313 West 12800 South, Suite 311
Draper, UT 84020
(801) 260-4040

# Test Report

Certification

| | |
|---|---|
| **FCC ID** | 2AAAS-TH05 |
| **Equipment Under Test** | TH05 |
| **Test Report Serial No** | V080638_01 |
| **Date of Test** | August 25, 2025 |
| **Report Issue Date** | September 5, 2025 |

| **Test Specifications:** | **Applicant:** |
|---|---|
| FCC Part 15, Subpart C, 15.249 | Vivint, Inc.<br>3401 N. Ashton Blvd.<br>Lehi, UT 84043<br>U.S.A. |

TESTING
NVLAP LAB CODE 100272-0

# Certification of Engineering Report

This report has been prepared by VPI Technology, Inc. to document compliance of the device described below with the requirements of Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

| | |
|---|---|
| **Applicant** | Vivint, Inc. |
| **Manufacturer** | Vivint, Inc. |
| **Brand Name** | Vivint |
| **Model Number** | TH05 |
| **FCC ID** | 2AAAS-TH05 |

On this 5th day of September 2025, I, individually and for VPI Technology, Inc., certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has accredited the VPI Technology, Inc. EMC testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the US government.

VPI Technology, Inc.

Tested by: Benjamin N. Antczak

Reviewed by: Jason Stewart

| Revision History | | |
|---|---|---|
| **Revision** | **Description** | **Date** |
| 01 | Original Report Release | September 5, 2025 |

# Table of Contents

# 1 Client Information

## 1.1 Applicant

| | |
|---|---|
| **Company Name** | Vivint, Inc.<br>3401 N. Ashton Blvd.<br>Lehi, UT 84043<br>U.S.A. |
| **Contact Name** | Norman Hansen |
| **Title** | Regulatory Compliance Engineer |

## 1.2 Manufacturer

| | |
|---|---|
| **Company Name** | Vivint, Inc.<br>3401 N. Ashton Blvd.<br>Lehi, UT 84043<br>U.S.A. |
| **Contact Name** | Norman Hansen |
| **Title** | Regulatory Compliance Engineer |

# 2 Equipment Under Test (EUT)

## 2.1 Identification of EUT

| | |
|---|---|
| **Brand Name** | Vivint |
| **Model Number** | TH05 |
| **Serial Number** | 2202520003031 |
| **Dimensions (cm)** | 11.5 x 11.5 x 2.4 (Enclosure) |
| | 10.7 x 10.5 x 1.8 (PCB) |

## 2.2 Description of EUT

The TH05 is a wireless Z-wave thermostat for use in Vivint smart homes. The EUT is mounted on the wall in a single orientation. It transmits on three channels, 908.4MHz, 908.42MHz, and 916MHz. EUT is powered by 24VAC input via AC Mains or four AA batteries. For testing, a White Rodgers 37-6609D 24VAC transformer.

This report covers the circuitry of the devices subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Subpart B was found to be compliant and is covered in VPI Technology, Inc. report V080637_01.

## 2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

| **Brand Name**<br>**Model Number**<br>**Serial Number** | **Description** | **Name of Interface Ports / Interface Cables** |
|---|---|---|
| BN: Vivint<br>MN: TH05 (Note 1)<br>SN: 2202520003031 | Z-Wave Thermostat | See Section 2.4 |
| BN: White Rodgers<br>MN: 37-6609D<br>SN: N/A | 120VAC to 24VAC Transformer | Thermostat Interface V+ and V- / Thermostat Cable<br>(Note 2) |

Notes: (1) EUT

(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.

## 2.4 Interface Ports on EUT

| Name of Ports | No. of Ports Fitted to EUT | Cable Description/Length |
|---|---|---|
| Thermostat Interface | 1 of 1 | Thermostat Cable with 8x 18 Gauge Conductors / 3 meters |

## 2.5 Modification Incorporated/Special Accessories on EUT

The following modifications were made to the EUT by the Client during testing to comply with the specification. This report is not complete without an accompanying signed attestation, that the product will have all of the documented modifications incorporated into the product when manufactured and placed on the market.

- Power level is set to 16 to comply with field strength limits.

## 2.6 Deviation from Test Standard

There were no deviations from the test specification.

# 3 Test Specification, Methods and Procedures

## 3.1 Test Specification

| | |
|---|---|
| **Title** | FCC PART 15, Subpart C (47 CFR 15)<br>15.203, 15.207, and 15.249<br>Limits and methods of measurement of radio interference characteristics of radio frequency devices. |
| **Purpose of Test** | The tests were performed to demonstrate initial compliance |

## 3.2 Methods & Procedures

### 3.2.1 §15.203 Antenna Requirement

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. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

### 3.2.2 §15.207 Conducted Limits

(a) Except as shown in paragraphs (b) and (c) of this section, 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 frequency ranges.

| **Frequency range (MHz)** | **Limit (dBμV)** | |
|---|---|---|
| | **Quasi-peak** | **Average** |
| 0.15 to 0.50* | 66 to 56* | 56 to 46* |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

**Table 1: Limits for conducted emissions at mains ports of Class B ITE.**

### 3.2.3 § 15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.

a) 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:

| Fundamental Frequency | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) |
|---|---|---|
| 902-928 MHz | 50 | 500 |
| 2400-2483.5 MHz | 50 | 500 |
| 5725-5875 MHz | 50 | 500 |
| 24.0-24.25 GHz | 250 | 2500 |

b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05-24.25 GHz band subject to the following conditions:

(1) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.

(2) The frequency tolerance of the carrier signal shall be maintained within ±0.001% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(3) Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

c) Field strength limits are specified at a distance of 3 meters.

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.

e) As shown in § 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

## 3.3 Test Procedure

VPI Technology, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2026. VPI Technology, Inc. carries FCC Accreditation Designation Number US5263. VPI Technology main office is located at 313 W 12800 S, Suite 311, Draper, UT 84020. The testing was performed according to the procedures in ANSI C63.10-2013, KDB 558074, and 47 CFR Part 15.

# 4 Operation of EUT During Testing

## 4.1 Operating Environment

| | |
|---|---|
| **Power Supply** | 120 VAC (AC Mains powered via 24VAC transformer)<br>and<br>6 VDC (4x AA Batteries) |
| **AC Mains Frequency** | 60 Hz (AC Mains powered via 24VAC transformer)<br>and<br>N/A (VDC via 4x AA Batteries) |

## 4.2 Operating Modes

The transmitter is a wall mounted device and is professionally installed in a single orientation which was tested. The AC mains voltage to the AC adapter was varied as required by §15.31(e) with no change seen in the voltage supplied to the transmitter or in transmitter characteristics and four new AA batteries were installed for testing. Both power modes were tested with no observed difference in emissions.

## 4.3 EUT Exercise Software

Vivant firmware was installed on the EUT that allowed constant modulated transmission in each modulation mode. A debug board was used with a command prompt to send commands to the EUT. Both debug board and command laptop were removed from the test area during the evaluation.

# 5 Summary of Test Results

## 5.1 FCC Part 15, Subpart C

### 5.1.1 Summary of Tests

| Section | Environmental Phenomena | Frequency Range (MHz) | Result |
|---|---|---|---|
| 15.203 | Antenna Requirements | Structural requirement | Complied |
| 15.207 | Conducted Disturbance at Mains Ports | 0.15 to 30 | Complied |
| 15.249(a) | Field Strength of Fundamental | 902-928 | Complied |
| 15.249(a) and 15.249(e) | Radiated Spurious Emissions | 30 - 9300 | Complied |
| 15.249(a) and 15.249(e) | 20dB Bandwidth | 902-928 | Reported |
| 15.249(b) | Fixed Point-to-Point Operation | 902-928 | Not Applicable |

## 5.2 Result

In the configuration tested, the EUT complied with the requirements of the specification.

# 6 Measurements, Examinations and Derived Results

## 6.1 General Comments

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Section 7 of this report.

When calculations in this report require EUT antenna gains, those values have been provided by the manufacturer unless otherwise noted.

## 6.2 Test Results

### 6.2.1 §15.203 Antenna Requirements

The EUT uses a PCB Trace antenna. All measurements were taken radiated.

**Result**

The EUT complied with the specification.

### 6.2.2 Conducted Emissions at Mains Ports Data (Hot Lead)

| Frequency (MHz) | Detector | Receiver Reading (dBµV) | Correction Factor (dB) | Measured Level (dBµV) | Class B Limit (dBµV) | Margin (dB) |
|---|---|---|---|---|---|---|
| 0.18 | Peak (Note 1) | 24.8 | 11.3 | 36.1 | 54.4 | -18.3 |
| 0.24 | Peak (Note 1) | 24.7 | 10.8 | 35.5 | 52.0 | -16.6 |
| 0.48 | Peak (Note 1) | 21.5 | 10.3 | 31.8 | 46.3 | -14.6 |
| 1.1 | Peak (Note 1) | 21.2 | 10.1 | 31.3 | 46.0 | -14.7 |
| 14.9 | Peak (Note 1) | 22.0 | 10.6 | 32.5 | 50.0 | -17.5 |
| 18.8 | Peak (Note 1) | 22.1 | 10.8 | 32.9 | 50.0 | -17.2 |

Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.
Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

**Result**

The EUT complied with the specification limit by a margin of 14.6 dB.

### 6.2.3 Conducted Emissions at Mains Ports Data (Neutral Lead)

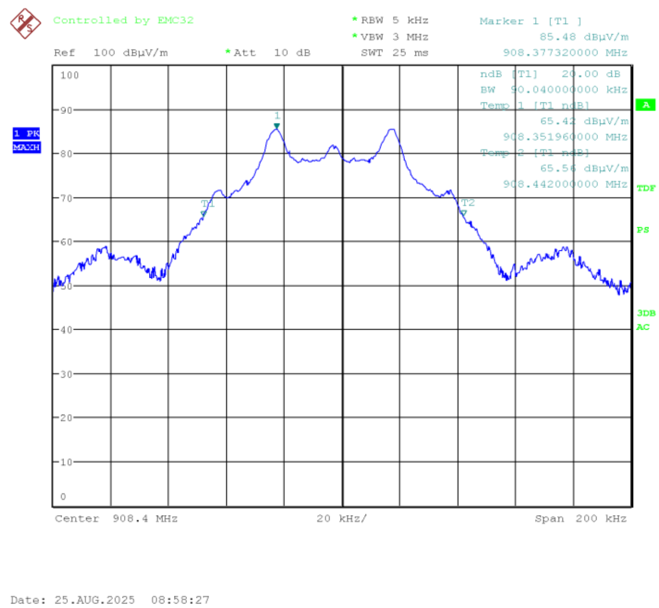
| Frequency (MHz) | Detector | Receiver Reading (dBµV) | Correction Factor (dB) | Measured Level (dBµV) | Class B Limit (dBµV) | Margin (dB) |
|---|---|---|---|---|---|---|
| 0.48 | Peak (Note 1) | 20.2 | 10.3 | 30.5 | 46.3 | -15.8 |
| 1.3 | Peak (Note 1) | 20.3 | 10.1 | 30.5 | 46.0 | -15.5 |
| 2.3 | Peak (Note 1) | 20.7 | 10.2 | 30.9 | 46.0 | -15.1 |
| 5.4 | Peak (Note 1) | 21.0 | 10.3 | 31.4 | 50.0 | -18.6 |
| 12.4 | Peak (Note 1) | 21.0 | 10.5 | 31.6 | 50.0 | -18.4 |
| 19.4 | Peak (Note 1) | 22.0 | 10.9 | 32.8 | 50.0 | -17.2 |
| Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.<br>Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits. | | | | | | |

**Result**

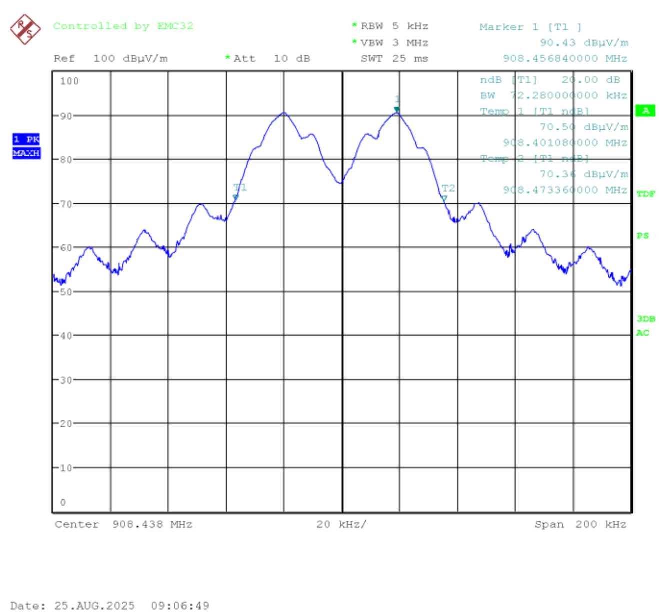
The EUT complied with the specification limit by a margin of 15.1 dB.

### 6.2.4 20dB Emissions Bandwidth

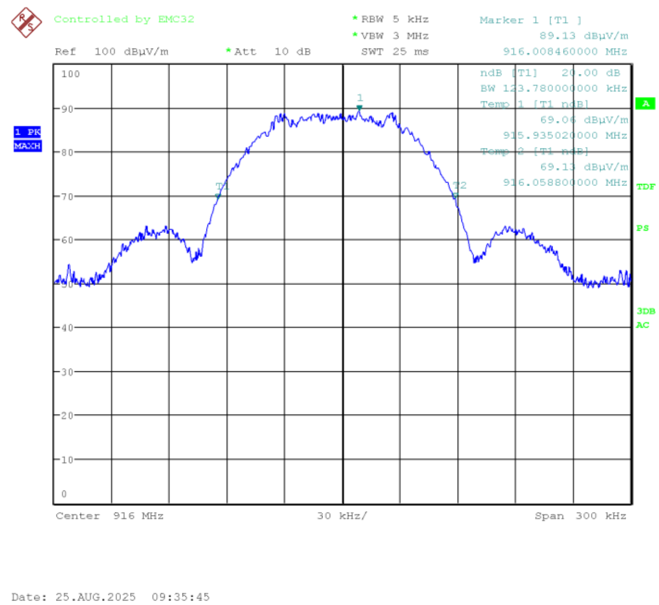
| Frequency (MHz) | Emission 20 dB bandwidth (kHz) |
|---|---|
| 908.40 | 90.04 |
| 908.42 | 72.28 |
| 916.00 | 123.78 |




**Graph 1: 908.40 MHz 20dB Bandwidth**




**Graph 2: 908.42 MHz 20dB Bandwidth**




**Graph 3: 916.00 MHz 20dB Bandwidth**

### 6.2.5 §15.249(a) Fundamental Field Strength

The fundamental field strength was evaluated with the ESU40 Test Receiver QP detector with a RBW of 120 kHz. The limit is 50 millivolts/meter, or 94dBuV/m, at 3 meters.

| Frequency (MHz) | Receiver Reading (dBuV) | Correction Factor (dB/m) | Field Strength of Fundamental (3 meter, Quasi-Peak, dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|
| 908.40 | 52.9 | 38.5 | 91.4 | 94.0 | -2.6 |
| 908.42 | 52.1 | 38.5 | 90.6 | 94.0 | -3.4 |
| 916.00 | 54.5 | 38.8 | 93.3 | 94.0 | -0.7 |

**Result**

In the configuration tested, the field strength of the fundamental was below 94dBuV/m; therefore, the EUT complied with the requirements of the specification.

### 6.2.6 §15.249(a) and §15.249(e) Spurious Emissions

**Radiated Spurious Emissions in the Restricted Bands of §15.205**

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emission was investigated to measure any radiated emissions in the restricted bands. The following tables show measurements of any harmonic, including those falling in the restricted bands of §15.205. The tables show the worst-case emission measured from the EUT. The noise floor was a minimum of 6 dB below the limit. The emissions in the restricted bands must meet the limits specified in §15.209. Tabular data for each of the spurious emissions is shown below for each of the units.

**Result**

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.

| Frequency (MHz) | Detector | Antenna Polarity | Receiver Reading (dBμV) | Correction Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 1816.8* | Peak | Vertical | 42.2 | -5.3 | 36.9 | 74.0 | -37.1 |
| 1816.8* | Average | Vertical | 28.9 | -5.3 | 23.6 | 54.0 | -30.4 |
| 1816.8* | Peak | Horizontal | -5.3 | -5.3 | -10.7 | 74.0 | -84.7 |
| 1816.8* | Average | Horizontal | -5.3 | -5.3 | -10.7 | 54.0 | -64.7 |
| 2725.4 | Peak | Vertical | 47.6 | -1.7 | 45.9 | 74.0 | -28.1 |
| 2725.2 | Average | Vertical | 43.4 | -1.7 | 41.7 | 54.0 | -12.4 |
| 2725.4 | Peak | Horizontal | -1.7 | -1.7 | -3.5 | 74.0 | -77.5 |
| 2725.2 | Average | Horizontal | -1.7 | -1.7 | -3.5 | 54.0 | -57.5 |
| 3633.8 | Peak | Vertical | 42.1 | 2.7 | 44.8 | 74.0 | -29.2 |
| 3633.5 | Average | Vertical | 30.4 | 2.7 | 33.0 | 54.0 | -21.0 |
| 3633.7 | Peak | Horizontal | 2.7 | 2.7 | 5.4 | 74.0 | -68.6 |
| 3633.6 | Average | Horizontal | 2.7 | 2.7 | 5.4 | 54.0 | -48.6 |
| 4541.8 | Peak | Vertical | 41.8 | 4.6 | 46.4 | 74.0 | -27.6 |
| 4541.9 | Average | Vertical | 35.9 | 4.6 | 40.4 | 54.0 | -13.6 |
| 4542.0 | Peak | Horizontal | 4.6 | 4.6 | 9.1 | 74.0 | -64.9 |
| 4541.9 | Average | Horizontal | 4.6 | 4.6 | 9.1 | 54.0 | -44.9 |
| 5449.8 | Peak | Vertical | 37.5 | 7.3 | 44.8 | 74.0 | -29.2 |
| 5450.3 | Average | Vertical | 24.1 | 7.3 | 31.4 | 54.0 | -22.6 |
| 5450.1 | Peak | Horizontal | 7.3 | 7.3 | 14.6 | 74.0 | -59.4 |
| 5450.5 | Average | Horizontal | 7.3 | 7.3 | 14.6 | 54.0 | -39.4 |
| 6359.0* | Peak | Vertical | 37.3 | 8.5 | 45.8 | 74.0 | -28.2 |
| 6358.8* | Average | Vertical | 26.0 | 8.5 | 34.4 | 54.0 | -19.6 |
| 6358.6* | Peak | Horizontal | 8.5 | 8.5 | 16.9 | 74.0 | -57.1 |

| Frequency (MHz) | Detector | Antenna Polarity | Receiver Reading (dBμV) | Correction Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 6358.8* | Average | Horizontal | 8.5 | 8.5 | 16.9 | 54.0 | -37.1 |
| 7267.2 | Peak | Vertical | 35.3 | 10.6 | 46.0 | 74.0 | -28.1 |
| 7267.2 | Average | Vertical | 24.7 | 10.6 | 35.4 | 54.0 | -18.6 |
| 7266.7 | Peak | Horizontal | 10.6 | 10.6 | 21.2 | 74.0 | -52.8 |
| 7267.1 | Average | Horizontal | 10.6 | 10.6 | 21.2 | 54.0 | -32.8 |
| 8175.3 | Peak | Vertical | 39.2 | 11.4 | 50.7 | 74.0 | -23.3 |
| 8175.6 | Average | Vertical | 34.8 | 11.4 | 46.2 | 54.0 | -7.8 |
| 8176.1 | Peak | Horizontal | 11.4 | 11.4 | 22.9 | 74.0 | -51.1 |
| 8175.6 | Average | Horizontal | 11.4 | 11.4 | 22.9 | 54.0 | -31.1 |
| 9083.5 | Peak | Vertical | 34.8 | 12.7 | 47.6 | 74.0 | -26.5 |
| 9083.9 | Average | Vertical | 24.7 | 12.7 | 37.4 | 54.0 | -16.6 |
| 9084.2 | Peak | Horizontal | 12.7 | 12.7 | 25.4 | 74.0 | -48.6 |
| 9084.3 | Average | Horizontal | 12.7 | 12.7 | 25.4 | 54.0 | -28.6 |
| *Frequency falls outside of the restricted bands of 15.205. | | | | | | | |

**Table 2: Transmitting at the 908.40 MHz**

| Frequency (MHz) | Detector | Antenna Polarity | Receiver Reading (dBμV) | Correction Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 1816.8* | Peak | Vertical | 43.2 | -5.3 | 37.9 | 74.0 | -36.1 |
| 1816.6* | Average | Vertical | 29.6 | -5.3 | 24.2 | 54.0 | -29.8 |
| 1816.8* | Peak | Horizontal | 44.7 | -5.3 | 39.3 | 74.0 | -34.7 |
| 1816.7* | Average | Horizontal | 30.4 | -5.3 | 25.1 | 54.0 | -29.0 |
| 2725.3 | Peak | Vertical | 48.6 | -1.7 | 46.9 | 74.0 | -27.1 |
| 2725.3 | Average | Vertical | 44.4 | -1.7 | 42.7 | 54.0 | -11.3 |
| 2725.2 | Peak | Horizontal | 46.0 | -1.7 | 44.3 | 74.0 | -29.7 |
| 2725.3 | Average | Horizontal | 40.3 | -1.7 | 38.6 | 54.0 | -15.4 |
| 3633.4 | Peak | Vertical | 43.2 | 2.7 | 45.9 | 74.0 | -28.1 |
| 3633.8 | Average | Vertical | 30.7 | 2.7 | 33.4 | 54.0 | -20.7 |
| 3633.7 | Peak | Horizontal | 42.5 | 2.7 | 45.2 | 74.0 | -28.8 |
| 3633.6 | Average | Horizontal | 29.3 | 2.7 | 31.9 | 54.0 | -22.1 |
| 4542.3 | Peak | Vertical | 42.0 | 4.6 | 46.5 | 74.0 | -27.5 |
| 4542.2 | Average | Vertical | 36.0 | 4.6 | 40.6 | 54.0 | -13.4 |

| Frequency (MHz) | Detector | Antenna Polarity | Receiver Reading (dBμV) | Correction Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 4542.1 | Peak | Horizontal | 40.6 | 4.6 | 45.2 | 74.0 | -28.8 |
| 4542.1 | Average | Horizontal | 31.6 | 4.6 | 36.1 | 54.0 | -17.9 |
| 5450.0 | Peak | Vertical | 38.4 | 7.3 | 45.7 | 74.0 | -28.4 |
| 5450.6 | Average | Vertical | 24.3 | 7.3 | 31.6 | 54.0 | -22.4 |
| 5450.7 | Peak | Horizontal | 38.5 | 7.3 | 45.7 | 74.0 | -28.3 |
| 5450.6 | Average | Horizontal | 24.6 | 7.3 | 31.9 | 54.0 | -22.1 |
| 6358.8* | Peak | Vertical | 37.5 | 8.5 | 46.0 | 74.0 | -28.1 |
| 6359.0* | Average | Vertical | 26.8 | 8.5 | 35.3 | 54.0 | -18.8 |
| 6358.7* | Peak | Horizontal | 37.5 | 8.5 | 45.9 | 74.0 | -28.1 |
| 6359.0* | Average | Horizontal | 26.3 | 8.5 | 34.7 | 54.0 | -19.3 |
| 7267.5 | Peak | Vertical | 35.6 | 10.6 | 46.2 | 74.0 | -27.8 |
| 7267.5 | Average | Vertical | 25.5 | 10.6 | 36.2 | 54.0 | -17.8 |
| 7267.5 | Peak | Horizontal | 35.4 | 10.6 | 46.0 | 74.0 | -28.0 |
| 7267.5 | Average | Horizontal | 22.9 | 10.6 | 33.5 | 54.0 | -20.5 |
| 8175.9 | Peak | Vertical | 39.9 | 11.4 | 51.3 | 74.0 | -22.7 |
| 8175.9 | Average | Vertical | 35.3 | 11.4 | 46.8 | 54.0 | -7.2 |
| 8176.0 | Peak | Horizontal | 35.7 | 11.4 | 47.1 | 74.0 | -26.9 |
| 8175.8 | Average | Horizontal | 26.0 | 11.4 | 37.4 | 54.0 | -16.6 |
| 9084.4 | Peak | Vertical | 35.2 | 12.7 | 48.0 | 74.0 | -26.1 |
| 9084.3 | Average | Vertical | 25.3 | 12.7 | 38.0 | 54.0 | -16.0 |
| 9084.2 | Peak | Horizontal | 35.4 | 12.7 | 48.1 | 74.0 | -25.9 |
| 9084.5 | Average | Horizontal | 21.9 | 12.7 | 34.6 | 54.0 | -19.4 |
| *Frequency falls outside of the restricted bands of 15.205. | | | | | | | |

**Table 3: Transmitting at 908.42 MHz**

| Frequency (MHz) | Detector | Antenna Polarity | Receiver Reading (dBμV) | Correction Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 1832.1* | Peak | Vertical | 42.4 | -5.0 | 37.4 | 74.0 | -36.6 |
| 1832.0* | Average | Vertical | 29.1 | -5.0 | 24.1 | 54.0 | -29.9 |
| 1832.0* | Peak | Horizontal | 42.3 | -5.0 | 37.3 | 74.0 | -36.7 |
| 1832.0* | Average | Horizontal | 29.1 | -5.0 | 24.1 | 54.0 | -30.0 |
| 2747.9 | Peak | Vertical | 48.1 | -1.7 | 46.5 | 74.0 | -27.5 |

| Frequency (MHz) | Detector | Antenna Polarity | Receiver Reading (dBμV) | Correction Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 2748.0 | Average | Vertical | 43.8 | -1.7 | 42.2 | 54.0 | -11.9 |
| 2748.4 | Peak | Horizontal | 46.5 | -1.7 | 44.8 | 74.0 | -29.2 |
| 2748.0 | Average | Horizontal | 40.8 | -1.7 | 39.1 | 54.0 | -14.9 |
| 3664.1 | Peak | Vertical | 42.1 | 2.9 | 45.1 | 74.0 | -29.0 |
| 3664.0 | Average | Vertical | 31.8 | 2.9 | 34.7 | 54.0 | -19.3 |
| 3663.7 | Peak | Horizontal | 41.8 | 2.9 | 44.7 | 74.0 | -29.3 |
| 3663.9 | Average | Horizontal | 28.7 | 2.9 | 31.6 | 54.0 | -22.4 |
| 4580.1 | Peak | Vertical | 42.0 | 4.6 | 46.6 | 74.0 | -27.4 |
| 4580.0 | Average | Vertical | 36.1 | 4.6 | 40.7 | 54.0 | -13.3 |
| 4580.4 | Peak | Horizontal | 40.2 | 4.6 | 44.8 | 74.0 | -29.3 |
| 4580.0 | Average | Horizontal | 31.9 | 4.6 | 36.5 | 54.0 | -17.5 |
| 5496.3* | Peak | Vertical | 38.1 | 7.3 | 45.5 | 74.0 | -28.6 |
| 5496.0* | Average | Vertical | 24.0 | 7.3 | 31.3 | 54.0 | -22.7 |
| 5496.5* | Peak | Horizontal | 37.7 | 7.3 | 45.0 | 74.0 | -29.0 |
| 5495.9* | Average | Horizontal | 24.0 | 7.3 | 31.4 | 54.0 | -22.7 |
| 6411.5* | Peak | Vertical | 37.3 | 8.3 | 45.6 | 74.0 | -28.4 |
| 6412.1* | Average | Vertical | 26.1 | 8.3 | 34.4 | 54.0 | -19.6 |
| 6411.8* | Peak | Horizontal | 37.2 | 8.3 | 45.4 | 74.0 | -28.6 |
| 6412.0* | Average | Horizontal | 25.8 | 8.3 | 34.1 | 54.0 | -19.9 |
| 7327.6 | Peak | Vertical | 35.3 | 10.9 | 46.1 | 74.0 | -27.9 |
| 7327.9 | Average | Vertical | 24.9 | 10.9 | 35.8 | 54.0 | -18.2 |
| 7328.5 | Peak | Horizontal | 34.5 | 10.9 | 45.4 | 74.0 | -28.6 |
| 7328.0 | Average | Horizontal | 21.8 | 10.9 | 32.7 | 54.0 | -21.4 |
| 8243.8 | Peak | Vertical | 40.0 | 11.8 | 51.8 | 74.0 | -22.2 |
| 8243.9 | Average | Vertical | 35.1 | 11.8 | 46.9 | 54.0 | -7.1 |
| 8243.8 | Peak | Horizontal | 35.7 | 11.8 | 47.5 | 74.0 | -26.5 |
| 8244.0 | Average | Horizontal | 25.1 | 11.8 | 36.9 | 54.0 | -17.1 |
| 9160.1 | Peak | Vertical | 34.8 | 12.7 | 47.5 | 74.0 | -26.5 |
| 9159.9 | Average | Vertical | 24.5 | 12.7 | 37.1 | 54.0 | -16.9 |
| 9159.5 | Peak | Horizontal | 34.4 | 12.7 | 47.1 | 74.0 | -26.9 |
| 9159.7 | Average | Horizontal | 21.9 | 12.7 | 34.6 | 54.0 | -19.4 |

*Frequency falls outside of the restricted bands of 15.205.

**Table 4: Transmitting at 916.00 MHz**

No other emissions were seen in the restricted bands

## 6.3 Sample Measurement Calculations

### 6.3.1 Filed Strength Calculations

The field strength is calculated by adding the *Correction Factor* (*Antenna Factor* + *Cable Factor*), to the measured level from the receiver. The receiver amplitude reading is compensated for any amplifier gain. When an average measurement requires an average measurement correction value, it is also accounted for. The basic equation with a sample calculation is shown below:

*Receiver Amplitude Reading=Receiver Reading-Amplifier Gain*

*Correction Factor=Antenna Factor + Cable Factor*

*Field Strength=Receiver Amplitude Reading + Correction Factor [+Average Correction Value]*

**Example**

Assuming a *Receiver Reading* of 42.5 dBμV is obtained from the receiver, the *Amplifier Gain* is 26.5 dB the *Antenna Factor* is 4.5 dB, and the *Cable Factor* is 4.0 dB. The *Field Strength* is calculated by subtracting the *Amplifier Gain* and adding the *Correction Factor*, giving a *Field Strength* of 24.5 dBμV/m.

$$Receiver\ Amplitude\ Reading\ =\ 42.5-26.5\ =\ 16.0\ \mathrm{dB\mu V/m}$$

$$Correction\ Factor\ =\ 4.5+4.0\ =\ 8.5\ \mathrm{dB}$$

$$Field\ Strength\ =\ 16.0+8.5\ =\ 24.5\ \mathrm{dB\mu V/m}$$

### 6.3.2 Conducted Measurement Value Calculations

A conducted emission value is calculated by adding the *Correction Factor* (*LISN Transducer Factor* + *Cable Factor*) to the measured value from the receiver. The LISN contains an internal 10dB (nominal) attenuation accounted for in the LISN Transducer Factor. Amplifiers are not utilized for this measurement. The basic equation with a sample calculation is shown below:

*Correction Factor = LISN Transducer Factor + Cable Factor*

*Conducted Emission Value = Receiver Amplitude Reading + Correction Factor*

**Example**

Assuming a *Receiver Reading* of 20.8 dBμV is obtained from the receiver, *LISN Transducer Factor* is 10.1 dB, and the *Cable Factor* is 0.3 dB. The *Conducted Emissions Value* is calculated by adding the *Correction Factor*, giving a *Conducted Emissions Value* of 31.2 dBμV.

$$Receiver\ Amplitude\ Reading\ =\ 20.8\ \mathrm{dB\mu V}$$

$$Correction\ Factor\ =\ 10.1+0.3\ =\ 10.4\ \mathrm{dB}$$

$$Conducted\ Emissions\ Value\ =\ 20.8+10.4\ =\ 31.2\ \mathrm{dB\mu V}$$

# 7 Test Procedures and Test Equipment

## 7.1 Conducted Emissions at Mains Ports

The conducted emissions at mains and telecommunications ports from the EUT were measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted emissions at mains ports measurements are performed in a screen room using a (50 Ω/50 µH) Line Impedance Stabilization Network (LISN).

Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

Where the EUT is a collection of devices with each device having its own power cord, the point of connection for the LISN is determined from the following rules:

- Each power cord, which is terminated in a mains supply plug, shall be tested separately.
- Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
- Power cords which are specified by the manufacturer to be connected via a host unit or other power supplying equipment shall be connected to that host unit and the power cords of that host unit connected to the LISN and tested.
- Where a special connection is specified, the necessary hardware to effect the connection is supplied by the manufacturer for the testing purpose.
- When testing equipment with multiple mains cords, those cords not under test are connected to an artificial mains network (AMN) different than the AMN used for the mains cord under test.

For testing, desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor and placed 40 cm from the vertical coupling plane (copper plating in the wall behind EUT table). Floor standing equipment is placed directly on the earth grounded floor.

| Type of Equipment | Manufacturer | Model Number | Asset Number | Date of Last Calibration | Due Date of Calibration |
|---|---|---|---|---|---|
| Spectrum Analyzer/Receiver | Rohde & Schwarz | ESU40 | V033119 | 12/02/2024 | 12/02/2025 |
| Spectrum Analyzer/ Signal Analyzer | Rohde & Schwarz | FSV40 | V044352 | 03/05/2024 | 03/05/2026 |
| LISN | Teseq | NNB 51 | V045406 | 12/19/2024 | 12/19/2025 |
| Conductance Cable Wanship Upper Site | VPI Labs | Cable J | V034832 | 12/19/2024 | 12/19/2025 |
| EMC32 Measurement Software | Rohde & Schwarz | 10.60.20 | N/A | N/A | N/A |

**Table 5: List of equipment used for conducted emissions testing at mains ports.**

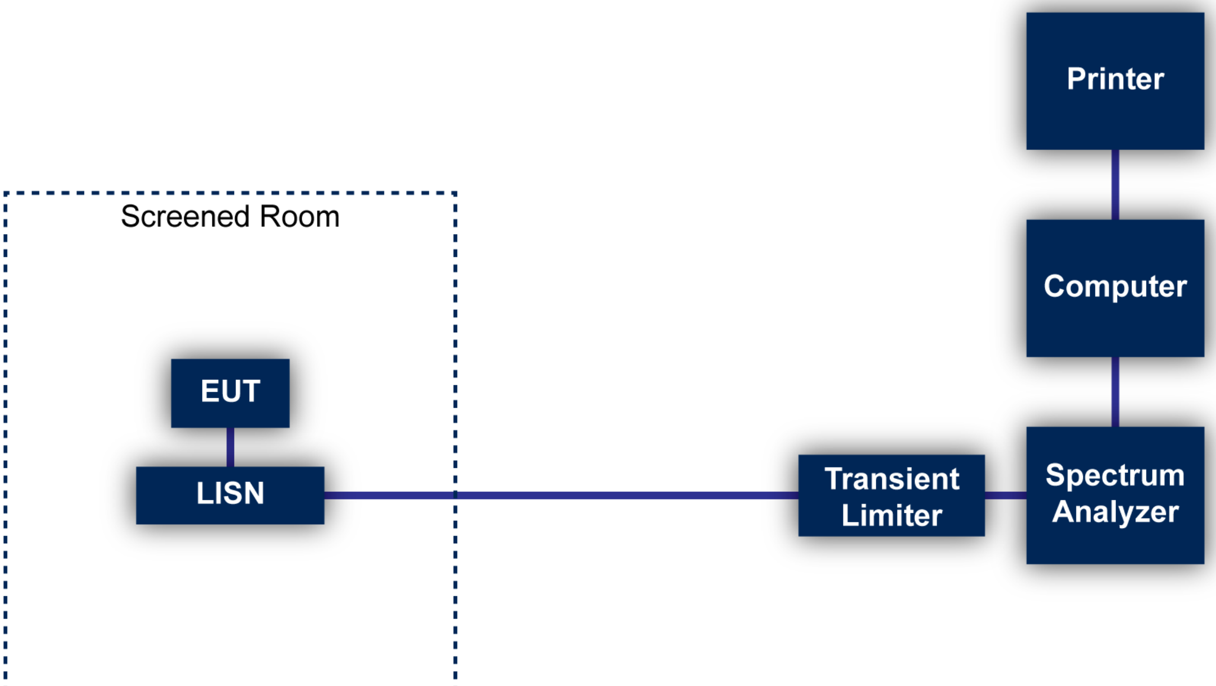



**Figure 1: Conducted Emissions Test**

## 7.2 Direct Connection at the Antenna Port Tests

| Type of Equipment | Manufacturer | Model Number | Asset Number | Date of Last Calibration | Due Date of Calibration |
|---|---|---|---|---|---|
| Spectrum Analyzer/Receiver | Rohde & Schwarz | ESU40 | V033119 | 12/02/2024 | 12/02/2025 |
| Spectrum Analyzer/ Signal Analyzer | Rohde & Schwarz | FSV40 | V044352 | 03/05/2024 | 03/05/2026 |
| 40GHz Switch Base Unit | Rohde & Schwarz | OSP-120 | V045406 | 12/19/2024 | 12/19/2025 |
| "DUT 5" Cable | N/A | N/A | V034832 | 12/19/2024 | 12/19/2025 |
| EMC32 Test Software | Rohde & Schwarz | 11.70 | N/A | N/A | N/A |

### 7.2.1 Test Configuration Block Diagram

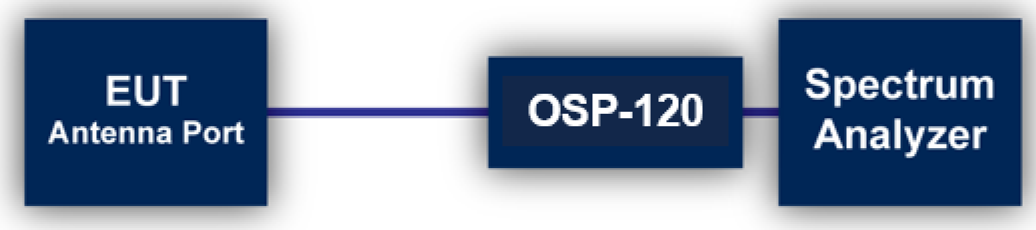



**Figure 2: Direct Connection at the Antenna Port Test**

## 7.3 Radiated Emissions

The radiated emissions from the EUT were measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings.

A preamplifier with a fixed gain was used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges. For frequencies below 30 MHz, a 9 kHz resolution Bandwidth was used.

A loop antenna was used to measure frequencies below 30 MHz. A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 3 meters from the EUT. The readings obtained by these antennas are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors. A double-ridged guide antenna was used to measure the emissions at frequencies above 1000 MHz at a distance of 3 and/or 1 meter from the EUT.

The configuration of the EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated emissions. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there were multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. For frequencies above 1000 MHz, the EUT is placed on a table 1.5 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

For radiated emissions testing that is performed at distances closer than the specified distance; an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

| Type of Equipment | Manufacturer | Model Number | Asset Number | Date of Last Calibration | Due Date of Calibration |
|---|---|---|---|---|---|
| Spectrum Analyzer/Receiver | Rohde & Schwarz | ESU40 | V033119 | 12/02/2024 | 12/02/2025 |
| Spectrum Analyzer/ Signal Analyzer | Rohde & Schwarz | FSV40 | V044352 | 03/05/2024 | 03/05/2026 |
| Biconilog Antenna | EMCO | 3142E | V035736 | 07/08/2025 | 07/08/2027 |
| Power Amplifier | HP | 8447E | V034189 | 12/19/2024 | 12/19/2025 |
| Double Ridged Guide Antenna | EMCO | 3115 | V034194 | 06/25/2025 | 06/25/2027 |
| Standard Gain Horn | ETS-Lindgren | 3160-09 | V034223 | ICO | ICO |
| High Frequency Amplifier | Miteq | AFS4-001018000-35-10P-4 | V033997 | 12/19/2024 | 12/19/2025 |
| 900 MHz High Pass Filter | Micro-Tronics | HPM50108-03 | V034185 | 12/19/2024 | 12/19/2025 |
| 2.4 GHz High Pass Filter | Micro-Tronics | HPM50111-03 | V034183 | 12/19/2024 | 12/19/2025 |
| 2.4 GHz Notch Filter | Micro-Tronics | BRM50702-03 | V034213 | 12/19/2024 | 12/19/2025 |
| 6’ High Frequency Cable | Microcoax | UFB197C-0-0720-000000 | V033638 | 12/19/2024 | 12/19/2025 |
| 20’ High Frequency Cable | Microcoax | UFB197C-1-3120-000000 | V033979 | 12/19/2024 | 12/19/2025 |
| 3 Meter Radiated Emissions Cable Wanship Upper Site | Microcoax | UFB205A-0-4700-000000 | V033639 | 12/19/2024 | 12/19/2025 |
| EMC32 Test Software | Rohde & Schwarz | 10.60.20 | N/A | N/A | N/A |

**Table 6: List of equipment used for radiated emissions testing.**

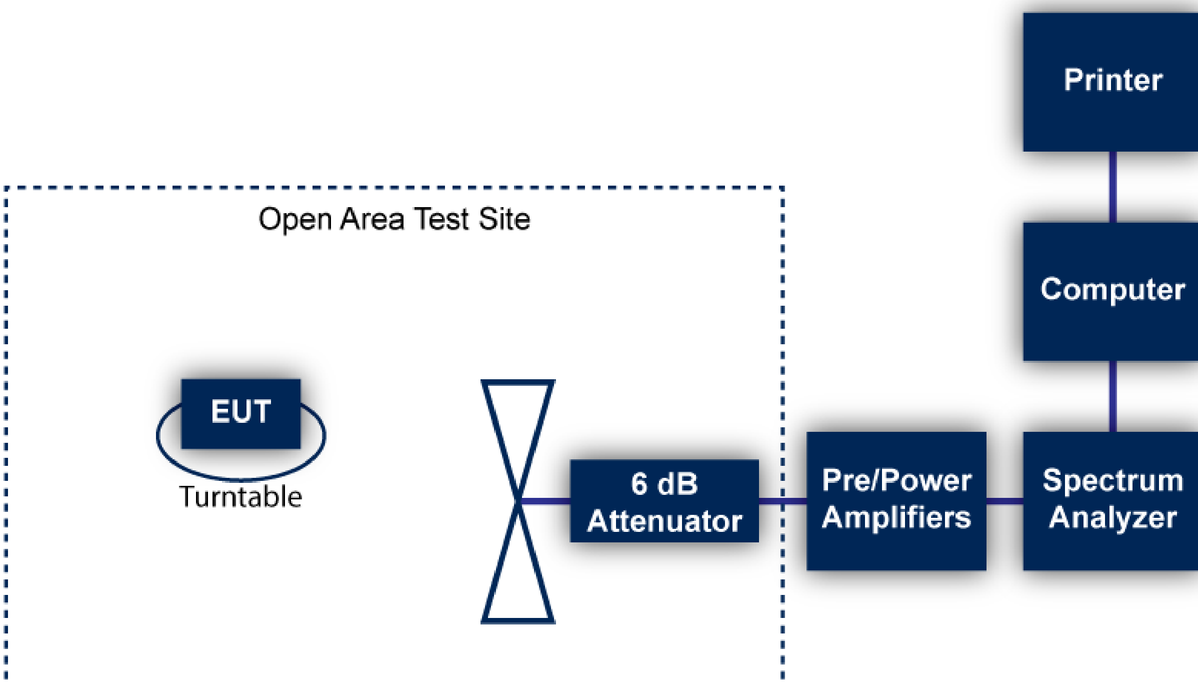



**Figure 3: Radiated Emissions Test**

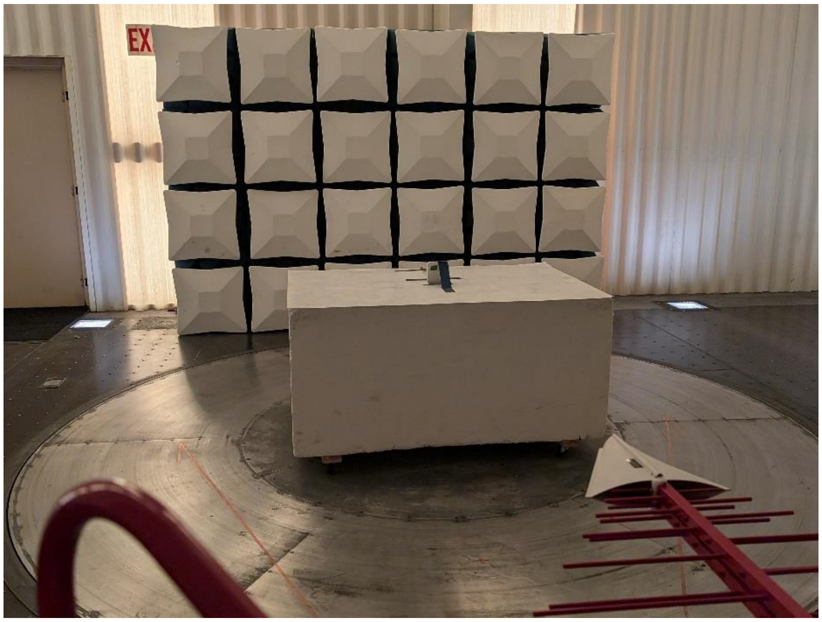
## 7.4 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or VPI Technology, Inc. personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

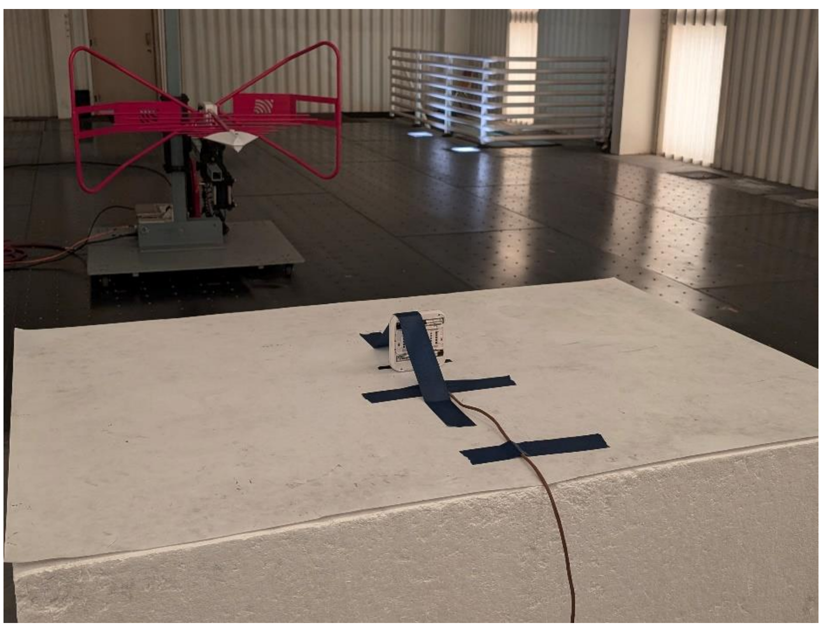
## 7.5 Measurement Uncertainty

| Test | Uncertainty (±dB) | Confidence (%) |
|---|---|---|
| Conducted Emissions | 2.8 | 95 |
| Radiated Emission (9 kHz to 30 MHz) | 3.3 | 95 |
| Radiated Emissions (30 MHz to 1 GHz) | 3.4 | 95 |
| Radiated Emissions (1 GHz to 18 GHz) | 5.0 | 95 |
| Radiated Emissions (18 GHz to 40 GHz) | 4.1 | 95 |

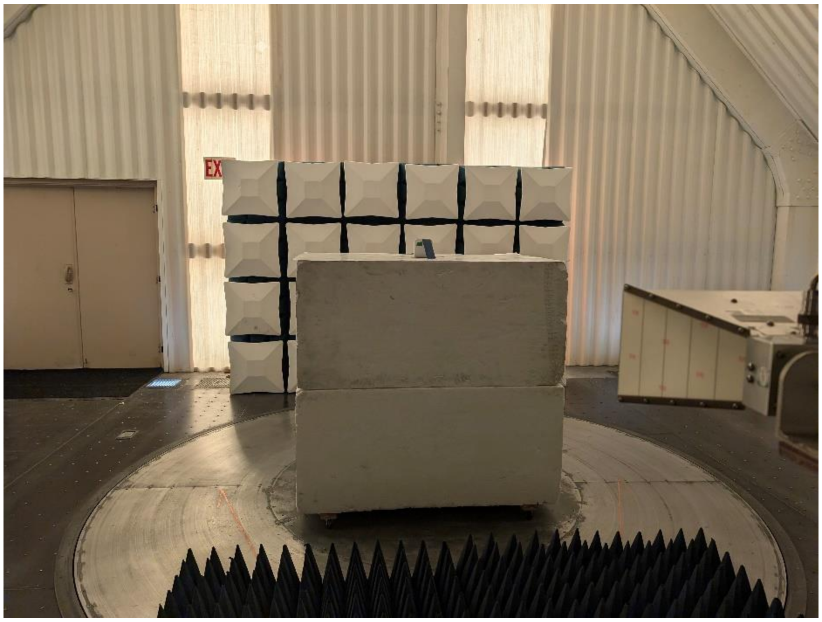
# 8 Photographs



**Photograph 1: Front View Radiated Emissions Worst-Case Configuration – Frequencies Under 1000 MHz**



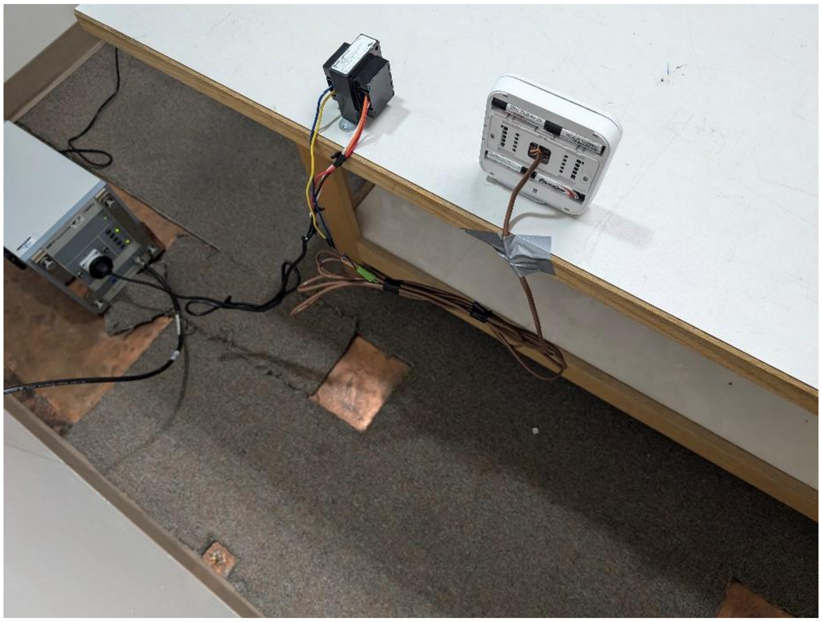
**Photograph 2: Back View Radiated Emissions Worst-Case Configuration – Frequencies Under 1000 MHz**



**Photograph 3: Front View Radiated Emissions Worst-Case Configuration – Frequencies Over 1000 MHz**

**Photograph 4: Back View Radiated Emissions Worst-Case Configuration – Frequencies Over 1000 MHz**

**Photograph 5: Front View Conducted Emissions Worst-Case Configuration**



**Photograph 6: Back View Conducted Emissions Worst-Case Configuration**

**Photograph 7: Front View of the EUT (Enclosure)**

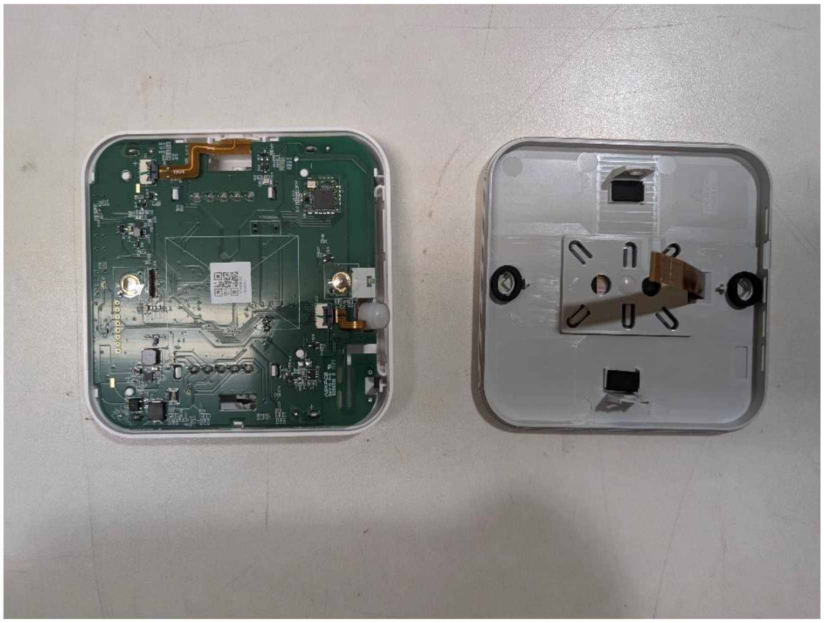
**Photograph 8: Back View of the EUT (Enclosure)**

**Photograph 9: Side 1 View of the EUT (Enclosure)**

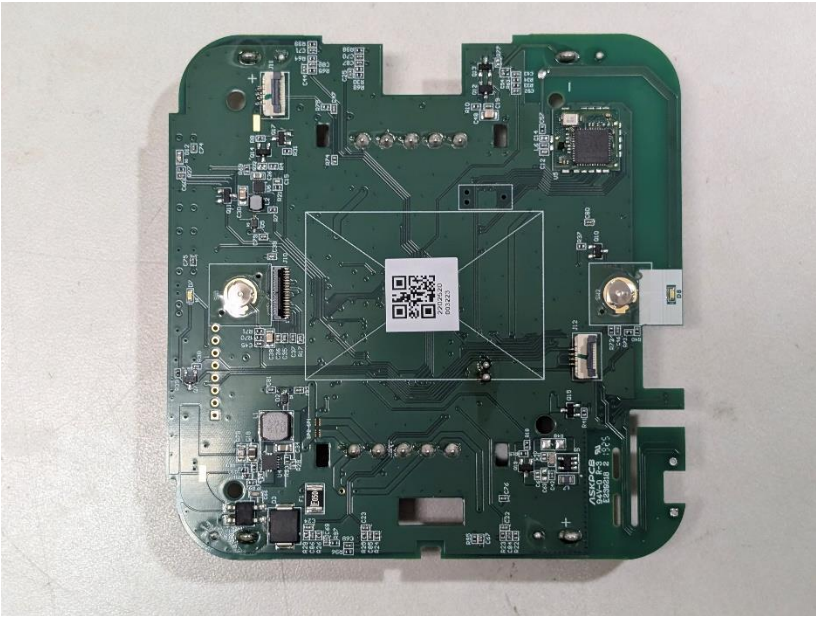
**Photograph 10: Side 2 View of the EUT (Enclosure)**

**Photograph 11: Side 3 View of the EUT (Enclosure)**

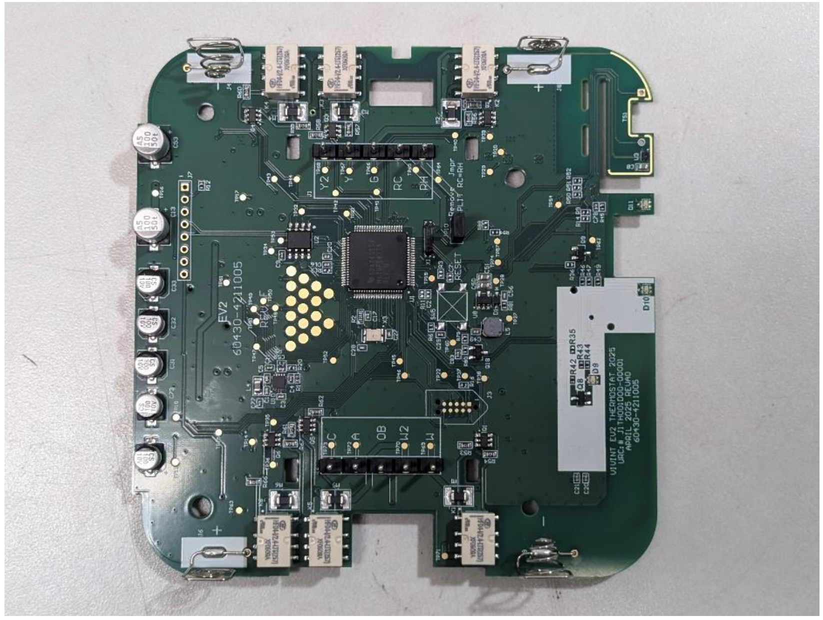
**Photograph 12: Side 4 View of the EUT (Enclosure)**



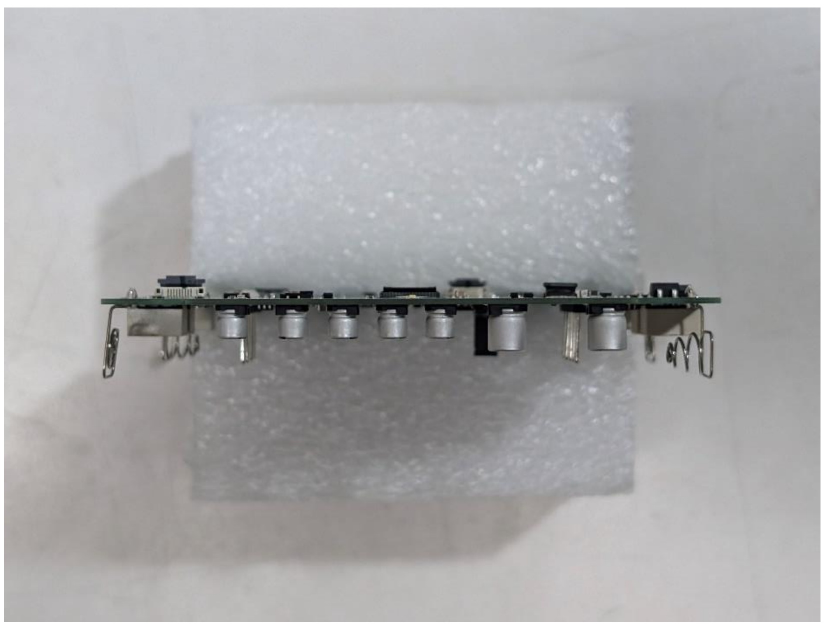
**Photograph 13: View of PCB Placement in Enclosure**



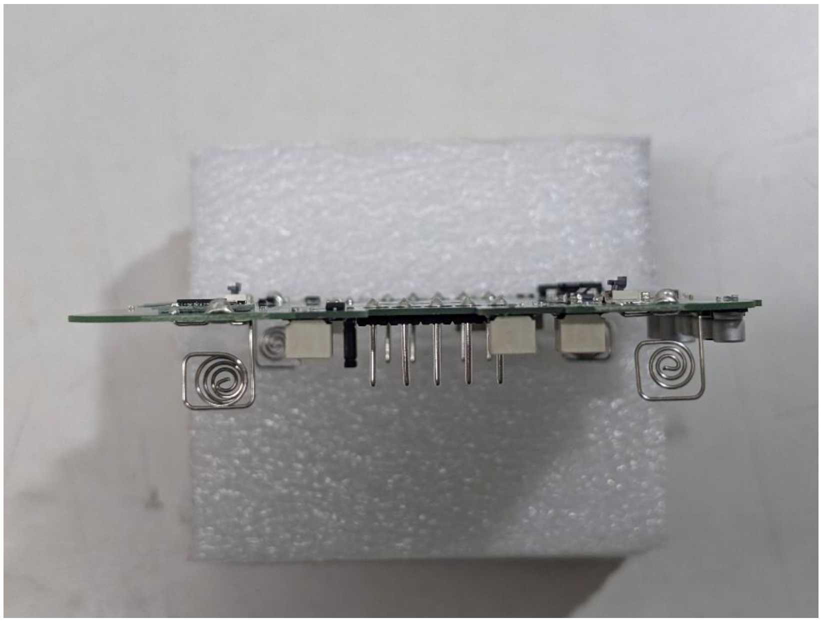
**Photograph 14: Front View of the PCB**



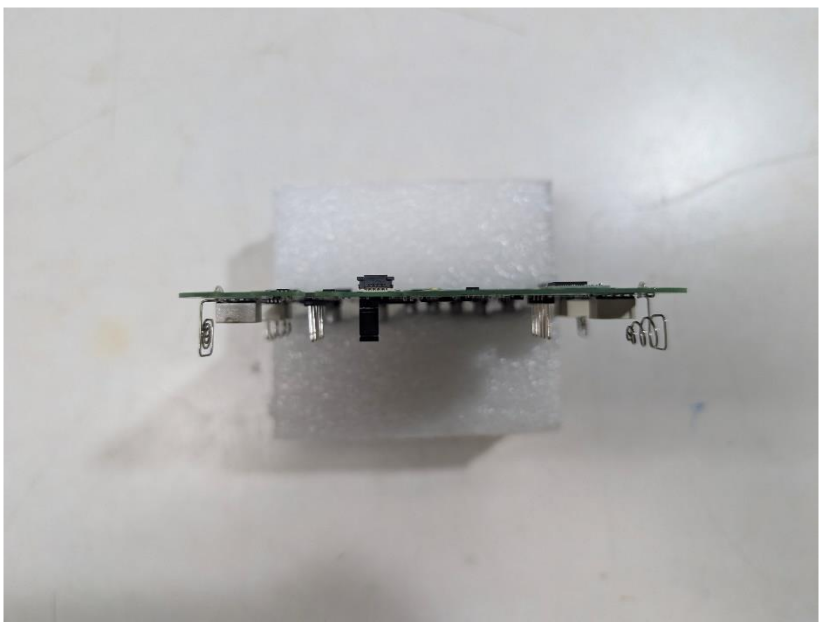
**Photograph 15: Back View of the PCB**



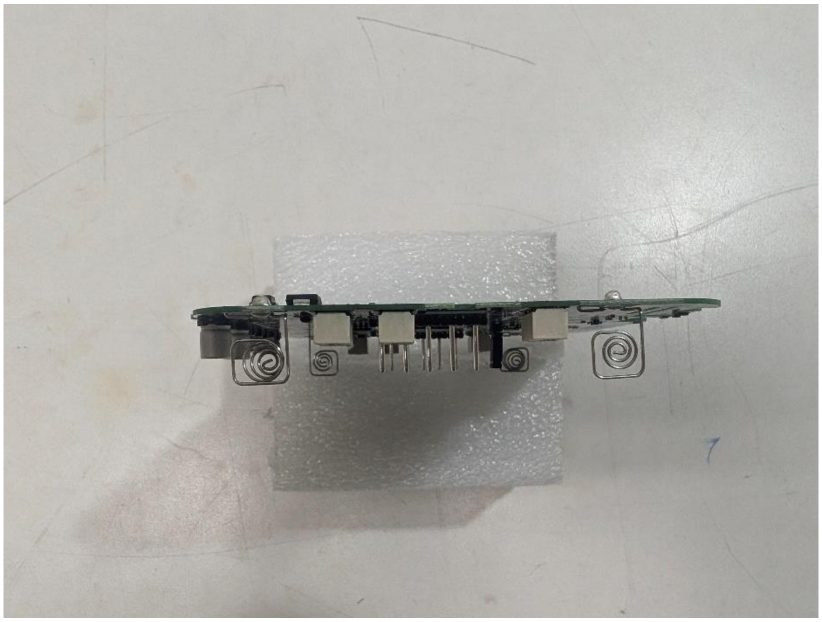
**Photograph 16: Side 1 View of the PCB**



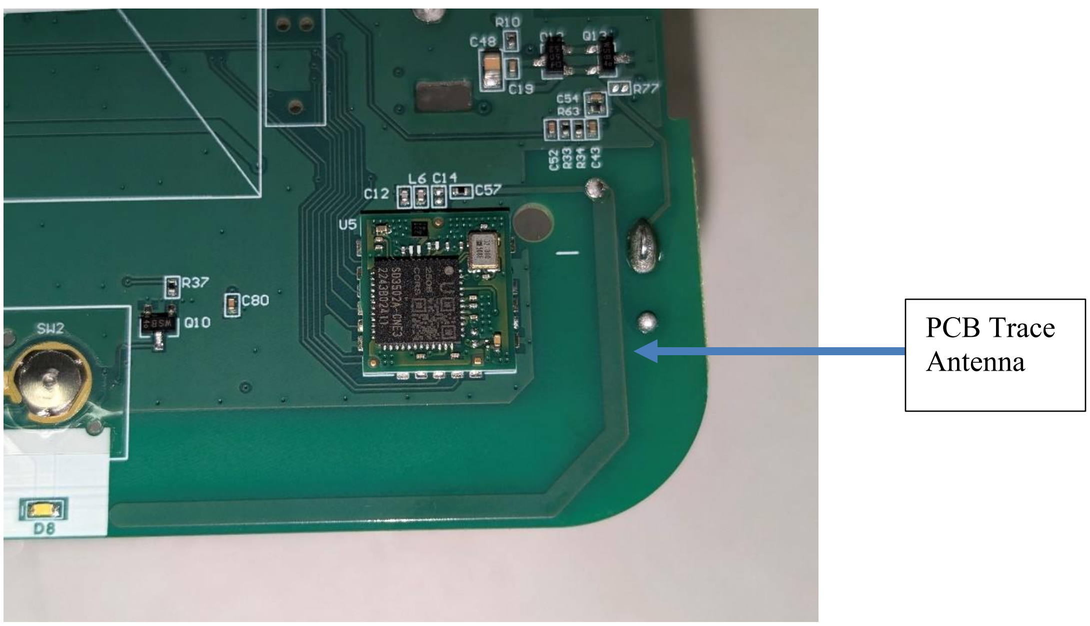
**Photograph 17: Side 2 View of the PCB**



**Photograph 18: Side 3 View of the PCB**



**Photograph 19: Side 4 View of the PCB**




**Photograph 20: Close-up View of the Radio Section of the PCB**

**--- End of Report ---**