# FCC PART 15, SUBPART C

## TEST AND MEASUREMENT REPORT

For

# AXEND, Inc.

2637 Manhattan Beach Blvd, Redondo Beach,
Los Angeles, CA 90278, USA

## FCC ID: 2A5R6AXPR200

| **Report Type:** Original Report | | **Product Type:** Perimeter Security Radar |
|---|---|---|
| **Prepared By** | Angel Cruz<br>RF Test Engineer | Angel Cruz |
| **Report Number** | R2408261-249 | |
| **Report Date** | 2024-10-31 | |
| **Reviewed By** | Christian McCaig<br>RF Lead Engineer | |
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ACCREDITED
CERTIFICATE #3297.02

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# DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | R2408261-249 | Original Report | 2024-10-31 |

# 1 General Description

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

This test and measurement report was prepared on behalf of *AXEND, Inc.*, and their product model: AXPR200, FCC ID: 2A5R6AXPR200, or the "EUT" as referred to in this report. The EUT is a Perimeter Security Radar.

| **Model Number** | AXPR200 |
|---|---|
| **FCC ID** | 2A5R6AXPR200 |
| **Radio Type** | 24GHz |
| Operating Frequency | 24050MHz ~ 24150MHz |
| Modulation | FMCW |
| Antenna Gain | 23.3 dBi |

## 1.2 Mechanical Description of EUT

The EUT measures approximately 21 cm (L) x 12 cm (W) x 5.7 cm (H) and weighs approximately 1.60 kg.

*The data gathered was from a production sample provided by AXEND, Inc. with S/N: T0807100009244240001*

## 1.3 Objective

This report is prepared on behalf of *AXEND, Inc.* in accordance with Part 2, Subpart J, and Part 15, Subparts C of the Federal Communication Commission's rules.

The objective is to determine compliance with FCC Part 15.249 rules for Antenna Requirements, RF Exposure, Bandwidth, AC Line Conducted Emissions, and Radiated Spurious Emissions.

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

N/A

## 1.5 Test Methodology

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

## 1.6 Measurement Uncertainty

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

| 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 17025:2005 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 and Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime and Aviation Radio Services;
  - 5 All Scope 5-Licensed Fixed Microwave Radio Services
  - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

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

- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

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

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

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

5 Other
- For Water Coolers (ver. 3.0)

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

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC
    US -EU EMC & Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;

# 2 System Test Configuration

## 1.9 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.

## 1.10 EUT Exercise Software

The exercising software used during testing was a web interface "Perimeter Security Radar", provided by *AXEND, Inc.* The software is compliant with the standard requirements being tested against.

| Modulation | Frequency (MHz) | Power Setting |
|---|---|---|
| FMCW | 24050-24150 | default |

## 1.11 Duty Cycle

| Radio | Radio Mode | On Time (ms) | Period (ms) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) |
|---|---|---|---|---|---|
| 24 GHz | FMCW | 0.2131 | 2.005 | 10.6 | 9.74 |

*Note: Duty Cycle Correction factor = 10log(1/duty cycle)*

**Duty Cycle 1**

**Duty Cycle 2**


## 1.12 Equipment Modifications

No modifications were made to the EUT during testing.

## 1.13 Local Support Equipment

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| Dell | Laptop | Latitude 5401 | 5XBTK33 |

## 1.14 Power Supply and Line Filters

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| - | AC Adaptor | 2LZH-7 | 2402T27830E-RF |

## 1.15 Interface Ports and Cabling

| Cable Description | Length (m) | To | From |
|---|---|---|---|
| Power Cable | < 1 m | AC Power Source | EUT |
| Ethernet Cable | > 1 m | EUT | Laptop |

# 3 Summary of Test Results

Results reported relate only to the product tested.

| FCC Rules | Description of Test | Results |
|---|---|---|
| FCC §2.1091 | RF Exposure | Compliant |
| FCC §15.203 | Antenna Requirement | Compliant |
| FCC §15.207 | AC Line Conducted Emissions | Compliant |
| FCC §15.215 | 20 dB Bandwidth | Compliant |
| FCC §2.1053, §15.205, §15.209, §15.249 (a)(c)(d)(e) | Radiated Spurious Emissions | 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 §2.1091 - RF Exposure

## 4.1 Applicable Standards

According to FCC §2.1091 and §1.1310(e)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

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

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

## 4.2 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

## 4.3 MPE Result

| | |
|---|---|
| EIRP (dBm): | 0.43 |
| EIRP (mW): | 1.1 |
| Prediction distance (cm): | 20 |
| Power density of prediction frequency at 20.0 cm ($mW/cm^2$): | 0.0002 |
| FCC MPE limit for uncontrolled exposure at prediction frequency ($mW/cm^2$): | 1.0 |

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0002 $mW/cm^2$. Limit is 1 $mW/cm^2$.

Note: EIRP (dBm) = 95.59dBuV/m @ 3m + 20*log(3m) – 104.7 dB = 0.43 dBm.

# 5 FCC §15.203 - Antenna Requirements

## 5.1 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.

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

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

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. 9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

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

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

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

## 5.2 Antenna Description

| Internal/Integral/ External | Frequency Range (MHz) | Antenna Type | Maximum Antenna Gain (dBi) |
|---|---|---|---|
| Internal | 24000-24150 | PCB | 23.12 |

# 6 FCC §15.207 - AC Line Conducted Emissions

## 6.1 Applicable Standards

As per FCC §15.207 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.

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

The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

## 6.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cords of support equipment were connected to LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data were recorded in the peak, quasi-peak, and average detection mode. Quasi-Peak readings are distinguished with a “QP.” Average readings are distinguished with an “Ave”.

### 6.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Correction Factor (CF) to indicated Amplitude (Ai) reading. The basic equation is as follows:

$$CA = Ai + CF$$

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Correction Factor (13.7 dB)

The Correction Factor is calculated by adding Cable loss (CL) and attenuation of the impulse limiter and the high pass filter. The basic equation is as follows:

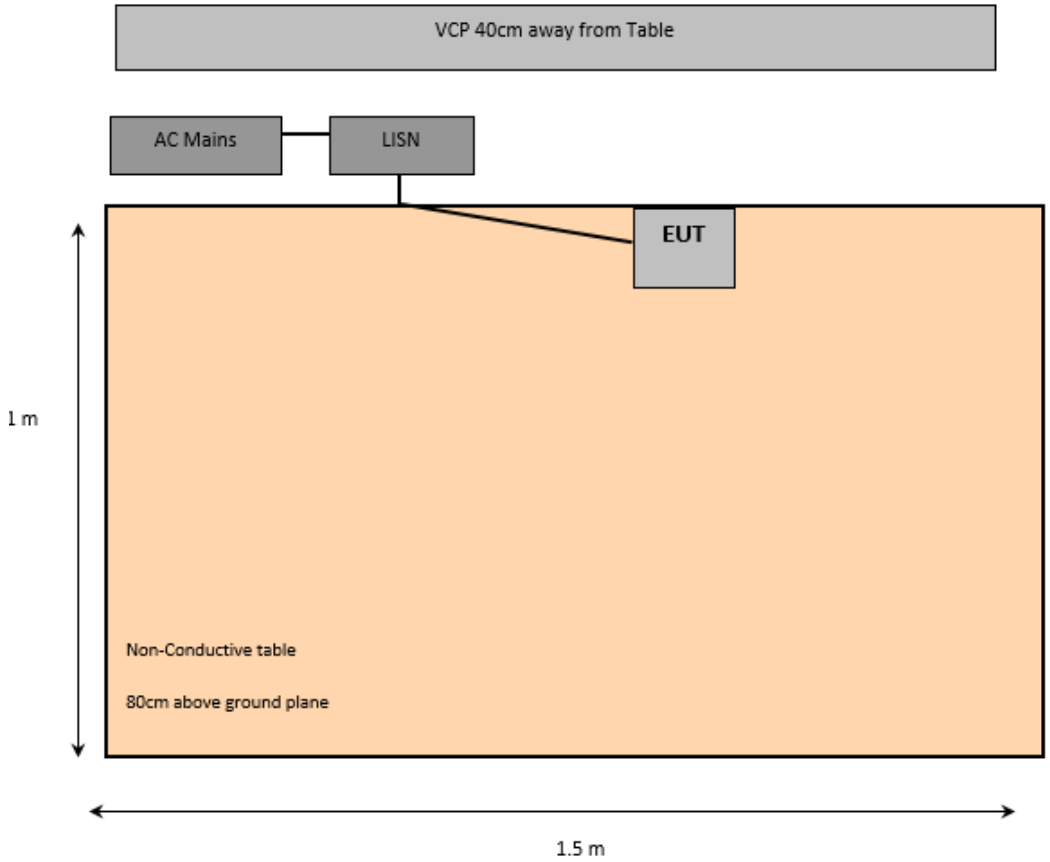
$$CF= CL + Attenuator$$

For example, a corrected amplitude of 13.7 dB = Cable Loss (3.7 dB) + Attenuation (10 dB)

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

$$Margin = Corrected\ Amplitude – Limit$$

### 6.5 Test Setup Block Diagram



## 6.6 Test Equipment List and Details

| BACL No. | Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|---|
| 124 | Rohde & Schwarz | EMI Test Receiver | ESCI 1166.5950K03 | 100044 | 2024-06-19 | 1 year |
| 681 | Rohde & Schwarz | Impulse Limiter | ESH3-Z2 | 101962 | 2024-09-17 | 6 months |
| 726 | Solar Electronics Company | High Pass Filter | Type 7930-100 | 7930150204 | 2024-09-17 | 6 months |
| 732 | FCC | LISN | FCC-LISN-50-25-2-10-CISPR16 | 160129 | 2024-09-13 | 1 year |
| 1241 | Pasternack | RG223 Coaxial cable 1500cm | PE3447-1500cm | N/A | 2024-07-26 | 6 months |

***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:** | 24.4 ºC |
| **Relative Humidity:** | 48.3 % |
| **ATM Pressure:** | 100.9 kPa |

*The testing was performed by Xinhao Jiang on 2024-10-02 in the ground plane.*

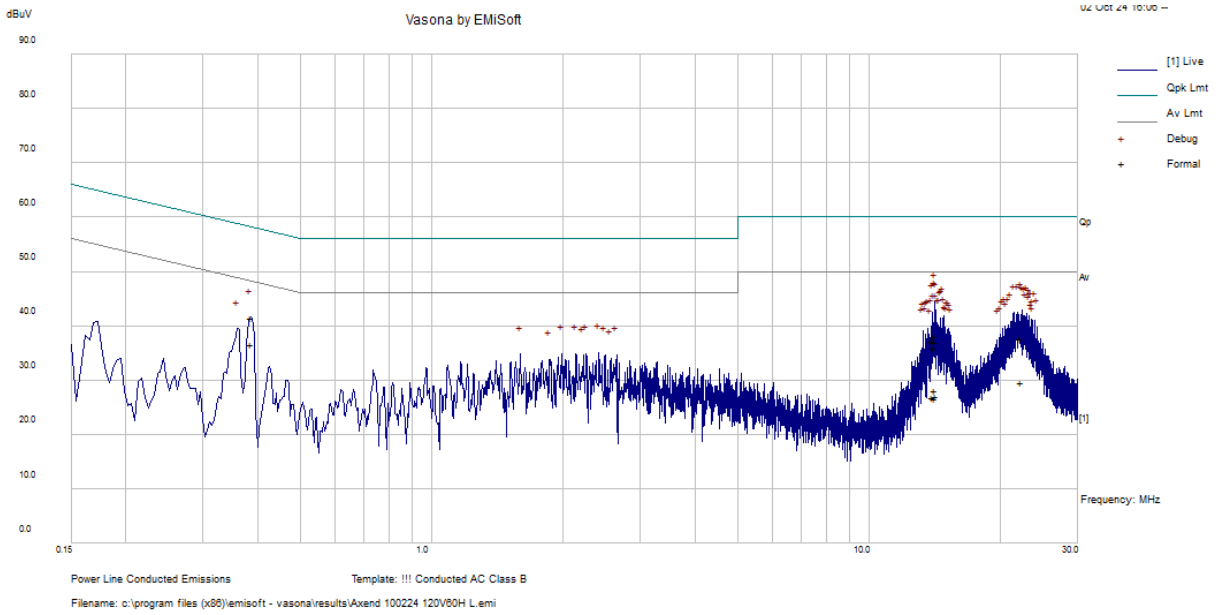
## 6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15C standard conducted emissions limits, with the margin reading of:

| Worst Case – AC Line: 120V, 60Hz | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Conductor Mode (Hot/Neutral)** | **Range (MHz)** |
| -9.51 | 0.386723 | Neutral | 0.15 to 30 |

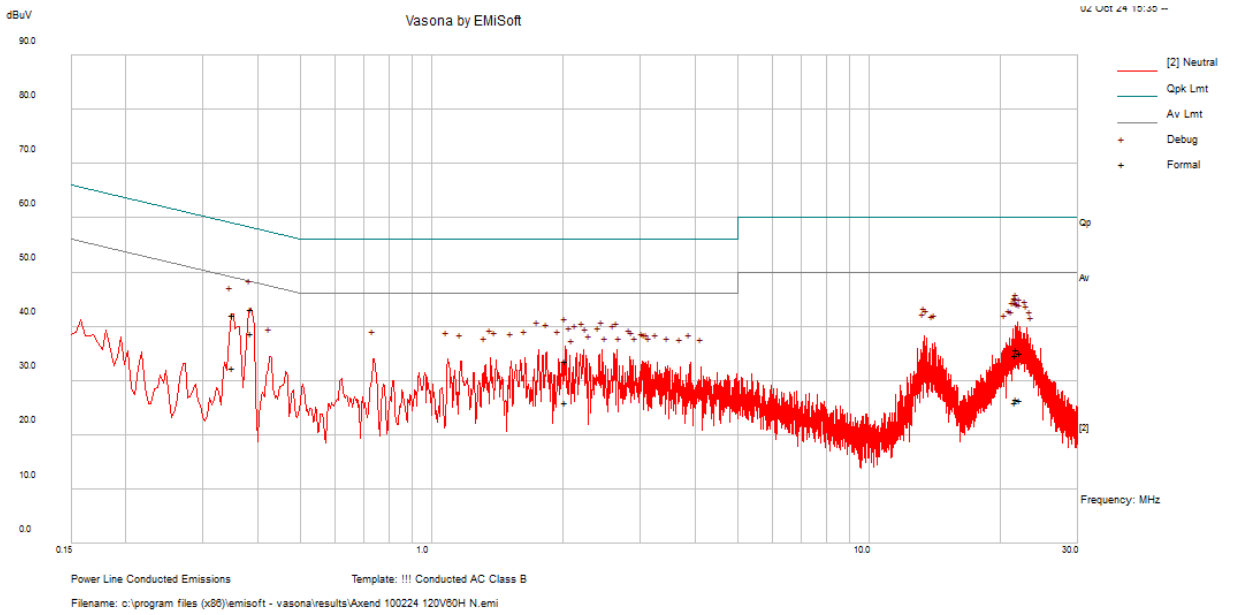
## 6.9 Conducted Emissions Test Plots and Data

### AC Line: 120V, 60Hz – Hot Conductor




| Frequency (MHz) | Ai. Reading (dBuV) | Correction Factor (dB) | Corrected Amplitude (dBµV) | Limit (dBµV) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|
| 14.156413 | 27.79 | 10.26 | 38.05 | 60 | -21.95 | Quasi Peak |
| 0.385895 | 31.18 | 10.35 | 41.53 | 58.15 | -16.62 | Quasi Peak |
| 14.107817 | 25.65 | 10.26 | 35.91 | 60 | -24.09 | Quasi Peak |
| 22.350923 | 27.26 | 10.49 | 37.75 | 60 | -22.25 | Quasi Peak |
| 14.195957 | 26.78 | 10.26 | 37.04 | 60 | -22.96 | Quasi Peak |
| 13.94254 | 27.07 | 10.26 | 37.33 | 60 | -22.67 | Quasi Peak |
| 14.156413 | 17.84 | 10.26 | 28.1 | 50 | -21.9 | Average |
| 0.385895 | 26.16 | 10.36 | 36.52 | 48.15 | -11.64 | Average |
| 14.107817 | 16.23 | 10.26 | 26.49 | 50 | -23.51 | Average |
| 22.350923 | 19.11 | 10.48 | 29.59 | 50 | -20.41 | Average |
| 14.195957 | 16.75 | 10.26 | 27.01 | 50 | -22.99 | Average |
| 13.94254 | 16.49 | 10.26 | 26.75 | 50 | -23.25 | Average |

## AC Line: 120V, 60Hz – Neutral Conductor




| Frequency (MHz) | Ai. Reading (dBuV) | Correction Factor (dB) | Corrected Amplitude (dBµV) | Limit (dBµV) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|
| 0.386723 | 32.85 | 10.35 | 43.2 | 58.13 | -14.93 | Quasi Peak |
| 0.350956 | 31.72 | 10.45 | 42.17 | 58.94 | -16.77 | Quasi Peak |
| 21.810351 | 25.3 | 10.46 | 35.76 | 60 | -24.24 | Quasi Peak |
| 2.026129 | 23.55 | 10.11 | 33.66 | 56 | -22.34 | Quasi Peak |
| 21.568332 | 24.29 | 10.45 | 34.74 | 60 | -25.26 | Quasi Peak |
| 22.148704 | 24.61 | 10.48 | 35.09 | 60 | -24.91 | Quasi Peak |
| 0.386723 | 28.28 | 10.34 | 38.62 | 48.13 | -9.51 | Average |
| 0.350956 | 21.81 | 10.45 | 32.26 | 48.94 | -16.68 | Average |
| 21.810351 | 16.11 | 10.46 | 26.57 | 50 | -23.43 | Average |
| 2.026129 | 15.92 | 10.11 | 26.03 | 46 | -19.97 | Average |
| 21.568332 | 15.57 | 10.45 | 26.02 | 50 | -23.98 | Average |
| 22.148704 | 15.94 | 10.47 | 26.41 | 50 | -23.59 | Average |

# 7 FCC §15.215(c) – 20dB Bandwidth

## 7.1 Applicable Standards

As per FCC §15.215(c) Additional provisions to the general radiated emission limitations:

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.

## 7.2 Test Setup

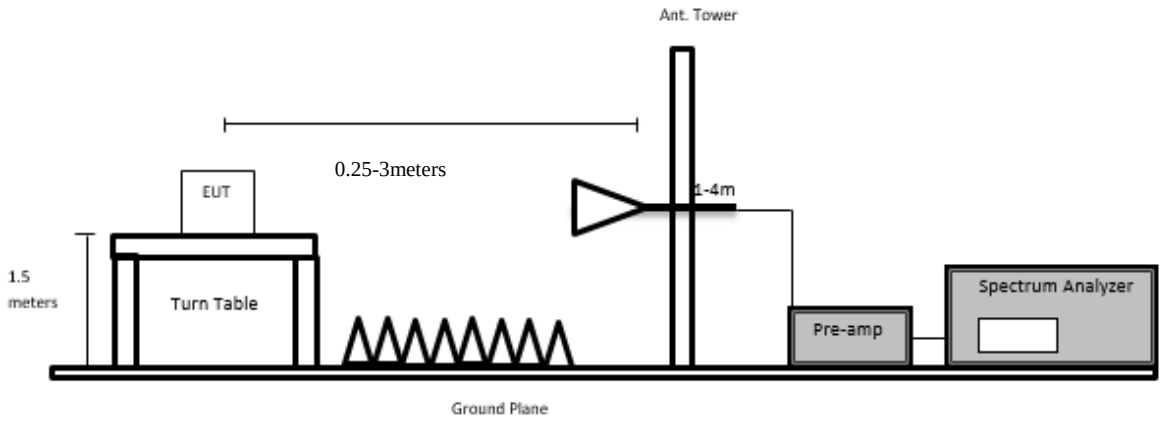
The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013.

The 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 Setup diagrams

20dB Bandwidth Test Above 1 GHz



## 7.4 Test Procedure

As per ANSI C63.10 Clause 6.9.3: Occupied bandwidth-relative measurement procedure

A dBc bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are −6 dB, −20 dB, and −26 dB, corresponding to 6 dB BW, 20 dB BW, and 26 dB BW, respectively. In this subclause, the ratio is designated by "−xx dB." The reference value is either the level of the unmodulated carrier or the highest level of the spectral envelope of the modulated signal, as stated by the applicable requirement. Some requirements might specify a specific maximum or minimum value for the "−xx dB" bandwidth; other requirements might specify that the "−xx dB" bandwidth be entirely contained within the authorized or designated frequency band.[51]

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be at least three times RBW, unless otherwise specified by the applicable requirement.

c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.6.2.

d) Steps a) through c) might require iteration to adjust within the specified tolerances.

e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dBOBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.

f) Set detection mode to peak and trace mode to max-hold.

g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).

h) Determine the "−xx dB down amplitude" using [(reference value) - xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.

i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).

j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "−xx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value. The dBc bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "−xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is

at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth

k) The dBc bandwidth shall be reported by providing spectral plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

[51] See 47 CFR 15.215(c) and 8.11 of RSS Gen Issue 5.

## 7.5 Test Equipment List and Details

| BACL No. | Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|---|
| 1432 | Keysight | MXE EMI Receiver | N9038B | MY60180008 | 2024-01-15 | 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 |
| 1449 | BACL | Preamplifier 0.1GHz-18GHz | BACL1313-A100M18G | 4052472 | 2024-08-19 | 6 months |
| 1192 | ETS Lindgren | Horn Antenna | 3117 | 00218973 | 2022-09-29 | 25 months |
| 1295 | Carlisle | 10m Ultra Low Loss Coaxial Cable | UFB142A-1-3937-200200 | 64639890912-001 | 2024-05-01 | 6 months |

***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

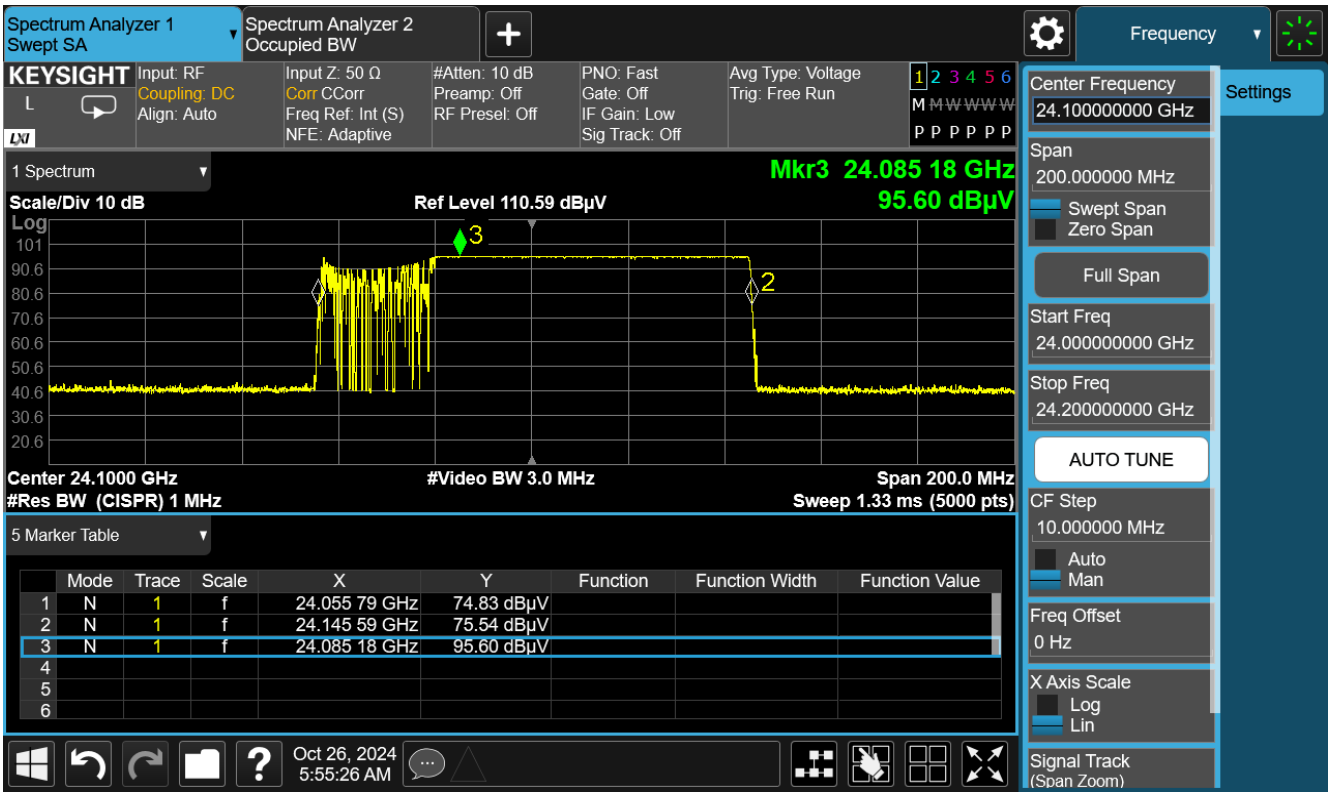
| | |
|---|---|
| **Temperature:** | 23 ºC |
| **Relative Humidity:** | 45.2 % |
| **ATM Pressure:** | 101.56 kPa |

*The testing was performed by Angel Cruz on 2024-10-26 in 5m3 chamber.*

## 7.7 Summary of Test Results

| Mode | -20 dB OBW (MHz) | Operation Band (GHz) | Result |
|---|---|---|---|
| FMCW | 89.8 | 24-24.25 | Pass |

## 7.8 Test Results



# 8 FCC §15.209, §15.249(a)(c)(d)(e) - Spurious Radiated Emissions

## 8.1 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 §15.249(a) and RSS-210 Annex 2 section A2.9: Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Frequency (MHz) | Field Strength of Fundamental (millivolts/meter) | Field Strength of Harmonics (microvolts/meter) |
|---|---|---|
| 902-928 | 50 | 500 |
| 2400-2483.5 | 50 | 500 |
| 5725-5875 | 50 | 500 |
| 24000-24250 | 250 | 2500 |

As per FCC §15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

## 8.2 Test Setup

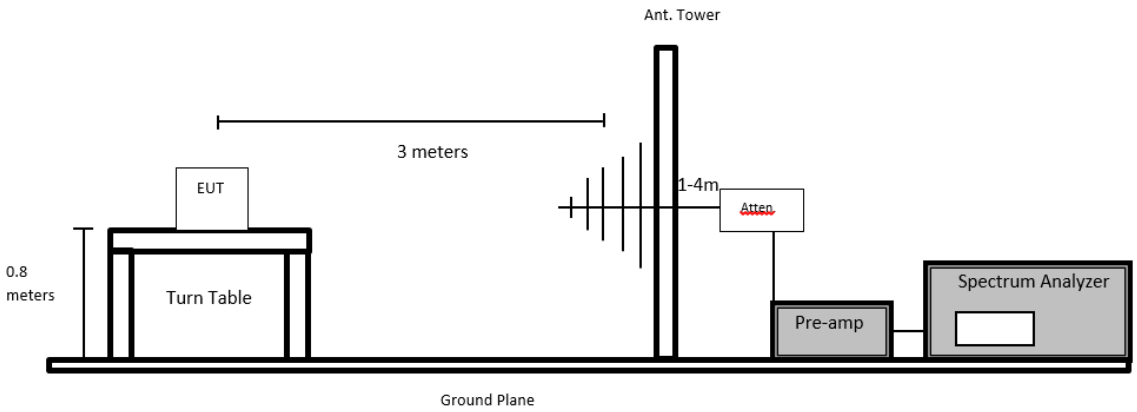
The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

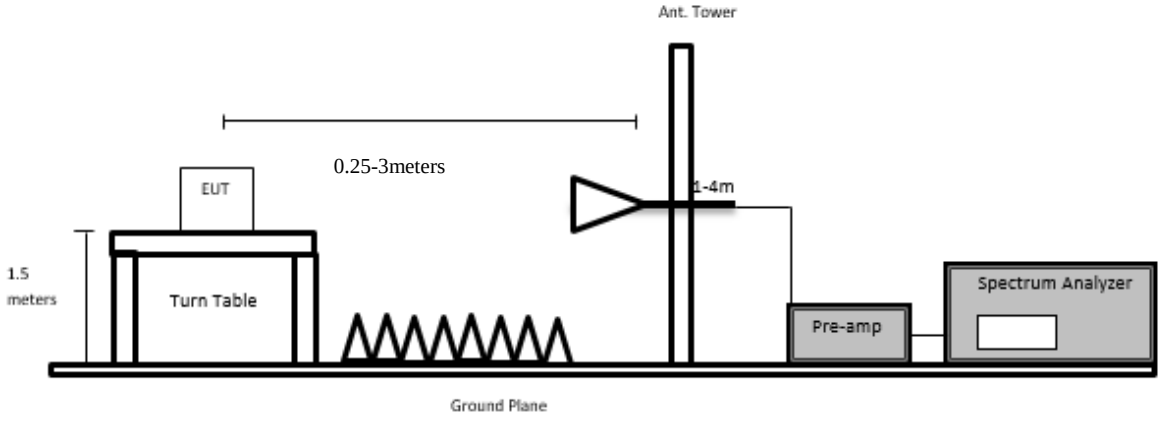
External I/O cables were draped along the edge of the test table and bundle when necessary.

## 8.3 Test Setup diagrams

Radiated Spurious Test Below 1 GHz




Radiated Spurious Test / Fundamental Emission Test Above 1 GHz



## 8.4 Test Procedure

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

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

The EUT was set 3 meter (or closer as needed) away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 0.8 meter and 1.5 meter above the ground plane for below and above 1000 MHz measurements, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna's polarity should be changed between horizontal and vertical.

The spectrum analyzer or receiver was set as:

Below 1000 MHz:

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

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 3MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 3MHz / Sweep = Auto

## 8.5 Corrected Amplitude & Margin Calculation

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

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)
The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

## 8.6 Test Equipment List and Details

| BACL No. | Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|---|
| 310 | Rohde & Schwarz | EMI test receiver 9 kHz to 3 GHZ | ESCI 1166.5950.03 | 100338 | 2024-05-29 | 1 year |
| 624 | Agilent | Spectrum Analyzer | E4446A | MY48250238 | 2024-06-14 | 1 year |
| 124 | Rhode & Schwarz | EMI Test Receiver | ESCI | 100044 | 2024-06-19 | 1 year |
| 1432 | Keysight | MXE EMI Receiver | N9038B | MY60180008 | 2024-01-15 | 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 |
| 1449 | BACL | Preamplifier 0.1GHz-18GHz | BACL1313-A100M18G | 4052472 | 2024-08-19 | 6 months |
| 658 | HP/ Agilant | Pre Amplifier | 8449B OPT HO2 | 3008A01103 | 2024-06-18 | 6 months |
| 1247 | Uti flex | Micro - Coax | N/A | N/A | 2024-06-18 | 6 months |
| 1451 | BACL | Preamplifier 18GHz-40GHz | BACL-1313-A1840 | 4052432 | 2024-08-16 | 6 months |
| 321 | Sunol Sciences | Biconilog Antenna | JB3 | A020106-2; 1504 | 2023-12-18 | 2 years |
| 1246 | HEWLET PACKARD | RF Limiter | 11867A | 01734 | 2024-04-09 | 1 year |
| 1245 | - | 6dB Attenuator | PE7390-6 | 01182018A | 2023-12-18 | 2 years |
| 1192 | ETS Lindgren | Horn Antenna | 3117 | 00218973 | 2022-09-29 | 25 months[1] |
| 91 | Wisewave | Antenna, Horn | ARH-4223-02 | 10555-02 | 2023-03-14 | 2 years |
| 92 | Wisewave | Antenna, Horn | ARH-2823-02 | 10555-01 | 2024-06-26 | 2 years |
| 861 | OML Inc. | Mixer and Horn Antenna set | M03HWA, M05HWA, M08HWA, M012HWA | 170615-1 | N/R | N/A |
| 1186 | Pasternack | Coaxial Cable, RG214 | PE3062-1050CM | N/A | 2024-04-09 | 1 year |
| 1248 | Pasternack | RG214 COAX Cable | PE3062 | N/A | 2024-04-04 | 1 year |
| 1249 | Time Microwave | LMR-400 Cable Dc-3 GHz | AE13684 | 2k80612-5 6fts | 2024-04-09 | 1 year |
| 1346 | RFMW | 2.92mm 10ft RF cable | KMSE-160SAW-240.0-KSME | N/A | 2023-11-03 | 1 year |
| 1354 | RFMW | 2.92mm 10ft RF Cable DC to 40 GHz | P1CA-29M29M-F150-120 | N/A | 2024-01-24 | 1 year |
| 1295 | Carlisle | 10m Ultra Low Loss Coaxial Cable | UFB142A-1-3937-200200 | 64639890912-001 | 2024-05-01 | 6 months |

**Note[1]: this equipment was only used for measurements performed in the 1-18GHz range up to the date 2024-10-26**

***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:** | 23 - 24.3 ºC |
| **Relative Humidity:** | 45.2 - 50.2 % |
| **ATM Pressure:** | 101.3 – 101.56 kPa |

*The testing was performed by Angel Cruz on 2024-09-25, 2024-09-26, and 2024-10-25 to 2024-10-30 in 5m3 chamber.*

## 8.8 Summary of Test Results

According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C standard radiated emissions limits, and had the worst spurious emission margin of:

| Worst Case-Mode: Transmitting | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Configuration** |
| -0.03 | 499.988751 | Vertical | Middle Channel |

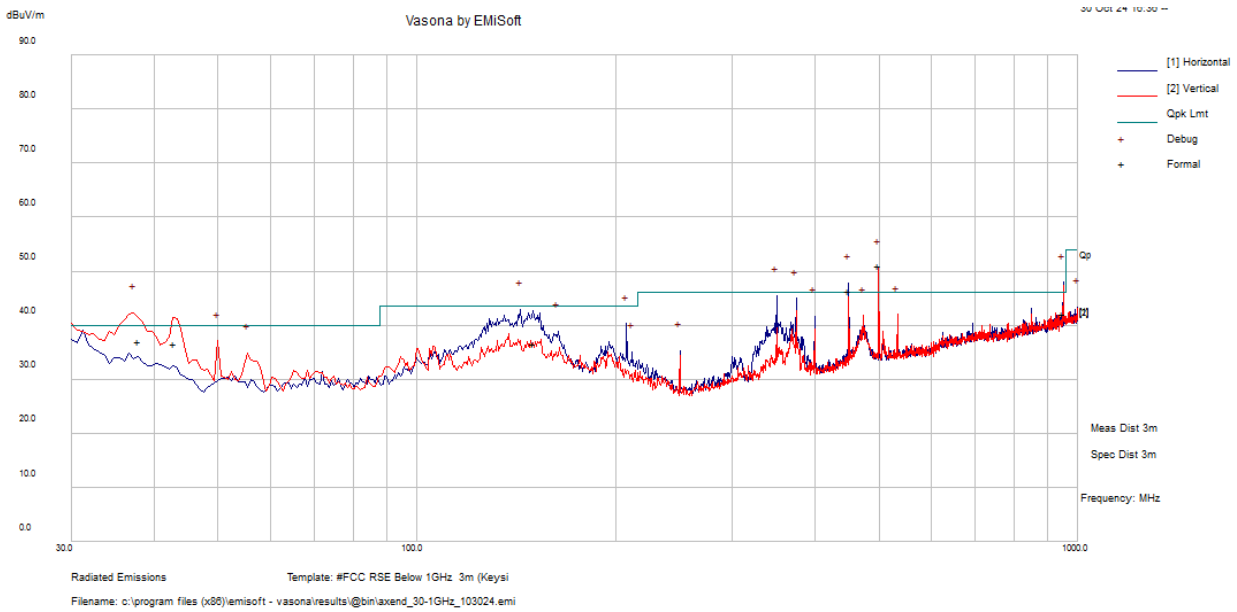
Please refer to the following table and plots for specific test result details

## 8.9 Radiated Emissions Test Results

### Radiated Test Data for Individual Channels

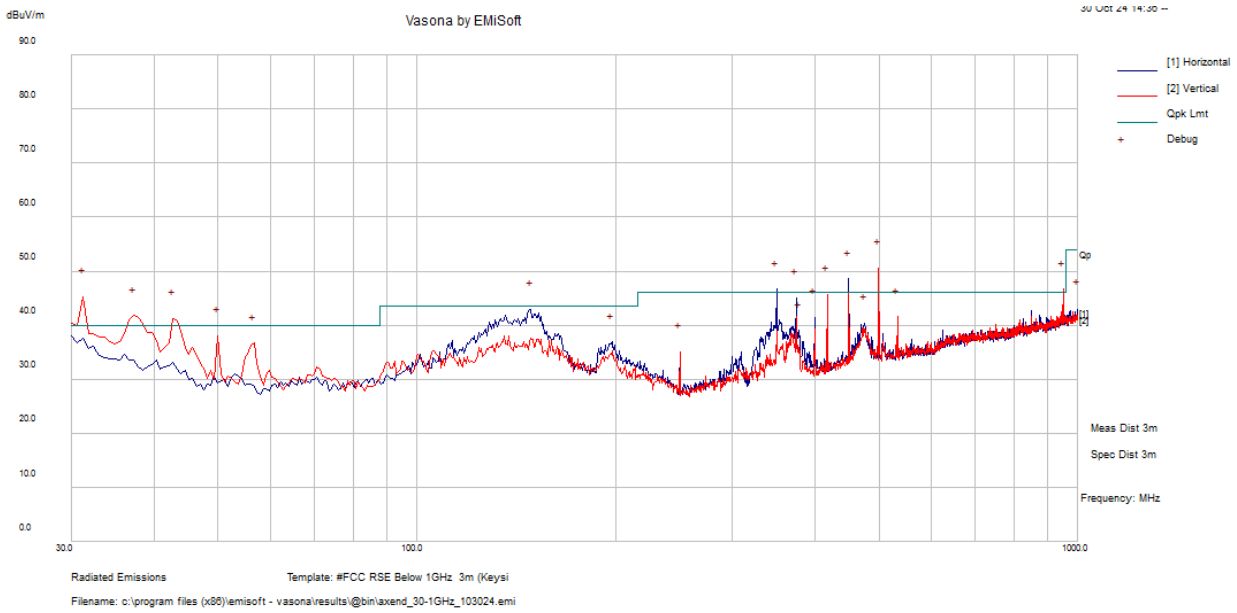
#### 1) 30 MHz – 1 GHz, Measured at 3 meters

**High Channel, 24150 MHz**



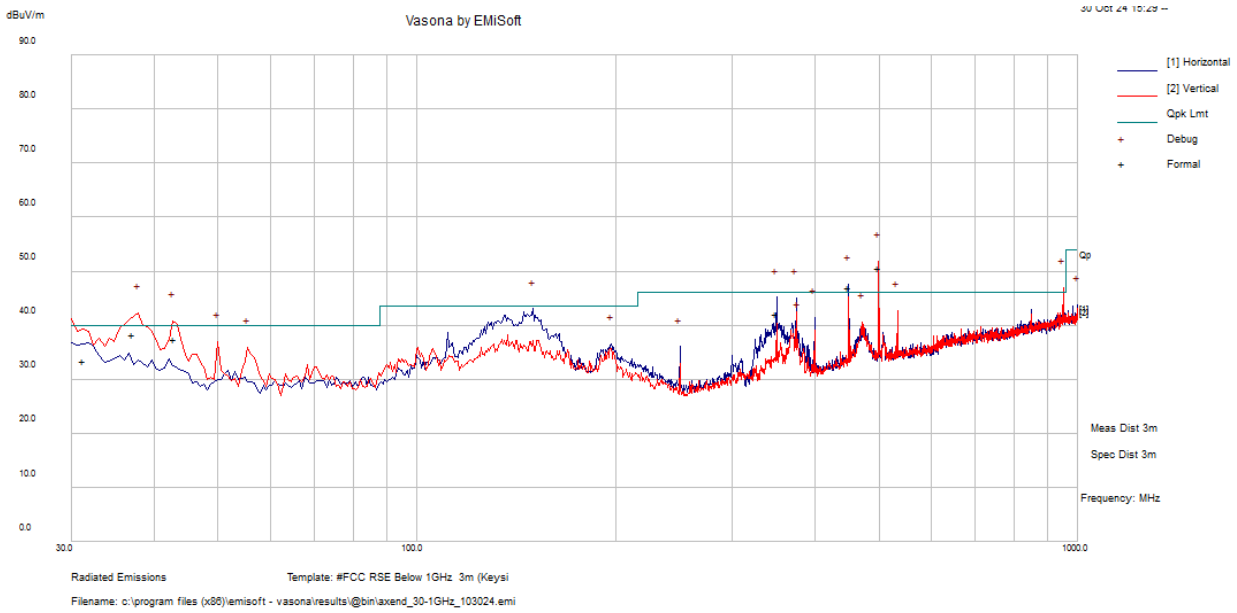

| Frequency (MHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 499.982188 | 45.08 | -0.02 | 45.06 | 100 | V | 109 | 46 | -0.94 | QP/Pass |
| 37.16375 | 43.41 | -5.44 | 37.97 | 109 | V | 233 | 40 | -2.03 | QP/Pass |
| 950.044063 | 31.18 | 6.89 | 38.07 | 273 | H | 293 | 46 | -7.93 | QP/Pass |
| 449.985 | 47.18 | -1.27 | 45.91 | 199 | H | 94 | 46 | -0.09 | QP/Pass |
| 349.97375 | 47.91 | -4.47 | 43.44 | 108 | H | 128 | 46 | -2.56 | QP/Pass |
| 143.248125 | 42.62 | -7.26 | 35.36 | 301 | H | 352 | 43.5 | -8.14 | QP/Pass |

**Low Channel, 24050 MHz**




| Frequency (MHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 31.287813 | 35.05 | -1.61 | 33.44 | 111 | V | 21 | 40 | -6.56 | QP/Pass |
| 499.995313 | 45.68 | -0.02 | 45.66 | 113 | V | 111 | 46 | -0.34 | QP/Pass |
| 449.9825 | 46.76 | -1.27 | 45.59 | 200 | H | 116 | 46 | -0.41 | QP/Pass |
| 37.178125 | 43.64 | -5.45 | 38.19 | 102 | V | 43 | 40 | -1.81 | QP/Pass |
| 42.965313 | 46.83 | -9.5 | 37.33 | 108 | V | 108 | 40 | -2.67 | QP/Pass |
| 349.967188 | 46.61 | -4.47 | 42.14 | 100 | H | 134 | 46 | -3.86 | QP/Pass |

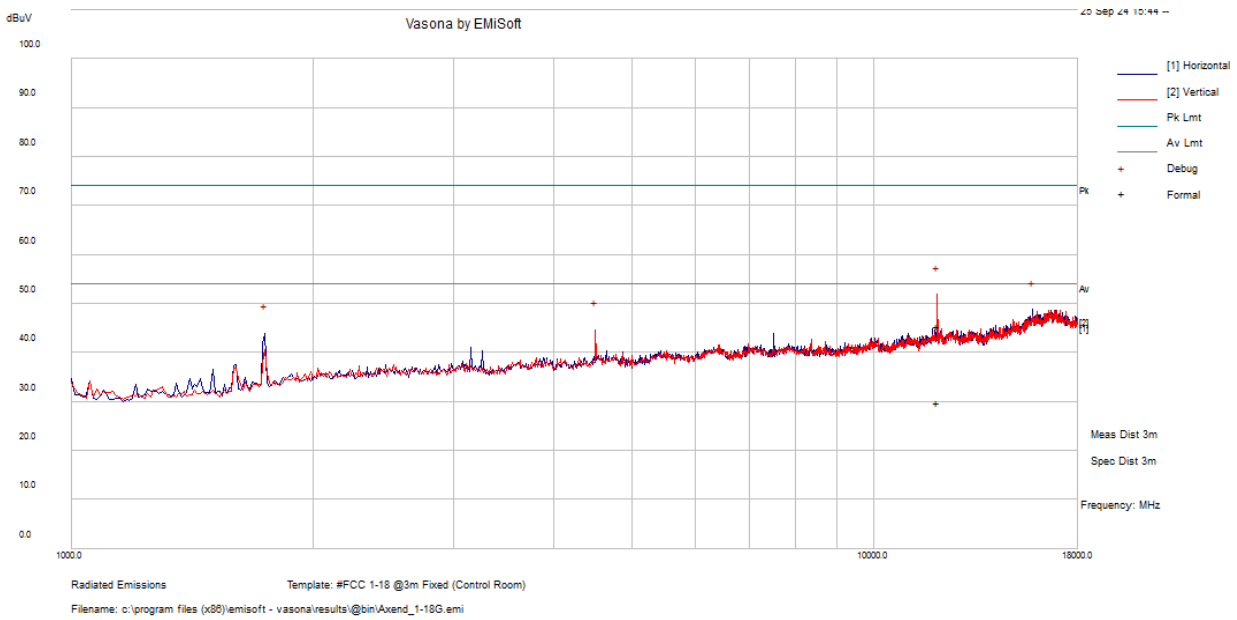
**Middle Channel, 24100 MHz**




| Frequency (MHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 499.988751 | 45.99 | -0.02 | 45.97 | 100 | V | 106 | 46 | -0.03 | QP/Pass |
| 37.957188 | 42.96 | -6 | 36.96 | 117 | V | 232 | 40 | -3.04 | QP/Pass |
| 449.994063 | 46.68 | -1.27 | 45.41 | 187 | H | 99 | 46 | -0.59 | QP/Pass |
| 950.039375 | 35.31 | 6.9 | 42.21 | 155 | V | 44 | 46 | -3.79 | QP/Pass |
| 42.975938 | 46.13 | -9.51 | 36.62 | 100 | V | 110 | 40 | -3.38 | QP/Pass |
| 149.945625 | 44.05 | -7.53 | 36.52 | 300 | H | 340 | 43.5 | -6.98 | QP/Pass |

### 2) 1–18 GHz Measured at 3 meter

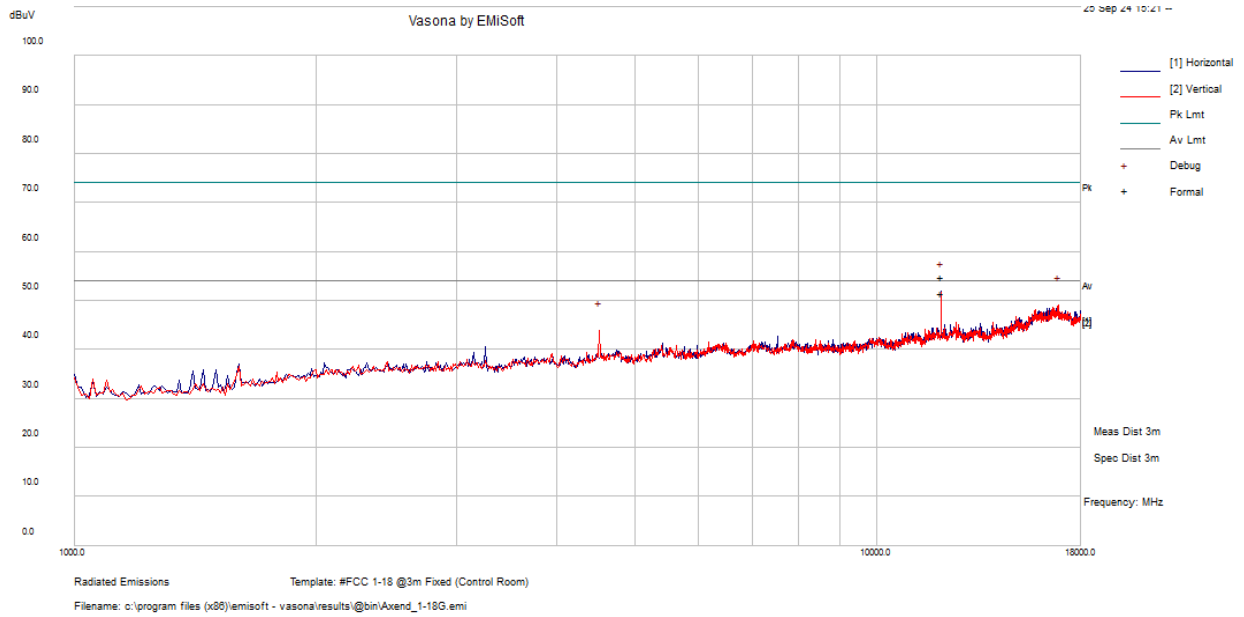
**Low Channel, 24050 MHz**




| Frequency (MHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 12027.335 | 36.35 | 8.92 | 45.27 | 195 | V | 255 | 74 | -28.73 | Peak/Pass |
| 12027.335 | 20.76 | 8.92 | 29.68 | 195 | V | 255 | 54 | -24.33 | Avg./Pass |

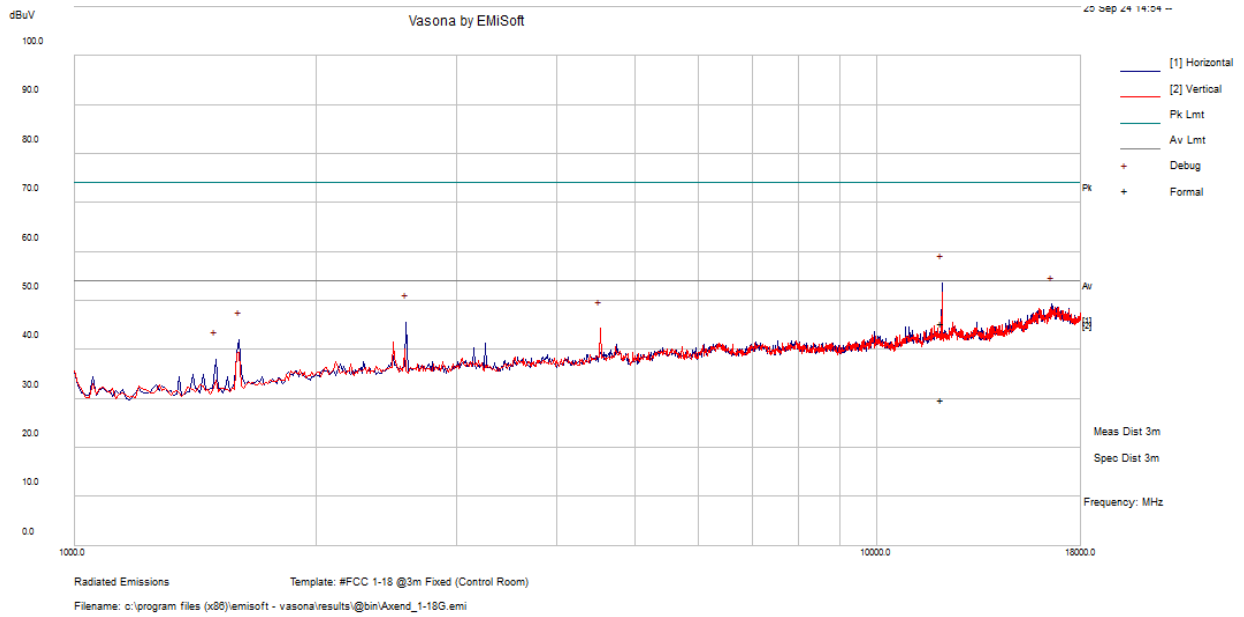
**Note:** Above shows Peak emission passing average limit to show worst-case compliance.

**Middle Channel, 24100 MHz**




| Frequency (MHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 12049.938 | 45.78 | 8.97 | 54.75 | 225 | H | 41 | 74 | -19.25 | Peak/Pass |
| 12049.938 | 42.45 | 8.98 | 51.43 | 225 | H | 41 | 54 | -2.57 | Avg./Pass |

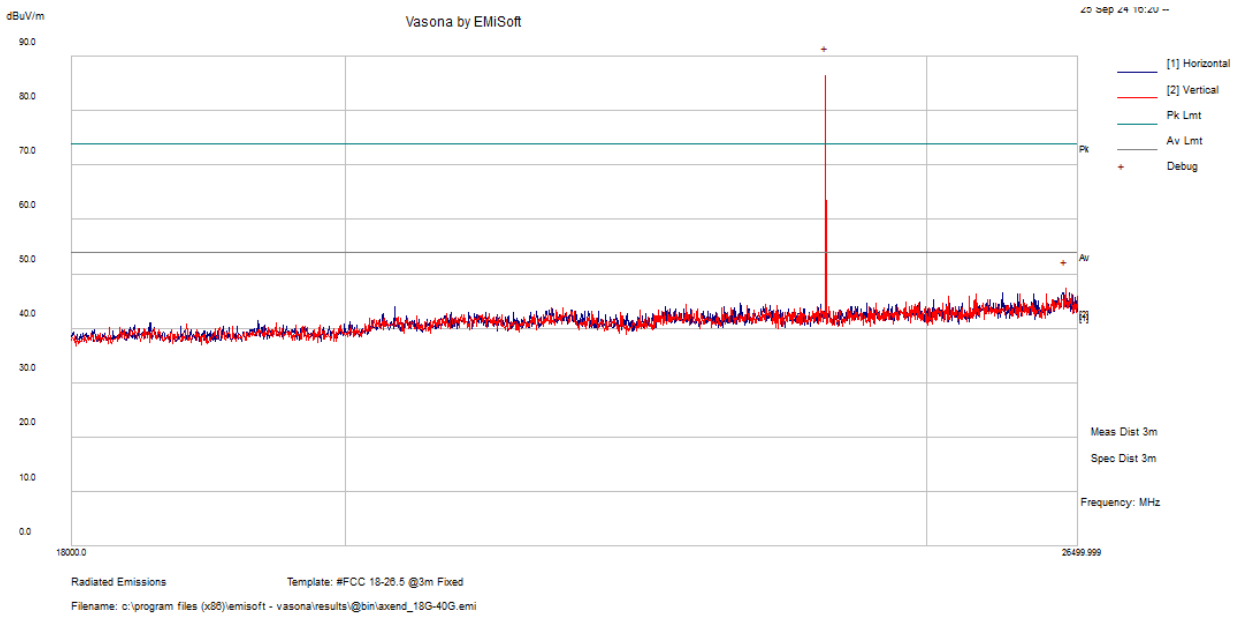
## High Channel, 24150 MHz




| Frequency (MHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 12071.468 | 36.48 | 8.99 | 45.47 | 106 | H | 281 | 74 | -28.53 | Peak/Pass |
| 12071.468 | 20.8 | 8.99 | 29.79 | 106 | H | 281 | 54 | -24.21 | Avg./Pass |

### 3) 18-26.5 GHz Measured at 3 meter

**Low Channel, 24050 MHz**

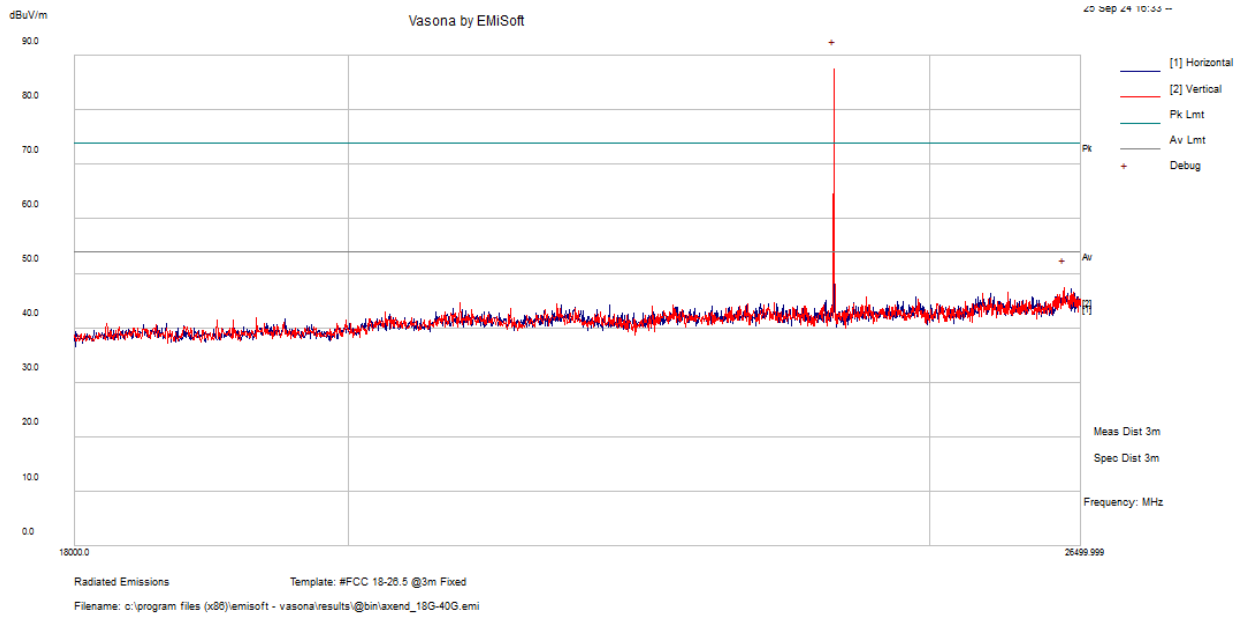



**Note:** Peak emission shown is fundamental frequency.

| 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) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 26372.499 | 44.1 | 3.19 | 47.29 | V | 200 | 0 | 54 | -6.71 | Peak/Pass |

**Note:** Above shows Peak emission passing average limit to show worst-case compliance.

**Middle Channel, 24100 MHz**

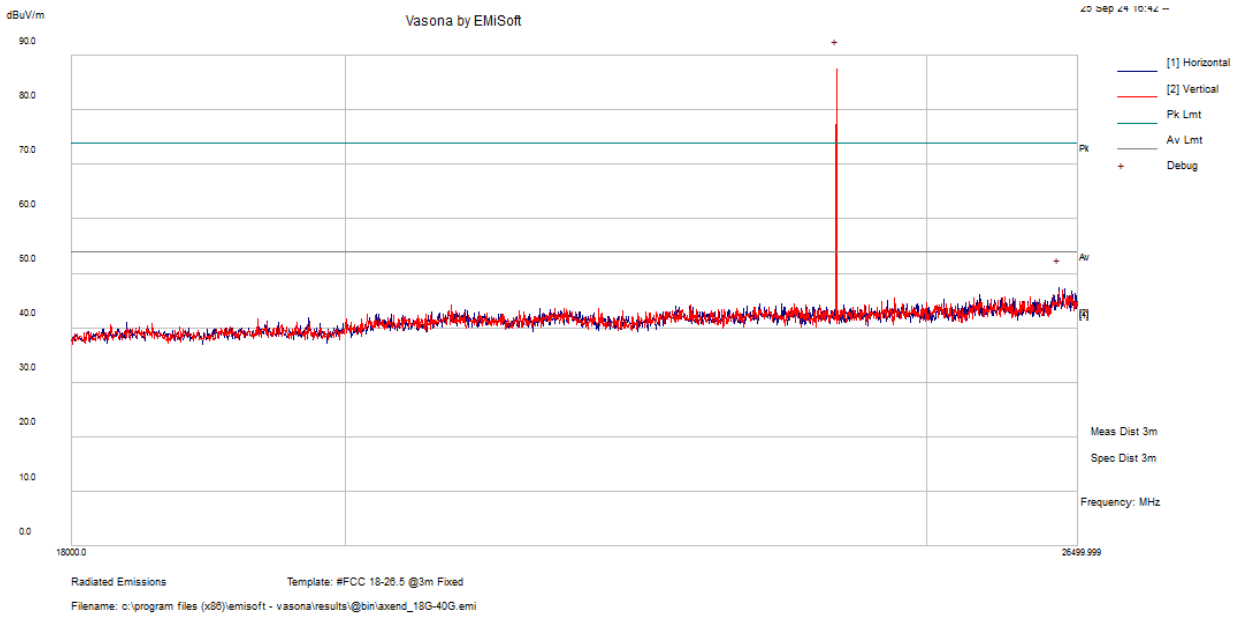



**Note:** Peak emission shown is fundamental frequency.

| 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) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 26329.999 | 44.24 | 3.13 | 47.37 | V | 200 | 0 | 54 | -6.63 | Peak/Pass |

**Note:** Above shows Peak emission passing average limit to show worst-case compliance.

**High Channel, 24150 MHz**



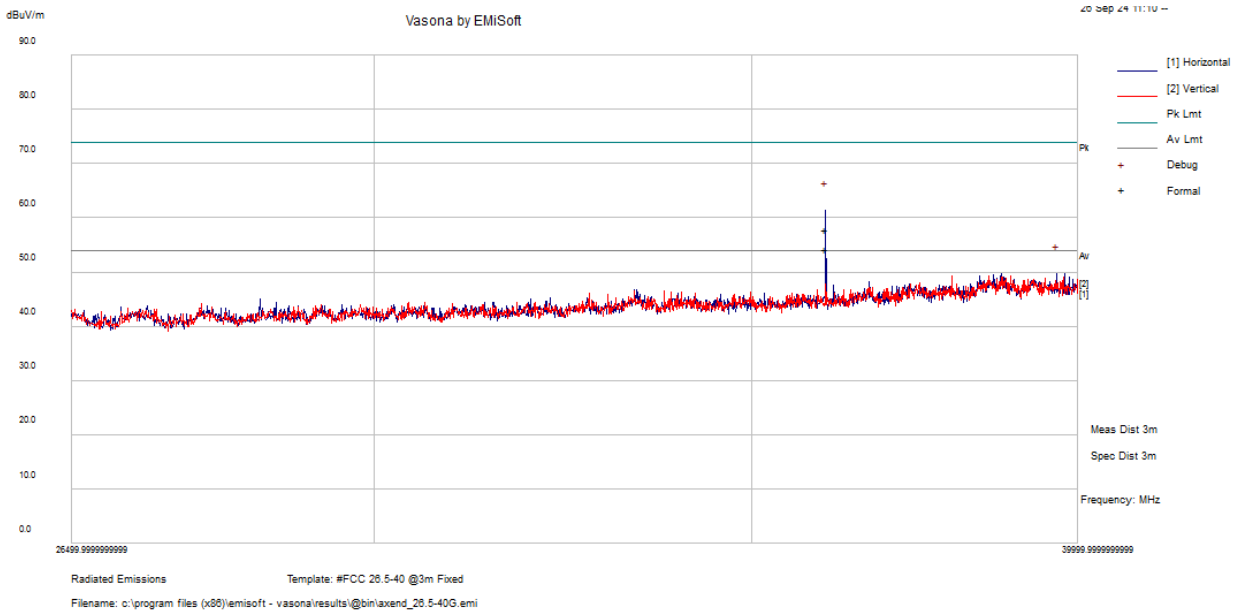

**Note:** Peak emission shown is fundamental frequency.

| 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) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 26303.437 | 44.29 | 3.09 | 47.38 | H | 200 | 0 | 54 | -6.62 | Peak/Pass |

**Note:** Above shows Peak emission passing average limit to show worst-case compliance.

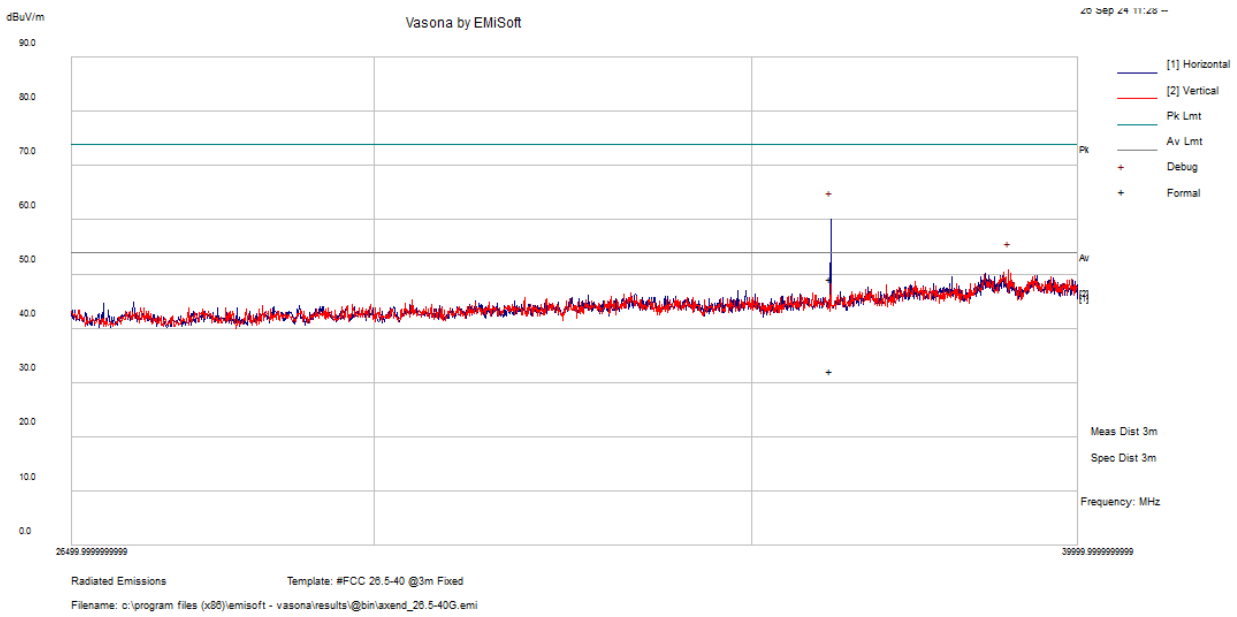
### 4) 26.5-40 GHz Measured at 3 meter

**Low Channel, 24050 MHz**



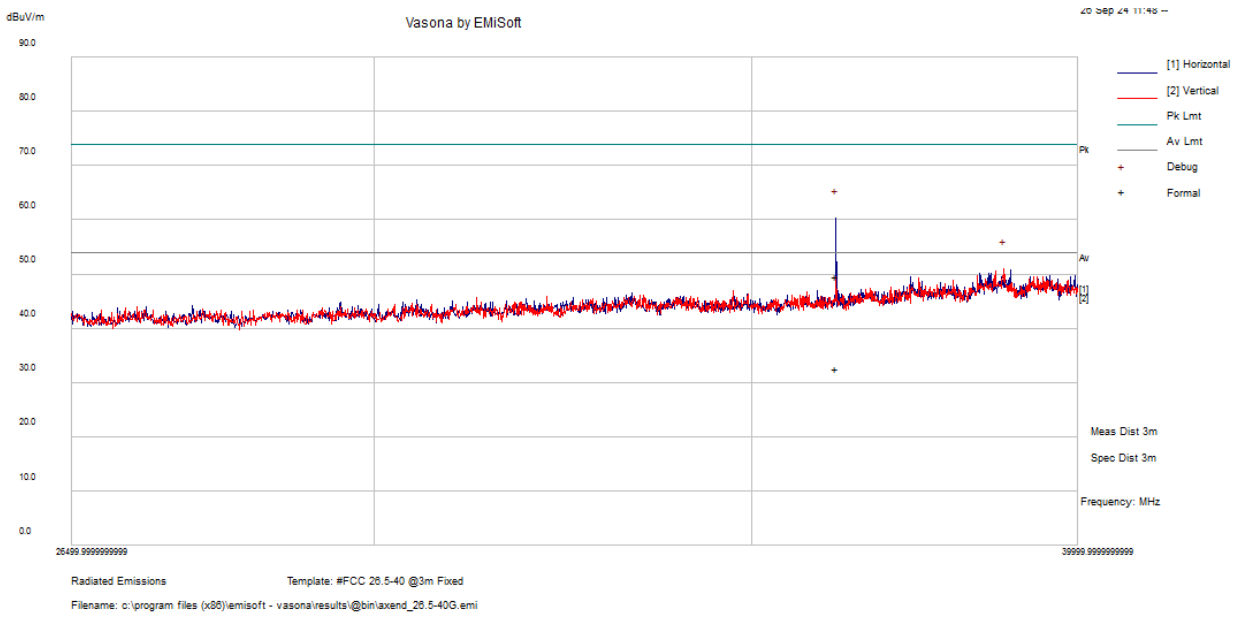

| Frequency (MHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Corrected Amplitude (dBµV/m) | Ant. Polarity (H/V) | Ant. Height (cm) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 36074.901 | 50.74 | 7.07 | 57.81 | H | 178 | 313 | 74 | -16.19 | Peak/Pass |
| 36074.901 | 46.12 | 7.08 | 53.2 | H | 178 | 313 | 54 | -0.8 | Avg./Fail[1] |

## Middle Channel, 24100 MHz




| 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) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 36153.073 | 42.06 | 7.08 | 49.14 | H | 123 | 222 | 74 | -24.86 | Peak/Pass |
| 36153.073 | 24.94 | 7.08 | 32.02 | H | 123 | 222 | 54 | -21.98 | Avg./Pass |

## High Channel, 24150 MHz



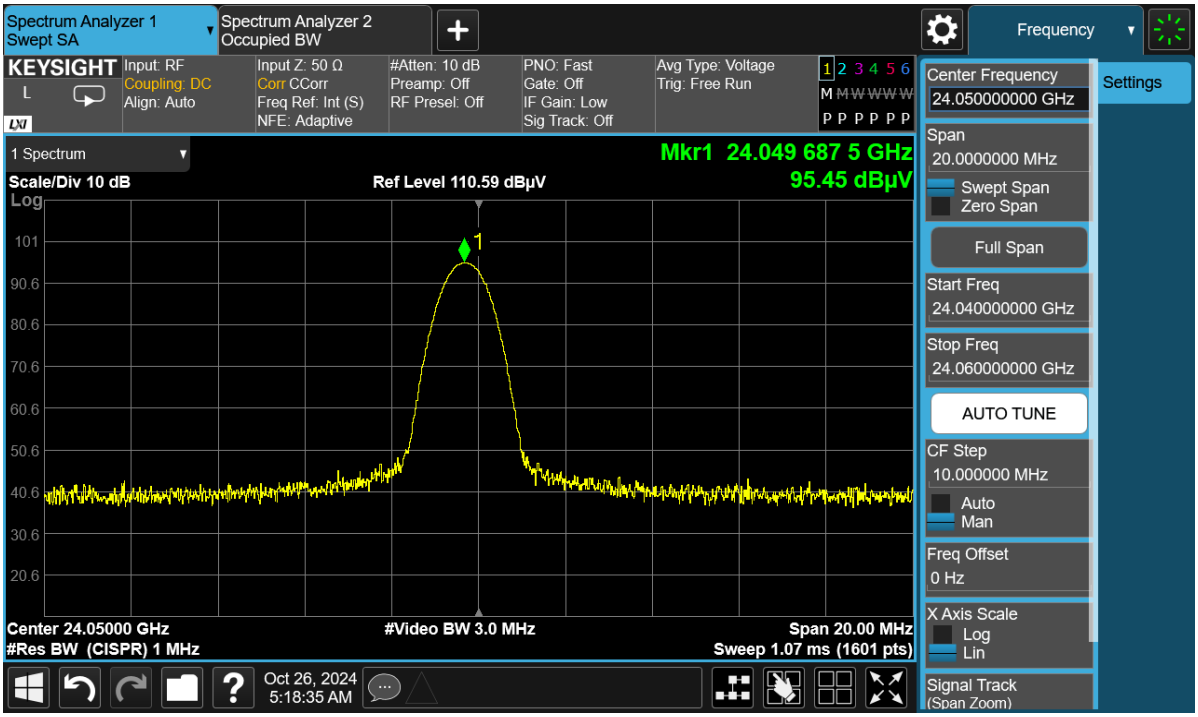

| Frequency (MHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Corrected Amplitude (dBµV/m) | Ant. Polarity (H/V) | Ant. Height (cm) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 36228.428 | 42.54 | 7.11 | 49.65 | H | 235 | 253 | 74 | -24.36 | Peak/Pass |
| 36228.428 | 25.54 | 7.10 | 32.64 | H | 235 | 253 | 54 | -21.36 | Avg./Pass |

**Fundamental Emission**

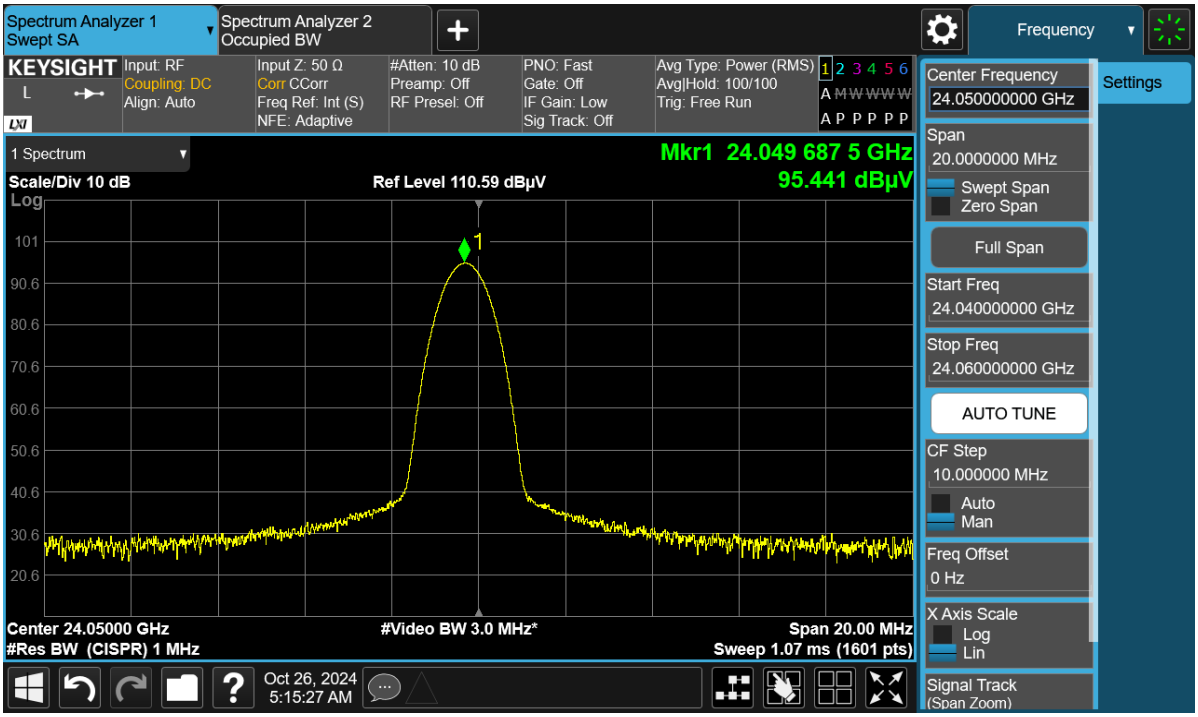
| Frequency (MHz) | Measured Amplitude (dBµV/m@3 m) | Ant. Polarity (H/V) | Ant. Height (cm) | Turntable Azimuth (degrees) | Limit (dBµV/m@3 m) | Margin (dB) | Detector (Peak /Ave.) |
|---|---|---|---|---|---|---|---|
| 24050 | 95.45 | V | 150 | 0 | 128 | -32.55 | Peak |
| 24050 | 95.44 | V | 150 | 0 | 108 | -12.56 | Ave. |
| 24100 | 95.59 | V | 150 | 0 | 128 | -32.41 | Peak |
| 24100 | 95.56 | V | 150 | 0 | 108 | -12.44 | Ave. |
| 24150 | 95.55 | V | 150 | 0 | 128 | -32.45 | Peak |
| 24150 | 95.53 | V | 150 | 0 | 108 | -12.47 | Ave. |

**Note: 250mV/m @3m limit converts to 108dBuV/m @3m**
**Note: Peak limit is 20dB +Average limit**

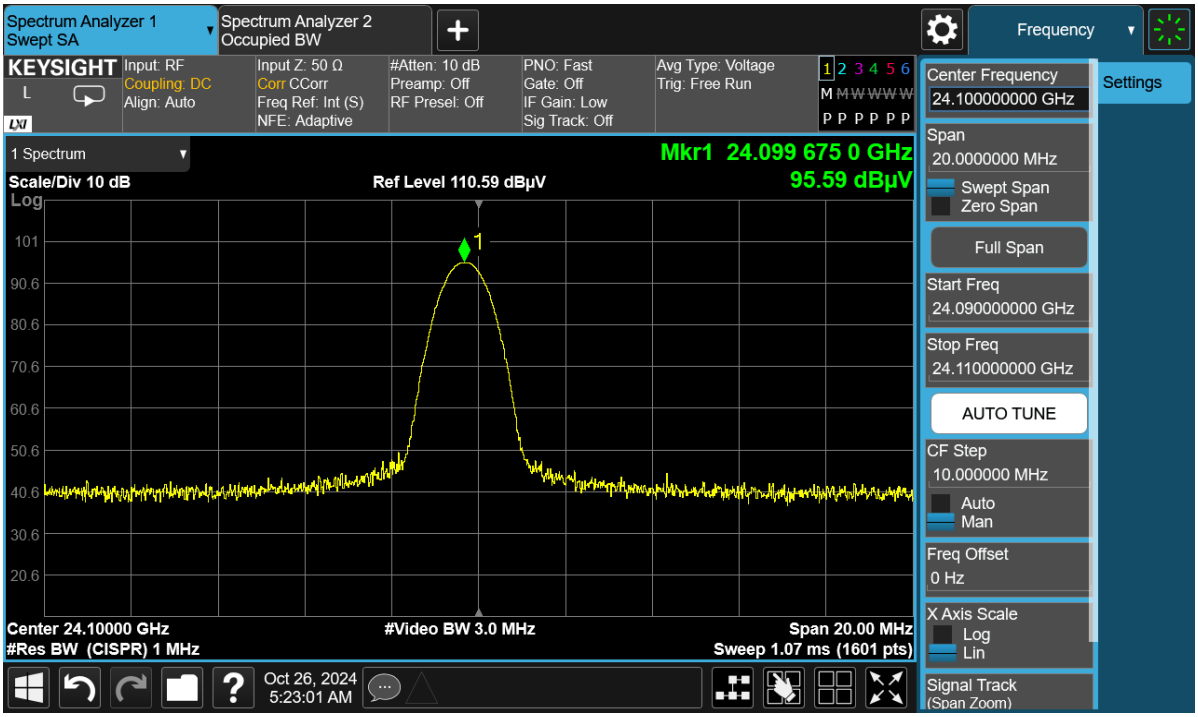
## Low Channel 24050 MHz, Peak



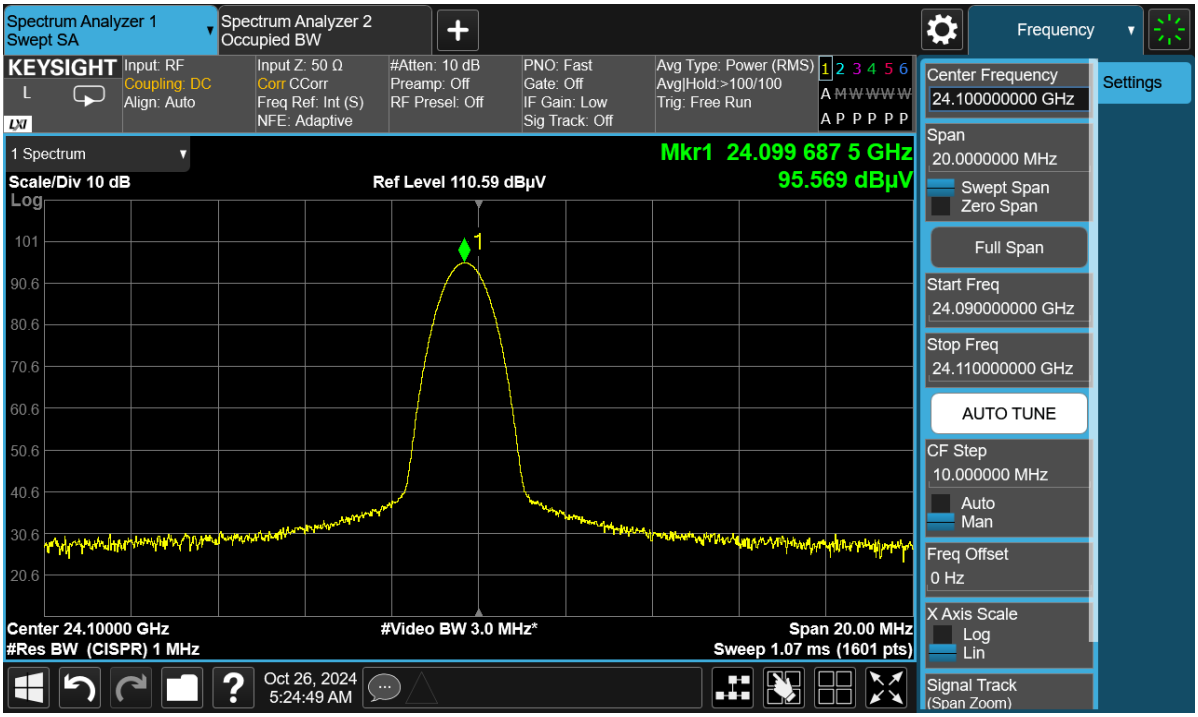

## Low Channel 24050 MHz, Avg.



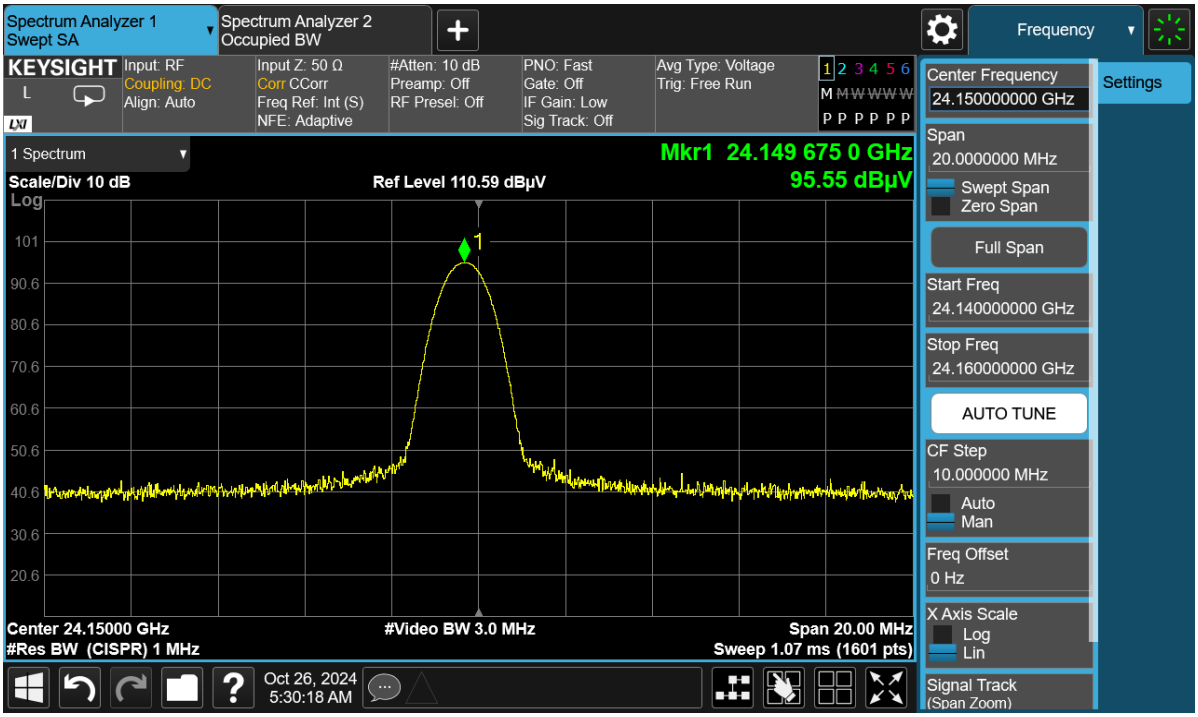
**Middle Channel 24100 MHz, Peak**



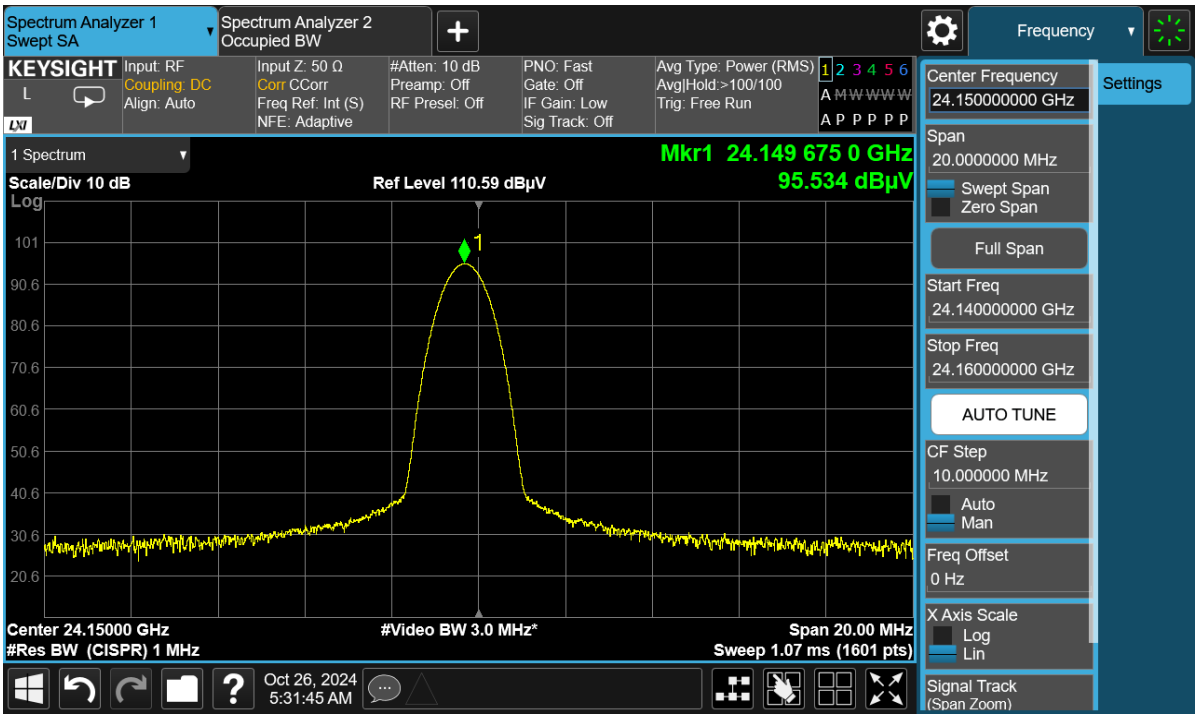

**Middle Channel 24100 MHz, Avg.**



**High Channel 24150 MHz, Peak**

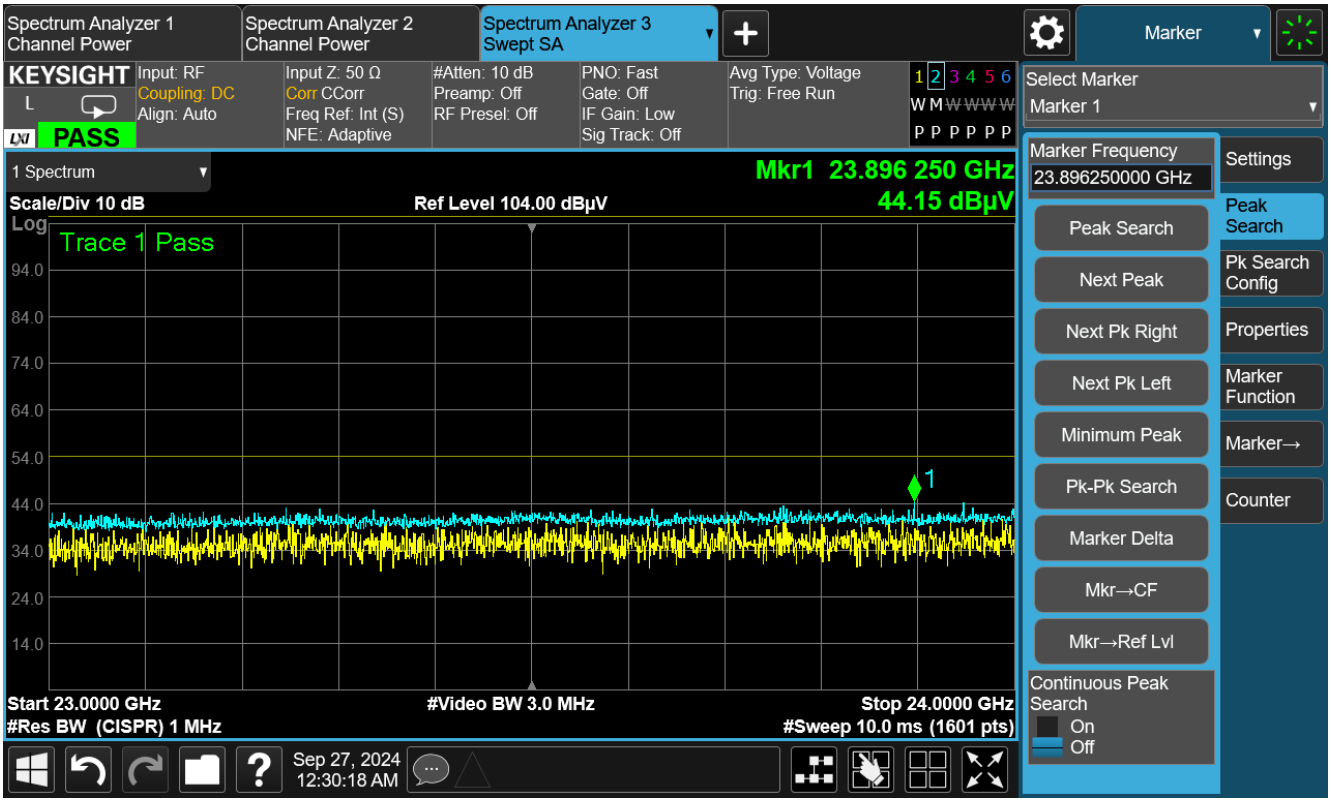



**High Channel 24150 MHz, Avg.**



**Bandedge Test**

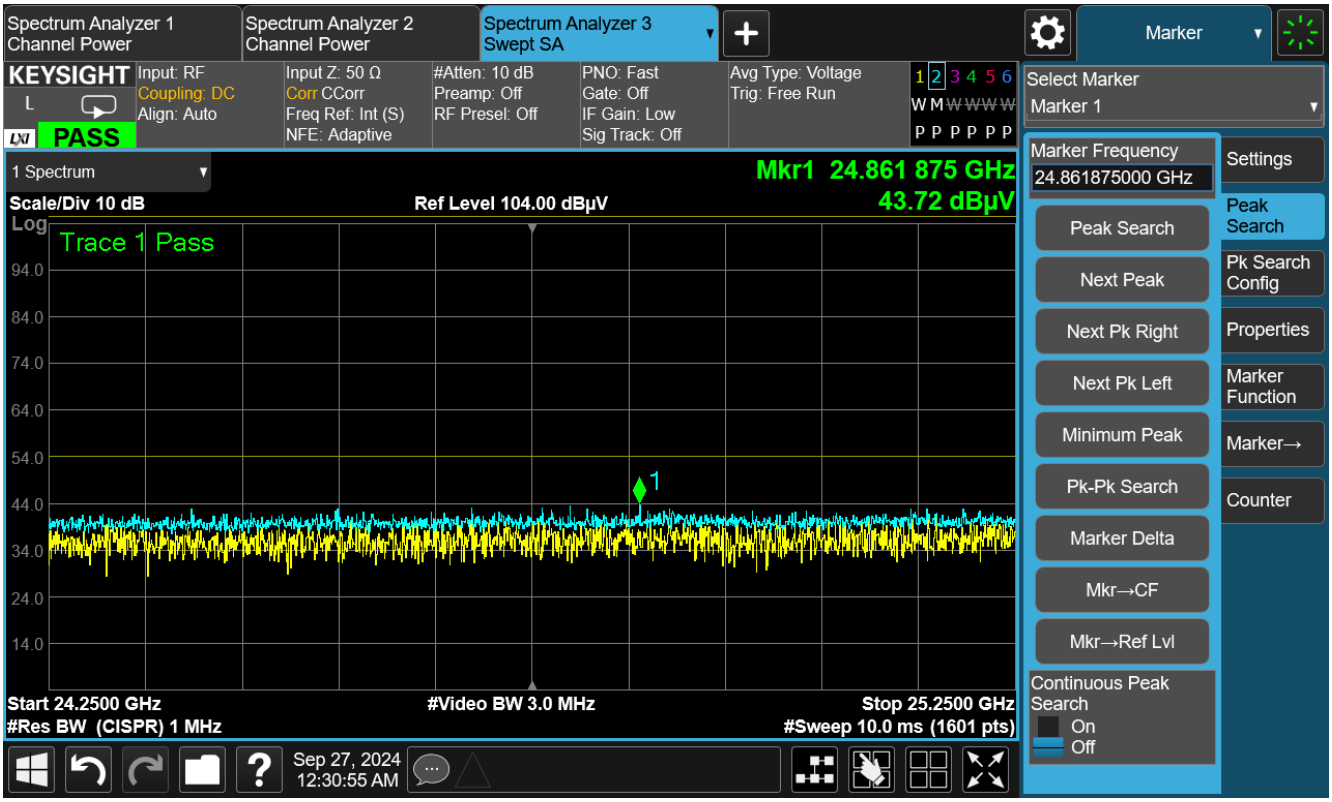
**Low Bandedge**




| Frequency (MHz) | Corrected Amplitude (dBµV/m@ 3m) | Ant. Polarity (H/V) | Ant. Height (cm) | Turntable Azimuth (degrees) | Limit (dBµV/m@3 m) | Margin (dB) | Detector (Peak /Ave.) |
|---|---|---|---|---|---|---|---|
| 23896.25 | 44.15 | H | 150 | 0 | 54 | -9.85 | Peak/Pass |

**Note:** Above shows Peak emission passing average limit to show worst-case compliance.

**High Bandedge**

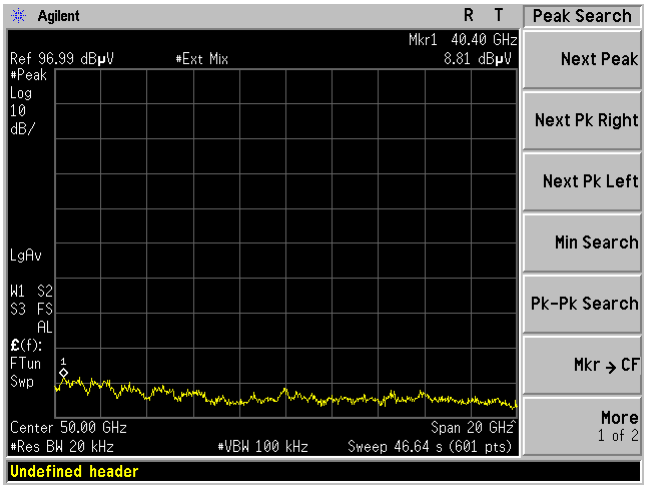



| Frequency (MHz) | Corrected Amplitude (dBµV/m@ 3m) | Ant. Polarity (H/V) | Ant. Height (cm) | Turntable Azimuth (degrees) | Limit (dBµV/m@3 m) | Margin (dB) | Detector (Peak /Ave.) |
|---|---|---|---|---|---|---|---|
| 24861.875 | 43.72 | H | 150 | 0 | 54 | -10.28 | Peak/Pass |

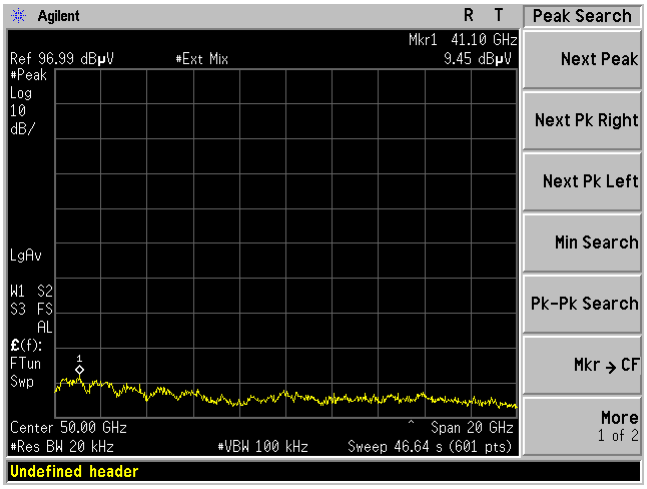
**Note:** Above shows Peak emission passing average limit to show worst-case compliance.

**40-60 GHz, Measured at 1 meter**

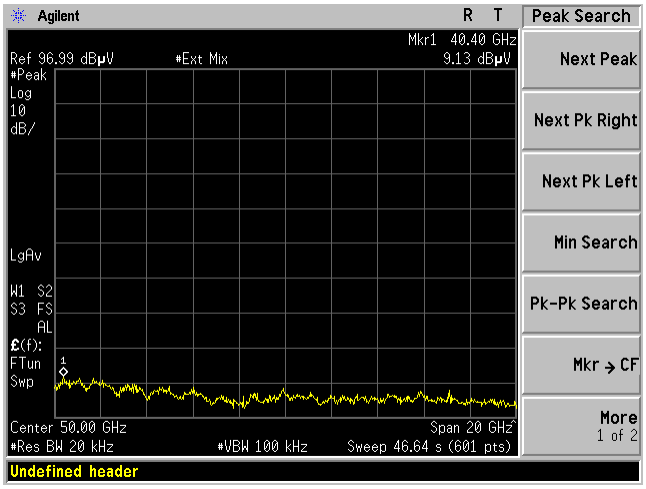
**Low Channel**




**Mid Channel**




**High Channel**

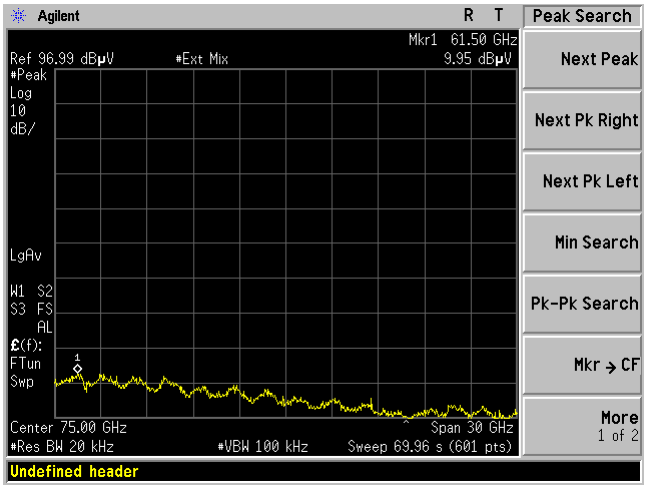



| Frequency Range (GHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Distance Conversion (dB) | Corrected Amplitude (dBµV/m@3m) | Limit (dBµV/m@3m) | Margin (dB) | Detector (Peak /Ave.) |
|---|---|---|---|---|---|---|---|
| Low | 8.84 | 42.4 | -9.54 | 41.7 | 54 | -12.3 | Peak/Pass |
| Middle | 9.45 | 42.4 | -9.54 | 42.31 | 54 | -11.69 | Peak/Pass |
| High | 9.13 | 42.4 | -9.54 | 41.99 | 54 | -12.01 | Peak/Pass |

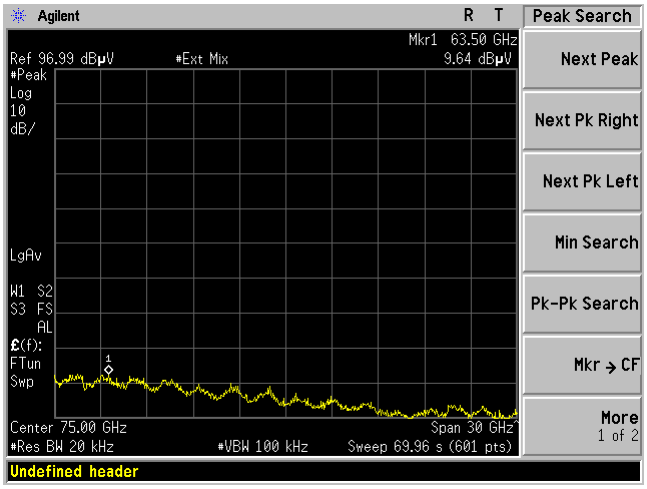
**Note**: Reduced RBW to show noise floor below average requirements
**Note**: Above measurement made at distance 1 meter
**Note**: Correction Factor includes Antenna Factor (dB/m) + Path Loss(dB)
**Note**: Distance conversion using formula 20*log(x/3m) for converting measurement to the applicable 3meter distance requirement
**Note:** Above shows Peak emission passing average limit to show worst-case compliance

**60-90 GHz, Measured at 0.6 meter**

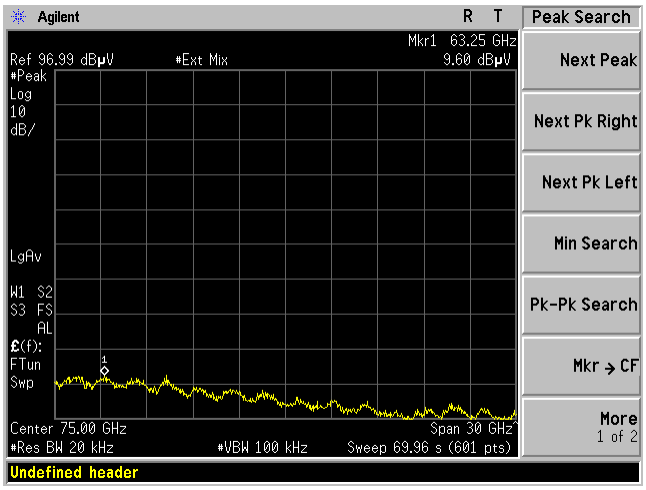
**Low Channel**




**Mid Channel**




**High Channel**

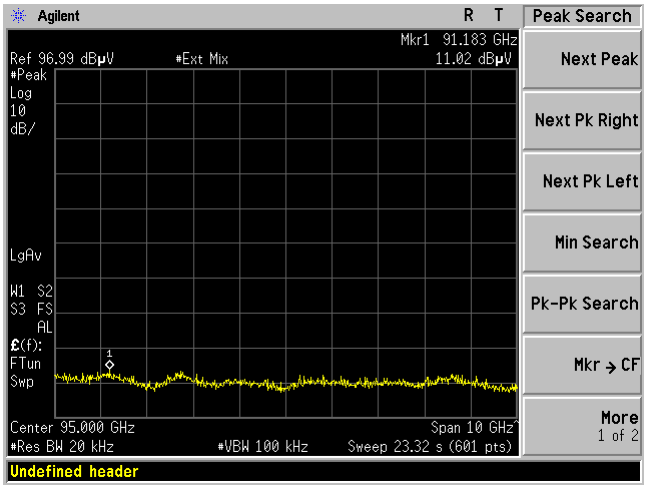



| Frequency Range (GHz) | S.A. Reading (dBuV) | Correction Factor (dB/m) | Distance Conversion (dB) | Corrected Amplitude (dBµV/m@3m) | Limit (dBµV/m@ 3m) | Margin (dB) | Detector (Peak /Ave.) |
|---|---|---|---|---|---|---|---|
| Low | 9.95 | 45.8 | -13.98 | 41.77 | 54 | -12.23 | Peak/Pass |
| Middle | 9.64 | 45.8 | -13.98 | 41.46 | 54 | -12.54 | Peak/Pass |
| High | 9.60 | 45.8 | -13.98 | 41.42 | 54 | -12.58 | Peak/Pass |

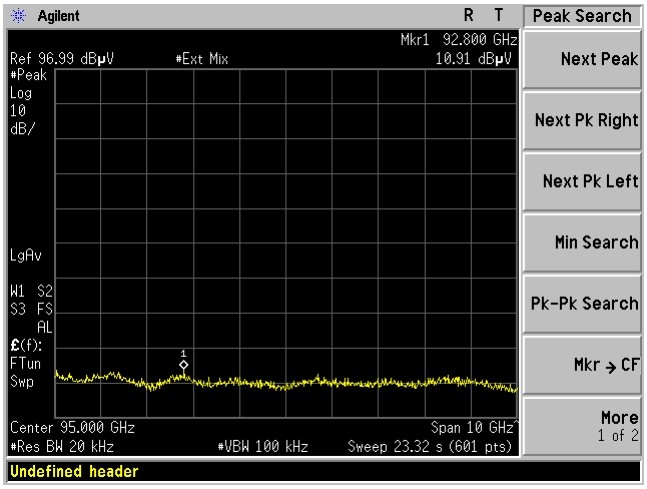
**Note**: Reduced RBW to show noise floor below average requirements
**Note**: Above measurement made at distance 0.6 meter
**Note**: Correction Factor includes Antenna Factor (dB/m) + Path Loss(dB)
**Note**: Distance conversion using formula 20*log(x/3m) for converting measurement to the applicable 3meter distance requirement
**Note:** Above shows Peak emission passing average limit to show worst-case compliance.

**90-100 GHz, Measured at 0.4 meter**

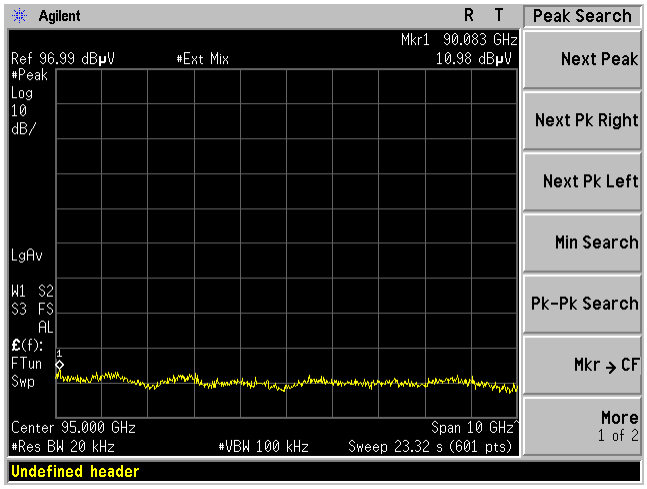
**Low Channel**




**Mid Channel**




**High Channel**




| Channel | S.A. Reading (dBuV) | Correction Factor (dB/m) | Distance Conversion (dB) | Corrected Amplitude (dBµV/m@3m) | Limit (dBµV/m@ 3m) | Margin (dB) | Detector (Peak /Ave.) |
|---|---|---|---|---|---|---|---|
| Low | 11.02 | 54.52 | -17.5 | 48.04 | 54 | -5.96 | Peak/Pass |
| Middle | 10.91 | 54.52 | -17.5 | 47.93 | 54 | -6.07 | Peak/Pass |
| High | 10.98 | 54.52 | -17.5 | 48 | 54 | -6 | Peak/Pass |

**Note**: Reduced RBW to show noise floor below average requirements
**Note**: Above measurement made at distance 0.4 meter
**Note**: Correction Factor includes Antenna Factor (dB/m) + Path Loss(dB)
**Note**: Distance conversion using formula 20*log(x/3m) for converting measurement to the applicable 3meter distance requirement
**Note:** Above shows Peak emission passing average limit to show worst-case compliance.

# 9 Annex A (Normative) – EUT Test Setup Photographs

Please refer to the attachment “EUT Test Setup Photographs 15.249”.

# 10 Annex B (Normative) – EUT External Photographs

Please refer to the attachment “EUT External Photographs”.

# 11 Annex C (Normative) – EUT Internal Photographs

Please refer to the attachment “EUT Internal Photographs”.

# 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 13th day of September 2024.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2026

*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 ---**