# Report on the Testing of the

# InVue Security Products Inc.
# OneKEY Ecosystem (LBAA0QB1SJ)

## FCC ID: 2AFR8-LB1SJ
## IC: 23313-LB1SJ

## In accordance with:
## FCC 47 CFR Part 15.247
## ISED RSS-247 Issue 2, February 2017

Prepared for: InVue Security Products Inc.
9201 Baybrook Ln
Charlotte, North Carolina 28277

## COMMERCIAL-IN-CONFIDENCE

Document Number: NC72165203.1 | Issue: 1

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| **NAME** | **JOB TITLE** | **RESPONSIBLE FOR** | **ISSUE DATE** |
| Brad A Reasoner | EMC Test Engineer | **Authorized Signatory** | 28 April 2021 |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD America, Inc. document control rules.

| | |
|---|---|
| FCC Accreditation<br>Designation Number US1148 New Brighton, MN Test Laboratory | Innovation, Science, and Economic Development Canada Accreditation<br>Site Number 4512A New Brighton, MN Test Laboratory |

**EXECUTIVE SUMMARY**

A sample of this product was tested and found to be compliant with the standards listed above and the tests shown in Table 1.3.1 of this report.

A2LA Cert. No. 2955.11



**ACCREDITATION**

Our A2LA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our A2LA Accreditation.

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# 1 Report Summary

## 1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

**Table 1.1-1 – Modification Record**

| Issue | Description of Change | Date of Issue |
|---|---|---|
| 1 | First Issue | 28 April 2021 |

## 1.2 Introduction

| | |
|---|---|
| Manufacturer | InVue Security Products Inc. |
| Applicant's Email Address | DanHepka@invue.com |
| Model Number(s) | LBAA0QB1SJ |
| Serial Number(s) | 0006-001122 |
| Number of Samples Tested | 1 |
| Test Specification/Issue/Date | FCC 47 CFR Part 15.247<br>ISED RSS-247 Issue 2, February 2017 |
| Order Number | 72165203 |
| Date of Receipt of EUT | 29 March 2021 |
| Start of Test | 19 April 2021 |
| Finish of Test | 20 April 2021 |
| Related Document(s) | KDB 996369 D04 |
| Manufacturer | InVue Security Products Inc. |

## 1.3 Scope of Testing

To perform testing for an FCC Class II Permissive Change to accommodate an antenna change. To perform investigation testing to confirm that the integration of host and wireless device(s) meet the requirements for radiated spurious emissions as per the Modular Transmitter Integration Guide (KDB 996369 D04).

## 1.4 Summary of Results

A summary of the tests carried out in accordance with the specifications shown below.

**Table 1.4-1 – Summary of Results**

| Section | Specification Clause | | Test Description | Accreditation | Base Standard |
|---|---|---|---|---|---|
| 2.1 | 15.203 | RSS-GEN | Antenna Requirements | A2LA | FCC Sub Part C 15.203 |
| 2.2 | 15.207 | RSS-GEN | Conducted Emissions | A2LA | ANSI C63.10:2013 |
| 2.3 | 15.247(d) | RSS-GEN | Radiated Spurious Emissions | A2LA | ANSI C63.10:2013 |

**Table 1.4-2 – Test Accreditation**

| Test Name | Name of Tester(s) | Results / Comments |
|---|---|---|
| Antenna Requirements | Sean Sellergren | Pass |
| Conducted Emissions | N/A | N/A |
| Radiated Spurious Emissions | Sean Sellergren | Pass |

Note: Tests marked with N/A were not tested due to EUT not meeting the full requirements for test applicability and therefore are not required.

## 1.5 Product Information

### 1.5.1 Technical Description

The Equipment Under Test (EUT):
A remote Key equipped with a LoRa wireless module.

**Table 1.5-1 – Wireless Module Technical Information**

| Detail | Description |
|---|---|
| FCC ID | 2AFR8-LB1SJ |
| IC | 23313-LB1SJ |
| Transceiver Model # | LBAA0QB1SJ-295 |
| Operating Frequency | 902.3 – 914.9MHz |
| Modulation Format | LoRa |
| Antenna Type / Gain: | Ceramic Antenna / Gain of 1.8 dBi @ 902 MHz |

A full description and detailed product specification details are available from the manufacturer.


**Photo 1.5-1 – View of the EUT (1)**

**Photo 1.5-2 – View of the EUT (1)**

Note: cutout into enclosure was for connection to control the radio and test purposes only and was made by InVue Security Products prior to arrival at test facility.

**Table 1.5-2 – Cable Descriptions**

| Cable/Port | Description |
|---|---|
| USB to 3 pin connectors | Support cable used for LoRa programming |

**Table 1.5-3 – Support Equipment Descriptions**

| Make/Model | Description |
|---|---|
| Charging base station | Support equipment used for charging and maintaining continual operation of the device during testing. |

### 1.5.2 Modes of Operation

The tested mode of operation was:

The EUT was placed in transmit mode using the radios applicable low, middle and high channels.

Transmit settings:
LoRa Tx mode (per module firmware command specification)
Power Level: 18dBm
Data Rate: SF10

## 1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

## 1.7 EUT Modification Record

The table below details modifications made to the EUT during the test program. The modifications incorporated during each test are recorded on the appropriate test pages.

**Table 1.7-1 – Modification Record**

| Modification State | Description of Modification still fitted to EUT | Modification Fitted By | Date Modification Fitted |
|---|---|---|---|
| 0 | Initial State | N/A | N/A |

## 1.8 Test Location

TÜV SÜD conducted the following tests at our New Brighton, MN Test Laboratory.

Office address:

TÜV SÜD America
141 14th Street NW
New Brighton, MN 55112 USA

# 2 Test Details

## 2.1 Antenna Requirements

### 2.1.1 Specification Reference

FCC 47 CFR Part 15 Subpart C, 15.203
RSS-GEN Issue 5

### 2.1.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

### 2.1.3 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 §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. 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 §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.

Note: Above statement is taken from FCC Part 15 Subpart C §15.203

**Table 2.1-1 – Antenna Used In EUT**

| Antenna Type | Connection Type | Antenna Gain |
|---|---|---|
| Ceramic | On-board | 1.8 dBi |

## 2.2 Conducted Emissions

### 2.2.1 Specification Reference

FCC 47 CFR Part 15 Subpart C, 15.207
RSS-GEN Issue 5

### 2.2.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

### 2.2.3 Date of Test

N/A

### 2.2.4 Test Results

**Test Summary**: EUT was evaluated as a stand-alone product that is battery powered. This test is not applicable.

**Test Result: N/A**

## 2.3 Radiated Spurious Emissions

### 2.3.1 Specification Reference

FCC 47 CFR Part 15 Subpart C, 15.247
RSS-GEN Issue 5

### 2.3.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

### 2.3.3 Date of Test

19 - 20 April 2021

### 2.3.4 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable and placed on a non-conductive table 0.8 m above a reference ground plane for 30-1000 MHz and 1.5m above the ground plane for above 1 GHz.

For 30-1000 MHz a pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using a peak detector; measurements were taken at a 3m distance.

For above 1 GHz a pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using peak and average detectors; measurements were taken at a 3m distance.

For all frequency ranges the final readings were maximized by adjusting the antenna height, polarization and turntable azimuth, in accordance with the specification. For below 1 GHz final measurements were taken with a quasi-peak detector and above 1 GHz final measurements were re-measured with peak and average detectors.

The EUT was assessed against the limits specified in FCC 47 CFR Part 15C §15.209.

### 2.3.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

### 2.3.6 Additional Observations

The highest frequency to which the DUT was measured was determined in accordance with §15.33(a)(1).

Automated measurements used BAT-EMC (v3.18) software. All measurements were done at a 3m distance. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

### 2.3.7 Sample Computation (Radiated Emissions)

| | | | |
|---|---|---|---|
| Measuring equipment raw measurement (dBµV) @ 30 MHz | | | 20.0 |
| Correction Factor (dB/m) | Cable 2 | 0.24 | 18.94 |
| | TEMC00011 (antenna) | 18.70 | |
| | | | |
| | | | |
| | | | |
| Reported Quasi-peak Final Measurement (dBµV/m) @ 30 MHz | | | 38.94 |

### 2.3.8 Test Results

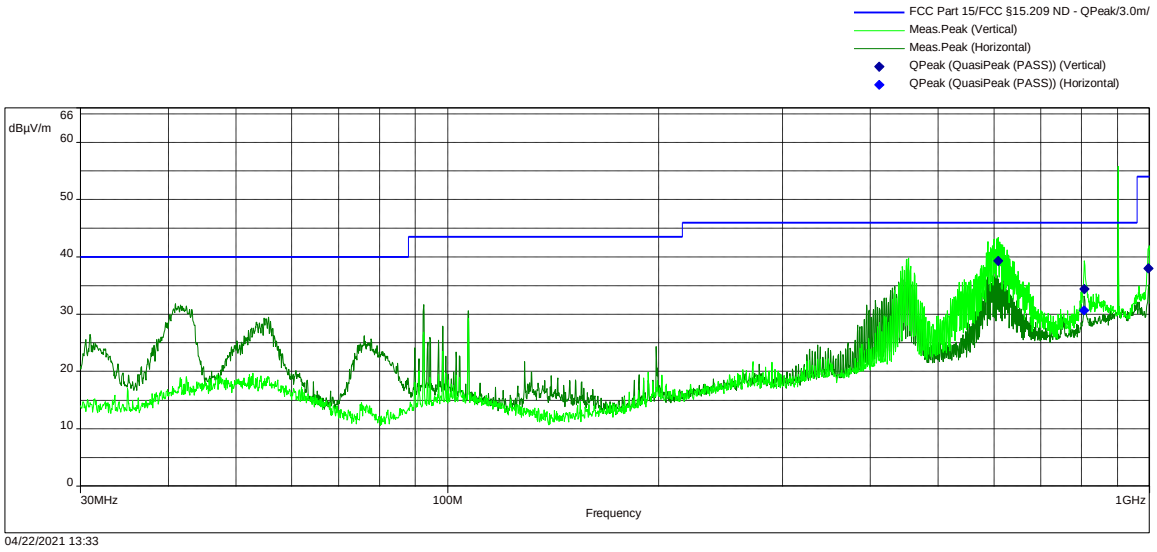
**Test Summary**: The EUT was set to transmit in the low, mid and high channels. In the transmit range measurements attenuation in front of the pre-amp to prevent overloading.

**Test Result: Pass**

See data below for detailed results.

## Spurious Emissions 30M-1GHz - Low Ch 902.3MHz

| Frequency Range | Polarity | Antenna Distance | RBW | Step Size | Sweep Time |
|---|---|---|---|---|---|
| 30MHz- 1GHz | Vertical | 3m | 100kHz | 18001Pts | Auto |
| 30MHz- 1GHz | Horizontal | 3m | 100kHz | 18001Pts | Auto |




**Limit:**
FCC §15.209

**Test Results:**
Pass

Test Notes: Low CH 902.3MHz. Frequency shown above the limit corresponds to the transmit frequency of the device and is not part of the scope of this test.

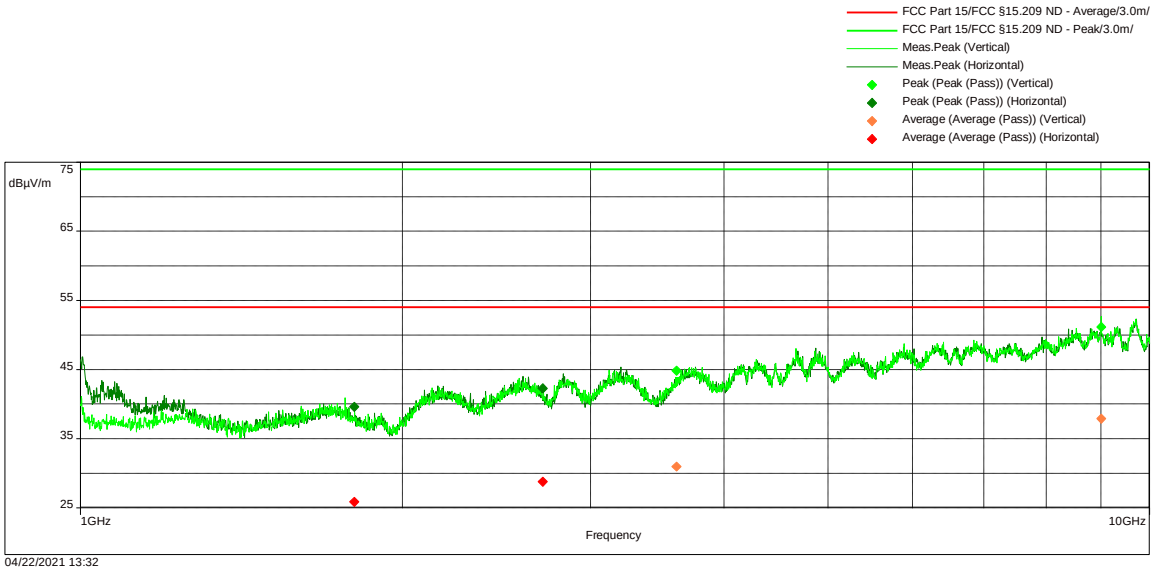
**Figure 2.3-1 – RE Spurious Emissions 30-1000 MHz – Low Channel**

**Table 2.3-1 – RE Spurious Emissions 30-1000 MHz – Low Channel**

| Frequency | QP Level (dBuV/m) | QP Limit (dBuV/m) | Margin (dB) | Azimuth (°) | Height (m) | Polarity | Result |
|---|---|---|---|---|---|---|---|
| 608.75031MHz | 39.28 | 46.00 | -6.72 | 58.00 | 1.00 | Vertical | Pass |
| 806.82767MHz | 30.62 | 46.00 | -15.38 | 90.00 | 3.02 | Horizontal | Pass |
| 807.81336MHz | 34.42 | 46.00 | -11.58 | 145.00 | 1.00 | Vertical | Pass |
| 996.03859MHz | 38.00 | 53.97 | -15.97 | 357.00 | 1.00 | Vertical | Pass |

## Spurious Emissions 1 - 10GHz - Low Ch 902.3

| Frequency Range | Polarity | Antenna Distance | RBW | Step Size | Sweep Time |
|---|---|---|---|---|---|
| 1GHz- 10GHz | Vertical | 3m | 1MHz | 18001Pts | Auto |
| 1GHz- 10GHz | Horizontal | 3m | 1MHz | 18001Pts | Auto |




**Limit:**
FCC §15.209

**Test Results:**
Pass

Test Notes: Low Ch. 902.3MHz Hybrid Mode

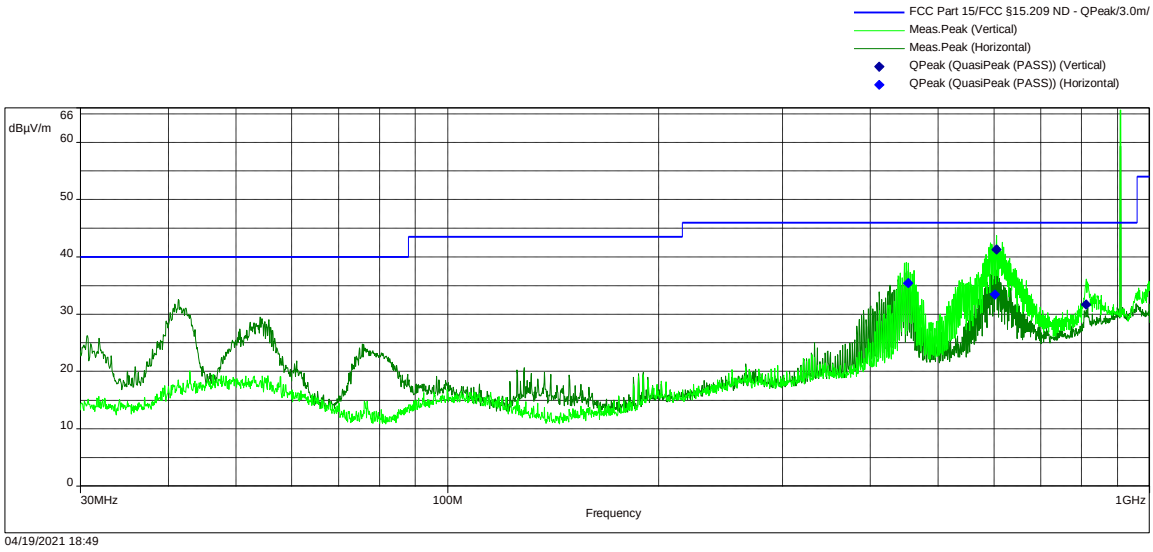
**Figure 2.3-2 – RE Spurious Emissions 1 – 10 GHz – Low Channel**

**Table 2.3-2 – RE Spurious Emissions 1 – 10 GHz – Low Channel**

| Frequency | Peak Level (dBuV/m) | Peak Limit (dBuV/m) | Peak Margin (dB) | Average Level (dBuV/m) | Average Limit (dBuV/m) | Average Margin (dB) | Azimuth (°) | Height (m) | Polarity | Peak Result | Average Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.804GHz | 39.58 | 74.00 | -34.42 | 25.87 | 54.00 | -28.13 | 61.00 | 2.21 | Horizontal | Pass | Pass |
| 2.706GHz | 42.26 | 74.00 | -31.74 | 28.78 | 54.00 | -25.22 | 226.00 | 2.15 | Horizontal | Pass | Pass |
| 3.609GHz | 44.82 | 74.00 | -29.18 | 30.95 | 54.00 | -23.05 | 313.00 | 3.53 | Vertical | Pass | Pass |
| 9.01GHz | 51.16 | 74.00 | -22.84 | 37.88 | 54.00 | -16.12 | 332.00 | 2.31 | Vertical | Pass | Pass |

## Spurious Emissions 30M-1GHz - Mid Ch 908.7MHz

| Frequency Range | Polarity | Antenna Distance | RBW | Step Size | Sweep Time |
|---|---|---|---|---|---|
| 30MHz- 1GHz | Vertical | 3m | 100kHz | 18001Pts | Auto |
| 30MHz- 1GHz | Horizontal | 3m | 100kHz | 18001Pts | Auto |




**Limit:**
FCC §15.209

**Test Results:**
Pass

Test Notes: Mid CH 908.7MHz. Frequency shown above the limit corresponds to the transmit frequency of the device and is not part of the scope of this test.

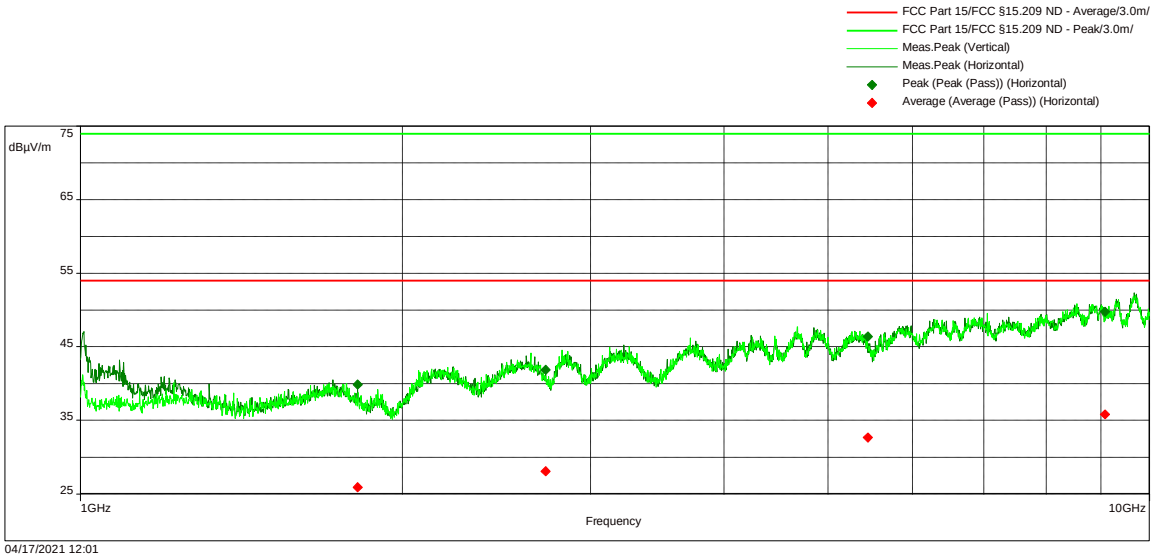
**Figure 2.3-3 – RE Spurious Emissions 30-1000 MHz – Mid Channel**

**Table 2.3-3 – RE Spurious Emissions 30-1000 MHz – Mid Channel**

| Frequency | QP Level (dBuV/m) | QP Limit (dBuV/m) | Margin (dB) | Azimuth (°) | Height (m) | Polarity | Result |
|---|---|---|---|---|---|---|---|
| 453.21867MHz | 35.44 | 46.00 | -10.56 | 344.00 | 1.90 | Horizontal | Pass |
| 602.19149MHz | 33.42 | 46.00 | -12.58 | 105.00 | 1.00 | Horizontal | Pass |
| 605.12432MHz | 41.28 | 46.00 | -4.72 | 35.00 | 1.00 | Vertical | Pass |
| 811.8745MHz | 31.69 | 46.00 | -14.31 | 160.00 | 1.04 | Vertical | Pass |

## Spurious Emissions 1 - 10GHz - Mid Ch 908.7

| Frequency Range | Polarity | Antenna Distance | RBW | Step Size | Sweep Time |
|---|---|---|---|---|---|
| 1GHz- 10GHz | Vertical | 3m | 1MHz | 18001Pts | Auto |
| 1GHz- 10GHz | Horizontal | 3m | 1MHz | 18001Pts | Auto |




**Limit:**
FCC §15.209

**Test Results:**
Pass

Test Notes: Mid Ch. 908.7MHz Hybrid Mode.

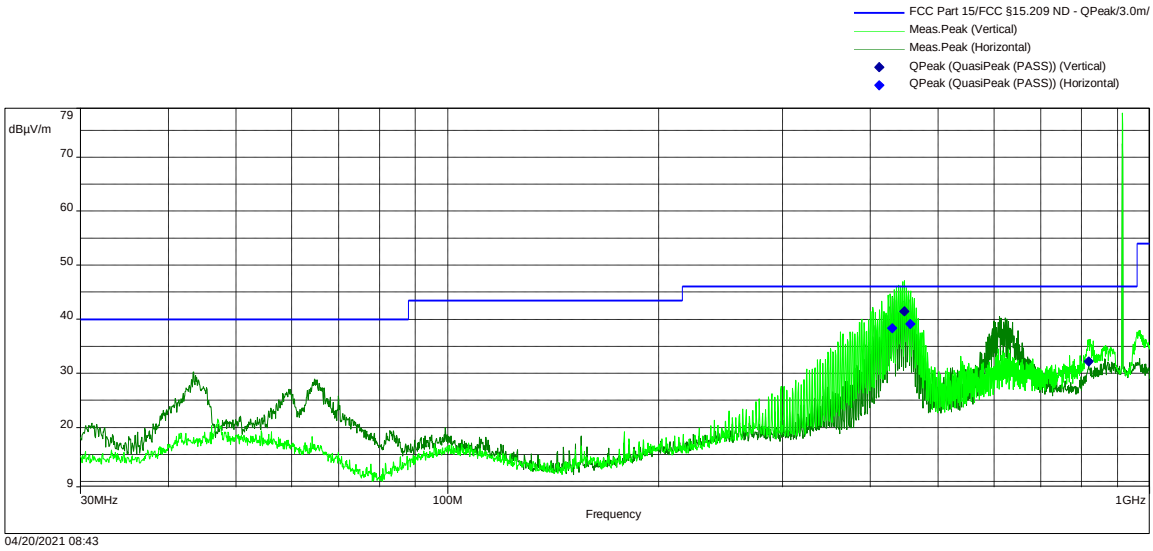
**Figure 2.3-4 – RE Spurious Emissions 1 – 10 GHz – Mid Channel**

**Table 2.3-4 – RE Spurious Emissions 1 – 10 GHz – Mid Channel**

| Frequency | Peak Level (dBuV/m) | Peak Limit (dBuV/m) | Peak Margin (dB) | Average Level (dBuV/m) | Average Limit (dBuV/m) | Average Margin (dB) | Azimuth (°) | Height (m) | Polarity | Peak Result | Average Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.817GHz | 39.88 | 74.00 | -34.12 | 25.90 | 54.00 | -28.10 | 79.00 | 3.17 | Horizontal | Pass | Pass |
| 2.7235GHz | 41.89 | 74.00 | -32.11 | 28.10 | 54.00 | -25.90 | 35.00 | 2.05 | Horizontal | Pass | Pass |
| 5.45GHz | 46.39 | 74.00 | -27.61 | 32.67 | 54.00 | -21.33 | 226.00 | 1.34 | Horizontal | Pass | Pass |
| 9.087GHz | 49.75 | 74.00 | -24.25 | 35.80 | 54.00 | -18.20 | 83.00 | 2.36 | Horizontal | Pass | Pass |

## Spurious Emissions 30M-1GHz - High Ch 914.9MHz

| Frequency Range | Polarity | Antenna Distance | RBW | Step Size | Sweep Time |
|---|---|---|---|---|---|
| 30MHz- 1GHz | Vertical | 3m | 100kHz | 18001Pts | Auto |
| 30MHz- 1GHz | Horizontal | 3m | 100kHz | 18001Pts | Auto |




**Limit:**
FCC §15.209

**Test Results:**
Pass

Test Notes: High CH 914.9MHz. Frequency shown above the limit corresponds to the transmit frequency of the device and is not part of the scope of this test.

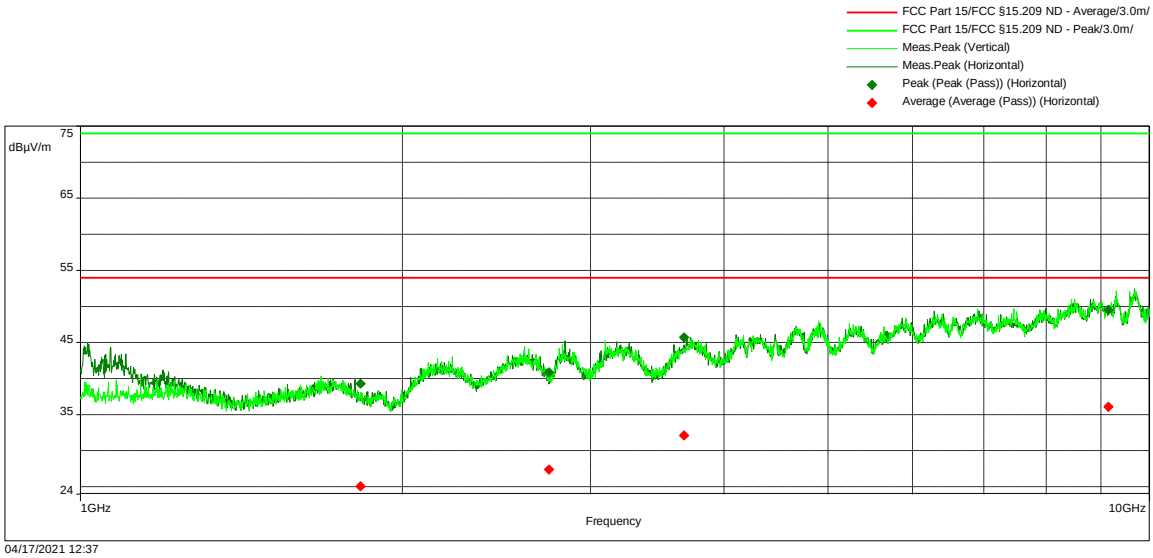
**Figure 2.3-5 – RE Spurious Emissions 30-1000 MHz – High Channel**

**Table 2.3-5 – RE Spurious Emissions 30-1000 MHz – High Channel**

| Frequency | QP Level (dBuV/m) | QP Limit (dBuV/m) | Margin (dB) | Azimuth (°) | Height (m) | Polarity | Result |
|---|---|---|---|---|---|---|---|
| 430.01991MHz | 38.31 | 46.00 | -7.69 | 259.00 | 1.29 | Horizontal | Pass |
| 447.72586MHz | 41.43 | 46.00 | -4.57 | 196.00 | 1.04 | Vertical | Pass |
| 456.35644MHz | 39.13 | 46.00 | -6.87 | 237.00 | 1.00 | Horizontal | Pass |
| 819.22835MHz | 32.19 | 46.00 | -13.81 | 200.00 | 1.04 | Vertical | Pass |

## Spurious Emissions 1 - 10GHz - High Ch 914.9MHz

| Frequency Range | Polarity | Antenna Distance | RBW | Step Size | Sweep Time |
|---|---|---|---|---|---|
| 1GHz- 10GHz | Vertical | 3m | 1MHz | 18001Pts | Auto |
| 1GHz- 10GHz | Horizontal | 3m | 1MHz | 18001Pts | Auto |




**Limit:**
FCC §15.209

**Test Results:**
Pass

Test Notes: High Ch. 914.9MHz Hybrid Mode

**Figure 2.3-6 – RE Spurious Emissions 1 – 10 GHz – High Channel**

**Table 2.3-6 – RE Spurious Emissions 1 – 10 GHz – High Channel**

| Frequency | Peak Level (dBuV/m) | Peak Limit (dBuV/m) | Peak Margin (dB) | Average Level (dBuV/m) | Average Limit (dBuV/m) | Average Margin (dB) | Azimuth (°) | Height (m) | Polarity | Peak Result | Average Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.829GHz | 39.28 | 74.00 | -34.72 | 25.07 | 54.00 | -28.93 | 328.00 | 3.73 | Horizontal | Pass | Pass |
| 2.744GHz | 40.85 | 74.00 | -33.15 | 27.36 | 54.00 | -26.64 | 200.00 | 3.22 | Horizontal | Pass | Pass |
| 3.669GHz | 45.69 | 74.00 | -28.31 | 32.11 | 54.00 | -21.89 | 141.00 | 3.78 | Horizontal | Pass | Pass |
| 9.149GHz | 49.53 | 74.00 | -24.47 | 36.06 | 54.00 | -17.94 | 174.00 | 1.04 | Horizontal | Pass | Pass |

### 2.3.9 Radiated Emissions photos

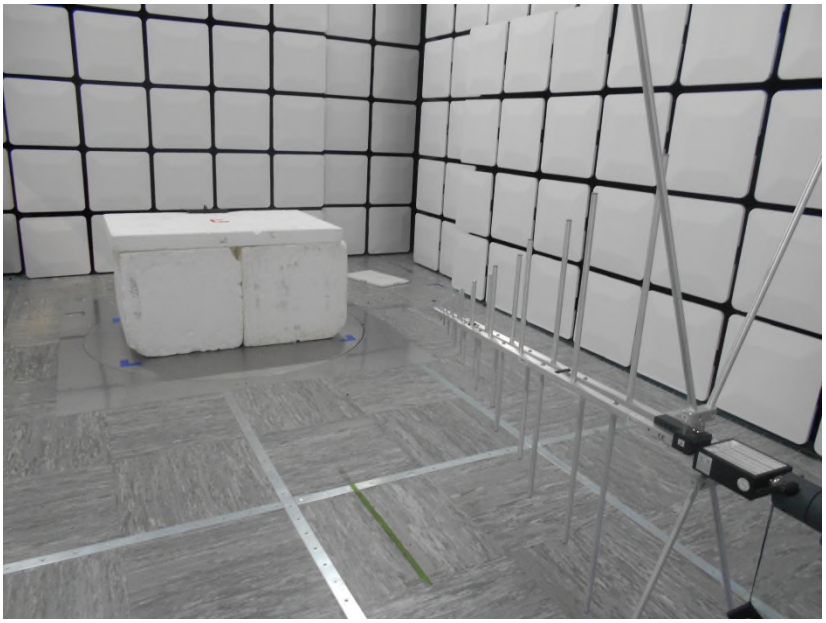


**Photo 2.3-1 – RE Spurious Emissions 30-1000 MHz – Front Side**

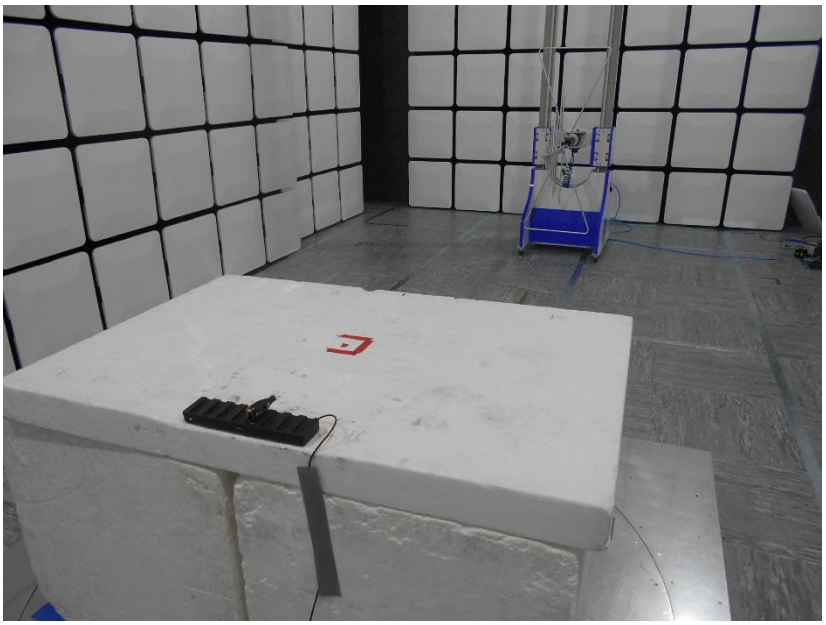


**Photo 2.3-2 – RE Spurious Emissions 30-1000 MHz – Back Side**

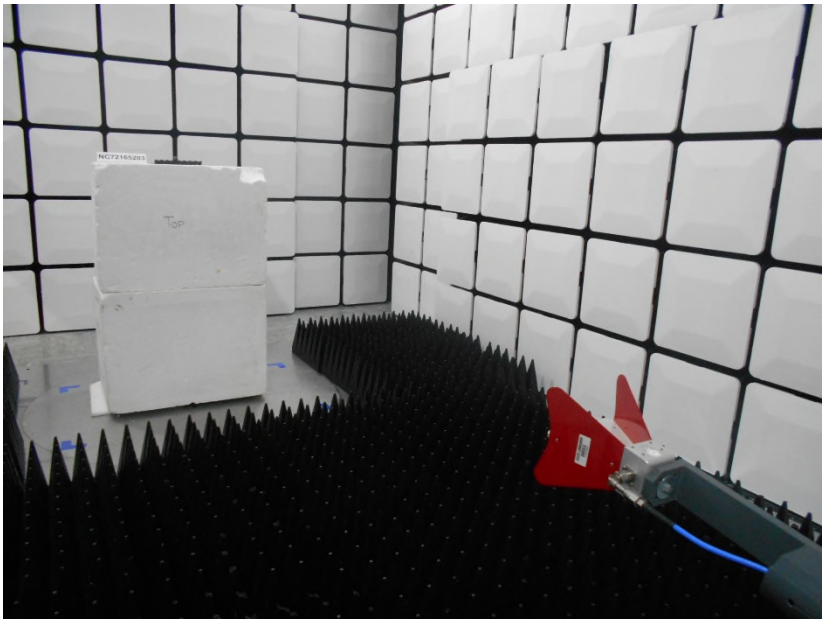


**Photo 2.3-3 – RE Spurious Emissions 1-10 GHz – Front Side**


**Photo 2.3-4 – RE Spurious Emissions 1-10 GHz – Back Side**

### 2.3.10 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.
Test Area: 3mSAC

**Table 2.3-7 – Radiated Emissions Equipment List**

| Device # | Manufacturer | Description | Model | Serial # | Cal Code | Cal Date | Cal Due |
|---|---|---|---|---|---|---|---|
| NBLE11141 | Hewlett-Packard | Preamplifier, 100 kHz-1300 MHz | 8447D | 2944A08773 | B | 01/08/2021 | 01/08/2022 |
| WRLE10517 | Mini-Circuits Lab | Filter, 900-950 MHz Notch | N03915M1 | 138901 | G | 03/31/2021 | 03/31/2022 |
| NBLE11555 | Rohde & Schwarz | Receiver, 2 Hz-44 GHz | ESW44 | 101537 | G | 12/31/2020 | 12/31/2021 |
| NBLE11607 | Pasternack | Attenuator, 10 dB | PE7017-10 | 11607 | G | 11/03/2020 | 11/03/2021 |
| NBLE11630 | ETS-Lindgren | Antenna, 1-18 GHz | 3117 | 00218816 | B | 09/04/2020 | 09/04/2022 |
| NBLE11645 | SCHWARZBECK MESS-ELEKTRONIK | Antenna, Trilog Broadband, 30-7000 MHz | VULB 9162 | 0254 | G | 04/09/2021 | 04/09/2023 |

Cal Code G = Calibration performed by an accredited outside source.
Cal Code B = Calibration verification performed internally.
Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.

# 3 Diagram of Test Set-ups

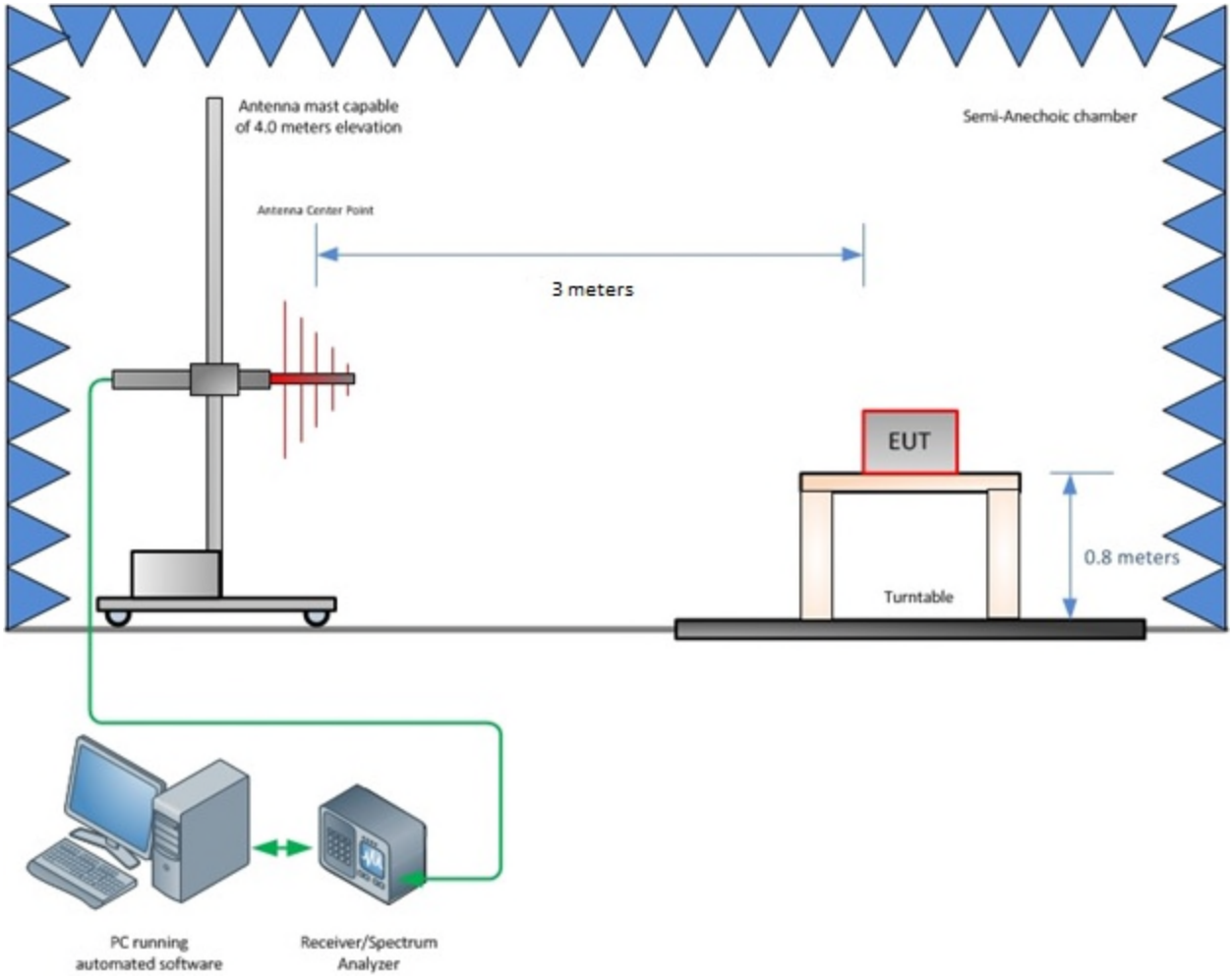



**Figure 3-1 – Radiated Emissions Test Setup up to 1 GHz**

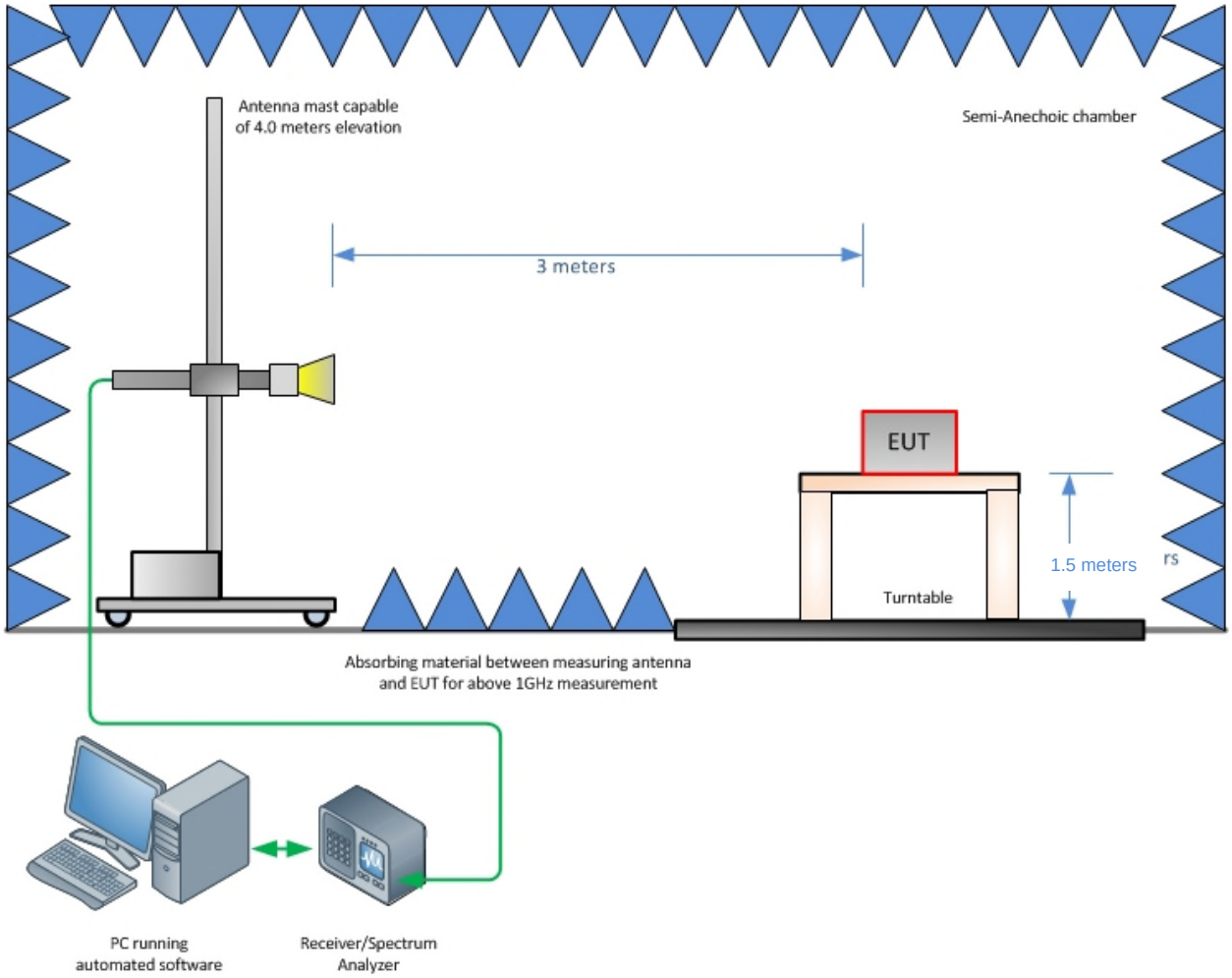



**Figure 3-2 – Radiated Emissions Test Setup above 1 GHz**

# 4 Accreditation, Disclaimers and Copyright

TÜV SÜD America Inc.'s reports apply only to the specific sample tested under stated test conditions. It is the manufacturer's responsibility to assure the continued compliance of production units of this model. TÜV SÜD America, Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD America, Inc.'s issued reports.

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This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the federal government.

**STATEMENT OF MEASUREMENT UNCERTAINTY – Emissions**

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. This test system has a measurement uncertainty of ±3.30 dB. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. This test system for 30 MHz-1000 MHz has a measurement uncertainty of ±5.88 dB and above 1 GHz a measurement uncertainty of ±4.47 dB. The measurement uncertainty values for conducted and radiated emissions meet the requirements as expressed in CISPR 16-4-2. The equipment comprising the test systems is calibrated on an annual basis.

**TEST EQUIPMENT**

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated to meet test method standard requirements and/or manufacturer's specifications