FCC PART 15, SUBPART C
ISEDC RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

Macari Baby, Inc.

30 Martin Street,
Cumberland, RI 02864, USA

FCC ID: 2AJEY-401AT
IC: 21973-401AT

Report Type:	**Product Type:**
Original Report	Baby Monitor (Camera Unit)

Prepared By:	Vincent Licata RF Engineer
Report Number:	R1804234-247
Report Date:	2018-05-29
Reviewed By:	Simon Ma RF Lead

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1804234-247	Original Report	2018-05-29

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Macari Baby, Inc.*, and their product model: *BD04010AT,* FCC ID: 2AJEY-401AT, IC: 21973-401AT or the "EUT" as referred to in this report. It is a Wireless camera.

1.2 Objective

This report is prepared on behalf of *Macari Baby, Inc,* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission's rules and ISEDC RSS-247 Issue 2, February 2017.

The objective is to determine compliance with FCC Part 15.247 and ISEDC RSS-247 rules for Output Power, Antenna Requirements, 20 dB Bandwidth, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Radiated Spurious Emissions, Number of Hopping Channels, Dwell Time, and Hopping Channel Separation.

1.3 Related Submittal(s)/Grant(s)

Equipment class: DXX as reported in test report: R1804234-DXX
FCC 15C submissions with FCC ID: 2AJEY-402AR and FCC ID: 2AJEY-401AM
RSS-247 submissions with IC: 21973-402AR and IC: 21973-401AM

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.

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 ° 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 and Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime and Aviation Radio Services;
  - 5 All Scope 5-Licensed Fixed Microwave Radio Services
  - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 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 and Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)

- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

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

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

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

5 Other
- For Water Coolers (ver. 3.0)

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

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I and Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - EMC Directive 2004/108/EC US-EU EMC and Telecom MRA CAB
  - 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 and Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I and Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC
  - 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 in accordance to ANSI C63.10-2013

2.2 EUT Exercise Software

None

EUT channel plan and power setting applied for testing is shown in the table below,

Modulation	Frequency (MHz)	Power Setting
FHSS	2417	Default
	2444	Default
	2468	Default

2.3 Duty Cycle Correction Factor

According to ANSI C63.10-2013 section 7.5:

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 s (100 ms). In cases where the pulse train exceeds 0.1 s, the measured field strength shall be determined during a 0.1 s interval. The following procedure is an example of how the average value may be determined. The average field strength may be found by measuring the peak pulse amplitude (in log equivalent units) and determining the duty cycle correction factor (in dB) associated with the pulse modulation as shown in following equation:

$\delta(dB) = 20\log(\Delta)$

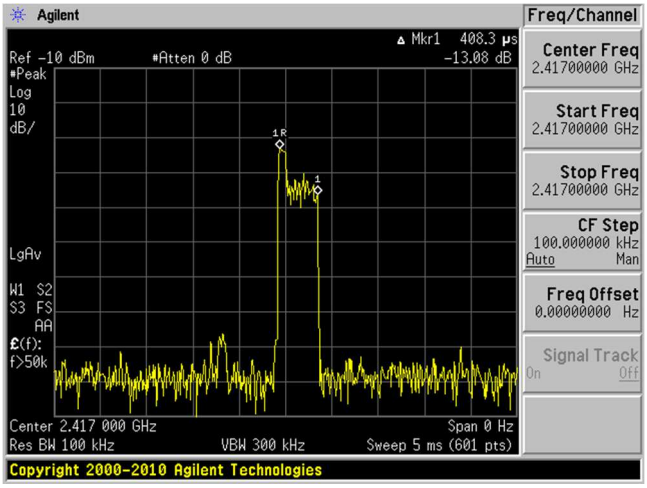
where
δ is the duty cycle correction factor (dB)
Δ is the duty cycle (dimensionless)

On Time/Pulse (µs)	Number of Pulses	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
408.3	18	100	7.35	22.68

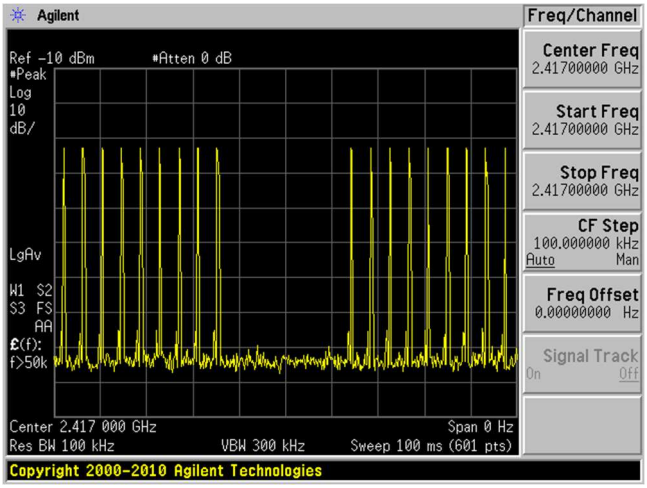
Duty Cycle = On Time (ms)/ Period (ms)

Please refer to the following plots.

One Pulse on Time



Pulse Number in 100ms



2.4 Equipment Modifications

A ferrite was added to the power supply cable. Detailed ferrite information is recorded in Section 2.5 of this report. Please refer to EUT photo for the ferrite location.

2.5 Local Support Equipment

Description	Manufacturer	Model
Ferrite	KE HANG Magnetic Industry	F9 SCRC 70C

2.6 Support Equipment

None

2.7 Power Supply/Adapter

Manufacturer	Description	Model
HUI GUAN	AC adapter	P5 0750500

3 Summary of Test Results

Results reported relate only to the product tested.

FCC and ISEDC Rules	Description of Test	Results
FCC §15.203 ISEDC RSS-Gen §6.8	Antenna Requirement	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §2.1091, §15.247(i) ISEDC RSS-102	RF Exposure	Compliant
FCC §2.1053, §15.205, §15.209, §15.247(d) ISEDC RSS-247 §5.5 ISEDC RSS-Gen §8.9, §8.10	Spurious Emissions	Compliant
FCC §15.247(a)(1) ISEDC RSS-247 §5.1 (1)	20 dB and 99% Emission Bandwidth	Compliant
FCC §15.247(b)(1) ISEDC RSS-247 §5.1(2)	Maximum Peak Output Power	Compliant
FCC §15.247(d) ISEDC RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(a)(1)(iii) ISEDC RSS-247 §5.1(4)	Number of Hopping Channels	Compliant
FCC §15.247(a)(1) ISEDC RSS-247 §5.1 (2)	Hopping Channel Separation	Compliant
FCC §15.247(a)(1)(iii) ISEDC RSS-247 §5.1 (4)	Dwell Time	Compliant

4 FCC §15.203 and ISEDC RSS-Gen §6.8 - 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 ISEDC RSS-Gen §6.8: Transmitter Antenna

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

4.2 Antenna Description

The antenna used by the EUT are permanent attached antenna and the antenna gain is 0dBi.

5 FCC §2.1091, §15.247(i) and ISEDC RSS-102 - RF Exposure

5.1 Applicable Standards

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

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

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF field

According to ISED RSS-102 Issue 5:

2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

5.2 MPE Prediction

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

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

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

5.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	16.82
Maximum peak output power at antenna input terminal (mW):	48.08
Prediction distance (cm):	20
Prediction frequency (MHz):	2444
Maximum Antenna Gain, typical (dBi):	0
Maximum Antenna Gain (numeric):	1
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.010
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.010 mW/cm$^{2.}$ Limit is 1.0 mW/cm^2.

5.2 RF exposure evaluation exemption for IC

16.82 + 0 dBi = 16.82 dBm < $1.31\times10^{-2}f^{0.6834}$ = 2.708 W = 34.327 dBm

Therefore the RF exposure is not required.

6 FCC §15.207 and ISEDC RSS-Gen §8.8 - AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 and ISEDC 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 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.
Note 2: 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 was FCC §15.207 and ISEDC 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 detection mode, 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 and 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 Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-06-23	2 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2017-07-24	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150203	2018-02-28	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160130	2018-04-05	1 year
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.*

6.6 Test Environmental Conditions

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

The testing was performed by Vincent Licata on from 2018-04-25 to 2018-04-30 in 5m chamber 3.

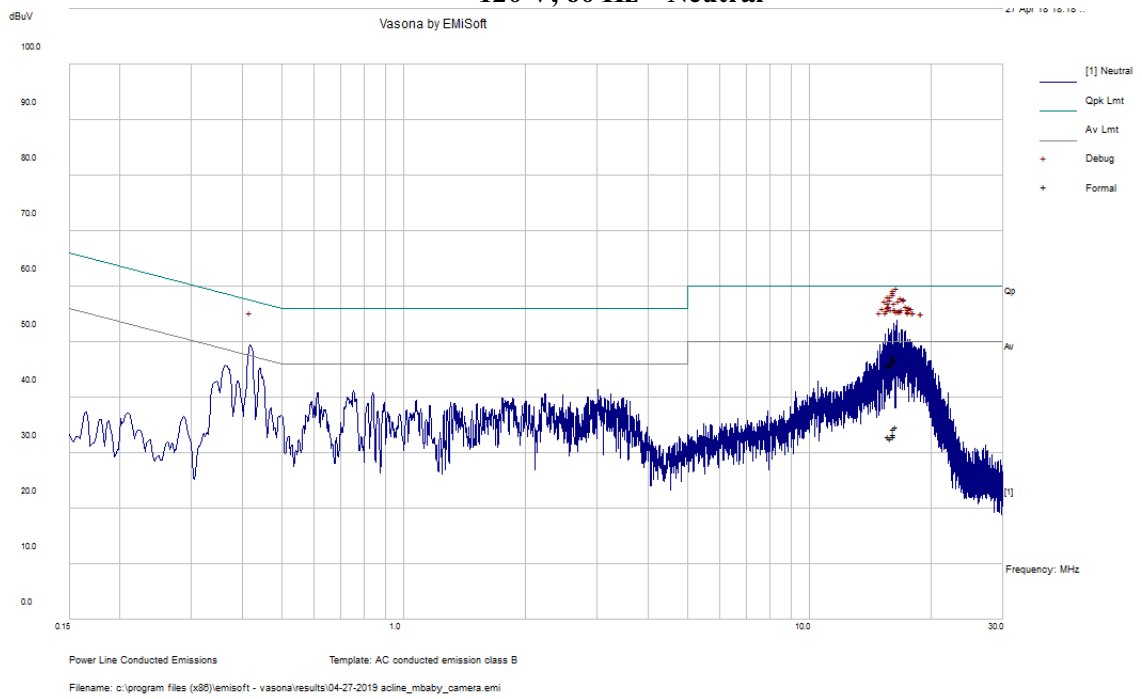
6.7 Summary of Test Results

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

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-0.94	0.418326	Line	0.15-30

6.8 Conducted Emissions Test Plots and Data

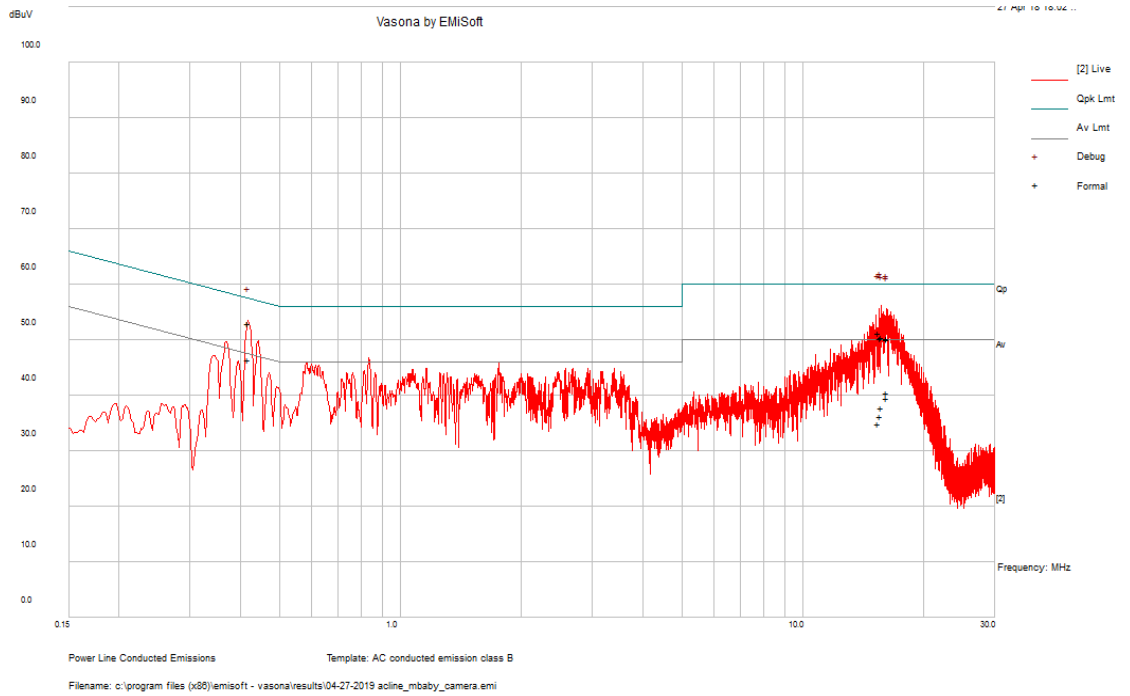
120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
16.39992	46.88	Neutral	60	-13.12	QP
16.12502	46.78	Neutral	60	-13.22	QP
16.12362	46.26	Neutral	60	-13.74	QP
16.15959	47.36	Neutral	60	-12.64	QP
15.65242	45.63	Neutral	60	-14.37	QP
15.91377	45.91	Neutral	60	-14.09	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
16.39992	34.67	Neutral	50	-15.33	Ave.
16.12502	33.45	Neutral	50	-16.55	Ave.
16.12362	33.1	Neutral	50	-16.9	Ave.
16.15959	34.34	Neutral	50	-15.66	Ave.
15.65242	33.08	Neutral	50	-16.92	Ave.
15.91377	32.56	Neutral	50	-17.44	Ave.

120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
15.6122	50.3	Line	60	-9.7	QP
0.418326	52.97	Line	57.48	-4.51	QP
16.14335	50.25	Line	60	-9.75	QP
15.42076	51.35	Line	60	-8.65	QP
15.67389	50.55	Line	60	-9.45	QP
16.20912	50.07	Line	60	-9.93	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
15.6122	36.28	Line	50	-13.72	Ave.
0.418326	46.54	Line	47.48	**-0.94**	Ave.
16.14335	39.61	Line	50	-10.39	Ave.
15.42076	34.91	Line	50	-15.09	Ave.
15.67389	37.75	Line	50	-12.25	Ave.
16.20912	40.46	Line	50	-9.54	Ave.

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

7.1 Applicable Standards

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As Per FCC §15.205(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 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

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).

As per ISEDC RSS-Gen 8.9,

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

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

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

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

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

As per ISEDC 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.

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 ISEDC RSS-247 limits.

The spacing between the peripherals was 10 centimeters.

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

7.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT 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 should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: Peak value – Duty Cycle Correction Factor

7.4 Corrected Amplitude and Margin Calculation

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

CA = Ai + AF + CL + Atten – Ga

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

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

Margin = Corrected Amplitude - Limit

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100044	2017-09-19	2 years
Agilent	Analyzer, Spectrum	E4440A	US45303156	2018-02-26	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2018-01-25	2 years
Agilent	Amplifier, Pre	8447D	2944A07030	2017-05-17	1 year
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2017-12-15	2 years
A.H. Systems	Pre-Amplifier	PAM-1840VH	170	2018-02-28	14 months
IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960-KPS	2018-01-04	1 year
-	Hi frequency Co AX Cable	-	-	Each time[1]	N/A
-	SMA cable	-	C00011	Each time[1]	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2017-06-15	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 years
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

7.6 Test Environmental Conditions

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

The testing was performed by Vincent Licata on from 2018-04-25 to 2018-04-30 in 5m chamber 3.

7.7 Summary of Test Results

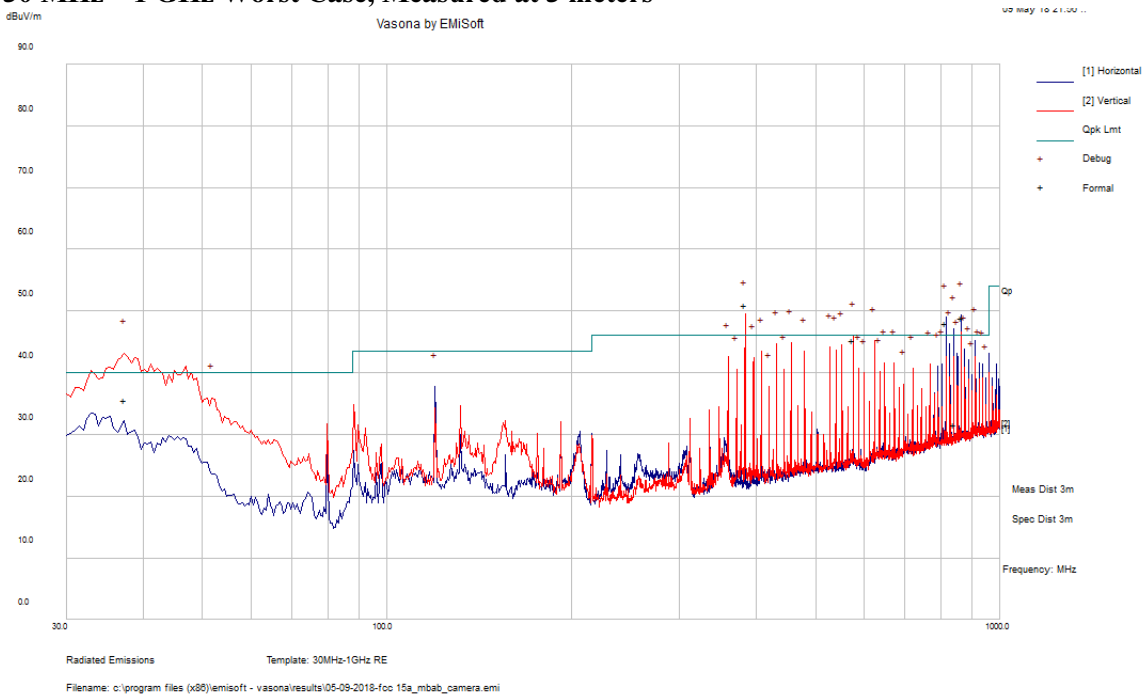
According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C and ISEDC RSS-247 standard's radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel**
-0.99	2483.5	Vertical	High Channel

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

7.8 Radiated Emissions Test Results

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
384.05	49.47	200	V	0	71.98	-22.51	PK
864.2	49.36	100	H	0	71.98	-22.62	PK
37.30975	35.67	130	V	283	40	-4.33	QP
840.19425	31.54	114	H	115	46	-14.46	QP
816.185	48.98	100	H	0	71.98	-23	PK
576.00325	45.35	101	V	312	46	-0.65	QP

Note: A Ferrite was added close to the EUT on the power cable from AC/DC adapter during testing, please refer to EUT photos.

2) 1–25 GHz Measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2417 MHz											
2417	75.64	340	247	H	28.94	5.76	0	110.34	-	-	PK
2417	52.97	340	247	H	28.94	5.76	0	87.67	-	-	AV
2417	76.80	29	247	V	28.93	5.76	0	111.49	-	-	PK
2417	54.13	29	247	V	28.93	5.76	0	88.82	-	-	AV
2390	33.65	340	247	H	28.94	5.76	0.00	68.35	74.00	-5.65	PK
2390	10.98	340	247	H	28.94	5.76	0.00	45.68	54.00	-8.32	AV
2390	35.38	29	247	V	28.93	5.76	0.00	70.07	74.00	-3.93	PK
2390	12.71	29	247	V	28.93	5.76	0.00	47.40	54.00	-6.60	AV
4834	59.99	175	245	V	32.56	9.39	33.15	68.79	74.00	-5.21	PK
4834	37.32	175	245	V	32.56	9.39	33.15	46.12	54.00	-7.88	AV
7251	44.82	0	100	V	36.73	12.06	33.25	60.36	74.00	-13.64	PK
7251	22.15	0	100	V	36.73	12.06	33.25	37.68	54.00	-16.32	AV
Middle Channel 2444 MHz											
2444	74.68	342	238	H	29.15	5.76	0.00	109.59	-	-	PK
2444	52.01	342	238	H	29.15	5.76	0.00	86.91	-	-	AV
2444	77.03	34	280	V	29.19	5.76	0.00	111.98	-	-	PK
2444	54.36	34	280	V	29.19	5.76	0.00	89.30	-	-	AV
4888	58.69	299	163	V	32.70	9.47	33.15	67.70	74.00	-6.30	PK
4888	36.02	299	163	V	32.70	9.47	33.15	45.03	54.00	-8.97	AV
7332	43.91	0	100	V	36.99	12.03	33.22	59.71	74.00	-14.29	PK
7332	21.24	0	100	V	36.99	12.03	33.22	37.04	54.00	-16.96	AV
9776	44.04	0	100	V	37.82	14.08	33.08	62.85	74.00	-11.15	PK
9776	21.37	0	100	V	37.82	14.08	33.08	40.18	54.00	-13.82	AV
High Channel 2468 MHz											
2468	74.04	0	253	H	29.25	5.87	0.00	109.16	-	-	PK
2468	51.37	0	253	H	29.25	5.87	0.00	86.49	-	-	AV
2468	74.02	63	157	V	29.18	5.87	0.00	109.07	-	-	PK
2468	51.35	63	157	V	29.18	5.87	0.00	86.39	-	-	AV
2483.5	37.55	0	253	H	29.25	5.87	0.00	72.67	74.00	-1.33	PK
2483.5	14.88	0	253	H	29.25	5.87	0.00	50.00	54.00	-4.00	AV
2483.5	37.96	36	163	V	29.18	5.87	0.00	73.01	74.00	**-0.99**	PK
2483.5	15.29	36	163	V	29.18	5.87	0.00	50.33	54.00	-3.67	AV
4936	55.59	113	163	V	32.79	9.47	33.15	64.70	74.00	-9.30	PK
4936	32.92	113	163	V	32.79	9.47	33.15	42.02	54.00	-11.98	AV
7404	44.50	0	100	V	37.02	12.07	33.22	60.36	74.00	-13.64	PK
7404	21.83	0	100	V	37.02	12.07	33.22	37.69	54.00	-16.31	AV
9872	44.63	0	100	V	38.06	14.27	32.80	64.15	74.00	-9.85	PK
9872	21.96	0	100	V	38.06	14.27	32.80	41.48	54.00	-12.52	AV

8 FCC §15.247(a) (1) and ISEDC RSS-247 §5.1, RSS-Gen §6.7 - Emission Bandwidth

8.1 Applicable Standards

According to FCC §15.247(a) (1) and ISEDC RSS-247 §5.1: the maximum 20 dB bandwidth of the hopping channel shall be presented.

8.2 Measurement Procedure

Span = approximately 2 to 5 times the 99% occupied bandwidth, centered on a hopping channel

RBW = 1% to 5 % of the 99% occupied bandwidth

VBW = 3RBW

Sweep = auto

Detector function = peak

Trace = max hold

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2018-02-26	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960-KPS	2018-01-04	1 year
-	SMA cable	-	C00011	Each time[1]	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2017-06-15	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

8.4 Test Environmental Conditions

Temperature:	22ºC
Relative Humidity:	42 %
ATM Pressure:	102.6 KPa

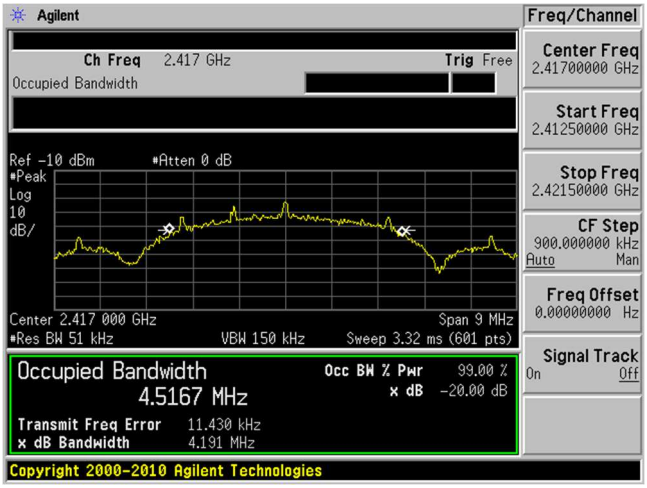
The testing was performed by Chin Ming Lui and Vincent Licata on 2017-05-16 in RF site.

8.5 Test Results

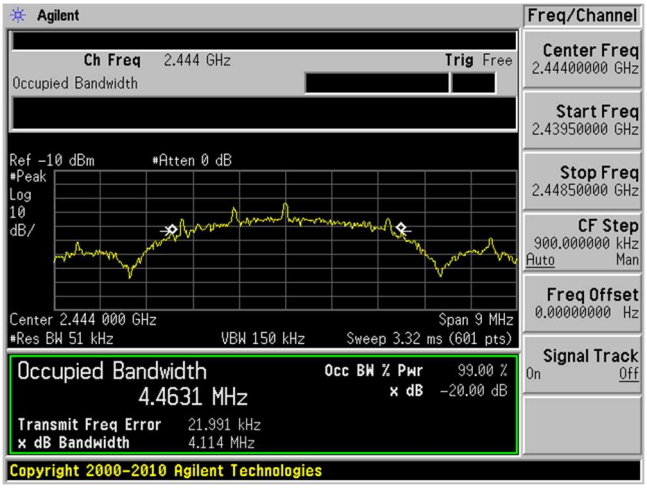
Channel	Frequency (MHz)	99% OBW (kHz)	20 dB OBW (kHz)
Low	2417	4516.7	4191
Middle	2444	4463.1	4114
High	2468	4368.1	4137

Please refer to the following plots for detailed test results.

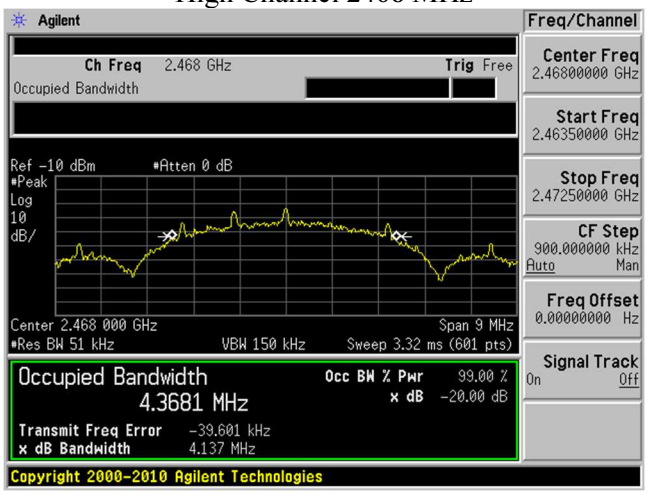
Low Channel 2417 MHz



Middle Channel 2444 MHz



High Channel 2468 MHz



9 FCC §15.247(b) (1) and ISEDC RSS-247 §5.4 -Output Power

9.1 Applicable Standards

According to FCC §15.247(b) (1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

According to RSS-247 §5.4: For frequency hopping systems operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels.

9.2 Measurement Procedure

Using Radiated Method to measure the field strength and cover to Conducted Output Power, 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 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 should be changed the polarization both of horizontal and vertical.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2018-02-26	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960-KPS	2018-01-04	1 year
-	SMA cable	-	C00011	Each time[1]	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2017-06-15	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

9.4 Test Environmental Conditions

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

The testing was performed by Vincent Licata on from 2018-04-25 to 2018-04-30 in 5m chamber 3.

9.5 Test Results

Channel	Frequency (MHz)	Measured Field Strength @3m (dBµV/m)	EIRP (dBm)	Conducted Output Power (dBm)	Limit (dBm)
Low	2417	111.49	16.33	16.33	30
Middle	2444	111.98	16.82	16.82	30
High	2468	109.16	14.00	14.00	30

Note: EIRP = E + 20 log (d) – 104.7
d: is the measurement distance, in m
E: is the filed strength of the emission at the measurement distance, in dBµV/m
Note: the antenna gian is 0 dBi.

10 FCC §15.247(d) and ISEDC RSS-247 §5.5 - 100 kHz Bandwidth of Band Edges

10.1 Applicable Standards

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

According to ISEDC 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.

10.2 Measurement Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW = 100 kHz
VBW = 300 kHz
Sweep = coupled
Detector function = peak
Trace = max hold

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2018-02-26	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960-KPS	2018-01-04	1 year
-	SMA cable	-	C00011	Each time[1]	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2017-06-15	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

10.4 Test Environmental Conditions

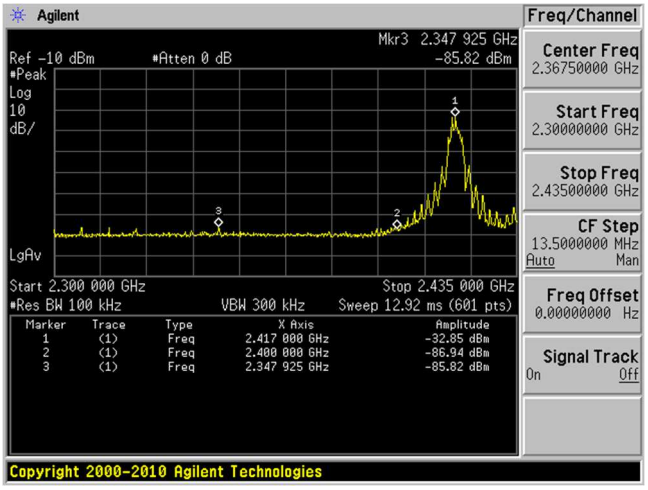
Temperature:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 kPa

The testing was performed by Vincent Licata on from 2018-04-25 to 2018-04-30 in 5m chamber 3.

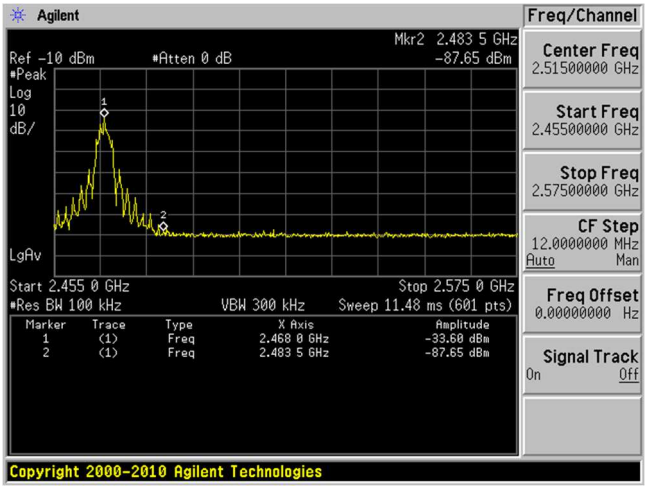
10.5 Test Results

Fixed Channel Mode

Low Channel 2417 MHz

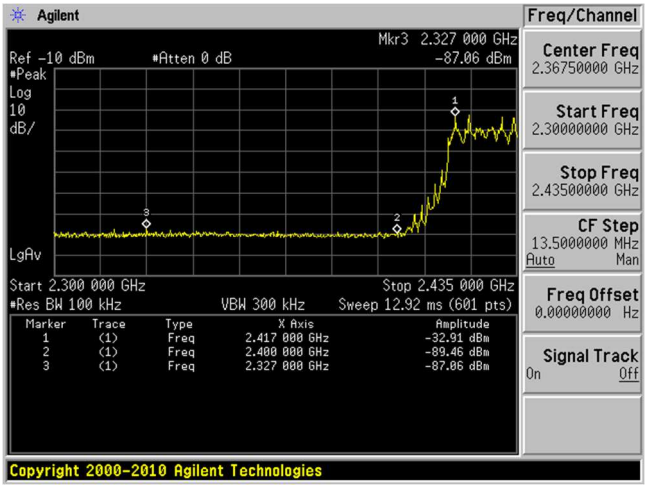


High Channel 2468 MHz

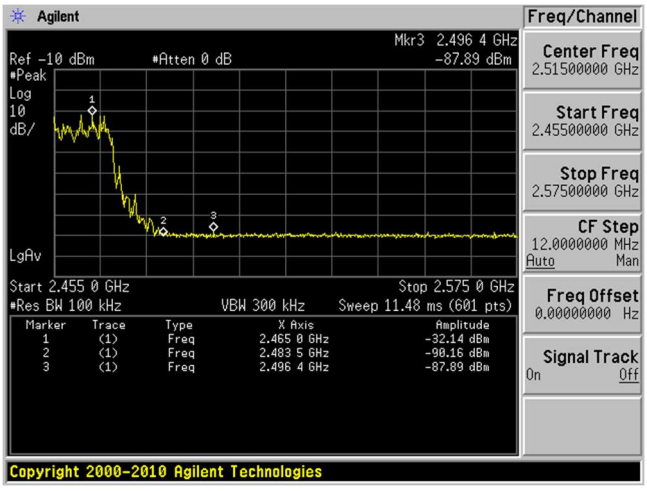


Hopping Mode

Low Edge



High Edge



11 FCC §15.247(a) (1) (iii) and ISEDC RSS-247 §5.1 (4) - Dwell Time

11.1 Applicable Standards

According to FCC §15.247(a) (1) (iii) and RSS-247 §5.1(4), Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

11.2 Measurement Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel
RBW ≤ channel spacing and where possible RBW should be set >> 1/*T*, where *T* is the expected dwell time per channel
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2018-02-26	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960-KPS	2018-01-04	1 year
-	SMA cable	-	C00011	Each time[1]	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2017-06-15	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

11.4 Test Environmental Conditions

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

The testing was performed by Vincent Licata on from 2018-04-25 to 2018-04-30 in 5m chamber 3.

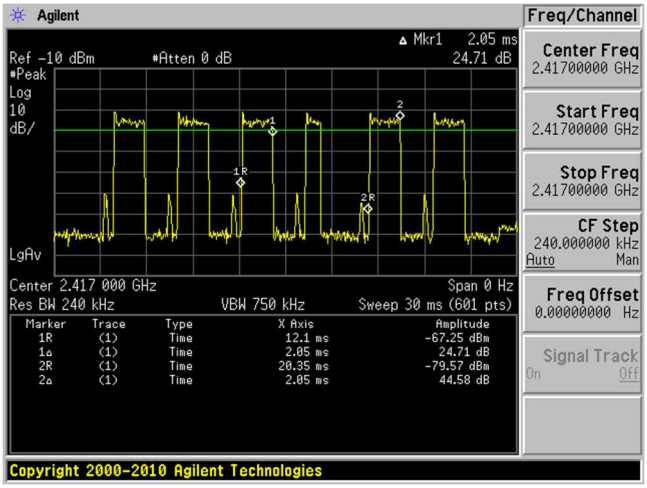
11.5 Test Results

Channel	Pulse Width (ms)	Number of Hops in the Period Specified in the Requirements	Average Time of Occupancy (s)	Limit (sec)	Results
Low	2.05	96	0.20	0.4	compliant
Middle	2.05	102	0.21	0.4	compliant
High	2.05	102	0.21	0.4	compliant

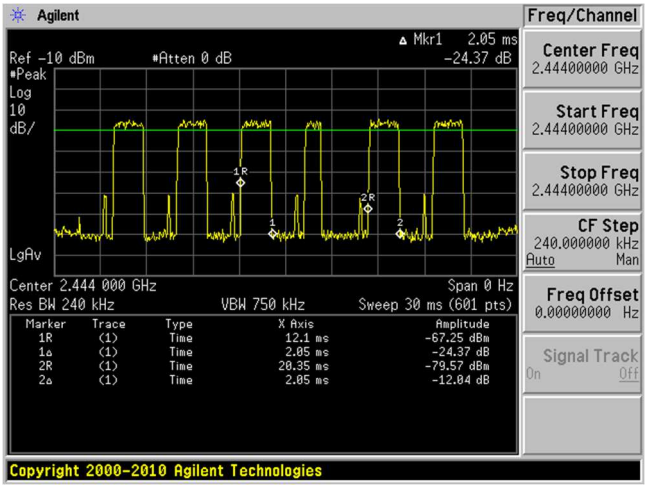
Please refer to the following plots for detailed test results.

Pulse Width

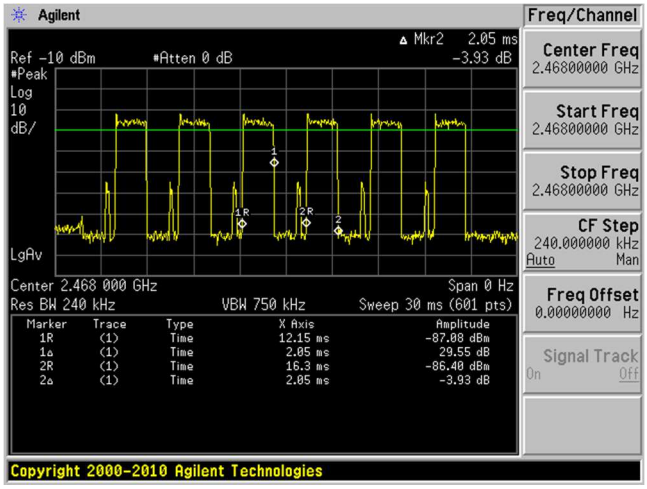
Low Channel 2417 MHz



Middle Channel 2444 MHz

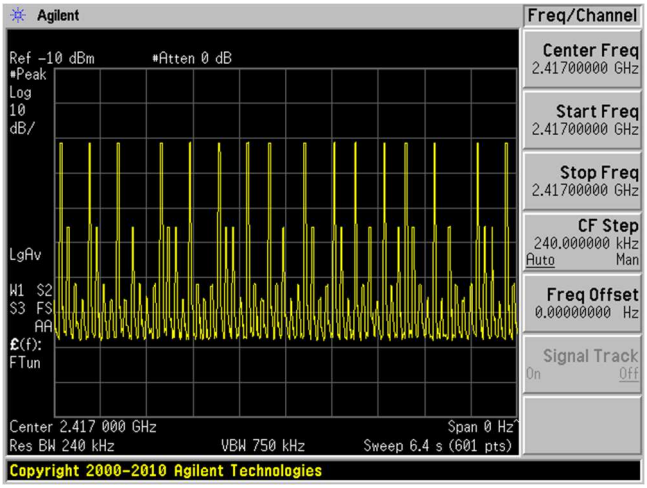


High Channel 2468 MHz

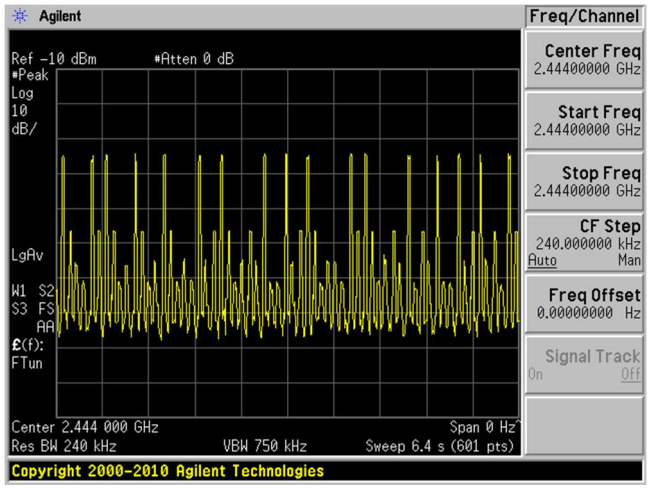


Number of Pulses within a Specified Time

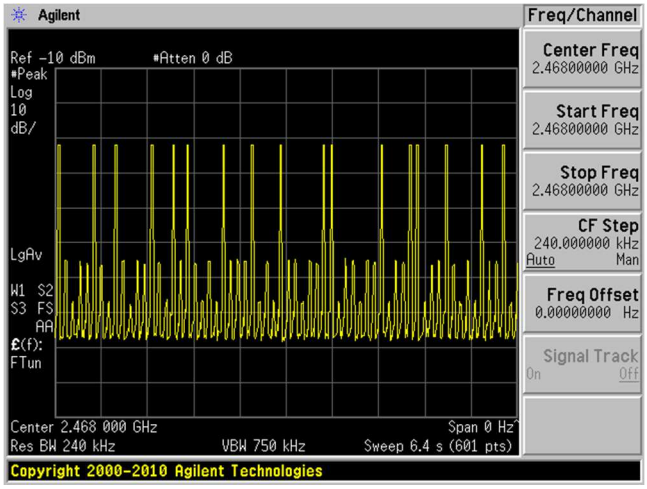
Low Channel 2417 MHz



Middle Channel 2444 MHz



High Channel 2468 MHz



12 FCC §15.247(a)(1)(iii) and ISEDC RSS-247 §5.1(4) - Number of Hopping Channels

12.1 Applicable Standards

According to FCC §15.247(a) (1) (iii) and RSS-247 §5.1(4): Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

12.2 Test Procedure

Span = the frequency band of operation

RBW < 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2018-02-26	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960-KPS	2018-01-04	1 year
-	SMA cable	-	C00011	Each time[1]	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2017-06-15	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

12.4 Test Environmental Conditions

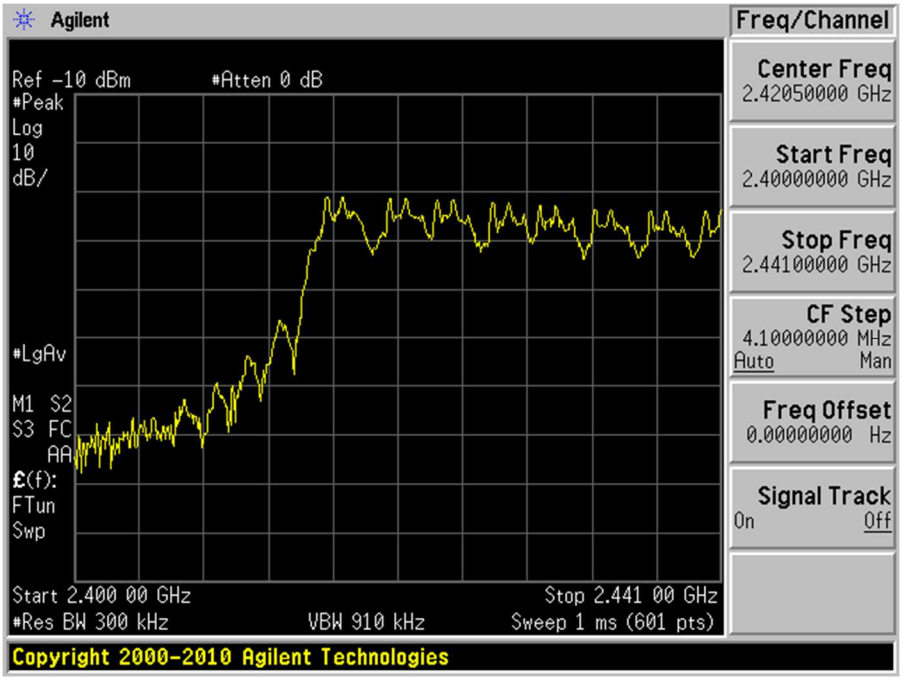
Temperature:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 kPa

The testing was performed by Vincent Licata on from 2018-04-25 to 2018-04-30 in 5m chamber 3.

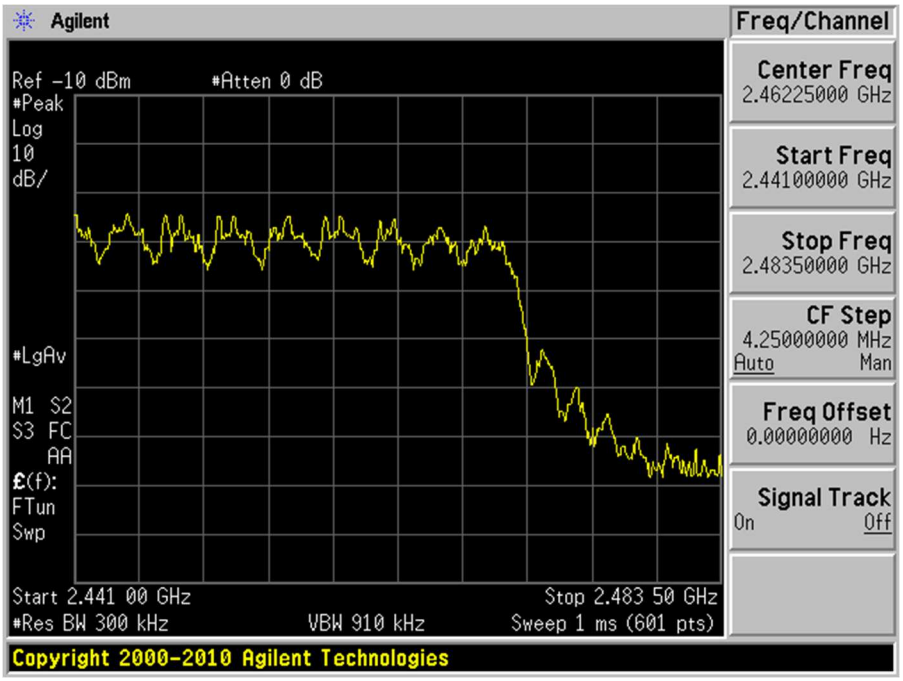
12.5 Test Results

Total 16 channels; please refer to the plots hereinafter.

8 Channels between 2400 to 2441 MHz



8 Channels between 2441 to 2483.5 MHz



13 FCC §15.247(a) (1) and ISEDC RSS-247 §5.1(2) - Hopping Channel Separation

13.1 Applicable Standards

According to FCC §15.247(a) (1) and RSS-247 §5.1(2): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

13.2 Test Procedure

Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≈ 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel

Video (or Average) Bandwidth (VBW) ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold

13.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2018-02-26	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960-KPS	2018-01-04	1 year
-	SMA cable	-	C00011	Each time[1]	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2017-06-15	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

13.4 Test Environmental Conditions

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

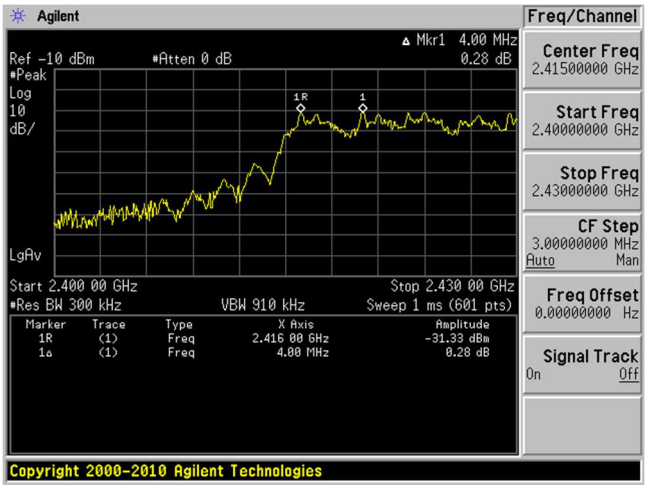
The testing was performed by Vincent Licata on from 2018-04-25 to 2018-04-30 in 5m chamber 3.

13.5 Test Results

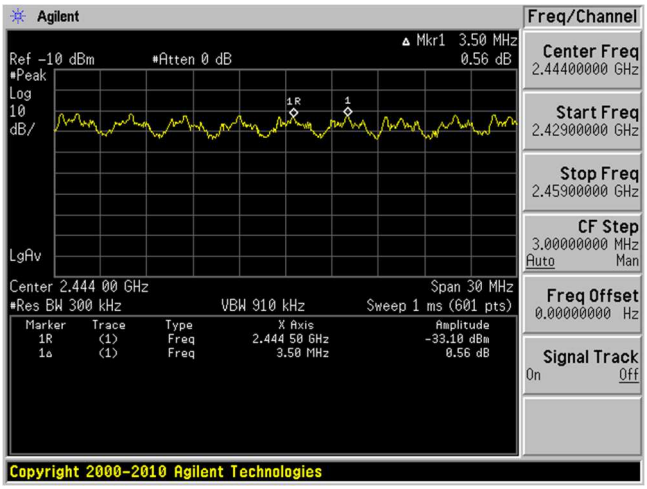
Channel	Frequency (MHz)	Channel Separation (kHz)	Limit > 2/3 20 dB OBW (kHz)
Low	2417	4000	2794
Middle	2444	3500	2743
High	2468	3000	2758

Please refer to following plots.

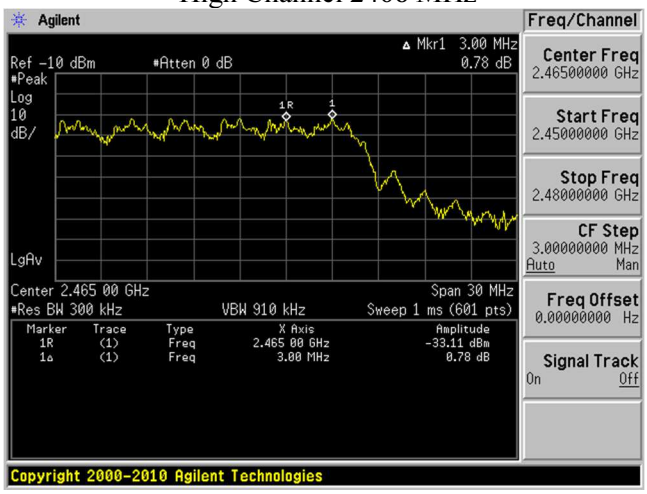
Low Channel 2417 MHz



Middle Channel 2444 MHz



High Channel 2468 MHz



14 Annex A - FCC & ISED Equipment Labeling Requirements

FCC ID Label Requirements

As per FCC §2.925,

(a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID: XXX123

Where: XXX—Grantee Code, 123—Equipment Product Code

As per FCC §15.19,

(a) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labeled as follows:

(3) All other devices shall bear the following statement in a conspicuous location on the device:
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified above is required to be affixed only to the main control unit. If the EUT is integrated within another device then a label affixed to the host shall also state, "Contains FCC ID: XXXXXX"

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

IC Label Requirements

As per IC RSP-100 Section 3.1, the certification number shall appear as follows:

IC: XXXXXX-YYYYYYYY

Where:

- The letters "IC:" indicate that this is an Innovation, Science and Economic Development Canada's certification number, but they are not part of the certification number. XXXXXXYYYYYYYYYYY is the ISED certification number.
- XXXXXX is the CN assigned by Innovation, Science and Economic Development Canada. Newly assigned CNs will be made up of five numeric characters (e.g. "20001") whereas existing CNs may consist of up to five numeric characters followed by an alphabetic character (e.g. "21A" or "15589J").
- YYYYYYYYYYY is the Unique Product Number (UPN) assigned by the applicant, made up of a maximum of 11 alphanumeric characters.
- The CN and UPN are limited to capital alphabetic characters (A-Z) and numerals (0-9) only. The use of punctuation marks or other symbols, including "wildcard" characters, is not permitted.

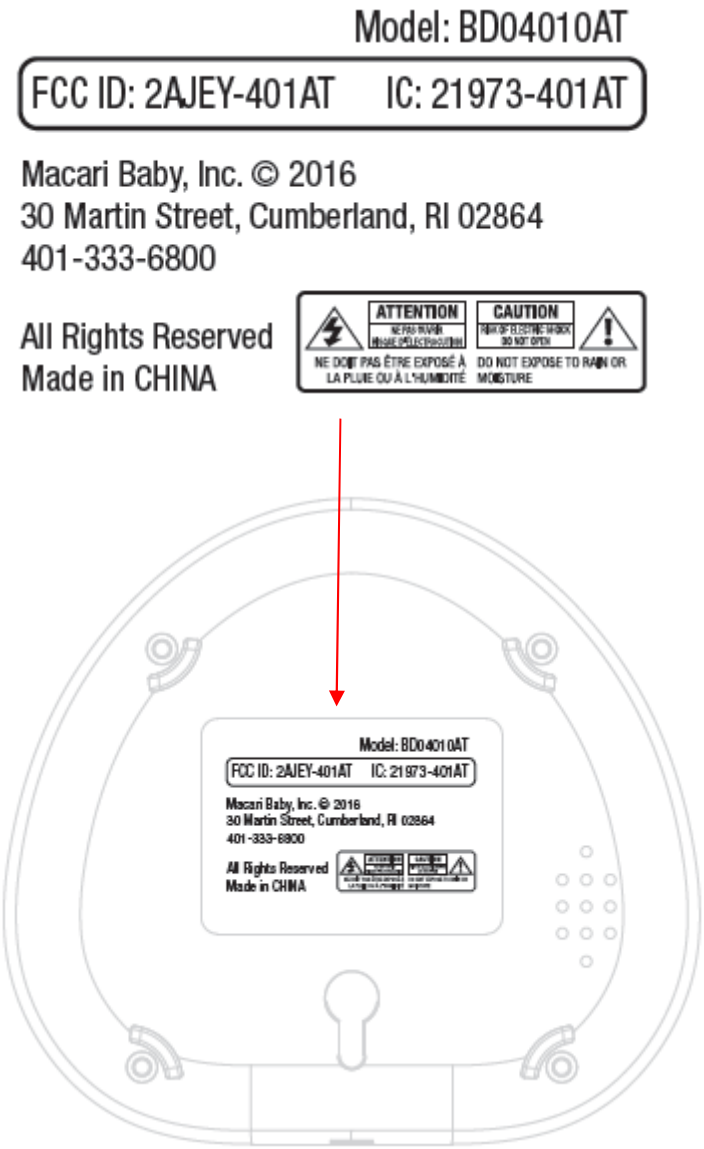
- The HVIN may contain punctuation marks or symbols but they shall not represent any indeterminate ("wildcard") characters.

As per RSS-Gen §2.1 Equipment Labeling:

The application for equipment certification shall be submitted in accordance with Industry Canada's Radio Standards Procedure RSP-100, Radio Equipment Certification Procedure which sets out the requirements for certification and labelling of radio apparatus. RSP-100 shall be used in conjunction with RSS-Gen and other Radio Standards Specifications (RSSs) specifically applicable to the type of radio apparatus for which certification is sought.

Recommended Label Contents and Location

Camera



15 Annex B -Photographs

Please see attachments:

Exhibit A – EUT Test Setup Photographs
Exhibit B – EUT External Photographs
Exhibit C – EUT Internal Photographs

16 Annex C (Informative) - A2LA Electrical Testing Certificate

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 any additional program requirements in the Electrical field. 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.

President and CEO
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2018
Revised November 14, 2016

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

---END OF REPORT ---