



FCC PART 15, SUBPART C

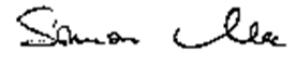
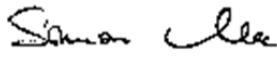
TEST REPORT

For

SecureALL Corporation

695 Woburn Court,
Mountain View, CA 94040, USA

FCC ID: Y29SA-OWL

Report Type: Original Report	Product Type: Wireless Door Lock Upgrade Kit
Prepared By: Christian McCaig 	
Report Number: R2008134-247	
Report Date: 2020-08-21	
Reviewed By: Test Engineer 	
Reviewed By: Simon Ma 	
Reviewed By: RF Supervisor	
Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: +1 (408) 732-9162, Fax: +1 (408) 732-9164	



Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by A2LA*, NIST, or any agency of the Federal Government.

* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “*” (Rev.2)

TABLE OF CONTENTS

1 General Description.....	5
1.1 Product Description for Equipment Under Test (EUT)	5
1.2 Objective.....	5
1.3 Related Submittal(s)/Grant(s)	5
1.4 Test Methodology	5
1.5 Measurement Uncertainty.....	5
1.6 Test Facility Registrations	6
1.7 Test Facility Accreditations	6
2 System Test Configuration.....	9
2.1 Justification.....	9
2.2 EUT Exercise Software.....	9
2.3 Duty Cycle	9
2.4 Equipment Modifications.....	10
2.5 Local Support Equipment	10
2.6 Remote Support Equipment.....	10
3 Summary of Test Results	11
4 FCC §15.203 -Antenna Requirements	12
4.1 Applicable Standards	12
4.2 Antenna Description	12
5 FCC §2.1091 & §15.247(i) - RF Exposure	13
5.1 Applicable Standards	13
5.2 MPE Results	13
6 FCC §15.209 & §15.247(d) - Spurious Radiated Emissions.....	14
6.1 Applicable Standards	14
6.2 Test Setup	15
6.3 Test Procedure	15
6.4 Corrected Amplitude and Margin Calculation.....	16
6.5 Test Equipment List and Details.....	16
6.6 Test Environmental Conditions	17
6.7 Summary of Test Results	17
6.8 Radiated Emissions Test Results	18
7 FCC §15.247(a) (2) -Emission Bandwidth	21
7.1 Applicable Standards	21
7.2 Measurement Procedure.....	21
7.3 Test Equipment List and Details.....	21
7.4 Test Environmental Conditions	21
7.5 Test Results.....	21
8 FCC §15.247(b) (3) - Output Power Measurement.....	26
8.1 Applicable Standards	26
8.2 Measurement Procedure.....	26
8.3 Test Equipment List and Details.....	26
8.4 Test Environmental Conditions	26
8.5 Test Results.....	26
9 FCC §15.247(d) - 100 kHz Bandwidth of Band Edges.....	29
9.1 Applicable Standards	29
9.2 Measurement Procedure.....	29
9.3 Test Equipment List and Details	29
9.4 Test Environmental Conditions	29

9.5	Test Results.....	29
10	FCC §15.247(e) - Power Spectral Density	31
10.1	Applicable Standards	31
10.2	Measurement Procedure.....	31
10.3	Test Equipment List and Details	31
10.4	Test Environmental Conditions	31
10.5	Test Results.....	31
11	FCC §15.247(d) - Spurious Emissions at Antenna Terminals	34
11.1	Applicable Standards	34
11.2	Test Procedure	34
11.3	Test Equipment List and Details	34
11.4	Test Environmental Conditions	34
11.5	Test Results.....	34
12	Annex A (Normative) - EUT Test Setup Photographs	37
13	Annex B (Normative) - EUT External Photographs.....	38
14	Annex C (Normative) - EUT Internal Photographs	39
15	Annex D (Normative) - A2LA Electrical Testing Certificate.....	40

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2008134-247	Original Report	2020-08-21

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *SecureALL Corporation*, and their product model: *SA-OWL, FCC ID: Y29SA-OWL* or the “EUT” as referred to in this report. It is a wireless door lock upgrade kit. The EUT operates using a ZigBee radio in the frequency range from 2405 to 2475 MHz.

1.2 Objective

This report was prepared on behalf of *SecureALL Corporation*, in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission’s rules.

The objective was to determine compliance with FCC Part 15.247 rules for Output Power, Antenna Requirements, 6 dB Bandwidth, Power Spectral Density, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Radiated Spurious Emissions.

1.3 Related Submittal(s)/Grant(s)

None

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB 558074 D01 DTS Meas Guidance v05r2: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

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

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

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

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

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

1.7 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 3297.02), 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 3297.03) 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 3297.01) to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

- 1 Electronics and Office Equipment:
 - for Telephony (ver. 3.0)
 - for Audio/Video (ver. 3.0)
 - for Battery Charging Systems (ver. 1.1)
 - for Set-top Boxes & Cable Boxes (ver. 4.1)
 - for Televisions (ver. 6.1)
 - for Computers (ver. 6.0)
 - for Displays (ver. 6.0)
 - for Imaging Equipment (ver. 2.0)
 - for Computer Servers (ver. 2.0)
- 2 Commercial Food Service Equipment
 - for Commercial Dishwashers (ver. 2.0)
 - for Commercial Ice Machines (ver. 2.0)
 - for Commercial Ovens (ver. 2.1)
 - for Commercial Refrigerators and Freezers
- 3 Lighting Products
 - For Decorative Light Strings (ver. 1.5)
 - For Luminaires (including sub-components) and Lamps (ver. 1.2)
 - For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
 - For Integral LED Lamps (ver. 1.4)
- 4 Heating, Ventilation, and AC Products
 - for Residential Ceiling Fans (ver. 3.0)
 - for Residential Ventilating Fans (ver. 3.2)
- 5 Other
 - For Water Coolers (ver. 3.0)

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

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science and Economic development Canada - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):

- BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
- NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
 - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
 - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
 - Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Media Development Authority - IMDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
 - ENERGY STAR Recognized Test Laboratory – US EPA
 - Telecommunications Certification Body (TCB) – US FCC;
 - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v05r02.

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

2.2 EUT Exercise Software

There isn't any test software, the TX frequency was changed manually.

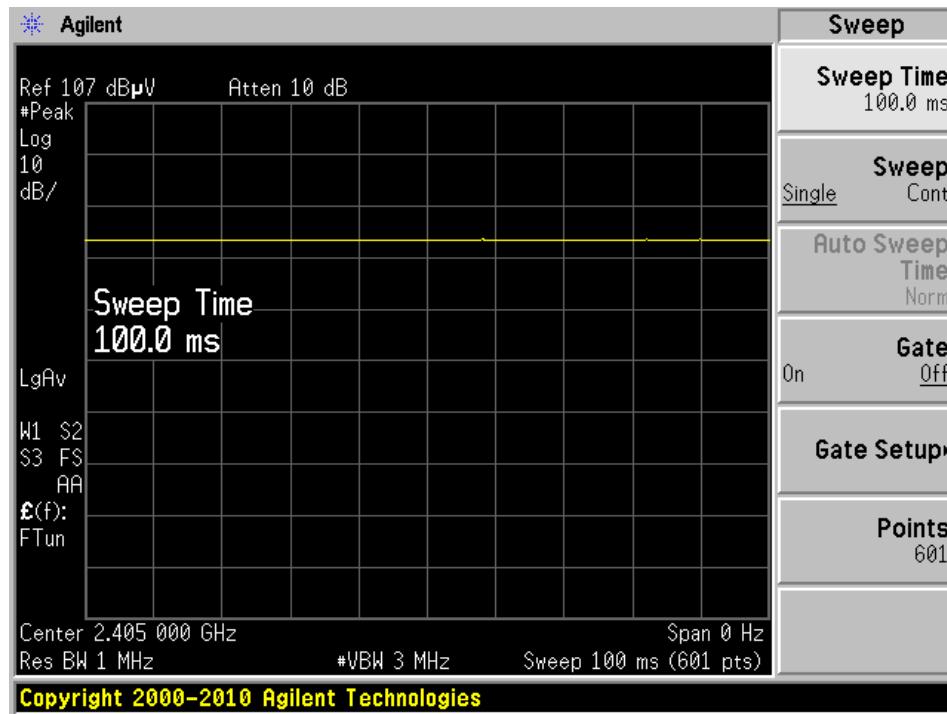
Frequency (MHz)	Power Setting
2405	Default
2440	
2475	

2.3 Duty Cycle

According to KDB 558074 D01 DTS Meas Guidance v05r02 section 6.0:

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data is being acquired (i.e., no transmitter off-time is to be considered).

On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
-	-	100	0



2.4 Equipment Modifications

None

2.5 Local Support Equipment

None

2.6 Remote Support Equipment

Manufacturer	Description	Model
Onity Panic	CT30 Wall Reader controller	C3XDU10
Onity Panic	Wall Reader	CT30

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.203	Antenna Requirement	Compliant
§15.207	AC Line Conducted Emissions	N/A*
§2.1091, §15.247(i)	RF Exposure	Compliant
§2.1051, §15.247 (d)	Spurious Emissions at Antenna Port	Compliant
§2.1053, §15.205, §15.209, §15.247 (d)	Radiated Spurious Emissions	Compliant
§15.247(a)(2)	6 dB and 99% Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Peak Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

*EUT is DC powered only, AC Line Conducted Emissions testing is not applicable.

4 FCC §15.203 -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.

4.2 Antenna Description

Frequency Range (MHz)	External/ Internal/Integrated	Max Gain (dBi)	Antenna Type/ Pattern
2400-2483.5	External	7	Whip, Omnidirectional

5 FCC §2.1091 & §15.247(i) - RF Exposure

5.1 Applicable Standards

According to FCC §15.247(i), 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

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

5.2 MPE Results

<u>Maximum rated output power at antenna input terminal (dBm):</u>	<u>4.5</u>
<u>Maximum rated output power at antenna input terminal (mW):</u>	<u>2.82</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2405</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>7</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>5.01</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.0028</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0028 mW/cm². Limit is 1.0 mW/cm².

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

6.1 Applicable Standards

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

As Per FCC §15.205(a), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	16.80425-16.80475	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	240 – 285		36.43 – 36.5
12.57675 – 12.57725	322 – 335.4		Above 38.6
13.36 – 13.41	399.9 – 410		
	608 – 614		

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

6.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart.

The spacing between the peripherals was 10 centimeters.

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

6.3 Test Procedure

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

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

The EUT was set 3 meter away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 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 or 1/T / Sweep = Auto

6.4 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:

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

6.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-06-26	18 months
Rhode & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2018-10-26	2 years
BACL	5m3 Sensitivity Box	1	2	2019-10-02	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Biconilog Antenna	JB3	A020106-2	2019-11-20	2 years
ETS Lindgren	Horn Antenna	3117	00218973	2019-02-13	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-01	2020-02-05	2 years
-	SMA cable	-	-	Each time ¹	N/A
IW Microwave	150 Series 2.92mm Cable	KPS1501AN-3780-KPS	DC 1925	2019-09-11	1 year
IW Microwave	157 Series Cable	KPS-1571AN-2400	DC 1922	2020-06-06	1 year
MDP Digital	Coaxial Cable 35\'	LMR400UF	BACL1904161	2020-05-20	1 year
AH Systems	Preamplifier	PAM 1840 VH	170	2019-09-24	1 year
Agilent	Preamplifier	8449B	3147A00400	2020-02-27	1 year
HP	Pre Amplifier	8447D	2443A04374	2020-08-17	1 year
-	Notch Filter	-	-	Each time ¹	N/A
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note¹: cable and notch filter included in the test set-up will be checked each time before testing.

Statement of Traceability: **BACL Corp.** attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 02 October 2018) “A2LA Policy on Metrological Traceability”.

6.6 Test Environmental Conditions

Temperature:	20-22 °C
Relative Humidity:	42-50 %
ATM Pressure:	102.7 kPa

The testing was performed by Christian McCaig from 2020-08-19 to 2020-08-20 in 5m chamber 3.

6.7 Summary of Test Results

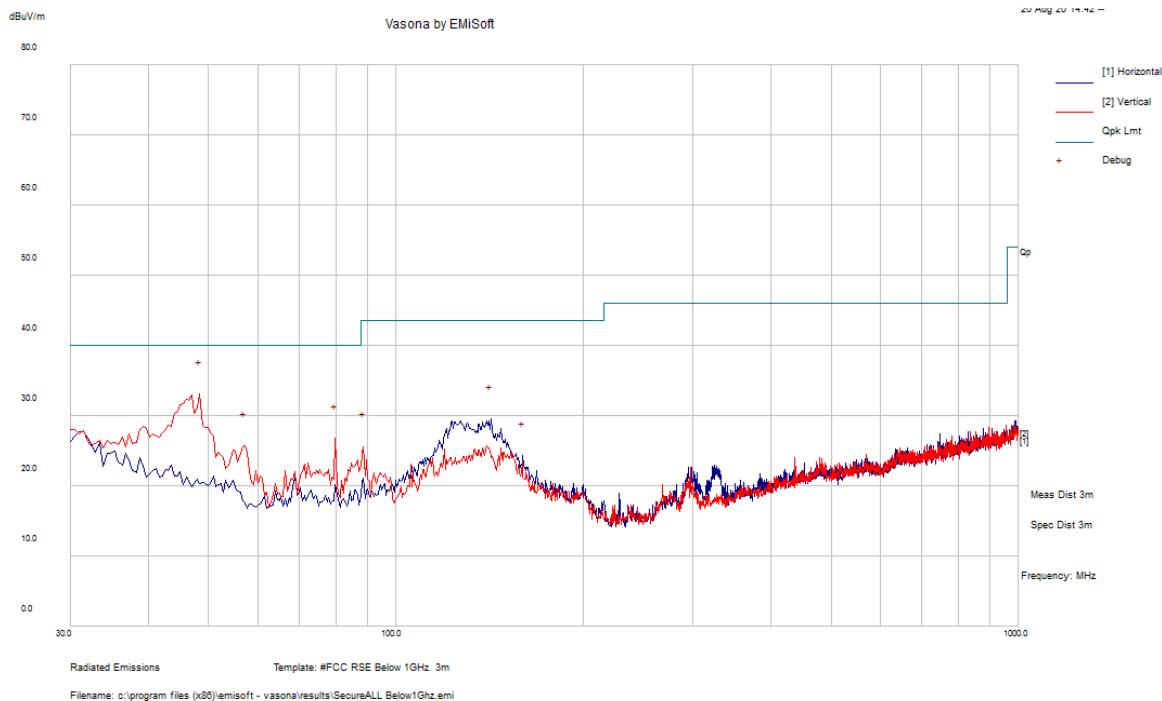
Different antenna placements were verified, and the worst case position was selected for final testing. Please refer to the test setup photos for details.

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

Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	channel
-1.422	4880	Horizontal	Middle Channel

6.8 Radiated Emissions Test Results

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

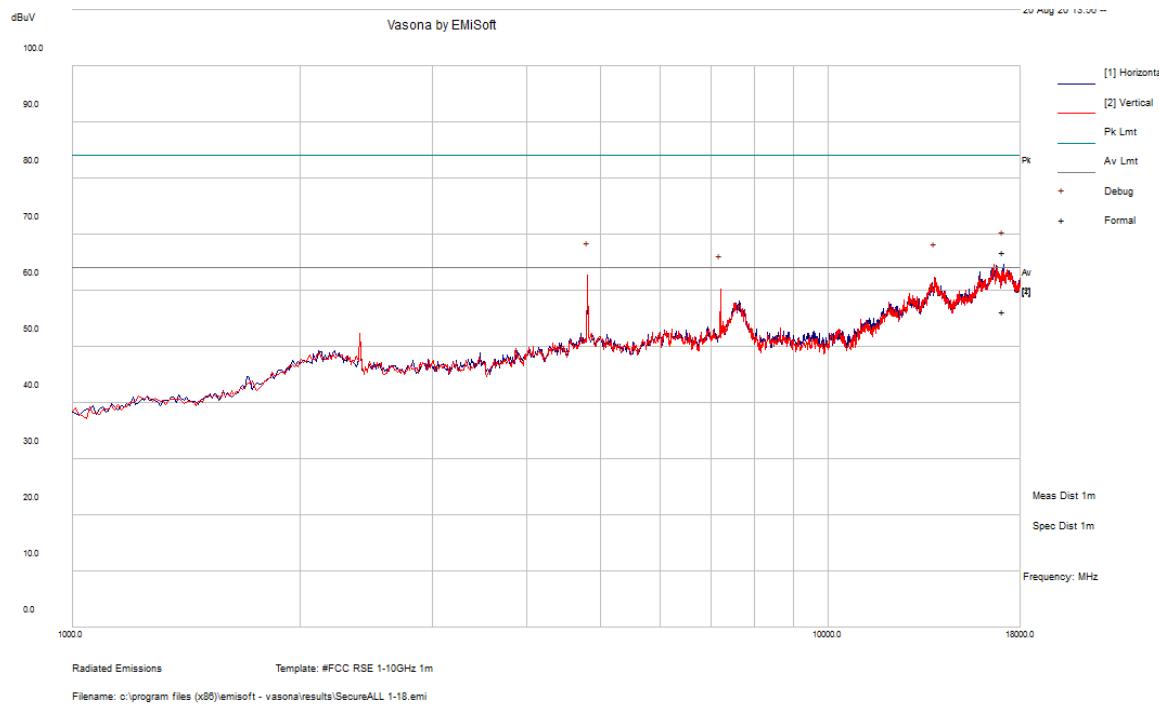
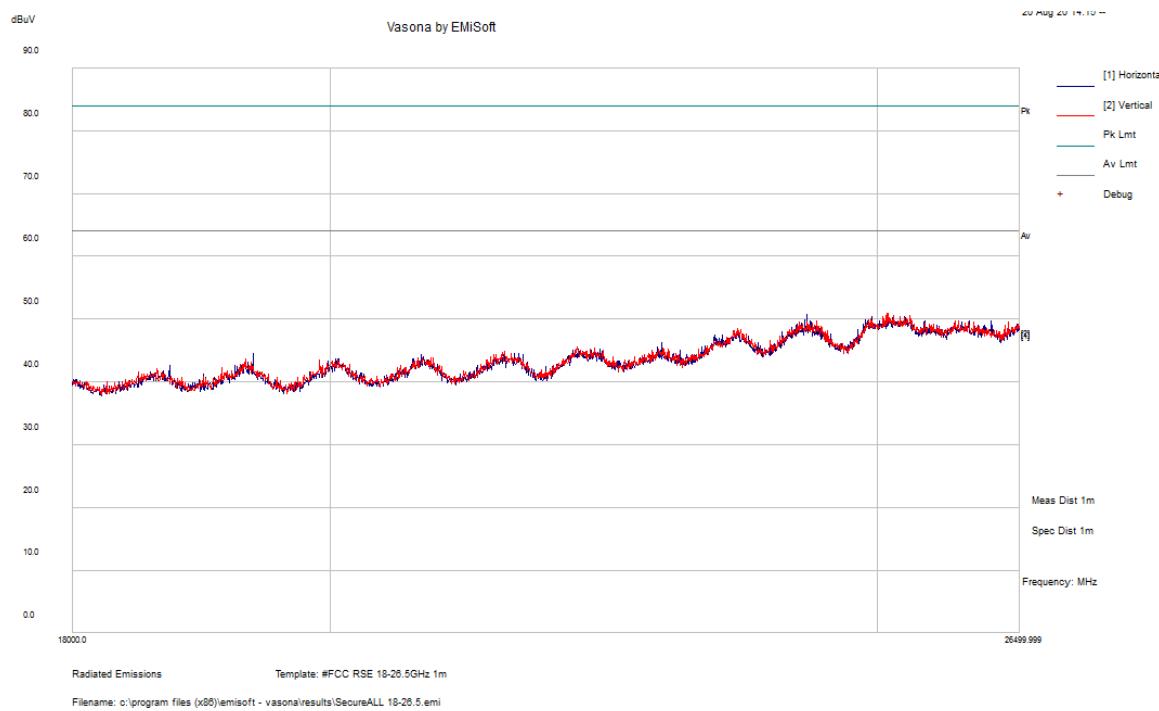


Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
48.637	22.6	185	V	340	40	-17.4	QP
79.98775	22.98	131	V	255	40	-17.02	QP
142.11	23.07	285	H	203	43.5	-20.43	QP
57.43925	15.45	270	V	218	40	-24.55	QP
88.47475	26.47	160	V	232	43.5	-17.03	QP
159.97625	17.97	170	H	88	43.5	-25.53	QP

2) 1-26.5 GHz Measured at 3 meters

Frequency (MHz)	S.A. Reading (dB μ V)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dB μ V/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dB μ V/m)	Margin (dB)	
Low Channel											
2405	69.45	-	-	V	32.6	5.72	-	107.77	-	-	Peak
2405	69.45	-	-	H	32.6	5.72	-	107.77	-	-	Peak
2390	50.27	0	100	V	32	6.33	36.42	52.18	74	-21.82	Peak
2390	51.65	80	120	H	32	6.33	36.42	53.56	74	-20.44	Peak
2390	38.22	0	100	V	32	6.33	36.42	40.13	54	-13.87	Ave
2390	39.12	80	120	H	32	6.33	36.42	41.03	54	-12.97	Ave
4810	48.61	142	294	V	35	9.89	35.43	58.07	74	-15.93	Peak
4810	51.19	30	112	H	35	9.89	35.43	60.65	74	-13.35	Peak
4810	39.89	142	294	V	35	9.89	35.43	49.35	54	-4.65	Ave
4810	42.90	30	112	H	35	9.89	35.43	52.36	54	-1.64	Ave
7215	45.89	18	105	V	36.1	9.83	35.82	56.00	77.77	-21.77	Peak ¹
7215	46.81	120	105	H	36.1	9.83	35.82	56.92	77.77	-20.85	Peak ¹
Middle Channel											
4880	49.03	145	296	V	35.2	10.96	35.43	59.76	74	-14.24	Peak
4880	50.14	28	296	H	35.2	10.96	35.43	60.87	74	-13.13	Peak
4880	39.98	145	296	V	35.2	10.96	35.43	50.709	54	-3.291	Ave
4880	41.85	28	296	H	35.2	10.96	35.43	52.578	54	-1.422	Ave
7320	45.28	345	160	V	36.1	10.95	35.82	56.51	74	-17.49	Peak
7320	46.36	237	300	H	36.1	10.95	35.82	57.59	74	-16.41	Peak
7320	35.10	345	160	V	36.1	10.95	35.82	46.325	54	-7.675	Ave
7320	35.94	237	300	H	36.1	10.95	35.82	47.167	54	-6.833	Ave
High Channel											
2483.5	50.48	0	100	V	32.2	5.65	36.34	51.99	74	-22.01	Peak
2483.5	53.56	100	200	H	32.2	5.65	36.34	55.07	74	-18.93	Peak
2483.5	37.56	0	100	V	32.2	5.65	36.34	39.07	54	-14.93	Ave
2483.5	42.29	100	200	H	32.2	5.65	36.34	43.80	54	-10.20	Ave
4950	46.83	220	155	V	35.4	11.07	35.43	57.87	74	-16.13	Peak
4950	49.08	45	205	H	35.4	11.07	35.43	60.12	74	-13.88	Peak
4950	37.89	220	155	V	35.4	11.07	35.43	48.93	54	-5.08	Ave
4950	40.93	45	205	H	35.4	11.07	35.43	51.97	54	-2.03	Ave
7425	46.83	340	292	V	36.1	12.73	35.9	59.76	74	-14.24	Peak
7425	46.81	290	292	H	36.1	12.73	35.9	59.74	74	-14.26	Peak
7425	36.88	340	292	V	36.1	12.73	35.9	49.81	54	-4.19	Ave
7425	36.63	290	292	H	36.1	12.73	35.9	49.56	54	-4.44	Ave

Note¹: Frequency outside of restricted bands, therefore limit is determined to be 30dB down from peak fundamental.

1 GHz – 18 GHz**18 GHz – 26.5 GHz**

7 FCC §15.247(a) (2) -Emission Bandwidth

7.1 Applicable Standards

According to ECFR §15.247(a) (2), systems using digital modulation techniques may operate in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

7.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8: DTS bandwidth

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Analyzer, Spectrum	FSV40	1321.3008K39-101203-UW	2020-02-06	1 year
-	RF cable	-	-	Each time ¹	N/A

Note¹: cable included in the test set-up will be checked each time before testing.

Statement of Traceability: *BACL Corp.* attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 02 October 2018) “A2LA Policy on Metrological Traceability”.

7.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Christian McCaig on 2019-08-20 in RF site.

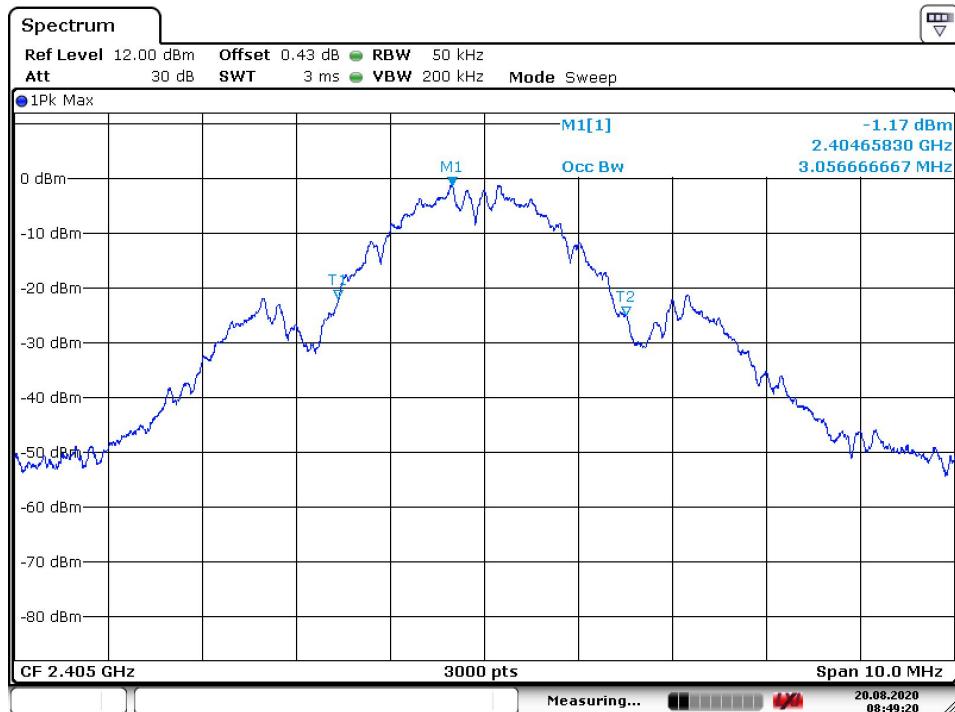
7.5 Test Results

Channel	Frequency (MHz)	99% OBW (MHz)	6 dB BW (kHz)	6 dB OBW limit (kHz)
Low	2405	3.057	1640	500
Middle	2440	3.027	1637	500
High	2475	2.907	1627	500

Please refer to the following plots for detailed test results.

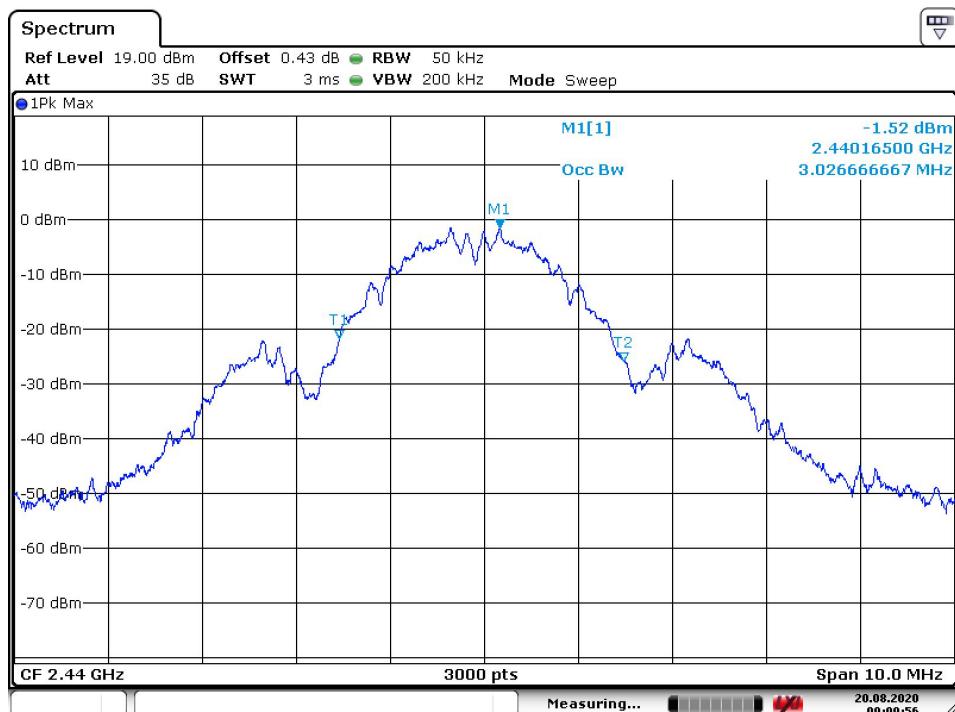
99% OBW

Low Channel 2405 MHz



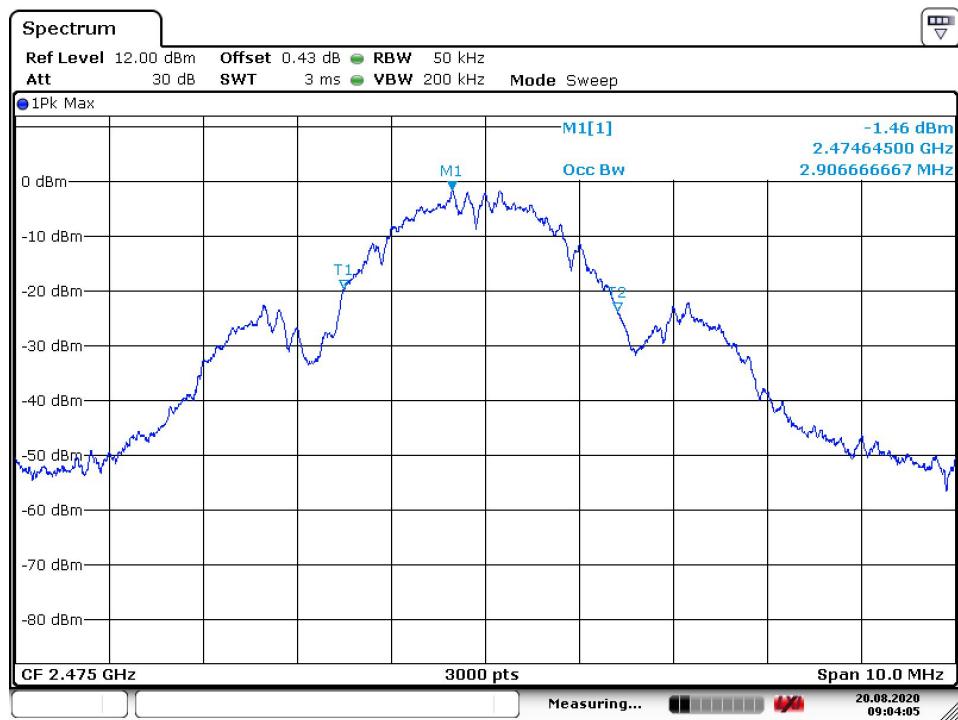
Date: 20.AUG.2020 08:49:21

Middle Channel 2440 MHz



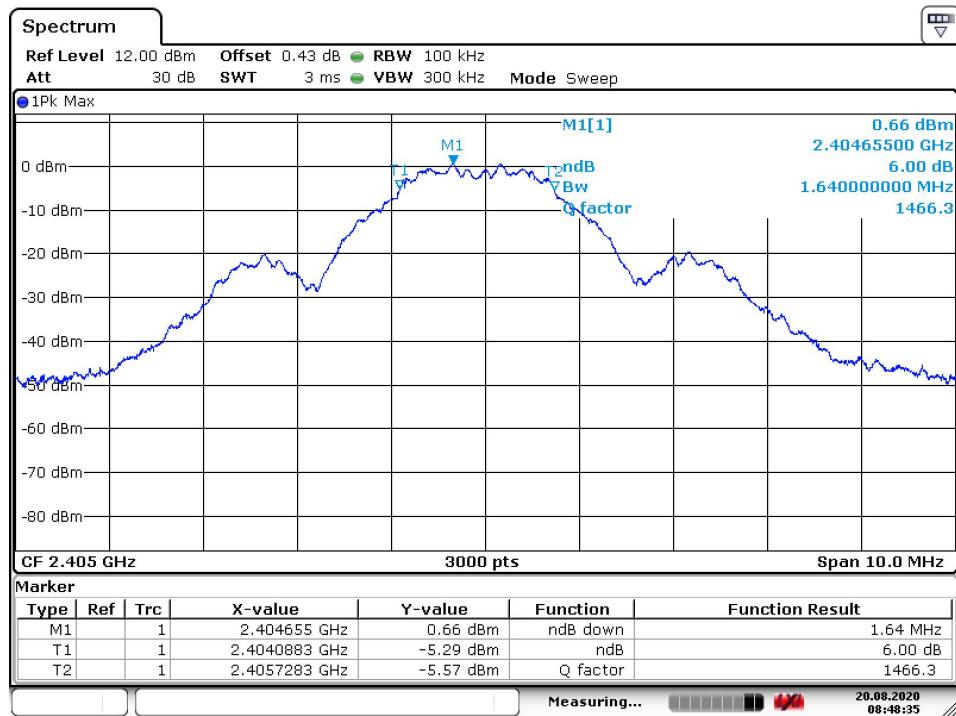
Date: 20.AUG.2020 09:09:56

High Channel 2475 MHz



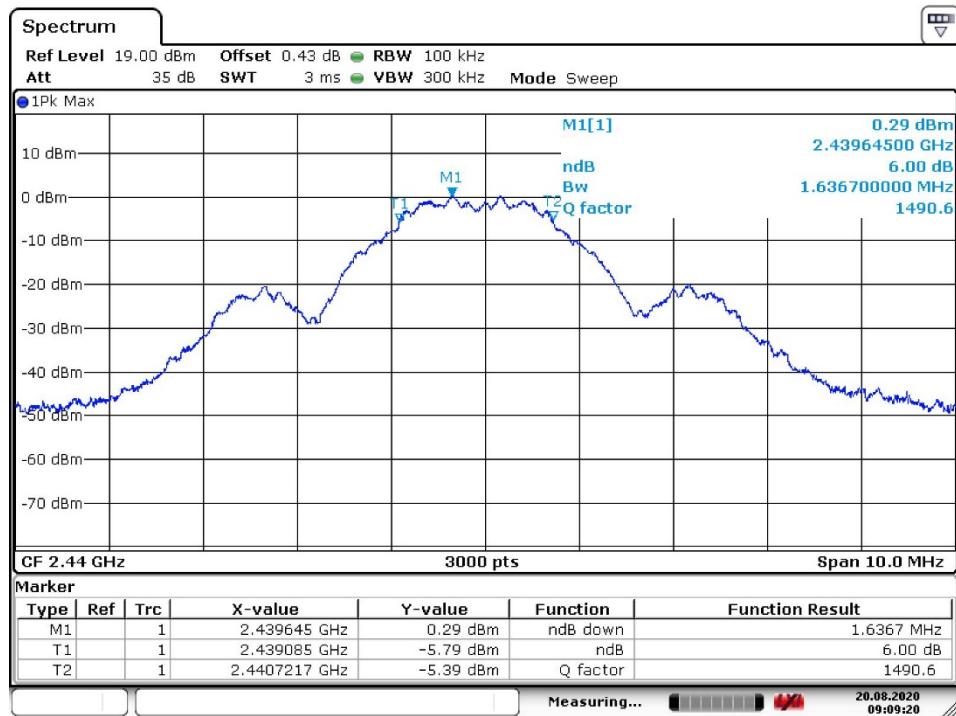
6 dB OBW

Low Channel 2405 MHz



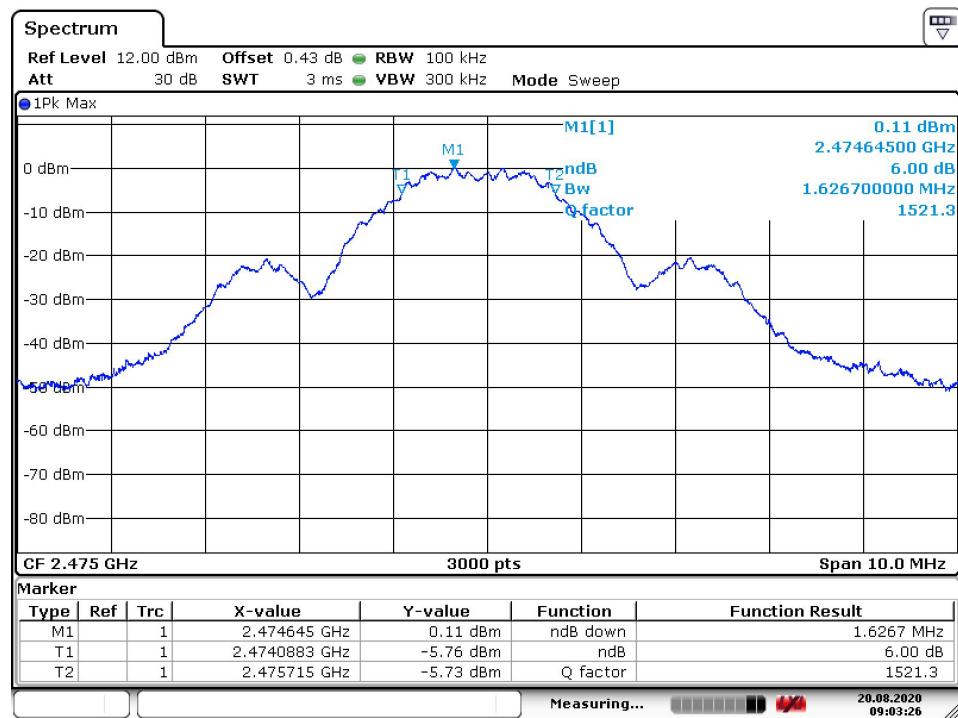
Date: 20.AUG.2020 08:48:35

Middle Channel 2440 MHz



Date: 20.AUG.2020 09:09:20

High Channel 2475 MHz



Date: 20.AUG.2020 09:03:27

8 FCC §15.247(b) (3) - Output Power Measurement

8.1 Applicable Standards

According to ECFR §15.247(b) (3), for systems using digital modulation in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands: 1 Watt.

8.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 9: Fundamental emission output power

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2020-04-29	1 year
-	RF cable	-	-	Each time ¹	N/A

Note¹: cable included in the test set-up will be checked each time before testing.

Statement of Traceability: *BACL Corp.* attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 02 October 2018) "A2LA Policy on Metrological Traceability".

8.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

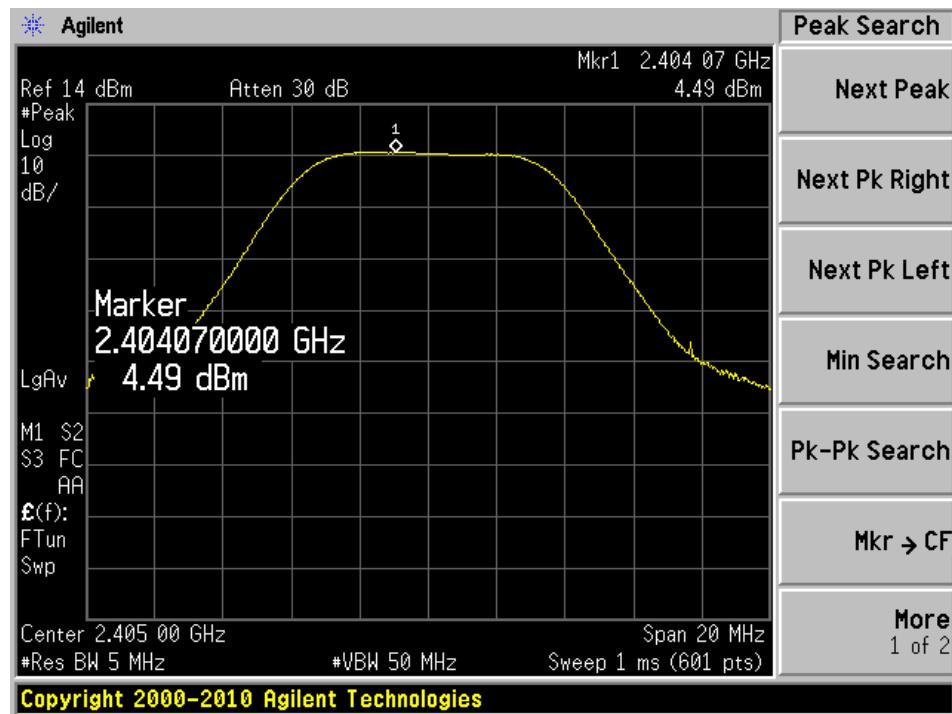
The testing was performed by Christian McCaig on 2019-08-20 in RF site.

8.5 Test Results

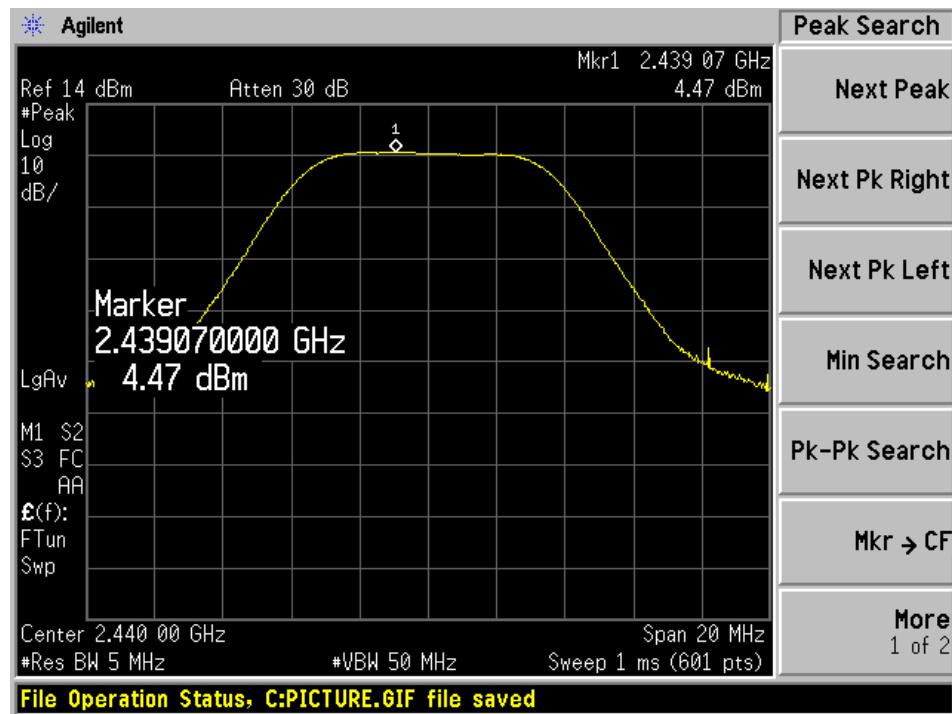
Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Limit ¹ (dBm)
Low	2405	4.49	29
Middle	2440	4.47	29
High	2475	4.47	29

Note¹: Limit reduced by amount by which antenna gain exceeds 6dBi.

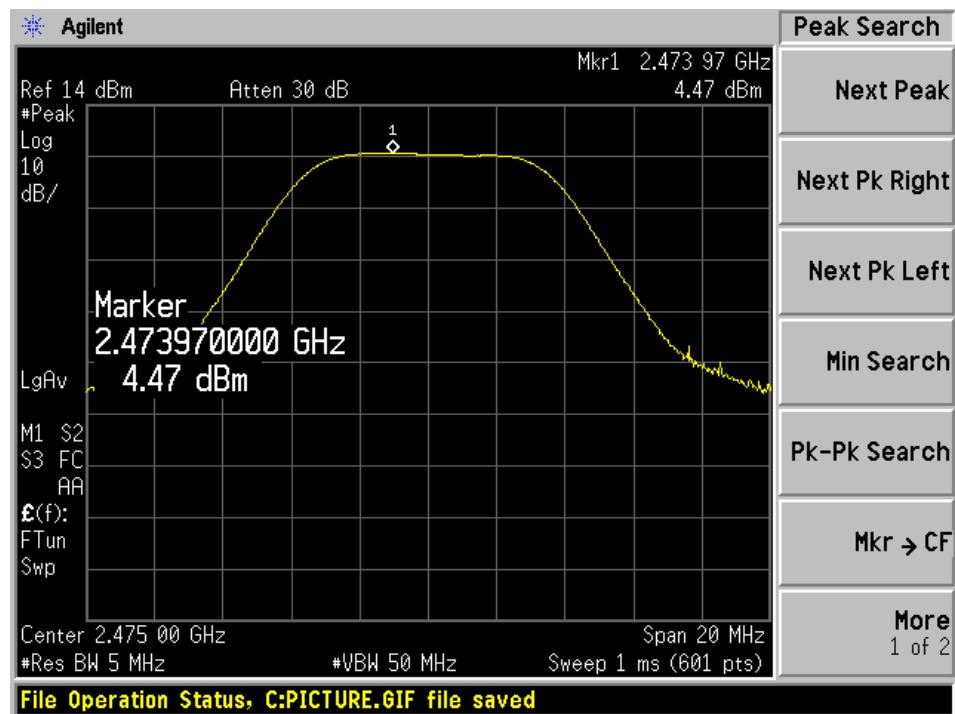
Low Channel 2405 MHz



Middle Channel 2440 MHz



High Channel 2475 MHz



9 FCC §15.247(d) - 100 kHz Bandwidth of Band Edges

9.1 Applicable Standards

According to ECFR §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).

9.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 13: Band-edge measurements

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Analyzer, Spectrum	FSV40	1321.3008K39-101203-UW	2020-02-06	1 year
-	RF cable	-	-	Each time ¹	N/A

Note¹: cable and attenuator included in the test set-up will be checked each time before testing.

Statement of Traceability: *BACL Corp.* attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 02 October 2018) "A2LA Policy on Metrological Traceability".

9.4 Test Environmental Conditions

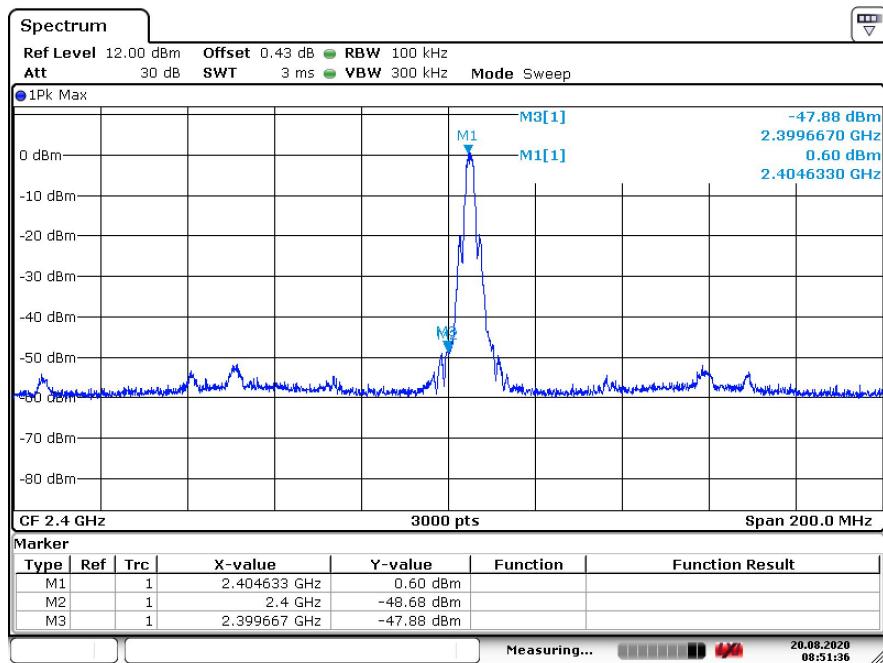
Temperature:	23° C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Christian McCaig on 2019-08-20 in RF site.

9.5 Test Results

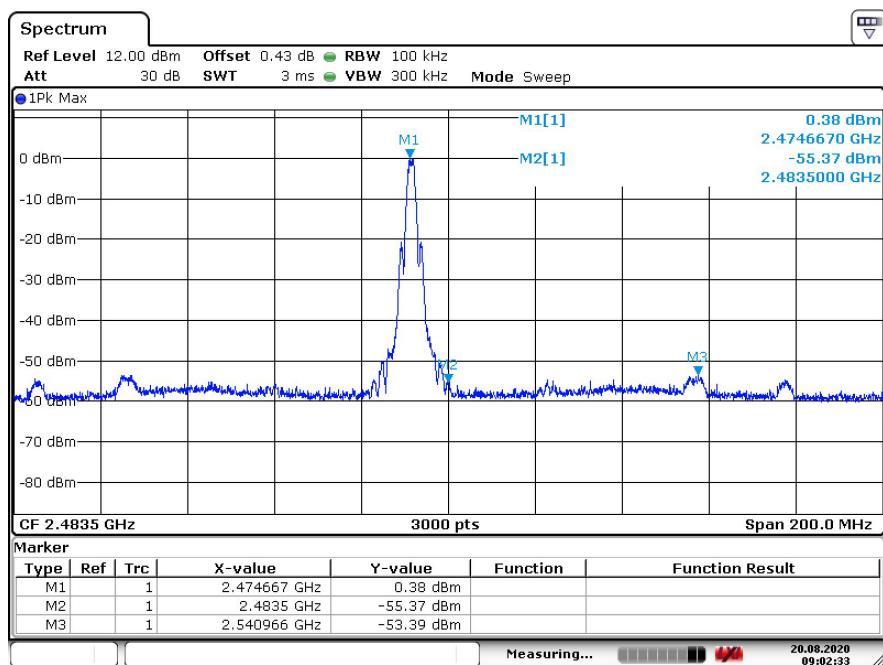
Please refer to the following plots.

Low Channel 2405 MHz



Date: 20.AUG.2020 08:51:37

High Channel 2475 MHz



Date: 20.AUG.2020 09:02:34

10 FCC §15.247(e) - Power Spectral Density

10.1 Applicable Standards

According to ECFR §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

10.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10: Maximum power spectral density level in the fundamental emission.

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Analyzer, Spectrum	FSV40	1321.3008K39-101203-UW	2020-02-06	1 year
-	RF cable	-	-	Each time ¹	N/A

Note¹: cable and attenuator included in the test set-up will be checked each time before testing.

Statement of Traceability: *BACL Corp.* attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 02 October 2018) "A2LA Policy on Metrological Traceability".

10.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

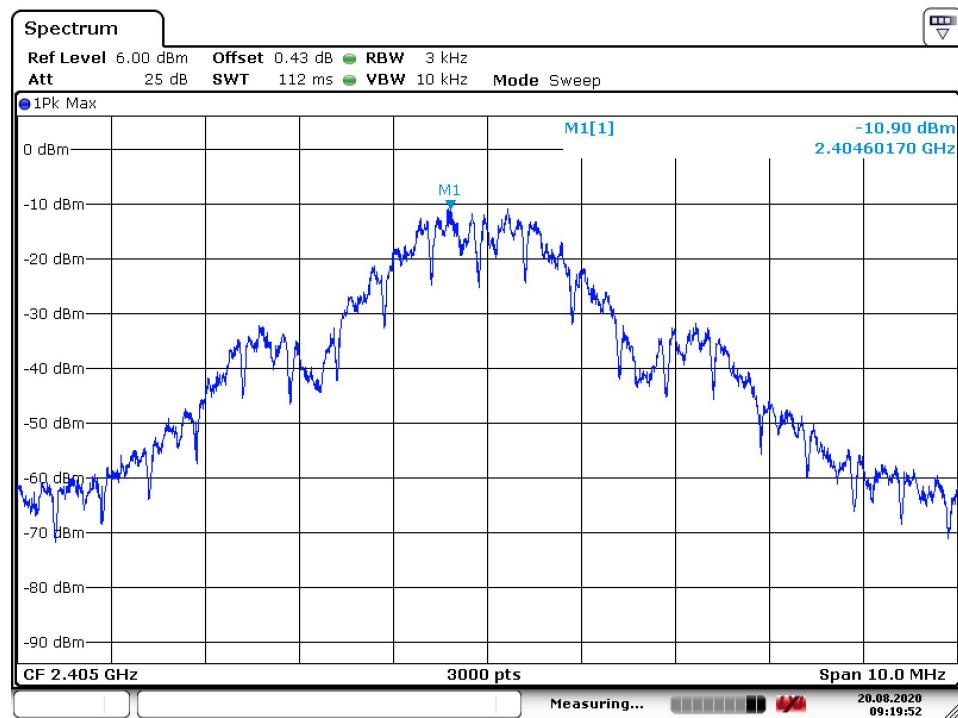
The testing was performed by Christian McCaig on 2019-08-20 in RF site.

10.5 Test Results

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit ¹ (dBm/3 kHz)
Low	2405	-10.90	7
Middle	2440	-11.98	7
High	2475	-11.88	7

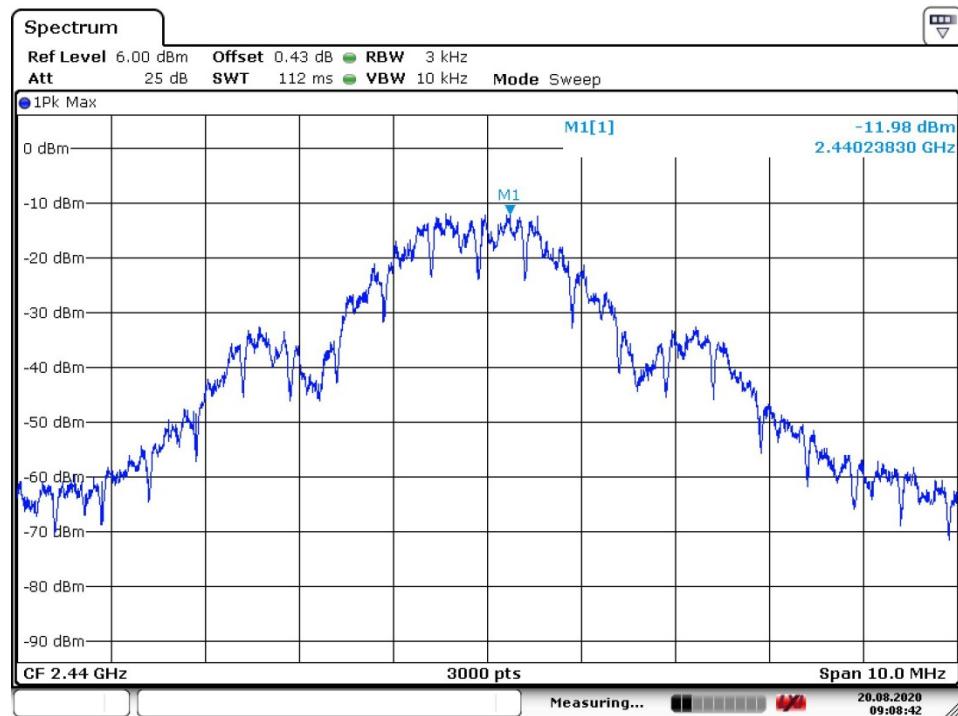
Note¹: Limit reduced by amount by which antenna gain exceeds 6 dBi.

Low Channel 2405 MHz



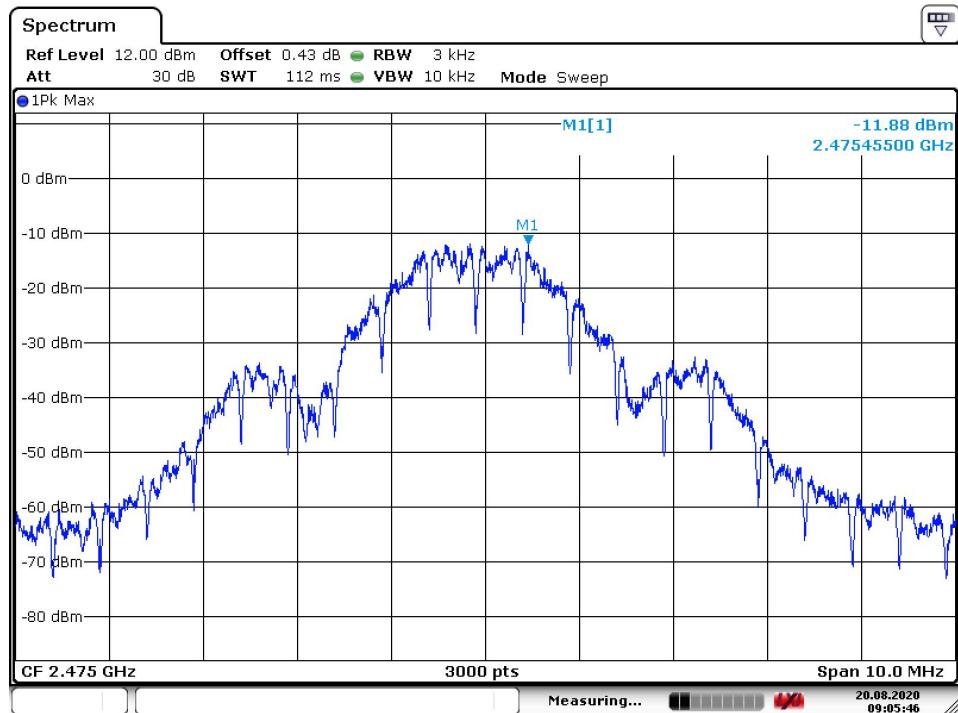
Date: 20.AUG.2020 09:19:52

Middle Channel 2440 MHz



Date: 20.AUG.2020 09:08:41

High Channel 2475 MHz



11 FCC §15.247(d) - Spurious Emissions at Antenna Terminals

11.1 Applicable Standards

For ECFR §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)).

11.2 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Analyzer, Spectrum	FSV40	1321.3008K39-101203-UW	2020-02-06	1 year
-	RF cable	-	-	Each time ¹	N/A

Note¹: cable included in the test set-up will be checked each time before testing.

Statement of Traceability: *BACL Corp.* attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 02 October 2018) “A2LA Policy on Metrological Traceability”.

11.4 Test Environmental Conditions

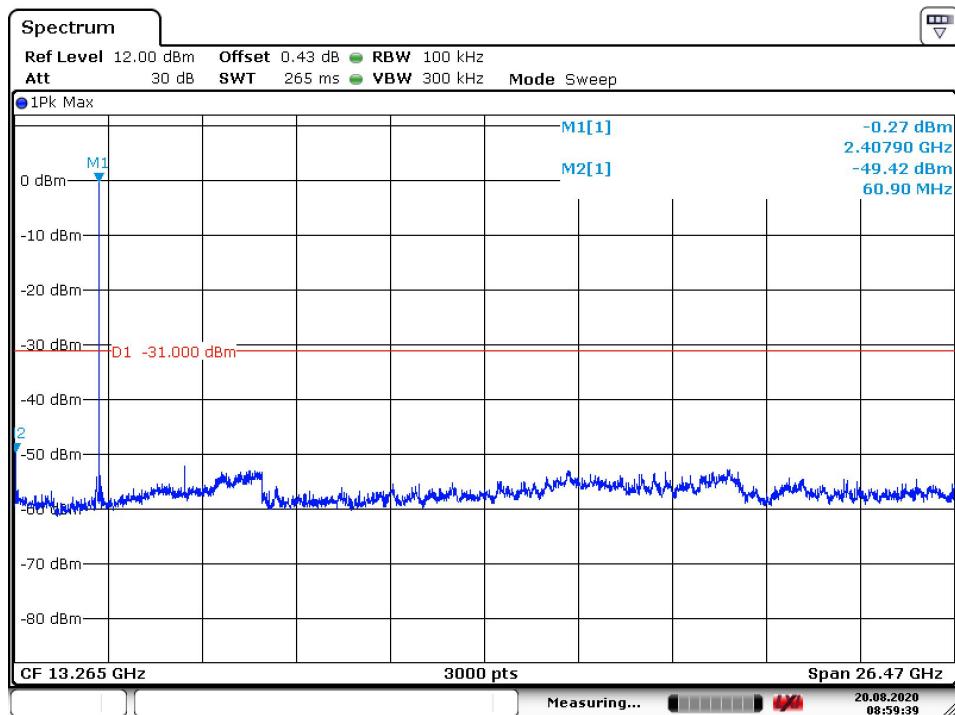
Temperature:	23° C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Christian McCaig on 2019-08-20 in RF site.

11.5 Test Results

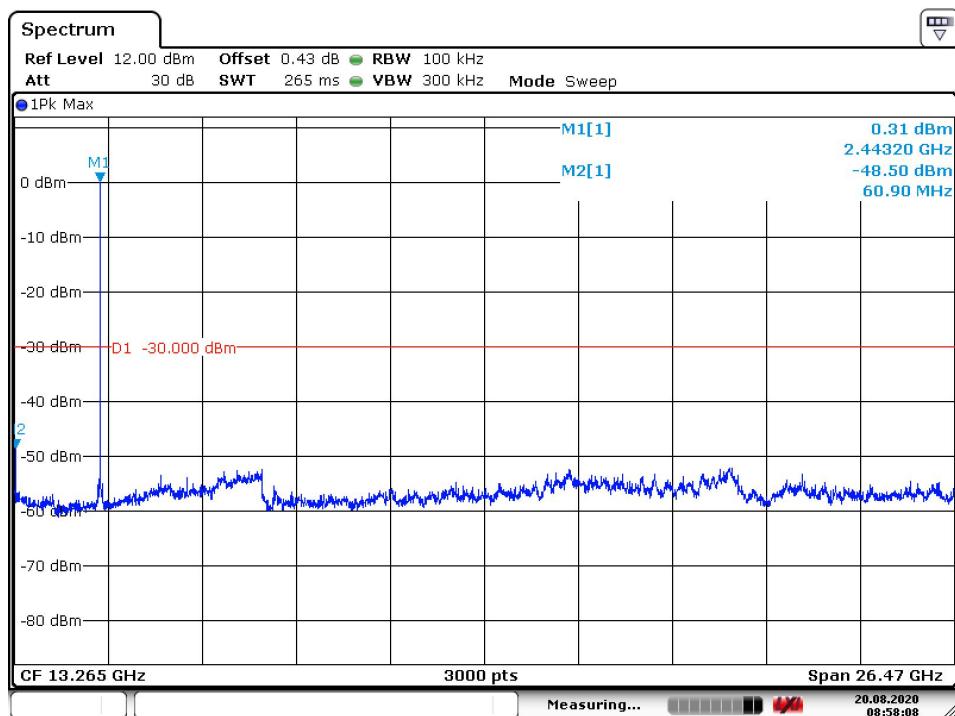
Please refer to the following plots.

Low Channel



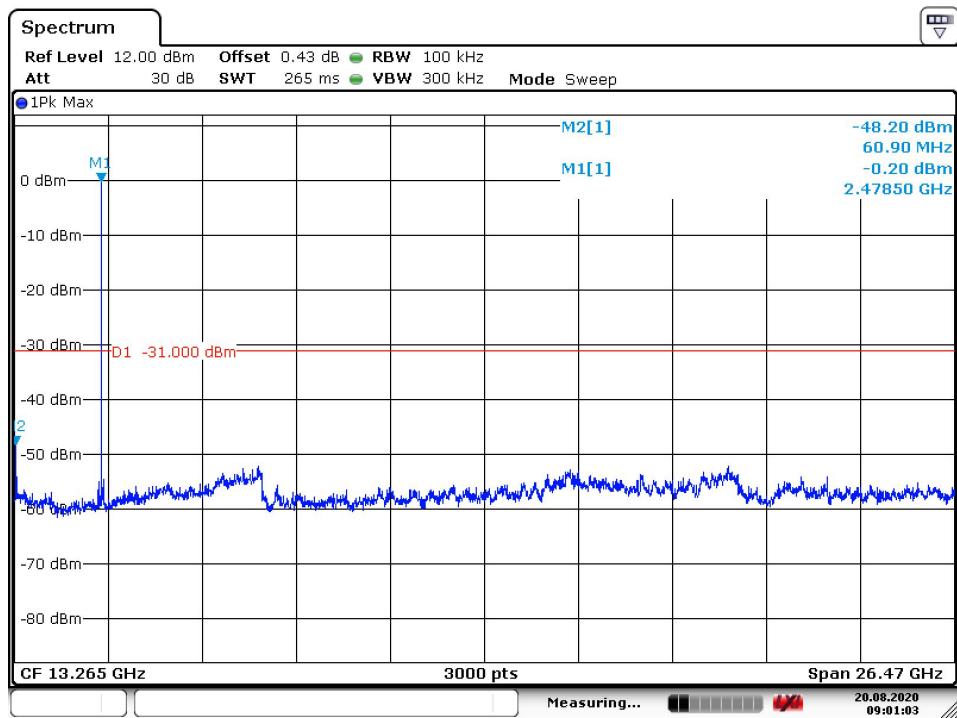
Date: 20.AUG.2020 08:59:39

Middle Channel



Date: 20.AUG.2020 08:58:08

High Channel



Date: 20.AUG.2020 09:01:04

12 Annex A (Normative) - EUT Test Setup Photographs

Please refer to the attachment.

13 Annex B (Normative) - EUT External Photographs

Please refer to the attachment.

14 Annex C (Normative) - EUT Internal Photographs

Please refer to the attachment

15 Annex D (Normative) - 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 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 April 2017).

Presented this 2nd day of October 2018.

A blue ink signature of a person's name, likely the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2020
Revised June 5, 2019



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

Please follow the web link below for a full ISO 17025 scope

<https://www.a2la.org/scopepdf/3297-02.pdf>

--- END OF REPORT ---