FCC PART 15, SUBPART C
ISED RSS 210 ISSUE 10 (DECEMBER 2019)

TEST REPORT

For

Infinition Inc

2965 rue des Prairies
Trois-Rivieres QC G8V1W4 Canada

FCC ID: PDG-LBRLX
IC: 12550A-LBRLX

Report Type:	**Product Type:**
Original Report	Instrumentation Device

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Report Number:	R2308184-255
Report Date:	2024-05-03
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CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2403184-255	Original Report	2024-05-03

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test report was prepared on behalf of *Infinition Inc,* and their product model: Lab Radar LX, *FCC ID: PDG-LBRLX, IC: 12550A-LBRLX*. The "EUT" as referred to in this report. The EUT is a Instrumentation Device which operates in the 57-64 GHz spectrum and is a field disturbance radar intended to be used outdoors. The radar also will co-locate with a BLE module (FCC ID: X8WBT832, IC: 4100A-BT832).

1.2 Mechanical Description of EUT

The EUT measures approximately 6 cm (L) x 7 cm (W) x 6 cm (H)

The data gathered is from a production sample provided by Infinition Inc with BACL assigned serial numbers: R2403184-1

1.3 Objective

This report was prepared on behalf of *Infinition Inc*, in accordance with Part 15 Subpart C of the Federal Communication Commission's rules as well as ISED RSS-210 Issue 10 (December 2019).

The objective was to determine compliance with ISED RSS-210 and FCC Part 15, Subpart C for Peak Fundamental Emission, Antenna Requirements, RF Exposure, Frequency Stability and Radiated Spurious Emissions. In addition, co-location was evaluated for the radar's performance alongside other two modules listed in section 1.1.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

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

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 º C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.7 Test Facility Registrations

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

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

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

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

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- *An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2017 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 17025:2017 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 17025:2017 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.

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

2.2 EUT Exercise Software

Test Software was verified to be compliant with the standard requirements being tested against. The following configurations were set for testing, and the corresponding power settings used are listed below.

Radio	Frequency (GHz)	Power Setting
Radar	61.2	Default
	61.44	Default
BLE	2.402	Default

2.3 Modulation Characteristics

Per FCC §2.1047(d) *Other types of equipment*: A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

Information pertaining to the radar listed below as declared by customer:

Parameter	Radar technical information
Number of channels	2
Modulation	CW

2.4 Equipment Modifications

None

2.5 Remote Support Equipment

None

2.6 Local Support Equipment

None

2.7 Interface Ports and Cabling

None

2.8 Far-Field Calculations

Antenna Model	Frequency Range (GHz)	Measurement Antenna		
		D (meters)	λ (meters)	R_m (meters)
M19RH	40-60	0.04625	0.004997	0.86
M12RH	60-90	0.03002	0.003331	0.54
M08RH	90-140	0.01969	0.002141	0.36
M05RH	140-162	0.01255	0.001852	0.17
	162-220	0.01255	0.001364	0.23

Note: Far-Field (Rayleigh) distance formula used is shown below (According to ANSI C63.26-2015 Section 4.4.3 Note f)

$$R_m = 2D^2 / \lambda$$

, where the R_m is the Rayleigh (far-field) distance, D is the largest dimension of the antenna aperture and λ is the free-space wavelength in meters at the frequency of measurement (calculated by speed of light divided by frequency).

Note: Measurements in report were made at distances greater than calculated far-field distances shown in table

3 Summary of Test Results

Results reported relate only to the product tested.

FCC/IC Rules	Description of Test	Results
FCC §15.203, §15.255(c), §2.909, ISEDC RSS-GEN §6.8	Antenna Requirement	Compliant
FCC §15.255(g), §1.1307(b), §1.1310, §2.1091 & ISEDC RSS-102	RF Exposure	Compliant
FCC §15.207, ISEDC RSS-GEN §8.8	AC Line Conducted Emissions	Compliant
FCC §15.255(d) & ISEDC RSS-210 (J.3), RSS-Gen §8.1,8.9,8.10	Radiated Spurious Emissions	Compliant
FCC §15.255(f), ISEDC-RSS 210 (J.6), RSS-Gen §8.11	Frequency Stability	Compliant
FCC §15.215(c), ISEDC-RSS 210 (J.6)	20dB Bandwidth	Compliant
FCC §15.255(c)(2), ISEDC RSS-210 (J.2)	Radiated Power limits	Compliant

BACL is responsible for all the information provided in this report, except when information is provided by the customer as identified in this report. Information provided by the customer, e.g., antenna gain, can affect the validity of results.

4 FCC §15.203, §15.255(c)(1)(B) & ISEDC RSS-GEN §6.8- Antenna Requirements

4.1 Applicable Standards

According to FCC §15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.255(c)(1)(B), the provisions of § 15.204(c)(2) and (4) that permit the use of different antennas of the same type and of equal or less directional gain do not apply to intentional radiator systems operating under this provision. In lieu thereof, intentional radiator systems shall be certified using the specific antenna(s) with which the system will be marketed and operated. Compliance testing shall be performed using the highest gain and the lowest gain antennas for which certification is sought and with the intentional radiator operated at its maximum available output power level. The responsible party, as defined in § 2.909 of this chapter, shall supply a list of acceptable antennas with the application for certification.

According to ISEDC 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 isotopically 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 license-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter 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

External/Internal/Integral	Total Antenna Gain (dBi)	Antenna Type
Integral	11	Patch

The antenna is factory-installed and is not modifiable by users.

5 FCC §255(g), §2.1091, §1.1310(d) (3) & RSS-102 - RF Exposure

5.1 Applicable Standards

As per FCC §15.255(g): Radio frequency devices operating under the provisions of this part are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 1.1310, 2.1091, and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements. Technical information showing the basis for this statement must be submitted to the Commission upon request.

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^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*($900/f^2$)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) 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
300-1,500			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:

2.5.2 Exemption Limits for Routine Evaluation — RF Exposure Evaluation

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

- below 20 MHz Footnote6 and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 4.49/*f*0.5 W (adjusted for tune-up tolerance), where *f* is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 *f*0.6834 W (adjusted for tune-up tolerance), where *f* is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

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

5.2 MPE Prediction

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

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

Where: S = power density
EIRP = Effective Isotropic Radiated Power
R = distance to the center of radiation of the antenna

5.3 MPE Results for the FCC

Radar Standalone

Maximum EIRP (dBm):	32
Maximum EIRP (mW):	1584.89
Prediction distance (cm):	20
Prediction frequency (MHz):	61200
Power density of prediction frequency at 20 cm (mW/cm^2):	0.315
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the FCC requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.315mW/cm^2. Limit is 1.0 mW/cm^2.

Worst Case Co-location MPE Calculation

Radio	Max EIRP (dBm)	Evaluated Distance (cm)	Worst-Case Exposure Level [mW/cm^2]	Limit [mW/cm^2]	Worst-Case Ratios	Sum of Ratios	Limit
Worst Case							
BLE	5.82	20	0.0008	1.0	0.08%	31.6%	100%
Radar	32	20	0.315	1.0	31.5%		

Note: For BLE data referenced above, please refer to original FCC certification's MPE calculations

5.4 MPE Results for IC

Radar

The EIRP of this device is 32 dBm (1.58 W) which is less than the exemption threshold, i.e., 5W. Therefore, the RF exposure evaluation is exempt.

BLE

The EIRP of this device is 5.82 dBm (3.82 mW) which is less than the exemption threshold, i.e., 1.31*10^(-2) * f^(0.6834)=2.68W. Therefore, the RF exposure evaluation is exempt.

Sum of Ratios: 1.58/5 + 0.00382/2.68 = 0.317 < 1

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

6.1 Applicable Standards

As per FCC §15.207 and ISEDC RSS-Gen Section 8.8: Conducted limits

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

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

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

6.2 Test Setup

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

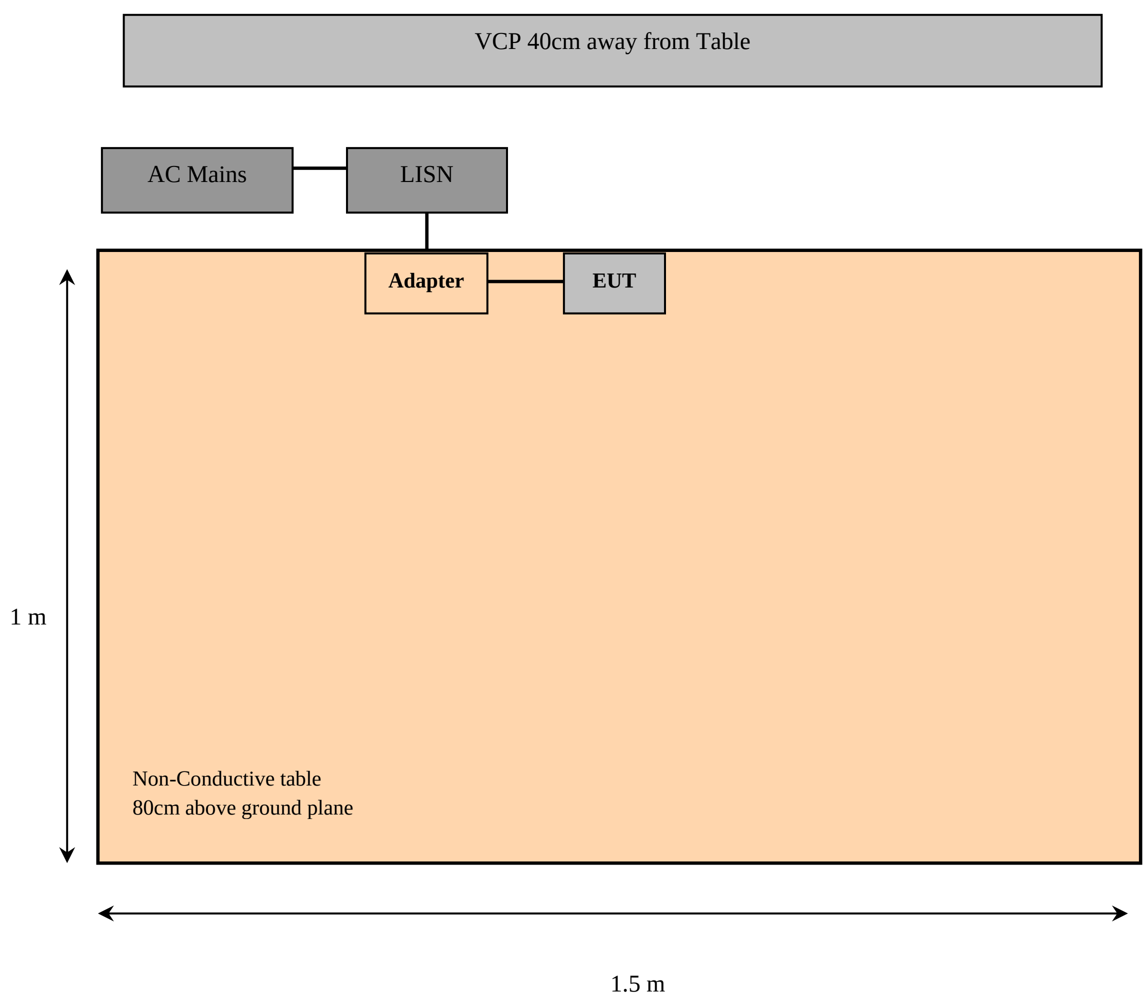
$$CA = Ai + CL + Atten$$

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

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
310	Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2023-05-11	1 year
680	Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101964	2024-03-22	1 year
724	Solar Electronics Company	High Pass Filter	Type 7930-100	7930150202	2024-03-22	1 year
732	FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2023-09-12	1 year
1425	Fairview Microwave	Micro-Coax Cable	FMC0101223-240	210241	2024-01-12	1 year
348	California Instruments	AC Power Source	5001ix-208	57079	Calibration not Required	Calibration not Required

Note[1]: cables, attenuators and notch filters included in the test set-up were 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".*

6.7 Test Environmental Conditions

Temperature:	21.9 to 22.0ºC
Relative Humidity:	49.6 to 50.4%
ATM Pressure:	101.9 kPa

The testing was performed by Libass Thiaw from 04-11-2024 on ground plane

6.8 Summary of Test Results

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

Worst Mode

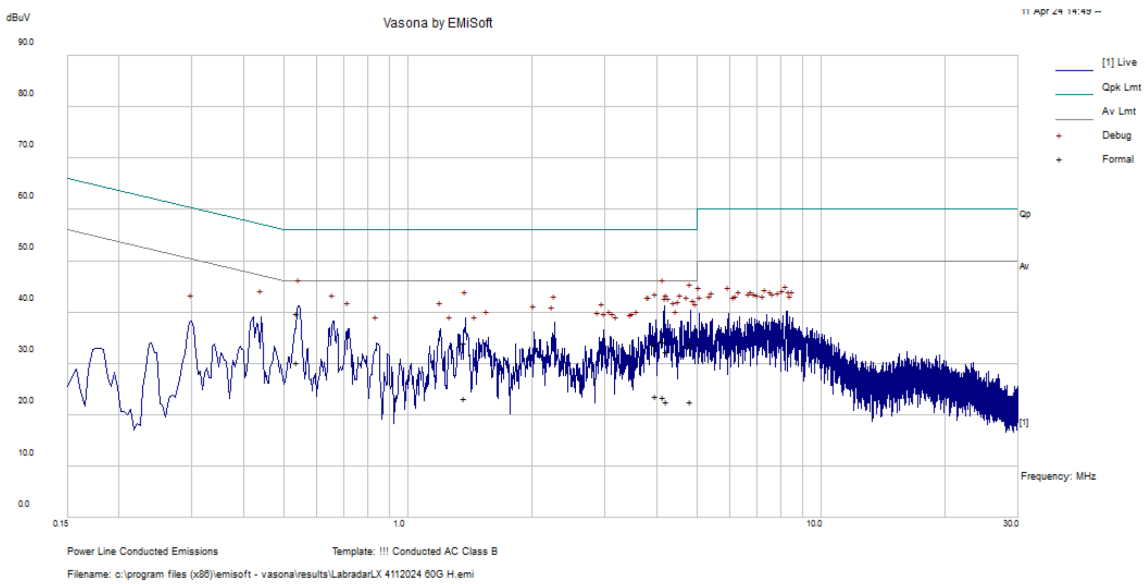
Worst Case – AC Line: 120 V, 60 Hz			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Hot/Neutral)**	**Range (MHz)**
-12.54	0.419658	Hot	0.15 to 30

Please refer to the tables and plots in the next section for detailed test results.

6.9 Conducted Emissions Test Plots and Data

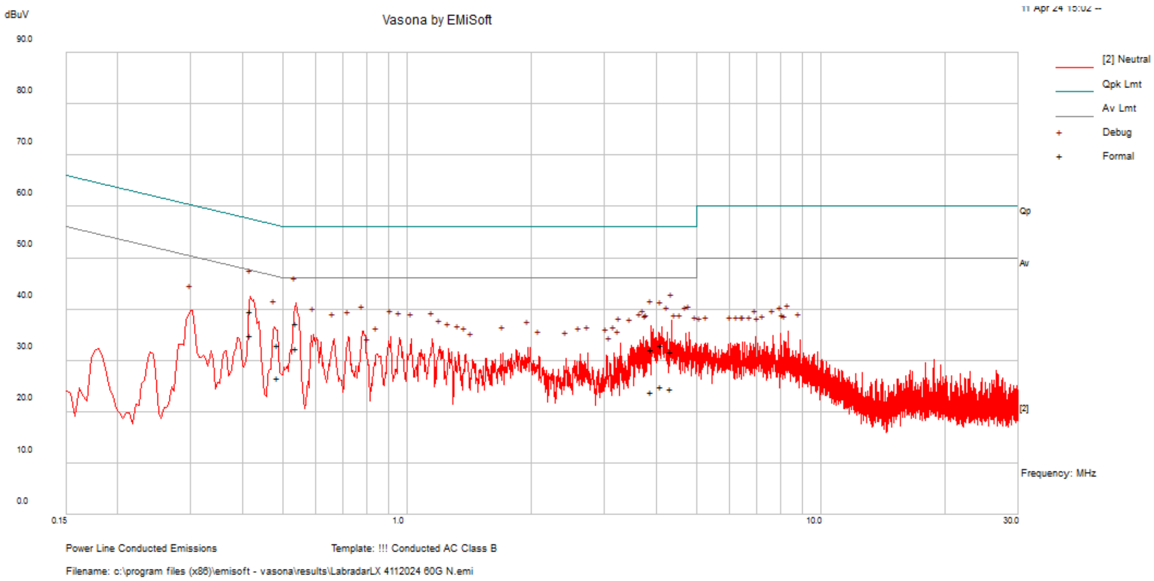
TX at 61.2 GHz + BT

AC Line: 120 V, 60 Hz – Hot Conductor



Frequency (MHz)	Ai. Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBμV)	Limit (dBμV)	Margin (dB)	Detector
4.152302	24.15	10.1	34.25	56	-21.75	QP
0.540085	29.54	10.22	39.76	56	-16.24	QP
4.832691	23.78	10.1	33.88	56	-22.12	QP
1.376134	23.97	10.16	34.13	56	-21.87	QP
3.989462	23.75	10.11	33.86	56	-22.14	QP
4.247295	22.15	10.1	32.25	56	-23.75	QP
4.152302	13.41	10.1	23.51	46	-22.49	Ave
0.540085	19.98	10.22	30.2	46	-15.8	Ave
4.832691	12.39	10.1	22.49	46	-23.51	Ave
1.376134	13.1	10.16	23.26	46	-22.74	Ave
3.989462	13.45	10.11	23.56	46	-22.44	Ave
4.247295	12.56	10.1	22.66	46	-23.34	Ave

AC Line (via AC/DC Adapter): 120 V, 60 Hz – Neutral Conductor



Frequency (MHz)	Ai. Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.540578	27.03	10.22	37.25	56	-18.75	QP
0.419658	29.1	10.38	39.48	57.45	-17.97	QP
4.347558	21.53	10.11	31.64	56	-24.36	QP
3.884613	22.09	10.11	32.2	56	-23.8	QP
4.120149	22.84	10.1	32.94	56	-23.06	QP
0.487084	22.8	10.14	32.94	56.22	-23.28	QP
0.540578	22.1	10.22	32.32	46	-13.68	Ave
0.419658	24.53	10.38	34.91	47.45	-12.54	Ave
4.347558	14.35	10.11	24.46	46	-21.54	Ave
3.884613	13.71	10.11	23.82	46	-22.18	Ave
4.120149	14.75	10.1	24.85	46	-21.15	Ave
0.487084	16.53	10.14	26.67	46.22	-19.55	Ave

7 FCC §15.255(c)(2) & ISEDC RSS-210 (J.2)- Radiated Power Limits

7.1 Applicable Standards

According to FCC §15.255(c)(2)(v): 61.0-61.5 GHz: For field disturbance sensors/radars that occupy 500 MHz bandwidth or less that are contained wholly within the frequency band 61.0-61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

According to ISEDC RSS-210:

J.2 Limits of radiated emissions within the band 57-71 GHz
Within the band 57-71 GHz, the power of any emissions, measured during the transmit interval, shall comply with the e.i.r.p. limits in this section.

For the purpose of this annex, the terms “average e.i.r.p.” and “peak e.i.r.p.” refer to e.i.r.p. with transmitter output power measured in terms of average value or peak value respectively

J.2.1 Fixed field disturbance sensors and interactive motion sensors

Following are the conditions for fixed field disturbance sensors and interactive motion sensors:

For fixed field disturbance sensors that occupy a bandwidth of 500 MHz or less and for which the bandwidth is contained wholly within the frequency band 61.0-61.5 GHz, the equipment’s average and peak e.i.r.p. in the channel bandwidth shall not exceed 40 dBm and 43 dBm respectively. In addition, the average and peak e.i.r.p. of any emission outside of the band 61.0-61.5 GHz, but still within the band 57-71 GHz, shall not exceed 10 dBm and 13 dBm respectively.

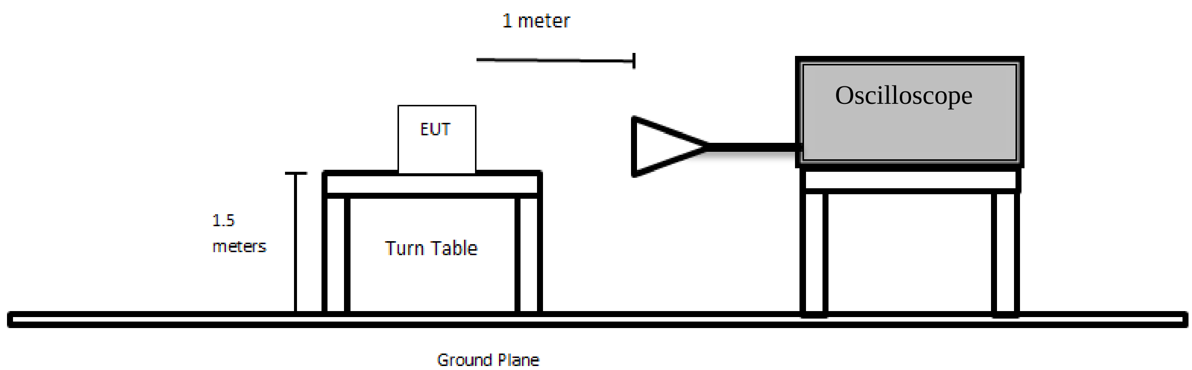
7.2 Measurement Procedure

Based on ANSI C63.10-2013 Subclause 9.11, the following procedure was followed:

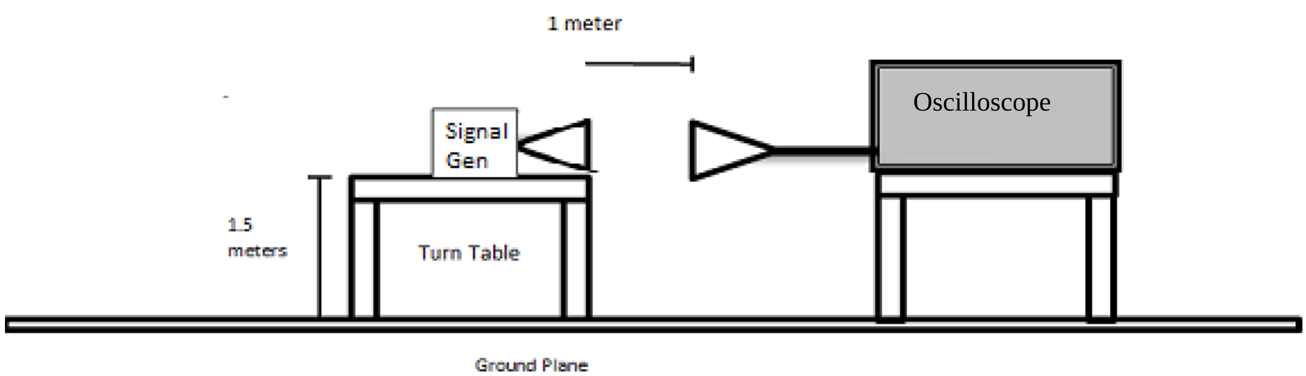
a) For all measurements, measure the level of the emission using substitution as follows:
   1) Record the average and peak voltages from the DSO with the EUT placed in front of measurement of antenna connected to DSO.
   2) Remove the EUT from the path of the measurement antenna.
   3) Connect a mm-wave 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 in step e1).
   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 steps e3) through e9) for the average voltage recorded in step e1).
   11) The resulting value is the applicable radiated power.

7.3 Test Setup Block Diagram

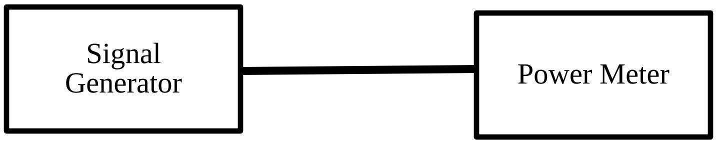
Substitution method part 1:



Substitution method part 2:



Substitution method part 3:



7.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
54	Tektronix	Oscilloscope	TDS7104	B020557	2024-04-04	1 year
861	OML Inc.	Horn Antenna	M12RH	17061501	N/R	N/A
1130	Aglient	MXG Signal Generator	N5183A	MY50140453	2023-10-31	1 year
1223	OML Inc.	Millimeter Wave Source Module	S12MS-A	210801-1	N/R	N/A
1385	Eravant	Band Amplitude Detector	SFD-5053753-15SF-N1	29186-01	N/R	N/A
1221	Agilent	Power Sensor	V8486A	MY53060009	2024-02-26	1 year
1231	Agilent	EPM Series Power Meter	E4419B	GB40202944	2023-04-25	1 year
-	-	RF cable	-	-	Each time[1]	N/A

Note[1]: equipment 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".*

7.5 Test Environmental Conditions

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

The testing was performed by Will Hu from 2024-04-08 to 2024-04-11 in 5 meter chamber 3.

7.6 Test Results

Peak Power

Frequency (GHz)	Oscilloscope Reading matched from EUT and substitution source (mV)	Measured Conducted Power from substitution source (dBm)	Substitution antenna gain (dBi)	Peak EIRP (dBm)	Peak EIRP Limit (dBm)
61.2	42.4	7.38	24.1	31.48	43
61.44	42.55	7.51	24.1	31.61	43

Average Power

Frequency (GHz)	Oscilloscope Reading (mV)	Measured Conducted Power from substitution source (dBm)	Substitution antenna gain (dBi)	Average EIRP (dBm)	Average EIRP Limit (dBm)
61.2	41.98	7.04	24.1	31.14	40
61.44	42.09	7.13	24.1	31.23	40

Note: EIRP (dBm) = Measured Conducted Power (dBm) + Substitution antenna gain (dBi)

8 FCC §15.255(d) & ISEDC RSS-210 (j) & RSS-Gen §8.1, 8.9, 8.10 – Spurious Radiated Emissions

8.1 Applicable Standards

As per FCC §15.255(d): Limits on spurious emissions:

(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/cm2 at a distance of 3 meters.

(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

According to ISEDC RSS-210 J.3: Spurious emissions
The power of any emissions outside the band 57-71 GHz shall consist solely of spurious emissions and shall not exceed:

a. the fundamental emission levels
b. the general field strength limits specified in RSS-Gen for emissions below 40 GHz
c. 90 pW/cm^2 at a distance of 3 m for emissions between 40 GHz and 200 GHz

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart C and ISEDC RSS-210 J.3, RSS-Gen 8.1,8.9,8.10 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.

8.3 Measurement Procedure

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

For radiated testing the EUT was set 3 or 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 and 1.5 meter above the ground plane for below and above 960 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 960 MHz:

Quasi Peak: RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 960 MHz:

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

Above 40GHz:

Per ANSI C63.10-2013 Section 9.9:

Maximize emissions as follows:
a) Connect the test antenna to the instrumentation system.
b) Place the EUT in a continuous transmission mode.
c) Set the instruments to the proper values.
d) For all tests, maintain the test antenna at a measurement distance less than or equal to the maximum measurement distance determined in 9.8.
e) Perform an exploratory search for emissions and determine the approximate direction at which each observed emission emanates from the EUT, as follows:
1) It is recommended that exploratory measurements be made at a closer distance than the validated maximum measurement distance. However, exercise care not to overload the measurement system when the test antenna is directed toward the main beam(s) of the EUT antenna.
2) Begin handheld measurements with the test antenna in a horizontally polarized position.
3) Scan the test antenna around all surfaces of the EUT, keeping the test antenna at a separation distance equal to the selected measurement distance, except increase the distance as needed to prevent measurement system overload when the test antenna is directed to the main beam(s) of the EUT antenna.
4) As the surfaces of the EUT are scanned, keep the test antenna pointed toward the EUT.
5) As the surfaces of the EUT are scanned, vary the test antenna polarization by rotating through at least 0° to 180° to cover all possible polarizations of the emission.
6) For each observed emission, note the approximate test antenna position at which the maximum level occurs.
7) Where applicable, using two active traces on a spectrum analyzer (one set to clear-write, the second set to max-hold) can aid the process.
f) For each emission observed, perform a final measurement as follows:
1) Begin with the test antenna at the approximate position where the maximum level occurred during the exploratory scan.
2) Move the test antenna away from the EUT, to the maximum measurement distance, if it is still possible to observe the emission at this distance and the emission has a signal-to-noise ratio of at least 6 dB. Otherwise,

move the test antenna away from the EUT to the distance at which the signal-to-noise ratio of the emission is 6 dB.
3) Slowly scan the test antenna around this position, slowly vary the test antenna polarization by rotating through at least 0° to 180°, and slowly vary the orientation of the test antenna (e.g., so that it is not always pointing directly at the EUT) to find the final position, polarization, and orientation at which the maximum level of the emission is observed.
Record the measured reading with the test antenna fixed at this maximized position, polarization, and orientation. Record the measurement distance.

> Note: Pre-scan was performed in order to determine worst-case orientation of device (shown in Test Setup Photos) with respect to measurement antenna. Plots/data shown represent measurements made in worst-case orientation.

Per ANSI C63.10-2013 Section 9.12:

The following procedure shall be used for measuring harmonic and spurious emissions for frequencies above 40 GHz:

a. Connect the test antenna covering the appropriate frequency range to a spectrum analyzer via an external mixer or directly to the spectrum analyzer if the instrument supports the required frequency range.
b. Set spectrum analyzer RBW = 1 MHz, VBW = 1 MHz or 3 MHz (as specified in the requirements), average detector, span as required, and so on.
c. Determine the maximum measurement distance using 9.8.
d. Search for emissions over the mixer band and maximize all observed emissions using 9.9.
e. Note the maximum power indicated on the spectrum analyzer. Adjust this reading, if necessary, by the conversion loss of the external mixer used at the frequency under investigation and the external mixer IF cable loss.
f. Calculate the maximum field strength of the emission at the measurement distance using Equation (19) and the adjusted/corrected power at the output of the test antenna.
g. Where applicable, calculate the EIRP from the measured field strength using Equation (22) and then convert to the linear form using Equation (24).
h. If measurements were made at any distance other than the distance specified by the limit, then extrapolate the maximum measured field strength to the field strength at the distance specified by the limit using Equation (20), and then convert to the field strength in V/m using Equation (21).
i. Where applicable, calculate the power density at the distance specified by the limit from the field strength at the distance specified by the limit using Equation (26).
j. Repeat the preceding sequence for every emission observed in the frequency band under investigation.
k. Repeat the preceding sequence for every external mixer band as needed to encompass the required frequency range of investigation (as specified by the regulatory requirements to which compliance is being tested).
l. Repeat the preceding sequence in all operating configurations supported by the EUT (e.g., forward-looking, side-looking, and rear-looking configurations, with the vehicle at rest and in motion)

8.4 Corrected Amplitude and Margin Calculation

For emissions below 1 GHz,

The Corrected Amplitude (CA) is calculated by adding the Correction Factor to the S.A. Reading. The basic equation is as follows:

CA = S.A. Reading + Correction Factor

For example, a corrected amplitude of 40.3 dBuV/m = S.A. Reading (32.5 dBuV) + Correction Factor (7.8 dB/m)

The Correction Factor is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) together. This calculation is done in the measurement software, and reported in the test result section. The basic equation is as follows:

Correction Factor = AF + CL + Atten – Ga

For emission above 1 GHz up to 40GHz,

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

CA = Ai + AF + CL + Atten – Ga

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

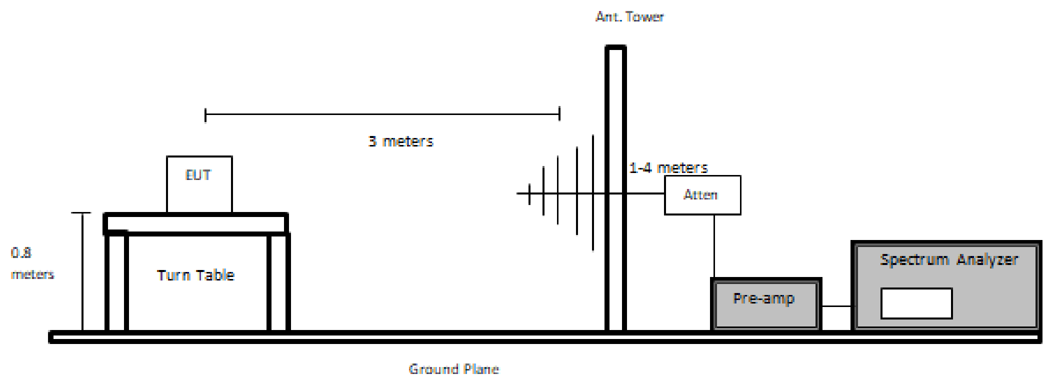
The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

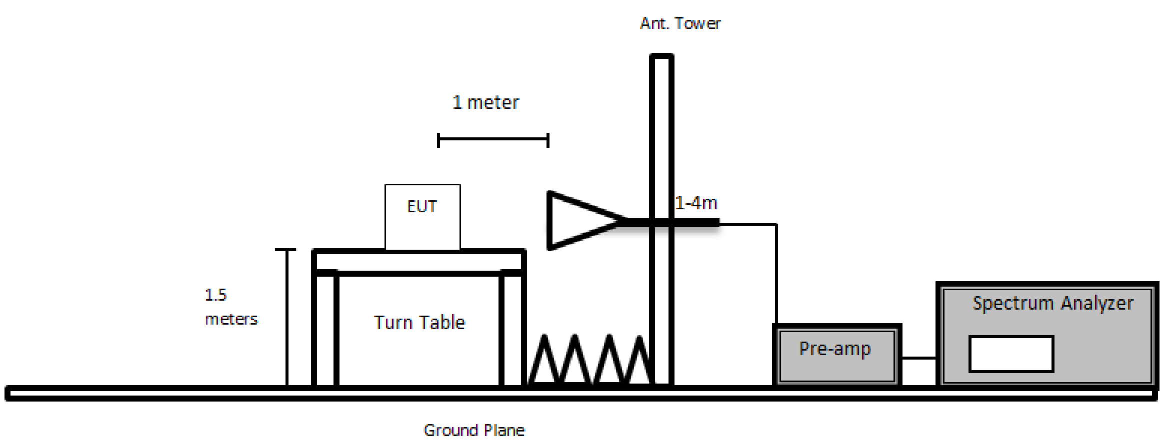
For corrections above 40GHz, please refer to notes in section 7.10

8.5 Test Setup Block Diagram

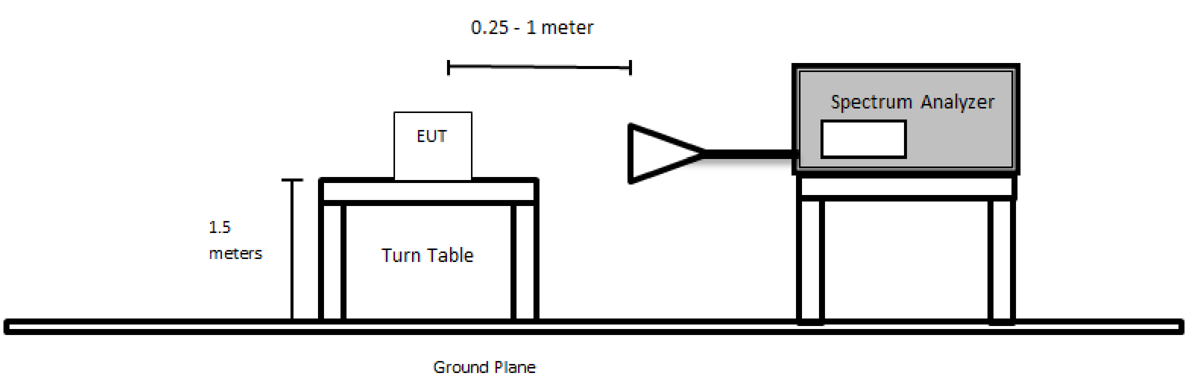
Below 1GHz:



1-40 GHz:



Above 40 GHz:



8.6 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
310	Rohde & Schwarz	EMI test receiver 9 KHZ to 3 GHZ	ESCI 1166.5950.03	100338	2023-05-11	1 year
624	Agilent	Spectrum Analyzer	E4446A	MY48250238	2023-05-12	1 year
327	Sunol Sciences	System Controller	SC110V	122303-1	N/R	N/R
1075	Sunol Sciences	Boresight Tower	TLT3	050119-7	N/R	N/R
1388	Sunol Sciences	Flush Mount Turntable	FM	112005-2	N/R	N/R
393	Com-Power	Active Loop Antenna	AL-130	17043	2023-05-26	2 years
321	Sunol Sciences	Biconilog Antenna	JB3	A020106-2; 1504	2023-12-18	2 years
1192	ETS Lindgren	Horn Antenna	3117	00218973	2022-09-29	2 years
91	Wisewave	Horn Antenna	ARH-4223-02	10555-02	2024-03-14	2 years
230	Wisewave	Horn Antenna	ARH-2823-02	10555-02	2024-03-14	2 years
316	Sonoma Instruments	Preamplifier 10 kHz - 2.5 GHz	317	260406	2024-02-27	6 months
658	HP/Agilent	Preamplifier	8449B OPT HO2	3008A0113	2023-12-01	1 year
827	AH Systems	Preamplifier	PAM 1840 VH	170	2023-11-08	1 year
1186	Pasternack	Coaxial Cable, RG214	PE3062-1050CM	N/A	2023-10-04	1 year
1247	Uti flex	Micro - Coax	N/A	N/A	2023-12-01	6 months
1248	Pasternack	RG214 COAX Cable	PE3062	N/A	2024-03-27	6 months
1249	time microwave	LMR-400 Cable Dc-3 GHz	AE13684	2k80612-5 6fts	2024-03-27	6 months
1346	RFMW	2.92mm 10ft RF cable	KMSE-160SAW-240.0-KSME	N/A	2023-11-03	6 months
1329	Pasternack	2.92mm short coaxial cable	PE360-12	N/A	2023-11-28	6 months
861	OML Inc.	Mixer and Horn Antenna set	M05HWA M08HWA M012HWA M19HWA M05RH M08RH M12RH M19RH	170615-1	N/R	N/A
-	-	RF cable	-	-	Each time[1]	N/A
672	Micro-Tronics	2.4-2.6 GHz Notch Filter	BRM50701	160	2024-03-06	1 year

Note[1]: 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".*

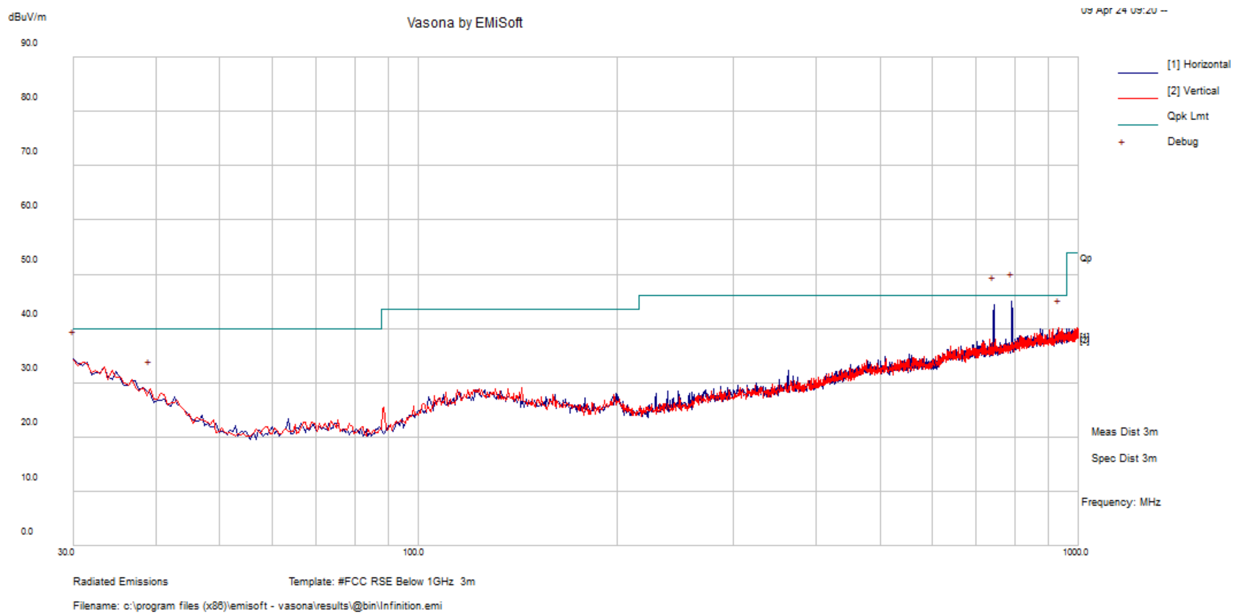
8.7 Test Environmental Conditions

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

The below 40 GHz tests were performed by Xavier Kelly from 2024-04-08 to 2024-04-10 in 5-meter chamber 3.
The above 40 GHz tests were performed by Will Hu from 2024-04-04 to 2024-04-05 in 5-meter chamber 3.

8.8 Test Results 30 MHz to 1 GHz measured at 3 meters

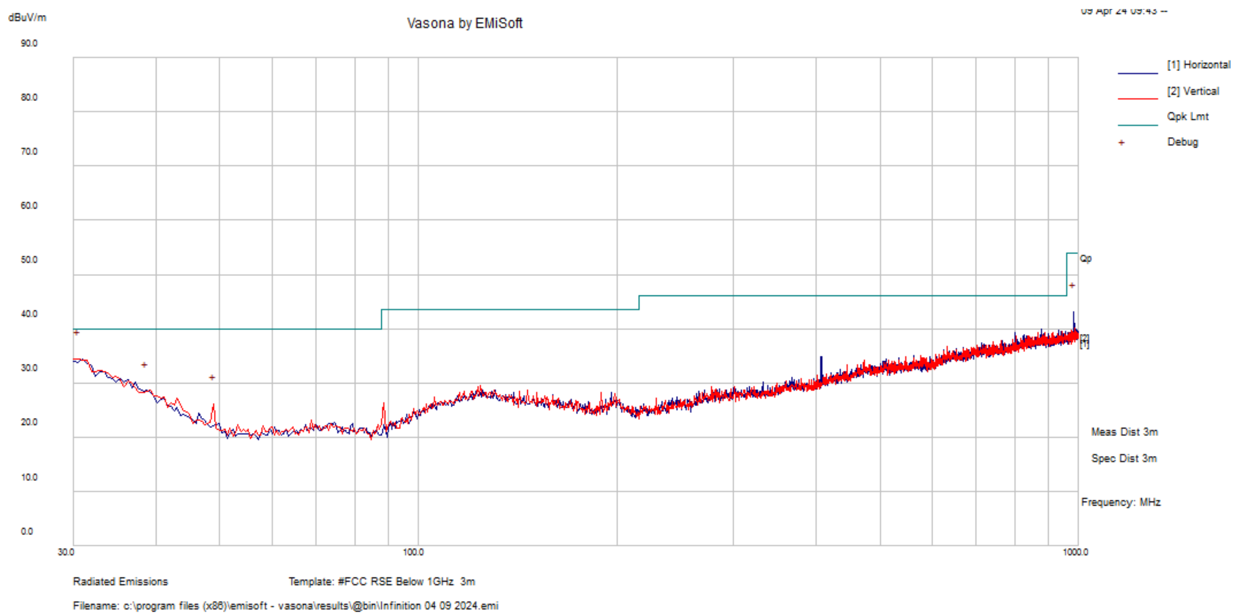
TX at 61.2 GHz + BT



Freq. (MHz)	S.A. Reading (dBµV)	Corr. Factor (dB/m)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
792.42	42.23	2.79	45.02	100	H	360	46	-0.98	Peaks
743.92	42.25	2.21	44.47	100	H	360	46	-1.53	Peak
30	35.37	-0.92	34.44	100	H	360	40	-5.56	Peak

Note: Peak measurements are used to compare to the quasi-peak limit to show compliance.

TX at 61.44 GHz + BT



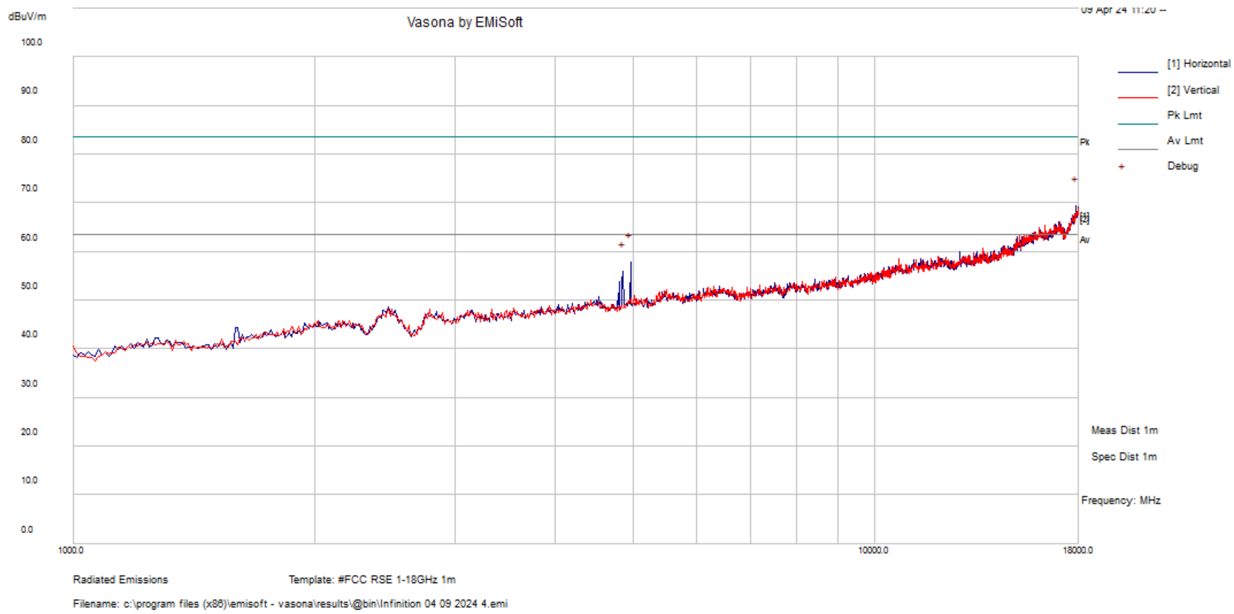
Freq. (MHz)	S.A. Reading (dBµV)	Corr. Factor (dB/m)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
30.485	35.75	-1.31	34.44	200	V	0	40	-5.56	Pass
983.51	37.97	5.17	43.14	100	H	0	54	-10.86	Pass
38.73	35.48	-6.9	28.58	100	H	0	40	-11.42	Pass
48.915	39.4	-13.22	26.18	100	V	0	40	-13.82	Pass

Note: Peak measurements are used to compare to the quasi-peak limit to show compliance.

8.9 Test Results above 1 GHz to 40 GHz measured at 1 meter

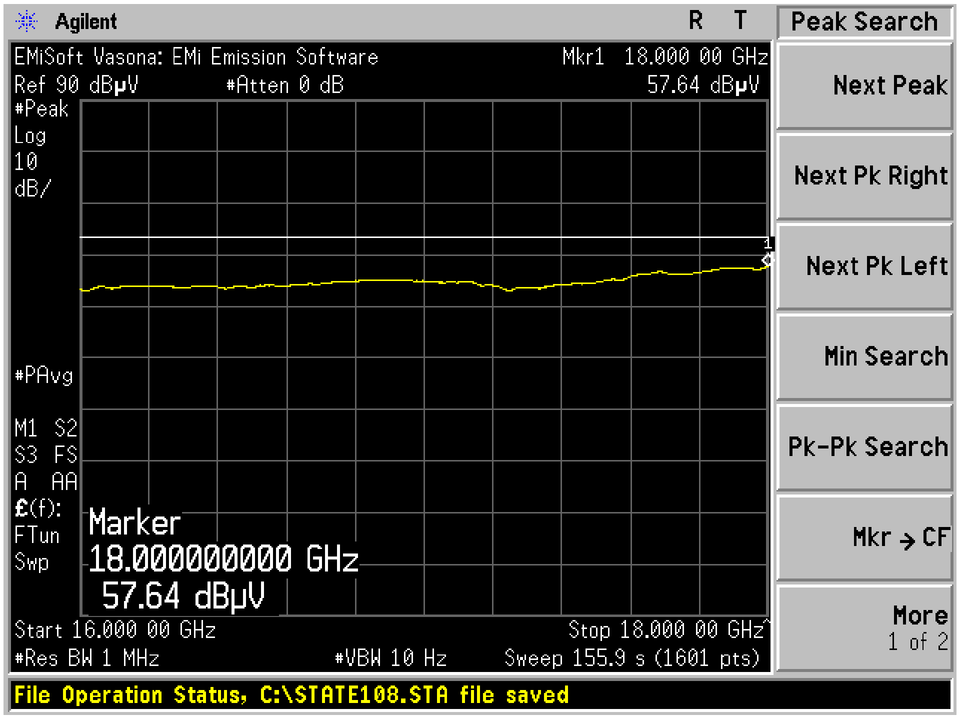
Note: For below spurious emissions, a peak detector was used in comparison to peak and average limits in order to show compliance. Where such a pre-scan exceeds the average limit, a formal measurement was performed.

Radar TX at 61.2 GHz + BT



Note: Above plot shows all peak emissions below 16GHz pass under average limit. Please refer to the next plot for 16 – 18 GHz results.

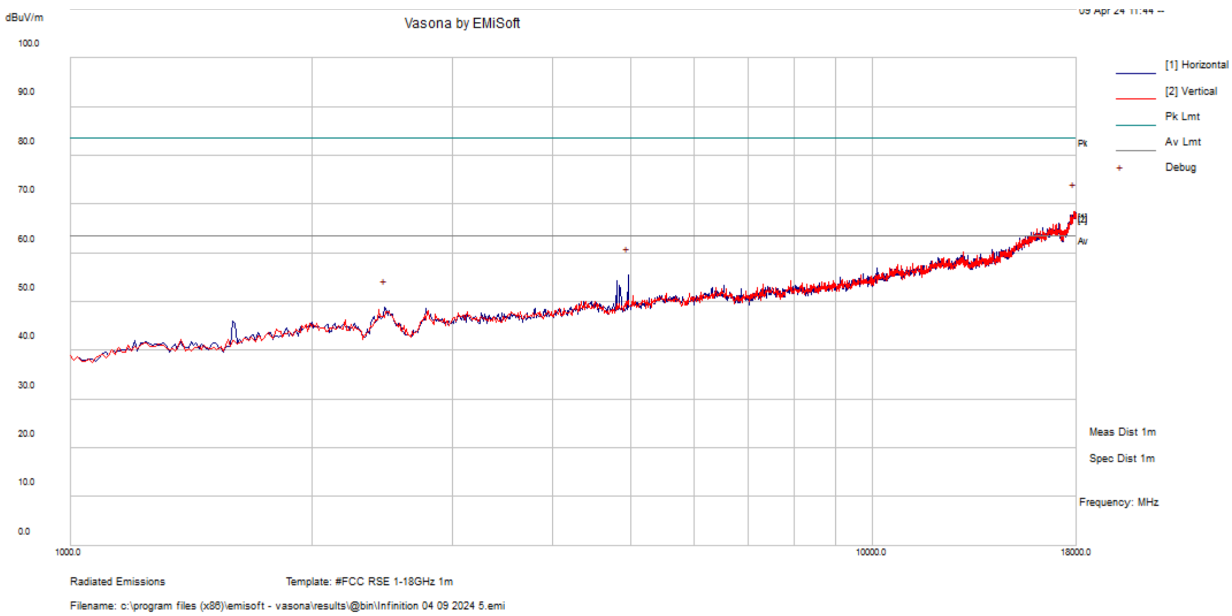
Average plot for 16 – 18 GHz



Note: above plot shows reduced VBW to make average measurements comparing to average limits and thus show compliance in range of 16-18GHz

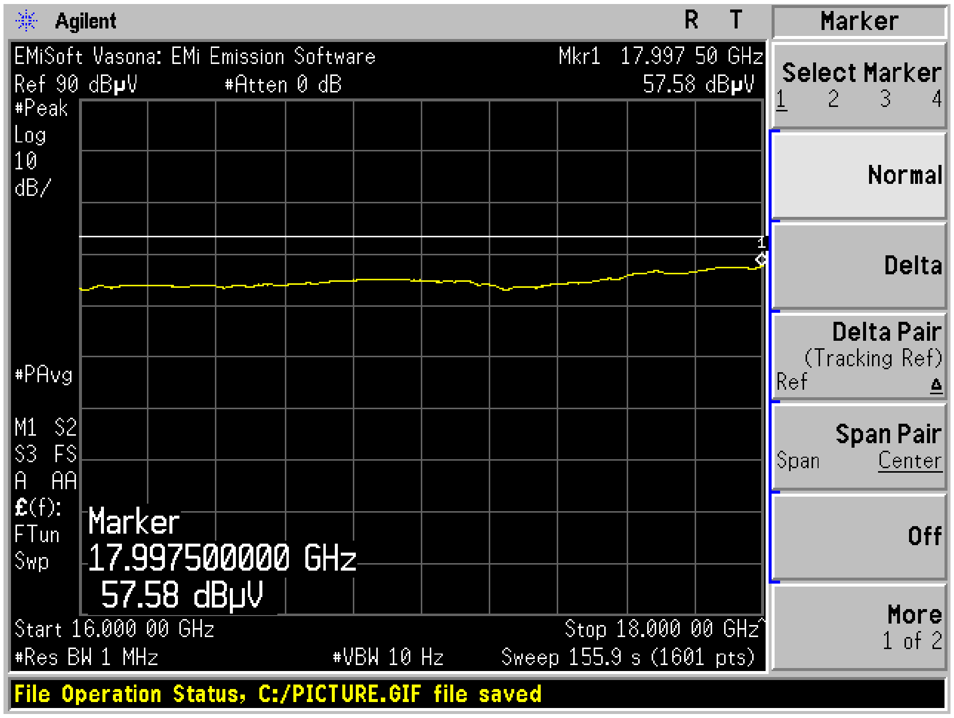
Frequency (MHz)	Corrected Amplitude (dBμV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)	Detector (Peak /Ave.)
18000	57.64	V	200	360	63.54	-5.90	Peak

Radar TX at 61.44 GHz + BT



Note: Above plot shows all peak emissions below 16GHz pass under average limit. Please refer to the next plot for 16 – 18 GHz results.

Average plot for 16 – 18 GHz

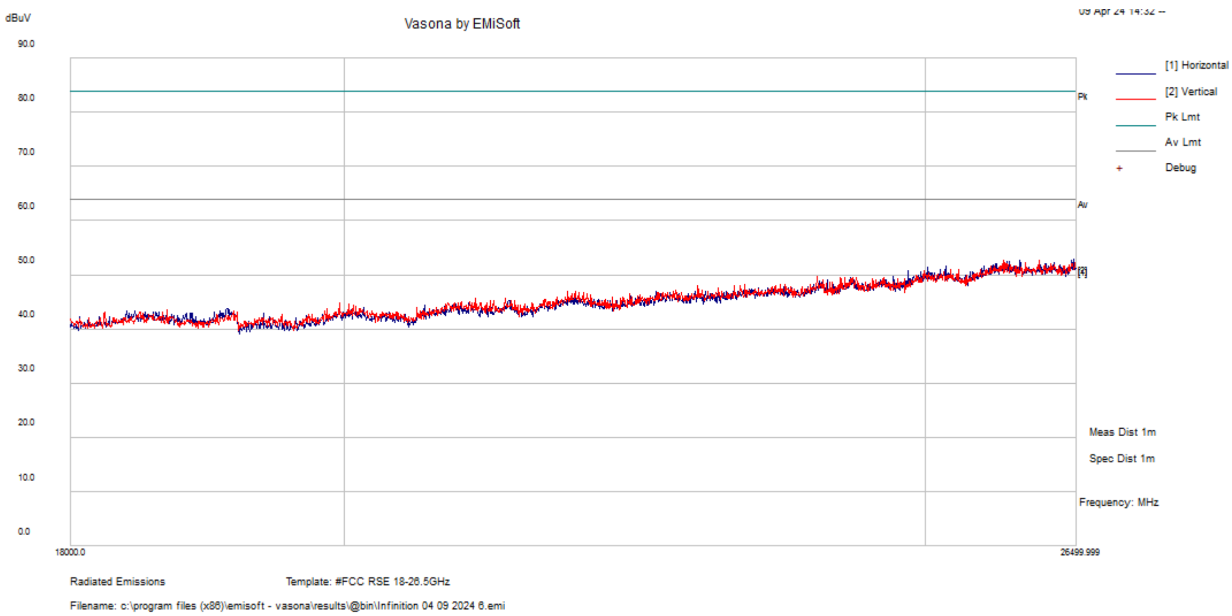


Note: above plot shows reduced VBW to make average measurements comparing to average limits and thus show compliance in range of 16-18GHz

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
17997.50	57.58	V	200	360	63.54	-5.96	Peak

18-26.5 GHz, measured at 1 meter:

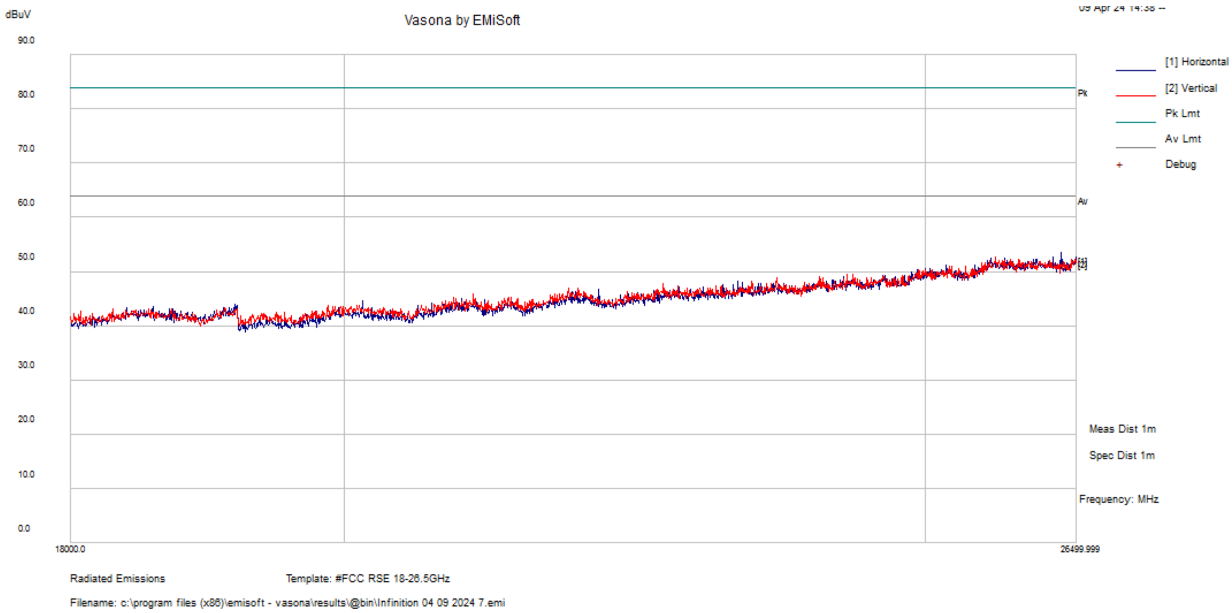
Radar TX at 61.2 GHz + BT:



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
25108.488	39.64	8.08	47.72	H	200	360	63.54	-15.82	Peak

Note: Peak measurement is compared to the average limit to show compliance.

Radar TX at 61.44 GHz + BT:

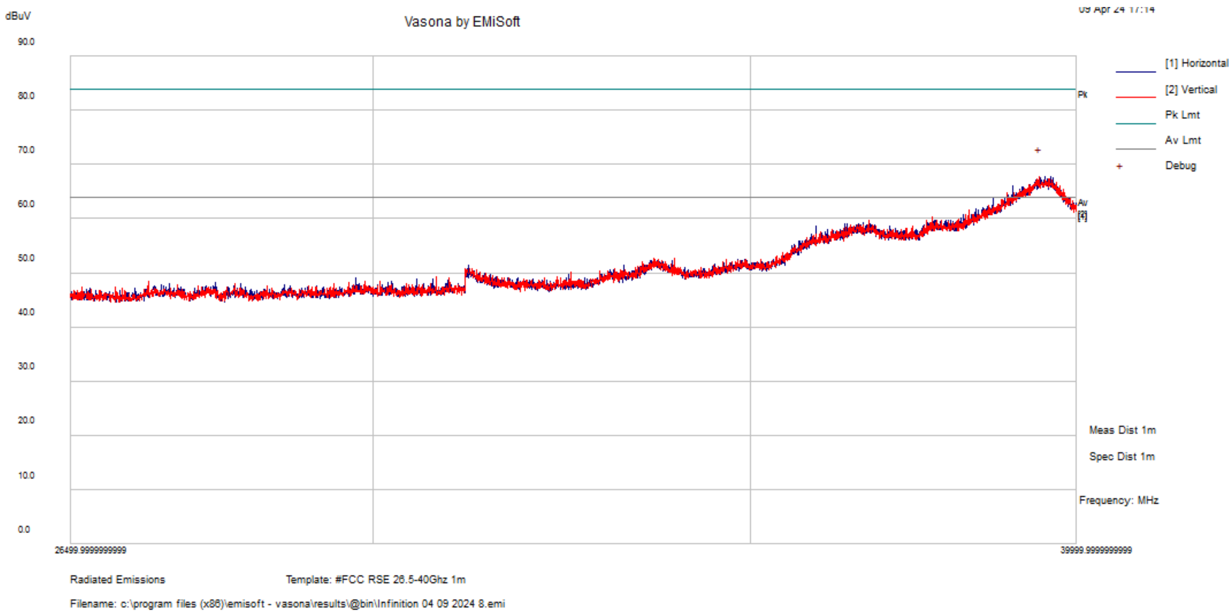


Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
25997.475	37.98	8.31	46.29	H	200	360	63.54	-17.25	Peak

Note: Peak measurement is compared to the average limit to show compliance.

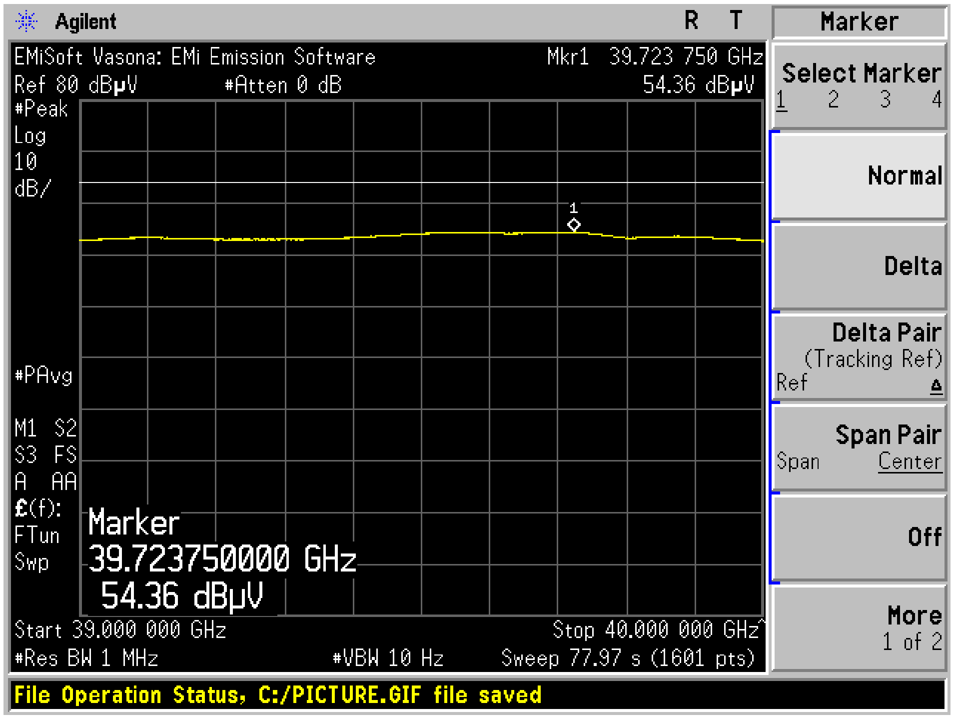
26.5-40 GHz, measured at 1 meter:

Radar TX at 61.2 GHz+ BT:



Note: Above plot shows all peak emissions below 39 GHz pass under average limits. Please refer to the next plot for 39 – 40 GHz results.

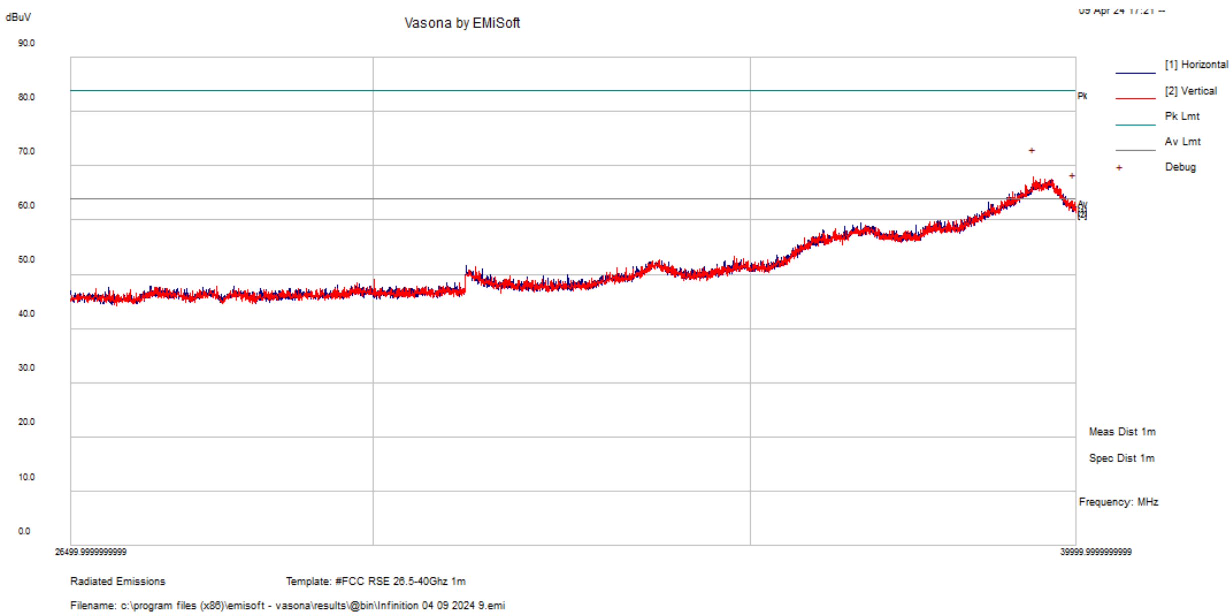
39 – 40 GHz Average Scan



Note: above plot shows reduced VBW to make average measurements comparing to average limits and thus show compliance in range of 39-40 GH

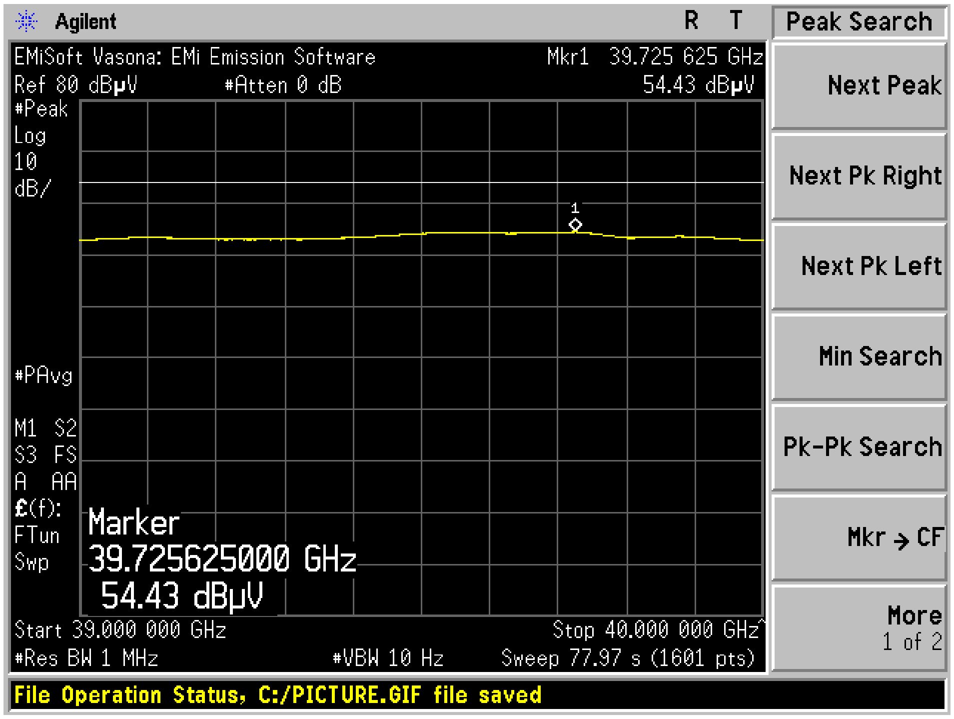
Frequency (MHz)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
39723.75	54.36	H	200	360	63.54	-9.18	Ave

Radar TX at 61.44 GHz



Note: Above plot shows all peak emissions below 39 GHz pass under average limits. Please refer to the next plot for 39 – 40 GHz results.

39 – 40 GHz Average Scan



Note: above plot shows reduced VBW to make average measurements comparing to average limits and thus show compliance in range of 39-40 GHz

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
39725.625	54.43	V	200	360	63.54	-9.11	Peak

8.10 Test Results 40 GHz to 200 GHz

Frequency Range (GHz)	Limit	
	(pW/cm^2) @ 3m	(dBm)
40-60	90	-9.85
60-90	90	-9.85
90-140	90	-9.85
140-200	90	-9.85

Unit conversion formulas for above limits:

unit	at 3m				dBm
	pW/cm2	mW/m2	V/m	dBuV/m	
value	90	0.0000009	0.018420098	85.3058386	-9.85
equation	-	pW/cm2*10^-8	(mW/m2*377)^0.5	20*log(V/m)+120	dBuV/m@3m+20log(3)-104.7

Note: For below spurious emissions, a peak detector was used in comparison to average limits in order to show compliance.
Note: The correction factors have been considered in the reference level offset as shown in the following measurement screenshots.
Note: Per ANSI C63.10-2013 Section 9.5, EIRP[dBm]= Field Strength [dBuV/m] + 20log(measurement distance[meters]) – 104.7
Note: Field Strength [dBuV/m] = dBuV + Equipment Factors [dB/m]
Note: Equipment Factors [dB/m] = Antenna Factor(dB/m) + path loss(dB)
Note: dBm = dBuV - 106.99dB
Note: Based on above, EIRP[dBm]= dBm + 2.29dB + Equipment Factors [dB/m] + 20log(measurement distance[meters])
Note: Therefore, 2.29dB + Equipment Factors [dB/m] + 20log(measurement distance[meters]) = offset [dB]

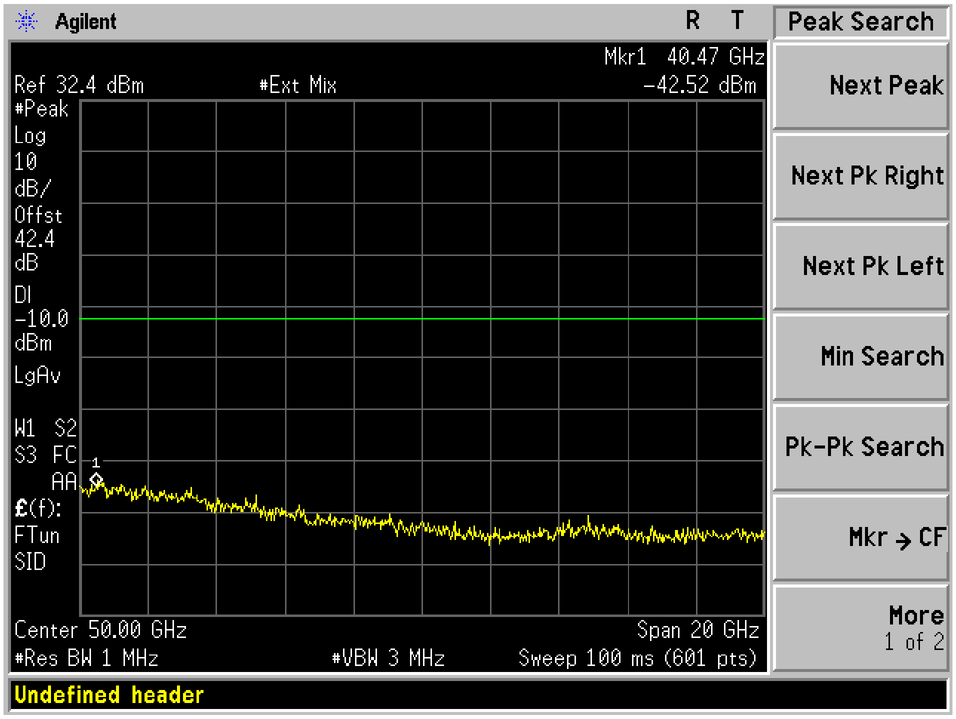
Frequency (GHz)	Correction Factor (dB/m)	Corrected Amplitude (dBm)	Limit (dBm)	Margin (dB)	Detector (Peak /Ave.)
TX 61.2 GHz					
40.47	42.4	-42.52	-9.85	-32.39	Peak
61.201	45.8	-34.27	-9.85	-24.14	Peak
90.17	49.5	-31.74	-9.85	-21.61	Peak
143.6	53.2	-28.41	-9.85	-18.28	Peak
TX 61.44 GHz					
40.47	42.4	-42.15	-9.85	-32.02	Peak
65.613	45.8	-37.64	-9.85	-27.51	Peak
90.17	49.5	-33.30	-9.85	-23.17	Peak
143.73	53.2	-29.00	-9.85	-18.87	Peak

Please refer to the following plots for the tabular data.

40-60 GHz, Measured at 1 meter
Note: Offset [dB] = 2.29dB + 40.11dB/m + 0dB = 42.4dB

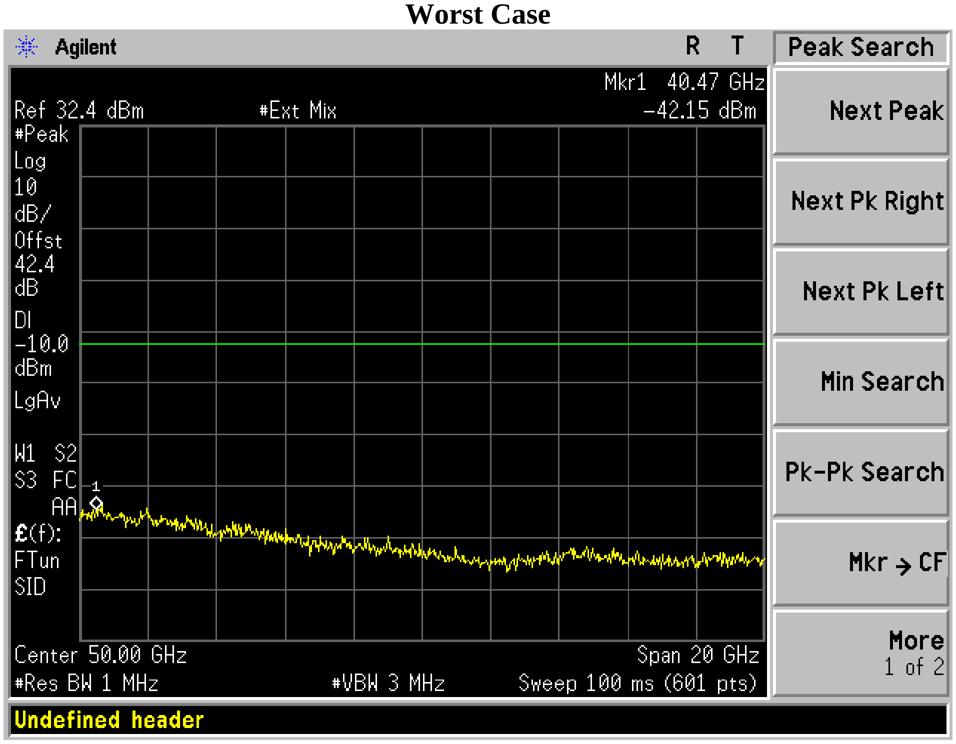
TX at 61.2 GHz + BT

Worst Case



TX at 61.44 GHz + BT

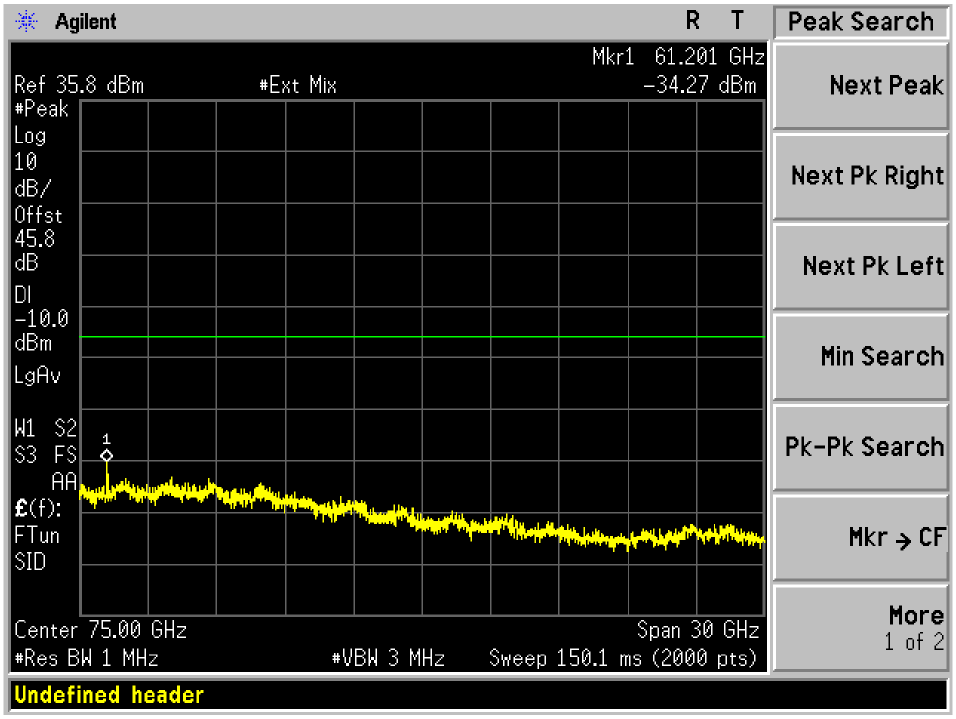
Worst Case



60-90 GHz, Measured at 1 meter
Note: Offset [dB] = 2.29dB + 43.51dB/m + 0dB = 45.8dB

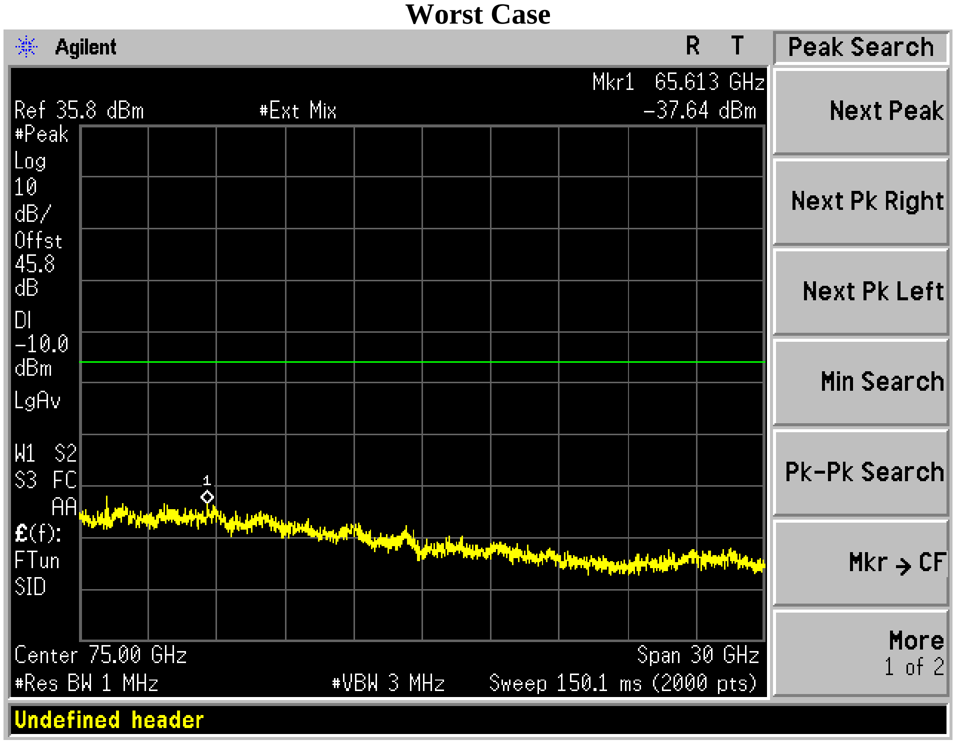
TX at 61.2 GHz + BT

Worst Case



TX at 61.44 GHz + BT

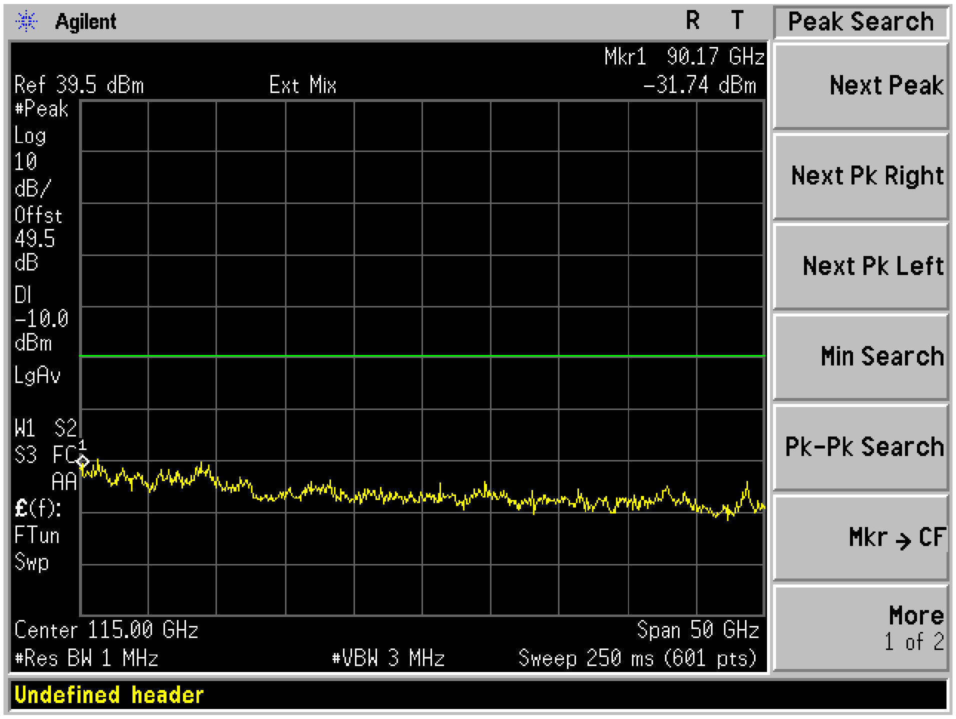
Worst Case



90-140 GHz, Measured at 0.5 meter
Note: Offset [dB] = 2.29dB + 53.23dB/m + -6.02dB = 49.5 dB

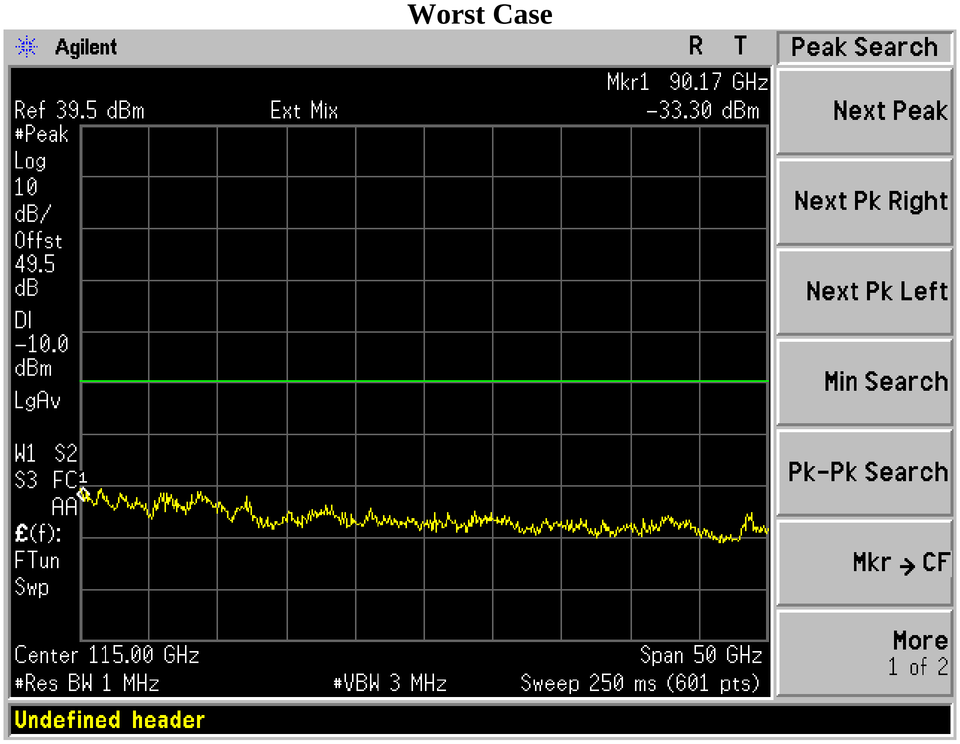
TX at 61.2 GHz + BT

Worst Case



TX at 61.44 GHz + BT

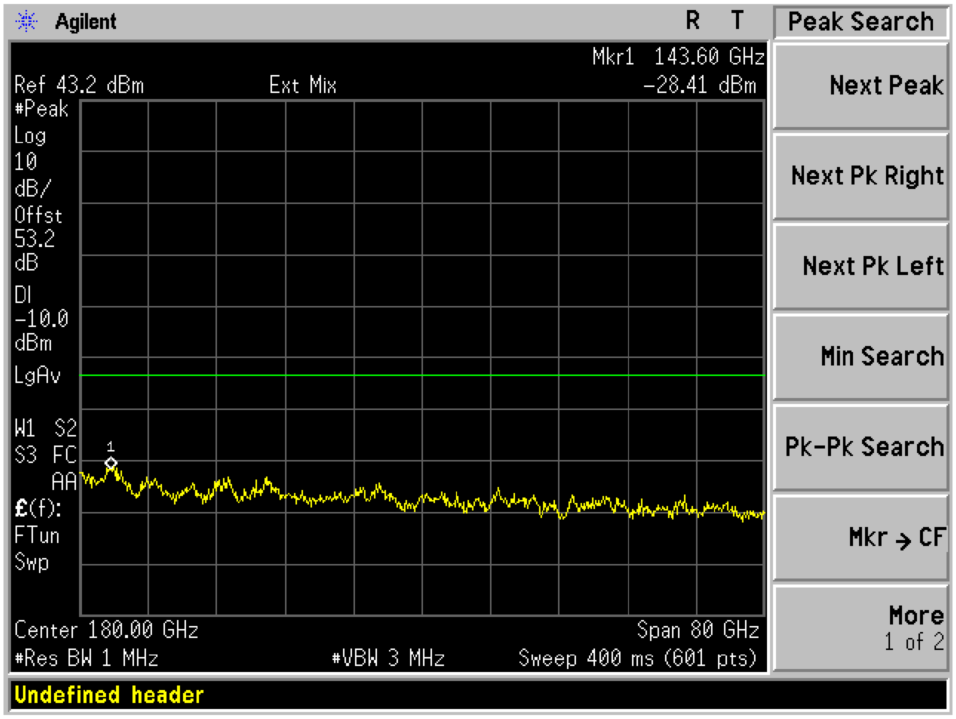
Worst Case



140-200 GHz, Measured at 0.25 meter
Note: Offset [dB] = 2.29dB + 62.95dB/m + -12.04dB = 53.2 dB

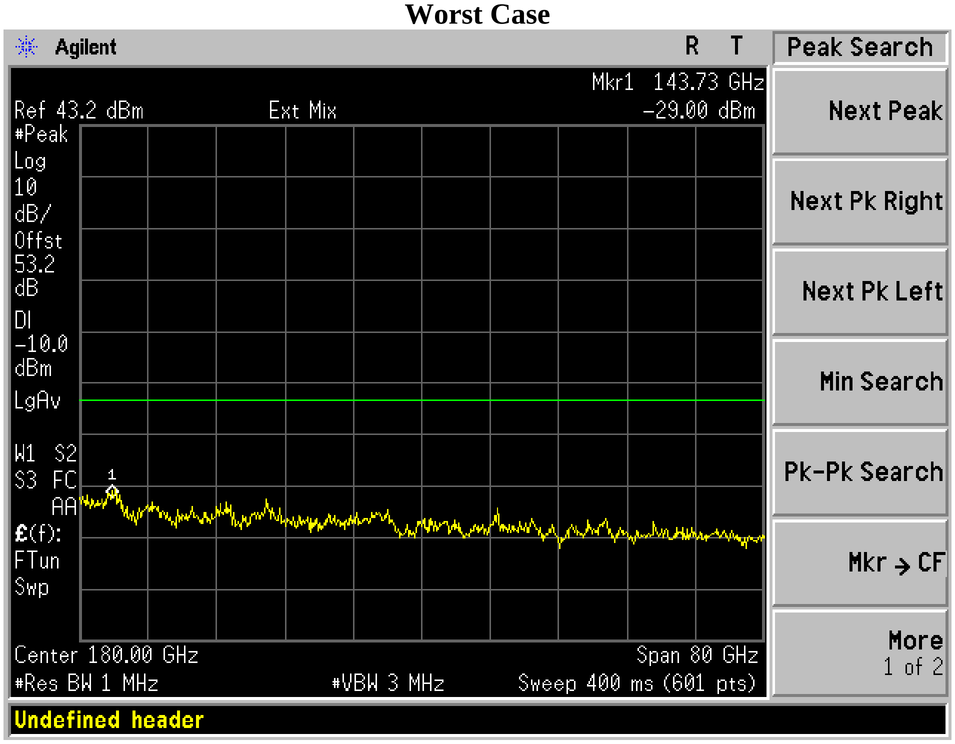
TX at 61.44 GHz + BT

Worst Case



TX at 61.44 GHz + BT

Worst Case



9 FCC §15.255(f) ISEDC-RSS 210 (j), RSS-Gen §8.11 - Frequency Stability

9.1 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 the ISEDC RSS 210 J.6: Frequency Stability

Fundamental emissions shall be contained within the 57-71 GHz frequency band during all conditions of operation when tested at the temperature and voltage variations specified for the frequency stability measurement in RSS-Gen.

According to RSS – Gen 8.11: Frequency stability

If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable RSS, the fundamental emissions of the radio apparatus should be kept within at least the central 80% of its permitted operating frequency band in order to minimize the possibility of out-of-band operation. In addition, its occupied bandwidth shall be entirely outside the restricted bands and the prohibited TV bands of 5-72 MHz, 76-88 MHz, 174-216 MHz, and 470-602 MHz, unless otherwise indicated.

9.2 Measurement Procedure

According to ANSI C63.10-2013 Subclause 9.14, the following procedure shall be used for determining frequency stability of millimeter-wave systems:

a) Arrange EUT and test equipment as shown in Figure 21. Some temperature chambers have a window or other opening that permits locating the receive antenna outside the chamber.

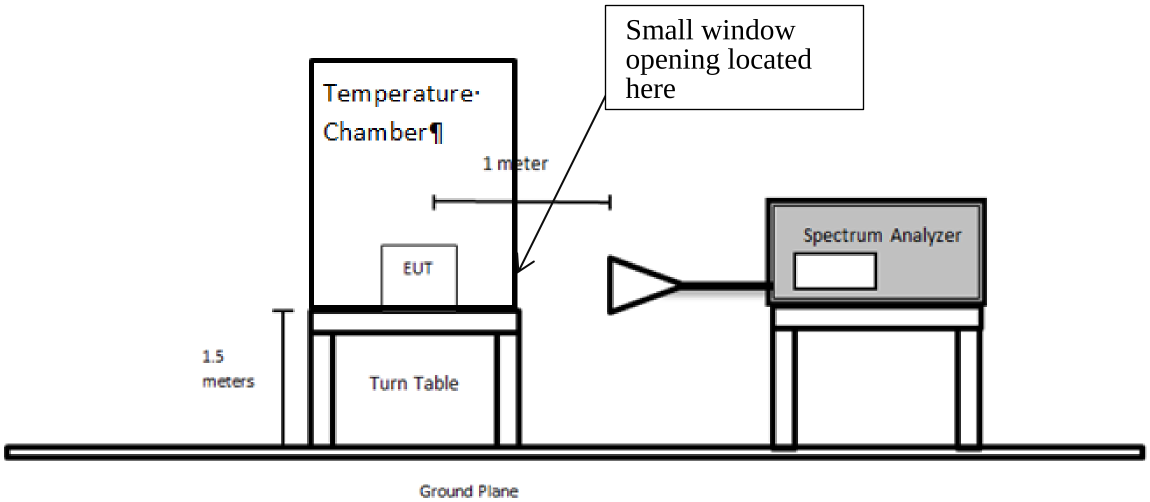
b) With the EUT at ambient temperature (approximately 25 °C) and voltage source set to the EUT nominal operating voltage (100%), record the spectrum mask of the EUT emission on the spectrum analyzer.

c) Vary EUT power supply between 85% and 115% of nominal, and record the frequency excursion of the EUT emission mask.

d) Set the power supply to 100% nominal setting, and raise EUT operating temperature to 50 °C. Record the frequency excursion of the EUT emission mask.

e) Repeat step d) at each 10 °C increment down to −20 °C

9.3 Test Setup Block Diagram



Note: Small window opening is located on the outside of the chamber which permits receive antenna to make measurements on EUT

9.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
624	Agilent	Spectrum Analyzer	E4446A	MY48250238	2023-05-12	1 year
861	OML Inc.	Mixer and Horn Antenna set	M012HWA M12RH	170615-1	N/R	N/A
-	-	RF cable	-	-	Each time[1]	N/A
1060	BACL	Temperature and Humidity Chamber	BTH-150-40	30078	2023-11-22	1 year
917	Volteq	DC Power Supply 50V 3A	HY5003D	020195051	N/R	N/A

Note[1]: 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".*

9.5 Test Environmental Conditions

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

The testing was performed by Will Hu on 2024-04-08 at RF Site.

9.6 Test Results

TX at 61.2 GHz

Voltage	Temperature (°C)	Frequency (GHz)	Fundamental Bands within 57GHz-71GHz
3.7V	-10	61.199907	Pass
	0	61.199894	Pass
	10	61.199899	Pass
	20	61.199897	Pass
	30	61.199877	Pass
	40	61.199877	Pass
4.255V	20	61.199881	Pass
3.145 V	20	61.199876	Pass

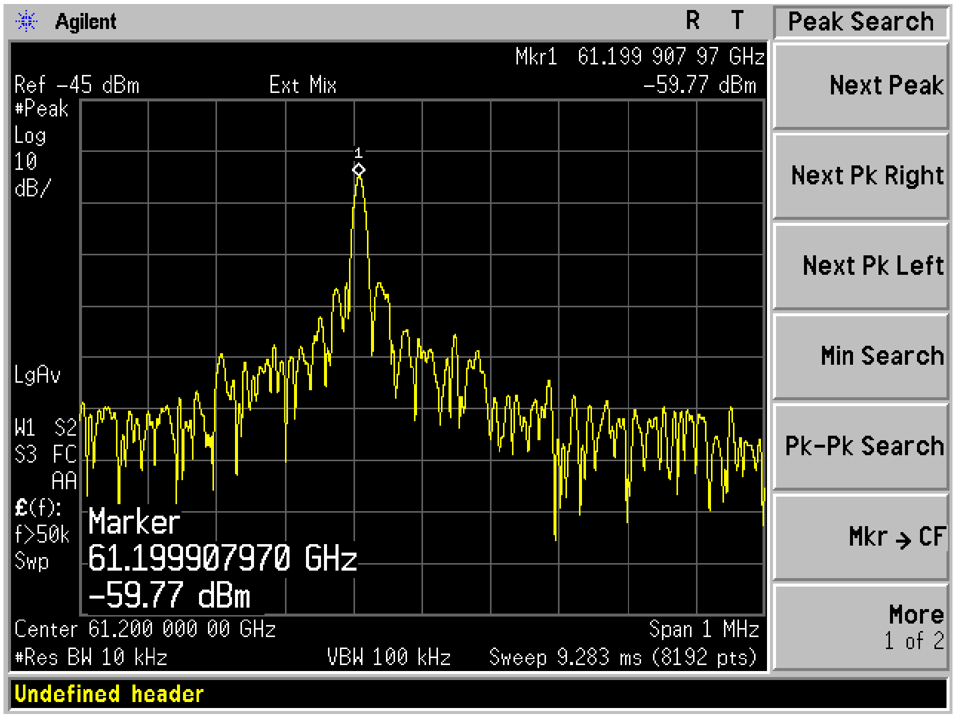
TX at 61.44 GHz

Voltage	Temperature (°C)	Frequency (GHz)	Fundamental Bands within 57GHz-71GHz
3.7V	-10	61.439905	Pass
	0	61.439896	Pass
	10	61.439899	Pass
	20	61.439888	Pass
	30	61.439878	Pass
	40	61.439876	Pass
4.255V	20	61.439876	Pass
3.145 V	20	61.439876	Pass

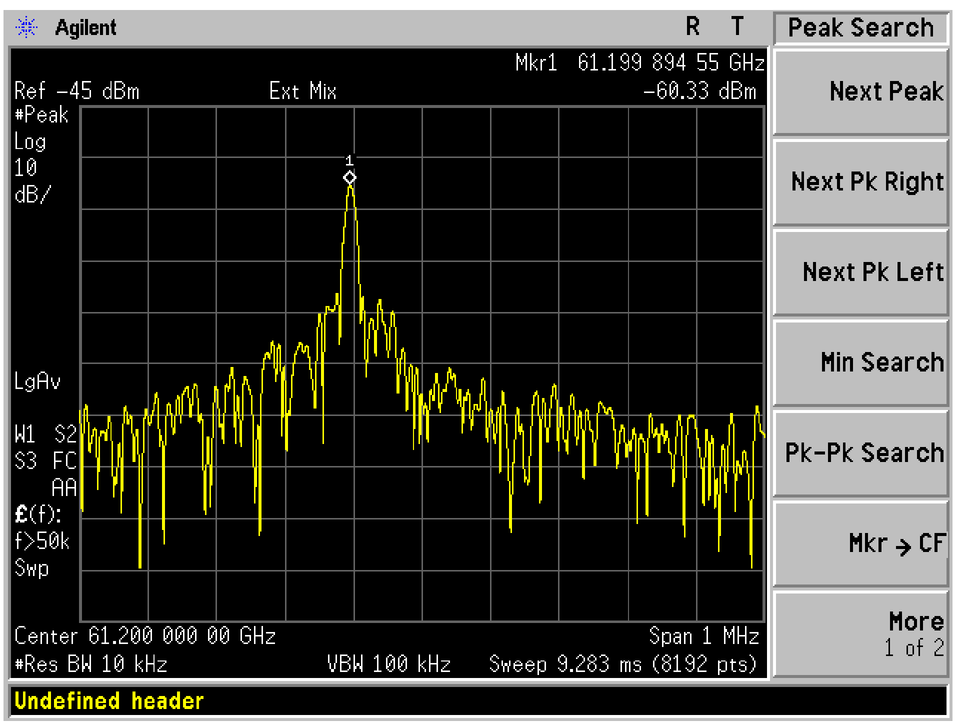
Note: the EUT is only capable of operating with -10°C - 40°C specified by Infinition Inc.
Note: the Extreme Voltage are tested at 85% and 115% of Normal Voltage.
Please refer to the following plots.

TX at 61.2 GHz

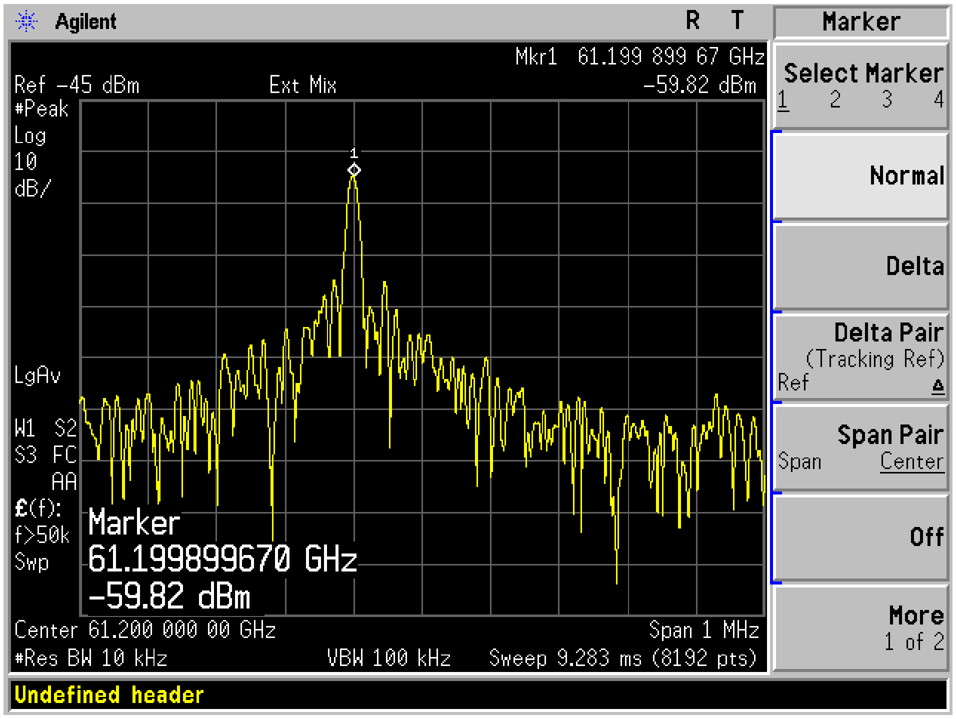
Normal Voltage, -10 °C



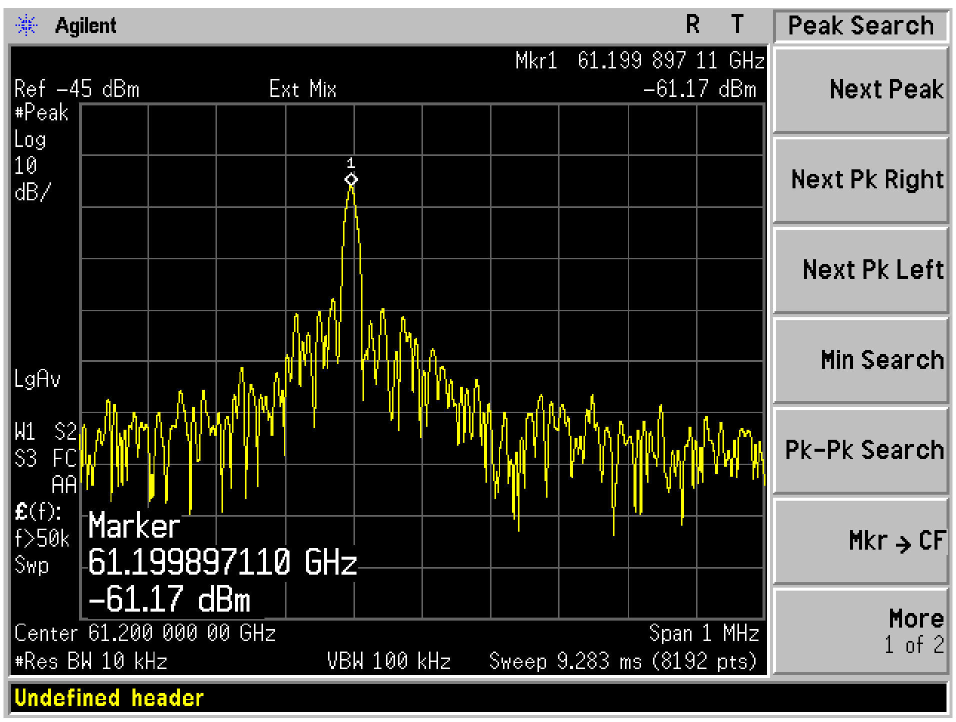
Normal Voltage, 0 °C



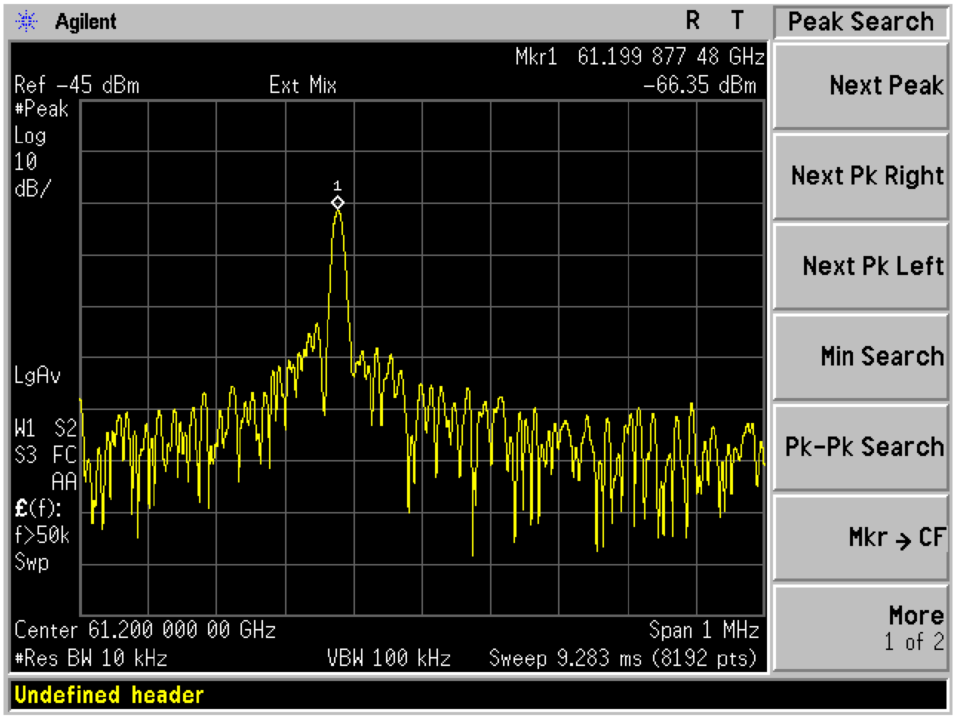
Normal Voltage, 10 °C



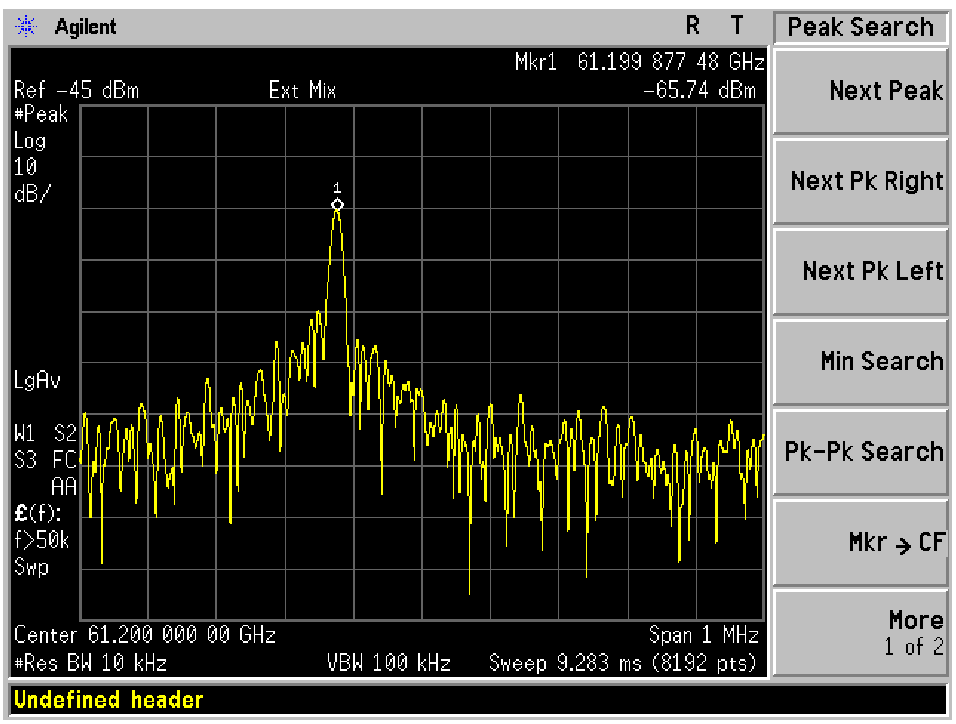
Normal Voltage, 20 °C



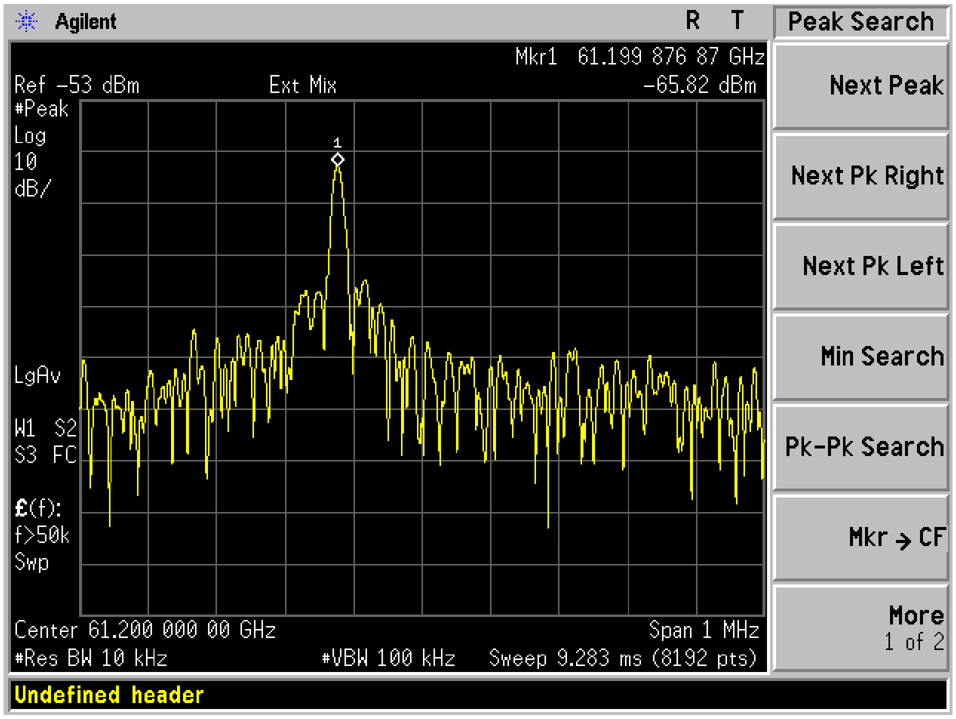
Normal Voltage, 30 °C



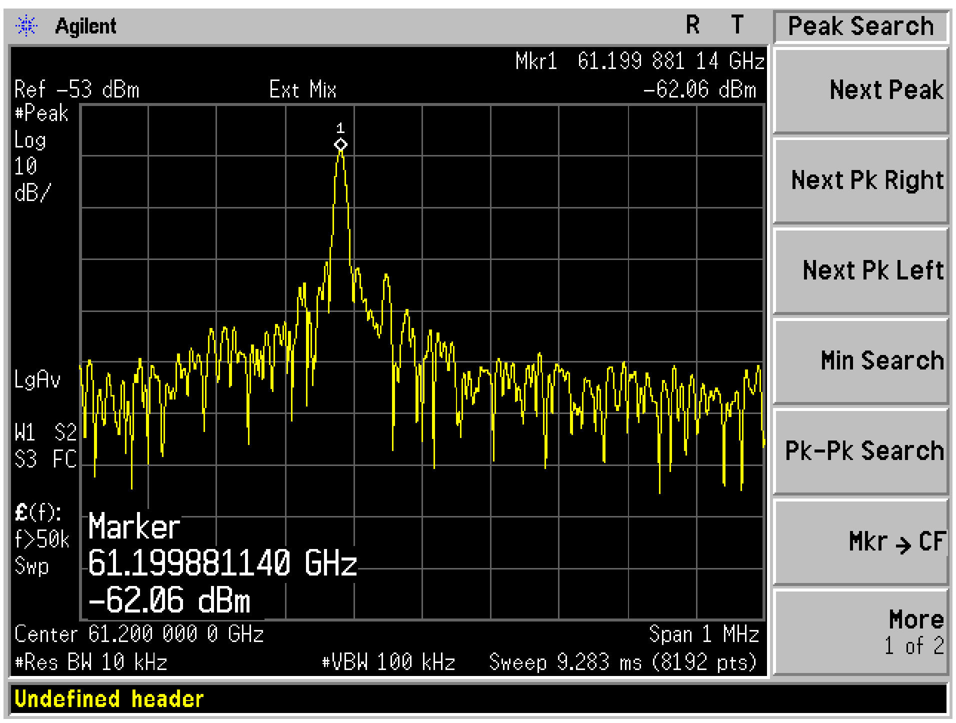
Normal Voltage, 40 °C



Low Voltage, 20 °C

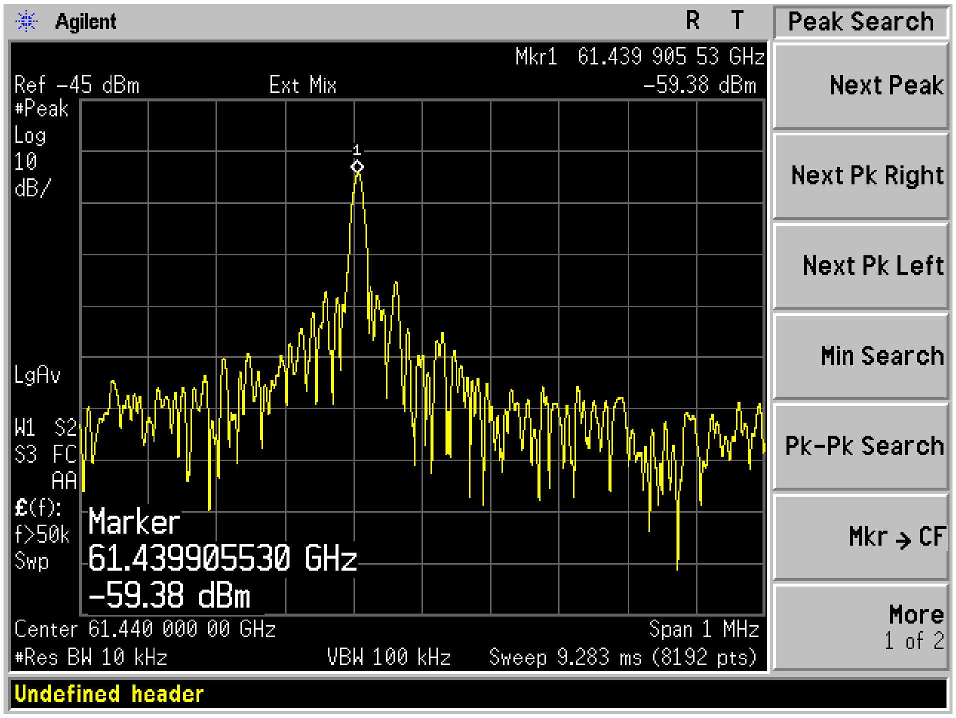


High Voltage, 20 °C

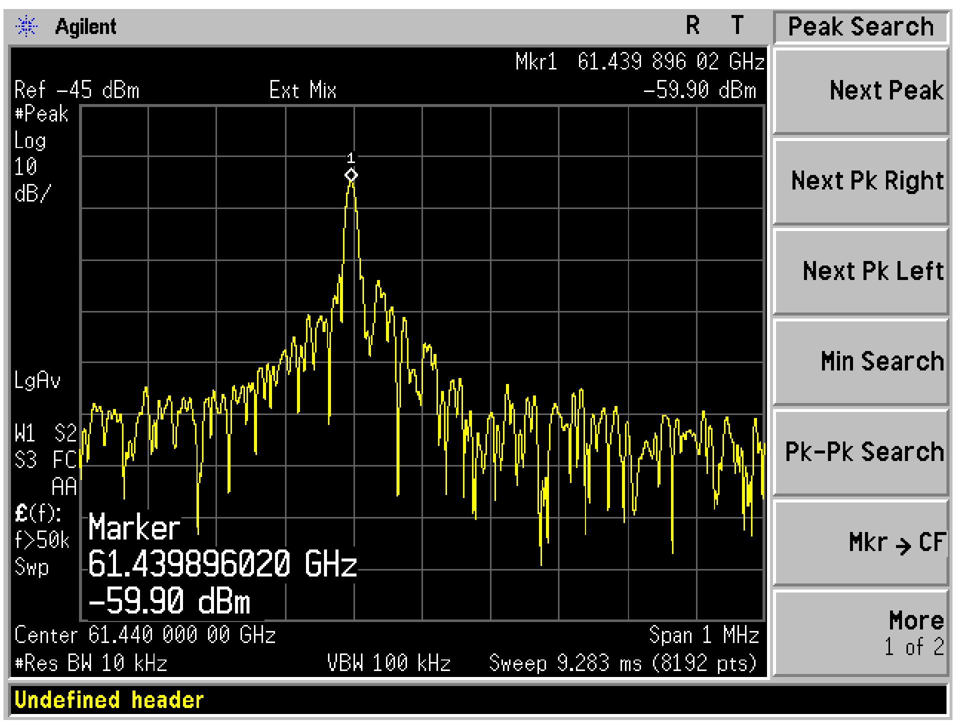


TX at 61.44 GHz

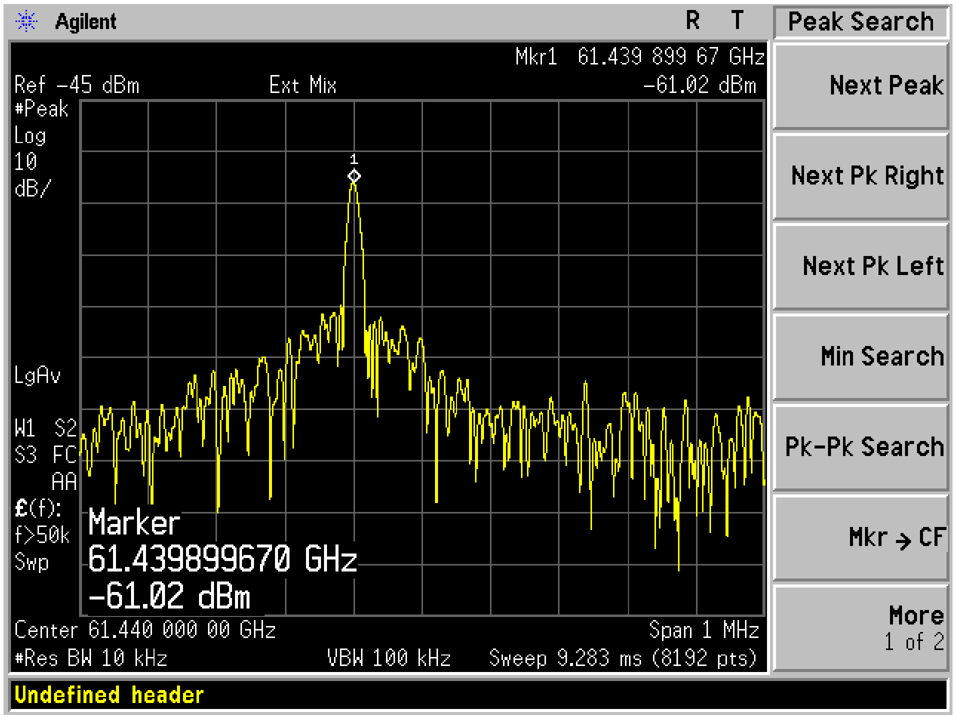
Normal Voltage, -10 °C



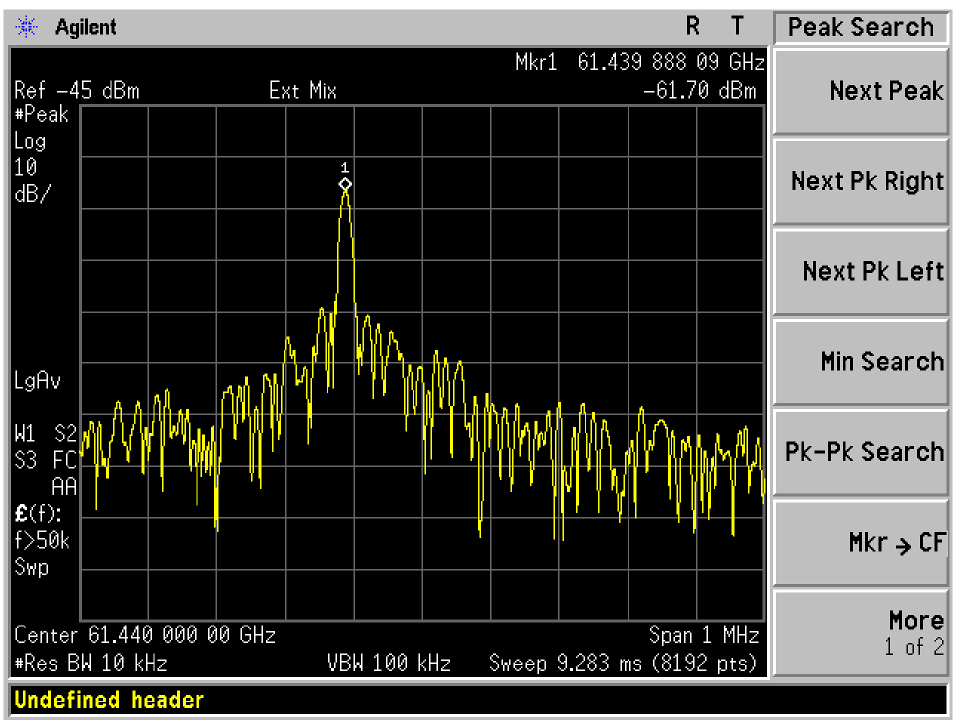
Normal Voltage, 0 °C



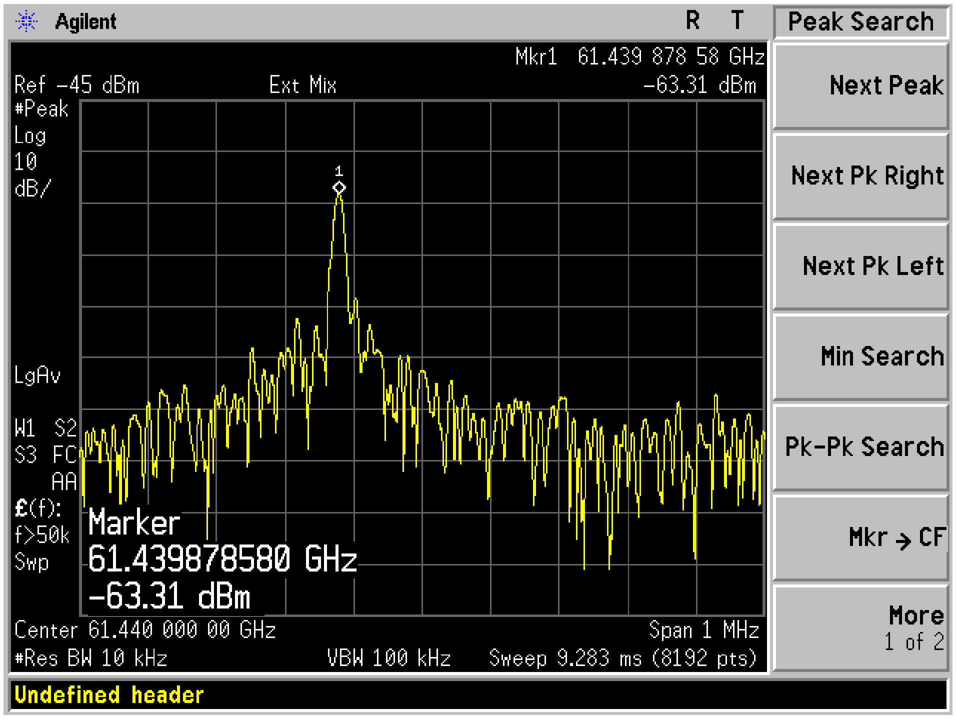
Normal Voltage, 10 °C



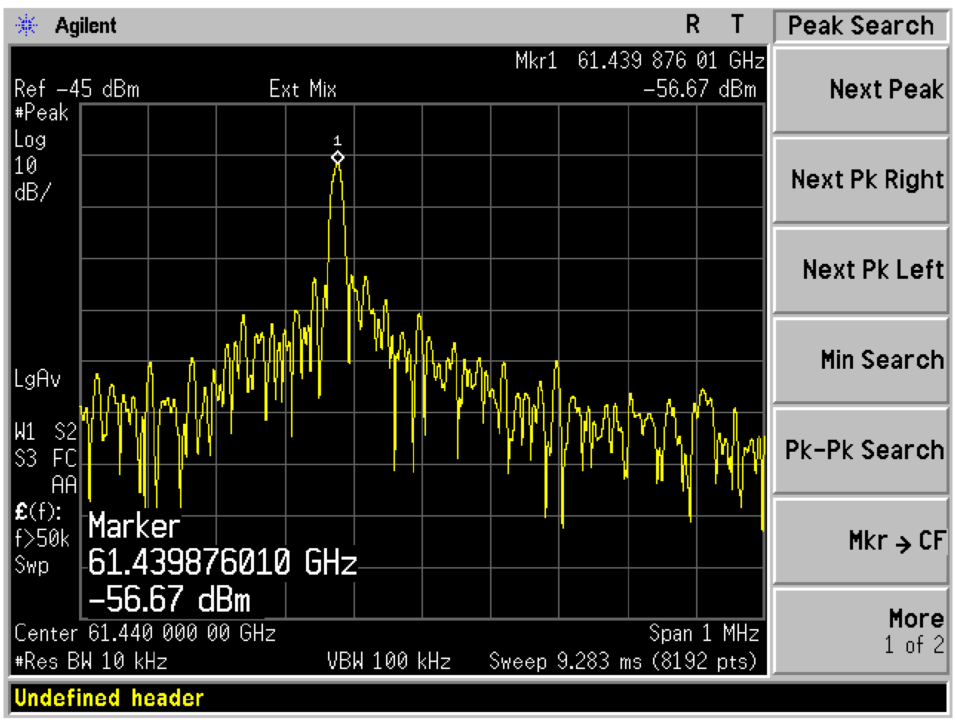
Normal Voltage, 20 °C



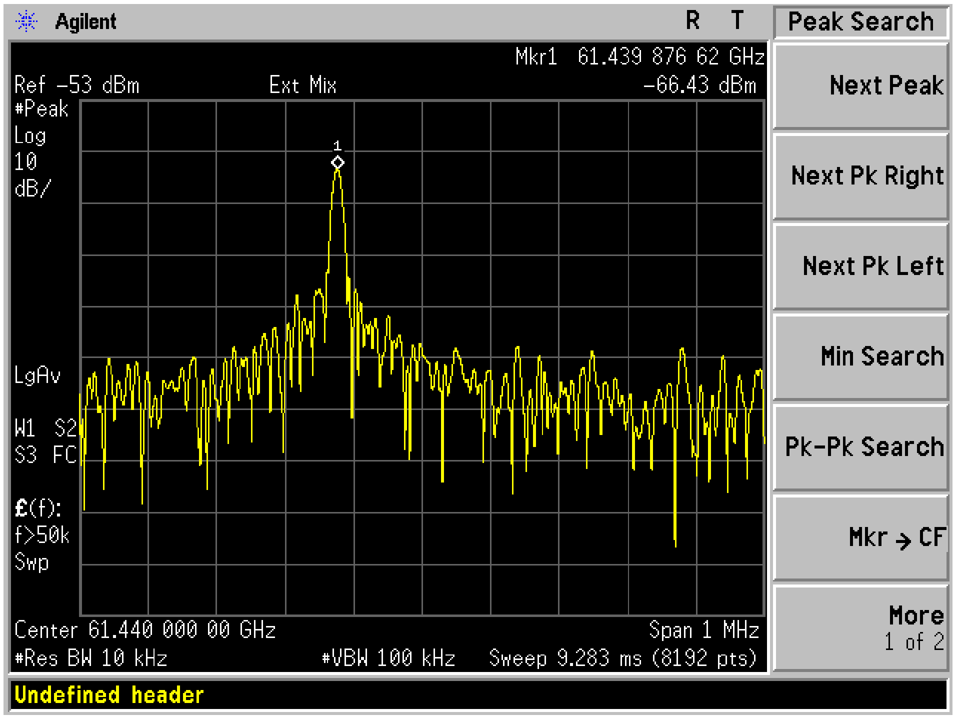
Normal Voltage, 30 °C



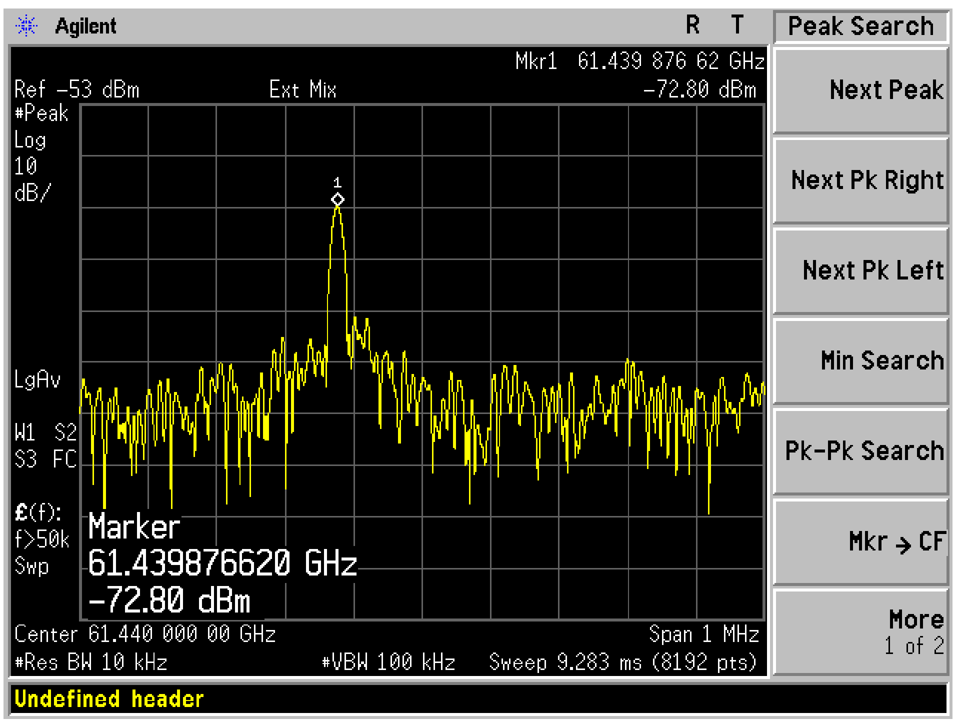
Normal Voltage, 40 °C



Low Voltage, 20 °C



High Voltage, 20 °C



10 FCC §15.255, 15.215(c), ISEDC-RSS 210 (j) – Power Bandwidth (99%) and 20dB Bandwidth

10.1 Applicable Standards

According to FCC §15.215(c): 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. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

According to FCC 15.255(c)(2)(V), For field disturbance sensors/radars that occupy 500 MHz bandwidth or less that are contained wholly within the frequency band 61.0-61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

According to the ISEDC RSS 210 J.6: Frequency Stability

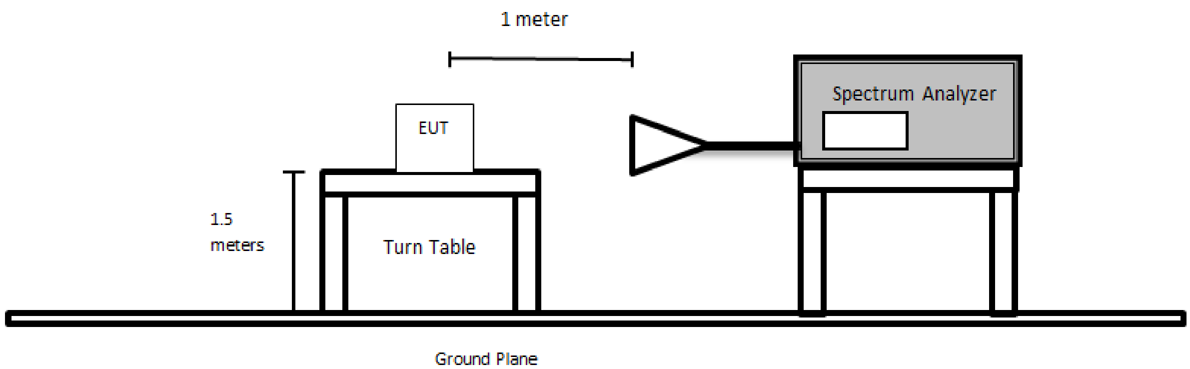
Fundamental emissions shall be contained within the 57-71 GHz frequency band during all conditions of operation when tested at the temperature and voltage variations specified for the frequency stability measurement in RSS-Gen.

10.2 Measurement Procedure

The following procedure shall be used for measuring 99% power bandwidth: Use the following spectrum analyzer settings:
1) Span equal to approximately 1.5 times the OBW, centered on the carrier frequency
2) RBW, prefer 1% to 5% of OBW, or a minimum of 1 MHz if this is not possible due to a large OBW
3) VBW approximately 3 × RBW
4) Set the reference level of the instrument as required to reduce the chance of the signal amplitude exceeding the maximum spectrum analyzer input mixer level for linear operation.
See guidance provided in 4.1.6.
5) Sweep = No faster than coupled (auto) time.
6) Detector function = peak.
7) Trace = max-hold.
b) The EUT shall be transmitting at its maximum data rate. Allow the trace to stabilize.
c) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency.
Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.
d) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

e) Repeat this test for each modulation scheme using the guidance of 5.6.2.1

10.3 Test Setup Block Diagram



10.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
624	Agilent	Spectrum Analyzer	E4446A	MY48250238	2023-05-12	1 year
861	OML Inc.	Mixer and Horn Antenna set	M012HWA M12RH	170615-1	N/R	N/A
-	-	RF cable	-	-	Each time[1]	N/A

Note[1]: 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".*

10.5 Test Environmental Conditions

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

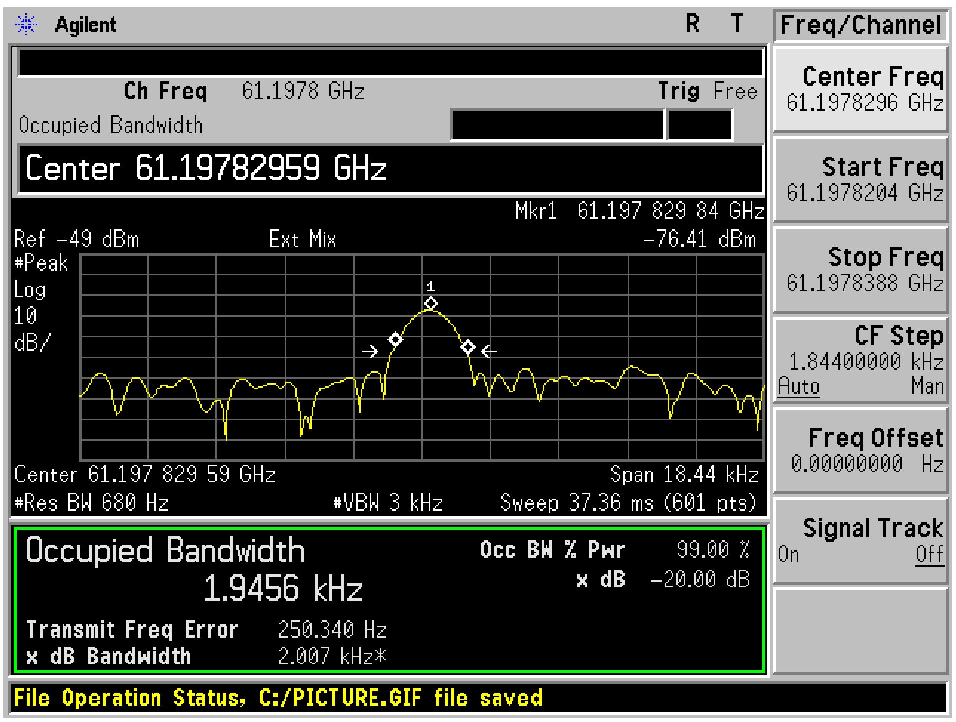
The testing was performed by Will Hu on 2024-04-08 at RF Site.

10.6 Test Results

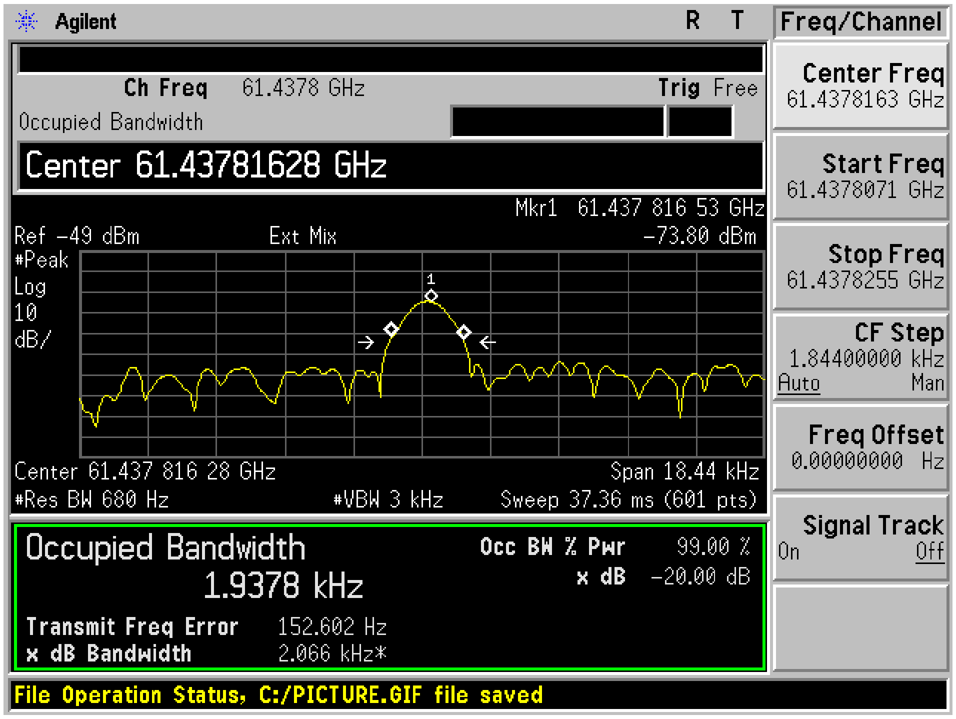
Fund Freq (GHz)	20dB BW (kHz)	99% BW (kHz)	F_L (GHz)	F_H (GHz)	Fundamental Bands within 57GHz-71GHz
61.2	2.007	1.946	61.19782758	61.1978316	Pass
61.44	2.066	1.938	61.43781421	61.4378135	Pass

Note: F_L and F_H are calculated using the 20 dB bandwidth and the fundamental frequencies.
Please refer to the following plots.

TX at 61.2 GHz



TX at 61.44 GHz



9 Annex A (Normative) - Test Setup Photographs

Please refer to the attachment

10 Annex B (Normative) - EUT External Photographs

Please refer to the attachment

11 Annex C (Normative) - EUT Internal Photographs

Please refer to the attachment

12 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 17025:2017 *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 21st day of December 2022.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2024

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 ---