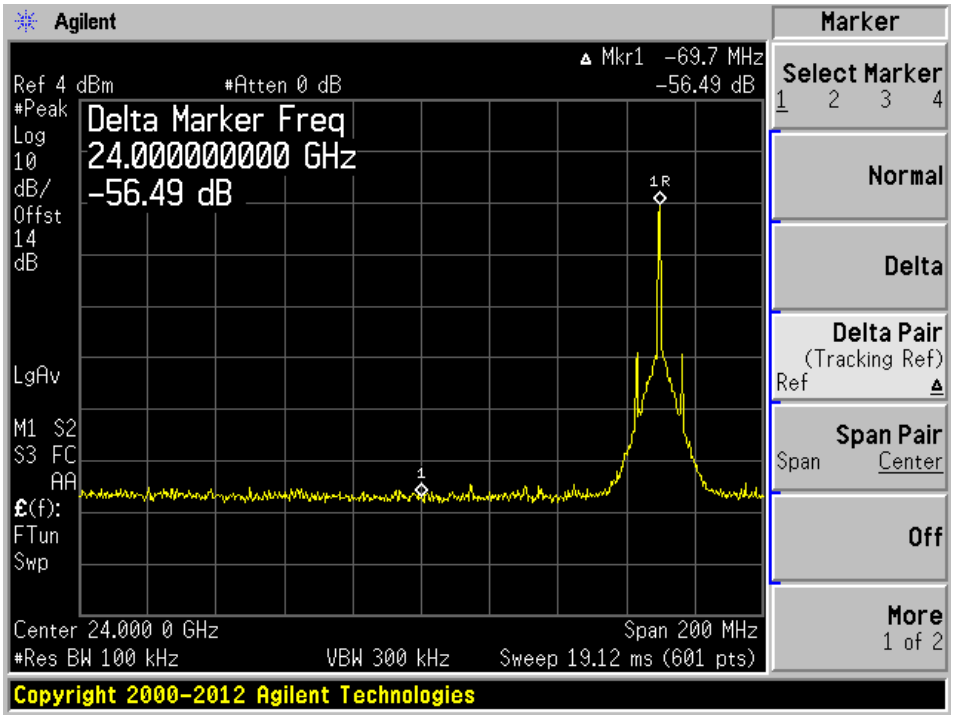
Frequency (GHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp (dB)	Distance Factor (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)					Limit (dBµV/m)	Margin (dB)	
24.16	66.41	29	175	H	36.41	19.00	0	9.5	112.32	127.96	-15.64	PK
24.16	67.64	198	169	V	36.41	19.00	0	9.5	113.55	127.96	-14.41	PK
24.25	52.52	29	175	H	36.177	18.90	35.541	9.5	62.56	74.00	-11.44	PK
24.25	45.84	198	155	V	36.177	18.90	35.541	9.5	55.88	74.00	-18.12	PK
36.76	48.02	0	100	H	40.846	24.65	24.2	9.5	79.82	87.96	-8.14	PK
37.3	47.02	0	100	V	40.846	24.65	24.2	9.5	78.82	87.96	-9.14	PK
40.53	23.29	0	100	H	34.5	0.00	0	9.5	48.29	74	-25.71	PK
40.63	24.20	0	100	V	34.5	0.00	0	9.5	49.20	74	-24.80	PK
61.8	26.30	0	100	H	40.846	0.00	0	9.5	57.65	74	-16.35	PK
60.1	25.61	0	100	V	40.846	0.00	0	9.5	56.96	74	-17.04	PK
92.7	25.08	0	100	H	40.846	0.00	0	9.5	56.43	74	-17.57	PK
90	24.92	0	100	V	40.846	0.00	0	9.5	56.27	74	-17.73	PK

Frequency (GHz)	Antenna Polarity (H/V)	Peak Cord. Reading (dBµV/m)	Duty Cycle Correction Factor (dB)	Average Cord. Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)
24.16	H	112.32	30.46	81.86	107.96	-26.10
24.16	V	113.55	30.46	83.09	107.96	-24.87
24.25	H	62.56	30.46	32.10	54.00	-21.90
24.25	V	55.88	30.46	25.42	54.00	-28.58
36.76	H	79.82	30.46	49.36	67.96	-18.60
37.3	V	78.82	30.46	48.36	67.96	-19.60
40.53	H	48.29	30.46	17.84	54	-36.16
40.63	V	49.20	30.46	18.75	54	-35.25
61.8	H	57.65	30.46	27.20	54	-26.80
60.1	V	56.96	30.46	26.51	54	-27.49
92.7	H	56.43	30.46	25.98	54	-28.02
90	V	56.27	30.46	25.82	54	-28.18

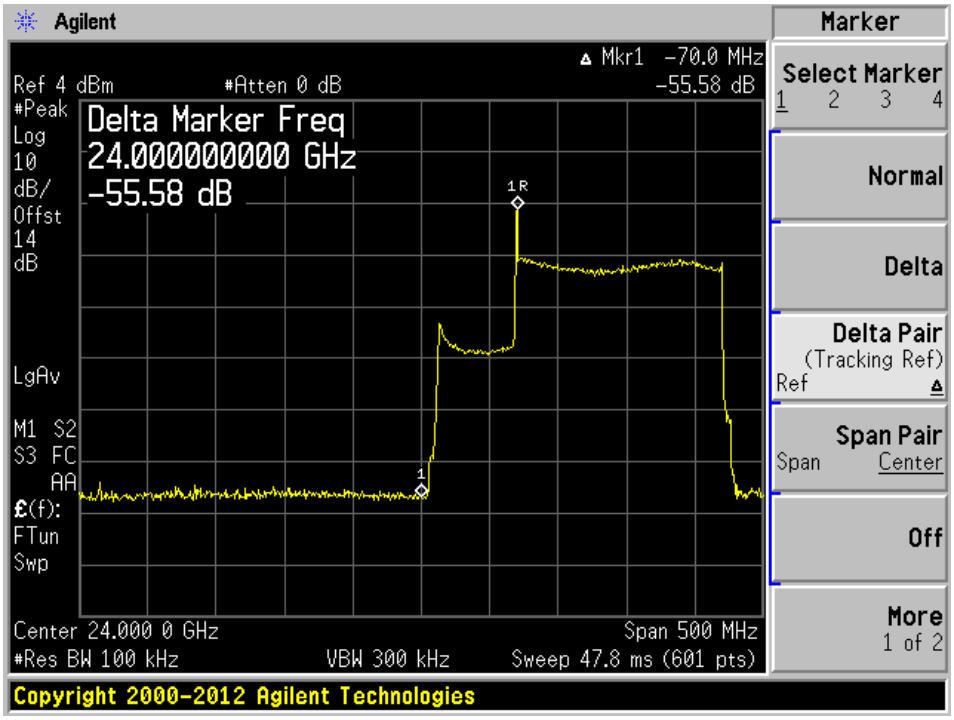
Note: Average value is calculated by peak value and duty cycle correction factor because the EUT is the pulse trains device.

7.8 Conducted Band-Edge Measurement

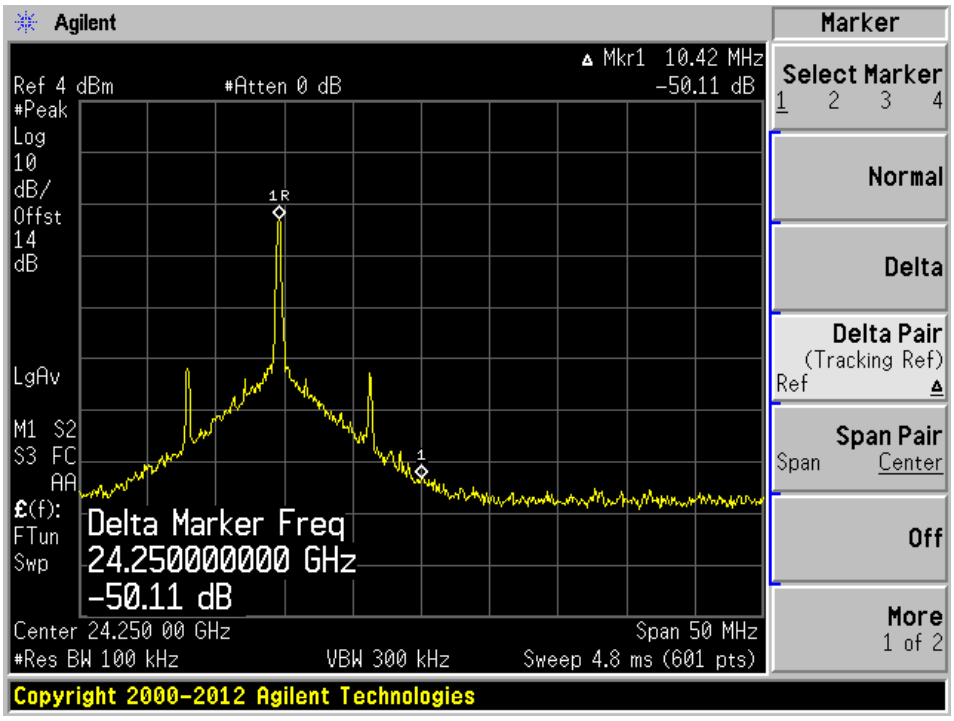
Low Channel-Non-sweeping Mode



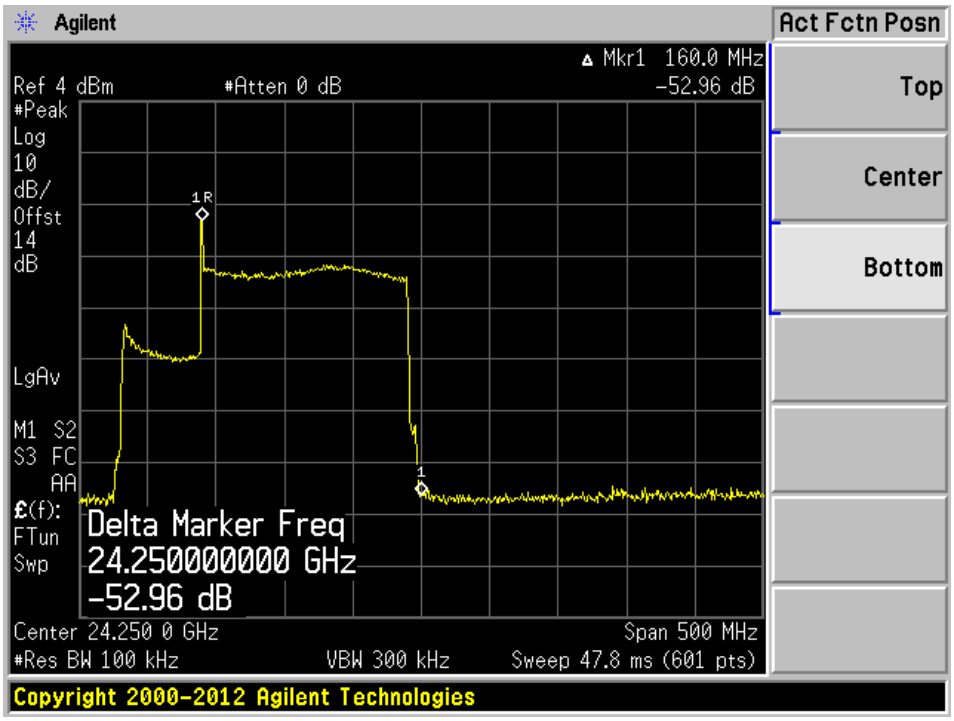
Low Channel- Sweeping Mode



High Channel-Non-sweeping Mode



High Channel- Sweeping Mode



8 FCC §15.215(C) & ISED RSS Gen §6.6 - 20 dB & 99% Emission Bandwidth

8.1 Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

8.3 Test Equipment List and Details

Manufacturers	Description	Model No.	Serial No.	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	MY48250238	2015-10-22	1 year

8.4 Test Environmental Conditions

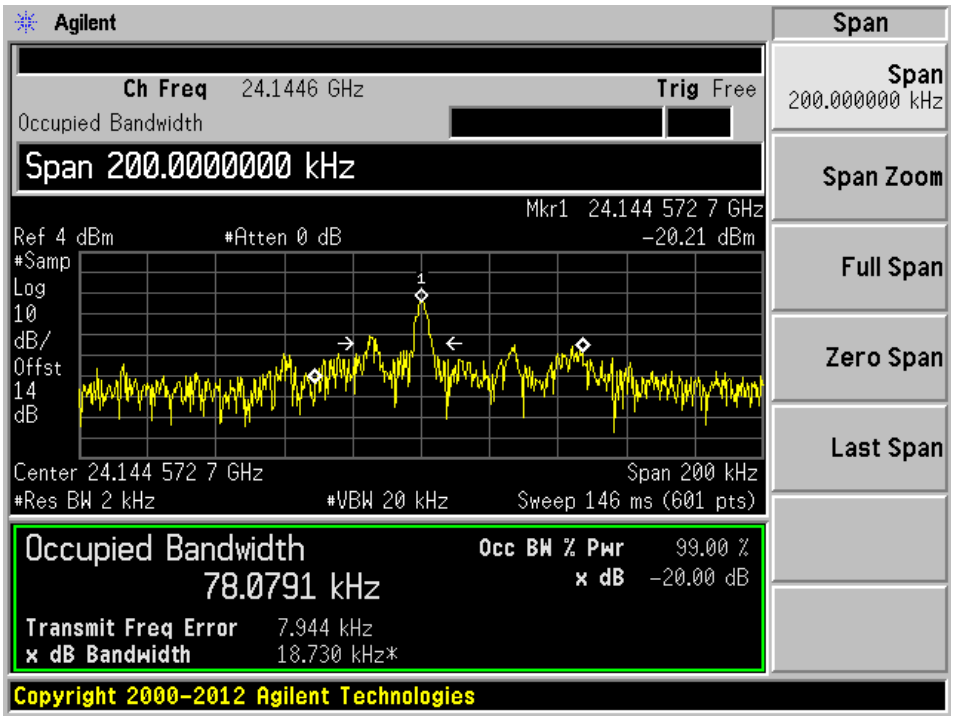
Temperature:	22°C
Relative Humidity:	33 %
ATM Pressure:	101.1kPa

**The testing was performed by Frank Wang on 2016-10-13.*

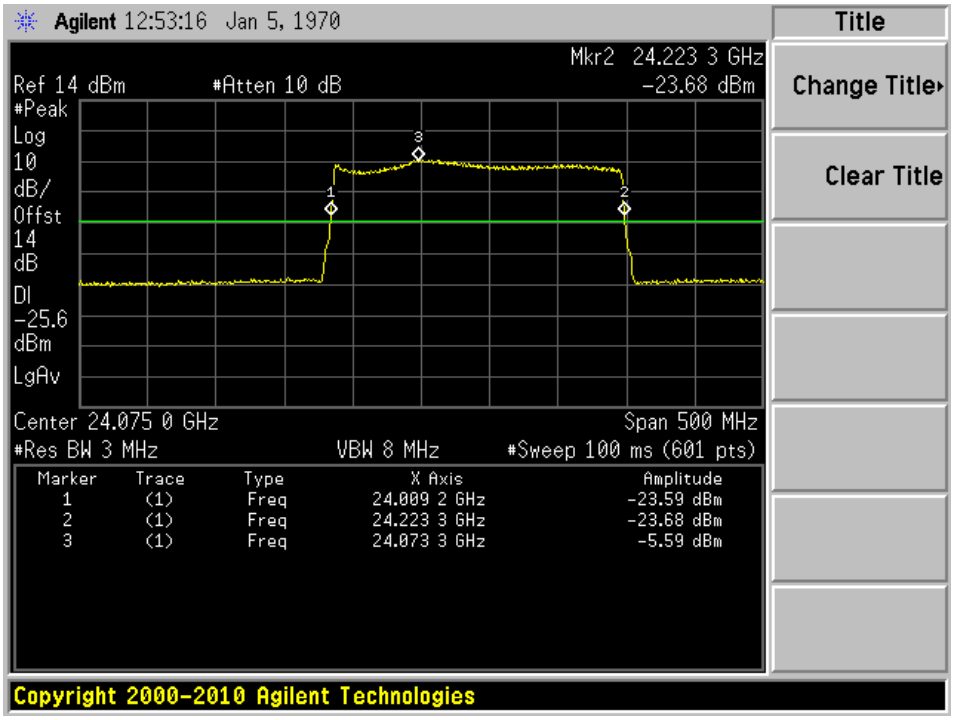
8.5 Test Results

Please refer to the following plots for detailed test results

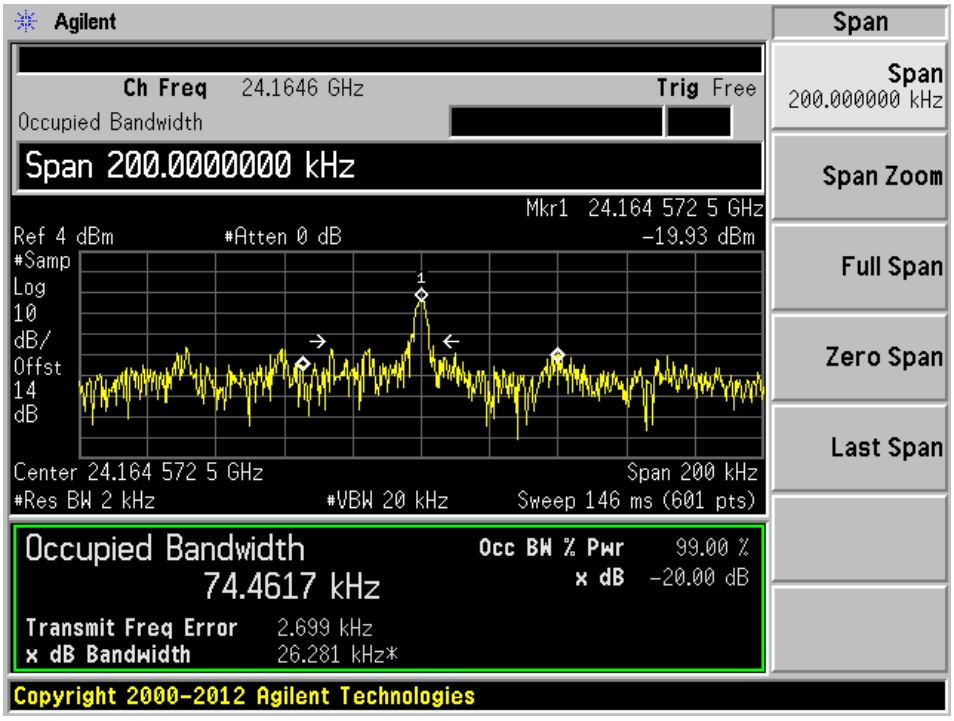
Low Channel-Non-sweeping Mode



Low Channel-Sweeping Mode



High Channel-Non-sweeping Mode



High Channel-Sweeping Mode