



# FCC PART 15, SUBPART C ISEDC RSS-210, ISSUE 10, DECEMBER 2019

## TEST REPORT

For

### Augmented Radar Imaging, Inc.

1680 Holt Ave, Los Altos,  
CA 94024, United States

**FCC ID: 2AXUT-UNI42  
IC: 26578-UNI42**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Radar Module
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\* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “\*” (b)(2)

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**DOCUMENT REVISION HISTORY**

<b>Revision Number</b>	<b>Report Number</b>	<b>Description of Revision</b>	<b>Date of Revision</b>
0	R2010224-225	Original Report	2020-11-12

## 1 General Description

### 1.1 Product Description for Equipment Under Test (EUT)

This test report was prepared on behalf of *Augmented Radar Imaging, Inc.*, and their product model: *UNI42*, *FCC ID: 2AXUT-UNI42*; *IC: 26578-UNI42*, or the “EUT” as referred to in this report. The equipment under test (EUT) was a radar module operating in 60 GHz band (60-64 GHz) for object movement and distance detection.

The EUT measures approximately 70 mm (L) x 75 mm (W) x 10 mm (H) and weighs approximately 0.05 kg.

Serial Number: *R2010224-1 and R2010224-2 assigned by BACL*

### 1.2 Objective

This report was prepared on behalf of *Augmented Radar Imaging, Inc.*, in accordance with Part 2, Subpart J, and Part 15, Subpart C of the Federal Communication Commission’s rules and ISEDC RSS-210 Issue 10, December 2019.

The objective was to determine compliance with FCC Part 15.255 and ISEDC RSS-210 rules for Output Power, Antenna Requirements, 20 dB Bandwidth, Fundamental EIRP Output Power, and Radiated Spurious Emissions.

### 1.3 Related Submittal(s)/Grant(s)

N/A

### 1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

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

## 1.6 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, 3<sup>rd</sup>-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):
  - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - o EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - o Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - o 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:
  - o ENERGY STAR Recognized Test Laboratory – US EPA
  - o Telecommunications Certification Body (TCB) – US FCC;-----
  - o 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.

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

### 2.2 EUT Exercise Software

The test software was provided by Augmented Radar Imaging, Inc. Two modes are able to be set, normal mode and testing mode. Normal mode is FM-CW signal sweeping in the operating band. Testing mode is one carrier signal operating at fixed frequency.

Mode	Frequency (GHz)	Power Setting
Normal	60-64	Default
Testing	60, 62, 64	Default

### 2.3 Equipment Modifications

No equipment modifications were made to the EUT

### 2.4 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Latitude E6410	3CKRAQ1

## 2.5 Support Equipment

Manufacturer	Description	Model
Vilros Adaptor	Power Supply	FJ-SW126G0513000U

## 2.6 Interface Ports and Cabling

Cable Description	Length (m)	To	From
Power cord	1	EUT	Power adaptor

### 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 §2.1091, §15.255(g) ISEDC RSS-102	RF Exposure	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §2.1053, §15.205, §15.209, §15.255(d) ISEDC RSS-210 J.3 ISEDC RSS-Gen §8.9 and §8.10	Radiated Spurious Emissions	Compliant
FCC §15.215 ISEDC RSS-Gen	Emission Bandwidth	Compliant
FCC §15.255(c)(3), §15.255(e) ISEDC RSS-210 J.2.1	Fundamental EIRP Output Power	Compliant
FCC §15.255(c)(3), §15.255(e) ISEDC RSS-210 J.2.1	Conducted Peak Output Power	N/T <sup>1</sup>
FCC §15.255(f) ISEDC RSS-210 J.6	Frequency Stability	Compliant

Note<sup>1</sup>: Conducted Peak Output Power was not tested because the EUT does not have a conducted antenna port. The conducted output power used in this report to compare with the limit was derived from the measured e.i.r.p. and antenna gain.

## 4 FCC §15.203 & ISED 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.

According to ISED RSS-Gen §6.8: Transmitter Antenna

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

### 4.2 Antenna Description

Antenna usage	Band of Operation (GHz)	Maximum Antenna Gain (dBi)
Integral antenna within the Integrated Circuit package	60-64	20

## 5 FCC §2.1091, §15.255(g) & ISEDC RSS-102 - RF Exposure

### 5.1 Applicable Standards

As per FCC §1.1310(d) (3), At operating frequencies above 6 GHz, the MPE limits listed in Table 1 in paragraph (e)(1) of this section shall be used in all cases to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part.

**TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(i) Limits for Occupational/Controlled Exposure</b>				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f <sup>2</sup> )	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
<b>(ii) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f = frequency in MHz

\* = Plane-wave equivalent power density

According to ISED RSS-102 Issue 5:

<b>Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)</b>				
<b>Frequency Range (MHz)</b>	<b>Electric Field (V/m rms)</b>	<b>Magnetic Field (A/m rms)</b>	<b>Power Density (W/m<sup>2</sup>)</b>	<b>Reference Period (minutes)</b>
0.003-10	83	90	-	Instantaneous*
0.1-10	-	0.73/ $f$	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10 <sup>-4</sup> $f^{0.5}$	6.67 x 10 <sup>-5</sup> $f$	616000/ $f^{1.2}$

**Note:**  $f$  is frequency in MHz.  
 \* Based on nerve stimulation (NS).  
 \*\* Based on specific absorption rate (SAR).

## 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 for FCC and IC

<u>Maximum E.I.R.P (dBm):</u>	<u>9</u>
<u>Maximum E.I.R.P (mW):</u>	<u>7.94</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>62000</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>):</u>	<u>0.0016</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>1.0</u>
<u>Power density of prediction frequency at 0.5 cm (W/m<sup>2</sup>):</u>	<u>0.016</u>
<u>IC MPE limit for uncontrolled exposure at prediction frequency (W/m<sup>2</sup>):</u>	<u>10</u>

The device is compliant with the FCC requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0016 mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

The device is compliant with the IC requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.016 W/m<sup>2</sup>. Limit is 10 W/m<sup>2</sup>.

## 6 FCC §15.207 & ISED 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  $\mu$ H/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 <sup>Note1</sup>	56 to 46 <sup>Note2</sup>
0.5-5	56	46
5-30	60	50

*Note1: Decreases with the logarithm of the frequency.*

*Note2: A linear average detector is required*

### 6.2 Test Setup

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

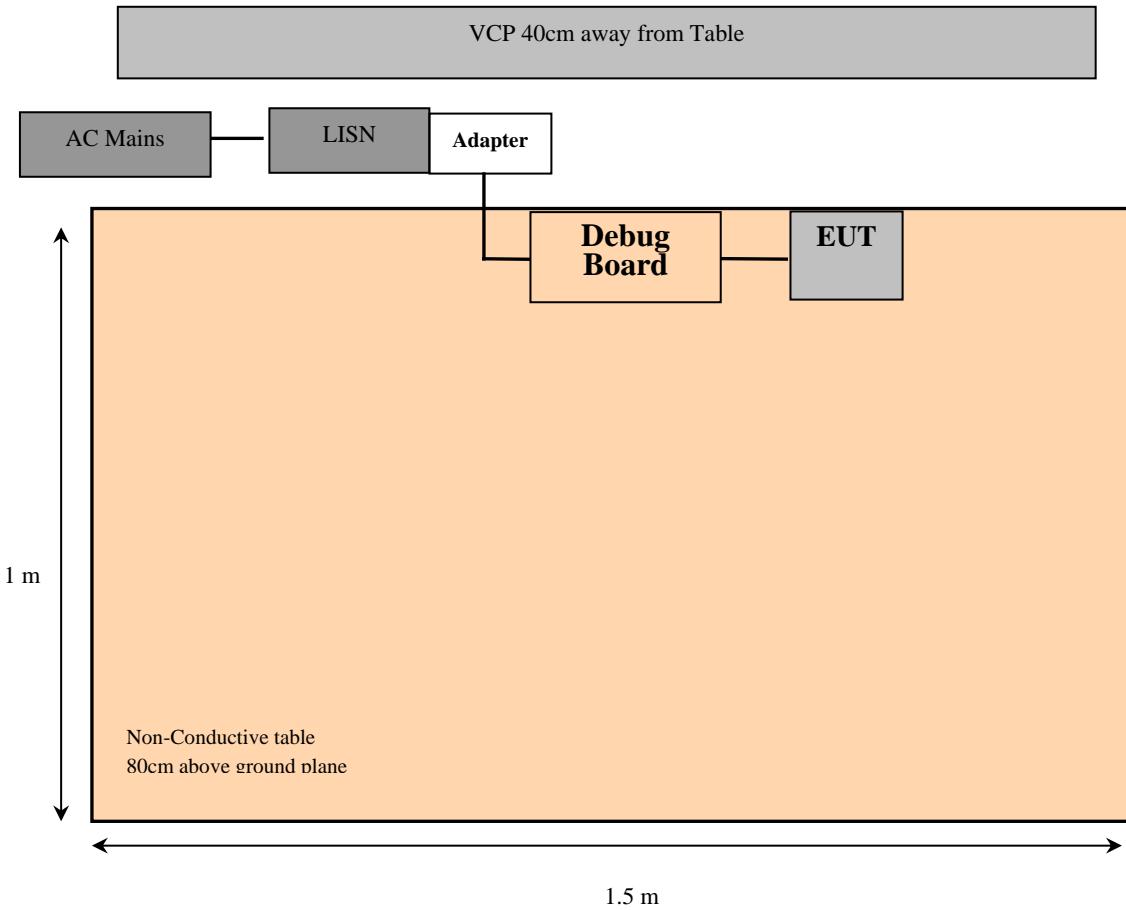
$$CA = Ai + CL + Atten$$

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:

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

## 6.5 Test Setup Block Diagram



## 6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100044	2018-10-26	2.5 years
Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101964	2020-07-02	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150202	2020-02-27	1 year
Fairview Microwave	Coaxial Cable	LMR240UF	BACL1907181	2020-08-25	1 year
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160130	2020-10-13	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

**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 the latest version of A2LA policy P102 “A2LA Policy on Metrological Traceability”.

## 6.7 Test Environmental Conditions

<b>Temperature:</b>	22° C
<b>Relative Humidity:</b>	48 %
<b>ATM Pressure:</b>	101.89 kPa

The testing was performed by Zhao Zhao on 2020-11-02 at ground plane test site.

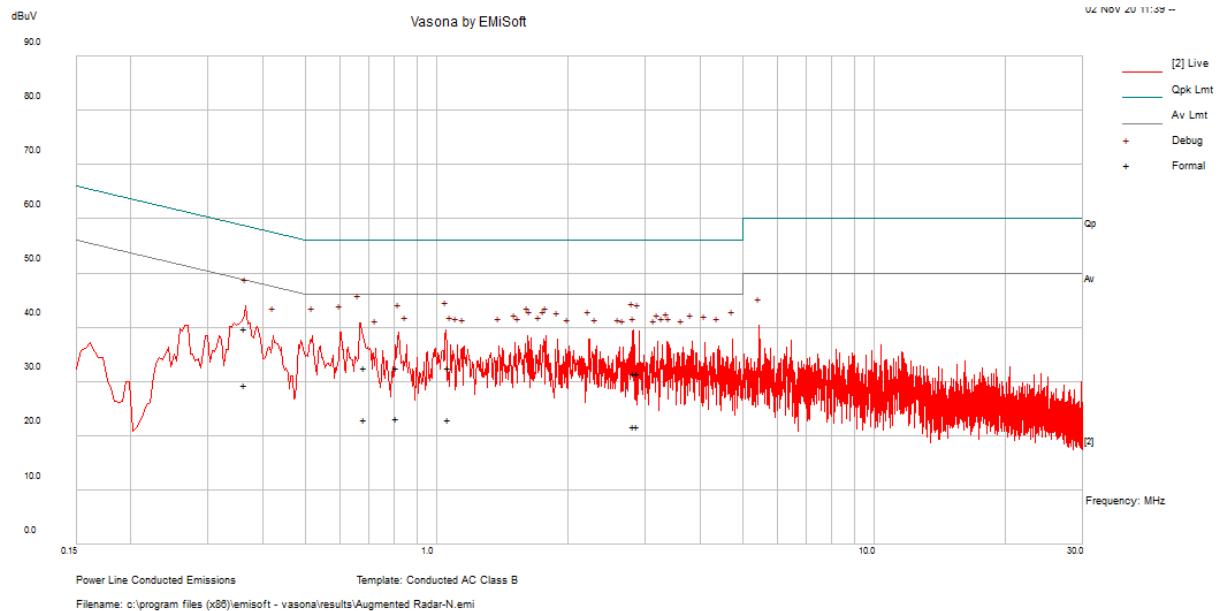
## 6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15.207 and ISEDC RSS-Gen standards' 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)
-18.92	0.364339	Line	0.15-30

## 6.9 Conducted Emissions Test Plots and Data

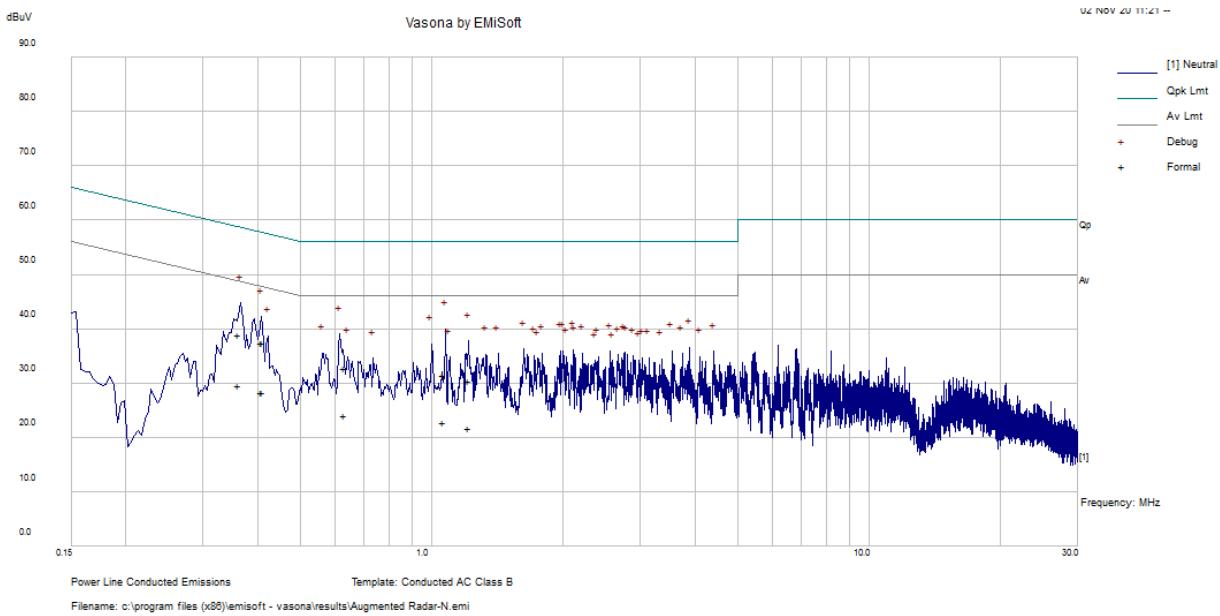
### 120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.364339	39.71	Line	58.63	-18.92	QP
0.682749	32.54	Line	56	-23.46	QP
1.06623	32.45	Line	56	-23.55	QP
2.82037	31.4	Line	56	-24.6	QP
2.879986	31.52	Line	56	-24.48	QP
0.811243	32.61	Line	56	-23.39	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.364339	29.34	Line	48.63	-19.29	Ave.
0.682749	22.92	Line	46	-23.08	Ave.
1.06623	22.93	Line	46	-23.07	Ave.
2.82037	21.64	Line	46	-24.36	Ave.
2.879986	21.6	Line	46	-24.4	Ave.
0.811243	23.24	Line	46	-22.76	Ave.

## 120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.361747	38.97	Neutral	58.69	-19.72	QP
0.40778	37.43	Neutral	57.69	-20.27	QP
1.062182	31.58	Neutral	56	-24.42	QP
0.631306	32.69	Neutral	56	-23.31	QP
1.212758	30.45	Neutral	56	-25.55	QP
0.412212	37.52	Neutral	57.6	-20.08	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.361747	29.59	Neutral	48.69	-19.1	Ave.
0.40778	28.39	Neutral	47.69	-19.3	Ave.
1.062182	22.74	Neutral	46	-23.26	Ave.
0.631306	23.95	Neutral	46	-22.05	Ave.
1.212758	21.78	Neutral	46	-24.22	Ave.
0.412212	28.34	Neutral	47.6	-19.26	Ave.

## 7 FCC §15.209, §15.255(d) & ISEDC RSS-210 J.3, 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	16.42 – 16.423	960 – 1240	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5.35 – 5.46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 – 167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

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

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

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

As per FCC §15.255(d):

- (1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.
- (2) Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.
- (3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm<sup>2</sup> at a distance of 3 meters.
- (4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

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

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

As per ISED RSS-210 J.3:

- a. The power of any emissions outside the band 57-64 GHz shall consist solely of spurious emissions and shall not exceed:
  - i. the general field strength limits specified in [RSS-Gen](#) for emissions below 40 GHz; and
  - ii. 90 pW/cm<sup>2</sup> at a distance of 3 m for emissions between 40 GHz and 200 GHz;
- b. The levels of spurious emissions shall not exceed fundamental emission levels.

## 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 ISED RSS-210 Section J 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

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.

Using equation  $2D^2/\lambda$  to calculate the far-field boundary distance. D is the largest antenna dimension and  $\lambda$  is wavelength.

D is 0.012 meter, and  $\lambda$  is about 0.0048 meter. Therefore the far-field boundary is 0.06 meter.

For radiated testing the EUT was set at 1 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 above the ground plane for 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:

Above 1000 MHz:

- (1) Peak: RBW = 1MHz / VBW = 3MHz / Sweep = 100 ms
- (2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

## 7.4 Corrected Amplitude and Margin Calculation

For the emissions from 30 MHz to 40 GHz:

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:

$$CA = Ai + AF + CL - Ga$$

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:

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

For the emissions from 40 GHz to 200 GHz:

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 e.i.r.p. is calculated from the corrected field strength by using the following formula,

$$EIRP = E\text{-meas} + 20\log(d\text{-meas}) - 104.7$$

Where:

EIRP: is the equivalent isotropically radiated power in dBm

E-meas: is the field strength of the emission at the measurement distance, in dBuV/m

d-meas: is the measurement distance, in m

Finally, use the formula below to calculate the power density and compare the result with the limit.

$$PD = \frac{EIRP_{\text{Linear}}}{4\pi d^2}$$

where

PD is the power density at the distance specified by the limit, in  $\text{W/m}^2$

EIRP<sub>Linear</sub> is the equivalent isotropically radiated power, in watts

d is the distance at which the power density limit is specified, in m

*The Specified distance is 3m.*

## 7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2019-08-24	1.5 years
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2020-03-17	1 year
OML	Harmonic Mixer and Horn Antenna Set	M03HWA; M05HWA; M08HWA; M12HWA; M19HWA	170615-1	N/R	N/R
Sonoma Instruments	Amplifier, Pre	315	303125	2020-07-20	1 year
IW	157 Series Cable Armored with 2.92mm Male Plugs on Both Sides	KPS-1571AN-2400	DC 1922	2020-06-06	1 year
-	RF cable	-	-	Each time <sup>1</sup>	N/A
Times Microwave	Coaxial Cable	LMR400-UF	1	2020-03-27	1 year
BACL	5m3 Sensitivity Box	1	2	2020-10-27	1 year
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-3	2020-03-02	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-02	2020-02-05	2 years
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2020-02-27	2 years
AH Systems	18-40GHz Pre-Amplifier	PAM-1840VH	170	2020-10-27	1 year
ETS Lindgren	Horn Antenna	3117	00218973	2019-02-13	2 years

Note<sup>1</sup>: cables 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 the latest version of A2LA policy P102 “A2LA Policy on Metrological Traceability”.

## 7.6 Test Environmental Conditions

<b>Temperature:</b>	22 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.6 kPa

The testing was performed by Zhao Zhao on 2020-10-30 in 5m chamber 3.

The testing from 30MHz to 1GHz was performed by Jerry Wang on 2020-11-04 in 10m chamber 1.

## 7.7 Summary of Test Results

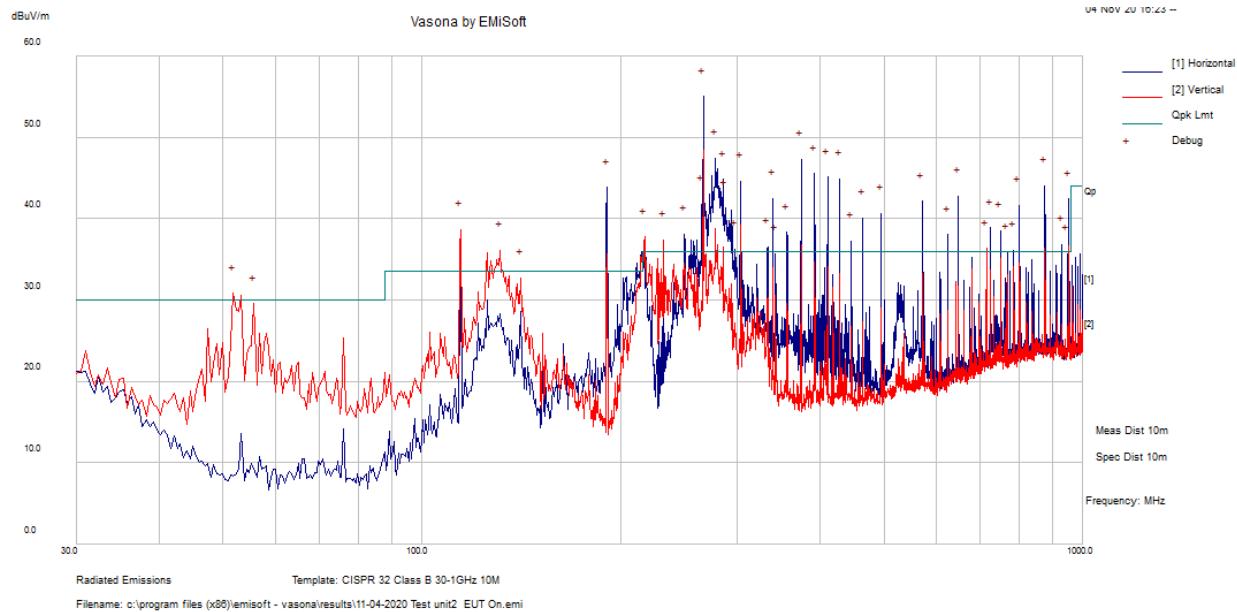
According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C and ISEDC RSS-210 standard's radiated emissions limits, and had the worst margin of:

Margin (dB)	Frequency (MHz)	Mode
-1.33	17265.66	TX

## 7.8 Spurious Emissions Test Results

### 1) 30 MHz to 1GHz measured at 10 meters.

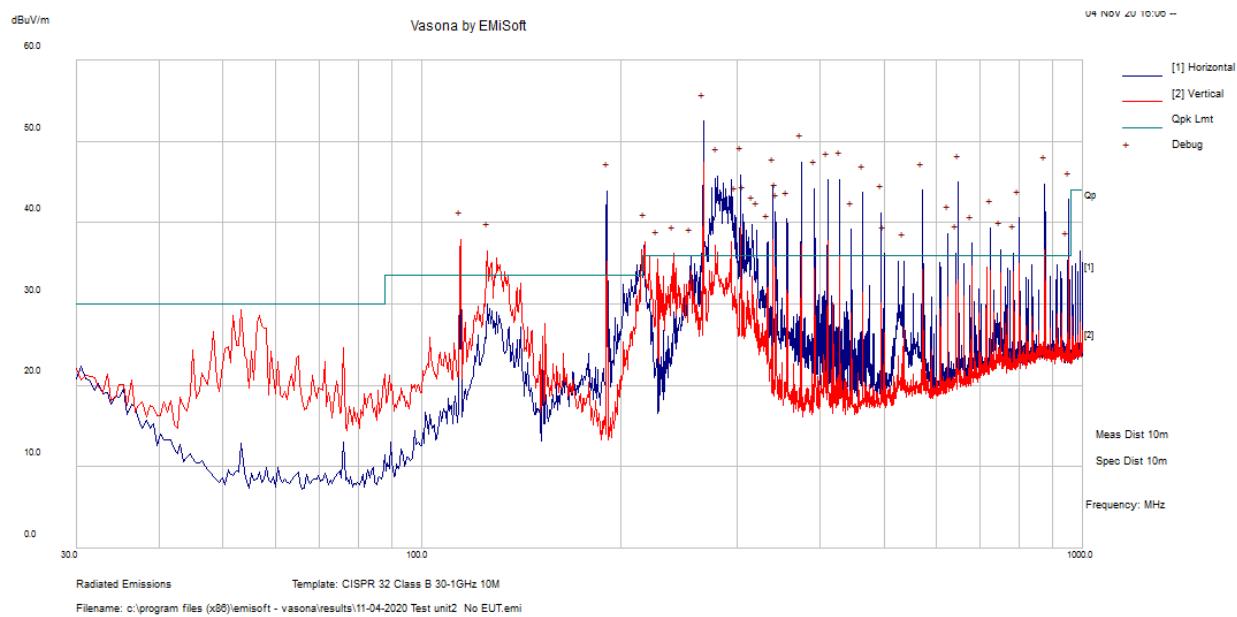
EUT Transmitting



Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB $\mu$ V/m)	Margin (dB)	Comment
285.73075	33.52	239	V	67	36	-2.48	QP
928.67625	19.73	269	V	144	36	-16.27	QP
51.4345	14.46	109	V	210	30	-15.54	QP
130.3275	27.56	254	V	181	33.5	-5.94	QP
249.9545	32.83	388	H	358	36	-3.17	QP
140.8885	31.16	139	V	204	33.5	-2.34	QP
714.30525	33.05	168	V	0	36	-2.95	QP
294.9865	31.78	217	H	4	36	-4.22	QP
767.922	29.24	130	H	361	36	-6.76	QP
232.15	34.49	112	V	35	36	-1.51	QP
55.3295	14.99	211	V	353	30	-15.01	QP

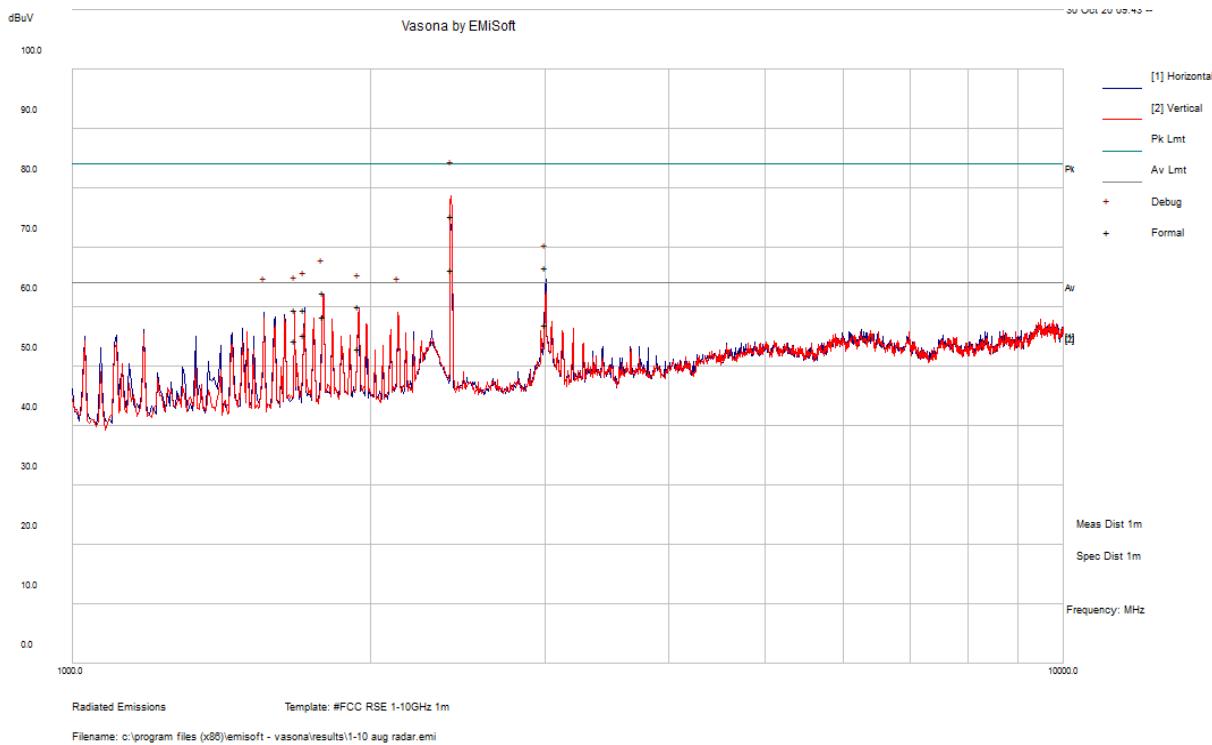
Note: To determine whether the emissions were generated by the EUT (radio module) or by the debug board, pre-scan has been performed for the debug board (Base line scan). Please refer to the base line scan result on the next page. Based on the comparison, the table above shows the formal emission results for the EUT.

## Base Line Scan



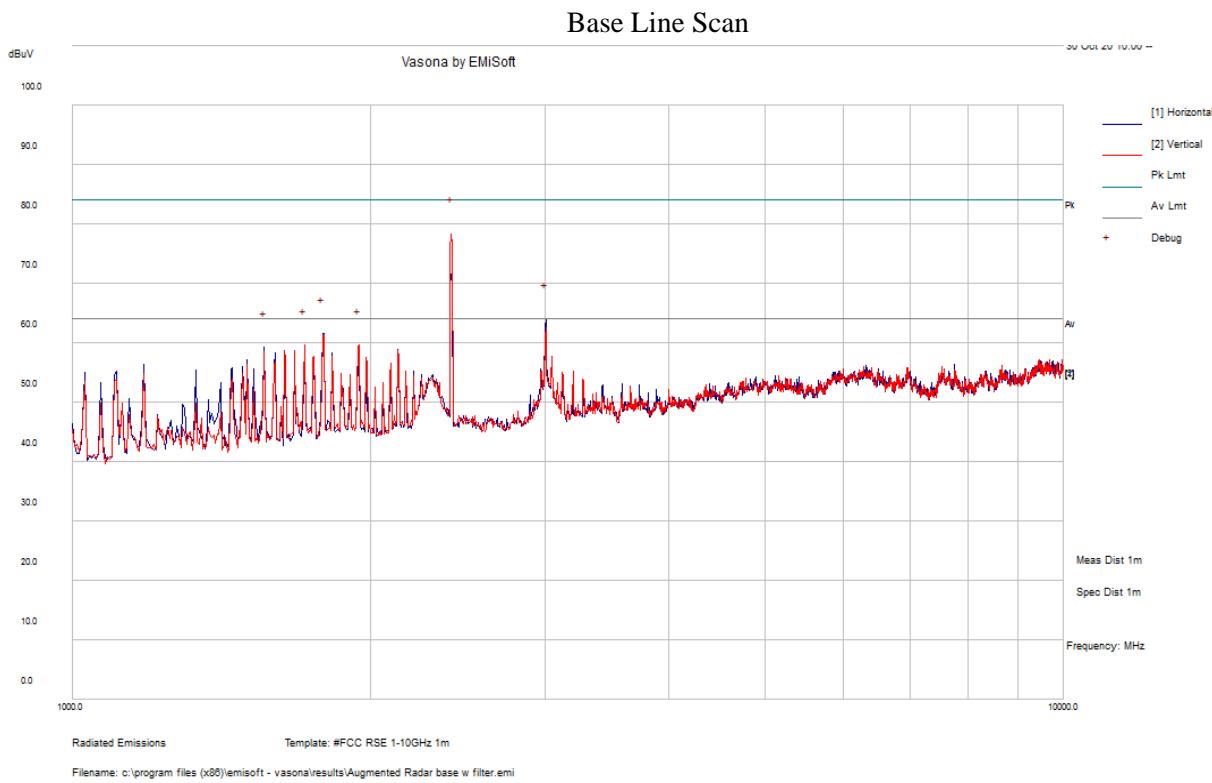
## 2) 1–10 GHz Measured at 1 meter

## EUT Transmitting

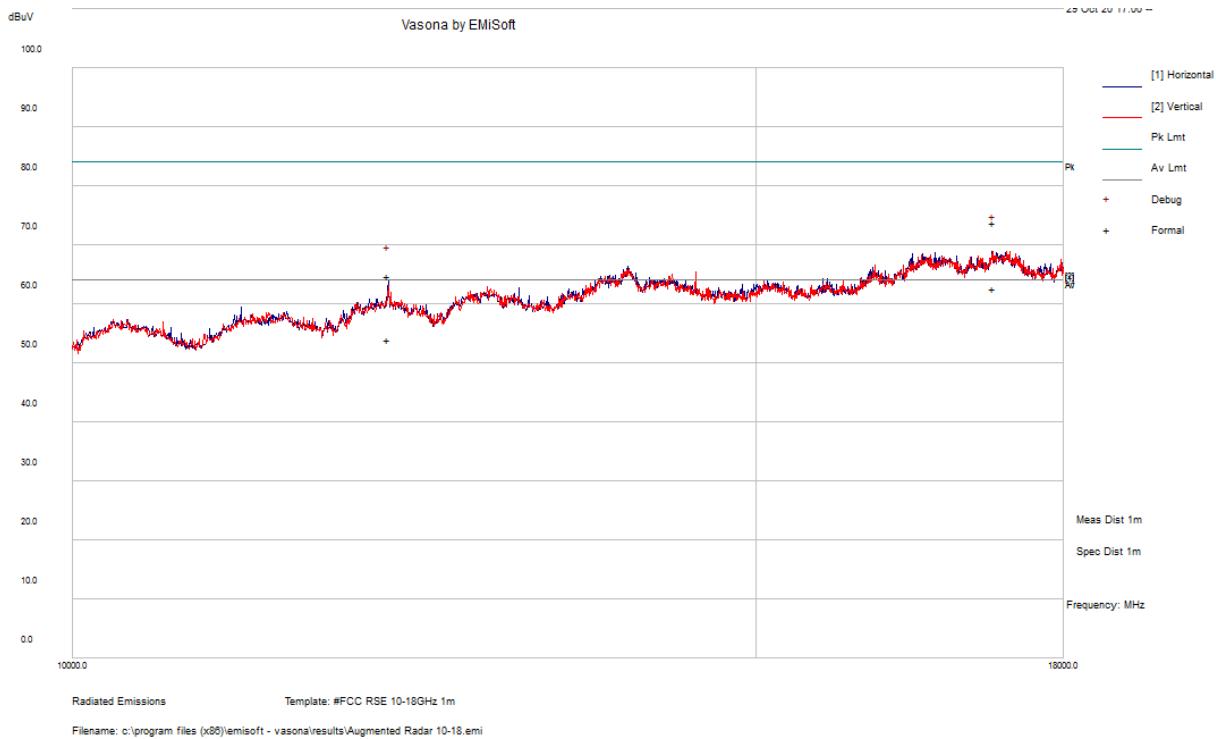


Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB $\mu$ V/m)	Margin (dB)	Comment
3000.4475	66.59	110	H	90	84	-17.41	Peak
3000.4475	57.09	110	H	90	64	-6.91	Average

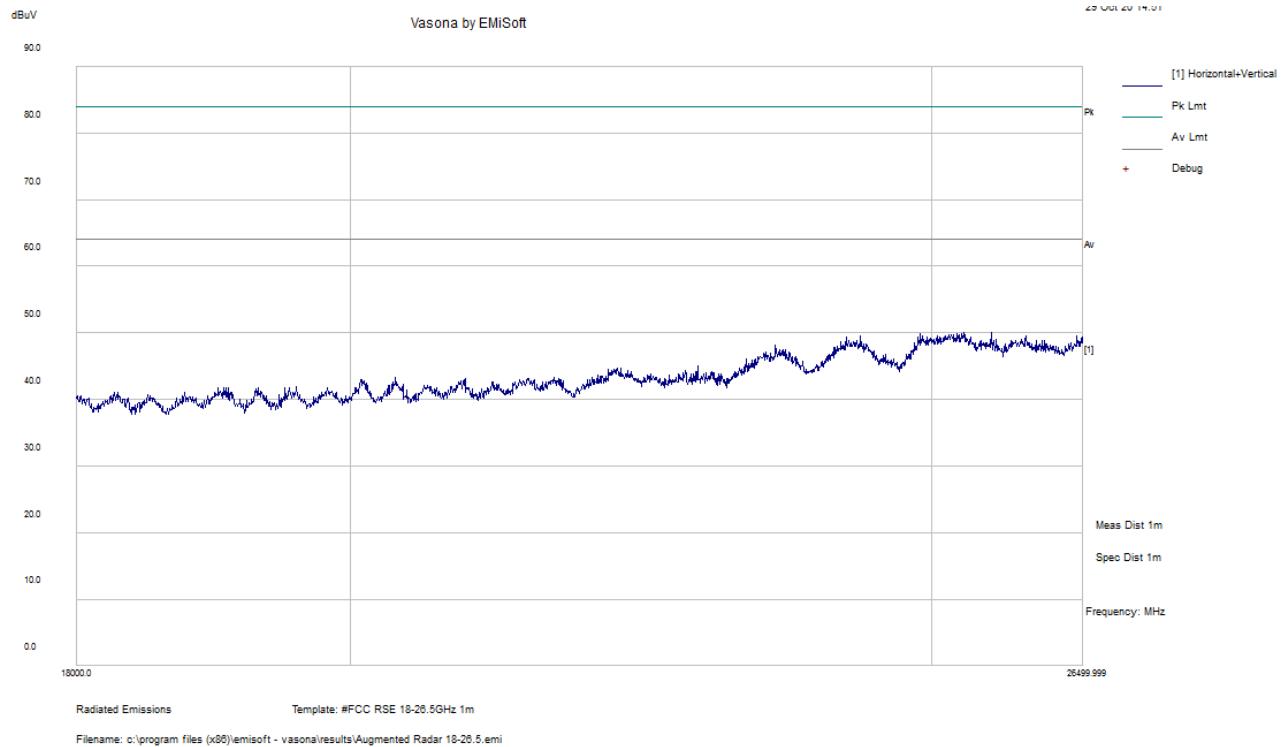
Note: To determine whether the emissions were generated by the EUT (radio module) or by the debug board, pre-scan has been performed for the debug board (Base line scan). Please refer to the base line scan result on the next page. Based on the comparison, the table above shows the formal emission results for the EUT.



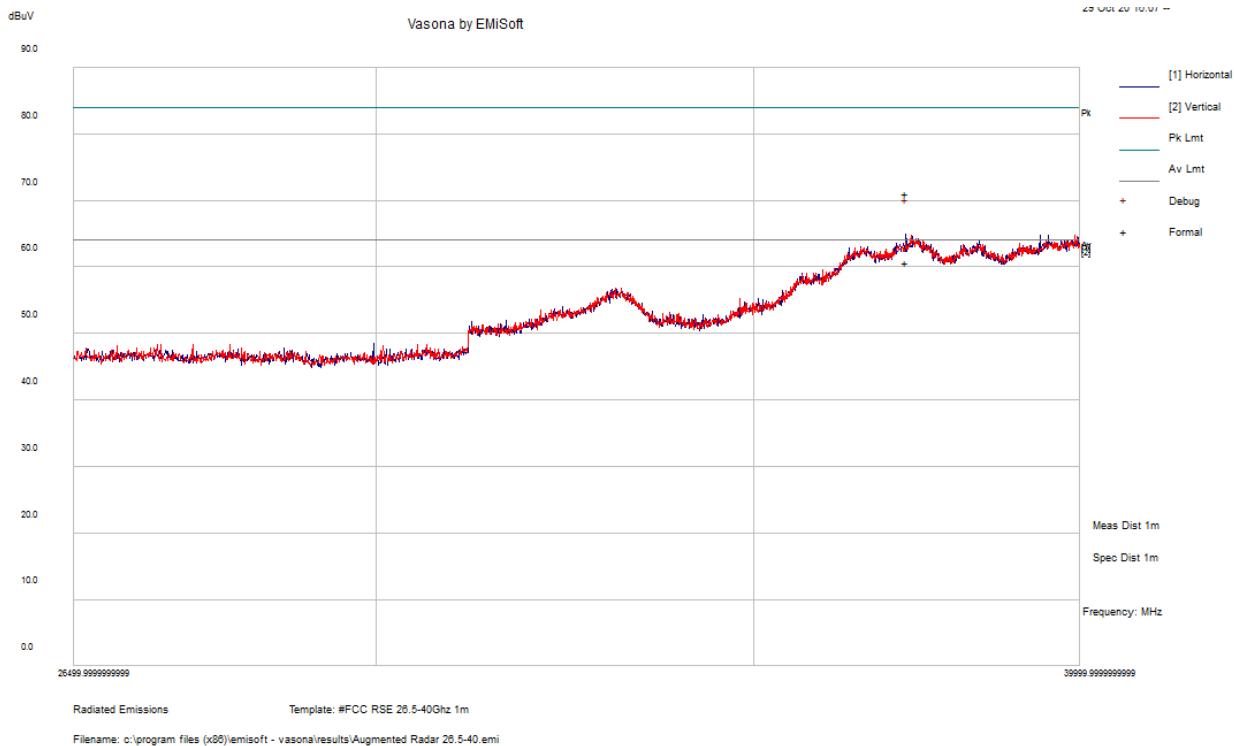
### 3) 10–18 GHz Measured at 1 meter



Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB $\mu$ V/m)	Margin (dB)	Comment
17265.66	73.68	199	V	85	84	-10.32	Peak
12058.988	64.7	126	V	190	84	-19.3	Peak
17265.66	62.67	197	H	338	64	-1.33	Average
12058.988	53.9	106	H	141	64	-10.1	Average

**4) 18-26.5 GHz Measured at 1 meter**

## 5) 26.5-40 GHz Measured at 1 meter



Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB $\mu$ V/m)	Margin (dB)	Comment
37245.855	71.14	199	V	121	84	-12.86	Peak
37245.855	60.65	275	H	203	64	-3.35	Average

**6) 40-200 GHz Measured at 1 meter**

Frequency (MHz)	S.A. Reading (dB $\mu$ V)	Turntable Azimuth (degrees)	Test Antenna		Corr'd. Reading (dB $\mu$ V/m)	EIRP (dBm)	Power Density (pW/cm <sup>2</sup> ) @3m	FCC/ISEDC	
			Height (cm)	Factor (dB/m)				Limit (pW/cm <sup>2</sup> )	Margin (pW/cm <sup>2</sup> )
40230	31.13	0	100	33.64	64.77	-39.93	0.0899	90	-89.9101
64677	31.04	0	100	40.52	71.56	-33.14	0.4291	90	-89.5709
92500	26.83	0	100	51.24	78.07	-26.63	1.9211	90	-88.0789
144000	25.14	0	100	58.57	83.71	-20.99	7.0396	90	-82.9604

## 8 FCC §15.215 & ISEDC RSS-Gen §6.7 - Emission Bandwidth

### 8.1 Applicable Standards

According to ECFR §15.215 Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

According to ISEDC RSS-Gen §6.7: The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

### 8.2 Measurement Procedure

The measurements are based on ANSI C63.10-2013.

### 8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode and Schwarz	Analyzer, Spectrum	FSU67	101360	2020-06-04	2 years
JUNKOSHA JUNFLOW MXW	RF cable	MWX261/B	1608T001	Each time <sup>1</sup>	N/A
LNF	Low Noise Amplifier 44 GHz to 77 GHz	LNR4577WA	022A	N/R	N/R
Millitech	Antenna Horn	56H-15-RA000	A17928	N/R	N/R

Note<sup>1</sup>: 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 the latest version of A2LA policy P102 “A2LA Policy on Metrological Traceability”.

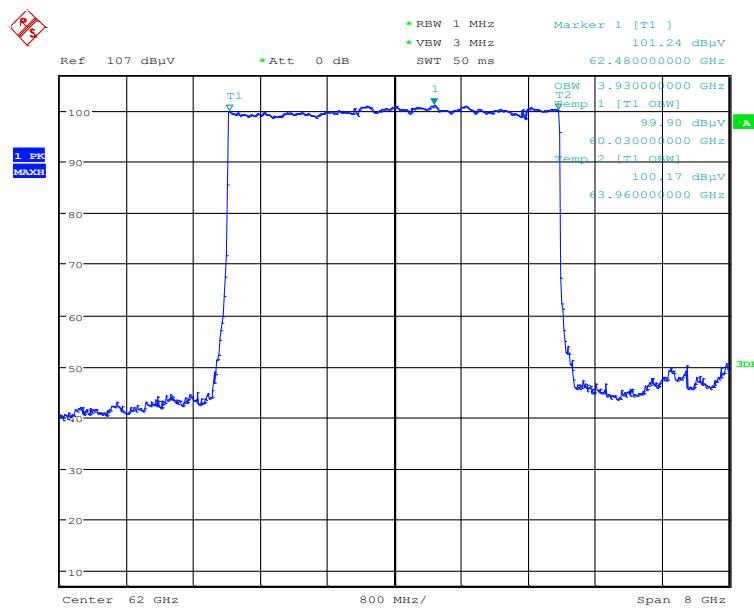
## 8.4 Test Environmental Conditions

<b>Temperature:</b>	22 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.6 kPa

The testing was performed by Zhao Zhao on 2020-10-30 at RF site.

## 8.5 Test Results

The 99% bandwidth is 3.93GHz.



## 9 FCC §15.255(c)(3), & ISEDC RSS-210 J.2.1 – Fundamental EIRP Output Power Measurement

### 9.1 Applicable Standards

According to ECFR §15.255 (c) (3) for fixed field disturbance sensors other than those operating under the provisions of paragraph (c)(2) of this section, and short-range devices for interactive motion sensing, the peak transmitter conducted output power shall not exceed -10 dBm and the peak EIRP level shall not exceed 10 dBm.

According to ISEDC RSS-210 J.2.1 b. For fixed field disturbance sensors other than those operating under the provisions of (a) above and for interactive motion sensors, the peak transmitter output power shall not exceed -10 dBm, and the peak e.i.r.p. shall not exceed 10 dBm.

### 9.2 Measurement Procedure

The measurements for Fundamental E.I.R.P Output Power where done by following the procedure in ANSI C63.10-2013 Clause 9.11Measurement of the fundamental emission using an RF detector.

The Setup was performed as follows:

- 1) Using equation  $2D^2/\lambda$  to calculate the far-field boundary distance. D is the largest antenna dimension and  $\lambda$  is wavelength. D is 0.012 meter, and  $\lambda$  is about 0.0048 meter. Therefore the far-field boundary is 0.06 meter.
- 2) The measurement instrument shall be a mm-wave RF detector that has an RF bandwidth encompassing the entire authorized frequency band. The input VSWT of the mm-wave detector shall be less than 3:1.
- 3) For radiated emissions measurements of transmitter output power, connect the test antenna for the fundamental frequency band to the mm-wave RF detector. Place the test horn in the main beam of the EUT at a distance that will provide a signal within the operating range of the RF detector.
- 4) Connect the video output of the detector to the  $50 \Omega$  input of a DSO.
- 5) Set the sampling rate of the DSO to at least twice the cutoff frequency of any LPF used or to at least twice the signal bandwidth without a LPF. Adjust the memory depth, the triggering, and the sweep speed to obtain a display that is representative of the signal considering the type of modulation.
- 6) Determine the maximum measurement distance and set the EUT within the distance.

The Test procedure was performed as follows:

- 1) Record the average and peak voltages from the DSO.
- 2) Disconnect the test antenna or EUT (as applicable for radiated or conducted tests) from the RF input port of the instrumentation system.
- 3) Connect an mm-wave source to the RF input port of the instrumentation system via a waveguide variable attenuator.
- 4) The mm-wave source shall be unmodulated.
- 5) Adjust the frequency of the mm-wave source to the center of the frequency range occupied by the transmitter.
- 6) Adjust the amplitude of the mm-wave source and/or the variable attenuator such that the DSO indicates a voltage equal to the peak voltage recorded
- 7) Disconnect the waveguide variable attenuator from the RF input port of the instrumentation system.
- 8) Without changing any settings, connect the waveguide variable attenuator to a wideband mm-wave power meter with a thermocouple detector or equivalent.
- 9) Measure and note the power.

10) Repeat the measurement for the average voltage.  
 11) Do calculation using the equations in ANSI C63010-2013 Clause 9

### 9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode and Schwarz	Analyzer, Spectrum	FSU67	101360	2020-06-04	2 years
Agilent	Power Meter	N1914A	MY5000822	2019-07-28	2 years
HP	Power Sensor	V8488A	US39010099	2019-10-12	2 years
OML	Harmonic Mixer/Multiplier	S12MS	130423-1	N/A	N/A
Vaunix	Signal Generator 6 GHz to 18 GHz	LMS-183DX	19760	2020-08-05	2 years
A-InfoMW	20 dBi Standard Gain Horn Antenna	LB-15-20-A	5202062579	N/R	N/R
LNF	Low Noise Amplifier 44 GHz to 77 GHz	LNR4577WA	022A	N/R	N/R
Millitech	Variable Level Set Attenuator 0 to 25 dBm	LSA-15-R0000	248-A17928	Each time <sup>1</sup>	N/R
Tektronix	Oscilloscope	TDS2024B	C047044	2019-10-17	2 years
Millitech	RF Detector	DET-15	-	N/R	N/R
JUNKOSHA JUNFLOW MXW	RF cable	MWX261/B	1608T001	Each time <sup>1</sup>	N/A

Note<sup>1</sup>: 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 the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".

### 9.4 Test Environmental Conditions

<b>Temperature:</b>	22° C
<b>Relative Humidity:</b>	48 %
<b>ATM Pressure:</b>	101.89 kPa

The testing was performed by Zhao Zhao on 2020-11-02 at RF site.

## 9.5 Test Results

The fundamental was measured at 0.5 meter.

DSO Reading (mV)	Substitution (dBm)	Ant Gain (dBi)	Pre-amp (dB)	Correct Reading (dBm)	E-field (dB $\mu$ V/m)	EIRP (dBm)	Limit (dBm)	MARGIN (dB)	Detector
Test Mode worst case: 62GHz									
50.4	-2.3	20	31.27	-53.57	119.54	8.81	10	-1.19	Peak
46.5	-2.9	20	31.27	-54.17	118.54	8.21	-	-	Ave.

**Note:** Middle channel was selected as the worst case among low middle and high channels during pre-scan, the test performed without pre-amp at a distance of 12 cm.

Channel (GHz)	DSO Reading (mV)	Detector
60	10.2	Peak
62	11.2	Peak
64	4.2	Peak

$$E = 126.8 - 20 \log(\lambda) + P - G \quad (19)$$

where

$E$  is the field strength of the emission at the measurement distance, in dB $\mu$ V/m

$P$  is the power measured at the output of the test antenna, in dBm

$\lambda$  is the wavelength of the emission under investigation [300/f<sub>MHz</sub>], in m

$G$  is the gain of the test antenna, in dBi

NOTE—The measured power  $P$  includes all applicable instrument correction factors up to the connection to the test antenna.

$$\text{EIRP} = E_{\text{Meas}} + 20 \log(d_{\text{Meas}}) - 104.7 \quad (22)$$

where

$\text{EIRP}$  is the equivalent isotropically radiated power, in dBm

$E_{\text{Meas}}$  is the field strength of the emission at the measurement distance, in dB $\mu$ V/m

$d_{\text{Meas}}$  is the measurement distance, in m

NOTE—Because this equation yields the identical result whether the field strength is extrapolated using the default 20 dB/decade of distance extrapolation factor, or the field strength is not extrapolated for distance, this equation can generally be applied directly (with no further correction) to determine EIRP. In some cases, a different distance correction factor may be required; see 9.1.

**Peak Conducted Output Power**

Peak EIRP (dBm)	Antenna Gain (dBi)	Peak Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)	Result
8.81	20	-11.19	-10	-1.19	Pass

## 10 FCC §15.255(f) & ISEDC RSS-210 J.6 - Frequency Stability

### 10.1 Applicable Standards

According to FCC §15.255(f) *Frequency stability*. Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

According to ISEDC RSS-210 J.6 Fundamental emissions shall be contained within the frequency bands specified in this section during all conditions of operation.

### 10.2 Measurement Procedure

The measurements are based on ANSI C63.10-2013.

### 10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode and Schwarz	Analyzer, Spectrum	FSU67	101360	2020-06-04	2 years
JUNKOSHA JUNFLOW MXW	RF cable	MWX261/B	1608T001	Each time <sup>1</sup>	N/A
A-InfoMW	20 dBi Standard Gain Horn Antenna	LB-15-20-A	5202062579	N/R	N/R
LNF	Low Noise Amplifier 44 GHz to 77 GHz	LNR4577WA	022A	N/R	N/R
InterPower	Power Source	85510510	39711	NCR	NCR
BACL	Chamber, Humidity	BTH-150-40	30078	2020-06-25	1 year

Note<sup>1</sup>: 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 the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".

### 10.4 Test Environmental Conditions

<b>Temperature:</b>	22° C
<b>Relative Humidity:</b>	48-50 %
<b>ATM Pressure:</b>	101.6-101.89 KPa

The testing was performed by Zhao Zhao from 2020-10-30 to 2020-11-02 in temperature chamber.

## 10.5 Test Results

### Extreme Temperature

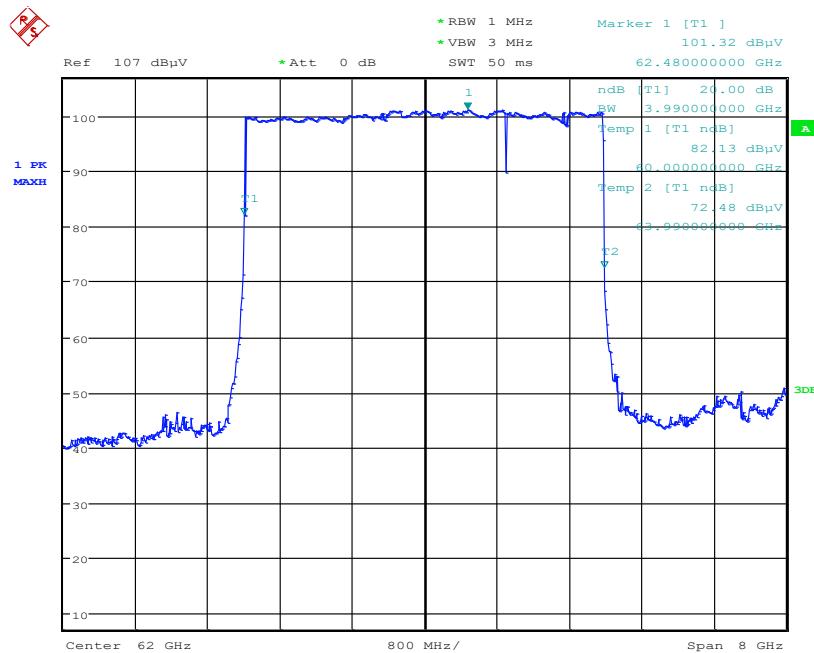
Voltage (V <sub>AC</sub> )	Temperature (°C)	Low Frequency (GHz)	High Frequency (GHz)	Limit (GHz)	Results
120V	-20	60	63.99	57-71	pass
	-10	60	63.99	57-71	pass
	0	60	63.99	57-71	pass
	10	60	63.99	57-71	pass
	20	60	63.99	57-71	pass
	30	60	63.98	57-71	pass
	40	60	63.99	57-71	pass
	50	60	63.98	57-71	pass

### Extreme Voltage

Temperature (°C)	Voltage (V <sub>AC</sub> )	Low Frequency (GHz)	High Frequency (GHz)	Limit (GHz)	Results
20	102	60	63.98	57-71	pass
	138	60	63.98	57-71	pass

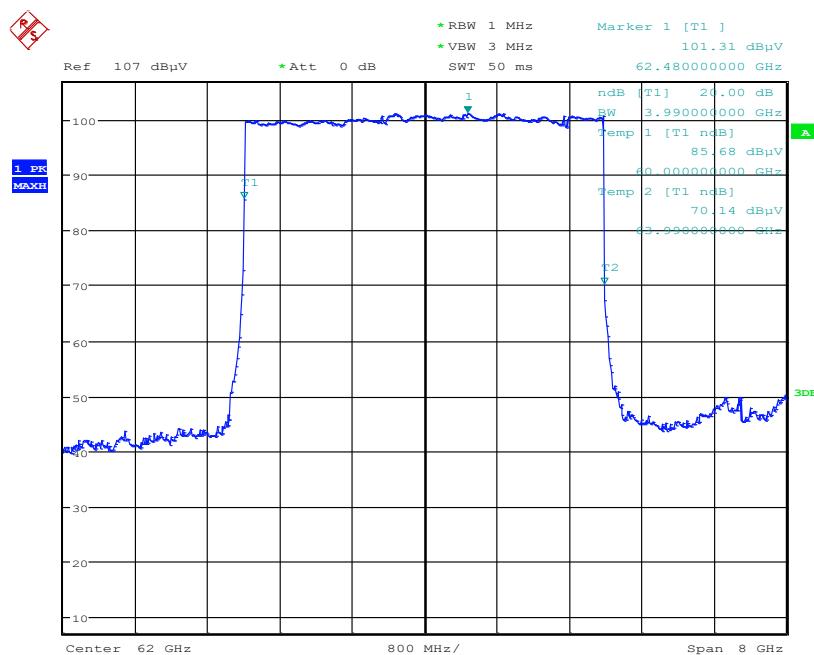
Please refer to the following plots for details

-20 °C



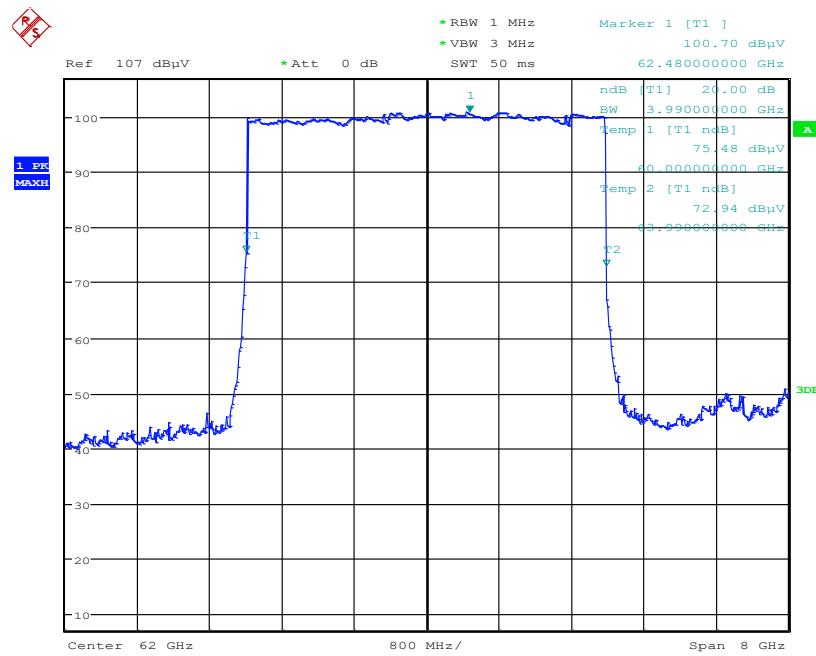
Date: 30.OCT.2020 14:45:17

-10 °C



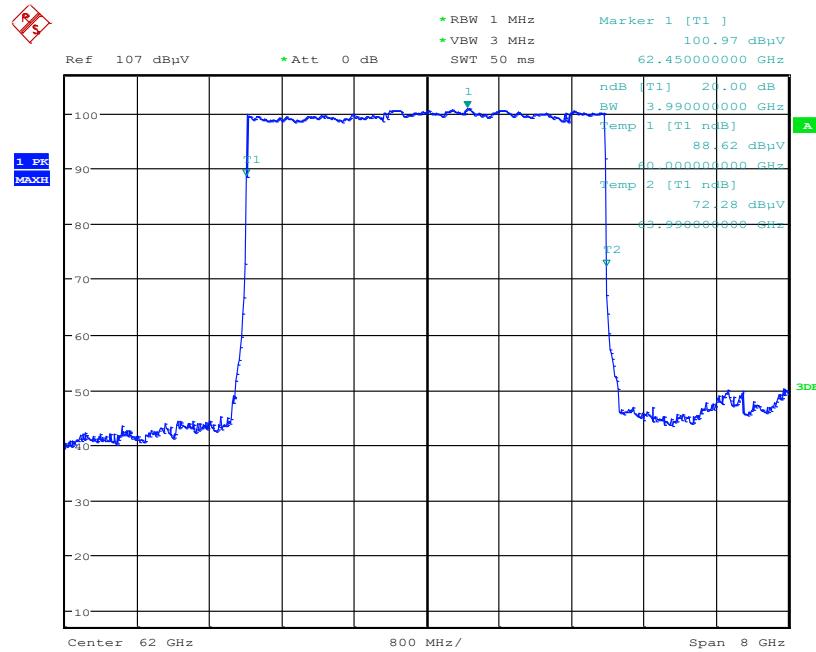
Date: 30.OCT.2020 15:09:59

0 °C



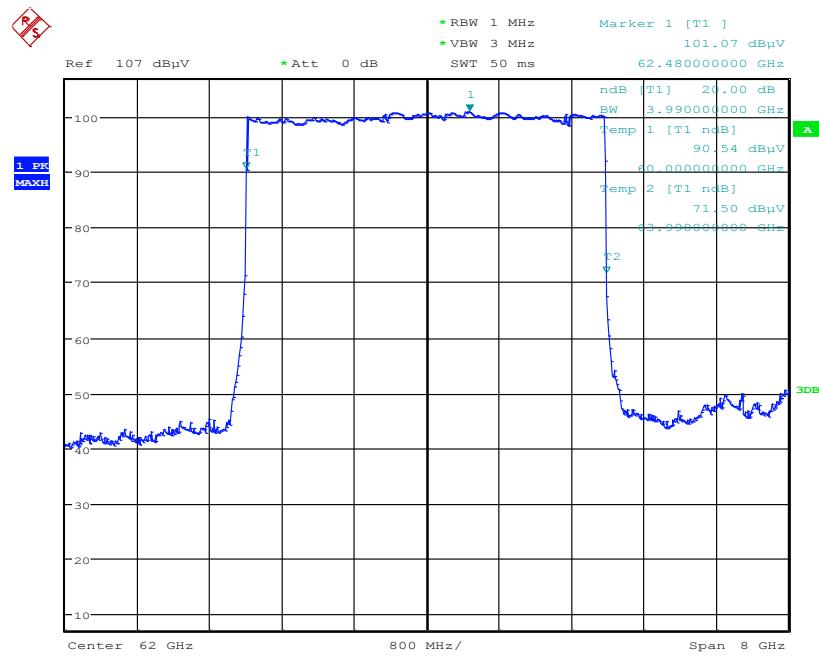
Date: 30.OCT.2020 15:23:20

10 °C



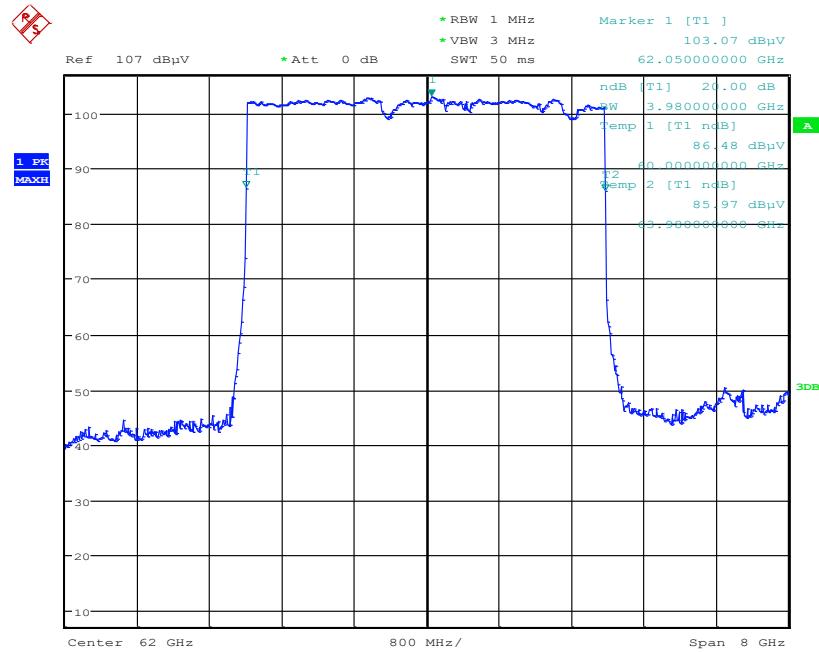
Date: 30.OCT.2020 16:05:24

20 °C



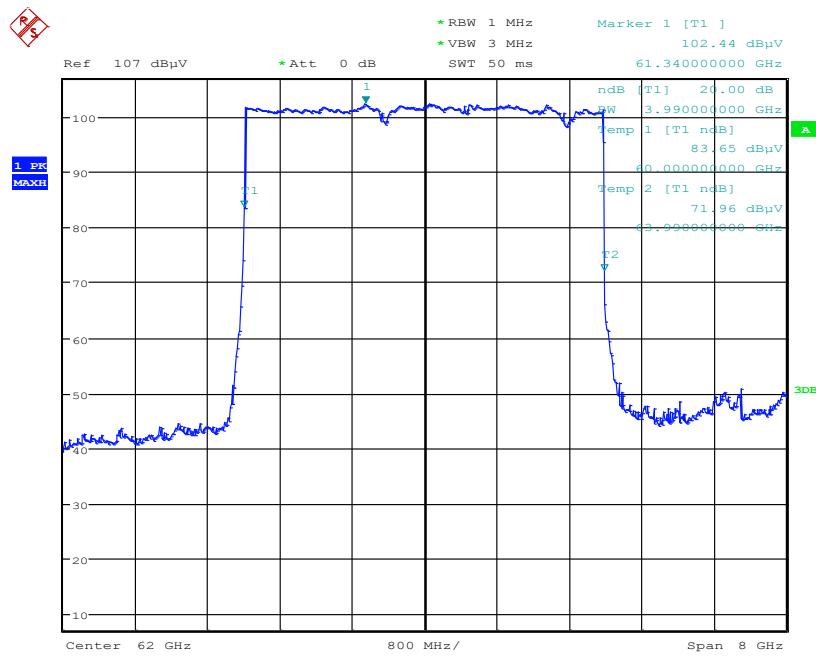
Date: 30.OCT.2020 16:16:50

30 °C



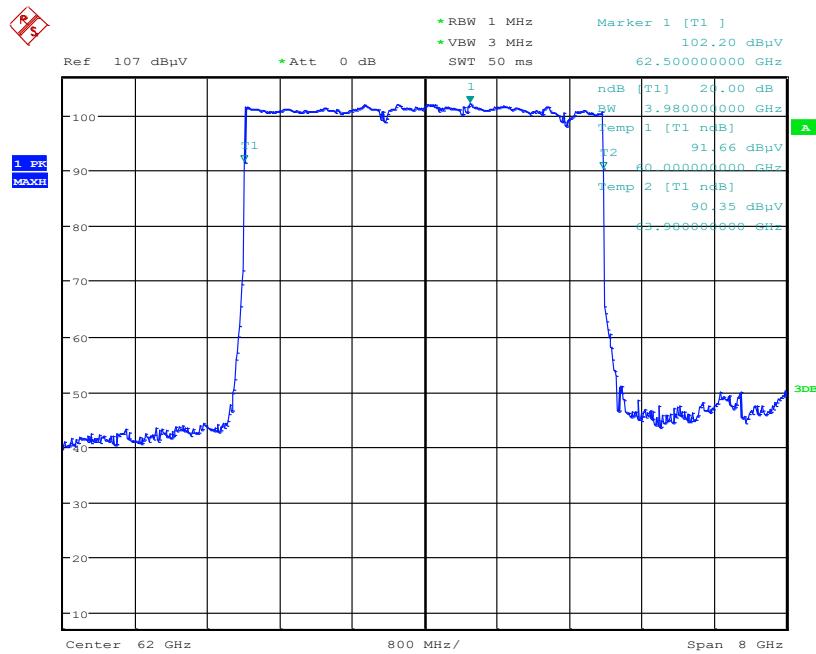
Date: 2.NOV.2020 09:38:35

40 °C



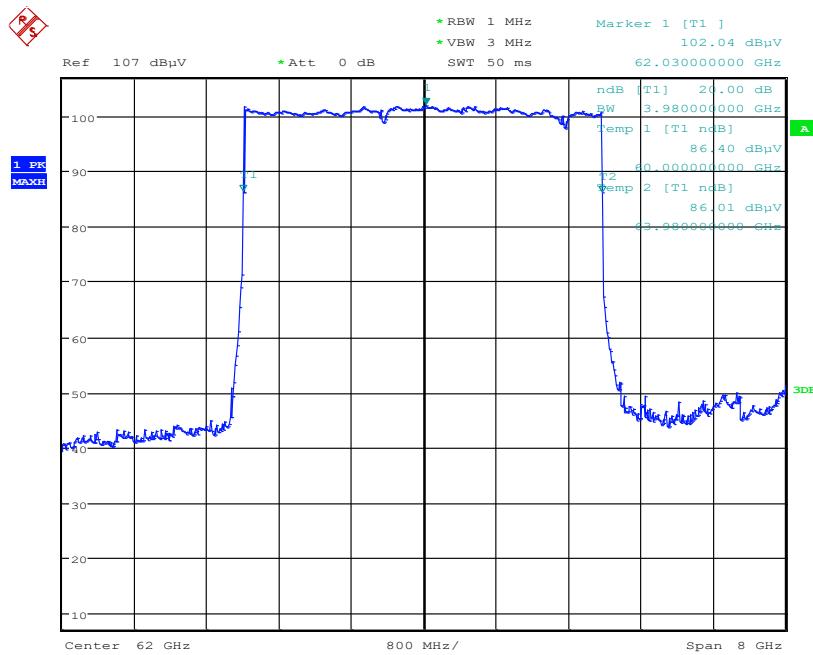
Date: 2.NOV.2020 10:01:10

50 °C



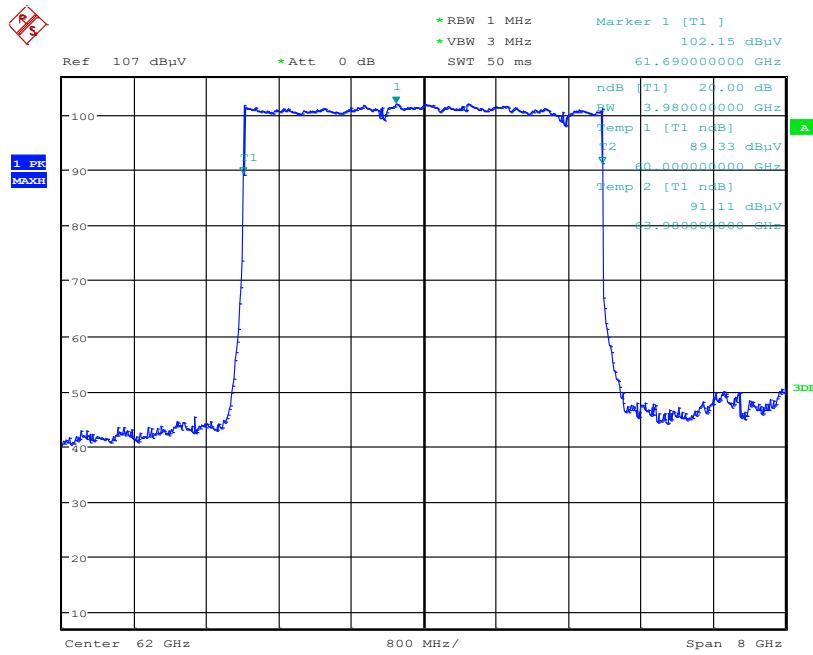
Date: 2.NOV.2020 10:27:27

102 V



Date: 2.NOV.2020 10:53:11

138V



Date: 2.NOV.2020 10:58:56

## **11 Annex A - EUT Test Setup Photographs**

Please refer to the attachment.

## **12 Annex B - EUT External Photographs**

Please refer to the attachment.

## **13 Annex C - EUT Internal Photographs**

Please refer to the attachment.

## 14 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 2<sup>nd</sup> day of October 2018.

A blue ink signature of a person's name, appearing to read 'John Doe'.

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 3297.02  
Valid to November 30, 2020  
Revised August 31, 2020

*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 ---